

# Future of Fly Ash in the Carolinas

## Recent Developments with Beneficial Use and Coal Ash Basin Closure in the Carolinas

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Management (CALM) Office

CRMCA Summer Meeting -- June 18, 2015



UNC CHARLOTTE

# Acknowledgements

Dr. John Daniels, Professor and Chair  
Dr. Milind Khire, Professor

**UNC Charlotte**  
Civil and Environmental Engineering  
Department

# Disclaimer and Limitations

The information provided in this presentation is an update on work product and applied research that is still in the process of being finalized. Any conclusions made from this information are made at the risk of those using and/or interpreting the information. This is not a professional report and/or a technical evaluation. This is an update of recent actions by a wide variety of professional organizations to assess and remediate the coal ash basins in North Carolina.

The views expressed in this presentation are not necessarily the views of UNC Charlotte or the Energy Production Infrastructure Center (EPIC). This is a review and recent update of what is happening with various state organizations, engineers and contractors who are working to solve the problems with coal ash and unlined ash basins in North and South Carolina.



# Background and Credentials of C. Hardin

- ▶ Professional Engineer registered in six states including NC, SC, VA and GA.
- ▶ Former member of the American Coal Ash Association (ACAA) Executive Committee
- ▶ Designed one of the first lined coal ash landfills in North Carolina – R.J. Reynolds Landfill in Rural Hall, NC and the first landfill after the TVA Kingston failure, Lee Steam Station in South Carolina.
- ▶ Designed and implemented one of the largest coal ash structural fills in North Carolina.
- ▶ Was present at the Dan River repair to coach and guide contractors.
- ▶ Currently Director of the Energy Production Infrastructure Center (EPIC) Coal Ash and Liquid Management (CALM) Office at UNC Charlotte.
- ▶ Part-time sustainable, organic farmer who regularly interacts with environmental groups in the Carolinas.
- ▶ Currently involved with some of the largest, and most challenging ash basin closure designs in the United States.



# Agenda and Topics

- ▶ Explanation and Introduction of the Coal Ash and Liquid Management Office
- ▶ Context of Laws, Regulations and Legal Ash on Coal Fly Ash
- ▶ Supply and Demand of Fly Ash – Will Sufficient High Quality Fly Ash Available?
  - ▶ How and Why can we promote more beneficial use of fly ash in the Carolinas?
- ▶ Consequences of CAMA 2014 and the Federal CCR Rule on fly ash beneficial use in NC and SC
- ▶ Update on Ash Basin Closure Design and Construction Methods – More Challenging than Expected

# Purpose and Objective of the CALM Office

**Purpose:** To develop practical, technology-based solutions for the electric power and energy production industries to address problems and challenges with coal ash and liquids management.

**Objective:** To work with a wide variety of Industry Partners, the electric power utilities and energy production companies to provide the most recent technology addressing waste management, **beneficial use (i.e. coal ash and other byproducts)** and liquids management and treatment. This will be accomplished by initiating **a combination of applied research projects, and large demonstration projects** that increase safety, achieve regulatory compliance, improve long term performance and reduce cost.

# What is the EPIC Coal Ash and Liquid Management Office?

- ▶ A practical *applied research* and *technical solutions* center for coal ash and energy liquids management.
- ▶ Will be an University Cooperative Research Center that can leverage the funds from a wide variety of sources including the Department of Energy, NSF and the National Energy Test Labs.
- ▶ A safe place to think and apply innovative thoughts.
- ▶ A place to discuss problems or sensitive topics about coal ash and energy liquids in a manner that is both *confidential* and *protective* of intellectual property.
- ▶ A place where competitors in the coal ash industry can come together to discuss and solve common problems about excavation safety, regulatory permits, and mis-information about the perceived risks of coal ash and energy liquids.

# Leadership of the EPIC Coal Ash and Liquids Technology Office

- ▶ Chris Hardin, P.E., Managing Director and Industry Liason for CALM Office. Working on several field applied research projects.
- ▶ Milind Khire, P.E., Technology Director of CALM Office. Initiating several important bench scale applied research projects.
- ▶ David Causey, P.E., Assistant Director of EPIC and Workforce Training for the CALM Office.
- ▶ John Daniels, P.E., Deputy Director and Chairman of the National Ash Management Advisory Board. The main adviser on coal ash issues for the CALM Office.

**Key Point:** **UNC Charlotte** and **NC State** are *applied research* universities that encourage change and sustainable lifestyles by initiating practical **Demonstration Projects**.

# Founding Industry Partners of the CALM Office



Since January 2016, ten additional industry partners and four electric power companies have joined the CALM Office

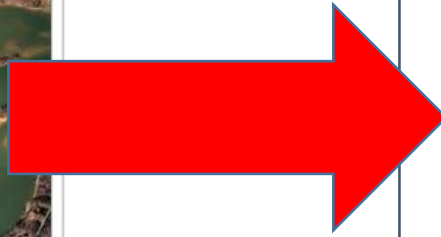
# Context of Laws, Regulations and Legal Action



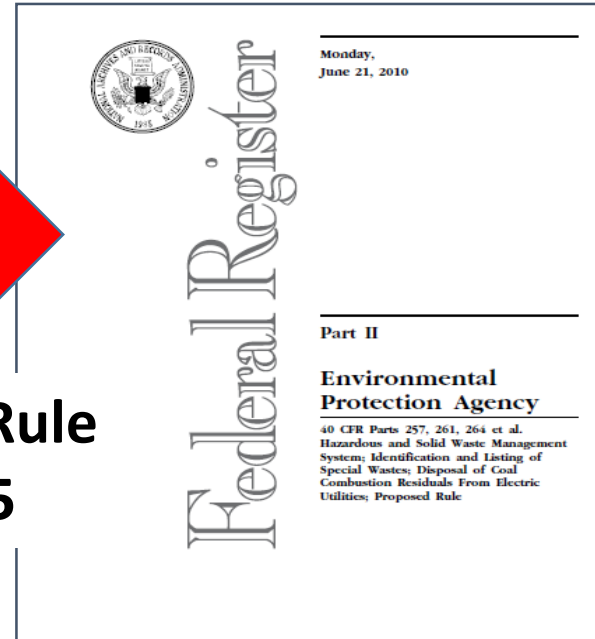
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## Federal CCR Rule April 2015



North Carolina is **LEADING** the way with State Implementation of the Federal CCR Rule!



## 2014 NC Coal Ash Management Act

APPROVE COAL COMBUSTION RESIDUALS SURFACE IMPOUNDMENTS CLASSIFICATIONS AND CLOSURE PLANS AND OTHERWISE STUDY AND MAKE RECOMMENDATIONS ON LAWS GOVERNING MANAGEMENT OF COAL COMBUSTION RESIDUALS; (4) REQUIRE EXPEDITED REVIEW BY THE DEPARTMENT OF ENVIRONMENT AND NATURAL RESOURCES OF ANY PERMIT NECESSARY TO CONDUCT ACTIVITIES REQUIRED BY THIS ACT; (5) ESTABLISH VARIOUS REPORTING REQUIREMENTS TO THE GENERAL ASSEMBLY, INCLUDING A QUARTERLY REPORT FROM THE DEPARTMENT OF ENVIRONMENT AND NATURAL RESOURCES ON ITS ACTIVITIES, PROGRAMS, AND PROGRESS WITH RESPECT TO THE REQUIREMENTS UNDER THIS ACT FOR COAL COMBUSTION RESIDUALS SURFACE IMPOUNDMENTS; (6) PROHIBIT LOCAL GOVERNMENT FROM CONSTRUCTION OF COAL COMBUSTION RESIDUALS SURFACE IMPOUNDMENTS; (7) PROHIBIT CONSTRUCTION OF NEW COAL COMBUSTION RESIDUALS SURFACE IMPOUNDMENTS EFFECTIVE OCTOBER 1, 2014; (8) PROHIBIT COAL COMBUSTION RESIDUALS SURFACE IMPOUNDMENTS AT COAL-FIRED GENERATING UNITS THAT ARE CURRENTLY PRODUCING COAL COMBUSTION RESIDUALS EFFECTIVE OCTOBER 1, 2014; (9) PROHIBIT DISPOSAL OF STORMWATER TO COAL COMBUSTION RESIDUALS SURFACE IMPOUNDMENTS EFFECTIVE DECEMBER 31, 2018; (10) REQUIRE ALL ELECTRIC GENERATING FACILITIES TO CONVERT TO GENERATION OF DRY FLY ASH ON OR BEFORE DECEMBER 31, 2017, AND DRY BOTTOM ASH ON OR BEFORE DECEMBER 31, 2020, OR RETIRE; (11) REQUIRE THE ASSESSMENT OF GROUNDWATER AT COAL COMBUSTION RESIDUALS SURFACE IMPOUNDMENTS; (12) REQUIRE CORRECTIVE ACTION

