

ISSUE 1 • 2011

ASH **at work**

Applications, Science and Sustainability of Coal Ash

THE \$100 BILLION BENEFIT COAL ASH IN AMERICA'S ROADS AND BRIDGES

ALSO IN THIS ISSUE

- World of Coal Ash in Review
- Comparing Coal Ash Environmental Risks
- Special Focus on Geotechnical Applications

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Applications, Science and Sustainability of Coal Ash

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On the Cover

More than 80,000 tons of coal fly ash were used in the Interstate 15 rebuild project in Salt Lake City – one of the largest design-build highway projects in history.

Photo Courtesy of
Headwaters Resources





STANDING UP TO OVER-REACHING REGULATIONS

By Thomas H. Adams, Executive Director ACAA

Over the last several months the American Coal Ash Association (ACAA) has been engaged in a number of activities. First and foremost, we have been working to protect the beneficial use of coal combustion products (CCP) from the over-reaching efforts of the U.S. Environmental Protection Agency to regulate CCP disposal. This task has used a very large percentage of our time. In 2010 we were occupied with public hearings across the country, responding to the EPA proposal, and visiting offices on Capitol Hill to inform the staffs of Congressmen and Senators of the threat to CCP recycling. EPA management “went dark” after the close of public comments on its proposals stating that they needed to review the 450,000 comments submitted before making any material statements. After the flurry of activity in 2010, things were strangely quiet. We have been informed that the EPA has a Notice of Data Availability (NODA) on the CCP rule-making coming “soon,” but there is no indication of what is in that notice.

Thanks to the results of the elections of November 2010, new leadership emerged in the U.S. House of Representatives. One freshman Congressman, David McKinley of West Virginia, decided to stand up to the EPA and proposed a bill to prohibit management of CCP as a hazardous waste. Congressman McKinley, a registered engineer, has a long history of using CCP in projects and appreciates the value added by CCP use. The original bill, HR 1391, has been modified and now exists as HR 2273. The bill has a long way to go before becoming the law of the land. However, no one initially expected this type of legislation would have any chance



New leadership has emerged in the U.S. House of Representatives. Congressman David McKinley of West Virginia has been standing up to the EPA.

of enactment. Rep. McKinley is to be applauded for his leadership. In addition, Congressmen Fred Upton of Michigan and John Shimkus of Illinois shepherded HR 2273 to bipartisan approval by the House Energy and Commerce Committee. The bill is now expected to be considered by the full House of Representatives this fall as a common-sense solution to concerns over disposal in a way that does not cast doubt on beneficial use.

Another important activity occurred in May in Denver. The World of Coal Ash was a success by any measure, except for the odd weather (80 degrees one day, snow the next). Attendance was strong. The presentations were timely and significant. The exhibit area was sold out. The socializing was very enjoyable. I would like to thank our partners at the University of Kentucky's Center for

Applied Energy Research and our ACAA staff for their dedication and hard work to make this event a success. While the loose ends from WOCA 2011 are being tied up, work has already begun for the 2013 WOCA back in the Bluegrass State.

The World Wide Coal Combustion Products Network is comprised of organizations around the world that advance beneficial use. Under the leadership of Anne Weir, Executive Director of the Canadian Industries Recycling Coal Ash (CIRCA), the WWCCPN met during WOCA to discuss ways to improve sharing information in a more efficient manner. In coming months visitors to the WWCCPN website will see new information on beneficial use developments around the world. Our partners are found around the globe – including several countries in Europe, Australia, Canada,



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The World of Coal Ash was a success by any measure. Attendance was strong. The presentations were timely and significant. The exhibit area was sold out.

Israel, Japan, South Africa and others. While each country must comply with local regulations, there are many similarities in the ways we all try to advance beneficial use of CCP.

Work on the 2010 CCP Production and Use Survey is nearly complete under the leadership of Dave Goss and Harry Roof. We expect to preview the 2010 data at our fall meeting in Indianapolis.

The ACAA is looking to the future. How will we manage the association in the next five to 10 years to best serve our members' needs? Do our bylaws and membership structure fit our vision of the future? How can we create a strong infrastructure that provides assurance that the ACAA is responsive in a timely fashion? What part will coal-fueled generation play in serving the energy needs of our country? These are among the important questions before us now. The answers to these questions will shape our actions going forward.



Finally, I would like to note that two dedicated employees of the U.S. Environmental Protection Agency recently retired. On July 1, 2011, Truett DeGeare retired after 43 years of service. On August 1, 2011, Bob Dellenger also retired. Both of these gentlemen have been voices of reason within the agency. They have taken their roles seriously and challenged us to provide data to substantiate our positions. In response, they helped guide us to outcomes that provide protection for human health and the environment while encouraging responsible recycling of CCP. Thank you, Truett and Bob. Best wishes for long and happy retirements! ♦

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UNITED WE STAND; DIVIDED WOULD BE 'HAZARDOUS' TO US ALL

By Mark Bryant, Chairman ACAA, Ameren Energy Fuels & Services

Congress went into recess in August and so we had a chance to catch our breath (and watch the stock market...). I am not sure which is worse: the regulatory uncertainty we have been experiencing or the financial uncertainty we look forward to. Such is life, but to refer to all of these events as theater or drama or even just a game of kick the can doesn't help quell the growing frustration that we all feel. I am reminded of the prayer:

**Lord, Grant me the serenity to accept
the things I cannot change,
Courage to change the things I can,
And wisdom to know the difference.**

And the less famous quote:

**"Politics are usually the executive
expression of human immaturity."
(Vera Brittain)**

Rest assured that we (ACAA management staff and leadership team) remain vigilant of the developments in Washington and will continue to press our case to achieve our common goal of a non-hazardous classification for all Coal Combustion Products. All members must remain engaged and actively communicate with our representatives. Remember this is a marathon, not a sprint, and pace is very important. I know we all look forward to the opportunity to finally declare victory. Based on the most recent discussions it appears that most of our legislators are starting from positions that will satisfy our simple objective of a non-hazardous classification but those positions are no doubt based on a time line of progress this year, a full house vote in the fall and positive Senate consideration thereafter. Should we slip to a 2012 or 2013 time line, the

**ACAA and its 160+ members represent
the wide horizon of the coal ash,
beneficial use and recycling industry that
was formed almost 50 years ago.**

landscape will most certainly change and we will have more work to do.

United We Stand...

They say the sun shines in Denver 300+ days a year, and this year's World of Coal Ash conference was blessed with a couple of those days and a couple of the other kind. However, the conditions inside the conference hall were quite fine and another successful WOCA is in the books. Over 525 attendees from 21 countries is a success by any measure. The national and international perspectives discussed at WOCA with our friends from Europe, Canada, South Africa and India, just to name a few, prompts a reflection and discussion of what the real purpose of the ACAA remains today. This has been on my mind a lot over the last year or two during a very dynamic period in our industry.

Industry associations come in all different sizes and shapes with purposes as broad as camera lenses or as narrow as rifle scopes; some are wide angle to take in the horizon and others are myopic with even a laser focus. ACAA and its 160+ members represent the wide horizon of the coal ash, beneficial use and recycling industry that was formed almost 50 years ago. Our members represent every segment of the value chain from producers and generators

to service providers, specifiers, contractors, manufacturers and marketers.

Many of you have noted that we see our beneficial use industry transforming. Some would observe that commercial landfill owners, landfill liner companies and their operators are unusual to have as part of our beneficial use and recycling industry association; that their purpose is somehow at odds with the mission and vision. But a simple answer would be that EPA's regulatory uncertainty has forced our industry to quickly adapt to new business realities including that until we get to 100 percent beneficial use, some of these materials will ultimately be destined for disposal. We have set a lofty goal of 100 percent beneficial use but, in the light of current regulatory uncertainty and recently added emission control technologies that degrade the quality of some ashes, many more changes to our membership will likely occur.

Landfills have long been users of ash as a suitable alternative cover which preserves natural resources and to me, this sounds like a beneficial use under our broad definition. This use is no less important than the mineral filler, structural fill or portland cement replacement contributions to our goals for recycling and reuse. So when



They say the sun shines in Denver 300+ days a year.

we stop to consider the diversity of our membership and the many unique and specific business interests that our individual members could have, our messages have been and will be necessarily general or broad and on behalf of all.

Our partner associations, like the National Ready Mix Concrete Association or the Utility Solid Waste Activities Group, have the ability to carry forward a much more focused message while working to resolve infinitely more specific issues. So while ACAAs staff will continue to support our individual members and their specific needs where possible, our overall purpose has to remain focused on the broad horizon and **today that means support Subtitle D (non-hazardous) based management of ash.** This objective benefits the environment and all our members. Our markets require this *consistent* interpretation for the many applications developed over the years. It is this clarity of thought that is our strength. Our message is simple, and behind it, our members can rally.

Ash needs to be managed as a solid waste able to be recycled and reused in commerce without the Subtitle C hazardous or special waste label. Sure there are issues and details to be developed regardless of which direction is selected, but for now our industry has one goal, one focus: **to get any Subtitle C proposal off the table and soon** so the industry can thrive. So when we collectively choose to support or endorse any initiative language or a piece of legislation, it is on behalf of all members.

To clarify who the term "WE" means when referring to our association leadership the following cross-section of interests participate. The ACAA "leadership team" is our officers and consists of representatives from a utility, a marketer/contractor and a

technology firm. ACAAs committee chairs represent a marketer/disposal company, a marketer/ash management company and a consultant to the industry and are all well respected experts in the areas covered by their committees. To round out our Executive Committee are six "At-Large" elected members, five of which are currently from utilities. Currently, fully half of the Executive Committee represents Utilities. Our Board of Directors is our membership and numbers about 60 of the 163 total membership roster. We have a small but mighty staff that continues to amaze me with what they are able to achieve and our budget is probably the smallest of ANY group engaged in the whole Subtitle C-D dialogue. We are a volunteer organization that represents an industry that is currently fighting for its life and we rely heavily on our members and partners, **BUT**, we are ever vigilant that our leadership, our message and our actions remain fair and balanced.

I firmly believe that our Association remains the big tent in this EPA effort to regulate coal ash with a goal so broad that many can come inside without jeopardy to their individual needs. To be the voice of a diverse group can be trying at times because many members would like our message to narrow and focus on their particular business needs sometimes even to the detriment of other industry members. But to succumb would be to weaken our message and our membership. We are not singularly cement or concrete driven, nor are we an extension of the utility, construction or landfill industry. We represent all of our members and that makes us strong. United we stand, divided would be hazardous to us all!

'Til next time, and see you in Indianapolis... ❖

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THE \$100 BILLION BENEFIT: NEW STUDY FINDS UTILIZING COAL ASH IN ROADS AND BRIDGES

A Key Strategy for Stretching America's Transportation Dollars

By Alison Premo Black, Senior Economist
American Road & Transportation Builders Association

The cost to build roads, runways and bridges would increase by an estimated \$104.6 billion over the next 20 years if coal fly ash is no longer available as a transportation construction building material, according to a new study by the American Road & Transportation Builders Association's Transportation Development Foundation (ARTBA-TDF).

