



# Harvesting of Coal Combustion Residuals from Landfills for Cement Production

ACAA/EPRI/CAER Workshops

Louisville, Kentucky

31 October 2018

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- Geosyntec Consultants, Chicago, IL
- M.S. Civil (Geotechnical) Engineering
- B.S. Civil (Soils and Construction) Engineering
- 40+ years experience
- 15+ years experience with CCBs
- Experience at dozens of CCB ponds and landfills
- Qualified Professional Engineer under the CCB Rule

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- Purpose and Goals
- Facility Background
- Preparations
- Program Design
- Implementation
- Helpful Hints

- The Purpose of the harvesting was to obtain removal all CCB and leave a “clean” site.
- The Goals of the harvesting program were to:
  - Have continuous removal without interruption. If the work stopped, it could jeopardize restarting as buyer may go elsewhere. This could cause the site to have increased maintenance and cause closure/capping in place.
  - Meet daily production/requirement from the buyer.

- 30-acre Landfill for 98 MW R Paul Smith Power Plant, Williamsport, Maryland
- CCB landfill and CCB sedimentation/treatment ponds located in West Virginia
- Landfill had portions soil lined and other portions lined with HDPE geomembrane/geocomposite clay layer (GCL) composite liner
- CCB was placed into the landfill from periodic cleaning out sedimentation/sludge Ponds 3 and 4 since the 1970s
- CCB was a combination of bottom ash and fly ash and soil fill from cleanouts
- Plant closed in 2012
- Permit will remain open until CCB is removed and post-closure monitoring is over.

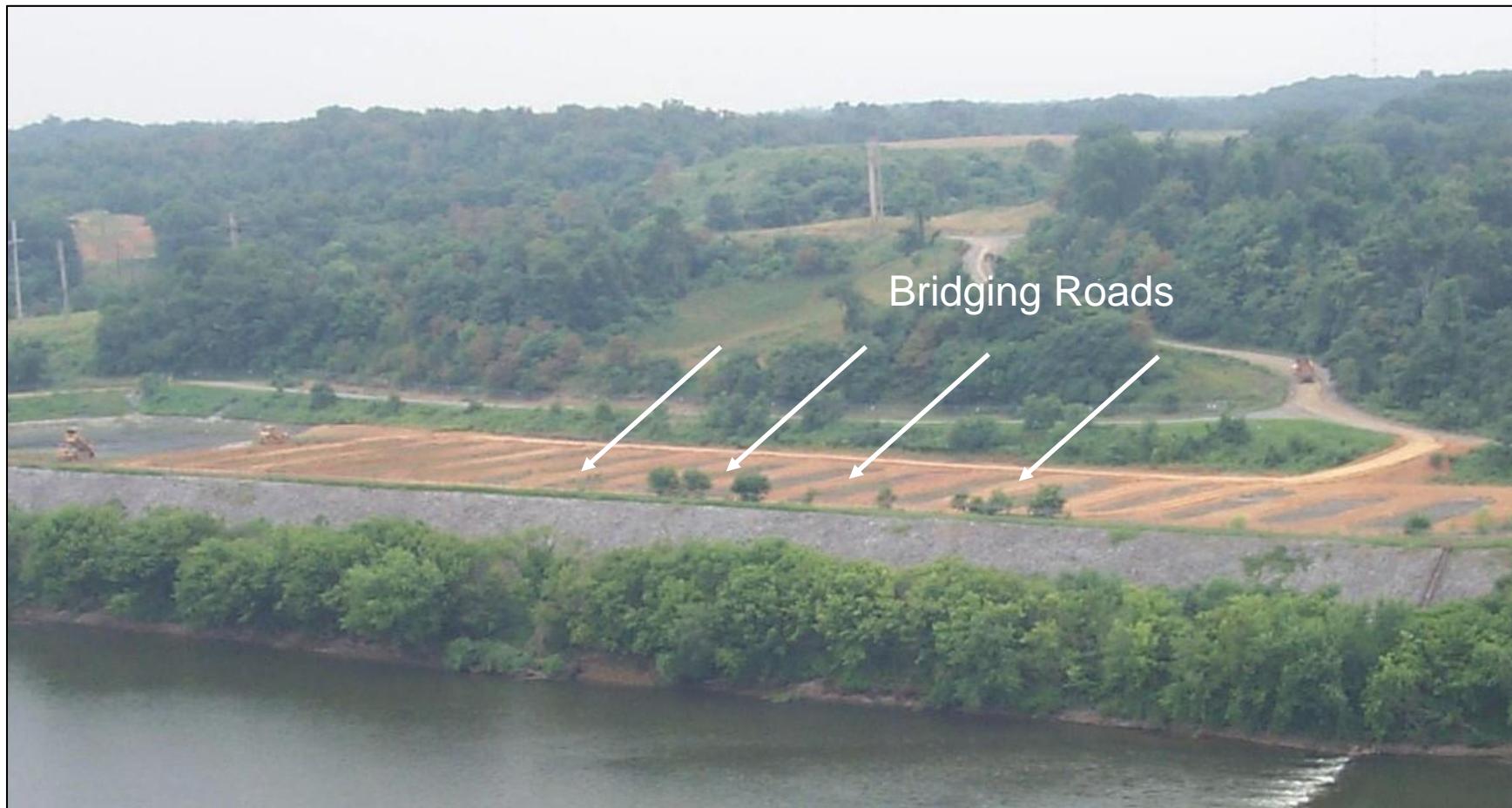
Site pre-CCB removal/harvesting.



