ISSUE 1 • 2024

ASH at work

Applications, Science, and Sustainability of Coal Ash

(Re)defining Beneficial Use?

30+ years after its designation as non-hazardous, coal ash beneficial use faces new regulatory threats

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Applications, Science, and Sustainability of Coal Ash

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Table of Contents

Welcome to WOCA 2024!

By John Halm, ACAA Chair

This issue of *ASH at Work* is going to press to be available onsite at the World of Coal Ash. As you read this, I want to welcome everyone who is attending WOCA to Grand Rapids and the 10th edition of the event—call it "WOCA X."

I am excited to see attendance at our events continuing to recover from the pandemic. We had a great turnout with perfect weather at our Winter meeting in San Antonio in February. Michigan in May promises to be wonderful, and I look forward to seeing many of you who have not been able to attend for several years. By all indications, we are on track to continue growing and break WOCA attendance records, with over 1,000 participants registered from all over the world.

The inaugural World of Coal Ash event took place in Lexington, Kentucky, in 2005 as a partnership between the ACAA and the University of Kentucky Center for Applied Energy Research (UK/CAER) with fewer than 500 attendees. By the mid-2010s, participation had grown to over 1,000 participants and, except during the pandemic period, has maintained this level since. This growth supports critical communications objectives related to safely and responsibly managing and marketing coal combustion byproducts by connecting producers, marketers, innovators, and customers in a way that is unique to our industry.

The ACAA/CAER team has worked hard to put together this world-class event. I want to recognize CAER's Bob Jewell, Anne Oberlink, and David Melanson for their tireless work. Kudos also to ACAA's Alyssa Barto and Tom Adams for coordinating activities, identifying locations, and generating the meeting agendas. They really don't get enough credit for how much work is involved, with over two years of planning required to produce this event. Thank you all.

This year, the team has worked to develop an expanded WOCA app that promises to provide a more personal experience with detailed information when you need it—enabling you to easily find programs and speakers, make connections with other attendees, and organize your day. The volume of excellent presentations can be overwhelming, and I encourage everyone to use the app as much as possible to help maximize your experience throughout the conference.

For many, WOCA is the only opportunity to participate with the larger ACAA membership, and I encourage you to take full advantage of the networking, educational opportunity, technology sharing, and professional camaraderie that WOCA offers. Additionally, if you are not a member and considering joining, I want to encourage you to learn more about the organization and see if it can add value.

ACAA members share a common interest in using CCPs as valuable products to enhance revenues, minimize disposal costs, reduce liability, and support environmental policies. As a member you can:

- Be part of a unified industry voice
- Participate in information exchange and networking
- Join us for educational opportunities and professional growth
- Advance your market awareness and development.

Personally, I find that one of the more valuable member resources comes from attending the monthly ACAA committee webinars, which provide updates from committee chairs John Ward on government relations issues and Dr. Sai Vaidya on ongoing technical matters. John does an outstanding job sharing his insight into the inner workings of state and federal government activities related to CCPs, balancing detailed explanations with cynicism and humor in a unique way. Both the Government Relations Committee and Technical Committee conduct webinar updates monthly. If you are interested in attending, please contact Alyssa Barto to get the meeting links, sit in on a couple of them, and see if they add value and insight for you.

For new members, I encourage you to get to know Alyssa Barto and Brooke Pirmann, who likely greeted you at the sign-in desk when you arrived. They are very knowledgeable about our membership and will be glad to assist in facilitating contacts and helping you connect the dots to make your experience more successful.

If you're *not* a member and considering joining, I encourage you to look at the organization website (www.acaa-usa.org), which contains a wealth of information on CCPs in the following areas:

- Past copies of *ASH at Work*
- CCP Production and Use Reports
- Member company list
- Case studies of the beneficial use of CCPs
- Extensive list of publications covering CCP testing, utilization, regulation, and risk management
- Safety Data Sheets and sustainability information
- Upcoming industry calendar events.

The members-only site offers more specific content, including:

- *The Phoenix* newsletter, published weekly with a detailed list of current events in the news and current case study spotlights
- Complete member directory
- Past comments for government requests for information
- Detailed reference library covering use and management of CCPs
- Past meeting documents and committee call recordings.

I hope that everyone attending WOCA has a productive meeting, takes advantage of the extensive resources available at the event, and considers membership in the future. Have a great meeting!

It Helps to Have Friends

By Thomas H. Adams, ACAA Executive Director

ACAA is fortunate to have a strong list of allies to help with our mission of advancing the beneficial use of coal combustion products (CCP). An ally is defined as a resource that works with others cooperatively for mutual benefit. Those benefits come in different forms. While an ally is most often used in a military context, that is not the case for ACAA. For us, an ally is sometimes working on a regulatory issue with us. Sometimes it is a funding issue. Other times it can be on education or research. The point is that no one organization can do all those things and do them well. As a small association, it is vital that we establish and maintain relationships with entities that have similar interests as ACAA.

One way we try to communicate the important role played by like-minded organizations is through our regular feature in this magazine, *ASH Allie*s. For the past 17 issues, including this issue, we have featured an organization that has worked with us closely. The regular exchange of information is a priority in these relationships. Helping to educate audiences on CCP strengthens our position outside of ACAA. As we communicate our story on beneficial use, we get feedback from other associations and entities.

It is important to remember that while we may have several common interests with such organizations, their top priority is not always beneficial use. And that is alright. We just want to be sure our story is being heard clearly. The degree to which an ally is going to take a serious interest in our goals depends on how we fit into their priorities. Keeping the lines of communication open is our way to demonstrate our value.

Below you will find a list of entities that have been featured as *ASH Allies*. Our roster of allies is much bigger than just these 17. The others will make it in eventually. I just wanted to call your attention to this important part of our work. When you stop and think about what we have achieved in recent years, I think you will agree that it helps to have friends.

- American Public Power Association (APPA)
- American Road and Transportation Builders Association (ARTBA)
- Ash Development Association of Australia (ADAA)
- Environmental Council of the States (ECOS)
- European Coal Combustion Products Association (ECOBA)
- Gypsum Association (GA)
- Highway Materials Group (HMG)
- National Coal Council (NCC)
- National Coal Transportation Association (NCTA)
- National Mining Association (NMA)
- National Ready Mixed Concrete Association (NRMCA)
- National Rural Electric Cooperative Association (NRECA)
- Natural Pozzolan Association (NPA)
- Portland Cement Association (PCA)
- United Kingdom Quality Ash Association (UKQAA)
- University of Kentucky Center for Applied Energy Research (CAER)
- Utility Solid Waste Activities Group (USWAG)

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Coal Ash Definition of Beneficial Use

(With Apologies to Jerry Garcia, What a Long Strange Trip It's Been)

By John N. Ward

It all started with a math error.

Well, actually it started way before that. Congress passed the Resource Conservation and Recovery Act in 1976, establishing the U.S. Environmental Protection Agency's authority to regulate the disposal of solid and hazardous wastes. It didn't take long to figure out that the law was not well suited for addressing some large-volume, low-toxicity materials. So in 1980, Congress passed the Bevill Amendment to RCRA (named for the 15-term Democratic Congressman from Alabama Tom Bevill), which exempted from regulation fossil fuel combustion waste; waste from the extraction, beneficiation, and processing of ores and minerals; and cement kiln dust.

But the Bevill Amendment also directed EPA to complete full assessments of each exempted waste and submit a formal report to Congress on its findings. And assess EPA did. The agency submitted Reports to Congress addressing coal ash in 1988 and 1999, issued a Regulatory Determination in 1993, and issued a Final Regulatory Determination in 2000 concluding that coal ash materials "do not warrant regulation" and that "the regulatory infrastructure is generally in place at the state level to ensure adequate management of these wastes."

The regulatory certainty provided by the Final Regulatory Determination proved to be a boon to the ash beneficial use industry, allowing it to attract investment to build out recycling infrastructure. Combined with active government/industry cooperation through EPA's Coal Combustion Products Partnership (C2P2 Program), 2000 to 2008 became the golden era for coal ash beneficial use growth. (See sidebar: "Regulations Matter – Even if You're Not Regulated.")

Then came the December 2008 Kingston coal ash spill. January 2009 opened with a political perfect storm—new Democratic majorities in the U.S. House and Senate, a new Democrat in the White House who had campaigned on eliminating coal, and a new EPA Administrator who seized on the spill and pledged to promulgate new coal ash regulations by the end of the year. EPA unceremoniously killed the C2P2 program, and it quickly became apparent that the Administrator wanted to overturn decades of previous regulatory determinations to regulate coal ash disposal as a hazardous waste. (Cynics such as the author of this article believe the motivation was related more to the desire to shut down coal plants than to address coal ash management issues, but that's a conversation for another day.)

Photo: Vecteezy.com

The regulations weren't forthcoming by the end of 2009, however. It was 2010 before a proposal was produced and, once EPA saw that a hazardous waste approach would be exceedingly difficult to justify, the rulemaking effort slipped into low gear. It took lawsuits by environmental groups and ash marketers to get a federal court to compel EPA to finish its Final Rule, which was enacted in 2015.

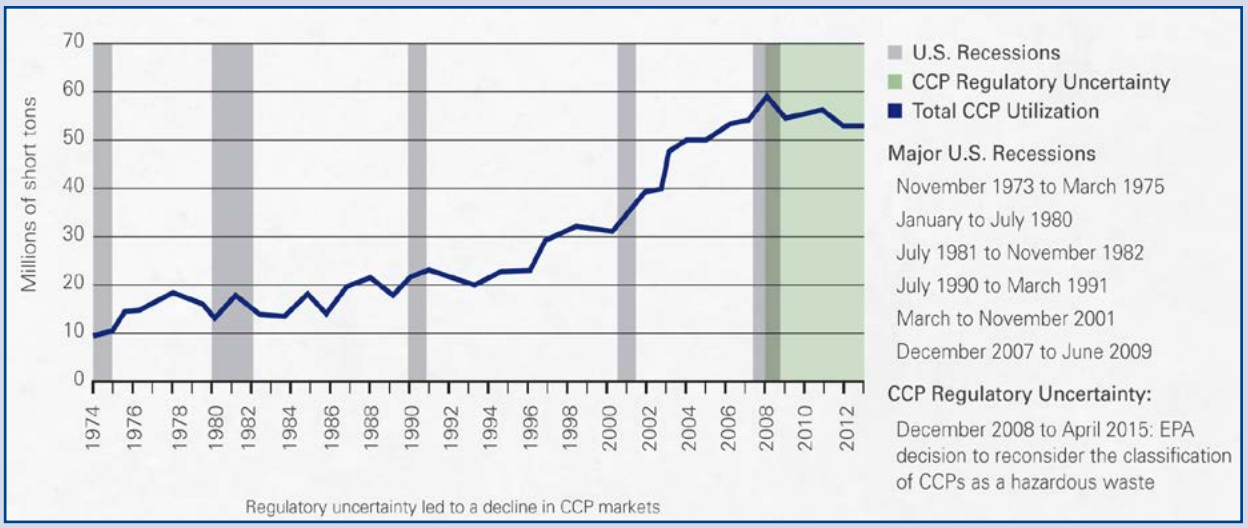
Regulations Matter – Even if You're Not Regulated

EPA policies can also have a major impact on beneficial use—both positive and negative.

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. 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. In 2014, EPA began signaling that the "hazardous waste" designation proposal was off the table and in 2015 finalized coal ash disposal regulations under the non-hazardous section of federal law. Ash utilization began to increase again once some regulatory uncertainty was restored. (Side note: Analysis by the American Road and Transportation Builders Association demonstrated that the 2009-13 performance was not linked to an economic downturn inasmuch as every previous recession saw ash utilization increase as users sought out more economical materials.)

On a positive note, a program led by EPA was in place during the most rapid expansion of coal combustion products beneficial use in history. The Coal Combustion Products Partnership (C2P2 program) was a cooperative effort between EPA, American Coal Ash Association, Utility Solid Waste Activities Group, U.S. Department of Energy, Federal Highway Administration, Electric Power Research Institute, and U.S. Department of Agriculture Agricultural Research Service to promote beneficial use of coal ash as an environmentally preferable alternative to disposal. The initiative included a challenge program, various barrier-breaking activities, and development of coal combustion products utilization workshops. 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 C2P2 program, beneficial use volume was 32.1 million tons. Just eight years later, when the C2P2 program was terminated and EPA initiated the aforementioned ash disposal rulemaking, beneficial use volume had nearly doubled to 60.6 million tons.

Utilization of CCPs has increased during recessions, but dropped during a period of regulatory uncertainty



Now for that math error...

The "Final" (in quote marks because litigation underway in 2024 alleges EPA continues to change the regulation while ignoring proper rulemaking procedures) Coal Combustion Residuals Rule created federal disposal standards under the non-hazardous section of RCRA and properly exempted beneficial use from regulation. But to determine what is exempt, EPA had to establish a definition of what constitutes a beneficial use. EPA included in the 2015 CCR Rule a four-part definition—of which the first three parts are straightforward:

- The CCR must provide a functional benefit.
- The CCR must substitute for the use of a virgin material, conserving natural resources that would otherwise need to be obtained through practices such as extraction.
- The use of CCR must meet relevant product specifications, regulatory standards, or design standards when available, and when such standards are not available, CCR are not used in excess quantities.

"Paraphrased, the fourth beneficial use criterion says: If it looks like a landfill and quacks like a landfill, it might be a landfill, so you need to demonstrate that it's safe."

It's the fourth part that is more convoluted. It states:

- When unencapsulated use of CCR involves placement on the land of 12,400 tons or more in non-roadway applications, the user must demonstrate and keep records, and provide such documentation upon request, that environmental releases to groundwater, surface water, soil, and air are comparable to or lower than those from analogous products made without CCR, or that environmental releases to groundwater, surface water, soil, and air will be at or below relevant regulatory and health-based benchmarks for human and ecological receptors during use.

The intent of the fourth criterion was to avoid sham beneficial use—evading disposal regulations by calling an activity a beneficial use when it's really just another landfill. The math relied on a "bigger than the smallest landfill" concept. EPA consulted its lists of landfills to determine which was the smallest and came up with the 12,400-ton number. Paraphrased, the fourth beneficial use criterion says: If it looks like a landfill and quacks like a landfill, it might be a landfill, so you need to demonstrate that it's safe.

What Would ACAA Do?

The American Coal Ash Association has recommended to EPA the following approaches to fixing the agency's definition of coal ash beneficial use, in order of preference:

1. **Eliminate the fourth beneficial use definition criterion entirely.** The first three beneficial use definition criteria are sufficient to prevent the "large-quantity," "indiscriminate" placement concerns that motivated the inclusion of a beneficial use definition. The third criterion's requirement to comply with "product specifications, regulatory standards, or design standards, when available" will be effective given the wide deployment of such specifications and standards. In the event that such specifications or standards have not been established, the third criterion's requirement that "CCR may not be used in excess quantities" will suffice. EPA's own survey of existing state-level beneficial use regulations shows that these applications do not lack for oversight. The continuing lack of damage cases for activities that have successfully utilized tens of millions of tons of materials over decades is an indication that this is not a matter of urgent regulatory concern.
2. **Just fix the math.** If EPA wants to stand by its original "if it looks like a landfill, it might be a landfill" rationale, then simply correcting the "smallest landfill" threshold for conducting evaluations is in order. The real smallest landfill in EPA's rulemaking record is approximately 74,800 tons.
3. **Require CCP structural fills to conform with ASTM standards.** ASTM E-2277 Standard Guide for Design and Construction of Coal Ash Structural Fills defines industry best practices and incorporates appropriate site location criteria. ASTM standards are derived from a consensus process that allows participation by all concerned parties and are regularly reviewed to ensure that they utilize the most current science. ASTM standards have been adopted, by incorporation or by reference, in many federal, state, and municipal government regulations.

"Three years have passed since the NODA activity. EPA quietly moved the beneficial use definition issue from its active regulatory agenda to its long-term actions list. The agency has offered no indication of when it intends to fix its math."

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Unfortunately, the benchmark smallest landfill EPA found in its database had reported volume in cubic yards (how landfill people think) on a form where EPA asked for volume in cubic feet (how at least one regulator thought). The error was readily discernible by looking at other columns on the same spreadsheet that showed the physical dimensions of the disposal unit. The real "smallest landfill" in EPA's database was a little over 74,000 tons.

A major ash marketer formally requested that EPA make a technical correction of the number. EPA refused. The issue then became a point of contention in litigation over the 2015 rule. In 2018, the U.S. Court of Appeals for the District of Columbia Circuit, as part of its "USWAG Decision," ruled that EPA's provision was arbitrary and remanded the issue to the agency to be fixed.