Fly ash is a byproduct of coal combustion for electricity generation. It is widely used as a supplementary cementitious material in the production of concrete. Fly ash concrete is a mixture of choice for many state and local transportation departments and transportation engineers because of its performance enhancing and cost-saving benefits. It has also been praised for its environmental benefits as a "green" building material – putting to use an energy production byproduct that reduces demand for carbon-intensive portland cement, requires less water in the setting process, and would otherwise wind up in a landfill.

Despite its many documented advantages and widespread use, new proposed disposal regulations may limit or eliminate its availability. The ARTBA-TDF study was conducted to forecast the potential economic impacts of the loss of fly ash availability in just one U.S. construction market – transportation infrastructure.



More than 80,000 tons of coal fly ash were used in the Interstate 15 rebuild project in Salt Lake City – one of the largest design-build highway projects in history.

The study identified \$5.23 billion in annual direct cost increases if fly ash were unavailable for use in concrete for transportation projects. That figure includes a \$2.5 billion

increase in the price of materials and an additional \$2.73 billion in pavement and bridge repair work due to the shorter pavement and service life of other portland cement blends.

Photo Courtesy of Headwaters Resources



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To put the \$5.23 billion figure in perspective, it is almost \$2 billion per year more than the federal government currently invests in the Airport Improvement Program and about 13 percent of the federal government's annual total annual aid to the states for highway and bridge work.

Without the availability of fly ash, American taxpayers would ultimately bear the burden, either paying more for the same level of transportation improvements, or dealing with the consequences of a scaled back improvement program.

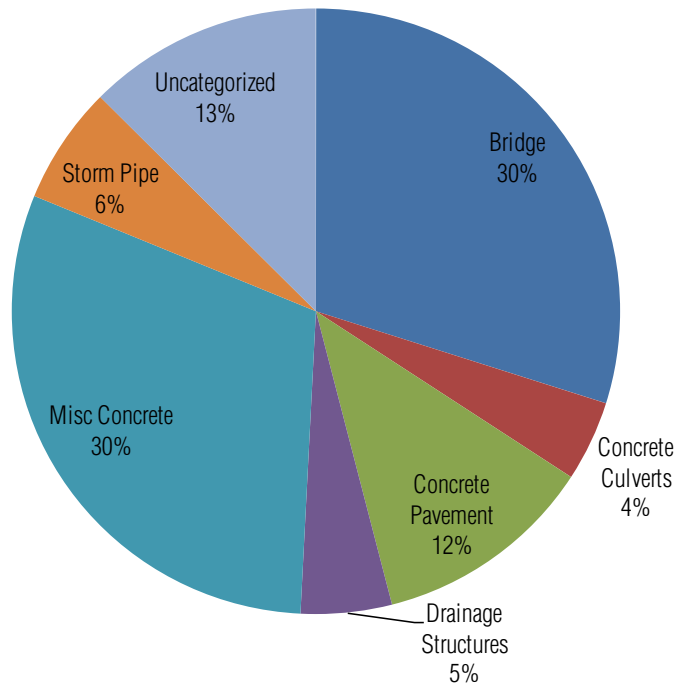
"The study's findings should be a real eye-opener for members of Congress and other federal policymakers," said Bill Gehrmann, president of Headwaters Resources, Inc., whose group commissioned the report. "Without coal ash, concrete will become more expensive and the environmental footprint of the transportation sector will only increase. There is nothing 'green' or sustainable in such a scenario."

The ARTBA Foundation study also explored how states would have to forego

the potential additional benefits and savings derived by using fly ash in new, high performance concrete pavements. Fly ash is a key component of high performance

concrete pavement designed for a lifespan of 30 to 60 years for concrete roads, compared to the current average of 20 to 25 years.

National Average Concrete Usage by Type



Source: Analysis of state DOT bid tab data provided by Oman Systems Inc.

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According to the study's findings, the estimated savings from the increased durability of various fly ash concrete life spans would be:

- \$25 billion over 20 years (\$1.2 billion per year average) if all concrete roadways were designed with fly ash concrete materials to last 35 years, compared to the current national average of 20 to 25 years.
- \$33.5 billion over 20 years (\$1.7 billion per year) if all concrete roadway repair and reconstruction work used fly ash concrete with a 40-year life span.
- \$51.5 billion over 20 years (\$2.6 billion per year) if all concrete roadway repair and reconstruction work used fly ash concrete with a 50-year life span.
- \$65.4 billion over 20 years (\$3.2 billion per year) if all concrete roadway repair and reconstruction work used fly ash concrete with a 60-year life span.

The analysis utilized bid tab data from 48 states and Washington, D.C., collected

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National Use of Concrete & Estimated Fly Ash (FA) Value (\$ Millions)

Year	Total value of concrete materials	Value of total bids	Concrete cost as % of total bids	Estimated FA concrete as % of total bids	Estimated value of FA concrete
2005	\$5,503	\$28,822	19.1%	15%	\$4,237.59
2006	\$6,201	\$33,284	18.6%	14%	\$4,774.61
2007	\$5,325	\$30,230	17.6%	14%	\$4,100.29
2008	\$5,043	\$28,120	17.9%	14%	\$3,883.41
2009	\$6,095	\$33,873	18.0%	14%	\$4,693.30
2010	\$6,628	\$31,717	20.9%	16%	\$5,103.41
Average	\$5,799	\$31,008	18.7%	14%	\$4,465.43

Source: Analysis of state DOT bid tab data provided by Oman Systems Inc.

Note: This table assumes an average of 77 percent of all concrete utilizes fly ash.

and organized by Oman Systems, Inc., in Nashville, Tenn. The same data are used by the Federal Highway Administration (FHWA) to calculate the National Highway Construction Cost Index. It also used transportation construction market data from the U.S. Census Bureau, FHWA's National Bridge Inventory and Highway Performance Monitoring

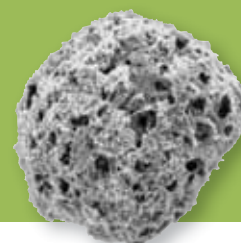
System and conducted extensive surveys and personal interviews with state transportation department officials and fly ash supply company executives to determine state market shares and penetrations.

The complete report is available in the "economics and research" section www.artba.org.

The study's sponsor – Headwaters Resources – is the largest manager of coal ash resources in the U.S. With ongoing projects at more than 100 utility locations and approximately 20 million tons of coal combustion products under management annually, Headwaters is responsible for more than half of the nation's total sales of coal fly ash for use in concrete applications

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The study's author – ARTBA-TDF – was established in 1985 as a 501(c)(3) tax-exempt entity that “promotes research, education and public awareness.” It supports an array of initiatives, including educational scholarships, awards, executive education seminars, roadway work zone safety and training programs, special economic reports and a national exhibition on transportation.

The American Road and Transportation Builders Association is the oldest and most respected national transportation construction-related association. Founded in 1902, it has more than 5,000 public and private sector members. ♦

Miles of Concrete Roadways by Type

	Rural	Urban	Total
Interstate	7,331	5,073	12,404
Other Freeways And Expressways	-	3,227	3,227
Principal Arterial Other	7,182	6,600	13,782
Minor Arterial	2,858	6,748	9,606
Major Collector	7,363	5,696	13,059
Total	24,734	27,344	52,078

Source: FHWA Highway Statistics 2008, Table HM-12

Note: Mileage is for the federal-aid system and does not include any local roads. Includes all 50 states and Puerto Rico.

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COAL ASH IN CONTEXT

Separating Science from Sound Bites As Regulatory and News Media Debates Continue

By Lisa JN Bradley, Ph.D, DABT, Vice President, AECOM Environment
and John N. Ward, Chairman, American Coal Ash Association Government Relations Committee

As America nears the end of three years of vigorous debate over how to regulate coal ash disposal, certain descriptions of coal ash are becoming commonplace and misunderstood. Supported by a steady stream of news stories, reports, and press releases from environmental activist and other groups, the phrases “toxic coal ash” and “hazardous waste” appear frequently in the news media.

What do these phrases really mean, and how does coal ash compare to other materials in the environment around us? Not surprisingly, the science paints a picture very different from media stories.

So what is coal ash?

Coal ash is the unburned/unburnable residuals from the combustion of coal. Coal is naturally present in our environment and was made over millions of years from decayed plant matter. Minerals present in the soil were taken up into the plants as they grew. When organic matter in the coal is burned and consumed, inorganic minerals are left unburned and make up what we know as coal ash. These same minerals are present in the soils in the U.S. today, and throughout the world.

The Electric Power Research Institute (EPRI) has published a report that compares the levels of minerals in coal ash and in natural materials (EPRI, 2010a). Of the four types of coal ash compared in the report, fly ash generally has the highest concentrations of unburned minerals, thus we will focus on that here. Figure 1 compares the range of concentrations of