Pond 4 removal preparation.



## Pond 4 removal – Bridging Road Grid



Typical pond cleanout- Bridging roads.



Typical pond cleanout.

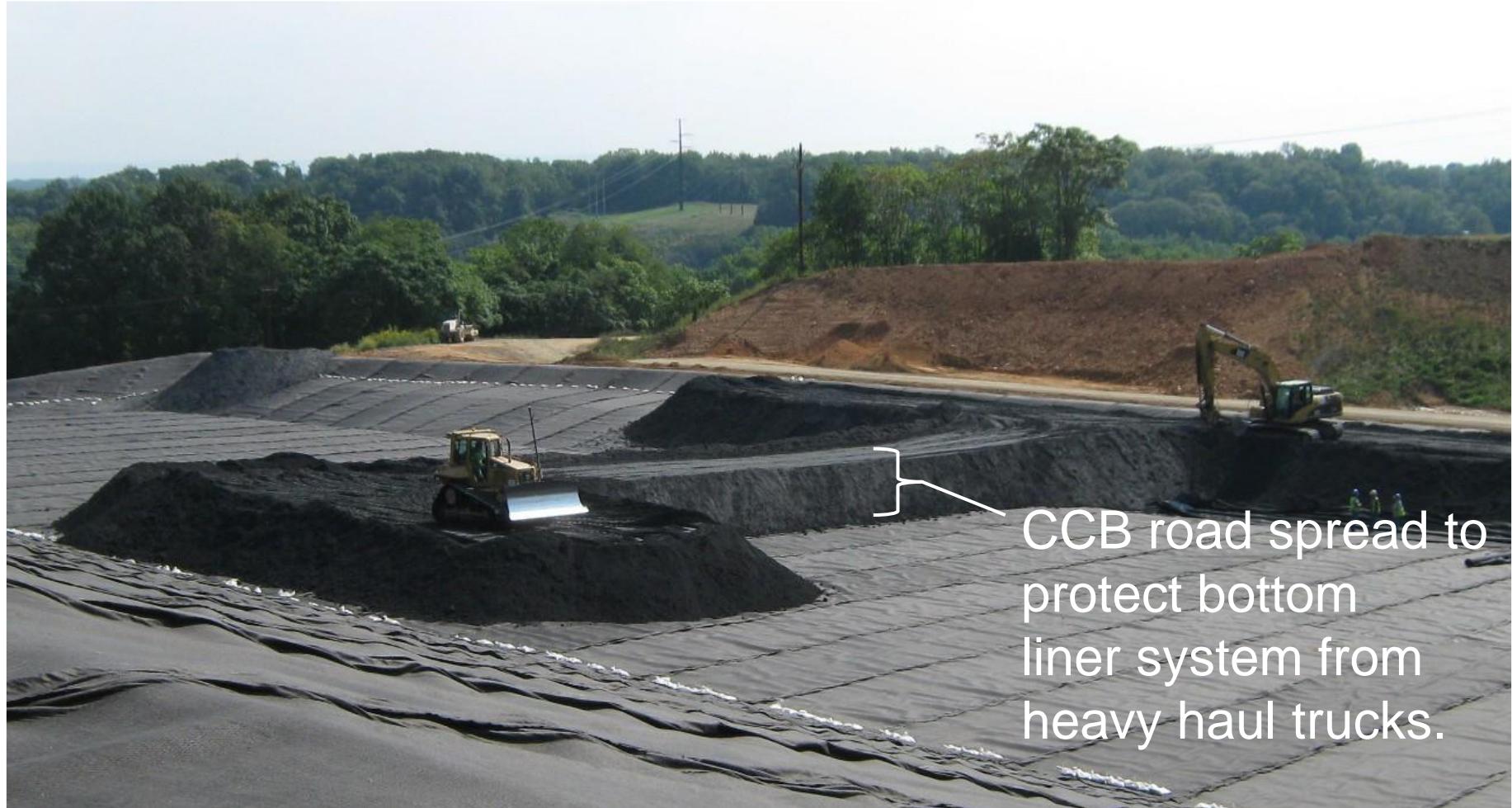


CCB continuously drained.

Pond 4 removal down to the underlying native shale.



### Constructing landfill CCB haul roads.



## Landfill CCB filling operation.



- No prior (pre 2009) success reusing CCB from the plant.
- Market demand for CCB as cement feed stock increased as coal fired plants began closing and there was less dry fly ash being made.
- R Paul Smith ash was a sustainable economic alternative to a diminishing dry fly ash supply and mined natural minerals.
- The market was mainly from the metropolitan areas of Washington, D.C. and Frederick, MD. *The key was the proximity of CCB and cement plants.*
- Paul Blum Company (PBCo) and Maryland Environmental Restoration Group (MERG) approached Allegheny Energy Supply (now FirstEnergy) to reclaim the CCB in the disposal areas.
- MERG and PBCo are trading partners and suppliers to the US and Canadian cement manufacturers.
- C William Hetzer, Inc., the site pond cleanout and landfill construction contractor, was partnered with PBCo to conduct site excavation, CCR handling and trucking to local cement manufacturers.

- Program started out slowly...obtaining more information incrementally.
- Initial sampling and testing was completed to assess suitability. Mineralogy testing included:
  - Content of lime, silica dioxide, aluminum trioxide, iron oxide, magnesium oxide, sodium oxide, potassium oxide, loss on ignition, total alkalis, and others.
- Testing results were favorable.
  - The material had the right amounts of aluminum and iron and the right ratio.
  - Water content was 22 to 26%, loss on ignition was 6 to 16%, and were consistent and consumed in the kiln.
- Obtain contracts and guarantees.
  - General provisions were important to keep responsibility on the contractor for site operations.
  - Needed to meet the requirements of the State DEP.

- Discussions with State DEP were required...they never had experienced this situation before! CCB “Un-disposal”?!
- DEP provided parameters for removal of materials (CCB and liners), temporary on site staging, reporting.
- Some delays as the original, very experienced permit writer retired and new DEP personnel needed to be brought up to speed.
- Permit modification covered the reclaim work and closure by removal.

