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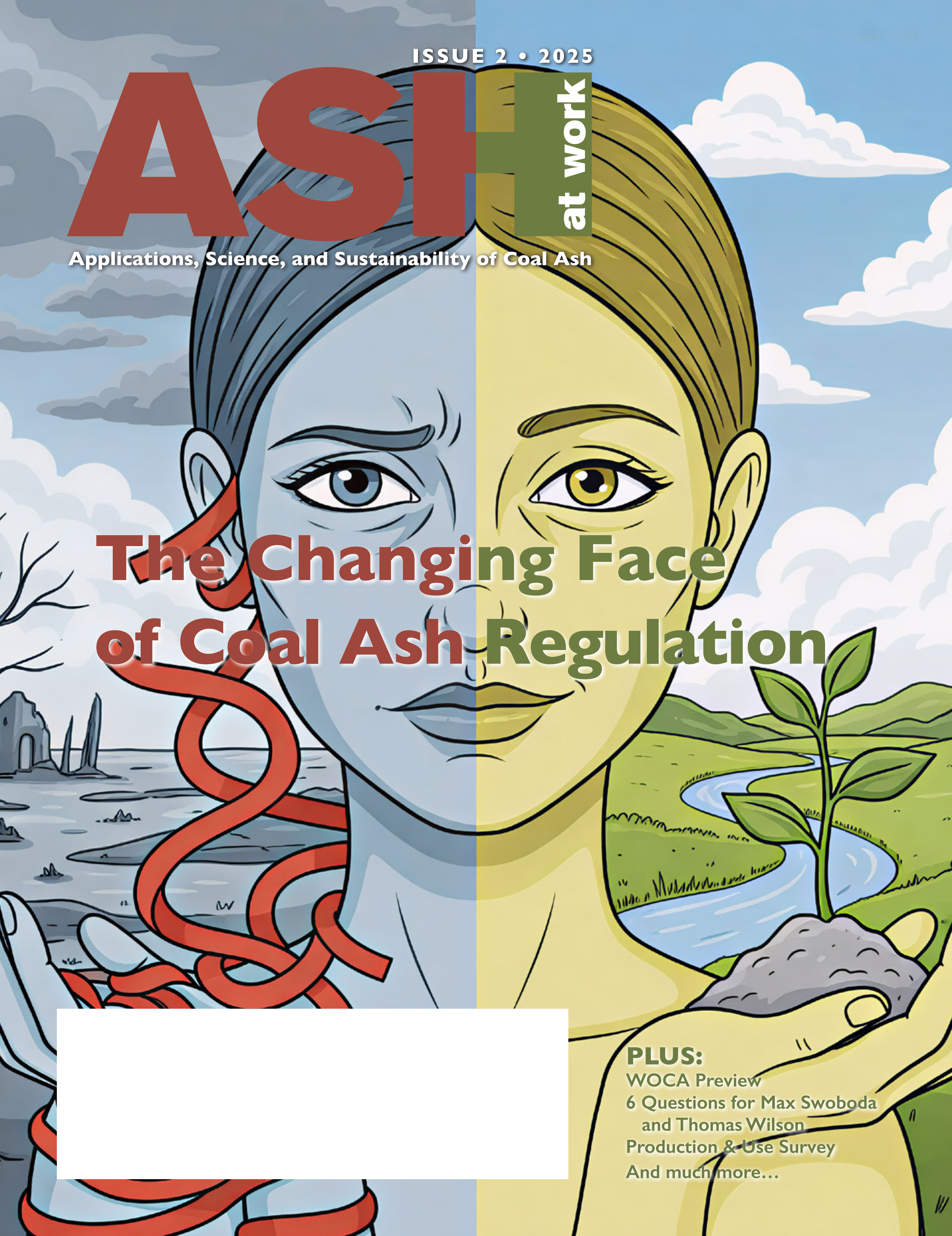
ASH at work

Applications, Science, and Sustainability of Coal Ash



The Changing Face of Coal Ash Regulation

PLUS:

- WOCA Preview
- 6 Questions for Max Swoboda and Thomas Wilson
- Production & Use Survey
- And much more…

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Driving Momentum in an Evolving Regulatory Landscape

By Tom Kierspe, ACAA Chair

Welcome to this special issue of *ASH at Work* dedicated to "The Changing Face of Coal Ash Regulation." The subject is timely and consequential for our industry, and I'm pleased to share some encouraging developments and key opportunities for engagement.

Less than a year into the current administration, we are seeing signs of a more balanced and constructive regulatory approach toward the coal ash beneficial use industry. Early executive actions signaled a renewed focus on revitalizing America's coal sector, strengthening grid reliability, and reducing regulatory burdens for stationary energy sources. While these orders do not rewrite existing statutes or regulations, they clearly establish policy priorities and guide how those priorities are carried out across the federal government.

At the agency level, the U.S. Environmental Protection Agency (EPA) has acted on this policy shift, advancing a more productive approach to coal ash beneficial use even amid the recent government shutdown:

- EPA has publicly committed to working more closely with state partners to transition greater implementation responsibility for the coal combustion residuals program to the states.
- The agency has continued to take stakeholder meetings related to a forthcoming proposal to reconsider the 2024 "Legacy" Coal Combustion Residuals Rule. In response to EPA staff feedback, beneficial use stakeholders have provided input on ash harvesting activities intended to establish a record for significantly longer timelines for disposal unit closure by removal for beneficial use.
- Coal ash industry stakeholders have submitted comments on EPA's proposal to extend near-term Effluent Limitation Guidelines (ELG) compliance deadlines while seeking input for a broader ELG reconsideration effort next year.

On Capitol Hill, the Coal Ash for American Infrastructure Act, sponsored by Rep. Andy Barr (R-KY), remains a focal point for advancing beneficial use priorities. Although congressional progress has slowed, industry advocates are poised to play a stronger role in shaping refinements and ensuring the bill reflects the practical and environmental value of our work.

These developments mark an important moment for the beneficial use industry. By sharing our technical expertise and practical experience, we can help shape how upcoming regulations are defined and implemented. ACAA members are encouraged to take an active role and ensure that the industry's perspective is reflected in future policy decisions.

If you wish to stay abreast of developments in Washington that impact our industry, I encourage you to participate in ACAA's Government Relations Committee calls, held every other Friday at 12:30 p.m. Eastern Time. To join, please contact Alyssa Barto at Alyssa.Barto@acaa-usa.org.

Speaking of member engagement, I was delighted by the strong turnout at the Fall Membership Meeting and "WOCA The Workshop," held in Salt Lake City in October. With over 200 attendees, the workshop covered the full spectrum of beneficial use topics—from regulatory developments to harvesting strategies, market dynamics, and emerging technologies. Your active participation drives the value of ACAA's programming.

Looking ahead, we will convene our 2026 Winter Membership Meeting at the Francis Marion Hotel in Charleston, South Carolina, February 10–11. I look forward to another robust agenda and the continued exchange of ideas and best practices.

Thank you for your leadership, your contributions to beneficial use of coal ash, and your commitment to shaping a stronger, sustainable future for our industry.

Governing at the Speed of Trump

By Thomas H. Adams, ACAA Executive Director

At the time of publication of this issue of *ASH at Work*, Donald J. Trump has been in office for less than one year in his second term as President of the United States. The first year of his second term has been breathtaking, to say the least. President Trump apparently does not sleep the prescribed eight hours per night. He seems to be in meetings, giving speeches, traveling, and governing around the clock. Pundits are telling us what we can see for ourselves: President Trump learned some very valuable lessons from his first term. He has appointed more qualified leadership for federal offices. And he has not slowed to the pace of governing customary in the District of Columbia. The usual process of conducting endless studies of issues and endless committee meetings before any action is taken is being swept aside under Trump II.

He is giving those who care to pay attention a master class in negotiation, whether domestically or internationally. His appointees are clear on his expectations and are executing. Even at the U.S. Environmental Protection Agency (EPA), we have heard reports that progress on some key issues has been too slow in the administration's view, and those responsible had better pick up the pace.

It would seem this style of governing is precisely what is needed at this time in our history. We have major issues in need of serious resolution—the national debt, defense preparedness, uncontrolled borders, a dysfunctional federal government working with technology incapable of supporting each agency, courts that attempt to act as all three branches of the federal government, rebuilding alliances with foreign governments, and much more. To those who wish to go back to a Washington, D.C., where governing is slower and more deliberate, I paraphrase the words of President Andrew Shepherd, played by Michael Douglas in the movie *The American President*: "We have serious problems to solve. And we need serious people to solve them… And your 15 minutes are up." Welcome to Trump II.

What will the remaining years of President Trump's second term bring? No one can really tell. The loyal opposition is trying to mount a response to regain control of the executive and legislative branches of the federal government. To date, that strategy can be reduced to three words: "I'm not Trump."

Over the next three years, the ACAA has an opportunity to work with the EPA to fully leverage the minerals in coal combustion residuals (CCR) from both current production and CCR stored in landfills and surface impoundments. At a time when demand is running well ahead of supply, we need to step up and do all we can to satisfy our customers while improving our environment.

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RCRA Origins – Refocusing on Beneficial Use

By Williamson Law + Policy PLLC

As the U.S. Environmental Protection Agency's (EPA's) regulation of power plants and coal residuals collides with the Trump administration's focus on energy dominance, there is an acute opportunity to revisit the history of the Resource Conservation and Recovery Act (RCRA) and remind policymakers that Congress originally saw RCRA as a launchpad for beneficial use of industrial byproducts.[1] After all, the words "resource" and "conservation" are right in the title—a fact that regulators sometimes seem to have forgotten.

For most of RCRA's 60-year history, EPA has focused on regulating waste disposal, often leaving resource conservation an orphan child. With new Administrator Lee Zeldin's vow to re-focus EPA on fundamentals,[2] this is an opportunity for EPA to realign with conservation as the guiding principle of RCRA. Tracing the statutory history reminds us that RCRA reflects Congress' concerted design to convert the nation's waste disposal problem into a successful beneficial use industry. Along the way, regulators have at times lost sight of the original plan to promote and support markets and instead fallen back on easier command-and-control prohibitions. Looking at the history of RCRA shows that we need more "yes" and less "no" in our resource management programs.

Congress Tackles the Growing Waste Problem Through Beneficial Use

As the nation's exponential industrial growth in the 20th century brought with it a dramatic increase in manufacturing and energy sector byproducts, Congress responded by passing the Solid Waste Disposal Act of 1965 (SWDA).[3] This RCRA predecessor created a framework for states to better manage solid waste, but ultimately this state-level approach failed to stem the ever-increasing volume of industrial waste.[4] By 1969, it was clear the "avalanche of waste and waste disposal problems" required further action.[5] In October 1970, President Nixon established the EPA to expand the federal government's role in the regulation of environmental issues through "consolidation of pollution control authorities."[6] Later that month, Congress passed the Resource Recovery Act of 1970, legislation amending the SWDA that Congress hoped would "promote the demonstration, construction, and application of solid waste management and resource recovery systems," as well as aid "in the planning of resource recovery" and "promote a national research and development program for improved management techniques, more effective organizational arrangements, and new and improved methods of collection, separation, recovery, and recycling of solid wastes."[7]

This 1970 precursor to RCRA put particular emphasis on "recovered resources" and "resource recovery system"—in effect reorienting our national approach from waste *disposal* to resource *recovery*.[8] To this end, Congress gave the Secretary of Health, Education, and Welfare[9] a broad mandate to study recycling opportunities and markets for beneficial use, including:

> *". . . means for* ***recovering materials and energy*** *from solid waste, recommended uses of such materials and energy for national or international welfare, including identification of* ***potential markets*** *for such recovered resources, and the impact of distribution of such resources on existing markets . . . the use of Federal procurement to develop* ***market demand for recovered resources*** *. . . recommended initiatives (including Federal grants, loans, and other assistance) and disincentives to* ***accelerate the reclamation or recycling*** *of materials from solid wastes . . . [and] the effect of existing public policies, including subsidies and economic incentives and disincentives, percentage depletion allowances, capital gains treatment and other tax incentives and disincentives, upon the recycling and reuse of materials, and the likely effect of the modification or elimination of such incentives and disincentives upon the* ***reuse, recycling, and conservation*** *of such materials."*[10]

From the highlighted phrases, it is clear that Congress was searching for ways to grow what we now call beneficial use. Congress directed the agencies to report the study results to the President and Congress and authorized "demonstration projects" to prove the viability of new conservation methods and technologies.[11] In the years leading up to the passage of RCRA in 1976, three key reports were published, focusing largely on paper, ferrous materials, glass, and plastics.[12] Each report undertook an intense "explor[ation of] resource recovery as a method of solid waste management and resource conservation."[13] One of the key conclusions from these reports was that solid waste generation in America was growing at an alarming rate and had "never been subject to greater uncertainties than under present conditions of rising material and energy prices and changing international bargaining relationships."[14] As a result, the reports recommended that "more stringent" regulations would be necessary to fill the gaps left by the SWDA.[15]

RCRA Cements Beneficial Use as a Key Policy Objective

Even as resource conservation was being studied, Congress recognized the need for more fulsome conservation programs to build on SWDA and the Resource Recovery Act of 1970. As early as 1971, lawmakers sought to expand solid waste management, recognizing "it is essential that we conserve our natural resources."[16] Legislators expressed a clear intention to promote the recovery and reuse of solid waste as "raw material for new products" and to spur "further efforts to conserve natural resources."[17] In the early 1970s, the Mideast oil crisis would expose the "finite character of [the United States'] natural resources" and highlight the urgency of "recycling waste material and returning it to the economy."[18] By 1976, calls for legislation promoting the conservation of natural resources culminated in the introduction of various bills that became RCRA. The discussions and debates during that time leave no doubt that "reclamation and reuse practices" were a "major objective of RCRA," as Congress was increasingly concerned with "consumption of this nation's domestic raw materials and the . . . balance of trade deficit . . . caused by the need to import raw materials."[19]

When Congress passed RCRA in October 1976, legislators sent a strong message to the still-new EPA that America needed a solution to waste management problems and that recycling was a key component. Congress wrote into the preamble a clear mandate that EPA promote beneficial use:

> *"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 useable 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."*[20]

"The legislation also provides for state and local development of methods for solid waste management which are environmentally sound and which will encourage the utilization of valuable resources and resource conservation," President Gerald Ford noted upon signing RCRA into law in 1976.

To this end, Congress framed RCRA's objective as "conserve valuable material and energy resources by . . . establishing a cooperative effort among the Federal, State, and local governments and private enterprises in order to recover valuable materials and energy from solid waste."[21]

EPA's Lost Focus

RCRA granted EPA broad authority to regulate solid waste, perhaps so broad that EPA has sometimes lost focus on conservation and recycling and instead fixated on a "cradle to grave" command-and-control regulatory scheme that watchdogs waste but does less to help conservation and recycling.[22] EPA's detailed waste management regime largely overlooks Congress' original directive to conserve and beneficially use natural resources. This shift away from Congressional intent began small but has built up over time. As one illustration, RCRA defines solid waste as "any garbage, refuse, sludge from a waste treatment plant, water supply treatment plant, or air pollution control facility and other discarded material."[23] In contrast, EPA's definition *begins* with "any discarded material."[24] While this difference may seem semantic, it is emblematic of EPA's stark deviation from Congressional intent that the agency actively engage with waste markets. For example, until 2015, cow manure was not regulated by EPA under RCRA because it was often spread over fields as fertilizer and considered not "discarded," even though Congress had contemplated that "'solid waste'" as defined by RCRA would include material "originat[ing] from 'agricultural operations.'"[25] Instead of turning away from an entire category of waste, EPA could have used its authority to actively promote recycling and reuse as solutions to waste generation in the agricultural sector.

Resource conservation as a pathway from "dependence on foreign sources of material" is as pertinent today as it was in 1976.

Legislation, Regulation, and Beneficial Use: The Key Events

1965 — Solid Waste Disposal Act (SWDA)
Created state-level framework but failed to contain increasing volumes of industrial waste

1970 — EPA Established & Resource Recovery Act
Reoriented the national approach from waste disposal to resource recovery

1976 — RCRA Passed
Cemented beneficial use as a key objective, mandating resource recovery and conservaton

2001 — C2P2 Program Established
A successful voluntary program encouraging beneficial use of Coal Combustion Products

2010 — C2P2 Program Suspended
Program abruptly halted, leading to a stagnation in coal ash utilization

2015 — CCR Rule Issued
Regulatory certainty restored, causing ash utilization to surge again

At times during its 50+-year history, EPA has engaged more meaningfully in conservation. For example, in 2001 EPA established the Coal Combustion Products Partnership (C2P2) program, which sought to encourage beneficial use, rather than disposal, of coal combustion products (CCPs).[26] EPA established C2P2 as a joint effort between the agency, the American Coal Ash Association, the Department of Energy, the Federal Highway Administration, and the Department of Agriculture. C2P2 was designed as a voluntary program with the goal of increasing beneficial use of CCPs in products like wallboard and cement by up to 50 percent.[27] Participants, including businesses, states, and professional and industrial associations, were eligible for awards recognizing their activities and achievements, such as documented increases in CCP utilization. The C2P2 program was highly successful, helping to raise beneficial use rates and lower disposal rates for coal ash as documented in a 2008 study by EPA's National Center for Environmental Economics.[28] The study also found that states with more C2P2 participants saw an increase in the beneficial use of coal ash by non-participants, as compared to those states with fewer C2P2 participants.[29] Despite how "effective in reducing the disposal of [coal ash]" the program was,[30] EPA abruptly suspended the program in 2010.[31] Beneficial use of coal ash once again stagnated for several years as EPA pursued a protracted rulemaking process that posed the threat of a "hazardous waste" designation for coal ash that is disposed.[32] Ash utilization surged once again after regulatory uncertainty was restored following the agency's issuance of the 2015 Coal Combustion Residuals (CCR) rule.

Resource conservation as a pathway from "dependence on foreign sources of material" is as pertinent today as it was in 1976. For example, rare earth minerals critical to clean technology, national defense, and consumer goods are found in coal ash.[33] One such metal, scandium, has not been produced in the United States since 1969.[34] Historically, China has controlled up to 85 percent of world scandium production and 99 percent of world rare earth element processing and, earlier this year, imposed export restrictions that effectively cut off supply of these rare earth elements to the United States and its allies.[35] The United States is taking steps to source these materials domestically, and conserving the natural resources found in coal ash could be part of the answer. EPA, with its broad authority to promote conservation and beneficial use, could play a key role in encouraging this development.

Conclusion

RCRA gives EPA the authority, and the duty, to promote *all* of Congress' objectives through RCRA, not just those focusing on regulating waste generation and disposal. However, EPA has periodically abdicated this duty and relegated itself to a command-and-control structure that doesn't work as well for resource conservation and recovery. In order to fulfill its mandate, EPA now has the opportunity to take decisive, bold steps to promote resource conservation and recovery.

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*Co-authored by **C.R. Hicks, Esq.** and **Max Williamson, Esq.** of Williamson Law + Policy, PLLC. WLP represents companies, trade associations, and coalitions in regulatory, corporate, transactional, and litigation matters spanning a wide range of sectors across five continents. WLP helped the coal ash recycling industry obtain EPA's clarification that coal ash is a non-hazardous RCRA waste.*

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2. Press Release, ICYMI: Administrator Zeldin's "Powering the Great American Comeback" Unveiled at the EPA (Feb. 4, 2025), https://www.epa.gov/newsreleases/icymi-administrator-zeldins-powering-great-american-comeback-unveiled-epa.

3. U.S. EPA, 25 Years of RCRA: Building on Our Past To Protect Our Future at 1 (Apr. 1, 2010), https://web.archive.org/web/20100401192252/http://www3.epa.gov/epa-waste/inforesources/pubs/k02027.pdf. The Solid Waste Disposal Act was originally codified at 42 U.S.C. § 3251 et seq., later incorporated into the RCRA provisions at 42 U.S.C § 6901 et seq.

