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

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Coal-Fired Power Plants in the Spotlight

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

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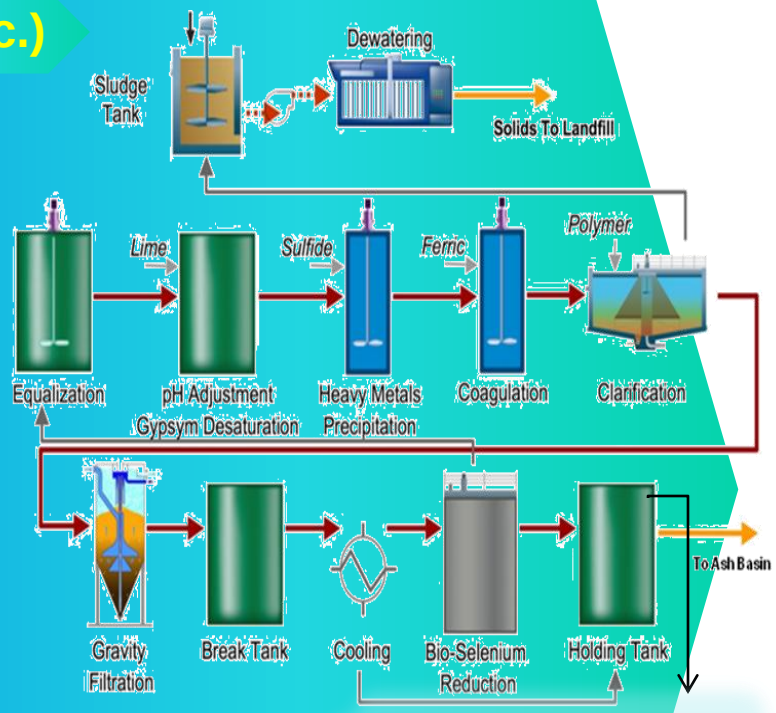
Addressing the Drivers will Take Significant Changes

From Here …

…to Here

+ (ELG, CCR Rule, etc.)



Limits:
- **pH**
- **TSS**
- **O&G**

Limits:
- **As 10 ppb**
- **Se 10 ppb**
- **Hg 20 ppt …**

Figure Courtesy of Siemens Water Technologies

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

Draft Merrimack Permit	FGD	Slag Pond
Aluminum, ug/L		1,080
Arsenic, ug/L	8	2.2
Cadmium, ug/L	50	
Chromium, ug/L	10	
Lead, ug/L	100	
Copper, ug/L	8	27
Manganese, ug/L	3,000	
Mercury, ug/L	0.014	0.007
Selenium, ug/L	10	57
Zinc, ug/L	12	
Chlorides, mg/L	18,000	
TDS, mg/L	35,000	

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Best Approach to Meeting Coming Requirements

