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ASH at work

Applications, Science, and Sustainability of Coal Ash

Table of Contents

Message from the ACAA Chair	2
Message from the ACAA Executive Director	4

Features

Plant Bowen: A Potential Model for Future Ash Harvesting Projects <i>By Grant Quasha</i>	6
NEU Leads the Journey to Reduce Carbon Emissions in Concrete <i>By Drew Burns, CAE</i>	8
2022: A Year of Progress Toward Cement's Carbon-Neutral Goals <i>By Mike Ireland</i>	12
Back to the Future <i>By Rafic Minkara, Ph.D., P.E.</i>	16
ACAA to Develop Product Category Rule for Supplementary Cementitious Materials <i>By Anna Lasso</i>	20
'Grave to Cradle' CCP Recycling Innovation Benefits Customers and the Environment <i>By Eric Effinger</i>	24
Value Streams from Coal Fly Ash Ponds and Landfills: Actual Sustainable Gains <i>By Martin Koepenick</i>	28
Matching Demand and Supply for Recycled Ash <i>By John Halm and Jimmy Knowles</i>	32

Also Featuring

Beneficial Use Case Studies	
De Hoop Dam	34
North Dakota Heritage Center & State Museum	36
Perot Museum of Nature and Science	38
Health and Safety: Beware of Fires and Falls During the Holiday Season	39
I'm Glad You Asked	40
6 Questions for Dan Chartier	42
ASH Allies: NMA	44
ASH Classics	46
In and Around ACAA	50
WOCA in Review	52
New Members	56
News Roundup	58
2022 ACAAEF Scholarship Winners	62
ACAA Membership Directory	66
An American Recycling Success Story	70

On the Cover

Proven product environmental performance will be increasingly required for CCPs to be specified in construction projects going forward.





Everything Old Is New Again

By Steve Benza, ACAA Chair

Forty years ago, I made my first appearance in the pages of *ASH at Work*. The brief profile highlighted my role as head of Pennsylvania Power & Light's ash disposal and ash marketing programs, as well as my service on the National Ash Association (NAA) Board of Directors.

A lot has changed since 1982. For one thing, *ASH at Work* has graduated from a four-page newsletter to a four-color magazine. The NAA would change its name to the American Coal Ash Association. Oh, and I no longer sport the shock of brown hair that I did as a 30-year-old.

Likewise, the U.S. coal ash industry itself has matured markedly over the same period. Of the 65 million tons of coal combustion products generated that year, 13 million tons were beneficially used—for a utilization rate of just 20 percent. The remaining 52 million tons were disposed.

The high disposal rates were a top concern for the association at the time. A story in that same issue of the newsletter pointed with pride to the “public relations campaign” that the association helped spearhead to convince Anne Arundel County, Maryland, officials to allow Baltimore Gas & Electric to utilize fly ash from its Brandon Shores Station for structural fill that would underpin an office building and warehouse.

Passage of the enabling legislation “redefines fly ash as a fill material instead of refuse and permits its use in three industrially zoned areas,” the article noted. “The idea of recycling resources is something we need to get into more and more,” Councilman Ronald McGuirk commented at the time.

Indeed.

Fast forward 40 years, and our industry faces a substantially different landscape. EPA has repeatedly affirmed coal ash as environmentally benign and on its website touts the “many environmental, economic, and product benefits” of its

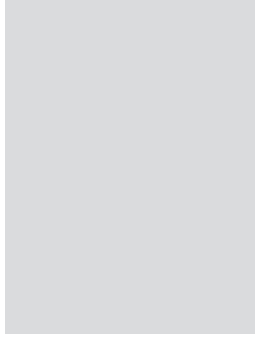
beneficial use. Our customers now well understand the value of CCPs both to their operations and to society as a whole. Beneficial use rates top 50 percent year after year.

Owing both to these high utilization rates as well as the retirement of a portion of the coal fleet, however, current-production fly ash is now often limited by regional or seasonal availability. As a result, previously disposed ash is now increasingly being harvested for beneficial use to supplement current-production ash in the manufacture of an array of high-value concrete products. Yesterday's “refuse” is today's resource—and a vast one at that, with an estimated two billion tons of CCPs stored in landfills and surface impoundments in the United States.

So is that the end of the story? Our industry is left to harvest this resource that can dramatically lower the release of greenhouse gas emissions associated with the manufacture of concrete and produce a stronger, more durable construction material required for the buildout of much-needed infrastructure across the world... and in the process restore erstwhile ash storage sites to their natural state?

If only. It turns out that coal ash isn't the only thing that is highly recyclable. As always, our industry can expect to face the same long-ago disproven arguments about coal ash's “toxicity” regurgitated anew for public consumption in the months and years ahead. It's not about science at this point; it's about keeping environmental lobbyists gainfully employed. We must keep up the good fight. And—as we have in the past—we will win, as the evidence in support of the safe beneficial use of CCPs continues to be overwhelming.

On a final note, this is my last column in my term as ACAA chairman. It's been a pleasure to work alongside the many fine officers, directors, and committees of the association these past two years—in service to the ACAA membership and our industry, the real environmentalists. I wish you all a happy, healthy, and prosperous new year.



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Are We Under-Regulated?

By Thomas H. Adams, ACAA Executive Director

// Regulations” are often characterized as a burden on American businesses. The regulations that have no clear purpose or benefit are the problem. Excessive expense and paperwork that are required to be in compliance consume money and staff time. Massive amounts of money are spent lobbying at all levels of government to deregulate certain industries or markets. Often, the argument is that easing or complete removal of regulation will let the free market determine how much product will flow to consumers and set prices at a level that truly reflects the value society places on a product or service.

This argument is true in many cases. But recent events have me thinking there are some markets that are just too important to leave to the ebb and flow of free market forces or weak oversight. The first is electric power. Reliable, resilient, robust, secure, and affordable electricity supply is vital to our society. Human health, our economy, and our security depend on having the surety of power supply to our homes, schools, hospitals, and businesses. The rush to renewables and the zero-carbon mania on display in recent years put this supply at risk. Being fashionable and righteous about climate change has pushed regulators and generators to make some risky decisions. We have seen grid stability steadily deteriorate, giving us severe weather-related events in Texas and California. Usage of certain appliances has been discouraged during periods of high demand. Yet the aggressive conversion to electric-powered vehicles continues even as we struggle to meet current demand.

Our country would be well served and more secure by committing to a national energy policy that makes use of all types of generation—coal, nuclear, natural gas, and renewables—in a balanced manner. Establishing a non-partisan panel with the authority and oversight responsibility is necessary to make this happen. Allocate to nuclear 20%, coal 20%, gas 30%, and renewables 30% of the market supply across the country. Use the most efficient plants in each grid and operate the plants to meet these targets. Power supply is too important to leave to politicians, environmental activists, or shareholders. I think most Americans would accept some low level of emissions if

it meant our supply of electricity was not at risk. Committing too much power generation to one or two sources puts America at risk.

The other market that troubles me is railroad transport. The largest of our railroads that move commodities that America needs are failing to serve their customers. For as long as I can remember, there have been complaints about rail service, but we learned to live with poor service, indifference to the customer, and high prices. Today, however, we are seeing the impacts of operating strategies and the Covid pandemic making a bad situation even worse. Prior to the pandemic, railroads laid off approximately one-third of their workforce. More were furloughed when the pandemic began. Most of those employees did not return to the railroads when called back from layoff as the economy started to recover. Further, railroads have not invested in the equipment and maintenance required to meet market needs. As a result, power generators wishing to purchase shipments of coal to maintain an inventory sufficient to run a power plant are forced on to a long waiting list as they compete with other industries, such as agriculture and construction materials, for delivery commitments. And then there is the current problem of lengthy, contentious contract negotiations with the 12 unions representing the employees that are still working on the railroads.

Rail transport of commodities is vital to our economy. Food and energy are two basic commodities that depend on rail transportation. As with energy policy, more oversight by non-partisan experts would help solve the problems of running the trains reliably and at a reasonable cost. The objectives of the employee unions and the shareholders of the railroad stocks do not align very well with the need for dependable, affordable rail service.

Sometimes responsible regulation is needed to maintain our standard of living, which is the envy of most of the rest of the world. Responsible regulation would also go a long way to improving homeland security. Europe is learning some severe energy lessons right now. Let's hope America is paying attention.



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Plant Bowen: A Potential Model for Future Ash Harvesting Projects

By Grant Quasha

Concrete is the most widely used man-made material on earth. Global concrete production amounts to approximately 4.4 billion tons annually—or about one thousand pounds per year for every person on the planet. Moreover, its use is projected to grow strongly in the years ahead as requirements for residential construction and infrastructure expand globally.

Over the past several decades, substitution of portland cement with supplementary cementitious materials (SCMs), including coal ash and steel slag, has played an important role in reducing the carbon intensity and cost of concrete, while boosting its performance. However, as coal plant retirements reduce the availability of fresh fly ash, we must boost supplies from nontraditional sources such as previously disposed ash.

The U.S. holds an estimated two billion tons of coal ash in landfills and surface impoundments—a resource with vast potential to be beneficiated for use in the manufacture of low-carbon concrete. Among these deposits is at Plant Bowen in Georgia, where Eco Material Technologies recently contracted with Georgia Power to harvest and beneficiate more than 9 million tons of previously disposed ash.

This partnership represents the largest project of its kind in the U.S. Beneficial use of this ash in concrete construction throughout the Southeast U.S. will prevent millions of tons of carbon dioxide from entering the atmosphere. It further represents a pivotal resource that Eco Material will draw on to realize its vision of doubling the volume of low-carbon concrete products delivered into the North American construction market by the end of this decade (see sidebar for details on Eco Material's corporate vision).

Under the agreement, Eco Material will harvest approximately 600,000 tons of ash per year from the plant's landfill and surface impoundment once operations are running at full capacity. Eco Material is currently building a new plant onsite to harvest the ash and is scheduled to begin ash removal in 2024. There is also the potential to expand operations to a second location and double annual production to over 1 million tons.

As utilities grapple with the requirements imposed by the EPA's Coal Combustion Residuals (CCR) rule—which for many will mean the closure of surface impoundments either in place or by removal of the ash—harvesting projects such as that at Plant Bowen can serve as a model for forward-thinking companies like Georgia Power and its owner-operator The Southern Company. Finding and securing opportunities to beneficially use previously disposed coal ash not only can save space in landfills and surface impoundments, but can also serve as a financial tool to help offset the cost of ash pond and landfill closures for their customers. Eco Material is a great partner for utilities, combining a variety of market-leading technologies for beneficiating ash with the nation's largest ash distribution and

sales network to provide the best value for our utility partners and their ratepayers.

For concrete manufacturers, and society more generally, harvesting coal ash for beneficial use represents a vast zero-carbon resource with which to replace a portion of the cement used in the growing volumes of concrete that the global construction industry is projected to require in the decades ahead. When combined with our company's natural pozzolan and Green Cement® products, Eco Material stands ready and committed to helping the concrete industry achieve its objective of zero-net-carbon status—by 2050 and beyond.

Grant Quasha is the Chairman and Chief Executive Officer of Eco Material Technologies. Previously, he served as Chief Executive Officer for Green Cement Inc. and, before that, he oversaw investments and operations of GFG Alliance's North American Metals business. He received his B.A. from Harvard College, Cum Laude, and an MBA with Distinction from Harvard Business School.

Doubling the Volume of Low-Carbon Concrete Products by 2030

Much has been made of the commitment of global cement and concrete manufacturers to achieve net-zero carbon dioxide emission by 2050. Eco Material Technologies is in the enviable position of being able to supply products and solutions that can help facilitate this transition to a more sustainable global concrete industry. Our new corporate vision is to expand the company's North American leadership position by doubling the volume of low-carbon concrete products delivered into this market by the end of this decade. This multi-pronged strategy will rely on:

Fresh Fly Ash—Existing supplier contracts ensure that the majority of the company's current volumes are secure for the next five years and a substantial portion for the next decade. Eco Material will look to maintain its existing portfolio and seek new contract wins to augment supplies of fresh fly ash over the next five years that will help offset volume declines related to coal power plant closures. Eco Material's industry-leading marketing, storage, transportation, and distribution footprint make us the best choice for utilities looking to safely and efficiently market their ash and provide the best return to their ratepayers.

Landfill Harvesting—Eco Material is already harvesting 100,000 tons annually from its Montour project in Pennsylvania and plans to ramp up production at the site to nearly 500,000 tons per year. Bottom ash harvesting and grinding will commence at a Texas power plant in the first quarter of 2023, which is expected to produce 600,000 tons annually. These projects combined with the harvesting at Plant Bowen, which could eventually add up to 1.2 million tons of ash for beneficial use per year, should position the company well with a future balance between harvested and “as produced” ash. While these projects are a great start, Eco Material is looking to build on this with a further 20 harvesting projects nationwide also under consideration.

Natural Pozzolan Processing—Operations continue to ramp up at the Kirkland natural pozzolan mine, northwest of Phoenix, Arizona. Once it is running at full capacity, the company expects to process up to 500,000 tons annually of this high-quality material for delivery to concrete markets in the southwest. We continue to investigate new opportunities to purchase, develop, and upgrade additional natural pozzolan deposits.

Manufactured Product—Eco Material's PozzoSlag® and PozzoCEM® cements can replace a significant portion of the portland cement required to make high-strength, durable concrete. As they can be manufactured at room temperature from coal ash and natural pozzolans with virtually no emissions, these are near-zero-carbon cements. In addition to growing sales and investing in new capacity of PozzoSlag® and PozzoCEM® at our Jewett, Texas facility, we will be breaking ground shortly on an additional plant that will produce another 300,000 tons annually of these advanced products. We are also evaluating building several more Green Cement® facilities around the nation to manufacture these advanced products, which can replace portland cement at 50-100 percent.

Gypsum—While synthetic gypsum is primarily used in the manufacture of wallboard, it also plays an essential role in cement—and thus concrete—production by slowing the setting of cement to maintain concrete's workability. Eco Material's gypsum division, SynMat, is using portable technology to process synthetic gypsum produced at utility sites and increasing harvesting sales to reach customers in this sector. An additional portable system added at Prairie State Generating Station in 2022 has doubled the capacity of processed material to 700,000 tons annually. The company will look to double this business in the next several years.



8% of global carbon emissions are associated with cement and concrete production. 1.25% of U.S. carbon emissions come from the manufacture of cement.

NEU Leads the Journey to Reduce Carbon Emissions in Concrete

By Drew Burns, CAE

An important step in the drive to meet carbon reduction goals in the concrete industry is American Concrete Institute's (ACI) uniquely positioned Center, NEU: An ACI Center of Excellence for Carbon Neutral Concrete. With the purpose of driving research, education, awareness, and global adoption of the use of carbon-neutral concrete materials and technologies in the built environment, NEU envisions a concrete industry in which all have access to technologies and the knowledge needed to produce and place carbon-neutral concrete and concrete products.

Currently, with the vast information out there, it is not easy for companies to determine the best technologies and materials to use when considering low-carbon concrete options. It is increasingly important that as new materials and technologies come forward, they are verified for their efficacy. NEU is creating a process to validate the claims of innovative and new materials and technologies associated with low-carbon concrete production and placement. With NEU's pathway to validation, those in the concrete industry will be able to evaluate and choose the appropriate method for their application.

Process for Assessment and Validation

The best way to evaluate new materials and technology is through an independent peer review based on claims specific to that product. NEU is developing a process for companies to submit proposals for validation consideration. The policies, procedures, and training associated with this program will be developed by NEU staff and a Validation Committee, which will have program oversight. NEU has outlined the basic phases of validation. These include:

- Initial application and staff review
- Subject matter expert (SME) panel formation
- Review of product, claims, and supporting data
- Report generation and validation committee review/ approval

This program will take an individualized approach with the end goal of validating specific claims put forth by the applicant. NEU is not producing broad reviews of materials or

technologies, but rather each specific product will be verified based on its own individual merits.

NEU foresees accepting proposals beginning in Spring 2023. However, validation is only one of the roles of NEU, and other functions are just as essential to aid in the pursuit of a carbon-neutral industry.

NEU Educates and Supports

Several methods will be pursued by NEU to ensure that information and education about low-carbon concrete is disseminated throughout the industry.

Technology transfer, or the education and dissemination of best practices associated with carbon-neutral concrete, is central to NEU's success. It is important that the industry understands the issues associated with lower-carbon concrete and the advancements being made along the way. NEU will act as a clearinghouse for the ACI information being developed on low-carbon concrete and will develop white papers and educational resources that assist professionals looking to incorporate these practices into their projects. NEU comes with the built-in advantage of being founded by the American Concrete Institute (ACI) and can capitalize on ACI's established network of professionals within industry and higher education institutions worldwide.

Manufacturing a cubic yard of concrete is responsible for the emission of about 400 lbs. of CO₂. That same 400 lbs. of CO₂ is roughly equivalent to the emissions released by burning a tankful of gasoline or using a home computer or microwave oven for a year.

NEU has several resources they will be setting up to provide the industry with vital information, including short courses (virtual and in-person), webinars, training programs (ACI Resource Centers), industry presentations, technical information sheets, carbon-neutral concrete summits, and future professional certification programs.

NEU has already begun making inroads in education:

- A new [Sustainable Concrete Guide](#) is in the works and will be released in late 2022.
- The first three webinars have been released and are on the [NEU website](#).
 - *How ACI Is Working to Address Carbon Neutrality in Concrete*
 - *An Overview of Sustainable Concrete Design*
 - *ABCs of Carbon-Neutral Concrete: LCAs, EPDs, and PCRs*
- Another valuable educational resource on NEU's website is a FAQs section about [carbon-neutral](#) concrete that is regularly expanded and updated.

A special upcoming event is NEU's first Carbon-Neutral Concrete Summit at the ACI Spring Convention in April 2023. This event will include educational sessions and case study overviews presented by industry leaders.



Other objectives of NEU include:

Advocacy and Technical Support. NEU will be able to use ACI's network to help in advocating for the use of sound technical information and the application of existing knowledge.

NEU will keep an eye on local procurement and building code issues, and help the industry find the right solutions to incorporate into specifications, codes, and standards. Additionally, NEU will be a resource for ACI committees in developing language for guides, standards, and codes associated with carbon-neutral concrete materials and technologies.

Technology Acceleration. NEU is envisioned as the gateway for new technologies to enter the industry and can direct necessary resources to accelerate the adoption of those technologies. Currently, no such entity serves the concrete construction industry in this way, and the lack of such an entity is a major hurdle to innovation.

Research. Even though much research and development has been conducted on technologies that support a reduced carbon footprint for the cement and concrete industry, more needs to be done to ensure the effective and efficient deployment of these decarbonization technologies.

Currently, significant resources are being channeled into ideas and technologies that simply will never be implemented. High-risk, high-reward research has its place, but this Center will keep its focus on technologies that experts can support as being realistic, applicable, economical, and technologically effective. It has been said that bringing the cement and concrete industry to carbon neutrality by 2050 is akin to the U.S. mission to travel to the moon in the last century. It will take a well-focused, informed, technologically advanced organization to develop the necessary technologies. NEU will assume the responsibility to work directly with major entities worldwide to achieve the desired outcomes.

International and Student Outreach. NEU will work with international ACI Chapters to help meet global needs. Additionally, empowering and motivating the next generation of engineers and technologists to be actively involved and support the decarbonization efforts are imperative. To this end, NEU will engage with ACI's contingent of student members and student chapters.

Moving Forward

Organizations across the value chain are financially and philosophically supporting and collaborating to execute the Center's objectives. Many companies have committed to help with NEU's mission at various levels of involvement, including Sustaining Members, Supporting Members, Affiliate Members, and Allied Organizations. All are united in the goal of finding the best methods of reducing carbon emissions in concrete.

Involvement is being seen from project owners, specifying agencies, architects/engineers, developers, contractors, material/product suppliers, trade associations, related NGOs, educational institutes, and federal and state agencies.

NEU is only beginning its journey in assisting the concrete industry in this immense transformation toward a greener future. Through the validation of new materials and technologies, as well as educating the industry, reduced carbon in concrete can become a reality.

For more information on NEU and how to get involved, go to www.neuconcrete.org, or email info@neuconcrete.org.

Drew Burns, CAE is Executive Director of NEU: An ACI Center of Excellence for Carbon-Neutral Concrete, where he oversees budgetary, operations, and strategic planning management. Previously, he served as Executive Director for the Slag Cement Association and the Great Lakes Cement Promotion Council. He can be reached at drew.burns@neuconcrete.org or (248) 848-3780.

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SRMG has added advanced blending capabilities in Phoenix and Tucson to increase its supply of Class F fly ash. In Phoenix, SRMG is blending Class C fly ash with Class F fly ash, resulting in an ASTM C618 Class F fly ash. In Tucson, SRMG is blending Class N natural pozzolan with Class F fly ash to produce a product known as Tucson Pozzolan which complies with ASTM C618 Class F requirements. In a market where many are experiencing supply shortages, SRMG continues to provide innovative solutions such as blending and harvesting.



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2022: A Year of Progress Toward Cement's Carbon-Neutral Goals

By Mike Ireland

Released ahead of COP27 in Egypt, the United Nations' latest climate report contained the blunt assessment that 2022 has been a "wasted year" for carbon emissions reductions. Despite this stark statement, I believe cement manufacturers can take pride in the progress made to reduce carbon emissions in the first year of the Portland Cement Association's (PCA) Roadmap to Carbon Neutrality. The Roadmap—an ambitious plan that goes beyond a single process or material and considers a structure's full life cycle—encourages collaboration across the entire cement-concrete-construction value chain to reach carbon neutrality by 2050.