This is when things really get strange...

Acting on the court's remand, EPA in 2019 proposed to eliminate the volumetric threshold entirely for "non-roadway, unencapsulated" uses and instead apply landfill-based site location criteria from the 2015 rule as the trigger for conducting environmental demonstrations under the fourth beneficial use criterion. The proposal landed like a lead balloon. Beneficial use advocates argued that this approach would erect significant barriers to a host of legitimate beneficial uses, requiring evaluations from the first ton of placement for uses ranging from agricultural gypsum to flowable fill. Environmental groups argued that the new proposal could allow utilities to evade disposal regulations and dump millions of tons of ash wherever they like. In short, everybody hated the proposal.

In 2020, EPA responded by taking a step back. "Based on the public comments received on the August 2019 proposal, the Agency does not intend to take final action at this time on the proposed revisions for the beneficial use definition and requirements for managing piles of CCR," EPA wrote in its Spring 2020 Unified Agenda. "The Agency will continue to reconsider these issues and plans to seek additional information. Pending the review and analysis of any additional information found, the Agency will determine the appropriate next steps."

In the summer of 2020, EPA conducted stakeholder outreach calls with a wide range of groups, including the American Coal Ash Association. Then, in 2021, EPA issued a Notice of Data Availability seeking written comments on a range of issues that were startling in their naivete. Despite EPA's decades of engagement with coal ash—producing two Reports to Congress, two Regulatory Determinations, a Final Rule, and sponsoring the highly successful C2P2 Program—EPA's NODA posed all kinds of elementary "how long is a rope" questions. Examples include: "What are the different types of CCR?" "What are the environmental and economic tradeoffs among the CCR beneficial use and its alternatives, e.g., disposal?" "What are the typical beneficial use applications for each type of CCR?" And much more.

Three years have now passed since the NODA activity. EPA quietly moved the beneficial use definition issue from its active regulatory agenda to its long-term actions list. The agency has offered no indication of when it intends to fix its math.

The last track on the Dead's "Long Strange Trip" album is "Ramble on Rose." Seems appropriate.

It's the Resource *Conservation and Recovery* Act

In all of its comments on EPA rulemakings, the American Coal Ash Association is diligent in pointing out that encouraging beneficial use is at the very foundation of Congress's intent for solid waste regulation.

EPA CCR disposal regulations are under the authority of the Resource *Conservation and Recovery* Act (emphasis added). In its findings establishing the Act, Congress stated: "The Congress finds with respect to materials, that—(1) millions of tons of recoverable material which could be used are needlessly buried each year; (2) methods are available to separate usable materials from solid waste; and (3) the recovery and conservation of such materials can reduce the dependence of the United States on foreign resources and reduce the deficit in its balance of payments." Furthermore, Congress stated specific objectives for encouraging materials recovery and reuse throughout Section 1003 of the Solid Waste Disposal Act.

John Ward *entered the coal ash marketing business in 1998 as Vice President, Marketing and Government Affairs, for ISG Resources (later Headwaters). For over a 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 almost 20 years ago—as a used coal salesman.*

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Beneficial Use of CCP: Into the Future

By William G. Petruzzi, P.G. and John H. Hull, P.E., BCEE

Introduction

The United States has a near- and long-term need for significant volumes of consistent-quality, high-performance, and affordable construction material and product ingredients to support our infrastructure and development goals. Concurrently, there is a growing priority to conserve resources when and where possible and to apply sustainable material management practices when opportunities exist. Ensuring the continued and future role of coal combustion products (CCP)—or "coal combustion residuals" (CCR) as referred to by the U.S. Environmental Protection Agency (EPA)—is essential to fulfill this need, and this can be realized by acknowledging that the harvesting and beneficial use of CCP is integral to the sustainability planning process. This will require that stakeholders focus on following sound scientific and engineering principles when engaging in beneficial use projects. This includes advocating for maintaining appropriate regulations, modifying existing regulations, and avoiding integrating concepts in future regulations that are based on perception.

CCP Defined

CCP, as defined by EPA, is produced primarily from the burning of coal in coal-fired power plants. Coal ash includes a number of byproducts produced from burning coal, including:

- **Fly ash**, a very fine, powdery material composed mostly of silica and made from the burning of finely ground coal in a boiler.
- **Bottom ash**, a coarse, angular ash particle that is too large to be carried up into the smokestacks, so it collects in the bottom of the coal furnace.
- **Boiler slag**, molten bottom ash from slag tap and cyclone-type furnaces that turns into pellets with a smooth glassy appearance after being cooled with water.
- **Flue gas desulfurization (FGD) material**, a material left over from the process of reducing sulfur dioxide emissions from a coal-fired boiler, which can be a wet sludge consisting of calcium sulfite or calcium sulfate or a dry powdered material that is a mixture of sulfites and sulfates.

Other types of byproducts are fluidized bed combustion ash, cenospheres, and scrubber residues.

CCP Disposal

The disposal of CCP is regulated by EPA under the Disposal of Coal Combustion Residuals from Electric Utilities final rule. This rule establishes technical requirements for CCP disposal units (i.e., landfills and surface impoundments) under Subtitle D of the Resource Conservation and Recovery Act (RCRA). These regulations establish specific design and compliance criteria for storage units, including schedules for closure and post-closure obligations. Also, some states have established (or plan to establish) programs to adopt and/or complement the federal regulations completely or in part.

CCP produced at coal-fired utilities was traditionally placed in on-site disposal units. These units vary in design and composition. Some units contain one specific type of CCP material (e.g., fly ash, bottom ash, etc.) and are considered a "monofill" of homogeneous material, while other units contain CCP materials that were placed in a co-mingled manner, resulting in a heterogeneous material in the disposal unit. According to EPA, CCR disposal occurs at more than 310 active on-site landfills and more than 735 active on-site surface impoundments. ACAA estimates that there are now over 1.5 billion tons of CCP stored in such disposal sites.

CCP Beneficial Use

Over time, it was discovered that the coal ash contained characteristics that made the material desirable for use in construction materials and as an ingredient in products in lieu of virgin or other traditional materials. EPA stated that CCP can replace virgin material removed from the earth, conserving natural resources. EPA encouraged the beneficial use of CCP in an appropriate and protective manner because this practice can produce environmental, economic, and product benefits, such as reduced use of virgin resources, lower greenhouse gases, reduced cost of coal ash disposal, and improved strength and durability of materials. For example, fly and bottom ash can provide pozzolanic characteristics like those of portland cement, used in the production of concrete, and FGD can be used to replace mined gypsum in wallboard. Other CCP, such as boiler slag, cenospheres, etc., have also been found to be useful as materials or ingredients in products. Recognizing this, EPA issued regulations in 2015 that distinguished between CCP disposal and beneficial use. The beneficial use of CCP definition includes four criteria:

(1) The CCR must provide a functional benefit;

(2) The CCR must substitute for the use of a virgin material, conserving natural resources that would otherwise need to be obtained through practices such as extraction;

(3) The use of CCRs must meet relevant product specifications, regulatory standards, or design standards when available, and when such standards are not available, CCRs are not to be used in excess quantities; and

(4) When unencapsulated use of CCRs involves placement on the land of 12,400 tons or more in non-roadway applications, the user must demonstrate and keep records, and provide such documentation upon request, that environmental releases to ground water, surface water, soil, and air are comparable to or lower than those from analogous products made without CCRs, or that environmental releases to ground water, surface water, soil, and air will be at or below relevant regulatory and health-based benchmarks for human and ecological receptors.

Beyond that definition, beneficial use of CCP was not further addressed in EPA's rules and is exempt from federal regulation; states generally have primary regulatory authority or provide guidance over beneficial use of CCP. Where guidance is not available from state agencies, ASTM does provide consensus-based guidance related to CCP harvesting and beneficial use.

"EPA encouraged the beneficial use of CCP in an appropriate and protective manner because this practice can produce environmental, economic, and product benefits, such as reduced use of virgin resources, lower greenhouse gases, reduced cost of coal ash disposal, and improved strength and durability of materials."

CCP in the Marketplace

Owners and operators of coal-fired energy plants have continued work with brokers and end users to divert material directly into the marketplace as it is produced, thus extending the lifecycle of the CCP beyond the disposal unit and into a beneficial use endpoint. According to the American Coal Ash Association (ACAA), in 2022, 46.8 million tons of coal combustion products, or 62 percent of all CCP produced, were beneficially used. Beneficial uses of CCP have been embraced by the marketplace, and it is noted that CCP end users need access to a consistent grade of high-quality, readily available, and fair-priced material into the future.

CCP beneficial use has proven to be a viable and sustainable practice, and it has continued to grow over time. Looking forward, harvesting and beneficial use of CCP will augment and replace the volume of material produced from operating coal-fired energy plants as these plants continue to close and produce less CCP, while the use of the material continues to increase. The strategy to harvest and beneficially use CCP from disposal units to yield the volumes of CCP needed to meet our infrastructure and development goals *is* the future. Current and former CCP disposal units are now considered as "storage units" and as an important asset.

CCP End Uses

The list of CCP end uses in *ASTM E3355-23 Standard Guide for Characterization of Coal Combustion Products (CCP) in Storage Areas for Beneficial Use* is broad and represents both *encapsulated* and *unencapsulated* uses, which are terms EPA commonly refers to when evaluating beneficial use. EPA defines encapsulated beneficial use of CCP within the regulations as "a beneficial use of CCR that binds the

CCR into a solid matrix that minimizes its mobilization into the surrounding environment." Beneficial use applications of encapsulated CCP include binding materials within wallboard, concrete, roofing materials, and bricks or other materials. Conversely, beneficial use applications of unencapsulated CCP are those where the material is used in a loose particulate, sludge, or other unbound form, such as in structural fill, agricultural use, soil modification, and loose aggregate or other applications.

	Encapsulated	Unencapsulated
Cement and Concrete	X	
Lightweight Aggregate		X
Flowable Fill	X	X
Structural Fill		X
Road Base/Subbase		X
Soil Amendment		X
Waste Stabilization/Solidification	X	
Agriculture		X
Metals and Rare Earth Elements	X	
Grout	X	
Mineral Filler	X	
Snow/Ice Traction Control		X
Blasting Grit/Abrasives		X
Roofing Granules	X	
Mining Applications		X
Gypsum Panels	X	
Asphalt	X	
Other	X	X

Source: ASTM E3355-23 Standard Guide for Characterization of Coal Combustion Products (CCP) in Storage Areas for Beneficial Use

Encapsulated beneficial use of CCP has a long and successful history. EPA has acknowledged that beneficial use of encapsulated CCP benefits the environment and the economy based upon their risk evaluation completed in 2016. The agency developed a methodology for the evaluation of the beneficial use of various industrial non-hazardous secondary materials, including CCP, along with an associated compendium. Several evaluations of the beneficial uses of CCP have been conducted in anticipation of, in accordance with, or in a manner consistent with the EPA methodology. The evaluations included the EPA's own risk evaluation of the beneficial uses of encapsulated CCP in fly ash concrete and FGD gypsum wallboard, the conclusions of which supported both beneficial uses. It is expected that any of the end uses for encapsulated CCP listed in ASTM harvesting or beneficial use standards would also pass, as well as an entire spectrum of byproducts and wastes that are commonly and safely beneficially used (e.g., foundry sand, drinking water treatment materials, dredged materials, etc.).

"One must understand that structural fill is placed in a manner that is compacted and possibly blended with other materials that may have pozzolanic (or other stabilizing) bonds similar to those realized from concrete curing."

The conclusion of the risk evaluation for encapsulated CCP supports its beneficial use. EPA (and other stakeholders) has long supported encapsulated beneficial use not only to make a quality product, but also to meet sustainability goals and achieve reduction in greenhouse gases, energy savings, and resource conservation.

Additional benefits of harvesting CCP for beneficial use accrue from closure-by-removal scenarios, resulting in a property that can be conserved or redeveloped. Stakeholders need to work together to ensure that the schedules for closure related to compliance and beneficial use applications are optimized.

Beneficial use of CCP in unencapsulated forms is also viable where supported by a risk evaluation. Approval- and compliance-related issues for use should be approached no differently for CCP than for any other construction material or ingredient.

It should be noted that EPA applied the same risk evaluation methodology for the beneficial use of encapsulated CCP as to that used for unencapsulated CCP. Their risk evaluation for the unencapsulated beneficial use of CCP as an agricultural amendment (i.e., FGD gypsum) found it to be "protective of human health and the environment."

Other unencapsulated beneficial uses of CCP, such as structural fill, have been the subject of discussion between stakeholders. EPA describes structural fill as "an earthen material used to create a strong, stable base" constructed by compacting earthen material that can support roadways or other structures when completed. CCP can be used in lieu of soil or natural aggregates for structural fill.

However, unencapsulated use of CCP, under the EPA definition of beneficial use, is subject to a 12,400-ton limit for placement on a non-roadway project. The end user can exceed this limit by demonstrating that environmental releases to select media are comparable to or lower than those from analogous non-CCP products or are below relevant regulatory and health-based limits. The 12,400-ton limit for storage and use is currently being debated among stakeholders, as it does not appear to be based on sound scientific or engineering principles. It should be revised to add a provision to allow for the completion of a site-specific risk evaluation or follow Department of Transportation of other applicable specifications for end use. Again, CCP should not be regulated any differently than traditional construction materials or raw, natural resources.

Consideration of CCP for beneficial use such as structural fill should undergo similar EPA risk evaluation, as opposed to meeting an arbitrarily determined volume limit that could prohibit its use. The source-path-receptor relationship needs to be considered in the risk evaluation, as well as potential exposure end points. This is no different than the evaluation completed for encapsulated beneficial use of CCP where the relative level of constituents and their solubility and mobility in the intended end use was evaluated to assess potential migration and availability of such constituents within modeled pathways to potential receptors.

One must understand that structural fill is placed in a manner that is compacted and possibly blended with other materials that may have pozzolanic (or other stabilizing) bonds similar

Photo courtesy of GYPSOIL (via PRWEB)

EPA's risk evaluation for the unencapsulated beneficial use of CCP as an agricultural amendment found it to be "protective of human health and the environment."

to those realized from concrete curing. The assumption that all constituents in the structural fill will potentially leach and migrate is overly conservative and not representative of post-placement conditions of the CCP. Also, engineering and institutional controls may be integrated into the unencapsulated beneficial use that further address any potential exposure or risks. Controlled placement (moisture content, achieved density) of CCP will result in the equivalent performance of encapsulated materials from a risk evaluation perspective as a result of the same mechanisms that occur from encapsulation—a reduction in the mobilization and migration of contaminants due to residual pozzolanic (or other stabilizing) activity within the CCP (in some cases) and a dramatic reduction of porosity and permeability due to controlled placement that will reduce the leachability of such materials.

EPA Sustainable Materials Management Model

The Federal Highway Administration, State Departments of Transportation, and ASTM have promoted the responsible use of unencapsulated CCP. Further, the use of CCP as structural fill materials has been well documented for decades via the completion of numerous large-scale, successful projects. CCP impoundments and landfills by their nature are highly engineered for potential risk factors (i.e., slope stability, bearing capacity, and minimization of long-term consolidation and differential settlement), just as is required of large-scale geotechnical projects such as dams, levees, highways, and foundations where beneficial use of CCP as structural fill could be considered. Consequently, proscriptions on unencapsulated beneficial use of CCP based on perceived outcomes, volume restrictions, etc., are not based on sound scientific and engineering principles.

There remains work to be done between stakeholders to resolve outstanding issues so that CCP beneficial use is perceived and treated no differently by regulators than any other byproduct or waste material.

10 Takeaways for the Beneficial Use of CCP into the Future

1. CCP is a wanted and needed construction material and ingredient in products.
2. Harvesting and beneficial use of CCP is a sustainable practice that yields a product that is consistent quality, high-performance, and affordable.
3. There is a need to fulfill market demand for CCP as coal-fired energy plants continue to close.
4. Harvesting of CCP from storage units can easily provide the volume of CCP needed by the market.
5. Beneficial use of CCP should not be viewed or regulated differently than any other raw resource, traditional construction material, or product ingredient.
6. Encapsulated beneficial use of CCP has a long-proven track record and is a standard practice.
7. Unencapsulated beneficial use of CCP is viable if designed and constructed to meet performance standards.
8. CCP regulations need to focus on applying sound science and engineering principles and accepted risk-based evaluations regardless of encapsulated or unencapsulated beneficial end use.
9. Beneficial use of CCP is primarily regulated by state agencies.
10. Beneficial use of CCP should be applauded and promoted as a sustainable practice.

