ISSUE 2 • 2018

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ACAA

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On the Cover

For half a century, *ASH at Work* has chronicled the many initiatives and achievements of the ACAA and the coal ash industry.

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Building on our 50-Year Legacy

By Kenny Tapp, ACAA Chair

At the recent ACAA Fall Meeting in New Orleans, I was honored to spend time with several past leaders of our organization. Their enthusiasm and commitment to the Association, as well as our industry, are unwavering and stand as an inspiration to me as I assume the chairmanship for the next two years.

In its first 50 years, ACAA has helped create enormous growth in the beneficial use of coal combustion products (CCPs). Acting as a unified industry voice on matters relating to CCPs, the Association has spearheaded efforts to remove technical, commercial, legal, and regulatory barriers to the use of these materials. Some of the most significant achievements—chronicled in greater detail in the historical feature articles in this issue of *ASH at Work*—include:

- *Launch of ACAA's ash utilization symposia and technical and marketing seminars.* Not only have these forums given industry participants practical knowledge on CCP reclamation and beneficiation, they helped to establish the public perception of coal ash as a legitimate mineral resource worthy of research, investment, and commercial acceptance in the marketplace.
- *Promotion of consensus standards to ensure CCPs' quality and performance characteristics.* ACAA's participation in developing specifications for CCP use under the auspices of groups such as the American Society for Testing and Materials and the American Association of State Highway and Transportation Officials has led to vastly greater acceptance of coal combustion products utilization in applications such as concrete for building and highway construction.
- *Mobilization of industry resources to defeat designation of disposed CCPs as hazardous waste.* ACAA successfully led the battles against repeated efforts at the federal level to regulate CCPs as hazardous waste, a designation that would have required the industry to institute elaborate and costly monitoring and reporting systems, jeopardizing the marketability of these materials.

The results of our members' work—as well as that of our industry and its allies—are undeniable: From a mere 12% utilization rate of coal combustion products in 1966, the industry now beneficially uses well over 50%. That success has been documented via another of our seminal initiatives—the annual Production and Use Survey launched the year before the formal founding of the Association.

Notwithstanding these successes, I am acutely aware that there is much work left to be done. Millions of tons of coal combustion products are still disposed every year, and the prospect of hyperbolic media coverage of any future breach of an ash impoundment brings with it the potential for regulatory overreach in response to public pressure.

The changing nature of the electric utility fleet presents new challenges for the industry. Decreasing levels of coal-fueled generation mean that growing proportions of CCPs are likely to come from landfilled ash as compared with current-production ash. Regulations requiring new emission control technologies for coal plants could modify the characteristics of next-generation ash. Emerging strategies such as materials blending and harvesting of previously disposed ash hold immense promise to meeting these challenges, but will require dedicated effort to fully bring into the market.

Over the years, I have been impressed by how effectively ACAA has addressed challenging issues such as these, drawing primarily on the volunteer support of our members. Kudos is due the many members who have worked diligently over the past half-century to put our Association and the industry in the strong position they are in today. I look forward to continuing that legacy over the next two years to ensure that together we keep ACAA strong, vibrant, and making a meaningful impact on our environment and the durability of our nation's infrastructure.

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Now What?

By Thomas H. Adams, ACAA Executive Director

As the ACAA moves into its 51st year, we are facing challenges never before witnessed by our industry. Our early years were spent educating ourselves and potential partners about the use of coal combustion products (CCPs). Utility companies were starting to come to grips with the need to manage the large volumes of CCPs being produced. In addition, those companies were beginning to feel the effects of environmental regulations. Fly ash was given away. On occasion, a utility paid a trucker to take the material just to get rid of it. Concrete producers were hearing about the benefits fly ash could bring to their operations. Bottom ash and boiler slag were mostly headed to landfills and ponds. There was no FGD gypsum produced in the early years. Progress in creating acceptance of CCPs was slow but steady. The vision of our early founders kept the ACAA together in those formative years.

Fast forward five decades to 2018. Today the use of CCPs is well known and understood. Ash marketing companies work with the utility industry to extract value from CCPs and avoid disposal whenever possible. The value of fly ash, bottom ash, boiler slag, flue gas desulfurization (FGD) gypsum, and cenospheres is clearly established. Beneficial use of CCPs is passing the 60% mark, double the rate observed at the beginning of the 21st century. Despite the regulatory assault on CCPs by the U.S. Environmental Protection Agency from 2009 to 2015 and an ongoing campaign of misinformation from anti-coal activists, demand for CCPs continues to be strong.

The question we face in late 2018 is: now what?

Maybe it is time for some SWOT analysis—Strength/Weakness/Opportunity/Threat.

Strength: Demand for fly ash and FGD gypsum continues to outstrip supply. The gap between demand and supply of concrete-grade fly ash is estimated to be about 25%. The gap for gypsum for wallboard is almost the same. Both industries have the same questions and seek answers for both the short and long term.

Weakness: Uncertainty in the generation mix of fuels and renewables makes prediction of supply and quality very difficult. User groups need to have confidence in our ability to meet their needs.

Opportunity: Research continues to reveal new, valuable uses for CCPs. Some good examples are the work being done on extraction of rare earth elements from coal ash and the blending of fly ashes to increase supply.

Threat: We have had three regulatory determinations from the EPA since 1993. None of those determinations called for RCRA Subtitle C regulation of CCRs as hazardous waste. Yet the 2015 CCR regulation had language in the preamble that leaves the door cracked open for the EPA to visit this issue again at some point in the future.

This is by no means a comprehensive analysis of where we are. The analysis needs more work to help us formulate the answer to the question posed above: now what? Our task is to work together to find this answer in the coming months to set the path forward.

And one final note. As I am writing this message, we are very near the 2018 mid-term elections. As you are reading this message, the results of that election have been dissected and discussed. No matter what those results tell us about the mood of the country, I hope we can find a way to govern our country with dignity, respect, and a commitment to the rule of law. Our history and heritage deserve nothing less.


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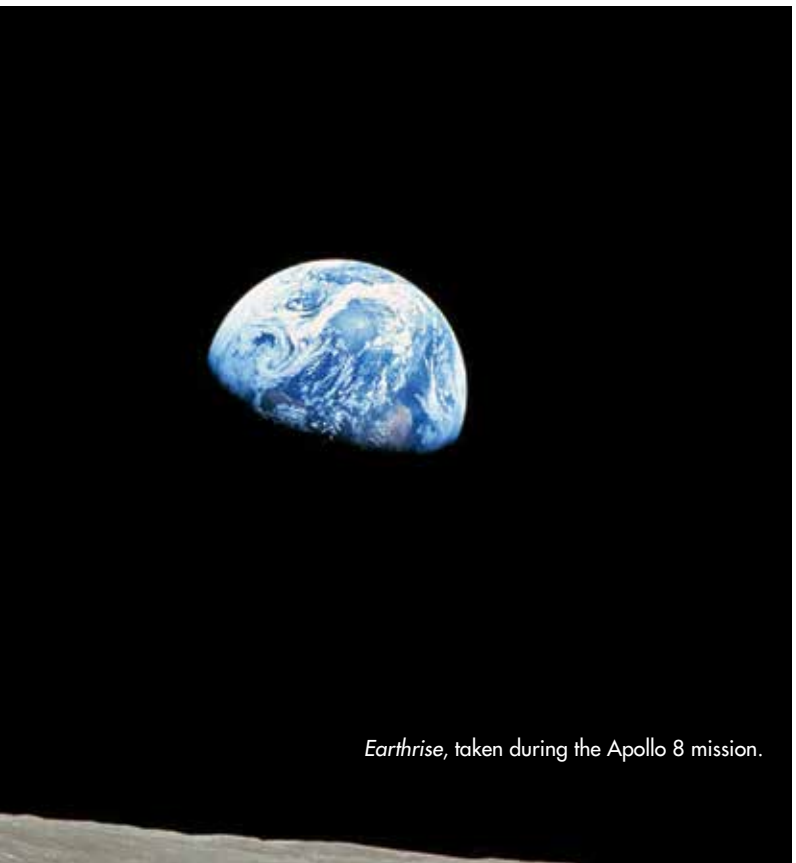
Fifty Years of Ash Management and Reuse

By Dave Goss

For those of you old enough to remember, 1968 was a tumultuous year in American history. Illinois National Guard troops were called to the Democratic National Convention in Chicago and engaged with anti-war demonstrators, leading to the tear-gassing of hundreds. The Vietnam War was at the center of the nation's conscience, and in March six platoons of American soldiers killed more than 500 Vietnamese civilians in what became known as the My Lai Massacre. In April, Martin Luther King Jr. was assassinated in Memphis, and in the following weeks riots took place in over 100 cities across the nation, leaving 39 people dead and nearly 21,000 arrested. That same year, Bobby Kennedy was assassinated in Los Angeles and North Korea seized the USS *Pueblo*. In the latter incident, one crew member died and the remaining 82 were imprisoned for 11 months before their release.

On the lighter side of this year, "Rowan and Martin's Laugh-in" debuted in January, and Boeing rolled out the first 747 jumbo jet.



Earthrise, taken during the Apollo 8 mission.

Hair opened on Broadway, introducing the mainstream public to sex, drugs, and draft resistance. Apollo 8 became the first manned spacecraft to successfully orbit the moon and return to Earth, capturing the event in the famous *Earthrise* photograph. In 1968, Arthur Ashe became the first African-American man to win the U.S. Tennis Open, O. J. Simpson claimed the Heisman Trophy, Richard Nixon won the U.S. Presidential election, and most importantly the National Ash Association (NAA) was established in Washington, D.C.

Despite the turbulent era of its birth, NAA became an eminently successful nonprofit association that would flourish over the next five decades. Whereas 747s have been retired from American airline fleets, NAA's successor—ACAA—continues to serve across the nation.

The "Group of Experts"

Ironically, the formation of what would become the nation's—some would say the world's—leading authority on coal ash utilization began in Europe eight years before the founding of NAA. In 1960, a group of researchers working under the auspices of the Coal Committee of the United Nations Economic Committee for Europe met in Paris to discuss problems related to the use of coal ash. Over the next six years, this group met 12 times and, at their final meeting in 1966, they became known as the "Group of Experts" on the use of coal ash. In 1967, as part of the first Ash Utilization Symposium (which was sponsored by the Edison Electric Institute [EEI], the National Coal Association [NCA], and the U.S. Bureau of Mines [USBM]), these experts presented a session on the progress being made in Europe. As a direct result of the work of these experts, European coal ash utilization was approaching 30% in those countries participating with the researchers.

Subsequently, several key individuals attending the ash symposium in Pittsburgh met later that year for more formal discussions around establishing an association to develop ash utilization in the United States as was being done in Europe. More than 50 representatives of coal companies, electric utilities, and railroads met in New York in October 1967. As a result of this meeting, the National Ash Association was formed on March 8, 1968, and based in Washington, D.C. John H. Faber was selected as the first NAA Executive Director. Faber began

to build an association of American experts, such as Harry and Craig Cain, from the Chicago Fly Ash Company, and Walter N. Handy (whose company had been formed in 1950 to sell fly ash) along with many others in the utility sector who shared a common vision for this emerging industry.

The early years of NAA were filled with expectations, ideas, enthusiasm, and a determined mission to educate the nation of the value of recycling, before it was considered that. The *ASH at Work* newsletter was created to disseminate the message about the many uses of fly ash, bottom ash, and boiler slag to the electric utility industry and governmental organizations. Beginning with the first issue in 1969, *ASH at Work* became a regular platform for promoting successes in and research about ash utilization. Allan Babcock played a major role in developing the articles in the NAA library, which included not only *ASH at Work,* but also technical bulletins, notices, reprints of symposium proceedings, presentations, advertisements, and reports on specific applications. John Faber traveled widely, making countless presentations to utilities, governmental groups, and academic gatherings. The titles of topics of interest ranged widely, from aggregates and blocks to mining and oil field grouting. There were articles on structural fills, skid-resistant pavement known as "Ashphalt," the potential for extracting uranium and rare earths from ash, ash beneficiation and carbon reduction, and even on the introduction of a new type of ash, "Type C," which is found in western coals.

In its early years, NAA member representatives were utility executives. Individuals who served as officers were almost without exception from senior leadership positions in the utility industry. Faber firmly believed that commitment from the highest levels of utility leadership was essential to make NAA become a viable, representative voice of this emerging industry. Speakers at symposiums, which began in Pittsburgh in 1968, included not only researchers and industry experts, but chief executive officers and senior vice presidents who willingly shared their commitment to ash and their vision for the future with attendees. By the time Faber stepped down in 1980, NAA was recognized as both a dynamic force in ash use and a technically competent and visionary organization striving to create a sustainable future for its constituents. Five international symposiums were organized by NAA prior to James Covey becoming Executive Director in 1980.

Federal Government's Role in Promoting Coal Ash

In parallel to the work of NAA, federal regulations played a key role in the industry's efforts to promote utilization. In 1970 the Clean Air Act was passed, and in 1976 the Resource Conservation and Recovery Act (RCRA) was enacted. RCRA established purchasing guidelines that required federal agencies to use fly ash in concrete as well as other recycled materials in any projects exceeding $10,000. This was a major factor in increasing the use of fly ash in concrete over the next decade and opened the way for state departments of transportation to increase fly ash usage in their own projects. In 1977 the Clean Air Act Amendments became law, and the corresponding Bevill Amendment in 1980 became the focal point for NAA (and later ACAA) in defining acceptable beneficial uses for the industry. RCRA created categories of waste streams—in particular, hazardous and non-hazardous—representing many thousands of hours of effort by the ash industry, government agencies, and environmental groups forging agreement upon acceptable beneficial uses under these definitions.

Coal Research Bureau and utility representatives discuss coal ash utilization with NAA Executive Director John Faber (right) at a 1968 meeting in Morgantown, West Virginia.

Alex Wilson, of the Central Electric Generating Board, John Faber, and a representative of John Laing and Son Ltd. view a lightweight aggregate operation during an NAA tour of England in 1969 to study ash utilization, engineering, and marketing practices.

Starting in 1983, NAA and EEI's Utility Solid Waste Activities Group (USWAG) worked closely to define and refine regulatory treatment of coal ash materials. USWAG's interests included materials and situations beyond coal ash, but the group was firmly supportive of NAA's efforts to reduce the stigmatization that was associated with the terms "coal ash wastes" and "coal

combustion wastes." Over the years, USWAG's Jim Roewer would be a subject matter expert and mentor to many NAA/ACAA members and staff. USWAG helped sponsor C^2P^2 activities, workshops, and awards programs. Likewise, the Electric Power Research Institute (EPRI) was instrumental in assisting NAA in its early years and subsequently worked in parallel with many of the Association's initiatives. Beginning in 1985 and for many years after, EPRI published on NAA's behalf the proceedings of the international ash symposiums that were held in odd-number years.

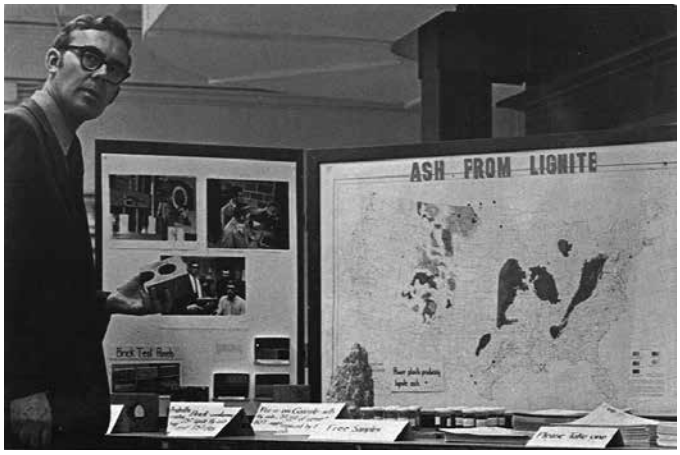
In 1985, under then Executive Director Tobias Anthony, NAA was transformed into the American Coal Ash Association. Like the phoenix adopted as the Association's symbol, ACAA became a fully mature partnership among members and end users. The Association continued to promote international ash symposiums; developed workshops and seminars for industry and governmental agencies; and sponsored the publication of highly regarded technical literature. Working with both EEI and EPRI, ACAA members helped develop data and conducted research, the results of which were incorporated into standards proposed by the American Concrete Institute (ACI) and the American Society for Testing and Materials (ASTM). In addition to fly ash in concrete, standards for autoclaved cellular concrete and the use of fly ash in aluminum matrixes led to a much broader perspective of the possible uses for CCPs.

Although not all were commercial successes, these projects clearly demonstrated that CCPs had value in many applications not previously considered. In part, due to this work, in 1988 the EPA's report to Congress *Wastes from the Combustion of Coal by Electric Utility Power Plants* confirmed that fly ash, bottom ash, boiler slag, and flue gas desulfurization wastes did not merit regulation as hazardous wastes. At the same time, however, other wastes needed to be further evaluated, which resulted in a second report to Congress in 1999. This 1988 determination was key to the industry's future, although it would not be without controversy. But the benefits of using CCPs were clearly seen as a result of the Association's work with many partners.

