

REINHOLD ENVIRONMENTAL[®]



2024 Reinhold/PCUG Round Table Presentation

Hosted by LG&E/KU and Co-hosted by Southern Co. and TVA
in The Marriott Resort Lexington Griffin Gate Hotel, Lexington,
KY on June 24-25, 2024

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Beneficial Use of Coal Ash



Tom Kierspe, P.E.
Executive Director, Business Development

2024 REINHOLD/PCUG CONFERENCE
June 24, 2024

AGENDA

- Introduction and Background
- What is Beneficial Use of Coal Ash?
- History of Beneficial Use
- Why Beneficial Use?
- How? Fly Ash Beneficiation Technologies
- Can I Beneficially Use my Coal Ash?
- EPA and Beneficial Use
- Summary
- Beneficial Use Case Study
- Questions?



Introduction and Background

A photograph of an industrial facility, likely a power plant or refinery, featuring a complex network of large, silver-colored pipes and metal structures. The pipes are arranged in a vertical stack, with some labeled "COOLING LOOP". The background shows a clear blue sky and parts of other industrial buildings.

Tom Kierspe, P.E.

Executive Director, Business Development

- The SEFA Group, 2020 - current
- Santee Cooper, 1983 – 2020

Leadership roles in several Lines of Business including Fossil and Hydro Generation, Engineering and Construction, Environmental, Water Systems, Property, and Transmission.

- Licensed Professional Engineer (SC)
- B.S. in Mechanical Engineering, Clemson University
- M.B.A., Charleston Southern University



Where We Have Been, Where We Are Going

- ✓ Began operations in 1976 marketing fly ash
- ✓ Operate Fly Ash Beneficiation Facilities since 1999
- ✓ Developed the STAR® Process
- ✓ Transportation Services
- ✓ Engineering, Construction & Electrical Services since 2005
- ✓ Joined Heidelberg Materials in 2023

Beneficial Use

Expertise

Over 25 Years Operating Recycling Technologies

1999 - Began operating first thermal beneficiation plant for fly ash

2008 – Developed and built first STAR Plant

2015 – Began harvesting legacy ash. SEFA was the first company in the world reclaiming and recycling coal ash from ponds for concrete on a commercial scale.

2024 - Operate and maintain Beneficiation Facilities. Market fly ash in 16 states to over 800 concrete plants. Over 30 million tons of fly ash recycled.



What is Beneficial Use?

Beneficial Use of Coal Ash



[Environmental Topics](#)

[Laws & Regulations](#)

[About EPA](#)

Search 2021 Snapshot



Related Topics: [Coal Ash](#)

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Frequent Questions about the Beneficial Use of Coal Ash

Beneficial Use under the Final CCR Disposal Rule

What is beneficial use?

Beneficial use is the recycling or reuse of coal ash in lieu of disposal. For example, coal ash is an important ingredient in the manufacture of concrete and wallboard, and EPA supports the responsible use of coal ash in this manner. This final rule supports the responsible recycling of coal ash by distinguishing beneficial use from disposal.

Beneficial Use of Coal Ash

Production(Fresh) Ash



Harvested Ash



History of Beneficial Use

Beneficial Use of Coal Ash



Roman Concrete used large amounts of volcanic ash in their structures.



It has been used extensively in the US since 1942 when fly ash was used in the Hoover Dam Spillway Repair Project.

Beneficial Use of Coal Ash

Projects using High Performance Fly Ash Concrete

World's Tallest Building:
Burj Khalifa, Dubai, UAE

Royal Ontario Museum, Toronto, Canada
(An "Engineering Wonder")

One Bryant Park, New York, N.Y.

Metropolitan Museum of Art, New York, N.Y.

San Francisco-Oakland
Bay Bridge, Calif., Eastern Span Replacement

Hoover Dam Bypass, Nev.-Ariz.

I-35W Saint Anthony Falls Bridge, Minneapolis, Minn.

