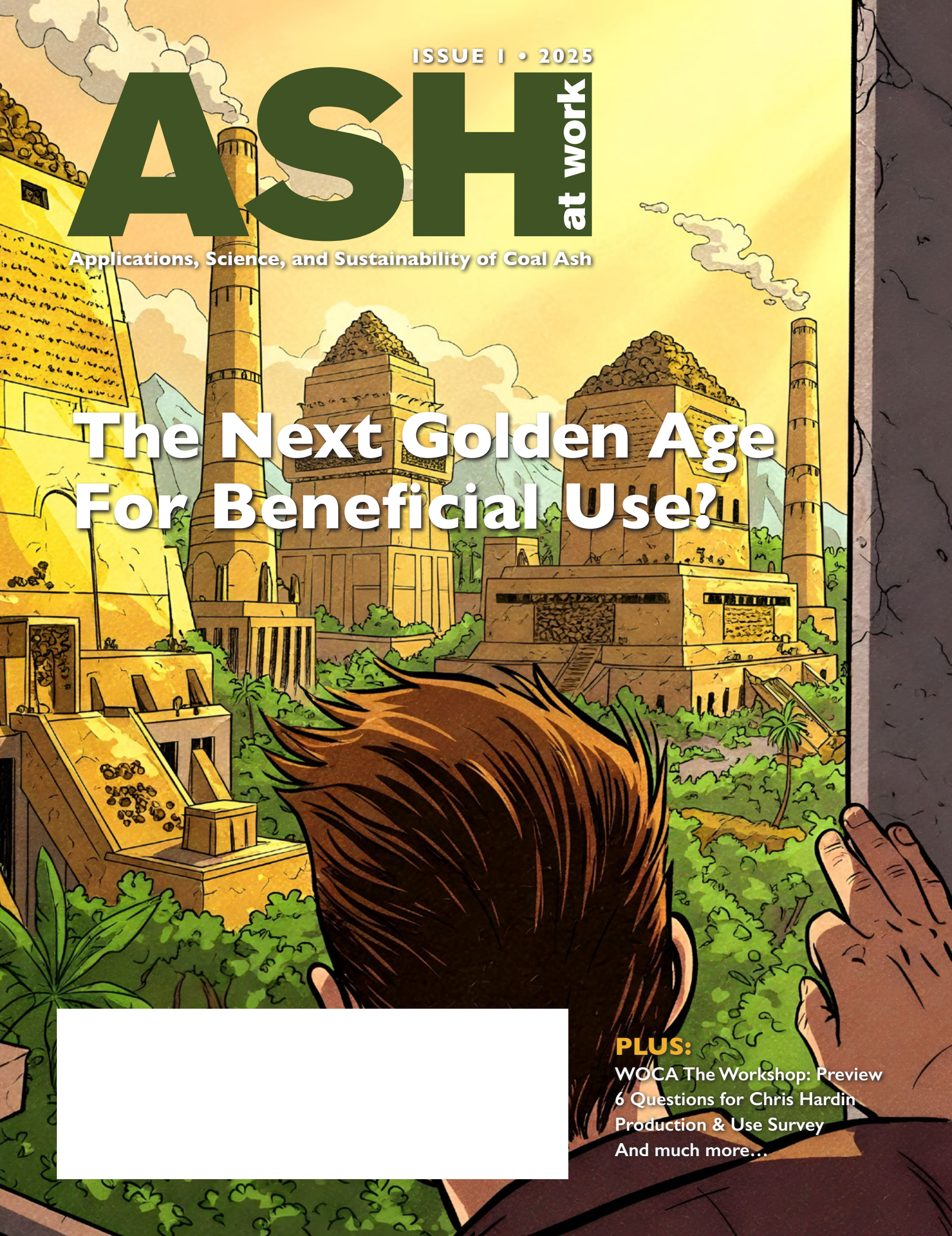
ISSUE 1 • 2025

ASH at work

Applications, Science, and Sustainability of Coal Ash



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Applications, Science, and Sustainability of Coal Ash

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Shifting Supply Dynamics Mark a New Chapter for Coal Ash Industry

By Tom Kierspe, ACAA Chair

Greetings, fellow ACAA members. As this is my first chairman's message since being elected to this role in January, let me take this opportunity to thank previous chair John Halm for his hard work and leadership over the past two years. I will endeavor to uphold the lofty standards that he set during his tenure in this position.

As I write this, ACAA has just published its newest production and use survey, which illustrates the dynamic nature of our industry. In 2023, over 69 percent of coal combustion products (CCPs) generated in the United States were recycled, the highest rate since recordkeeping began. Fly ash also registered its highest-ever recycling rate—at almost 75 percent. At the same time, production of both fresh fly ash and CCPs continue their year-over-year decline.

Clearly, the market values our products. But with as-produced CCPs volumes continuing to shrink, we must develop new sources of supply. Fortunately, there are positive developments on several fronts:

- Harvesting is emerging as a significant source of concrete-grade fly ash. In 2023, more than four million tons of previously disposed coal ash was harvested and utilized in concrete as well as a variety of other applications—the equivalent of 8.6 percent of the volume of ash recycled from current power plant operations.
- The outlook for the supply of fresh ash has stabilized in recent months. Recent surges in electricity demand—largely the result of data centers' support for artificial intelligence and cryptocurrency operations—have driven "well over half of the continent [to] elevated or high risk of energy shortfalls over the next 5 to 10 years," according to the North American Electric Reliability Corporation's latest long-term reliability assessment. A number of coal utilities have responded by delaying previously announced plant retirements, improving the ash supply outlook over previous forecasts.
- The Environmental Protection Agency's review of several rules that impact our industry offers potential relief for coal utilities faced with aggressive emissions compliance deadlines. Final rules pertaining to the so-called "Clean Power Plan 2.0," Mercury and Air Toxics Standards for coal plants, and the Greenhouse Gas Endangerment Finding are all undergoing agency re-evaluation and have the potential to extend the life of some coal plants as well as the availability of ash.

This issue of *ASH at Work* explores not only the evolving supply-side dynamics of our industry, but also emerging product markets that could boost demand for our materials. We survey several ACAA members who are working to develop new processes and technologies to beneficiate landfilled and impounded ash, extract critical minerals from these materials, and generate new low-carbon products for the construction market. Bricks, pavers, rare earth minerals, and lightweight aggregate all hold promise as growth markets for coal ash beneficial use in the years ahead.

The future is unwritten, of course. But these are indeed exciting times for our industry. I look forward to working with the ACAA membership to boost coal ash beneficial use to new heights.

Finally, as we continue to advance the mission of the ACAA, I believe the organization is in excellent hands, not only with respect to our ACAA staff, but also with support from a strong cadre of volunteers in Board and Committee leadership positions. ACAA is operationally and financially sound moving forward.

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Time for a 12-Step Program for the Federal Government?

By Thomas H. Adams, ACAA Executive Director

As we go to press with this issue of *ASH at Work*, we are witnessing arguably the most intense effort to reform the federal government's operations in generations. Everything and everyone is on the table for examination and evaluation. It is generally agreed that business as usual in Washington is no longer sustainable. The Department of Government Efficiency (DOGE) has assigned teams of managers to look at agency missions, expenditures, and staffing in an effort to reduce and eliminate waste, fraud, and abuse. DOGE has been embraced by some and reviled by others. As usual, opinions seem to depend on whose ox is being gored. While many previous administrations have talked about doing so, this administration is acting. Will this effort pay off in using our resources more efficiently and effectively? Time will tell. One thing is for sure: the answers to the questions posed by the managers will be interesting. We may find we need to develop a 12-step program to cure the addictions that trouble our federal government.

* * *

That harvesting coal ash for use in production of concrete mixtures is making an important impact in some regional markets is not disputable. As recently as 2021, there was little to report on this specific type of beneficial use. However, in 2022, according to a market survey by the ACAA, harvesting added 1.8 million tons of supply to concrete producers. In 2023, the increase over 2021 was estimated at 3.0 million tons. The estimate for 2024 is 4.0 million tons. Up to four major projects are expected to be in operation by the end of 2025, which drive the total increase since 2021 to almost 5.0 million tons. This amount of concrete-grade coal ash from harvesting is in addition to the 11 to 12 million tons going to the market directly out of power plant operations, bringing the amount of coal ash being used as a supplementary cementitious material to 16 to 17 million tons by the end of 2025. And the market wants and needs even more.

Three important facts to remember when reflecting on the reality of coal ash supply to the producers of concrete mixtures:

1. Coal ash markets have always been very regional, due mostly to logistics. Long hauls of coal ash have been the exception rather than the rule. Therefore, some markets still have shortages of coal ash supply.

2. When considering alternative SCMs to coal ash, the total quantity of all other SCMs is less than half the amount of coal ash furnished today. Coal ash is still the #1 SCM by far. The logistical challenges for coal ash are even greater for the alternative materials.

3. New materials are coming to the market seemingly almost daily. Most have little potential for major impacts on the current and short-term market conditions. However, calcined clays and steel slag are the exception. It will be interesting to watch for developments in these and other alternative SCMs.

More updates and reports on Harvesting, Markets, Technologies, and Regulations will be featured in the workshop scheduled for October 8 and 9 in Salt Lake City, Utah, at the Marriott City Center Hotel. For several years, the Center for Applied Energy Research (CAER) at the University of Kentucky and the ACAA have joined forces to offer a workshop in the years between the World of Coal Ash (WOCA) events to offer updated information on CCP issues. For 2025, "WOCA The Workshop" will offer the type of high-quality technical content WOCA attendees have come to expect. For more information on WOCA The Workshop, please visit www.acaa-usa.org/events/upcoming-events.

Speaking of WOCA, mark your calendar for May 4–7, 2026, for WOCA XI in Lexington, Ky.

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The Next Golden Age of Coal Ash Beneficial Use

By John N. Ward

Coal ash has undergone a remarkable evolution. In the early years of electric power generation, ash was considered an unwanted waste, typically landfilled or sluiced into ponds with little regard for environmental impact or resource value. However, the post-war construction boom and growing environmental awareness in the 1970s sparked the first waves of interest in beneficially using coal ash, particularly fly ash, as a supplementary cementitious material (SCM) in concrete.

Regulations, including the Resource Conservation and Recovery Act, Clean Water Act, and Clean Air Act, also played a role in establishing coal ash's value as a potential resource. Initially, that value was primarily economic. Utilities could avoid disposal and regulatory costs by making ash available for use as construction materials—an activity that utilities would often subsidize. As builders began to recognize the benefits of ash use, its economic value increased, allowing utilities and marketers to begin sharing revenues generated by the activity and increasing incentives to do more with ash in more places. Ash had transitioned from a waste to a valuable byproduct.

The Coal Combustion Products Partnership Era

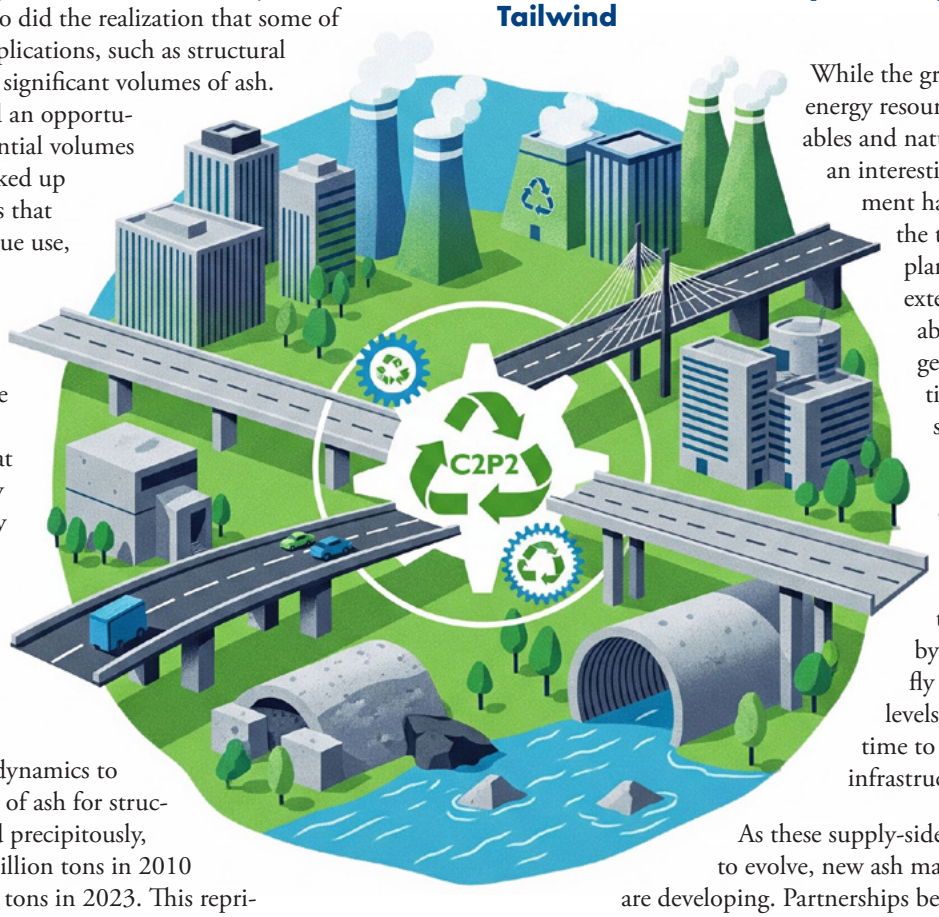
The early 2000s marked what many industry stakeholders consider the first "golden age" of coal ash beneficial use. The U.S. Environmental Protection Agency, along with other federal agencies, utility companies, and industry organizations, launched the Coal Combustion Products Partnership (C2P2) to promote safe and environmentally sound uses of coal combustion products. The program helped to standardize best practices, fund research, and educate stakeholders across the construction and energy sectors.

Unlike in the previous era, coal ash increasingly was being specified for its performance advantages rather than its economic benefits. For instance, in fresh concrete, coal ash improved pumpability and workability while reducing its water requirements. In hardened concrete, fly ash increased long-term strength and resistance to sulfate attack while reducing the risks of alkali-silica reaction, thermal cracking, and water penetration.

During this period, production and usage volumes of coal combustion products, and coal fly ash particularly, reached their highest levels to that point. At its peak, the C2P2 era saw approximately 45 percent of produced fly ash recycled for beneficial use. Fly ash, by this time a common component of highway and commercial concrete mixes, was also being widely used in structural fills, embankments, and mine reclamation projects—reflecting both regulatory incentives and growing demand for sustainable alternatives to virgin materials.

The Shift in Application Value: From Fill to Functional Material

As awareness of the performance benefits of fly ash in concrete continued to grow, so did the realization that some of these lower-value applications, such as structural fill, were consuming significant volumes of ash. Structural fill offered an opportunity to utilize substantial volumes of ash, but often locked up ash resources in ways that precluded higher-value use, such as in concrete.



Ash marketers also began developing and deploying a wide array of beneficiation technologies that improved the quality of ash. Lower-quality ashes that previously might only be suitable for fill activities could now be "upgraded" for higher-value uses.

This caused market dynamics to shift. As a result, use of ash for structural fill has declined precipitously, from more than 9 million tons in 2010 to less than 100,000 tons in 2023. This reprioritization is central to the next chapter in coal ash utilization.

Harvesting for the Future: A New Supply Chain Model

The key to unlocking the next golden age lies in a paradigm shift: from disposal avoidance to strategic harvesting. Ash harvesting—extracting previously disposed ash from landfills and ponds for processing and use—is rapidly gaining traction as a sustainable and economically viable solution.

Harvested ash, once thought of as degraded or inconsistent, can now be processed and beneficiated through advanced technologies. Thermal processing, carbon burnout, electrostatic separation, ammonia slip mitigation, and proprietary processes such as staged turbulent air reactor technology are just a few of the innovations that enable producers to meet rigorous quality standards required for concrete-grade fly ash.

This consistency is crucial. For concrete specifiers and producers, reliable supply and predictable performance are essential. Employing beneficiation technologies, harvested ash now often exceeds the quality of freshly produced ash. Furthermore, harvesting provides a more stable, long-term ash supply independent of real-time coal combustion, alleviating concerns over dwindling production as the power sector transitions to non-coal energy sources.

Plant Retirement Delays: A Surprising Tailwind

While the growth of competing energy resources such as renewables and natural gas continues, an interesting counter-development has recently emerged: the timeline for coal plant retirements is extending. Grid reliability concerns, geopolitical disruptions, and capacity shortfalls have led to delays of planned coal plant closures. This is providing a short- to medium-term tailwind for the coal ash market by maintaining fresh fly ash production levels while allowing more time to scale up harvesting infrastructure.

As these supply-side dynamics continue to evolve, new ash management strategies are developing. Partnerships between ash processors and concrete producers are proliferating, and legislative interest in supporting domestic materials for infrastructure is adding momentum. These developments create a favorable environment for building robust ash harvesting networks and logistics systems.

Concrete Confidence: Higher Replacement Rates, Broader Adoption

Perhaps the most compelling promise of this newly emerging golden age is the increased flexibility that it affords for the use of greater volumes of coal ash across a wider spectrum of applications. As supply chains stabilize and quality assurance continues to improve, specifiers are more willing to approve

higher replacement rates—sometimes exceeding 40 percent of cement content—in critical applications such as bridges, high-rise buildings, and marine structures. Similarly, this more robust supply allows ash to be utilized more frequently in lower-value applications, such as non-specification concrete work and controlled low-strength material.

Confidence also enables expansion into new markets, including regions that previously lacked access to consistent fly ash supply. Improved logistics and storage solutions, including regional terminals and blending facilities, are bridging the gap between sources and end users.

Expanding fly ash penetration, particularly in concrete markets, is critical not just for ash marketers, but for the environment. Every ton of cement replaced with fly ash in the production of concrete avoids roughly one ton of CO2 emissions from cement manufacturing. With the construction sector remaining under pressure to reduce embodied carbon, fly ash offers a proven, pragmatic, and scalable method to achieve steep cuts in concrete's embodied carbon. Use of fly ash also commensurately reduces the need for the energy-intensive operations to mine and process the virgin materials it replaces in concrete.

What's Possible: Metrics and Market Potential

To understand the scale of opportunity, consider this: in the U.S., annual cement consumption exceeds 100 million tons. Current average fly ash replacement rates in concrete hover around 15-20 percent, with significant regional variation. If logistical and quality barriers are overcome, replacement rates could conservatively rise to 30-40 percent nationwide.

That would require tens of millions of tons of fly ash annually—an amount that could be met through a combination of ongoing coal generation, accelerated harvesting, and strategic imports. The U.S. is estimated to have over 2 billion tons of stored coal ash, most of it untapped. Harvesting even a small fraction of this material could dramatically expand the SCM supply base.

In economic terms, this translates into billions of dollars in potential savings for concrete producers and project developers—not to mention stronger, more durable infrastructure. Environmentally, it means greatly reduced greenhouse gas emissions, fewer landfills, and reduced use of virgin mined materials.

Conclusion: A Second Golden Age Within Reach

The stars are aligning for coal ash to reenter the spotlight—not as a problem to be managed, but as a solution to be embraced. The convergence of improved harvesting technologies, supply chain investments, policy support, and sustainability imperatives is setting the stage for a new era of beneficial use.

Continuing the transition from linear disposal to circular utilization, coal ash can help the construction industry meet its climate goals while enhancing performance and reducing costs. With the right investment and coordination, the next golden age of coal ash beneficial use isn't just possible—it's imminent.

John N. Ward *is President of John Ward Inc., a marketing, communications, and public affairs consultancy currently focusing primarily on energy issues. He is Chairman of the American Coal Ash Association's Government Relations Committee and serves as Executive Director of the National Coal Transportation Association.*

Delayed Coal Plant Retirements Promise Yet More Ash for Concrete Markets

By John Simpson

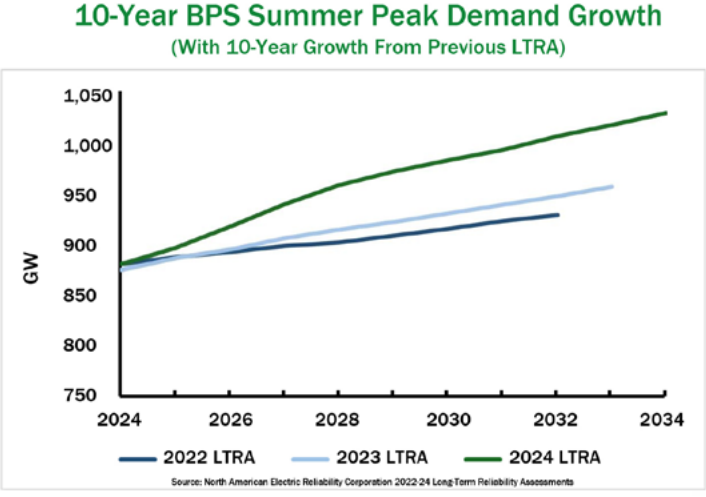
In the last issue of ASH at Work, "Rumors of Coal Ash's Demise Are Greatly Exaggerated" focused on how harvesting of previously disposed coal ash will help ensure the availability of ample supplies of this critical material for decades to come. Since then, a number of utilities have announced that they are postponing the shuttering of coal plants previously slated for retirement. This article focuses on the reasons behind these delays, recent regulatory activities that could impact the retirement dates of still other coal plants, and the implications for the availability of ash in the years ahead.