Closing Statement

Encapsulated and unencapsulated beneficial use of CCP is a proven and supported approach to advance sustainability goals. Ensuring that there is a continued supply of CCP for beneficial use is critical. Achieving this will require that stakeholders follow sound scientific and engineering principles when engaging in beneficial use projects. This includes advocating for maintaining appropriate regulations, modifying existing regulations, and avoiding integrating concepts in future regulations that are based on perception rather than the CCP material's documented performance and applied risk evaluations.

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Using Risk Assessment as a Framework for Managing Risk and Perception

By Jay Peters

With rampant misinformation in the public domain regarding risks related to coal combustion residuals (CCR), stakeholders deserve clear communication on risk assessment results that are based on science and not speculation. Our ability to manage risks depends on our ability to identify the risk, and this is particularly important for CCR because CCR is comprised entirely of naturally occurring elements,[1] so understanding the backdrop of naturally occurring conditions in the environment is essential to informing risk management decisions about CCR. Using a scientific and data-driven approach to assess potential risk provides a means to then develop and implement risk mitigation strategies, if needed, and to communicate risks to stakeholders. With that in mind, let's dive into what a risk assessment is and what it can do for you so that you can determine when and how to use risk assessment as a tool to identify potential risks and how to manage them before they become a problem.

Risk Assessment Overview

Risk assessment is the process of evaluating if exposure to a chemical or element (constituent) may pose adverse health or environmental effects that may need steps to be taken to protect public health and the environment. Risk assessments are most commonly used to determine if land that has been affected by releases of constituents may need response actions in the form of institutional controls, engineering controls, or active remediation. Risk assessment provides the decision-making steps that link the understanding of the nature and extent of constituents present in the environment to decisions about whether those conditions could be addressed through response actions. For this reason, risk assessment is an underpinning to most federal and state regulatory programs that manage hazardous sites, including sites managed under federal and state Superfund, Resource Conservation and Recovery Act (RCRA), brownfield redevelopment, and voluntary programs.

The risk assessment process essentially answers four questions: (1) who could be exposed to the constituents in environmental media, based on current and possible future land uses such as industrial property, recreational land, and residential property; (2) how could exposure occur, based on where constituents are located, such as surface soil, groundwater, and air; (3) how exposure could occur, the activity patterns of those who could be exposed, and how much exposure could occur, based on knowledge of the constituent concentrations in environmental media; and (4) would the amount of exposure cause a possible risk to human health or the environment that is deemed unacceptable by the responsible regulatory authority. **An underlying principle in the risk assessment process is that risk can only occur if there is exposure.** For example, the presence of constituents in groundwater does not translate to risk if there is no mechanism for exposure to groundwater to occur.

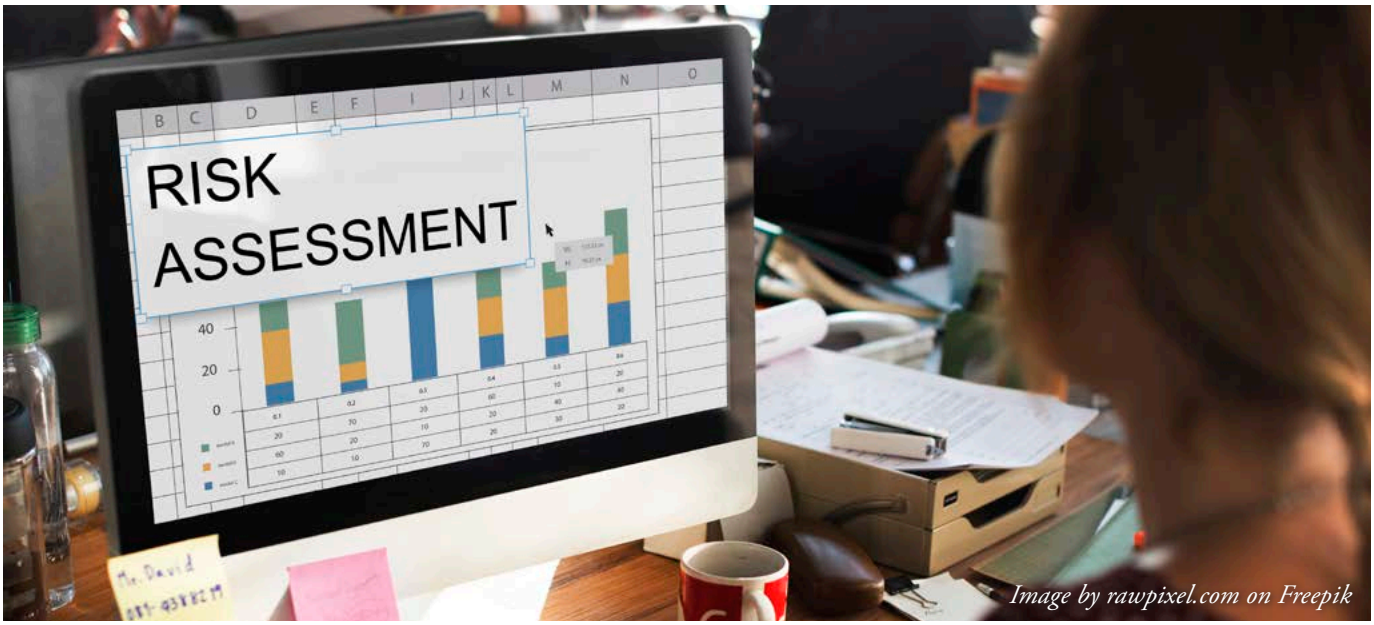

Image by rawpixel.com on Freepik

To help ensure that risk assessments yield consistency across various regulatory frameworks and different types of study areas, EPA and states have developed guidance that standardizes certain aspects of risk assessments.[2] These include the sources of values that quantify the toxicity associated with chemicals and constituents, and many of the numerical values that describe how much exposure can occur to various media for different populations. For example, by applying standardized techniques, the risks estimated for residential exposure to the same concentration of a constituent in surface soil should be similar across geographies of types of study areas.

Risk Management

There are three key concepts embodied in the risk assessment process that are essential to inform risk management decisions that are developed from the results of a risk assessment:

1. The recognition that any exposure to a constituent poses some level of risk; however, regulatory agencies have determined that certain levels of risk are acceptable.

2. Exposure to naturally occurring and anthropogenic background conditions in the environment also poses risk.

3. Response actions are not required when risks are indistinguishable from those posed by background conditions.[3]

Under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA),[4] the United States Environmental Protection Agency (EPA) established that risks from exposure that are related to health outcomes other than cancer (non-cancer risks) are acceptable if they are not above a hazard index of one. A hazard index above one indicates that the estimated exposure is above a level that is considered safe for all populations, including infants and children and those who are at higher risk due to medical or genetic conditions. However, an initial hazard index above one does not mean that action is necessarily needed, but rather that the results should be evaluated in greater detail to determine if action is warranted.

Similarly, under CERCLA, EPA has established a target cancer risk range within which cancer risks are managed. The risk range is one in one million (10^{-6}) to one in ten thousand (10^{-4}),

Exposure to naturally occurring and anthropogenic background conditions in the environment carries risk.

ENGOs Attack Coal Ash Beneficial Use in Structural Fill

Environmental activists have stepped up their attacks on coal ash beneficially used in structural fills in recent months, citing a recently revised EPA risk assessment and claiming that it "reveals significant new human health risks."

More than 150 environmental groups signed on to a December 11, 2023, letter to EPA urging the agency to "take the following actions: (1) quantify the full range of health risks posed by coal ash used as structural fill, particularly the risk from radiation; (2) investigate areas where coal ash fill has been placed near residences and require cleanup; (3) initiate a rulemaking to prohibit the use of coal ash as structural fill; and (4) issue a public advisory recommending that coal ash fill in residential areas be immediately terminated pending a final rulemaking."

EPA on November 7, 2023, announced a Notice of Data Availability related to the agency's proposed regulation of "Legacy CCR Surface Impoundments and CCR Management Units." EPA was compelled to develop the regulation following litigation that was decided by the U.S. Court of Appeals for the D.C. Circuit in 2018. Included in the November notice was a new risk assessment that concludes "that leaching from both legacy surface impoundments and CCRMUs has the potential (to) adversely affect groundwater quality and cause risks to future receptors in the range OLEM typically considers for regulation."

Announcing the December 11 letter to EPA, Earthjustice claimed: "People may be exposed to dangerous levels of radiation in coal ash that has been used as fill in neighborhoods, backyards, parks, and public areas, including playgrounds and school grounds. Exposure to excess levels of radiation causes cancer. Millions of tons of coal ash are used every year as a substitute for clean fill, and there are few restrictions and little to no oversight by EPA as to how it is used."

Environmental groups have previously unsuccessfully sought bans on unencapsulated coal ash beneficial use from Congress and in comments on other EPA rulemakings.

which represents the risk that someone may develop cancer because of exposure. Risks above 10^{-4} normally need a response action, whereas risks below 10^{-6} do not. Risks within the range typically do not require a response action unless site-specific conditions dictate that lower risk management thresholds are appropriate. To put these numbers in perspective, at the 10^{-6} cancer risk level, one million people would need to be exposed to the constituents at a study area at the assumed level of exposure for one extra cancer case to occur. The natural cancer incidence in the United States is approximately one in three for women and one in two for men.[5] Stated another way, EPA manages cancer risks associated with exposure to chemicals and constituents in the environment at a level that is 3,000 to 500,000 times lower than the risk of developing cancer through natural causes.

"EPA manages cancer risks associated with exposure to chemicals and constituents in the environment at a level that is 3,000 to 500,000 times lower than the risk of developing cancer through natural causes."

Since RCRA is often delegated to states, risk thresholds imposed by state regulatory programs are used to guide response action decisions. States use a hazard index of one and a cancer risk that can range from 10^{-6} to 10^{-4}, with many states using a 1 in 100,000 cancer risk (10^{-5}) threshold for initial risk decision making.

Risk Assessment Applications

The risk assessment process provides an unbiased, scientifically based framework from which decisions about how to manage risks can be made (risk management decisions). Risk assessments can be completed using either deterministic (single values typically representing the reasonable maximum exposure [RME] are used for each parameter to quantify risk) or probabilistic methods (where a distribution of input parameters such as ingestion rate are used and a distribution of risk outcomes is developed, thus representing a conservative, yet more reasonable assessment of risk). Consequently, the risk assessment process has been used in numerous applications, which generally fall into the following categories:

- *Assessment of hazardous sites*. These risk assessments are used to determine if response actions are needed to abate potential risks to human health and the environment from modeled or measured exposures. They can use a comparison of constituent concentrations to risk-based screening levels or standards. Risk-based screening levels and standards define the constituent concentrations that are associated with specified levels of acceptable risk for specific land uses. Alternatively, they can use information specific to the study area and constituent concentrations to calculate estimated exposures and risks, which are then compared to acceptable risk targets.
- *Beneficial use evaluations*. These risk assessments are used to evaluate if use of a material as a substitute for an original material could pose greater risks to human health and the environment than use of the original material. The outcomes of these risk assessments are used to determine if the beneficial uses are appropriate.
- *Establishment of regulations*. The risk assessment process is used to evaluate if use or application of a material is associated with acceptable risks. This type of risk assessment is used by the EPA Office of Pesticide Programs to evaluate pesticide application rates and pesticide safety, and it is used by the EPA Toxic Substances Control Act (TSCA) to evaluate the safety of consumer uses of chemicals regulated under TSCA. Similarly, EPA's draft October 2023 "Risk Assessment of CCR: Legacy Impoundments and CCR Management Units" (CCRMUs), prepared by the EPA Office of Resource Conservation and Recovery, is intended to characterize risks associated with CCR disposal in legacy impoundments and CCRMUs. The outcomes of these risk assessments are used to inform regulations.

Risk Assessment and Coal Combustion Residuals

EPA has completed risk assessments to evaluate beneficial uses of CCR, and the findings support the use of CCR for beneficial use.[6] EPA has also completed risk assessments to evaluate whether EPA should regulate coal ash. EPA's 2014 risk assessment of CCR concluded that unlined surface impoundments containing CCR may be associated with risks that are above risk thresholds applicable to determining if regulation is needed, but that CCR landfills (lined or unlined) did not. The results of the risk assessment were used to support the promulgation of the CCR Rule of 2015. EPA updated the 2014 risk assessment in 2023 and is using it to support the CCR Legacy Rule.

"An underlying principle in the risk assessment process is that risk can only occur if there is exposure. The presence of constituents in groundwater does not translate to risk if there is no mechanism for exposure to groundwater to occur."

2014 EPA CCR Risk Assessment

EPA's 2014 risk assessment of CCR evaluated leaching of CCR constituents from surface impoundments and landfills to groundwater using probabilistic modeling that simulated leachate migration through the subsurface and underlying groundwater to a hypothetical drinking water well placed outside of the surface impoundment or landfill.[7] Cancer risks and non-cancer hazards were probabilistically derived for each of the CCR constituents. EPA compared the probabilistic results for the most conservative exposure scenario (which assumed high rates of leaching from unlined impoundments and landfills) to three risk management criteria: a hazard index threshold of 1; a cancer risk of 10^{-5}, which is the point of departure for determining RCRA hazardous waste listings (RCRA listing threshold); and the CERCLA risk range of 10^{-6}

In its beneficial use evaluation of FGD gypsum in wallboard, EPA concluded that the potential exposures to ionizing radiation are comparable to those associated with mined material, and eliminated radionuclides as a concern.

to 10^{-4}. The results indicated that cancer risks for arsenic were above the RCRA listing threshold (10^{-5}) and slightly above the upper bound of the CERCLA cancer risk range (10^{-4}), and the hazard index values for arsenic, lithium, and molybdenum were above the threshold value of 1. Since these risks exceeded the RCRA listing threshold, EPA determined that CCR impoundments and landfills required regulation under the CCR Rule of 2015.

Although EPA used the risk assessment process to evaluate potential risks associated with CCR surface impoundments and landfills to determine if it would require regulation of CCR, under the CCR Rule the application of a risk assessment framework is constrained to evaluation of groundwater using groundwater protection standards (GWPS). GWPS are constituent concentrations that are protective for use of the groundwater as a source of drinking water. The Rule requires that sampling data for monitoring wells located immediately adjacent to the impoundments be used to evaluate compliance with GWPS. **However, this application of risk assessment disregards the fundamental principle of the risk assessment process**—that risk is first and foremost dependent on whether there is exposure. Application of GWPS assumes that groundwater is used as a source of drinking water, yet groundwater adjacent to coal ash basins is seldom if ever used as drinking water, nor will it realistically be used as such in the future. Therefore, for most CCR units, there is no risk, despite there being monitoring wells adjacent to the ash basins that likely contain constituents at concentrations above GWPS.

Applying the risk assessment process, the more reasonable risk potentially attributable to CCR-related constituents in groundwater would be associated with other non-potable uses of groundwater that might be occurring, or migration of groundwater to surface water. Under CERCLA, if groundwater use is not reasonable (because it is beneath a landfill for example), then other uses of the groundwater are evaluated. If those other uses are determined to be associated

Product Liability Protection

We all have seen what chaos can be created when the rules for an activity are changed with little or no notice, or due process. Currently, we are seeing the EPA considering use of a risk assessment that would greatly increase the reported cancer risk associated with arsenic ingestion. The EPA has been trying to put this risk assessment into place for over 10 years in similar forms. The pushback by stakeholders has been strong, led by the Arsenic Science Task Force. If adopted, many practices and products which have been regarded as safe for decades would have to carry hazardous warning labels. The practice of using coal ash for structural fills would be included. It has been estimated that about 70 percent of all items in your local grocery store would have to have a hazardous warning label.

Given this threat, one question that arises is, "How can I protect myself against product liability claims?" The answer starts with knowing your products and where they are to be used. Regular testing to evaluate constituents of concern gives you data needed to defend any accusations. Often such accusations are made with no science to support them. Once the word "arsenic" is heard, it often becomes hard to have a reasonable discussion.

Too many times, the background conditions at a site are either not known or ignored. Take the example of claims of elevated hexavalent chromium near coal ash disposal units in North Carolina. Efforts were made to claim the hexavalent chromium was coming out of the coal ash. Investigation eventually identified the elevated background levels are from the geology in the region, not the coal ash.

The first step in avoiding liability claims is having good science on your side.