I have fond memories of working with ACAA and the great partnership between ACAA and the Department of Energy. The organization certainly has numerous strengths, but three really stand out and were extremely useful to me. Specifically (and not in order of priority):

1. The ACAA annual coal ash survey—by far the most complete collection of information regarding byproducts produced and used. I used this often as a reference for various presentation materials.
2. ACAA's biannual conference (WOCA)—arguably the best conference on the topic—a perfect one-stop shop to hear presentations ranging from utilization to marketing and chemistry.
3. C^2P^2—the partnership between ACAA, EPA, and DOE to increase the utilization of byproducts in the U.S—a lofty, challenging goal that ACAA spearheaded and promoted.

—Lynn Brickett, Carbon Capture Technology Manager, U.S. Department of Energy



University of North Dakota Professor and NAA member Oscar Manz was an early and effective promoter of increased utilization of lignite ashes through his research and educational activities.

The 1990s: A Period of Transition and Rejuvenation

The period between 1990 and 1993 marked another transition of the "phoenix." For reasons not known, these early years in the 1990s saw no publication of *ASH at Work* and minimal strategic planning. ACAA member representatives were no longer utility executives, but were employees who worked with fly ash, bottom ash, and other products in their day-to-day activities at coal-fueled plants across the nation. Following Executive Director Erast Borissoff's departure in 1993, ACAA's Executive

Over 400 delegates from the U.S. and abroad attended NAA's 2nd Ash Utilization Symposium in Pittsburgh in 1970.

NAA members and staff meet with Sen. Jennings Randolph (right), chairman of the U.S. Senate Public Works Committee, to discuss ways to encourage recycling and recovery of solid wastes in 1974.

Directorship was taken over by Sam Tyson, who had served as the Association's Technical Director since 1987. Under the leadership of Tyson and ACAA Chairman Andrew Stewart, from Great River Energy, ACAA was rejuvenated.

Under Stewart, ACAA formally began a decades-long partnership with European ash industry colleagues. Working with EPRI, the Association sponsored trips to Japan, South Korea, and other international destinations to share with these countries the work being done in the U.S. This planted the seeds of future research and cooperation that strengthened the global industry. ACAA's relationship with the European Coal Combustion Products Association (ECOBA) and other international groups from Canada, South Africa, Australia, India, and China would result in the eventual formation of the World Wide Coal Combustion Products Council in 1999. In addition to ACAA's own international ash symposium, these partnerships were strengthened by joint participation in conferences on fly ash, silica fume, slag, and natural pozzolans, as well as ash symposiums sponsored by the Center for Applied Energy Research (CAER) at the University of Kentucky.

Still headquartered in the nation's capital, ACAA worked tirelessly to promote the coal combustion byproducts (CCBPs) industry, as it was then known. In partnership with the Federal Highway Administration (FHWA), ACAA published its most influential document, *Fly Ash Facts for Highway Engineers*. Still other influential publications produced during this period included ACAA's *Soil and Pavement Base Stabilization with Self-Cementing Fly Ash*. This manual helped to promote greater beneficial use of fly ash produced west of the Mississippi River by supporting and legitimizing a second major market for Class C fly ashes through specifications. Beginning in 1966, production and use of coal ash products had been surveyed and published. By the 1990s, ACAA's Production and Use Reports were widely acknowledged as the best indicator of utilization and would play a prominent role in increasing use into the new millennium.

Tyson, like Faber before him, traveled widely and worked hard to increase acceptance of CCBPs. ACAA was active in ASTM meetings and the development of standards pertaining to fly ash in concrete (C618), structural fills (PS23-95, E1861, E2277), and many other specifications that provide explicit guidance of successful utilization of coal combustion products. ACAA partnerships with the Office of Surface Mining (OSM), Department of Energy (DOE), EPRI, West Virginia University, Energy and Environmental Research Center (EERC) at the University of North Dakota, University of Wisconsin - Milwaukee, The Ohio State University, and the University of New Hampshire all led to wider acceptance of CCBPs and beneficial uses only hoped for in the early 1970s. Those partnerships continue and as a result ACAA members are blessed with countless resources to support the resolution of operational, environmental, and political issues that still face the industry today.

NAA staff, flanked by President Tobias Anthony (left) and Chairman Jack Weber (right) meet in 1984 to prepare for the 7th International Ash Utilization Symposium and Exhibition.

In 1996, ACAA furthered its research and educational commitment by establishing the ACAA Educational Foundation, marked by a special first-day cachet and postal event. The Foundation was launched as an avenue for young people to become engaged

> One of the most significant aspects of ACAA was when the Association pooled efforts and resources from member companies to pursue the "strength in numbers" approach—via engaging and educating various government agencies, contractors, and the public via conferences and seminars. These group challenges may have even been the catalysts that helped improve the growth in membership and in [production and use] survey respondents in the early 2000s. I'd like to think that the survey was, and still is, a useful reference that helps guide utilities and marketers alike in their due diligence on whether or not investments in CCP beneficiation are economically viable.
>
> *—Carl Togni, former CCP Manager for American Electric Power*

ASH AT WORK

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American Coal Ash Association Adopted; NAA Identity Dropped

Weber Is New CEO, Pheonix Is Symbol

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

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

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

Chairman Weber

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

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

ACAA's Phoenix

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

ACAA's Phoenix

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

Coal Ash

your industry and coal ash as one of our country's most important resources."

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

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

ADOT Approves Ash In Road Structures

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

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

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

1. Environmental - Its use decreased the need for producers to dispose of the material.

2. Conservation - The use of fly ash conserves Portland cement;

3. Economy - Fly ash can save money for the contractor, the owner, and the taxpayer;

4. Performance - In tests, conducted in the laboratory and in the field by the ADOT and others, the performance of fly ash improved workability, sulfate resistance, and resulted in higher ultimate strength.

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

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

One of the prime Arizona highway contractors, Ball, Ball & Brosamer, used about 250,000 tons of fly ash on a section of I-10. One the firm's mixes for mainline uses 313 lb. of Portland cement and 74 lb. of fly ash -- a substitution of about 12.6 percent.

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

in meaningful ash-related research. Scholarships are awarded annually with stipends of amounts up $5000. It is self-sustaining and promotes understanding of coal ash management. Its initiatives, in additional to the scholarships, consist of developing and distributing educational materials, financial support for research, and sponsorship of coal ash forums. ACAA members serve as judges and enthusiastically support the Foundation's activities financially and administratively.

New Terminology for Coal Ash, New Initiatives for ACAA

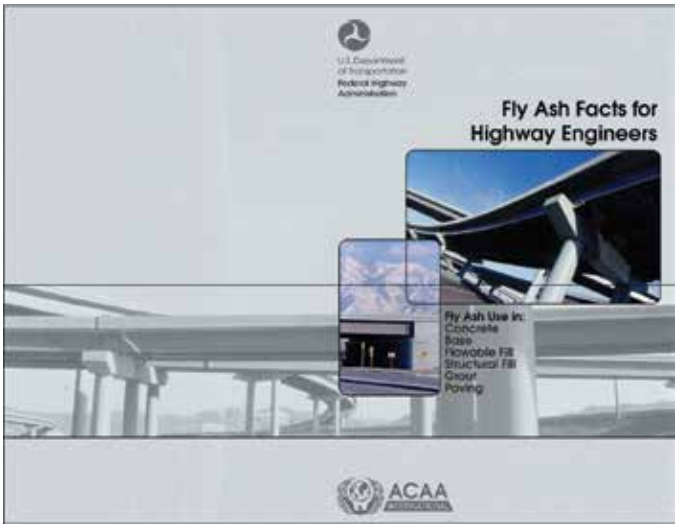
Throughout ACAA's existence, the changing world of environmental regulations has challenged, frustrated, and at times bewildered the ash industry. First it was "coal ash" (including virtually all products produced by coal fuel power plants). Then, with RCRA, it became "coal combustion waste." ACAA and the larger industry worked hard to gain recognition for coal combustion byproducts (as opposed to wastes) and to eventually persuade the EPA to recognize the existence of coal combustion "products," or "CCPs." These subtle terminology changes made a huge difference in public perceptions and commercial acceptance of their use. Following the "final" determination that CCPs were not hazardous in 2000, the EPA, ACAA, FHWA, and DOE adopted this usage when they formed the Coal Combustion Products Partnership (C^2P^2) in 2003. This highly successful but short-lived program helped move overall CCP utilization toward a goal of 50%. Through workshops, publications, government-supported project demonstrations, and recognition of successes by the presentation of awards, C^2P^2 broke down utilization barriers and created new markets. With the joining of the U.S. Department of Agriculture (USDA) in this industry/government partnership, widespread research related to flue gas desulfurization materials (in the form of FGD gypsum) enabled many states to expand or introduce new uses for this valuable agricultural product. By 2016 CCP utilization had reached 56%.

NAA's Allan Babcock (left) discusses the use of fly ash in cement blocks at a Virginia building supply company.

The 1990s saw a renewed effort by ACAA to partner with international ash industry groups.

In 1999, ACAA moved its offices from Washington, D.C., to Alexandria, Virginia, where they remained until 2001. With a transition of leadership in 2001, interim Executive Director Corey Trench moved ACAA's operations briefly to Syracuse, New York. Then in 2002, with the hiring of David Goss as Executive Director, the Association relocated to Aurora, Colorado, a suburb of Denver. By 2002, ACAA's membership had declined and the challenge Goss faced was another example of the phoenix rising. Over the course of the next few years, ACAA's utility membership increased, with significant members such as Duke Energy and Southern Company rejoining. Other utilities that had not been members also joined, and by 2005 ACAA was again a robust presence in the industry. The critical publication *Fly Ash Facts for Highway Engineers* had been updated and reprinted, and *ASH at Work* emerged as an industry source of information and reporting. In 2005 ACAA and the University of Kentucky's CAER became partners in the first "World of Coal Ash." WOCA, as it has become known, grew from approximately 400 attendees in 2005 (in St. Petersburg, Florida) to the seventh and most recent WOCA held in 2017, which welcomed more than 1000 attendees. The partnership between CAER and ACAA made this the premier international coal ash event, drawing participants from across the globe with exhibitors and speakers from more than 30 nations.

By the early 2000s, ACAA had become much more involved with ACI, ASTM, and the National Ready Mixed Concrete Association (NRMCA). The Association was partnering with many other organizations promoting the beneficial use of industrial materials such as foundry sands, scrap rubber, slag, recycled asphalt, and recycled shingles. ACAA was a founding member of



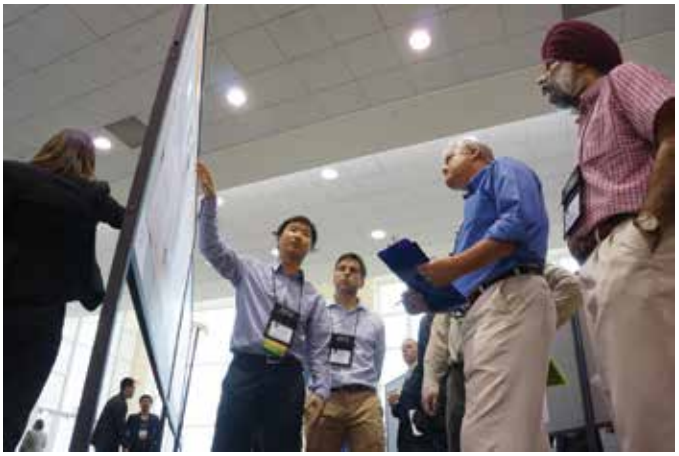
I really had to jog my memory to go back to the days of the National Ash Association when, in 1981, I first met and became instant friends with both Oscar Manz and John Faber. I had never heard of Class C ash but Oscar soon made sure to teach me all about it, and John enlightened me about the complexity of the market. I owe it to those two guys for stirring my curiosity about ash. They were the best mentors, colleagues, and friends one could wish for, and we kept in touch for all the years until their passing (John in 2007 and Oscar in 2012).

My fondest memory, however, was when they visited South Africa and we drove with them in Kruger National Park, sharing the experience of meeting wild animals up close and personal. They enjoyed every moment and mentioned this occasion in almost every e-mail received from them after that. This must have made such an impression on Oscar that he convinced his son, Brad, to find employment in South Africa. Not only did he achieve this, but it is also where he met his future wife. They were married in Johannesburg in 1993. I had the privilege of "giving away the bride," and Yvonne (my wife) played the role of the bride's mother, giving advice and ideas. A few years later, they moved back to the U.S., but we still have contact with them.

The influence of Oscar and John instilled a love of the U.S. to such an extent that Yvonne and I have been back countless times, having attended every NAA and subsequently ACAA international conference since 1981. It was through these friends that I had the privilege of forming a lifelong friendship with Jim Burnell and other members—not the least of them Dave Goss, with whom I have had the privilege and pleasure of meeting up with and traveling to many places in the U.S. as well as other countries of the world.

—Dr. Richard Kruger, former President of the South African Coal Ash Association

the Industrial Resources Council and an active member of the Green Highways Partnership, a joint government/industry effort to promote the use of recycled materials in road construction. The FHWA, University of New Hampshire, The Ohio State University, University of Wisconsin, state organizations, and industry suppliers supported both the green highways concept and Recycled Materials Resource Center. These efforts to make state and federal highway engineers aware of the properties and appropriate uses of recycled materials, including CCPs, have proven that the reasoned presentation of factual information and performance data can create better transportation projects for less cost and with lower impact on the environment than using virgin materials. Countless other organizations and individuals also participated in these partnerships and projects, whose combined effect has been the savings of millions of dollars—and significant quantities of greenhouse gas emissions—in the construction of needed infrastructure.



In 1996 the Association launched the ACAA Educational Foundation, an avenue for students to become engaged in ash-related research.

In 2004, the dormant *ASH at Work* publication was revived, and ACAA began publishing a glossy magazine of the same title. In its new format, the magazine began being issued twice a year, containing articles contributed by members, guest authors, researchers, marketers, utilities, and international experts. Then as now, topics included a wide range of stories encompassing almost all the various forms of CCPs that have or are being used, tested, or envisioned to be products or processes in the future. In addition to covering the current marketplace, many articles discuss the regulatory environment at the federal, state, and local levels. University students and professors share their research, and innovators introduce the audience to ideas not yet proven but with some measure of potential. Interestingly, some articles from the new century reflect ideas first published in the early *ASH at Work* issues of the 1970s. The extraction of rare earths and metals, the use of CCPs in remediation and soil improvement, and uses for materials not even contemplated in 1968 have been routinely covered and promoted. The Association's annual Production and Use survey is published each year in the magazine, and the metrics of utilization show a slow but continual increase toward that 50% or greater goal envisioned under C^2P^2. *ASH at Work* became so widely read

SOURCE: OSU

I first got involved in 1981 when I began working in the coal ash group at PPL. I attended every NAA/ACAA meeting from 1981 through July 2011 and had the great honor of serving on the Executive Committee for most of this time, as well as serving as Chairman during 1999 and 2000. I enjoyed meeting various members from utilities and marketing companies, including pioneers like Craig Cain, Bart Thomas, and Bill Fletcher, who were gentlemen whom I respected and admired. There were so many members that I admired, I could not possibly name them all.

The ACAA was blessed to have had so many professionals who were committed to increasing the knowledge and uses of coal ash. I honestly don't believe I ever attended a meeting without learning something that I could apply in my company's programs. I also can't remember a meeting that wasn't fun! I have been retired for seven years already and have lost touch with the CCP industry; however, I know the same challenges that have historically existed are still around. I believe if the quality of leadership remains high, the ACAA will celebrate many more anniversaries in the future. Congratulations on your 50th!

—Joel Pattishall, former Chair and representative for Pennsylvania Power and Light

In 2005 ACAA melded its international symposia with those of the University of Kentucky Center for Applied Energy Research to establish the biennial World of Coal Ash conference.

that it helped spawn another partnership when, in 2009, ACAA and CAER created a peer-reviewed, online, open-access journal, abstracts of which are published as inserts. In the *Coal Combustion Products and Gasification Products Journal,* authors are not required to pay to be published. It contains many national and international research reports and updates. This method of sharing university-based research with the industry has helped both sectors become more aware of current needs and future opportunities. This is not unlike the early joint efforts by ACAA and EPRI to share and promote sound, documented CCP research.

EPRI and ACAA have had a great working relationship, to the benefit of the members of both organizations. Dave Goss and Tom Adams have regularly attended our advisory committee meetings, keeping us informed on evolving regulatory issues as well as providing an important link to industry needs that helps to shape our research agenda. In recent years, we have worked with ACAA, along with the University of Kentucky, on several very well attended ash workshops, which provide industry forums for addressing emerging issues. The progress made over the last two decades in using ash and gypsum speaks clearly to the success and importance of ACAA in supporting the growth of beneficial use of CCPs.