The North American Reliability Corporation's December 2024 Long-Term Reliability Assessment (LTRA) couldn't have put it more bluntly:

- Electricity demand is climbing rapidly, with demand growth now higher than at any point in the last two decades.[1]
- Most of the North American bulk power system faces mounting resource adequacy challenges over the next decade as surging demand growth coincides with thermal generators' announced plans for retirement.[2]
- Well over half of the continent is at elevated or high risk of energy shortfalls over the next 5 to 10 years.[3]

NERC's assessment is all the more alarming given that its newest demand projections are sharply higher than those that it made just one year earlier. Since its 2023 forecast, NERC raised its (cumulative) 10-year summer peak demand forecast by more than 50 percent, while its winter peak demand forecast grew almost 14 percent over the same period (see chart to the right).[4]

What is behind the projected dramatic surge in electricity consumption? Data centers. The energy-intensive processes required of data centers that support everything from artificial intelligence models to machine learning and cryptocurrency mining are ballooning projections for electricity demand in the



decade ahead. According to a December 2024 report by the U.S. Department of Energy, data centers alone consumed about 4.4 percent of total U.S. electricity in 2023 and are expected to consume approximately 6.7 to 12 percent of total U.S. electricity by 2028.[5]

Industrial and Utility Response

As the magnitude of the potential electricity deficit has emerged, industry and utilities have put forth a number of solutions to help boost power supplies. Tech companies, including Amazon and Google, have announced their intention to invest in scalable nuclear reactors. As yet, however, small modular reactors are not a mature technology and face potential regulatory hurdles and lengthy licensing processes.[6]

Wind and solar energy continue to displace fossil fuel-based generation in the U.S. However, as noted in NERC's LTRA, greater reliance on renewable energy in the resource mix has the potential to expose the electric system to supply shortages under abnormal weather patterns. "There is also a higher likelihood for energy droughts to be more likely to occur during high-load periods than at other times, underscoring the importance in considering such events in planning for resource and storage needs," NERC noted.[7]

A growing number of coal utilities have responded by postponing the retirement of some of their plants. Based on 2023 coal consumption figures, the delayed retirements of just those plants listed in the below table will result in the consumption of approximately an additional 40 million tons of coal and generate approximately two million additional tons of coal ash over the next decade.

This may be a conservative estimate of the additional volumes of coal ash that can be expected to be generated over the next decade, however. As utilities continue to react to revised electric load projections, it is reasonable to expect further postponements of coal plant retirements—and thus the generation of additional ash.

It is worth noting that, even before NERC's revised assessment of future electric load growth, coal plant retirements had already slowed greatly. According to the U.S. Energy Information Administration, retirement of coal-fueled capacity decreased to 4.0 gigawatts (GW) in 2024, less than the 9.8 GW of coal capacity retired in each of the preceding 10 years.[8]

Recently Announced Delays in Coal Plant Retirements

Plant Name	Original Closure Date	Extended Closure Date	2023 Coal Consumed, Tons
Brandon Shores	2025	2029	522,000
Herbert A. Wagner	2025	2029	20,500
Huntington	2036	2045	1,580,000
Hunter	2042	2045	1,826,000
Baldwin Energy Complex	2025	2027	3,731,000
Columbia (WI)	2024	2029	2,614,000
Gibson	2035	2038	4,118,000
Edgewater	2025	2028	1,212,000
Intermountain Power Project	2025	Potential Restart Post 2026	2,137,000
Merrimack	2024	2028	70,000
Crystal River	2027	2034	1,837,000
Wyodak	2039	\	1,362,000
Dave Johnson	2039	\	2,523,000
Jim Bridger	2039	\	5,055,000
Naughton	2036	\	1,025,000
Victor J. Daniel	2027	2028	To be added

Source: FirmoGraphs

"Clean Power Plan 2.0" Repeal?

Just as the aforementioned market forces have improved the outlook for production ash in the next decade, the EPA's recently announced review of the agency's so-called "Clean Power Plan 2.0," finalized in 2024, may offer brighter prospects for coal plants and the availability of fresh ash over the longer term.[9] Under EPA's final rule—which is currently being litigated in the courts—coal plants retiring by 2039 would have to reduce their carbon emissions 16 percent by 2030, while those operating beyond 2039 would have to lower emissions 90 percent by 2032.[10]

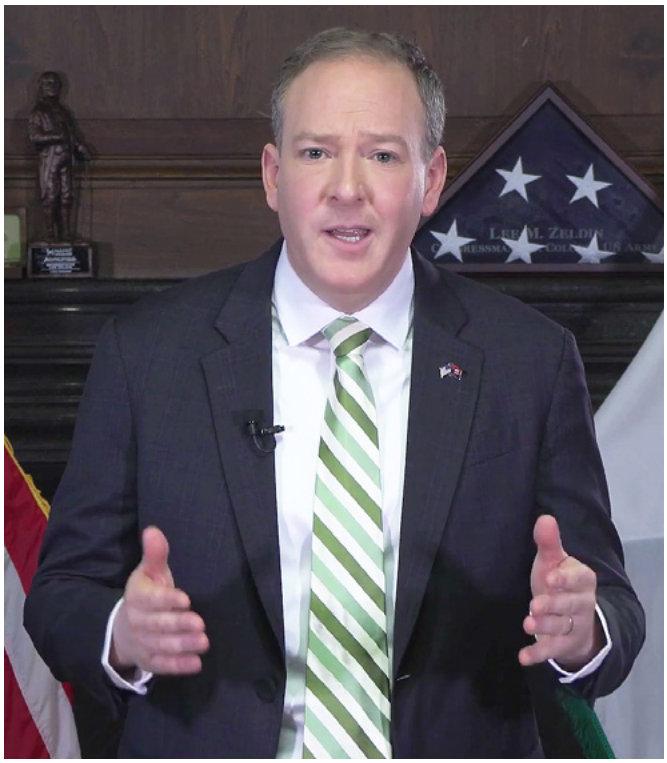
EPA's review will also reconsider agency rules passed at the same time that:

- Strengthen the Mercury and Air Toxics Standards for coal-fueled power plants—tightening the emissions standard for metals by 67 percent and finalizing a 70 percent reduction in the emissions standard for mercury from existing lignite-fueled sources; and
- Reduce pollutants discharged through wastewater from coal-fueled power plants by more than 660 million pounds per year.[11]

While EPA's actions—which also include reviewing the Legacy Coal Combustion Residuals Management Units Rule as well as the Greenhouse Gas Endangerment Finding[12]—will inevitably be challenged in court if and when they come to pass, the agency can be expected to defer compliance with many of these rules while events play out.

Previously Disposed Ash a Growing Resource

Beyond the additional volumes of fresh ash that are expected to be generated by coal plants with a new lease on life, it should be noted that previously disposed ash is available in greater volumes than ever. The ACAA's latest production and usage figures show that over 4 million tons of previously disposed ash was utilized in a variety of applications in 2023—including coal ash pond closure activities, concrete products, cement kiln raw feed, and gypsum panel manufacturing.[13] Harvested ash utilization volumes now equal approximately 8.6 percent of the volume of ash recycled from current power plant operations. ACAA's production and usage statistics further show that—despite a coal ash recycling rate of 69 percent in 2023—more than 20 million tons were disposed rather than beneficially used.[14]



EPA Administrator Lee Zeldin announces the agency's reconsideration of a host of rules that impact both coal plants and coal ash.

The upshot of it all? While harvesting clearly represents the future of the U.S. coal ash industry, postponing the retirement of a portion of the coal fleet will likely provide an effective "bridge" supply of ash in the meantime.

***John Simpson** is editor of ASH at Work.*

Endnotes

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Emerging Markets for Harvested Ash

By John Simpson

How are new markets for coal combustion products developed? In the case of FGD gypsum wall panels, federal regulation proved to be a major catalyst. The Clean Air Act of 1970 and its subsequent amendments required many coal utilities to install flue gas desulfurization equipment to remove sulfur dioxide from exhaust flue gas, thereby generating the raw material to create synthetic gypsum.

In 2014, its peak year of production in the U.S., utilities generated over 34 million tons of FGD gypsum,[1] while in 2017—it's peak year of utilization—almost 23 million tons were beneficially used.[2] By 2022, over 83 percent of FGD gypsum was recycled for use in an array of applications, including wallboard manufacturing, soil modification, and CCR pond closure activities.[3]

Where will the next market emerge for coal combustion products? No one knows. But a handful of entrepreneurs, ACAA members among them, are now working to develop new processes to beneficiate landfilled and impounded coal ash, extract critical minerals from these materials, and generate new products for the construction market.

Driving Cost-Effective, Beneficial Use of Impounded Ash

Approximately 75 percent of surface impoundments contain CCR that cannot be harvested for beneficial use in concrete due to the presence of FGD by-products commingled with the ash. FGD by-products, such as gypsum and calcium sulfite, increase sulfur content, making the ash unsuitable for concrete applications. While several efforts are underway to harvest landfilled ash, they focus primarily on sites without sulfur contamination. To date, no commercially viable technology has existed to effectively separate sulfur from ash—until now.

The team at PHNX Materials—comprising highly specialized PhDs and postdoctoral researchers with experience at national laboratories, technology companies such as Tesla, and Stanford University—has engineered a combined chemical and physical separation process to remove FGD gypsum from coal ash without producing any solid waste. Unlike conventional methods that rely on high-temperature or energy-intensive treatments, PHNX's approach employs selective separation techniques to recover the ash. The process uses off-the-shelf mining equipment, ensuring low operational costs and scalability. Additionally, PHNX's method does not rely on hazardous chemicals nor does it produce hazardous waste, making it a safer, sustainable solution.

The company is currently processing 10 kilograms of material per day and has outlined a clear roadmap to scale up to 10 tons per day within the next 18 months. PHNX has demonstrated effectiveness across a range of contaminated ash compositions, including those with commingled gypsum, calcium sulfite, high loss-on-ignition (LOI), and activated carbon.

Laboratory analysis confirms that PHNX's processed fly ash meets ASTM C618 specifications, making it a high-quality material for use in concrete manufacturing. Additionally, the extracted gypsum meets specifications for agricultural and construction applications, expanding the range of industries that can benefit from this technology.

PHNX Materials has already secured partnerships with six utility companies, demonstrating the demand for FGD by-product separation and harvesting solutions. The company is actively seeking additional pilot and commercial partners to validate the process at scale and unlock nearly two billion tons of previously disposed ash. Please reach out to Krish Mehta at krishm@phnxmaterials.com to discuss partnership opportunities.

17 kg of ash, processed February 24, 2025, that meets ASTM requirements.

A More Sustainable Brick

In 2021, the Ohio Environmental Protection Agency approved Brixx Technology LLC's harvesting of coal ash from the Richmond Mill Inc. No. 2 landfill in Toronto, Ohio, for use in manufacturing building materials.[4] The company is now converting approximately 20 million tons of ash previously deposited at the site from the nearby W.H. Sammis power plant into sustainable, high-strength bricks, blocks, and other products.[5]

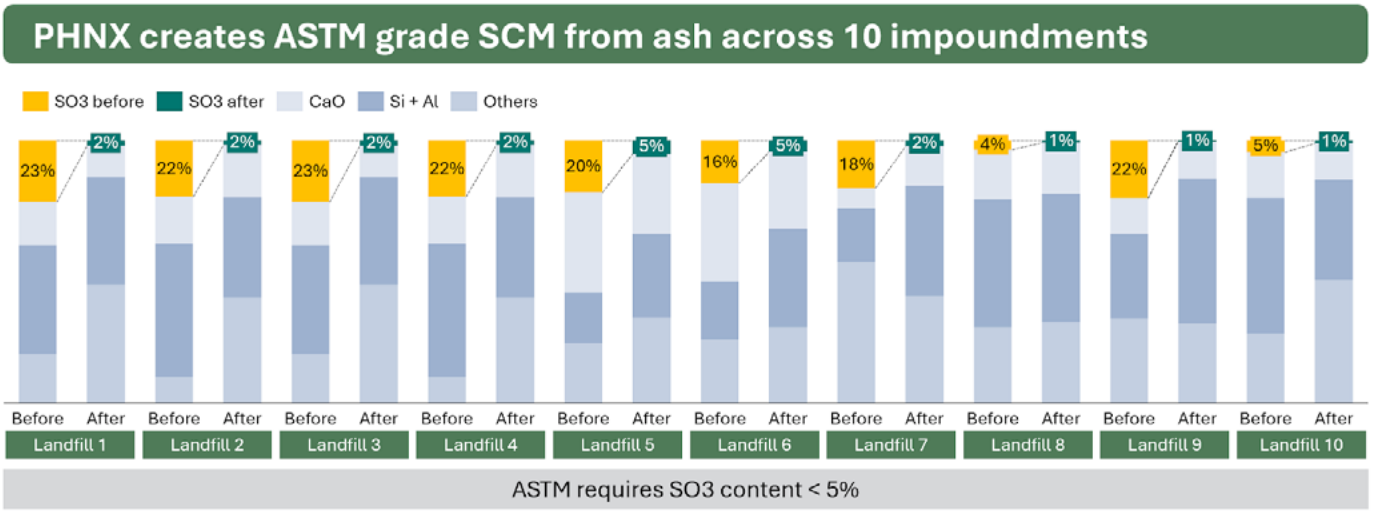
During manufacturing, a mixture containing up to 92 percent fly ash and bottom ash, a calcium oxide or calcium hydroxide-based mineral binder, and water is blended, compacted into shape, and hydrothermally cured in an autoclave to produce strong, weather-resistant building products.[6] The process can accommodate fly ash with a loss on ignition greater than 3 percent.[7]

Because Brixx uses thermal curing instead of a kiln, its process consumes 70 percent less energy than the latest roller kilns and 90 percent less energy than modern high-efficiency clay brick kilns. Furthermore, this method produces no secondary solid, liquid, or gaseous waste streams and can recycle 100 percent of any "off-spec" products back into the production process.[8]

Brixx has demonstrated its process for mass production by creating various bricks and pavers in different configurations while ensuring high quality. The process can produce any shape or size as long as it can be pressed into a mold.[9]

The company's products demonstrate greater strength than most that are manufactured using clay-based, kiln-fired methods. Their bricks, for instance, are strength-rated at 10,000 pounds per square inch, allowing them to withstand heavier and higher-volume traffic than those made through traditional methods. Acknowledging their structural strength, the Ohio Department of Transportation has accepted Brixx's products as structural bricks and aggregates for concrete.[10]

Given the energy and material efficiencies of its manufacturing process, the company can produce bricks for just a few cents per unit and has already marketed its products for various applications, including face bricks for apartment complexes, pavers, and retaining walls. As anticipated market demand remains strong, Brixx plans to increase production to 80,000 tons of coal ash products annually, with a goal to boost total volume to 200,000 tons each year.[11]



Lightweight Aggregate

Lightweight aggregate (LWA) is a coarse, rock-like material used in the production of concrete block, structural concrete, pavement, and other construction, architectural, and landscaping applications. It is typically produced from mined materials, including clay, shale, or slate.[12]

While fly ash is well suited to substitute for these virgin materials in the production of LWA, to date its use in this application has been relatively minimal in the U.S. Production and use reports from the American Coal Ash Association show bottom ash, FGD gypsum, and even fluidized bed combustion ash are more frequently used to produce LWA—but even these represent a tiny sliver of the overall lightweight aggregate market.[13]

Coal combustion products, particularly production fly ash, traditionally have been more often used in concrete, agriculture, and other higher-value applications. The growth of ash harvesting, however, may provide new impetus for the use of previously disposed ash in LWA as maturing technologies are used to bring off-spec fly ash to a standard that allows for its use in this application at an industrial scale.

Holcim UK has produced lightweight aggregate from fly ash for over 50 years.[14] Its Lytag® lightweight aggregate has been used to reduce the density and dead load of structural concrete, allowing for smaller foundations, thinner section beams and columns, and additional floors.[15]

Lytag® is made by pelletizing fly ash, which is then heated on a sinter strand to approximately 2,000 degrees Fahrenheit. The resulting round particles are a hard, honeycombed structure of interconnecting voids. The aggregate generally ranges in size from a little over one-half inch down to fines, which is processed to the required grading, depending on the final use. Lytag® aggregate is up to 50 percent lighter than typical aggregate and exhibits excellent fire resistance and freeze-thaw properties.[16]

Photo CC by SA 2.0 - Jeff Buck

In 2017 the Canal & River Trust undertook a complete refurbishment of the then-84-year-old Acton Swing Bridge near Liverpool, England. A key objective of the project was to enhance the structural integrity of the concrete pontoons that provide support at the bridge's base.

Lead contractor Kier Construction chose Holcim's Lytag® lightweight aggregate to replace the infill within the framework. Ultimately, Holcim supplied 100 metric tons of 0/14mm Lytag®, a blend of aggregates specifically designed for lower concrete density.

Opting for fly ash LWA effectively reduced the concrete's weight/density from 2,400kg/m^3 to 1,650kg/m^3—providing the same level of structural performance as normal-weight concrete while reducing the structure's dead load. This approach also avoided the need for quarried aggregate.[17]

Tapping a Vast Resource

Expanding the use of coal ash beyond its traditional construction applications is a win-win for the natural and built environments. An estimated two billion tons of ash lies in U.S. landfills and surface impoundments that, with ongoing advances in technologies to process and beneficiate harvested ash, provide an abundant resource by which to create more sustainable and durable bricks, pavers, aggregate, and other building products. Virgin resources can be preserved; manufacturing costs and energy can be saved; and landfills and surface impoundments can be returned to their natural state.

***John Simpson** is editor of ASH at Work.*

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Data Center Boom Driving Need for Low-Carbon Concrete

By Grant Quasha

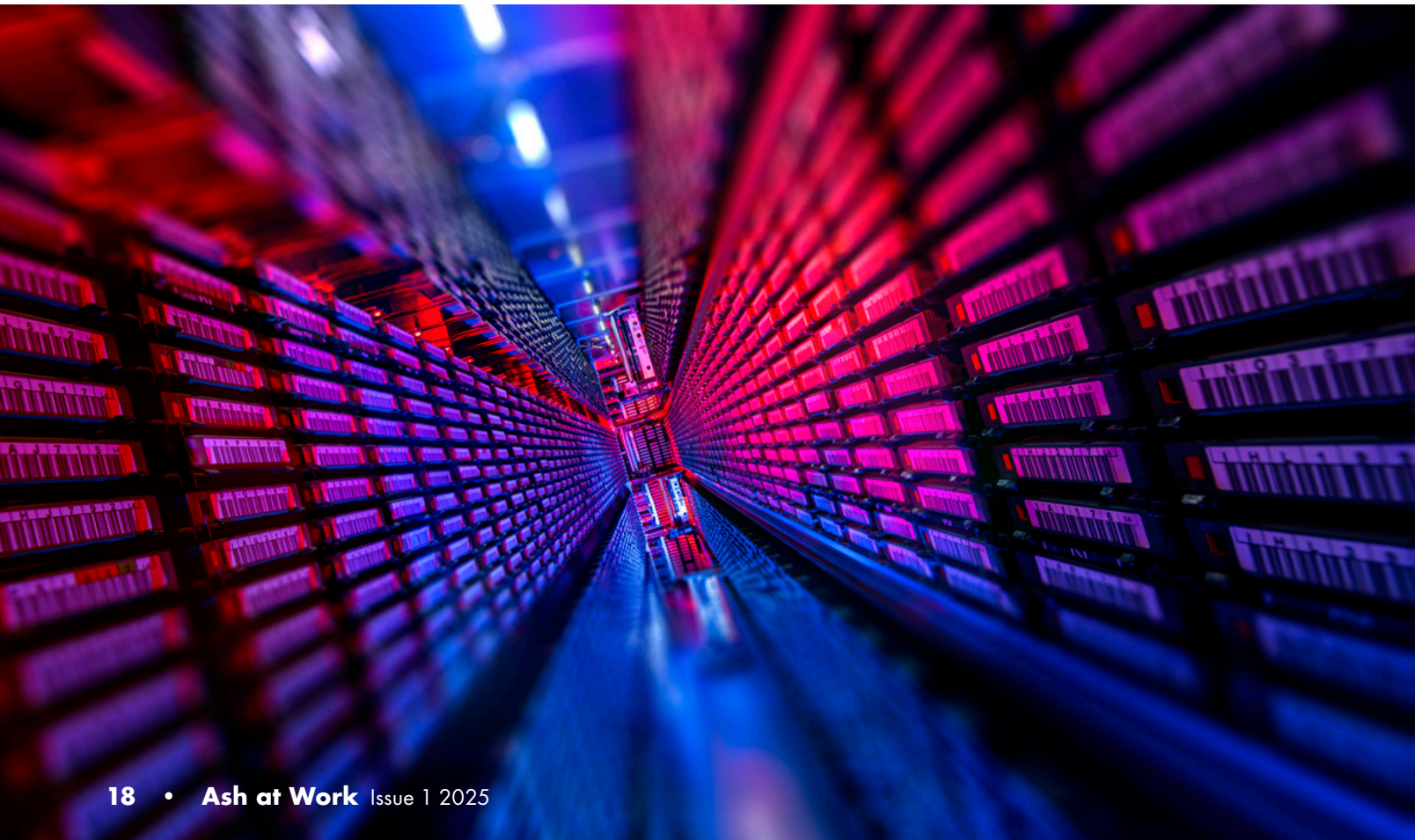
The demand for cloud computing services and artificial intelligence has driven a boom in the construction of data centers across the United States. During the first six months of 2024 alone, 78 data center projects were launched at a cost of $9 billion, totaling approximately 12 million square feet of space.[1] Moreover, the Association for Computer Operations Management's eighth annual State of the Data Center report says new data center construction projects will increase sixfold in the next three years.