The Roadmap includes the major links of the value chain known as the "Five C's": clinker, cement, concrete, construction, and concrete as a carbon sink. It also prioritizes continued cooperation at each step, demonstrating a commitment to place sustainability at the heart of the built environment.

Many approaches to reduce emissions call for collaboration, but often that task can seem vague or not applicable to one's organization. The Roadmap has specific levers and actions outlined and, while new opportunities to reduce emissions will emerge, this document provides tangible actions that businesses can take in the near term to realize a more sustainable built environment. Readers may find that they are already practicing some of

these recommendations, exemplifying how we can all improve by doing our part. While strides have been made on many levers, working together is the vehicle to our success.

Strong Progress in Year One of the Roadmap

This past October marked the one-year anniversary of the Roadmap, and we have seen companies, plants, private businesses, and cities around the country investing in the innovations and solutions to significantly reduce emissions along our value chain. There is much work to be done, and our industries are doing amazing things that people need to hear about.

We are pleased to report strong progress with our near-term goal of widespread portland limestone cement (PLC) adoption. PLC reduces the footprint of concrete production by about 10 percent and has now been approved by 45 state departments of transportation. Caltrans' adoption in January 2022 was a key win, as California is the largest cement market in the United States. This has the potential to dramatically reduce CO₂ emissions: a four-mile stretch of California's Highway 101 was recently reconstructed using PLC, which Caltrans estimates will cut emissions by 28,000 tons a year—the equivalent of taking more than 6,000 cars off the road. The demand for low-carbon

The "Five C's" of the Cement-Concrete-Construction Value Chain



cement and concrete is increasing as more consumers understand the need for sustainable concrete.

Other cements blended with either limestone, fly ash, or slag can gain even more sustainable benefits for users. But for these blends to be used more widely, there needs to be a shift from current industry approaches and mindsets. It is important to inform cement users of the diverse options available when it comes to cement blends and cement-based products. Educating producers, users, consumers, the government, academia, contractors, the construction industry, and the public has been PCA's hallmark effort for more than a decade.

Beyond incorporating low-carbon cement blends into construction projects, concrete also has many inherent sustainable properties. The reflectivity of all surfaces affects the climate, and the measurement of surface reflectivity is known as "albedo." Cities, especially dense ones where pavement comprises around 40 percent of the urban space, are starting to implement lighter and more reflective concrete pavements that create a higher albedo, absorb less heat, and offset CO₂. This solution is crucial as American cities experience more severe heatwaves.

According to the Massachusetts Institute of Technology, an increase in pavement albedo on all U.S. roads would offer climate benefits that are equivalent to avoiding the CO₂ produced by around 4 million cars driven for one year. Chicago has already incorporated strategies such as installing green or cool roofs and reflective pavements into its long-term planning efforts to help lower urban temperatures.

As decisionmakers realize the inherent benefits of concrete construction, cement manufacturers continue to push forward with innovations to increase efficiency and reduce emissions. Multiple U.S. cement manufacturers are investing in research that will enable them to capture carbon before it is emitted and then store or use it for a different purpose—commonly called carbon capture, storage, and utilization (CCUS). Two PCA member companies have CCUS projects that continue to advance with the help of U.S. Department of Energy (DOE) funding.

PCA is proud of the progress since the Roadmap's launch, and we applaud all our members and partners who have taken first steps in this past year to create and implement solutions needed to bring us closer to a carbon-neutral future.

Progress at the Federal Level

Policymakers at the federal and state levels are also important in this joint effort. Investing in infrastructure should not be a partisan issue; it is something that is good for our nation. As such, our industry advocated relentlessly for the passage of the Infrastructure Investment and Jobs Act in 2021 and saw the plan begin to take root in 2022.

Currently, more than 5,000 infrastructure projects have already been launched in 3,200 counties across the country. The \$550 billion measure will also help finance research and development of CCUS technologies vital to capturing the CO₂ created in the cement manufacturing process and central to our carbon-neutrality plans. Because of this comprehensive legislation and additional environmental provisions in recently passed legislation, we are in a stronger position to reach our sustainability goals than ever before.

As we embark on our second year, we need to leverage this momentum and continue to align with policymakers on both sides of the aisle to ramp up these technologies as well as create the national network of roads and pipes needed to make large-scale carbon capture, transportation, and storage possible. There is more to do at both the federal and state levels. Updating key legislation, including the Resource Conservation and Recovery Act, the National Environmental Policy Act, and the New Source Review program will allow us to reduce emissions at a faster rate, making concrete an even more compelling sustainable building solution for the extreme weather events accompanying climate change.

Next Steps

Much more can be done to accelerate the progress achieved in the past year. The most energy-intensive phase of the value chain is at the cement plant, where two critical materials are produced: clinker and cement. While cement production is a 24/7 process and is inherently energy intensive, there are opportunities to optimize energy consumption and shift away from the use of traditional fossil fuels.

Using alternative fuels and biomass, instead of fossil fuels such as coal or petcoke, reduces the CO₂ created in the combustion process. Moreover, switching to renewable sources of electricity such as wind and solar eliminates the CO₂ created by fossil fuel plants. Today, the industry's fuel mix includes 60 percent coal/



Photo: MnDOT

petcoke, and we want to reduce that amount by a factor of five with a goal of no more than 10 percent coal/petcoke in the mix by 2050.

Alternative fuels are a fraction of the current fuel mix, and there is an opportunity to quickly scale up use to displace traditional fossil fuels. From cellulosic biomass to non-recycled plastics, and residuals from paper and cardboard recycling to agricultural wastes, all these options give spent materials a second productive life.

Current regulations limit the use of non-hazardous secondary materials, even when those materials can be used in lieu of fossil fuels. The unintended consequence of these regulations often means materials that could be fuels instead become waste. Cement plants are already equipped to use alternative fuel materials, provided the supply is available. With the right policies and regulations, alternative fuels could make up 50 percent of the industry's fuel mix.

PCA is also advocating for the use of "transitional" fuels, such as natural gas, while renewable fuel sources become available at scale. Displacing traditional fossil fuels with natural gas in the near term cuts CO₂ combustion emissions by 24 percent. With

the right infrastructure investment, cement producers hope to use fully renewable, non-polluting sources of energy. To leverage these renewable sources of energy, investment is needed in associated infrastructure.

2022 was a year of early progress, but there is no silver-bullet solution to achieve our goal, and challenges lie ahead in 2023. While the landscape may be unknown and always shifting, the horizon and our goal are very much the same. PCA remains committed to staying the course toward carbon neutrality. With your help, we are closer each day to getting there.

To learn more about what each step of the cement-concrete-construction value chain can do to reduce CO₂ emissions and improve sustainability, please visit www.cement.org to read PCA's Roadmap to Carbon Neutrality or contact us at customerservice@cement.org.

Mike Ireland is President and Chief Executive Officer of the Portland Cement Association (PCA). Previously, he served for 12 years as Associate Executive Director of the American Society of Mechanical Engineers. He holds a Bachelor of Arts degree in Industrial Education from Brigham Young University.



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Back to the Future

Coal Ash Harvesting Successfully Deployed in France for Over 30 Years

By Rafic Minkara, Ph.D., P.E.

In the United States, harvesting of coal ash from landfills and surface impoundments for beneficial use is still a young industry. With coal-fueled electricity generation providing a robust supply of ash to concrete and cement markets, there has been relatively little incentive to tap into the nation's vast supplies of previously disposed ash. However, as coal plants have begun to be shuttered over the past decade, continuing demand from the construction sector for high-quality fly ash has spurred interest in harvesting these deposits. Harvesting from both landfills and ponds has now been underway in the U.S. for several years, with a number of large-scale projects expected to be launched in the near future.

Surschiste: A Pioneer in Ash Harvesting

In France, however, coal ash harvesting has a far longer history. Owing to its government's large-scale transition to nuclear power following the oil crisis of 1973-74, the country retired much of its coal fleet decades ago. In 1989, Surschiste, which today is the fly ash marketing subsidiary of GazelEnergie, began harvesting ash deposits at the Hornaing and Émile-Huchet (Saint Avold) power plants in North and East France to help meet the construction industry's ongoing requirements for concrete-grade fly ash.





Surschiste had been founded in 1959 in Hulluch, France, originally to manufacture bricks from shale. As recently as the 1980s, the company produced 50 million shale bricks per year for use in housing construction (see photos on facing page). In 1990, Surschiste sold its brickyard to focus on ash harvesting and has operated the two sites ever since, which are believed to be the longest-running harvesting sites for beneficial use in concrete in the country.

Both the Hornaing and Émile-Huchet sites began receiving and storing ash from thermal plants over 50 years ago. Approximately 6 million metric tons of fly ash was sluiced, in slurry form, into unlined surface impoundments at the Hornaing site, and a further 2.5 million tons deposited in ponds at Saint Avoild. In 1989 at Hornaing, and the following year at Saint Avoild, Surschiste began harvesting these deposits—initially to supplement supplies required to meet

the construction industry's high demand for ash in summer, when there was little availability of current-production ash, with stocks that had been built up during the winter heating season. From 2010 onward, as current-production fly ash supplies throughout the country became increasingly scarce, harvesting at the two sites accelerated.

“To our knowledge, France was the first country to process previously disposed ash,” says Surschiste Chief Executive Officer Fabrice Fayola. As such, the company was forced to devise its own sampling, testing, and processing methods to ensure the fly ash would meet the chemical and physical properties required under the European standard (EN-450) for its use in concrete construction. Surschiste was the first company to succeed in obtaining EN-450 certification for harvested and processed fly ash.



Pretreatment of Harvested Ash

All ash excavated from the impoundments undergoes a lengthy pretreatment to ready the materials for processing. Ash is first dewatered in stockpiles for up to three months, after which the material is screened to remove roots and other vegetation debris. Pretreatment to lower the ash's moisture content enhances the screening efficiency and lowers the energy costs associated with the subsequent drying of the material.

Because the ash contains high levels of moisture even after pretreatment, it must be further dewatered in purpose-built dryers. A variety of dryer designs were tested—including vertical flash dryers, rotary kilns, and thermodynamic dryers—and the resulting ashes assessed for their physical, mechanical, and chemical attributes. Vertical flash dryers were ultimately selected and installed at both harvesting sites.

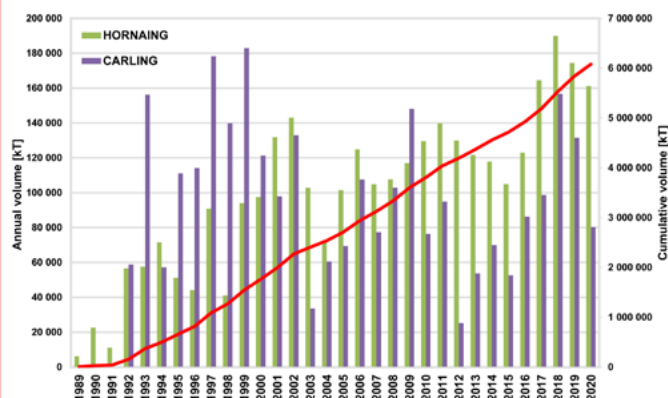
“We opted for vertical flash dryers as recommended by our engineers,” Fayola says. “It was a first-of-its-kind project—a prototype—and is still working very well.”

Hornaing's dryer has a capacity of 50 metric tons, depending on the moisture content of the ash feed, and operates 24 hours a day during the peak construction season of May thru October and in the daytime only during the off-season. Situated near both rivers and highways, its dryer can receive wet ash via barge or truck from other sites. Saint Avold's (“Carling”) dryer has a capacity of 80 tons per hour during the summer construction season and can receive ash from other sites via rail or truck. Up to 350,000 tons of ash are now dried each year at these two sites.

Since the commencement of drying operations in 1989/90, the two sites have cumulatively processed 6 million metric tons (see chart below). Approximately 2.5 million tons remain to be harvested at the Hornaing site and 200,000 tons at Saint Avold. At current market demand rates, that equates to the rough equivalent of 12 years and 1 year of supply, respectively.

Collectively, the two harvesting sites generate approximately 300,000 tons of fly ash annually for the country's construction market (the volume varies year to year based on the availability of fresh ash produced). That amounts to roughly 25 percent of France's total market demand for fly ash and

Output of Dryers at Hornaing and Saint Avold, 1989-2020



Hornaing Process: Drying

- Burner
- Flash Drying Tube
- Hammer Mill
- Cyclone
- Vibrating Screen
- Dedusting (filter bag)

Carling Process: Drying / Separation

- Burner
- Flash Drying Tube
- Hammer Mill
- Dynamic Separator
- Cyclone
- Dedusting (filter bag)

SURSCHISTE in Brief

Turnover: 17 Million €
Tonnage: 515,000 Tons
Staff: 30 People

Quality, Safety, & Environmental Certification



Member of:

ECOBA: European Coal Combustion Association
UFCC: French Coal Ash Association
AFOCO: French Association of Industrial By-Products Operators

Mixing Unit-1: 2000



75 tons/hour
2 Silos 430 m³

Mixing Unit-2: 2001

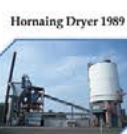


15 tons/hour
2 Silos 2 500 m³
Capacity for an important
construction site

Mixing Unit-3: 2016



80 tons/hour
3 Silos 2 500 m³
Capacity for an important
construction site



Hornaing Dryer 1989
50 tons/hour
+ 120 000 Tons/year
Silo 1 400 m³

Carling Dryer 1990



80 tons/hour
+ 150 000 Tons/year
Silo 5 000 m³



supplies markets in the country's north, eastern, and central regions. Imports are used to supply markets in southern and western France. Approximately 75 to 80 percent of the harvested fly ash is beneficially used by concrete producers; most of the remainder is used to manufacture blended cements; and a smaller portion is used for the production of mortars and specialty binders.

A Continuing Demand for Harvested Ash

Fly ash has been used in major civil engineering and road construction projects in France for many years. The enlargement of the Road Nationale 47 between Lens and La-Basse was built using nearly 50,000 tons of fly ash, 30,000 tons were used in the construction of the Dunkirk methane terminal, and 20,000 tons were used at the Port of Calais. Currently, both the Hornaing and Saint Avold sites are supplying fly ash for the Grand Paris Express, a massive expansion of the French capital city's rail network—adding 68 new rail and metro stations and 200 kilometers of underground tracks—that constitutes the largest transport project currently under construction in Europe.

As is the case in the U.S. and elsewhere throughout the world, coal plants are closing in France at the same time that climate considerations are creating a more urgent need for the use of fly ash as a substitute for cement in the manufacture of

concrete. With perhaps only a decade or so of fly ash supply remaining at Hornaing, Surschiste is evaluating several other existing ash deposits in France and abroad for their suitability to be harvested. The company believes that such sites may contain over 10 million tons of deposited ash.

After 30 years and six million tons of ash harvested at its two existing ash sites, Surschiste continues its pioneering work of supplying sustainable material to the French construction sector—and in the process should provide inspiration to like-minded companies around the world as they begin to develop this heretofore largely untapped resource. Surschiste has hosted many visitors from around the world to learn about their experience in ash harvesting.

Rafic Minkara, Ph.D., P.E., is President of NXT Innovations LLC, a consulting services business in the energy, environment, and construction materials markets with a focus on CCP reclamation, closure and environmental compliance, processing technologies, and beneficial use applications. He has over 30 years of diverse professional experience, including consulting, engineering design, construction management, and research and development in the environmental, construction materials, and utility industries. Dr. Minkara received his BS, MS, and Ph.D. degrees in engineering, as well as his MBA, from the University of Toledo. He serves as Chairman of the American Coal Ash Association Technical Committee.



ACAA to Develop Product Category Rule for Supplementary Cementitious Materials

By Anna Lasso

Sustainable. Green. Eco-friendly. These are all terms that companies and industries routinely use to describe the environmental benevolence of their activities. More often than not, these claims—whether accurate or not—are not based on scientific evidence.

As consumers, investors, and governments increasingly hold companies responsible for their environmental footprint, however, the need has grown for transparent, science-based information on the carbon inputs associated with the products and services they provide. Manufacturers and materials suppliers to the construction industry are under particular scrutiny, as the built environment generates nearly half of global CO₂ emissions.

With this in mind, the ACAA Board of Directors has approved funding of a proposal to create a Product Category Rule (PCR) for supplementary cementitious materials. The PCR is the necessary first step in the creation of an Environmental Product Declaration (EPD), which is increasingly required by project owners. Failure to supply an EPD may be cause for rejection of a material for inclusion in the project.

ACAA is developing the PCR as a joint venture with the Natural Pozzolan Association, as their products are closely related to coal ash in their application and use in concrete mixtures. The associations have retained the services of Smart EPD to guide development of the PCR.

Why Now?

While PCRs and EPDs have already been developed for concrete, cement, and slag, there are currently none covering SCMs such as fly ash. This could put ash marketers at a potential disadvantage where developers require objective information on the life-cycle environmental impact of products used in a construction project.

Consumption of concrete materials is closely associated with public spending. Roughly 40 percent of all concrete in North America is purchased by public agencies, an increasing number of which are implementing low-carbon procurement policies. At the state level, “Buy Clean” policies have been enacted in California, Colorado, Minnesota, Oregon, and Washington that prioritize the use of lower-carbon materials in the construction and maintenance of publicly funded buildings and infrastructure. On the federal level, these policies are being further encouraged by passage of the Inflation Reduction Act of 2022, which includes \$250 million to support the development and standardization of EPDs for construction materials (see sidebar on page 22).

In the private sector, more and more companies have set net-zero-carbon goals for their operations, many of which have included the supply chain-embodied carbon of their buildings in their zero-carbon commitments. Currently, 171 global businesses—including Deloitte, Deutsche Bank, Goldman Sachs, and Siemens AG—have signed the World Green Building

Figure 1. The PCR Development Process



Council's Net Zero Carbon Buildings Commitment. By 2030, these signatories pledge to:

- Reduce all operational emissions of new and existing built assets;
- Achieve maximum reductions in embodied carbon for new developments and major renovations over which they have direct control;
- Compensate for any residual operational and upfront embodied emissions that cannot be mitigated; and
- Advocate for wider emission reductions via their business activities and report on their impact, to enable and accelerate the sector-wide transition to net zero.

Step 1: Development of a Product Category Rule

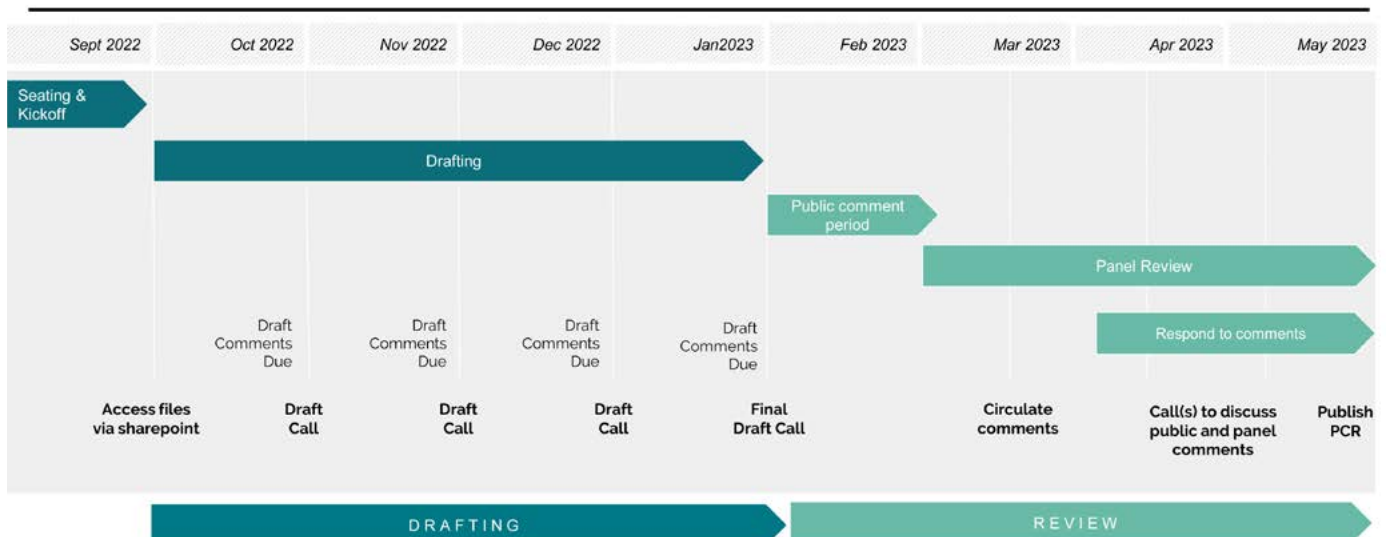
The first step in determining the embodied carbon of building materials and products is the creation of a Product Category Rule. The PCR is the standard that is applicable to a particular product category, such as fly ash, or related SCMs such as ground bottom ash. It provides the guidelines, or the “recipe,” as well as the calculations and reporting requirements needed to prepare steps two and three of the process: the creation of Life Cycle Assessments (LCAs) and product-specific EPDs.

