

EVOLVE CAPP

Evolve Central Appalachia

VCCER ADVISORY BOARD UPDATE

BLACKSBURG, VA

24 OCTOBER 2023



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ACKNOWLEDGEMENT

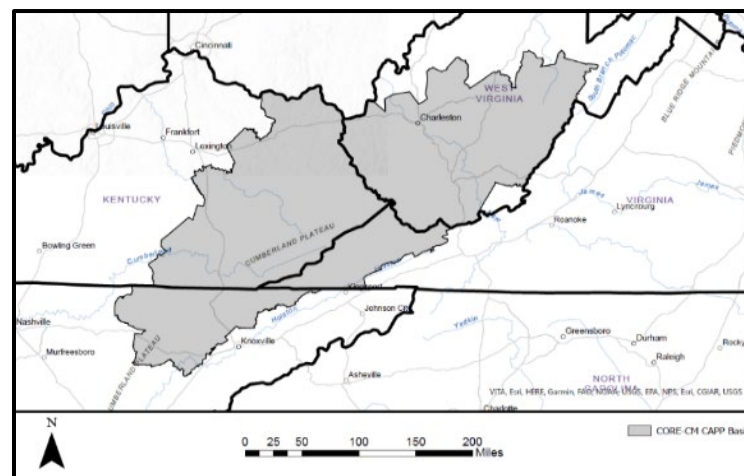
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EVOLVE CAPP IS PART OF AN INITIATIVE FOR U.S. COAL BASINS

- *Expanding & transforming the use of coal & coal-based resources to produce Rare Earth Elements (REE), Critical Minerals (CM) & novel high-value, nonfuel, Carbon-Based Products (CBP), as part of our next generation of domestic U.S. materials*
- *Enable the U.S. to reduce dependency on REE & CM imports & advance new industry*
- *Education & training for technicians, middle-skills workers & STEM professionals*



GLOBAL RARE EARTH OXIDE, METAL & MAGNET PRODUCERS

- Map of Global Rare Earth Oxide, Metal & Magnet producers
- **Only 5 non-China Western rare earth refineries** in operation, construction or recommissioning

Source: Goldman Sachs (July 2023)



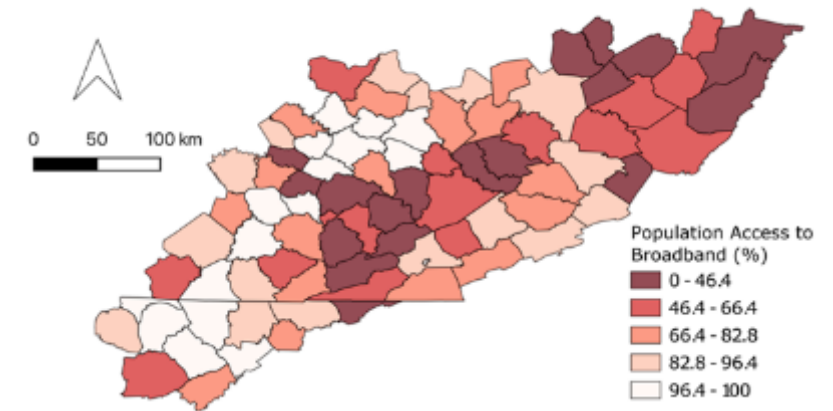
Source: Goldman Sachs (July 2023)

INITIAL INFRASTRUCTURE ASSESSMENT

Screening for various metrics, including:

- Cheapest source of electricity
- Primary & secondary roads
- Power generation
- Railroad networks
- Commercially navigable waterways
- Fly ash pond locations
- Population with access to broadband
- Educational opportunities

