COAL IS A MAJOR ENERGY SOURCE
PRIMARY GOAL

Recommend a viable ash pond closure solution based on the assumptions provided by Sargent and Lundy (sponsor):

- 500 MW Power plant
- 200 tons/hr coal consumption
- 15 tons/hr bottom ash production
- 30 acre X 10’ deep ash pond
- 2000 gpm ash sluice water
PROJECT OBJECTIVES

Evaluate the impacts of eliminating an ash storage pond from a power plant including:

• Current status of CCR and wastewater regulations

• Alternatives for ash disposal and reuse.

• Alternatives for water treatment and disposal.

• Cost and other implications (environmental, space, etc) of unlined ash pond closure.
SOLUTION PROCESS

Phase 1
- Develop project strategy.
- Identify research objectives.

Phase 2
- Gather and analyze sub-team data.
- Identify viable options.

Phase 3
- Integrate sub-team research.
- Formulate recommendation for ash pond closure solution.
TEAM STRUCTURE

TEAM LEADER
• Nicole Firnbach

REGULATIONS SUB-TEAM:
• Shana Burnett (Sub-team leader)
  • Chad Parker
  • Jennifer Agosto

CURRENT BOTTOM ASH HANDLING SUB-TEAM:
• Graham Port (Sub-team leader)
  • Nicole Firnbach
  • Dan Gardner

WATER TREATMENT SOLUTIONS SUB-TEAM:
• Sheena Enriquez (Sub-team leader)
  • Dan Kipp
  • Robert Herman

ALTERNATIVE BOTTOM ASH HANDLING SUB-TEAM
• Joseph Sanchez (Sub-team leader)
  • Susan Rafalko
EPA REGULATIONS

• After TVA/Kingston incident, EPA is proposing major regulation changes.

• Two Proposals under EPA consideration:
  • Subtitle C labels bottom ash as hazardous material, and in many cases requires ash pond closure and post closure care.
  • Subtitle D maintains a non-hazardous status, yet adds more regulations and may be most expensive.

• Further analysis will include regulatory impacts on power plants based on given assumptions.
CURRENT BOTTOM ASH HANDLING

• Mechanical
  • Submerged Flight Conveyor. (SFC): Horizontal flights move the accumulated ash up a dewatering ramp where it falls through a discharge chute to a truck or bunker.

• Hydraulic
  • Hydraulic Sluice System: A Hydraulic system collects ash from the furnace in a water impounded hopper and then transports it in a sluice pipeline to a pond.

  • Recirculation System: A complete recirculation system replaces the ash pond with dewatering bins which separates the water and ash, a settling tank and surge (storage) tank.
WASTEWATER SOLUTIONS

• Ash pond water contains high concentrations of toxic metals.

• Wastewater disposal or spillage raises fears of possible drinking water contamination.

• Possible solutions include Metfloc heavy metal chemical removal and Ion exchange trace metal removal systems.

• Submerged scraper conveyer may also be used to remove metals from bottom of ash pond.
ALTERNATIVE ASH SOLUTIONS

- Dry CCR technology eliminates need for ash pond storage.
- Greater heat recovery maximizes system fuel efficiency.
- The VAX and DRYCON systems are best examples.
- Further cost analysis of system investment and implementation is primary objective moving forward.
ANTICIPATED CHALLENGES

- Perform a relevant cost analysis of systems mentioned within the report.
- Analysis of the specific demands of an actual plant as specified by Sargent and Lundy.
- Establish contacts with local power plants and CCR management systems manufacturers.
- Confirm the neutrality and credibility of all data sources.
- Challenges are significant, but our team is confident in our project’s success.
QUESTIONS?
APPENDIX
IPRO 302’s GUIDE TO BOTTOM ASH MANAGEMENT

Inside the Power Plant:
- Coal → Boiler
  - Yields fly ash, bottom ash
- Add water to bottom ash
  - Option 1: Dewatering bin
    - Yields water, bottom ash
  - Option 2: Alternatives
- Surface Impoundment (ash pond)
  - Taken offsite to be used for other use in other industries
  - Water + heavy metals
  - Groundwater (through seepage)
  - Lakes, rivers, and ponds
## Pros and Cons:

### Pros

- **Submerged Flight Conveyor** –
  - Proven bottom ash system
  - Most common system
  - Most cost-effective
  - Less energy and water consumption than sluice systems
  - Modular design simplifies field erection and reduces installation cost
  - Continuous Removal of Ash
  - Lower Power Consumption
  - Easily incorporates mill rejects
  - No ash storage pond

- **Recirculation** –
  - Allows zero discharge of water into the environment
  - Minimal system make up water usage
  - Shortest outage time for converting existing sluice system
  - Easily incorporates mill rejects

- **Hydraulic Sluice System** –
  - Hopper storage: 8 to 12 hrs
  - No internal hopper moving parts
  - Easy conveyor routing and maintenance
  - Emergency gravity discharge possible • No ash retention ponds

### Cons

- **Submerged Flight Conveyor** –
  - The high discharge rate of ash over the head pulley during backlog recovery.
  - Poor dewatering of ash on the dewatering slope, resulting in slurry being discharged.
  - Ash spillage over the side wall at the intersection between horizontal and incline during backlog recovery.
  - Potential stalling of the SSC drive due to inadequate drive power during "backlog recovery" conditions.

- **Recirculation** –
  - Expensive Installation
  - Large yard footprint (its big)

- **Hydraulic Sluice System** –
  - Water treatment
  - Higher disposal costs
  - Cooling water requirements
  - Significant energy losses
  - Significant energy consumption
  - Maintenance intensive
Wastewater Solutions

• Contaminated Water
  • High concentration of heavy metals
    • Has negative effects on the environment
  • Sits in holding ponds outside
    • Possibility of a spill
    • Ends up in lakes, rivers and streams
    • Can leach into groundwater
      • Negatively affects our drinking water
Possible Wastewater Solutions

- Metfloc
  - Heavy metal chemical removal system
- Ion Exchange Treatment
  - Trace metal removal system
- Submerged Scraper Conveyor
  - Scrapes the bottom of the pond
Pros & Cons

• Pros:
  • Eliminate the need for an ash pond/water
  • Capture more heat from the bottom ash and circulate it back to the boiler- greater heat recovery.
  • Lower maintenance
  • Resulting ash is more environmentally friendly in comparison to other methods?

• Cons:
  • DRYCON & VAX are fairly new, not enough case studies, non-biased information, etc.
  • Initial investment costs are high.