—Thomas Adams, Executive Director, American Coal Ash Association

with acceptable risks, then an Alternate Concentration Limit (ACL) can be established, which is a groundwater concentration that is protective for the downgradient uses of the water. The ACL is applied at a location between the source of groundwater contamination and the downgradient point of use and is used as the compliance point to monitor groundwater conditions. The same concept could be applied at CCR units, legacy units, and CCR Management Units (CCRMUs), but the Rule does not allow for that.

2023 EPA CCR Risk Assessment

In October 2023, EPA updated its 2014 risk assessment of CCR to include an evaluation of surface impoundments and landfills that were previously excluded from the risk assessment because they were determined not to be subject to the CCR Rule (legacy impoundments).[8] The evaluation was based on the same methodology used in the 2014 risk assessment. It concluded that leaching from non-regulated surface impoundments would pose risks to groundwater assumed to be used as drinking water that are similar to those estimated for regulated units, and therefore would be subject to regulation.

EPA also included evaluations of CCRMUs, including CCR used as structural fill, in the 2023 risk assessment. The CCRMU evaluation focused on risks associated with CCR constituents leaching to groundwater assumed to be used as drinking water, and exposure to radium as a constituent in CCR structural fill.

Unlike the 2014 risk assessment, EPA did not use probabilistic analysis to evaluate risks, but rather used RME deterministic inputs, which yielded more conservative results. EPA concluded that the 90th percentile modeled groundwater concentrations of several constituents would be above GWPS at the boundary of the CCRMU and would be associated with cancer risks that are above the RCRA listing threshold, the upper bound of the CERCLA risk range, and a hazard index of one at distances of 1,000 feet from the CCRMU. However, it is relevant to note that when EPA modeled the volume of water associated with risks for arsenic exposure, their results showed that although risks for high-end exposure would be above the RCRA listing threshold, risks would not be above the upper bound of the CERCLA risk range. **Significantly, these results demonstrate that although CCRMUs may leach CCR constituents at levels that would drive regulation, they are unlikely to leach CCR constituents at levels that would pose unacceptable health risks.**

EPA's evaluation of potential exposures to radium in CCRMUs considered emission of radon and exposure to ionizing radiation under the assumption that a home is constructed on top of the CCRMU, which is rarely if ever the case. The results of the assessment showed that moderate risks for potential exposure to radon were slightly above the RCRA listing threshold, but that even the high-end risks were not above the upper bound of the CERCLA risk range, indicating that radon emission from CCRMUs would not be expected to pose unacceptable health risks. **EPA concluded that radon emission from CCRMUs was indistinguishable from the radon emission that occurs from naturally occurring radium in soil, and therefore did not retain radon emission as a pathway that necessitates regulation.** The modeled results also showed that exposure to ionizing radiation would remain below the RCRA listing threshold when more than one foot of soil cover is over the CCRMU—a condition that is expected to predominate. It is only when EPA assumed the CCR fill gets mixed with surface soil that the combined contribution of radium and arsenic results in risks above the upper bound of the CERCLA risk range. However, EPA used a more conservative deterministic model, rather than a probabilistic model, to arrive at the conclusion that CCR mixed with surface soil would pose risks above risk management criteria.

Radiological Risks for CCR and Background

EPA used the results of the deterministic model in its 2023 CCR risk assessment to advance a position that CCRMUs require regulation due to concerns about ionizing radiation exposures. This conclusion has led to recent and multiple press releases that flagged concerns about radioactivity in CCR.[9] It is important to note that the same deterministic model used by EPA to arrive at these conclusions also predicts that levels of radium that naturally occur in soil (background levels) would be associated with risks that are above the RCRA listing threshold and equal to the upper bound of the CERCLA risk range.

Understanding background risks is critical for putting the potential risks associated with exposure to CCR in context, since it is derived from coal, which is comprised of naturally occurring constituents. With respect to radium, USGS concluded that radium in most fly ash is within the range that occurs in granitic rocks, phosphate rocks, and shale, and that the majority of coal and fly ash are not significantly enriched in radioactive elements, or in associated radioactivity, compared to common soils or rocks.[10] In EPA's beneficial use evaluation of FGD gypsum as a replacement for mined material in wallboard, EPA concluded that the potential exposures to ionizing radiation are comparable to those associated with mined material, and therefore eliminated radionuclides as a concern.[11]

People are exposed to radiation every day, from natural sources such as minerals in the ground and granite countertops, to man-made sources such as medical X-rays. According to the National Council on Radiation Protection Measurements (NCRP), the average annual radiation dose per person in the U.S. is 620 millirem.[12] For comparison, the exposure to radium under the assumption that a house is built on a CCRMU, even assuming that there is no soil cover over the CCRMU, is only 23 millirem above the dose received from background radium in soil. This means that if a house was constructed over a CCRMU, the people living in the house would receive an additional radiation exposure over the course of a year that is equal to the radiation received from two chest X-rays.

Closing

Although the CCR Rule does not allow the use of risk assessment for decision making, risk assessment is an important communication tool for putting risks into perspective. This is particularly relevant for CCR because the reasonable exposure pathways to CCR constituents do not include an assumption that groundwater at the edge of a surface impoundment or landfill is used as drinking water. Furthermore, comparing risks associated with the constituents in coal ash to the same constituents that naturally occur in our environment enables us to place CCR-related risks in the context of the risks that we encounter every day just through living. In the case of radium in structural fill, the potential exposures are not significant and represent less than 2 percent of the of the overall radiation exposure that we receive from our environment.

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A Golden Decade for Coal Ash Beneficial Use Revisited

By John Simpson

"The Congress finds with respect to materials that millions of tons of recoverable material which could be used are needlessly buried each year."[1]

—Resource Conservation and Recovery Act of 1976

The Resource Conservation and Recovery Act (RCRA), which amended the Solid Waste Disposal Act of 1965, is the primary law governing the disposal of solid and hazardous waste in the United States. Adopted in 1976, the Act establishes a cradle-to-grave system (under Subtitle C) to control materials classified as "hazardous waste," while delegating (under Subtitle D) to states the authority to develop comprehensive plans for managing nonhazardous solid waste.

Initially, it was unclear whether fly ash and other coal combustion products (CCPs) were deemed to be (unhazardous) solid waste under RCRA and, as such, regulated under Subtitle D.

Former U.S. Senator Tom Bevill (D-AL), author of RCRA's Bevill exemption.

In 1980, Congress passed an amendment to the law temporarily excluding CCPs from regulation as hazardous waste until further assessment had been carried out. Known as the "Bevill amendment," this exemption temporarily regulated CCPs as solid waste under Subtitle D until a formal study was concluded by the U.S. Environmental Protection Agency (EPA).

In 1993, EPA issued a regulatory determination concluding that CCPs should continue to be exempt from Subtitle C of RCRA because of the "limited risks posed by them and the existence of generally adequate state and federal regulatory programs." With this regulatory certainty, fly ash utilization grew at an average annual rate of 10 percent, doubling from 10.5 million tons in 1993 to 20.1 million tons in 2000—outstripping even the growth rate of the ready-mixed concrete market, which increased at an average annual rate of 7 percent over the same period.[2]

The EPA issued a "Final Regulatory Determination" in 2000 that retained the Bevill exemption for fly ash, reaffirming its 1993 finding. EPA also determined that there would be no additional regulation for fly ash and that the agency did "not wish to place any unnecessary barriers on the beneficial use of fossil fuel combustion wastes so that they can be used in applications that conserve natural resources and reduce disposal costs."[3]

The Coal Combustion Products Partnership (C2P2)

Having established certainty over the laws under which CCPs would be regulated, EPA subsequently embarked on a program to encourage the beneficial use, rather than disposal, of these materials. The Coal Combustion Products Partnership ("C2P2") was a cooperative effort between EPA, the American Coal Ash Association (ACAA), Utility Solid Waste Activities Group, Department of Energy (DOE), Federal Highway Administration (FHWA), and the United States Department of Agriculture to promote the beneficial use of CCPs and the environmental benefits that result from their use.

"In conducting these two regulatory determinations [1993 and 2000], EPA did not identify any environmental harm associated with the beneficial use of CCPs in highway construction applications and concluded ... that these materials did not warrant regulation as hazardous waste."

–Using Coal Ash in Highway Construction: A Guide to Benefits and Impacts (EPA, 2005)

Recipients of EPA's C2P2 Award, recognizing achievements including documented increases in CCP utilization.

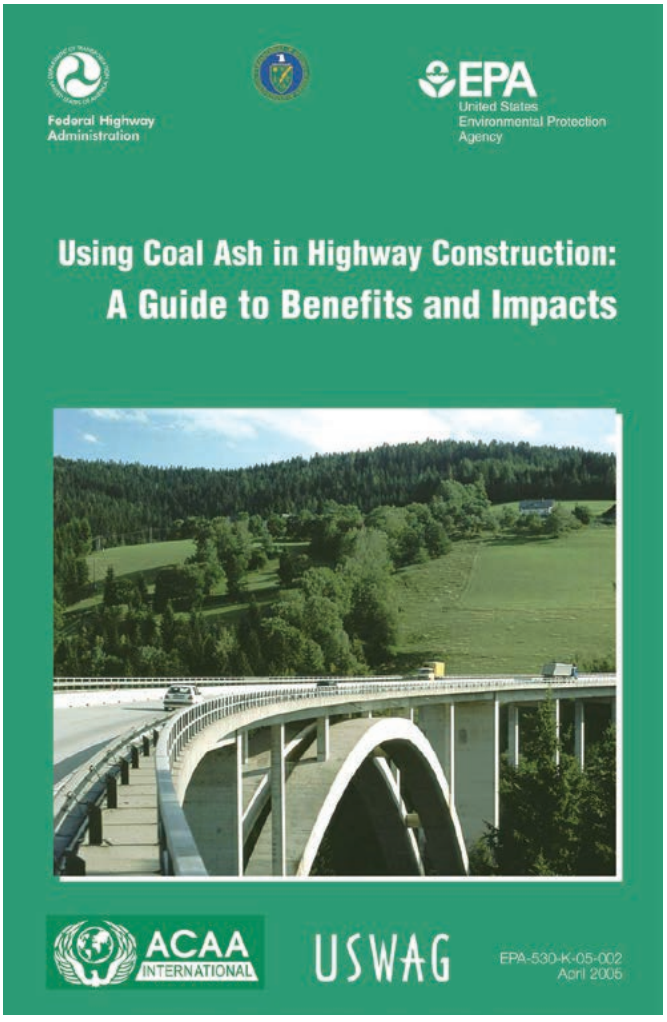
C2P2 set the following goals:

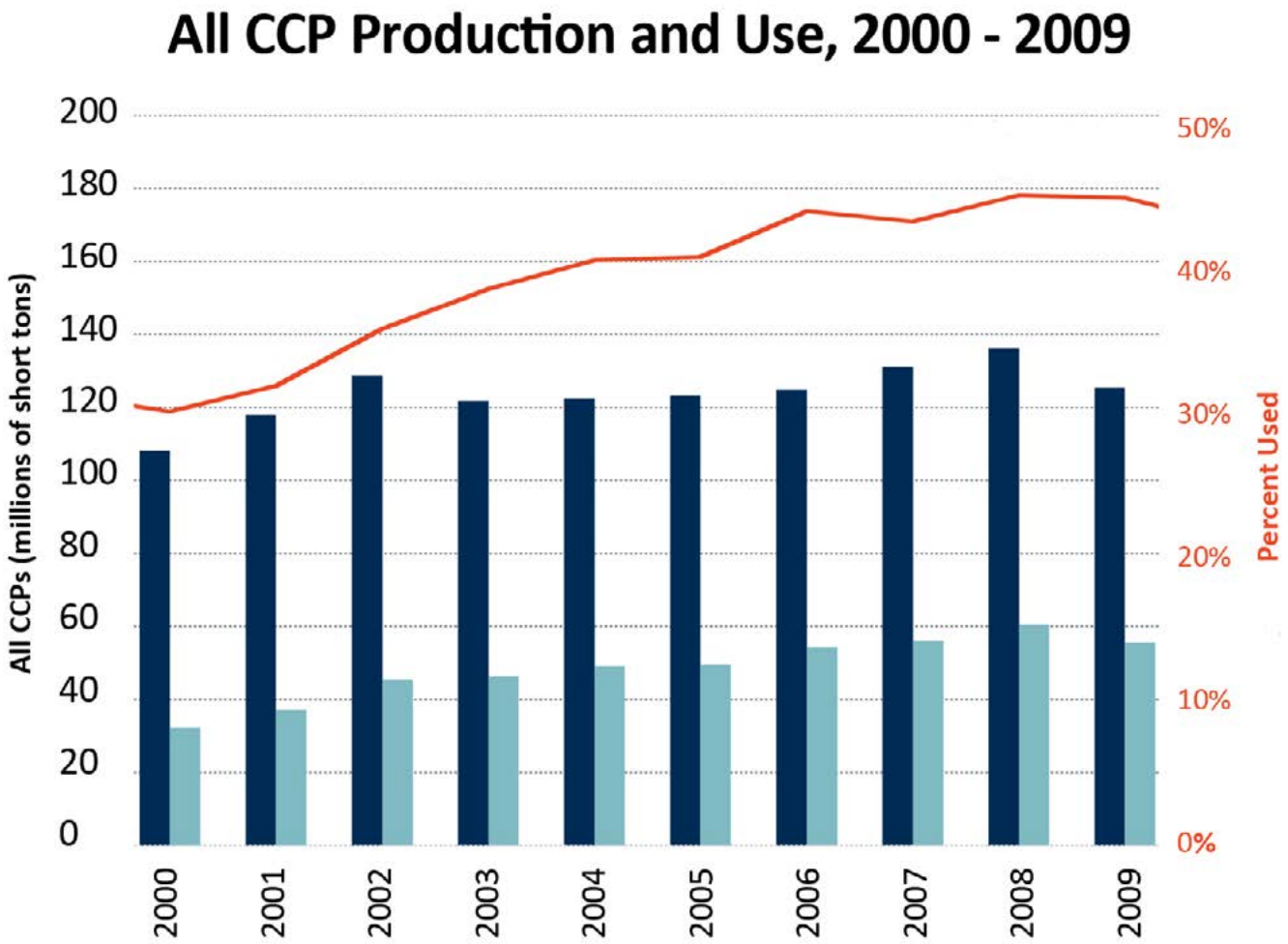
- Reduce adverse effects on air and land by increasing the use of coal combustion products from 32 percent in 2001 to 50 percent by 2011; and
- Increase the use of CCPs as a supplementary cementitious material (SCM) in concrete by 50 percent, from 12.4 million tons in 2001 to 18.6 million tons by 2011—thereby lowering greenhouse gas emissions from avoided cement manufacturing by approximately 5 million tons annually.[4]

The C2P2 program aimed to achieve these goals by working with C2P2 Partners, supporting research and technical assistance activities, and conducting outreach and education. Similar to EPA's WasteWise program, C2P2 promoted and recognized participants—businesses, states, and professional and industrial associations—for their voluntary efforts to increase the beneficial use of CCPs. In return, participants were eligible for awards recognizing their activities and achievements, such as documented increases in CCP use and success stories in CCP promotion and utilization.

A dedicated program of research and technical assistance was developed to support these activities, including:

- A C2P2 website with comprehensive information on the C2P2 program and a wide variety of resources;
- Case studies demonstrating how CCPs have successfully been used and identifying barriers to CCP utilization;
- A *Fly Ash Facts for Highway Engineers* booklet prepared in collaboration with the FHWA and ACAA;
- A *Using Coal Ash in Highway Construction* booklet outlining the benefits and impacts of using CCPs in highway applications;
- A Building Resources webpage providing guidance on the use of CCPs in building construction applications and the associated environmental effects and benefits;
- A construction initiative with DOE, FHWA, states, trade associations, and other parties to facilitate the beneficial use of industrial byproducts in large construction projects; and
- The Green Highways Initiative with FHWA and other stakeholders to help enhance stewardship and sustainability in transportation planning, design, construction, and maintenance.[5]





C2P2 Results

In the years that followed, beneficial use volumes and utilization rates both grew strongly for all major CCP categories. In 2001, 22 million tons of fly ash, or 32.32 percent of that produced, was beneficially used. By 2008, 30.1 million tons of fly ash, or 41.6 percent of that produced, was beneficially used. For bottom ash, 5.7 million tons, or 30.4 percent of that produced, was beneficially used in 2001. By 2008, 8.1 million tons, or 43.8 percent of that produced, was beneficially used. Finally, in 2001, 7.6 million tons of FGD gypsum, or 26.6 percent, was beneficially used. By 2008, 10.7 million tons, or 60 percent of that produced, was beneficially used.[6]

"Studies examining the effects of ingestion of fly ash constituents by animals have not suggested any associated health problems."