4. U.S. EPA, 25 Years of RCRA, supra note 3 at 1

5. Gladwin Hill, MAJOR U.S. CITIES FACE EMERGENCY IN TRASH DISPOSAL; Growing National Problems May Parallel the Crisis in Air and Water Pollution, THE NEW YORK TIMES (June 16, 1969), https://www.nytimes.com/1969/06/16/archives/major-us-cities-face-emergency-in-trash-disposal-growing-national.html.

6. Presidential Directive, Reorganization Plan No. 3 of 1970, 35 Fed. Reg. 15,623 (Oct. 6, 1970).

7. RESOURCE RECOVERY ACT OF 1970, Pub. L. No. 91-512, 84 Stat. 1227 § 101 ("1970 Act").

8. 1970 Act at § 102 ("The term 'recovered resources' means materials or energy recovered from solid wastes . . . The term 'resource recovery system' means a solid waste management system which provides for collection, separation, recycling, and recovery of solid wastes, including disposal of nonrecoverable waste residues.")

9. HEW was later divided into the Department of Health and Human Services and Department of Education.

10. 1970 Act at § 104 (emphasis added).

11. 1970 Act at § 104.

12. Office of Solid Waste Management Programs, Third Report to Congress; Resource Recovery and Source Reduction, U.S. EPA NAT'L SERV. CENT. FOR ENV'T PUB. (Sept. 3, 1975), NSCEP Link; Office of Solid Waste Management Programs, Second Report to Congress; Resource Recovery and Source Reduction, U.S. EPA NAT'L SERV. CENT. FOR ENV'T PUB. (Mar. 26, 1974), NSCEP Link; Office of Solid Waste Management Programs, First Report to Congress; Resource Recovery and Source Reduction, U.S. EPA NAT'L SERV. CENT. FOR ENV'T PUB. (Feb. 22, 1973), NSCEP Link.

13. Office of Solid Waste, First Report to Congress, supra note 12 at ix.

14. Office of Solid Waste, Third Report to Congress, supra note 12 at 8; Office of Solid Waste, First Report to Congress, supra note 12 at 1 ("The production of 1,000 tons of steel, for instance, results in 2,800 tons of mine wastes, 121 tons of air pollutants, and 970 tons of solid waste.")

15. Office of Solid Waste, Second Report to Congress, supra note 12 at 111.

16. 92 Cong. Rec. S10844 (1971) (statement of Sen. Moss).

17. 92 Cong. Rec. H3470 (1971) (statement of Rep. Dow).

18. 93 Cong. Rec. S13030 (1973) (statement of Sen. Dominici); see also 93 Cong. Rec. E313 (1974) (statement of Rep. Talcott) ("Mr. Speaker, our Nation is inconvenienced by fuel shortages and threatened with a food shortfall. Possible shortages in other areas can be prevented by thoughtful Federal legislation. Recycling of waste material and returning it to the economy–returning waste into a usable resource–and thereby alleviating some of the drain on our environment and natural resources is just such a move").

19. H. Rep. No. 94-1491, 94th Cong., 2d Sess. (Sept. 9, 1976) (statement of Rep. Stagger).

20. RESOURCE CONSERVATION AND RECOVERY ACT, Pub. L. No. 94-580, 90 Stat. 2795 (Oct. 21, 1976); 42 U.S.C. § 6901(c) (emphasis added).

21. 42 U.S.C. § 6901(a)(11).

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30. Lange, supra note 28 at 3.

31. Letter from EPA Assistant Administrator Mathy Stanislaus to EPA Inspector General Arthur Elkins, Response to OIG Evaluation Report (June 16, 2011), https://19january2021snapshot.epa.gov/sites/static/files/2015-10/documents/11-p-0173_agency_response.pdf.

32. Coal ash is a regulated solid waste but was specifically exempted from regulation as "hazardous waste" by the 1980 "Bevill Amendment" to RCRA and a 2000 final regulatory determination by EPA determining 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." See Simpson, supra note 26 at 24; U.S. EPA, Notice of Regulatory Determination on Wastes From the Combustion of Fossil Fuels, 65 Fed. Reg. 32,214, 32,221 (May 22, 2000).U.S. EPA, Hazardous and Solid Waste Management System; Disposal of Coal Combustion Residuals From Electric Utilities; Final Rule, 80 Fed. Reg. 21,302, 21,312 (April 17, 2015).

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35. See G. Baskaran & M. Schwartz, The Consequences of China's New Rare Earths Export Restrictions, CENTER FOR STRATEGIC & INTERNATIONAL STUDIES (April 14, 2025), https://www.csis.org/analysis/consequences-chinas-new-rare-earths-export-restrictions.

Coal Ash Regulatory Reform:
Proposals in Motion, But Uncertainty Proves Persistent

By John N. Ward

When future historians consider the 2020s, they may decide that America's environmental regulatory pendulum never swung faster—or further—than it has on the issue of coal ash.

The trajectory of coal ash regulation in the previous decade was tumultuous, but mostly linear. A high-profile failure of a coal ash impoundment at Tennessee's Kingston power plant in 2008 triggered a far-reaching U.S. Environmental Protection Agency (EPA) rulemaking that eventually led to enactment of the 2015 Coal Combustion Residuals (CCR) Rule. Subsequent litigation over the CCR Rule led to a 2018 federal court decision remanding several issues to EPA, including a mandate to develop regulations for "legacy" CCR disposal sites that ceased receiving material prior to the effective date of the 2015 rule.

When President Joe Biden took office in 2021, the pendulum began its swing. EPA prioritized completion of the still-unfinished "Legacy" CCR Rule. But actions went much further. EPA announced that future coal ash regulatory actions would proceed under EPA's "long-held" position that coal ash disposal units could never be closed in contact with groundwater—triggering more litigation from industry representatives who pointed out that position was not, in fact, "long-held." EPA began denying applications for "cease receipts" deadline extensions and alternative liner demonstrations allowed under the 2015 rule. EPA ceased approving or even acting on applications for state-led CCR permit programs as directed by Congress. EPA produced a "free liquids" guidance document and a new coal ash risk assessment to provide back-up for its shift in regulatory priorities. And in 2024, EPA finalized a Legacy CCR Rule that included a new regulatory construct—CCR Management Units (CCRMU)—that arguably went far beyond the federal court's remand.

And then Donald Trump won the 2024 presidential election.

The Trump Administration's Deregulatory Imperative

In his first week back in office, President Donald Trump signed a cascade of Executive Orders declaring a "National Energy Emergency" and promising to "Reinvigorate America's Beautiful Clean Coal Industry." Subsequent actions—such as "Strengthening the Reliability and Security of the United States Electric Grid"—directed EPA to prioritize reliability, streamline permitting, and reduce regulatory barriers that, in the administration's view, had constrained American energy production.

The administration's emphasis on "regulatory relief for stationary sources" quickly reshaped EPA's approach to coal-fueled power generation, including CCR. Early steps focused on rescinding Biden-era environmental justice and climate directives, reorienting enforcement initiatives, and taking steps to refocus on EPA's statutory obligations. In the case of CCR, those moves raised hopes for a potential return to the original purpose of the Resource Conservation and Recovery Act (RCRA), namely *resource conservation and recovery* rather than prohibition and punishment.

The U.S. Environmental Protection Agency, under Administrator Lee Zeldin, has moved to prioritize reliability, streamline permitting, and reduce regulatory barriers that, in the administration's view, had constrained American energy production.

From Deadlines to Deliberation

EPA's early actions pushed the pause button on a series of near-term compliance deadlines—most notably related to the 2024 "Legacy" CCR Rule and its new category of CCRMU.

In July 2025, EPA proposed to extend CCRMU Facility Evaluation Report deadlines and delay groundwater monitoring milestones by more than a year. This action mirrored recommendations from utilities and trade groups who warned that EPA's reconsideration of the Legacy Rule would otherwise force companies to waste resources on compliance steps for requirements likely to be rewritten.

EPA made similar moves in other proceedings. The agency proposed delays in near-term compliance deadlines in its Effluent Limitation Guidelines (ELG) rule for steam electric power plants while stating its intent to reconsider the underlying rule in the coming year. EPA also proposed extending by three years the deadlines for 11 power plants that opted for alternative closure deadlines under the 2015 CCR Rule. (This option allowed facility owners to continue operating unlined impoundments larger than 40 acres at plants that committed to cease operation of coal-fueled boilers and complete impoundment closure by October 17, 2028.)

Taken together, these actions formed a pattern: EPA is using short-term deadline extensions to provide breathing room as the agency undertakes more comprehensive (and time-consuming) regulatory reform. This "sequenced regulatory strategy" appeared designed to harmonize overlapping RCRA and Clean Water Act compliance frameworks—a tacit acknowledgment that one-size-fits-all rules can't effectively address the enormous diversity of coal ash disposal units, groundwater conditions, and beneficial use opportunities across the country.

Beginning as early as January 2026, industry observers expect EPA to advance more comprehensive CCR regulatory reforms. The most likely first step will be a proposal to reconsider the 2024 "Legacy" CCR rule, although that proposal may also advance reforms to the original 2015 rule.

Guidance Under Review: Technical Foundations in Flux

EPA's regulatory reconsiderations extend beyond the rules themselves to the technical guidance documents that supported them. For instance, on July 10, 2025, EPA formally disavowed its April 2024 "Free Liquids Memorandum" after industry engineers demonstrated that its "elimination of all porewater" standard was technically impossible. As TRC's Chris Hardin explained in *ASH at Work* (Issue 1, 2025), "complete elimination of porewater in CCR units is not possible using the best available technology." EPA has since confirmed that the memo "does not impose legally binding requirements."

Also up for scrutiny is EPA's 2023 Coal Ash Risk Assessment, which was used to underpin the 2024 "Legacy" CCR Rule (a topic addressed by Jay Peters in "Using Risk Assessment as a Framework for Managing Risk and Perception," *ASH at Work* Issue 1, 2024). Widely criticized for flawed assumptions that inflated exposure and radioactivity risk estimates, the Risk Assessment is attracting plenty of attention as EPA works to reconsider its CCR policies. A November 10, 2025, Utility Solid Waste Activities Group memo to EPA provided a report completed by Gradient that established "hypothetical risks predicted for CCRMU fills and historical disposal units are significantly overstated." The report utilized EPA's own data and applied the more realistic risk assessment assumptions EPA utilized in its previous 2014 coal ash risk assessment to conclude "…risks from CCRMU fills fall below the threshold for regulation. For other types of CCR units, the evaluations presented in this report show that it would be more effective to assess risks on a site specific basis…"

By revisiting both its technical and policy foundations, EPA is effectively rebuilding its CCR framework from the ground up. Whether this results in long-term clarity or another cycle of reinterpretation will depend on how future administrations choose to proceed.

State Programs Back in the Game

At the same time, EPA began to reinvigorate state permit program approvals authorized under the 2016 Water Infrastructure Improvements for the Nation (WIIN) Act. These programs allow states to administer their own CCR regulatory systems—provided they are "at least as protective as" federal standards—thereby ending the fully self-implementing regime of the 2015 rule. EPA previously approved state permit programs for Oklahoma, Texas, and Georgia before the Biden administration denied Alabama's application and ceased work on applications by other states.

In November 2025, EPA approved North Dakota's CCR permit program, the first such action since 2021. Approval of Wyoming's program was proposed in August, with similar actions anticipated for Louisiana, Virginia, and Illinois in the near future.

Congressional appropriators reinforced this direction by proposing funding for EPA's review of state permit program

North Dakota Governor Kelly Armstrong (seated left) and Rep. Julie Fedorchak (seated right) join EPA Administrator Lee Zeldin (seated center) to announce the approval of the state's coal combustion residuals permit program.

ACAA Executive Director Thomas Adams testifies on coal ash beneficial use before the House Committee on Energy and Commerce in June 2025.

applications and ordering the agency to act on the WIIN Act's directive to finalize a federal CCR permit program for non-participating states.

Beyond Ash: The Broader Coal Regulatory Context

The deregulatory wave extends well beyond coal ash. EPA initiated reconsiderations of several cornerstone rules that shape coal-fueled generation economics, including the Clean Power Plan 2.0 carbon regulation, Mercury and Air Toxics Standards, and elements of the Regional Haze Program. The agency also launched reassessments of its Greenhouse Gas Endangerment Finding and Social Cost of Carbon methodologies—actions that could reset the analytical foundation for all future climate-related rulemakings.

For coal ash generators and marketers, these proceedings are not peripheral. They directly affect plant operating horizons, which in turn determine the continuity of ash supply, storage, and harvesting opportunities.

Congress Takes Notice

Congressional interest in coal ash issues also surged. On June 26, 2025, the U.S. House Energy and Commerce Committee's Environment Subcommittee convened a hearing titled "A Decade Later: A Review of Congressional Action, EPA Rules, and Beneficial Use Opportunities for Coal Ash."

Testifying at the hearing, American Coal Ash Association Executive Director Thomas Adams told lawmakers that "coal ash beneficial use already constitutes one of America's greatest recycling success stories," noting that "over the past several decades, hundreds of millions of tons of coal ash have been used to construct resilient infrastructure and manufacture more sustainable building materials." He reminded the panel that "conservation and recovery are not just words in a statute—they are the purpose of the Resource Conservation and Recovery Act itself."

Adams also emphasized that "those who would argue against harvesting ash are really arguing for continued reliance on imported cementitious materials and for exporting the environmental impacts of manufacturing those imported materials." His testimony echoed growing bipartisan interest in resource recovery as an economic and environmental bridge between energy and infrastructure agendas.

Following the hearing, Representative Andy Barr (R-KY) introduced the Coal Ash for American Infrastructure Act, establishing "beneficial use staging units" to encourage recycling during site closures. House appropriators followed by including beneficial use support language in the FY 2026 EPA budget—urging the agency to speed state program approvals and "further efforts to limit waste and reduce the need for new landfills by encouraging reuse of materials."

The Long View: Policy Whiplash as the Norm?

While the current reset of CCR policy is widely viewed as favorable by the regulated community, questions remain regarding its durability. The 2015 CCR Rule was drafted under one federal administration, amended under another, expanded under a third, and is now being reconsidered under a fourth. Each transition resets the baseline for compliance planning and capital investment. Each regulatory reconsideration involves a time-consuming rulemaking process followed by inevitable time-consuming litigation over the results.

In short, highly technical planning for CCR regulatory compliance is complicated by the decidedly non-technical question: "What's going to happen in the next election?" Regulatory uncertainty, it seems, has become a feature (not a bug) in American environmental policy.

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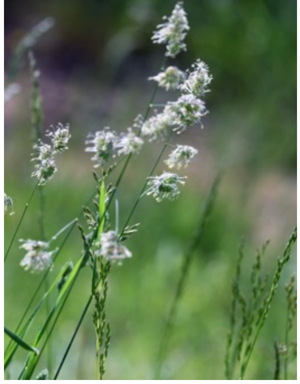






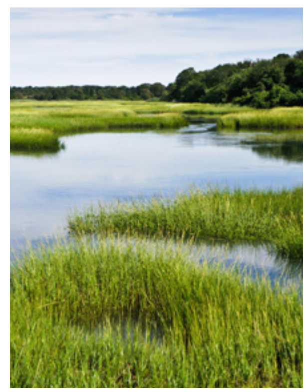

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Putting Radiation Risks in Context

By Jay Peters

It's been well established that coal ash—being derived from coal—contains the same naturally occurring elements that are in coal. Among the elements present in coal and coal ash are thorium and uranium. Thorium and uranium emit radiation, largely due to radium that co-occurs with these elements from the natural process of radioactive decay. Questions about the safety of using coal ash for various beneficial uses, including structural fills and in concrete, as well as FGD gypsum in wallboard, have previously been addressed. Specifically, beneficial use determinations by the United States Environmental Protection Agency (EPA) have recognized that radium in coal ash and gypsum does not pose a health risk of concern. Similarly, EPA has approved gypsum as an agricultural amendment for soil.

More recently, EPA developed a risk assessment in 2024 to support the Coal Combustion Residuals (CCR) Legacy Rule. EPA's risk assessment included an evaluation of potential exposures to radiation from CCR used in structural fill and concluded that under reasonable circumstances, radiation would not pose a health risk of concern. However, EPA also concluded that under some circumstances, health risks for exposure to radiation in fill could exceed the level that EPA uses to inform regulation—and under extreme exposure conditions could even exceed the level that EPA uses to guide Superfund cleanup.

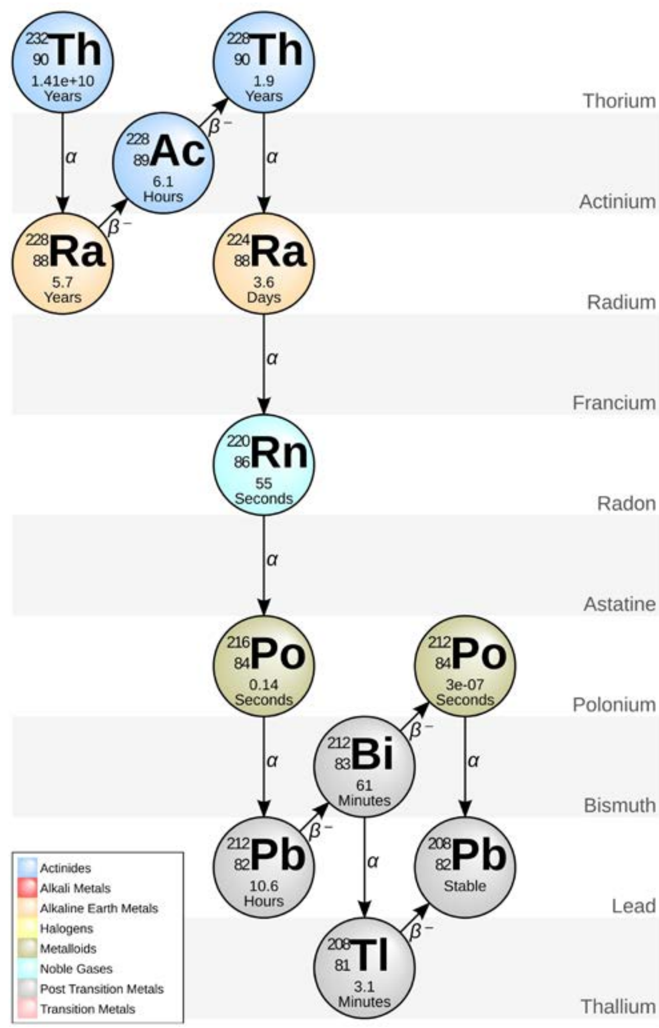
Publication of this risk assessment immediately prompted multiple alarming articles regarding radiation risk from structural fills and follow-up letters to the EPA demanding immediate action. Unfortunately, these reports and letters were more alarming than factual. Without providing the proper context, the risk of radiation exposure from coal ash was inflated and the lack of exposure pathways was disregarded.

While it's understandable for people to be concerned about such conclusions, it is important to look at the underlying science of any public health assessment and what it means in practical terms before jumping to conclusions. So, with that in mind, let's examine what radiation is, where it comes from, how people are exposed to radiation in daily life, and what those exposures mean in the context of overall public health.

What Is Radiation?

In simple terms, radiation is the energy that is released when a radioactive material breaks down. Radioactive materials contain certain elements (called radionuclides) that are unstable, meaning that the elements' nuclear structures are constantly breaking down. When the structures break down, they form different radionuclides, which in turn also break down until the cycle results in the creation of a stable element. With each step of this breakdown process, which is called radioactive decay, energy is released in the form of radiation.