A BILL TO BE ENTITLED  
AN ACT TO (1) REQUIRE A COAL COMBUSTION RESIDUALS IMPOUNDMENT OWNER TO PROVIDE PERMANENT ALTERNATIVE WATER SUPPLIES FOR RESIDENTS IN AREAS SURROUNDING COAL COMBUSTION RESIDUALS SURFACE IMPOUNDMENTS; (2) EXTEND THE PERIOD FOR PUBLIC COMMENT AND REVIEW OF PROPOSED RISK CLASSIFICATIONS FOR COAL COMBUSTION RESIDUALS SURFACE IMPOUNDMENTS; AND (3) MODIFY APPOINTMENTS TO THE COAL ASH MANAGEMENT COMMISSION, THE MINING COMMISSION, AND THE OIL AND GAS COMMISSION, IN ACCORD WITH THE HOLDING OF *MCCRORY V. BERGER*.  
The Coal Ash Management Act of 2014 required the owner of a coal combustion residuals surface impoundment to sample and analyze the water quality of drinking water wells in areas surrounding coal combustion residuals surface impoundments and, if the sampling and water quality analysis indicated that water from a drinking water supply well did not meet groundwater quality standards for constituents associated with the presence of the impoundment, required the owner to replace the contaminated drinking water supply well with an alternate supply of potable drinking water and an alternate supply of water that is safe for other household uses; and  
Whereas, the Department of Environmental Quality recently reported that well water of residents living nearby coal ash residuals impoundments met federal requirements for safe drinking water, but the General Assembly nonetheless recognizes that confusion and worry has

## 2016 NC Senate Bill 071

- (1) Any hazards to public health, safety, or welfare resulting from the impoundment.
- (2) The structural condition and hazard potential of the impoundment.



# Increasing Pressure on Electric Power Utilities and Energy Production Companies From All Sides...Safe, Cost Effective, and NOW

- ▶ Duke Energy, AEP, TVA and all coal-fired power utilities are being pressured to clean up their wet ash ponds, increase beneficial use and discover new cost effective methods.
- ▶ **Constructability** and **safety** of working over and around soft, saturated coal ash is a MAJOR issue.
- ▶ Aggressive state and Federal regulations for ash pond closures and all types of energy production increase the need for applied research and field demonstration projects.
- ▶ **Energy production** and **electric power companies** have similar struggles with byproduct management and wastewater treatment.
- ▶ Dewatering of wet ash materials, energy production wastewater treatment and stabilization of FGD wastewater sludge all present challenges where there are few cost effective options.

# Final CCR Rule and NC CAMA 2014 (1 of 2)

Provisions of Final CCR Rule – April 2015	Provisions in North Coal Ash Management Act - 2014
CCR Compliance Schedule and phased closures for ash impoundment from 2017 to 2029 flexibility depending on groundwater impacts, structural integrity, etc.	Specific dates for closure of High Priority sites – 12/2019, requires all sites to be classified as High, Intermediate or Low by 12/31/2015.
Location Restrictions and Structural Integrity	Additional criteria for risk classification above and beyond the requirements of the Final CCR Rule. Including requirements for proximity to surface waters, structural condition/hazard potential and “any other factor deemed relevant by the NCDENR”.
Inactive Units – Quick Turn Closure of Older Already Impoundments	May or may not allow quick turn closure of “inactive sites” depending on impoundment classification according to the Risk Classification Criteria from NCDENR.
Groundwater Monitoring is required, but degree of extent to be determined by the State regulatory agencies.	Additional requirements that includes extensive groundwater assessments and corrective action following the guidelines of the NCAC 2L regulations.
Allows management of stormwater and decant water through CCR impoundments throughout the closure process.	Requires special discharge requirements for treatment of decant water through CCR discharges. After 12/31/2019 the discharge of stormwater through surface impoundment is prohibited.



# Final CCR Rule and NC CAMA 2014 (2 of 2)

Provisions of Final CCR Rule – April 2015	Provisions in North Coal Ash Management Act - 2014
Public Notification, Recordkeeping and Internet Posting	Similar to the Final CCR Rule. Additional public review by the NC Coal Ash Management Commission, NCDENR, and the NC Environmental Management Commission.
Liner Design Criteria	Design and permitting of new landfills and impoundments
Liquefaction and Seismic Stability of Impoundments.	Will follow the requirements of the Final CCR Rule, but will need to account for local seismic events of static liquefaction as ash impoundments are excavated to clean closure.
Beneficial Use – not specifically addressed in the Final Rule, but provides for classification as “encapsulated” or “unencapsulated” uses of CCRs.	Emphasizes beneficial use of CCRs as the preferred longterm alternative. Requires specific reports on the technical and business aspects of beneficial use in North Carolina from Duke Energy and the NC Coal Ash Management Commission.
Self Implementing Aspects of the Final CCR Rule – requires implementation by electric power utilities ahead of adoption by the States. Implement the citizen enforcement clause for “gray areas”.	<b>NC CAMA passed approximately 1 year ahead of the Final CCR Rule.</b> Provides for adjustments to NC CAMA by the Coal Ash Management Commission, but places an emphasis on quicker closure and compliance to protect groundwater and surface water.



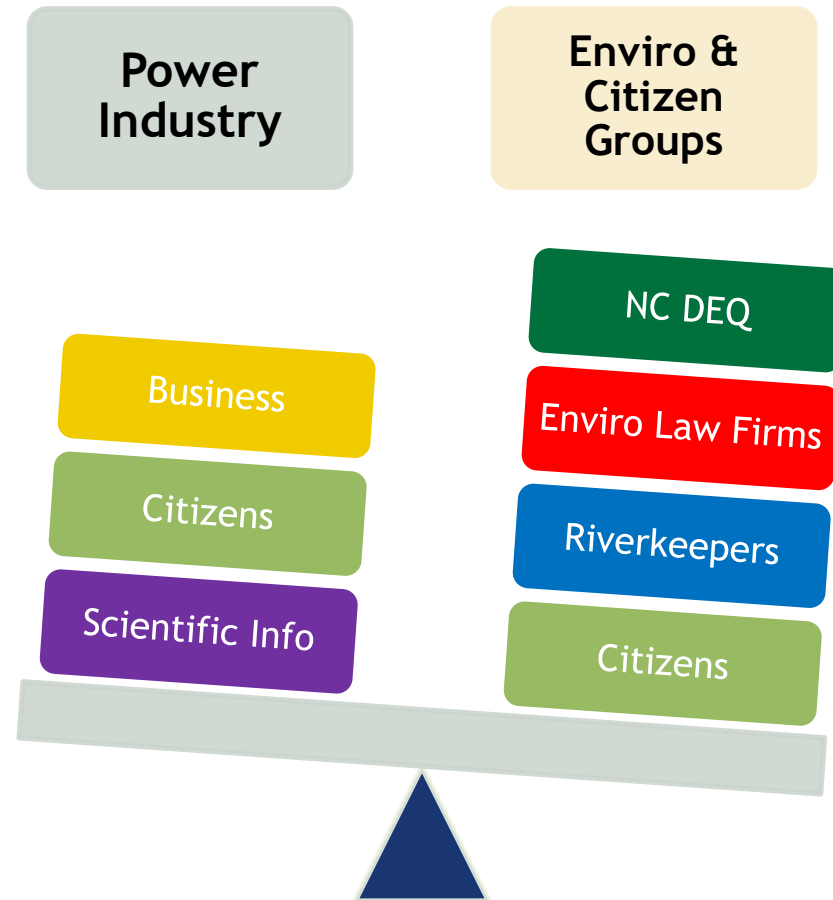
# Lawsuits, Legal Action from Industry and Environmental Groups

Question: How does the legal conflict over coal fly ash affect business in North and South Carolina?