–Using Coal Ash in Highway Construction: A Guide to Benefits and Impacts (EPA, 2005)

Unfortunately for the CCP industry and those who rely on its products, in 2010 EPA abruptly canceled the C2P2 program. Concurrent with C2P2's cancellation, the agency initiated a new CCP disposal rulemaking that, yet again, left open the possibility that coal ash would be regulated under the hazardous waste provisions of Subtitle C of RCRA. EPA's action would leave the industry under a cloud of regulatory uncertainty for the four-plus years during which the agency worked on finalizing its disposal rule.

Overall CCP utilization rates would stagnate during this period. CCP beneficial use rates reached a five-year low in 2010, at 42.5 percent, before rebounding above 50 percent in the first full year (2015) following EPA's issuance of its final rule (which ultimately preserved coal ash's regulation under Subtitle D of RCRA), where it has remained ever since.[7]

Lessons Learned

Among the lessons to be learned from the C2P2 program are that public-private initiatives such as this that address legal, institutional, economic, market, informational, and other barriers to CCP utilization can be a very effective way to boost beneficial use rates. By contrast, when regulatory certainty over a material's status as non-hazardous is repeatedly removed, consumers are less likely to use it. State and local governments may prohibit the use of such materials; specifying agencies may opt for alternative materials; professional liability insurance may not be available for designers who include these materials in their projects; and finally venture capitalists may be reluctant to invest in businesses that market or use these materials.

Unfortunately, language contained in EPA's 2015 Coal Combustion Residuals final rule has set the stage for renewed regulatory uncertainty over how the agency will regulate coal ash. EPA created controversy over its definition of beneficial use in the final rule by requiring environmental evaluations of "unencapsulated" uses involving more than 12,400 tons in non-roadway applications that are in direct contact with the ground, as well as setting up inconsistent regulatory treatment of piles staged for beneficial use. After an abortive attempt to resolve these issues, EPA has removed the issue from its regulatory agenda and, almost a decade after the agency's issuance of its disposal rule, CCP beneficial use remains in an uncertain regulatory limbo.

John Simpson *is editor of ASH at Work.*

Endnotes

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The ACAA Champion Award—A Primer

By Thomas H. Adams, ACAA Executive Director

In pursuit of the ACAA mission to encourage the beneficial use of coal combustion products (CCP) in ways that are protective of the environment, technically sound, commercially competitive, and supportive of a more sustainable society, it takes many serious, committed leaders. Leaders are needed for different roles and reasons. These leaders can have special impacts at important points in time or they may make contributions over a long period of time.

ACAA has an award that is intended to recognize extraordinary contributions to the ACAA mission of encouraging the beneficial use of CCP. This award is entitled The ACAA Champion Award. The selection of a recipient is the sole prerogative of the Chair of the Board of Directors. There are no restrictions on selection. The recipient may be an organization or individual(s), living or dead, member or non-member. Established in 2012, the recipients have been recognized for leadership in regulatory affairs, ACAA stability, research, market development, and standards and specifications. The selection is not revealed in advance of the actual award at an ACAA Membership Meeting.

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

2022
Lawrence L. Sutter, Professor, Michigan Technological University, for research and leadership in specification and standards organizations to improve and advance CCP use.

2020
Charles E. Price, Founder, Charah Solutions, for innovation and market development for CCP beneficial uses.

2018
Bruce W. Ramme, Vice President, WEC Energies Group, for innovation and market development for CCP.

2017
Center for Applied Energy Research at the University of Kentucky, for research and education in CCP beneficial uses.

2015
USDA Agricultural Research Service, U.S. Department of Agriculture, for research in the use of FGD gypsum in agriculture.

2014
Former U.S. Representative David B. McKinley, for advocating for beneficial use in the U.S. House of Representatives.

2013
David C. Goss, retired ACAA Executive Director, for stabilizing and growing ACAA membership.

2012
John N. Ward, ACAA Government Relations Committee Chairman, for leadership in regulatory affairs.

Who will be the next recipient of an ACAA Champion Award? No one knows at this time. But the person(s) or organization will be joining a very distinguished roster!

ECOMATERIAL TECHNOLOGIES

Join us at our WOCA 2024 Reception and Pub Trivia Night!

(Below is your trivia cheat sheet; answers at bottom. Shhh...)

1. Which of the following companies are part of the roots of Eco Material Technologies?
- a. Headwaters Resources
- b. Boral Material Technologies
- c. ISG Resources
- d. Green Cement LLC
- e. JTM Industries
- f. U.S. Ash Company
- g. Pozzolanic International
- h. All of the above (and more!)

2. Which of the following products does Eco Material Technologies offer?
- a. Coal ash
- b. Pozzolanic cements
- c. Natural pozzolans
- d. Highly reactive refined pozzolans
- e. Synthetic gypsum for wallboard
- f. Synthetic gypsum for agriculture
- g. Ash beneficiation technologies
- h. All of the above

3. In how many states does Eco Material Technologies serve customers?
- a. 12
- b. 25
- c. 33
- d. 41

4. How many customers does Eco Material Technologies serve?
- a. Less than 1,000
- b. Between 1,000 and 2,500
- c. Between 2,500 and 4,000
- d. More than 4,000

Peerless product line. Unrivalled market reach. Nothing trivial about it.

Answers: 1(h) 2(h) 3(d) 4(d)

Don't forget to visit Eco Material at WOCA 2024 Booth #96/125

Beat the Heat This Summer

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

Image by Freepik

Climate models predict that extreme heat—periods of high humidity and temperatures above 90 degrees that last for three days consecutively or more—will become more frequent and intense as climate change continues. Extreme heat is responsible for the highest number of annual deaths among all weather-related hazards in the U.S. Preparation and knowledge can help you stay safe during such events.

Prepare for Extreme Heat

- Don't rely on a fan as your primary cooling device, as they do not reduce body temperature or prevent heat-related illnesses.
- Identify places in your community where you can go to get cool, if necessary, such as libraries and malls.
- Cover windows with curtains or shades and weather-strip doors and windows.
- Use a powered attic ventilator, or attic fan, to regulate heat levels by clearing out hot air.
- Install window air conditioners and insulate around them.

Be Safe During a Heat Event

- If air conditioning is not available in your home, go to a cooling center.
- Take cool showers or baths.
- Wear loose, lightweight, light-colored clothing.
- If you must be outside, wear a hat wide enough to protect your face.
- Drink plenty of fluids to stay hydrated.
- Avoid high-energy activities or work outdoors, particularly during midday heat, if possible.
- Check on family members and older adults and neighbors.
- Never leave people or pets in a closed car.
- If pets are outside, make sure they have plenty of cool water and access to shade.

Know How to Spot and Respond to Heat Illness

- Heat *stroke* is marked by extremely high body temperature, red/hot skin, lack of sweat, rapid/strong pulse, and dizziness, confusion, or unconsciousness. In such instances, cool down the afflicted person WITHOUT offering a drink and call 911 or get them to a hospital.
- Heat *cramps* are muscle pains/spasms in the stomach and/or arms/legs. Heat *exhaustion* is marked by heavy sweating, paleness, fatigue, weakness, headache, or nausea. In either case, remove excess clothing and move the afflicted person to a cooler location, have/administer a drink, and call a healthcare provider if symptoms persist.

These materials were adapted from ready.gov.

I'm Glad You Asked

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

This issue's guest columnist is Steve Michalanko. Steve is a Senior Ecologist with GEI Consultants Inc. specializing in ecological risk assessments and wetland ecology. Steve has over 23 years' experience evaluating ecological risks, conducting ecological investigations, and preparing ecological risk assessment reports at industrial sites throughout the United States. In addition to Steve's work as Senior Ecologist, he has over a decade of experience as Project Manager for National Pollutant Discharge Elimination System (NPDES)-related issues at industrial sites nationwide, including permitting, monitoring, plan development, and green stormwater treatment implementation.

Q. What is the difference between a risk assessment and a risk evaluation?

A. The world of environmental regulation can be a minefield of acronyms, confusing terms, and commonly misused phrases and definitions. As a risk assessment professional, a frustration I frequently hear from my clients pertains to seemingly interchangeable regulatory terminology. Two commonly misunderstood terms that we risk assessors routinely get asked about are risk assessment versus risk evaluation. To many, these two terms seem synonymous. "Assessment versus evaluation? Those are the same thing, right?" In actuality, these two terms represent different phases of the environmental investigation and remediation process. Understanding the key roles of both can be critical to efficient and effective management of environmental issues at coal ash sites.

First, let's explore these terms in a framework we may all be familiar with. You head out to your car to run an errand. Once in your car, you start the ignition and … nothing. No sound of an engine, no radio, just a series of loud "clicks." We all know that sound. The car is not starting, so we begin the diagnostic process. We inspect our fuel gauge to ensure we actually have gas, we check our lights and accessories, etc. We determine based on our "data" that we have a dead battery. We then have a choice. Do we just jump it and head on our way, running the risk of a recurrence at the store? Do we invest both time and money buying a new battery? Do we just walk back into the house and pretend like the whole thing did not just happen!

This common scenario basically is a simplistic example of the "risk assessment vs. risk evaluation" process. The assessment of "data"—or in this case, the review of the information the car is providing you (e.g., full gas gauge, no lights or accessories, rapid clicking) in order to make the determination that your battery is dead—is a real-world analogy for a risk assessment. What you choose to do about the risk you assessed (e.g., just jump it and hope it doesn't happen again, spend money to replace the battery, do nothing) is your all-important risk evaluation.

In short, an assessment is the use of collected observations and data to determine what your potential risks or problems are. Getting back to the environmental world, your data could be analytical in the form of soil, sediment, groundwater, or surface water data. As risk assessors, my colleagues and I can utilize state and federal guidelines for risk assessment to determine which constituents could potentially pose an unacceptable risk or hazard to human health or the environment. But that assessment does not tell the whole story. Springing into action to remediate all the assessed potential risks that are possible at a site is not only inefficient and often ineffective, it could also be costly.

Where the real magic happens in this process is in the art of evaluation. The evaluation process will consider how impactful concentrations of certain constituents may truly be and what will be the best methods to eliminate the potential threat to human health and the environment. Some constituents with data showing a potential risk may actually not be bioavailable, or not present in a state that would pose harm to the surrounding environment. Perhaps remediating a "slight" potential ecological issue may require the clear cutting of a mature growth forest, thus potentially causing more harm than good. If remediation is necessary in some form, how much should be undertaken? These are all issues whose answers are generated through the evaluation process.

Like the car battery example, some fixes are cheap and quick (i.e., just jumping the battery and hoping it doesn't happen again the next time you start your car at the store) and may represent the best solution for your site. Sometimes averting future risk, while more time consuming and costly (like investing the time and money to replace the battery), proves to be the better outcome in the long run. The bottom line is this: do not let your assessment solely dictate your outcome when it comes to making remedial decisions. Make sure you evaluate all the possibilities. Answer the "what ifs" that are generated throughout the assessment process. And if all else fails … call a risk assessor!

Question: Who Is Responsible???

Scenario: A breech in your containment system has been confirmed, resulting in contamination of an adjacent river.

Forensic Findings:

- Geosynthetics materials were installed with the incorrect sides up/down leading to friction failure.
- Failing moisture/density tests on the soil base were approved on a regular basis.
- Out-of-spec subgrade was approved for geosynthetics because an electric leak location survey was going to be performed. Note, regulator was present at time of approval.
- Thermal geomembrane seaming was regularly performed at elevated temperatures compromising the adjacent geomembrane quality. All seam destructive samples passed.
- Improper geosynthetics cover material placement procedures resulted in excessive entombed wrinkles and damages.

Question: What party is responsible for the breech, remediation and regulatory fines?

a. Design Engineer	f. General Contractor
b. Installer	g. CQA Firm
c. Certifying Engineer	h. Material Manufacturer
d. Third-Party Testing Laboratory	i. Regulator
e. All of the Above	j. None of the Above

Answer: j. None of the Above

Who, Then, Is Responsible?

Per government regulators: **"We're coming after the site owner.**

"We're coming after them no matter whose fault it is... Ultimately, we will fine and hold the site owner responsible. They can sue whomever they want."

These Forensic Findings come from a long list of issues we've found during our project audits, helping our clients fix the problems in real-time and avoid being a front-page headline.

"We're coming after the site owner."

— Government Regulator

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PLENARY SPEAKERS

Grant QUASHA

CEO of Eco Material Technologies

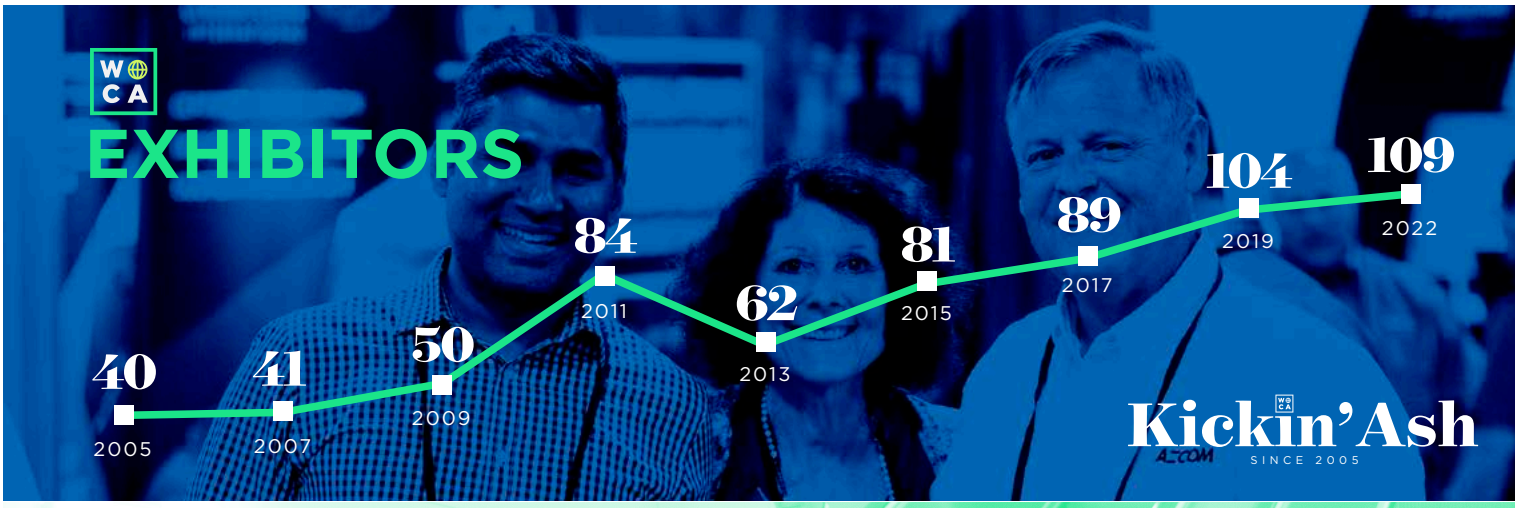
Grant Quasha is the Chairman and CEO of Eco Material Technologies which he founded in 2021 via the merger or Green Cement Inc. and Boral Resources. He is the former Chief Executive Officer for Green Cement. Prior to that, he built the largest wire rod steelmaker in the US for Liberty Steel and built and helped manage two US mining companies. He also worked for JP Morgan's Investment Bank in their Natural Resources Group. He received his B.A. from Harvard College, Cum Laude, and an MBA with Distinction from Harvard Business School.

Ed SULLIVAN

Senior Vice President and Chief Economist of Portland Cement Association

Edward Sullivan is Chief Economist and Senior Vice President of Market Intelligence for PCA. Ed has more than 30 years of industrial economic analysis in support of senior executives and has played an important role in several U.S. Government automotive trade policy decisions. In the past, Ed has held the position of Vice President at Chase Manhattan Bank Economics, Standard & Poor's, and Wharton Economics where he worked with Nobel Lauriat, Lawrence Klein. His background also includes positions as a senior intelligence officer at the Central Intelligence Agency, where he was awarded a commendation from Bob Gates (then Deputy Director of Intelligence and later Secretary of Defense). He was also an economist within the Office of Senator Edward M. Kennedy.
Ed has taught economics at St. Joseph's and Villanova Universities in Philadelphia, Fairfield University in Connecticut, as well as Columbia and Fordham Universities in New York City.

