Best Management Practices for Coal Ash Storage Facilities

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Outline of Presentation

• The Fundamentals of Moist Coal Ash Basin Management and Design
• Overview of What is Working Well
• Explanation of Coal Ash Strength Properties
• Dry and Moist Ash Handling and Landfilling
• Recommendations for BMPs
Common Coal Ash Storage and Disposal Methods

- Controlled structural fills for coal ash
- Moist ash processing and dewatering basins
- Dry ash storage and landfills
- Moist ash storage and landfills
- Continual push towards reuse
The Fundamentals
Effective Moist Coal Ash Basin Management and Design

• Design for the geotechnical properties of coal ash – slope stability and seepage design
• Build Smart - exterior structural berms, soil/soil foundations, ash interior dikes only
• Design flow control of water inside and out
• Conduct regular dam inspections
The Fundamentals (con’t)
Effective Moist Coal Ash Basin Management and Design

• Operations plans for ash and water removal

• Maintain freeboard and storage capacity

• Adequate redundancy of critical features

NOTE: The vast majority of Southeast electric utilities are already following the Fundamentals.
What Are We Doing Right?

- Conducting regular dam safety inspections.
- Extensive slope stability, and foundation evaluation and design
- Triple Bottom Line – Creates a natural incentive for good business, and a strong environmental compliance culture
- Making a shift toward better, more efficient ash handling methods
- Always looking for ways to improve
Things We Could Do Better

• Take the time to **learn** from the lessons provided by recent failures. Wait for the TVA failure investigation reports

• Make the transition to better coal ash handling methods based on good science and good management

• Avoid tendency to react and over regulate – this approach will cause the problems to migrate somewhere else
Geotechnical Properties of Coal Ash Material

- Vary from site to site depending on coal source and coal combustion method
- Unit weight: ranges from 45 to 85 pcf
- Ash is a silt size particle that is very susceptible to changes in water content
- Strength properties of coal ash are difficult to determine
Build Smart – Geotechnical Common Sense

• Conduct extensive slope stability analysis with adequate third party review
• Limit use of estimated soil strength properties – confirm with lab or in-situ testing
• Design seepage and water control features into coal ash storage facilities
• Redundant features including engineered soil embankments around perimeter of site

NOTE: Most Southeast utilities are already “building smart” by conducting extensive geotechnical evaluations.
Effective Coal Ash Basin Management
A Balanced Engineering Approach

- Stormwater Design
- Dredge Facility Management US ACOE
- Earth Dam Design and Inspection
- Slope Stability Design and Construction Engineering
Dam Safety Inspections – Continue to Trust, but Verify

- Methods for dam inspections are well understood, and effective for identifying early problems
- Extensive State and Federal dam safety checklists evaluate outlet structures, seepage conditions, overtopping, and impacts due to erosion
- Dam safety inspections are working well – expand to include design principles

Most Southeast utilities already have an extensive dam safety inspection program for the ash basins that exceed Federal guidelines.
Coal Ash is Susceptible to Rapid Changes in Water Content

- Coal ash drains like a silt material
- It is lighter than most soils
- It can be subject to a rapid buildup in porewater pressure
- Rapid drawdown near and within coal ash embankments can be problematic
Case Study No. 1
Rapid Drawdown Dike Failure

Rapid Drawdown:
Water dropped 10 ft over 24 hours, instead of 2 weeks.
Ash Basin Operations Plans

• Controlling stormwater and near surface water is imperative for effective ash basin management

• Weirs and spillways for surface water control. Standard ACOE methods for dredge facilities

• Subsurface drains for near surface water seepage control

• Plan for high precipitation and high ash production events
Weir and Thin Lift Placement from a Typical Dredge Facility
Adequate Redundancy in Design and Operation

- Go back to the Fundamentals
  - Overlap geotechnical, operations, stormwater and dam safety design
  - Exterior berms – engineered soils, high enough for freeboard and storage capacity
  - Annual dam inspections
  - Third party engineering and outside peer review

Most Southeast utilities already follow the principles of “redundancy” for the design and operation of coal ash basins.
Consider Dry Coal Ash Processing and Disposal

• Some facilities remove coal ash dry for reuse or disposal in offsite landfills. Transition from moist to dry is expensive.
• Main advantage is that coal ash remains dry and leaching of constituents is minimized.
• Dry coal ash must still be disposed in onsite or offsite landfills and other regulated facilities.
• Dry coal ash requires dust control and can require re-wetting prior to compaction.
Dry Ash Collection Process

Fig. 1 Coal ash generation from a pulverized coal-fired boiler
Source: Japan Fly Ash Association
Coal Ash Landfills

• Advantages
  – Can provide better protection of groundwater
  – Control of leachate and stormwater runoff
  – Consistent and time-tested method for solid waste disposal

• Disadvantages
  – Permanently impacts land
  – Minimizes potential for reuse
  – Long term post closure care
Typical Coal Ash Landfill
Recommendations for BMP of Coal Ash Basins and Landfills

- Focus on the Fundamentals
- Continue regular dam safety inspections
- Continue and expand geotechnical stability evaluations
- **Learn** from utilities who are not having problems
- **Learn** from the recent struggles of others
- Do not be too quick to react and over regulate. Good regulation takes time.
Summary and Conclusion

- Geotechnical engineering is an essential part of coal ash storage facility design
- Parameters used for coal ash strength and stability can vary from site to site
- Continue dam safety inspections
- The industry is in the midst of rapidly changing regulatory environment

• Conclusion: Take the time to review and understand coal ash facility design principles.