—Ken Ladwig, Technical Executive, Electric Power Research Institute

Kingston Ash Spill Rekindles Old Debates

On December 22, 2008, the ash industry was turned upside down when an ash dike ruptured at the Tennessee Valley Authority's Kingston Fossil Plant. More than 5 million cubic yards of coal ash in slurry form was released into the surrounding area, and the fallout from the spill would continue for years. During her January confirmation hearings, the EPA's soon-to-be administrator, Lisa P. Jackson, vowed that the agency would promulgate new ash regulations by the end of 2009. ACAA and the entire industry was placed under significant pressure to justify the continued beneficial use of CCPs, which were labeled by some environmental groups as "toxic wastes." The news media, more interested in sound bites than facts, repeated activists' allegations of the event as the "worst environmental disaster since the Exxon Valdez." Ten years later, the impact of the spill, although spectacular at the time, is much less serious than the public was led to believe by the press and industry critics. Nonetheless, the industry engaged in a lengthy process to respond to the proposed rulemaking that the EPA put out for comment in 2010. ACAA submitted 10,629 pages of testimony and comments on the rulemaking, which were compiled by members requiring nearly 14,000 volunteer hours. The rulemaking continues to be refined as recently as 2018, and the arguments concerning the safe and beneficial use of CCPs will likely persist for many more years. Further, as a direct result of Kingston, the EPA suspended the C^2P^2 program and backed away from any further partnerships with the industry.

In early 2009, David Goss retired from ACAA, and Thomas H. Adams was selected as the new Executive Director. At the same time, ACAA began its search for a new home. A move to Farmington Hills, Michigan, took place in mid-year to a location on the ACI campus. In 2010 and continuing through the next four years, Chairman Mark Bryant and Chair Lisa Cooper (supported by many female and male members of ACAA) established the first meetings of the Women's Leadership Forum. For many years, the utility and building materials industries (and ACAA) had been largely male-dominated arenas. As more women emerged within the government, utility, and industrial materials sectors, there became a need to foster within ACAA professional dialogue, development, and camaraderie for women. The Women's Leadership Forum furnished, and continues to

provide, this avenue. Over the last decade, the forum has become a very effective resource for women and a rich source for filling leadership roles within ACAA and beyond. ACAA fully supports these opportunities.

In 2012, ACAA entered into an agreement with Creative Association Management (CAM), a subsidiary of the ACI. CAM evolved into the current Advancing Organizational Excellence (AOE), which provides ACAA full-service support in association management, event planning, marketing and public relations, crisis communications, and operations, as well as training and educational services expertise. Adams' strong background in the concrete industry (ACI, American Shotcrete Association, and Michigan Concrete Association) enabled him and ACAA to further expand its connections and communications with concrete experts, users, and producers across the nation.

New Standards Address Evolving Markets

As noted, ACAA members have spent thousands of hours participating in the development of industry standards. Standards for the use of fly ash in concrete, CCPs in structural fills, leaching and test procedures, and many other technical documents have been issued and continue to be updated through the work of ACAA members and colleagues in state and federal agencies and research organizations. Perseverance by the Association has allowed CCP use to increase despite the ramifications of Kingston. Participation in ASTM and ACI has enabled ACAA members to help develop standards and guidance for the use of CCPs that have addressed some of the fears first raised following Kingston, as well as to address changing market conditions. In recent years, the utility industry has transitioned away from the use of coal to provide generation, in many cases replaced by natural gas and solar or wind power. With the shutdown of individual units at power plants, the industry has looked for new ways to provide quality fly ash for use in concrete, construction, and other applications. Marketers have developed innovative ways to reclaim ash from existing landfills; engineers have developed methods to reduce the contaminants in emission-control systems and provide a product that meets existing and evolving specifications. ACAA and its partners have fully supported ongoing standards development and revisions to address these changing market conditions.

ACAA has also expanded the focus of its activities in recent years. While still strongly supportive of CCP utilization, in response to rulemakings and the needs of its utility members ACAA has developed conferences and workshops to address the disposal of CCPs. The original goal of both NAA and ACAA was to reduce disposal. However, with changing perspectives by federal and state regulators, and concerns over the risks of inappropriate disposal techniques, WOCA and ACAA meetings regularly include speakers addressing topics such as landfill construction, groundwater monitoring, ash reclamation, regulatory compliance options, economic assessments, and environmental policies. In the course of 50 years, the industry has returned to a time when disposal has become a key issue. Today the industry is addressing long-term disposal techniques—including

The 2008 rupture of an ash dike at the TVA's Kingston Fossil Plant would revive public debate over whether coal ash should be designated a hazardous waste.

When I started working for Oscar Manz in 1977, he was establishing the Coal Byproducts Utilization Institute (CBUI), and we were running standard ASTM C618 tests on samples from all over the country. Southeastern Fly Ash (now SEFA) sent weekly samples from quite a few power plants in their area, and other clients included Nebraska Ash, American Fly Ash, and National Minerals Corp. (to name just a few). Oscar was involved in developing the ASTM fly ash specifications for use of Class C fly ash in concrete and worked closely with a local ready-mix company to do testing of various mix designs, especially for Class C. I remember when he talked about the specification limits, he said they pretty much took the numbers for the ashes that worked and started there.

When we moved to the (now) EERC facility, the engineering testing remained in the civil engineering lab, but all other coal ash work moved with us. Oscar retired shortly after that (mid-1980s). I continued to work with David Hassett and others to keep the program going. In about 1990, I attended my first ACAA meeting, was the only female in attendance, and met so many people: Charlie Brown from Duke, Roger Ophaug (Chair at the time) from Michigan, and Tom Hendrix from SEFA. When I returned to the office/lab, I remember telling my supervisor that ACAA was going to be the organization we needed to be connected with if we wanted to be able to do research that served the industry. At one meeting, Cheri Miller of TVA gave a presentation on water quality, and I remember thinking that finally someone was talking my language. Over time, Cheri and I found lots of common interest both professionally and personally.

—Deborah Pflughoeft-Hassett, former Research Manager for the Energy and Environmental Research Center (EERC) at the University of North Dakota

ways to reclaim materials disposed many years ago to preserve and ensure the supply of high-quality CCPs for beneficial use amid shrinking coal-fueled power production.

In closing this historical summary of ACAA's first 50 years, it is imperative to remember that an organization's history is not simply its events and activities. People who have led and participated in these activities must be remembered. Starting with the visionary men who created the NAA, the Association has flourished at critical times during which leadership brought success. The thousands of individuals who have stepped forward as volunteers to serve as Association presidents, chairs, officers, and committee members must be credited with the majority of ACAA's successes. With the formation of the ACAA Educational Foundation in 1996 and the Women's Leadership Forum in 2010, voices that had not been widely recognized before became part of ACAA's legacy. Students and female members share important roles in the future of the Association. International experts continue to be essential to the industry's future, through the exchange of information, sharing of technology, and willingness to support WOCA and workshops. It would be impossible to recognize individually the faithful, devoted men and women who have guided NAA and ACAA throughout these 50 years. Thanks to their dedication in the past, this industry has had a remarkable history. The future is unknown, but there are many individuals willing to meet new challenges and opportunities as they serve and support ACAA. Our thanks go out in advance to all of them.

In 2010 the ACAA Women's Leadership Forum was launched as a vehicle by which to foster professional dialogue, development, and camaraderie among women in the industry.

Two of ACAA's most valuable contributions to the industry have been the formation of the World of Coal Ash and the joint sponsorship of the *Coal Combustion and Gasification Products* journal. At the 2003 ACAA conference in St. Petersburg, Florida, ACAA's Executive Director and its Chairman invited the University of Kentucky's International Ash Utilization Symposium (IAUS) leadership to a breakfast meeting where the concept of a merged conference was considered for 2005. The format and the organizational "ownership" of the merged meeting (combining ACAA's biennial ash utilization conferences and the biennial IAUS meetings) then underwent further negotiations. The basic structure of the current WOCA meeting, with spring odd-year meetings rotating between Lexington and a non-Lexington site, was established in those early negotiations and has succeeded very well.

The concept of a journal co-sponsored by ACAA and the Center for Applied Energy Research was based both on the success of the WOCA meeting and on the frustrations associated with dealing with huge, well-established journals. As an open-access journal, *Coal Combustion and Gasification Products* is unusual in having a structure in which the author rarely pays to publish—the exceptions being very long manuscripts or papers with an excessive number of color figures—and the reader can freely read any paper without paying. This is a unique approach to sharing peer-reviewed research in a printed format.

—Jim Hower, Principal Research Scientist, Applied Petrology Laboratory, University of Kentucky Center for Applied Energy Research

I discovered ACAA as a total newcomer to the coal ash business in 1988. Its purpose was to promote and facilitate the sales and use of ash left behind when coal was used to generate electricity. It seemed to be the only show in town that focused on that goal. Given the significant growth and much-improved focus that was to come after 1988, it was a rather weak and narrow focus on CCP utilization that I found at the first meetings I attended. From 1988 until my retirement in 2009, I witnessed and was complicit in the best of times and the worst of times. I experienced and dealt with on a personal level five executive directors of ACAA. The organization grew and then shrank to the point of nearly fading into financial and membership oblivion. But due to a strong core's (members') desires to save ACAA, we managed to resurrect it, like the symbol the phoenix, from the ashes of financial and leadership ruin. These were the worst of times and then subsequently the best of times. Under new leadership in 2002, ACAA grew into what it had been previously—and what it remains today.

My involvement with ACAA spanned 21 years, nearly my entire professional career with the company. I was privileged and able to work on all the major committees and working groups of the Association. What made it the best of times more than anything else was the personal and professional relationships I had with ACAA members of all categories. Those people stood strong when strength was required. I think and reflect often on the people and times and am thankful for both.

—Ted Frady, former Chair and representative for South Carolina Electric and Gas

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Dave Goss served as Executive Director of the American Coal Ash Association from 2002 through 2008.


We are the ash industry pioneers.
Congratulations ACAA on 50 years supporting the beneficial use of coal combustion products.
Boral Resources is proud of the part it played in growing this vibrant industry. Our predecessor companies have been with ACAA every step of the way. Developing new ash utilization technologies and products. Investing in logistics necessary to bring those products to market. Supporting development of sensible engineering standards and regulatory policies. In an industry that demands creativity and adaptability, experience matters. Boral Resources has that experience.
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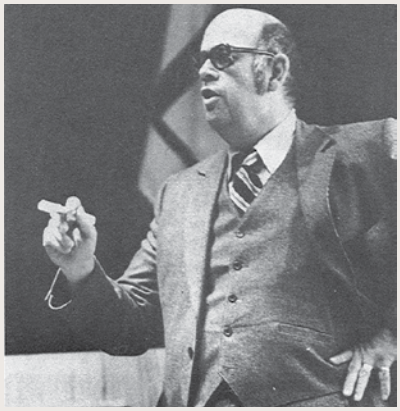
31 Key Events in ACAA History

By John Simpson

1968 – 1985: Foundation of an Industry

1. 1st Symposium on Ash Utilization

In 1958, John H. Faber, a chemical engineer with the U.S. Bureau of Mines, in Morgantown, West Virginia, begins working with the coal subcommittee of the U.N. Economic Committee for Europe. Two years later, this multinational group holds the first of 12 meetings working on coal ash utilization. They become known as the "Group of Experts" and conduct the first symposium on fly ash utilization, in Pittsburgh in March 1967. The event attracts more than 500 participants from the U.S., Canada, and Europe and features 27 formal presentations by experts on all major phases of fly ash production, utilization, and research.



John H. Faber, NAA's First Executive Director

2. NAA Is Launched

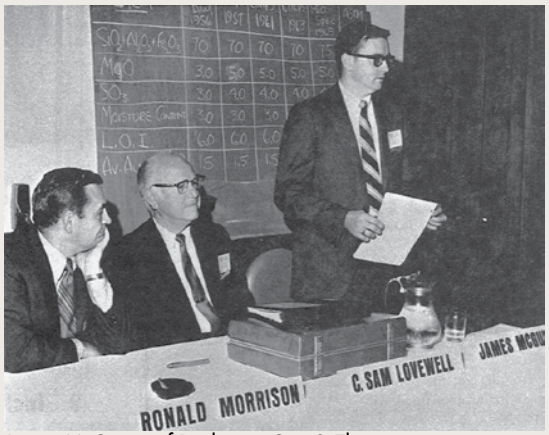
A follow-up October 1967 meeting in New York of more than 50 representatives of coal companies, electric utilities, and others interested in establishing a trade association is held. Prime movers in this effort are Dr. Harry Perry of the U.S. Bureau of Mines, Leonard Bradley of the National Coal Association, Herbert Cohen of American Electric Power Co., James Williamson of Dayton Power & Light Co., Ronald Morrison of American Electric Power Co., and Gerard Gambs of Consolidation Coal Company. The following year, the National Ash Association is established to represent coal ash producers and marketers, as well as coal companies and suppliers of related equipment and services, in protecting and expanding the various markets for coal ash. The headquarters office opens in Washington on July 8, 1968, with Faber as executive director. Faber insists on the office being located in the nation's capital because, in his words, "That is where the action is."

3. Annual Production & Use Survey Initiated

In 1967 an annual Production and Use Survey is begun, providing valuable statistics to both industry and government. The voluntary data collection effort estimates the percentage of coal combustion products used beneficially and/or disposed. Data from each respondent is rolled into comprehensive statistics, protecting the identity of each company while illustrating national and regional trends. The survey data will come to be used by the EPA, DOE, and other federal agencies as a measure of the effectiveness of their respective outreach programs promoting CCPs. The first such survey—covering 1966—shows an overall utilization rate of 12%.

4. NAA Holds First Annual Technical Meeting

The National Ash Association holds its first annual technical meeting in Charleston, West Virginia, in October 1970. More than 50 people attend the two-day event, which is organized to consider the technical and marketing aspects of the use of fly ash in concrete. The meeting features a workshop on marketing, trouble shooting, and proportioning of ready-mixed concrete, mass concrete, and concrete masonry units—after which participants visit the Appalachian Power Company's Kanawha River Station to learn the benefits associated with producing a high-specification ash and tour the plant and its ash-handling facilities. The meeting is the first of many dozens the Association will conduct over the years to educate industry participants on technical issues and practices associated with ash management.



James McGuire, of Rochester Gas & Electric

5. Specification for Fly Ash for Use in Concrete Approved

In 1971 ASTM officially approves ASTM C618—Standard Specification for Coal Fly Ash for Use in Concrete. Six years later, ASTM issues a modified C618 specification covering the use of fly ash as a mineral admixture in concrete, culminating a multi-year effort by the ash industry to achieve a more realistic approach to testing procedures contained in the specification. An important element is the incorporation of a classification for lignite or western ashes for the first time. These fly ashes are referred to as Class C material in the specification.

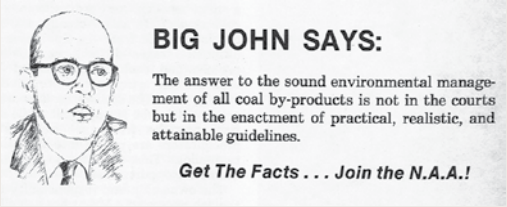

Fly ash concrete is used in the smokestack at Ohio Edison's Dilles Bottom plant

6. Push for Use of Coal Ash in Federal Transportation Projects

In 1972, over 2.8 million tons of power plant ash is placed in U.S. road projects. Prior to that, the lack of field data on ash properties, handling data, and performance statistics were a potential deterrent to its use in roadbuilding. By 1974, NAA's generation and dissemination of technical data on ash utilization helps persuade the U.S. Department of Transportation to formally sanction fly ash's use in construction. The Federal Aviation Administration develops a new item (P-305) for inclusion in its *Standard Specifications for Construction of Airports* handbook, while the Federal Highway Administration (FHWA) endorses its use in a memorandum (N 508004) directed to field office personnel and state highway officials. In 1975 NAA publishes the 72-page *Design Guide for Use of Fly Ash Base Mixes in Highway Construction*, and surveys of state DOTs indicate that 30 state highway departments have ash specifications. A decade later, the Association collaborates with the FHWA on publication of the first edition of *Fly Ash Facts for Highway Engineers*.

7. Defeat of Legislative Provision Classifying Coal Ash as Hazardous Waste (Part I)

In 1978 proposed amendments to the 1976 Resource Conservation & Recovery Act (RCRA) appear headed toward the classification of coal ashes as "hazardous wastes," which would have required of the industry elaborate monitoring, recordkeeping, security, and reporting systems. The NAA, together with the Utility Solid Waste Activities Group (USWAG), formulates a detailed response and marshals support from allied groups to thwart this designation. In 1980 Congress enacts the Solid Waste Disposal Act amendments to RCRA dictating that certain wastes, including CCPs, are to be temporarily excluded from Subtitle C regulation under the Act. Under the so-called Bevill Amendment, "fossil fuel combustion wastes," as they are called (including fly ash, bottom ash, boiler slag, and particulates removed from flue gas), fall under Subtitle D and become subject to regulation under state law as solid waste. EPA is further instructed to "conduct a detailed and comprehensive study and submit a report" to Congress on the "adverse effects on human health and the environment, if any, of the disposal and utilization" of coal ash and related materials.