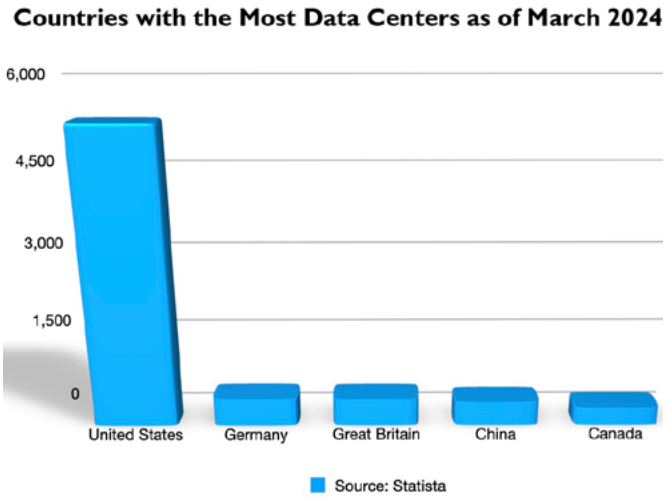
Already, the United States leads all countries with more than 5,000 data centers, with the largest concentrations in Northern Virginia, Dallas and Fort Worth, Silicon Valley, Chicago, Phoenix, New York, Atlanta, and Hillsboro in Oregon.[2] That number is expected to grow by an additional 450 new facilities per year through 2030, according to U.S. Department of Commerce forecasts. Globally, the data center construction market is projected to exceed $369 billion by 2030,[3] including $49 billion in annual spending.[4]

Environmental Impact

While advanced cloud and AI technologies offer the potential to make our lives better, the data center boom raises a number of construction-related environmental concerns. Most data centers are built with massive volumes of concrete, a material that is responsible for about 8 percent of man-made global CO2 emissions. According to Gensler Research Institute, concrete represents up to 80 percent of embodied carbon emissions in data centers.[5]

Fortunately, specifiers have a well-established way to reduce concrete's carbon footprint: substitute fly ash for a portion of portland cement, a key ingredient in many low-carbon concrete mixes. Fly ash, a by-product of coal combustion, has been used for decades as a supplementary cementitious material to make concrete more durable and easier to work with. While the manufacture of one ton of portland cement generates about 0.9 tons of CO2 emissions, substituting fly ash for cement in





concrete mixes significantly reduces those emissions. Every ton of portland cement displaced by fly ash in the production of concrete delivers nearly a ton of CO2 reductions. Given the expected growth in data center construction, concrete specifiers have an unprecedented opportunity to turn millions of tons of ash stored in landfills and impoundments into low-carbon concrete for data centers, significantly reducing the emissions associated with their construction.

Tech giants are already discussing the vital role ash may play in decarbonizing data centers. In December, Meta reported the company is "piloting and deploying concrete that has significantly lower embodied carbon emissions" for data centers, including "substituting cement with tried and tested alternatives such as fly ash." Microsoft's *2024 Environmental Sustainability Report* similarly cites a need to use low-carbon concrete.

Small wonder, given the sheer size of many of these projects: Last year, Kansas-based QTS Data Centers launched a $1.5 billion project in New Albany, Ohio, that consists of four separate data warehouses totaling 1.5 million square feet of facility space. Tech giants Microsoft, Google, Meta, and Amazon are reportedly planning to utilize campuses in the area. According to Dodge Construction Network, the New Albany campus will be the largest data center on record, yet may soon "seem modest by comparison" as the data center market grows in the years to come.[6] Dodge claims cloud and AI infrastructure "will drive the sector to expand … 24 percent in 2025, ending the year at $24 billion."

Eco Material's Role

My company, Eco Material Technologies, estimates that, on average, each new data center will require approximately 25,000 cubic yards of concrete to build. Eco is the leading producer and supplier of fly ash and other sustainable cement alternatives in North America. Our teams have supplied low-carbon material for data centers and semiconductor manufacturers across the United States. For example, we supplied 60,000 tons of fly ash to lower the carbon footprint of a data center in Jackson, Mississippi, built with 1 million cubic yards of concrete. Eco also delivered over 100,000 tons of supplementary cementitious materials for construction of a large chip factory in Taylor, Texas, and a further 200,000 tons of SCMs for two fabs in Phoenix, Arizona. Other building projects utilizing ash supplied by Eco include a Google data center in Kansas City and a tech data logistics facility in Fontana, California.

Photo - Meta

Big Tech's Own Experiments

Tech giants also are pioneering efforts to formulate low-carbon concrete for their data centers. In 2022, Meta worked with researchers at the University of Illinois at Urbana-Champaign to test concrete mixes with lower embodied carbon emissions using an artificial intelligence model.[7] The results were tested for a three-building expansion of Meta's $800 million data center in DeKalb, Illinois, which comprised 2.4 million square feet of space. Test applications were poured in non-critical areas of the DeKalb Data Center, and the effort created "a sustainable concrete mix with greater strength and 40 percent lower carbon emissions."[8]

In the process, the researchers developed a new artificial intelligence model designed to optimize concrete mixtures for sustainability as well as strength. They "trained" the AI model using the Concrete Compressive Strength database, which contains 1,030 concrete formulas, and their validated strength attributes, combined with the Cement Sustainability Initiative's Environmental Product Declaration tool, which is used to assess a material's environmental performance. Using the data on concrete formulas along with their corresponding compressive strengths and carbon footprint, the AI model was able to generate a number of promising new concrete mixes, from which five were selected for further testing at a lab. The mixes, which incorporated upwards of 50 percent cement replacement with Class C fly ash and slag, were field-tested and results confirmed that the low-emission concrete formulas exceeded the 7-day and 28-day strength requirements with a carbon impact 40 percent lower than the regional benchmark for slab mix designs.

Abundant Supply of Ash

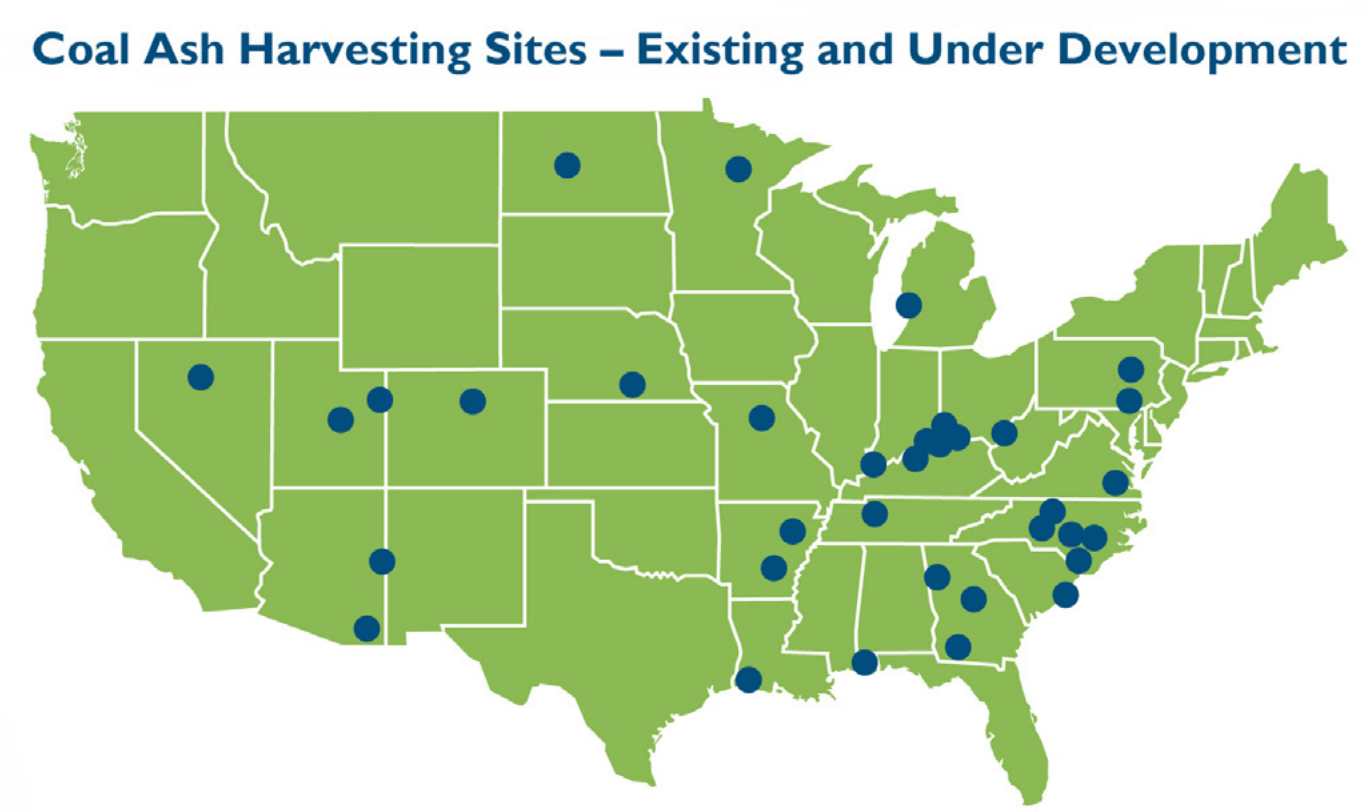
The good news for data centers and decarbonization is that fly ash is in abundant supply. While coal plants continue to be retired, the American Coal Ash Association estimates that approximately 2 billion tons of ash is available in landfills and impoundments around the country to be harvested to meet the concrete sector's net-zero-carbon targets. Utilizing those 2 billion tons of fly ash in concrete production would thus avoid the

release of almost 2 billion tons of CO2 into the atmosphere. The rise of ash harvesting also promises a more reliable supply of ash for specifiers and ready-mix producers, as its availability is unaffected by seasonal or other variations in the operation of coal plants. In addition, the U.S. materials industry has worked to develop consensus standards to encourage responsible harvesting of previously disposed ash, including the development of ASTM C618—Standard Specification for Coal Ash and Raw or Calcined Natural Pozzolan for Use in Concrete. This standard states that processed fly ash may come from a harvesting site, rather than directly from the power plant, to produce concrete.

For the past five years, Eco Material Technologies has been harvesting ash from a landfill in Pennsylvania and improving its characteristics in preparation for sale. Ash harvesting is now integral to our business plan, and operations are underway at two harvesting sites in Georgia that are expected to produce approximately 1.2 million tons of ash annually once they are fully operational. Eco has several other harvesting projects underway in the Gulf Coast, Midwest, and Texas. We are also incorporating some of these ashes in our Green Cement products, which can replace an even higher proportion of carbon-intensive portland cement in concrete mixes.

So while there's reason to be concerned about the environmental impact of data centers' massive electricity usage, developers have the means, and are increasingly showing the willingness, to decarbonize the building materials used in their construction. Substituting a portion of the cement used to produce concrete with fly ash is a proven method by which to decarbonize concrete, and therefore dramatically lower the embedded carbon in data centers' construction.

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.*



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WOCA The Workshop to Examine Regulation, Technologies, Harvesting, and Markets for CCP

Industry leaders will gather October 8-9, 2025, for WOCA The Workshop, the only workshop in the CCP industry that aims to explore the interplay of regulations, technologies, harvesting, and market factors influencing the increasingly dynamic ash industry.

The two-day event, hosted by the American Coal Ash Association and the University of Kentucky Center for Applied Energy Research, will take place alongside ACAA's annual Fall Membership Meeting at the Salt Lake City Marriott City Center in Salt Lake City, Utah.

Topics include current regulatory issues, innovative technologies, and relevant discussions on harvesting—including engineering and consulting topics, regulatory and permitting concerns, and harvesting facilities—while emphasizing ongoing marketing challenges and inquiries.

More than two dozen experts will lead the full schedule of breakout sessions. The workshop's lunchtime keynote speakers include Grant Quasha, Chief Executive Officer of Eco Material Technologies, and Emy Lesofski, Director of the Utah Office of Energy Development (invited).

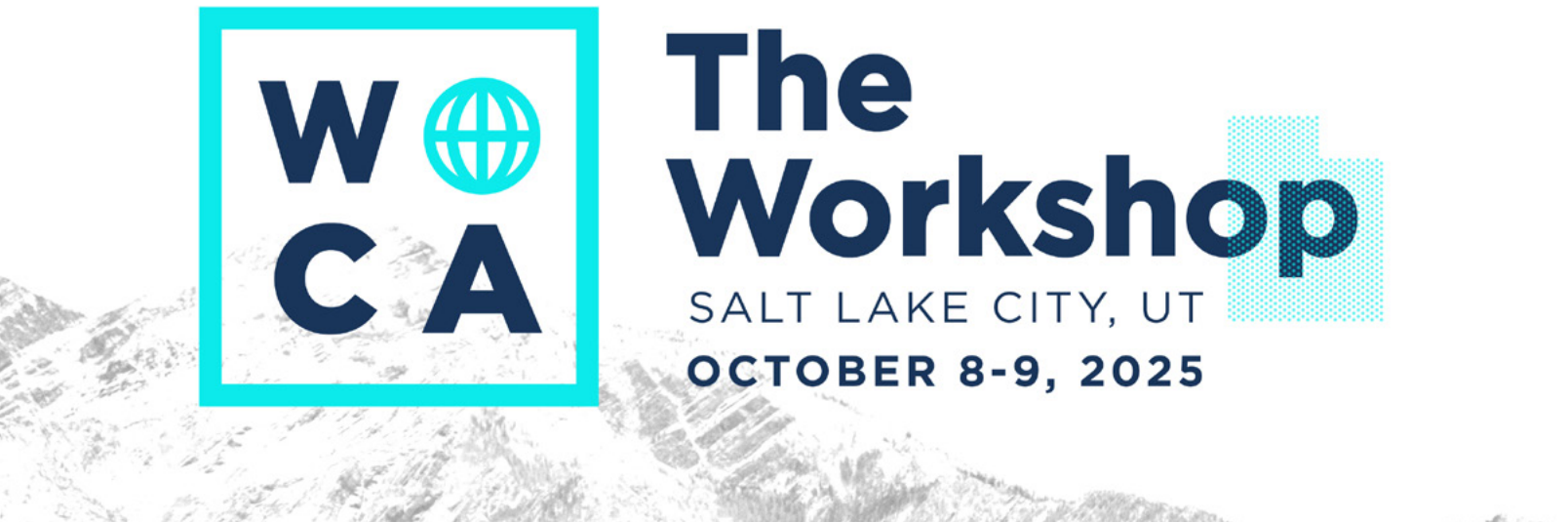
Pre-registration for attendance is open until 5 p.m. EDT on Wednesday, October 1. Register online by visiting acaa-usa.org/events/upcoming-events, or call 1-866-961-8700 and reference the American Coal Ash Association.

Early bird rates for attending WOCA The Workshop are as follows:

- Early Bird—Government Rate—$500.00 (registration rate for government employees; registrations will be reviewed and verified for accuracy).
- Early Bird—Rate if also attending ACAA meeting—$700.00 (discounted registration if you're attending the 2025 Fall ACAA Membership Meeting).
- Early Bird—Rate if attending workshop only—$800.00 (registration rate for attendees of the workshop only).

Sponsorship slots for WOCA The Workshop are still available. Purchasers of sponsorships will earn points giving them a higher priority when selecting their booth space on the exhibition floor at World of Coal Ash 2026, which will be held May 4-7, 2026, in Lexington, Kentucky. Sponsors will receive two additional points to improve their order of selection. For more information, contact Alyssa Barto at alyssa.barto@acaa-usa.org.

Thank you to our current sponsors: Ames Construction, Geocycle, R.B. Jergens, Saiia, and Watershed Geo.



Beneficial Use Case Study

Gordie Howe International Bridge

Coal Combustion Product Type
Fly ash

Project Name
Gordie Howe International Bridge

Project Location
Detroit, Michigan; Windsor, Ontario

Project Participants
Windsor-Detroit Bridge Authority, Bridging North America, ACS Infrastructure, Fluor, AECOM, Holcim, St. Mary's Cement, Smyrna Ready Mix

Project Completion Date
September 2025

Project Summary
Scheduled for completion in fall 2025, the Gordie Howe International Bridge is set to become the longest cable-stayed bridge in North America and the newest gateway between the United States and Canada. Named after Canadian ice hockey legend Gordie Howe, the 1.6-mile-long bridge features two A-shaped, 722-foot towers on each side of the Detroit River that suspend a six-lane road deck 151 feet above the water using 216 cable stays. The crossing includes a multi-use path for pedestrians and cyclists and is expected to carry 26,500 vehicles daily between Detroit, Michigan, and Windsor, Ontario, enabling efficient movement of people and goods across the U.S.-Canadian border.

Project Description
As the Gordie Howe International Bridge is intended to fulfill a service life of 125 years, multiple mixes were developed for the bridge's concrete components with the objectives of achieving both sustainability and durability. To that end, fly ash was incorporated extensively; in total 95,000 metric tons of fly ash were used at an average 7 percent substitution for cement across all of the bridge's concrete elements.

Substituting fly ash for a portion of the cement in concrete mixes is a well-established method both for reducing the carbon footprint of concrete and enhancing its durability. The U.S. Environmental Protection Agency estimates that for every ton of fly ash used in substitution of portland cement in a concrete mix, almost one ton of carbon dioxide is prevented from entering the Earth's atmosphere. Similarly, incorporating fly ash is a proven method by which to boost its resistance to sulfate attack, alkali/silica reaction, and permeability.

More recently, fly ash has been shown to yield additional performance benefits when used in combination with the blended cements that are increasingly utilized in today's construction projects. For the Gordie Howe bridge project, Holcim supplied Alpena Type IL portland limestone cement (PLC), which can reduce CO2 emissions 10 percent compared with ordinary portland cement—as blending limestone in mixes allows for a reduction in the amount of clinker. Research has further demonstrated a synergistic effect between fly ash and limestone powder in ternary cements that improves the mechanical properties of concrete mixes, including later-age compressive strength.

The project has drawn plaudits on both sides of the border, earning the Institute for Sustainable Infrastructure's Envision Platinum Award as well as the Canadian Brownfields Network's 2023 Best Large Project Award.

Photo courtesy of Gordie Howe International Bridge Project

Beneficial Use Case Study

Arkansas State University Sidewalk

Coal Combustion Product Type
Reclaimed fly ash; fresh Class F fly ash

Project Name
Arkansas State University Sidewalk

Project Location
Jonesboro, Arkansas

Project Participants
Eco Material Technologies, Arkansas State Facilities Management, NEAR Ready Mix, Boral Resources

Project Completion Date
August 2021

Project Summary
In 2021 engineering students at Arkansas State University (ASU) conducted a field demonstration to compare the performance of concrete made with reclaimed fly ash versus concrete containing fresh Class F fly ash. With research grants obtained through the U.S. Department of Transportation and Arkansas Department of Transportation, the students partnered with Arkansas State Facilities Management to replace an existing 50-foot-long sidewalk on campus using 1,200 pounds of ash as a supplementary cementitious material.

Project Description
Reclaimed ash was sourced from Eco Material Technologies, which excavated and processed fly ash from a power plant landfill in the southeastern United States. To investigate the feasibility of harvesting landfill ash for beneficial use, the power plant owner used test borings to obtain samples for laboratory analysis. Samples were tested for beneficial use properties in ASTM C618, including bulk composition, fineness, loss-on-ignition, and moisture content.

After initial laboratory evaluation of the landfilled ash suggested that only drying would be required for the samples to meet specifications for use as an SCM, a pilot plant was built to further test its feasibility for beneficial use. At the pilot plant, the excavated ash was screened for debris removal and dried using a diesel-fired rotary dryer. After treatment of a small pocket of fly ash with "slightly excessive" SO3, samples of the dried harvested ash were shipped to ASU for further testing and use.

At ASU, students tested the chemical composition, moisture content, and loss on ignition of the reclaimed fly ash and compared them with those of the fresh production fly ash. Both the reclaimed and fresh fly ash met ASTM C618 requirements for Class F fly ash use in concrete.

To test the performance of reclaimed fly ash versus fresh ash in concrete, the ASU team placed half of a 50-foot-long campus sidewalk with concrete containing reclaimed fly ash and half using concrete containing fresh Class F fly ash. Both mixes used a 20 percent replacement of traditional portland cement, and identical slumps were achieved during pouring.

