**Problem Statement**
Evaluate the impacts of eliminating an ash storage pond from a power plant to meet pending EPA regulations and avoid future ash pond disasters.

**Background**
Path From Coal to Energy

**Coal Combustion Residuals (CCR) Solutions**

**Assumptions** *(Provided By Sargent & Lundy)*
Average coal power plant located in Illinois:
- 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

**Objectives**
To Determine:
- Current and pending coal combustion residuals (CCR) / wastewater regulations.
- CCR disposal and reuse alternatives.
- Waste water treatment and disposal alternatives.
- Pond closure and outsourcing opportunities.
- Costs and environmental implications of unlined ash pond

**Team Structure**

**Regulations Sub-Team**
Research current Environmental Protection Agency (EPA) regulations on the handling and disposal of bottom ash at coal powered power plants.

**Current Bottom Ash Handling Sub-Team**
Research current methods of bottom ash handling and disposal

**Alternative Bottom Ash Handling Sub-Team**
Identify alternative methods for handling bottom ash in power plant and at ash pond

**Water Treatment Solutions Sub-Team**
Research methods for decontamination and removal of ash-pond water.

**Research Analysis**

**Diagram of Bottom Ash Conveyence Process**

**EPA’s Proposed Regulations Changes**
**Article C:**
- Ash designated “Special Waste”.
- Ash ponds must be phased out within 7 years.
- Monitoring of all ash dumps is required.
- Ash generation, storage, transportation, and disposal of coal ash are regulated.

**Article D:**
- Ash designated non-hazardous.
- Ash ponds must be upgraded.
- Utilities not required to monitor ash dumps.
- Regulations only for disposal.

**Alternatives Considered**
- Existing Pond
- Retire Pond
- Retire Pond/Upgrade Wet System
- Convert to Dry Ash-handling System
- Article C: Hazardous
- Article D: Non-Hazardous

**To Determine:**
- Current and pending coal combustion residuals (CCR) / wastewater regulations.
- CCR disposal and reuse alternatives.
- Waste water treatment and disposal alternatives.
- Pond closure and outsourcing opportunities.
- Costs and environmental implications of unlined ash pond

**Team Structure**

**Regulations Sub-Team**
Research current Environmental Protection Agency (EPA) regulations on the handling and disposal of bottom ash at coal powered power plants.

**Current Bottom Ash Handling Sub-Team**
Research current methods of bottom ash handling and disposal

**Alternative Bottom Ash Handling Sub-Team**
Identify alternative methods for handling bottom ash in power plant and at ash pond

**Water Treatment Solutions Sub-Team**
Research methods for decontamination and removal of ash-pond water.
IPRO 302
Coal Combustion Residuals (CCR) Solutions

An Environmentally Sound and Cost Effective Solution to Handling Bottom Ash in Coal Power Plants

IPRO 302's Recommended Steps Toward Eliminating Ash Storage Pond

Phase 1: Convert to dry ash-handling system
- **Dry System vs. Wet System**
  - **INITIAL INVESTMENT COSTS ($)**
    - **DryCON** (dry system): $1,615,000
    - **SSC** (wet system): $1,210,000
  - **ANNUAL OPERATING COSTS ($)**
    - **DryCON** (dry system): $69,400
    - **SSC** (wet system): $145,200

Phase 2: Establish a ground water monitoring zone (GMZ)
- **Ground Water Monitoring Zone Basics**
  - Monitoring wells are drilled around ash pond area.
  - GMZ required to manage on-site contamination.
  - System can be managed on and off-site.
  - EPA must approve ground water monitoring zone before implementation.

Phase 3: Treat and dispose of ash pond wastewater
- **Best solution is to outsource task to wastewater specialists, like Charah.**
- **Chemical solutions and extraction wells both considered**
  - Chemical removal systems are not cost effective.
  - Extraction wells pose a risk of long term seepage.

Phase 4: Cap ash pond using a geo-synthetic membrane cover
- **Porous membrane will allow for natural ground flow.**
- **Geo-synthetic membrane, compacted clay, and layered earth caps were all considered.**

Total Cost of Ash Pond Closure

<table>
<thead>
<tr>
<th>Closure Activity</th>
<th>Cost ($ in millions)</th>
</tr>
</thead>
<tbody>
<tr>
<td>DryCON Investment</td>
<td>1,615.00</td>
</tr>
<tr>
<td>Ground Water Monitoring Zone</td>
<td>151.60</td>
</tr>
<tr>
<td>Wastewater Treatment/Disposal</td>
<td>600.00</td>
</tr>
<tr>
<td>Geo-synthetic Membrane Cover</td>
<td>11,200.00</td>
</tr>
<tr>
<td><strong>Total Capital Costs</strong></td>
<td><strong>13,566.60</strong></td>
</tr>
</tbody>
</table>

Sources: Clyde Bergman Materials Handling Ltd, Ameren UE, Van Cleef Engineering Associates.

IPRO 302 Team

Jennifer Agosto
- Business
- Minor: Architecture
Shana Burnett
- Business Administration
Sheena Enriquez
- Architecture
Nicole Firnbach
- Architecture
- Minor: Structural Engineering
Andrew Graebner
- Civil Engineering & Applied Mathematics

Robert Herman
- Electrical Engineering & Mathematics
Donal Kipp
- Mathematics & Computer Science
Chad Parker
- Business Administration
Graeme Port
- Humanities
Susan Roland
- Computer Engineering
Joseph Sanchez
- Business Administration

Acknowledgements

Sponsor:
Sargent & Lundy

Advisors:
Dr. Myron Gottlieb
Dr. Don Tijunelis

[poster compiled by: Nicole Firnbach & Sheena Enriquez]