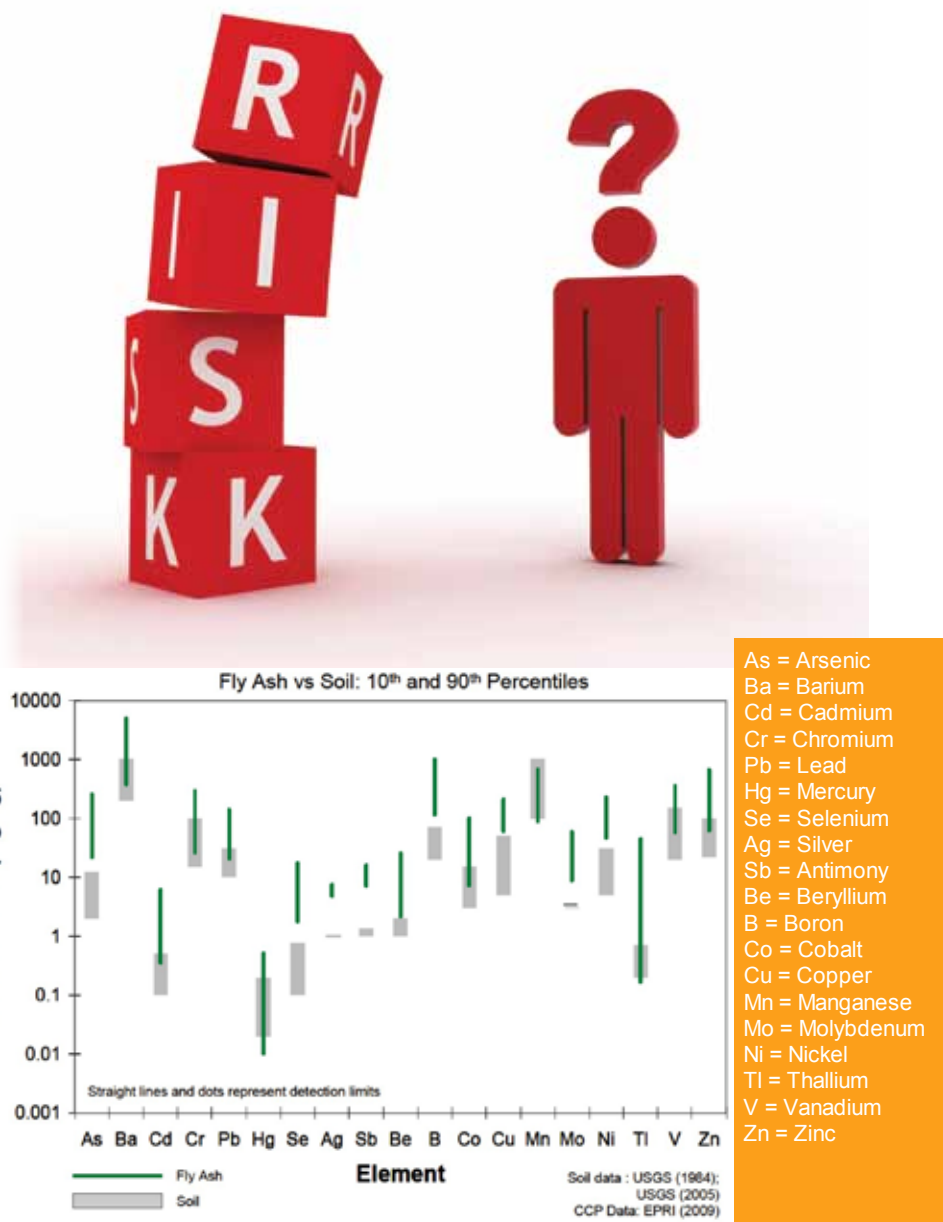


Figure 1: Coal Ash is Similar to Other Natural Materials.

Source: EPRI, 2010. Comparison of Coal Combustion Products to Other Common Materials – Chemical Characteristics. Report No. 1020556. Available for download at www.epri.com.



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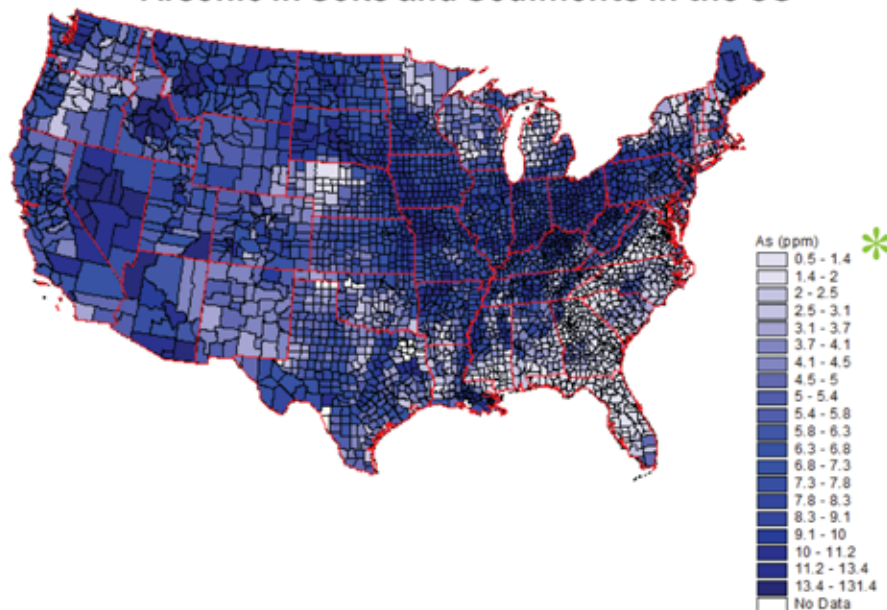
minerals in fly ash versus soils in the U.S. As shown, there are many cases of overlap between the concentration ranges, although fly ash generally has a higher concentration range than soil.

Of the minerals presented in Figure 1, arsenic has gained the most attention. Figure 2 shows the range of concentration of arsenic in soils in the U.S., in data compiled by the U.S. Geological Survey (USGS, 2010). Note that USGS has compiled national maps for many of the minerals present in coal ash, and they are continually adding to this database.

Is coal ash “hazardous waste?”

In the regulatory world, “hazardous waste” has a very specific meaning. This meaning has frequently been taken out of context in the public debate over coal ash. According to U.S. Environmental Protection Agency (EPA) regulations, a material is considered “hazardous” for the purposes of disposal if constituents are “leached” from the material at concentrations higher than regulatory-defined levels. The test used to make this determination, called the Toxicity Characteristic

Arsenic in Soils and Sediments in the US



The USEPA regional screening level for arsenic in soil at a 1 in one million risk level is 0.39 ppm; *
thus, the arsenic concentrations in the majority of soils in the U.S. are above the 1 in one million risk level.

Figure 2: Arsenic is Present in our Natural Environment

Sources: USEPA, 2010. Regional Screening Level Table. May 2010. <http://www.epa.gov/region09/superfund/prg/index.html>
USGS, 2010. The National Geochemical Survey. Database and Documentation. <http://tin.er.usgs.gov/geochem/doc/home.htm>

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Leaching Procedure (TCLP), is meant to mimic the harsh and acidic conditions found in municipal solid waste (MSW) landfills. If a material is classified as hazardous using this procedure, it cannot be disposed of in a municipal solid waste landfill and it can be considered for regulation as a “hazardous” waste (40 CFR Part 261.24).

Rarely have samples of coal ash “failed” the TCLP test (EPRI, 2010a), indicating that coal ash does not qualify for regulation as a “hazardous waste” based on its toxicity. Indeed, the EPA reached this conclusion in two Reports to Congress (in 1988 and 1999) and two formal Regulatory Determinations (in 1993 and 2000).

So where did the prevalent link of “hazardous waste” to coal ash come from? Responding to the failure of a Tennessee coal ash disposal facility in December 2008, the EPA proposed options for regulating coal ash disposal in proposed rules issued in June 2010. One of those options called for regulation under Subtitle C of the Resource Conservation and Recovery Act (RCRA), which is the section that covers “hazardous waste.” Two things about that proposal are worth noting. First, EPA did not claim that coal ash qualifies as a hazardous waste based on the toxicity characteristic. Rather, the agency cited “damage cases” like the Tennessee incident as justification for regulation under Subtitle C. Second, the landfill design EPA proposed under both its “hazardous” (Subtitle C) and “non-hazardous” (Subtitle D) regulatory options were essentially the same. EPA acknowledged that disposing of coal ash in landfills that meet “non-hazardous waste” design is protective of human health and the environment. Note that only regulation under Subtitle C would provide EPA with direct enforcement authority over coal ash disposal that excludes the states.

Is coal ash “toxic?”

As noted earlier, the sensational word “toxic” has appeared frequently in the media. And like hazardous waste, it too

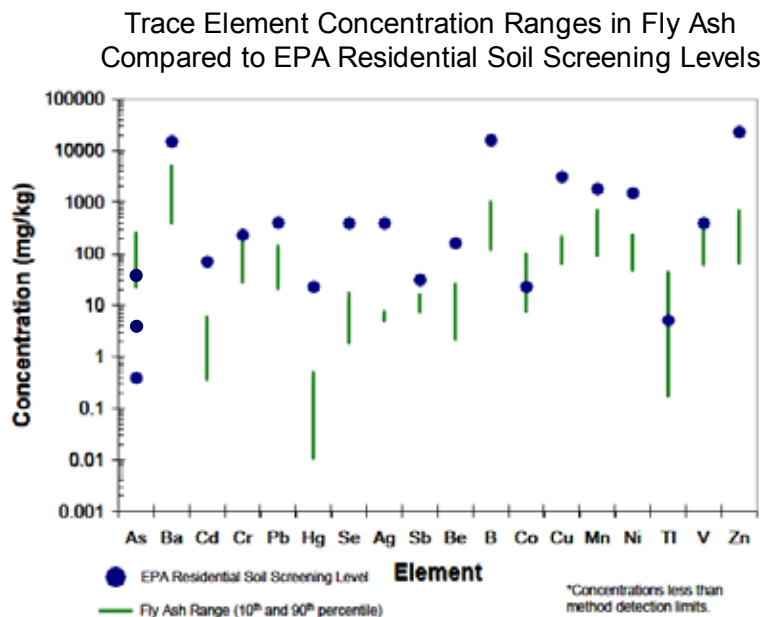


Figure 3: Coal Ash Levels Similar or Less than Risk-Based Screening Levels

Source: EPRI, 2010. Comparison of Coal Combustion Products to Other Common Materials – Chemical Characteristics. Report No. 1020556. Available for download at www.epri.com.

has a specific scientific meaning. A substance is considered to be toxic only if it has a way to move from a material in the environment and into a person or organism in sufficient quantities to cause damage.

For example, one of the elements of concern in coal ash is mercury. But compact fluorescent light bulbs in our homes contain mercury – in much higher concentrations than in coal ash¹. The presence of mercury in coal ash does not make it “toxic” any more than light bulbs are “toxic.” To determine if a material poses a “toxic” threat, environmental scientists and regulators perform “risk assessments.”

Risk assessment is a process that combines estimates of exposure with estimates of toxicity to identify if a health risk is posed by a specific exposure. Risk assessment can also be used to develop screening levels for constituents in soil in a residential setting (USEPA, 2011). These are levels in soil that a child and adult could be exposed to daily without adverse effect. These levels take into consideration

both potentially carcinogenic effects and noncarcinogenic effects (i.e., effects other than cancer). These are called screening levels because they are derived for a very generic and universal exposure setting and can be applied anywhere. If concentrations are below these levels, then it is accepted that there is no expectation of adverse effects. However, if concentrations are higher than these levels, the specific situation needs to be evaluated in more detail. It does not mean that there is a risk of adverse effects. Higher levels can also be without adverse effect, depending on the specific situation.

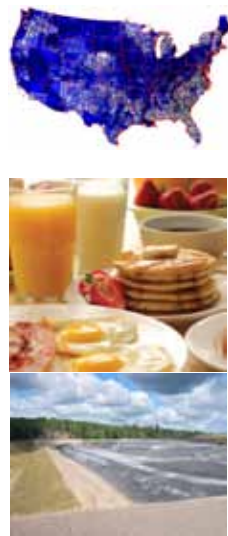
Figure 3 shows the range of mineral concentrations in fly ash compared to the EPA’s residential soil screening levels. Other than for arsenic, all of the minerals have concentration ranges in fly ash below the residential soil screening level, or overlapping the screening level (only cobalt and thallium).