After one year, the section made with reclaimed fly ash was judged to have performed as well as the section containing fresh fly ash, with no cracking present outside of the control joints. Both sections were visually identical.

The study concluded that reclaimed fly ash is a viable alternative for cement, as it can produce more durable concrete; the material cost of concrete can be lowered by about 15 percent; and the use of reclaimed fly ash can reduce the amount of materials stockpiled in landfills.

Photo courtesy of Arkansas State University

Beneficial Use Case Study

Sukh Eco-house

Coal Combustion Product Type
Fly ash

Project Name
Sukh Eco-house

Project Location
New Delhi, India

Project Participants
NTPC Limited

Project Completion Date
2024

Project Summary
Sukh Eco-house is an initiative of India's government-owned electric utility NTPC to utilize fly ash for constructing houses that are ecological and economical. The structure of the house—including its foundation, roof, and window and door frames—is built entirely from ash-based materials. The house's innovative interlocking wall blocks do not require mortar or aggregate, resulting in reduced costs and significantly lower carbon emissions compared to conventional home-building methods.

Project Description
Sukh Eco-house is a pioneering housing solution that uses 80 percent fly ash and ash-based products sourced from thermal power plants throughout the building structure to create a sustainable, affordable home powered with solar energy. Designed by NTPC Limited, India's largest integrated power utility, this innovative home is built from interlocking wall blocks that eliminate the need for steel, sand, cement, mortar, and natural aggregates, thereby lowering both carbon emissions and topsoil erosion. The prototype spans approximately 323 square feet and includes a bedroom, kitchen, toilet, and drawing room.

Sukh Eco-house complies with PMAY-G standards, a program of the Indian government that aims to provide affordable housing to eligible households in rural areas of the country. At a cost of 150,000 Indian Rupees (₹1.5 lakh), or about US $1,730, NTPC's Eco-house can be constructed in just 15-20 days. The design allows the house to be dismantled and re-erected with minimal damage, adding to its practicality.

Sukh Eco-house was showcased at the 2024 India International Trade Fair in New Delhi, India, and has been hailed as a groundbreaking construction method that conserves natural resources and reduces carbon emissions by up to 75 percent compared to conventional homes. NTPC confirmed the durability of the house's construction by exposing it to over two years of harsh weather, including rain and high winds.

In 1999, India's Ministry of Environment and Forests issued guidelines calling for full utilization of the nation's coal ash. NTPC has since embarked on a program that had boosted the utility's fly ash recycling rate to almost 83 percent by fiscal year 2022-23—utilizing it primarily in applications such as cement, fly ash bricks, road embankment construction, mine filling, low-lying land development, and ash dyke raising.

Photo courtesy of NTPC

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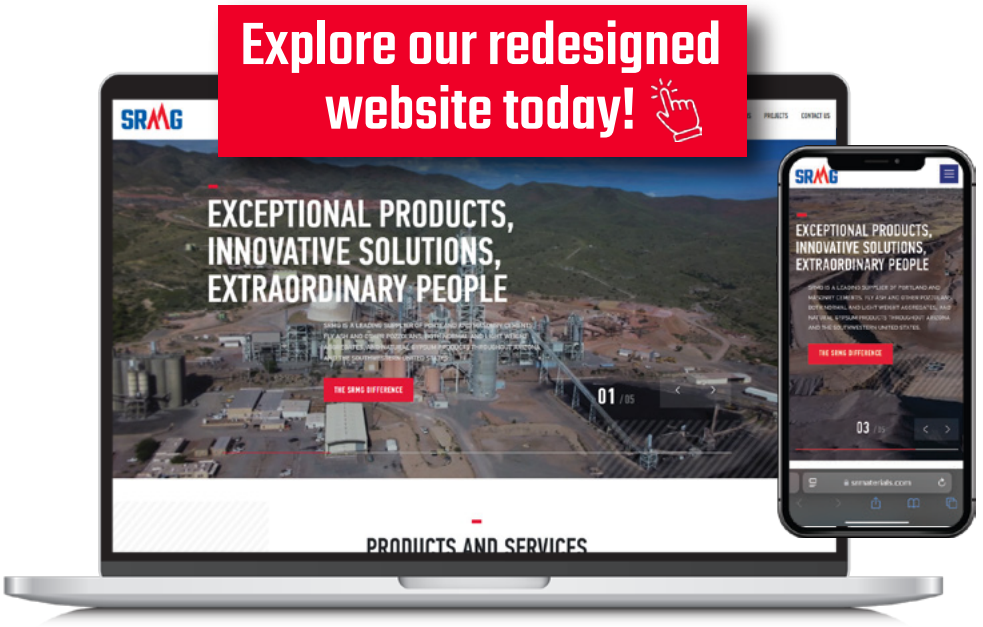

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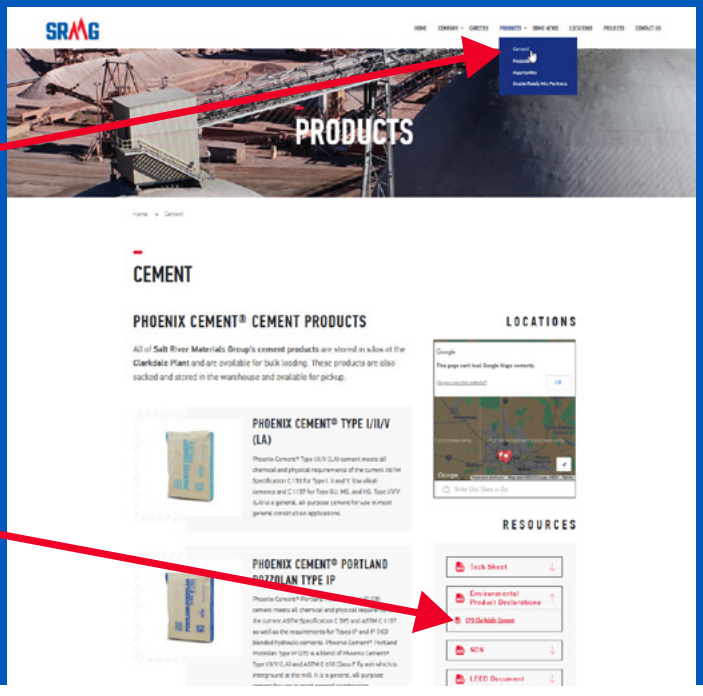


Under Resources Click on Environmental Product Declarations

ASTM C618 Says Goodbye to Class N

By Thomas H. Adams

For a very long time, ASTM C618 was titled the "Standard Specification for Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete." This document has served as the cornerstone specification for the industry. AASHTO, the American Association of State Highway and Transportation Officials, has its own specification, AASHTO M295. It is very similar to ASTM C618. These specifications include requirements for Class C and Class F fly ashes, as well as Class N pozzolans. On December 7, 2022, ASTM Committee C09 approved major changes in C618 to add bottom ash and harvested ashes. The title of the specification was changed to "Standard Specification for Coal Ash and Raw or Calcined Natural Pozzolan for Use in Concrete." AASHTO has accepted the changes approved for C618 and has modified its specification. ASTM has worked to harmonize the standards to reduce confusion and cost in the marketplace. This work has been successful.

With the rapid growth in the demand for supplementary cementitious materials (SCM) availability, pozzolans suppliers have expressed a desire to have a stand-alone specification for pozzolans totally separate from C618. The primary reason for this interest is that some of the requirements of C618 do not apply to pozzolans, placing an unnecessary burden on pozzolan suppliers. For example, loss on ignition limitations for coal ash is a significant problem for fly ash users. High levels of loss on ignition in coal ash are indicative of the presence of unburned carbon. The unburned carbon can cause problems in producing air-entrained concrete mixtures. However, high loss-on-ignition levels in pozzolans have nothing to do with unburned carbon. The levels in pozzolans are due to bound water and do not impact generation of air-entrainment systems within concrete. This is just one example of how Class N differs from Class C and Class F coal ash.

Recently, ASTM issued ASTM C1945, Standard Specification for Raw or Calcined Natural Pozzolan for Use in Concrete. This specification was established to start the process for removal of Class N materials from C618. To maintain order in the marketplace and reduce confusion, the specifications for Class N materials were copied exactly as they appear in C618. For the near future, Class N materials will appear in both ASTM C618 and C1945. Gradually, changes will be made in both specifications simultaneously. When the market has become aware of and familiar with the C1945 specification, voting to remove Class N specifications from C618 can take place. This process may take a few years.

The pozzolan marketplace is getting very busy, with new pozzolans being introduced at a rapid pace. Some of these pozzolans are raw, manufactured, calcined, activated chemically, activated mechanically, activated thermally, and so on. Writing a specification to address all the types of pozzolans coming to the marketplace will be a very daunting task.

Future versions of C618 focused solely on coal ash use in concrete will be helpful to those using coal ash as an SCM. Consideration of Class N issues will no longer be necessary, making improvements to C618 easier and faster.

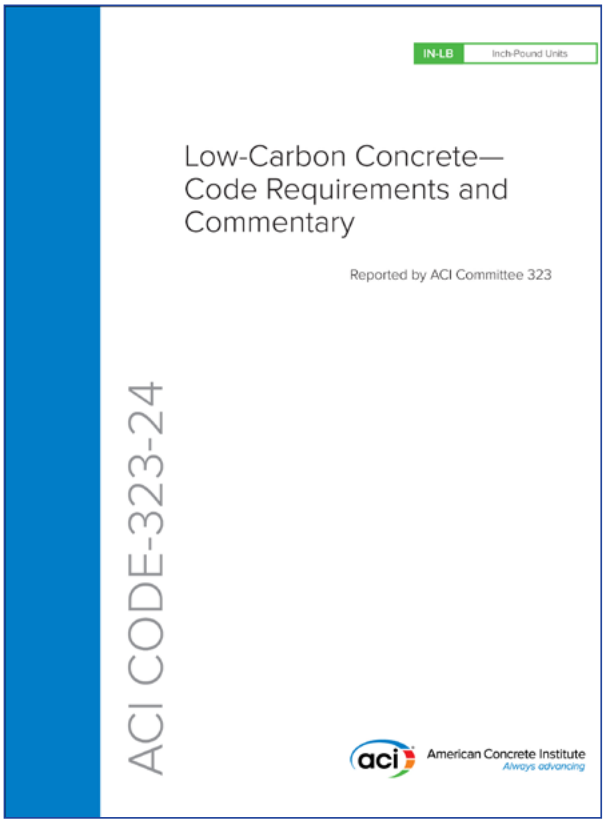
Ultimately, the market will benefit from more options when selecting an SCM to meet the increasing demands for concrete performance improvements while minimizing the impact of concrete construction on the environment. Coal ash will continue to be a major contributor.

Thomas H. Adams *is Executive Director of the American Coal Ash Association.*

Introducing ACI Code 323 to the Coal Ash Community

By Christopher C. Ferraro, Ph.D., PE, FACI, and Matthew P. Adams Ph.D., FACI

The American Concrete Institute (ACI) recently published the first edition of the Low-Carbon Concrete Code (ACI CODE 323-24), which provides provisions for concrete where reduced global warming potential (GWP) is required. The Code provides performance-based requirements for designing low-carbon concrete mixtures. Rather than prescribing fixed material proportions, the Code focuses on achieving target carbon intensity thresholds, measured through Environmental Product Declarations (EPDs) and other documentation, and represents a major step in codifying sustainable construction practices within the U.S. concrete construction industry.



ACI Code 323 introduces a modified carbon budget framework and emphasizes the use of EPDs for benchmarking, with a goal of standardizing methodologies for the reduction of carbon emissions in newly placed construction. It applies to cast-in-place concrete with design compressive strengths ranging from 2500 to 8000 psi and is intended for use by entities seeking to implement low-carbon concrete practices.

ACI Code 323 does not establish requirements related to the strength, stability, serviceability, durability, or structural integrity of concrete structures. These aspects remain governed by other applicable codes, such as ACI 318. The Code is intended solely to address the carbon performance of concrete mixtures and does not supersede, modify, or replace established provisions for structural design, performance, or safety. The Code can be adopted as a stand-alone standard or used alongside structural design codes or low-carbon material codes. It is presented in a format that allows for reference without change to its language, while the accompanying commentary provides background, suggestions, and deeper insight into Code provisions.

Coal ash has long been recognized as a proven supplementary cementitious material (SCM). Coal ash enhances the long-term strength, durability, and resilience of concrete while reducing portland cement content, a primary source of carbon emissions in concrete construction. Under ACI Code 323, performance-based pathways allow concrete producers greater flexibility to optimize their mixes for both sustainability and durability. Fly ash's demonstrated ability to improve strength development, decrease permeability, and extend service life makes it a natural fit for meeting the new Code's criteria. By not prescribing mixture designs and instead setting a performance requirement, the Code allows the engineer to use the materials most suitable to their structural, durability, and economic requirements.

ACI Code 323 was written to support the concrete industry as demand for lower-carbon concrete increases. The provisions provide a measured approach to reducing embodied carbon in construction projects, while not requiring mixture designs that are not technically feasible due to material availability and other design requirements. Coal ash, among other technologies and materials, will continue to be an important material for supporting reduced GWP without sacrificing strength, durability, or resiliency.

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Protect Your Home From Wildfire

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.

Your home is likely the biggest investment you will ever make. Protect it from the threat of wildfire by taking the following steps.

Before a Wildfire

- ***Roofs/Walls***—Replace flammable wood and shingle roofs and walls with composite, metal, clay, or tile. Regularly clear leaves and other debris from the roof to prevent ignition.
- ***Chimneys***—Close the fireplace flue during wildfire season when the chimney is not in use.
- ***Windows***—Add screens to operable windows to catch embers. Fit dual-paned windows with at least one tempered glass layer to withstand fire-induced breakage.
- ***Decks***—Construct decks from ignition-resistant building materials, such as composite; maintain an ember-resistant zone beneath decks by removing all flammable materials.
- ***Garages***—Equip garage doors with battery backups to ensure functionality during power outages. Apply weather stripping around/under garage doors to block ember entry. Store a fire extinguisher within reach.
- ***Fences***—Use nonflammable materials for portions of a fence that connect to the house.
- ***Water Supply***—Install long garden hoses that can reach all areas of your property, including roofs and decks.
- ***Landscaping***—Remove dead or dying vegetation from your yard; avoid using flammable mulch, particularly within five feet of your home; trim trees regularly to keep branches six feet from the ground and ten feet from other trees.
- ***Watering***—Keep plants and lawn watered so as to reduce their flammability.
- ***Insurance***—Update your policy after home improvements; verify the accuracy of your home's details, including possessions within, in your policy.
- ***Emergency Kit***—Pack an emergency kit with cash, credit cards, passport, food/water, maps, prescriptions, glasses, and a change of clothing.

During a Wildfire

- ***Emergency Kit***—Put your pre-packed emergency kit in your car.
- ***Gas, A/C***—Turn off the gas at the meter, pilot lights, and air-conditioning.
- ***BBQ, Propane***—Move grills and propane away from the house.
- ***Patio Furniture***—Move flammable items such as doormats and furniture inside or place them in your pool.
- ***Proceed to Evacuation Route.***

These materials were adapted from the California Department of Forestry and Fire Protection.

- *Wet Ash Pond Closure Partnerships*
- *Amphibious CCR Excavation*
- *Landfill Construction, Operation & Closure*
- *Water Management and Dewatering*
- *Value Engineering*
- *Mass Earthwork & Conventional Heavy-Civil*
- *In-situ CCR Testing*
- *Soil and CCR Chemical Stabilization*

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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.

This issue's guest columnist is Doug Green. Doug recently retired from the law firm of Venable LLP, where he represented the Utility Solid Waste Activities Group (USWAG) and individual utility clients on a wide range of environmental issues, including compliance with EPA's coal combustion residuals (CCR) rule. As counsel for USWAG, Doug prepared scores of comments and position papers advocating for the development and implementation of a cost-effective and environmentally protective federal CCR program, including maintaining the exemption from federal regulation for CCR beneficial use. In addition to participating in the ACAA Government Relations Committee, Doug serves as a Director for Fox Islands Wind, a 4.5-MW, land-based wind generation facility in Vinalhaven, Maine.

Q. What steps will EPA have to take to revise CCR rules under the new administration?

A. In answering this question, it's useful to look first at what EPA itself has said about future revisions to the CCR rules. In its March 12, 2025, CCR press release, EPA committed to "updates to the coal ash regulations," including the CCR legacy rule, stating that it "*aims to complete rule changes within a year.*" Left unsaid, however, is how EPA will go about making these changes.

Generally, any substantive changes to the CCR rules will require the agency to adhere to the notice and comment procedures set forth in the Administrative Procedure Act (APA). The basic steps involve:

(1) Issuing a proposed rule;

(2) Allowing for a public comment on the proposal; and

(3) After evaluation of the public comments, issuance of the final rule revisions.

Importantly, there is no set time period under the APA for an agency to complete a notice-and-comment rulemaking. Some proposals linger for years, as is the case, for example, of the still-pending EPA August 2020 proposal to reconsider the beneficial use criteria and the regulation of on-site and off-site CCR piles. On the other hand, some rulemakings are conducted in an accelerated fashion and can be completed—from start to finish—in under a year, and even less in some cases. In fact, completion of the CCR legacy rule took just one year, from issuance of the proposal to the publication of the final rule in the *Federal Register*. That was a very fast rulemaking, given the scope and complexity of the rule. Election year politics likely played an important factor in the rapid issuance of the CCR legacy rule. The last administration reportedly wanted to ensure publication of the rule in the *Federal Register* before the deadline under which it would have been subject to the Congressional Review Act, which would have allowed the new Congress the opportunity to repeal the rule.

"Resolution of the pending industry group challenges to the CCR legacy rule may well provide the vehicle for EPA to establish the process and schedule for making CCR rule revisions."

Here, resolution of the pending industry group challenges to the CCR legacy rule may well provide the vehicle for EPA to establish the process and schedule for making CCR rule revisions. Recall that industry groups filed their opening briefs challenging the CCR legacy rule on January 31. Shortly thereafter, however, consistent with the new administration's directive for EPA to defer taking action on any pending litigation to enable EPA to reassess its litigation positions, EPA filed an unopposed motion to have the CCR legacy rule litigation held in abeyance (i.e., put on hold). The court approved the unopposed motion and directed the parties to file motions governing future proceedings in the case by June 13.

Putting the case on hold provides the new administration with time to determine how best to address industry group concerns with the CCR legacy rule, consistent with EPA's commitment to implement "updates" to the CCR rules. Given its goal to complete CCR rules changes within a year, EPA may try to resolve the CCR legacy rule litigation through a settlement agreement in which the agency agrees to take the CCR

legacy rule back (through what's called a voluntary remand) for purposes of undertaking regulatory revisions pursuant to a set schedule. The current CCR rules would remain in effect until the regulatory revisions are implemented. EPA has pursued similar settlement strategies in the past when a new administration changes course in litigation involving challenges to rules issued under the prior administration.

In monitoring EPA's strategy, it will be interesting to see how the agency responds to the January 15 industry group letter to Administrator Zeldin asking, among other things, for EPA to (1) summarily withdraw the CCR management unit component of the legacy rule and certain of the rule's new definitions through what's called a "voluntary vacatur," and (2) rescind the prior administration's interpretation that on-site uses of CCR do not qualify as exempt beneficial uses. Both of these actions could, potentially, be taken relatively quickly without EPA going through the full APA notice-and-comment process.

It is uncertain, however, whether EPA would want to face some of the potential procedural hurdles to taking such abbreviated action. While we don't have a crystal ball as to EPA's strategy, what seems more likely is that the agency will develop a relatively rapid schedule to undertake a full notice-and-comment rulemaking (again, perhaps in a settlement to the CCR legacy rule litigation) to revise and/or correct elements of the CCR rule. Importantly, though, even with an accelerated rulemaking schedule to revise the CCR rule, the new administration will want to be sure that any regulatory changes are fully supported by the rulemaking record, as any rule revisions are almost certain to be challenged by ENGOs. Therefore, interested parties should be prepared to participate in the rulemaking process to provide record support for any of EPA's proposed revisions.

Hopefully, the timing and process for how the new administration intends to revise the CCR rules will come into clearer focus when, on June 13, EPA and the other parties in the CCR legacy rule litigation file motions to govern future proceedings in the case. Until then, stay tuned.

ACAA
AMERICAN COAL ASH ASSOCIATION

ACAA CHAMPION AWARD HONOREES

The ACAA Champion Award

ACAA established The Champion Award in 2012 to recognize those who have made extraordinary contributions to the beneficial use of coal combustion products. These contributions are found in many forms, including research, discovering and advancing applications, marketing, education and training, regulatory and government affairs, and industry organization and leadership. Recipients may be individuals, private or public institutions, or members or non-members of the ACAA, living or deceased. The recipient is selected exclusively by the Chair of the ACAA Board of Directors and is known only to the Chair until the moment the presentation is made.