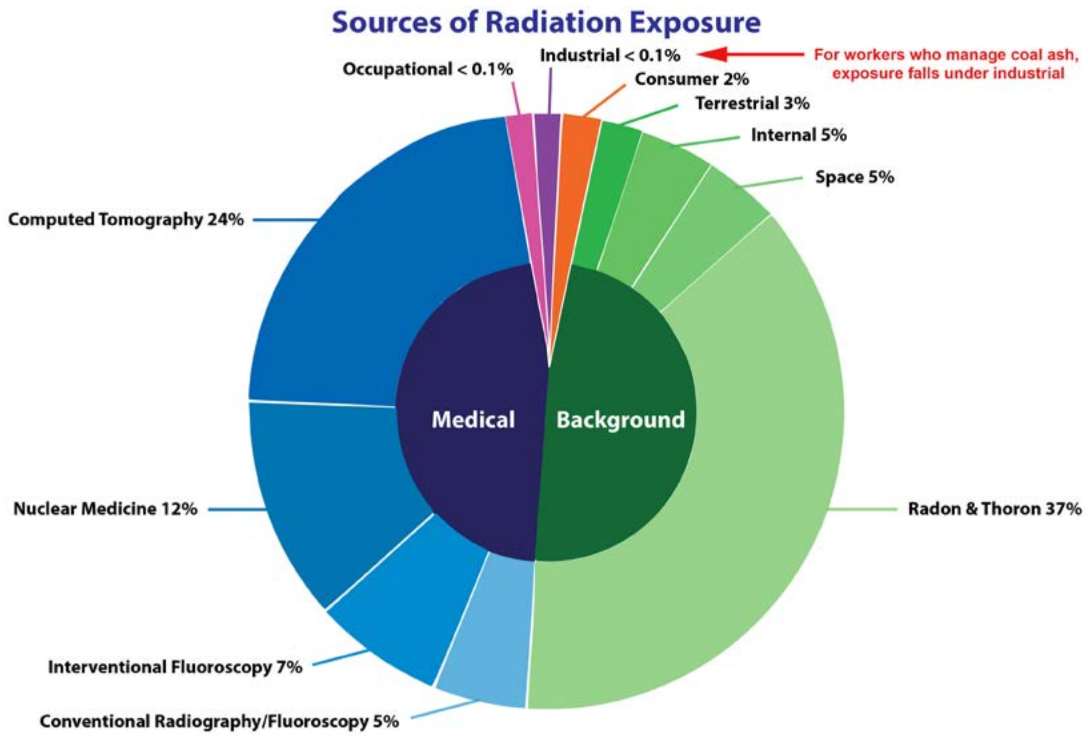
Figure 1. Radioactive decay for thorium-232. Source: Wikimedia Commons.



Each radionuclide that is formed during the radioactive decay process has a unique rate of decay. These rates, called half-lives, can range from billions of years to less than a second. Generally, the shorter the half-life, the higher the energy (radiation) emitted during radioactive decay.

Three different forms of radiation can be released through radioactive decay: alpha, beta, and gamma. The types of radiation and amount of energy released are determined by the radionuclide and the associated mode of radioactive decay. The graphic above shows the radioactive decay for thorium (specifically, thorium-232); thorium makes up 0.001 percent of the earth's crust and is therefore present in most rock and soil across the earth. As shown in the graphic, thorium decays into ten different radionuclides before it becomes lead, which is stable. Also shown

Figure 2. Sources of radiation exposure. Source: United States Environmental Protection Agency https://www.epa.gov/radiation/radiation-sources-and-doses.



in the graphic are the half-lives and the type of radiation emitted during each step in the radioactive decay chain. For example, in a sequence of the thorium-232 decay, thorium-228 decays to radium-224 with a half-life of 1.9 years and emits alpha radiation in the process. With a half-life of 3.6 days, radium-224 then decays to radon-220, which has a half-life of 55 seconds, emitting alpha radiation in the process. Though not shown in this graphic, certain radionuclides in the decay series also emit gamma radiation, particularly radium-228, actinium-228, and thallium-208.

Consequently, much of the radiation produced by radioactive elements can be from the radionuclides produced during radioactive decay, rather than from the parent radionuclide. In this example, thorium-232 is considered virtually stable and in and of itself produces very little radiation, but the radionuclides produced in the radioactive decay can emit comparatively large amounts of radiation. For uranium and thorium, the majority of radiation is associated with radium.

Where Does Radiation Come From and How Are People Exposed to It?

Radiation comes from three main sources: cosmic (cosmic radiation), naturally occurring radionuclides in the earth's crust (terrestrial radiation), and man-made radionuclides.

Cosmic radiation comes from space—specifically, gamma radiation that is emitted from the sun and other stars that have high enough energy to penetrate the earth's atmosphere. A portion of this radiation hits the ground where we live, while the remainder stays in the atmosphere. The gamma radiation that stays in the atmosphere can create other radionuclides such as carbon-14 and tritium. Gamma radiation has enough energy to pass through our skin and our bodies, so people are exposed to it simply by being proximal to the source. However, certain materials can shield us from gamma radiation, particularly metal and concrete. People therefore have higher exposure to cosmic radiation when they are outdoors or at higher elevations (i.e., living at higher elevations, such as in Denver, Colorado, or spending time in airplanes).

Naturally occurring radionuclides include uranium, thorium, and potassium-40 and are the source of most terrestrial radiation. These elements occur in most rocks across the earth, and since rocks break down to form soil, they occur in most soil across the earth. As discussed above, the source of radiation for uranium and thorium is largely related to radionuclides formed during radioactive decay, notably radium and radon. Potassium-40 is a component of all potassium, so it is in our food and therefore in our bodies as well. These naturally occurring radionuclides produce alpha, beta, and gamma radiation. People are exposed to these forms of radiation when they ingest food, inhale dust from soil, or breathe air (primarily air within buildings) that contains radon. People are also exposed to gamma radiation from naturally occurring radionuclides by being proximal to them. They are present everywhere, such as the soil and rock around and beneath houses, the concrete used in construction, food, and even granite counter tops, so people are always exposed to gamma radiation that results from naturally occurring radionuclides.

Man-made sources of radiation are used for medical diagnoses such as x-rays, computed tomography (CT scans), and fluoroscopy, as well as medical treatments (primarily radiation treatments for cancer). These medical uses often rely on gamma radiation. Other sources of man-made radionuclides include elements created by nuclear weapons testing and nuclear power accidents. These radionuclides become dispersed in the atmosphere and are universally present in very small quantities. People can be exposed to these radionuclides by ingesting food and water. Finally, some radionuclides, such as americium-241, are used in consumer goods such as smoke detectors.

The graphic on the previous page shows the average sources of radiation exposure to people. As indicated, most radiation exposure to the general public occurs through medical applications and background sources, particularly inhalation of radon and thoron.

How Is Radiation Measured?

One of the most confusing aspects of radiation is how it is measured and what the measurements mean. This is complicated by the existence of both international and U.S. units of measurement, and by the fact that there are three different types of radiation measurements that the terms apply to. For example, there are the infamous Geiger counters, which measure radioactivity by counting the radioactive emissions that occur during reactive decay.

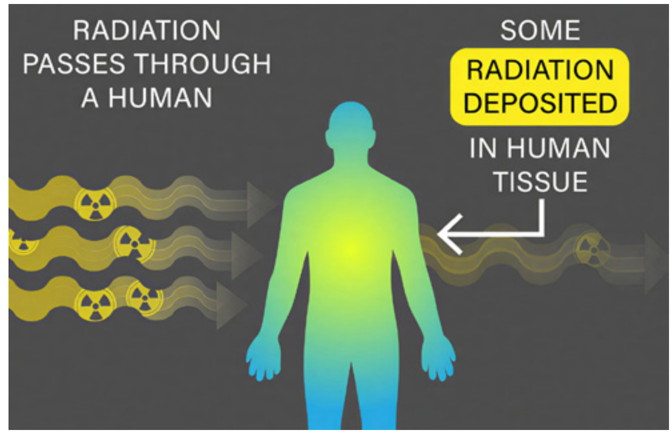
Another method of measuring radioactivity is to collect and analyze samples of environmental media—soil, groundwater, surface water—for radionuclides in a laboratory or to directly measure radon in indoor air. Laboratory measurements identify specific radionuclides and their concentrations in a manner that is analogous to measuring metals and organic chemicals in environmental media.

Exposure

Moving from measures of radioactivity to exposure, the amount of gamma radiation (also referred to as ionizing radiation) that someone may be exposed to can be measured using a radiation monitor; the monitor measures the amount of ionizing radiation in the air.

However, exposure does not describe the amount of ionizing radiation that is received by the body of an individual. That measure is described by radiation dose. The radiation dose to an individual can be measured or derived in two ways: the absorbed dose and the effective dose.

Figure 3. Absorbed dose. Source: United States Environmental Protection Agency https://www.epa.gov/radiation/radiation-sources-and-doses.



Absorbed dose measures the amount of radiation from gamma radiation that an individual is exposed to. As gamma radiation passes through a person, some of the radiation is absorbed in human tissue; the amount absorbed is the absorbed dose. Absorbed dose can be measured directly using a radiation dosimeter.

Figure 4. Effective dose. Source: United States Environmental Protection Agency https://www.epa.gov/radiation/radiation-sources-and-doses.

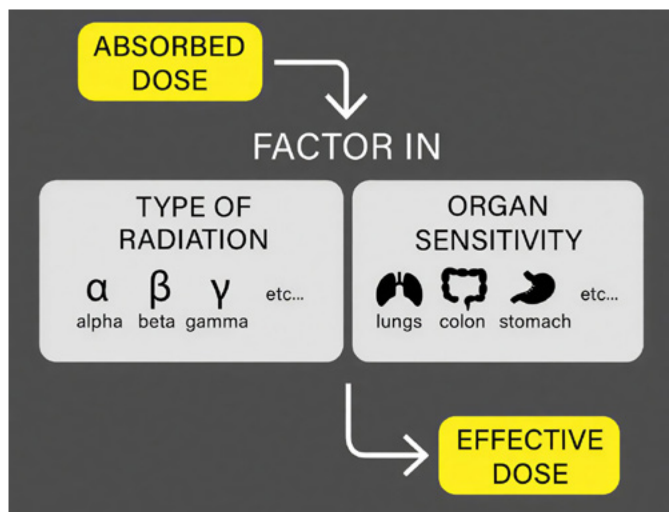


Table 1. Measures of radiation.

Type of measurement	U.S. units	International units
Radioactivity	Counts per minute (CPM)	Counts per minute (CPM)
	Picocuries (pCi) per volume or mass (e.g,. pCi/L or pCi/g)	Becquerels (Bq) per volume or mass (e.g., Bq/L or Bq/g)
Exposure	Roentgen (R)	Coulomb/Kg (C/Kg)
Absorbed dose	Rad (Rad)	Gray (Gy)
Effective dose	Roentgen equivalent man (rem). Often, the unit of millirem (mrem) is used, which is 1/1000th of a rem.	Sievert (Sv). Often the unit of millisievert (mSv) is used, which is 1/1000th of a Sv.

Figure 5. Average annual radiation doses by source. Source: National Council on Radiation Protection & Measurements, Report No. 160.

	Background				Medicinal				Other		
Source	Radon & Thoron	Space	Internal	Terrestrial	Computed Tomography	Nuclear Medicine	Interventional Fluoroscopy	Conventional Radiography/Fluoroscopy	Consumer	Industrial	Occupational
Avg. Annual Radiation Dose (mrem)	228	33	29	21	147	77	43	33	13	0.3	0.5

For workers who manage coal ash, exposure falls under industrial

The effective dose (also referred to as dose equivalent) of radiation accounts for the type of radiation (alpha, beta, gamma) and the specific biological interaction of the radionuclide with organs and tissues. For beta and gamma radiation, the effective dose is about equal to the absorbed dose. For alpha radiation, the effective dose is highly influenced by where the alpha-emitting radionuclide sequesters in the body (e.g., after ingesting or inhaling it) and the energy of the alpha particles. Effective dose is used to evaluate potential health effects from exposure to radiation and radionuclides. Effective dose cannot be directly measured; instead, it is either calculated from the absorbed dose or modeled with software using radioactivity measurements (i.e., media concentrations).

What Levels of Radiation Are People Typically Exposed To?

We can apply our knowledge of how radiation is measured to understand that effective dose is the measure we use to evaluate radiation exposure and implications for health outcomes resulting from exposure.

In the U.S., the average annual radiation dose per person is 620 mrem, with contributions from the sources identified above in Figure 5 at the top of the page.

With the exception of radon and thoron, the doses received from these sources are primarily from ionizing radiation. The doses received from breathing air with radon and thoron are largely from alpha radiation. If the dose contribution from medical procedures is excluded, for example to represent someone who does not get x-rays or other medical procedures that employ radiation, then the dose received from background sources of radiation is about 350 mrem per year. However, many people do receive radiation exposure through annual medical procedures (e.g., mammograms).

As discussed above, radiation is energy that is released when radionuclides decay. When radiation is transferred through our bodies—either from gamma radiation sources external to our bodies or alpha, beta, and gamma radiation from radionuclides within our bodies—the energy can disrupt cellular functions. Specifically, the energy can cause electrons that exist within cellular structures, like DNA, to be stripped away, leading to direct damage of the cell. In addition, the energy can cause water molecules, which exist in every tissue of our bodies, to create free radicals (unstable chemicals that can strongly bind to cellular structures), which can in turn directly damage cells. Ultimately, enough cellular and DNA damage can lead to cellular mutations, which can in turn lead to cancer.

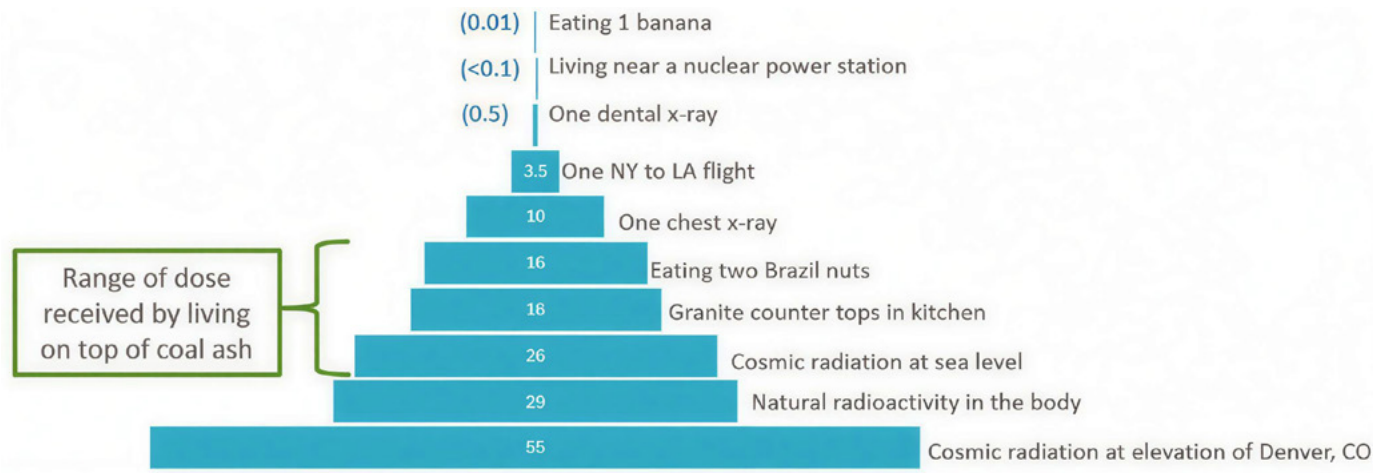
So, if we are exposed to radiation every day from background sources and normal medical procedures, and radiation causes cellular damage that can lead to cancer, then are we all at risk for getting cancer from radiation? The EPA and the National Council on Radiation Protection and Measurements use a model to support establishing regulatory limits based on an assumption that exposure to any amount of radiation carries with it some risk of developing cancer. However, people who are exposed to higher levels of radiation than the average public, such as airline pilots and workers at nuclear power plants in the United States, have not exhibited higher rates of cancer. This is because our immune systems constantly repair DNA damage and address damaged cells. In fact, research has demonstrated that exposure to low levels of radiation has a beneficial effect on stimulating the immune system, particularly with anti-tumor and anti-inflammatory effects.

Putting Radiation Dose in Perspective

As discussed previously, people are exposed to radiation every day, and in the U.S. the average annual radiation dose per person is 350 mrem with medical procedures excluded. In comparison, the radiation dose that aligns with a 1 percent increased average risk of cancer is 10,000 mrem. The average annual radiation dose per person at 350 mrem is nearly 30 times lower than the dose that is associated with a 1 percent increased risk of developing cancer. For perspective, the average risk of developing cancer in the U.S. is 50 percent for men and in 33 percent for women. Thus, at a 10,000 mrem radiation dose, the cancer risk increases to 51 percent for men and 34 percent for women. The radiation dose we receive from normal background exposures does not yield a rate of cancer that is distinguishable from the overall lifetime cancer risk we face.

Low-level radiation doses (below 100 mrem per year) received from various activities and sources are shown on the following page and highlight the fact that we are all exposed to radiation simply by our existence on Earth, normal activities, and the foods we eat. It's notable that U.S. regulations governing the

Figure 6. Low-level radiation doses (below 100 mrem per year) received from various activities and sources.



decommissioning of radiation sources (e.g., nuclear power plants) stipulate a decommissioning (cleanup) standard of 25 mrem per year, about the same dose of cosmic radiation that is received just by living at sea level.

Radiation and Coal Ash

As discussed above, uranium and thorium are present in most rocks and soil throughout the earth, and the naturally occurring radioactivity from these elements is largely associated with radium that is formed during radioactive decay. It is therefore not a surprise that coal—a naturally occurring sedimentary rock—also contains thorium and uranium. Consequently, when coal is burned, the coal ash also contains naturally occurring uranium and thorium and the radioactivity associated with naturally occurring radium. However, since coal ash typically contains higher concentrations of these naturally occurring elements than coal, questions have been raised about whether coal ash contains levels of radiation that are a concern.

The presence of the trace amounts of radium in coal ash has been well researched. A report prepared by the United States Geological Survey (USGS) concludes that radium in most fly ash is within the range that occurs in granitic rocks, phosphate rocks, and shale. The USGS also concluded that the majority of coal and fly ash is not significantly enriched in radioactive elements, or in associated radioactivity, compared to common soils or rocks (https://pubs.usgs.gov/fs/1997/fs163-97/FS-163-97.html).

Separately, EPA has studied the safety of using coal combustion materials in building materials such as concrete and wallboard (https://www.epa.gov/coal-combustion-residuals/coal-combustion-residual-beneficial-use-evaluation-fly-ash-concrete-and). EPA concluded that the potential exposures to ionizing radiation from coal ash in concrete and FGD gypsum in wallboard are comparable to those associated with mined materials. Based on that evaluation, EPA eliminated radiation as a concern in these materials.

In a 2024 risk assessment performed by EPA to support the Coal Ash Legacy Rule of 2024, EPA evaluated exposure to radiation from coal combustion residuals (CCR). Specifically, EPA used available information on the radium content in coal to construct a simulation model for what the exposure may be to someone living in a house constructed on top of coal ash. EPA concluded that under typical circumstances where the coal ash would be covered by at least 6 inches of surface soil, radium would not pose a health risk of concern. Furthermore, EPA concluded that risks from exposure to radon from radium in CCR would not be distinguishable from the risks associated with radon as a natural background condition. This makes sense because the radium concentrations that EPA modeled in CCR (6.4 pCi per gram (pCi/g) at the 50th percentile and 11.8 pCi/g at the 90th percentile) are similar to or lower than the radium concentration threshold of 10 pCi/g that applies to gypsum used as an agricultural amendment to soil (https://www.nrcs.usda.gov/sites/default/files/2024-10/Amending-Soil-Properties-with-Gypsum-Products-%28333%29-%28ac%29-Standard-Document.pdf).

In EPA's risk assessment, it was only when EPA assumed that coal ash containing radium was mixed with soil at the ground surface that they concluded that risks could be above EPA's upper risk limit of 1 excess cancer case in 10,000. Aside from the unlikelihood of someone living in a house built on a coal ash/soil mixture, the actual risk needs to be put in perspective. Taking into account the difference in radium concentrations between CCR and background radium (where background was identified by EPA as 2.1 pCi/g and 3 pCi/g at the 50th and 90th percentiles, respectively), the exposures that EPA modeled would result in radiation doses of only 14 mrem per year and 28 mrem per year for the 50th and 90th percentiles, respectively.