Of the minerals present in fly ash, arsenic is the only one classified as a carcinogen for the ingestion route of exposure. As a carcinogen, three residential soil

¹ Compact fluorescent light bulbs (CFLs) currently contain approximately 5 milligrams of mercury (NEWMOA, 2008; see the EPA-funded report at <http://www.newmoa.org/prevention/mercury/imerc/factsheets/mercuryinproducts.pdf>). The maximum amount of mercury detected in the various types of coal ash is 1.5 milligram of mercury, in a kilogram of ash (EPRI, 2010a), though the normal range of mercury in coal ash is much lower than this.

screening levels are depicted on the graph in Figure 3, corresponding to EPA's target risk range for regulatory purposes of a one in one million risk level (the lowest blue dot on the graph), a one in one hundred thousand risk level (the middle blue dot on the graph), and a one in ten thousand risk level (the upper blue dot on the graph). Thus, the risks associated with daily direct ingestion exposure to fly ash over a residential lifetime overlap and are slightly above EPA's target risk range. This type of exposure scenario could only occur if someone lived on top of a fly ash landfill or if all of the soil in their yard was replaced specifically with fly ash. Also note that even the range of background concentrations of arsenic in soils (shown in Figure 1) are above EPA's residential soil screening levels for the one in one million and one in one hundred thousand risk levels.

Because arsenic is naturally present in soils, it is also present in the foods that we eat. Figure 4 shows the range of concentrations of arsenic in soils, and in fly ash and bottom ash (EPRI, 2010a). The U.S. Agency for Toxic Substances and



ARSENIC COMPARISONS

Material	Arsenic
Average in the Earth's crust	3.4 mg/kg
Background levels in soils in the US	
Range	<0.001 - 97 mg/kg
Average	7.2 mg/kg
Range in Fly ash	22 - 261 mg/kg
Range in Bottom Ash	2.6 - 21 mg/kg
Total Daily Exposure from Food	0.05 - 0.058 mg/day
Range of incidental arsenic ingestion if child exposed to fly ash rather than soil on a daily basis	0.0044 - 0.052 mg/day
Range of incidental arsenic ingestion if child exposed to bottom ash rather than soil on a daily basis	0.00052 - 0.0042 mg/day

Figure 4: Arsenic in Perspective

EPRI, 2010. Comparison of Coal Combustion Products to Other Common Materials – Chemical Characteristics. Report No. 1020556. Available for download at www.epri.com/ATSDRToxicologicalProfileforArsenic. Available for download at www.atsdr.cdc.gov/toxprofiles/index.asp; See text for calculation.

Disease Registry (ATSDR) has estimated the amount of arsenic ingested from a standard diet in the U.S. population (ATSDR, 2007); this is also presented in Figure 4. Using the same assumptions about exposure used by EPA to calculate the residential soils screening levels, and

assuming that a child does live on top of a fly ash or a bottom ash landfill, the amount of arsenic that would be ingested from the coal ash has been calculated², and presented in Figure 4. As shown, these ranges are within or below the range of arsenic exposure from our diet.

In other words, a person would have to eat a lot of coal ash in order for it to become “toxic.”

What about the “2 in 100” risk number that gets reported?

As part of its rule-making proposal, EPA published a draft risk assessment for the disposal of coal ash (EPA, 2010). This risk assessment evaluated the risk of using groundwater as drinking water down gradient from a coal ash disposal unit. EPA made many conservative assumptions when conducting the risk assessment, such that the risk results are much more likely to over-estimate than underestimate risk to human health and the environment. (This element of the EPA

² Calculated assuming a child incidentally ingests 200 milligrams of soil or coal ash per day [e.g., for fly ash at the low end of the concentration range: (200 mg coal ash per day) × (22 milligrams arsenic per kilogram of coal ash) ÷ (1,000,000 mg coal ash per kilogram of coal ash) = 0.0044 milligrams of arsenic per day].



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risk assessment has not been widely noted in the media.) Despite this, it is instructive to look at the results in more detail.

The highest risk that EPA calculated was for coal ash surface impoundments that contain both coal ash and coal refuse (which is coal that is not suitable to be burned). The predicted drinking water risk is two in one hundred, which is clearly much higher than the EPA's target risk range identified above. This number has been used in media reports and in public comments on the rule-making process to support the need for a "hazardous waste" designation for coal ash. But what does this risk result really mean?

EPA's objective for the risk assessment was to "evaluate, at a national level, risk to individuals who live near WMUs [waste management units] used for CCW [coal ash] disposal." However, this was not achieved due to the structure of the risk assessment. EPA evaluated 508 coal-fueled electrical utility facilities in its risk assessment, and ran 10,000 calculations for each disposal scenario that it evaluated. For each and every one of those

scenarios, EPA assumed that someone lived downgradient of the coal ash disposal unit and used shallow groundwater for drinking water. EPA did not acknowledge conditions where exposure would not occur, such as where no one lives downgradient of a coal ash disposal unit, or where municipal water or deep wells may be used for drinking water. EPRI did a detailed evaluation of aerial photos of the 508 facilities that EPA included in their risk assessment (EPRI, 2010c). EPRI found that only 15 percent of the facilities evaluated by EPA had buildings present downgradient from an ash disposal unit that could be residential dwellings. Fewer than 3,000 potential dwellings were identified. Based on U.S. Census data results showing an average of 2.59 people per household in the U.S. (USCB, 2010), this could be a population of less than 7,770 individuals compared to the U.S. population of over 307 million. If we assume that all of these potential 7,770 individuals live downgradient from an unlined surface impoundment, the scenario with the highest predicted risk of 2 in 100, and assume that they all use shallow groundwater as drinking water, then it can be

calculated that 155 individuals could potentially develop cancer. Thus, the "risk to individuals who live near WMUs used for CCW disposal" "at a national level" is 155 in a population of 307 million, not a risk of 2 in 100.

To provide further context to EPA's predicted risks and these results, the measured background cancer incidence in the U.S. is 1 in 2 for men and 1 in 3 for women.

How does coal ash disposal compare to disposal of other wastes?

EPRI has published a report that provides a risk-based comparison between leachate generated from MSW landfills and coal ash management units (EPRI, 2010b). From the results presented in that report it can be concluded that the relative health risks associated with leachates from MSW landfills and coal ash management units are similar. One striking difference is that there is only one carcinogen that is a risk driver for the coal ash leachate, while MSW leachate risk drivers

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comprise over 30 potential carcinogens, including volatile organic compounds, semivolatile organic compounds, PCBs, dioxins and furans and pesticides. Thus, the engineering controls used to successfully manage “non-hazardous” MSW landfills and their contents and the generated leachate under Subtitle D of RCRA can be applied to coal ash management units and be protective of the environment.

While toxicity risks for coal ash and MSW are similar, the EPRI report points out that managing an MSW disposal facility is much more complicated than managing coal ash disposal. Coal ash is typically disposed in “monofills” containing a single, homogenous type of inorganic material. MSW landfills have a wide variety of contents including residential food scraps, yard trimmings, wood, metals, plastics, glass, and other materials. These materials are attractive to “disease vectors,” such as vermin and other animals that must be managed at an MSW landfill to prevent the spread of diseases. Furthermore, because of the organic nature of much of

the MSW landfill contents, methane gas is produced by the natural breakdown of these contents. Methane is flammable and explosive, as well as a potent greenhouse gas. Controlling for disease vectors and flammable gases are not issues associated with coal ash disposal facilities.

What are appropriate management approaches for coal ash disposal?

EPA’s proposed Subtitle D “non-hazardous” regulations for coal ash disposal would be fully protective of human health and the environment. Also, legislation currently under consideration in Congress would create a coal ash disposal regulatory structure modeled after successful MSW disposal programs. HR 2273 – the “Coal Residuals Reuse and Management Act” – would prevent the EPA from regulating coal ash disposal as a “hazardous waste” while simultaneously directing states to enact enforceable permit programs modeled after successful municipal solid waste programs. HR 2273 would mandate a state-administered

permit program to create enforceable requirements for groundwater monitoring, lining of landfills, corrective action when environmental damage occurs and structural criteria. The bill also would provide the federal EPA with the authority to directly regulate coal ash disposal if a state is unable or unwilling to implement the permit program.

More than 240 million tons of MSW are generated in the United States each year, compared to approximately 135 million tons of coal ash. States operate effective regulatory programs for the disposal of MSW at more than 1,900 locations and are more than capable of doing the same for coal ash – a material with similar toxicity risks and fewer management problems.

When science is considered over sound bites, coal ash is neither “hazardous” nor “toxic.” America’s environment would benefit if less time was spent on non-science-based arguments and inflammatory language in the media and more time enacting meaningful, appropriate, and protective disposal regulations. ♦

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Royal Mines & Minerals Corp.

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Royal Mines and Minerals Corporation (RYMM) has committed years to the research and refinement of precious metal extraction. We have focused primarily on a closed loop, leach process for typical ores. Our newest development is called the Cholla process and exposes recoverable gold from select ash deposits.

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Since September 2010 RYMM has been laboratory and pilot testing the Cholla process. Independent bench scale tests have validated that we are exposing recoverable gold using our process and we have realized in-house values from our bench scale tests ranging from 0.25 oz of gold per ton to multiple ounces of gold per ton. We have run over 50 tons of coal fly ash to date, consistently exposing 1 oz of gold per ton. We are currently processing 4 tons per day and plan to increase this amount as our equipment permits.

Our team possesses the technical and engineering expertise to execute RYMM's business objectives. We intend to work with strategic partners to scale up the Cholla process and expand production to multiple locations.



- Photos of the Phoenix facility.
- We have recently constructed a second facility in Scottsdale, Arizona.



- 5 ounces of gold produced from 5 tons of coal ash run through the Cholla process.

The information in this discussion contains forward-looking statements. These forward-looking statements involve risks and uncertainties, including statements regarding the Company's capital needs, business strategy and expectations. Any statements contained herein that are not statements of historical facts may be deemed to be forward-looking statements. In some cases, you can identify forward-looking statements by terminology such as "may," "will," "should," "expect," "plan," "intend," "anticipate," "believe," "estimate," "predict," "potential" or "continue," the negative of such terms or other comparable terminology. Actual events or results may differ materially. In evaluating these statements, you should consider various factors, including the risks described below, and, from time to time, in other reports the Company files with the United States Securities and Exchange Commission (the "SEC"). These factors may cause the Company's actual results to differ materially from any forward-looking statement. The Company disclaims any obligation to publicly update these statements, or disclose any difference between its actual results and those reflected in these statements.

WORLD OF COAL ASH 2011: THE SCIENCE, APPLICATIONS AND SUSTAINABILITY OF COAL ASH WORLDWIDE



Biennial International Symposium Makes a Successful Stop in the Mile High City

Denver, Colorado provided the backdrop for the fourth biennial World of Coal Ash (WOCA) Symposium May 9-12, 2011. Some 525 attendees – including 83 international attendees representing 21 countries – gathered to discuss coal ash management and utilization strategies, present scientific research, socialize and more.

The symposium provided a backdrop for numerous “satellite” meetings sponsored by government and private organizations, as well as an educational short course. A sold-out exhibit hall featured displays by a variety of coal ash industry companies. The academic portion of the program also featured awards competitions for student presenters.