A PCR:

- Defines the rules, requirements, and instructions needed to create Type III eco labels (Environmental Product Declarations);
- Ensures a common, harmonized approach to the underlying LCA studies used to inform EPDs by defining all relevant calculations and methodological decisions as well as EPD reporting instructions;
- Defines what information is communicated in the EPD, how the information is to be used, and the markets of applicability; and
- Is a published yet dynamic document that must be developed and maintained by a Program Operator (Smart EPD) who follows International Organization for Standardization (ISO) 14025 requirements.

Figure 1 above lists the steps that will be taken in the development of the PCR. As documented in the chart, a public call for participation is issued to interested parties, and applications are submitted to participate on the PCR committee. The committee develops a draft document that outlines the calculation and reporting requirements for the LCAs and EPDs. The draft then goes through an open consultation period with interested

Figure 2. PCR Development Timeline



parties and a third-party external review. Smart EPD will synthesize comments and formulate a plan with the committee for addressing and revising the drafts, if necessary. Upon approval of the PCR, it is published and available for public use—and individual companies can then prepare the LCA and ultimately the EPDs for their particular fly ash product.

Step 2: The Life-Cycle Assessment

Life-cycle assessment (LCA) is a method to determine the environmental impacts across a product’s life. Performed according to the PCR, the LCA documents the cradle-to-grave impacts of the product, addressing sourcing and extraction of the material; manufacturing processes; environmental aspects of production; and generation of wastes. Product delivery considerations such as distance to markets are also included. An LCA report containing results, data, methods, assumptions, and limitations is provided to an independent verifier who confirms conformance with the PCR and other applicable ISO and industry standards. While the LCA report for a specific fly ash product would not be made available to the public, certain aspects of the LCA are reported in an EPD and are again verified by an independent party to confirm conformance with the PCR and other required standards.

Product Impacts	
Declared Unit: 1 m ³ of 10,000 psi concrete at 28 days	
Amount Per Declared Unit	
Global Warming Potential	445 kgCO ₂ eq
Emitted	460 kgCO ₂ eq
Sequestered	-15 kgCO ₂ eq
Ozone Depletion	0.000 kgCFC11eq
Acidification	2.96 kgSO ₂ eq
Eutrophication	0.09 kgNeq
Smog Formation	0.61 kgO ₃ eq
Primary Energy Demand	3017 MJ
Non-renewable	3000 MJ
Renewable	17 MJ

The Need for Transparency

Transparency, which is tenable through greater availability of verifiable information, is increasingly seen as part of the solution to complex social, economic, and environmental issues. Accurate and easy-to-find environmental information empowers public officials, corporations, workers, and consumers to make informed decisions that impact our well-being.

With the increasing demand for lowering carbon in a wide range of products, project owners are beginning to insist on EPDs for all materials. Failure to provide an EPD may be cause for exclusion from bidding opportunities. For specifiers, architects, and engineers, EPDs allow them to choose the most sustainable options for their projects. Manufacturers, such as ready-mix concrete producers, are able to market the carbon transparency of their products.

EPDs demonstrate a manufacturer’s commitment to measuring and reducing the environmental impact of its products and reporting these impacts in an objective way. EPDs dissuade manufacturers from engaging in “greenwashing,” encouraging them instead to report factual, third-party-verified data that delineate both the good and the bad about the environmental performance of their products.

Step 3: The Environmental Product Declaration

An EPD is a transparent, verified report of the environmental impacts of product manufacturing. Also known as Type III Environmental Declarations, EPDs are product labels developed by industry in accordance with ISO Standard 14025 (ISO 2006). They are developed using LCA procedures and follow the industry consensus methodology described in the governing PCR document. As specified in ISO 14025, EPDs undergo third-party verification before being published.

An EPD Program Operator oversees the independent third-party verification process of the LCA and EPD to assess for conformance to the PCR. While ISO 14025 has defined specific requirements for the PCR review, LCA, and EPD verification, ISO itself does not review the credentials of critical reviewers or enforce any standards. After the successful completion of the review process, the Program Operator will publish the EPD, which would typically remain valid for a period of five years.

The Inflation Reduction Act of 2022

The Inflation Reduction Act aims to drive aggressive emissions reduction and low-carbon procurement within the building sector. Green building and policy leaders have determined that the Act has the potential to reduce over 200 million metric tons of carbon dioxide emissions annually by 2030. It includes the following investments in green procurement, which all require EPDs to be accessible:

- \$250 million for environmental product declarations assistance
- \$100 million for low-embodied-carbon labeling for construction materials
- \$2.15 billion for use of low-carbon buildings
- \$2 billion for low-carbon transportation grants
- \$4 billion for improving climate resilience of affordable housing

Anna Lasso is Managing Director and Chief Executive Officer of Smart EPD, a Program Operator focused on fully digitizing Environmental Product Declaration (EPD) workflows to allow efficient creation of EPDs at scale. A Life Cycle Assessment Certified Professional, Anna has MS degrees in Mechanical Engineering and Technology Policy from MIT and BS degrees in Industrial Design and Industrial Engineering from North Carolina State University.

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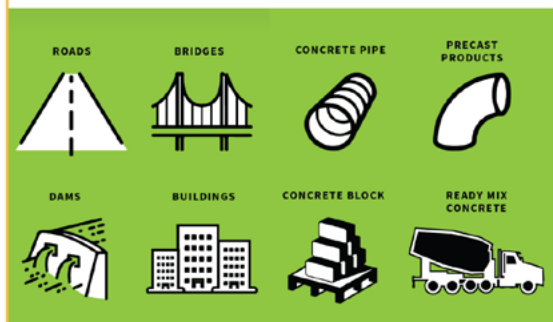
JoeLa@WasteConnections.com
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'Grave to Cradle' CCP Recycling Innovation Benefits Customers and the Environment

By Eric Effinger



Fly ash improves concrete durability, strength, mixability, and finish. This concrete is used to build infrastructure to keep the economy moving.



FOR EVERY TON OF FLY ASH USED TO REPLACE TRADITIONAL CEMENT, .87 TONS OF CO₂ IS SAVED FROM ENTERING THE ATMOSPHERE.

Innovation has always been a key driver in the coal ash industry, and it remains critical today with leading companies actively developing groundbreaking technologies, processes, and services that not only solve complex problems but create new revenue sources. Innovation benefits utilities by supporting their aggressive environmental goals, while it also benefits the environment through sustainable practices that conserve virgin resources, reduce or eliminate greenhouse gas emissions, decrease landfill disposal, conserve and protect water, and remediate land for reuse. Our industry's work is one of America's best examples of resource conservation and recovery through the recycling of coal ash and other coal combustion products (CCPs), ash harvesting, ash beneficiation, impoundment closure services, and the remediation of land. It is a story that does not receive nearly enough credit in the mainstream media as we work and innovate day in and day out to make our planet a better place to live.

The recycling and beneficial use of coal ash and other CCPs is a growing business. According to the ACAA's 2020 Production and Use Survey, 59% or a total of 40.8 million tons of the CCPs produced across the country were recycled, saving over 35 million tons of CO₂ from entering the atmosphere. Looking back over the last 10 years (2011 – 2020), the percentage of CCPs that has been beneficially recycled increased by 15% with approximately 536 million tons of CCPs recycled over this period, representing a CO₂ savings of over 466 million tons. During this time frame, innovative technologies and processes have been introduced to make recycling CCPs more cost effective, and new products that utilize recycled CCPs have been developed that better meet the needs of utility customers and significantly benefit the environment.

For over 40 years, CCPs have been regulated as nonhazardous materials by the states under Subtitle D of the EPA's Resource Conservation and Recovery Act (RCRA) to encourage "cradle to grave" management of these products. While RCRA gives the EPA the authority to control hazardous waste from "cradle to grave"—which includes the generation, transportation, treatment, storage, and disposal of hazardous waste as well as a framework for the management of nonhazardous solid wastes like CCPs—the term is also a fitting metaphor for the coal ash industry's focus on recycling and conservation. Perhaps the terminology that the EPA really should use is "grave to cradle" or "cradle to grave and back to cradle," as our industry gives entirely new life for these CCP products through recycling and reuse.

While recycling of current-production fly ash has increased over the past decade—from 39% in 2011 to 65% in

2020—the continuing shuttering of coal plants, and resulting decreased supplies of fresh fly ash, has meant having to develop new and more economic ways to access fly ash to meet market demand. This EPA policy has helped clear the way not only for industry innovation to develop the products that utilize recycled CCPs, but also for new methods in which we harvest and prepare these products for recycling.

Let's take a look at the innovative ways in which our industry is beneficially recycling CCPs to meet the “grave to cradle” management objective and how these solutions benefit the environment and utility sustainability goals in the process.

Beneficial Use of CCPs

This process starts at the utility level by burning pulverized coal in a boiler furnace, which creates both bottom ash and fly ash. The bottom ash is mechanically collected at the bottom of the boiler furnace, whereas fly ash is captured by routing flue gas through electrostatic precipitators. FGD gypsum is produced in a separate process via the removal of sulfur and oxides from power plant flue gas streams by emissions control systems (“scrubbers”). These CCPs, including fly ash, bottom ash, conditioned ash, ponded ash, and gypsum, are managed throughout the process, collected, and then beneficially used in products for multiple industries, giving them new life through sustainable processes.

The beneficial recycling of these byproducts not only dramatically reduces greenhouse gas emissions but also decreases landfill disposal, conserves and protects our waterways, and remediates land for reuse—all while conserving virgin resources.

Dry Fly Ash for Ready-Mix Concrete

Class C and Class F fly ash that meets specification grade is collected at the utility and transported via truck, barge, or rail to ready-mix concrete producers where it is beneficially used in the production of green concrete to meet the growing infrastructure demand—providing an environmentally friendly replacement for portland cement in the production of ready-mix concrete and concrete products such as America's network of roads, bridges, and infrastructure. In fact, many federal and state regulations now require the substitution of fly ash for traditional portland cement. Per the EPA's Waste Reduction Model (WARM), for every ton of fly ash used to replace traditional cement, 0.87 tons of CO₂ is saved from entering the atmosphere. Green concrete using recycled fly ash not only lasts longer, is more durable and better performing, but is also more sustainable by beneficially using ash that would otherwise be stored in landfills or ponds. These industry efforts support infrastructure built with green concrete that has a lower carbon footprint while preserving virgin raw materials and providing a higher-standard product at a lower cost. The recycling of fly ash also greatly contributes to meeting Global Cement and Concrete Association (GCCA) member companies' commitment to producing carbon-neutral concrete by 2050.

Encapsulated Conditioned Fly Ash for Structural Fill

Conditioned fly ash that does not meet specification grade for use in concrete production can be used in certain instances in structural fill projects, where it is encapsulated with an engineered base and cap liner system meeting applicable regulations. Upon completion, this land is reclaimed and used for community or commercial use, allowing for thousands of acres of land to be returned to use each year. Encapsulated fly ash has been used as structural fill for years to construct stable base layers for roads, bridges, airfields, and large buildings across the country as it is stronger, cheaper, and easier to work with than other materials while also conserving natural resources.

Ash for Kiln Feed

Ponded and conditioned ash is recycled and used to replace virgin raw materials as a component of raw kiln feed in the manufacturing of cement, serving as a source of SiO₂, Al₂O₃, and/or Fe₂O₃ in the kiln feed. This raw feed substitution not only saves energy by improving clinker burnability, but equates to lower carbon dioxide emissions while conserving natural resources.

Gypsum for Drywall

Raw gypsum byproduct from the utility is sold to drywall manufacturing plants where it is beneficially used in residential and commercial construction projects. The use of this raw gypsum product conserves virgin natural gypsum resources that would otherwise have to be mined for use in drywall production.

Gypsum for Kiln Raw Feed

Gypsum is used as a kiln raw feed replacement in the production of portland cement when added to clinker.

Gypsum for Agriculture Fertilizer

Raw gypsum byproduct is sold to agricultural growers, who use it as fertilizer to enhance soil health and improve plant nutrition, again conserving virgin natural gypsum and replacing the need for other fertilizers.

Ash Harvesting and Beneficiation

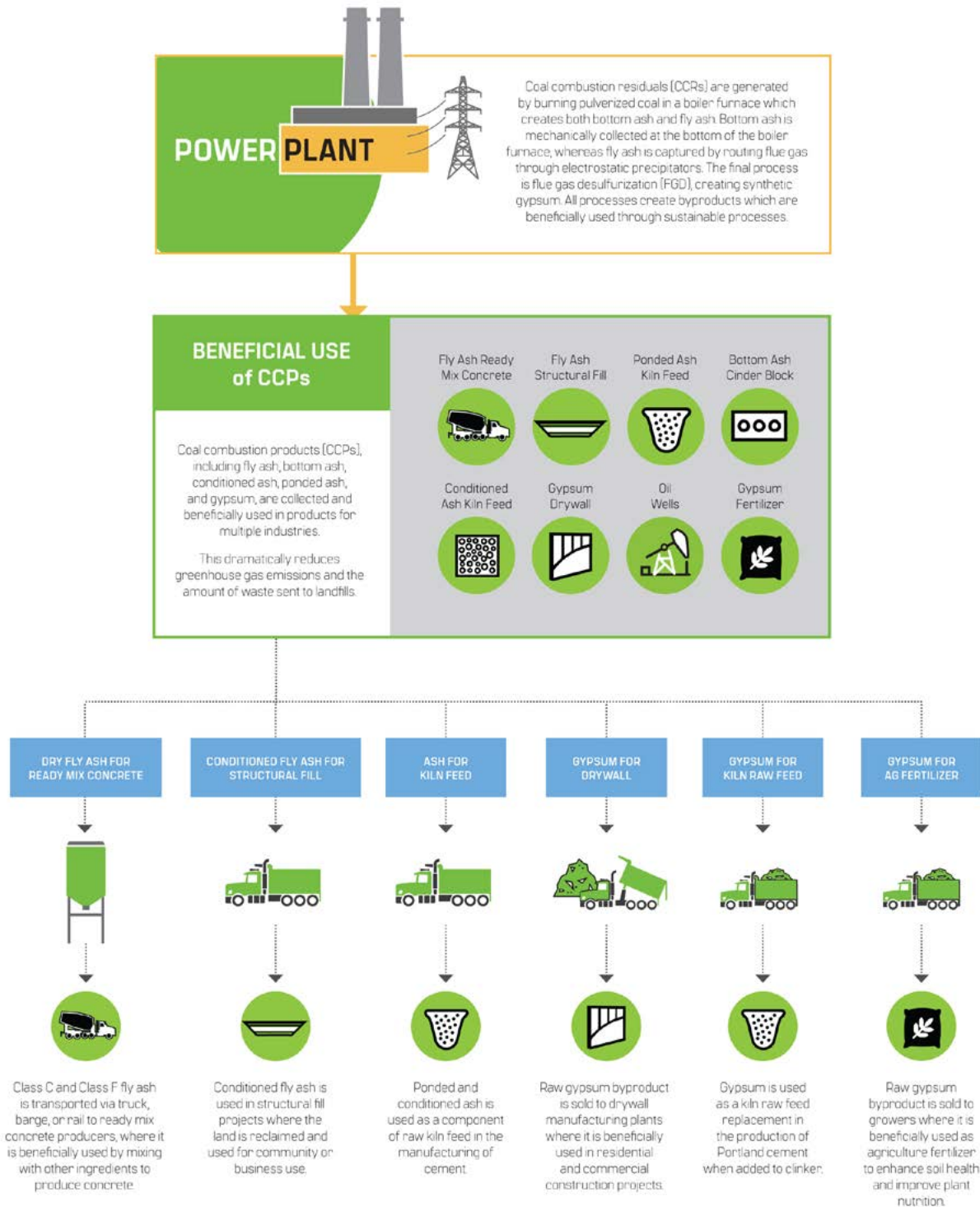
Ash was historically sent to ponds and landfills before beneficial use became more prevalent. In the more recent past, ash that is too high in carbon content or too coarse to meet specification for use in concrete or cement production has typically also been sent to a pond or landfill. Through the use of new ash harvesting techniques and innovative ash beneficiation technologies, this high-carbon ash can be removed from legacy ponds, landfills, and impoundments and beneficiated to produce specification-grade fly ash that is recycled and sold to ready-mix producers for use in the production of green concrete.

Charah Solutions' proprietary EnviroSourceSM fly ash technology beneficiates ash through a thermal process to reduce the loss on ignition (LOI) of the ash while also sizing the material through grinding to meet ASTM specifications—making formerly unusable fly ash stored in ponds or landfills immediately marketable. This technology reduces the need for landfills, ponds, or other disposal methods while significantly increasing the tonnage of fly ash used in concrete and vastly decreasing the use of natural resources. EnviroSource fly ash beneficiation technology supports power industry customers across the nation as they work to meet their sustainability goals and address the more than 1,000 regulatorily mandated

surface impoundment closures resulting from tightening federal and state environmental regulations.

Ash Pond Land Remediation

Through the closure by removal of onsite ash ponds at utilities across the country, land is remediated and redeveloped for community use; renewable energy; and agricultural, commercial, or other industrial redevelopment opportunities. This remediated land can be used to build parks, green spaces, or natural habitats benefiting the environment and our communities at the same time.

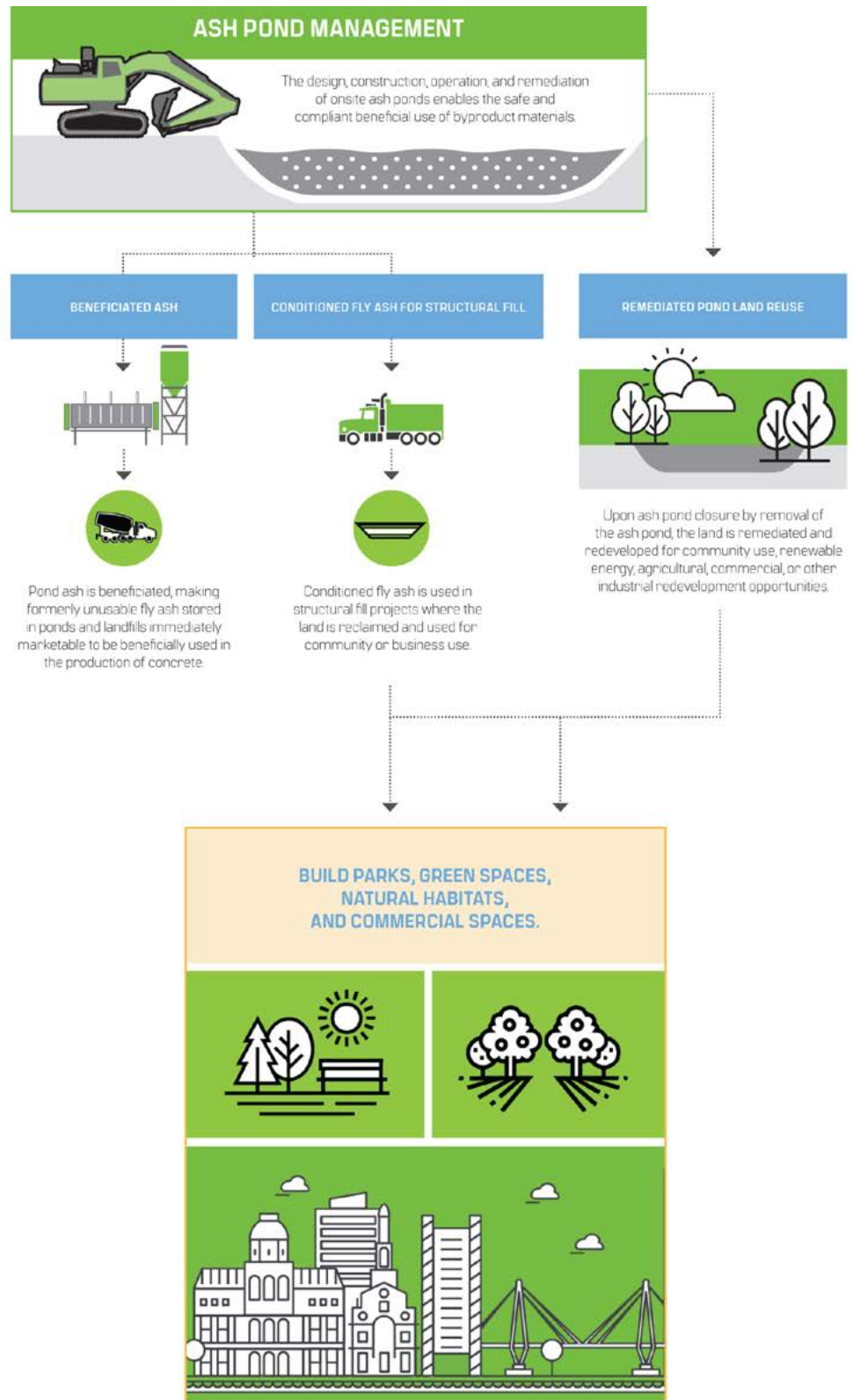


Innovation That Delivers Results

It is quite remarkable to look back over the last 40 years since the EPA implemented RCRA to understand just how many innovative technologies and processes have driven our industry to solve very complex environmental problems while creating jobs and new revenue streams. This innovation has not come at the expense of the environment or the communities in which we work and operate.