The World of Coal Ash 2024
GRAND RAPIDS, MI



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19	Barr Engineering Co
26	Braun Intertec
104	Burns & McDonnell
33	C.E.R.E.S Remediation Products
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23	Carrier Vibrating - CPEG
16	CBP Environmental
111	CETCO
103	Charah Solutions
41	Chase Corporation
1/2	Chesapeake Containment Solutions
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119	DustMaster
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11	Firmographs
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83	Forgen
62	GAI Consultants
82	Geo-Solutions
121	Geo-Synthetics System (GSI)
109	Geocomp Corporation
47/48	Geocycle
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110	Geosyntec Consultants
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37	Keystone Drill
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29	Lhoist NA
87	Marietta Silos
68	Mintek Resources
35	Montrose Environmental
115	Mustang Extreme
63	Phillips & Jordan
17	Pickett Industries
45	Plastatech
6	Profile Products
73/88	R.B. Jergens
79	Rain for Rent
122	Ramboll
44	Redox Tech, LLC
5	Saiia
34	Schenck Process
108	Schnabel Engineering
52	Scott Equipment Co.
92	SCS Engineers
71	Separation Technologies
75	Sequoia Services
118	Sevenson Environmental Services, Inc.
54	Solmax
57/58	Stantec
38	Sturtevant, Inc
39	SynTerra
27	Tarmac International, Inc.
114	TERRAMAC
91	Tetra Tech
46	The Mouat Company
66/95	The SEFA Group
101/102	TransAsh-Northstar
81	TRC
76	TRI Environmental
112	TTL, Inc.
7/8	TVA
9/10	UCC Environmental
18	Verdantas
93/94	Waste Connections
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Beneficial Use Case Study

Davis Wade Stadium Renovation

Coal Combustion Product Type
Class C Fly Ash

Project Name
Davis Wade Stadium Renovation

Project Location
Starkville, Mississippi

Project Participants
Holcim US, MMC Materials, MSU Construction and Materials Research Center, Roy Anderson Corp. Contractors, LPK Architects, Walter P. Moore, 360 Architecture

Project Completion Date
2014

Project Summary
Built in 1914, Mississippi State University's Davis Wade Stadium is the sixth-oldest Division 1 college football ground. To celebrate its centennial, the university in 2012 initiated a $75 million renovation and expansion involving the replacement of its north end zone bleachers, reconstruction of the west side main concourse, and the addition of new elevator towers, concessions, restrooms, and more than 6,000 seats. Home to the Construction and Materials Research Center (CMRC), the university's officials prioritized the center's involvement in the project to research and test an array of construction materials.

Project Description
As is often the case in stadium construction projects, concrete was to be the primary building material; in the end over 23,000 cubic yards would be used in the renovation. With sustainability, budget, performance, and durability all priorities, CMRC investigated the use of a number of potential concrete mixes incorporating high levels of supplementary cementitious materials (SCMs).

Coincidentally, the stadium renovation dovetailed with CMRC research investigating the substitution of ordinary portland cement (OPC) with portland limestone cement (PLC) with the objective of maximizing the SCM replacement rate. PLC offers environmental benefits over OPC stemming from its lower clinker content. SCMs, meanwhile, can yield both sustainability benefits—because many, such as fly ash, bottom ash, etc., are recycled products—and performance improvements resulting from their specific chemistries.

Holcim US, Separation Technologies LLC, Lehigh Cement Company (now part of Heidelberg Materials) and Headwaters Inc. (now part of Eco Material Technologies) all provided CMRC with cementitious materials as part of the research. In all, over 200 concrete mixtures, as well as hundreds of paste and mortar mixtures, were analyzed and tested. Ultimately, concrete mixes incorporating PLC and 50 percent SCM substitution—including 20 percent Class C fly ash—were incorporated into most concrete elements of the project. However, a smaller portion of the renovation that used OPC served as the basis for a comparative analysis.

Among the conclusions of the analysis were that: (1) without SCMs, PLC mixes were merely equivalent in strength performance to OPC mixes; (2) in combination with Class C fly ash, PLC concrete mixes exceeded all OPC performance; (3) setting times were shorter for all PLC mixtures, but especially with Class F fly ash (alone) and with Class C fly ash mixed with slag; and (4) SCM replacement levels above 50 percent that use Class C fly ash and slag may be possible that yield additional setting benefits while maintaining the same performance advantage.

The Davis Wade renovation has been widely lauded for its execution, including being named runner-up in the World of Concrete's Triad Award for innovation, sustainability, and leadership.

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Beneficial Use Case Study

London Power Tunnels

Coal Combustion Product Type
Fly Ash

Project Name
London Power Tunnels

Project Location
London, England

Project Participants
National Grid, Hochtief-Murphy Joint Venture, Wagners, AECOM, Mott MacDonald, WSP, Tarmac, Capital Concrete

Project Completion Date
2026

Project Summary
London Power Tunnels is a project to reinforce London's electricity transmission network by building over 60 km of deep-level tunnels carrying high-voltage cables. Phase two of the project involves constructing 20.2 miles of tunnels, 10 feet in diameter and up to 200 feet below street level, from Wimbledon to Crayford in southeast London. Part of the project involved infilling the base of the 180-foot-deep tunnel shaft at the Hurst Substation in South London—a job that National Grid chose to complete with cement-free concrete.

Project Description
In 2020, National Grid Electricity Transmission, which owns and maintains the high-voltage electricity transmission network in England and Wales, committed to achieving carbon-neutral construction emissions by 2026. "National Grid Infrastructure projects are responsible for half the UK's carbon emissions," the company wrote in its report *Our Route to Net Zero Emissions*. "Building new assets such as substations is a big part of our job. We therefore need to find ways to make our construction work less carbon intensive, which goes hand-in-hand with reducing costs for the business."

Capital Concrete had previously supplied "Earth Friendly Concrete" (EFC)—which substitutes ordinary portland cement with chemically activated fly ash and slag in a geopolymer binder—for use in other London-based projects where the material's low levels of embodied carbon, high tensile strength, and low shrinkage helped meet project requirements. After extensive trialing of the cement-free concrete at various other London Power Tunnels sites, the green light was given to use EFC in the infilling of the Hurst Substation tunnel shaft.

Appropriately, on April 22, 2023—Earth Day—a record EFC placement of 25,992 cubic feet was carried out over an 11-hour period. The concrete mix incorporated 55.2 metric tons of fly ash—sourced from Tarmac in Tudela, Spain—at a substitution rate of 25 percent. Use of the cement-free concrete reduced carbon emissions by an estimated 72 metric tons—or 64 percent—the equivalent emissions of driving a car around the world 18 times. In addition to the environmental advantages of the mix, the use of supplementary cementitious materials, particularly fly ash, helped reduce the heat of hydration associated with the placement.

Additional actions carried out to help achieve the project's environmental goals included diverting 99.98 percent of project waste from landfill—representing a 21 percent reduction against the carbon reduction pre-project baseline—for shafts, tunnels, and headhouses. This equated to a savings of 25,250 metric tons of CO2.

Photo courtesy of Capital Concrete

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Beneficial Use Case Study

Yusufeli Dam

Coal Combustion Product Type
Fly Ash

Project Name
Yusufeli Dam

Project Location
Artvin Province, Turkey

Project Participants
Limak Construction, ARQ Consulting Engineers, Su-Yapi Engineering and Consulting, General Directorate of State Hydraulic Works

Project Completion Date
2023

Project Summary
Yusufeli Dam is one of more than a dozen hydroelectric projects that are planned to be built in the Çoruh River District in northeastern Turkey. Part of the Turkish government's plan to replace imported gas and oil with domestic energy, the double-curvature concrete arch dam will store 2.2 billion cubic meters of water to power three 186-MW turbine units. After entering service at the end of 2023, it is now capable of producing 1,900 Gwh of electricity annually, or enough to meet the needs of 650,000 people.

Project Description
Situated in a steep and narrow gorge, Yusufeli Dam rises 275 meters from its foundation, making it the tallest dam in Turkey and the fifth-highest double-curvature arch dam in the world. With a crest length of 540 meters, a width at its base of 110 meters and at its top of 8 meters, the dam would eventually incorporate approximately 4 million cubic meters of concrete, presenting daunting thermal control challenges.

The dam was constructed as 29 individual cantilevered formwork-enclosed concrete blocks involving a total of 1,901 placement lifts each 3 meters in height. Blocks were then grouted together at the joints, but only after each concrete block had cooled to a pre-determined temperature to ensure the stability and air/water-tightness of the structure. Ensuring the structure's integrity while meeting the Turkish government's demands for a speedy construction schedule—initial plans called for placement of the concrete in a mere 26 months, meaning crews would have to place an average of approximately 150,000 cubic meters each month—required extensive thermal modeling and ongoing analysis during the dam's construction.

To help control the concrete's heat of hydration, engineers settled on a mix for the primary concrete (representing 80 percent of the dam concrete) containing 130 kg/m^3 CEM1 cement, 70 kg/m^3 fly ash, 110 liters/m^3 water, and 2,183 kg/m^3 aggregates with a maximum size of 120 mm—effectively a 35 percent fly ash substitution for cement. Cooling of the concrete post-placement was achieved using 19 mm-diameter steel cooling pipes in coils and required careful calibration to ensure that the concrete would not crack, while keeping the construction rate on the desired schedule. Use of fly ash is credited with helping keep the thermal stresses of the dam to a minimum during construction while allowing for the dam's completion in just 30 months.

After more than a decade of engineering and construction, followed by many months to fill the reservoir behind it, the dam is now running at full capacity.

Photo courtesy of Limak Group of Companies

- *Wet Ash Pond Closure Partnerships*
- *Amphibious CCR Excavation*
- *Landfill Construction, Operation & Closure*
- *Water Management and Dewatering*
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6 Questions for Benjamin Gallagher

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.

Benjamin Gallagher, P.E. is Program Leader at the Electric Power Research Institute (EPRI). Prior to joining EPRI, he worked as an engineer for over 10 years for Southern Company, where he directed and completed geotechnical engineering studies for clean air improvements, CCP storage, and new generation sites. Gallagher holds a bachelor's degree in civil engineering from the University of Toldeo, a master's degree in geotechnical and geoenvironmental engineering from the University of Missouri–Rolla, and an MBA from the University of Alabama at Birmingham.

ASH at Work (AW): You lead a research program on Coal Combustion Product (CCP) Management at EPRI. How did you become involved in CCP research?

Benjamin Gallagher (BG): After graduating from the University of Toledo, I worked as a geotechnical engineer at a consulting firm. We focused on delivering results on time and within budget, and that required solving problems using the tools and information at hand. I left consulting and moved to an electric utility just before the 2008 ash spill in Tennessee. The entire industry responded to that event, and my role rapidly shifted from power plant geotechnical engineering to CCP management. During that time, I worked on nearly every aspect of CCP management, from field to lab and design to construction.

My role in CCP management included support for new air emissions controls. Potential new CCPs, including spray dryer absorber materials, led me to work with the utility's research and development department. I found the chance to explore questions more deeply, and the opportunity to think beyond the present issue, to be a great fit. After serving as a utility advisor to EPRI for several years, I jumped at the opportunity to join the team full-time in 2019.

AW: How does this research area operate at EPRI?

BG: EPRI is an independent, non-profit research and development organization with a public benefit mission. We use a collaborative research model to bring together folks with many perspectives to push the frontier of innovation. My team seeks to stay abreast of the challenges in CCP management by listening to stakeholders inside and outside the energy industry. For example, we created a landfill user group to foster the exchange of experiences among utilities and other key stakeholders. The user group members recently collaborated to develop practical guidance for monitoring water flows at CCP landfills. Ultimately, we aim to deliver independent and objective research, including in the area of CCP management, to benefit society.

AW: What are some key challenges in CCP management today?

BG: Many surface impoundments and landfills are currently under closure. Effective post-closure care is one key challenge, since these closed units will require continued inspection and maintenance. A current EPRI collaboration with a researcher at the University of Central Florida aims to better understand the life cycle of closed CCP units and inform utilities and regulators regarding the performance of closed units. This research on post-closure care complements research led by my colleagues, Bruce Hensel and Lea Millet, that addresses groundwater monitoring and remediation.

Another challenge relates to beneficial use, where off-specification CCPs and mismatches between local production and demand still result in CCP disposal. In the past few years, we've completed research to understand the potential to use CCPs in applications like pavement. For example, our collaborator at Temple University demonstrated that replacing a portion of asphalt binder can limit cracking and extend pavement life. Furthermore, coal ash was shown to improve binder performance in second-life use, helping to promote pavement recycling.

AW: What challenges for CCP management do you see on the horizon?

BG: Harvesting CCPs from impoundments and landfills for beneficial use is the most significant future challenge. This challenge only increases as harvesting moves from easy-to-access, higher-quality CCP deposits to difficult-to-access, lower-quality CCP deposits. The power industry and ash marketing companies will need civil engineering tools to facilitate safe access to, and advanced technologies to economically process, off-specification CCPs. New beneficial use markets may also play a role in continued harvesting by providing avenues for materials not easily processed for current markets. Of course, safe, environmentally responsible harvesting is a prerequisite for these activities to continue.

EPRI is planning for the challenge of harvesting by growing the capacity of EPRI's lab in North Carolina and executing research on new beneficiation approaches. A current EPRI lab project aims to develop a low-cost approach to rapidly characterize CCPs in the field and thereby support efficient harvesting and

processing. A new collaborative research project aims to develop a new technology for separating commingled ash and sulfate/sulfite compounds. Currently, commingled fly ash and flue gas desulfurization gypsum don't meet specifications for beneficial use, and a new technology able to efficiently separate these materials would open more CCP deposits to harvesting.

AW: We're in the middle of the energy transition. How is this influencing CCPs and your research program?

BG: Many domestic utilities are shifting away from coal, including in their research activities. As adoption of new energy technologies brings new challenges, there is value in the experience developed through decades of CCP management research. The expertise in waste valorization derived from CCP beneficial use research directly transfers to new energy technologies and new energy wastes.

The CCP management research program is growing to include a broader range of byproducts associated with energy production. For example, I'm working with one utility on approaches to valorize solid byproducts from a proprietary hydrogen production technology. Successful valorization of the solid byproducts may drive the selection of this technology over competing technologies, much in the way the production of wallboard-grade gypsum influenced the favored approach for flue gas desulfurization.

Several EPRI colleagues are working on water treatment technologies such as desalination, and others are working with pyrolysis for waste wind turbine blades and utility poles. Desalination and pyrolysis technologies have the potential to create brines and solids with management and beneficial use challenges like those we experience with CCPs. When it comes to the challenge of CO2 management, mineralization and soil amendment processes also share common challenges with CCPs. Adapting the research program by adding new byproducts should help us maintain our expertise in CCP management for a longer time.

AW: When you are not working on CCP management issues, what do you enjoy in your leisure time?

BG: I've always enjoyed outdoor activities like cycling and hiking. My favorite hike is along the Pictured Rocks National Lakeshore in Michigan's Upper Peninsula. Three years ago, my wife, Sarah, finally convinced me to try downhill skiing, and I fell in love with it.

I've also been contributing to a citizen science project called CoCoRAHS, which gathers daily rainfall data from volunteers across the U.S. The National Weather Service uses CoCoRAHS data to optimize its radar-based rain estimates. This weather observation appeals to me because I can combine it with electronic tinkering. I'm currently testing a low-cost optical rain gauge using an Arduino-based data logger.

AW: Thank you for taking the time to talk with *ASH at Work*.

Charah Solutions: 35+ Years of Powerful Services and Sustainable Solutions

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

Established in 1987 and headquartered in Louisville, Kentucky, Charah Solutions is a leading provider of environmental services and byproduct recycling to the power generation industry. With over 35 years of experience, we assist utilities and independent power producers with all aspects of sustainably managing and recycling ash byproducts, solving their most complex environmental challenges and mission-critical needs. We design and implement proven solutions for ash pond management and closure, landfill construction, structural fill projects, decommissioned power plant remediation, and site redevelopment.

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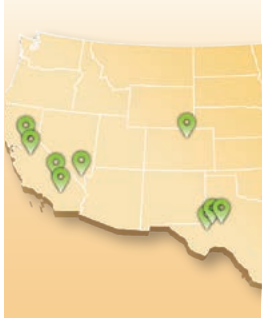
Charah Solutions is committed to developing innovative and sustainable solutions for the betterment of the planet, our customers, and the communities in which we operate. For more information, contact sales@charah.com, call 1-877-314-7724, or visit www.charah.com.



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The SEFA Group: Customized Solutions to Recycle Coal Ash

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

SEFA truck leaving STAR beneficiation facility in Goldsboro, N.C. Photo: ©2023 Benton Henry.