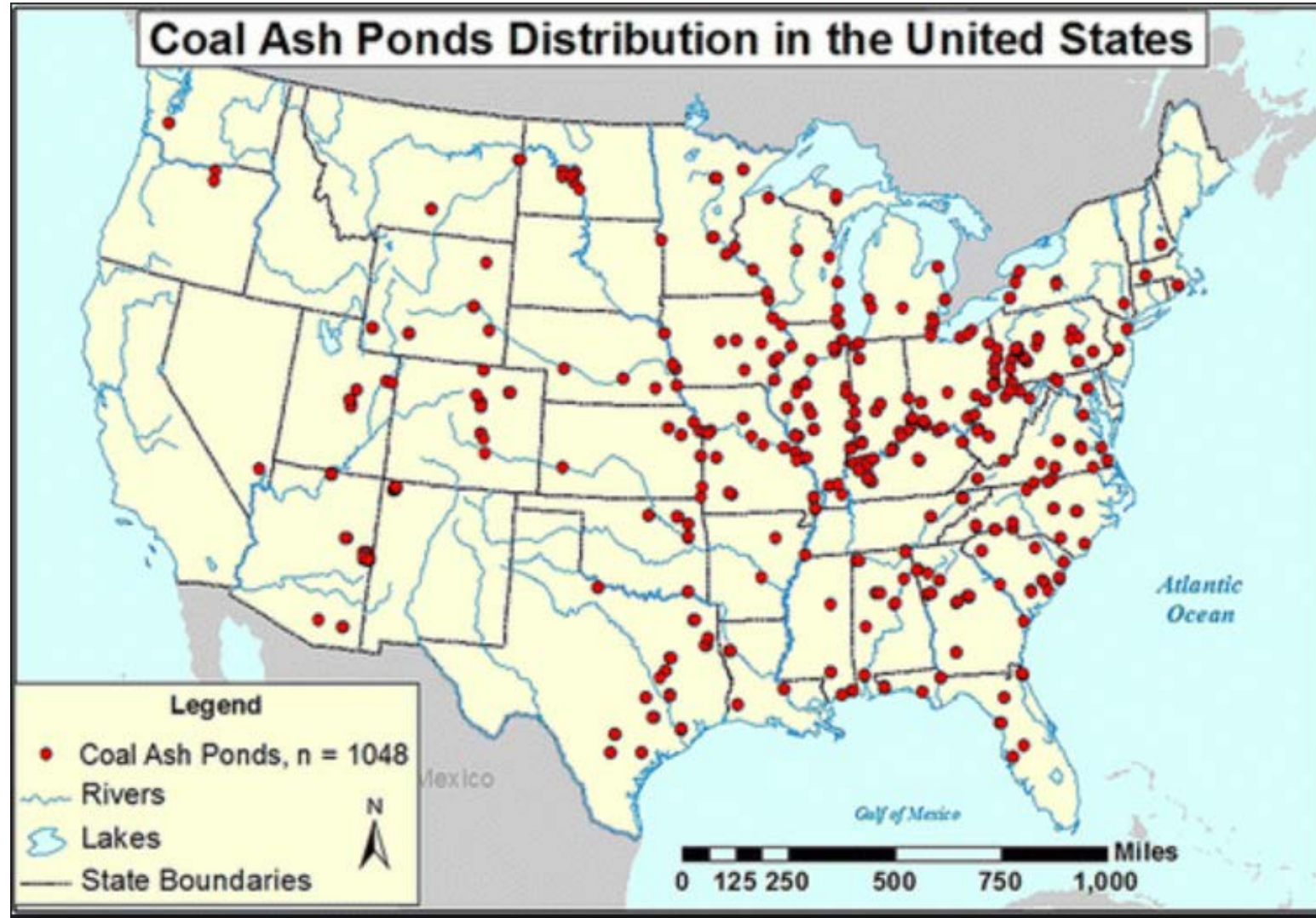
New River Gorge Bridge, Fayetteville, W.V.

Arthur Ravenel Jr. Bridge, Cooper River, S.C.