8. NAA Documentary Depicts the Many Uses of Coal Ash

In 1983, NAA releases a documentary film—*Power Plant Ash: A Resourceful Alternative*—developed in cooperation with the FHWA. The 27-minute documentary traces the lifecycle of ash from the coal mine to the power station and into various construction applications. In particular, the film highlights established ash uses such as base construction, structural fills, soil stabilization, flexible and rigid pavements, embankments, and grouting. "It is suitable for the knife-and-fork civic club circuit or technical presentations to engineers and consultants," *ASH at Work* notes at the time.


Placement of fly ash in a structural fill near Charleston, WV

9. NAA Members Provide Input on EPA Consideration of Rules to Classify Coal Ash as Hazardous Waste

Later in the year, the NAA issues an "Ash Alert" to members after the Environmental Protection Agency (EPA) schedules hearings to accept public comment on an amendment to redefine the materials that should be classified as hazardous wastes when recycled under Section 3001 of RCRA. NAA files a brief at the initial hearing stating that power plant ash should not be placed under the hazardous waste umbrella and to do so would jeopardize the marketability of the material. The brief notes that the reuse of ash is not harmful to human health or the environment. NAA members appear at subsequent public hearings and their comments are collected for input into the Association's position statement. It will be five years before the EPA in 1988 issues its report to Congress, pursuant to the Bevill Amendment, recommending that coal ash not be regulated as hazardous waste.


ACAA President Gerald Bowdren speaks with members about regulatory matters pertaining to coal ash

1985 – 2009: Maturation and Market Growth

10. American Coal Ash Association Is Born

At the NAA's 1985 annual meeting, the Board of Directors votes to adopt a new name, logo, and emblem. The Board selects "American Coal Ash Association" as the name and a phoenix as the renamed Association's symbol. "The ancient Egyptian legend provides a 21st-century beacon of silver light on coal ash utilization for the rebuilding of our cities and roads, our farms and industry," an editorial in *ASH at Work* states. "It serves as a vital and youthful reminder that coal ash is this nation's fourth-largest readily available mineral resource, after crushed stone, coal, and sand and gravel." Jack Weber, head of Weber-McNeil Materials Sales, is named the new Chairman of the Board, succeeding James Plumb, and becomes the first non-utility executive to head the Association since its inception.

11. Blueprint for the Future of Ash Utilization

ACAA's members in 1988 determine that the Association's function is to identify, then ease or remove, real or perceived technical, commercial, legislative, regulatory, and informational barriers to 100% ash utilization. As part of its 1988-1990 business plan, the Association identifies barriers in three market sectors: high-volume highway, landfill, and infrastructure applications; medium-technology applications in ready-mixed, precast, and roller-compacted concrete, masonry units, and lightweight aggregate manufacture; and high-technology end uses in filler applications in paints and plastics, as well as in metals recovery from coal ash. Staff and member committees set objectives to ease or remove each barrier over the three-year time frame.

12. Renewed Focus on Promoting Fly Ash Use in Highway Concrete

Under the aegis of the Transportation Research Board's Committee A2E05, "Chemical Additions and Admixtures for Concrete," ACAA Director of Technical Services Sam Tyson chairs a session on "Optimization of Mixture Proportions for Highway Concrete Containing Coal Fly Ash." ACAA publishes and distributes the session papers in 1989 to help promote an increase in the national average of the replacement of portland cement with fly ash from 15% to 30% (or as technically appropriate for the application). The move is part of ACAA's Business Plan program to stimulate a reduction in the major differences among state specifications, encourage less-rigid coal fly ash and coal fly ash concrete specifications, and institutionalize source approvals based on performance and uniformity standards.

13. ACAA Expands to Include Honorary Members

At the July 1992 Board of Directors Meeting, a new policy is adopted allowing for honorary membership in ACAA. The objective is to promote membership in ACAA of individuals who are recognized as "outstanding experts in one or more areas of coal combustion byproduct technology and use." Such individuals are to be retired from their field of expertise or, if not retired, unable or ineligible for membership in one of the other classes of membership. Members are encouraged to nominate colleagues for honorary membership, together with a description of why they believe it should be granted, for review and recommendation by the Administrative Committee followed by selection by the Board.

Former ACAA Secretary and Treasurer Allan Babcock was among the first-selected Honorary Members

14. EPA Issues "Final" Determination Exempting Coal Ash from Regulation as Hazardous Waste

In early 1993—with a final "regulatory determination" of the EPA's 1988 recommendation to Congress that coal ash not be regulated as hazardous waste looming—ACAA, together with the Edison Electric Institute (EEI) and USWAG, prepares comments to the agency supporting the affirmation of its conclusions of five years earlier. ACAA's comments stress the importance of fly ash, bottom ash, boiler slag, and flue gas desulfurization material being exempted from regulation as hazardous materials under Subtitle C of RCRA. EPA rules favorably on the matter, noting it "has determined that large-volume wastes from coal-fired electric utilities pose minimal risks to human health and the environment. Therefore, it is unnecessary to manage these wastes as hazardous. The agency believes that industry and the states should continue to review appropriate management methods" for these materials. Fluidized bed combustion wastes and low-volume wastes (boiler blowdown, coal pile runoff, cooling tower blowdown, demineralizer regenerant rinses, metal and boiler cleaning wastes, and pyrites and co-managed wastes)—referred to as "remaining wastes"—are outside the regulatory determination and are to be addressed at a later date. EPA rules that more study is needed on these remaining wastes.

15. ACAA Reports Barriers to CCBP Use to DOE, Congress

A provision in the Energy Policy Act of 1992 charges the U.S. Secretary of Energy with conducting a "detailed and comprehensive study on the institutional, legal, and regulatory barriers to increased utilization of coal combustion byproducts (CCBPs) by potential governmental and commercial users"—and reporting the findings to Congress. DOE selects ACAA member the Energy and Environmental Research Center (EERC) to perform the study, which is to serve as the basis for recommendations of actions to be taken to increase CCBP utilization. The DOE "barriers" study is designated a priority activity by ACAA's Government Relations Committee, and the Association conducts an open forum to gather member input. The consensus is that coal ash use is impeded in numerous applications in which competing materials and products face comparably fewer obstructions—and that such barriers invariably derive from regulatory origins. In 1994, EERC issues *Barriers to the Increased Utilization of Coal Combustion/Desulfurization Byproducts by Government and Commercial Sectors*—with a follow-up report four years later—concluding that "the primary regulatory barrier identified was the lack of a coherent policy among federal and state agencies covering the beneficial use of coal byproducts." The report adds, "The regulation of byproducts as a solid waste is also the major factor underlying legal barriers to increased byproduct use. When a byproduct is considered a solid waste, the issue of environmental liability becomes a strong disincentive for byproduct use and sales."

16. ACAA Compiles State Regulations Governing CCBP Use

In 1994 ACAA initiates a review of state solid waste regulations and/or policies governing the use of CCBPs throughout the U.S. The following year, the Association publishes a report on its findings, *State Solid Waste Regulations Governing the Use of Coal Combustion Byproducts*. The report provides an overview and comparison of state regulations and policies governing the use of coal ash and identifies those in which such regulations and/or policies have one or more favorable features with respect to the "beneficial use" of CCBPs. ACAA's report assists environmental analysts and state regulators in the exchange of regulatory guidance that may enhance the use of CCBPs.

17. ACAA Pushes Coal Ash for Flowable Fill Applications

In the early 1990s, ACAA's promotion of high-volume utilization options for its members focuses on the use of fly ash in ready-mixed flowable fill—a grout-like material that helps end users achieve economies in backfill-type applications through reduced labor and inspection costs. ACAA Executive Director Sam Tyson participates as guest speaker in a series of seminars and demonstrations promoting flowable fill mixes containing fly ash to local, county, and city engineering departments, as well as contractors and consulting engineers—each conducted in a classroom setting followed by an on-site placement of flowable fill delivered by a ready-mix truck. The fill is placed in a trench alongside an identical ditch backfilled with soil layers using compaction equipment. Attendees receive a dramatic lesson in some of the advantages of using flowable fill—reduced project time, improved safety, and elimination of labor and compaction equipment requirements. In 1995, a flowable fill video is produced and released.

18. Promoting the Environmental Benefits of Coal Ash

With the issue of climate change increasingly a focus of national and international discussion and policy in the 1990s, ACAA actively promotes the benefits of CCBPs in reducing CO_2 emissions. In 1995 staff publish and present at various industry forums two papers, *Climate Change and New Opportunities for Coal Combustion Byproducts* and *Further Opportunities for Coal Combustion Byproducts to Reduce Greenhouse Gas Emissions*. Both papers highlight ways that CCBP use in various applications helps reduce the amount of CO_2 released into the environment by major portland cement and aluminum manufacturers. Later that year, ACAA and member company Ontario Hydro sponsor an educational seminar on life cycle assessment (LCA) methods applied to CCBPs. Attendees are given a basic understanding of LCA methodology and the various ways that the coal ash industry can use LCA to demonstrate the environmentally preferable aspects of its increased use.

19. ACAA Launches Educational Foundation

At the October 1995 meeting of ACAA's Administrative Committee, a business plan, budget, bylaws, and articles of incorporation for a proposed "American Coal Ash Association Educational Foundation" are reviewed. The focus of the Foundation is to include educational activities such as the international symposium organized by ACAA every two years, a scholarship program, and an environmental awards program. In 1997, five students are selected as the first recipients of scholarship awards from the John H. Faber Scholarship Program based on proposals that the Foundation's Scholarship Committee finds to be "well conceived and likely to produce a semester-project that will advance each student's knowledge of technically sound, commercially competitive, and environmentally safe management and use of coal combustion products."

20. Coal Combustion "Byproducts" Become Coal Combustion "Products"

ASTM Subcommittee E50.03 in 1997 proposes the use of new terminology pertaining to coal ash in new standards. The term "coal combustion product" (CCP) is to supplant "coal combustion byproduct." The definition of CCPs is to state that they are materials "produced/resulting primarily from the combustion of coal." ACAA's Strategic Planning/Steering Task Force had already recommended the previous year that the Association begin using the "CCP" terminology.

21. Impact of NOx Reduction Strategies on Fly Ash Marketability Calculated, Shared with DOE

Regulations promulgated pursuant to the 1990 Clean Air Act Amendments force many coal-fueled electric utilities to switch to low-NOx burners to reduce nitrous oxide emissions—negatively impacting fly ash's marketability in cement and concrete markets. A 1996 ACAA survey of utilities documents that 40% have experienced a decrease in marketable CCPs of more than 100,000 tons. Half of utility respondents indicate that, as a result of NOx reduction strategies, their companies have lost CCP marketing revenue, and roughly the same proportion of utilities have experienced an increase in CCP management and disposal costs. A survey of utilities carried out following EPA's promulgation of the 1998 Ozone Transport Rule reveals that at least 2.4 million tons of the 9.4 million tons of fly ash used in cementitious applications could be rendered unusable for that market. An additional 1.8 million tons of fly ash used in non-cementitious applications may also be unusable. At least $16 million in ash marketing revenues are estimated to have been lost to coal-fueled utilities and an additional $27 million in resultant disposal costs incurred. ACAA publishes *Unintended Effects of EPA's Recent Ozone Transport Rule* and presents results of the latter survey to the DOE's National Energy Technology Laboratory.

22. EPA's Second Report to Congress Concludes Coal Ash Does Not Warrant Hazardous Waste Regulation

In 1999, EPA completes its study of the "remaining wastes" not included in its 1993 "regulatory determination" regarding coal ash wastes and, the following year, recommends that these materials—fluidized bed combustion wastes and low-volume wastes (boiler blowdown, coal pile runoff, cooling tower blowdown, demineralizer regenerant rinses, metal and boiler cleaning wastes, and pyrites and co-managed wastes)—be exempted from federal hazardous waste regulations and regulated by the states under authority of Subtitle D of RCRA. EPA states that additional regulation of coal ash that is beneficially used is not warranted; however, national standards for the use of coal ash in mining applications must be developed.

23. C^2P^2 Ushers in Era of Renewed Industry-Government Cooperation on CCPs

In 2003, the Coal Combustion Products Partnership (C^2P^2) is formed. The USDA, DOE, EPA, FHWA, ACAA, and USWAG join together to find ways to promote the safe beneficial use of CCPs. C^2P^2 activities include the staging of workshops in which presentations are made detailing the current state of the art in beneficial use, as well as the production of documents providing information on beneficial uses. Dozens of individual companies sign on as partners, and a website is created and hosted by EPA to provide a home for C^2P^2 information. Launched three years after the EPA's final determination that CCPs do not warrant hazardous waste management in disposal, the partnership helps boost the beneficial use of CCPs from 30% to almost 45% by 2008.

WE Energies earns the 2005 C^2P^2 Overall Achievement Award

24. "Green Highways" Program Launched

In late 2004, ACAA's Board of Directors approves a plan implementing a "green highways" concept. The plan emphasizes use of CCPs in highways in a variety of ways—alone, in combination with other forms of CCPs, and combined with non-ash materials—to confer their performance, economical, and environmental benefits in highway construction. Although the primary use is fly ash in concrete, other uses of CCPs include soils stabilization, binders for in-place pavement recycling, use in flowable fills, aggregates, source materials for structural fills and embankments, components in manufactured soils, and granular base courses beneath pavements. The effort dovetails with work simultaneously being undertaken by EPA, FHWA, and other organizations to develop their own environmentally responsible highway construction/repair initiative. ACAA works with the agencies to promote the "Green Highway Forum" in 2005, at which a draft "roadmap" is presented. Intended as a guide to executive-level participants, the roadmap outlines 10 guiding principles, among them that coal ash and other industrial byproducts can contribute to the greening of America's highways by conserving natural materials, reducing greenhouse gas emissions, and lowering overall costs.

25. ACAA Folds International Symposia into World of Coal Ash

In 2005, ACAA commits to combining its international symposia with those of the University of Kentucky's Center for Applied Energy Research into a single "World of Coal Ash." This new biennial conference is to focus on a wide variety of topics, ranging from basic information to technical presentations, together with opportunities for sponsorship and exhibits. The first-ever gathering is a week-long event held in April in Lexington, Kentucky, featuring papers delivered on topics ranging from distribution of mercury in FGD byproducts to release of ammonia from SCR/SNCR fly ashes, as well as presentation of the C^2P^2 Awards. Also incorporated are meetings and workshops for the U.S. Office of Surface Mining and the DOE's National Energy Technology Laboratory. The conference immediately becomes the premier fixture on the international coal ash industry calendar for the exploration of the science, applications, and sustainability of global CCPs and gasification products.

26. Kingston Coal Ash Slurry Spill Renews Discussion on Regulation of CCP Disposal

On December 22, 2008, an ash containment dike at the Tennessee Valley Authority's Kingston power plant fails. Approximately 300 acres, several homes, and portions of two nearby rivers are flooded by more than a billion gallons of slurry. Public and regulatory attention again focuses on how coal ash disposal is to be regulated. EPA commences what will become a six-year-long coal ash disposal rulemaking and terminates the C^2P^2 program. Beneficial-use volumes subsequently decline. (If annual beneficial use from 2009 to 2013 had simply remained level with 2008's use, 26.4 million fewer tons of coal ash would have been deposited in landfills and impoundments.)

2009 – 2018: Mobilization and Resurgence

27. ACAA Rallies Industry to Fight Hazardous Waste Designation for Coal Ash

ACAA staff and members join the ensuing debate, participating in public hearings across the country, responding with detailed comments to EPA proposals, and visiting offices on Capitol Hill to educate Congressional and Senatorial staffs on the threat to CCP recycling. ACAA informs EPA and legislators that the industry requires consistent regulation of disposed coal ash as a non-hazardous solid waste able to be recycled and reused in commerce—and without any special-waste label. ACAA reasserts coal ash's economic, environmental, and performance benefits to the nation across its many end-use markets.

SOURCE: Diliff-Wikipedia

28. Women's Leadership Forum Debuts

In 2010, ACAA launches the Women's Leadership Forum. The goals of the group are to develop interest and qualifications of female members for ACAA committee leadership and officer positions; acquaint ACAA women members with the wide range of energy and building materials careers, as well as professional organizations and meetings, with the goal of opening paths for further career development; and promote professional interactions and camaraderie among female ACAA members and those in related fields, including government, energy, building materials, and consulting. The group meets at sponsored luncheons at ACAA business meetings, where invited speakers provide an overview of their careers and discuss the challenges and successes they have met along the way.

Former ACAA Chair Lisa Cooper greets the Women's Leadership Forum keynote speaker, Janet Gellici, of the American Coal Council.