Following are the past awardees and their specific areas of contribution. While this is by no means a comprehensive record of all persons and organizations who have made important contributions in pursuit of the ACAA mission, the list identifies some of the industry's dedicated leaders and their areas of focus that have helped to maintain, modify, and grow the markets we serve today.

Past Awardees

2025 – Thomas C. Hendrix, The SEFA Group

Thomas C. Hendrix, founder of The SEFA Group (now part of Heidelberg Materials), was honored for his lifetime dedication to coal combustion product beneficial use, support of the industry, and development of technologies to improve the processing of byproducts, with an emphasis on harvesting resources from coal ash landfills. The SEFA Group was one of many small businesses that started up during the 1970s to address CCP materials that were being generated and sent to disposal units. Over the years, the company expanded operations to support sales along the eastern seaboard and, at the same time, developed a process to beneficiate ash to meet market needs. This technology, known as STAR, has proven to be particularly effective in ash landfill harvesting applications and is recognized as the first technology to be used on ponded ash on a commercial scale.

2022 – Lawrence L. Sutter, Michigan Technological University

Lawrence L. Sutter is Professor Emeritus at Michigan Technological University. Prior to retiring to Emeritus status, Professor Sutter taught Materials Science and Engineering and served as Associate Dean of Research and External Relations, as well as Director of the Applied Chemical and Morphological Analysis Laboratory. For over 40 years, Professor Sutter has been engaged in materials characterization, concrete materials research, and concrete durability issues. Much of that work has focused on secondary and recycled materials such as fly ash and blast furnace slag. He has also closely studied the effects of deicing chemicals on concrete pavements. Professor Sutter is actively engaged in numerous committees and subcommittees of ASTM International and the American Concrete Institute. He is a fellow of both organizations and has received many awards from ASTM and ACI for his contributions. In recent years, he has worked to continually revise and improve numerous guides, specifications, and standards, most notably ASTM C618, Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete—the cornerstone specification for the use of fly ash in concrete in the U.S.

2020 – Charles E. Price, Charah Solutions

Charles E. Price is the retired founder of Charah Solutions and former chairman of the American Coal Ash Association. Price founded Charah in his Louisville, Kentucky, home with his wife Janet in 1987. The company started out completing publicly bid general contracting work and then expanded into civil construction jobs for local surface coal mines. In 1992, Charah performed its first coal ash project, completing a pond excavation project for Big Rivers Electric Cooperative in western Kentucky. Charah primarily focused on coal ash pond and landfill projects throughout the 1990s, expanding outside of Kentucky with projects in the Carolinas, Pennsylvania, and Florida. The company moved into fly ash and bottom ash marketing in the early 2000s. Price was always focused on new and inventive ideas for performing work, which resulted in his receipt of three patents related to processing coal ash for beneficial use. In 2012, he directly oversaw research and development of the first synthetic gypsum pelletizing plant in the United States to allow for easier and more efficient use of synthetic gypsum in agricultural applications. At the time of his retirement in 2019, Price had overseen the growth of Charah from a ground-zero startup to a publicly traded company on the New York Stock Exchange employing over 1,000 people.

2018 – Bruce W. Ramme, WEC Energies Group

Dr. Bruce W. Ramme, retired Vice President of Environmental for WEC Energy Group, joined WEC Energies in 1980 as a civil engineer in the transmission engineering division. Subsequent assignments found him involved in civil engineering design and project management, power plant leadership roles, and environmental responsibilities that included coal combustion product management. He was named an ACI Fellow in 2005 and has received many other honors, including several engineer-of-the-year awards. Dr. Ramme is the author of numerous papers on concrete and fly ash, as well as a comprehensive handbook on coal combustion product utilization. He holds more than a dozen patents on CCP management and use. A professor at the University of Wisconsin - Milwaukee College of Engineering and Applied Science, he serves as Associate Director of the university's Center for By-Products Utilization.

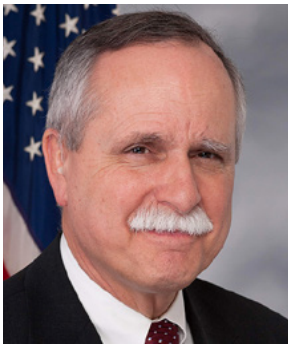
2017 – University of Kentucky Center for Applied Energy Research

The Center for Applied Energy Research (CAER) at the University of Kentucky received the ACAA Champion Award in recognition of its decades of research, education, and training on coal ash beneficial use. ACAA and CAER are especially close partners—since 2005 cosponsoring the World of Coal Ash, which has grown to become the flagship event for the international coal combustion product industry. Additionally, CAER's Materials Technologies Group specializes in developing construction materials from a wide variety of CCPs. Founded in 1972 with a grant of $400,000 from the Kentucky General Assembly to advance coal use, CAER's multidisciplinary research work extends far beyond the coal ash world as it investigates energy technologies to improve the environment; contributes to technically sound policies related to coal, energy, and the environment; adds to the teaching and instruction aim of UK by educating students from pre-college to postgraduate levels and being involved in labor force development for Kentucky; promotes UK's objective of developing and benefiting from its intellectual property with a balance between the publication of scientific results and patenting; and provides public service through scientific education and its energy-related competencies.

2015 – USDA Agricultural Research Service

USDA's Agricultural Research Service was selected as the recipient of the fourth ACAA Champion Award in recognition of its multi-year efforts to qualify flue gas desulfurization (FGD) gypsum as a useful and desirable soil amendment. Because FGD gypsum is comparable to mined gypsum and more readily available in many parts of the country, there is significant potential to increase its use in agricultural settings. However, available research documenting the effects of FGD gypsum on plants, soils, and the environment was limited prior to ARS's activities. Beginning in 2007, a number of projects were undertaken by scientists from USDA Agricultural Research Service locations in Auburn, Ala.; Beltsville, Md.; Oxford, Miss.; and Watkinsville, Ga., to study the agricultural effectiveness of FGD gypsum as a soil amendment and determine safe levels for FGD gypsum application. Of particular interest to this group was reducing the transport of soluble P contamination from areas receiving applications of poultry litter and evaluating the potential for loss of contaminants into the environment. Experiments demonstrated that water quality could be greatly improved with the use of gypsum to decrease both P and microorganisms in runoff from poultry litter applications. FGD gypsum also improved soil quality, increasing the amount of rainwater infiltrating into the soil. In addition, trace elements in runoff were shown to be below EPA water quality standards.

2014 – U.S. Representative David B. McKinley



Former Congressman David B. McKinley of West Virginia, a registered professional engineer with a deep knowledge of beneficial use of CCP, became the elected voice for beneficial use in the U.S. Congress in his very first month following his election in 2010. Within 30 days of being sworn into office, McKinley authored a bill preventing the EPA from creating hazardous waste regulations for the management of CCP. That one-paragraph bill was the first in a series of bills passed by the House of Representatives with bipartisan support. During the process of getting his bill through the House Energy and Commerce Committee, Congressman McKinley worked hard to convince his colleagues to focus attention on the issue, even confronting former Speaker of the House John Boehner in a heated discussion. In the dark days of 2010, the ACAA needed a strong, passionate champion in Washington, D.C., and David McKinley was the right man at the right time.

2013 – David C. Goss, Former ACAA Executive Director

ACAA bestowed the second-ever Champion Award on former ACAA Executive Director David C. Goss. During his tenure as Executive Director of the association, Goss helped ACAA stabilize its fragile financial condition, grew the services provided, increased membership, and improved the association's reputation to outside organizations. He also brought the ACAA together with the Center for Applied Energy Research at the University of Kentucky to create the highly successful World of Coal Ash. Goss retired in December 2008, just as the coal ash spill at the Kingston generating station in Tennessee changed the coal ash landscape dramatically. To assist ACAA in facing the challenge, he stayed on as a volunteer and consultant assisting the organization on several fronts.

2012 – John N. Ward, ACAA Government Relations Committee Chairman

ACAA presented its first Champion Award to John N. Ward for his exceptional work in providing leadership in meeting challenges from the U.S. Environmental Protection Agency and ENGOs following the Kingston, Tenn., ash spill in December 2008. Ward entered the coal ash marketing business in 1998 as Vice President, Marketing and Government Affairs, for ISG Resources (later Headwaters). He has since served as president of John Ward Inc., a public affairs consultancy to the coal ash and energy industries. Ward is the longstanding chairman of ACAA's Government Relations Committee and the author of ACAA's weekly *Phoenix* newsletter. With his deep experience behind the scenes in Washington, D.C., he has consistently provided valuable advice and strategic guidance to the association.

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6 Questions for Chris Hardin

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.

Chris Hardin, P.E., is a Principal Engineer and Subject Matter Expert (SME) with TRC supporting companies in the coal combustion residuals (CCR) industry. From 2015 to 2022, Mr. Hardin served as the Managing Director of Coal Ash and Liquid Management (CALM) Initiative. CALM was an industry leading organization consisting of coal ash basin owners and CCR industry contractors and engineers that developed safety training programs and practical, technology-based solutions for the energy production industry to address problems and challenges with coal ash and liquids management. Chris' over 30 years of professional experience has focused on responsible waste management practices, sediment remediation, coal ash management, and containment system design. His project experience includes the engineering design and construction of lined landfills, slope stability monitoring systems, and wet ash basin closure projects in the Mid-Atlantic, Southeast, and Midwest.

Previously, Chris was the technical advisory consultant to the North Carolina Coal Ash Management Commission that helped guide the initial response after the Dan River coal ash spill and downstream remediation. While serving as a working member of the E50 committee, he was responsible for writing several sections of ASTM E2277, the Standard Guide for Design and Construction of Coal Ash Structural Fills. In addition, he has written or co-authored numerous technical papers and presentations, including "The Dagu Canal Sediment Remediation Landfill" (Tianjin, China 2004), "Best Management Practices for Coal Ash Storage Facilities" (2009), "Practical Considerations for Wet Coal Ash Pond Systems" (2011), "Evaluation of the Settlement Behavior of Flyash for Ash Basin Closure Projects" (2013), "Stability Evaluation and Monitoring During Staged Construction of Fly Ash Closure Projects" (2017), "Geotechnical Characteristics and Safety Considerations for Wet Ash Basin Closure" (2017), and "Integrated Approach to Dewatering and Stabilization of Ash Basins for Closure" (2017).

ASH at Work (AW): According to recent regulatory guidelines from the U.S. Environmental Protection Agency (EPA), to allow close-in-place, coal combustion residuals (CCR) units and/or impoundments must be dewatered and all "free liquids" eliminated. What does eliminating "free liquids" mean, and is it possible from an engineering design and construction perspective?

Chris Hardin (CH): Thank you for the opportunity to provide input on these important questions. As a Professional Engineer, I want to make it clear my responses in this article should not be considered a professional engineering statement. At the same time, hopefully my responses provide helpful insights for coal ash basin closures, beneficial use of CCRs, and the challenging regulatory issues that are being encountered by the owners and operators, contractors, and engineers working on these projects.

"Complete 'elimination' of porewater in CCR units is not possible using the best available technology (BAT) from an engineering design and/or construction perspective."

In EPA documents from 2018 (that were confirmed by a more recent EPA review in 2025), the term "free liquids" was defined as the near-surface liquids that need to be removed and/or stabilized prior to installation of the CCR impoundment cover system. It is possible to remove the near-surface CCR free liquids as it was defined by the EPA prior to 2020, as confirmed by numerous CCR industry construction and engineering experts, as well as the applied research of the Electric Power Research Institute (EPRI) from 2015 to 2019. See "Closing Coal Combustion Residual Ponds," EPRI article in *PowerMag*, February 2017.

However, the 2024 CCR Legacy Rule redefined previously established and agreed upon definitions of "free liquids." In addition, changes were also made to the performance standard for dewatering so that elimination of "free liquids" appears to be the expected performance standard in CCR units and impoundments for the close-in-place option. Elimination of all "free liquids" is the new performance standard for all close-in-place CCR units, and EPA now requires complete drying and/or removal of the CCR for the closure of coal ash basins.

Complete "elimination" of porewater in CCR units is not possible using the best available technology (BAT) from an engineering design and/or construction perspective. Even with closely placed dewatering wells, the porewater is bound to the fine-particle CCRs and micropore space between the CCR particles. This principle, well established in the fields of geotechnical engineering and agricultural soil science, applies equally to CCRs as to any other clay/silt-sized particle industrial by-product material.

AW: How do the changes in the definitions of CCR "free liquids," "porewater," and "groundwater" influence the close-in-place approach used by regulated utilities and other owners of CCR units and impoundments? What additional challenges do these changed definitions present?

CH: Since 2012, contractors and CCR design engineers have removed near-surface free liquids from a CCR impoundment via pumping, shallow rim ditches, and shallow dewatering wells. Changing the definitions without incorporating input from CCR industry experts, contractors, and design engineers has resulted in a new "standard" that may be preferred from a legal and enforcement perspective, but is nonetheless not possible from a practical and technical perspective.

Removal of porewater below the CCR impoundment surface is much more difficult because it is "locked up" and/or contained in the micropore space of the fine-particle CCR materials. These limitations are well understood and documented in numerous technical papers, case studies, and CCR impoundment closure design documents that have been presented at WOCA conferences and in EPRI applied research documents.

During EPA Industry Day in August 2022, several industry experts presented information about the practical limitations for the "complete removal" and elimination of porewater from CCR impoundments. It does not appear that these inherent technical limitations in the BAT for CCR porewater removal and elimination were taken into account in the development of the EPA Memo dated August 22, 2024, for inclusion in key technical sections of the 2024 CCR Legacy Rule. Based on a review of the publicly available information, it seems that this EPA Memo may not have undergone the standard scientific and technical peer review process typically required for EPA guidance documents.

If all porewater in CCR units is considered "free liquids" and must be removed from a covered and contained CCR impoundment, the close-in-place option will effectively be eliminated and/or become technically impracticable for most remaining CCR impoundments and CCR beneficial use storage areas. The impacts will include the significant additional costs of closure by removal and elimination of beneficial use as a viable management option.

Porewater pressure piezometers used to measure inward gradient and excess and/or negative porewater pressure near CCR units (Photo courtesy of Geokon).

EPA has stated that it is not required to take the cost of its redefinition of "free liquids" into consideration because this change is already covered as part of the Resource Conservation and Recovery Act (RCRA). In addition, CCR impoundments that were covered and utilized the close-in-place option could and/or would be considered to be in non-compliance with the CCR Legacy Rule even if these CCR units and CCR impoundments were in compliance with the state and federal CCR Rule at the time of closure prior to 2020.

AW: Are there other methods to contain and control CCR porewater so it remains "bound" within CCR impoundments and CCR units that would be equally protective of human health and the environment and would allow the CCR close-in-place option?

CH: The straightforward answer is "yes." There are many methods that can and have been used to contain and control the porewater in CCR impoundments that are covered and contained using standard solid waste containment technology:

- *Inward gradient and negative pressure of the CCR porewater.* Typical CCR impoundments can be dewatered using specialized dewatering wells and bottom-of-the-CCR-unit horizontal drains to create an "inward gradient" and a "negative pressure" where the porewater is contained in the CCR unit. See photos at the top of the next page.

- *CCR porewater pressure can be measured and the porewater in the CCR unit contained.* On numerous CCR impoundments that utilized the close-in-place option from 2014 to 2020 in Ohio, West Virginia, Georgia, and Alabama, there are cover systems, perimeter containment trenches, and porewater pressure measurement devices that have been used to verify that the CCR porewater and constituents of potential concern (COPCs) in the CCRs are contained.

- *Demonstration projects to verify dewatering and CCR porewater containment.* Recognizing that EPA and state regulatory agencies will require measurement of the inward gradient and negative pressure to verify that the cover system is sufficient and the COPCs are adequately contained, porewater pressure devices could be deployed and checked to verify compliance.

AW: EPA has focused on disposal of coal ash in CCR units and/or remediation of CCR impoundments where porewater is in contact with groundwater and/or has the potential to migrate to nearby off-site receptors and drinking water wells. How can site-specific uncertainty about protecting groundwater resources and drinking water wells be addressed using BAT for dewatering and CCR porewater measurement?

CH: Experienced CCR closure design engineers and contractors have designed, installed, and operated groundwater wells and monitoring networks that demonstrate that the groundwater and drinking water around CCR impoundments are protected from the migration of CCR porewater. Results from these programs have been used to confirm a reduction in the levels of COPCs adjacent to CCR close-in-place projects in numerous states. State regulatory agencies have established

Fine-particle CCRs in a partially saturated CCR basin. Note how the CCR porewater is "locked up" in the CCR materials. This "free liquids/porewater" cannot be eliminated. It helps to hold the CCR COPCs in place, preventing offsite migration.

Fine-particle CCRs in layers, showing excess porewater. This type of free liquids/porewater can be removed by dewatering. The containment of the porewater measures as a negative pressure. There is no hydraulic head or gradient to allow offsite migration.

and approved CCR programs that follow the 2015 CCR Rule and the technical programs developed using peer-reviewed and approved guidelines from EPA.

"These unachievable performance standards and guidelines are causing continual conflicts between NGOs, citizens, and owners of CCR units and significantly increasing the cost of CCR impoundment closure."

Experts in many EPA regional offices have been supportive of these methods for implementing the 2015 CCR Rule requirements, but their input was overlooked as EPA headquarters in Washington, D.C., established stricter CCR regulations and performance standards between 2020 and 2024. The 2024 CCR Legacy Rule provides several examples where the technical opinions and technology limitations shared by CCR closure technical experts and organizations with extensive practical field experience were not considered. EPA's denial of several state CCR programs from 2022 to 2024 demonstrates a departure from technically based standards with conflicting rule interpretations that deviate from state agencies and EPA's enforcement of performance standards that are simply not possible from a practical and technical perspective.

At this time, it is reasonable to request that the EPA reconsider its current approach to the regulation of CCR impoundments by adhering to the established technical guidelines in the 2015 CCR Rule and science-based guidelines in the 2024 CCR Legacy Rule. The 2024 CCR Legacy Rule raises valid concerns regarding the protection of groundwater, human health, and the environment. EPA policy leaders should consider collaborating with regional offices and state regulatory agencies to develop permitting programs that are "reasonable and prudent" and equally protective of groundwater and surface water resources, rather than prescribing specific "means and methods" for compliance.

AW: How has current regulatory uncertainty created confusion with the general public, and risk from citizen lawsuits and NGOs, that may or may not have technical basis?

CH: Over the past five to seven years, the number of lawsuits against utilities and other companies involved with the beneficial use of CCR materials has increased substantially. The constantly changing EPA regulatory guidelines as they apply to CCR materials and units/impoundments have created a costly "unsolvable problem." The unexpected consequences that will have far-reaching impact on both the general public and the regulated community include:

- *Continual and substantial increases in the cost of electric power*—because the cost of compliance for the closure of CCR impoundments and/or CCR units is typically passed on to businesses and consumers (estimated at over $400 billion if the closure-by-removal model in North Carolina is used across the United States).
- *Research organizations' hesitancy to test and research coal ash*—Respected research organizations like the U.S. Geological Survey, EPRI, and numerous university-based research teams have been discredited by previous NGO legal action and in the media because they attempted to address the "problem of coal ash" containment and beneficial use in an objective and scientific manner. See U.S. Geological Survey research on trace elements in coal ash.
- *Development and enforcement of a performance standard that cannot be met.* EPA's changes to the definitions of "liquids" and "free liquids" have created confusion about the technical issues associated with containment of CCRs and porewater. This effectively creates an "unsolvable problem" because, while the 2024 CCR Legacy Rule says CCR and porewater must be removed and "dry" for compliance, practical

The GeoNet low-power, wireless data acquisition network (photo courtesy of Geokon).

science and construction methods indicate all porewater and "free liquids" cannot be removed.

- *Continual lawsuits to enforce an impossible performance standard.* Even though CCRs can be covered and contained using the close-in-place option with appropriate engineered and institutional controls, the 2024 CCR Legacy Rule requires a performance standard to eliminate all porewater, which is improperly defined as "free liquids." Complete removal or "elimination" of porewater is impossible to achieve even with BAT. At the same time, environmental NGOs and law firms are expecting that owners of CCR units/impoundments can achieve the EPA performance standard, which should be enforced by state regulatory agencies.

Simply put, these unachievable performance standards and guidelines are causing continual conflicts between NGOs, citizens, and owners of CCR units and significantly increasing the cost of CCR impoundment closure. These additional regulatory requirements do not necessarily equate to significant environmental benefits or reduce risk to off-site groundwater.

AW: How should the CCR closure and beneficial use industry proceed from here?

CH: From my past experience serving as technology leader for the North Carolina Coal Ash Management Commission and assisting with multiple successful coal ash basin closure and beneficial use projects, there are a few ways the CCR closure and beneficial use industries can encourage meaningful change:

- *Clearly Defined and Defensible Performance Objectives:* It is logical to recommend that the definitions of CCR "free liquids" and the performance standard to eliminate all free liquids/porewater from CCR units and/or impoundments be aligned with what is scientifically possible and practically achievable from a design and construction perspective. For example, based on the physical and chemical properties of coal ash, complete "elimination" of porewater/free liquids is not possible from a technical and construction standpoint. However, there are technically sound methods to effectively contain and control the porewater in a CCR close-in-place project while protecting human health and the environment.