The SEFA Group serves utility companies and concrete producers in maximizing the beneficial use of fly ash. SEFA was acquired by Heidelberg Materials on May 2, 2023, and is now part of one of the world's largest integrated manufacturers of building materials and solutions, with leading market positions in cement, cementitious materials (slag and fly ash), aggregates, and ready-mixed concrete. SEFA's capabilities have grown exponentially with Heidelberg Materials' infrastructure and logistics network.

Providing technical expertise to concrete producers for more than four decades, SEFA has recycled over 30 million tons of fly ash. Over the past 25 years, the company expanded and diversified to offer a variety of services to meet the demand for specification-grade material and added transportation and industrial construction services to support its customers.

SEFA is an integral part of some of the country's most successful coal ash recycling programs. The company has remained at the forefront of coal ash recycling since 1999, with the longest record in the U.S. for thermal beneficiation that improves the quality of coal combustion products for recycled use in concrete construction. In 2015, SEFA became the first company to use thermal beneficiation to process harvested ash from legacy coal ash ponds, transforming coal ash into a consistent high-quality ash for recycled

use that meets or exceeds industry specifications. SEFA is now reclaiming over 1.5 million harvested tons annually and offers customized solutions to recycle coal ash.

The company's technologies, strategies, and techniques to beneficiate coal ash are continually advancing to increase recycling. SEFA's proprietary STAR Technology is one tool in their toolbox, but in some situations, harvested ash may not require thermal treatment. Because each coal ash impoundment, landfill, and surrounding market area is unique, SEFA works closely with each utility partner and offers tailored solutions to optimize a beneficiation solution. Every harvesting application requires some combination of screening, drying, classifying, grinding, and carbon treatment for beneficiation to meet their specific needs and convert the raw feed material into a consistent and high-quality specification-grade material for concrete applications.

SEFA Transportation services help set the company apart, delivering fly ash and other bulk materials for customers. The company's fleet consists largely of pneumatic tankers to provide environmentally responsible transport services for customers.

The company's industrial construction services include mechanical, electrical, instrumentation, and fabrication services for utility, manufacturing, and industrial customers.

The safety of employees, customers, communities, and the environment is the highest priority at SEFA. In addition to safety and environmental training appropriate for employees' roles and responsibilities, SEFA promotes safety through targeted safety programs. The company recognizes and rewards employees for their safe behaviors at work through a peer-recognition safety program.

SEFA History

SEFA has operated and maintained facilities using a variety of beneficiation technologies and has the longest track record in the U.S. for beneficiation. SEFA was also the first company processing harvested ash on a commercial scale.

1999
Wateree CBO Plant
SCE&G built and owned the first Carbon Burn-Out (CBO) plant. SEFA operated and marketed the ash from this facility.

2002 - 2014
Winyah CBO Plant
SEFA built and owned a CBO plant at Santee Cooper's Winyah Station in Georgetown, SC.

2008
McMeekin STAR Plant
SEFA recognized the need for a technology that offered more flexibility and commercialized its own patented STAR Technology.

2012
Morgantown STAR Plant
Next generation STAR facility was built at GenOn Morgantown Generating Station in Newburg, MD.

2015
Winyah STAR Plant
SEFA replaced the CBO process island with a STAR facility capable of processing production ash and reclaimed material.

2020/2021
NC STAR Facilities
Operations began at 3 STAR Plants in NC. SEFA served as Owner's Engineer, OEM, and fabricator of custom components.

2023
Heidelberg Materials Acquires SEFA
Heidelberg Materials announced on May 2, 2023, that it completed the purchase of The SEFA Group.

Heidelberg Materials

ASHCOR™

Ashcor: RAM™ Technology Powers Solutions for Fly Ash Challenges

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

Established as a fly ash marketing company in 1998, Ashcor is now the largest independent marketer of coal ash in Western Canada and has developed a leading-edge technology to beneficiate ponded and landfilled coal ash. Ashcor is a subsidiary of ATCO Ltd., a diversified $24 billion global corporation delivering essential services throughout many different industries, including energy and modular structures. Ashcor is actively expanding its coal ash beneficiation footprint in the United States.

To address regional fly ash shortages due to declining coal-fired generation, Ashcor engineered a patent-pending ash beneficiation solution known as RAM™ (Reclaimed Ash Management). RAM technology utilizes a thermo-mechanical process to transform impounded coal ash, often a mixture of fly ash and bottom ash, into a marketable supplementary cementitious material (SCM) without producing an ash waste stream. Ashcor's innovative solution not only adds a supply of high-quality SCM, but also offers significant environmental benefits by removing ash from impoundments through beneficial use, minimizing long-term environmental risks and costs.

RAM is scalable and can be designed to address a wide range of ash deposit sizes. Recognizing the unique needs of utilities and the varying characteristics of coal ash impoundments, Ashcor identified a niche opportunity to develop a smaller, more rapidly deployable mobile version of RAM design. Ideal for smaller ash deposits, mobile RAM technology is engineered to produce smaller volumes of beneficiated ash annually and can easily be moved from one site to another upon completion of the beneficiation project.

Ashcor's RAM ash stands out as the first of its kind CSA A3001 and ASTM C618 compliant SCM, produced from harvested coal ash containing commingled fly ash and bottom ash. Unlike traditional fly ash, which is generated at coal-fired power plants with limited control over product characteristics, RAM ash is a manufactured product. The RAM process includes grinding and classification steps to maintain a uniform particle size distribution in the product, while preserving the spherical fly ash shape to optimize product performance. A series of quality assurance and quality control processes are performed to confirm product consistency. RAM ash provides exceptional performance in mitigating alkali-silica reaction and in resisting sulfate expansions in concrete. Current customers of RAM ash include ready-mix concrete producers and oil-well cementing companies.

"RAM technology is a proven example of an innovative approach to solving two significant challenges—cleaning up CCR impoundments and replacing traditional live fly ash that is in short supply as many coal-burning power plants are decommissioned or converted to natural gas. The benefits to Ashcor's pioneering RAM technology are many, as impacted communities desire to have CCR impoundments remediated," noted Ashcor President, John Tiberi. "At the same time, ready-mix concrete producers, concrete product manufacturers, and oil and gas well cementing companies all need a high-quality, technically manufactured ash product that they can rely on for many years to come," he added.

ASH Allies: UK Quality Ash Association

The UK Quality Ash Association (UKQAA) was founded in 1997 with a remit to promote and develop markets for coal-derived fly ash (CDFA). A key motivation at the time was the fact that the UK government had just introduced a landfill tax and the supply of CDFA was significantly in excess of demand.

With all coal-fired power production projected to cease by the end of 2024, the focus is now very much based on seeking new sources of supply, as well as maintaining market confidence that there is still a future for this highly versatile and unique product.

While imports can provide a short-term solution, the UKQAA has been successfully working with the UK government to safeguard existing stockpiles of CDFA, which are estimated to be in excess of 100 million metric tons. The need to safeguard legacy stockpiles of CDFA is now referred to in the latest publication of the *National Planning Policy Framework*.

The UKQAA, in parallel with LKAB and Master Builders, has been sponsoring a Ph.D. project at Dundee University to understand better the chemical and physical characteristics of CDFA, some of which has been stored in the ground for over three decades. The preliminary findings from Dundee have then led to collaboration between two UKQAA members—STET and Atritor—to combine their processing expertise to create a product that complies with both U.S. and European standards for use in cementitious applications.

In June 2023, STET brought its pilot plant over to the UK to sit alongside the Atritor pilot plant located at Atritor's main manufacturing facilities in Coventry. The pilot plants were able to successfully de-agglomerate and remove carbon from a number of CDFA stockpiles sourced in the UK and to meet the physical and chemical requirements of EN450 A/N, EN450 B/N, and ASTM C618 standards for use in cement and concrete.

At the time of writing, it is understood that a number of feasibility studies are currently in advanced stages of discussions, and it is hoped that official announcements should be forthcoming in the next 6 to 12 months regarding these critical investment projects, which will bring additional capacity to the market.

UKQAA membership is open to anyone involved in the UK supply chain for CDFA, including producers, importers, technology companies, materials handlers, logistics providers, ash marketers, and end users across cementitious and non-cementitious applications.

The UKQAA plays an active role in support of similar associations, such as the American Coal Ash Association (ACAA) and the World Wide Coal Combustion Products Network (WWCCPN), and feeds into the activity of the wider European Coal Combustion Products Association (ECOBA) in developing standards, regulations, and best practices.

ASH Classics

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

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

In 1980, Congress amended the Resource Conservation and Recovery Act to temporarily exclude CCPs from regulation as hazardous waste until further assessment had been carried out. It would be 1988 before EPA would issue its follow-up report to Congress recommending that coal ash not be regulated as hazardous waste—a period during which the agency would hold repeated hearings seeking public input on the issue. This ASH Classic, from 1985, reports on federal officials, at the ACAA-sponsored 7th International Ash Utilization Symposium, airing their support for CCPs' continuing regulation as non-hazardous mineral resources.

ASH AT WORK

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American Coal Ash Association Adopted; NAA Identity Dropped

Weber Is New CEO, Pheonix Is Symbol

WASHINGTON — The nation's leading advocate for the complete utilization of power plant ash has initiated a program to rebuild itself from within under a new name, a new leader, and a unique new symbol.

The industry's trade association is now operating under the banner of the AMERICAN COAL ASH ASSOCIATION. Its new identity was adopted at the organization's annual meeting in Orlando and replaces the well-known connotation, the National Ash Association, which had been in use since the establishment of the body in 1968.

Chairman Weber

At the same time a new symbol — a Phoenix — was selected which brings the ancient Egyptian legend into modern reality. It is designed to signify a new beginning for the agency and the wings to carry ACAA into the 21st century.

Jack Weber of Glastonbury, Connecticut, is the new chairman of the board succeeding outgoing chairman James P. Plumb of Houston (TX) Lighting and Power Company. He is the first non-utility executive to head the Association since its inception. Weber's company, Weber-McNeil Material Sales, is a coal ash marketing organization.

Alan A. Hill, Chairman of President Reagan's Council on Environmental Quality, termed the Phoenix "as an appropriate symbol" in keynote remarks at the Seventh International Ash Utilization Symposium at Orlando in March. He noted "its legendary strength and versatility, its power to overcome adversity and create for itself a position of high respect and to rebuild itself from itself. All of these characteristics are evident in your industry and coal ash as one of our country's most important resources."

ACAA's Phoenix

brings ancient Egyptian legend into modern reality. ACAA's Phoenix, rising from its own building blocks, provides a 21st century beacon of silver light on coal ash use for the rebuilding of our cities and roads, our farms and industry.

ACAA's Phoenix

a unique symbol for a unique new beginning: complete utilization of one of our most important resources:

Coal Ash

Other ACAA officers for the current fiscal year are incumbents Tobias Anthony, president; Allan W. Babcock, secretary; and John J. Gillis, treasurer. Members of the Executive Committee include Gerald Bowdren, Public Service Gas & Electric Co.; Gary Courts, Virginia Power Co.; John R. Dorsett, Texas Utilities Generating Co.; Ronald E. Morrison, American Electric Power Service Corp.; David W. Parks, Baltimore Gas & Electric Co.; Mr. Plumb, Houston Lighting & Power Co.; Paul Reinhardt, Wisconsin Public Service Co.; Charles Tackett, Pennsylvania Power & Light Co.; Richard Waite, Utah Power & Light Co.; Joseph Mullan, National Coal Association; Craig Cain, American Fly Ash Co.; Barton A. Thomas, JTM Industries, Inc., and Mr. Weber.

In a recent appearance before the North Carolina Coal Institute's Summer Trade Seminar at Myrtle Beach, President Anthony set the tone of the ACAA's new resolve. He told the delegates, "we can utilize ash in an environmentally sound manner while providing a benefit to the public and we have a national commitment to the ever increasing use of these versatile resources to conserve energy to substitute for natural minerals which must be gouged out of hillsides. And, thirdly, we will provide instructions for this material's proper use.

ADOT Approves Ash In Road Structures

PHOENIX, AZ — The Arizona Department of Transportation has approved the use of fly ash as a substitute for Portland cement in concrete for overpasses and other structural applications, according to a news article appearing in the July issue of *Highway & Heavy Construction.*

The ADOT had studied and researched the use of ash for about 10 years. It was first approved as an option in pavement construction; three years ago it was also added as an acceptable material for use in LCB - lean concrete base. The first optional use came on a section of I-10 through Tuscon on a freeway east of here.

In approving the use of fly ash, the ADOT looked at four major factors:

1. Environmental - Its use decreased the need for producers to dispose of the material;
2. Conservation - The use of fly ash conserves Portland cement;
3. Economy - Fly ash can save money for the contractor, the owner, and the taxpayers;
4. Performance - In tests, conducted in the laboratory and in the field by the ADOT and others, the performance of fly ash improved workability, sulfate resistance, and resulted in higher ultimate strength.

The article further stated — "Fly ash can play an important role in the quest for premium pavement."

And, now under the new Environmental Protection Agency guidelines, the law also requires government procurement agencies to permit the optional use of fly ash.

One of the prime Arizona highway contractors, Ball, Ball & Broasmer, used about 259,000 tons of fly ash on a section of I-10. One the firm's mixes for mainline uses 513 lb. of Portland cement and 74 lb. of fly ash — a substitution of about 12.6 percent.

Engineers on the I-10 project incorporated the use of fly ash in both the LCB and the PCCP as a part of the premium pavement concept.

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ASH AT WORK

Jack Weber, *Chairman of the Board*
Allan W. Babcock, *Editor*

Published quarterly by the American Coal Ash Association, 1819 H Street, NW, Washington, DC 20006, for its members, their friends and supporters.

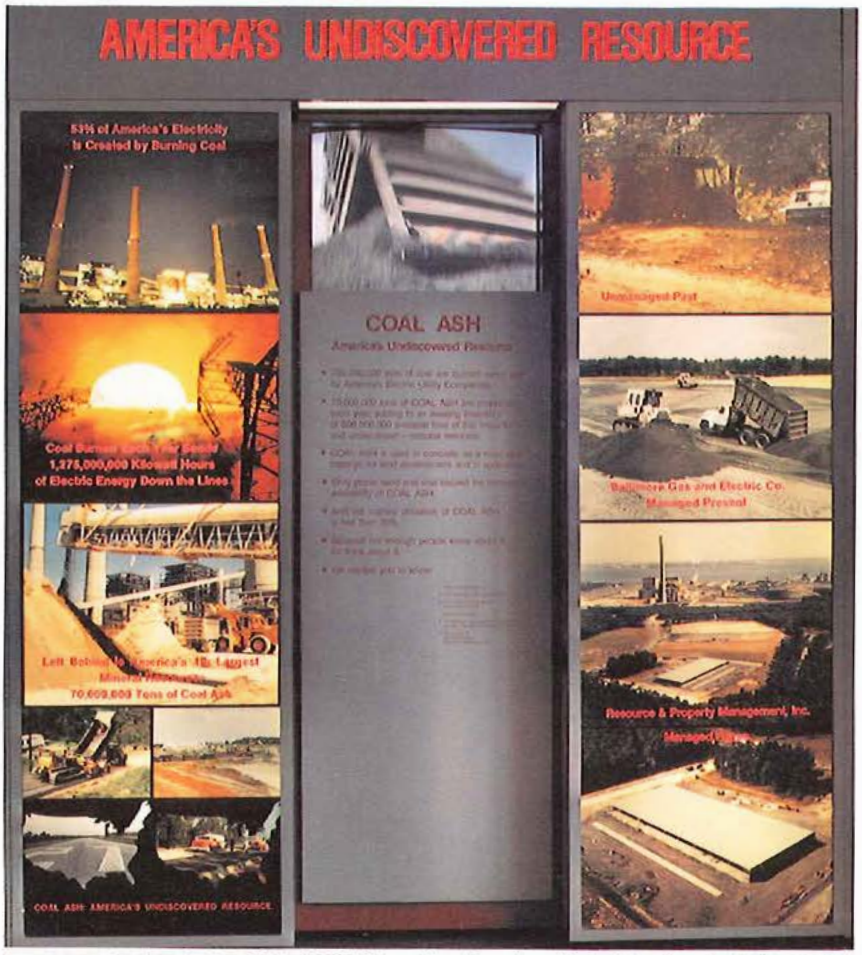

EXHIBIT AVAILABLE FOR SHOWS — The American Coal Ash Association's exhibit shown above and entitled "America's Undiscovered Resource," is available for use at trade shows and exhibit. Contact the ACAA Washington office for further details.