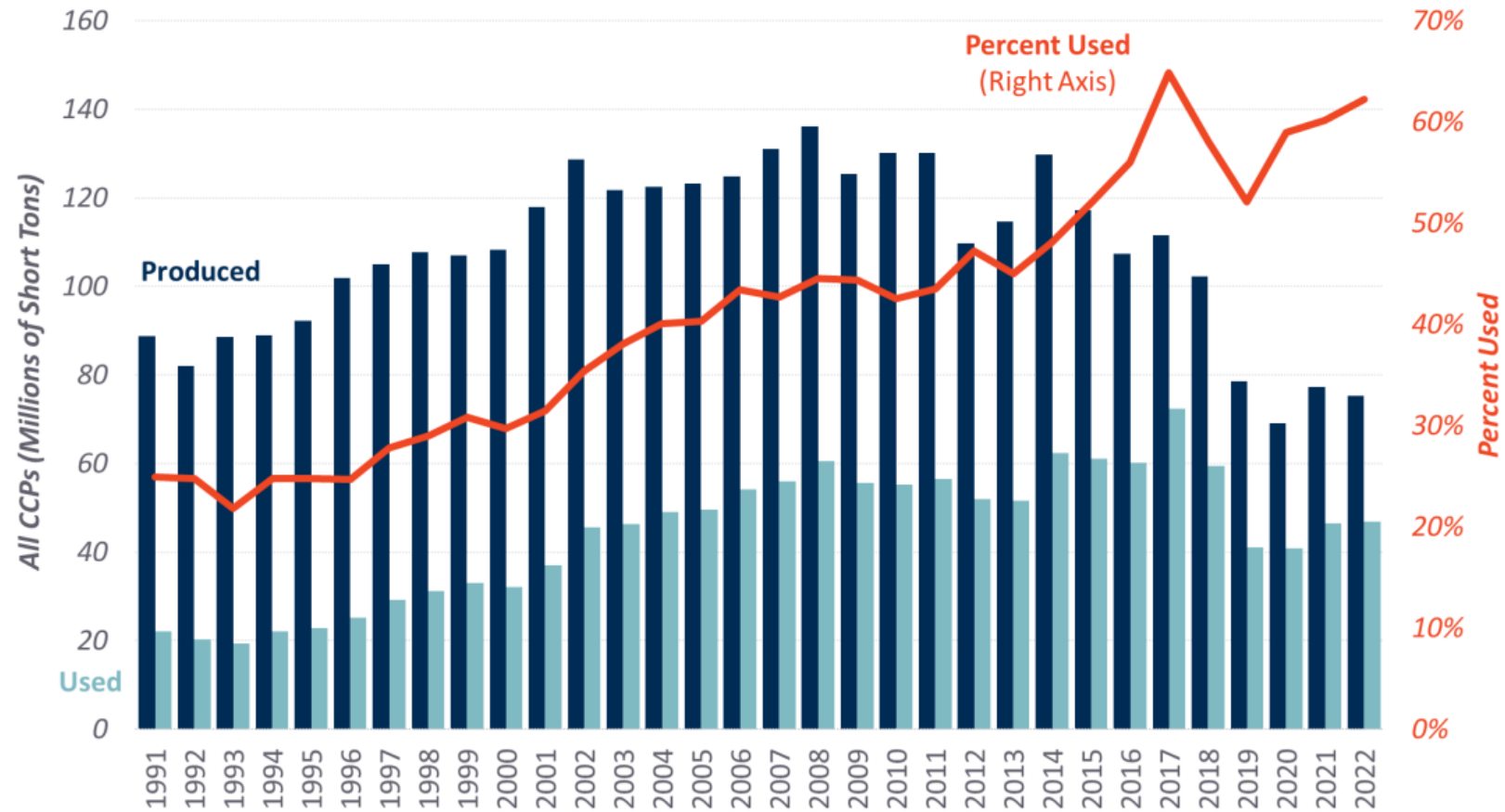
Why Beneficial Use?

Reclaiming Coal Ash for Beneficial Use



Beneficial Use of Coal Ash

All CCP Production & Use (1991–2022)



ACAA 2022 Production & Use Report

Beneficial Use of Coal Ash

Benefits of Recycling in Concrete:

- ✓ Cost Effective (Avoided Disposal)
- ✓ Improved Concrete Properties
- ✓ Reduced Global Energy & Emissions