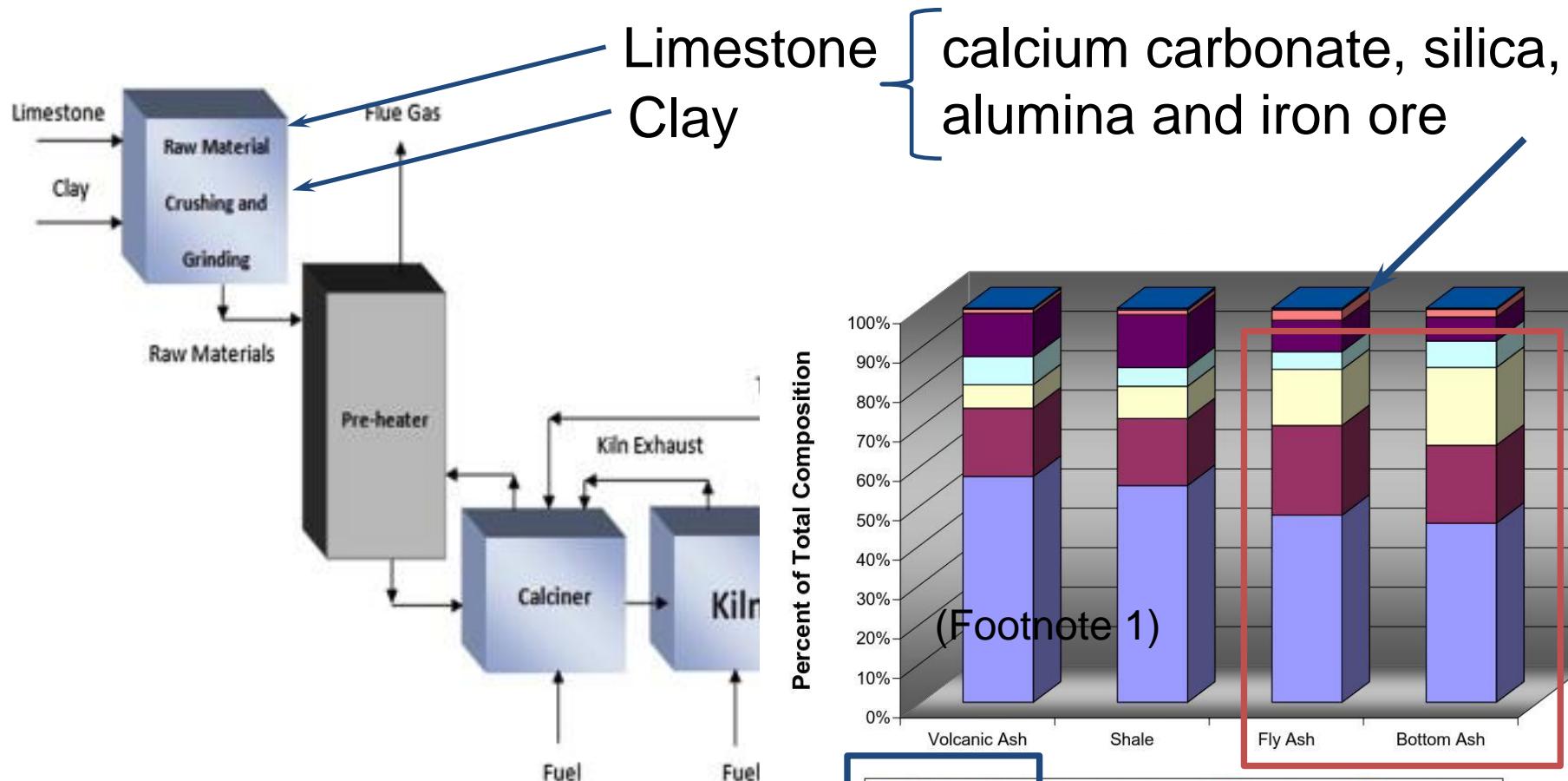
- No design drawings nor specifications. Very little “paper”.
- Document removal plan in permit renewal.
- No surface water ponding over work footprint during removal.
- Could not place any CCB outside of current landfill footprint/over native soil.
- Final topography needed to drain.
- Revegetate area of disturbance.

- Work from upper elevations to liner/lower elevation maintaining liner as long as possible.
- Geosynthetics to be disposed in off site landfill.
- Dust control required per existing permit.
- Document closure
  - No visible CCB verified by four-feet deep test pits excavated at a rate of one per acre.
  - No remaining liner system/geosynthetics.

- Document closure (continued)
  - Revegetation in accordance with the permit.
  - Closure certification by WV professional engineer (Contractor had the certifying P.E.).
- Acceptable groundwater monitoring results for five years.
- Then the DEP would consider eliminating groundwater monitoring requirements and the Solid Waste Permit would not be needed.

- Needed to obtain periodic testing results for cement manufacturers.
- Cement manufacturers blended the material in with limestone and other feedstock to make cement.
- Mineralogy of shales used for pond closure road building in ponds was helpful to cement manufacture product.

## Cement Manufacturing



1. EPRI, Comparison of Coal Combustion Products to other Common Materials, 2010, Report 1020556.

- Organic content remaining in the CCB was fuel for the cement kiln.
- Site excavation operators were able to control the amount of CCB and shale by blending at the site during excavation such that the CCB continuously met cement manufacturer's chemistry criteria.
- Cement manufacturers provided daily tonnage requirement to the Contractor to excavate enough to meet the daily requirement.

## ■ Excavation

- Material needed to be dry enough to load and transport on trucks without any dripping of water; the *in situ* CCB met this criteria without modification.
- Tarps over the trucks were required.
- Removal of CCB in horizontal layers working downward toward the geosynthetics-lined area to reach final grade.
- Needed to balance excavation in difficult areas with easy areas to provide the daily requirements.
- It was acceptable to mix shale-rich material with the little remaining CCB to attain closure by removal.