EPA's risk assessment evaluated the significance of these doses in the context of excess cancer risk and concluded that these doses would result in risks in excess of the threshold that EPA uses to manage Superfund sites. However, it is essential to put these risks into context by considering how the radiation doses compare to those that we receive from background sources. The average dose received from living in a home built on top of CCR is about equal to the dose received from eating two Brazil nuts each day or two round-trip New York to Los Angeles flights. At the 90th percentile, the dose received is about equal to the dose associated with exposure to cosmic radiation at sea level. Consequently, even under an assumption that people are living in homes constructed on top of coal ash, the excess radiation dose for those people would be at most 28 mrem per year—648 mrem as opposed to 620 mrem—or about 4.5 percent more than the radiation dose that we all receive from normal background sources.

As this article demonstrates, radiation is a topic that is made complex by the many ways that it can be expressed—types of radiation, concentration, and exposure versus dose and risk. Simply stating the dose or risk associated with a certain aspect of exposure—such as exposure to coal ash—does not put that exposure into context because we are exposed to naturally occurring radiation every day at levels well above what any exposure to coal ash would be.

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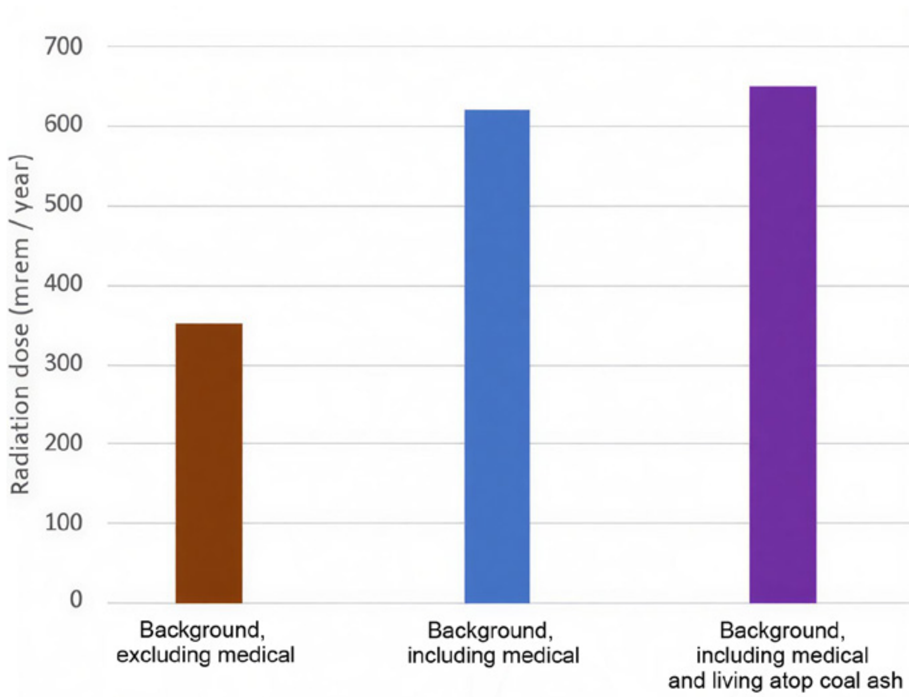
Figure 7. Comparison of radiation doses from background sources and living on top of coal ash.



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Rare Earth Recovery Across the Coal Value Chain

By John Simpson

The U.S. Department of Energy and NETL are advancing a range of extraction and separation technologies to strengthen domestic supplies of rare earth elements and other critical minerals, including those recoverable from coal-related resources.

A 2024 study by the University of Texas at Austin estimates that as much as 11 million tons of rare earth elements (REEs) may be recoverable from coal ash stored across the United States—nearly eight times the country's current domestic reserves.[1] Based on current market prices, the researchers also estimate that the accessible portion of this resource could represent roughly $8.4 billion in potential REE value.

This analysis reinforces a growing body of research showing that coal and its byproducts could become a major domestic source of critical minerals essential to advanced electronics, defense, and energy applications. The stakes are high: U.S. rare earth production has lagged for years, allowing China to dominate supply chains critical to next-generation manufacturing technologies (see Figure 1).

A Legislative Push

The renewed focus on coal-based critical-mineral recovery also has momentum on Capitol Hill. Earlier this year, Representative Andy Barr of Kentucky introduced the RESCUE Act (Rare Earths from Coal for U.S. Energy), which seeks to strengthen federal investment in pilot projects and streamline permitting for facilities that recover REEs from coal, coal refuse, and combustion residuals.[2] The bill reflects increased congressional interest in positioning coal-based materials as a domestic critical-mineral resource.

Understanding the Resource

Studies supported by the U.S. Department of Energy (DOE) and university research groups have shown that the coal combustion process naturally concentrates rare earths in ash. When coal is burned, most of the carbon and other volatile components are driven off, while the mineral portion—including REEs—remains. As a result, the rare earths present in the original coal can end up several times more concentrated in the ash—often on the order of four- to ten-fold enrichment.[3] This natural "upgrading" helps explain why coal ash is attracting so much attention as a practical starting point for recovery.

Nonetheless, coal combustion byproducts vary widely in composition, reflecting differences in both regional geology and plant operation. Ash from Appalachian Basin coals typically contains the highest REE concentrations—averaging around 400 mg/kg—but can be more difficult to process due to complex glassy phases. Western ashes, such as those from the Powder River Basin, hold lower concentrations (near 260 mg/kg) but are more chemically accessible. Ashes from the Illinois Basin fall between these ranges.

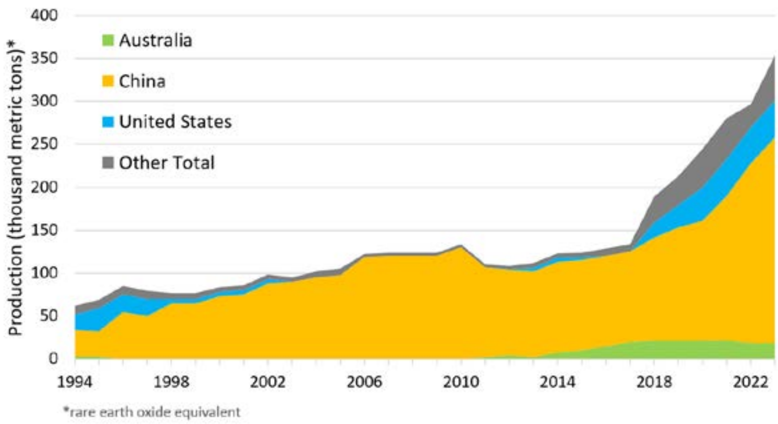
Taken together, these regional differences and combustion effects mean that not all ashes have the same potential. Mapping and characterizing this variability remain key steps toward developing regional recovery strategies and identifying the most promising feedstocks for pilot-scale facilities.

Advances in Extraction

A range of extractive technologies are now moving beyond bench-scale testing, several of which are being advanced through DOE's ongoing pilot and demonstration programs.[4] In November 2025, the agency reinforced this momentum by announcing a $355 million funding initiative—of which up to $275 million is designated specifically for facilities capable of recovering critical minerals from industrial and coal-based by-products.[5] The announcement explicitly identifies coal-derived feedstocks as eligible for pilot-scale development. This initiative is expected to accelerate deployment of promising extraction approaches across multiple regions.

In parallel with DOE-supported efforts, a number of university and laboratory groups are also advancing complementary extraction pathways:

Figure 1. Leading global producers of rare earth oxides (1994-2023).



- *Supercritical-fluid extraction*, developed jointly at Washington University and Sandia National Laboratories, uses pressurized carbon dioxide and water with organic acids to produce high-purity concentrates without generating liquid effluents.[6]

- *Thermal activation*, as demonstrated at Rice University, rapidly heats ash to alter its structure, often doubling subsequent extraction yields under gentle leaching conditions.[7]

- *Ionic-liquid and bioleaching systems*, under development at Georgia Tech and other institutions, rely on reusable solvents or specialized microorganisms to mobilize REEs through low-impact chemistry.[8]

- *Hydrometallurgical leaching* (e.g., NETL's Targeted Rare Earth Extraction, or TREE, process) uses mild reagents at ambient temperature and pressure to selectively leach REEs from fly ash while limiting waste generation.[9]

Collectively, these methods demonstrate that REE recovery can advance under controlled, low-emission conditions suited for industrial deployment. (An informal *ASH at Work* survey of researchers focused on extracting REEs from coal ash is presented in Figure 1 at the end of this article.)

Beyond Ash: REE Recovery from Mine Drainage and Residuals

Researchers at West Virginia University have also developed an approach for recovering rare earths from acid mine drainage (AMD)—the metal-rich water that emerges from legacy mine sites. Their process captures dissolved REEs and other valuable metals while generating treated water as a byproduct.[10]

Similar efforts at Penn State and the University of Kentucky are extending recovery techniques to coal-processing wastes and fine-grained residuals, including the use of mobile pilot plants that can operate directly at field locations.[11]

Low-Rank Coals as Emerging REE Sources

Low-rank coals such as North Dakota lignite continue to show promise as feedstocks. Average concentrations near or above 300 parts per million—the DOE's nominal economic threshold—have been reported, with unusually high proportions of heavy REEs and scandium.[12] Because lignite is soft and readily beneficiated, mechanical preparation and leaching steps can be integrated with existing surface-mining operations, potentially lowering capital and permitting costs.

The next phase of development centers on making these steps work together as a single system—starting with concentrating the REE-bearing portion of the material and ending with a saleable, refined product. Some projects are testing multi-stage filtration and solvent-recovery systems designed specifically for coal-derived materials. As these demonstrations progress, researchers are assembling practical cost and performance data that can guide public- and private-sector investment in larger-scale facilities.[13]

Outlook

Extracting REEs from ash, coal-based residuals, or mine water offers multiple benefits when compared with opening new hard-rock mines. It makes use of materials that are already managed on site, reduces the need for new excavation, and can align with ongoing ash-beneficiation efforts. After REE recovery, remaining solids may still be suitable for construction or cementitious use, tying resource recovery to practical end markets.

Going forward, the focus will be on making these systems more efficient, more affordable, and entirely domestic—from initial extraction through final refining and alloy production. In practice, that means developing processes that use fewer chemicals, operate at lower energy input, and link seamlessly to new U.S. separation and finishing facilities.

The technical feasibility has been established in multiple pilots; the task now is scale and implementation.[14] Supported by initiatives like the RESCUE Act and DOE's ongoing pilot and demonstration programs, efforts to recover REEs from coal and coal-derived materials are moving from concept to practice—and could help shape America's next generation of manufactured products.

Figure 2. An *ASH at Work* survey of researchers focused on extracting REEs from coal ash shows a range of technologies being tested. All of the laboratories who responded to this survey report that the coal ash remains viable for use in cement and concrete even after REEs have been extracted.

Respondent / Institution	Research Focus	Extractive Technologies	Target REEs	Remaining Ash Usable in Concrete/Cement?	Next Steps
Guangping Xu / Sandia National Laboratories	Recovery of critical minerals from coal ash and beneficial reuse of cleaned residual ash.	Citric-acid leaching with or without supercritical CO_2.	Nd, Y (based on concentration and price).	Yes — >90% of ash remains; heavy metals substantially reduced.	Scale up to continuous/semi-continuous operation; collaborate with cement producers.
Arthur Ragauskas / University of Tennessee	REE extraction from coal ash.	Magnetic separation and bioleaching.	All REEs.	Yes.	Advance Technology Readiness Level through further research.
Jack Groppo / University of Kentucky	Extraction of critical materials from coal-related byproducts and alternative feedstocks.	Physical concentration → leaching → precipitation → solvent extraction.	Nd, Pr, Dy, Sm, Y.	Yes.	Reduce costs; optimize physical concentration; cut acid/base consumption.
Krish Mehta / PHNX Materials	Extraction of alumina and gallium from impounded coal combustion residuals while preserving ash for SCM use.	Combined chemical and physical dissolution and recovery.	Gallium, alumina.	Yes — ash retains SCM performance.	Scale up through pilot demonstrations; optimize economics; prepare for commercial deployment.
James Tour / Rice University	Recovery of critical metals from coal ash and other waste feedstocks.	Flash Joule heating for rapid thermal activation.	All REEs, with emphasis on the most critical.	Yes — residues remain usable.	Build pilot-scale equipment and facility.
PBCo LLC / MERG / GenOn / RPM Solutions / Tephralytics / University at Buffalo	Characterization, mining, and concentration of REEs from coal-ash landfills that are being mined for beneficial use.	Digital analytics + real-time GIS mapping; gravity-feed hydraulics; vibration + screening to generate REE-rich concentrate.	Highest REE concentrations identifiable; also removes Hg and reduces LOI.	Yes — suitable for portland cement or SCM use.	Scale-up validation; automate in-situ REE mapping; refine flowsheets; partner with midstream refiners; align permitting and commercialization.
Colleen Doherty / North Carolina State University	Using plants to extract REEs from coal ash while retaining ash structure for downstream use.	Phytomining and biomining using plants grown in ash.	All REEs; current focus on Dy and Tb; also developing Ce- and La-specific plants.	Yes — plant growth does not hinder subsequent cement use.	Scale from pilot to economic deployment; improve selectivity and uptake of specific REEs.

Endnotes

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

New SCMs on the Horizon

By Thomas H. Adams

For a long time, marketers of fly ash had to work very hard to convince project owners, architects, engineers, and contractors that supplementary cementitious materials (SCMs) could significantly improve concrete performance. This effort to expand the beneficial use of coal combustion products (CCP) proved difficult and progressed at a slow pace. At the dawn of the twenty-first century, the American Coal Ash Association (ACAA) was still actively educating the marketplace about the value of using fly ash in concrete mixtures. At that time, fly ash, the most effective and readily available SCM, was used in concrete production mainly for economic reasons.

In 2002, the Coal Combustion Products Partnership (C2P2)—an initiative of the Environmental Protection Agency, Department of Energy, ACAA, the Utility Solid Waste Activities Group, and others—began promoting CCP's environmental benefits. These efforts reinforced the idea that including or increasing the use of CCP in concrete mixtures could reduce the embodied carbon in concrete structures and help drive sustainable construction practices. Between 2000 and 2008, when the EPA abruptly canceled the C2P2 initiative, beneficial use rates rose by roughly 50 percent.

As fly ash usage has increased in the years since, it has demonstrated its value in providing a range of *performance* benefits. Concrete producers no longer regard fly ash as simply a low-cost filler to replace portland cement, but rather as an essential tool to achieve higher compressive strengths, improved resistance to alkali-silica reactions, and lower permeability. Over the past decade, fly ash beneficial use rates have soared above 70 percent.

Evolving Supply Strategies for a Changing Market

Against this backdrop, ash marketers have had to redouble their efforts to supplement fly ash supplies from a coal fleet that has been shrinking over much of the same period. Fortunately, for concrete producers—and despite the Biden administration's efforts to close as many fossil-fuel power plants as possible—the decline in power plants' supply of fly ash for concrete has leveled off over the last few years. This baseline supply, about 12 million tons per year, as reported in the ACAA's annual Production and Use Surveys through 2023, is now being supplemented by harvested coal ash. Harvested coal ash, recovered from surface impoundments and landfills, began to impact concrete producers' supply in 2015. Today, harvesting is adding approximately 5 million tons of coal ash meeting the requirements of AASHTO M295 and ASTM C618 to the 12 million tons of "fresh" coal ash coming from power plant operations. Additional harvesting projects are under development across the United States.

As the gap between the available supply of "legacy" SCMs—fly ash, natural pozzolans, slag cement, and silica fume—and market demand has widened, new SCMs have also been coming to the market. Ground glass pozzolan was the most recent of these. And while announcements of other new SCMs have been coming quickly in recent years, most of these products are in the very early stages of development and remain years away from commercial impact. Claims by the developers that the new materials perform as well or better than fly ash are being made with little or no independent test data to substantiate them.

Current test methods used for legacy SCMs may or may not be appropriate for all of these materials. In addition, proving that a material performs as expected is difficult and time-consuming. Due diligence demands that specifiers require data that will help them separate the "contenders" from the "pretenders."

Two Emerging SCMs Nearing Commercial Reality

Today, two new SCMs are attracting significant attention as they approach entry into the U.S. commercial market. Calcined clay pozzolans have been studied extensively in Europe. Research has shown they can be effective pozzolans. RILEM, the International Union of Laboratories and Experts in Construction Materials, Systems and Structures, a global standards organization similar to ASTM International, has created specifications for calcined clay pozzolans. These standards are being debated within ASTM International. Potential commercial sources in the U.S. are initially identified as being located in the Southeast. It is expected that this material will be introduced into the SCM markets soon.

Calcined clay pozzolans are expected to be introduced into the SCM markets soon. Photo courtesy of Saint-Gobain Construction Chemicals.

The other SCM that is close to commercial introduction is "steel slag." Not to be confused with "slag cement," this material is produced by an electric arc furnace (EAF) processing scrap steel to create new steel products. Steel produced in blast furnaces has been in decline for some time. It is reported that only two blast furnaces remain active in the U.S. at this time. To date, slag produced in EAFs has been primarily used as an aggregate.

Efforts have been ongoing for some time to make this slag suitable for use as an SCM. The primary problems to date have been identified as iron content and calcium content. Currently, projects are underway to develop processes to address these two issues.

Because of the large volume of steel slag produced each year in the U.S. and the volume in disposal units from previous years, an SCM based on steel slag could make a significant contribution to the effort to close the gap between supply and demand. ASTM International has a subcommittee drafting a specification for this material. Such a specification will be a boost to market acceptance. In the meantime, it is expected that field testing of steel slag is imminent. Stay tuned.

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

Beneficial Use Case Study

Theodore Roosevelt Presidential Library

Coal Combustion Product Type
Class F Fly Ash

Project Name
Theodore Roosevelt Presidential Library

Project Location
Medora, North Dakota

Project Participants
Snøhetta; JLG Architecture; JE Dunn Construction; Magnusson Klemencic Associates; Dickinson Ready Mix & Concrete Products; Winn Construction; Beton Consulting Engineers LLC; Eco Material Technologies

Project Completion Date
Scheduled for July 4, 2026

Project Summary
Inspired by the environmental legacy of President Theodore Roosevelt, the Theodore Roosevelt Presidential Library is designed to set a new benchmark for sustainable construction. The 96,000-square-foot facility—currently under construction near Theodore Roosevelt National Park—aims to exceed LEED Platinum certification and achieve the rigorous Living Building Challenge designation. Designed by Snøhetta with JLG Architecture as architect of record, the library's mission is to embody Roosevelt's spirit of conservation through regenerative design, local sourcing, and low-carbon materials. Recognizing that concrete represents the largest contributor to embodied carbon, the design and construction teams made it a central focus for innovation, incorporating high volumes of fly ash supplied by Eco Material Technologies to achieve major carbon reductions across all concrete elements.

Project Description
To meet the library's ambitious carbon-neutral goals, Dickinson Ready Mix & Concrete Products worked with Beton Consulting Engineers to develop seven low-carbon concrete mixes for use in the building's foundations, retaining walls, and green roof systems. Each mix utilized a ternary blend of 1L portland cement, Class F fly ash, and Grade 100 slag—replacing 67–73% of the cementitious content with supplementary cementitious materials (SCMs), including 25–28% fly ash. Over 1,000 tons of Class F fly ash, sourced by Eco Material Technologies from the Coal Creek Station Plant in Underwood, North Dakota, were incorporated into the mixes and delivered to Dickinson Ready Mix via local haulers.

"The decision to utilize a ternary blend was made with a couple of factors in mind—primarily the carbon reduction goal, but also the materials available to us played a big role," said Ben Olin, CQTM and Ready Mix Division Manager at Dickinson Ready Mix. "Fly ash was utilized not only with the carbon footprint in mind but also for the positive effect on durability that utilizing fly ash provides."

To maintain performance with such a high replacement rate, the team relied on an admixture package that included a Mapei strength enhancer, a low water-to-cement ratio, and high-range water reducers to improve placement and early strength. "I think that we wouldn't have been nearly as successful if we didn't utilize the admixture package we did," Olin noted. "The use of a strength enhancer was a critical element in all the concrete placed."