Beneficial Use of Coal Ash

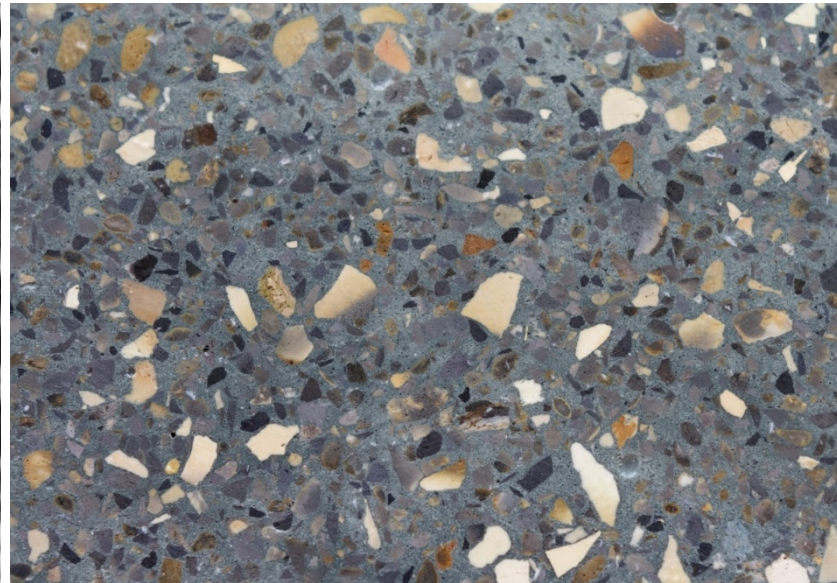
Encapsulated Use vs. Unencapsulated Use

ELECTRON MICROGRAPH



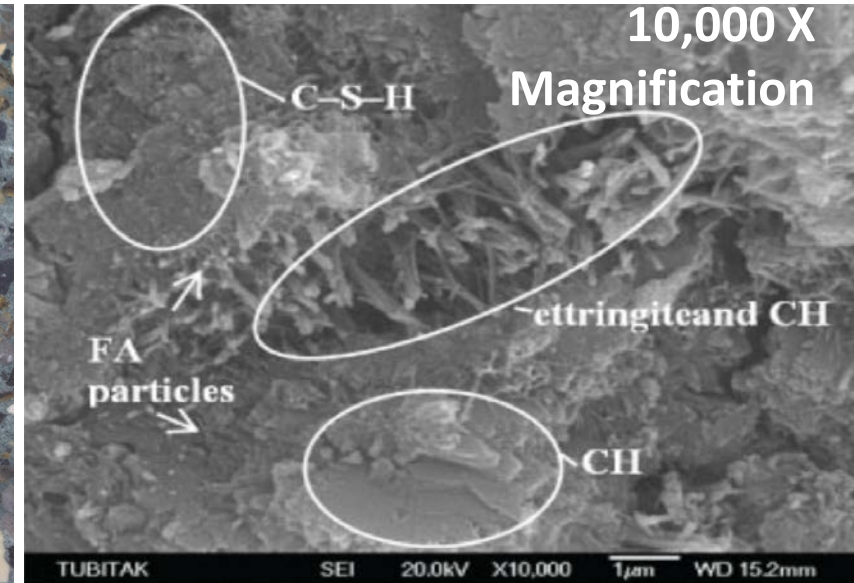
FRESH CONCRETE

CROSS-SECTION OF CONCRETE



HARDENED CONCRETE - 7 DAYS OLD

ELECTRON MICROGRAPH



INCREASED SUSTAINABILITY



*Every ton of coal fly ash used in concrete
reduces carbon emissions by one ton*

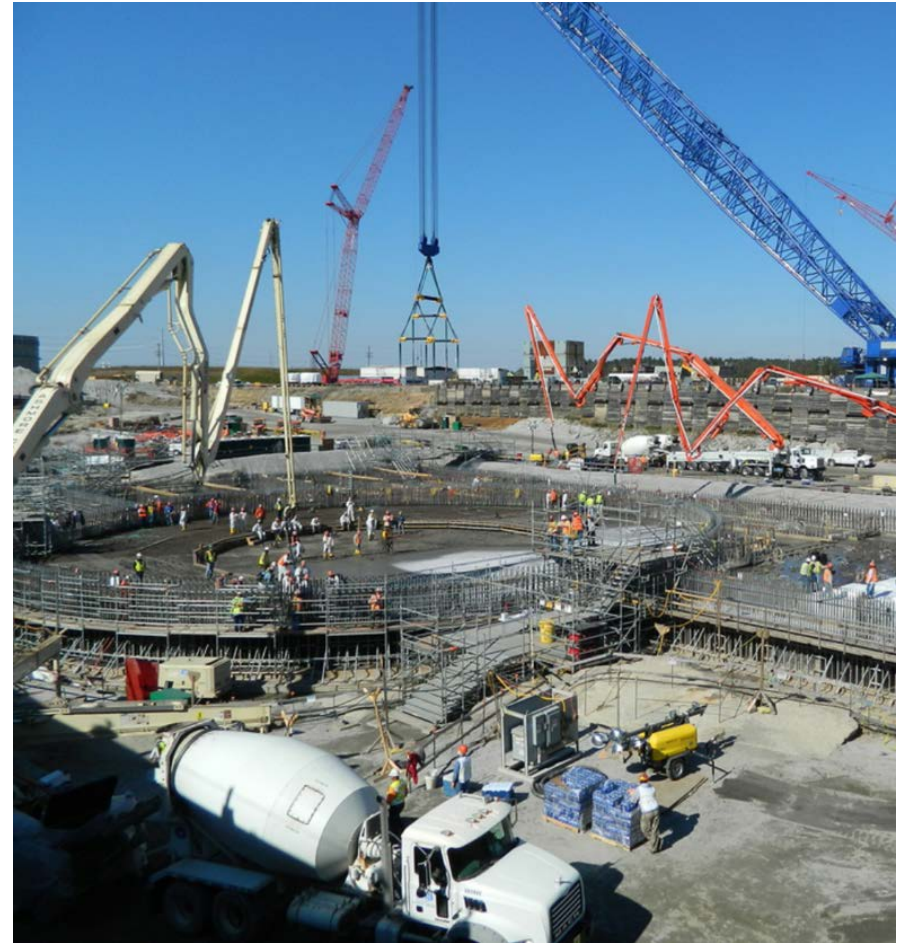
Improved Strength and Durability of Concrete

- ✓ Greater Ultimate Strength
- ✓ Improved Durability / Longer Life
- ✓ Lower Cost of Concrete
- ✓ Proven Environmental Benefits
- ✓ Increased Sustainability

Beneficial Use of Coal Ash



Cement Manufacturing



Concrete Products

How? Beneficial Use Technologies

Coal Ash Beneficiation Technologies

What is Fly Ash Beneficiation?

- ✓ The treatment of raw material to improve physical chemical properties and to make more suitable for subsequent use.