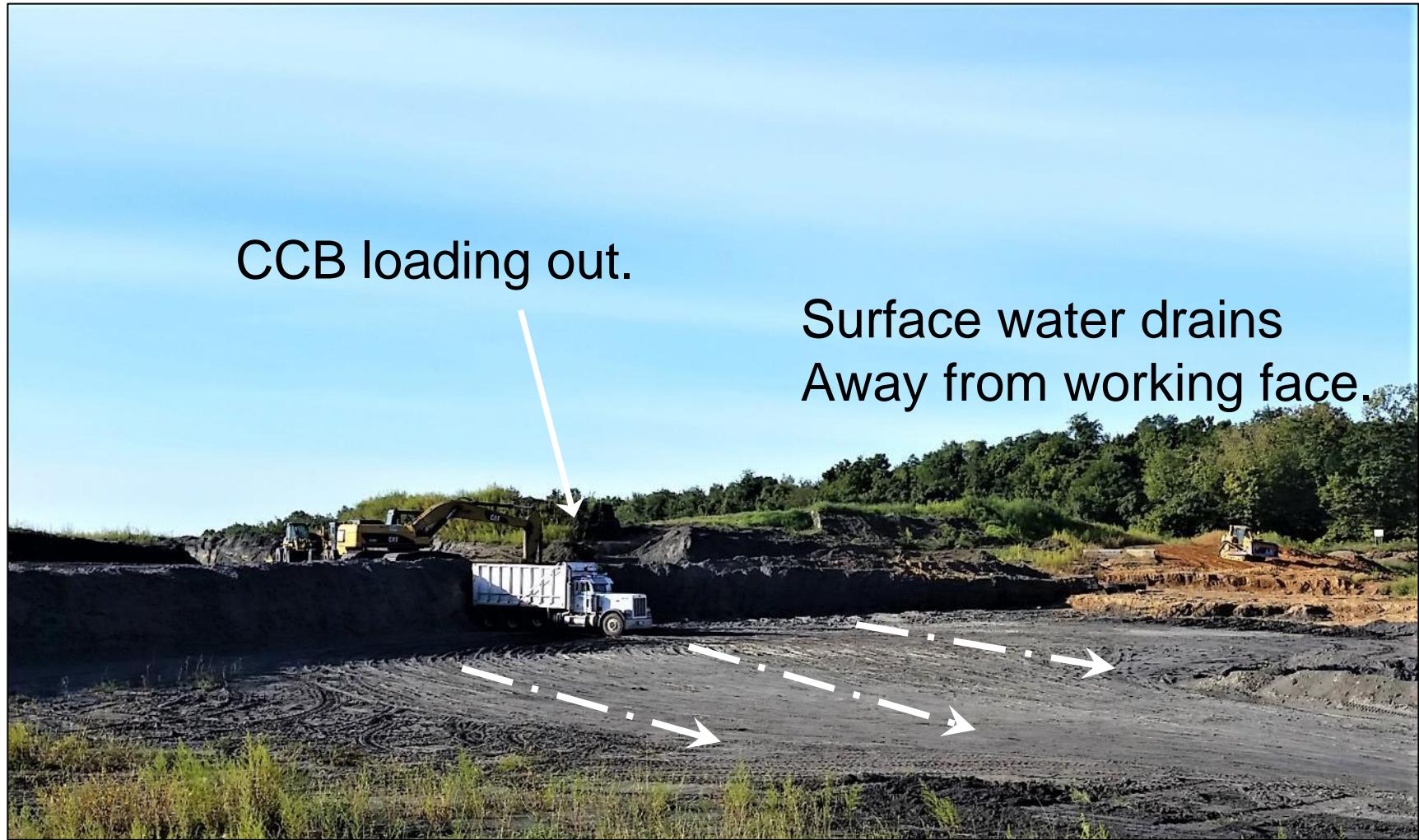
- Need to control stormwater runoff
  - Utilize existing stormwater sedimentation pond (Pond 4) to treat runoff.
  - Site designed to meet natural topography that drained naturally toward sedimentation pond.
  - Ponding on the surface was avoided.
  - No significant issues with having free moisture because it remarkably consistent between 22 to 26%.

## Stormwater drains to Sedimentation Pond 4



## Wet CCB removal from low spot





Typical over the road haul truck.