Through the use of new and efficient sustainable practices, our industry today continues to conserve virgin resources, reduce greenhouse gas emissions, decrease landfill disposal, conserve and protect water, and remediate land for reuse while meeting aggressive EPA and utility customer environmental goals. These “grave to cradle” innovations continue to drive results in CCP recycling that meet the RCRA challenge and make our planet a better place to live today and far into the future.

Eric Effinger is Vice President of Operations at Charah Solutions Inc. A registered professional engineer and certified project management professional, he has over 15 years of experience executing and managing large-scale heavy civil construction and utility-related projects throughout the United States. Effinger earned a Bachelor of Science in Civil Engineering Technology from the University of Southern Indiana.





A recently installed triboelectrostatic separator.

Value Streams from Coal Fly Ash Ponds and Landfills: Actual Sustainable Gains

By Martin Koepenick

For decades fly ash has proven to be a valuable additive for concrete buildings, bridges, and other structures. However, as coal-fueled power plants are phased out, a steady supply source is diminishing. Because of declining coal power generation, rising demand as a cement extender in concrete, and environmental concerns for fly ash stored in landfills and ash ponds, harvesting and beneficiating fly ash residing in impoundments is gaining momentum. With over a billion tons stored in impoundments, there is enough fly ash to meet demand for decades.

What is referred to as Class F fly ash is what's of interest to the cement and concrete industry. And while ASTM C618 calls for the loss on ignition (LOI), an indicator of carbon content, to be less than 6 percent, in practice the market generally expects values to be less than 3-3.5 percent. There are currently two commercial methods used to reduce the carbon content, i.e., beneficiate, fly ash: triboelectrostatic separation or combustion. This article will focus on triboelectrostatic separation and its application with harvested ash because of its history of proven performance and the far greater number of installations.

There are performance benefits associated with substituting fly ash for cement. Still, from an environmental standpoint,

the ability to reduce CO₂ generated from cement production by utilizing a waste stream is an attractive driver, which is compounded by the desire to remove the billion-plus tons of ash from landfills and ash ponds to protect the environment from groundwater contamination. With an eye on maximizing sustainability, comprehensive solutions, including every aspect of remediation, must be sustainable—i.e., environmentally friendly/responsible, minimizing the environmental impact—and financially accountable.

A core technology from Separation Technologies (ST), triboelectrostatic separation, ensures harvested fly ash can be beneficiated through a sustainable carbon removal process to produce a building materials product with the quality required for even the most challenging construction projects (e.g., the new World Trade Center). Simple and robust, ST's technology is small enough to fit inside a shipping container. Having few moving parts, it consumes almost no energy. A technology now proven over two decades, it could be the de facto standard for beneficiating harvested ash into a premium construction product.

In addition to its separation technology, utilities are looking to ST to supply other equipment, such as drying and screening

systems, and the know-how to make the most of ash value streams. ST has the advantage of providing its brand, ProAsh®, to its parent Titan America, a cement manufacturer and leader in AI-driven process and product gains for the industry.

Seeking to showcase recent advances in harvesting, *ASH at Work* sat down with Tom Cerullo, President of Separation Technologies (ST), a subsidiary of Titan America LLC, for an update on developments at the company. Cerullo invited several pioneering customers to participate as well.

ASH at Work (AW): Tell us about ST's role in reclaiming fly ash from coal ash.

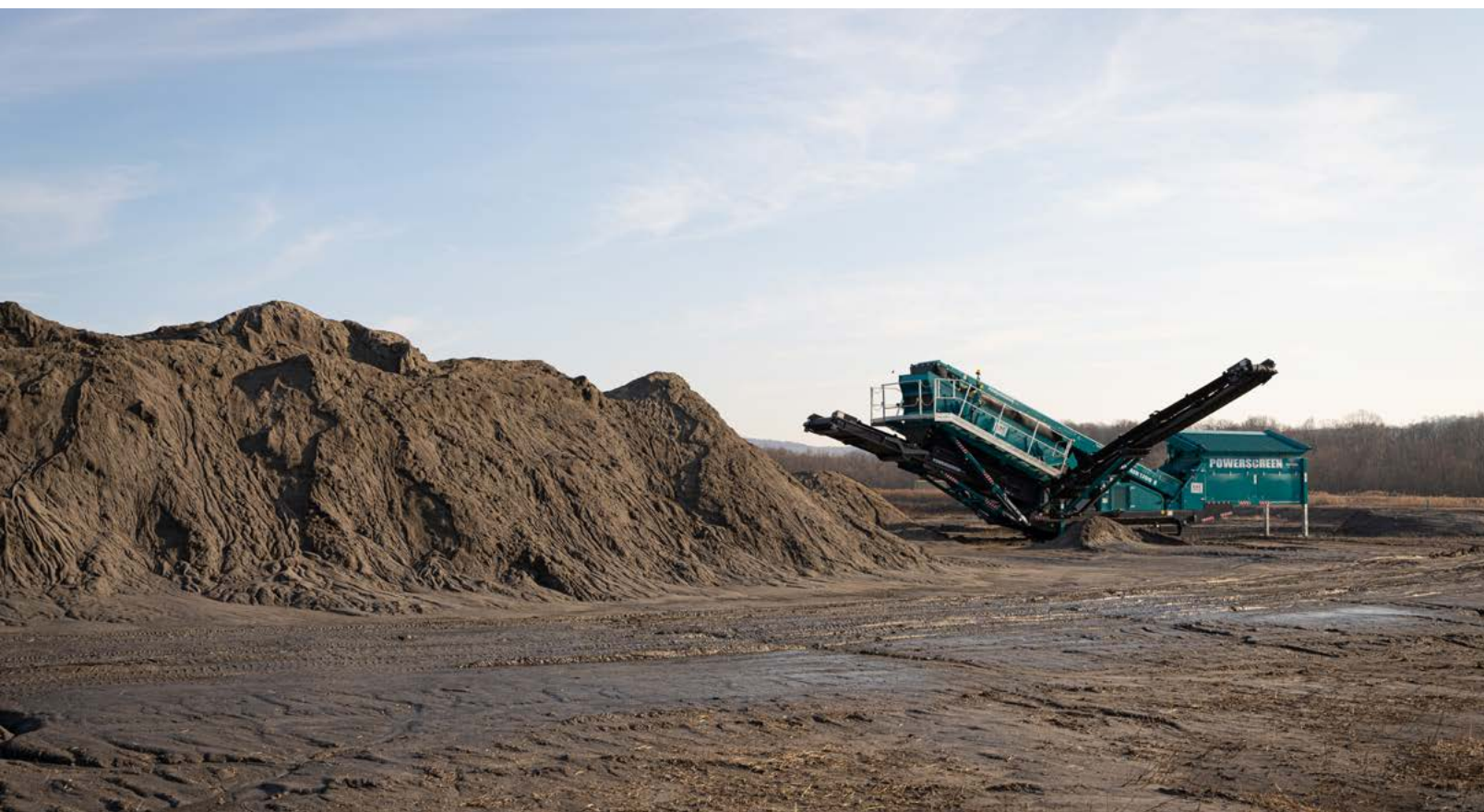
Tom Cerullo: Over the past two decades, ST has delivered small-footprint electrostatic separation modules to recover fly ash in North America, Europe, and Asia. Our electrostatic separators are a proven approach for utilities to turn waste from coal combustion into construction materials that meet specifications for the most demanding projects using the most sustainable, environmentally friendly process available. And, as expected, our separation technology performs equally well on harvested ash. With a lower capital investment and operating costs, we believe our combustion-free, highly sustainable process is the solution of choice for the utility, ratepayers, the community, and the environment. While our separation technology is at our core, with Titan's expertise, we are also able to provide

comprehensive solutions. Our scope can be very narrow or big-picture comprehensive.

Scott Blair, VP, Major Projects, Talen Energy: Talen Energy and ST's collaboration began in 1999 with the start-up of an electrostatic separation-enabling fly ash beneficiation at our Brandon Shores Power Station in Anne Arundel County, Maryland. Our relationship expanded with a ProAsh® equipment installation at Brunner Island in 2006. Since then, ST has processed and marketed millions of tons of the branded material to our mutual benefit. The most famous building we supplied with ProAsh® is the One World Trade Center (Freedom Tower) in Manhattan, but many other signature structures have a connection to us.

The next logical step in our ash remediation developments was a demonstration plant to explore more comprehensive processing of harvested ash. So, in 2021 ST provided a complete industrial-scale operation to reclaim fly ash from coal ash impoundment basins. We now have the opportunity to produce more ProAsh®, ST's established ASTM C618 concrete-grade fly ash product, and EcoTherm, an alternative to bauxite, silicon dioxide, aluminum oxide, and iron oxide sources, to augment ground limestone in cement kiln raw feed. We can handle highly variable feeds and process fast and consistently.

The opportunity to make sustainability gains is always of great interest to us and communities where we operate.



ST's coarse screening operation removing coarse debris from ponded ash. From here, the screened reclaimed ash is transported to ST's beneficiation operation for drying, particle size control, and carbon removal (i.e., separation).

AW: How are ash recovery efforts paying off in Poland?

Piotr Solecki, Manager, Zakład Separacji Popiołów Siekierki Sp. z o.o.): Since December 2017, our ash separation plant has run smoothly. The unit was developed as a joint-venture company of PGNiG TERMIKA SA (a local power and heat generation company) and Lafarge Cement SA. The plant uses technology from ST, employing its proprietary electrostatic process.

Using ST know-how and equipment to separate carbon particles from fly ash gives a new quality of ash. Thanks to the ST separator, two products are created from our fly ash: ProAsh® with a combustible content below 5 percent, which makes it an attractive product in the construction industry, and EcoTherm™, which is recycled for re-combustion in power boilers to reduce the amount of hard coal burned.

It is evident that companies such as ours or companies implementing new technologies, such as ST, are part of the broadly understood environmental protection policy and contribute to the minimization of human exploitation of the surrounding environment. I believe that this type of activity should be set as a model for others, in particular, to inspire and seek new and better solutions.

AW: What about progress in the American West?

Dale Diulus, Salt River Materials Group, Senior VP, Pozzolan: Our Phoenix Cement Company, dba Salt River Materials Group (SRMG), purchased and licensed the ST particle separator. ST also provided engineering and commissioning services for a fly ash beneficiation facility at a power generating station in Utah. ST equipment installation and operations began in August 2021.

Turning waste into a value stream has its challenges. A commercially effective and reliable beneficiation process is a must. Because of our decades-long approach to beneficiating fly ash, we have successfully recycled millions of tons of fly ash that otherwise would have ended up in landfills forever. We build customer confidence in our products and are the respected fly ash supplier in the southwestern U.S.

I want to point out a few facts about Salt River Materials Group. SRMG, headquartered at the Salt River Pima-Maricopa Indian Community's Chaparral Business Park near Scottsdale, Arizona, is the only Native American-owned producer of portland cement in the U.S. It is also a major manufacturer and marketer of sand and gravel and recycled coal combustion products (fly ash) and pozzolans throughout Arizona and the southwestern United States. Sustainability is truly the foundation of our approach to business.

AW: Comment on environmental and social issues that you face.

Justin Canipe, SRMG Operations Manager: Being owned by the Salt River Pima-Maricopa Indian Community, we are especially aware of the importance of going beyond environmental compliance and setting a standard for waste-to-value manufacturing. ST shares similar values. Together we are making a real difference. After all, why consider any product to be waste when it has a valuable purpose?

It's common for our Native American owners to look far into the future concerning any decisions they make. Seven generations ahead are the norm. They have considerable respect and honor for the earth—the sun, water, and what we do to generate energy sustainably.

AW: What's ahead for ST separators and new technologies to harvest coal ash?

Tom Cerullo: In our 25th year of developing industry-leading solutions for the construction material and power generation sectors, we are proud of our reputation as having the most environmentally friendly, sustainable, robust, and proven process available. By harnessing the power of our separation and related technologies, ST turns waste into high-grade, low-carbon construction products and fuel-rich products for cement manufacturing and power generation.

Fly ash ponds and landfill reclamation represent the future of the supplementary cementitious materials industry. This is clear from our customers featured in this interview and global leaders. Our separation technology will continue to be the best choice for sustainably processing fly ash to maximize beneficial use and minimize the volumes left in or returned to landfills. While we are known for separation technology, we can offer additional services for reclamation projects. Where multiple providers are chosen, we are open to working with third parties.

This technology and others in development support the Titan Group's commitment to sustainable business practices, carbon dioxide reduction, and developing environmentally responsible projects and products.

ST's separation technology, proven over more than 25 years at North American utilities and across eight countries, produces consistent, high-quality fly ash for concrete-mix designs with a lower CO2 footprint compared to those with portland cement as the sole binder or those using fly ash produced using combustion to remove carbon. We are focused on maximizing the volume of ash removed from the earth and processed for beneficial use to effect long-term environmental benefits using the most sustainable solutions available.

Martin Koepenick, who runs Innova International, is a global strategist and experienced marketing branding leader. His specialty is advancing product and technology solutions for sustainability. He has visited and captured success in words, images, and videos at over 300 industrial facilities around the world.



What Is Your Coal Ash Industry Future?

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Interested candidates should reply to info@MyCoalAshFuture.com.

All inquiries will be kept strictly confidential.



Photo by BentonHenry.com

Matching Demand and Supply for Recycled Ash

By John Halm and Jimmy Knowles

In 2016, Duke Energy announced plans to remove coal ash from the Buck Steam Station in Salisbury, North Carolina, and safely recycle the material for concrete. Duke Energy was already recycling about 75 percent of its coal combustion byproducts (coal ash and gypsum) produced in the state.

North Carolina officials recognized the potential for coal ash to be a resource for the state; however, much of the ash stored in basins had too much carbon to be used in concrete products. Beneficiation and recycling was the only way to avoid permanent disposal of the material. North Carolina's coal ash law encouraged increased recycling and required the company to install three recycling units across the state, making 900,000 or more tons of material available each year.

Duke Energy was under a strict time frame and announced plans for the second reprocessing unit location in late 2016 and then the third location in 2017—all three using STAR Technology from The SEFA Group. The process of recycling coal ash from the first site began in 2020.

Shifts in Production and Use in the Industry

In December 2021, the ACAA's annual "Production and Use Survey" showed that harvested ash is beginning to play a meaningful role in beneficial use activities. ACAA Executive Director Thomas H. Adams said, "As we work diligently to utilize the nearly half of coal combustion products that are still disposed annually, our industry is also taking significant strides in developing strategies for improving the quality and availability of these materials."¹

He explained in the press release that increasing beneficial use requires ash marketers to ensure that products are consistent and available when customers need them—requiring large investments in technology and logistics.

1. American Coal Ash Association. "2020 Production and Use Survey Results." News Release. December 1, 2021. <https://acaa-usa.org/wp-content/uploads/2021/12/News-Release-Coal-Ash-Production-and-Use-2020.pdf>.

Adapting Fly Ash Sales with Consistent Supply

Today, the consistent supply of quality fly ash in the Carolinas for the concrete industry achieves a better balance between demand and supply. Concrete customers need a dependable supply of quality fly ash in the local market to have the confidence to include more ash in their mix designs. Local supply is an important convenience factor.

The SEFA Fly Ash Sales Team in the Carolinas now has more than double the amount of fly ash to offer producers that they had five years ago and are able to bid on projects that they would not have been able to supply before. As Duke Energy's North Carolina STAR plants are producing at capacity, SEFA's team is helping customers optimize mixes, and customers are increasing the percentage of fly ash replacing portland cement.

Gregg Hendrix, Chief Executive Officer of SEFA, said, "An uninterrupted supply is a key to maximizing sales. For 45 years, we had supply interruptions during mild winters and springs when there was low power demand for coal-burning power plants. We missed opportunities to be involved in projects because we could not guarantee the ash would be available."

"Consistent supply opens a lot of doors, and customers are increasing the percentage of fly ash in mixes," said Bert Nunn, Vice President of Fly Ash Sales. "There is also growth in the Charlotte and Raleigh-Durham metro areas and tremendous growth in warehouses in the Carolinas, which can be a million square feet under one roof. The key is delivering it there on time."

SEFA's new normal of increased supply is a big opportunity with new challenges. While fly ash needs to be delivered within 24 hours, some customers have limited silo capacity at their concrete plants to store the increased amounts of fly ash. SEFA meets those challenges with their transportation services and portable storage pigs. Their transportation fleet consistently provides an industry best on-time service performance. SEFA is able to continually service customers with the interconnected "system" of multiple STAR plants in the Carolinas.

"Our team members are the major key to the success of our business," said Hendrix. "As we have throughout our history, we are committed to consistently provide the highest level of safety and service to our customers."

John Halm is Byproducts Marketing Manager for Duke Energy and also serves as Vice Chair of the ACAA Board of Directors. Previously, he worked for United States Gypsum Company in wallboard manufacturing and research roles. Jimmy Knowles is Vice President of Research and Market Development at The SEFA Group. He joined the company over 35 years ago and has served in a variety of roles.

Coal Combustion Product Type

Fly Ash

Project Name

De Hoop Dam

Project Location

Limpopo, South Africa

Project Participants

Ash Resources, PPC Cement, ARQ Consulting Engineers, De Hoop Construction West, B&E International, Quanza JV, Limpopo RR & Construction, SA Rock Drills, SA French, NSI, Twin Cities, BASF

Project Completion Date

2014

Project Summary

The Limpopo province lies in the northernmost region of South Africa and boasts a hot, dry climate. Access to water has long been a concern for the towns and rural communities throughout the province. Equally important, water is also required for use by the mining sector to unlock Limpopo's vast platinum deposits—the largest known unexploited mineral wealth in the country. Construction of the De Hoop Dam is intended to store water for both of these purposes.

Project Description

Construction of the De Hoop Dam was first announced by former President Thabo Mbeki in 2003. Site selection settled on a portion of the Steelpoort River in Limpopo's water-stressed Sekhukhune district. Plans called for an 81-meter-high, 1-kilometer-long roller compacted concrete (RCC) dam that would store 347.6 million cubic meters of water.

Several concrete mix designs were considered for the dam's construction. Past RCC dams in South Africa had opted for a mix incorporating low levels of cementitious material. Engineers for the De Hoop project ultimately settled on "high-paste, high-workability" mix designs where both immersed poker vibration and roller compaction were used together during placement—both firsts in South African dam construction.

High workability was important for the mixes because crusher sand had to be used for the project. The mixes' high cementitious content helped provide a more impermeable

concrete than traditional RCC mixes—allowing engineers to avoid the need to build the "skin concrete" normally required to attain the density required as a barrier to upstream water.

Ash Resources' Matla plant supplied the fly ash for the mix, which amounted to roughly 70 percent of the dam wall's total cementitious content. During the roughly five years of construction, the company supplied almost 165,000 metric tons of DuraPozz®Pro ash for the project. The workable concrete mixes allowed for fast-track construction, and several concrete placement "firsts" were set—including a (South African) record for placement of 131,000 cubic meters over 28 days during November 2011.

Construction of De Hoop Dam was recognized with several awards, including winning both the "Sustainable Concrete" and "Civil Engineering Structure" categories at the 2013 Fulton Awards, sponsored by the Concrete Society of Southern Africa.



Photo: CC BY-ND 2.0 - GCIS

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Coal Combustion Product Type

Fly Ash

Project Name

North Dakota Heritage Center & State Museum

Project Location

Bismarck, North Dakota

Project Participants

State of North Dakota, Great River Energy, HGA Architects and Engineers, Lightowler Johnson and Associates, Braun Intertec, Comstock Construction, Blackhawk Drilling, Strata Corporation

Project Completion Date

November 2014

Project Summary

First opened in 1981, the North Dakota Heritage Center is the headquarters of the State Historical Society of North Dakota and home to its largest museum. In 2009, the state's Legislative Assembly authorized \$51.7 million for a 97,000-square-foot addition—nearly doubling the size of the facility—to house an expanded exhibit/collection space, state-of-the-art research technology, improved public amenities, and additional office and support space.

Project Description

A primary objective in designing the addition was to embrace sustainable building methods, including using recycled and low-carbon construction materials and incorporating renewable energy for heating and cooling. To that end, Great River Energy donated \$500,000 of fly ash generated from its nearby Coal Creek Station, which was incorporated into all of the addition's concrete components.

Engineers specified a range of high-volume fly ash concrete mixes with minimum 25 percent, and maximum 50 percent, substitution in place of portland cement. The 50 percent mixes were used in the construction of foundations and walls, while 35 percent replacement mixes were specified for flatwork and pan/joist systems.

"This donation is an opportunity for the North Dakota Heritage Center to use a local—and a recycled—product as part of the building materials," noted Al Christianson,


Great River Energy's director of business development and North Dakota governmental affairs. "It's another great story that demonstrates the energy industry's many positive contributions to North Dakota's economy and quality of life."

Use of fly ash helped the building meet Leadership in Energy and Environmental Design (LEED) Silver standards. Other sustainable features included tapping geothermal energy wells that lie underneath the facility's parking lot for heating and cooling purposes and the recycling of communication and electrical wiring removed from the building, which were woven into containers and sold in the museum's store.

The building expansion—completed in 2014 in time for the 125th anniversary and celebration of North Dakota's statehood—earned a Gold Star Award for Sustainability in Design from the North Dakota Ready Mix and Concrete Products Association.