CAPP Region Population With Access to Broadband



CAPP Region Railroad Network



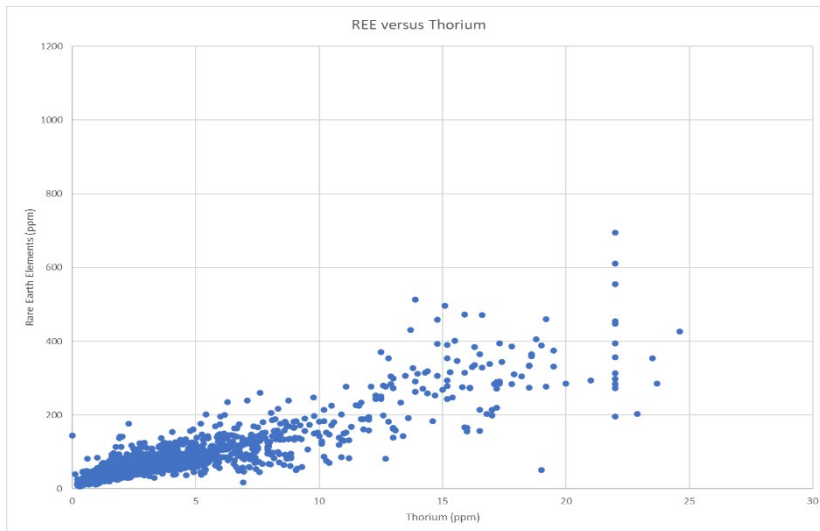
ASSESSMENT OF CORE-CM RESOURCES

- **Initial Sampling:**

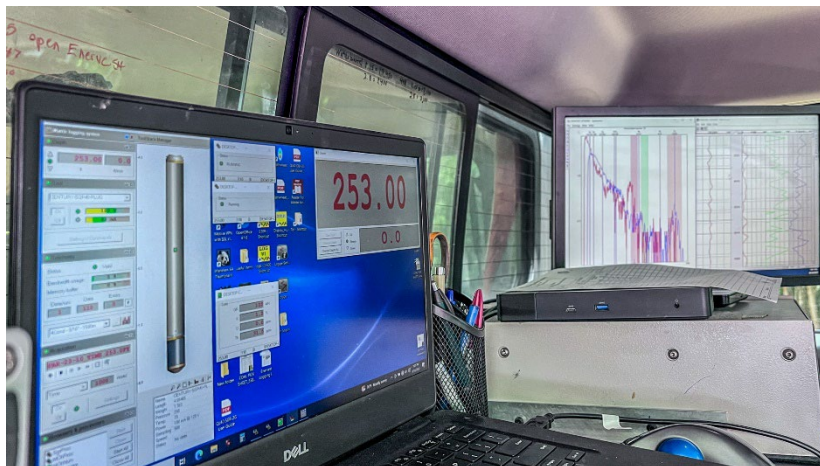
- CCR sampling commenced **September 2022 (25 samples)**
- ESUP drill core samples **September 2022 (19 samples)**
- Produced water sampling commenced **December 2022 (30 samples)**
- Mine sampling commenced **July 2023 (30 samples)**
- Additional samples received since **August 2023 (>144 samples)**



DOWNHOLE SPECTRAL GAMMA



- REEs vs Thorium correlation, detectable w/ Spectral Gamma
- Gamma measured by converting gamma rays to electronic pulses that are measured & counted



P-XRF SCREENING

Core Hole
CH-1-2014 and CH-1R-2014

- Notes:
1. See Map A1 for location.
 2. Datum: Pocahontas No. 9 Seam

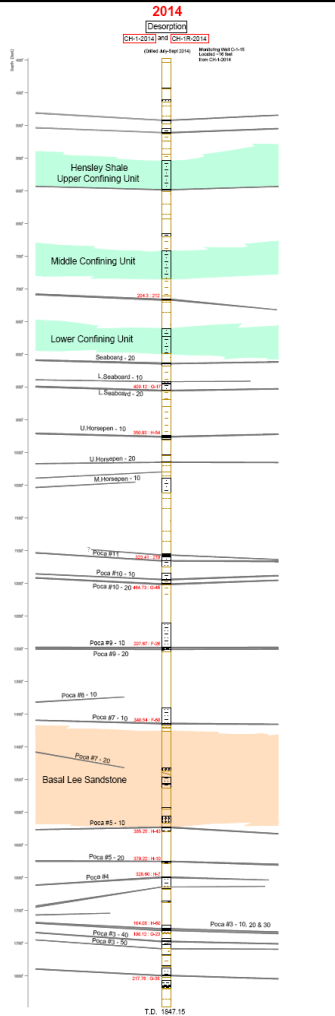
Lithologies

- Bone
- Boney Coal
- Coal
- Coal With Bone
- Fireclay
- Hard Sandstone
- Sandstone
- Sandstone with Coal Spar(s)
- Sandstone with Shale Streak(s)
- Sandy Shale
- Shale
- Shale with Coal Streak(s)
- Unknown Lithology

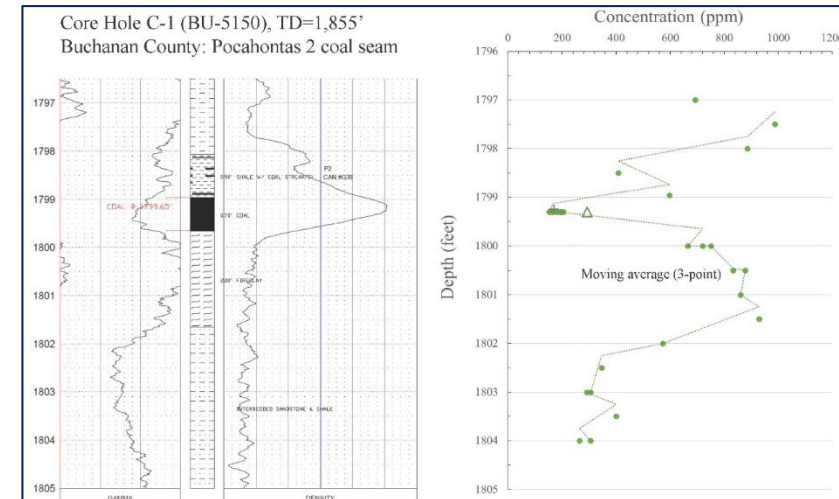
- 2007 CBM Well Completion Year
- Quartz Arenite
- Shale Confining Unit