WOCA is a joint meeting combining separate symposia previously held by the American Coal Ash Association and the University of Kentucky Center for Applied Energy Research. Topics addressed at the symposium encompass not only the utilization of coal ash, flue gas desulfurization materials, and gasification products, but also covered sustainable projects using coal combustion products, emerging technologies, general ash management (including disposal), mercury related topics, recent research and specific case studies, international activities and regulatory topics from the local, state and federal perspectives.

Plenary speakers at WOCA 2011 included Dr. Lisa Bradley, a Senior Toxicologist and Vice President for AECOM



Plenary session speakers Dr. Lisa Bradley (above) and Anne Weir (right) discussed environmental impacts of coal ash and international standards harmonization.

Environment, and Anne Weir, Executive Director of the Association of Canadian Industries Recycling Coal Ash (CIRCA). Dr. Bradley addressed the toxicity and environmental risks associated with coal ash. Ms. Weir discussed the World Customs Organization Harmonized System Classification of Coal Ash and its implications for international coordination of coal ash management practices.

The symposium’s academic program featured 142 oral presentations and 31 poster presentations on a wide variety of topics.

Continued on page 28



Photography by Bill Cronin

Agru/Closure Turf™ Helps Local Governments Reduce the Economic and Environmental Impact of Landfill Closure

Municipalities discover how closing landfills with innovative product helps them save money both now and in the future

Municipal solid waste directors are feeling the pressure from regulatory requirements, tighter budgets and the desire for increased sustainability. Agru America Inc., located in Georgetown, South Carolina with factories in Nevada and South Carolina, is offering relief through new technology that drastically reduces the time, cost and environmental impact associated with landfill closure.

The traditional process of closing a landfill costs between \$85,000 and \$200,000, depending on the required clay, soil and vegetative cover to be placed over the geomembrane liner. An additional \$30,000 to \$50,000 per acre is needed to complete the 30 years of monitoring and maintenance required by the EPA. Agru/Closure Turf™, a synthetic turf system with a unique impermeable barrier, can reduce closure costs by 30 to 70 per cent. The product, composed of UV-resistant, polyethylene grass laid over a structured drainage geomembrane provided by Agru America along with a specialized sand embedment material, can be laid directly on the required intermediate soil cover therefore eliminating the need for the top two feet of soil and grass. On average, municipalities have realized a per acre savings of \$10,200 on construction cost, a \$8,500 savings on the reduction of vertical gas wells (when also using Agru/ClosureTurf™ patented surface collection system), a post-closure maintenance savings of \$51,070, and additional airspace revenue of \$40,600. All total, landfills can improve their economics by over \$100,000 per acre. Additionally, Agru/Closure Turf™ can also be installed quickly, requiring just a few weeks where traditional closure would require several months. This provides communities with rapid control of landfill gas and odors. Closing in a more frequent, incremental manner provides for significant improvement in the



containment of greenhouse gasses.

Already applied in MSW landfills in Louisiana, Texas, Missouri and Pennsylvania, and current projects under development in Georgia and throughout the Caribbean, Agru/Closure Turf™ continues to appeal to site operators across the country. Mike Friesen, a district landfill engineering manager for IESI Corp., explains, “When we realized that we could gain two feet of airspace, coupled with reduced post-closure costs and a dual-use gas collection system, it became a very easy decision for us. The gain in airspace alone has the potential to offset half or more of the cost per acre of using the turf.” He also appreciates the ease of installation and maintenance. “The grass looks great. We have had over 150 inches of rain to date and very severe winds with no maintenance required afterwards. We probably would have re-graded and re-vegetated the cap several times by now if it was a soil cover.”

The company’s most recent project is the closure of a 65-acre county landfill in California. Agru/Closure Turf™ was selected because of its ability to withstand high winds,

and provide very stable slopes under seismic activity. Furthermore, the local community appreciates that it will take several thousand truckloads of dirt off the road and will recharge the water systems with water free from silt and potential nitrates commonly found in the local borrow soils. Product co-developer Mike Ayers notes, “With communities placing increasing value on sustainability, the use of Agru/Closure Turf™ benefits the environment immediately by reducing construction carbon emissions by 70 per cent and later on by providing a platform for future renewable-energy initiatives.” He explains that solar developers appreciate the ease in which solar panels can be integrated into the system while providing a clean and easily accessible solar field. “We are currently working on three solar landfill sites and we expect this to grow as we see more and more communities looking to extract value from land that would otherwise lie dormant. Even if communities are not ready to invest in current solar technology, just having the foundation in place for possible future implementation demonstrates smart economic and environmental stewardship.” ♦

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ISO-Veyor

Sustainable transport of CCP's for the cement industry

InBulk's ISO-Veyors save time and money in the transportation, storage and distribution of blended cements and related minerals, providing an economical platform for sustainable development.

Blended cements have grown in popularity for both technical and economic reasons. The high amount of energy and CO₂ produced in manufacturing and transporting cement, means the industry must take steps to reduce the impact on the environment. Transportation is a key area where costs and emissions can be reduced, through intermodal strategies for distribution. With road congestion, global trade and fuel costs on the increase; there is an economic and environmental challenge to be faced.

Patented and built by InBulk Technologies, ISO-Veyors are versatile, intermodal containers for effective transportation, storage and horizontal discharge of Dry Bulk Materials (without need for tipping). Available in a range of configurations, specifications, sizes and materials, they're ideal for all types of cement and CCP's.

The ISO-Veyor has a highly impressive technical specification. Available in mild steel, stainless steel or aluminium, it is also available in either 20ft or 30ft configurations.

ISO-Veyors are discharged by standard 2-barg air supply. They can be used in conjunction with a variety of intermodal infrastructure commonly used for box containers, including Intermodal Transfer Points, Rail Ports, Reach Stackers, Side Lifting Trailers and Cranes.



Intermodal Solution

The future proofed intermodal solution

As the transportation landscape evolves, and the demands of projects change, the ISO-Veyor provides a flexible, cost effective solution.

Road Transportation

The ISO-Veyor can be placed on a skeletal trailer and deployed as a powder road tanker. This combination provides an equivalent to road tankers at a significant cost advantage, with no loss in performance and a small payload difference. Customers utilising ISO-Veyors benefit from driver controlled deliveries, and are able to drop or switch loads without queuing for discharge slots. There's also no requirement for expensive tipping chassis, as ISO-Veyors discharge from a horizontal position.

Rail Transportation

The ISO-Veyor can be placed on a rail car and used in the same way as a powder rail tanker. This delivers great rail economics with all the flexibility of Just-In-Time road deliveries, allowing suppliers, end-users and rail operating companies new opportunities for intermodal rail freight supply.

Sea Transportation

ISO-Veyors are ideally suited for either short or deep sea shipping, in the same way as standard box containers. This allows customers to increase their export reach and widen their geographical radius of supply. ISO-Veyors can be stacked on either container ships or barges.



Benefits

Ground Storage

Used on the ground, the ISO-Veyor becomes a ready-made weatherproof silo, for storage of cement blends to be used for construction or precast projects. This helps to avoid multiple handling and cuts investment in new silo capacity.

Cost Benefits

ISO-Veyors provide the functionality of dedicated powder road or rail tankers – without the expense. Dedicated modal solutions require storage silos to receive the material at either end of the transport chain. ISO-Veyors remove this requirement. Product integrity is ensured as the material itself is not handled until discharge into the final process.

Intermodal Benefits

ISO-Veyors are easy to fill, discharge, and handle. Deliveries of Dry Bulk materials are safe, efficient and secure, as there's no requirement to transfer the material from one modal container to another.

Environmental Benefits

The ISO-Veyor is a closed, sealed system resulting in zero opportunity for pollution or spillage of material during transfers. There's also a greatly reduced chance of accidental discharge into waterways, the atmosphere or other sensitive areas. The balancing of loads between road, rail and sea has a significant effect on air pollution and provides little opportunity for contamination.

Flexibility

ISO-Veyors can be utilised in any transport and storage setting. They offer strategic flexibility as the transportation landscape evolves and projects change.

Safety

As ISO-Veyors can be discharged in a horizontal position, without the need for tipping, this leads to a reduced risk of accidents and represents a major improvement to the safety of on-site deliveries.

Case Study

ISO-Veyors play a crucial part in building the world's longest railway tunnel

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Above: American Coal Ash Association Executive Director Thomas Adams addressed symposium participants.

Top right and below right: One of the popular WOCA social events was a reception with a beer tasting menu featuring Colorado beers.



Of those, 17 oral presentations and 6 poster presentations were offered by students.

Awards to the student presenters included a tie for the best oral presentation between Nate Mauger of The Ohio State University and Chris Shearer of the Georgia Institute of Technology. The best student poster award went to Jooyoung Park of Yale

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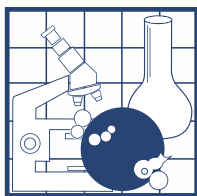
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The new journal *Coal Combustion and Gasification Products* sponsored a well-attended reception during the symposium.

University. Additionally, the Midwest Coal Ash Association awarded four \$500 cash stipends to students, including Josh Brein of University of Kentucky; Igor De laVarga of Purdue University, Nate Mauger of The Ohio State University, and Anne Oberlink of University of Kentucky.

Additional financial support for WOCA came from 25 sponsors and 58 exhibitors. The exhibitors represented a wide range of interests, including two universities, two affiliate associations, an

The exhibitors represented a wide range of interests, including two universities, two affiliate associations, an analytical laboratory, 13 engineering firms, an environmental firm, 13 coal ash marketers, two ceramics firms, three specialty equipment companies, four geotechnical liner companies, five specialty marketers, and the Lexington, Kentucky, Visitor and Convention Bureau.



More than 50 exhibitors displayed their products and services in the packed exhibit hall.



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analytical laboratory, 13 engineering firms, an environmental firm, 13 coal ash marketers, two ceramics firms, three specialty equipment companies, four geo-technical liner companies, five specialty marketers, and the Lexington, Kentucky, Visitor and Convention Bureau.

The next World of Coal Ash symposium will be held in Lexington, Kentucky, in the spring of 2013.

Detailed information about WOCA 2011, including copies of papers and presentation as well as records of previous World of Coal Ash events, can be found at www.worldofcoalash.org. ♦



Top and above: Judges and symposium attendees scrutinized the poster presentations.



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Symposium attendees enjoyed an evening reception at Colorado's world famous Red Rock Amphitheater.



Meeting rooms were packed for the symposium's oral presentations and always popular Coal Combustion Products Short Course.



College students in attendance at the symposium were honored at a student lunch.



A meeting of the World Wide Coal Combustion Products Network was conducted concurrent with the WOCA symposium.



SOIL STABILIZATION FOR ROAD CONSTRUCTION

**Local, State and Federal Cooperation Using Recycled Materials
Makes Wisconsin Project a Success**

By James R. Rosenmerkel, P.E.