Who is winning?

Who is losing?

How can we promote a longterm and sustainable solution?



Question: Do the Enviro Law Firms accurately represent the consensus of opinion from Citizens and Environmental Groups?

# Correction of Mis-Formation: Is Coal Fly Ash Toxic?

## Ash has less Toxicity than Most “Old Men’s Vitamins”

- ▶ Toxicity is a correlation of nutrient or “contaminant” levels and dose.
- ▶ Most of the heavy metals in coal fly ash are considered nutrients that are necessary for healthy function of the human body.
- ▶ One exception is Arsenic, a naturally occurring substance or heavy metal that is present in 80 percent of the earth’s crust.
- ▶ Boron, Cadmium, Chromium, Zinc, Iron and Molybdenum are all in coal fly ash and are considered essential for human health.
- ▶ Most of the mg/L levels in vitamins are higher than the Maximum Contaminant Levels (MCLs) for groundwater.
- ▶ **Summary: All things in moderation. Do not take more than one vitamin per day, Do not eat coal fly ash. Do not eat soil from the Piedmont region of the United States.**

Scientific Truth about coal fly ash toxicity can help prevent unnecessary legal action and ineffective legislation.

No Color Added • No Artificial Flavors • No Preservatives • No Yeast • Gluten Free  
SUGGESTED USE: Take one tablet daily with a meal. For easier swallowing, take with water before and during ingestion.

Supplement Facts			
Serving Size 1 Tablet			
Amount Per Tablet	% Daily Value	Amount Per Tablet	% Daily Value
Vitamin A 2500 IU	50%	Biotin 30 mcg	10%
(as Vitamin A Acetate and 60% as Beta Carotene)		Pantothenic Acid 10 mg	100%
Vitamin C (as Ascorbic Acid) 180 mg	300%	(as d-Calcium Pantothenate)	
Vitamin D <sub>3</sub> (as Cholecalciferol) 1000 IU	250%	Calcium (as Calcium Carbonate) 162 mg	16%
Vitamin E (as d-Alpha Tocopheryl Acetate) 50 IU	167%	Iodine (as Potassium Iodide) 150 mcg	100%
Vitamin K (as Phytonadione) 80 mcg	100%	Magnesium (as Magnesium Oxide) 100 mg	25%
Thiamin (as Thiamin Mononitrate) 1.5 mg	100%	Zinc (as Zinc Oxide) 15 mg	100%
Riboflavin 1.7 mg	100%	Selenium (as Sodium Selenate) 70 mcg	100%
Niacin (as Niacinamide) 20 mg	100%	Copper (as Cupric Sulfate) 2 mg	100%
Vitamin B <sub>6</sub> (as Pyridoxine Hydrochloride) 4 mg	200%	Manganese (as Manganese Sulfate) 4 mg	200%
Folic Acid 400 mcg	100%	Chromium (as Chromium Chloride) 120 mcg	100%
Vitamin B <sub>12</sub> (as Cyanocobalamin) 18 mcg	300%	Molybdenum (as Sodium Molybdate) 75 mcg	100%

OTHER INGREDIENTS: Cellulose Gel, Corn Starch, Maltodextrin, Croscarmellose Sodium, Hypromellose, Magnesium Stearate, Silicon Dioxide, Gelatin, Polyethylene Glycol.  
Distributed by: **Nature Made Nutritional Products**,  
Mission Hills, CA 91346-9606, U.S.A. 1-800-276-2878 • [www.NatureMade.com](http://www.NatureMade.com)

Keep bottle tightly closed. Store in a cool, dry place, out of reach of children.  
Do not use if imprinted seal under cap is broken or missing.  
USP has tested and verified ingredients, potency and manufacturing process. USP sets official standards for dietary supplements.  
[www.uspverified.org](http://www.uspverified.org)

# **Supply and Demand of Fly Ash**

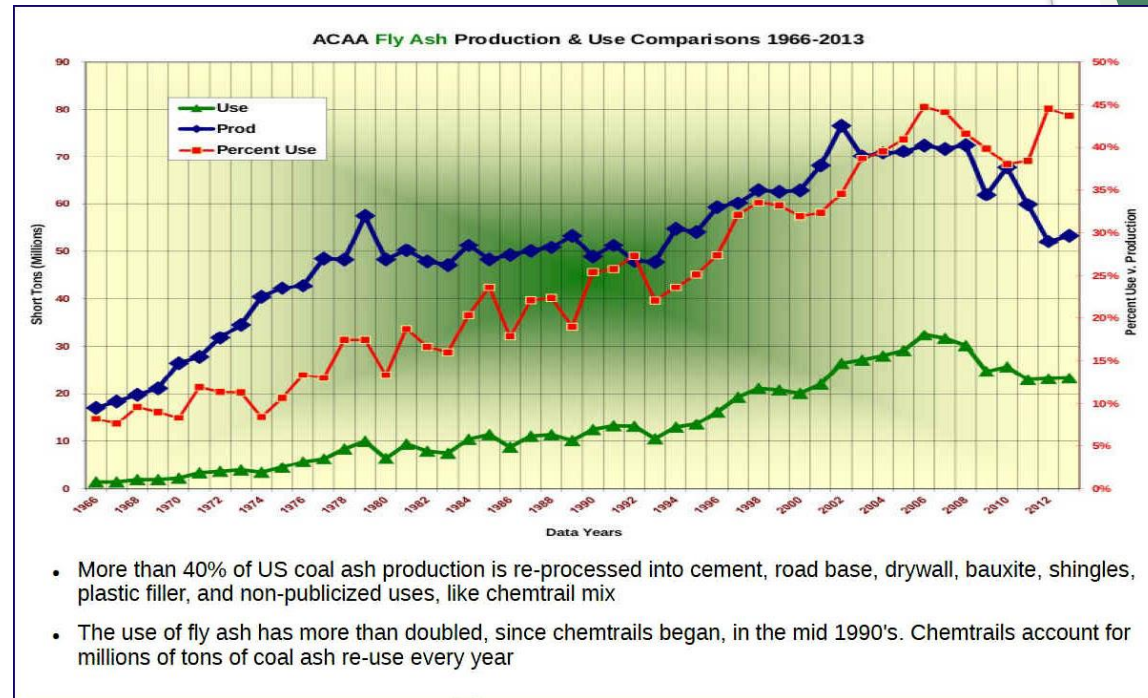
## **Will Sufficient Fly Ash Be Available?**





# ACAA and Headwaters Report on Fly Ash Supply

- ▶ ACAA shows that the balance between production and beneficial use in concrete and other production should be consistent for the next 10 years.
- ▶ Headwaters Resources indicates that the balance between production and use of fly ash should be consistent much longer.
- ▶ There are “clouds on the horizon” depending on the location of high quality fly ash and the cost of transport to Redi-mix concrete supplies.
- ▶ Summary: North Carolina and South Carolina are two states show the benefits and challenges with production and use of fly ash.





# Quotes from Recent Articles on North Carolina and South Carolina Fly Ash for Concrete (1 of 2)

## Concrete makers look to import coal ash, Charlotte Observer

March 2016, Bruce Henderson

“As Duke Energy ships coal ash across the Piedmont to dump it in a former clay mine, Charlotte’s largest concrete company is negotiating to buy ash in Asia.

Ash, the focus of a statewide cleanup that Duke estimates will cost \$3.4 billion, is a coveted ingredient for concrete makers. Despite the 157 million tons in ponds and landfills across the state, the industry says it can’t secure enough ash in Duke’s home base.

They’re proceeding with the cleanup but they’re really not pursuing a strategy to put it in the hands of somebody else, other than put it in the ground,” said Henry Batten, president of Charlotte’s Concrete Supply Co.c

## A Practical and Sustainable Approach to Dealing with Coal

**Ash,** Charlotte Observer Editorial June 2016, Chris Hardin

“What happens if we dig up all the coal ash, and move it to a lined landfill by 2024 as required by CAMA? Moving this amount of industrial waste byproduct has never been done before, and would require over 600,000 rail cars and/or over 6,000,000 roundtrip truck loads. This scenario would also require treatment and discharge to the rivers of over 8 billion gallons of water. The cost, based on real numbers from other similar projects, would be staggering – at least \$20 billion dollars.”