- *CCR Is a Potential Resource for Beneficial Use:* It is consistent with the 2015 CCR Rule to establish reasonable CCR unit closure and beneficial use schedules to maximize the use of CCRs while managing short-term and long-term risks.

- *Development of State CCR Permit Programs:* Consistent with recent initiatives by the EPA in Washington, D.C., encourage greater collaboration between the EPA regional offices and the state regulatory agencies and the regulated entities—electric utilities and beneficial use companies. The purpose of this collaboration would be to develop practical applications, the "means and methods" for CCR unit/impoundment closure, and reasonable performance standards that can be achieved and enforced.

- *Alignment of the CCR Rules with the Established Performance Standards of Existing RCRA and Clean Water Act Programs:* Regulated entities and state and federal regulatory agencies should maintain their focus on protecting human health and the environment and groundwater and drinking water near CCR units/impoundments. These standards are already part of RCRA and the Clean Water Act, but the "means and methods" need to be adjusted and focused on the unique site-specific conditions that are present in and around CCR units/impoundments.

- *Establish and Encourage Demonstration Projects:* From experience with other RCRA programs, demonstration projects should be considered for use when in doubt about the "means and methods" to contain and control CCR porewater and protect groundwater resources. This time-tested approach is part of the RCRA demonstration program and has been used to develop a wide variety of solutions for difficult-to-solve problems on complex sites. When RCRA Subtitle D was developed for municipal solid waste landfills, its use resulted in several practical and cost-effective technology advancements.

Slag Cement Association: Advancing Resiliency and Performance in Concrete

The Slag Cement Association (SCA) is an industry-leading organization dedicated to providing knowledge and promoting the use of blast furnace slag-based cementitious products. It promotes the increased use and acceptance of these products by educating customers, specifiers, and other end-users on the varied attributes, benefits, and applications of slag cement.

Established in 2001, the association's membership consists of companies that produce and supply slag cement in the United States. In recent years, SCA has experienced incredible growth; the association now represents more than 95 percent of all slag cement utilized in U.S. concrete construction.

SCA's mission is to serve as the leading source of knowledge and technology transfer for the growth of slag cement. Through collaboration with educators, partners, and its own membership committees, the association provides the knowledge and tools necessary to integrate slag cement into construction projects effectively.

The association provides comprehensive resources, including technical guides, case studies, and life-cycle tools, to assist engineers, architects, and contractors in understanding the advantages of incorporating slag cement into their projects. SCA also collaborates with academic institutions and government organizations to further the development of sustainable concrete solutions.

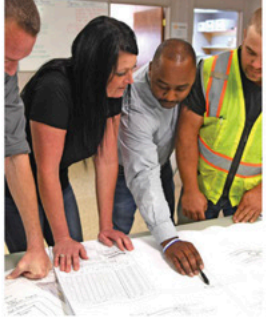
As part of its commitment to industry leadership, SCA advocates for the benefits of using slag cement through supporting research, producing technical resources, and creating outreach programs. Each spring, the SCA hosts two major events that highlight the importance of slag cement in concrete construction.

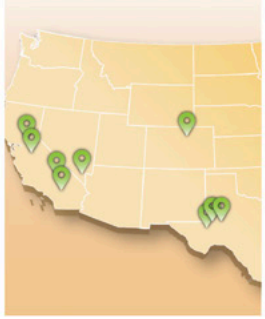
The Slag Cement in Sustainable Concrete Awards recognize exceptional concrete projects that incorporate slag cement to achieve superior durability, resilience, and sustainability. These awards celebrate concrete infrastructure, durability, high performance, architecture, carbon reduction, and innovative applications.

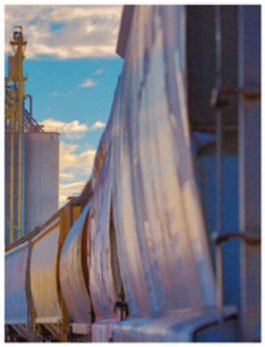
Cornell University Ph.D. student Lyn Zemberekci receives SCA's 2023 Slag Cement in Sustainable Concrete Research Award.

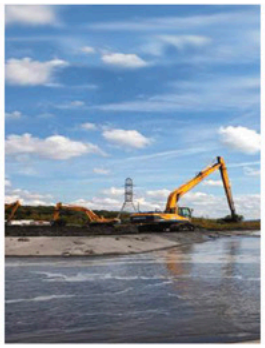
Slag Cement School is an annual educational event designed to provide engineers, specifiers, and industry professionals with in-depth knowledge on the benefits, applications, and technical aspects of slag cement. Through presentations, case studies, and interactive discussions, attendees gain valuable insights into optimizing slag cement usage in their projects.

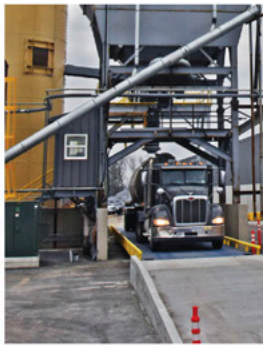
With its commitment to sustainability, education, and industry collaboration, the Slag Cement Association continues to be a driving force in promoting the widespread adoption of slag cement as a key component of modern concrete construction.











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Leading the Way in Circular Construction

Editor's note: In this onging series, ASH at Work highlights ACAA member companies and the valuable products and services they provide.

As one of the largest industrial waste management solutions providers in the world, **Geocycle LLC**, a subsidiary of **Holcim (US)**, is transforming how coal combustion residuals (CCRs) are recovered, repurposed, and reintegrated into the built environment. As part of Holcim's global commitment to sustainability and innovation, Geocycle is at the forefront of circular economy solutions that reduce carbon emissions and create lasting environmental and economic value.

Geocycle's mission is simple yet powerful: to provide sustainable solutions to municipalities and industries by transforming waste into resources. Through a combination of deep technical knowledge and industry-leading operational practices, Geocycle delivers scalable, science-backed solutions that drive circularity, decarbonization, and cleaner communities.

As a leading North American player in CCR recovery and beneficial use marketing—working hand-in-hand with Holcim's extensive sales, distribution, and cement plant network—Geocycle ensures that fly ash, bottom ash, synthetic gypsum, and other CCRs are managed responsibly and marketed profitably. Additionally, being both a leading marketer and major consumer of these materials, we are uniquely positioned to deliver superior environmental and economic benefits while supporting the infrastructure that powers North America.

Breaking Ground in Skippers, Virginia

In June 2025, Geocycle will break ground on its new state-of-the-art ash beneficiation facility in **Skippers, Virginia**—another significant step forward in the company's pursuit of sustainable innovation and circular construction. Developed in collaboration with Holcim's Holly Hill cement manufacturing plant in South Carolina, the Virginia-based facility will recover and repurpose **8 million tons of coal ash** from landfills starting in 2025.

This reclaimed material will be transformed into high-quality **supplementary cementitious materials (SCMs)** that not only reduce CO_2 emissions but also **enhance the strength and longevity of concrete**—paving the way for low-carbon construction at scale.

At the heart of the project is **cutting-edge material processing technology** built to optimize fly ash beneficiation. By leveraging advanced drying, separation, carbon reduction, and blending systems, the facility will ensure consistent quality and top-tier performance for cement and concrete applications.

Reimagining Waste for a Better Tomorrow

Geocycle understands the growing environmental concerns and economic opportunities associated with existing CCR sites—landfills and surface impoundments—as well as the non-negotiable importance of adhering to utility CCR utilization policies, and to all federal, state, and local regulatory requirements.

Geocycle's multidisciplinary team of engineers, chemists, and scientists is committed to designing solutions that go beyond compliance. Their work supports greener communities, stronger infrastructure, and a world where nothing goes to waste.

Because at Geocycle, waste isn't the end of the line—it's just the beginning.

EP Power Minerals:
Locally rooted and globally connected.

Expertise in all aspects of CCP and SCM handling, processing, use, and trading
Pioneered the reclamation and beneficiation of landfilled fly ash for concrete use
Pioneered close to 100% utilization of CCPs for German coal-fired utilities
Major global supplier and trader of SCMs for the decarbonization of the built environment

We make cementitious materials available. EP Power Minerals is your global expert for cementitious materials. We started out more than 40 years ago in Germany with the task of developing beneficial use strategies for power plant by-products, operating processing plants, and organizing the distribution of residual materials from power plants and other industries. With our global network and numerous subsidiaries, we have since evolved to become experts in managing cementitious materials such as fly ash and granulated blast furnace slag.

We recently acquired U.S.-based National Minerals Corporation, a key regional player in the Supplementary Cementitious Materials market. This strategic move strengthens EP Power Minerals' position in the U.S. market and expands its capabilities to supplying materials in the growing sustainable construction market.

We care for a sustainable future. We care for a reliable future.
We care for a solid future. We care for a **cementitious** future.

In and Around ACAA

Asheville, North Carolina

(L-R): Former ACAA Chair John Halm, Duke Energy, listens while Jim Clayton, of Heidelberg Materials, accepts ACAA's Champion Award on behalf of SEFA Group founder Tom Hendrix at the association's 2025 Winter Meeting.

San Antonio, Texas

ACAA Executive Director Thomas Adams on May 21, 2025, presenting on the topic of coal ash harvesting logistics at the National Coal Transportation Association Spring Meeting in San Antonio, Texas.

Lexington, Kentucky

Ben Gallagher delivers an update on recent developments at the Electric Power Research Institute before an audience at the ACAA 2024 Fall Meeting.

San Francisco, California

(L-R): PHNX Materials team members Maryam Pirmoradi, Krish Mehta, Jorge Osio-Norgaard, and Monica Barney at company headquarters. The company's work is featured on pages 14-15 of this issue of *ASH at Work*.

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At Saiia, we partner with some of the largest utilities and publicly held companies to provide comprehensive CCR management services including impoundment closures and new landfill construction. With a seven-decade legacy of industry experience and regulatory expertise, we're ready to partner with your team to ensure safe and environmentaly sound CCR management solutions.

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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, focusing on issues and events that were part of the beneficial use industry's defining years.

The following ASH Classic, from 2018, includes predictions of "what lies ahead" for coal combustion products. "Current market conditions do not necessarily reflect future market conditions," the article's author notes. As shown by the growth in ash harvesting operations and recent announcements delaying planned coal plant retirements, the ash supply/demand picture indeed changes constantly.

Future Coal Ash

What Lies Ahead for Beneficial Use of Coal Combustion Products?

By John Ward

What deep dive into an organization's past would be complete without at least a glance into its future?

I'm honored to be the American Coal Ash Association's designated soothsayer for this task. A caveat to begin: I rarely write in the first-person voice but feel compelled to do so now because what you are reading represents my own opinions and not necessarily those of ACAA or its members. Furthermore, ask anyone familiar with my track record predicting the outcome of 2016 U.S. elections or college football betting pools and you will know what a cracked crystal ball stands before you now.

James Baldwin said, "Know from whence you came. If you know whence you came, there are absolutely no limitations to where you can go." With that bit of real sage advice, let's consider the future of coal ash in terms of trajectories.

Trajectory #1—From waste to byproduct to product

This edition of *ASH at Work* chronicles a half-century of the evolution of our industry. In the beginning, the industry dealt with coal combustion wastes (CCWs.) As it became apparent that these wastes had value, terminology shifted to coal combustion byproducts (CCBPs.) When encouraging beneficial use of the materials became a high priority for both the public and private sectors, terminology shifted again to coal combustion products (CCPs.) (The regulatory adoption of the term coal combustion residuals—CCRs—in the context of the U.S. Environmental Protection Agency's 2015 rule governing disposal practices creates semantic confusion, in this author's opinion, but at least avoids sliding back into a characterization as "waste.")

The net of this evolution is that coal combustion products fully evolved from one man's trash into another man's treasure, setting the stage for the second trajectory.

Trajectory #2—From something to be sold to something in demand

When I began my adventure in coal combustion products two decades ago, I spent most of my time trying to persuade people to use CCPs. "Here's what they are. Here's what they're used for. Here's why they'll make your products perform better. Here's why it's good for the environment." I haven't given that presentation to a customer audience in probably eight years. When I dusted it off recently to help train some new industry employees, the PowerPoint graphics quality was hilarious.

Today, when I (and other ACAA representatives) meet with CCP users, they already know what the products can do for them. They like the products. More importantly, they now need the products to help them solve specific issues in their own industries.

We are no longer pushing products to other industries. CCPs are being pulled in and the users want to know how they can get more—with consistent quality and reliable supply. (For a deeper dive on how CCP markets work, see "CCP Marketing—Unique Industry Depends on Private Investment and Sensible Public Policy for Growth."[1])

Trajectory #3—From cinders to "toxic waste"

Not all trajectories are favorable. Fifty years ago, people had a more intimate and less fearful relationship with coal. (A few may even have had coal furnaces in their homes—or at least the coal chutes where the fuel used to be delivered.) Today, because of a couple of high-profile coal ash disposal site failures and relentless publicity by well-funded anti-coal environmental organizations, a Google search for "coal ash" produces results dominated by words like "toxic," "dangerous," "hazardous," and even "deadly." Recent jury decisions emerging from a personal injury case in Tennessee will only serve to accelerate this phenomenon.

The situation has potential to create cognitive dissonance at the end user level. Coal combustion products are incorporated in building materials that show up in every part of a person's home and community. "What? There's toxic waste in my home?" Dealing with this conundrum is tricky. Do you try to defend the coal ash by pointing out that in the world of toxic things, this stuff is pretty darned mild? (Just look in your garage, medicine cabinet, or under your kitchen sink if you want to see some really poisonous stuff.) Or do you focus on the "safe when properly used" aspects? Either way, it will need to be dealt with. Continually.

Trajectory #4—Regulatory policy matters

Another situation that requires continual attention is the ever-shifting regulatory landscape. Although beneficial use of coal combustion products remains specifically exempt from federal disposal regulations, every new debate over those regulations has potential to create uncertainty that can affect the beneficial use industry's ability to source material and attract capital to expand logistics.

For instance, the volume of coal ash utilization stalled between 2009 and 2013 as EPA pursued a protracted rulemaking process that posed the threat of a "hazardous waste" designation for coal ash that is disposed. (See Figure 1.) Even though beneficial use was exempt from the proposed regulation, ash producers, specifiers, and users restricted coal ash use in light of the regulatory uncertainty and publicity surrounding EPA's activities. Once regulatory certainty was restored, utilization growth rebounded. Conversely, the most rapid expansion of coal combustion products beneficial use in history occurred when regulators actively worked with industry to encourage responsible beneficial use through the Coal Combustion Products Partnership (C^2P^2 program). In 2000, when EPA issued a Final Regulatory Determination that coal ash should be regulated under "non-hazardous" RCRA Subtitle D and subsequently initiated the C^2P^2 program, beneficial use volume was 32.1 million tons. Just eight years later, when the C^2P^2 program was terminated and EPA initiated the aforementioned ash disposal rulemaking, beneficial use volume had nearly doubled to 60.6 million tons.

Trajectory #5—Track record of consistent innovation

Whenever someone accosts me with the latest existential threat to the CCP beneficial use industry (i.e., "The power plants are closing!

The ash marketing industry at this moment is like the proverbial dog that caught the car and now has to figure out what to do with it. The beneficial use rate in 2017 hit 64%; concrete producers would use more fly ash if they could get it; numerous key markets can be characterized as "under-supplied."

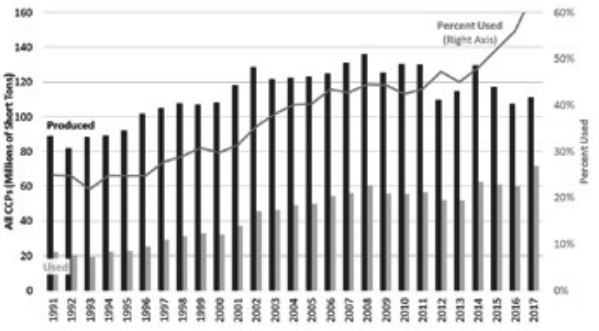

Figure 1. ACAA 2017 Coal Combustion Products Production and Use Survey, all CCPs production and use with percent.

The power plants are closing!"), I remind them of the litany of previous existential threats. Fuel switches. Low-NOx burners. Selective catalytic reduction. Mercury injection. Economic dispatch. The list goes on, and each time some new strategy or widget affecting power plant operations comes into play, naysayers predict the end of CCP marketing. But take another look at Figure 1. What happened?

For one thing, CCP marketers are a pretty resourceful bunch. They've never had direct control over manufacturing of the product they sell and, out of necessity, have learned to adapt quickly to changing situations. This includes deploying a wide array of technologies that address whatever complications are created by shifting power plant operations. Beneficiation technologies such as carbon removal, carbon passivation, and ammonia slip mitigation are examples. More recently, CCP users have taken an expanding role in this innovation. (See Trajectory #2.) Two decades ago, ash users tended to be very picky about their specifications. Now that they truly want and need the materials, ash users are actively working with marketers to allow new strategies for blending materials, processing materials, and harvesting previously disposed materials.

Grand Prognostications[2]

So what happens next? If (my interpretation of) the past can be relied upon, here are three predictions for our industry:

Prediction #1—Markets will continue to drive beneficial use

CCP marketers will continue to do what they've always done: adapt to shifting market conditions. That means the markets, not the materials themselves, are the drivers.

Twenty years ago, if a local market was short on ash, the marketer would find the most economical way to supply it. (Find a new

Santee Cooper's Winyah Generation Station (l) uses the SEFA Group's Staged Turbulent Air Reactor (STAR) technology to reclaim coal ash from on-site ponds for its primary raw feed. Dry stack harvesting is carried out (r) at Boral Resources' Washingtonville, Pennsylvania, monofill.

local source? Transport materials from farther away?) Today, the process is exactly the same, but the tool box has grown bigger. (Beneficiate lower-quality materials? Blend materials? Harvest previously disposed CCPs? [See examples in photos above.] Import CCPs?) Different geographic markets will see different solutions based on their individual economic opportunities.

Prediction #2—Technology will continue to address challenges

It's worth noting that the innovation addressed in Trajectory #5 is not exactly rocket science. For the most part, the CCP marketing industry has become adept at evaluating technologies used in other industries and then adapting them to address specific challenges. This provides solutions that come to market more quickly and with less risk. Odds are that these kinds of step-change innovations will continue to find favor over breakthrough technologies in the CCP beneficial use industry.

However….if you want to invent the machine/pixie dust that eliminates performance variability among ash types and sources, that would be a true breakthrough—enabling the CCP world to shift from a series of local markets to a single fungible commodity market. So—calling all rocket scientists—there's your brass ring.

Prediction #3—Current market conditions do not necessarily reflect future market conditions

In some respects, the ash marketing industry at this specific moment in time is like the proverbial dog that caught the car and now has to figure out what to do with it. As reported elsewhere in this publication, the beneficial use rate in 2017 hit 64%—blowing well past the previously mentioned C^2P^2 program goal of 50%. Concrete producers would use more fly ash if they could get it. Numerous key markets can be characterized as "under-supplied."

That situation imposes risks. First of all, it creates opportunities for competing materials to step in. (Natural pozzolans and ground glass are two examples currently taking a run at it.) It also imposes risks associated with whipsawing from shortage to oversupply. (With several large ash harvesting operations scheduled to come online in the near future, some local markets could quickly become swamped with material, potentially undercutting market conditions necessary to sustain investments in expanding distribution infrastructure.)

Grand Conclusions

Fifty years of ACAA experience demonstrates that coal combustion products are here to stay. Despite potential competition, CCPs remain the most abundant and accessible materials for the job. Furthermore, the role of CCPs in enhancing performance of end-use products and providing significant environmental benefits cannot be talked about enough.

Similarly, CCP marketers over the decades have proven to be resilient and adaptable to rapidly changing market conditions. Right now, a great deal of focus is on the supply side, finding ways to get more materials to market. Because I fully expect these efforts to succeed, I recommend returning our focus very soon to the demand side—building support for beneficial use applications that have declined while materials were in "short supply" for high-value applications, such as fly ash in concrete.

The job of ash marketing is never done. Stay nimble, my friends.

Footnotes

1. "CCP Marketing—Unique Industry Depends on Private Investment and Sensible Public Policy for Growth," *ASH at Work,* Issue 1, 2017. https://www.acaa-usa.org/Portals/9/Files/PDFs/ASH01-2017.pdf

2. I chose the word "prognostications" because it sounds so much more impressive than "predictions" or "forecasts." Plus, I wanted you to picture me wearing a coat with tails and a very tall hat, standing on the back of a colorfully painted 1880s wagon hawking a small bottle of cure-all. Plus, this is an article in *ASH at Work,* so I felt like it needed more than one footnote.

John Ward entered the coal ash marketing business in 1998 as Vice President, Marketing and Government Affairs, for ISG Resources (later Headwaters). For the past decade, he has served as president of John Ward Inc., a public affairs consultancy to the coal ash and energy industries. He is the longstanding chairman of ACAA's Government Relations Committee and was the first recipient of ACAA's Champion Award. He is the author of ACAA's weekly *Phoenix* newsletter and introduces himself the way his son did at a seventh-grade career day 12 or so years ago—as a used coal salesman.