Before exterior placements began, Dickinson Ready Mix and concrete contractor Winn Construction collaborated to pour a series of test panels to evaluate finish quality, strength gain, and winter durability. "We worked together with the concrete contractor to pour numerous test panels before the exterior placements on site," Olin said. "The test panels allowed Winn to see how the concrete finishes and see how it held up over the winter."

"There was a learning curve on this project, not only for the concrete contractor but for us as the supplier as well," Olin added. "Neither of us had ever batched or placed concrete with this high a replacement rate. The long-standing relationship with Winn, and the ability to have the space to place test batches, alleviated a lot of apprehension with these mixes. The ability to run test batches and placements gave us and the contractor the opportunity to make any changes needed to achieve the desired results."

By pioneering a high-fly-ash, locally sourced concrete for a project of national significance, the Theodore Roosevelt Presidential Library demonstrates how coal combustion products can advance the construction industry's carbon reduction goals while extending durability and material stewardship—continuing Roosevelt's enduring legacy of environmental responsibility.

Rendering - Snøhetta Plomp

Beneficial Use Case Study

ACAA

Erosion Mitigation Units

Coal Combustion Product Type
Fly Ash

Project Name
Erosion Mitigation Units

Project Location
Clifton Springs, Victoria; Kangaroo Island, South Australia

Project Participants
Reef Design Lab, Dezeen Awards, Good Design Australia, Victorian Premier's Design Awards

Project Completion Date
2022

Project Summary
As coastal erosion and habitat degradation intensify due to climate change and historical overfishing practices, Reef Design Lab—based in Melbourne, Australia—developed a novel solution: Erosion Mitigation Units (EMUs). Designed to form a permeable barrier that reduces wave energy and simultaneously fosters native marine ecosystems, the EMUs use a specially developed low-carbon concrete that incorporates 30 percent fly ash as a replacement for portland cement. First installed in 2022 at Clifton Springs, Victoria, and later in 2023 off the coast of Kangaroo Island, these sculpted structures offer an affordable, multifunctional approach to shoreline protection and marine biodiversity restoration.

Project Description
Historically, Port Phillip Bay's shellfish reefs have been decimated by two centuries of dredging and bottom trawling. To address both ecological loss and shoreline vulnerability, Reef Design Lab designed and deployed 46 EMUs—each measuring approximately 6.5 feet in diameter and weighing 1.6 metric tons—60 meters offshore in the shallow waters of Clifton Springs. A second installation of 12 EMUs was later completed near Kingscote on Kangaroo Island.

The EMUs were fabricated using a concrete mix composed of 30 percent fly ash and a recycled shell aggregate in place of traditional rock or gravel. This shell-based aggregate, while inherently weaker, was made workable thanks to the use of fly ash, which lowered the carbon footprint and improved the mix's compatibility with the recycled material. Vibrating the mix during casting allowed the shell particles to rise to the surface, which were then exposed through sandblasting to create a complex, textured substrate ideal for marine colonization.

The units' undulating design promotes water flow and encourages recreational interaction such as swimming and snorkeling, while also attracting oysters, mussels, sea snails, shrimp, crabs, and rays. Installed via a simple barge and crane system anchored to the seabed, the EMUs have already shown early signs of success, with growing seagrass mounds, stable placement, and increased marine activity.

The project was recognized with the 2023 Dezeen Award for Sustainable Design (Building Product of the Year), a Good Design Award for Sustainability, and a commendation from the Victorian Premier's Design Awards. As the EMUs continue to be monitored, their multifunctional benefits are positioning this form of engineered reef as a scalable, sustainable model for future coastal protection initiatives.

Photo - Alex Goad and Reef Design Lab

Beneficial Use Case Study

Oil Field Well Closure

Coal Combustion Product Type
Fly Ash (PozzoCem H-65 and PozzoSlag)

Project Name
Oil Field Well Closure

Project Location
Harris County, Texas; Alberta, Canada

Project Participants
Eco Material Technologies, O'Neill Industries

Project Completion Date
March 2025

Project Summary
The Humble Oil Field in Harris County, Texas, discovered in 1905, is the second oldest in the state and was once owned by business magnate Howard Hughes Sr. After more than a century of production, aging wells in the field now require permanent closure under regulations overseen by the Texas Railroad Commission. Known as "plug and abandonment," this process prevents oil and gas reservoir fluids from migrating upward and potentially contaminating other formations or freshwater aquifers. In December 2023, O'Neill Industries carried out one such closure using a new low-carbon cement solution developed by Eco Material Technologies. The project not only honored regulatory requirements but also highlighted an innovative approach to reducing emissions in a traditionally carbon-intensive process.

Project Description
For the closure, Eco Material Technologies supplied PozzoCem H-65, a specially formulated green cement blend made of 65 percent PozzoSlag and 35 percent Type H cement. The cement grout was injected through tubing to the base of the wellbore, then allowed to rise upward to form a continuous, durable plug. The spherical shape of the fly ash particles in PozzoSlag provided a "ball-bearing effect" that improved plasticity and workability, allowing for less water use, greater cohesiveness, and smoother pumping into place. The result was a strong, uniform seal that met all technical and regulatory requirements.

The use of PozzoCem H-65 reduced greenhouse gas emissions by approximately 70 percent compared with traditional portland cement. In addition to lowering the environmental footprint of the closure process, the material helps limit fugitive methane emissions by ensuring wells are permanently sealed. This first application at Humble Oil Field demonstrated a replicable model for low-carbon well closure across the U.S. energy sector.

Building upon this success, Eco Material Technologies extended its innovation to the Canadian oil and gas market in 2024, developing a new high-temperature green cement for a thermal well closure in Alberta. That formulation—containing one-third PozzoSlag, one-third portland cement, and one-third silica flour—was designed to withstand temperatures exceeding 300 degrees Fahrenheit, such as those encountered in deep reservoirs and steam-enhanced recovery operations.

Together, the Humble Oil Field closure in Texas and the subsequent thermal well project in Alberta demonstrate how Eco Material Technologies' green cement solutions can be adapted to different conditions while delivering both performance and environmental benefits. These projects highlight the scalability of products like PozzoCem H-65 and related formulations to meet the growing demand for low-carbon, environmentally responsible well closure practices across North America.

Photo - Eco Material Technologies, a CRH Company

Beneficial Use Case Study

Missoula Federal Credit Union

Coal Combustion Product Type
Class C Fly Ash

Project Name
Missoula Federal Credit Union

Project Location
Missoula, Montana

Project Participants
MacArthur, Means, and Wells Architects; Missoula Federal Credit Union; Western Transportation Institute at Montana State University; Beaudette Consulting Engineers Inc.

Project Completion Date
2007

Project Summary
In 2007, the Missoula Federal Credit Union partnered with MacArthur, Means, and Wells Architects (MMW) and researchers at Montana State University's Western Transportation Institute to use a pioneering concrete mix in the construction of its Russell Street branch. The project sought to achieve LEED Platinum certification by incorporating locally sourced recycled materials, including Class C fly ash and pulverized glass. The building became one of the first commercial structures in the United States to use 100 percent fly ash concrete with recycled glass aggregate in a structural application.

Project Description
The Missoula Federal Credit Union (MFCU) Russell Street branch project provided an opportunity to test and showcase a new low-carbon building material. With the goal of achieving Platinum LEED certification, architects from MMW approached Montana State University's (MSU's) Western Transportation Institute to help design a concrete mixture that replaced traditional portland cement with locally produced Class C fly ash from the Corette Power Plant in Billings, Montana, and substituted natural aggregate with recycled glass processed by Headwaters Recycling in Helena.

The research team refined the mix to ensure workability, strength, and durability, ultimately developing two trial designs—one using a blend of coarse and fine glass, and one with fine glass only. Laboratory and field testing confirmed that the concrete achieved strength comparable to or greater than conventional mixes, with 28-day strengths above 4,000 psi and long-term strengths exceeding 8,000 psi. Testing also showed the material to be highly resistant to alkali-silica reactivity and freeze-thaw cycles, both of which are critical for long-term durability in Montana's climate.

The project used this innovative concrete for the building's footings, foundation walls, slabs, precast exterior panels, and two interior load-bearing beams. Reinforced beam testing further confirmed that the material behaved predictably and performed within existing design standards.

By incorporating fly ash and recycled glass into a structural building material, the project reduced the carbon footprint of construction while diverting waste glass from landfills. It also advanced research into sustainable concrete applications and demonstrated that 100 percent fly ash concrete can serve as a viable and durable alternative to portland cement-based mixes. The collaboration between MFCU, MMW Architects, and MSU researchers underscored how owners, designers, and engineers can work together to push sustainable building practices forward.

Photo - Missoula Federal Credit Union

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.

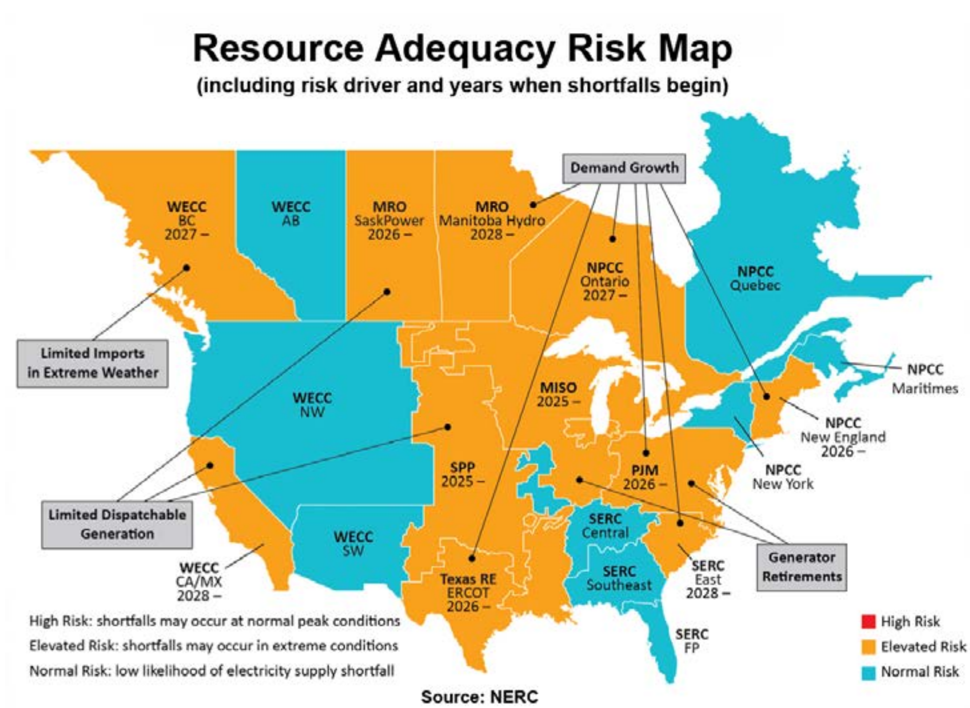
This issue's guest columnist is Randy Eminger. Randy has worked for over 40 years in a range of governmental affairs positions in the energy and environmental arenas. Currently, he is Proprietor of Eminger LLC, which provides consultative services to clients in the electric power industry. Prior to that, Randy served as Executive Director of the Energy Policy Network, an industry trade organization whose mission is to promote low-cost environmentally compatible electricity from coal. Previously, he served for over 20 years as Vice President for the American Coalition for Clean Coal Electricity, where he oversaw government relations in 11 southern states.

Q. What is the outlook for the existing coal-fueled power generation fleet in light of exploding electricity demand projections?

A. For more than a decade, the U.S. power sector's planning assumptions followed a familiar storyline: steady coal retirements, flat demand, and a generation mix shifting steadily toward renewables and gas. But 2024–2025 has blown up that narrative. Electricity demand is now rising at the fastest pace in 20 years, driven by an unprecedented boom in data centers, AI computing, electrification, and heavy industry. And suddenly, the existing coal fleet—historically seen as a diminishing part of the power mix—is emerging as one of the few dependable assets capable of holding the grid together.

The North American Electric Reliability Corporation (NERC)'s reliability assessments are blunt. Summer peak demand will jump by more than 122 GW over the next decade. Winter demand will rise nearly 14 percent. Meanwhile, 115 GW of firm generation—mostly coal and gas—is scheduled to retire, and the bulk of the replacement capacity is wind and solar that contributes little to peak needs. The result: "well over half of the continent" is now at elevated or high risk of energy shortfalls. MISO, SPP, the Southeast, ERCOT, New England, and the West all face tightening reserve margins as load surges faster than new, dependable supply can be built.

That risk is already showing up in NERC's latest (November 2025) Winter Reliability Assessment. Peak demand this winter is 20 GW higher than last year, but new resources add up to less than half of that. Nearly every region reports year-on-year load growth, with hot spots—especially the Southeast, Mid-Atlantic, and West—pushing 10 percent. Data centers are a major driver: U.S. computing power demand could double by 2030, and by 2050 the U.S. Energy Information Administration expects computing to consume more electricity in commercial buildings than cooling or ventilation. AI workloads alone are so energy-dense that tech giants now admit they cannot run future data centers without massive amounts of firm, always-on generation. That rules out wind and solar as primary suppliers—and new nuclear capacity remains many years away.



This mismatch between demand and dependable supply has triggered the most significant wave of coal-plant retirement deferrals in years. At least 49,000 MW of U.S. coal capacity has already seen retirement dates pushed back. In Wisconsin, Alliant and We Energies have held off on retiring multiple aging coal units because MISO warns of seasonal capacity shortages. In Colorado—one of the country's most aggressively decarbonizing states—Governor Jared Polis supported extending the life of Comanche 2 to maintain reliability after the breakdown of Comanche 3. Tri-State expects federal orders to keep Craig Unit 1 running even though state policy had anticipated its closure. DOE has repeatedly used Section 202(c) authority to keep dispatchable units online when reliability is at risk.

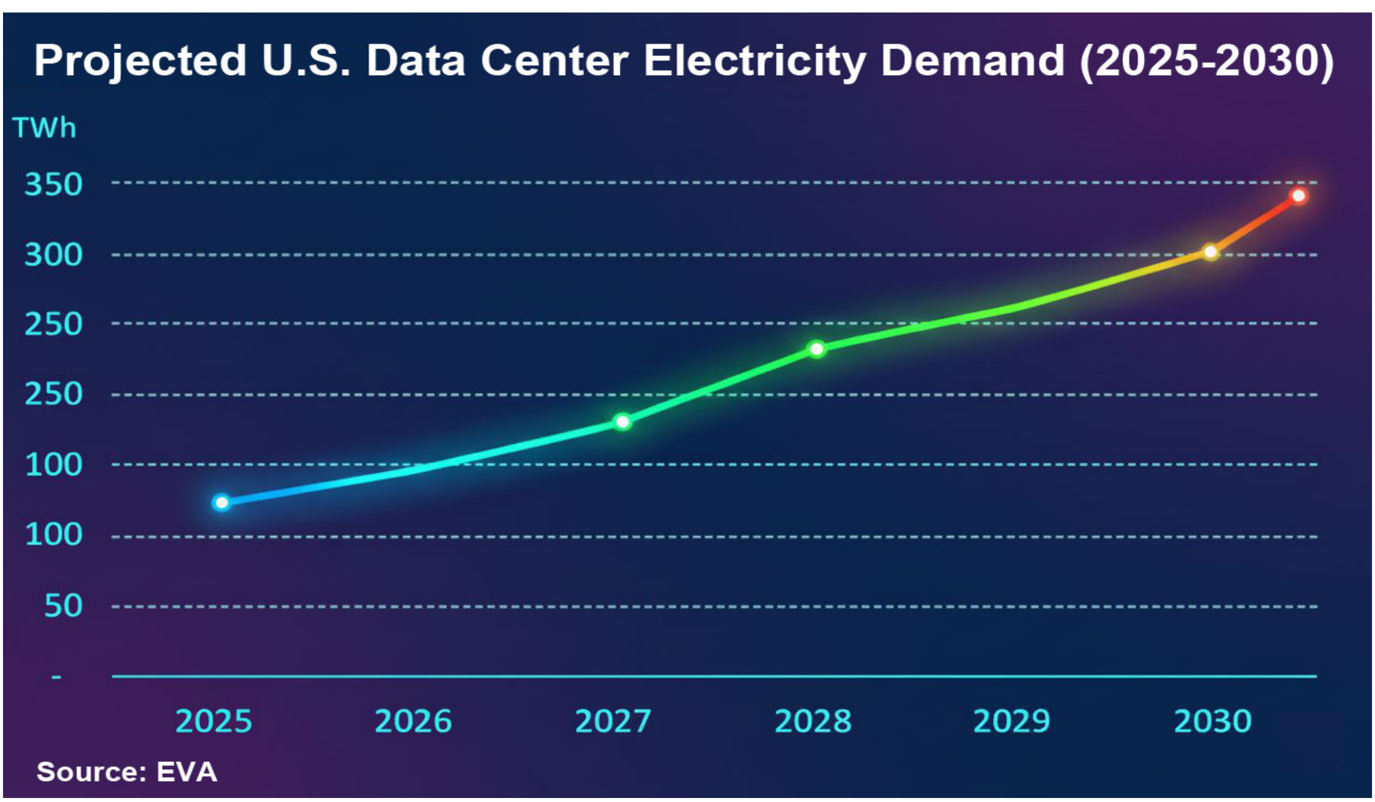
Even utilities committed to 100 percent carbon-free targets are quietly acknowledging what NERC has been signaling for two years: the grid cannot afford to lose firm megawatts faster than replacements can be permitted, financed, and built. Solar, wind, and batteries are growing, but not fast enough—and not with the peak-hour performance the system needs during extreme heat or cold. In MISO, new solar installations added to the grid contribute only about 1 GW toward winter peaks even though many times that amount of new solar has been built. Wind's dependable contribution during peak hours—the share of wind capacity the grid operator counts on during peak demand—has also been reduced based on updated reliability modeling.

Policy momentum is also shifting. Expected rollbacks of EPA's PM NAAQS, MATS, Clean Water Act jurisdiction, and carbon-pollution rules will ease compliance pressures on coal plants. Instead of facing mandatory retirements tied to expensive controls or carbon-capture retrofits, utilities may find it cheaper—and strategically necessary—to keep existing units operating longer as reliability backstops.

The outcome is not a coal revival in the traditional sense. But rising demand has unquestionably strengthened the strategic value of existing, dispatchable assets. Many units will run harder, more often, and for more years than planners expected. Others may shift to seasonal or reliability-must-run roles. Some may even be converted to gas once pipeline and permitting issues ease.

The broad takeaway is unmistakable: explosive electricity demand has elevated the importance of every firm megawatt on the grid. Data centers want 24/7 power. Electrification is rising. Transmission expansion is crawling. New thermal generation is scarce, and new nuclear capacity remains on a much longer development horizon. In this environment, the existing coal fleet is no longer a legacy afterthought—it is a buffer. A stabilizer.

The future is still one of transition, but the pace and path have changed. Instead of asking whether coal will retire, the conversation is shifting toward how retirement timelines should adapt to reliability needs. In the era of the AI load surge, coal's second act is being defined not by nostalgia, but by necessity.



Don’t Get Left in the Dark: Power Outage Safety

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.

A power outage is a disruption in the supply of electricity to homes, businesses, and other facilities. They are more likely to occur during severe weather events, such as thunderstorms, hurricanes and winter storms, or other natural disasters, such as wildfires. Ensure your safety by observing the following tips.

Prepare for a Power Outage

Power outages can disrupt the operation of many of the essentials of daily life: communications, water, transportation, grocery stores, gas stations, etc. Prepare yourself beforehand:

- Take an inventory of the items you need that rely on electricity (refrigerator, heat, A/C, lights, etc.).
- Gather emergency supplies (food, water, batteries, etc.) to last for several days.
- Check supplies regularly and before predicted extreme weather events.
- Keep mobile phones and other electronic equipment charged before a power outage.
- Have flashlights for every household member.
- Determine how long any medications you rely on can be stored at higher temperatures and get specific guidance for required refrigeration or any medications that are critical for life.
- Make sure your vehicle’s gas tank has plenty of fuel before predicted extreme weather events.
- Consider purchasing a generator to power essential appliances while the electricity is off.