**Question:** Is this reasonable, practical and sustainable from a technical and economic standpoint?”



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# Quotes from Recent Articles on North Carolina and South Carolina Fly Ash for Concrete (1 of 2)

## New law prohibits out-of-state coal ash in South Carolina's Class 2 landfills, [Waste Dive, March 2016, Arlene Karidis](#)

“South Carolina Governor Nikki Haley has signed legislation outlawing the dumping of coal ash from out-of-state in Class 2 South Carolina landfills, though the mandate excludes electric utilities that bury the toxic waste in DHEC-approved landfills under that agency's watch. The state legislation follows the federal government's ash rule requiring new landfills be lined to prevent the leakage of coal ash. Nine of South Carolina's 12 Class 2 landfills that can accept coal ash are unlined, according to Greenville News.”

## JEDA Finances Fly Ash Recycling Plant for The SEFA Group

*Creates 20 New Jobs, Retains 150 Jobs -- Georgetown, SC – Georgetown County*

The South Carolina Jobs-Economic Development Authority (JEDA) has issued \$40 million in tax-exempt revenue bonds to help The SEFA Group create a coal fly ash recycling facility in Georgetown.

“Our mission is to maximize the beneficial utilization of coal combustion byproducts in an environmentally friendly way. JEDA financing is helping us expand our ability to do that,” said Tom Hendrix, Chief Executive Officer of The SEFA Group in Lexington.

# Implementation of CAMA 2014 and the Federal CCR Rule in NC and SC



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Groundwater, Surface Water  
Discharges

Risk Classification and Closure  
Schedule

- Coal Ash Management Commission Creation and Review – **Disbanded by Gov. McCrory on May 10, 2016.**
- Duke Energy: Groundwater Assessment and High Risk Site Closure Planning and Design – **Mostly Complete, More Data Needed**
- NCDENR/EMC Review/Reporting – **COMPLETE**
- NCDENR Completes Risk Classification – **May 18, 2016, All Remaining Sites Classified as Intermediate.**
- RFPs for Innovation and Beneficial Use – **Submitted, but most are not implemented due to CAMA 2014 Schedule.**

# North Carolina Risk Classification and Closure Schedule

Cost of the Excavating and Dewatering, and Treatment of over 100 million tons of fly ash is staggering: \$20B, plus, based on recent estimates compiled from actual project cost in other states.

Is this a sustainable and fiscally prudent approach to handling North Carolina's fly ash?

Low Risk

Closure Plan Submittal → Closure

12/31/2018 → 12/31/2029

Intermediate Risk

All Remaining Sites are Intermediate

Closure Plan Submittal → Closure

12/31/2017 → 12/31/2024

High Risk

Closure Plan Submittal → Closure

12/31/2016 → 12/31/2019

All impoundments classified as High, Intermediate or Low Risk

12/31/15

## Initial Analysis of Groundwater from NCDENR Press Release April 21, 2014:

**“We understand the importance of these findings for residents who recently received letters alerting them to the presence of metals in their water supplies that exceed state groundwater standards,” said Tom Reeder, assistant secretary for the N.C. Department of Environment and Natural Resources.** “We are providing those individuals with information to improve their drinking water quality. Also, **DENR will investigate the source of any constituents that exceed groundwater standards.** If we determine that groundwater standards in a well have been exceeded and that a coal ash pond is the source of that exceedence, we will require Duke Energy to provide the residents with an alternative water supply.”

**Many constituents that were tested in the public and private drinking water wells may be naturally occurring or unrelated to coal ash ponds.** As part of its probe, DENR scientists will seek to determine the source of the metals present in groundwater at these locations and whether they are naturally occurring.

DENR required Duke Energy to contract with private laboratories to collect samples at water supply wells within 1,000 feet of each facility’s boundary, as a requirement of the Coal Ash Management Act of 2014.



# Perspective on North Carolina versus Other States

- ▶ All other states besides North Carolina – Are required to START evaluating groundwater by October 17, 2017.
- ▶ For North Carolina, Duke Energy installed 40 to 60 wells for each of its 14 sites and COMPLETED sampling and modeling by Fall 2015.
- ▶ On May 18, 2016 NC DEQ ranked all remaining sites as Intermediate, requiring complete excavation of over 100 million tons of coal ash. Duke Energy says it will take over 20 years. CAMA requires it to be completed by 2024.
- ▶ South Carolina started partial excavation and closure of several large ash basins at the Santee Cooper Grainger Plant in 2014. Eventually 11 million tons will be beneficially used for concrete and other cementitious materials.
- ▶ Other States like Ohio, Pennsylvania, West Virginia, Georgia and Indiana are allowing ash basin closure to proceed as they develop and refine their regulatory process for managing CCRs.



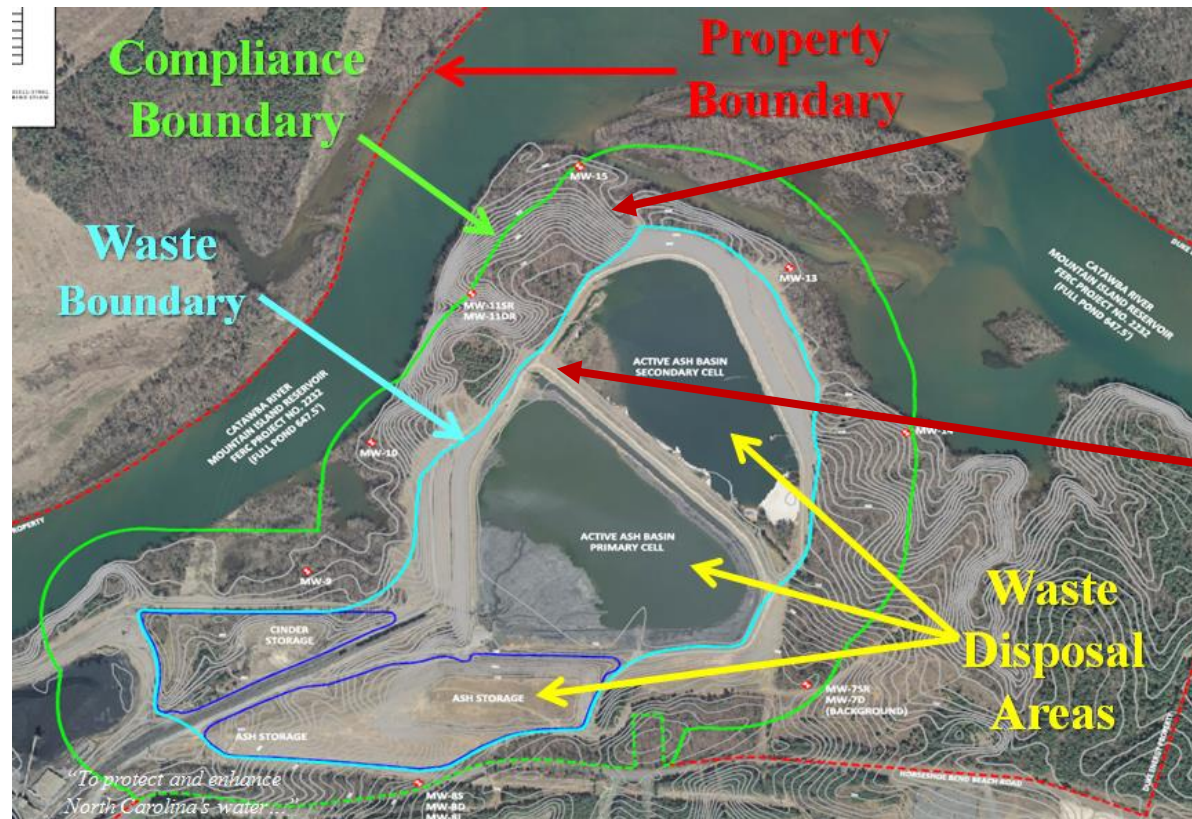
# Consequences of CAMA 2014 and the Federal CCR Rule in NC and SC



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# A Few Concerns from the Excavation Only Option



What happens to all the decant water and porewater that must be treated and discharge in rivers near the drinking water sources?