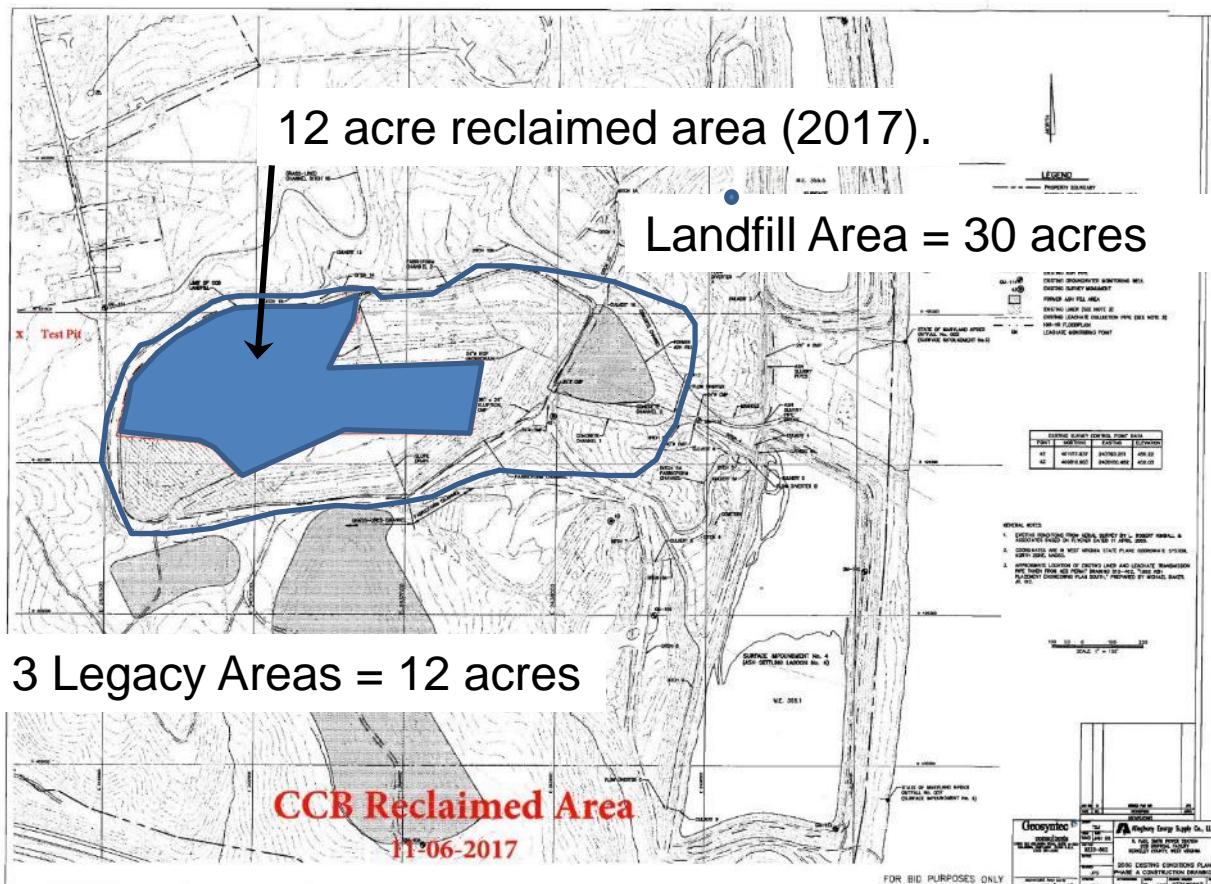


Area ready for clean closure.