29. ACAA Study Refutes Claims That Coal Ash Is a Risk to Human Health

In 2012, ACAA releases *Coal Ash Material Safety: A Health Risk-Based Evaluation of USGS Coal Ash Data from Five U.S. Power Plants*. Results of the study, analyzing concentrations of metals and inorganics from power plants across the U.S., demonstrate that with few exceptions constituent concentrations in coal ash are below screening levels for residential soils—and are similar in concentration to background U.S. soils. It further concludes that, not only does coal ash not qualify as a hazardous substance from a regulatory perspective, it would not be classified as hazardous on a human health risk basis. Because exposure to coal ash used in beneficial applications, such as concrete, road base, or structural fill, are much lower than in a residential scenario, these uses also do not pose a direct contact risk to human health.

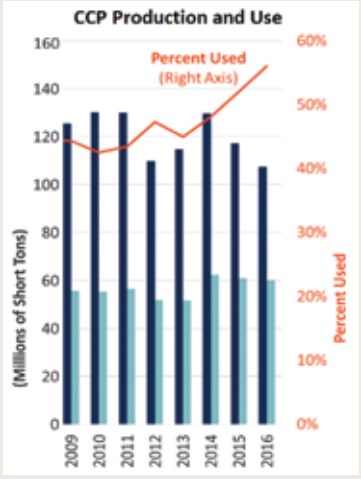
30. EPA Reaffirms Safety of Coal Ash Use

In 2015, EPA publishes standards for coal ash disposal and exempts beneficial use from regulation—treating it as a non-hazardous waste material under Subtitle D of RCRA. Congress then acts to give states the ability to enforce the EPA standards, rather than rely on citizen lawsuits as prescribed by previous law.

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

31. Coal Ash Recycling Rate Reaches Record in 2016

ACAA's 2016 Production and Use Survey documents that 56% of the coal ash produced during the year is recycled—establishing a new record and marking the second consecutive year that more than half of the coal ash produced in the United States is beneficially used rather than disposed. The survey shows that approximately 60.2 million tons of CCPs are beneficially used out of 107.4 million tons produced during the year. The rate of ash utilization represents a four-percentage-point increase over 2015 and the third straight year of significant improvement in the beneficial use rate.

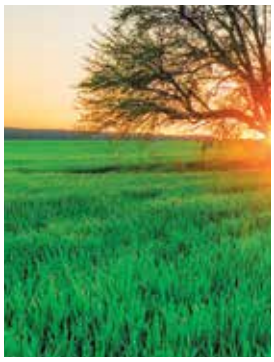












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Future Coal Ash

What Lies Ahead for Beneficial Use of Coal Combustion Products?

By John Ward

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

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

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

Trajectory #1—From waste to byproduct to product

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

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

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

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

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

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

Trajectory #3—From cinders to "toxic waste"

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

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

Trajectory #4—Regulatory policy matters

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

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

Trajectory #5—Track record of consistent innovation

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

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

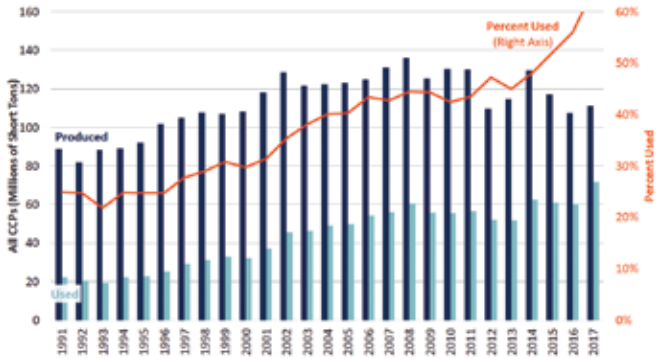

Figure 1. ACAA 2017 Coal Combustion Products Production and Use Survey, all CCPs production and use with percent.

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

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

Grand Prognostications[2]

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

Prediction #1—Markets will continue to drive beneficial use

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

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

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

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

Prediction #2—Technology will continue to address challenges

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

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

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

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

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

Grand Conclusions

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

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

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

Footnotes

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

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

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











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Beneficial Use Case Study

1144 Fifteenth Street

Coal Combustion Product Type
Fly Ash

Project Location
Denver, Colorado

Project Participants
Hines Interests Limited Partnership, Martin/Martin Consulting Engineers, CTL|Thompson, Kendall/Heaton Associates, Pickard Chilton, Hensel Phelps Construction Company, Martin Marietta

Project Completion Date
January 2018

Project Summary
1144 Fifteenth is the first class-A office tower constructed in Denver in over 30 years. The 42-story, 603-foot-high building, the city's fifth-tallest, is a LEED Gold-certified glass tower providing 640,000 square feet of office space. It consists of two levels of below-grade parking, twelve levels of podium parking above grade, twenty-seven levels of office space, and two penthouse levels for mechanical equipment.

Project Description
Construction of 1144 Fifteenth, in Denver's LoDo neighborhood, involved solving a number of design challenges—not the least of which was how to safely anchor a heavy skyscraper on a comparatively small footprint in the sedimentary bedrock that sits beneath the city. Local firm CTL|Thompson—which operates one of a handful of laboratories in the U.S. with deep expertise in the use of fly ash in concrete—was enlisted to provide the geotechnical investigation and environmental site assessment for the project.

SOURCE: Wikimedia Commons

SOURCE: Wikimedia Commons

SOURCE: Hines

SOURCE: Wikimedia Commons

Site analysis by CTL|Thompson and Martin/Martin Consulting Engineers revealed that the site's bedrock was relatively shallow—at the same elevation as the building's lower level. So, rather than digging down into the bedrock to build a platform supporting a drilled pier and reinforced concrete mat core, the engineers instead opted to put in place a tie-beam connecting and supported by drilled concrete piers sunk over 100 feet into the bedrock.

The system comprises eight drilled piers measuring 10 feet in diameter and capable of supporting seven-foot-wide, seven-foot-deep tie-beams. Beams running along the longitudinal axis of the building are pulled together by shorter perpendicular beams in a system designed to rest against bedrock three stories below street level and reduce lateral loads on the piers that support the foundation. The drilled piers provide lateral resistance.

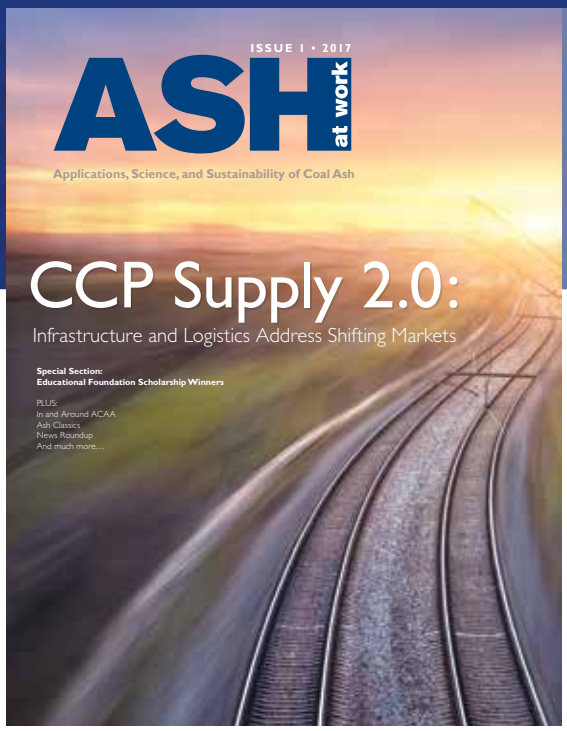
Due to the massive volumes of concrete required for the foundation—2400 cubic yards across eight piers—engineers developed a custom mix to reduce the heat generated when water and portland cement react, slow the initial curing process, and preserve the strength and quality of the concrete. Martin/Martin and CTL|Thompson developed a mix for concrete supplier Martin Marietta that incorporated up to 40% fly ash for the job.

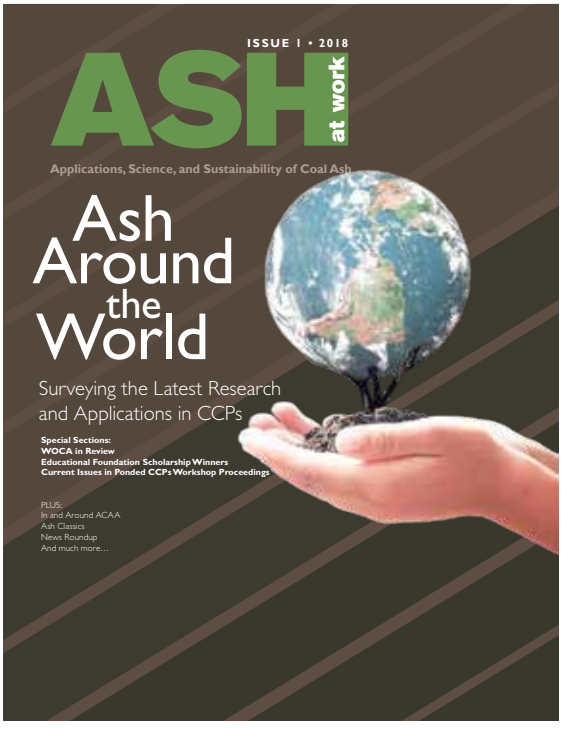
During the filling process, concrete temperatures were continuously monitored to ensure that they stayed within the desired range. With the strength gain slowed, the allowable minimum compressive strength requirement at 28 days was eased to 56 days.

According to CTL|Thompson, use of fly ash in the design solution helped minimize the volumes of cement and concrete required for the core foundation, while reducing costs and boosting its strength.

ASH at work

Applications, Science, and Sustainability of Coal Ash





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Beneficial Use Case Study

Engineered Fill Using Recycled Coal Combustion Products

Coal Combustion Product Type
Fly Ash

Project Location
North Georgia

Project Participants
Environmental Protection Agency, Georgia Power Company, Georgia Environmental Protection Division, Georgia Department of Transportation, Southern Company Services

Project Completion Date
2012

Project Summary
As part of an effort to foster the beneficial use of coal fly ash, a project was developed to demonstrate the safety and effectiveness of using fly ash in a large highway fill application. Longer-term goals were to support regulatory and statutory changes in Georgia to allow ash use in future commercial fill applications—thereby reducing the need for landfills, land consumption, and depletion of natural resources.

SOURCE: Georgia Environmental Protection Division, Georgia Department of Transportation, Southern Company Services

SOURCE: Georgia Environmental Protection Division, Georgia Department of Transportation, Southern Company Services

Project Description
The demonstration consisted of building a research test section of a coal combustion engineered fill on a new highway construction project. Ash (31,000 tons) was rolled and compacted to Georgia Department of Transportation (GDOT) standard specifications for roadway fill application. The compacted ash height extended 10 to 12 feet across the section. Normal fill material (sand, silt, clay, rock) was placed above the ash in lifts and compacted to at least 95% of the maximum laboratory dry density. Material within one foot of the pavement was also required to be free of rock fragments and compacted to 100% of maximum laboratory dry density.

GDOT conducted tests to confirm that compacted fly ash would meet specifications required for roadway fill application prior to the project. These tests included soil classification in accordance with GDOT and AASHTO classification systems and remolded, unconsolidated, undrained triaxial compression testing. Tests were also performed on the in-place material, including classification and in-place density using the sand cone method and nuclear gauge.

SOURCE: Georgia Environmental Protection Division, Georgia Department of Transportation, Southern Company Services

To monitor any settlement, dipping, or rutting in the roadway and along the median and shoulders of the fly ash fill section, a high-definition laser scanner (HDLS) was used. Scanning was first done in July 2011, and a scan was performed every three months over the next year. The HDLS operates by taking many shots (scans) very quickly, forming the same framework as a digital camera image but in three dimensions and comprising millions of dot pixels in order to form a three-dimensional point cloud. An HDLS lidar scan was also conducted along an area with normal fill. There were no abnormalities noted in the test section based on the HDLS.

Geotechnical evaluations conducted showed that fly ash is an acceptable substitute for commercial fill applications such as a roadbase fill.

- No discernible differences from a geotechnical standpoint were noted in tests conducted on the fly ash section and normal fill sections.
- Soils and rock in the area contained overlapping concentration ranges—in some cases higher concentrations—for many trace elements compared to the fly ash used in the test.
- Statistical exceedances above background concentrations tended to be rare, isolated events that did not represent trends. They generally showed good correlation with total iron concentrations, suggesting a naturally occurring source.

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Beneficial Use Case Study

Hoover Dam Bypass

Coal Combustion Product Type
Class F Fly Ash

Project Location
Lake Mead National Recreation Area, Clark County, Nevada; Mohave County, Arizona

Project Participants
HDR Inc., T.Y. Lin International, Sverdrup Civil Inc., Headwaters Resources, Obayashi Corporation, PSM Construction USA Inc., Casino Ready Mix, Federal Highway Administration, Arizona Department of Transportation, Nevada Department of Transportation, RE Monks Construction, Vastco Inc., Edward Kraemer & Sons Inc.

Project Completion Date
2010

Project Summary
The Mike O'Callaghan–Pat Tillman Memorial Bridge is a concrete arch bridge spanning the Colorado River between Arizona and Nevada. Located 1,500 feet downstream of the Hoover Dam, the bridge rerouted US 93 from its previous location along the top of dam. The bridge incorporates the widest concrete arch in the Western Hemisphere and, at 900 feet above the canyon floor, is the world's highest concrete arch bridge.

Project Description
As with the construction of the nearby Hoover Dam itself three-quarters of a century earlier, building the Mike O'Callaghan–Pat Tillman Memorial Bridge carried a number of design challenges. The remoteness of the build site, the strength requirements for the concrete arches, the size of the placement, and the hot desert conditions all contributed to challenges in mix design, thermal control, concrete delivery, and placement.

Designers specified that concrete would need to achieve compressive strength of 10,000 psi in 56 days and thermal control to minimize cracking. Strength requirements were further addressed by use of a material content of 200 lbs. of fly ash to 800 lbs. of cement per cubic yard—and a very low water-to-cement ratio of under 0.31. The mixture typically achieved strengths of 4000 psi in a little more than a day and over 12,000 psi in 56 days.

A challenge associated with this mix was that, in its natural curing condition, it would reach temperatures in excess of 190° F—well above the 155° F limit of the design specifications. Further, the usual mitigation methods—such as chilled batch water or ice chips, shading the aggregate stockpiles, and pouring at night—were deemed to be insufficient to reduce the maximum curing temperature to within the desired range.

Ultimately, liquid nitrogen was used to precool the concrete to temperatures that would allow a maximum peak curing temperature of under 155° F. Use of liquid nitrogen dropped the batched temperature of 85° F to a predelivery temperature of 40° F—allowing temperatures at the point of placement to be in the 60° F range with peak curing temperatures of less than 150° F.

The finished bridge's twin concrete arches are made of 106 pieces—53 per arch—mostly 24-foot cast-in-place sections. The arch was constructed from both sides of the bridge concurrently, supported by diagonal cable stays strung from temporary towers. Construction required hoisting both workers and up to 50 short tons of materials 890 feet above the Colorado River using 2300-foot-long steel cables held aloft by a "high-line" crane system.

Haley & Aldrich congratulates ACAA for successfully promoting the beneficial use of CCPs in a technically sound and environmentally responsible way!

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Beneficial Use Case Study

J. Craig Venter Institute

Coal Combustion Product Type
Fly Ash

Project Location
La Jolla, California

Project Participants
J. Craig Venter Institute, ZGF Architects LLP, McCarthy Building Companies, KPFF Consulting Engineers, Jacobs Consultancy

Project Completion Date
2013

Project Summary
The J. Craig Venter Institute (JCVI) is a three-story, 45,000-square-foot laboratory facility located on a 1.75-acre coastal site within the University of California, San Diego campus. It incorporates one building consisting of a single-story, 12,605-square-foot laboratory wing; a three-story, 28,600-square-foot office wing; a 3560-square-foot loading dock area; and a partially below-grade parking garage. The laboratory and office wings sit atop the roof/podium deck of the parking garage. Designed by the Los Angeles office of ZGF Architects, the building features unusual geometry with varying angles, together with full-height shear walls and architecturally exposed concrete.

SOURCE: McCarthy Building Companies

SOURCE: McCarthy Building Companies

Project Description
From the outset, JCVI—a biological laboratory engaged in genomic research—was designed to be environmentally friendly, from its materials selection to its achievement of net-zero-energy status, the first biological laboratory in the world to do so.

The exposed architectural concrete on the building's exterior was essential to the desired look, yet posed one of the greatest structural challenges for the building team. Architectural as-cast concrete is one of the most demanding concrete finishes, but adding 30% fly ash to meet LEED Platinum standards gave the process an additional challenge. During initial testing, the fly ash composition produced a marbling effect, making it challenging to create the intended aesthetic quality of the exposed concrete walls.