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ACAA
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Welcome, New ACAA Members!

Cemtec Inc., headquartered in Enns, Austria, provides ash processing solutions to ACAA members. This includes equipment and plants to reduce ash size by drying and grinding it for use in cementitious products. The company joins as an Associate Member. For more information, please visit www.cemtec.at.

DHGreen Counseling was founded by Doug Green, who recently retired from Venable LLP, where he was counsel to the Utility Solid Waste Activities Group on legislative, regulatory, and counseling issues related to federal and state regulation of coal combustion residuals (CCR), including policies and regulations related to the beneficial use and harvesting of CCR. He also represented individual companies on issues relating to their beneficial use of CCR. Since retiring from Venable, he remains interested in staying abreast of and involved in federal and state laws and policies involving the beneficial use/harvesting of CCR, as he believes this is among the most productive means for managing this valuable material. Joining as an Associate Member, Doug looks forward to working with both ACAA and potentially individual members in addressing CCR beneficial use/harvesting opportunities.

Kevin Harshberger is a registered professional engineer with extensive CCR and environmental construction experience, including wet ash pond closures, development of greenfield landfill sites, remediation and disposal, soil stabilization, and overall site development. He has published and presented technical papers at multiple conferences. After years of employment with R.B. Jergens, Kevin has transitioned into a consulting and advising role, where he continues to support the CCR construction industry. He joins as an Associate Member.

National Gypsum Company, headquartered in Charlotte, N.C., is the exclusive service provider of reliable, high-performance building products manufactured by its affiliate companies and marketed under the Gold Bond®, ProForm®, and PermaBASE® brands. National Gypsum joins as an Associate Member. For more information, please visit www.nationalgypsum.com.

PHNX Materials Inc. has developed innovative technology to separate FGD by-products from impounded ash to enable beneficial use in concrete and support clean closure of impoundments. The company's process is cost-effective, scalable, and does not use any hazardous chemicals. PHNX Materials is working with 1,000 lbs. of impounded coal combustion residuals from six utilities and will set up a pilot facility within the next year and a half. They join as an Associate Member. For more information, please visit www.phnxmaterials.com.

Slater Infrastructure Group, headquartered in Alpharetta, Ga., provides coal combustion residuals services, including beneficial reuse support; dewatering/water management; groundwater extraction and treatment; handling, management, transportation, and disposal; in-house geosynthetic liner resources and equipment; HDPE pipe conveyance system installation; landfill closure, including closure/cap in place and closure by removal; new landfill/impoundment construction; stabilization and solidification (in-situ and ex-situ); storm water management/erosion and sediment control; decommissioning/decontamination/demolition/reclamation; and contaminated sediments dredging, treatment, and disposal. For more information, please visit www.slaterinfrastructuregroup.com.

UES are experts in the areas of environmental and earth sciences, sustainable infrastructure solutions, and geophysical technologies. Their nationwide network of nearly 4,000 engineers and technical professionals identifies and solves complex engineering and construction challenges by providing specialized engineering, environmental, testing, and inspection services. In the CCP area, they perform environmental assessments, CQA/CQC services, geotechnical engineering and assessments, drilling and groundwater monitoring, seismic analysis, engineering and design, as well as specialized analysis and engineering to support CCP projects. UES joins as an Associate Member. For more information, please visit www.teamues.com.

News Roundup

Coal Ash Recycling Rate Reaches 69 Percent in 2023

Sixty-nine percent of the coal ash produced during 2023 was recycled—increasing from 62 percent in 2022 and marking the ninth consecutive year that more than half of the coal ash produced in the United States was beneficially used rather than disposed.

In addition to this "fresh" ash production and use, the rapidly growing practice of harvesting previously disposed ash has begun to supply significant volumes of material to beneficial use markets. ACAA estimates that more than 4 million tons of previously disposed ash was utilized in a variety of applications in 2023, including coal ash pond closure activities, concrete products, cement kiln raw feed, and gypsum panel manufacturing.

"Harvested ash utilization represents growth in coal ash recycling above and beyond the increasing volumes of ash recycled from current power plant operations," said Thomas H. Adams, ACAA Executive Director. "The rapidly increasing utilization of harvested CCP shows that beneficial use markets are adapting to the decline in coal-fueled electricity generation in the United States."

According to ACAA's 2023 survey, 46.3 million tons of newly produced coal combustion products were beneficially used in all applications in 2023, approximately level with the previous year. Production of new CCP declined from 75.2 million tons in 2022 to 66.7 million tons in 2023.

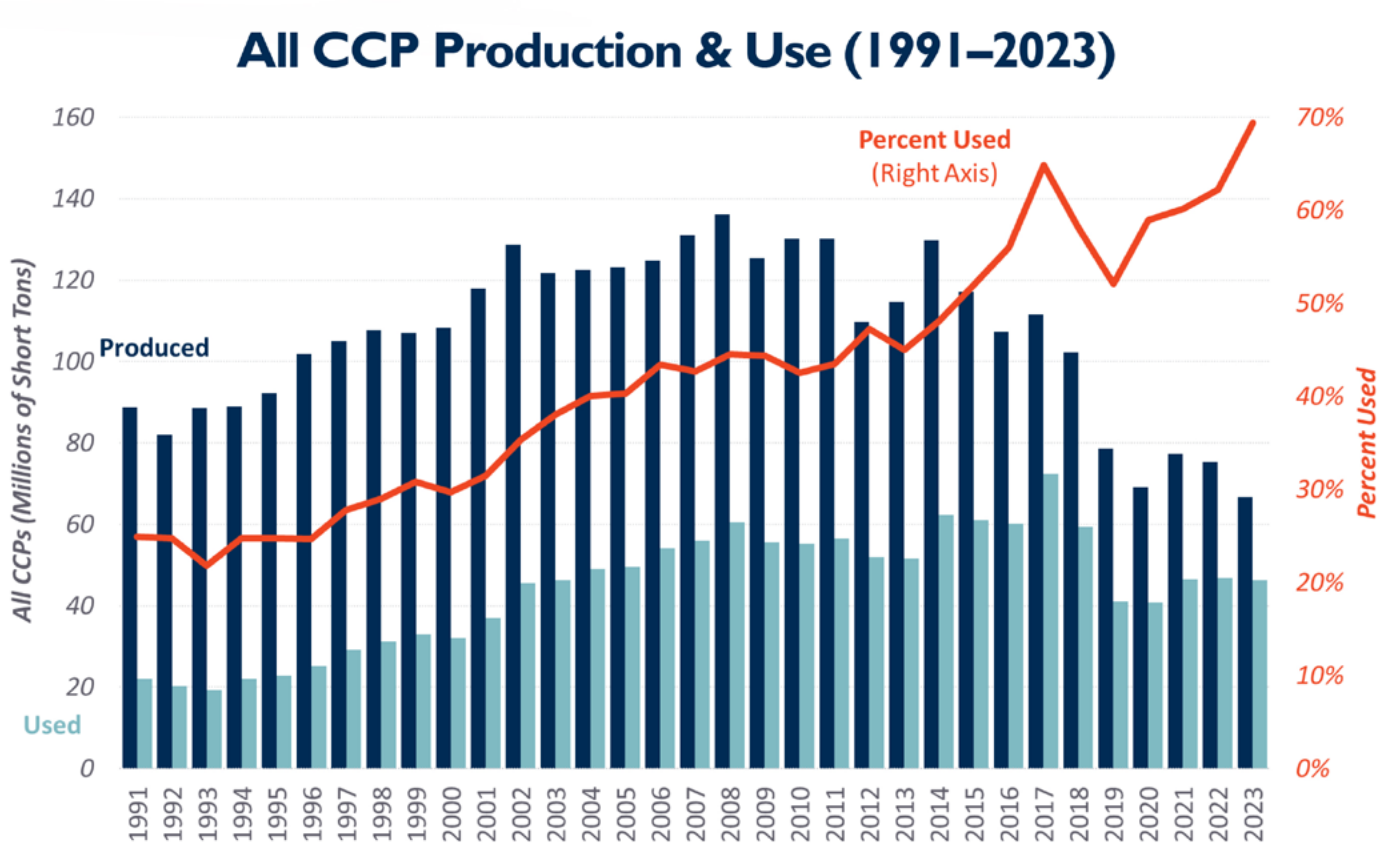
ACAA Elects New Officers and Directors

American Coal Ash Association members elected new officers and directors January 28, 2025, at the association's Winter Meeting in Asheville, North Carolina.

Officers elected for two-year terms included Tom Kierspe, Heidelberg Materials, as Chair; Tara Masterson, Tennessee Valley Authority, as Vice Chair; and Christine Harris, UES, as Secretary/Treasurer.

Two open Board of Directors seats reserved for utilities were filled by Glenn Amey, Talen Energy (three-year term); and Leif Tolokken, Dairyland Power Cooperative (two-year term). An open Board seat reserved for marketers was filled by Bobby Raia, Charah Solutions (three-year term). Two open Board seats reserved for associate members were filled by Dave Donahue, Xylem (three-year term); and Johnny Lowe, Schnabel Engineering (one-year term).

Final attendance at the Winter Meeting totaled 176. ACAA offers its heartfelt thanks to all of the meeting attendees, sponsors, exhibitors, and those who contributed to the Asheville hurricane relief effort sponsored by the association.



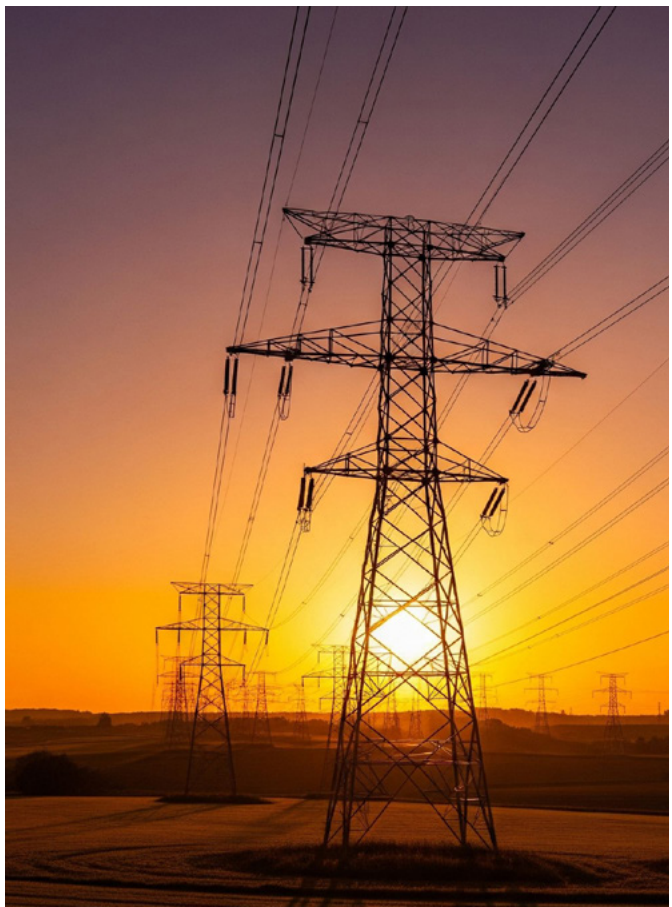
Executive Orders Target Energy and Environmental Policy

Representatives of 10 public and investor-owned utilities on January 15, 2025, submitted a letter to U.S. Environmental Protection Agency Administrator-nominee Lee Zeldin urging swift action on regulatory reforms for coal-fueled power plants.

The letter was signed by representatives from Duke Energy; Vistra; Talen Energy; Basin Electric Power Cooperative; Lower Colorado River Authority; City Utilities of Springfield, Missouri; Southern Illinois Cooperative; Gavin Power; Ohio Valley Electric Corp.; and Louisville Gas and Electric Co. & Kentucky Utilities Energy. The letter singled out power plant carbon regulations and Coal Combustion Residuals regulations as the top priorities for immediate reform or repeal.

"We are united in requesting swift and sustained action by the incoming Trump administration to support our efforts to ensure electricity is available, affordable, and reliable," the letter said. "Recent changes made by the U.S. Environmental Protection Agency ("EPA") to air, water, and waste regulations have resulted in significant burdens on the Nation's power sector without tangible benefits. These regulations, individually and collectively, threaten the reliability of the power grid, jeopardize national security, are a drag on economic growth, increase inflation, and hinder the expansion of electric power generation to support the critical development and deployment of Artificial Intelligence and related technologies."

On his first day back in office on January 20, 2025, President Donald Trump signed dozens of Executive Orders, several of which directly affect energy and environmental policy. Key Executive Orders issued include:



- Initial Recissions of Harmful Executive Orders and Actions
- Regulatory Freeze Pending Review
- Unleashing American Energy
- Declaring a National Energy Emergency
- Putting America First in International Environmental Agreements
- Delivering Emergency Price Relief for American Families and Defeating the Cost-of-Living Crisis

Subsequently on April 8, 2025, President Trump issued three Executive Orders and a Proclamation aimed at "reinvigorating America's beautiful clean coal industry" and "strengthening the reliability and security of the United States electric grid." The actions included:

- An Executive Order for "Reinvigorating America's Beautiful Clean Coal Industry and Amending Executive Order 14241"
- An Executive Order for "Strengthening the Reliability and Security of the United States Electric Grid"
- An Executive Order for "Protecting American Energy from State Overreach"
- A Presidential Proclamation for "Regulatory Relief for Certain Stationary Sources to Promote American Energy"

"This relief is necessary to maintain operational coal plants, protect energy security, and allow time for viable technology solutions, avoiding broader risks to America's economy and defense readiness," the White House said.

Luke Snell Tribute a Highlight of Adams Lecture Series

Since January 1, ACAA Executive Director Thomas Adams has been on the road giving presentations to a number of organizations. The common thread in the requests for presentations is the concern for the future of coal ash availability and quality. Adams has delivered remarks to the Indiana Ready Mixed Concrete Association Conference; Utah Concrete Workshop; New York Construction Materials Association; Greater Michigan Chapter of the American Concrete Institute; Missouri ACI Chapter; Utility Solid Waste Activities Group CCR Workshop; AshTrans Conference; and San Antonio ACI Chapter.

During the question-and-answer portion of these presentations, the growing success of coal ash harvesting is the most common subject of inquiries. Audiences are surprised to learn

that harvested coal ash for use in concrete mixtures has grown to be the second largest supplementary cementitious material in the U.S. in 2025.

In March, Adams served as the guest lecturer at Southern Illinois University at Edwardsville (SIUE) as part of its annual lecture series honoring retired Professor Luke M. Snell, who chaired SIUE's Construction Department for over two decades. In addition to teaching, Snell has been very active in the ACI on local, national, and international levels and was one of the earliest consultants to recognize the value and importance of supplementary cementitious materials.

"Professor Snell has a unique gift for connecting the classroom and the construction site," Adams commented. "For many years he demonstrated practical application of industry codes and standards to solve the evolving demands in concrete construction."

Federal Funding for EPDs Remains in Limbo

The American Cement Association (formerly Portland Cement Association) has reported that federal funding for completing Environmental Product Declarations remains in limbo. The project officer assigned to administer the program has been terminated along with other federal employees on probationary status.

ENVIRONMENTAL IMPACTS

Declared Product:
Mix 14H115VA • San Francisco Plant 30 Plant
Description: 2500 PSI
Compressive strength: 2500 PSI at 28 days

Declared Unit: 1 m^3 of concrete

Global Warming Potential (kg CO_2-eq)	222
Ozone Depletion Potential (kg CFC-11-eq)	8.15E-6
Acidification Potential (kg SO_2-eq)	1.53
Eutrophication Potential (kg N-eq)	0.30
Photochemical Smog Creation Potential (kg O_3-eq)	34.1
Total Primary Energy Consumption (MJ)	1,928
Nonrenewable (MJ)	1,853
Renewable (MJ)	74.2
Total Concrete Water Consumption (m^3)	1.81
Batching Water (m^3)	0.07
Washing Water (m^3)	0.02
Nonrenewable Material Resource Consumption (kg)	2,275
Renewable Material Resource Consumption (kg)	1.59
Hazardous Waste Production (kg)	0.01
Nonhazardous Waste Production (kg)	1.95

Product Components: natural aggregate (ASTM C33), crushed aggregate (ASTM C33), Portland cement (ASTM C150), slag cement (ASTM C989), fly ash (ASTM C618), batch water (ASTM C1602), admixture (ASTM C494)

The American Coal Ash Association on July 16, 2024, was part of an ACA-led partnership selected by the U.S. Environmental Protection Agency to receive $2.4 million to assist in improving both the quantity and quality of cement and concrete industry Environmental Product Declarations. EPDs are the most widely used tools to measure the potential environmental impact of concrete ingredients.

ACA began setting up the program to provide up to $5,000 per facility to reimburse robust EPD development and verification costs for cementitious products covered by a valid Product Category Rule. Additionally, the program planned to develop an industry-wide PCR and a tech support help desk. However, EPA did not disburse the awarded funds, which are now frozen by the Trump administration.

Given the continuing uncertainty regarding the program, ACA has invited other stakeholders to begin considering efforts to fund industry-average EPDs in the absence of federal funding.

ASTM to Develop New CCP Guide

Following discussions at in-person committee meetings in April 2025, ASTM Subcommittee E50.03 on Beneficial Use registered a work item number to begin development of a new Standard Guide for Describing Coal Combustion Products in Field Investigations for Beneficial Use. The new guide will be intended to inform users about approaches to identifying and describing coal combustion products encountered, including drill samples and test pit samples collected during field investigations of CCP deposits.

When completed, the new standard guide would be a companion to previously approved ASTM E3183-19 - Standard Guide for Harvesting Coal Combustion Products Stored in Active and Inactive Storage Areas for Beneficial Use, and ASTM E3355-23 - Standard Guide for Characterization of Coal Combustion Products (CCPs) in Storage Area(s) for Beneficial Use.

Maria Juenger Elected ACI President

Maria Juenger, FACI, has been elected to serve as president of the American Concrete Institute for 2025-2026.

Juenger is a Professor and the Ernest Cockrell, Jr. Centennial Chair in Engineering #2 in the Fariborz Maseeh Department of Civil, Architectural, and Environmental Engineering at the University of Texas at Austin. Her teaching and research focus on materials used in civil engineering applications. She primarily examines chemical issues in

cement-based materials, including phase formation in cement clinkering, hydration chemistry of cements and supplementary cementitious materials (SCMs), and chemical deterioration processes in concrete. Her current research efforts emphasize the interaction of cement-based materials and the environment. This work encompasses the development and characterization of cementitious systems with lower carbon dioxide and energy footprints, as well as the capacity of cementitious materials to produce or remove airborne and waterborne pollutants.

Juenger is a Fellow of ACI and the American Ceramic Society (ACerS). She is a member of numerous ACI committees and has received several awards from ACI for her research, teaching, and service. She received her BS in chemistry from Duke University and her Ph.D. in materials science and engineering from Northwestern University.

EPA Proposes to OK North Dakota CCR Permit Program

The U.S. Environmental Protection Agency on May 12, 2025, announced a proposal to approve North Dakota Department of Environmental Quality's application to allow that state's coal combustion residuals permit program to operate in lieu of the federal CCR program. EPA preliminarily determined that the North Dakota program meets the standard for approval under the Resource Conservation and Recovery Act.

The proposed North Dakota approval is the first EPA action on state permit program requests since the agency denied Alabama's application in May 2024. Alabama has sued EPA, challenging its denial, and Wyoming has sued EPA for failing to act on its permit program application.

The Alabama denial hinged on groundwater concerns. Coal ash disposal unit closure with material in contact with groundwater emerged as a contentious issue as the Biden administration's EPA moved forward with implementation of the 2015 CCR rule. Beginning in January 2022, EPA began issuing long-overdue decisions on utility applications for extensions of cease receipts deadlines and alternative liner demonstrations. In proposing denials of most of those applications, EPA asserted the agency had a "longstanding" position that ash disposal units may not be closed in contact with groundwater. Litigation ensued challenging that assertion and claiming that EPA changed the interpretation of its 2015 regulation without going through required rulemaking steps.

Prior to the Alabama denial, EPA approved state CCR permit programs in Oklahoma, Georgia, and Texas. State-level permit programs were authorized by Congress in the 2016 Water Infrastructure Improvements for the Nation (WIIN) Act. (Prior to the WIIN Act, EPA's 2015 CCR rule was self-implementing with citizen lawsuit enforcement.) The WIIN Act requires state programs to comply with either the federal regulations or with state requirements that EPA determines are "at least as protective as" federal regulations. Congress also mandated creation of a federal permit program for use in states that don't seek EPA approval of their own permit programs and in Indian Country. EPA has yet to finalize a federal permit program proposal.

EPA to Reconsider Numerous Coal, Environmental Regulations

The U.S. Environmental Protection Agency on March 12, 2025, announced an unprecedented 31 actions to reconsider environmental regulations, including not just Biden administration policies, but also foundational rules that underpin numerous regulations.