While the Power Is Out

- Turn off or disconnect appliances, equipment, or electronics. Power may return with momentary surges or spikes that can cause damage.
- Never use a gas stovetop or oven to heat your home.
- Avoid carbon monoxide poisoning. Generators, camp stoves, or charcoal grills should always be used outdoors and at least 20 feet away from windows.
- Use flashlights, lanterns, and other battery-powered lights. Don’t use gas stoves or candles to heat and/or illuminate your home.
- Keep freezers and refrigerators closed and use coolers with ice if necessary.

- Monitor food temperatures with a thermometer and throw food out if the temperature is 40 degrees or higher.
- Pay attention to water advisories. Boil water or use bottled water from your emergency supply kit, if needed.
- Stay fire safe. Always use fireplaces, portable heaters, and wood-burning stoves safely.
- If you use your vehicle as a source of power or warmth (or coolness), make sure to run it in a well-ventilated place outside. Never leave a vehicle running inside a garage, even if the garage door is left open.

After the Power Returns

- Throw away any food that has been exposed to temperatures 40 degrees or higher for two hours or more, or that has an unusual odor, color, or texture.
- If the power has been out for more than a day, discard any medication that requires refrigeration, unless the drug’s label says otherwise.

These materials were adapted from Ready.gov.

The World of Coal Ash 2026

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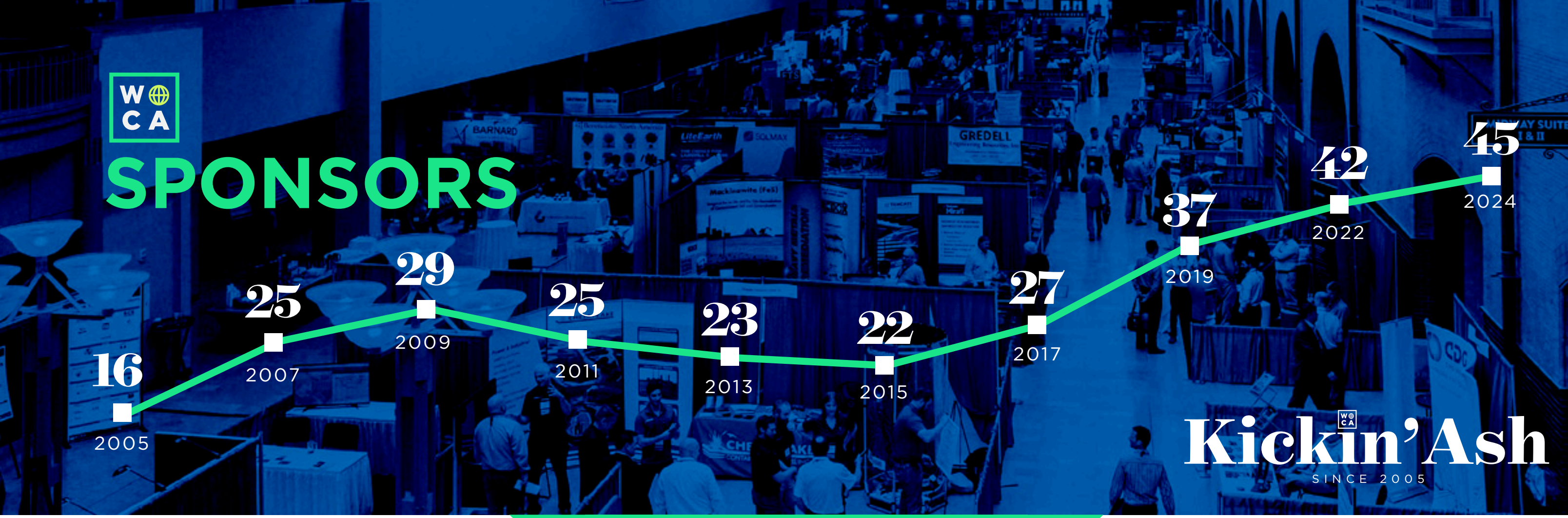

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6 Questions for Max Swoboda and Thomas Wilson

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.

Max Swoboda has over 30 years' experience working in a variety of Applications and Technical Sales Engineer roles in the water industry. Currently, he is Business Development Manager at Xylem, a Fortune 500 water solutions company, where he focuses on wastewater treatment and environmental compliance. Prior to Xylem, Max served as Business Development Executive at Evoqua Water Technologies, providing clients with tailored solutions to enhance operational efficiency and NPDES compliance. He holds a Bachelor of Science degree in Civil Engineering from the Virginia Military Institute.

Thomas Wilson is the Vice President and General Manager of Xylem's Heavy Industries division. He has held leadership positions within the company since 2002, including areas of supply chain management, life sciences, global order execution, and General Manager within two divisions. He has a Master's degree in Business Administration from the University of Alaska and a Bachelor's degree in Mechanical Engineering from Montana State University.

ASH at Work (AW): The EPA's 2024 final rule on Effluent Limitations Guidelines establishes a zero liquid discharge (ZLD) standard for flue gas desulfurization (FGD) wastewater. In practical terms, what does this requirement involve, and why is it such a significant change for power plants?

Max Swoboda and Thomas Wilson (MS-TW): In practical terms, establishing a zero-discharge limitation for all pollutants in FGD wastewater eliminates the allowed discharges of the prior rule. Earlier ELGs regulated specific constituents, such as arsenic, mercury, and selenium, by setting numeric limits for discharge to the environment. This meant utilizing treatment systems that were specific to treating these constituents only.

The 2024 rule identifies the Best Available Technology (BAT) as a suite of advanced processes, used individually or in combination, which ensures no regulated wastewater streams leave the facility. Unlike prior rules that set numeric discharge limits for dissolved constituents like arsenic, mercury, and selenium, the new ELGs cover all dissolved constituents. In other words, instead of treating a few of the constituents in the water, all the constituents in the water must be removed along with the water that contains them.

The only technology capable of achieving this is crystallization, which uses thermal processes to evaporate water until solids precipitate as crystals. These crystals contain whatever was dissolved in the wastewater, and their composition varies by plant, depending on coal type and operating conditions.

ZLD means no liquid discharge, so the treated water must be reused. While boiling water to vapor is possible, it is highly energy-intensive. Therefore, the core strategy for ZLD is to recover the heat contained in the vapor and recycle a clean permeate or distillate—water separated from pollutants—back into the plant, often as makeup water for the FGD system or the Electric Generating Unit (EGU).

However, ZLD also produces concentrated brine and solid crystals that require disposal. Common practices include encapsulation in fly ash (FA) for landfill disposal, direct encapsulation, or placement in evaporation ponds.

Achieving 100% water recycling is technically challenging and energy-demanding, making ZLD a significant operational shift for power plants.

AW: Once wastewater is treated under ZLD, what typically happens to the solids and the water, and how does salt content affect whether the water can be reused in the plant?

MS-TW: A ZLD system is engineered to minimize energy use while separating water from dissolved solids in wastewater. The process begins with membrane technologies that concentrate the wastewater by increasing its total dissolved solids (TDS) as much as possible before the final crystallization step. Water recovered from membranes and distillate from the ZLD process is recycled back into the plant, while constituents are concentrated into solid forms for disposal.

After the treatment, the challenge that remains is managing the solids produced. These solids typically consist of six common salts: calcium sulfate, sodium sulfate, magnesium sulfate, calcium chloride, sodium chloride, and magnesium chloride. Other salts may be present but usually at much lower concentrations.

Because these salts have different solubilities, the crystallization step can yield a salt cake, a concentrated brine, or a combination of both. The final consistency depends on the ratio of these six salts. This consistency also determines how much stabilization material is required to solidify the salts for safe landfill disposal.

AW: When brine is created, EPA has suggested encapsulating that brine with fly ash. What are the implications of this approach for utilities, landfills, and beneficial use markets?

MS-TW: Disposal of brine presents major challenges for utilities, landfills, and beneficial use markets, involving tradeoffs in feasibility, cost, and environmental impact.

Feasibility Factors:

- Economic feasibility: Brine encapsulation requires specialized equipment such as batch mixing tanks or pug mills. The corrosive nature of brine and abrasive properties of fly ash demand durable, often costly materials for all wetted surfaces.
- Chemical requirements: Additives like quicklime (≈5% by weight) are typically needed to stabilize the mixture.
- Fly ash availability: A common ratio is 4 parts fly ash to 1 part brine, and the final material must pass paint filter tests and Toxicity Characteristic Leaching Procedure (TCLP) standards.

The rule promotes membrane concentration combined with encapsulation as the disposal method. However, membrane systems alone may not reduce brine volume enough to avoid consuming all fly ash produced by a plant.

For example, a membrane system concentrating wastewater to 200,000 ppm may only achieve 85% volume reduction. A 300 gpm FGD wastewater stream would still generate 108,000 gallons of brine per day, requiring 2,700 tons of fly ash daily. That volume likely eliminates all beneficial use FA sales at an EGU and could leave a deficit.

EPA concluded that fly ash encapsulation will not significantly impact the overall market; the example suggests another conclusion. The way to reduce fly ash consumption is to minimize brine volume by making greater concentrations of brine. Achieving 70%+ volume reduction shifts from membrane technologies to evaporation and crystallization. To reach reasonable encapsulation FA requirements, wastewater volume reduction of over 97% is likely required.

An encapsulation approach with only membrane treatment diverts valuable fly ash away from beneficial use, creating both lost revenue and added disposal costs. Diverting fly ash from markets, especially for portland cement replacement, removes environmental benefits such as reduced energy use, water consumption, and greenhouse gas emissions, while increasing reliance on virgin materials.

Encapsulation also impacts landfill operations by increasing solid waste volumes and introducing materials prone to leaching. Another concern is that the non-TCLP salts (chloride, sulfate), while not regulated, could dissolve in water. Additional research is needed to understand landfill disposal impacts. Some studies show selenium levels in leachate exceeding EPA standards, suggesting a need to convert selenium to insoluble forms.

On a positive note, engineered encapsulation mixes with additives like quicklime and aluminate can produce materials with very low hydraulic conductivity, even outperforming landfill liner requirements. This reduced permeability makes it less likely for rainfall to infiltrate and liberate salts.

While encapsulation can work, it introduces significant economic and environmental challenges. Systems that achieve true ZLD through evaporation and crystallization may offer long-term benefits by eliminating brine and reducing landfill impacts.

AW: EPA's 2020 rule concluded that diverting fly ash to wastewater treatment would unduly restrict its availability for beneficial use. Yet in 2024, the agency adopted the opposite stance, contending that supply is adequate for both encapsulation and beneficial use. How do you interpret this policy reversal, and what consequences does it carry for fly ash supply and beneficial use?

MS-TW: The 2024 rule's encapsulation requirements increase demand for fly ash at a time when total fly ash production is declining due to ongoing coal plant retirements. Industry comments also noted that EPA's recent findings suggest older CCR storage areas, potential future sources, are less likely to contain fly ash of consistent and reliable composition, limiting their value for beneficial use or encapsulation.

In 2020, EPA evaluated EGUs individually, but in 2024 the agency considered the aggregate relationship between fly ash production and FGD wastewater volumes. At the center of the reversal, there are observations of what could or would happen.

EPA estimates that 6.03 million tons of FGD wastewater and 4.64 million tons of combustion residual leachate may require encapsulation. The agency concluded that "even under the strictest regulatory option, there will still be approximately 20 million tons of fly ash generated that maybe be [sic] sold for beneficial reuse." Using these figures, if all unsold fly ash were diverted to encapsulation, plants would need to achieve roughly 40% wastewater concentration. This is a plausible concentration with membranes; however, not every plant has unsold ash, meaning facilities may need to reduce fly ash sales or import fly ash from other locations to meet encapsulation needs.

Another option is operating FGD systems at maximum concentration to minimize wastewater volume—but whether this is a reasonable operating condition for all EGUs remains uncertain.

The core consequence of this policy shift is potential disruption to local fly ash markets, which depend on a stable supply for construction materials such as cement and wallboard.

AW: What strategies should be considered to minimize or eliminate the need for brine encapsulation, and what alternative-use products could be developed instead?

MS-TW: The most energy efficient and effective process to achieve ZLD from power plant FGD brines begins with Reverse Osmosis membranes followed by crystallization. As we see from our example before, achieving a higher concentration reduces the encapsulation. Going from 98% to 99% volume reduction is 50% less brine volume; each percentage of volume reduction starts to be more valuable.

Brines may hold potential value in beneficial use markets. As noted earlier, these brines contain high concentrations of common salts. Industrial applications for compounds such as calcium sulfate, sodium sulfate, magnesium sulfate, calcium chloride, sodium chloride, and magnesium chloride represent opportunities worth exploring for beneficial use.

However, the final step, the stabilization of the concentrate salt mixture (brine, salt, or both), varies. If the final mixture is primarily salt, the goal is to dry the salt and then test for leaching of RCRA metals. If the final mixture is only a brine or a mixture of brine and precipitated salts, then the goal may be to experiment with stabilization materials that utilize the least mass of materials possible while making a dry product. In addition, a direct-fired thermal dryer may be an option to drive out water and thermally dry the mixture prior to any attempt at stabilization.

AW: Looking ahead, what opportunities do you see for organizations like the American Coal Ash Association and its members to advance beneficial use markets for brines and other byproducts under the rule as it is currently written?

MS-TW: ACAA and its members can use its network to connect utilities with downstream users who can safely incorporate these byproducts into their processes—helping uncover and grow demand for these alternative materials in manufacturing, agriculture, and de-icing markets. The brines will require marketing and/or specifications to develop beneficial use pathways so that they become a useful and consistent commodity. With stricter regulations increasing disposal costs, creating a revenue-neutral or revenue-positive outlet for byproducts is attractive. Beneficial use markets can help offset the cost of ELG compliance, and the ACAA can quantify and communicate that value.

National Concrete Pavement Technology Center at Iowa State University

Standing at the nexus of public agencies, industry, and academia, the National Concrete Pavement Technology Center (CP Tech Center) at Iowa State University focuses on developing and implementing best practices for the design, construction, and maintenance of sustainable and resilient concrete pavements.

The CP Tech Center is changing practice by providing technology transfer resources and training to practitioners across the country and worldwide. The center is also known for its ability to provide independent and first-rate technology support to agencies and industry throughout the United States.

Guided by a national-level, long-term perspective, the center collaborates with public agencies and industry to identify priority topics and strategic needs within the concrete paving community and to meet those needs in useful, accessible ways that encourage implementation. Key partners include the Federal Highway Administration, Federal Aviation Administration, state departments of transportation, and concrete pavement industry groups such as the American Concrete Institute, American Cement Association, and the American Concrete Pavement Association.

The center draws from a deep pool of expertise—including in-house staff as well as researchers and consultants around the United States and internationally—to conduct research and provide cutting-edge information and technology to all types of practitioners. Information is disseminated through several channels:

- Manuals, guides, and technical briefs
- Workshops, presentations, webinars, and information-sharing forums
- Demonstration projects and pilot projects
- Site visits
- Expert advisory teams for training and troubleshooting

The center's primary audiences include state and local agencies, particularly through the National Concrete Consortium (NC^2), and industry, primarily through industry trade associations.

Given the central role of coal ash in modern concrete paving practice, the topic has featured in several research studies, technical publications, videos, presentations, and webinars from the CP Tech Center. Topics have included the benefits of coal fly ash and similar supplementary cementitious materials in concrete paving, best practices for the use of fly ash, and the use of harvested fly ash in highway infrastructure.

Since its inception more than 20 years ago, the CP Tech Center has been instrumental in advancing strategic improvements in how concrete pavements are specified, built, and maintained. Significant impacts have included growth in the adoption of concrete overlays, advances in performance-engineered mixture (PEM) concepts, and accelerated acceptance and use of Type 1L cements.

Trans Ash

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

Founded in 1960 and headquartered in Cincinnati, Ohio, Trans Ash has grown from a regional civil contractor into a national leader in civil construction and coal ash remediation—a critical service in today's evolving world for environmental accountability and sustainable energy practices.

With over six decades of experience, Trans Ash brings unmatched expertise to complex, large-scale projects that help utilities and energy providers meet increasingly stringent federal and state regulations. From CCR basin closure, landfill construction, and capping to dredging, civil site work, new generation site prep, and operational plant support services, the company offers turnkey solutions that blend engineering solutions with environmental stewardship.

"We're more than a general contractor—we're a long-term partner," says company leadership. "Our focus is on delivering safety, compliance, and quality on every project."

This commitment to excellence has earned Trans Ash the trust of major utility companies across the country. As coal-fired power plants are decommissioned or upgraded, the demand for safe, compliant coal ash basin and landfill closures continues to rise. Trans Ash has positioned itself as the go-to contractor, offering scalable services that align with both regulatory mandates and utility industry expectations.

In January 2023, Trans Ash entered a new chapter of growth through its acquisition by NorthStar Group Services, a national leader in environmental remediation and deconstruction. The acquisition has expanded Trans Ash's reach and resources, integrating it into a broader platform of infrastructure and industrial services.

Despite its national expansion, Trans Ash remains deeply rooted in their company core values. The company's family-founded values, long-tenured workforce, and strong safety culture continue to define its identity. With an extensive fleet of heavy equipment and a team of skilled professionals, Trans Ash tackles everything from site restoration to large-scale earthwork with a focus on sustainability and compliance.

Looking ahead, changing environmental standards, increased energy demand, and rising public expectations all create challenges for the industry but also create opportunities. The company is actively pursuing CCR harvesting and new generation site development, ensuring it remains at the forefront of the industry.

Trans Ash has proven they can evolve as the industry evolves. For utility companies seeking a proven partner in coal ash remediation, environmental construction, and civil construction, Trans Ash delivers a combination of experience, adaptability, and integrity.

NMC NATIONAL MINERALS CORPORATION

EP Power Minerals

National Minerals Corporation

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

National Minerals Corporation (NMC) has a 50+ year history in maximizing fly ash utilization in concrete as well as discovering and pursuing other industrial, high-volume beneficial use applications for coal combustion by-products. Our business is dedicated to representing our utility partners in the marketplace to achieve 100 percent utilization and maximize the value of fly ash as a cement replacement product. We employ a very experienced team of industry professionals who provide market analysis, technical expertise, beneficiation experience, and effective market support to ensure full utilization of the production of the coal combustion materials our utility partners produce. In addition, NMC is a pioneer in building and operating dedicated fly ash storage terminals. Our dedicated network of company-owned storage terminals assures our concrete producer customers a reliable product supply for Class C fly ash. In addition, our utility partners are assured of 100 percent storage and utilization.

NMC also operates a transportation division that includes a fleet of pneumatic trailers, railcars, and on-site construction equipment that is dedicated to our customers and utility partners for on-site services including active landfill management and reclamation.

In April of 2025, NMC was acquired by EP Power Minerals Americas Inc., the U.S.-based subsidiary of the global supplier of cementitious materials and part of the EP Holding group of companies (https://www.epholding.cz/en/companies). EP Power Minerals acquired NMC to strengthen EP's commitment to the growth of the fly ash and pozzolans business in the U.S. EP Power Minerals is a world-wide network of companies with operations throughout Europe, Asia, and the U.S. focused on the cementitious and construction materials industry. In addition, EP Power Minerals is a global leader and pioneer in the reclamation and beneficiation of stored fly ash deposits with beneficiation projects in the U.K, France, and Germany. EP brings experience, a high-level of commitment, and investments in sustainability to NMC and ultimately to our utility partners and customers.

In and Around ACAA
(WOCA The Workshop Edition)

Salt Lake City, Utah

(L-R): Mark Rokoff, Business Development Manager, Environmental Services, at Burns & McDonnell, and John Duffey, Vice President, Northstar Demolition & Remediation LP.

Salt Lake City, Utah

(L-R): Doug Hooton, NSERC/CAC Industrial Research Chair in Concrete Durability & Sustainability, at the University of Toronto, and Simonida Grubjesic, Group Director, CTLGroup.

Salt Lake City, Utah

The ACAA's Women's Leadership Forum

Salt Lake City, Utah

(L-R): John Halm, CCP Byproduct Marketing Manager, Duke Energy, and Danny Gray, Executive Vice President, Eco Material Technologies.