Photo: State Historical Society of North Dakota



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Coal Combustion Product Type

Fly Ash

Project Name

Perot Museum of Nature and Science

Project Location

Dallas, Texas

Project Participants

Holcim US, Morphosis Architects, GFF Architects, Datum Engineers, John A. Martin Associates, Inc., Buro Happold, Balfour Beatty Construction, Lattimore Materials Corporation

Project Completion Date

December 2012

Project Summary

The Perot Museum of Nature and Science is a 180,000-square-foot facility designed by Pritzker Prize-winning architect Thom Mayne, located in Victory Park northwest of downtown Dallas. Clad in precast concrete panels, the 14-story cubic structure houses 11 permanent exhibit halls and 6 learning labs in which the public is invited to “ponder the vast mysteries of science.”

Project Description

Early in the design process, the architect focused on the concept of the building as an exhibit in and of itself. For the museum’s exterior, that resulted in specifying the use of precast concrete panels designed to evoke a sedimentary geological formation. Exposed concrete is likewise featured in the interior for flooring and walls.

Concrete was chosen as the primary building material also for its sustainability. Mixes with 50 percent fly ash replacement for portland cement were used in the building’s piers, columns, and slabs expressly for the purpose of attaining Leadership in Energy and Environmental Design (LEED) certification. Lower-volume fly ash concrete was specified in the exterior cladding.



The 30,000 square feet of concrete flooring in the museum’s exhibit space is among the museum’s primary aesthetic features. Continuing with the theme of incorporating nature in the building design, the architect specifically sought to expose the aggregate within the concrete. Owing to the concrete’s high fly ash content—which made the flooring particularly hard and durable—exposing the aggregate within required extensive milling, diamond grinding, and polishing. The end result, however, has been lauded as both an aesthetic and functional triumph.

Beyond its LEED value as a recycled, low-carbon material, the museum’s high-volume fly ash concrete has earned recognition for the other sustainable attributes it brings to the building’s design, including:

- Durability
- Resistance to fire, flooding, and other natural disasters
- Heat-island mitigation
- Use of locally sourced materials
- Thermal/energy performance
- Noise resistance
- Avoidance of sealants and coatings that can contain volatile organic compounds.

Upon its opening, the museum held the distinction of being one of only five buildings to have received four Green Globes for sustainability practices and was the only Green Globe-certified museum.

Photo: Perot Museum of Nature and Science

Beware of Fires and Falls During the Holiday Season

Editor's Note: As a service to our readers, ASH at Work publishes a recurring series on everyday health and safety topics. We welcome contributions from readers with expertise in health-related issues. Article length should be approximately 500 words. Please submit topic suggestions in advance to John Simpson at johnfsimpson@gmail.com.



Image by Freepik

The holidays are a time for family, food, and festivity. However, the holiday season can also pose hidden dangers stemming from the extra cooking and decorating that takes place at this time of the year. Lower your risk of fires and falls by following these tips:

Cooking Safety

- Never leave your stove or grill unattended. Unattended cooking is the leading factor in home cooking fires.
- Move flammables, such as dish towels, bags, paper, and curtains, away from the stove.
- In the event of an oven fire, turn off the oven and keep the door closed until it is cool.
- Keep an eye on what you fry! Most cooking fires start when frying food.

Fire Safety

- Don't overload extension cords.
- Keep candles 12 inches away from things that can burn throughout the holiday season—or consider using flameless candles.

- Ensure that there are operable smoke alarms throughout your house, particularly in areas close to where anyone may sleep.
- Always turn your holiday lights off before going to bed or leaving home.
- Extinguish all controlled fires (i.e., fireplace and candles) before going to bed or leaving home.
- Keep your Christmas tree well watered; a dry tree is more flammable.
- Position your Christmas tree at least 3 feet away from all heat sources.

Ladder Safety

- Put ladders on a stable and level surface that is not slippery.
- Maintain a 3-point contact (two hands and a foot, or two feet and a hand) when climbing/descending a ladder.
- Face the ladder when climbing and descending.
- Never carry tools in your hands while climbing up or down a ladder.
- Extend the top of the ladder three feet above the landing.
- Be aware of nearby overhead power lines.

Sources: [Ready.gov](https://www.ready.gov) and [OSHA.gov](https://www.osha.gov).

I'm Glad You Asked

Editor's Note: "I'm Glad You Asked" is a recurring feature that invites a different expert each issue to answer a commonly asked question about coal combustion products. If you would like to submit a question and/or volunteer to provide a written answer to one, please contact the editor at johnfsimpson@gmail.com.



Natalie Biggs is the global head of thermal coal markets in Wood Mackenzie's metals and mining group. She has over 16 years of experience in the global coal and energy industry, conducting research, authoring reports, forecasting markets, developing models, and performing financial valuations of individual mining assets.

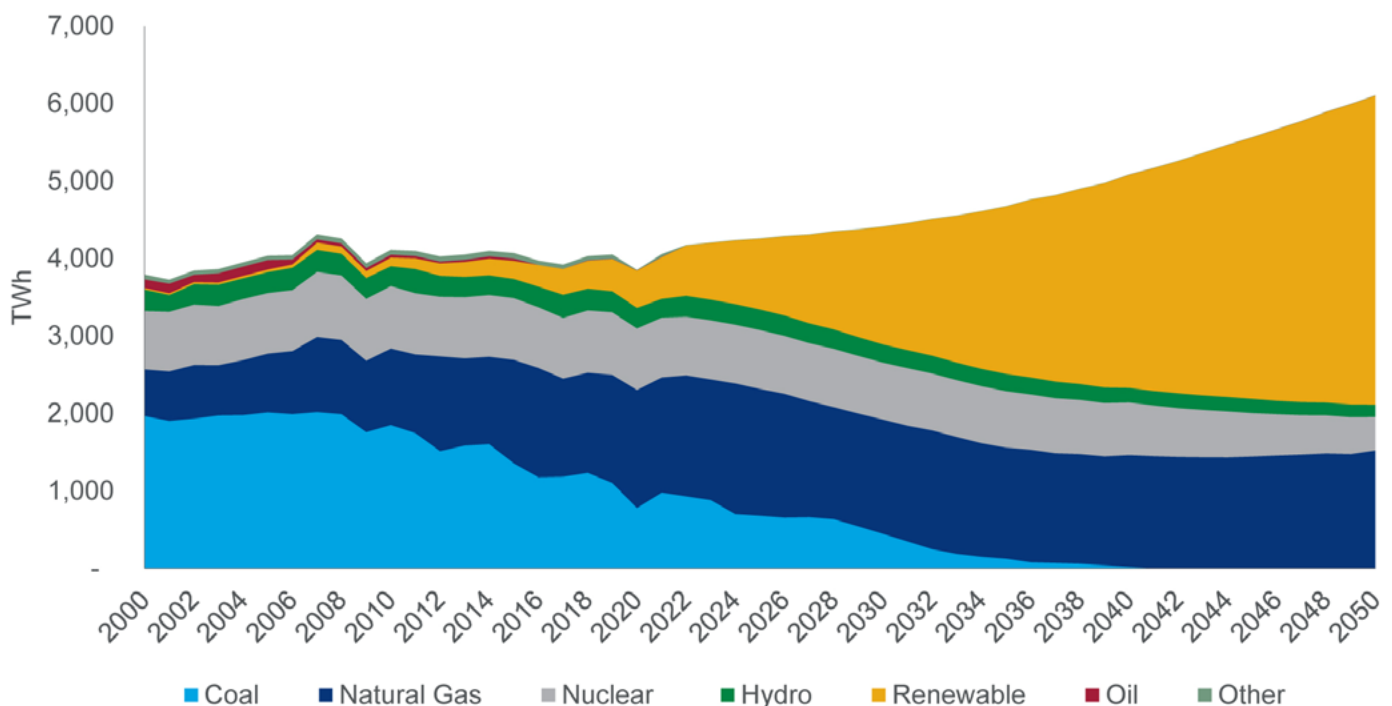
Prior to Wood Mackenzie, Natalie worked in U.S.-based coal research and consulting, gaining experience with linear programming models for forecasting U.S. coal prices, supply, and demand. Natalie holds a Master's in Finance, MBA, and a BS in Business Economics.

Q. How much longer will utilities be consuming coal for generating electricity in the United States?

A. It depends on several factors but our view is that, by 2040, almost every currently operating U.S. coal plant will be retired. A shocking timeframe, certainly. However, it is not too far-fetched considering that a third of U.S. coal-fired capacity has already been retired over the past 10 years.

During the last decade, the trend in retirements was driven more by economics than policy. U.S. coal-fired generation was battered by natural gas competition, as fracking technology revolutionized natural gas production. Now, advancements in battery and renewable technologies are transforming the power market once again. Growth in renewable generation is eating into the share of fossil fuels in the U.S. electricity mix, further heightening coal-gas competition.

United States Generation by Source – Wood Mackenzie Forecast



Renewables are rapidly becoming the lowest-cost source of new generation (levelized cost basis) for most of the world, including Asia—the largest region for coal demand. In the U.S., wind and solar generation are the lowest-cost new source (even without subsidies in many regions). Battery technologies are improving, which means that the reliability of renewables is becoming less of a challenge.

Meanwhile, coal market conditions are becoming more difficult. As political support grows for decarbonization efforts, governments worldwide are adopting more anti-coal policies. Major financial institutions and insurance companies continue to ratchet up ESG commitments against participation in the coal market. Capital sources are limited for coal producers and discount rates are rising, increasing the cost of coal investments.

Although federal policies regulating coal mining and combustion were not the largest contributor to declining coal generation, they have tipped the scales further in that direction. There are a whole host of U.S. federal policies regulating emissions of SO₂, NO_x, mercury, particulate matter, and other toxic air pollutants that have required utilities to add expensive pollution mitigation equipment to plants. These retrofit requirements have pushed many coal-fired units “over the edge” into retirement in recent years. New Source Performance Standards have effectively banned any new coal-fired units from being developed in the U.S., as it would require carbon capture and sequestration, which is currently cost prohibitive.

The next major policy that could influence coal unit retirements is the federal Clean Water Act’s Effluent Limits Guidelines, which regulate wastewater discharges from plants. Plants would have to make costly improvements to how they handle wastewater or retire (or convert to natural gas in some cases). Plant owners have until 2028 to make this decision. This will likely speed up retirement dates for many marginal coal units.

In our view, carbon policy ultimately will not cause the demise of coal-fired generation in the U.S. We do not assume a federal carbon tax or cap-and-trade program in our forecast. In general, while federal policies have further pressured the coal power market, competition with natural gas and renewables has been more impactful. It is one thing to fight against the current of government policy, but it is another to fight against economics—arguably a more powerful, long-lasting pull.

There are risks to our projections that could result in a longer shelf life for coal-fired generation in the U.S. Coal plants could be kept on for energy security and reliability purposes. The European Union is a key example of how coal-fired power can reliably fill in during an energy crisis, with arguably more dependable fuel supply than natural gas. Further, as renewable generation grows, the U.S. will be more dependent on other countries for supplies of battery and raw materials, which could have foreign political implications. Having a diverse mix of electricity supply would strengthen the U.S. power market’s reliability, and coal may still be able to play a role in the future.



6 Questions for Dan Chartier

Editor's Note: "6 Questions for..." is a regular ASH at Work feature in which leaders with unique insight affecting the coal ash beneficial use industry are asked to answer six questions.

Daniel Chartier is Executive Director of the Utility Solid Waste Activities Group (USWAG), a trade association of over 130 utility operating companies, energy companies, and industry associations that is responsible for addressing waste, byproduct, and chemical management and transportation issues on behalf of the utility industry. USWAG supports the industry's efforts to comply with federal environmental regulations, protect the environment, and serve its customers. As part of that effort, USWAG engages in regulatory advocacy, regulatory analysis and compliance assistance, and information exchange pertaining to RCRA, TSCA, and HMTA.

Prior to this role, Dan served as Regulatory Director, Environmental Policy at the National Rural Electric Cooperative Association, where he led strategy and advocacy for the association's environmental and regulatory policies related to air quality and climate change issues. He has expertise in the development of air quality and climate change regulatory and legislative policy in the context of the Clean Air Act, as well as the design and analysis of market-based (e.g., emissions trading) systems at the state, regional, and national levels.

ASH at Work (AW): You joined USWAG this spring to replace longtime executive director Jim Roewer, who retired. Any first impressions stand out?

Daniel Chartier (DC): USWAG has a long history of being a well-run organization and in 2023 will celebrate its 45th year of service to its members. In part, it was USWAG's solid reputation as an industry leader that made me feel comfortable in applying to replace Jim.

I will admit, even with the knowledge that USWAG was a well-respected organization, it was a little daunting to apply knowing that Jim had guided USWAG for 32 years prior to his retirement. Those are some big shoes to fill. Yet, it's been the strong support I've received from members, staff, and counsel plus a few long conversations with Jim where he has provided mentoring, and imparted his historical perspective and institutional knowledge, that has allowed for a transition that has been almost seamless.

To address the specific question on first impressions, there are three key items that have stood out over my first 6+ months leading USWAG.

First is the depth of the industry knowledge that USWAG has in its technical committee leadership. Across all issues, the volunteer leaders of USWAG's technical committees are unparalleled experts in their fields. The guidance they provide to the membership to help prioritize issues is invaluable. They are the frontline managers making sure that USWAG is utilizing its legal and technical resources efficiently, effectively, and within the budget constraints set by USWAG's Policy Committee.

Second has been the strong relationship USWAG has with U.S. EPA. EPA is the agency regulating USWAG members for most of the issues we cover. The ability to get on the phone and talk through issues, ask for clarification, or even simply get updates on the status of reviews and rulemakings is critical. As a further example of this collaboration, USWAG had three speakers from EPA, including Carlton Waterhouse, OLEM's Deputy Assistant Administrator, speak at our recent CCR Workshop, and we have multiple EPA speakers scheduled for USWAG's upcoming Decommissioning Workshop. These simple and often informal interactions and dialogues can help avoid potential future issues or misunderstandings.

Third is the strength of the legal team that supports USWAG's technical committees. Over the last several decades, the outside counsel supporting USWAG has developed deep expertise on issues surrounding solid waste and chemical regulation and management that is unparalleled in industry, making USWAG one of the best resources to help its members navigate complex compliance issues.

AW: How does USWAG's mission compare to other trade association roles you have filled in Washington, D.C.?

DC: USWAG's core mission is to support industry's efforts to comply with federal environmental regulations, protect the environment, and serve its customers. To achieve its mission, USWAG engages in regulatory advocacy, regulatory analysis, compliance assistance, and information exchange. That aligns perfectly with what I have done while working in the utility

sector for both an investor-owned utility and a merchant power producer; working for the U.S. EPA; and working for other trade associations, including EEI and NRECA. Executing USWAG's mission requires a combination of skills that focuses on education, dialogue, and collaboration.

AW: One of your first assignments was to engage in litigation over the Environmental Protection Agency's actions on CCR closure deadline extension requests. Where do you see that litigation heading?

DC: The wheels were in motion when I joined USWAG regarding a potential challenge to EPA's January 11th actions. USWAG has a long record of engaging with and advocating before EPA on CCR issues. In this instance, our challenge is in litigation so I can't really speak too much about it. However, our opening brief is due later this month, and our concerns with EPA's January 11th actions will be fully laid out then. I will say that while USWAG's goal is always to try and resolve issues through dialogue with an agency, there are times, such as this current example, where we need to ask the court to intervene to help settle a disagreement over interpretation of a statute or regulatory requirement.

It is also worth noting that it is not always industry that disagrees with a position that may be taken by EPA and initiates litigation. Many times, it is an environmental organization that litigates a decision by EPA. In fact, USWAG has intervened in support of EPA in litigation initiated by the environmental community far more times than USWAG has directly challenged an EPA action.

AW: EPA has several other open rulemakings related to coal ash management. How quickly do you think the agency will be able to address that heavy workload?

DC: It has been well documented in the press that due to a variety of factors, EPA's staffing levels are down and, as in the private sector, EPA likely is having a challenging time attracting talent in today's ultracompetitive labor markets. That has led to delays in several rulemakings of interest to USWAG's membership. For example, we understand that the timeline for the final Federal CCR Permit rule, originally expected in October 2022, has been delayed and that the rule is now anticipated in July 2023. We also understand that the timeline for the legacy impoundment proposal has slipped from the end of this year to approximately May 2023. This is just a sampling of the expected delays. We are waiting for the Fall Regulatory Agenda to see the updated delivery dates for these and other rules impacting USWAG's membership.

AW: Will USWAG continue to support coal ash beneficial use?

DC: The beneficial use of coal combustion products (CCPs) remains a priority for USWAG and its members. Overall, that includes supporting the redirection or diversion of newly produced CCPs into beneficial use and the potential, when appropriate, for harvesting ash that has already been disposed for potential beneficial use. It also emphasizes the need for USWAG to continue to collaborate with ACAA. That partnership existed under my predecessor, and I look forward to continuing it in the future.

AW: What non-ash issues remain on USWAG's plate?

DC: USWAG is far from a one-issue organization. While supporting our members on their ash-related compliance remains an important priority for USWAG—and one of our most visible issues, since the closure and long-term care of ash disposal sites is a top priority with many members right now—the fact is that two-thirds of USWAG's technical budget is directed to supporting other solid waste, chemical management, and DOT issues through our technical committee structure.

For example, through our DOT Committee, USWAG provides technical advice on complying with the DOT Hazardous Materials Regulations. Our Remediation and Response Committee provides technical assistance and support for the management of remediation wastes generated during site cleanups and brownfields redevelopment. The Low Volume Waste Committee provides support on issues including used oil regulations, universal waste management standards, and other RCRA issues. And our TSCA Chemical Management Committee is responsible for addressing compliance with the federal rules under TSCA, including EPA's PCB use and cleanup regulations and the development of risk management regulations for other chemical substances, including asbestos.



NMA
National
Mining
Association

National Mining Association

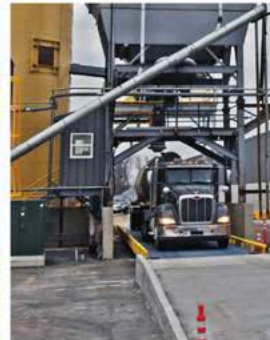
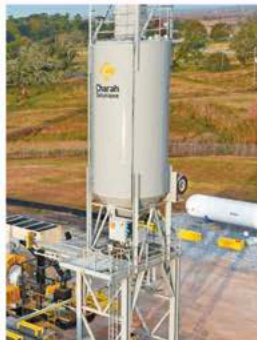
The National Mining Association (NMA) is the only national trade organization that serves as the voice of U.S. mining, and the hundreds of thousands of American workers it employs, before Congress, the federal agencies, the judiciary, and the media—advocating for public policies that will help America fully and responsibly utilize its vast natural resources. Mining is essential to each of our daily lives, providing the raw materials for nearly every industry. For this reason, it is essential to tell mining’s story and advocate in the interests of mining. Headquartered in Washington, D.C., the NMA has a membership of more than 250 companies and organizations involved in every aspect of mining.

The NMA highlights seven pillars that mining supports:

- *Economy*—Mining supports nearly two million high-paying jobs and contributes to economic activity in every state. American miners are deeply proud of the contributions they make to our country each day, fueling America and supplying the materials that help make our high quality of life possible.
- *Energy*—Americans expect reliable and affordable energy powered by a diverse mix of coal, natural gas, nuclear power, oil, and renewable sources. More than 20 percent of U.S. electricity comes from coal, and minerals such as copper, nickel, and silver are necessary for renewable energy production.
- *Environment*—Twenty-first-century mining projects begin with extensive environmental and engineering studies, public involvement in major decision-making, and compliance with scores of state and federal laws and regulations governing every facet of the environment. The projects end with land reclamation, making reclaimed mining sites useful to the community for developed recreation, wildlife enhancement, and other local community needs.
- *Infrastructure*—From foundations to roofs, power plants to wind farms, roads and bridges to communications grids and data storage centers, America’s infrastructure projects begin with mining. One example of mining’s contribution to infrastructure is steel, a material dependent on both metallurgical coal and iron ore for its production.
- *Innovation*—Modern mining innovates within and without, using new technologies to provide safer and more environmentally friendly methods of mining and also supplying materials for new technologies such as electric and hybrid vehicles.
- *National Security*—Our Armed Forces rely on domestic metals and minerals for sophisticated weapons systems and safe transport of our troops. Import reliance for these inputs subjects our supply chains to geopolitical instability and supply disruption. America’s security depends on our ability to access and utilize the domestic energy and mineral resources that are abundant in the U.S.
- *Safety*—It is the goal of every mining company to ensure miners return home safely every day. Today’s mining companies recognize that continuous performance improvement necessary to achieve the industry goals of zero fatalities and injuries means going beyond what is required by regulations. Over the past 15 years, our commitment to safety has led to a 56 percent reduction in the rate of injuries in U.S. mines and a 63 percent decrease in the fatal injury rate. More can and will be done.

The NMA stands for coal—the affordable, reliable energy it provides and the metallurgical coal our infrastructure needs. Throughout the recent energy crisis and beyond, using a mix of domestic coal, natural gas, nuclear power, oil, and renewable sources ensures that U.S. households and businesses can access affordable and reliable energy. And technologies such as advanced coal-fired power generation and carbon capture and storage will give Americans energy choices that are aligned with environmental and climate objectives without having to sacrifice reliability and affordability.