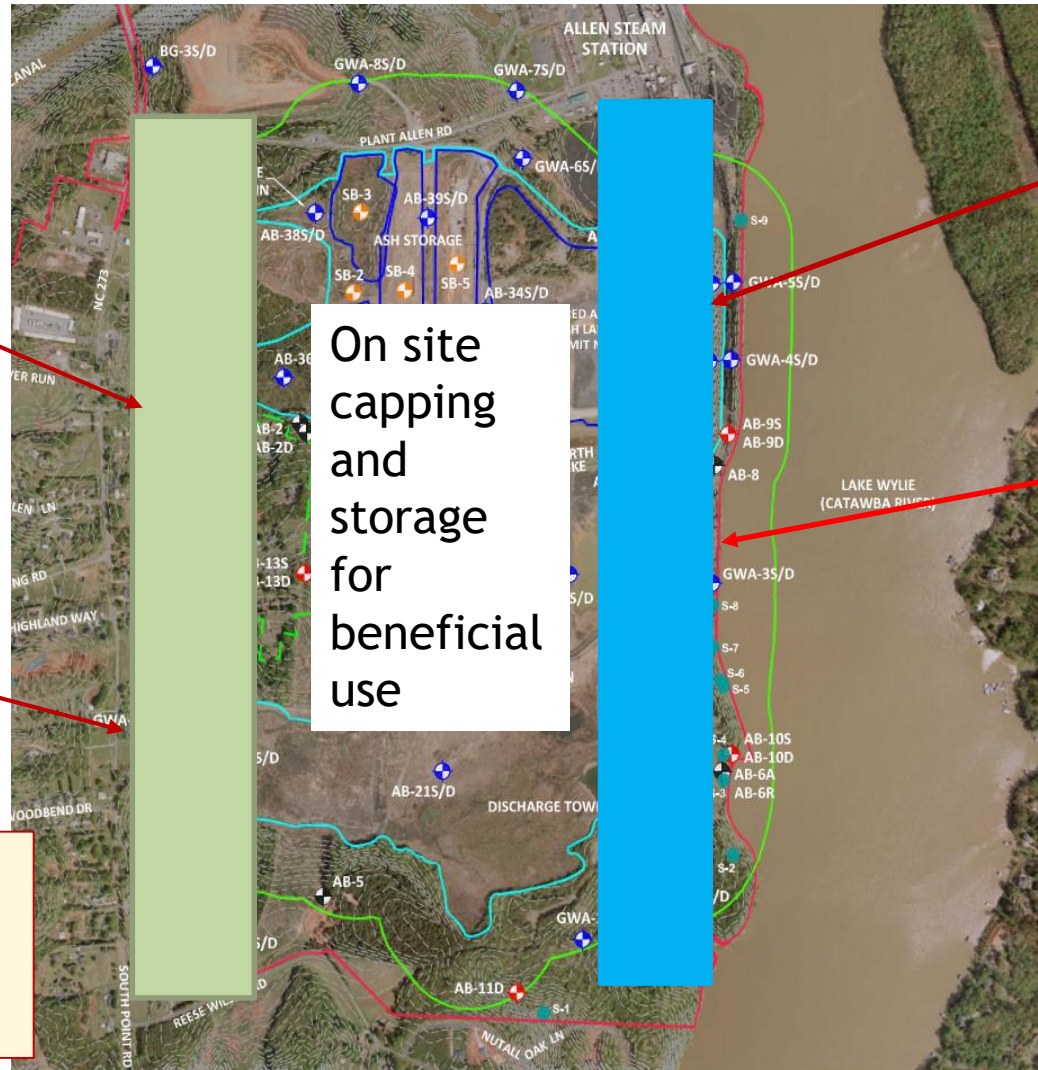
Can the dust and disturbance to surrounding communities be effectively managed?

# Are there better ways to safely address groundwater impacts and promote beneficial use?

Selective  
Excavation  
Buffer from  
residents and  
drinking water  
wells

How about  
flowable fill  
barrier walls using  
low quality fly ash?

Flowable fill barriers  
could use an additional  
1M tons of fly ash per  
site.



On site  
capping  
and  
storage  
for  
beneficial  
use

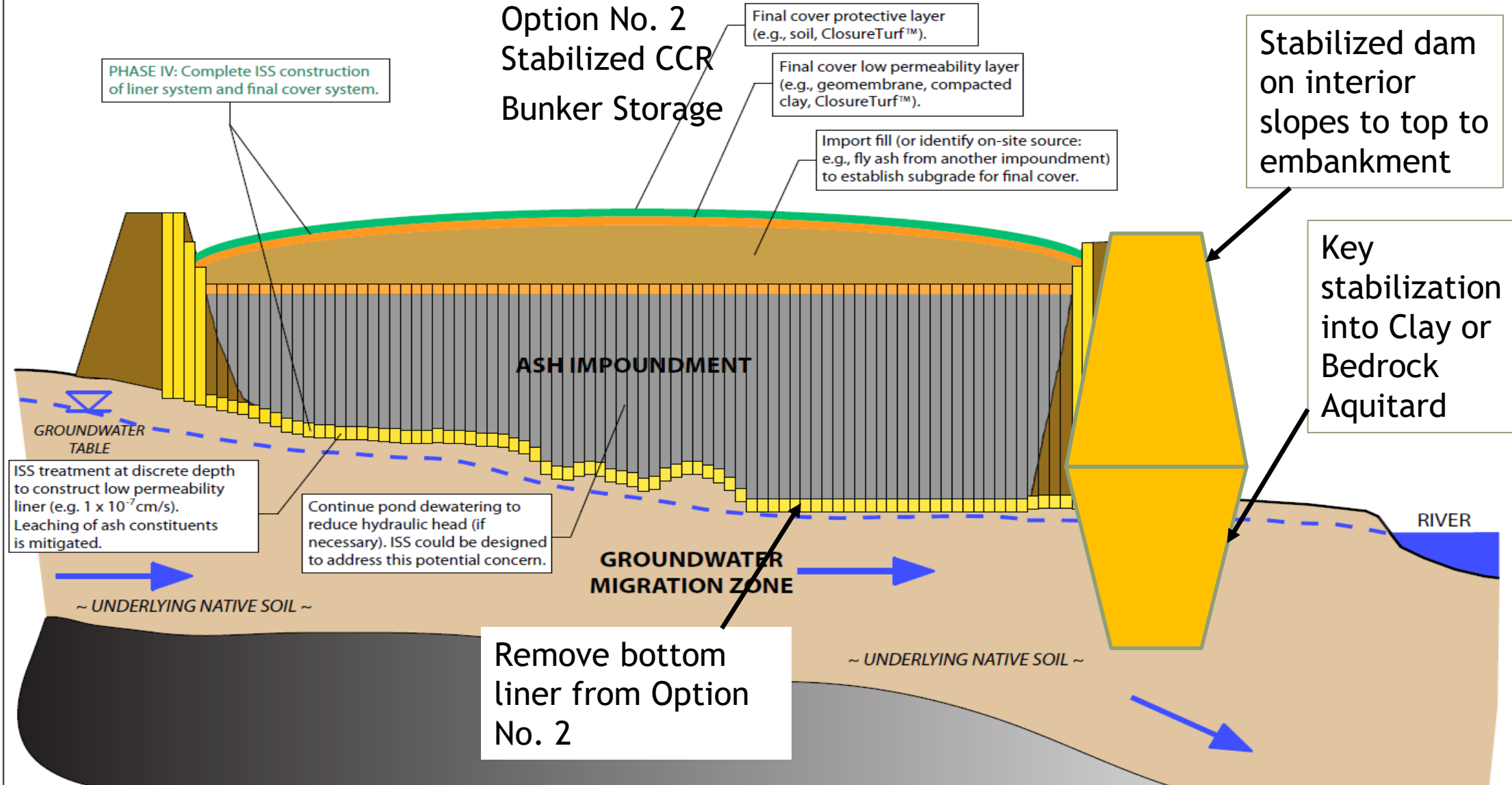
Selective  
Excavation  
Buffer from  
rivers and  
wetlands

How about  
flowable fill  
barrier walls using  
low quality fly ash?

Ref: Allen  
Steam Station -  
Figure from  
groundwater CSA  
report.