ASH Classics

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

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

The following ASH Classic, from 1984, includes commentary from then-ACAA Executive Vice President Tobias Anthony lamenting that—even if all of the fly ash then produced were incorporated into concrete—utilization rates would still not eclipse 30 percent. Forty years later, fly ash utilization has climbed above 75 percent—and concrete producers would use more if not for the impact on certain regional markets of shifting supply dynamics associated with closures of coal-fueled power plants.

ASH AT WORK

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Orlando Is Site For Seventh International Ash Utilization Symposium in March 1985

WASHINGTON — The NAA has contracted with Meeting Planning Associates of Menlo Park, CA to assist in the planning, coordination, and management of the Seventh International Ash Utilization Symposium to be held in Orlando, FL on March 3-7, 1985.

MPA President Kathy Davis will work directly with Co-Chairmen Allan W. Babcock and Jack Weber in staging the event which will be held at the Sheraton Twin Towers. John Gillis is the liaison with the NAA staff.

The group met with the hotel and convention reps in Orlando recently to finalize details for the four-day program which is expected to attract 400-500 delegates representing all facets of the ash industry.

An official Call For Papers will be issued by mid-March setting forth the various subject areas in which technical papers are being solicited. Special emphasis will be placed on "how-to presentations" dealing with specific applications.

The international symposium is held every three years. The initial program, which led to the formation of the National Ash Association, was held in Pittsburgh in 1967.

NAA Annual Meeting Set For Washington, April 3

WASHINGTON — The annual meeting of the National Ash Association will be held at the Ramada Renaissance Hotel here on Tuesday, April 3, according to President James P. Plumb.

The session will begin at 10 a.m. in the New Hampshire III Room. Agenda items include the President's Report and subcommittee presentations.

Members of the Board of Directors will convene at the close of the business meeting to elect officers and to designate an Executive Committee to conduct the day-to-day affairs of the association.

A luncheon will conclude the program.

Optimism Growing That EPA Findings Favorable

WASHINGTON — NAA Executive Vice President Tobias Anthony expressed optimism the Environmental Protection Agency will ultimately issue a favorable report stating power plant ash is a non-hazardous product.

The ash industry spokesman says he has been reliably informed "the EPA is leaning towards the conclusion that high volume ash presents no problem to the environment."

"At this point we are hopeful the language in the report to be submitted to Congress late this year or early in 1985 will not adversely impact the continued and expanded re-use of these valuable coal by-products," he added.

Anthony urged producers, marketers, and users to continue to document applications so the industry can develop the data base to refute allegations that power plant ash is harmful to human health and the environment.

The association will catalog the material in its reference library, he added.

Two Utilities Join Association Team

Two electric utilities operating coal-fired generating stations have been accepted into membership in the National Ash Association.

The first is Utah Power & Light Company headquartered in Salt Lake City. The utility operates six coal-fired stations with a rated capacity of 3.2 million kilowatts. UPLCo serves 470,000 customers in Utah, southeastern Idaho, and southwestern Wyoming.

Mr. Waite

Richard Waite, chief engineer-generation, is the firm's designated representative to the NAA Board of Directors. Harry Lundell is the president and chief executive officer for the utility.

Delmarva Power & Light Company of Wilmington, Delaware, is the second Class P member to join the Association in 1984. The utility serves the 292,000 customers residing in Delmarva peninsula in Delaware as well as portions of Maryland and Virginia. Delmarva currently operates six (6) coal-fired generating units and jointly owns four (4) others located in Pennsylvania.

Mark Schneider, a project engineer, is the designated representative to the Association's Board of Directors. Nevius M. Curtis is the president and chief executive officer.

Bayou Ash, Inc. of Baton Rouge, LA has become a Class M marketing member. The firm, owned by James J. Conner, serves customers in the Gulf Coast area extending as far east as Florida.

A Kansas consulting firm, Koch-Carbon, Inc. of Wichita, is a new Class E member. The contact person is Ms. Sarah Allender.

Steve Benza and Dennis L. Kinder, two ash industry exponents, have

(Continued on Page 2)

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ASH AT WORK

James P. Plumb, *President* Allan W. Babcock, *Editor*

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

NAA Message Board

Tobias Anthony
Executive Vice President

Several weeks ago, I chatted with Ron Morrison about the prospects for increasing the use of coal ash. Ron is manager of American Electric Power's ash utilization and research section, a pioneer and a futurist.

It bothered me that we were using only 20% of our ash in this country while in Europe 70% or more is common. Then, he told me bluntly that if we took all of our ash and mixed it with all the concrete produced in this country, we wouldn't use more than 30%. Since not all ash is usable, that figure is on the high side.

Well, I did some investigating and found out that Ron was right, as usual. Last year's production of cement or clinker, was some 55 million tons. If you could use a maximum of a 20% mix, fly ash to cement, then in the best-of-all worlds we could not have used up more than 11 million tons of fly ash. Since we produced 48 million tons of fly ash in 1982, that would mean only 23% could have been used if you could use it all.

In addition to fly ash, we produce bottom ash and boiler slag. Last year, it amounted to 65 million tons in total. We utilized only 20% and disposed of the rest. How can we reverse that situation? That is my personal goal.

The answer for the near term, Ron says, lies in using ash as structural fill. In the future, it will be economical to mine materials from ash pits, but such is not the case currently. But, structural fill or creating a construction base is the way to go over the near term.

This is what I mean. Utilities are permitted to diversify and can enter the land development or even real estate business. Who knows more about real estate, demographics, promoting settlement of industry and working with governments then do electric utilities.

What is the incentive? Economists have a term called value-added and that is where the incentive lies. The story goes something like this. There is a lot of fallow land around which is unsuitable for building structures. Let's say that land can be bought for $100 an acre. A layer of ash, excellent for providing a construction base, could raise the value of that land to say, $1-2,000 an acre. Buildings such as commercial structures could raise the value to $10-20,000 an acre. The pay back comes in the form of capital gains.

Ash, which is not suitable for admixtures, can be used for fortifying construction land, and Baltimore Gas & Electric is already out front on this one.

Unquestionably, the real estate community will recognize this value and in the future I expect small entrepreneurs to jump into this market.

Of course, there is a benefit to state and local governments in that fallow land would be added to the tax rotable category.

The NAA is convinced that ash can be utilized safely this way, make it truly, the resource it is. One of the top priorities for 1984 will be to convince all governments that this proposition is valid and all barriers to this fact should be eliminated.

40 HIGHWAY DEPARTMENTS

WASHINGTON — A 1983 survey of highway departments revealed that 40 states have utilized power plant ash in actual road construction and maintenance projects, according to the National Ash Association.

All 50 states responded to the questionnaire. The survey also depicted a more diversified use of these versatile aggregates than at any previous time.

As one might expect, the most widely accepted application in highway construction is the use of fly ash as a cement replacement in concrete. Thirty (30) states permit its use in concrete pavements, median barriers, drainage ditches, or in structures. An additional four (4) highway departments use 1-P cement but not as a replacement in concrete.

The results of the survey are presented in the table on the opposite page on a state-by-state basis.

Ranking second is the use of fly ash as a mineral filler in asphalt mixes by 20 states, 16 others reported grout applications, 13 more utilize ash in stabilized base courses, and nine (9) in structural fills.

A total of 34 states have developed specifications for one or more uses of power plant ash. The 63 specs now on file in the NAA's reference library in Washington covered 23 different applications.

Some states reported satisfactory performances with fly ash, bottom ash, or boiler slag dating back to the 50's and 60's.

Sixteen (16) highway departments have utilized bottom ash or boiler slag in some way including 12 in asphalt paving, nine in ice control, seven in base course construction, five in skid resistant surfaces, and three in stabilized bases.

With the Federal Highway Administration advocating the use of power plant ash where "technically feasible and economically attractive," the use of coal ash in highway applications should continue to expand.

Another factor is the diminishing availability of natural aggregates in many areas of the country.

Two Utilities *(Continued from Page 1)*
announced the formation of a new consulting and marketing company, KBK Enterprises, Inc., and have joined the NAA as a Class M member. The new firm will basically operate in a five-state area including Pennsylvania, West Virginia, Virginia, Maryland, and Ohio. Offices will be maintained in Mifflinville, PA and Charleston, WV.

Benza was formerly associated with Pennsylvania Power & Light Co. and Kinder with American Electric Power Service Corp.

ILIZE POWER PLANT ASH ON ROAD CONSTRUCTION & MAINTENANCE PROJECTS

X - Field Use O - Experimental or Limited Use S- Specification Written	FLY ASH								BOTTOM ASH							BOILER SLAG						
	Type 1 P Cement	Grouts	Cement Replacement in Concrete: Pavement & Incidentals	Cement Replacement in Concrete: Structures	Structural Fill	Stabilized Subgrade	Stabilized Base	Mineral Filler in Asphalt	Asphalt Paving	Stabilized Base	Ice Control Material	Filter or Drainage Media	Structural Fill	Backfill	Unstabilized Aggregate Base	Base Course Aggregate	Asphalt Paving	Ice Control Material	Filter or Drainage Media	Backfill	Skid Resistant Surface	Chip and Seal
ALABAMA	X, S	X, S	X, S	X, S		X	X	X, S								X						
ALASKA																						
ARIZONA	X, S	X	X, S	X, S	X	X	X															
ARKANSAS		X, S	X					X, S													X	
CALIFORNIA	X, S	X, S	X, S	X, S																		
COLORADO		X	X, S	X			X	X, S														
CONNECTICUT								S														
DELAWARE																						
FLORIDA	X, S	X, S	X, S	X, S																		
GEORGIA	X, S		X, S	X, S			X, S	X, S		X		X		O	X	X						
HAWAII																						
IDAHO																						
ILLINOIS	X, S	X, S	X, S		X		X, S	X, S			X					X, S	S	X	X, S	X, S	X, S	
INDIANA	O										X					X, S	X, S	X, S			X, S	
IOWA		X	X																			
KANSAS								X, S									X, S	X, S				
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LOUISIANA	X	X, S			O			X, S														
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MARYLAND			X, S				X						X			X, S	X, S				X, S	
MASSACHUSETTS																						
MICHIGAN	X, S		X, S					X, S														X
MINNESOTA	S		X, S	X, S	X			X								X, S	X, S		X		X	X
MISSISSIPPI	X, S		X, S			O																
MISSOURI	X, S				X		O										X, S	X				
MONTANA								X, S														
NEBRASKA				X				X														
NEVADA	X, S	X, S	X, S	X, S				X														
NEW HAMPSHIRE																						
NEW JERSEY						O	X															
NEW MEXICO			X, S					X														
NEW YORK	X	X, S			X	O	O	X, S														
NORTH CAROLINA		X		X, S				X, S														
NORTH DAKOTA			X, S			X, S	X, S	X, S			X											
OHIO	X, S	X	X		X, S		X, S			X	X			X, S	X, S					X, S		
OKLAHOMA			X, S			X, S																
OREGON			X	X																		
PENNSYLVANIA	X		X, S	X, S	X			X, S			X, S						O	X				
RHODE ISLAND																						
SOUTH CAROLINA	X, S																					
SOUTH DAKOTA			X																			
TENNESSEE	X, S	X					X, S															
TEXAS	O	X, S	O	O		X, S	X, S		X			X			X							
UTAH			X, S																			
VERMONT																						
VIRGINIA	X, S		X																			
WASHINGTON			X																			
WEST VIRGINIA	X, S	X, S	X, S		X, S		X, S	X, S	X, S	X, S	X, S		X, S		X, S			X, S				
WISCONSIN			X, S		X																	
WYOMING			X				X, S	X														
FIELD USE (X)	17	16	27	13	9	5	13	20	2	3	6	2	2	1	4	7	6	5	2	2	5	
TOTAL EXPERIMENTAL (O)	2	0	1	1	1	3	2	0	0	0	0	0	0	1	0	0	1	0	0	0	0	
SPECIFICATION (S)	17	10	20	9	2	3	8	16	1	1	2	0	1	1	2	4	6	4	1	2	3	

BOR'S First RCC Dam to Keep It 'Cool' with Ash

SALT LAKE CITY, UTAH — When the Upper Stillwater Dam in Central Utah takes its place as a major water storage reservoir in the late 80's it will be the Bureau of Reclamation's first dam utilizing roller-compacted concrete (RCC).

RCC combines the basic building material of the concrete dam with the high volume construction methods of earth and rockfill structures.

The technique involves placing a lean dry concrete in horizontal layers and compacting the concrete with a vibratory roller. The BOR plans to place the RCC with facing elements, or curbs, which are formed horizontally by a laser-guided paving machine. The "curbs," similar to highway median barriers, serve as the upstream and downstream faces of the dam.

The roller-compacted concrete is placed without the use of artificial cooling pipes, which would drastically slow down the rate of placement. How does the RCC keep its cool without the pipes? Enter fly ash, a by-product of the power plant production cycle. By reacting with water and the free lime in cement while generating only half the heat of an equal amount of cement.

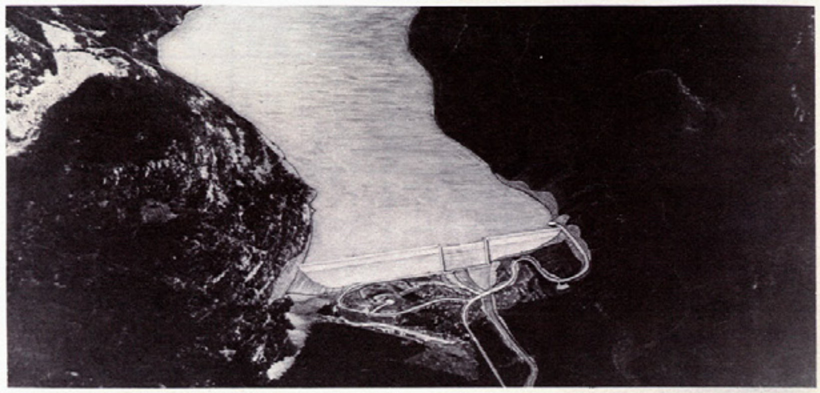
In the case of Upper Stillwater, 75 percent of the cement will be replaced with fly ash to achieve both high strength and lower heat generation. Although fly ash has been used in BOR dams for many years, it has never been used in such large quantities.

Upper Stillwater will be the world's largest RCC gravity dam, requiring about 1½ million cubic yards of the no-slump concrete mix. Also, it will be the first dam of its kind in the United States to be used strictly for water storage.

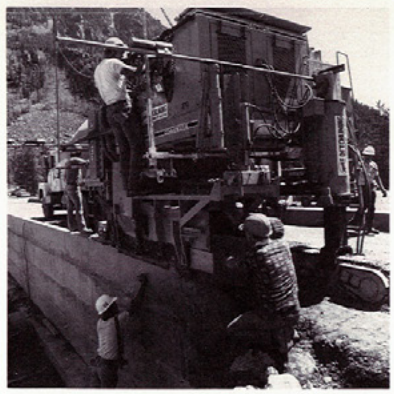
Located in the Uinta Mountains about 120 miles southwest of Salt Lake City, the RCC dam is expected to be completed in only two construction seasons as compared to three or four seasons for most dams.

The mix design for the dam includes 1½ inches of maximum sized aggregate, clean processed sand, and 290 pounds of fly ash plus 130 pounds of cement per cubic yard. The specs for the facing concrete will be one-inch maximum sized aggregate, clean sand, 270 pounds of fly ash, and 350 pounds of cement per cubic yard. This will represent a 50 percent replacement of cement with fly ash by volume.

The use of fly ash will also be a cost saving feature over conventional concrete or earth and rockfill structures. Savings will be achieved by less costly methods of concrete placement, a shorter construction time frame, and a reduction in the volume of materials such as labor intensive formwork.



Proposed Upper Stillwater RCC Dam. (BOR Photo)



RCC batch plant. (BOR Photo)

Test strip of RCC concrete. (BOR Photo)

Bids on the low-cost method came in $15 million under the western water agency's estimate. Tyger Construction Co. of Spartansburg, SC was the low bidder among 20 contractors at $60.6 million.

Because of the remoteness of the dam site, it is estimated that 50-70 truckloads of cement and fly ash will be required to meet construction timetable. The contractor will be required to supply 6,000 tons of cement plus fly ash storage at his batch plant (about 4,300 tons of fly ash). Sand is to come from a source located seven miles south of the dam site. Coarse aggregate will be obtained from a quarry site located in the reservoir area.

RCC was first proposed as a means of rapid concrete construction in the early 1970's. Tests placement by the Corps of Engineers and the Tennessee Valley Authority indicated the concept was a viable means of construction. The Corps recently completed Willow Creek Dam, which was an RCC flood control structure.

Placing "test" curbs. (BOR Photo)

The use of over million cubic meters of RCC for emergency repairs on an outlet works structure and spillway stilting basin at Tarbella Dam in Pakistan proved that large quantities of concrete could be placed in a short time span. As much as 20,000 cubic meters of RCC was placed in a single day - a placement rate which would allow the completion of a structure the size of the Grand Coulee Dam in less than 1½ years.

Welcome, New ACAA Members!

Beneficial Reuse Management designs beneficial reuse programs that manage industrial by-products and waste streams, in turn preserving landfill space, conserving natural resources, reducing CO2 emissions, and boosting local economies. The company operates several manufacturing and processing facilities that create value-added products from recycled industrial by-products. They also have a vast distribution network of locations across the continental United States, where they store and distribute materials for beneficial reuse programs. The company's most commonly handled by-products include cement kiln dust (CKD), gypsum derived from manufacturing processes, foundry by-products, lime and biosolids residuals from municipal water treatment facilities and paper mills, and recycled wallboard. They join as a Specialty Marketer. For more information, please visit www.beneficialreuse.com.

CTLGroup is a trusted leader in engineering consulting, structural condition assessment, and materials testing. Our experts in engineering, science, and architecture leverage 50,000+ square feet of advanced laboratories to deliver solutions in forensic engineering, building performance, and construction materials analysis. Licensed across the country and active in 70+ countries, CTLGroup combines global reach with rigorous quality standards, including ISO 9001 certification, and our laboratories hold ISO 17025 and AASHTO accreditations. Clients rely on CTLGroup for innovative, research-driven solutions that improve infrastructure, extend asset life, and protect critical investments across transportation, energy, buildings, and water resources. The company joins as an Associate Member. For more information, please visit www.ctlgroup.com.

Forsite Environmental Solutions operates primarily in the risk transfer arena, supporting coal combustion residual (CCR) owners in managing their environmental liabilities—often taking ownership of specific CCR units. The company can perform CCR construction and management under an EPC arrangement with owners, using financial security instruments and insurance products to minimize (or eliminate) an owner's risks. With extensive hands-on CCR construction and management experience, the company has the proven experience not only to mitigate risks, but also control total costs. Forsite Environmental Solutions joins as an Associate Member. For more information, please visit www.forsiteinc.com/environmental-solutions.

Industrial Fabrics Inc. is a manufacturer of geosynthetic materials used in various coal ash site work applications, such as geogrids for haul roads and various products for pond slope protection. Headquartered in Baton Rouge, La., the company joins as an Associate Member. For more information, please visit www.ind-fab.com.

Pacific States Environmental Contractors is in partnership with an emerging technology startup that utilizes membrane technology for super-concentration of compounds and elements, resulting in high water recovery percentages. The company seeks access to various types of coal combustion products (CCPs) from different regions to analyze their specific chemical composition and perform a pilot test to prove the efficacy and financial viability of compound and mineral extraction from CCPs. Pacific States Environmental Contractors joins as an Associate Member. For more information, please visit www.pacificstates.net.

Westmoreland Mining provides goods, services, and partnership opportunities related to coal ash projects and operations. Headquartered in Lone Tree, Colorado, the company joins as an Associate Member. For more information, please visit www.westmoreland.com.