EPA pledged "swift action" on coal combustion residuals regulations, including re-energizing approvals of state permit

programs. The agency also stated: "EPA is also reviewing the Legacy-Coal Combustion Residuals Management Units Rule. A key part of that review is evaluating whether to grant short- and long-term relief, such as extending compliance deadlines. The agency aims to complete rule changes within a year." EPA also announced it will reconsider the 2024 limits established under the Steam Electric Effluent Limitation Guidelines.

Other actions announced by EPA that will affect coal-fueled power generation generally include plans to:

- Reconsider the Clean Power Plan 2.0 carbon regulation for power plants
- Reconsider the Mercury and Air Toxics Standards rule
- Restructure the Regional Haze Program
- Terminate all of the agency's Environmental Justice Programs
- Reconsider the agency's Greenhouse Gas Reporting Program
- Revise the Waters of the United States rule

Actions related to foundational environmental policies included plans to:

- Reconsider the agency's Greenhouse Gas Endangerment Finding

- Reconsider the agency's Social Cost of Carbon Measurement

EPA also pledged to shift more environmental policymaking to states by clearing the backlog of Clean Air Act State Implementation Plans and collaborating more closely with states on the Good Neighbor Plan (interstate air transport rule).

On March 12, 2025, the agency also issued a memorandum revising its National Enforcement and Compliance Initiatives to make them consistent with recent Executive Orders by President Donald Trump. Coal ash enforcement was included as one of six initiatives in August 2023 when EPA established its NECI priorities for the 2024-2027 period. The memorandum stated: "This NECI focuses in large part on perceived noncompliance with current performance standards and monitoring and testing requirements and is motivated largely by

environmental justice considerations, which are inconsistent with the President's Executive Orders and the Administrator's Initiative. To align this NECI with those, henceforth enforcement and compliance assurance for coal ash at active power plant facilities shall focus on imminent threats to human health. Except where expressly required by statute or regulation, under no circumstances may enforcement or compliance assurance incorporate environmental justice considerations. Any order or other enforcement action that would unduly burden or significantly disrupt power generation shall require the advance approval described above."

On April 14, 2025, EPA announced it was granting two-year extensions on Mercury and Air Toxics Standards (MATS) compliance for coal-fueled power plants, representing more than a third of the remaining U.S. coal generating capacity. A total of 68 units at 47 plants received the extensions pursuant to an April 8, 2025, Presidential Proclamation that determined it is in the national security interest of the United States to invoke a Clean Air Act provision to exempt plants from compliance with the latest version of the MATS rule for a period of two years beyond the rule's compliance date of July 8, 2027. The proclamation determined that the technology to implement the MATS rule does not exist in a "commercially viable form sufficient to allow implementation" by the original compliance date.

Tom Hendrix Receives ACAA Champion Award

Tom Hendrix, Founder of the SEFA Group, has been selected as the ninth recipient of the ACAA Champion Award. The award was announced January 29, 2025, by former ACAA Chairman John Halm at the association's Winter Meeting. Hendrix received the award "for his lifetime dedication to CCPs' beneficial use, support of the industry, and development of technologies to improve the processing of byproducts, with an emphasis on harvesting resources from ash landfills," Halm commented.

SEFA was founded in 1976 to market ash to the ready-mixed concrete and public utility industries in the Carolinas, one of many small businesses that started up during the period to address CCP materials that were being generated and landfilled, Halm noted. Over the next 47 years, the company expanded operations to support sales along the eastern seaboard and, at the same time, developed a process to beneficiate ash to meet market needs. This technology has proven to be particularly effective in ash landfill harvesting applications.

"Developing and commercializing his STAR technology was a true achievement for a relatively small company," Halm said. "The hardest step in developing accepted technology is having a good idea and the conviction and perseverance to see it from concept to full commercialization. Tom personified this. While Tom relied on his staff, his continuous support and grit during a 20-year development period have resulted in tremendous results that I have had a unique opportunity to see firsthand," he added.

ACAA established the Champion Award in 2012 to recognize extraordinary contributions to the beneficial use of coal combustion products. The recipient is selected exclusively by the Chair of the ACAA Board of Directors and is known only to the Chair until the moment the presentation is made. The recipient may be an individual or individuals; an institution—private or public; a member of the ACAA or a non-member; living or deceased. To read about past honorees, please see page 32.

Illinois Pollution Control Board Proposes CCR Rulemaking Changes

The Illinois Pollution Control Board on May 15, 2025, proposed several substantive changes in its long-running coal combustion residuals rulemaking. In 2021, the Board adopted a new Part 845 to its rules, which created standards for the disposal of CCR in surface impoundments. In August 2024, the Board issued first notice of proposed amendments to Part 845, generating four public comments from utilities and the Illinois Environmental Protection Agency. In response to those comments, the Board proposed the following changes and moved the amendments to second notice:

- *CCR Storage Piles/Management Units*. The Board agreed with concerns expressed by Illinois EPA that previously proposed changes could create CCR landfills within Part 845, which is intended to regulate only CCR surface impoundments. The Board accepted clarifying amendments proposed by Illinois EPA and opened a new sub-docket to address elements of the amendments that were not previously noticed.

- *Fugitive Dust*. The Board accepted amendments proposed by Illinois EPA to expand the scope of required evaluations to all CCR surface impoundments instead of limiting it to only impoundments located in areas of environmental justice concern. The Board also accepted proposed IEPA amendments to "require" owners or operators to revise facility fugitive dust control plans to include additional mitigation measures, including air quality (dust) monitoring at the property boundary.

- *Historic Unconsolidated Coal Ash Fill*. The Board previously requested a rulemaking proposal to incorporate into Part 845 the new CCR Management Unit definition contained in the U.S. Environmental Protection Agency "legacy" rule that became effective November 2, 2024. In its May 2025 order, the Board agreed with utilities and Illinois EPA that the final CCRMU federal rule is self-implementing and does not require Board action at this time to add it to Part 845.

AN AMERICAN RECYCLING SUCCESS STORY

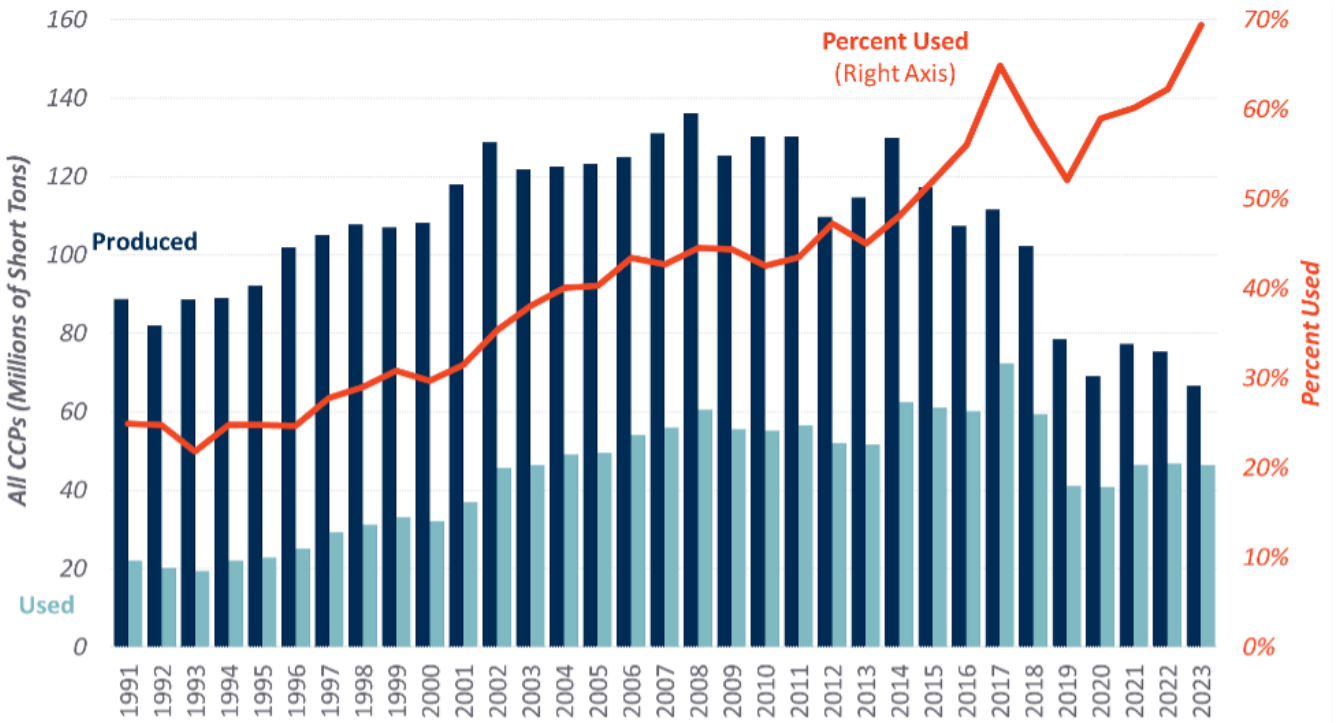
Coal combustion products – often referred to as "coal ash"– are solid materials produced when coal is burned to generate electricity. There are many good reasons to view coal ash as a resource, rather than a waste. Using it conserves natural resources and saves energy. In many cases, products made with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

As coal continues to produce 20 percent 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-nine percent of the coal ash produced during 2023 was recycled – increasing from 62 percent in 2022 and marking the ninth consecutive year that more than half of the coal ash produced in the United States was beneficially used rather than disposed.

In addition to this "fresh" ash production and use, a rapidly growing practice of "harvesting" previously disposed ash has begun to supply significant volumes of material to beneficial use markets. ACAA estimates more than 4 million tons of previously disposed ash was utilized in a variety of applications in 2023, including coal ash pond closure activities, concrete products, cement kiln raw feed, and gypsum panel manufacturing.

All CCPs Production and Use with Percent



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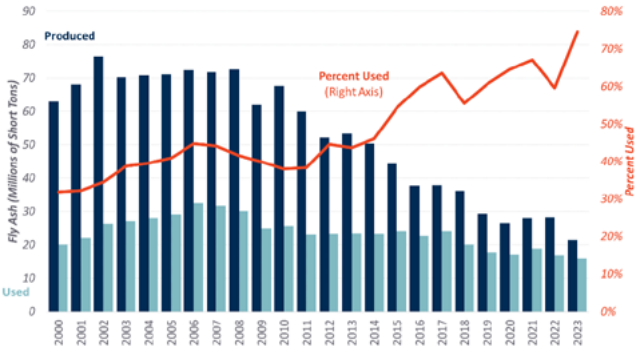
Fly Ash

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 – 2023



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

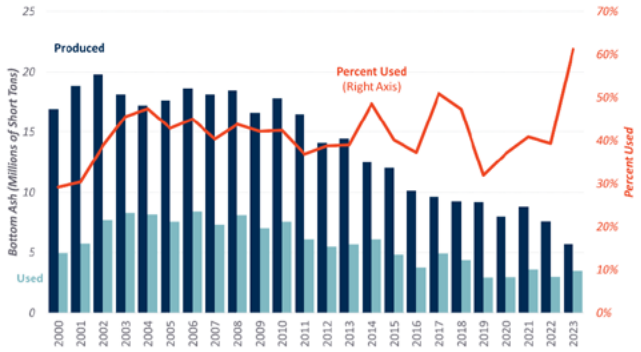
The American Road & Transportation Builders Association estimates coal fly ash use in roads and bridges saves $5.2 billion per year in U.S. construction costs.

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. Increasing volumes of bottom ash are being ground for use in concrete like fly ash.

Bottom Ash Production & Use 2000 – 2023



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

Synthetic Gypsum

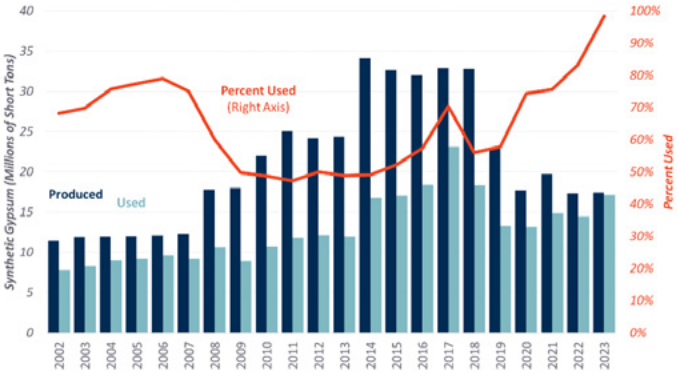
Power plants equipped with flue gas desulphurization ("FGD") emissions controls, also known as "scrubbers," create byproducts that include synthetic gypsum. Although this material is not technically "ash" because it is not present in the coal, it is managed and regulated as a coal combustion product.

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 – 2023



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.

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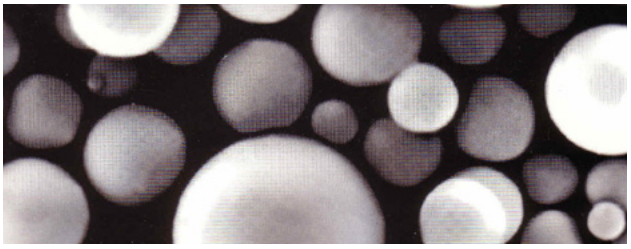
Other Products and Uses

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 public policy makers are increasing their focus on the potential for extracting strategic rare earth minerals from ash for use in advanced manufacturing. Researchers and ash marketers are also focusing heavily on improving beneficiation processes used in harvesting ash that has already been disposed for beneficial use in established applications.

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2023 Coal Combustion Product (CCP) Production & Use Survey Report

Beneficial Utilization versus Production Totals (Short Tons)

2023 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	**21,423,716**	**5,676,177**	**3,322,110**	**17,424,765**	**5,392,015**	**3,296,140**	**0**	**10,176,388**	**66,711,312**
Total CCPs Used by Category	**15,994,917**	**3,471,766**	**384,810**	**17,144,903**	**6,360**	**44,416**	**0**	**9,272,650**	**46,319,822**
1. Concrete/Concrete Products /Grout	11,868,495	403,598	0	1,216,081	0	0	0	0	13,488,173
2. Blended Cement/ Feed for Clinker	3,304,658	1,324,489	123,110	2,034,977	0	0	0	0	6,787,233
3. Flowable Fill	343	0	0	0	0	0	0	0	343
4. Structural Fills/Embankments	0	44,950	0	0	0	0	0	0	44,950
5. Road Base/Sub-base	26,578	108,921	0	0	0	0	0	0	135,498
6. Soil Modification/Stabilization	275,732	0	0	11,067	0	0	0	0	286,800
7. Mineral Filler in Asphalt	1,137	0	0	0	0	0	0	2,846	3,983
8. Snow and Ice Control	0	36,789	2,587	0	0	0	0	0	39,377
9. Blasting Grit/Roofing Granules	0	30,949	259,113	0	0	0	0	0	290,062
10. Mining Applications	0	0	0	0	0	0	0	9,269,804	9,269,804
11. Gypsum Panel Products (formerly Wallboard)	0	0	0	13,061,563	0	0	0	0	13,061,563
12. Waste Stabilization/Solidification	363,046	0	0	0	6,360	0	0	0	369,406
13. Agriculture	0	0	0	733,938	0	0	0	0	733,938
14. Aggregate	0	0	0	62	0	0	0	0	62
15. Oil/Gas Field Services	115,067	0	0	0	0	44,416	0	0	159,483
16. CCR Pond Closure Activities	0	1,522,071	0	0	0	0	0	0	1,522,071
17. Miscellaneous/Other	39,862	0	0	87,216	0	0	0	0	127,078

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	15,994,917	3,471,766	384,810	17,144,903	6,360	44,416	0	9,272,650	**46,319,822**
Category Use to Production Rate (%)	**74.66%**	**61.16%**	**11.58%**	**98.39%**	**0.12%**	**1.35%**	**0.00%**	**91.12%**	**69.43%**
2023 Cenospheres Sold (Pounds)	0	Data in this survey represents 75.272 GWs of Name Plate rating of the total industry wide approximate 182.5908 GW capacity based on EIA's May 2024 Electric Power Monthly.							
CCPs Imported in 2023 (Short Tons)	0								
CCPs Exported in 2023 (Short Tons)	0								

Notes:

These are estimates for entire U.S. utility and IPP sectors calculated by dividing the survey respondents' data by the portion of the overall industry's coal burn they represent, as reported in the July 2024 EIA Electric Power Monthly (30%).

Coal Ash Harvesting Growing Rapidly

With the number of coal-fueled power plants in the United States declining, the coal ash beneficial use industry is evolving to increasingly utilize previously disposed ash through an activity known as "harvesting." Harvested ash utilization represents growth in coal ash recycling above and beyond the increasing volumes of ash recycled from current power plant operations.

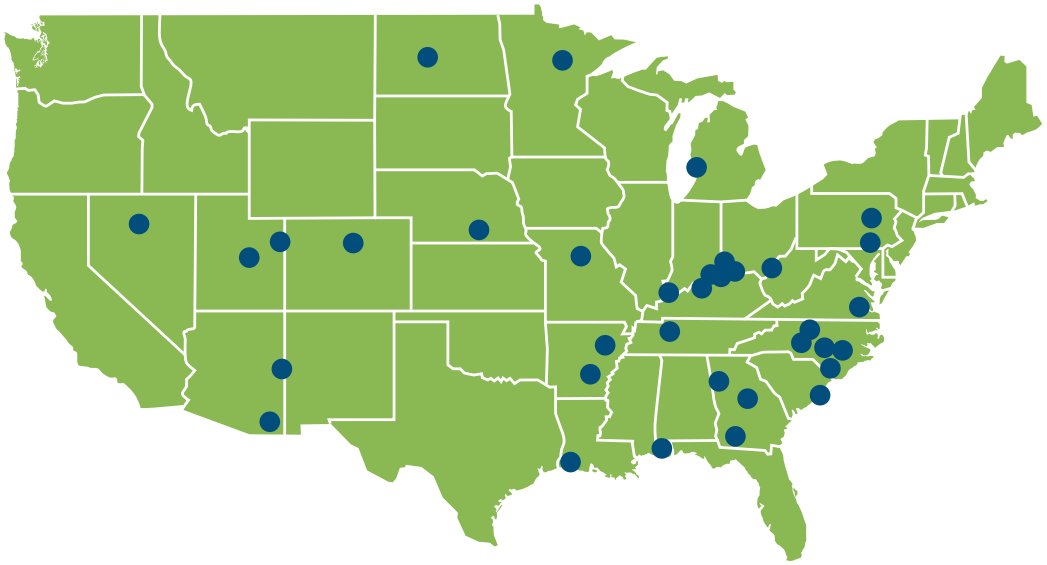
A variety of ash beneficiation technologies have been developed to ensure that harvested ash meets all product performance specifications and additional consensus standards have been adopted to guide the characterization of harvestable materials and the operation of harvesting projects.

ACAA estimates more than 4 million tons of previously disposed ash was utilized in a variety of applications in 2023, including coal ash pond closure activities, concrete products, cement kiln raw feed, and gypsum panel manufacturing. Major harvesting projects are operating and under development in all regions of the United States.

Eco Material Technologies harvests approximately 100,000 tons of coal ash annually from a monofill in Montour County, Pa.

Heidelberg Materials' Winyah STAR® plant, in Georgetown, S.C., has processed 2.4 million tons of harvested ash since commencing commercial operations in 2015.

Coal Ash Harvesting Sites – Existing and Under Development



ACAA
AMERICAN COAL ASH ASSOCIATION

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.*


LEX RIDES AGAIN.
WOCA
The World of Coal Ash 2026
LEXINGTON, KY
MAY 4-7, 2026
Registration
WOCA is the premier international conference on the science, application, and sustainability of coal combustion products. Join us for our 11th bi-annual meeting.
Center for Applied Energy Research
ACAA

Building Confidence Through Integrity and Results.

Trans Ash delivers CCR and Civil Construction projects on time and on budget through our technical expertise and unwavering commitment to **Safety**, **Quality**, and **Integrity**. With core values of **Accountability** and **Diligence** as our foundation, we confidently meet strict regulations and aggressive deadlines without compromise.

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TransAsh

ECO MATERIAL TECHNOLOGIES

Concrete Solutions for the Concrete Industry

On the road to carbon neutrality, there is no single silver bullet.

Eco Material Technologies provides multiple silver bullets with our range of products and technologies to lower the carbon footprint of concrete while simultaneously improving its performance. Solutions include:

- The nation's largest supply of coal fly ash for concrete, with a coast to coast logistics network, extensive in-house laboratory capabilities, and the industry's deepest bench of fly ash experts.
- Pozzoslag® products useful in replacing high volumes of carbon-intensive portland cement.
- Kirkland Natural Pozzolan, bringing new supplementary cementitious materials supplies to markets challenged by coal plant closures.
- Micron3® refined pozzolan for high performance concrete applications.
- A full suite of beneficiation technologies enabling utilization of lower quality coal ashes and harvesting of previously disposed coal ashes.

Eco Material Technologies is the leading producer and supplier of sustainable cement alternatives in North America.

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