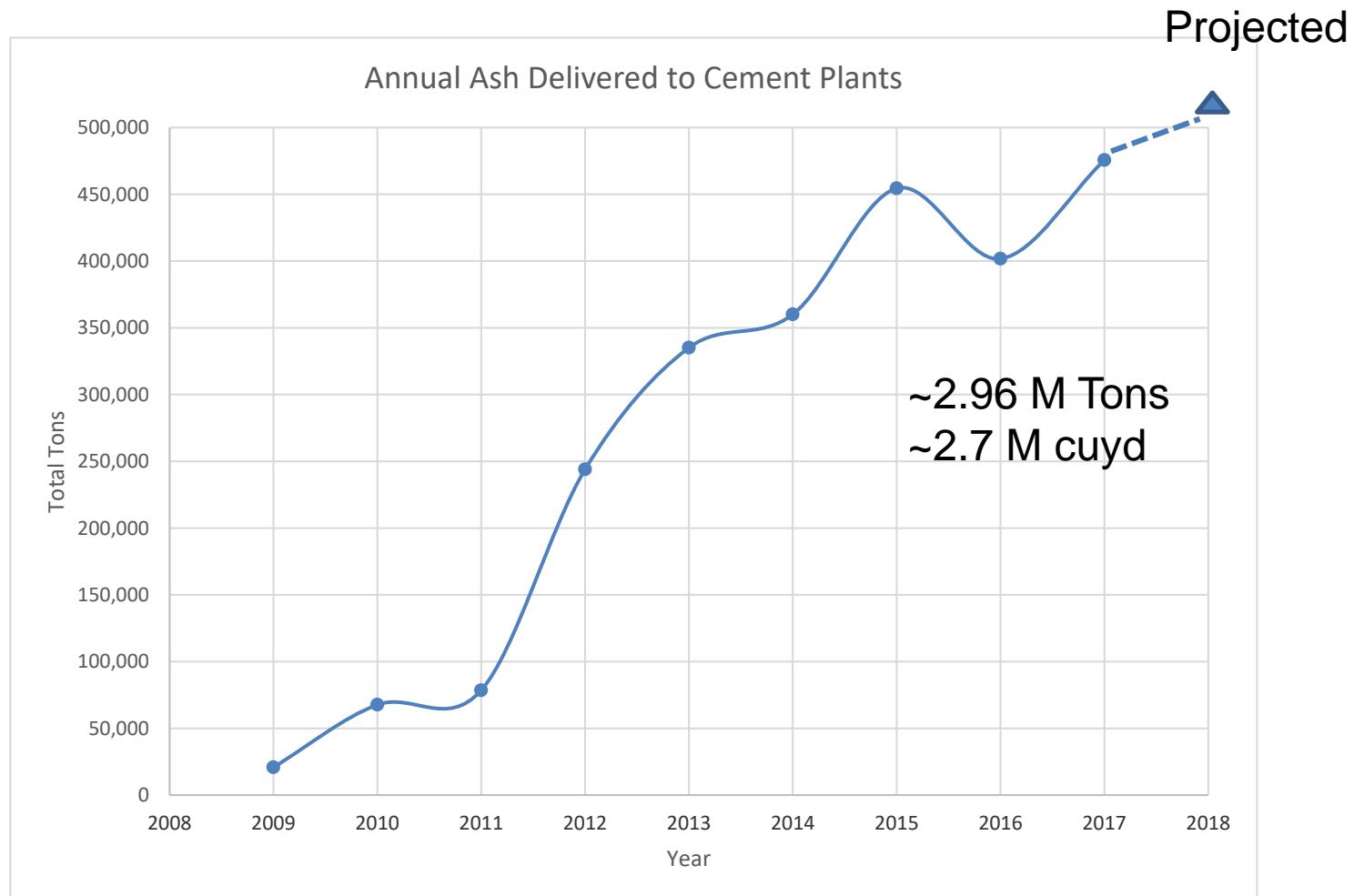
- Example of reclaimed area documentation map



Removal of HDPE geomembrane, GCL and geocomposite drainage layer.



■ Final Results:



## Final Results (Continued)

- Cement plant accepted all CCB (no rejections).
- Some wood debris was removed at the plant.
- Shale and lumps processed in a pug mill at the plant.
- CCB met cement manufacturer's CCB daily tonnage requirement.
- No stoppages.
- One area successfully certified as to have removed all CCB in 2017.
- Finishing up removal in early 2019.

- The key was having the CCB close to the cement plants.
- The CCB has to have the right combinations of minerals to be used as feed stock.
- LOI and water content (often issues for use as cement replacement) were not problems for use as cement feed stock.
- Obtain landfill permit for geosynthetics disposal with a longer lead time.
- Have a plan to remove geosynthetics for more efficient hauling and disposal. Don't let them get all "balled up".
- Exposed GCL absorbed water and gained weight (increased disposal cost). Have a plan for removal and covering/tarping.
- Avoid stopping removal operation by setting up operating criteria up front.
- **It was a sustainable project because it avoided need for mined bauxite (for Al), silica and iron sources**
- ***Hire a good contractor!***

## THANK YOU!

- Dave Hoone- FirstEnergy
- Ralph Borsani, P.E.- FirstEnergy
- Steve LaRue, P.E.- C. William Hetzer, Inc. (Contractor)
- Dan Baker- Paul Blum Company
- Rich Elman- MERG