NOTE: DRAWING NOT TO SCALE



Source: Tim Silar, Silar Services Inc., 983 Butler Pike, Blue Bell, PA 19422, phone 215-266-6299, fax 215-646-7549, email [tsilar@silarservices.com](mailto:tsilar@silarservices.com)

# Summary of Problems with CAMA 2014

- ▶ **Aggressive Compliance Schedule:** CAMA required the dates for compliance to be 12 to 24 months ahead of the timeframe required by the Federal CCR Rule. High Risk sites completed by 2019. Intermediate Risk sites completed by 2024.
- ▶ **Preference for Beneficial Use, but No Plan to Implement:** The original version of CAMA required Duke Energy and the Environmental Management Commission (EMC) to investigate beneficial use of CCRs, but provided no firm requirements.
- ▶ **Created the Coal Ash Management Commission (CAMC) to Adjust CAMA:** The CAMC was created by CAMA to provide a “check and balance” for the NC Department of Environmental Quality (DEQ) and Duke Energy so that decisions were based on good science and economics. **The CAMC was disbanded on March 10, 2016.**
- ▶ **Prescriptive Remediation Methods Developed by Non-Engineers:** The CAMA prescribed excavation and placement in a lined landfill or beneficial use if its available as the only methods allowed for High and Intermediate risk ash basins.

**Summary:** An aggressive schedule for remediation and no clear guidelines for establishing the market and production capabilities for beneficial use, makes it virtually impossible to use the lower quality ash located from unlined ash basins. **We need some Game Changing demonstration projects!**

# Final Analysis from the NC Coal Ash Management Commission, March 10, 2016

- ▶ The CAMA mandated excavation for all Intermediate risk impoundment will preclude the consideration of other options.
- ▶ Discouraging to hear that NC DEQ regulators do not have time to consider other options than excavation and transport to “unwelcoming” neighboring communities.
- ▶ Coal ash in NC unlined basins must be improved or beneficiated to be acceptable for use in concrete.
- ▶ Ironically there is shortage of high quality fly ash in other states (TX, CA, FL), and North Carolina will very likely have a similar shortage in 5 to 7 years.
- ▶ **Summary: It is troubling and confusing to see NC buying fly ash for concrete from other states, and at the same time paying to dispose of fly ash from its unlined basins.**



## NORTH CAROLINA COAL ASH MANAGEMENT COMMISSION

MICHAEL JACOBS, CHAIRMAN



NATALIE K. BURDWELL, EXECUTIVE DIRECTOR

March 10, 2016

### Environmental Review Commission Members:

One of the three primary responsibilities that the Coal Ash Management Commission is charged with under CAMA is to make recommendations on provisions of the Act and “other statutes and rules related to the management of coal combustion residuals.” Given the timeline and series of events under CAMA, there is a specific provision that we believe should be addressed in the upcoming 2016 legislative session.

Our concern is that the statutorily mandated excavation of all Intermediate Risk impoundments would preclude considering beneficial use programs for impoundments in this category which might potentially be more sustainable, economical, and more protective of human safety and the environment. While it would be legislatively possible to change the allowed closure options after categorizations are finalized, we believe it would be preferable to establish closure options for each category prior to assigning the category.

Let me be clear that we are not suggesting watering down prescribed corrective actions. We are not recommending extending the deadlines or changing environmental protection standards. We are simply asking for the flexibility to consider alternative closure plans that might be more economical and/or sustainable for Intermediate Risk sites without compromising our environmental objectives.

Despite the uncertainty over the past year about the composition of the Coal Ash Management Commission, the staff and the three commissioners appointed by the Governor have been working diligently to develop a strategic framework for the management of coal ash in North Carolina. We have consulted extensively with various stakeholders and technical experts and performed research to understand this mission from a holistic perspective.

We have looked at how coal ash is managed in other states and countries and attempted to understand not just what is being done today, but what might be possible and desirable in the future. The global technologies and strategies for managing coal ash are burgeoning, and there will be new methodologies and approaches developed as other states begin to address coal ash under the federal CCR rule.

The classification of impoundments, which will occur in 2016, will dictate which methods of closure can be utilized in North Carolina. Once an impoundment categorization is finalized, there is no provision in CAMA that would allow consideration of alternative closure options for Intermediate



# Beneficial Use in SB 071 – An Attempt to Fix CAMA?

**SECTION 1.1.(a)** G.S. 130A-309.214 reads as rewritten:

**"§ 130A-309.214. Closure of coal combustion residuals surface impoundments.**

...

(g) Notwithstanding any other requirement for closure under this section or Part, no later than December 1, 2016, an impoundment owner shall submit plans to the Department of Environmental Quality to make at least 2.5 million tons of coal combustion residuals per year available for beneficial use for addition to concrete. At least fifty percent (50%) of the coal combustion residuals made available for beneficial use shall be removed from the current inventory of coal combustion residuals. Facilities that are receiving or have received coal combustion residuals from other sites will be the sites from which the coal combustion residuals inventory will be used first. No later than June 1, 2018, an impoundment owner shall begin to supply such coal combustion residuals for beneficial use in accordance with this subsection."

- Summary: If 50% of NC fly ash is beneficially used from Duke Energy's Current Inventory in its ash basins then between 2017 and 2024 this would amount to **1.25 million tons for 7 years or 8.75 million tons of fly ash reuse**. Result: Reuse of less than 10 % of the total volume stored in North Carolina's unlined ash basins. **WE STILL HAVE A LONG WAY TO GO!**





Source: JEFF WILLHELM - [jwillhelm@charlotteobserver.com](mailto:jwillhelm@charlotteobserver.com)

## Beneficial Use from Ash Basin Closure

AND/OR ??

Disposal from  
Ash Basin  
Closure



ENGINEERING

# Correction of Mis-Formation: Duke Energy says: “Limited technology hurts recycling of ash” NOT True!

- ▶ The technology to excavate and improve coal ash is being effectively used in neighboring South Carolina.
- ▶ It has been stated that Duke Energy will not sign a 10 to 15 year contract that provides a consistent feed stock of low quality fly ash so it can be improved for concrete and other encapsulated uses.
- ▶ Reality: The North Carolina Redi-Mix members may be forced to transport its low quality fly ash to South Carolina and/or import low quality fly ash from India to meet its need for fly ash in concrete.
- ▶ Existing, well established technology and industry practice for Flowable Fill slurry walls could be used to create containment walls using low quality fly ash. FHWA Fly Ash Facts for Engineers.
- ▶ **Summary: Can we use an additional 1 million tons per year of flowable fill and fly ash to remediate coal ash basins?**

**Virtually any coal fly ash can be used in flowable fill mixes.** The fly ash does not have to meet AASHTO M 295 (ASTM C 618) specification requirements as a concrete admixture to be suitable for use in flowable fill, even fly ash with high LOI or carbon content is suitable. The individual specifying agencies may have applicable specifications or regulations regarding fly ash flowable fill. Regardless of the type of handling practices, fly ash for flowable fill can be used in a dry or moisture conditioned form. Fly ash recovered from storage ponds has been used successfully. Flowable fill mixes using high-calcium fly ash may not require any cement. Mix design and performance testing are typically prepared to determine the suitability of a fly ash and other ingredients for the specific flowable requirements. **FHWA Fly Ash Facts for Engineers**

# Suggested Demonstration Project No. 1:

## Two Regionally Based Fly Ash Beneficiation Plants

- ▶ Consider General Assembly support for at least two North Carolina based beneficiation plants. Have NC DOT provide input on where plants should be located.
- ▶ Encourage Duke Energy to sign long term contracts to guarantee low quality fly ash “feed stock” at NO COST to the two regionally based, fly ash beneficiation plants. Note: Currently Duke Energy is headed toward paying at least \$50 per ton to excavate and haul over 100 tons of its low quality fly ash to off-site or on-site lined landfills.
- ▶ Initiate legislation, similar to SB 071, where NC DOT contractors ***are required to use at least 50 percent recycled material*** for their concrete and asphalt pavement projects. Note: This is similar to legislation in Texas (Red state), California (Blue state) and several Northeast and Midwest states.
- ▶ Work with UNC Charlotte and NC State to gently “monitor and enforce” the technology and financial feasibility of these projects to promote goodwill and acceptance by environmental groups.