SOURCE: McCarthy Building Companies

To ensure the desired aesthetics of the architectural concrete, McCarthy performed all of the concrete work, drawing on the expertise of the same concrete specialists who developed a pioneering concrete mix and installation procedure for the nearby Salk Institute East Building. Similar to the Salk Institute project, the concrete craftsmen created several generations of mock-ups to refine the mix design and fine-tune the finishing and forming techniques to produce the concrete's smooth and flawless finish.

McCarthy ultimately performed all the concrete work, including the concrete walls, columns, footings, slab on grade, slabs on metal deck, and podium deck. Use of 30% fly ash in the architecturally exposed concrete walls, columns, footings, slabs, and podium deck contributed to the LEED credits in the category of recycled content—and its eventual certification at the Platinum level.

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Beneficial Use Case Study

Transbay Block 9 Residential Tower

Coal Combustion Product Type
Fly Ash

Project Location
San Francisco, California

Project Participants
SOM, Fougeron Architecture, Balfour Beatty, Webcor Concrete Group

Project Completion Date
Concrete placement completed June 2017; residential tower expected to be finished in summer 2019

Project Summary
Over 10 years ago, SOM, working with the San Francisco Redevelopment Agency, developed a master plan for the area now known as Transbay and Rincon Hill. The design of Block 9 is consistent with this vision, strengthening Folsom Street as the neighborhood's new main commercial and public thoroughfare. The project is comprised of a tower flanked by two lower volumes that will house 456 market-rate units, 114 affordable units, shared open spaces and amenities, and retail along Folsom Street. The basement will feature six below-grade parking and mechanical levels with a total of 288 parking stalls. Although it will be constructed as one building, Block 9 will have the appearance of two low-rise buildings bracketing a high-rise tower.

Project Description
Balfour Beatty's U.S. California Division successfully completed a placement comprising 8218 cubic yards of concrete at the 42-story Transbay Block 9 residential tower project site at 500 Folsom Street in San Francisco. The amount of concrete poured is equivalent to 32 miles of a four-foot-wide sidewalk. The 24-hour, non-stop placement marks the largest on record for the company's California vertical construction business unit.

To meet the project's commitment to sustainability, the team used concrete comprising 40% fly ash, a cement replacement, and recycled water in its production process. Fly ash is an environmentally friendly solution that meets or exceeds concrete performance specifications and is recognized by the U.S. Green Building Council's LEED rating system as a post-industrial recycled material.

Forty-five trucks, driven by 90 drivers on alternating schedules, delivered 888 truckloads of concrete to five pumps strategically located on the project site. The placement covered a 30,000-square-foot surface area to form the mat foundation situated 75 feet—or six floors—below the ground surface. Concrete thickness of the mat foundation ranged from 10 feet beneath the tower to five feet outside the tower. The mat is also composed of 2.5 million pounds of reinforcing rebar.

SOURCE: Balfour Beatty

SOURCE: Balfour Beatty

SOURCE: Balfour Beatty

SOURCE: Balfour Beatty

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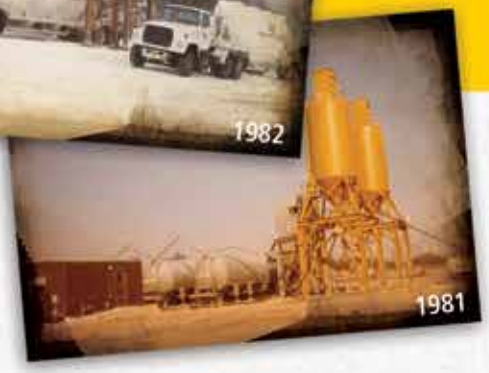

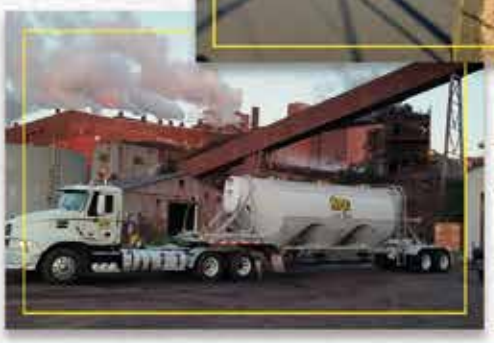

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Beneficial Use Case Study

UAB Football Operations Center

Coal Combustion Product Type
Fly Ash

Project Location
Birmingham, Alabama

Project Participants
HOK, Goodwyn, Mills & Cawood, Lithko Contracting, M.J. Harris Construction Services, Kirkpatrick Concrete

Project Completion Date
August 2017

Project Summary
The new $22.5 million Football Operations Center at the University of Alabama at Birmingham includes a covered pavilion practice field, new athletic offices for the football staff, a weight room, and several therapy pools. The main building of the new athletic facility features a massive concrete foundation that required careful coordination to place.

Project Description
Owing to site-specific considerations, project engineers opted to underpin the main building with a huge foundation mat rather than the more common spread footings or caissons.

"For this location, they decided that either driving piles or drilling caissons wasn't going to work," said Kirkpatrick Sales Manager Rick Passey. "So they basically are pouring a 2000-cubic-yard foundation mat over a mud mat, and the whole thing is just going to provide the support for this building."

Overnight placement of the concrete was carried out by Lithko Contracting and overseen by M.J. Harris Construction Services. Kirkpatrick Concrete delivered approximately 140 to 150 cubic yards per hour to the job site, which involved much of the company's truck fleet.

Delivery challenges for the project centered primarily around the two large foundation pours—each of which was over a thousand cubic yards. Because of warm evening temperatures, careful monitoring was required to ensure the material steered clear of thermal cracking.

"When concrete is poured that thick, the hydration of the cement in the concrete can create temperatures that can actually crack the concrete," Passey noted. "So we had to be very mindful of the mix that we used, the admixtures, [and] the temperature of the concrete."

Laboratory specialists at Concrete South—which comprises ready-mix providers Kirkpatrick, Hodgson, and Walker Concrete—worked closely with the project's contractors to develop a special mix design suitable for the mass concrete placement. In particular, fly ash was specified in the mix to help keep the material within temperature specifications.

"Fly ash is good for controlling the temperature of the concrete because there's not quite as much cement in [there]. The total cementitious content of the concrete still allows for later strength gain," Passey said.

"They really weren't in a hurry for any higher or early concrete strengths, which is very difficult to achieve with mass concrete anyway," he added. "So we made maximum use of our fly ash substitution in the concrete mixture."

SOURCE: Concrete South

SOURCE: Concrete South

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Beneficial Use Case Study

Wacker Drive Renovation

Coal Combustion Product Type
Class F Fly Ash, Ground Granulated Blast Furnace Slag

Project Location
Chicago, Illinois

Project Participants
Chicago Department of Transportation, Wiss Janney, Elstner Associates Inc., University of Illinois-Chicago, Prairie Concrete, Headwaters Resources

Project Completion Date
2003

Project Summary
Three-quarters of a century after its initial construction, Wacker Drive—a 1.5-mile-long arterial road servicing Chicago's downtown Loop—was in need of rebuilding. The concrete structure of the two-level viaduct, which handles tens of thousands of vehicles daily, had been considerably degraded after decades of heavy traffic and the application of harsh deicing chemicals. Rebuilding occurred in two phases, with reconstruction of the east-west segment of the road completed in 2003 and the north-south portion completed a decade later.

Project Description
Owing to the road's importance to the flow of downtown traffic, the Chicago Department of Transportation stipulated that the rebuilt Wacker Drive should attain a service life of 75 to 100 years. To give added resistance against corrosion—as well as to protect against the potentially ravaging effects of freeze-thaw cycles—engineers specified a high-performance concrete using Class F fly ash for the new cast-in-place concrete structure.

Wiss Janney, Elstner Associates Inc., and the University of Illinois-Chicago were selected to design the concrete mixes. To avoid the potential for cracking of the deck due to thermal changes, their mixes aimed for durability over pure compressive strength. Ultimately, the final specifications incorporated concrete compressive strengths of between 6000 and 9500 psi in 28 days with chloride permeability in ponding tests of less than 2000 coulombs to prevent the ingress of deicing salts into the concrete.

The mix design included 525 lbs./yd^3 of cement, with 10% Class F fly ash, 15% ground granulated blast furnace slag, and 5% silica fume. The proportions of each were chosen to minimize permeability. Fly ash content was limited to 10% to reduce the impact of potential variations in chemical composition, while silica fume proportions were limited to 5% to avoid a high water demand.

Collectively, materials were chosen to offset the potential weaknesses of one against the strengths of the others. For example, use of Class F fly ash, together with other materials, helped to mitigate possible alkali-silica reactivity from local fine aggregates. Supplementary cementitious materials were used to achieve a less-permeable cementitious mix for enhanced corrosion protection.

Over the course of the two-year project to restore the east-west portion of Wacker Drive, more than 10,000 tons of Class F fly ash was sourced from Indianapolis Power & Light's Petersburg generating station, located in southwest Indiana.

SOURCE: Wikimedia Commons

SOURCE: Wikimedia Commons

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Beneficial Use Case Study

W Philadelphia Hotel

Coal Combustion Product Type
Fly Ash

Project Location
Philadelphia, Pennsylvania

Project Participants
Cope Linder, O'Donnell & Naccarato, Tudor Perini, TP Carney, Silvi Concrete

Project Completion Date
Spring 2018

Project Summary
The W Philadelphia Hotel, located at 1414 Chestnut Street in Philadelphia, is a 51-story, 773,500-square-foot building that, upon its opening in 2018, is the largest concrete structure in Philadelphia's history. The facility features meeting and banquet facilities, food and beverage venues, an outdoor pool bar and terrace, retail space, and parking for 171 cars.

Project Description
To support the structure—which houses both the 295-room W Philadelphia and the 460-room Element Philadelphia Hotel—general contractor Tudor Perini teamed up with concrete contractor TP Carney and Silvi Concrete on the largest continuous concrete placement in Philadelphia's history. Upon completion, the nine-foot-thick foundation covered 20,000 square feet and contained 25.2 million pounds of concrete.

At the outset, project engineers were concerned with the potential for thermal cracking due to high core temperatures and low exterior temperatures. This eliminated the use of more commonly used high-strength cementitious products such as slag or silica fume. Instead, fly ash was specified for its ability to slow down the hydration process, which reduces the total heat generated in the core of the concrete. Ultimately, Silvi was called upon to perform the project with less than two weeks of notice, as they were the only supplier with enough fly ash.

Engineers determined that the core of the slab had to be limited to 154° F. Silvi was required to create a 10,000-psi mix containing 50% fly ash (356 pounds per cubic yard) and deliver it at below 90° F in the peak of summer. To further combat concrete's natural heat-of-hydration process, Carney placed six miles of cooling tubes throughout the rebar that ran chilled water for one week following the completion of the pour.

In order to complete the monolithic placement per the engineer's specification, Silvi committed to deliver 5868 cubic yards over a 28-hour period. The company employed 136 trucks and drew on four 12-yard central mix concrete plants. Since the mix contained almost as much fly ash as it did cement, Silvi stockpiled fly ash in portable blimps for days in advance to meet the demand.

At 2 am on the day of the placement, mixer trucks began feeding four pump trucks strategically staged around the foundation, including two 53-meter pumps. The hole in the ground was 54 feet below street level and thus required very large pumps to reach all the corners of the mat foundation. The combination of narrow one-way streets and open sidewalks for pedestrian foot traffic limited the number of pumps Carney could use for the pour. With only four total pumps and two smaller pumps, which required 300 feet of hard piping, the team was limited to pouring only 205 cubic yards per hour, resulting in the unusually lengthy placement.

SOURCE: Silvi Concrete

SOURCE: Silvi Concrete

Editor's Note: "Six 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.

Dave Goss served as Executive Director of the ACAA from 2002 through 2008. During that time, he oversaw the Association headquarters' move from Washington, D.C., to Aurora, Colorado (after a brief period in Syracuse, New York), as well as the resurrection of *ASH at Work* and its reconfiguration from newsletter format to four-color magazine. Dave presided over a busy and successful period of the Association's history, highlighted by the industry's partnerships with federal agencies and like-minded organizations in the C^2P^2 initiative, which explored ways to encourage the safe beneficial use of CCPs, and in the Green Highways Partnership, which promoted coal ash and other industrial byproducts' use in "greening" America's highways by conserving natural materials, reducing greenhouse gas emissions, and lowering overall costs. This period also saw the Association join with the University of Kentucky's Center for Applied Energy Research to create the highly successful World of Coal Ash—then as now the premier industry conference for the exploration of the science, applications, and sustainability of global CCPs and gasification products. We asked Dave for his observations on the changes, challenges, and successes he witnessed during his time in the industry, as well as those that have helped shape the ACAA over its 50-year history.

ASH at Work (AW): How successful has ACAA been in encouraging a voice in—and participation by—women and younger people in industry affairs?

Dave Goss (DG): I believe the establishment of the ACAA Educational Foundation in 1996 was a firm commitment to encouraging and supporting students from across the nation to become involved in the study and research of CCPs. Awarding scholarships to many of these students has made a significant difference in their lives and studies. Similarly, ACAA's partnership with universities and their researchers has furthered this important relationship. The formation of the Women's Leadership Forum in 2010 has fostered dialogue, development, and camaraderie among female members of ACAA and their peers. The forum has become a very effective resource for women and is a rich source for filling leadership roles within ACAA and beyond. Men do not appreciate some of the challenges of being a professional woman in an industry that has historically been dominated by men. The forum has been a valuable opportunity for women to network and support one another.

AW: How, if at all, has the mission of ACAA changed or evolved over the years? What was that in response to?

DG: ACAA has evolved to address changing circumstances over the last five decades while continuing to promote the positive uses of CCPs. Whether it is the development of new applications, preserving existing uses, or finding solutions in times of regulatory uncertainty, the Association has risen to the occasion. Most recently, following Kingston and the EPA's CCR rulemaking, ACAA has worked hard not just to continue supporting beneficial use, but also to develop strategies to preserve supplies to the marketplace as the utility industry has shuttered plants or reduced production tonnage. Harvesting fly ash from previously landfilled materials is a perfect example of adapting to a changing need while continuing to support the overall mission. I doubt that the early founders of NAA would have envisioned the need to recover these materials from landfills to be able to meet demand in some areas. ACAA has fully supported both the good times and the difficult times, to the benefit of the industry.

AW: What lessons did you learn from your time as ACAA Executive Director that you would pass along to future ACAA leaders?

DG: Leadership at any level is not a solo trip. Trusting and relying upon others to do what they do best make any organization more effective. There are many experts within ACAA, each able to serve the Association when needed provided they are given the opportunity. Diversity of viewpoints gives an organization strength because, only by openly sharing and receiving different opinions, can leaders make informed, thoughtful decisions. Evaluating an issue from operational, environmental, economic, and analytical viewpoints usually results in the best judgments. No one is all-knowing, but together we all become more knowledgeable and effective.

AW: How do you think the founding fathers of the U.S. coal ash industry—the so-called "Group of Experts"—would view the progress that NAA and ACAA went on to achieve in its first 50 years? What would they be surprised by?

DG: I think they would be proud to see that the vision they had in the early years would be rewarded in the following 40-plus years by individuals who likewise have had vision and perseverance. I am guessing they thought that eventually their efforts would be justified as marketplaces opened up, and demands for the variety of CCPs would grow. The merry-go-round of regulatory uncertainty and instant adverse media coverage of CCPs would have been unknown to them. However, I also believe they thought their genuine convictions of the benefit of utilization would eventually be widely recognized. They laid the foundation upon which we have been successful in increasing CCP usage to more than 50%. They believed in themselves and trusted that others, following later, would make sound decisions and implement successful technical, economic, and environmental practices to sustain their hopes for the future.

AW: Looking back over the first 50 years, what has impressed you most about ACAA's successes?

DG: It may sound trite, but in my opinion it has been its people. So many individuals and groups have been firmly committed to the goals of the Association. In the beginning it was the utility leaders who believed in the need to find a way to develop markets for valuable resources that were otherwise being disposed. They developed technology, conducted research, committed resources, and widely communicated their message and results to skeptics and believers alike. Then, as environmental regulations made significant impacts on producers, many more individuals found ways to address the new limitations or challenges, again through technology, testing, partnerships, and outreach. In 2010, in response to the proposed CCR rulemaking, more than 14,000 hours of work resulted in 10,000 pages of well-reasoned, logical data that helped persuade regulators of the value of the materials in question. Hundreds, if not thousands, of volunteers have made themselves available to respond to Congressional inquiries, reject simplified demonization of CCPs by critics, and create new or revised standards and specifications. Utilities, marketers, recycling partnerships, researchers, regulators, students, and communicators have all contributed to this industry, and because of them I am optimistic about our future. This strong commitment to ACAA's goals by so many different people has been its greatest success.

AW: What's up next for Dave Goss in retirement?

DG: I'll continue to enjoying traveling, spending time with my two grandchildren, reading, and riding bikes with my wife and friends in Colorado.

Former ACAA Executive Director **Dave Goss** is now retired and lives in Aurora, Colorado. The Association greatly appreciates his contributions to the industry, as well as his assistance in putting together the historical narratives contained in this issue of *ASH at Work* and the ACAA's 50th anniversary video.