On October 3, the NMA launched a new brand. The NMA’s updated visual identity includes a new logo whose “M” shape evokes a mountain, representing the entirety of the industry. It is stylized to lead viewers to see below the surface, an analogy to the work our industry does. The “M” also delivers new dimensions, focusing on a forward-driving center point that showcases our commitment to the future and the essential role that industry plays in technology and innovation.



MULTISOURCE® MULTIPLIES YOUR FLY ASH SALES.

Effective byproduct sales and marketing is all about the strength of your network. Utilities and fly ash customers both know they can count on the Charah® Solutions MultiSource materials network and our dedicated sales team to deliver results. With nearly 40 strategic locations nationwide and our proven EnviroSource™ fly ash beneficiation technology, we are ready with the network, the team, and the expertise to keep your ash moving. **For more information, contact us at 877-314-7724 or visit charah.com.**

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- BOTTOM ASH SALES
- GYPSUM SALES
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- TERMINAL OPERATIONS
- KILN FEED PRODUCT SALES
- DELIVERY
- LOGISTICS



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ASH Classics

A Look Back at the Beginnings of the U.S. Coal Ash Industry

"ASH Classics" is a recurring feature of *ASH at Work* that examines the early years of the American Coal Ash Association and its predecessor, the National Ash Association (NAA), focusing on issues and events that were part of the beneficial use industry's defining years.

In the late 1970s, proposed amendments to the Resource Conservation & Recovery Act (RCRA) threatened to classify coal ashes as "hazardous wastes." This issue of *ASH at Work*, from 1979, reports on an amendment pushed by Senator Jennings Randolph (D-WV) in legislation reauthorizing RCRA to "postpone" regulation of power plant ash as hazardous. This effort would ultimately succeed.

ASH AT WORK

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1979

No. 3

NAA Participates In Technology Exchange With U.S.S.R.

TVA's Falkenberry, Bell And Faber Are Co-Hosts

WASHINGTON—The National Ash Association played a major role in the recently concluded 10-day technology exchange by the US/USSR Joint Project Group on the Design and Operation of Air Pollution Reduction and Waste Disposal Systems for Thermal Power Plants.

Executive Director John H. Faber served as a co-host with Harold Falkenberry and Ron Bell of Tennessee Valley Authority. Mr. Falkenberry is co-chairman of the Joint Project Group with V. I. Gorin of the USSR.

NAA members participated in the event by hosting luncheon meetings, power plant tours, and/or presenting technical papers. The five-man USSR delegation began their visitations in the New York-New Jersey area, held a technical session on Liquid Effluent Control in New Orleans, visited facilities in the Chicago area, and concluded the program here at a luncheon and signing of protocol hosted by the Industrial Gas Cleaning Institute.

The program was the third in a series of exchanges that began in 1977. Last year's program was staged in the Soviet Union.

Faber chaired one of the technical sessions in New Orleans. James P. Plum of Houston Lighting & Power presented a report on HLP's ash disposal system at their Parish Station and John Pizzella of Potomac Electric Power referenced PEPCo's "Liquid Effluent



US/USSR Joint Project Group in New Orleans



V. A. Zazulin

Control From Dry Ash Disposition." William Webster, a consultant to the NAA, discussed "Water Scrubbing Particulate Removal."

On the opening day the delegates visited Public Service Electric and Gas Company's Hudson Generating Station; American Electric Power hosted the second program; and American Admixtures shared a three-day stop-over in Chicago with visitations to Waukegan, Will County, and Joliet power stations.

(See TVA's on Page 3)

Eight New Utilities Join NAA; Position Roles Are Clarified

Six electric utilities operating coal-fired generating stations have enrolled in the NAA's new Technical Awareness Program and two others have verbally asked membership acceptance.

Executive Director John H. Faber identified the new enrollees as Florida Power & Light Co. of Miami, FL; Central and Southwest Services, Inc. of Dallas, TX; Omaha Public Power District of Omaha, NE; Iowa Power and Light Company of Des Moines, IA; Philadelphia Electric Co. of Philadelphia, PA; and Colorado-Ute Electric Association, Inc. of Montrose, CO.

Additionally, Texas Utilities and Colorado Public Service Company are processing applications.

Director Faber also disclosed position statements clarifying the role of the Edison Electric Institute, the Electric Power Research Institute, and the

(See EIGHT NEW on Page 4)

IN THIS ISSUE

US/USSR Exchange Data . . .	1-3
Eight Utilities Join NAA . . .	1-4
E. O. Goeb Profile	2
How to Kill an Association . . .	2
Ash is \$100 Million Industry . .	3
Congress on Coal Conversion . .	3
Randolph Seeks RCRA Delay . .	4

HOW TO KILL AN ASSOCIATION

Don't participate beyond paying your dues—let "them" handle things.

Then complain that members have no voice in management.

Decline all offices and committee appointments—you're too busy.

Then offer vociferous advice on how they should do things.

If appointed to a committee, don't work—it's a courtesy appointment.

Then complain because the organization has stagnated.

If you do attend management meetings, don't initiate new ideas.

Then you can play "Devil's Advocate" to those submitted by others.

Don't rush to pay your dues—they're too high anyway.

Then complain about poor financial management.

Don't encourage others to become members—that's selling.

Then complain that membership is not growing.

Don't read the mail from headquarters—it's not important.

Then complain that you're not kept informed.

Don't volunteer your talents—that's ego fulfillment.

Then complain that you're never asked; never appreciated.

And, if by chance, the organization grows in spite of your contributions

Grasp every opportunity to tell the youngsters how tough it was; how hard you worked in the old days to bring the organization to its present level of success.

(Reprinted from the Journal of The Virginia Academy of Family Practice)

Personal Profile Eugene O. Goeb

WILLOUGHBY, OH—Eugene O. Goeb, a veteran cement technologist, has been named vice president engineering for Penn Virginia Materials Corporation whose major product line is Vial Fly Ash Pozzolan.

His primary responsibility will be as a liaison with the electric utility industry in the area of recycling power plant ash. Other duties include quality assurance, market research, and technical information management.

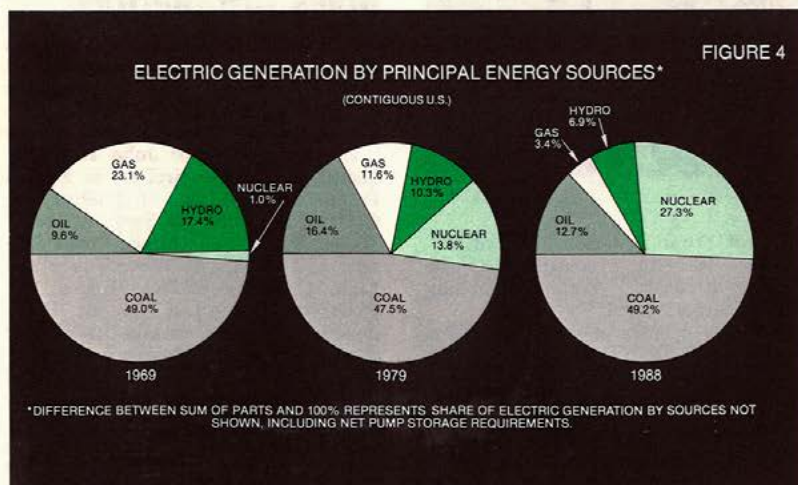


Prior to joining Penn Virginia, Goeb was director of marketing services for Medusa Cement Co. Earlier he served as manager of the ready-mix section and a field engineer for the Portland Cement Industry and was formerly technical service director and sales manager for the Huron Cement Co.

Vial Fly Ash Pozzolan has been used for over 20 years to improve the workability and durability of concrete products and as an additive in structural concrete, concrete blocks, pre-cast concrete, and ready-mix applications.

Goeb received a B.S. degree in civil engineering from Marquette University and is a registered professional engineer. He is a member of the American Society for Testing Materials and American Society of Civil Engineers.

Other activities included participation in Prestressed Concrete Institute, National Concrete Masonry Association, Masonry Cement Research and Education Group, the Great Lakes Paving, Region Paving Promotion Committee of the American Concrete Paving Association.



(CHART—Courtesy National Electric Reliability Council)



Power Plant Ash Represents \$100 Million Industry

WASHINGTON (AP)—There's cash in coal ashes. Ask the National Ash Association who predicts industry sales will reach \$100 million annually by the mid-1980's.

These figures were given added credence by President Carter. He has called for electric utilities to triple coal burning by 1995 to reduce U.S. dependence on foreign oil. That would mean the production of more ashes.

"We're gratified by the president's goal," said John Faber, executive director of the worldwide group that includes companies in England, France, Spain, Canada and Australia.

Some European nations are more advanced in ash research, says Faber, but this country isn't exactly standing still.

Many people envision ash as only an additive in cement (pozzolan) products or as a spread for icy sidewalks.

Transformed by science, coal ashes wind up in building blocks, sanitary landfills, roadbeds, plastic furniture, sandblasting materials, roofing granules, asphalt mixes, automobile parts and structural fills.

One exotic form of ash may go into space. Extremely strong and light substances called cenospheres have been tested and approved for the nose cones of space shuttles. At \$500 a ton, they could be one of the cheaper ingredients of the multi-billion-dollar NASA project.

Even clinkers aren't clinkers in the world of commercial ashes.

"We sell about 40 percent of them," said Faber. They form a base for skid-control materials that take the place of sand and salt on icy winter roads. These aren't your huge clinkers—they're about 1/4 to 1/2 inch in diameter.

Faber threw in a bit of history: "Coal ashes are almost identical to volcanic ashes that were used 2,000 years ago in building the aqueducts and coliseums of ancient Greece and Rome."

But ashes have come a long way since then, and the end isn't in view. To coordinate technology, an international ash utilization organization will be developed within the next six months. Ash seminars and meetings are held regularly.

There's another bonus from ashes. Since most producers are coal burning utilities, profits from ash sales lead to smaller electric bills for consumers.

"Savings could amount to several billions of dollars after we reach 40 percent utilization in about five or six years," said Faber.

Congressional Action Says Utilities Must Use Coal

WASHINGTON (UPI)—Sen. Wendell Ford (D-KY) has introduced legislation that would require 66 electric power plants in 19 states and the District of Columbia to begin burning coal rather than fuel oil.

The amendment to the Energy Supply Act would direct the Energy Department to issue conversion orders to all electric generating plants identified by the President's Commission on Coal as capable of using coal.

Ford said the Power Plant and Industrial Fuel Use Act of 1978 gave the energy secretary authority to order utilities to use coal but did not make the switch mandatory—something he would like to change.

The Kentucky senator noted the commission estimated the switch would cost utilities \$5.2 billion by 1985.

The states are Maryland, Massachusetts, New York, Maine, Illinois, New Jersey, Delaware, Michigan, Georgia, Connecticut, Kansas, Oklahoma, Nebraska, Pennsylvania, Colorado, New Hampshire, Florida, Virginia, and Wisconsin.

Utilities operating the plants that would be ordered to switch to fossil fuel include Baltimore Gas & Electric, Boston Edison, Central Hudson Gas & Electric, Central Maine Power, Commonwealth Edison, Consolidated Edison, Deepwater Operating, Delmarva Power & Light, Detroit Edison, Georgia Power, Jersey Central Power & Light, Hartford Electric Light, Kansas Power & Light.

Long Island Lighting, New England Gas & Electric, New England Power, Niagara Mohawk, Northeast Utilities, Oklahoma Gas & Electric, Omaha Public Power, Orange and Rockland Utilities, Philadelphia Electric, Potomac Electric Power, Public Service of Colorado, Public Service of New Hampshire, Public Service Electric & Gas, Savannah Electric & Power, Tampa Electric, United Illuminating, Virginia Electric Power, and Wisconsin Public Service.

Currently, only 25 percent of total ash production is being used. That leads to a question that has plagued the industry since its start and will get thornier as coal burning increases.

Where do you stash big caches of ashes?

"They go into what we like to call storage," said Faber. "You have to expect some big mounds of ashes around in places." But he noted ashes often improve eyesore locations through covering and filling in.

TVA's ... (Continued from Page 1)

Members of the USSR delegation were V. YE Denisov, G. S. Chekanov, V. A. Zazulin, M. V. Pechenkin, G. V. Martynov. Mr. Zazulin, Chief Specialist of the Institute "Teploeksploiyet" (Heat and Power Design), acted as principal spokesman.

Two representatives of the Environmental Protection Agency, Frank T. Princotta and Julian W. Jones, also addressed the group. Jones reviewed "Effluent Treatment and Recycle Technology to Meet Regulations For Coal-Fired Steam Electric Plants."

Poland Seminar Set

BIELSKO-BIALA, Poland—Papers are being solicited for a "Seminar on the Extraction, Removal, and Use of Ash From Coal-Fired Thermal Power Stations" to be held here September 16-20, 1980.

The program is to be held under the auspices of the United Nations Committee on Electric Power. It is being organized by the Government of Poland with the assistance of the Enterprise for the Utilization of Waste from Electric Power Stations.

Three major groups of topics on which papers may be submitted for consideration are (1) Installations for the collection, extraction, fractional separation and removal of fly ash and slag produced by coal-fired stations; (2) Proposal for the use of fly ash and slag, and (3) Dust control in the storage and transport of fly ash.

The last UN sponsored ash seminar was held at Ankara, Turkey in November 1970. A large delegation of ash technologists, headed by NAA Director John H. Faber, represented the United States at that session.

Randolph Seeks RCRA Delay On Power Plant Ash

WASHINGTON—Senator Jennings Randolph (D-W.Va.) sees a "very good chance" that the bill as enacted by Congress this year to extend the Resource Conservation and Recovery Act (RCRA) will include a provision postponing regulation of power plant ash as a hazardous waste.

It is already in the Senate version of the legislation (S. 1156), thanks to a floor amendment strongly endorsed by the West Virginian as Chairman of the Environment and Public Works Committee.

If similar language is not embodied in the bill on the subject passed by the House, he has made it clear he will work hard to have the Senate amendment retained in conference on the legislation.

"The postponement is fully justified in the absence of any clear showing of hazardous characteristics in that material", Randolph asserted in a statement here. "Re-use of this type of by-product is entirely in keeping with one of the primary goals and purposes of the resource conservation and recovery program and it would be extremely unfortunate if regulations were imposed limiting such utilization unless they are shown to be necessary."

Randolph said he was "gratified and encouraged" by the decision of the Environmental Protection Agency to proceed with a comprehensive study of the issue even before there is final action on the extension bill.

He said he had been advised that the agency has, with industrial concurrence, selected 16 "representative" sites for the purposes of the study and evaluation of utility wastes and that the undertaking would begin shortly on a contract basis.

The study is expected to take a year or more to complete, he said he was told.



COAL CONVERSION—A pointed pitch for converting oil and gas burning utility plants came recently during the meeting between lawmakers and Administration officials. Senator Jennings Randolph (D-WV), chairman of the meeting, is shown above greeting Secretary of Energy Charles Duncan (left) and EPA Administrator Douglas Costle. Senators Birch Bayh (D-Ind) and John Warner (R-VA) flank Randolph. During the two-hour meeting, Duncan promised immediate action on utilizing present laws to increase coal use and said new legislation will be coming to Capitol Hill soon to speed coal conversion efforts.

Fly Ash Aids In SO₂ Removal

An official of Peabody Process Systems says fly ash can be effectively utilized to remove SO₂ from boiler flue gases.

In an article appearing in the June issue of *Power Engineering*, Carlton Johnson reports fly ash is an attractive and viable alternative to conventional lime/limestone scrubbing systems.

Ash used as a source of alkali values to partly or completely supplant lime/limestone in scrubber systems can

reduce initial and operating costs and improve system reliability, Johnson relates.

He summarized the economic benefits as including (1) elimination of alkali cost, (2) reduction in power consumption, (3) reduction in initial capital investment, (4) reduction in waste solids handling and disposal cost, and (5) improved system reliability.

NAA members may obtain copies of the report by contacting the association's Washington office.

EIGHT NEW UTILITIES JOIN NAA

(Continued from Page 1)

National Ash Association is promulgating the continued and expanded use of all recycled ash by-products are being sent to utility executives across the country.

The message is contained in a letter from EEI President William McCollam Jr. and in EPRI's monthly Executive Report. EPRI identified the functions of each agency under the general title of "Coal Waste Utilization: A Necessary Alternative" as follows:

EPRI—EPRI, through projects both underway and planned, will develop technical data based on coal waste properties, carry out demonstrations of generic utilization options, and develop

economic and environmental impact data;

EEI—EEI, through its ad-hoc Utility Solid Waste Activities Group and working in the regulatory arena, will utilize this and other data to influence governmental agencies not to prohibit intentionally or unintentionally the use of coal ash products by regulation;

NAA—NAA will provide a central clearing house for information on use and re-use options, disseminate this information particularly to potential user industries, provide case-by-case technical assistance to help utilities and potential customers determine the suitability of ash use in specific instances, and promote the desirability of ash use to industry and the interested public.

In and Around ACAA



Manchester, UK

ACAA Chairman Steve Benza addresses the audience September 6 at AshTrans 2022, billed as “The International Meeting Platform for By-Product Logistics & Trading.”



Birmingham, AL

Anna Lasso, Managing Director of Smart EPD, delivers remarks at the ACAA 2022 Fall Membership Meeting. ACAA and the Natural Pozzolan Association are partnering with Smart EPD to develop a North American Product Category Rule for supplementary cementitious materials (see News Roundup for more details).



Birmingham, AL

Ashley Burke, Senior Vice President of Communications at the National Mining Association, discusses the “Results of Recent Public Polling” at ACAA’s 2022 Fall Membership Meeting.



Manchester, UK

Nathan Boone, Chief Commercial Officer at Charah Solutions Inc., presents “Meeting Fly Ash Demand Through Ash Harvesting and Beneficiation” at AshTrans 2022.

ACAA Winter Membership Meeting

January 31 – February 1, 2023

Rosen Plaza Hotel • Orlando, Florida



Photo: Rosen Plaza Hotel

Join us for the 18-hole golf scramble at the Shingle Creek Golf Club to benefit the ACAA Educational Foundation! The scramble will be held on **Monday, January 30.**

Pre-registration for in-person attendance will not be available after 12:00 pm EST on Monday, January 23rd. After this time, on-site registration at the hotel will still be available.



WOCA 2022 Proves Worth the Wait

After a one-year pandemic-induced delay, World of Coal Ash returned in force May 16-19, 2022, to the Northern Kentucky Convention Center in Covington, Kentucky. The final tally of 1,057 participants fell just shy of WOCA attendance records, despite smaller-than-usual numbers of attendees from countries still struggling with COVID travel restrictions. Ultimately, 397 abstracts were submitted and 245 presentations were delivered during the conference.

A packed exhibit hall and new features like the Technology Showcase kept attendees busy in between concurrent technical presentations on a wide range of topics. Social events including an Ohio River riverboat cruise provided a welcome return to industry socializing.

Presentations and proceedings papers from WOCA 2022 are now available online for conference attendees at <https://worldofcoalah.org/2022-woca-proceedings>. WOCA registrants have been emailed a password to the proceedings archive. If you lost your password, contact ACAA's Alyssa Barto at alyssa.barto@acaa-usa.org.

The American Coal Ash Association and the University of Kentucky Center for Applied Energy Resources thank all conference sponsors, exhibitors, and attendees for making WOCA 2022 such a success!

WOCA 2022 Award Recipients

Alice Marksberry Memorial Award

Sponsored by the UK Center for Applied Energy Research

Winner: Bruce Hensel, Electric Power Research Institute

WOCA Student Poster Award

Sponsored by American Coal Ash Association Educational Foundation

Winner: Benjamin Kienzle, University of Texas at Austin

WOCA Poster Award

Sponsored by Electric Power Research Institute

Winner: Chin-Min (Jason) Cheng, The Ohio State University

WOCA Student Oral Presentation Award

Sponsored by the Midwest Coal Ash Association

Winner: Omar Amer, Clemson University





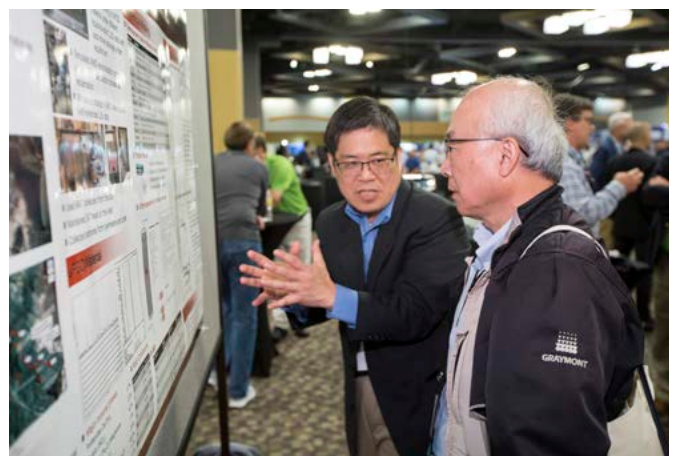




Photo: Experience Grand Rapids

WORLD of COALASH 2024

MAY 13 - 16

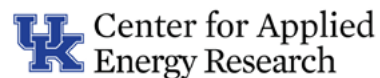


DeVos Place Convention Center
Grand Rapids, Michigan

Host Hotel: Amway Grand Plaza



Organized by the American Coal Ash Association and
The University of Kentucky Center for Applied Energy Research



Welcome, New ACAA Members!



