POWER PLANT WASTEWATER MANAGEMENT TO MEET NEW REGULATIONS FOR McILVAINE COMPANY

HOT TOPIC HOUR: COAL ASH PONDS AND WASTEWATER TREATMENT ISSUES

Presented by
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DISCUSSION TOPICS—
BASED ON CH2M HILL’S EXPERIENCE

- New requirements on power plants
- Approach to meeting the coming requirements
- Understanding water and wastewater sufficiently
- Alternatives to replace ash ponds through wastewater stream elimination, segregation, treatment
- Tank-based treatment tips and tricks

Will present from CH2M HILL project experience
Pressure from all sides affects water management

- **Air regulations**—creating new wastewater streams
- **Wastewater discharge regulations**—driving plants toward dry ash handling; potentially to ZLD or near-ZLD. New Effluent Limitation Guidelines (ELGs) beginning to impact discharge permits.
- **Solid waste regulations**—concerns with structural safety, groundwater contamination risk may lead to pond closures or costly modifications
- **Water use limitations**
- **Ponds nearing capacity**—difficulty permitting new ponds
- **Risk management**—knowing how to deal with unknown regulatory future
ADDRESSING THE DRIVERS WILL TAKE SIGNIFICANT CHANGES

Figure Courtesy of Siemens Water Technologies

From Here …

+ (ELG, CCR Rule, etc.)

…to Here

Limits:
- pH
- TSS
- O&G

Limits:
- As 10 ppb
- Se 10 ppb
- Hg 20 ppt
Forecasting Regulations—Insights on ELG from Merrimack Draft Permit

- Reduced thermal discharges, reduced withdrawal of river water, improved fish return
- Set tight wastewater discharge limits on final discharge and on treated FGD wastewater
- Would require biological treatment of FGD wastewater to meet Se limits

<table>
<thead>
<tr>
<th>Draft Merrimack Permit</th>
<th>FGD</th>
<th>Slag Pond</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aluminum, ug/L</td>
<td></td>
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<td>Arsenic, ug/L</td>
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<td>Cadmium, ug/L</td>
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<td>Chromium, ug/L</td>
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<td>Lead, ug/L</td>
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<td>Copper, ug/L</td>
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<td>Manganese, ug/L</td>
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<tr>
<td>Mercury, ug/L</td>
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<td>0.007</td>
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<td>Selenium, ug/L</td>
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<td>Zinc, ug/L</td>
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<tr>
<td>Chlorides, mg/L</td>
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</tr>
<tr>
<td>TDS, mg/L</td>
<td>35,000</td>
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</table>
1. Understand water and wastewater sufficiently
   • Balances: Flows and compositions
   • Variability

2. Develop and evaluate alternatives to meet potential future regulatory limits:
   • Eliminate wastewater streams
   • Segregate streams with tight regulations or that adversely affect reuse (TDS)
   • Treat remaining high-volume / easily treatable wastewater for reuse or discharge

3. Plot a path forward for efficient, sequential implementation of ash pond replacement strategy…rather than suddenly facing ash pond closure without the info needed to make good decisions
1. **UNDERSTAND WATER AND WASTEWATER SUFFICIENTLY**

- Start with the end in mind
- Identify data needed to meet goals
- Identify data gaps, then fill gaps with sampling and flow monitoring data
- Peak and average
- Flows and key ions
1. UNDERSTAND WATER AND WASTEWATER SUFFICIENTLY

Flow balance example—from alternatives evaluation and design to replace ash pond
2. **Eliminate, Segregate, Treat**

- **Fly ash sluice water**
  - High flow (1 to 7 MGD. Rough estimate: 3,000 gpd/MW).
  - Medium toxic equivalents and TDS
  - Dry-handling technologies are well established
  - But “dry” fly ash systems can still have significant fly ash wastewater to manage.

