Consortium to Assess Northern Appalachia Resource Yield (CANARY) of CORE-CM for Advanced Materials DE-FE0032052

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Center for Critical Minerals



PennState

U.S. Department of Energy National Energy Technology Laboratory Resource Sustainability Project Review Meeting October 25 - 27, 2022

Project Overview

Funding (DOE and Cost Share)

- Federal Cost: \$1,264,129
- Non-Federal Cost Share: \$320,414
- Overall Project Performance Dates
- October 1, 2021 September 30, 2023

Project Participants

- Penn State, University of Kentucky, Virginia Tech, Colorado School of Mines,
- Tetra Tech, Materia USA, Texas Mineral Resources Corp., USA Rare Earth American Resources Corporation

Project Overview

Overall Project Objectives

- Assess and catalog Northern Appalachian (NA) basin CORE-CM resources and waste streams
- Develop strategies to recover CORE-CM from these streams
- Assess the infrastructure, industries, and businesses in the NA basin to determine CORE-CM supply chain gaps
- Review technology gaps related to CORE-CM production
- Formulate plans to establish Technology Innovation Centers
- Develop stakeholder outreach and engagement in educational activities



Technology Background

- This project is building on prior work by and current expertise of Penn State and other leading research universities and industrial partners, including some who currently own, develop, and operate carbon ore and critical mineral plants in the US.
- CANARY is collaborating with US and State Geological Surveys to review the USGS National Geochemical Database, ongoing efforts of the Earth Mapping Resources Initiative (MRI), historic mining and processing sites (PA DEP data and data from other similar agencies), and data currently held by the project team members (e.g., Penn State Coal Database) and by an expanded PSU Power and Minerals Industrial Stakeholders Group (PMISG) membership.

Technology Background

- To identify information gaps, CANARY will use GIS and Machine Learning applications, to map the resource, infrastructure, and market data in a Data Commons and in accord with NETL RIC geospatial modeling activities.
- Research needs and technology gaps are being assessed, and resources will be targeted for sampling and characterization. This will provide a complete NA CORE-CM value chain basinal assessment to enable quick development of commercial projects.

Technical Approach/Project Scope

- 1. Assessment of Northern Appalachian Basin CORE-CM Resources
- 2. Development of Strategies for Reuse of Waste Streams
- 3. Development of Strategies for CORE-CM Infrastructure, Industries, and Businesses
- 4. Assessment of CORE-CM Technology, Development, and Field Testing
- 5. Development of Strategies for Technology Innovation Centers
- 6. Development of Stakeholder Outreach and Education, including Job Creation Outcomes
- 7. Assessment of Environmental Justice Considerations, Economic Development and Job Creation Outcomes, and Environmental, Safety, and Health Analysis for Products Proposed to be Manufactured From CORE-CM Resources

Technical Approach/Project Scope

Project schedule/key milestones—

- Quarterly reporting, interim reports due Sept 30, 2022,
- Final reports due Sept 30, 2023

The five success criteria for the project include

- 1. Completing all tasks and submitting reports on time as vetted by industrial partners across all segments of the supply chain,
- 2. Providing data for the Energy Data Exchange (EDX) as it is obtained,
- 3. Providing inputs for NETL REESED Sample Data needs,
- 4. Providing resource samples for mineral characterization and analyses and,
- 5. Completing the Phase 1 Final Report

Technical Approach/Project Scope

- Project risks and mitigation strategies

- **Project management**—quarterly and interim report and team/stakeholder's meetings will keep the project on track
- **Technical**—sampling and characterization will follow guidelines developed through the CORE-CM Characterization Work Group
- **Financial**—reputable project developers are providing cost-share and are participating in the monitoring of the progress on a regular basis

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Environmental Justice Considerations

An overview of the Northern Appalachian Basin with respect to environmental justice considerations. The counties highlighted in gray are those "marginalized, underserved, and overburdened by pollution." <u>https://screeningtool.geoplatform.gov/en/#3/33.47/-97.5</u> Excel spreadsheet available by census track

Economic Revitalization and Job Creation

 Data obtained from the Appalachian Regional Commission (ARC) including economic status, infrastructure, etc.



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Environmental, Safety, and Health Analysis

• Evaluating for entire supply chain—exploration, mining, processing, refining, etc.



Resources—Primary and Secondary (Tasks 2 and 3)

- Targets Identified and Historical Data Collected/Historical Samples (Specimens and Cores) Evaluated
 - Acid mine drainage/sludge
 - Clays
 - Tailings impoundments (ash from FBCs, coal, metal mines)
 - Metal slags
 - Coarse coal preparation plant refuse
 - Coal underclays
 - Coal for carbon ore/graphite









Data Commons in PASDA Created to Map ALL Data

- <u>Pennsylvania Spatial Data Access (PASDA)</u> is Pennsylvania's official public access geospatial information clearinghouse. PASDA was developed in 1995 by the Pennsylvania State University and has served as the GIS data portal for Pennsylvania for twenty-six years.
- Data being entered for environmental justice and economic revitalization and job creation considerations along with resource data to map and identify target areas for site access and sampling in Year 2





Infrastructure, Industries, and Businesses (Task 4)

- Initially worked with an undergrad student in identifying major and minor companies in lithium production and feedstock needs. With the addition of a grad student, research has expanded into carbon ore and assessment of infrastructure and workforce needs.
- The student is currently identifying existing infrastructure, industries, and businesses within the basin as part of these supply chains as well as identify gaps in the supply chain.
- Data available through ARC and PASDA.