Several years ago, Gordon Food Service, the nation's largest supplier of foodstuffs to the hotel and restaurant industry, acquired a parcel of land on County Road 'N' in Kenosha, Wisconsin, for a new distribution facility. It is adjacent to the Kenosha airport, has very convenient access to Interstate 94 and to the local state highway system. When Gordon Food contacted Kenosha County to secure utilities and some necessary roadway upgrades, they were told the County does not provide those amenities and could not meet the time requirements. But they agreed to contact the City of Kenosha to see if they could help. The City agreed to a jurisdictional transfer and to provide the facility upgrades Gordon Food needed to be successful.

This section of County Road 'N' in the Town of Somers, is about 1.5 miles long, consists of an old asphalt pavement, 22 feet in width with lots of adjacent trees and very narrow shoulders. It crosses the

Kilbourn Road Ditch which had a history of flooding most springs. It also borders the Kenosha airport and connects County Road 'S' [formerly State Highway 142] on the east with the I-94 frontage road system on the west. After several meetings, the City of Kenosha agreed to the transfer and began the pre-design analysis of the new street requirements. First order of business was to name it 38th Street. And while this seemed like a good idea, many of the residents along the new street were not happy with the prospect of a wider street that would be lighted and carry more traffic. They were also concerned about the possibility of tax increases since they were officially residents of the Town of Somers, not the City of Kenosha.

Design

The City engineering staff, headed by Mike Lemens, P.E., his project manager Cathy Honeyager and the Kenosha Water Utility staff, engaged a local engineering firm, Clark-Dietz to provide design services for the new street. Soil borings

were taken, preliminary utility designs were laid out, a field survey of the facility was completed and the work began. It became clear that typical utility construction would not work and the new sanitary sewer would need to be designed as a 40-foot deep tunnel project rather than the more typical open trench method. It also became evident that storm sewer and water main construction would result in variable soil types after the work was completed and trenches were backfilled. The native soils were of non-uniform bearing capacity at best, but the big issue was there was no site to dispose of unsuitable soils when they were encountered and time to construct this street was crucial. The options were listed, evaluated and the concept of stabilizing the new roadway with fly ash was selected.

Above: Highly variable and unstable soils in the area were stabilized using Class C fly ash prior to road construction.

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Before and after: A two-lane county road was widened and improved to support operations of a major distribution center constructed in the area.

A number of advantages were available with this option. First, a class 'C' fly ash source was nearby at the Pleasant Prairie Power Plant just five miles away and the city staff had completed other successful projects using this method. Second, the cost advantages were compelling. Third, after the demolition of trees and

pavement was complete and the underground work was complete, stabilizing the newly widened subgrade with fly ash before constructing the base course would provide a very stable, uniform platform on which to build the new concrete pavement. Fourth, since the project needed to be constructed in several sections and in virtually every weather condition spring to fall, performance of the new subgrade would be predictable. The segmented construction was necessitated to keep the street open for traffic from both east and west for the duration and to accommodate construction of a new bridge over the Kilbourn Road Ditch. It also needed to be coordinated with new construction along I-94 during the same time.

Construction Details

The first section of the new street was the east end, connecting County Road 'S' with the Gordon site about half a mile west. As construction proceeded, Cathy Honeyager and many of the Kenosha engineering staff were on site since it was the first project using fly ash stabilization most had seen. GESTRA, the geotechnical firm that performed field testing, was also on site. At the end of one early spring days, Honeyager observed "I can't believe how firm the subgrade materials became in such a short time." The day after the first fly ash stabilization was completed, new base course was completed and the process continued. Shortly after that, the first section of new concrete pavement was placed. The new 36 foot face-face concrete pavement section consists of two 12-foot driving lanes, adjacent bike lanes and standard curb and gutter. In areas of intersecting roadways, dedicated turn lanes were provided for the large volume of trucks.

The application rates for the fly ash as determined by Midwest Engineering Services lab testing was 120# /SY and the material was blended to a depth of 12 inches. Production rates for mixing were in the 50 – 55 feet per minute range, typical of this method. On-site quality assurance [Q/A] testing revealed densities over 95 percent of Proctor in most instances. On at least one occasion after the stabilizing had been completed for the day, rain fell on the new surface over night, yet the next day, the grade remained firm, much to the surprise of first time observers. Rain on a properly stabilized, compacted, graded

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and smooth rolled base is actually an asset since the additional moisture prolongs the hydration process. Some jurisdictions actually require the contractor to spray water on newly stabilized subgrades for several days prior to paving.

Teamwork

After new 38th Street became a City asset, plans to pay for the work needed to be finalized. The city would be responsible for the new right of way and construction. The county agreed to assist with some construction costs. And since this improvement would benefit Gordon Food, projecting that as many as 350 new jobs would be produced, Wisconsin Department of Transportation provided a TEA [Transportation Economic Assistance] grant for the primary construction. TEA grants are intended to support road improvement projects that result in new jobs.

After the bridge design was completed and plans were approved by the state [DOT and DNR], ARRA funds became available, even though some additional design modifications would be required

to qualify. Modifications were made and the new bridge constructed last fall now serves the immediate region well. It is unlikely that spring floods will have any impact on the truck traffic. According to Mr. Lemens, coordinating all the agencies involved in the financing of the work was nearly as much work for Ms. Honeyager as the engineering.

Last Phase and Evaluation

There remains one short section of 38th Street to complete. It is along the north side of the Kenosha airport. The plan is to mill two inches of the existing asphalt, widen the road by adding pulverized material from previous phases and place a new portland cement concrete pavement section across both the remaining asphalt and the pulverized material to match the adjacent section.

In a recent interview with Mr. Lemens and Ms. Honeyager, the latter said she was "pleased with the uniform soil condition, the good performance even after rain events, and the sustainability aspects of fly ash stabilization." She indicated she would use fly ash stabilization again.

Value of Materials Reuse

Stabilizing existing road materials with fly ash conserves resources and makes beneficial use of a product that might otherwise be discarded. In addition to stabilizing sub-grade materials with predominantly clay soils, fly ash is also used for stabilizing reclaimed asphalt pavement. In this application, soft sub-grades exhibit CBR increases from 4-6 to as much as 50-70 when treated with 10-12 percent Class 'C' fly ash.

The American Coal Ash Association, along with Federal Highway Administration and others, is developing a Green Highway Initiative that promotes sustainable construction techniques in improving the national transportation system. A large part of each of these initiatives is a concern for rapidly diminishing space for disposal sites in this country. They are a positive focus on reducing the "throw away" mentality in America. ♦

About the author: James R. Rosenmerkel, P.E. is a consultant to Lafarge North America. He can be reached at 262-547-2585 or at jrbrosie@sbcglobal.net.

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INNOVATION

Maximizing the Potential of Fly Ash

FLOWABLE FILL USING SPRAY DRYER ASH

Testing Shows Addition of Foam Improves Freeze Resistance

By Stan Peters, P.E.

Flashfill Services operates a three truck fleet of volumetric mixers in the Denver metro area supplying flowable fill mixes (or flash-fill) to a number of contractors and agencies. The company has provided these services since 2005, although personnel with the company have flash-fill experience that dates back to 1994.

Flashfill's mix designs have been used for difficult projects, such as filling voids left by abandoned piping systems. More commonly, however, flash-fill is used to backfill trenches and street cuts repairing utility services for potable water, sanitary and stormwater sewers, steam lines, fiber optic and communications cables and chilled water systems.

The ingredients for these mixes consist of Class C fly ash produced in Colorado and Nebraska and Class F ash with spray dryer adsorbent (SDA) residue from power plants in the Denver metro area. Originally, flash-fill mixes used just Class C



Core samples showed formation of ice lenses in upper layers of filled trenches

and Class F ashes alone, but when the local utility began scrubbing its units, the SDA residues were co-mingled with the Class F ash. Testing demonstrated little impact of the SDA material on the performance of the flash-fill and these mix designs have been used for more than three years.

In early 2010, Flashfill was notified by a local water district that they were observing raised portions of asphalt pavement patches over the flash-fill in a number of

locations throughout the district. In investigating these heaved patches Flashfill discovered that several other districts and counties had seen the same phenomenon which had also been investigated by several geotechnical engineering firms in recent years. Installation during cold winter weather was, at first, thought to be the main cause. However, in the evaluation of the 41 heaved patches reported, 37 percent were placed during the winter months (December to February), 10 percent in the spring, 29 percent during the summer months and 24 percent in the fall. Furthermore, a report was available from a different local municipality that investigated a heaved patch that had been placed in December 2002, nearly seven years earlier by a contractor other than Flashfill.

Flashfill retained the services of a materials engineer with a strong background in concrete and aggregates and a local geotechnical engineering firm to help analyze these heaved patches. During the laboratory testing, a specific set of samples from

cored flash-fill beneath a heaved patch were extensively examined and tested. These samples showed the formation of ice-lenses in the upper 12 inches of the flash-fill mixture in the trench. These ice crystals were very noticeable during the excavation of another failed repair. However, 10 to 12 inches below the top of the flash-fill mixture there was no evidence of cracking or ice formation in the mix. Initially, ettringite formation was considered, but XRD analysis of excavated samples showed no crystal formations, nor elevated levels of ettringite present in any of the surface material adjacent to the ice lenses, compared to the intact flash-fill mix.

A contributing factor was also identified that if the mix was not given about two hours to gain sufficient strength, compacting asphalt patches above the flash-fill too quickly could cause fracture cracking on the upper portions of the flash-fill. These cracks could then be affected by surface or groundwater seeping into the repaired area around the edges of the patch, allowing freezing temperatures to form ice in the cracks. Furthermore, in some situations, there were isolated patch-heaves along a trench where there was no evidence of other heaving in the same trench that might have been hundreds of feet in length. In many cases, the failures seemed to be associated with repairs of water system lines where excess moisture could have been present. In most cases, the heaved patches receded during warm weather seasons and were most pronounced in the colder, winter months. These heaves could then become problems for snow removal equipment.

As part of the engineering investigation, a literature search was conducted and a 2008 National Cooperative Highway Research Program Report #597 entitled "Development of a Recommended Practice for the Use of Controlled Low-Strength Material (CLSM) in Highway Construction" was located. An ACI 229R report on CLSM was also reviewed and both reports indicated that purposely entrained or introduced air content served to limit ultimate strength gain for future excavatability. The NCHRP report also indicates that higher air content also improves resistance to freeze-thaw damage in CLSM. It should be noted

that neither report mentioned ice-lenses developing in fracture cracks in CLSM.

This latter insight led Flashfill Services to explore developing mix designs that used pre-formed cellular foams to incorporate air intentionally into flash-fill mixes. A series of laboratory tests were conducted followed with field testing in which different proportions of Class C ashes with Class F SDA material were tested using different amounts of cellular foam. The field engineer and technicians sampled each test trench during the pour and took samples to the laboratory for further analysis and testing. Through this evaluative process the foamed mixtures were shown to resist freeze-induced cracking and these designs became the main product that Flashfill offers contractors, depending on the specific conditions of the repair project. Upon the completion of the field testing, the company made face-to-face presentations with laboratory data and engineering reports to each agency and water district that had been affected with the patch-heaving. As a result of the test data, Flashfill was authorized to use the new foamed flash-fill, whereas a ban on using conventional (non-foamed) flash-fill still exists in Jefferson County. Specifications requiring 15 to 21 percent air content for flash-fill were adopted by the Denver area Metropolitan Governmental Pavement Engineers Council (MGPEC). These air contents also make this material more easily excavated in the future.