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**Evaluation of fly ash contribution to ash pond water**

*From evaluation of effect of going to dry fly ash*

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Evaluation of fly ash contribution to ash pond water

<table>
<thead>
<tr>
<th></th>
<th>Fly Ash sluice water</th>
<th>Bottom Ash sluice water</th>
<th>Coal pile runoff (annualized)</th>
<th>Cooling Tower Blowdown</th>
<th>Demin. Brine Waste</th>
<th>Pyrites sluice water</th>
<th>Sumps</th>
<th>FGD WW</th>
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</thead>
<tbody>
<tr>
<td>As (kg/day)</td>
<td>10</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
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<tr>
<td>Se (kg/day)</td>
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<td>5</td>
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2. ELIMINATE, SEGREGATE, TREAT

- FGD wastewater
  - Low flow: 0.1 to 1 MGD typically
  - Most significant concentrations of toxic equivalents and TDS
  - Will be regulated separately under ELG
  - High TDS (expensive to treat and less suitable for reuse)
  - Treating separately has significant advantages

FGD WWTP Arrangement
From design of FGD WWTP
2. **Eliminate, Segregate, Treat**

- **FGD wastewater** - Some plants choosing to stop the “pollutant de jour” trend, so evaluating ZLD
  - EPA considering ZLD in developing ELGs
  - High cost relative to conventional treatment
  - O&M challenges, limited track record with FGD water
  - Need to consider true ZLD vs “near ZLD”
2. **ELIMINATE, SEGREGATE, TREAT**

- **Bottom ash and other streams**
  - High flow if once-through: 1 – 7 MGD ~ 3,000 gpd/MW
  - Relatively low in TDS and toxic equivalents
  - TSS—Many solids large, easily removed; fine, abrasive solids remain
  - More difficult to convert to dry handling. Options:
    - Use recirculating water (*hydrobin*) system to reduce wastewater flow
    - Treat ‘once-through’ sluice water for discharge or reuse
2. Eliminate, Segregate, Treat

- If fly ash and FGD wastewaters are kept separate, treating for the fines from bottom ash and other waste streams (runoff, sumps) to meet discharge and/or reuse options is relatively easy.

  - **Discharge** – Easier to meet current and future regulations
  - **Reuse** – Presents opportunity to provide a reuse water

  *Example: Use treated wastewater for reuse in cooling tower, then use cooling tower blowdown for FGD makeup water.*
3. Plot a Path Forward…

…that allows for efficient, sequential implementation of an ash pond replacement strategy

• Alternative: Suddenly facing ash pond closure without the information needed to make good decisions.
ASH POND REPLACEMENT – TIPS FOR TREATMENT

First Floor
- Sludge Unloading Pit
- Rolloffs
- H₂SO₄
- FeCl₃
- NaOH
- Polymer Organosulfide

Second Floor
- PDC
- Filter Presses
- Cloth Wash
- Laboratory
- Control Room
- Sludge A
- Sludge Batch B
- Recycle

Clarifier A
- Influent Tank
- Effluent Tank

Clarifier B
Avoid temperature and flow swings

- Intermittent high flow and/or high temperature can cause washout or thermal currents
- Maintain <10°F/hr temperature rise and <1,000 gpm/hr flow variation
  - Influent equalization or
  - Effluent recycle
ASH POND REPLACEMENT – TIPS FOR TREATMENT
LESSONS-LEARNED EXAMPLE

Provide means to dewater solids from other sources

Sludge Unloading Pit Pumps
Decant Lines
Sludge Storage Tanks
CLOSING THOUGHT: USE A “POWER PROGRESSION” TO SEEK THE MOST COST-EFFECTIVE SOLUTION

1. Negotiate more favorable permit conditions
2. Modify existing chemistry to meet treatment objectives
3. Resolve with tank-based physical/chemical treatment
4. Add a low cost natural treatment system if biological treatment is a must
5. Use tank-based physical/chemical treatment followed by in-tank biological treatment
6. Explore use of low-cost ZLD mechanisms and use thermal ZLD as a last resort