Core Hole

Description	Gas Content Test	
	scft	Canister ID
204.3		212



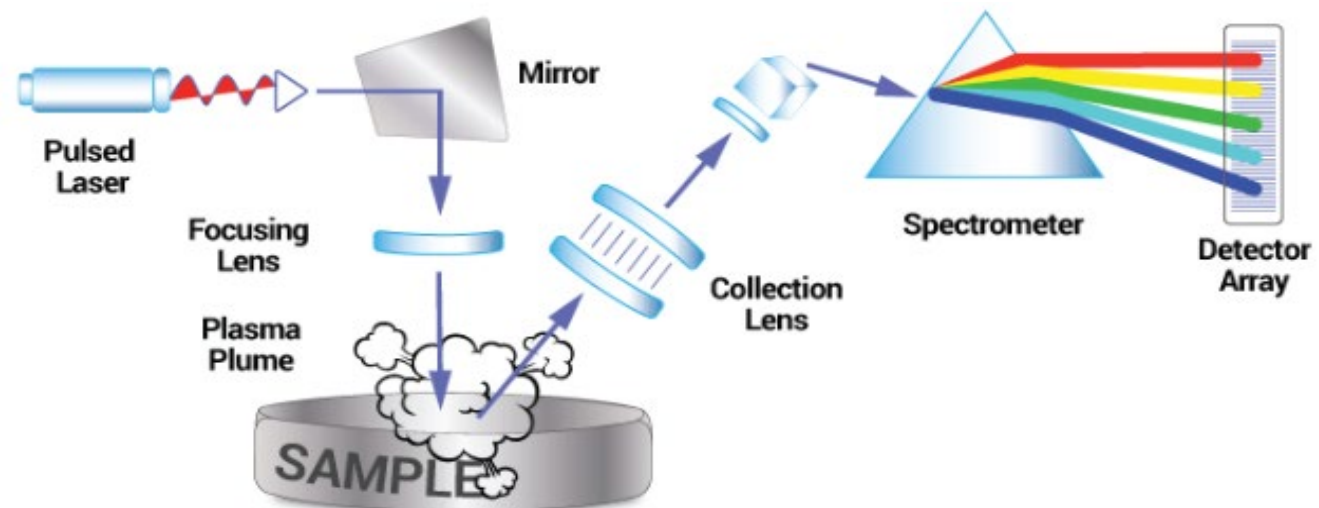
- Analyzing Core Holes for REE-CMs
- Comparing pXRF to LIBS & ICP-MS



LIBS SCREENING



- **L**aser **I**nduced **B**reakdown **S**pectroscopy
- Used >30 years as a lab technique capable of analyzing any element in the periodic table, now available handheld
- A pulsed, focused laser fired at sample to create a plasma.
- As the plasma cools, atoms combine with electrons & emit UV, Optical & IR light compared with known wavelengths



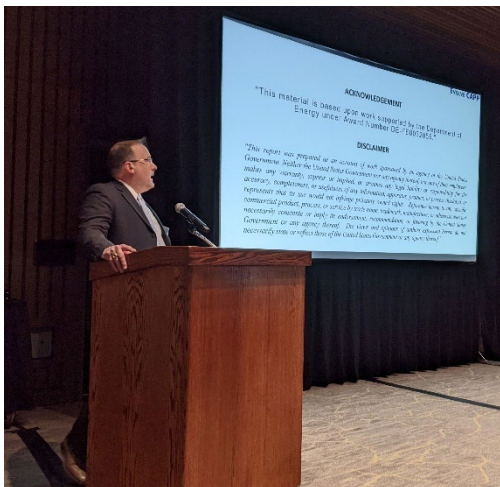
IMPORTANT OPPORTUNITIES IN THE REE INDUSTRY

- Existing conditions in global market & region support establishment / growth of REE industries
- U.S. Government support is essential
- Targeted incentives:
 - Production tax credits
 - Research & development funding
 - Export restrictions or tariffs



STAKEHOLDER OUTREACH & EDUCATION

- *Open Public Session + Stakeholder Mtg: Abingdon, VA, **March 2022***
- *Stakeholder Meeting: Lexington, KY, **December 2022***
- *Open Public Session + Stakeholder Mtg: Julian, WV, **August 2023***
- *Public Outreach, Education & Engagement: **19 presentations to date..***
 - **MCPA, USEA, SSEB, SME, SME-CAS, SME-FL, etc.**



RECENT MEDIA COVERAGE..