All three Flashfill Services trucks have been modified with on-board foam generators that inject the cellular foam in the flash-fill

at the job site. This allows operators to adjust air content in the field to accommodate specifications that may differ between agencies, contractors or conditions.

The Colorado Department of Transportation has now implemented a new specification for flash-fill, requiring 15 to 25 percent air content, and allowing non-specification fly ash provided that the final mixture meets their new performance requirements.

Although it was not possible to determine the causes of the horizontal and fracture cracking in every case, the use of a foamed flash-fill has solved the patch-heaving problem since it was implemented in July 2010. Foamed flash-fill patches were monitored by several agencies over the 2010-2011 winter and they performed well. Flashfill has replaced failed sections, as requested by agencies and water districts, and is using the foamed mix designs for most all street repairs. If the application is not subject to freeze-thaw cycles, then FS is still using conventional (un-foamed) mixes to fill deep underground voids or piping systems. Additionally, flash-fill with high air contents using only Class C ash and a rapid-setting temporary pavement repair system, more durable than cold-mix asphalt, is being developed. Several patents are pending on these products and new technology. ♦

For additional information, contact Doug Hernandez, President Flashfill Services (flashfill@qwestoffice.net) or Stan Peters, P.E., of Castle Rock Consulting (StanPetersPE@aol.com).



Blended ash is used in a variety of trench and void-filling operations.



Photos courtesy of Charah, Inc.

STRUCTURAL FILL FOR AIRPORT EXPANSION PROJECT

Coal Ash Used in Conjunction with Geosynthetic Liner Systems

By Mary Reed, courtesy of Construction Equipment Guide

North Carolina's Asheville Regional Airport expansion project features an environmentally responsible component: the use of coal combustion products as fill material.

A regional partnership comprised of the airport, Raleigh, N.C.-based utility company Progress Energy Carolinas Inc. and Charah Inc. of Louisville, Ky. cooperated on the project, which began in 2009 when the airport identified opportunities to develop a new taxiway and general aviation commercial parcel in the southwest portion of the airport property.

"The site identified for development contains approximately 53.5 acres of land that was partially wooded with a couple of drainage features passing through the property providing outfall for stormwater runoff from the airport's existing infrastructure," said Norman Divers, senior engineer of Charah Inc. "To facilitate the future development of a new taxiway and commercial aviation site, known as the Westside Development project, significant site grading would be required.

Above: Crews install synthetic liner for the cap liner system at Asheville Regional Airport.

"Charah approached the airport's management staff to present a solution to the significant site development economics for the Westside Development project," Divers went on. "The solution involved the use of Coal Combustion Products (CCPs) as a suitable engineered structural fill material that would facilitate the rough grading needed to make the Westside Development project a reality. Using CCPs as an eco-fill material would offset the significant cost that soil structural fill material was presenting to the development of the project, as well as provide the means to conserve a natural resource by allowing any offsite soil borrow to remain undisturbed and left in place.

Coal combustion products have been recycled and used for decades for various construction purposes, including such historic projects as Boston's Big Dig and the Hoover Dam. CCPs also have been utilized for airport construction in Pennsylvania, Texas, and Wisconsin. Use of these by-products saves natural resources ton for ton and space at landfills, and in addition there are significant cost savings for the client.

"This project is the first of its kind, being an 'encapsulated' engineered fill meeting stringent protective features as found in the EPA's proposed rules for the reuse of Coal Combustion Products," stated Danny Gray, Charah's executive vice president.

Development of the site required approximately 2.1 million cu. yds. (1,614,434 cu m) of structural fill to establish the necessary rough grade elevations across the site, an amount of suitable structural soil that would both be hard to locate in western North Carolina and would involve the use of several borrow sources, as well as presenting a significant financial strain on the project. Estimates for suitable structural soil fill ranged from \$7 to \$8 per cu. yd. providing an overall cost of approximately \$15.8 million dollars.

"In addition to the fill requirements, the site presented a drainage challenge which involved the preservation of the existing runway stormwater drainage patterns, while still allowing the engineered fill material to be placed. Significant drainage improvements were constructed along



PC 400 Komatsu Excavator loading dewatered fly ash for transfer to project site.



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the eastern side of the engineered fill project to re-direct runoff around the work area and continue to maintain stormwater drainage as needed to maintain safe maneuvering, take-off and landing of airplanes,” said Lew Bleiweis, A.A.E., airport director at the Asheville Regional Airport Authority.

The Asheville Airport project, which is expected to be completed in 2014, will create 15 acres of aeronautical use land. The project created approximately 50 jobs for local residents and utilized numerous pieces of equipment.

“The engineered fill project was extensive and required a vast array of earth moving equipment. Large track excavators, Caterpillar 330CL, were used to remove soils to develop the subgrade surface of the engineered fill. Artic 40-ton end dumps were used to transport soils throughout the project to allow for the construction of containment berms, sediment basins and haul roads needed to serve the project,” Charah’s Vice President of Operations, Scott Sewell, said.

“Large bulldozers including the Caterpillar D6R were used to move soils as needed to achieve final grade elevations along slopes and the base surface of the engineered fill surface,” he continued. “Compaction was achieved using a Cat 815 compactor. Fine grading was performed using a Case 885 motorgrader and rolled to a final surface ready for deployment of liner using a Dynapac vibratory smooth drum roller.”

Liner was deployed by Chesapeake Containment Systems (CCS), Charah’s



Ash placement over lined fill area.

liner installation subcontractor, using retractable forklifts fitted with spreader bars. Rubber tired mules and rubber tracked mini-excavators were the only types of equipment allowed for use in placing the liner materials. Seaming for HDPE liner materials was performed principally using a double hot shoe welder that matched liner panels together. Seams were tested on-site using both vacuum and air test equipment and destructive testing also was performed on-site as well as sent to a lab for Construction Quality Assurance purposes.

“CCPs were spread using a Caterpillar D6N LGP dozer equipped with grade control to ensure the material was placed within the specified elevation tolerance of ± 0.25 feet,” Sewell stated. “Compaction of the CCP material was achieved using a Dynapac vibratory smooth drum roller. Numerous passes were made throughout each day, varying in direction achieving the compaction requirement of 95 percent modified Proctor. Compaction was confirmed using both nuclear and standard density testing methods.”

Coal combustion products have been recycled and used for decades for various construction purposes, including such historic projects as Boston’s Big Dig and the Hoover Dam.

Soil material in the final cover was moved and placed by using the Artic end dumps, D6 dozer, and motorgraders, and compaction was achieved using the 815 compactor and smooth drum roller. Soil materials were screened using a Chieftain Powerscreen to ensure particle size requirements were met as well as establishing an organic free soil material.

Protection for the environment and public concerns as related to the use of CCP materials was not limited to maintaining stormwater runoff for the existing runway. Additional measures of environmental and public health protection were provided in the design of the Westside Development engineered fill project, as Divers explained.

“A comprehensive liner system consisting of two layers of non-woven geotextiles encapsulating a layer of bentonite, commonly referred to as a geocomposite clay liner (GCL) in conjunction with a 60-mil high density polyethylene (HDPE) textured liner was provided between the excavated subgrade of the engineered fill limits and the CCP material. The GCL and HDPE liners act as a barrier layer preventing any CCP material or related moisture to pass through the comprehensive liner system into the subgrade soils or underlying groundwater table,” Divers said.

Presenting a hydraulic conductivity less than 5×10^{-9} cm/s, the GCL provides 200 times the protection currently required by Subtitle D regulations for clay that is a part of a liner system serving a municipal solid waste landfill.

“Closure of the engineered fill project included the installation of a 30-mil textured HDPE cap liner that was extended across the limits of the engineered fill providing a complete ‘encapsulation’ of the CCP material,” Divers noted. “In addition to the HDPE cap, six feet of soil cover was installed across the CCP fill limits at a compaction rate of at least 95 percent modified Proctor meeting FAA fill placement requirements for the development of aviation facilities and infrastructure. These improvements provide the necessary site conditions conducive to the continued development of the new taxiway and commercial aviation site.”

Speaking of the various complications involved in the Asheville Airport project, Sewell observed that “In an industry not traditionally known for its innovation, Charah has remained committed to developing and providing innovative solutions that are environmentally conscious. With nearly 20 years of engineered fill experience, our team of experts not only has done this before but we also are well versed in complying with government regulations as well as implementing the most up-to-date solutions.”

At the time of the project, state regulations allowing the use of CCP materials as suitable fill did not require the added use of the comprehensive liner system nor the provision for an HDPE cap liner. Charah and Progress considered the application of these design elements environmentally responsible and progressive to industry standards, while the project solved the economic strains that were preventing a much-needed infrastructure and commercial development for the airport, as well as providing an advanced and conscientious use of CCP material.

“Charah provides a broad base of services to the coal-fired utility industry to assist them in meeting the increasing environmental requirements under which they operate. We are committed to providing our utility partners innovative, environmentally conscious solutions to meet all of their ash management and power plant support services needs. In approaching the Asheville Regional Airport about this idea, we were able to provide a solution for Progress Energy and the airport, solving two problems at the same time,” said Charles Price, president and CEO of Charah Inc.

“As a group, Progress Energy, Charah and the Asheville Airport agreed to utilize only state-of-the-art products and materials for this project. We worked hard to design and construct the first of its kind, next generation facility utilizing the latest in environmentally sound engineering,” added Rob Reynolds, project manager at Progress Energy.

The Asheville Airport project was recently recognized by the South-East Chapter of the American Association of

Airport Executives when it was presented with their General Aviation Project of the Year Award for creative use of a regional partnership to efficiently, effectively, and safely conduct a major fill project.

Charles Price founded Charah Inc., in 1987 and has more than 35 years of experience in the construction industry. In 1992, he began focusing exclusively on ash management and is now recognized as an industry leader and expert. He currently serves on the board of directors of the American Coal Ash Association as Secretary/Treasurer.

Based in Louisville, Ky., Charah Inc. is a coal combustion products (CCP) management company working in the coal-fired electric utility industry. In operation for more than twenty years and handling more than six million tons of various CCPs annually, its areas of expertise include support services for power plants, construction of ash ponds and landfills and development of markets here and abroad for client's CCP material as well as assistance in meeting industry-wide environmental requirements.

Charah's work in the coal by-product industry earned it the 2005 Innovation Award from the EPA's Coal Combustion Products Partnership (C2P2) for increasing the use of coal-combustion products with its ash-based packaged concrete. The company is currently processing bottom ash that is being sold to Quikrete for production into packaged concrete at an Ameren facility outside St. Louis. The final product is being sold into Home Depot locations in Missouri.