Technology Assessment, Development, and Field Testing (Task 5)

- One aspect is innovative and sustainable mining techniques. This includes the need to apply new exploration technologies for these very diverse resources. A graduate student is exploring innovative exploration and mining techniques for each of the resource categories. During the assessment, we will determine if any field testing is required for these innovative technologies.
- The second aspect relates to processes to extract, separate, and purify REE and CM. Team members are identifying various processes to be described, will provide descriptions, including TRL levels, and identify sample quantities needed in the future for testing of selected processes (related to Site Access Agreements)

Technology Innovation Centers (Task 6)

- Discussions at May, July, and September 2022 Stakeholder's Meetings
 - Opportunities to have materials analyzed
 - Virtual center—connecting people and companies
 - Large facility to test processes
 - Need to attract private industry
 - Testing may be at different locations with facilities coordinated



Stakeholder Engagement and Education (Task 7)

- Discussions at May, July, and September 2022 Stakeholder's Meeting
 - Continuing to expand Stakeholders group and invited others based on suggestions during the May meeting as we move into Year 2 of CANARY CORE-CM
- Education and Training Needs Identified
 - Training is most needed for displaced workers
 - Awareness is needed for legislators, the public, and environmental groups
 - Involvement of all constituents including DEP.



Plans for the Future

- Oct-Dec 2022: finalize data collection and mapping; set target site selection criteria; map data in Data Commons; continue other tasks
- Jan-Feb 2023: finalize target sites (5-7), complete site access agreements; finalize sample collection/analysis protocols for each site; continue preparation of technology assessments (mining/processing) based on targeted resources
- Mar-Apr 2023: collect samples at target sites, ensuring sufficient sample is collected for potential field testing; complete required analysis of samples
- May-Jun 2023: MINING PA Conference May 8-10—Penn Stater, in person TOC and Stakeholder meetings; present Technology Innovation Center Plan for comment; present Stakeholder Outreach and Education Plan for comment; highlight Northern App CORE-CM resources; begin any field testing of technologies related to collected samples
- Jul-Aug 2023: conclude any field testing of technologies related to collected samples; begin compilation of required reports
- Sept 2023: complete required reports; submit any required samples to NETL

Outreach and Workforce Development Efforts or Achievements

Outreach

- On August 10, 2022, over 60 PA Legislators and their staff toured the Mineral processing, Advanced Microscopic and Mineral Characterization, and Critical Mineral Separation facilities.
- NSF ERVA (Engineering Research Visioning Alliance) Listening Session was hosted by PSU on August 15, 2022, with several regional stakeholders
- CANARY CORE-CM Presentations at SME Pittsburgh/PCMIA meeting October 2021 and October 2022
- Included in presentation to Pennsylvania Aggregate and Concrete Association in September 2022 (targeting SE PA quarries for potential REE minerals)
- Stakeholders Meetings May 25 (in person), July 28 (virtual), September 19 (virtual), 2022

Summary Slide

Following several internal Penn State project team, technical operating committee, and stakeholder's meetings.

- Targets for NA CORE-CM resources were identified.
- Discussions regarding the vision for technology innovation centers and the needs for education and training helped to focus our efforts.
- All CORE-CM resource data and vital statistics for the basin will be housed in Data Commons under PASDA at Penn State that will allow mapping of resources related to environmental justice and economic development and job creation opportunities.
- The team continues to review the resource targets and identify opportunities for sample characterization and collection and continues discussions on the technology assessment, development, and field-testing task.
- Year 2 will feature site selection/site access/sampling/characterization/field testing/technology assessment/MINING PA (May 8-10)

Take away: The Northern Appalachian basin contains numerous resources for carbon ore, rare earth elements, and critical minerals waiting to be recovered in an economically-viable and environmentally-benign way.

Appendix

CANARY Organization Chart

Dr. Sarma Pisupati,

Consortium Director/Project PI Overall Direction/External communications/budgets/contracts

Dr. Barbara Arnold

Consortium Managing Director

Day-to-day operations within the Consortium, Committee Meetings, Data Collection, Reports

Technical Operations Committee

PSU- Drs. Liu, Karamalidis, Burgos, White, Kleit, Bhattacharyya, Wang, Mathews

UK- Rick Honaker

VT- Roe-Hoan Yoon

CSM - Erik Spiller

Tetra Tech –Heather Trexler

Project Advisory Committee

PSU - Sarma Pisupati, Barbara Arnold Tetra Tech – Heather Trexler UK - Rick Honaker VT- Roe-Hoan Yoon CSM - Erik Spiller American Resources Corp. - Mark Jensen USARE- Doug Newby TMRC - Anthony Marchese Materia USA – "Zeke" Moskowitz

Project Gantt Chart

		2	2021						20)22						2023								
	Task Description	Oct	Nov D	ec Jai	n Fe	b Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul J	Jul /	Aug Sep
Task 1	Project Management Plan Update																							
Milestone	Modifed Project Magement report			х																				
1.1	Summary of Environmental Justice Considerations																							
1.2	Summary of Economic Revitalization and Job Creation Outcomes																							
1.3	Environmental, Safety, and Health Analysis																							
1.4	Site Access Agreement																							
Milestone	Completetion of Site Access Agreements											Х												
Task 2	Basinal Assessment of CORE-CM Resources																							
2.1	Characterization and Data Acquisition Plan																							
Milestone	Characterization and Data Acquisition Plan Completion											Х												
Milestone	Stakeholder Outreach and Education Session 1											Х												
Report	Phase 1 Interim Progress											Х												
Task 3	Basinal Strategies for Reuse of Waste Streams																							
Task 4	Basinal Strategies for Infrastructure, Industries and Businesses																							
Task 5	Technology Assessment, Development and Field Testing																							
Task 6	Technology Innovation Centers																							
Milestone	Technology Innovation Center Plan submission																							Х
Task 7	Stakeholder Outreach and Education																							
Milestone Stakeholder Outreach and Education Session 2 Report																								X
Report	Phase 2 Final Report																							Х