In & Around ACAA

Louisville, KY

Attendees of the Ponded Ash Harvesting and Beneficiation Workshops listen to a presentation. The event, held October 30-31, 2018, featured coverage of topics including legal, design, and seismic issues relating to ash ponds, their materials, and closures. It was co-sponsored by the American Coal Ash Association, Electric Power Research Institute, and the University of Kentucky Center for Applied Energy Research.

New Orleans, LA

The American Coal Ash Association Women's Leadership Forum met during ACAA's Fall Meeting October 2-3, 2018. Former ACAA Executive Director Dave Goss addressed the group, which was launched in 2010 as an avenue for developing the interest and qualifications of female ACAA members for committee leadership and officer positions; acquainting women members with the wide range of energy and building materials careers—as well as professional organizations and meetings—with the goal of opening paths for further career development; and promoting professional interactions and camaraderie among female ACAA members and those in related fields, including government, energy, building materials, and consulting.

New Orleans, LA

Past ACAA chairmen gathered at the 2018 Fall meeting (l-r): Kenny Tapp, Senior Byproducts Coordinator, LG&E and KU Services Company; Mark Bryant, Manager, Emission Control Commodities, Ameren Missouri; Al Christianson, Director of Business Development and Governmental Affairs, Great River Energy; Andrew Stewart, Director of Business Operations, Great River Energy; Ted Frady, Senior Engineer, Ash Utilization and Disposal, South Carolina Electric and Gas (Retired); and Hollis Walker, Coal Support Manager, Southern Company.

Washington, DC

ACAA Executive Director Thomas H. Adams delivers the latest Production and Use Survey results at a November 13, 2018, news conference at the National Press Club.

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Coal Ash Recycling Rate Climbs to Record 64.4%

Over 64% of the coal ash produced in the United States during 2017 was recycled—establishing a new record and marking the third consecutive year that more than half of the coal ash produced was beneficially used rather than disposed.

According to ACAA's just-released "Production and Use Survey," 71.8 million tons of coal combustion products were beneficially used in 2017 out of 111.3 million tons produced. The rate of ash utilization increased to 64.4% from 56% in the previous year, and the total volume of material utilized increased by 11.6 million tons. Coal ash production volume increased 4% over 2016 levels.

Highlights of CCP production and use in 2017 include:

- Use of coal fly ash in concrete remained approximately level with the prior year at 14.1 million tons. Concrete producers and consumers indicated a desire to use more fly ash, but several regional markets were affected by shifting supply dynamics associated with closures of coal-fueled power plants.
- Utilization of a key "non-ash" coal combustion product—synthetic gypsum, a byproduct of flue gas desulfurization units—increased significantly. Use of synthetic gypsum in panel products (i.e., wallboard) increased 60% to 15.9 million tons in 2017. The large increase is attributed to lower-than-usual synthetic gypsum shipments reported in the prior year and growth in wallboard production.
- Synthetic gypsum in agricultural applications—in which gypsum is used to improve soil conditions and prevent harmful runoff of fertilizers—also increased 50% to 1.2 million tons. Part of this growth is attributed to a large new synthetic gypsum source entering the market.
- Use of CCPs in pond closure activities increased dramatically from 435,000 tons in 2016 to 4.5 million tons in 2017 as utilities ramped up compliance with environmental regulations that effectively require an end to the practice of wet disposal. Fly ash, bottom ash, and synthetic gypsum were all used in the construction of new permanent disposal facilities.
- Use of fly ash and bottom ash in structural fills continued a multi-year decline, decreasing 72% to 1.3 million tons.
- Production of boiler slag increased 18%. Approximately 1.4 million tons of boiler slag was utilized in the production of blasting grit and roofing granules.
- Approximately 148,000 pounds of cenospheres—a valuable form of ash harvested mainly from wet disposal impoundments—were sold in 2017, up from zero in the prior year.

Court Ruling Could Spur Rewrite of EPA Surface Impoundment Regs

A three-judge panel of the U.S. Court of Appeals for the District of Columbia on August 21, 2018, largely sided with

Use of synthetic gypsum in agricultural applications increased 50% in 2017.

environmental groups on key aspects of the litigation over the U.S. Environmental Protection Agency's 2015 coal combustion residuals disposal regulations.

In a 72-page decision (**http://bit.ly/2NshYc5**), the judges ruled that EPA's regulations relating to unlined surface impoundments, clay-lined impoundments, and "legacy" ponds are inadequate and need to be rewritten by the agency. The court's decision that EPA's authority under the Resource Conservation and Recovery Act extends to regulating sites that may not have received material for decades could be seen as establishing a new precedent. Utilities affected by the ruling are still studying the decision and have not determined whether to appeal it to the U.S. Supreme Court.

Of interest to the coal ash beneficial use community, the court ruled that EPA acted arbitrarily in establishing a 12,400-ton threshold for "unencapsulated" non-transportation beneficial uses. The effect of that ruling was limited, however, inasmuch as EPA has already commenced reconsideration of that part of the regulations, as well as regulations related to "coal residual piles" held for future beneficial use.

Written pleadings in the litigation were completed on July 14, 2016, but oral arguments were not held until November 20, 2017. The court's August 2018 decision comes as EPA is already deep into reconsideration of aspects of the 2015 regulations (see story below). One set of revisions has already been finalized, and a second set of proposed revisions was expected by year's end. The effect of the court's ruling will be to place additional requirements on how the regulation revisions can be structured.

EPA Acts to Give States, Utilities New Flexibility Under CCR Rule

The U.S. Environmental Protection Agency announced final revisions (**http://bit.ly/2uKz6SO**) to coal ash disposal regulations, but acted on only a portion of the revisions first proposed by the agency in March. EPA also postponed some compliance deadlines, bringing them into line with similar postponements already enacted in the agency's related Effluent Limitation Guidelines rule reconsideration.

In a pre-publication copy of the final rule, EPA finalized certain revisions to the 2015 regulations for the disposal of Coal Combustion Residuals ("CCR") in landfills and surface impoundments to:

- Provide states with approved CCR permit programs under the Water Infrastructure Improvements for the Nation (WIIN) Act (or EPA where EPA is the permitting authority) the ability to use alternate performance standards;
- Revise the groundwater protection standard for constituents that do not have an established drinking water standard (known as a maximum contaminant level or MCL); and
- Provide facilities that are triggered into closure by the regulations additional time to cease receiving waste and initiate closure.

EPA also finalized two types of alternative performance standards that were proposed in March 2018. The first one allows a state director (in a state with an approved coal ash permit program) or EPA (where EPA is the permitting authority) to suspend groundwater monitoring requirements if there is evidence that there is no potential for migration of hazardous constituents to the uppermost aquifer during the active life of the unit and post closure care. The second allows issuance of technical certifications in lieu of a professional engineer.

In addition, EPA revised the groundwater protection standards for four constituents (cobalt, lithium, molybdenum, and lead) for which MCLs under the Safe Drinking Water Act have not been established.

EPA also is extending from early next year until 2020 the deadline by which facilities must close coal ash units for two situations:

- Where the facility has detected a statistically significant increase above a groundwater protection standard from an unlined surface impoundment; or
- Where the unit is unable to comply with the location restriction regarding placement above the uppermost aquifer.

EPA announced that provisions from the March 2018 proposed rule that are not finalized in this notice will be addressed in a subsequent rulemaking.

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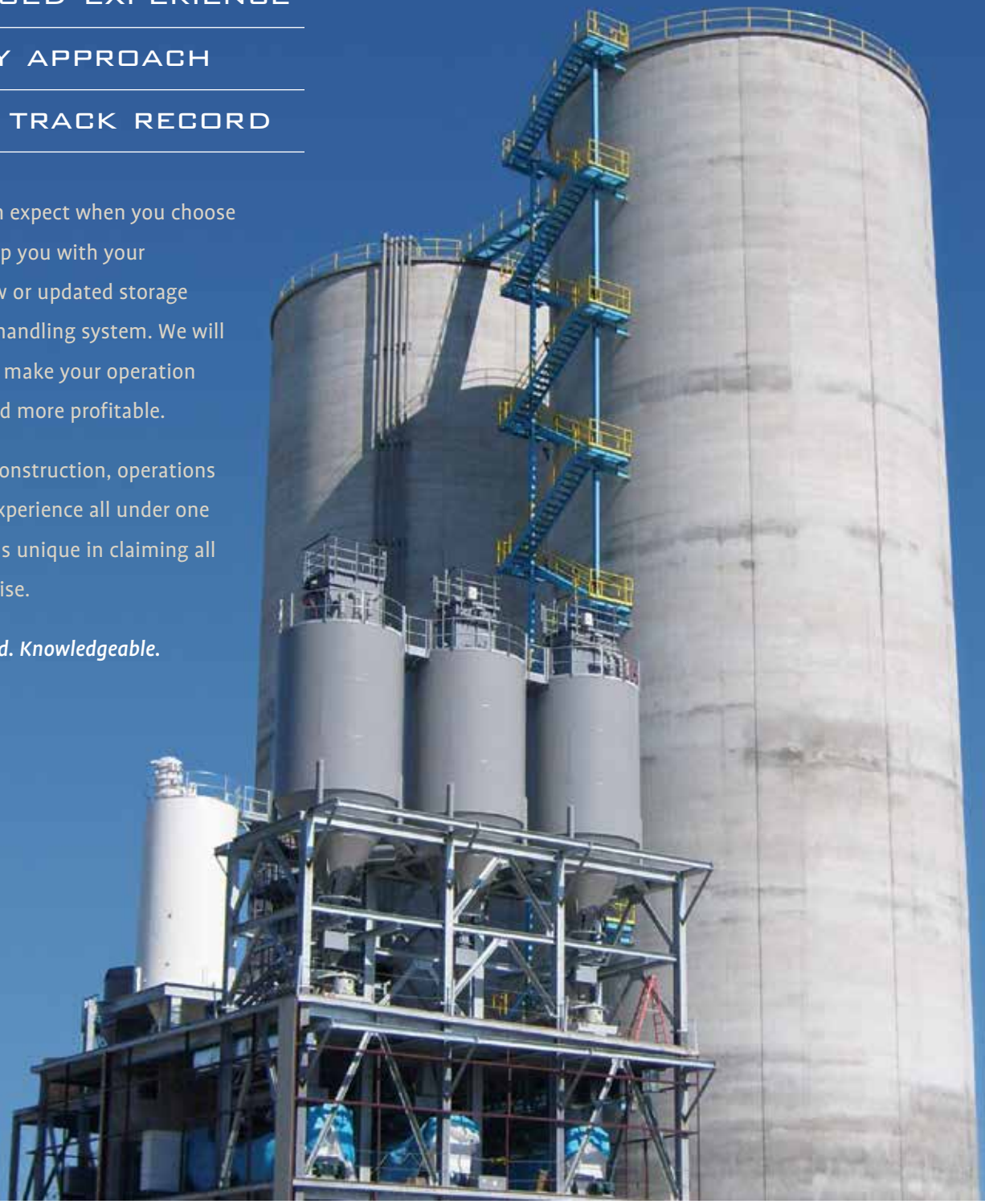

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Kenny Tapp Commences Two-Year Term as Chairman

New American Coal Ash Association officers and directors took their seats during ACAA's Fall Meeting, held October 2-3 at the Royal Sonesta Hotel in New Orleans. Officers who will serve two-year terms include Chairman Kenny Tapp, Senior By-Products and Industrial Coal Coordinator, LG&E and KU Utilities; Vice Chairman Steven Benza, Vice President Business Development, Boral Resources; and Secretary/Treasurer Lisa J.N. Bradley, Ph.D., DABT, Vice President and Senior Toxicologist, Haley & Aldrich. New directors who will serve three-year terms include Ann Couwenhoven, Engineer Manager, Talen Energy/Raven Power; Al Christianson, Director of Business Development and Governmental Affairs, Great River Energy; and Dale Diulus, P.E., Senior Vice President Pozzolan, Salt River Materials Group.

Incoming Chairman Kenny Tapp (right) with new Vice Chairman Steve Benza.

Dr. Bruce Ramme Named ACAA's 2018 Champion Award Winner

Dr. Bruce W. Ramme, Vice President of Environmental for WEC Energy Group, was selected as the sixth recipient of the American Coal Ash Association Champion Award. Dr. Ramme accepted the award at ACAA's 2018 Fall Meeting, where it was also announced that a new "Award for Innovation in CCP Beneficial Use" is being created by ACAA that will be named in his honor (see sidebar).

Dr. Ramme joined We Energies in 1980 as a civil engineer in the transmission engineering division. Subsequent assignments found him involved in civil engineering design and project management, power plant leadership roles, and environmental responsibilities that included coal combustion product management. He was named an ACI Fellow in 2005 and has received many other awards and honors, including several engineer-of-the-year awards. Dr. Ramme is the author of numerous papers on concrete and fly ash, as well as a comprehensive handbook on coal combustion product utilization. He holds more than a dozen patents on CCP management and use.

ACAA established the Champion Award in 2012 to recognize extraordinary contributions to the beneficial use of coal combustion products. Dr. Ramme was selected by outgoing ACAA Chairman Charles Price, who praised him for his decades of service in developing innovative beneficial use strategies. The recipient is selected exclusively by the Chair of the ACAA Board of Directors and is known only to the Chair until the moment the presentation is made. The recipient may be an individual or individuals; an institution—private or public; or a member of the ACAA or a non-member, living or deceased.

Dr. Bruce W. Ramme (with plaque) receives the Champion Award, flanked by incoming ACAA Chairman Kenny Tapp (left), Communications and Membership Committee Chairman Fred Gustin (center right), and ACAA Executive Director Thomas H. Adams (right).

ACAA Announces Creation of Bruce W. Ramme Award for Innovation in CCP Beneficial Use

Over the past several decades, innovation has played a vital role in creating new markets while protecting existing ones, resulting in steady growth in the rate of CCP beneficial use. To call attention to the products and processes that are part of expanding the coal ash industry, and encourage the continuing development of more innovations, the ACAA is establishing an award to recognize the innovators behind these products and processes.

Beginning in 2019, the ACAA Technical Committee will receive nominations for the Bruce W. Ramme Award for Innovation in CCP Beneficial Use. Nominees may be individuals or organizations, members or non-members of the ACAA. The nomination may be for products, processes, or research that helps expand beneficial use.

"This is very humbling"—Dr. Ramme said, acknowledging the new award that will carry his name—"just knowing how many engineers, scientists, and other folks from the industry have worked so hard and so long to turn these underappreciated materials into valuable resources that are now an essential part of our infrastructure and used in products that are in our homes, in advanced materials manufacturing, and even being used to help grow food that we eat."

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Omri Lulav: 1940 - 2018

Omri Lulav, a leading figure in the coal ash community, passed away on July 3, 2018. Omri created the Israeli Coal Ash Administration and, except for the first two years of its existence, served as its General Director—and did so to his last day. In this capacity, he performed nothing less than a miracle. When Omri assumed this position, most of the coal ash in Israel was disposed of in the sea. Now, all coal ash produced in Israel is beneficially used, and the demand for ash exceeds its supply.

His success in turning ash from a waste to a resource did not come easily. All of us who are involved in the world of coal ash understand how hard it is to overcome unfounded fear and regulatory barriers to ash utilization, as well as the influence of business interests dealing with competing raw materials. In this context, Omri's achievement in making use of all the coal ash produced in Israel and eliminating the need to dispose any of it is even more impressive.

Omri was a devoted public servant. He gave all of himself as head of the Coal Ash Administration to advance the cause of coal ash use. He understood the value of coal ash as a byproduct that can substitute for raw materials, some of which are diminishing resources. Omri organized a number of international workshops designed to formulate proper regulations and optimal procedures for the use of ash consistent with protecting human health and the environment. He kept in touch with leading experts on coal ash worldwide and initiated research projects in which the beneficial use of coal ash in various areas—including building, infrastructure, sewage treatment, and agriculture—was demonstrated and protocols for maximizing ash's benefits were developed.

With the help of the Coal Ash Administration staff, Omri developed a website that became an unparalleled source of information regarding coal ash, its regulation, uses, disposal, and properties. He devoted much energy and time to the formulation of a set of guidelines and environmental conditions that will ensure safe use of coal ash and to the harmonization of these guidelines with those in force in leading coal-consuming nations. The preparation of this set of regulations was completed not long before Omri passed away, and its future adoption by Israeli authorities may be a fitting memorial to him.

Omri was recognized internationally as a leading expert on coal ash and as a farsighted and trustworthy colleague. He was well liked and respected both at home and abroad. Witness, for example, the condolence letter from Professor David Kosson, of Vanderbilt University. David wrote, "Omri was a great man with vision and leadership." And indeed, Omri was just that.