Commercial Fly Ash Beneficiation Processes

- ✓ Chemical Treatment
- ✓ Electrostatic Separation
- ✓ Thermal Beneficiation

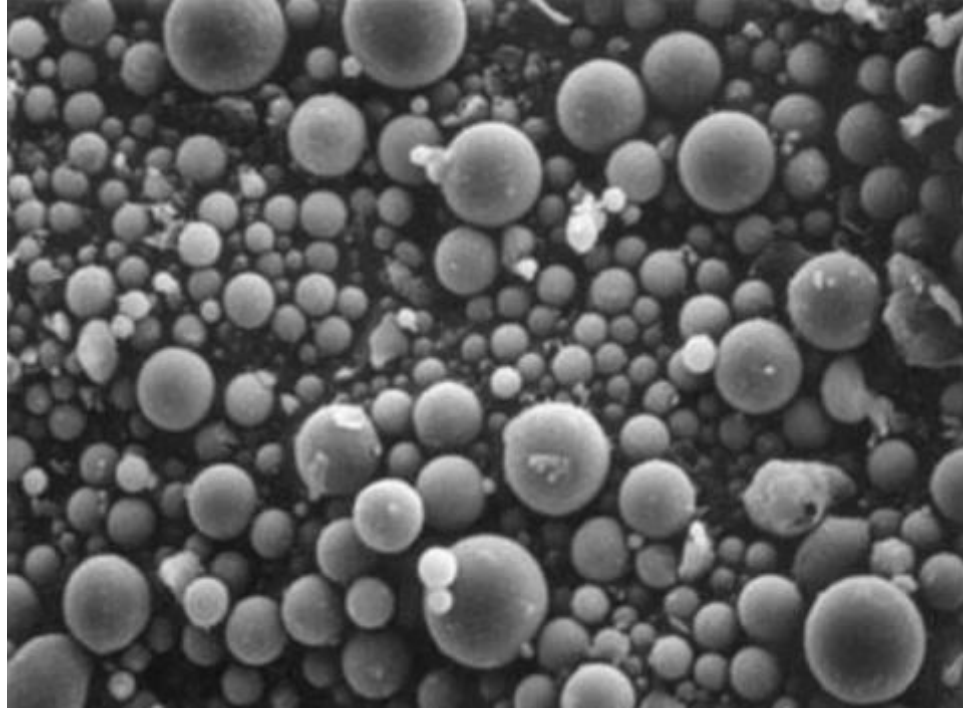
Coal Ash Beneficiation

Chemical Treatment

- Inoculates Unburned Carbon
- Dosage rate varies by LOI and Carbon Type

Product Fly Ash

- Improved Air-Entraining Characteristics
- No reduction in LOI
- No change in Fineness and Strength



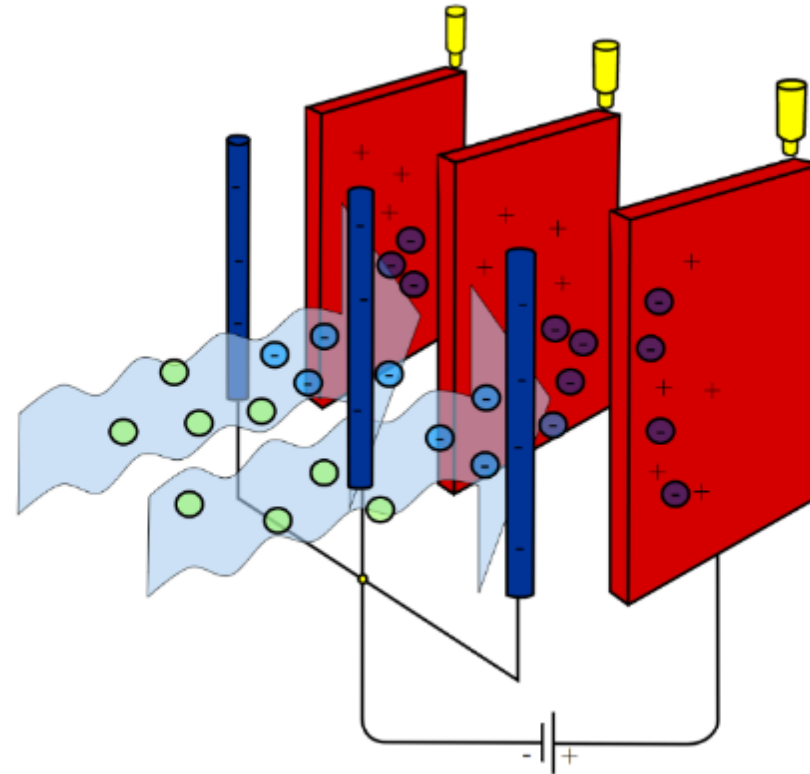
Coal Ash Beneficiation

Electrostatic Separation

- Separates Unburned Carbon
- Two Product Streams:
 - Low Carbon Fraction
 - High Carbon Fraction

Product Fly Ash

- Improved Air-Entraining Characteristics
- Reduction in LOI
- Improved Fineness and Strength



Coal Ash Beneficiation

Thermal Beneficiation

- Oxidizes Unburned Carbon
- Self-Sustaining
- Exothermic Process
- No Solid Waste Stream

Product Fly Ash

- Transparent Air-Entraining Characteristics
- Increased Fineness
- Increased Strength



THERMAL BENEFICIATION

- Self-Sustaining
- Exothermic Process
- No Residual Ash Waste Stream

Premium Product
for Concrete

Pure Mineral
Matter

No
Organics

WASTE HEAT



- Up to 75% of Heat Input Available as a By-Product:
 - ✓ Hot Water / Steam
 - ✓ Hot Air
 - ✓ Hot Oil / Thermal Fluid
- Potential Beneficial Uses:
 - ✓ Boiler Loop
 - ✓ Direct Electricity Generation
 - ✓ Process Steam for Third Parties
 - ✓ Other Uses such as Calcining, Drying, Building Heat, Etc.
 - ✓ Process Reclaimed Pondered Ash