# Suggested Demonstration Project No. 2

## Regionally Based Storage Facilities

- ▶ Initiate a study project funded by the excess operation funds from the NC Coal Ash Management Commission to determine where **regional, covered fly ash storage facilities should be located**.
  - ▶ The study would be based on the location of existing concrete Redi-mix suppliers, upcoming NC DOT projects, and the largest unlined ash basin or structural fill fly ash projects.
  - ▶ Allow storage facilities to be located on Duke Energy sites, and/or temporary storage at lined landfills and covered unlined facilities.
- ▶ Require that Duke Energy provide low quality, **un-beneficiated fly ash for these facilities at No Cost for the next 10 to 15 years**, recognizing that they will be paying at least \$50 per ton for the excavate and transport to an off-site lined facility.

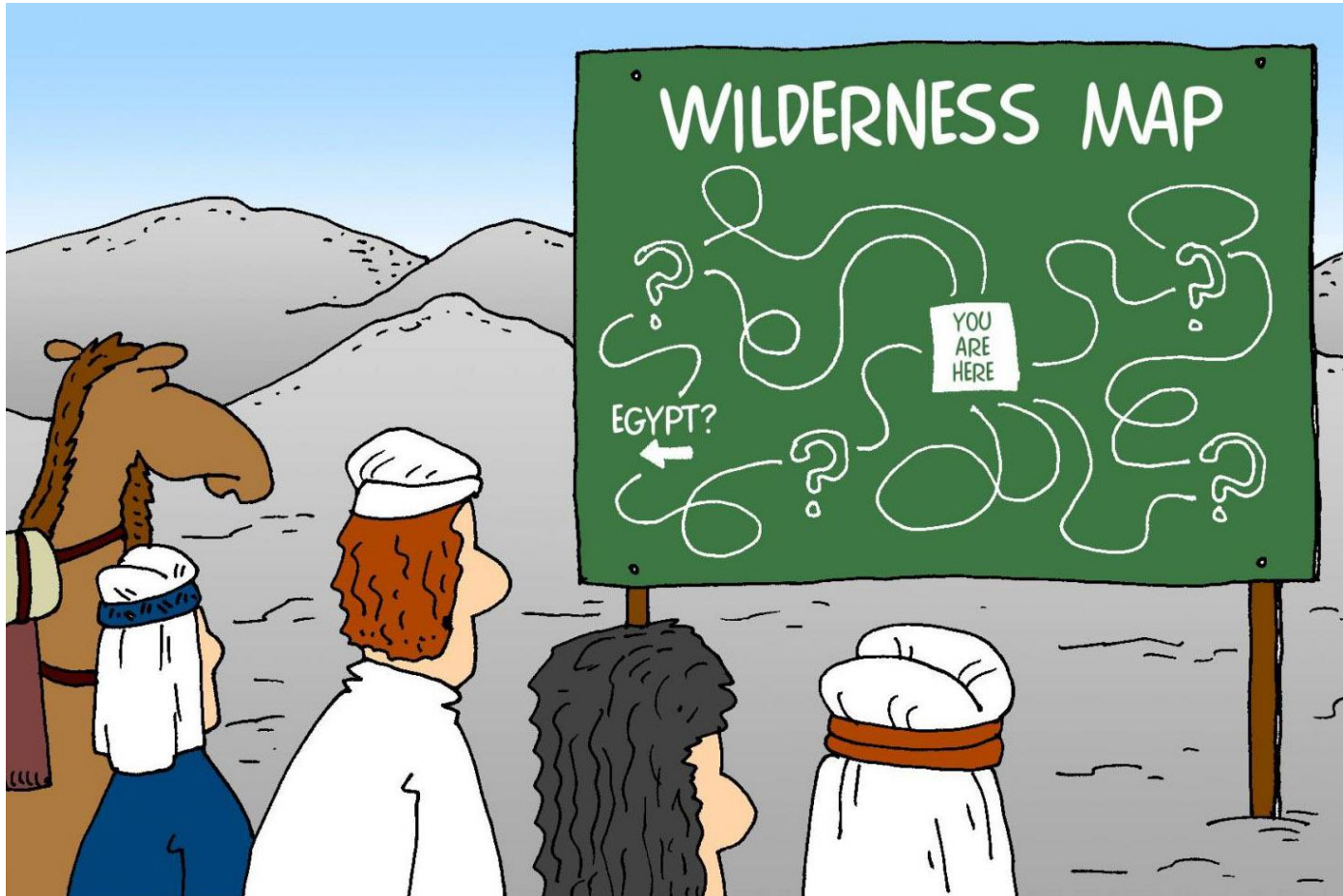


# Suggested Demonstration Project No. 3

## Flowable Fill for On-site Containment of CCRs

- ▶ **Initiate at least two (2) large scale demonstration project that utilize flowable fill with on-site fly ash materials to stabilize and contain the perimeter or wet fly ash basin projects.**
  - ▶ It is recognized and well established technology based on years of experience by the Federal Highway Administration (FHWA) that low quality fly ash material produce a high quality “flowable fill” for containment and reduction in the leaching characteristics of fly ash.
  - ▶ Allow, encourage and/or nudge Duke Energy to utilize the skills of the Redi-mix suppliers from North and South Carolina to develop mix designs and the means and methods to stabilize the perimeter of Duke Energy’s unlined ash basins.
  - ▶ Permit the interior of these unlined ash basins to be excavated over the next 10 to 15 years as the “current inventory” for North and South Carolina’s Redi-mix industry needs instead of importing fly ash from India and other non-United States sources.
- ▶ **Develop an independent cost-benefit evaluation of the cost of purchasing fly ash from out of state sources, as compared to excavation and hauling to lined landfills, and taking into consideration the ancillary costs and impacts to the environment and citizens near the ash basins.**

# How do we stop wandering through the Wilderness and Desert of Not Enough Fly Ash?





How do we facilitate change without  
“upsetting the apple cart?”

Discussion and Input.

Could the CALM Office work with  
CRMCA members to promote 2 or 3  
“game changing” Demonstration  
Projects?

Who do we approach and when?

# Update on Ash Basin Closure Examples of Large Demonstration Projects

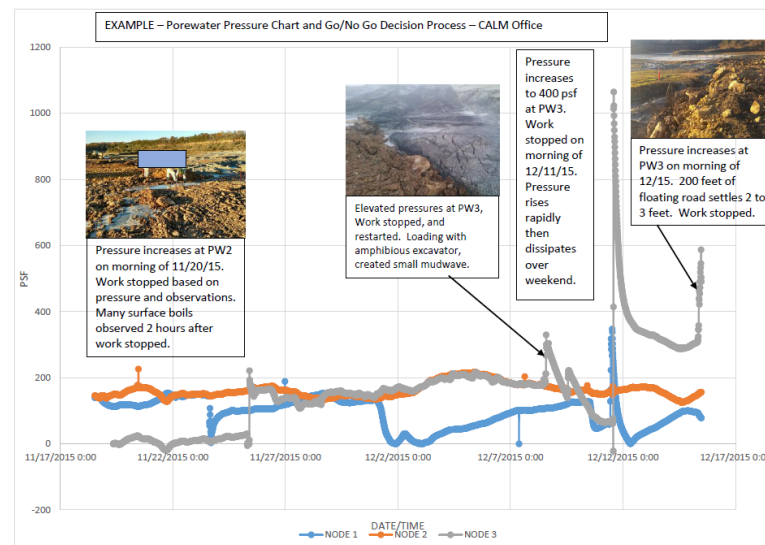


UNC CHARLOTTE

EPIC

# Excavation and closure of ash basins is more difficult than expected

- ▶ Access to ash basin to remediate and excavate is more difficult than the power companies, engineers, and contractors expected.
- ▶ The safety issues are significant.
- ▶ Beneficial use of fly ash for concrete is possible if the timeframe for dewatering and excavation is reasonable and cognizant of the difficulties that will be encountered.
- ▶ Utilizing lower quality fly ash for stabilization using flowable fill is a well established technology that has been mostly “ignored or neglected” by design engineers and/or the power companies.
- ▶ Summary: Most typical ash basins have challenging wet and soft subgrade conditions that are very difficult to address for the excavation and hauling of material.