News Roundup

Coal Ash Recycling Rate Reaches 72 Percent in 2024

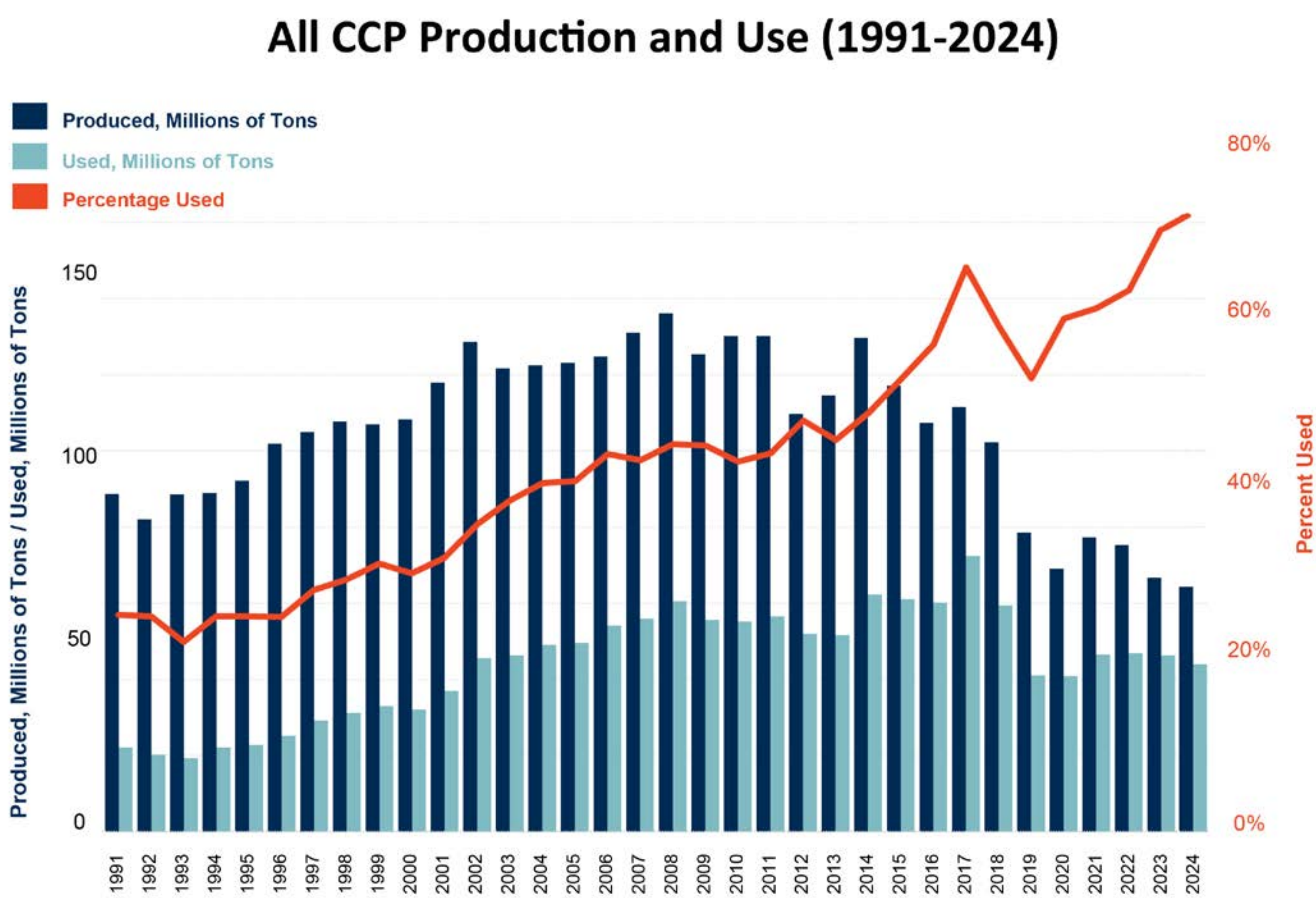
Seventy-two percent of the coal ash produced during 2024 was recycled—increasing from 69 percent in 2023 and marking the 10th consecutive year that more than half of the coal ash produced in the United States was beneficially used rather than disposed.

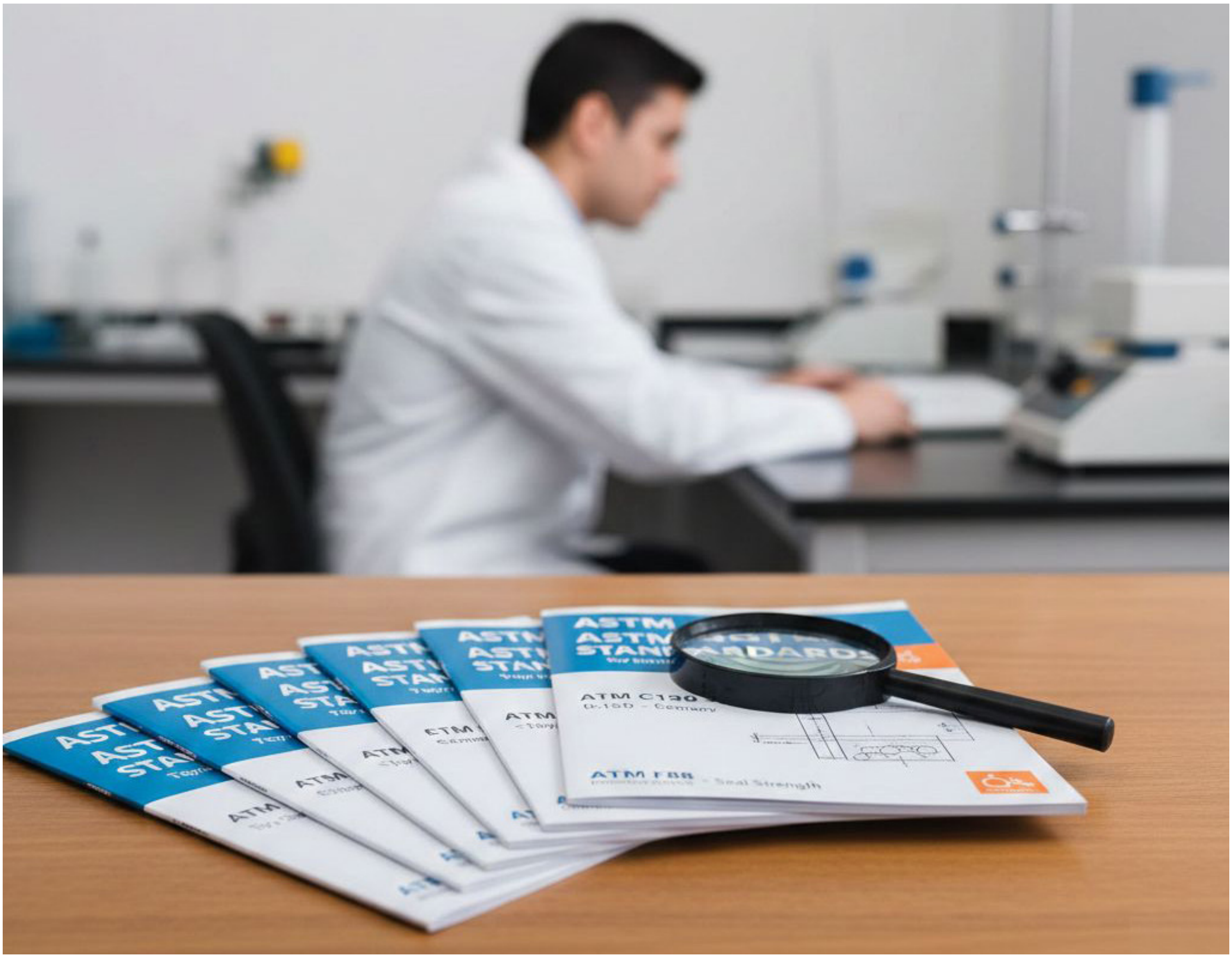
According to the American Coal Ash Association's 2024 production and use survey, 45 million tons of newly produced coal combustion products were beneficially used in all applications in 2024, slightly lower than the previous year. Production of new CCP declined from 66.7 million tons in 2023 to 64 million tons in 2024.

In addition to "fresh" ash production and use, the rapidly growing practice of "harvesting" previously disposed ash has begun to supply significant volumes of material to beneficial use markets. ACAA estimates that several million tons of previously disposed ash was utilized in a variety of applications in 2024, including coal ash pond closure activities, concrete products, cement kiln raw feed, and gypsum panel manufacturing.

ACAA has commenced a new study to quantify the volumes of harvested ash now being utilized in addition to the fresh ash metrics tracked in its legacy survey. Results of the first harvesting study are anticipated early in 2026 and will be used to update results of 2024's survey.

"Harvested ash utilization represents growth in coal ash recycling above and beyond the increasing volumes of ash recycled from current power plant operations," said Thomas H. Adams, ACAA Executive Director. "The rapidly increasing utilization of harvested CCP shows that beneficial use markets are adapting to changing dynamics in coal-fueled electricity generation in the United States. With soaring electricity demand forecasts delaying many anticipated coal plant closures, the combination of continued fresh ash production and significant expansion of harvesting activity portends ample ash supplies for construction markets for many years to come."





ASTM Work Item: Standard Guide for Determining Water Content of CCPs

ASTM Subcommittee E50.03 on Beneficial Use opened a new work item to develop a Standard Guide for determining and reporting the water content of coal combustion products for beneficial use.

A range of field and lab methods are available to determine water content of CCPs. These methods include but are not limited to oven drying, moisture balances, thermogravimetric analysis, water content reflectometry, near infrared spectroscopy, and moisture meters.

These methods offer tradeoffs between speed and cost. Furthermore, the water in coal combustion products may be present in free or chemically bound forms, and particular methods may or may not be suited to evaluate the water content depending on the forms of water present. Finally, the forms of water that are relevant may depend on the particular beneficial use under consideration. This guide will aim to describe the range of methods available and how water content methods may be selected to support beneficial use.

ASTM Work Item: Proposed Standard Describing CCPs in Field Investigations

ASTM Committee E50 on Environmental Assessment, Risk Management, and Corrective Action opened a new work item to develop a proposed standard for describing coal combustion products in field investigations for beneficial use. The proposed standard will inform users about approaches to identifying and describing coal combustion products encountered, including drill samples and test pit samples collected during field investigations of coal combustion products (CCP) deposits.

"Existing standards for identification and classification of drilling and test pit samples focus on natural soil materials," said ASTM member Eric Hageman. "While coal combustion products exhibit similar particle size ranges as natural soils, CCPs are man-made materials, and the beneficial use of CCPs requires specific characteristics be identified and reported during field investigations."

ASTM members interested in joining this task group should contact ASTM Technical Committee Operations Manager Molly Lynyak and refer to work item WK94485.

AN AMERICAN RECYCLING SUCCESS STORY

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

As coal continues to generate 15 percent to 20 percent of United States electricity, significant volumes of coal ash are produced. Since 1968, the American Coal Ash Association has tracked the production and use of all types of coal ash. These surveys are intended to show broad utilization patterns and ACAA's data have been accepted by industry and numerous government agencies as the best available metrics of beneficial use practices.

Seventy-two percent of the coal ash produced during 2024 was recycled – increasing from 69 percent in 2023 and marking the 10th consecutive year that more than half of the coal ash produced in the United States was beneficially used rather than disposed.

In addition to this "fresh" ash production and use, a rapidly growing practice of "harvesting" previously disposed ash has begun to supply significant volumes of material to beneficial use markets. ACAA estimates several million tons of previously disposed ash was utilized in a variety of applications in 2024. ACAA has commenced a new study to quantify the volumes of harvested ash now being utilized in addition to the fresh ash metrics tracked in its legacy survey. Results of the first harvesting study are anticipated early in 2026.

All CCPs Production and Use with Percent (1991 – 2024)

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Fly Ash

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

Concrete made with coal fly ash is stronger and more durable than concrete made with cement alone. By reducing the amount of manufactured cement needed to produce concrete, fly ash accounts for approximately 14 million tons of greenhouse gas emissions reductions each year.

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

Fly Ash Production & Use 2000 – 2024

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

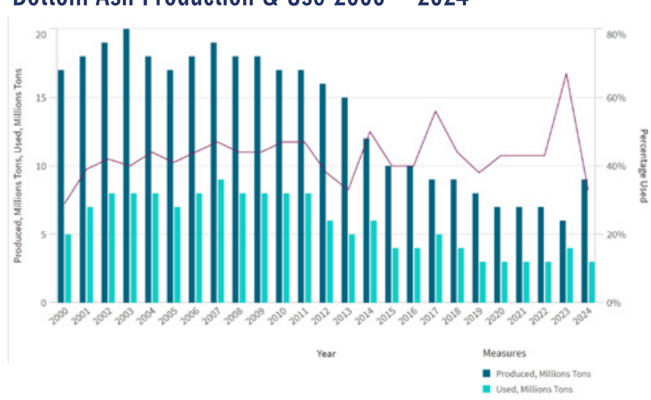
The American Road & Transportation Builders Association estimates coal fly ash use in roads and bridges saves $5.2 billion per year in U.S. construction costs.

Bottom Ash

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

Other major uses for bottom ash include constructing structural fills and embankments, mine reclamation, and use as raw feed in cement manufacturing. Increasing volumes of bottom ash are being ground for use in concrete like fly ash.

Bottom Ash Production & Use 2000 – 2024



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

Synthetic Gypsum

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

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

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

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

Synthetic Gypsum Production & Use 2002 – 2024

Synthetic gypsum is often more pure than naturally mined gypsum.

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

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

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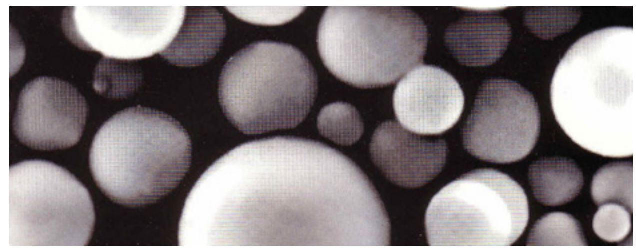
Other Products and Uses

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

Nearly 90 percent of all boiler slag is beneficially used.

Cenospheres – are harvested from fly ash and are comprised of microscopic hollow spheres. Cenospheres are strong and lightweight, making them useful as fillers in a wide variety of materials including concrete, paint, plastics and metal composites. ACAA's Production and Use Survey found no cenosphere production from coal ash in 2023 or 2024.



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

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

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

New Uses on Horizon

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

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2024 Coal Combustion Product (CCP) Production and Use Survey

Beneficial Utilization versus Production Totals (Short Tons)

2024 CCP Categories	Fly Ash	Bottom Ash	Boiler Slag	FGD Gypsum	FGD Material Wet Scrubbers	FGD Material Dry Scrubbers	FGD Other	FBC Ash	CCP Total Production / Utilization Totals
Total CCPs Produced by Category	**24,718,600**	**7,666,800**	**1,580,936**	**16,860,200**	**5,122,215**	**1,687,795**	**52,602**	**5,885,300**	**63,574,448**
Total CCPs Used by Category	**19,386,568**	**2,720,561**	**889,947**	**17,142,322**	**0**	**6,388**	**7,255**	**5,885,300**	**46,038,342**
CCP Type / Application									
1. Concrete/Concrete Products /Grout	14,593,135	379,959		10,155					14,983,249
2. Blended Cement/ Feed for Clinker	3,364,973	474,525		1,501,065		5,819			5,346,382
3. Flowable Fill	11,532								11,532
4. Structural Fills/Embankments	97,871	175,649							273,521
5. Road Base/Sub-base	102,199	218,181						12,539	332,919
6. Soil Modification/Stabilization	194,112	7,332							201,444
7. Mineral Filler in Asphalt						569			569
8. Snow and Ice Control		13,324	155						13,479
9. Blasting Grit/Roofing Granules		178,325	834,866						1,013,191
10. Mining Applications		11,592						5,443,670	5,455,262
11. Gypsum Panel Products (formerly Wallboard)				12,875,501					12,875,501
12. Waste Stabilization/Solidification	14,517								14,517
13. Agriculture				730,602					730,602
14. Aggregate	2,694	257,293							259,988
15. Oil/Gas Field Services	9,345						7,255		16,600
16. CCR Pond Closure Activities		7,364							7,364
17. Miscellaneous/Other	996,190	997,017	54,926	2,024,999				429,090	4,502,222

Summary Utilization to Production Rate

2024 CCP Categories	Fly Ash	Bottom Ash	Boiler Slag	FGD Gypsum	FGD Material Wet Scrubbers	FGD Material Dry Scrubbers	FGD Other	FBC Ash	CCP Total Utilization Total
Totals by CCP Type/Application	**19,386,568**	**2,720,561**	**889,947**	**17,142,322**	**0**	**6,388**	**7,255**	**5,885,300**	**46,038,342**
Category Use to Production Rate (%)	**78%**	**35%**	**56%**	**102%**	**0%**	**0%**	**14%**	**100%**	**72%**

Total CCP production for Fly Ash, Bottom Ash, FGD Gypsum, and FBC Ash is taken directly from the Ash Mart, which is based on the EIA's 2024 data for coal power plants. Production estimates for Boiler Slag and the Wet, Dry, and Other categories are derived using the 10-year average results from the 2014–2023 surveys, benchmarked against the Ash Mart totals for Bottom Ash and FGD Gypsum. The 17 individual CCP category estimates presented in this report are calculated from the responses to the "2024 Coal Combustion Product (CCP) Production and Use Survey." Special thanks to all survey participants.

Coal Ash Harvesting Growing Rapidly

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

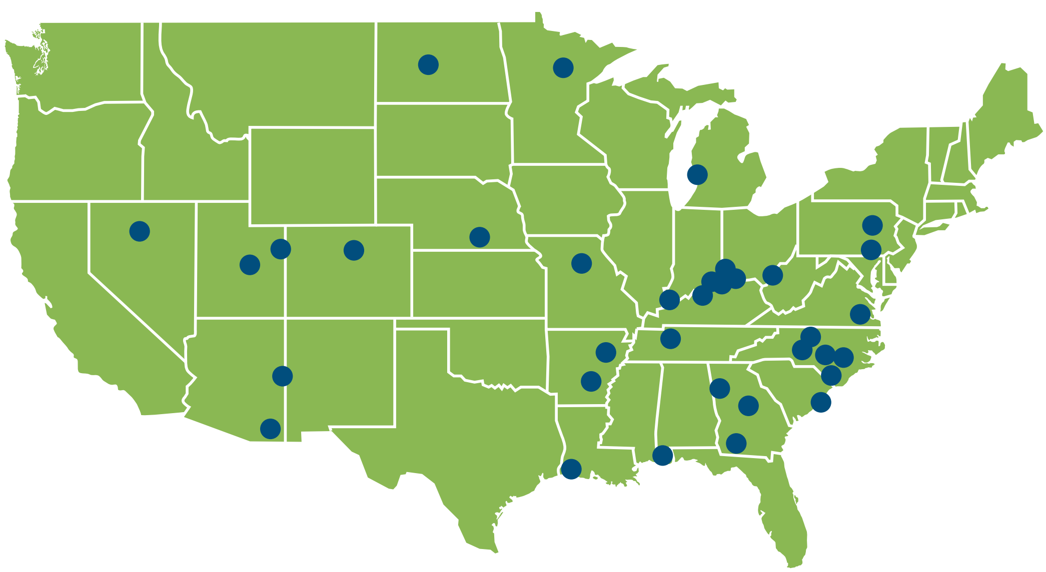
A variety of ash beneficiation technologies have been developed to ensure that harvested ash meets all product performance specifications and additional consensus standards have been adopted to guide the characterization of harvestable materials and the operation of harvesting projects.

ACAA estimates more than 4 million tons of previously disposed ash was utilized in a variety of applications in 2024, including coal ash pond closure activities, concrete products, cement kiln raw feed, and gypsum panel manufacturing. Major harvesting projects are operating and under development in all regions of the United States.

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

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

Coal Ash Harvesting Sites – Existing and Under Develop-



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

2025 American Coal Ash Association Membership Directory

Utility

Ameren Missouri
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American Electric Power
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Reagent Procurement & CCP Marketing
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Big Rivers Electric Corporation
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