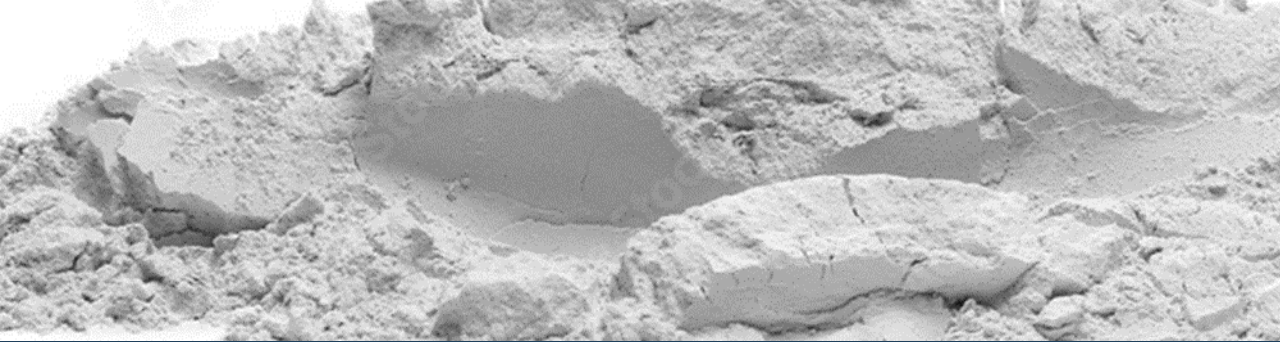
Beneficial Use? Is it an Option?



Evaluation Process

- What's in the storage unit?
- Fuel source(s)?
- Quantities?





Possible Issues

- Gypsum
- Fuel treatments
- CFB
- Vegetation

Characterize the Ash as much as practicable

- Boring plan
- Sampling
- Analyze for constituents



Constituent Analysis

Typically analyze samples for:

- LOI
- Moisture
- Fineness
- Sulfur
- Oxides (Iron, silicon, aluminum)
- Chlorides
- Sodium





Other Considerations

- Transportation
- Markets
- Timeframes
- Environmental Justice

EPA and Beneficial Use

Final Rule – Legacy Coal Combustion Residuals Surface Impoundments and CCR Management Units

[Biden-Harris Administration Finalizes Suite of Standards to Reduce Pollution from Fossil Fuel-Fired Power Plants](#)

Four final rules deliver on the Biden-Harris Administration’s day-one commitment to lead on climate action and to protect all communities from pollution

EPA News Release: Biden-Harris Administration Finalizes Suite of Standards to Reduce Pollution from Fossil Fuel-Fired Power Plants

Release Date: April 25, 2024

Prepublication Copy Notice:

The Administrator of the United States Environmental Protection Agency signed the following document on April 24, 2024:

Title: Hazardous and Solid Waste Management System: Disposal of Coal Combustion Residuals from Electric Utilities; Legacy CCR Surface Impoundments

Action: Final Rule

Docket No.: EPA-HQ-OLEM-2020-0107

Benefits of Beneficiation - EPA

Beneficial use of coal ash can produce positive environmental, economic and performance benefits such as **reduced use of virgin resources, lower greenhouse gas emissions, reduced cost of coal ash disposal, and improved strength and durability of materials.** Feb 21, 2024



U.S. Environmental Protection Agency (.gov)

<https://www.epa.gov> › [coalash](#) › [frequent-questions-abo...](#) ⋮

Benefits of Beneficiation - EPA

The beneficial use of CCR [both encapsulated and unencapsulated] when performed correctly, can offer significant environmental benefits, including greenhouse gas (GHG) reduction, energy conservation, reduction in land disposal (along with the corresponding avoidance of potential CCR disposal impacts), and reduction in the need to mine and process virgin materials and the associated environmental impacts. 245

245 80 Federal Register at 21,329

Utility Options?

Why Harvest?

ENVIRONMENTAL BENEFITS

- removes coal ash from the environment
- reduces use of limited natural resources
- lowers greenhouse gas emissions from producing concrete



STRUCTURAL BENEFITS

- improves durability for longer-lasting infrastructure
- reduces the effect of water on concrete
- improves the strength of concrete roads, bridges, buildings



ECONOMIC BENEFITS

- lowers material costs as a reuse of waste materials
- tax payer savings with longer lasting roads and bridges
- lowers cost of impoundment closures



Removing coal ash from ponds and converting the material for recycled use is an economical and sustainable solution with a variety of benefits.

Questions?

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