Arizona Electric Power Cooperative is a member-owned, not-for-profit electric generation and transmission (G&T) cooperative. Its mission is to provide reliable, affordable power to electric co-ops across the Southwest. The company is active in the fly ash market and has produced and sold fly ash from its coal facility for over 40 years. It has a continued interest in the national policy decisions governing coal-fired generation and the production of fly ash for beneficial use. The company joins as a Utility Member. To learn more, please visit www.azgt.coop/about/arizona-electric-power-cooperative.



Commercial Liability Partners helps owners of distressed assets discharge their environmental and remedial liabilities. The company purchases industrial sites all over the U.S., cleans them up, and positions them for re-sale. They join as an Associate Member. To learn more, please visit www.commercialliabilitypartners.com.



EP Power Minerals Americas Inc. is engaged in the procurement, management, and marketing of CCPs in the United States, Europe, and Asia. The company joins as a General Marketer Member. To learn more, please visit www.eppowerminerals.com.



Heritage Environmental Services offers a variety of services and solutions: beneficiation services for coal combustion residues (CCRs); on-site wastewater, stormwater, and groundwater treatment solutions; industrial maintenance and cleaning services; decommissioning services; ESG services (life-cycle assessments, GHG inventories, sustainability reporting, environmental product declarations); and site remediation and brownfield redevelopment services. The company joins as a Non-Utility Member. To learn more, please visit www.heritage-enviro.com.



HTH, LLC assists companies with managing their coal combustion products and other supplementary cementitious materials. The company joins as an Associate Member.



ME2C Environmental is a leading environmental technologies company developing and delivering patented and proprietary solutions to the global power industry. ME2C's leading-edge mercury emissions technologies and services have been shown to achieve emissions removal at a significantly lower cost and with less operational impact than currently used methods, while maintaining and/or increasing power plant output and preserving the marketability of fly ash for beneficial use. The company joins as an Associate Member. To learn more, please visit www.me2cenvironmental.com.

NXT Innovations, LLC is a consulting services business in the energy, environment, and construction materials markets with a focus on CCP reclamation, closure and environmental compliance, processing technologies, and beneficial use applications. The company joins as an Associate Member.



Ohio Valley Cement Materials has over 40 years of experience collectively in the building materials industry. The company uses all manner of cementitious materials in its ready-mix operations and strives to find alternative solutions to supply chain constraints, including the use of CCPs. It also distributes cement and other cementitious materials to its established customer base. The company joins as an Associate Member. To learn more, please visit www.ohiovalleycementmaterials.com.



Ozinga Bros. Inc. is a supplier of concrete, bulk materials, and energy solutions, while offering transportation services through an extensive network of truck, rail, barge, and ship terminals. Ozinga is proud to be an American-owned, fourth-generation family business serving the communities "where we live, work, and play." The company joins as an Associate Member. To learn more, please visit www.ozinga.com.



Romano Consulting Company provides consulting services to the construction and energy industry with respect to beneficial use of coal combustion products. The company joins as an Associate Member.

Romano Consulting Company

Vecor Technologies is a research and commercialization company focused on ceramics, ceramic composites, and advanced materials. Coal ash beneficiation is at the core of Vecor Technologies' history. Utilizing materials that would otherwise become waste, and creating products that are environmentally positive, remain a central focus of the company's R&D. The company joins as an Associate Member. To learn more, please visit www.vecortech.com.



News Roundup

Coal Ash Recycling Volumes Increase in 2021

Sixty percent of the coal ash produced during 2021 was recycled—increasing from 59 percent in 2020 and marking the seventh consecutive year that more than half of the coal ash produced in the United States was beneficially used rather than disposed.

The American Coal Ash Association's annual "Production and Use Survey" also showed that use of harvested ash is continuing to grow. Nearly 4.5 million tons of previously disposed ash was utilized in a variety of applications in 2021, including coal ash pond closure activities, concrete products, cement kiln raw feed, and gypsum panel manufacturing. The volume of harvested ash that was utilized increased 12 percent, or more than 500,000 tons, over the previous year.

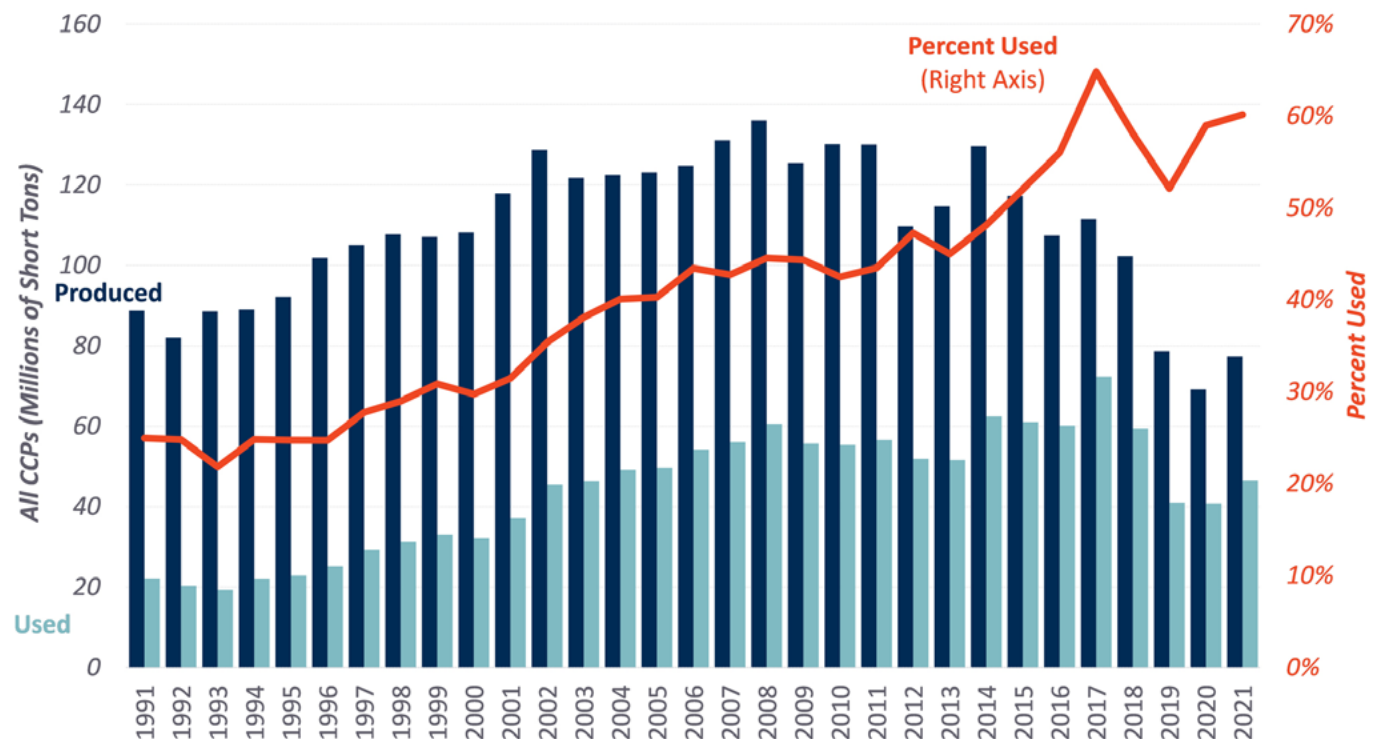
"Harvested ash utilization volumes now equal nearly 10 percent of the volume of ash recycled from current power plant operations," said Thomas H. Adams, ACAA Executive

Director. "The rapidly increasing utilization of harvested coal combustion products (CCPs) shows that beneficial use markets are adapting to the decline in coal-fueled electricity generation in the United States. New logistics and technology strategies are being deployed to ensure these valuable resources remain available for safe and productive use. We must continue to support these practices that safely conserve natural resources while dramatically reducing the need for landfills."

According to ACAA's 2021 survey, 46.5 million tons of coal combustion products were beneficially used in 2021, an increase of nearly 6 million tons over the previous year. Production of new CCPs also increased from 69.1 million tons in 2020 to 77.3 million tons in 2021 as utilities consumed more coal for generating electricity.

"Coal ash" is a generic term encompassing several coal combustion products that can be beneficially used in a wide variety of applications. Highlights of CCP production and use in 2021 include:

All CCPs Production and Use with Percent





- Use of coal fly ash in concrete increased slightly, from 11.1 million tons to 11.9 million tons. Concrete producers and consumers indicated a desire to use more fly ash, but several regional markets continued to be affected by shifting supply dynamics associated with closures of coal-fueled power plants. Fly ash improves concrete durability and significantly reduces greenhouse gas emissions associated with concrete production.
- Use of all coal combustion products in cement production increased 14 percent to 5.6 million tons.
- Utilization of a key “non-ash” coal combustion product also posted a significant increase. Synthetic gypsum is a byproduct of flue gas desulfurization units, also known as “scrubbers,” located at coal-fueled power plants. Use of synthetic gypsum in panel products (i.e., wallboard) increased 15 percent to 11.7 million tons.
- Synthetic gypsum use in agricultural applications—in which the gypsum improves soil conditions and prevents harmful runoff of fertilizers—remained about level at 822,902 tons.
- Use of CCPs in pond closure activities declined from 3.4 million tons to just under 3 million tons. This activity is driven by utility compliance with coal ash regulations enacted in 2015 that effectively require an end to the practice of wet disposal. Fly ash, bottom ash, and synthetic gypsum were all used in construction of new permanent disposal facilities.
- Use of CCPs in structural fills rebounded in 2021 following several years of declines, increasing from 816,543 tons in 2020 to just over 2 million tons in 2021.
- Production of boiler slag also rebounded from 834,000 tons in 2020 to 1.2 million tons in 2021, with utilization in the

production of blasting grit and roofing granules increasing from 273,548 tons to 481,245 tons.

- Following a year in which no cenospheres were reported as being marketed, 2021 saw 107,835 pounds of the material sold.

ACAA Launches Product Category Rule Development

American Coal Ash Association and the Natural Pozzolan Association are partnering with Smart EPD to develop a North American Product Category Rule (PCR) for supplementary cementitious materials (SCMs). Developing this new PCR is the first step in developing Environmental Product Declarations (EPDs), which will allow cement and concrete manufacturers, as well as other pozzolan users, to evaluate environmental impacts of SCMs from an “apples-to-apples” comparison that follows ISO International Standards.

Product Category Rules help minimize confusion among various types of environmental reporting by establishing a clear, consistent evaluation method by which the environmental impact claims of products—including carbon emissions—are evaluated. Once a PCR is established, an EPD can be created based on product evaluations. The resulting EPD allows for a fairer comparison of environmental impacts between similar products and is an important transparency tool. To produce an EPD, companies must first develop a life cycle assessment for their product that addresses product-specific calculations and requirements specified in a PCR.

Smart EPD is a type III EPD Program Operator focused on developing rigorous, consensus-based PCRs and leveraging digital tools to create, certify, and exchange product environmental impact data at scale. Smart EPD was founded with the vision of helping organizations create EPDs at scale and



explore innovative reporting solutions all while maintaining highly rigorous third-party quality standards.

“We applaud the coal ash and natural pozzolan industries’ efforts to develop this PCR because it is a big first step in providing transparency for SCMs and, consequently, cement and concrete,” said Anna Lasso, Managing Director of Smart EPD, who will also serve as the PCR project manager. “This is an important industry-led effort to enable procurement of lower-carbon materials required by federal and state ‘buy clean’ policies.”

For more information about the PCR development process, contact info@smartepd.com.

Key Coal Ash Standards Under Development

Coal ash beneficial use remains front and center in the standards development activities of two major ASTM International committees.

ASTM Committee C09 on Concrete and Concrete Aggregates continues to pursue multiple initiatives related to the use of coal fly ash and other supplementary cementitious materials. Efforts include initiatives to evaluate SCMs based on

performance rather than prescriptive requirements, removing the Standard C618 requirement of an LOI limit of 6 percent, and revising C618 to include bottom ash and acknowledge that fly ash may come from a harvesting site rather than directly from the power plant.

ASTM Committee E50 on Environmental Assessment, Risk Management, and Corrective Action is preparing to reapprove the E 2060 Guide for Use of Coal Combustion Products for Solidification/Stabilization of Inorganic Wastes. Committee members are also developing a new standard guide addressing “Characterization of Coal Combustion Products (CCPs) in Storage Area(s) for Beneficial Use.” The proposed guide is intended to serve as a companion document to ASTM E3183-18 Standard Guide for Harvesting Coal Combustion Products Stored in Active and Inactive Storage Units for Beneficial Use.

Litigation Commences on Coal Ash Disposal Regulation

Litigation has commenced over actions the U.S. Environmental Protection Agency took in January 2022 to enforce elements of its 2015 coal ash disposal regulations. Challenges have been filed in the U.S. Court of Appeals for the District of Columbia Circuit by the Utility Solid Waste

Activities Group and by a collection of individual utilities directly affected by EPA's decisions.

The Petitions for Review allege that EPA unlawfully revised aspects of its regulation when it acted on utility requests for extensions of "cease receipts" deadlines for coal ash disposal units. The lawsuits claim EPA's actions essentially changed the substance of the regulation without proper opportunities for public notice and comment.

In January 2022, EPA said it reviewed the 57 demonstrations submitted by facilities for extensions to the cease-receipt-of-waste deadline. The Agency is now slowly working through the list of demonstrations that were marked complete to either approve or deny the deadline extensions.

Meanwhile, a consortium of environmental groups sued the U.S. Environmental Protection Agency seeking to expand the universe of inactive coal ash disposal sites subject to the EPA's Coal Combustion Residuals regulations.

In a complaint filed on August 25, 2022, with the U.S. District Court for the District of Columbia, the groups claimed "exemption of inactive CCR landfills allows hundreds of dangerous and leaking toxic dumps to escape critical safeguards, including monitoring, inspection, closure, cleanup, and reporting requirements. Data reveal that the toxic heavy metals leaking from inactive CCR landfills located throughout the U.S. pose an unabated and significant threat to human health and the environment."

EPA's 2015 CCR rule imposed groundwater monitoring requirements for CCR landfills that accepted ash after October 19, 2015, existing surface impoundments, and, to a limited degree, inactive CCR surface impoundments, but exempted inactive CCR landfills from the regulations. In response to a petition from environmentalists, EPA expanded the rule in 2016 to apply to inactive surface impoundments that still contained both CCRs and liquids.

In 2018, the U.S. Court of Appeals for the District of Columbia Circuit ruled that EPA must expand the rule

further to address inactive CCR disposal units that are located at closed power plants, also known as legacy sites. In late 2020, EPA initiated an Advanced Notice of Proposed Rulemaking to take comments on the legacy sites issue. In the most recent published regulatory agenda, EPA indicated it would issue a Notice of Proposed Rulemaking for legacy sites in November 2022 and a Final Rule in November 2023.

The new litigation by environmental groups seeks an even broader definition of legacy sites to include inactive CCR disposal units both at power plant locations and off-site. Environmental groups estimate that at least 500 million tons of CCRs are contained in approximately 300 legacy landfills in 38 states.

Coal Ash Mine Placement Program Approved

The U.S. Office of Surface Mining Reclamation and Enforcement (OSMRE) approved a long-awaited amendment to the Pennsylvania regulatory program for beneficial use of coal ash at active surface coal mining sites.

Mine placement of coal ash is exempt from the U.S. Environmental Protection Agency's 2015 regulations for disposal of coal combustion residuals. Since 1982, Pennsylvania has operated its own regulatory program for mine placement of coal ash under conditional approval by OSMRE, a unit of the Department of the Interior.

In a request made over a decade ago, Pennsylvania asked OSMRE to approve regulations related to the beneficial use of coal ash at active coal mine sites. Key provisions of the amendment include operating requirements for beneficial use, including certification guidelines for chemical and physical properties of coal ash beneficially used, and water quality monitoring requirements.

OSMRE actively reviewed the request in 2014 and 2015, including soliciting public comment and holding public hearings. Final approval of the amendment became effective on May 12, 2022.

2022 ACAA Educational Foundation Scholarship Winners Selected

The American Coal Ash Association Educational Foundation (ACAAEF) has distributed a total of \$31,000 in scholarship awards to nine graduate and undergraduate students with an interest in the management and beneficial use of coal combustion products. The cash awards ranged from \$1,000 to \$5,000 and went to applicants representing a wide variety of fields of study, including biogeochemistry; materials science; and civil, environmental, and mechanical engineering.

Students receiving \$5,000 David C. Goss Scholarship Awards were Yousif Alqenai – PhD, Civil Engineering, Drexel University; Shaivan Shivaprakash – Graduate, Biogeochemistry, Georgia Institute of Technology; Mohammadreza Sharbaf – PhD, Civil Engineering, Pennsylvania State University; and Qitong Liu – Graduate, Civil & Environmental Engineering, University of Wisconsin – Madison. Students receiving \$2,500 John Faber Scholarship Awards were Weiqi Wang – Graduate, Civil Engineering, Clemson University; Fabian Rodriguez – Graduate, Civil Engineering, Purdue University; Casey Sundberg – Graduate, Materials Science & Engineering, Michigan Technological University; and Andrew Witte – Graduate, Civil Engineering, University of Illinois Urbana-Champaign. Donovan Cranfield – Sophomore, Mechanical Engineering, North Carolina Agricultural & Technical State University, received a \$1,000 ACAAEF Scholarship Award.

Applications were reviewed and rated by multiple judges based on course work, grades, recommendations, career goals, and essays. ACAA thanks the following member volunteers for participating in the evaluation process: Glenn Amey, Charah Solutions; Travis Collins, National Minerals Corporation; Peggy Rennick, Charah Solutions; Mark Rokoff, Burns & McDonnell; John Trast, GEI Consultants; Mindy Ward, Eco Material Technologies; and Thomas Adams, ACAA.

ACAAEF was established by the American Coal Ash Association to promote understanding of the management and beneficial use of coal combustion products through scholarship awards, development and distribution of educational materials, supporting targeted research, and sponsorship of educational forums. The ACAAEF Board comprises Chair, Steve Benza, HTH, LLC; President, Thomas Adams, ACAA; Secretary/Treasurer, Travis Collins, National Minerals Corporation; Director, Glenn Amey, Charah Solutions; Director, Ivan Diaz, Ozinga Bros.; Director, Dale Diulus, Salt River Materials Group; Director, Anne Oberlink, UKY-CAER; Director, Russell Stapp, Eco Material Technologies; and Director, John Trast, GEI Consultants.

David C. Goss Scholarship Winners



Yousif Alqenai, Drexel University

Essay: “Evaluating controlling parameters associated with the manufacturing process of high-performance lightweight aggregates (LWA) from waste coal combusted ash”

Abstract: The use of waste coal ash to produce a beneficial product can help reduce its harmful effect on the environment. Understanding and optimizing the manufacturing process of lightweight aggregate (LWA) from waste coal ash will help reduce wasted energy, time, and material. Enhancing the physical and mechanical properties of the resultant LWA will produce an efficient product that best fits its intended application. The manufacturing of LWA from waste coal ash consists of many controlling factors that affect the LWA’s final properties. The investigated controlling parameters that affect the LWA performance include the specific gravity, water absorption, unit weight, LWA particle size distribution (LWA-PSD), compressive strength, and leachability. This research attempts to analyze and optimize these controlling

parameters in order to achieve high-performance lightweight aggregates. The study will further optimize sintering properties for laboratory and pilot-scale production to assure the feasibility of large-scale industrial production. In addition, this research strives to produce an efficient product with high-performance capabilities that can benefit the concrete industry.



Shaivan Shivaprakash, Georgia Institute of Technology

Abstract: New 2019 EPA rules require closure of unlined coal ash impoundments, including clay-lined impoundments. Safe design of impoundments, handling, and management of CCPs requires a fundamental knowledge of the intrinsic properties of coal ash and its behavior. Shortcomings in the literature are highlighted, and evidence obtained for cenospheres and plerospheres is discussed. Further testing plans to obtain intrinsic properties of CCPs are also discussed. This should serve as a foundation to build larger-scale computational models and capture failure mechanisms.



Mohammadreza Sharbaf, Pennsylvania State University

Essay: “Evaluation of Fluidized Bed Combustion Fly Ash and Ground Bottom Ash as Sustainable Supplementary Cementitious Materials”

Abstract: Recently, there have been significant supply shortages of conventional supplementary cementitious materials (SCM), such as silica fume, fly ash, and slag, for use in concrete. This essay evaluates the performance of fluidized bed combustion (FBC) fly ash and ground bottom ash (GBA) as sustainable and vastly available SCM alternatives. Based on the results of this study, most of the FBCs’ and GBAs’ physical and chemical properties comply with ASTM C618 standard requirements, and they have a great potential to be used as SCM in cement-based materials.

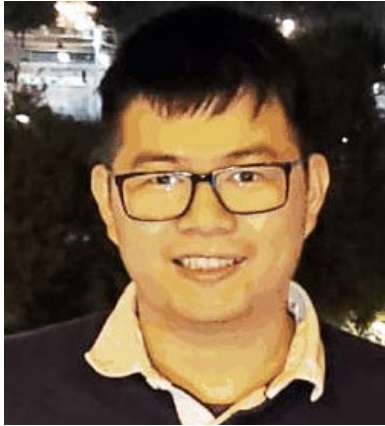


Qitong Liu, University of Wisconsin – Madison

Essay: “Beneficiation and Utilization of Flue Gas Desulfurization Fly Ash in Cement-Based Materials”

Abstract: The application of semi-dry or dry flue gas desulfurization (FGD) fly ash (FA) is very limited due to its high sulfur content. In this study, an accelerated method was proposed to investigate the detrimental effect of high-sulfur FA (HSFA) on cement-based materials. Next, HSFA was beneficiated through treating by dilute acid solution to reduce its sulfur content. To assess the suitability of the beneficiated FA (BFA) for cement-based materials, compressive strength and electrical resistivity of cement mortars were examined. Results show that, compared to the control mix, BFA resulted in higher compressive strength and electrical resistivity after 28 days of curing.