Bergman is New President of Allegheny Power System

NEW YORK — Klaus Berman has been selected president and chief executive officer of Allegheny Power System, Inc. and Allegheny Power Service Corporation. The appointment was effective April 1, 1985.

In his new positions, Mr. Berman succeeds Charles B. Finch who continues as Chairman of the Board of the two corporations. Mr. Finch reached normal retirement date in March.

While assistant general counsel for American Electric Power Service Corporation Bergman played an active role in the formation of the National Ash Association in 1967 and 1968. He later served as the NAA's first secretary.

ACAA /NAA

CANDID PHOTOS

7th International Ash Utilization Symposium

Pictures by Bruce C. Bennett
Towers Photo, Orlando, FL

(Editor's note: Two high ranking members of Reagan Administration addressed the more than 400 delegates attending the Seventh International Ash Utilization Symposium held in Orlando, Florida. A resume of their remarks follows:)

ORLANDO, FL — President Reagan's top Environmental Quality Control Official, Alan A. Hill, told the conference participants "the Federal government is solidly behind recognition of coal ash as an important national resource and will continue to encourage its increased use as part of the promotion of a balanced energy resource system in the United States."

Chairman of President's Council on Environmental Quality. Hill said maximum utilization of coal ash "currently meets the Federal government's objective of recycling valuable resources.

"The American Coal Ash Association's influence in the recent issuance of guidelines mandating the use of coal ash in all federally-sponsored concrete products should have a significant impact on ash utilization in the future," he added.

Jack S. Segal, Deputy Director of Department of Energy's Office of Fossil Energy, projected coal ash production at 170 million tons a year by the year 2,000. This compares with 1984 ash production of 70 million tons.

In his remarks, Segal said, "the coal-fired utility industry is on sound environmental footing when it comes to the issue of solid waste disposal." The ash by-product from coal combustion, viewed as a mineral asset, "falls comfortably below EPA's toxicity standards for waste," Segal said. "The trace metal concentrations in coal ash fall below 10% of the allowable limits and we think this is clear evidence that coal is non-hazardous and should be treated as such in future regulations."

Segal added "a step was taken in the right direction a year ago when the EPA issued guidelines for the purchase of cement and concrete containing coal ash for all Federal or federally funded projects."

Commenting on ACAA's efforts to increase ash utilization, DOE's Segal said, "from where I sit I can say without hesitation that yours is an effort that makes good sense for business, good sense for our economy, good sense for our environment, and good sense for our nation."

Gulf States Uses Ash To Control Erosion On Coal Storage

WESTLAKE, LA — Fly ash is being utilized by Gulf States Utilities Co. to control wind and rain erosion on inactive coal storage pile banks at its Nelson Station near here.

The high calcium fly ash, applied to a depth of 2-3 inches and dampened forms a crust of sufficient strength to support a person's weight, has proven to be an excellent method of erosion control.

Fuel Handling Supervisor D.E. Simmons explained that the main problem was the loss of thousands of dollars each year in coal and additional coal pile maintenance due to frequent and heavy rains in this Gulfcoast community which has an average rainfall of 56 inches.

"There is a definite rainy season in the winter months and the long summer brings heavy tropical type downpours often accompanied by high winds," he added.

Simmons noted the water flowing through the compacted coal has a tendency to wash away the fine particles of coal leaving the remaining coal susceptible to oxygen infiltration and spontaneous combustion as the coal fines act as a sealing medium.

Initial efforts to return the eroded coal to the stockpile also proved to be a costly experience for Gulf States. The original material was transported to the pile via conveyor belt. From the stackout point, the coal was placed in storage by large rubber-tired scrapers and dozers. Because the storage pile had been built on unstabilized soil, the continual wet weather resulted in extremely poor traction on the perimeter of the pile. The rubber tired tractors were unable to move the fines up the coal pile slope with an incline of 15° forcing the utility to use an outside contractor with a track-type vehicle at a cost of approximately $2,500 per day.

The fuel handling supervisor noted that after one rainy season of continual contract work and its expense, we decided to try a chemical binder on the slopes. The application was not a total success, but the binder did form a ¼- to ½-inch crust over the upper portion of the slope which survived light to moderate rains only to breakdown under repeated heavy downpours.

The utility has since puchased their own tracked vehicle and altered the incline of the outslope to about 30°. The move also reduced the amount of the slope exposed to direct rainfall drastically reducing the bank erosion.

Nelson Station is utilizing subbituminous coal from the Power River Basin in Wyoming. The resultant ash has a calcium oxide content of 17 to 34 percent.

The ash used in the treatment process is transported from the aerated storage silo to the coal pile by pneumatic tanker. The truck is also used to apply the ash to the outslopes.

Simmons suggests the following procedures be followed to ensure success:

- Pneumatic truck discharge should not be higher than 4 psig. Higher pressures generate fugitive dust and poses a safety hazard to operators.
- Coal pile slope should not exceed 30-35 degrees. A steeper slope causes much of the ash to flow to the bottom.
- Slopes must be dampened with water. This helps reduce the free-flowing characteristic of the aerated ash. Repeated dampening of the ash between applications is also necessary to impede flow and to react with the calcium oxide to produce a hardened crust.
- Optimum ash depth is about three inches, though experience may show that greater thickness if helpful to increase durability and strength.
- Slopes must have a concistent grade. Longitudinal rides in excess of 2 inches eventually lead to crust failure.

The spokesman related the technique had been borrowed from procedures generally followed and employed by Basin Electric at its Laramie River Project and by Public Service of Oklahoma at its Northwestern Station.

The utility has now successfully applied ash over approximately 175,000 square feet of inactive coal pile slopes.

Aerated Storage Silo

Pneumatic Truck Discharge

Fly Ash Application

Slope Identification

Treated Coal Pile

Utility Coal Consumption To Increase During 1985

WASHINGTON — Coal consumption will be on the rise in 1985 because of higher demand from electric utilities, according to a report from the U.S.Department of Commerce.

Electric utilities, which consume about three-quarters of the nation's coal production, are expected to increase their use of coal to 677 million tons this year. This figure would represent about 54 percent of anticipated coal sales.

The growth rate in the electricity sector was put at 2.5 percent.

In and Around ACAA

Las Vegas, Nevada

(L-R): James Carusone, Vice President, West Region, at Eco Material Technologies, and ACAA Executive Director Thomas Adams at World of Concrete.

San Antonio, Texas

(L-R): Jimmy Lambert, Vice President, Central Region, Eco Material Technologies, and John Bauer, Plant Manager, Rainbow Energy Center, detail the companies' joint investment in new beneficiation and harvesting plants at the Coal Creek Station.

San Antonio, Texas

Dr. Maria Juenger, Professor of Engineering, University of Texas at Austin, discusses reactivity tests for supplementary cementitious materials at the ACAA Winter Meeting.

San Antonio, Texas

Michael Nasi, Partner, Jackson Walker LLP, addresses ACAA Winter Meeting attendees on issues pertaining to ERCOT and the Texas grid.

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Blending


Beneficiation

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Welcome, New ACAA Members!

Atlantic Coast Consulting Inc. is a comprehensive solid waste consulting firm based in the southeast, with offices in Georgia and Tennessee. ACC offers consulting services for CCR management, emphasizing design, construction quality assurance (CQA), engineering, and groundwater monitoring of CCR facilities. ACC provides personalized service from experienced professionals, including engineers and geologists with expertise spanning various CCR projects and civil engineering initiatives for environmental compliance. ACC's strong presence and relationships with regulatory agencies expedite services, ensuring quality solutions. For more information, please visit www.atlcc.net.

Braun Intertec is a premier employee-owned engineering, environmental consulting, and testing firm with more than 1,000 employees located in 35 offices across Arkansas, Colorado, Iowa, Illinois, Kansas, Minnesota, Montana, North Dakota, South Dakota, Texas and Wisconsin. Based in Minneapolis, Braun Intertec also owns Edwards-Pitman Environmental, a Division of Braun Intertec, based in Atlanta, Georgia, with offices in Georgia and South Carolina. For more information, please visit www.braunintertec.com.

Clear Water Services, headquartered in Everett, Washington, was established in 1998 to provide innovative construction and industrial stormwater, groundwater, and process water treatment solutions custom-designed for each client's unique goals, challenges, and mission. Our water treatment experts gather pertinent water quality information and develop a best-fit comprehensive treatment approach focused on balancing project economics and effectiveness. For more information, please visit www.clearwaterservices.com.

TTL Inc., headquartered in Tuscaloosa, Alabama, is a multidisciplinary consulting engineering firm that provides services from civil, environmental, and geotechnical engineering to construction quality assurance services regarding CCP. Services have been provided for power generation to beneficial reuse facilities to impoundments and enclosures. The firm is dedicated to pursuing opportunities to provide engineering services related to CCP. For more information, please visit www.ttlusa.com.

SAVE THE DATE!

ACAA 2024 Fall Meeting
October 22-23

Lexington Hilton, Lexington, Kentucky

Photo by Brett Hait, courtesy to VisitLEX

ACAA
AMERICAN COAL ASH ASSOCIATION

News Roundup

ACAA Director Elections

Three members of the American Coal Ash Association Board of Directors were elected February 6, 2024, during the association's Winter Meeting in San Antonio, Texas. Two utility representatives and one marketer representative were elected to serve for the 2024-2027 term. The directors include John Bauer, Plant Manager of Coal Creek Station, Rainbow Energy Center; Vicky Payne, Manager of Fuels Procurement, Big Rivers Electric Corporation; and Dale Diulus, P.E., Senior Vice President for Pozzolan, Salt River Materials Group.

Ohio EPA Comments

The American Coal Ash Association on March 22, 2024, submitted comments to Ohio EPA's Division of Materials and Waste Management as part of early stakeholder outreach designed to influence the state's upcoming rulemaking for coal combustion residuals disposal. The Ohio division called the outreach phase "an opportunity to shape the direction of rules."

In the 10-page comment letter, ACAA Executive Director Thomas Adams touted the benefits of viewing coal combustion products "as a valuable mineral resource, rather than a waste." He told regulators the beneficial use of CCP "conserves national resources, saves energy, and reduces greenhouse gas emissions," adding that both federal and state environmental agencies have repeatedly determined CCP beneficial use is "exempt from regulation and should be encouraged."

ACAA's comments cautioned against new regulations affecting beneficial use: "Any movement toward placing unjustified restrictions or cumbersome reporting requirements on CCP beneficial use will only serve to erect barriers that reduce or eliminate the substantial environmental benefits achieved by utilizing a valuable resource rather than placing it in landfills." The letter also urged that development of regulations for CCR disposal should include "flexibility that encourages harvesting of previously disposed CCPs for beneficial use."

Ohio EPA will offer additional opportunities to comment on specific rule language later in the process.

FBC ash, commonly used in mine reclamation—as shown above in Pennsylvania—may be considered for use in concrete.

FBC Ash Webinar

In the United States today, demand for supplementary cementitious materials such as coal ash, slag cement, natural pozzolans, and others is very strong and, in some regions, running ahead of supply. For the last several years, approximately 10 to 15 million tons of fluidized bed combustion (FBC) ash has been produced from coal-fueled power plants using fluidized bed technology. This ash has been used primarily for mining applications and waste stabilization.

While some limited use in concrete and portland cement production has been reported, under current specifications from AASHTO and ASTM, FBC ash is not permitted for use in concrete mixtures. The primary concern over using FBC ash in concrete is the potential for excessive expansion.

Recently, however, there has been increased interest in investigating FBC use in concrete mixtures. On March 12, ACAA hosted a webinar on FBC ash use in concrete mixtures. Dr. Farshad Rajabipour, Professor of Civil and Environmental Engineering at Penn State University, presented research on this topic and discussed research that is needed to advance consideration of changing specifications to allow for the use of the material.

NARUC Webinars

The National Association of Regulatory Utility Commissioners (NARUC) conducted a pair of webinars on current issues in the beneficial use of coal ash and related technologies in coal-fueled generation of electricity.

- Panelists on a January 18, 2024, webinar included Danny Gray, Executive Vice President of Strategy and Business Development, Eco Material Technologies; Bill Goodloe, Director of Technical Services, Cemex; and Bill Easter, CEO, Semplastics. Presentation slides and a recording of the webinar are available on NARUC's YouTube channel.

- Panelists on a February 15, 2024, webinar included American Coal Ash Association Executive Director Thomas Adams, Tom Sarkus of the National Energy Technology Laboratory, and Kara Fornstrom of the University of Wyoming. A recording of the webinar is available on NARUC's YouTube channel. Additional resources from NARUC's Subcommittee on Clean Coal and Carbon Management can also be found on NARUC's website.

Fly ash concrete could receive a boost under a federal program designed to encourage use of climate-friendly construction materials.

EPA Enforcement Alert

U.S. Environmental Protection Agency published an enforcement alert under its National Enforcement and Compliance Initiative alleging "widespread noncompliance" with coal combustion residuals regulatory requirements, such as groundwater monitoring, corrective action implementation, and disposal unit closure.

In its December 2023 alert, the agency claimed to have detected noncompliance related to closure and groundwater remediation pertaining to:

- Closure by removal of all coal ash
- Closure with coal ash remaining in the unit
- Groundwater monitoring efforts
- Remedy selection

EPA has been monitoring compliance with coal ash regulations since Congress provided the agency the authority to do so in 2016. EPA's final CCR Rule allows either closure by removal of all coal ash, or closure with coal ash remaining in the unit, both of which have associated performance standards that must be met to ensure no further releases of coal ash and coal ash contaminants from the unit, including into groundwater. The coal ash regulations do not mandate a particular closure option; rather, each facility is provided flexibility to choose an appropriate closure option that meets applicable and relevant performance standards.

Low-Carbon Incentives

Federal government officials announced a pair of actions in the Biden administration's drive to incentivize the production and use of low-carbon emissions construction materials.

The U.S. Environmental Protection Agency on March 5, 2024, released draft criteria for Product Category Rules (PCRs) in support of a new label for more climate-friendly construction materials and products as part of the $100 million Label Program for Low Embodied Carbon Construction Materials created under the Inflation Reduction Act. Comments on the draft criteria were due April 4, 2024.

PCRs are guidelines for developing Environmental Product Declarations (EPDs), which communicate climate and other environmental impacts of products, and will be used to determine a product's eligibility for the new label. EPA said the draft criteria will improve PCRs by establishing consistent requirements for data quality and transparency in EPDs. The American Coal Ash Association is currently developing a PCR for supplementary cementitious materials, including coal ash. ACAA is also participating with the Portland Cement Association and trade associations for other materials to apply for a share of $100 million in EPA grants to support development and verification of EPDs.

The U.S. Department of Energy on March 8, 2024, announced $425 million in funding to reduce industrial emissions and advance clean energy manufacturing. Funded by the Bipartisan Infrastructure Law, the Advanced Energy Manufacturing and Recycling Grant Program will support small- and medium-sized manufacturers in current and former coal communities that are focused on producing and recycling clean energy products, as well as investing in decarbonization at their facilities. This opportunity is in addition to a first round of grants in 2023 that provided $275 million of federal funding to seven selected projects in seven states.

In this round of funding, DOE will prioritize: "(1) Clean Energy Manufacturing and Recycling (which was funded during the first round of the program) and (2) Industrial Decarbonization." Projects under this funding program, across either area of interest, must occur in communities where coal mines have closed since December 31, 1999, or coal-fueled power plants have closed since December 31, 2009. Concept papers were due April 8, 2024, and full applications are due June 24, 2024.

Announcing ACAAEF Scholarships

The May 24 application deadline is fast approaching for the American Coal Ash Association Educational Foundation (ACAAEF) 2024 Scholarship Program. Graduate and undergraduate students with a demonstrated interest in the management and beneficial use of coal combustion products (CCP) have the opportunity to earn awards of between $1,000 and $5,000.

Are you currently a student attending a college or university in the United States? If so, find scholarship application submittal instructions and tips on the AACA website at www.acaa-usa.org/about-acaa/acaa-educational-foundation.

- Applicants are evaluated on their course work, grade point average, personal recommendations, and an essay describing their interest in CCP-related issues.
- Past recipients represented a wide variety of fields of study, including civil engineering, material science, environmental engineering, and public policy.
- The ACAAEF Board of Directors will make awards based on the quality of the applications received.

The deadline for submittal of applications is May 24.
Announcement of awards is scheduled for July 12. Hurry and apply now!

EDUCATIONAL FOUNDATION
AMERICAN COAL ASH ASSOCIATION, INC.
ACAA

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- 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.

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