CARDINAL NEWS
SERVING SOUTHWEST AND SOUTHSIDE VIRGINIA

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Quest for rare earth elements and critical minerals in Central Appalachia gets new boost

These elements and minerals are found in technological applications like electric cars and smartphones, and are considered essential to the economy. A half-million dollars in new federal funding will extend a project to find new sources for these minerals, including in Southwest Virginia.

by **Matt Busse**
August 7, 2023



A coal waste site in Central Appalachia. The Evolve CAPP project aims to extract rare earths and other critical minerals from sources including waste coal left over from mining operations. Photo courtesy of Evolve CAPP.

VIRGINIA MERCURY

CRIMINAL JUSTICE + POLICING ENERGY + ENVIRONMENT GOV + POLITICS EDUCATION HEALTH COMMENTARY

ENERGY + ENVIRONMENT

Four takeaways from Southwest Virginia's critical mineral investigation

U.S. Department of Energy-funded initiative presents update on research in Central Appalachia

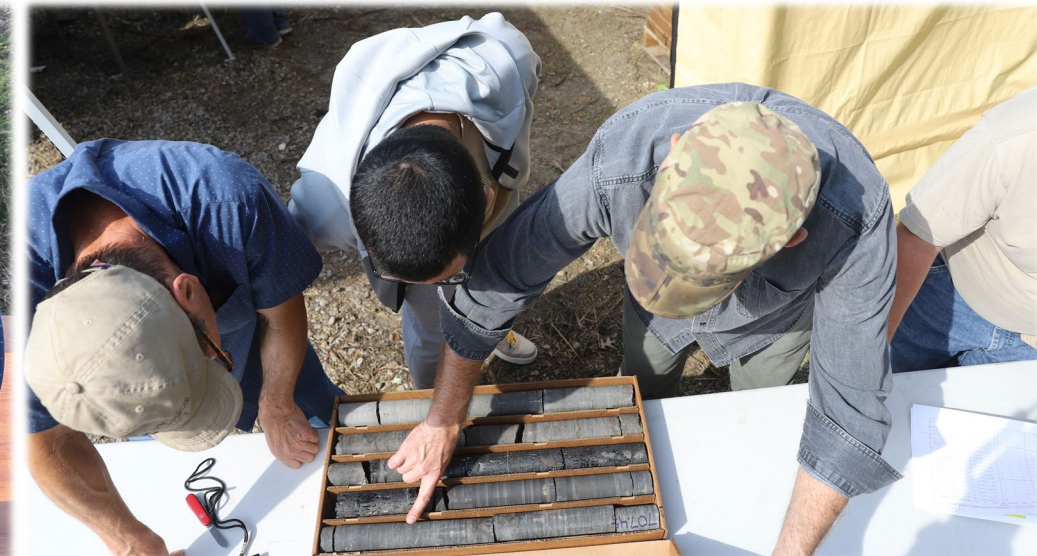
BY: **CHARLIE PAULLIN** - AUGUST 8, 2023 12:02 AM



Big Stone Gap, Va., a historically coal-dependent town in Wise County. (Sarah Vogelsong / Virginia Mercury)

UPCOMING EVENTS

- **November 4, 2023:** Mine Rescue Competition at Training & Conference Center in Julian, WV
- **February 28, 2024:** CORE-CM Technical Session at SME Annual Conference in Phoenix, AZ

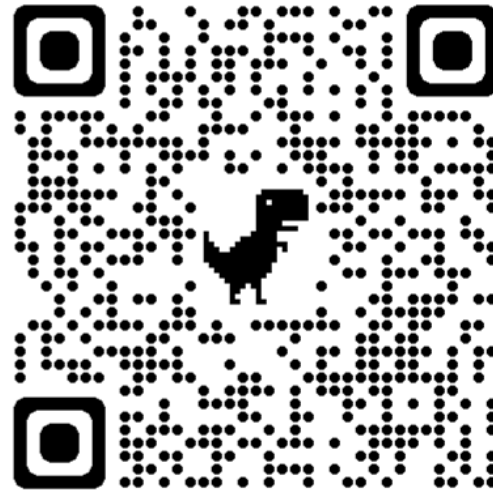


QUESTIONS?

EVOLVE CAPP

Evolve Central Appalachia

*Scan QR code
for more info:*



<https://energy.vt.edu/research/evolve-capp.html>