The company's current projects include the design, permit, construction, and operation of a 65-acre landfill for and in partnership with Constellation Power Source Generation Inc., of Baltimore. With a capacity of about seven million tons of CCBs and an anticipated life span of 22 years, it will be the first in Maryland featuring CCPs and built to the EPA's new potential regulations. Special features include a leachate collection system, groundwater monitoring wells, stormwater management system and the preservation of on-site wetlands. ♦

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AMERICAN COAL ASH ASSOCIATION MEMBERSHIP

Your Membership Supports Advancing the Management and Use of Coal Combustion Products



BENEFITS OF MEMBERSHIP

Membership in ACAA provides support for the development, implementation, and continuation of effective programs for the management and use of CCPs. There are numerous benefits for coal-burning electric utilities resulting from the use of CCPs in lieu of disposal. In addition to avoiding disposal costs and creating revenue, added benefits come from public and government recognition of the utility as a supporter of sound policies for recycling and sustainable development. ACAA members share a common interest in using CCPs as valuable products to enhance revenues, minimize disposal costs, reduce liability, and support environmental policies. ACAA members are active at national, regional, state, and local levels.

Unified Industry Voice

- Establish coal ash, or CCPs, as a mineral resource that conserves natural resources
- Promote CCPs as engineering and manufacturing materials
- Support federal agency activities that promote the use of CCPs
- Represent CCP industry in national standards committees and industry groups
- Provide information to government, industry and public sectors
- Assist in development of sound engineering practices
- Serve as centralized source of technical information
- Create and present educational programs

Information Exchange and Networking

- Meet with specifiers, purchasers and users of CCPs
- Produce technical papers for publication and presentation
- Develop consensus standards and guides for the use of CCPs
- Identify regulatory and legislative opportunities
- Participate in trade shows and exhibitions
- Distribute promotional items and literature
- Provide networking opportunities

Educational Opportunities and Professional Growth

- Hold regular committee meetings and educational workshops
- Host international symposium on the management and use of CCPs
- Publish workshop and conference proceedings
- Provide educational programs for CCP managers
- Distribute newsletter, technical briefs and general information
- Produce technical papers, reports, manuals and videos

- Create technical assistance programs tailored to member needs
- Facilitate exchanges of technical information

Market Awareness and Development

- Coordinate the implementation of consensus standards for use of CCPs
- Communicate government policies for procurement of CCPs
- Promote comparisons of CCPs to competing materials and products
- Reduce CO₂ emissions from other industries through increased use of CCPs
- Advance technically sound, commercially competitive & environmentally safe uses
- Remove technical, legal and regulatory barriers to the use of CCPs
- Support “infrastructure development” and “sustainable growth” using CCPs
- Distribute published materials for educational and promotional activities

HOW DO I JOIN?

ACAA members share a common interest in recycling coal combustion products as valuable materials that support environmental sustainability, minimize the

need for disposal, generate revenues, and reduce liability. Our members are active at national, regional, state, and local levels. An application form is provided for submission.

MEMBERSHIP CATEGORIES/CLASSES

U – Electric Utility Producers: CCP producers include electric utilities and independent power producers located in North America or the Territories of the United States of America.

N – Non-utility Producers: Non-utility CCP producers or persons controlling such producers, not otherwise included in membership Category U, whose CCP-producing facilities are located in North America or the territories of the United States of America.

M – General Marketer: General marketers manage or broker CCPs for application such as, but not limited to, fly

ash pozzolanic and cementitious uses, waste and/or soil stabilization, etc.

MS – Specialty Marketer: Specialty marketers manage or broker specialty products ONLY, such as non-pozzolanic, non-cementitious materials including but not limited to cenospheres, bottom ash, synthetic gypsum, CCPs for structural fill or reclamation, etc.

I – Individual Membership: Individuals may join ACAA if they do not represent an organization that would otherwise fall into Categories O, M, N, U or Class Associate (below). These are persons acting individually as consultants or advisors for CCP issues consistent with the mission of ACAA.

H – Honorary Membership: Honorary members are nominated and subsequently recognized by ACAA as outstanding individuals and experts in one or more areas of CCP technology.

AS – Associate Member: Organizations, domestic or international, with the same goals as ACAA, but not specifically part of the CCP industry and not otherwise eligible for membership in any category of the “Member” category. Examples of Associate Members are organizations that support cement and concrete, green building and sustainable development and general construction, and have an indirect interest in the promotion of CCPs as it might support their own goals.

AF or UV- Affiliate Membership: Not-for-profit organizations, whose goals directly support the CCP industry and consequently support the goals of the Association. The primary purpose of affiliate membership is to facilitate the exchange of educational, technical and related information between ACAA and affiliate members. Such organizations include other CCP associations, domestic and international, and groups who work together with the Association on compatible goals, common points of interest and issues of impact upon the CCP industry. ♦



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ACAA MEMBERSHIP APPLICATION

SECTION 1: APPLICANT INFORMATION

APPLICANT CONTACT INFORMATION

Applying Organization or Individual Name:

Business Address:

City:	State:	ZIP Code:
Phone:	Website Address:	

PRIMARY POINT OF CONTACT

Designated Primary POC Name/Title:

Phone:	E-mail:	Fax:
Address (If different from above):		

City:	State:	ZIP Code:
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ALTERNATE POINT OF CONTACT

Designated Alternate POC Name/Title:

Phone:	E-mail:	Fax:
Address (If different from "Business Address" above):		

City:	State:	ZIP Code:
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SECTION 2: ACAA MEMBERSHIP CLASSES

Please read the following membership category descriptions, checking off the one which best describes your CCP involvement. Complete the referenced following sections indicated for your selection.

GENERAL MEMBERSHIP CLASS DESCRIPTIONS

<input type="checkbox"/>	Electric Utility CCP Producer (Category U): CCP producers to include electric utility and independent power producers (IPPs) located in North America or the Territories of the United States of America. (Complete Section 3 A., 4, 5 and 6 below)
<input type="checkbox"/>	Non-Electric Utility CCP Producer (Category N): Producers of CCPs other than Class U or persons controlling such producers of CCPs who have CCP producing facilities located in the United States or the Territories of the United States of America (Complete Sections 3 B., 4, 5 and 6 below)
<input type="checkbox"/>	General CCP Marketer (Category M): General marketers manage or broker CCPs for applications such as, but not limited to, fly ash in pozzolanic and cementitious uses, waste and/or soil stabilization, etc. (Complete Section 3.C., 4, 5 and 6 below)
<input type="checkbox"/>	Specialty CCP Marketer (Category MS): Specialty marketers manage or broker specialty CCPs only, such as non-pozzolanic, non-cementitious materials including but not limited to, cenospheres, bottom ash, synthetic gypsum, CCPs for structural fill or reclamation, etc. (Complete Section 3.D., 4, 5 and 6 below)
<input type="checkbox"/>	Individual (Category I): Individuals may join ACAA if they do not represent an organization that would otherwise fall into categories M, N, U or Class Associate. These are persons acting individually as consultants or advisors for CCP issues consistent with the mission of ACAA. (Complete Section 3.E., 4, 5 and 6 below)

ASSOCIATE MEMBERSHIP CLASS

<input type="checkbox"/>	Class Associate Member (Category AS): are organizations with commercial, research and development, or other related interest in the utilization of CCPs which do not qualify for membership in any other ACAA membership categories. (Complete Section 3.F., 4, 5 and 6 below)
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AFFILIATE MEMBERSHIP CLASS

<input type="checkbox"/>	Class Affiliate Member (Category AF or UV): "Not-for-profit" organizations whose goals directly support the CCP industry and consequently support the goals of ACAA. The primary purpose of Affiliate membership is to facilitate the exchange of educational, technical and other related information between ACAA and Affiliate members. Such organizations include other CCP associations, domestic and international, or groups who work together with ACAA on compatible goals, common points of interest and issues which impact the CCP industry. Affiliates do not pay dues. (Complete Section 3.G., 4, 5 and 6 below) <u>Universities, before selecting this option, should contact the ACAA staff for more information.</u>
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SECTION 3: MEMBERSHIP DUES

Membership dues are calculated on a full year's membership and, where applicable, prorated on a calendar year basis. "Voting rights" are granted to eligible members who pay dues equal to or greater than \$3300. Check the desired membership dues status box related to the membership category you chose in Section II above.

A. Electric Utility Producer (Category U): Dues for Electric utility producers of CCPs shall be computed at \$4.00 per megawatt of owned operating coal-fired generation. The maximum annual dues amount for any Category U members is \$15,000. The minimum annual dues amount is \$1,650. The minimum voting membership dues are \$3,300. Complete a Category U Dues Calculation Worksheet available for download on the ACAA "How do I join" page. The Category U calculation worksheet is handled as confidential information. After completing the worksheet, fax it along with this application to ACAA.

Enter total owned, coal-fired megawatts: _____	Check if voting status desired and calculated dues are less than \$3,300	
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<u>B. Non-Electric Utility CCP Producer (Category N):</u>	Voting Member (\$3,300)		Non-Voting Member (\$1,650)	
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<u>C. General CCP Marketer (Category M):</u> General Marketer dues are subject to established limits up to a maximum of \$13,500. These are based on the total tons of CCPs marketed, brokered or managed during the previous calendar year. Any marketing data submitted to ACAA for the purpose of determining annual dues is treated as confidential. Check the amount of marketed CCPs applicable to your organization.	Small - Up to 250,000 Tons/Year (\$6,000)		
	Medium - 250,001 to 500,000 Tons/Year (\$8,500)		
	Large - 500,001 to 1,000,000 Tons/Year (\$11,000)		
	Very Large - Over 1,000,000 Tons/Year (\$13,500)		

<u>D. Specialty CCP Marketer (Category MS):</u>	Voting Member (\$3,300)		Non-Voting Member (\$1,650)	
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<u>E. Individual (Category I)</u> (Not Pro-ratable):	Voting Member (\$3,300)		Non-Voting Member (\$300)	
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<u>F. Class Associate Membership (Category AS):</u>	Voting Member (\$3,300)		Non-Voting Member (\$1,650)	
--	-------------------------	--	-----------------------------	--

<u>G. Class Affiliate Membership (Category AF or UV):</u>	Pay no dues.			
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SECTION 4: CCP RELATED INTEREST AND/OR INVOLVEMENT

Provide a descriptive profile of applicant's CCP related business interests and activities **THIS SECTION MUST BE COMPLETED TO PROCESS THE APPLICATION.** (If necessary, attach additional sheet).

SECTION 5: ACAA COMMITTEE INVOLVEMENT

Check one or more boxes to indicate your interest in serving on any of the following ACAA program committees

Government Relations		Technical		Communications & Marketing	
----------------------	--	-----------	--	----------------------------	--

SECTION 6: CERTIFYING SIGNATURE

Name/Title of Designated Representative Submitting this Application:	
Signature of Designated Representative:	
Date of Application Submission:	

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