# CALM Office Safety Awareness Workshops

## Addressing the First Potential Problem



Energy Production and Infrastructure Center (EPIC)  
Coal Ash & Liquid Management (CALM) Office

**A whole new industry  
has been created to  
handle wet/soft ash.**



Energy Production and Infrastructure Center (EPIC)  
Coal Ash & Liquid Management (CALM) Office

### AGENDA – Ash Basin Safety Awareness – Workshop No. 1

**Purpose:** To develop practical, technology based guidelines and best management practices for working over and around saturated ash materials, while completing ash basin closure, dewatering and excavation projects.

**Objective:** To have an interactive discussion with recognized industry leaders and technical professionals involved with wet coal ash basin closures. The topics of discussion and interaction will include:

- a) applicable OSHA compliance for excavation and shoring
- b) different types of ash basins and wet ash
- c) site investigations, and real time monitoring and excavation;
- d) practical and adequately flexible Job Hazards Assessments;
- e) forming a coordinated team with the Owner, Design Engineers and Contractors in this new and changing field.

**Goal:** Develop a working Manual of Ash Basin Safety Awareness that can be used by contractors, engineers and ash basin owners for safety awareness training and guidelines.

**Note:** Clear desire and intent by contractors/engineers to keep risk and liability away from Power Utility clients.

### AGENDA

#### Day 1: Ash Basin Safety Awareness – Workshop No. 2

#### Day 2: Ash Basin Closure Technology Update

**Purpose:** To develop practical, technology based guidelines and best management practices for working over and around saturated ash materials, while completing ash basin closure, dewatering and excavation projects.

**Objective:** To have an interactive discussion with recognized industry leaders and technical professionals involved with wet coal ash basin closures. The topics of discussion and interaction will include:

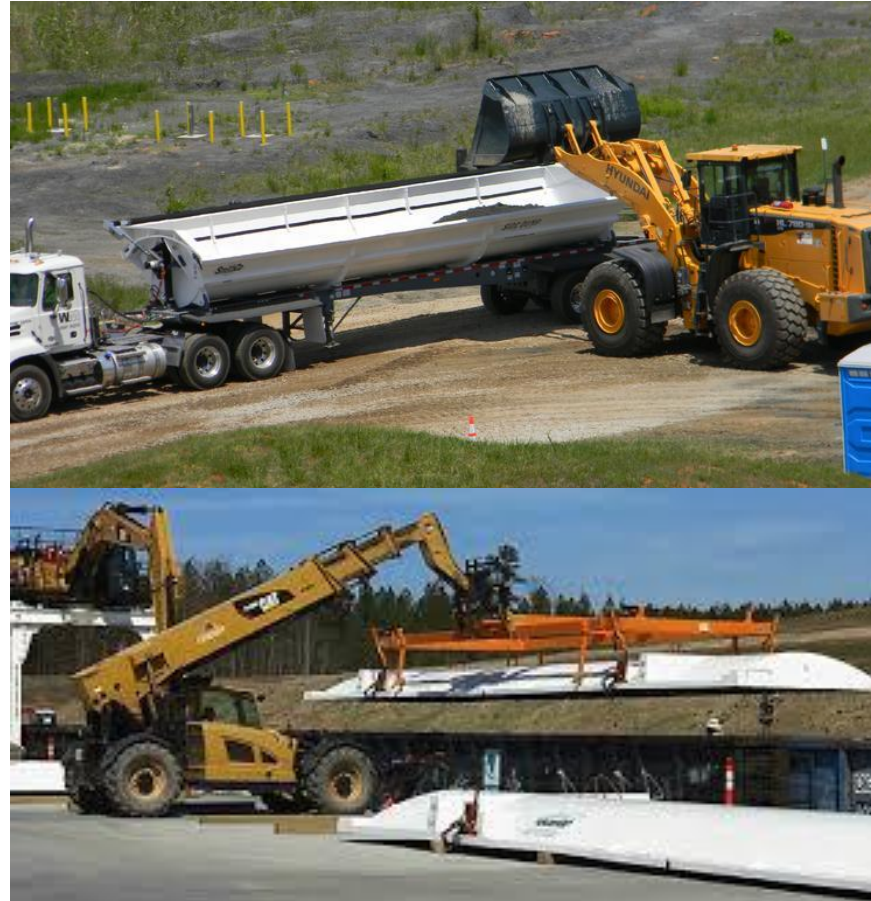
**Goal:** Develop a working Manual of Ash Basin Closure Technology Update that can be used by contractors, engineers and ash basin owners for safety awareness training and guidelines.

**Note:** Continued intent to keep liability away from Power Utility clients, and utilize a proactive approach to avoiding issue through better planning and instrumentation.



# Charah Specializing in Rail and Truck Transport of Coal Ash

- ▶ Recent purchase of the Charah locomotive and over 600 rail cars.
- ▶ Clean and covered transport of coal ash from ash basin to lined landfills.
- ▶ Charah can provide ash hauling services to other contractors in the Carolinas and Georgia.
- ▶ **Transportation methods could be used for beneficial use if the policy and regulatory framework allowed or required recycling of fly ash.**





# Proactive Approach to Materials and Ash Basin Site Management – R.B. Jergens

- ▶ A Hybrid approach to closure
  - ▶ Utilization of Multiple technologies
  - ▶ Upstream and down stream stormwater management
  - ▶ Innovative technology application on a regular basis
- ▶ Collaborative approach of working closely with Owner and the Design Engineer
- ▶ Effective cost control by addressing Issues before they become big problems.
- ▶ Initiated Ash Basin Safety Awareness Training.



# Dewatering and Decant Water Treatment Operations



Question and Concern: Preliminary computations and current NPDES discharge requirements would require that the system would be 10 to 15 acres for a 45 acre site. How does the rate of treating dewatering water affect the rate at which ash can be excavated?



**METROPOLITAN**  
ENVIRONMENTAL SERVICES, INC.  
A BARNHART COMPANY

Source: Project  
Photos from  
Metropolitan  
Environmental  
Services



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# The Rim Ditching Approach and Pre-Drainage Prior to Excavation

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A photograph showing a deep, narrow ditch dug into dark, wet ash. A yellow excavator is visible in the background, working on the rim of the ditch. The ground is saturated with water, reflecting the sky.

## Rim Ditching Approach

Slow drainage is localized areas  
Equipment is above water  
Productivity can be unpredictable

A photograph showing a large excavation site with a yellow excavator and a dump truck. A long, white pipe is laid out along the edge of the excavation, connected to several well points. The ground is dry and dark, indicating pre-drainage.

## Pre-Drainage and Well Points

Water is removed months prior  
Equipment works over dry ash  
Earthwork productivity increased



# Slurry Wall Containment and In-situ Stabilization Great Lakes E&I and RECON



GREAT LAKES  
ENVIRONMENTAL &  
INFRASTRUCTURE SOLUTIONS



# Ash Basin Surface Stability Projects

## Undrained Shear Strength and Geogrid

Field Vane Shear Testing Data

Probe Number: GV-1		Station Number: Stationing not established					
Boils (Y/N) N		Drainage (Y/N) N					
Test No.:	TST-4	TST-5	TST-5	TST-5	TST-6	TST-7	TST-7
Depth (Ft)	2-3'	1-2'	2-3'	3'	1-2'	1-2'	2-3'
Reading	5	5	6	11.6	6.4	4.2	4.6
Blade No.:	4	4	4	4	2	4	4
Multiplier	0.0625	0.0625	0.0625	0.0625	1	0.0625	0.0625
Results (KPA)	3.1	3.1	3.8	7.3	64.0	2.6	2.9
Results (PSF)	65	65	78	151	1337	55	60

Probe Number: GV-1		Station Number: Stationing not established					
Boils (Y/N) N		Drainage (Y/N) N					
Test No.:	TST-7	TST-8	TST-8	TST-8	TST-9	TST-9	TST-9
Depth (Ft)	3.5'	1-2'	2-3'	3.5'	1-2'	2-3'	3-4'
Reading	8.8	3.8	4.2	5.2	6	4.2	2.2
Blade No.:	4	4	4	3	3	3	3
Multiplier	0.0625	0.0625	0.0625	0.5	0.5	0.5	0.5
Results (KPA)	5.5	2.4	2.6	26.0	30.0	21.0	11.0
Results (PSF)	115	50	55	543	627	439	230

Area Sketch



Note: Photos and figures edited to ensure client and project confidentiality.



# Ash Basin Subsurface Stability Using Real Time Porewater Pressure Monitoring