—Uri Mingelgrin

Ad Index

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Ash Allies: Research, Engineering, and Standards Committee of the NRMCA

The National Ready Mixed Concrete Association (NRMCA) was founded in 1930 with a mission to provide services to its members with the objective of expanding the use of ready-mixed concrete. At the time of its founding, ready-mixed concrete was a relatively new product. However, it was becoming clear that the industry was going to be a force in the world of construction. It needed a national organization to speak on behalf of the industry.

The ready-mixed concrete industry has been and continues to be a major direct consumer of fly ash. Indirectly, the industry accounts for additional consumption of fly ash, bottom ash, and FGD gypsum used to produce the portland cement purchased by concrete producers. Approximately 75% of the cement sold in the U.S. today is used by ready-mixed concrete producers. The NRMCA partners with state ready-mixed concrete associations across the country to provide support for regional activities. It represents the bulk of ready-mixed concrete production in the U.S.

The NRMCA has numerous committees that address the needs of the industry in a variety of areas. Environment, government relations, operations, safety, and sustainability are just a few of its standing committees. One committee has a direct tie to the American Coal Ash Association—the Research, Engineering, and Standards (RES) Committee. The mission of the committee is to:

- Coordinate all standardization activities of the NRMCA, including the development of codes, standards, specifications, and recommended practices;
- Provide oversight of procedures and policy for certification of production facilities, personnel, and testing agencies and equipment standards;
- Maintain contact and cooperation with other standardization bodies, such as ACI, ASTM, and transportation agencies;
- Coordinate technical education;
- Provide oversight of priorities for the research activities at the NRMCA Research Laboratory; and
- Develop technical publications and programs.

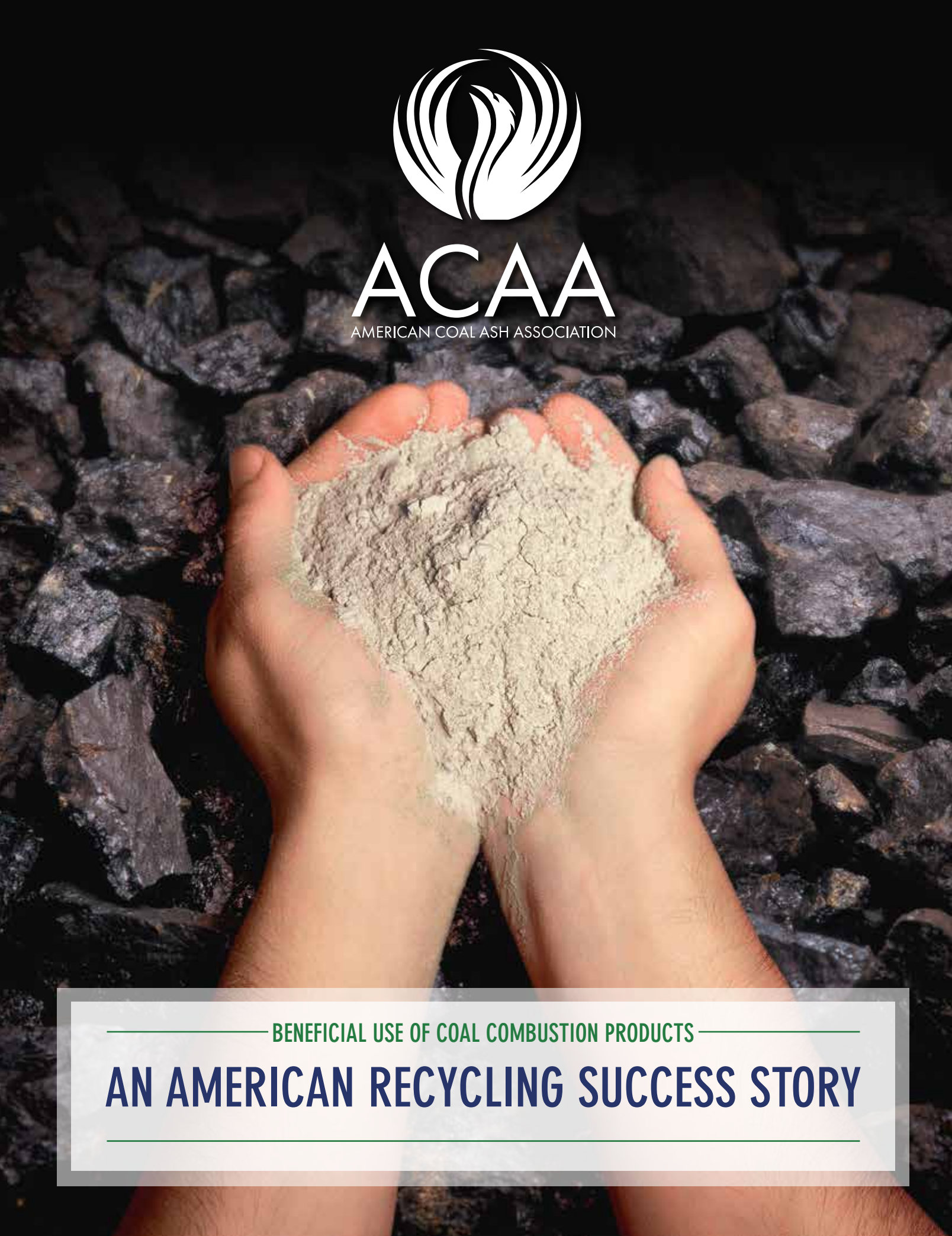
One of the very first committees established by the NRMCA, it has now been managing technical issues for several decades.

The American Coal Ash Association participates on the RES Committee. The committee is interested in maintaining close relationships with organizations that supply materials (such as the ACAA) and equipment to ready-mixed concrete producers. With the issues affecting fly ash quality and supply in recent years, the RES has been especially interested in hearing from the ACAA. During the U.S. Environmental Protection Agency's CCR rulemaking, members of the RES Committee responded to ACAA's appeals for submittals to the agency on the importance of protecting fly ash from hazardous waste regulations. At NRMCA's recent "Concrete Works" event, ACAA members presented information on the technologies used for beneficiating fly ash.

The RES Committee has surveyed NRMCA members on their use of supplementary cement materials (SCM). The survey revealed good news for ACAA members. Fly ash use could potentially double if several basic obstacles could be overcome. Consistency of quantity and quality, poor specifications, and contractor acceptance were identified as barriers to increasing the consumption of fly ash by the concrete industry. ACAA is in discussion with the RES to update this survey in 2019.

NRMCA staff providing support to this committee include Dr. Colin Lobo, Executive Vice President of Engineering, and Dr. Karthik Obla, Vice President of Technical Services. An additional five employees work in the Engineering Division, mostly in the NRMCA Research Laboratory. The lab performs work to support Engineering Division activities, as well as the concrete industry and non-member entities. Some of the first research on the use of fly ash in ready-mixed concrete was performed by the lab in 1954. Recently, it has carried out research on high-volume fly ash mixtures. The lab is accredited by CCRL and AASHTO.

The ACAA benefits from our relationship with the NRMCA in general, and by the RES Committee in particular. Open communication with a major user group has never been more important as we work to close the gap between supply and demand for concrete-grade fly ash.



ACAA

AMERICAN COAL ASH ASSOCIATION

BENEFICIAL USE OF COAL COMBUSTION PRODUCTS

AN AMERICAN RECYCLING SUCCESS STORY

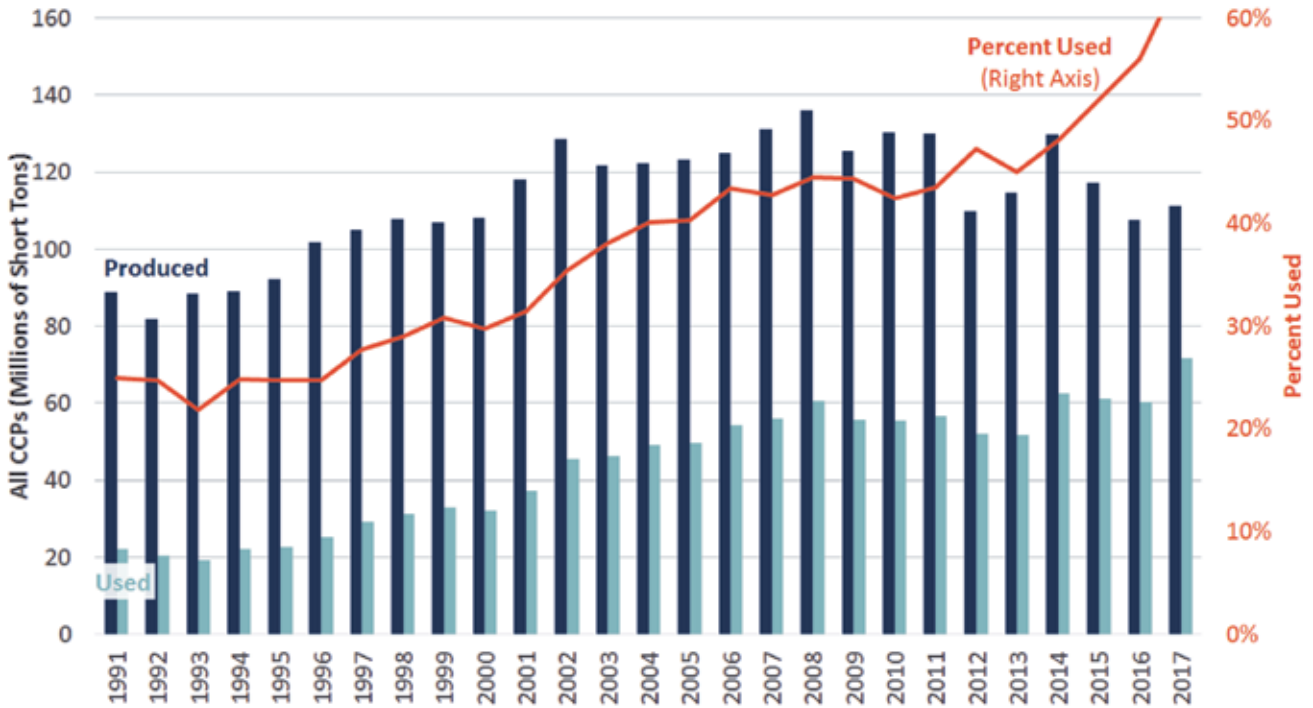
AN AMERICAN RECYCLING SUCCESS STORY

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

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

Sixty-four percent of the coal ash produced during 2017 was recycled – establishing a new record and marking the third consecutive year that more than half of the coal ash produced in the United States was beneficially used rather than disposed. Use of coal fly ash in concrete remained approximately level with the prior year at 14.1 million tons. Concrete producers and consumers indicated a desire to use more fly ash, but several regional markets were affected by shifting supply dynamics associated with closures of coal-fueled power plants. Utilization of a key "non-ash" coal combustion product increased significantly. Synthetic gypsum is a byproduct of flue gas desulfurization units, also known as "scrubbers," located at coal-fueled power plants. Use of synthetic gypsum in panel products (i.e. wallboard) increased 60 percent to 15.9 million tons in 2017. The large increase is attributed to lower-than-usual synthetic gypsum shipments reported in the prior year and growth in wallboard production.

All CCPs Production and Use with Percent



Fly Ash

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

Concrete made with coal fly ash is stronger and more durable than concrete made with cement alone. By reducing the amount of manufactured cement needed to produce concrete, fly ash accounts for approximately 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 – 2017

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

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

Bottom Ash

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

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

Bottom Ash Production & Use 2000 – 2017

Bottom ash can be used in asphalt paving.

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

Synthetic Gypsum

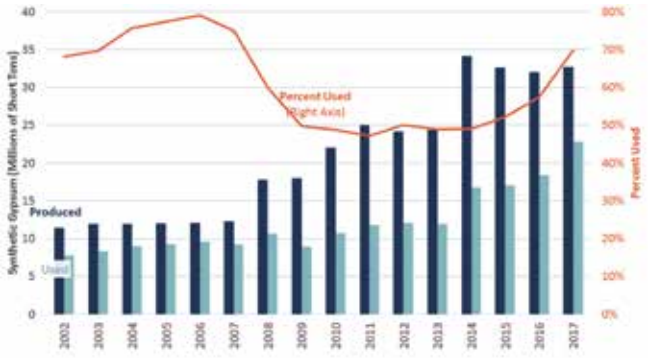
Power plants equipped with flue gas desulphurization ("FGD") emissions controls, also known as "scrubbers," create byproducts that include synthetic gypsum. Although this material is not technically "ash" because it is not present in the coal, it is managed and regulated as a coal combustion product.

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

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

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

Synthetic Gypsum Production & Use 2002 – 2017



Synthetic gypsum is often more pure than naturally mined gypsum.

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

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

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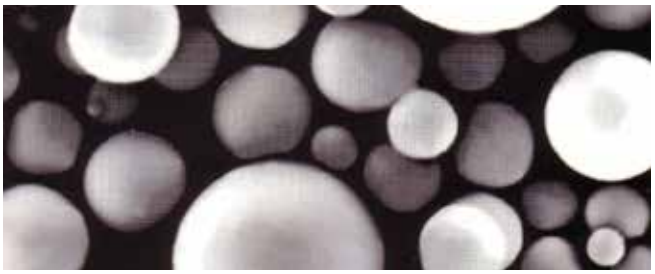
Other Products and Uses

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

Nearly 90 percent of all boiler slag is beneficially used.

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



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

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

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

New Uses on Horizon

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

ACAA
AMERICAN COAL ASH ASSOCIATION

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Email: info@acaa-usa.org

2017 Coal Combustion Product (CCP) Production & Use Survey Report

Beneficial Utilization versus Production Totals (Short Tons)

2017 CCP Categories	Fly Ash	Bottom Ash	Boiler Slag	FGD Gypsum	FGD Material Wet Scrubbers	FGD Material Dry Scrubbers	FGD Other	FBC Ash	CCP Production / Utilization Totals
Total CCPs Produced by Category	38,189,790	9,655,931	2,574,673	32,707,136	11,311,344	2,454,818	6,293	14,469,553	111,369,538
Total CCPs Used by Category	24,099,590	4,839,420	1,570,375	22,839,385	3,905,009	382,048	2,407	14,134,477	71,768,712
1. Concrete/Concrete Products /Grout	14,066,791	785,527	0	67,009	0	0	0	0	14,918,326
2. Blended Cement/ Feed for Clinker	1,079,724	1,022,512	132,160	2,317,445	0	91	0	0	3,552,010
3. Flowable Fill	86,379	0	0	0	0	0	0	0	86,379
4. Structural Fills/Embankments	466,553	671,079	0	0	0	0	0	0	1,137,529
5. Road Base/Sub-base	674,155	159,084	0	2,460	0	11,931	0	0	847,630
6. Soil Modification/Stabilization	360,796	48,876	0	0	0	0	0	0	409,673
7. Mineral Filler in Asphalt	59,317	0	0	0	0	7,019	0	0	66,336
8. Snow and Ice Control	69,192	276,989	4,220	0	0	0	0	0	350,402
9. Blasting Grit/Roofing Granules	0	17,706	1,412,685	44,981	0	0	0	0	1,475,371
10. Mining Applications	901,181	232,110	0	927,949	3,905,009	202,092	0	14,037,913	20,206,254
11. Gypsum Panel Products (formerly Wallboard)	0	0	0	15,859,606	0	0	0	0	15,859,606
12. Waste Stabilization/Solidification	1,066,993	48,964	0	3,035	0	114,645	0	96,564	1,329,193
13. Agriculture	0	0	0	1,157,877	0	35,121	0	0	1,192,998
14. Aggregate	0	10,237	21,267	0	0	0	0	0	31,504
15. Oil/Gas Field Services	78,716	0	0	0	0	11,188	0	0	89,905
16. CCR Pond Closure Activities	1,468,203	430,600	0	2,270,326	0	0	0	0	4,169,130
17. Miscellaneous/Other	220,480	34,840	0	188,705	0	0	2,407	0	446,442

Summary Utilization to Production Rate

CCP Categories	Fly Ash	Bottom Ash	Boiler Slag	FGD Gypsum	FGD Material Wet Scrubbers	FGD Material Dry Scrubbers	FGD Other	FBC Ash	CCP Utilization Total
Totals by CCP Type/Application	24,099,590	4,839,420	1,570,375	22,839,385	3,905,009	382,048	2,407	14,134,477	71,760,712
Category Use to Production Rate (%)	63.09%	50.12%	60.99%	69.83%	34.52%	15.56%	38.25%	97.68%	64.44%
2017 Cenospheres Sold (Pounds)	147,468	Data in this survey represents 115.20701 GWs of Name Plate rating of the coal industry vide approximate 263.0478 GW capacity based on EIA's July 2017 Electric Power Monthly.							
CCPs Imported in 2016 (Short Tons)	0								
CCPs Exported in 2016 (Short Tons)	0								

2018 American Coal Ash Association Membership Directory

These listings are organized into the following five membership categories:

▪ Utility ▪ Marketer ▪ Specialty Marketer ▪ Associate ▪ Individual

Utility

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E-mail: jechelbarger@aep.com

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President
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