John Faber Scholarship Winners



Weiqi Wang, Clemson University

Essay: “Use of High-Alkali Reclaimed Fly ashes (RFAs) and Ground Bottom Ashes (GBAs) as Alternative Supplementary Cementitious Materials (SCMs) for Mitigating Alkali-Silica Reaction (ASR) in Concrete”

Abstract: This study proposes an investigation into the quantification and qualification of alkalis present in ground bottom ashes (GBAs) as well as reclaimed fly ashes (RFAs), i.e., available and/or unavailable alkalis, to study the availability of these alkalis to be readily released into the pore solution and the role of these alkalis in affecting ASR in concrete. For this study, four GBAs and four RFAs (with varying total alkali content) from Duke Energy will be investigated in combination with a known source of reactive aggregate—a siliceous argillite aggregate from Gold Hill Quarry in North Carolina. The alkali release from SCMs into a pore solution of concrete will be investigated and analyzed as a function of the available and the total alkali content of these ashes. Subsequently, the potential of these alkalis to participate in ASR distress in concrete will be evaluated using a series of standard test methods, such as ASTM C1293 (unboosted and boosted alkali levels), modified AASHTO T380 test method (with and without soak solution) along with ASTM C1567 test methods. In addition, the pozzolanic reactivity of these ashes will be studied using the R3 test (ASTM C1897) as well as the modified Chapelle test (French norm NF P 18-513, Annexe A). Based on the results from this study, a recommendation will be developed to evaluate the nature of the alkalis present in these ashes and their potential to mitigate ASR distress in concrete.



Fabian Rodriguez, Purdue University

Essay: “Use of Coal Combustion Products as Replacement for Ordinary Portland Cement on Mixtures for 3D-Printing Concrete”

Abstract: 3D-Concrete Printing (3DCP) has emerged in recent years as a promising fabrication technique for a wide range of infrastructure applications in an attempt to modernize and revolutionize the construction processes and materials. Initial efforts to demonstrate the viability of 3D-printing of concrete or cementitious materials as an alternative to conventional cast concrete have focused on the development of suitable materials for printing. The research presented here aims to determine the potential use of non-conventional supplementary cementitious materials (SCMs) such as selected coal combustion products (CCPs) on mortar mixtures for 3D-printing based on their mixture composition, rheological behavior, and fresh-state properties (physical and mechanical) right after the extrusion process.





Casey Sundberg, Michigan Technological University

Abstract: It is important that modern structures have reliable safety features to guard against damage caused by fires and other high-temperature emergency conditions. Currently portland cement concrete (PCC) is often relied upon for high-temperature resistance. However, it is a hydraulic material and begins to dehydrate above 100°C, completely disintegrating by 1100°C. It is also brittle and tends to fracture suddenly without visible warning. Fly ash-based alkali-activated cement (AAC) can be used directly in place of PCC and offers measured benefits in safety and performance over PCC. Low-calcium Class F fly ash-based AACs do not require hydration to maintain structural integrity. They exhibit a glass transition and are plastic at high temperatures, improving safety. AACs can also immobilize contaminants and hazardous radioactive materials, such as those found in a nuclear power plant (NPP) after a meltdown.



Andrew Witte, University of Illinois Urbana-Champaign

Abstract: Fly ash is a critical supplementary cementitious material (SCM) in the concrete industry. Unfortunately, current fly ash ASTM standards lack dependability in measuring pozzolanic reactivity. As such, I plan to investigate trends that can lead to improved standards and treatment methods to widen the range of fly ashes used as SCMs, making the concrete industry more sustainable. To that end, my current research involves characterizing ashes taken from various power plants across the U.S., as well as some off-specification ashes, using SEM-EDS, XRF, XRD, and Raman spectroscopy. Research up to this point has demonstrated the ability of Raman imaging to detect and map mineral phases, including glassy phases. Differentiating siliceous glasses from calcium-rich silicate glasses is possible in both Raman and XRD, but Raman allows for analysis at the individual particle level. Raman imaging also shows promise as a useful tool for evaluating the effects of particle size and morphology on the characteristics and performance of fly ash.

ACAAEF Scholarship Winner



Donovan Cranfield, North Carolina Agricultural & Technical State University

Abstract: As of my sophomore year at North Carolina A&T State University, being enrolled in a Strength of Materials class under Dr. Kunigal Shivakumar, I was given the opportunity to explore a research project. This project is still young, having only started in the summer of 2021. The ultimate goal is to make usage of pond ash and fly ash, mixed with a specific amount of alkaline solution, to create a substance that can replace the usage of concrete.

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ACAA
AMERICAN COAL ASH ASSOCIATION



— BENEFICIAL USE OF COAL COMBUSTION PRODUCTS —

AN AMERICAN RECYCLING SUCCESS STORY

AN AMERICAN RECYCLING SUCCESS STORY

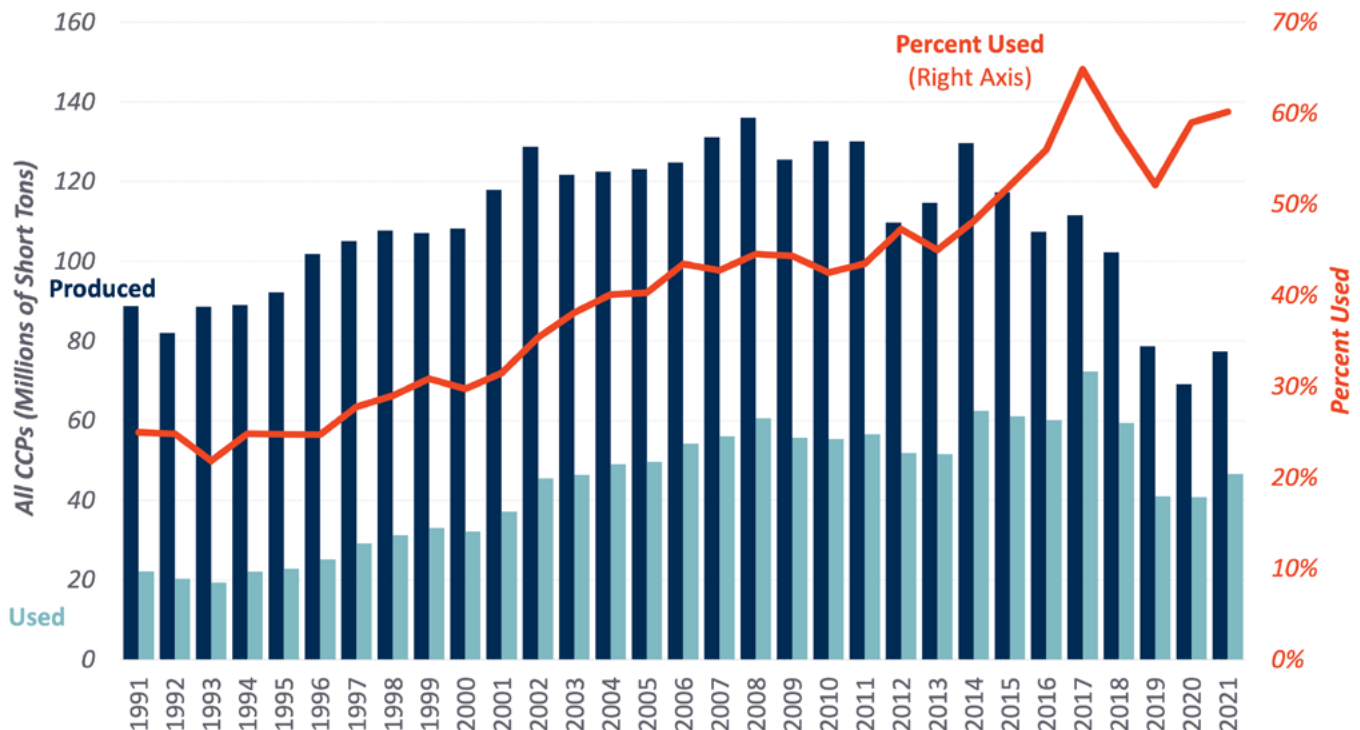
Coal combustion products – often referred to as “coal ash” – are solid materials produced when coal is burned to generate electricity. There are many good reasons to view coal ash as a resource, rather than a waste. Using it conserves natural resources and saves energy. In many cases, products made with coal ash perform better than products made without it.

As coal continues to produce approximately one-quarter of the electricity generation in the United States, significant volumes of coal ash are produced. Since 1968, the American Coal Ash Association has tracked the production and use of all types of coal ash. These surveys are intended to show broad utilization patterns and ACAA's data have been accepted by industry and numerous government agencies as the best available metrics of beneficial use practices.

Sixty percent of the coal ash produced during 2021 was recycled—increasing from 59 percent in 2020 and marking the seventh consecutive year that more than half of the coal ash produced in the United States was beneficially used rather than disposed.

American Coal Ash Association's 2021 “Production and Use Survey” also showed that use of harvested ash is continuing to grow. Nearly 4.5 million tons of previously disposed ash was utilized in a variety of applications in 2021, including coal ash pond closure activities, concrete products, cement kiln raw feed, and gypsum panel manufacturing. The volume of harvested ash that was utilized increased 12 percent, or more than 500,000 tons, over the previous year.

All CCPs Production and Use with Percent



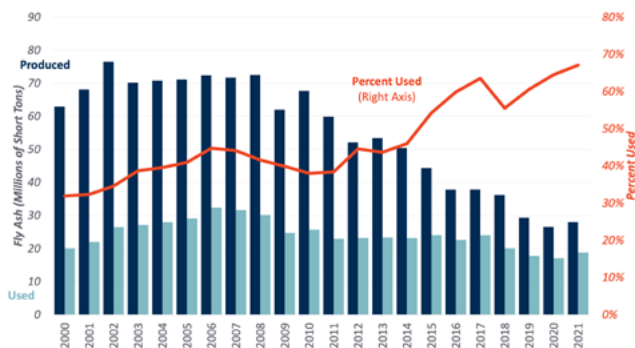
Fly Ash

Fly ash is a powdery material that is captured by emissions control equipment before it can “fly” up the stack. Mostly comprised of silicas, aluminas and calcium compounds, fly ash has mechanical and chemical properties that make it a valuable ingredient in a wide range of concrete products. Roads, bridges, buildings, concrete blocks and other concrete products commonly contain fly ash.

Concrete made with coal fly ash is stronger and more durable than concrete made with cement alone. By reducing the amount of manufactured cement needed to produce concrete, fly ash accounts for approximately 12 million tons of greenhouse gas emissions reductions each year.

Other major uses for fly ash include constructing structural fills and embankments, waste stabilization and solidification, mine reclamation, and use as raw feed in cement manufacturing.

Fly Ash Production & Use 2000 – 2021



Fly ash ranges in color from gray to buff depending on the type of coal.



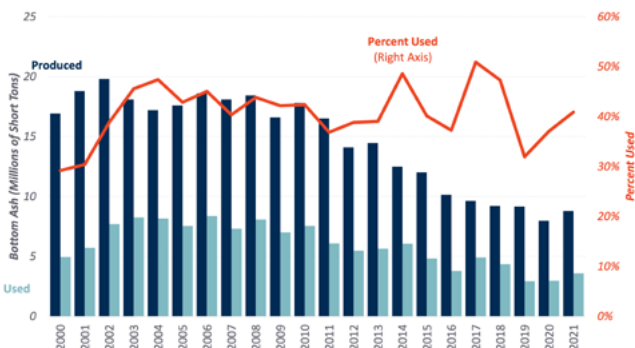
The American Road & Transportation Builders Association estimates coal fly ash use in roads and bridges saves \$5.2 billion per year in U.S. construction costs.

Bottom Ash

Bottom ash is a heavier, granular material that is collected from the “bottom” of coal-fueled boilers. Bottom ash is often used as an aggregate, replacing sand and gravel. Bottom ash is often used as an ingredient in manufacturing concrete blocks.

Other major uses for bottom ash include constructing structural fills and embankments, mine reclamation, and use as raw feed in cement manufacturing.

Bottom Ash Production & Use 2000 – 2021



Bottom ash can be used in asphalt paving.



Bottom ash is a granular material suitable for replacing gravel and sand.

Synthetic Gypsum

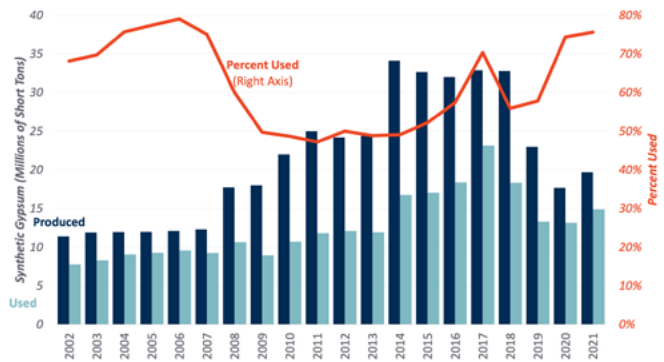
Power plants equipped with flue gas desulphurization (“FGD”) emissions controls, also known as “scrubbers,” create byproducts that include synthetic gypsum. Although this material is not technically “ash” because it is not present in the coal, it is managed and regulated as a coal combustion product.

Scrubbers utilize high-calcium sorbents, such as lime or limestone, to absorb sulfur and other elements from flue gases. Depending on the scrubber configuration, the byproducts vary in consistency from wet sludge to dry powdered material.

Synthetic gypsum is used extensively in the manufacturing of wallboard. A rapidly growing use of synthetic gypsum is in agriculture, where it is used to improve soil conditions and prevent runoff of fertilizers and pesticides.

Other major uses for synthetic gypsum include waste stabilization, mine reclamation, and cement manufacturing.

Synthetic Gypsum Production & Use 2002 – 2021



Synthetic gypsum is often more pure than naturally mined gypsum.



More than half of the gypsum wallboard manufactured in the United States utilizes synthetic gypsum from coal-fueled power plants.



Synthetic gypsum applied to farm fields improves soil quality and performance.



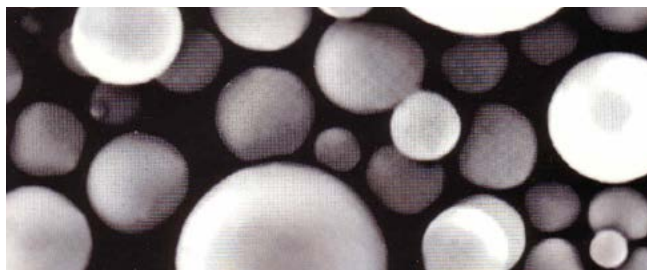
Other Products and Uses

Boiler Slag – is a molten ash collected at the base of older generation boilers that is quenched with water and shatters into black, angular particles having a smooth, glassy appearance. Boiler slag is in high demand for beneficial use as blasting grit and roofing granules, but supplies are decreasing because of the retirement from service of older power plants that produce boiler slag.



Nearly 90 percent of all boiler slag is beneficially used.

Cenospheres – are harvested from fly ash and are comprised of microscopic hollow spheres. Cenospheres are strong and lightweight, making them useful as fillers in a wide variety of materials including concrete, paint, plastics and metal composites.



Because of their high value, cenospheres – seen here in a microscopic view – are measured by the pound rather than by the ton.

FBC Ash – is a category of ash from Fluidized Bed Combustion power plants. These plants reclaim waste coal for fuel and create an ash by-product that is most commonly used to reclaim abandoned surface mines and abate acid mine drainage. Ash from FBC power plants can also be used for waste and soil stabilization.



This regional park was constructed with FBC ash on the site of a former waste coal pile.

New Uses on Horizon

New beneficial uses for coal ash are continually under development. Researchers and ash marketers are currently focusing heavily on the potential for harvesting ash that has already been disposed for potential beneficial use. There is also renewed interest in the potential for extracting strategic rare earth minerals from ash for use in electronics manufacturing.



2021 Coal Combustion Product (CCP) Production & Use Survey Report

Beneficial Utilization versus Production Totals (Short Tons)										
2021 CCP Categories	Fly Ash	Bottom Ash	Boiler Slag	FGD Gypsum	FGD Material Wet Scrubbers	FGD Material Dry Scrubbers	FGD Other	FBC Ash	CCP Production / Utilization Totals	
Total CCPs Produced by Category	28,004,916	8,783,796	1,195,311	19,688,381	7,032,003	4,284,941	63,578	8,310,124	77,363,050	
Total CCPs Used by Category	18,787,042	3,591,948	734,652	14,890,701	0	226,109	0	8,310,124	46,540,576	
1. Concrete/Concrete Products /Grout	11,936,154	617,000	0	32,395	0	38,183	0	0	12,623,732	
2. Blended Cement/ Feed for Clinker	3,291,107	773,999	103,884	1,430,135	0	0	0	0	5,599,124	
3. Flowable Fill	48,687	0	0	0	0	0	0	0	48,687	
4. Structural Fills/Embankments	198,746	1,698,855	145,869	0	0	0	0	0	2,043,469	
5. Road Base/Sub-base	74,702	95,608	0	0	0	0	0	0	170,309	
6. Soil Modification/Stabilization	103,207	0	0	0	0	0	0	0	103,207	
7. Mineral Filler in Asphalt	7,544	0	0	0	0	0	0	0	7,544	
8. Snow and Ice Control	0	56,311	3,655	0	0	0	0	0	59,965	
9. Blasting Grit/Roofing Granules	0	52,452	481,245	0	0	0	0	0	533,697	
10. Mining Applications	87,636	0	0	0	0	31,465	0	8,310,124	8,429,225	
11. Gypsum Panel Products (formerly Wallboard)	0	0	0	11,740,314	0	0	0	0	11,740,314	
12. Waste Stabilization/Solidification	433,456	53,243	0	977	0	13,587	0	0	501,263	
13. Agriculture	0	3,516	0	742,546	0	76,839	0	0	822,902	
14. Aggregate	1,843	43	0	453,114	0	0	0	0	455,000	
15. Oil/Gas Field Services	55,677	0	0	0	0	15,696	0	0	71,373	
16. CCR Pond Closure Activities	2,351,905	150,696	0	449,700	0	0	0	0	2,952,301	
17. Miscellaneous/Other	196,378	90,226	0	41,520	0	50,339	0	0	378,462	
Summary Utilization to Production Rate										
CCP Categories	Fly Ash	Bottom Ash	Boiler Slag	FGD Gypsum	FGD Material Wet Scrubbers	FGD Material Dry Scrubbers	FGD Other	FBC Ash	CCP Utilization Total	
Totals by CCP Type/Application	18,787,042	3,591,948	734,652	14,890,701	0	226,109	0	8,310,124	46,540,576	
Category Use to Production Rate (%)	67.08%	40.89%	61.46%	75.63%	0.00%	5.28%	0.00%	100.00%	60.16%	
2021 Cenospheres Sold (Pounds)	107,832	Data in this survey represents 115,36786 GWs of Name Plate rating of the total industry wide approximate 210,141 GW capacity based on EIA's July 2021 Electric Power Monthly.								



The American Coal Ash Association was established in 1968 as a trade organization devoted to recycling the materials created when we burn coal to generate electricity. Our members comprise the world's foremost experts on coal ash (fly ash and bottom ash), and boiler slag, flue gas desulfurization gypsum or "synthetic" gypsum, and other "FGD" materials captured by emissions controls. While other organizations focus on disposal issues, ACAA's mission is to advance the management and use of coal combustion products in ways that are: environmentally responsible; technically sound; commercially competitive; and supportive of a sustainable global community.

Gone for Good.

Permanently removing coal ash from the environment

- **Serving utility customers**
with industry leading throughput of recycled product
- **Developing optimized custom solutions**
that resolve issues for utilities and communities
- **Delivering consistent, high-quality material**
to meet the increasing need of the concrete industry

The SEFA Group has been making a positive difference by recycling coal combustion residuals for over 45 years. SEFA began investing in recycling technologies over 20 years ago, as it became evident that the availability and quality of fly ash would decline.

Since that time, SEFA has been operating recycling facilities and developed STAR® Technology, commercially proven since 2008. As environmental requirements evolve, SEFA will continue to offer services to process and recycle material reclaimed from legacy coal ash impoundments.

For more information, contact:

STARinfo@sefagroup.com | 844-790-5551



www.sefagroup.com

New Name. Stellar Pedigree. Visionary Outlook.

Eco Material Technologies combines the operations of Boral Resources – America’s largest manager and marketer of fly ash and other coal combustion products – with Green Cement Inc. – a manufacturer of near-zero carbon cement alternatives.

Building on more than two decades as a leader in providing construction materials industries with products that enhance performance and create environmental improvements, Eco Material Technologies is poised to play a key role in its customers’ initiatives to achieve carbon neutrality.

Quality products. Proven technologies. Unparalleled experience. Operations coast to coast.

Eco Material Technologies is your partner in a cleaner future.