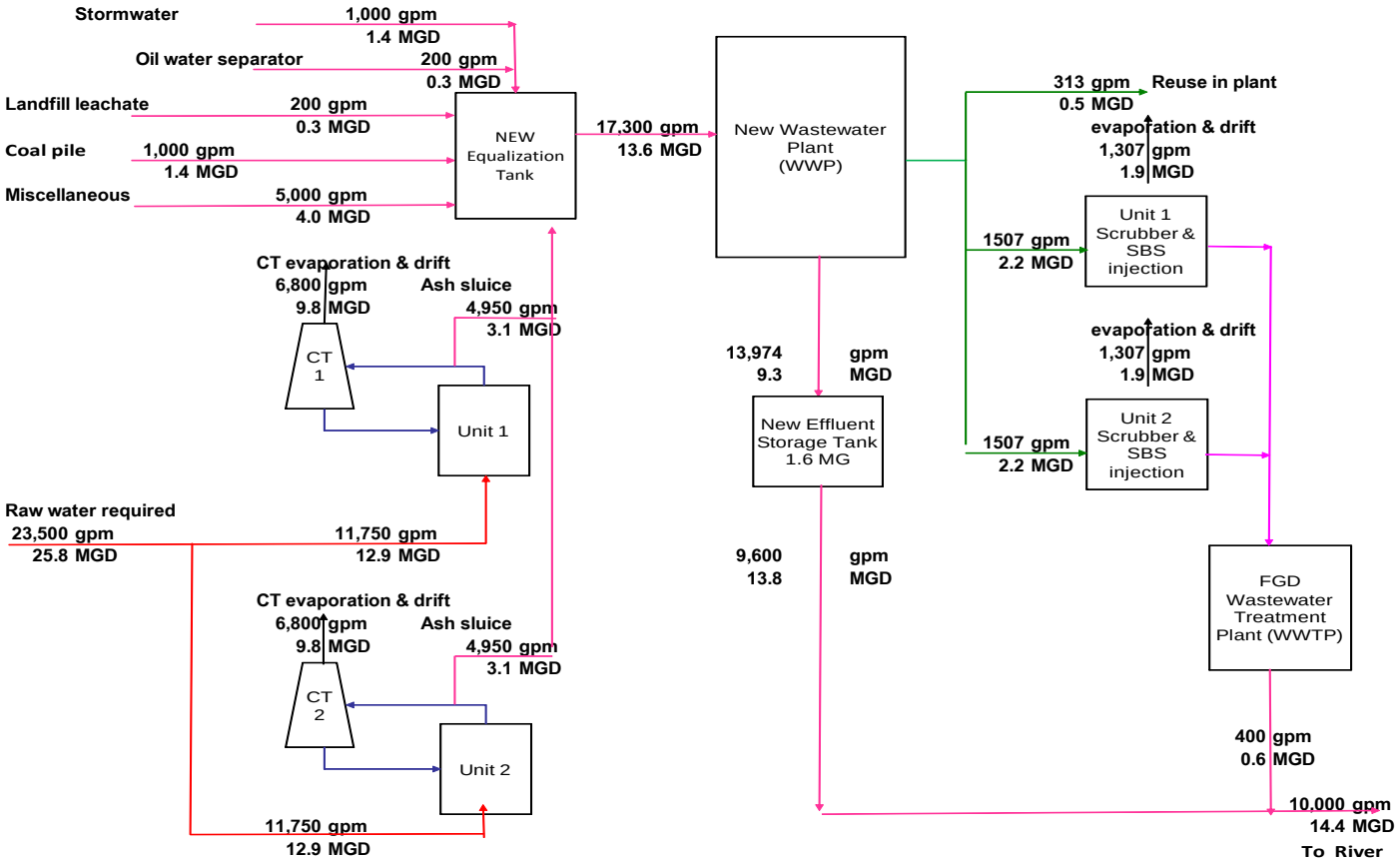
1. Understand water and wastewater sufficiently
   - Balances: Flows and compositions
   - Variability
2. Develop and evaluate alternatives to meet potential future regulatory limits:
   - Eliminate wastewater streams
   - Segregate streams with tight regulations or that adversely affect reuse (TDS)
   - 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*



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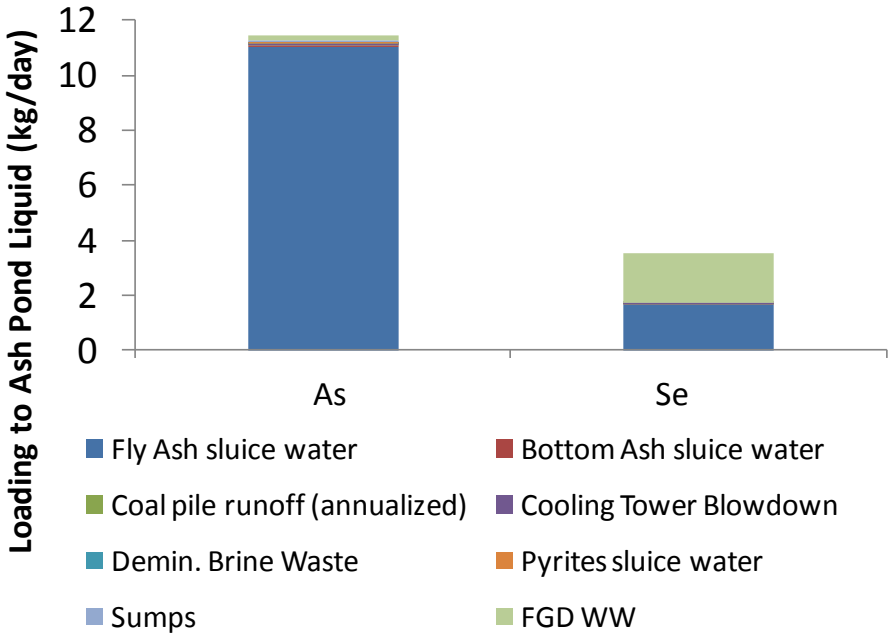
2. ELIMINATE, SEGREGATE, TREAT

- 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.

Evaluation of fly ash contribution to ash pond water

From evaluation of effect of going to dry fly ash



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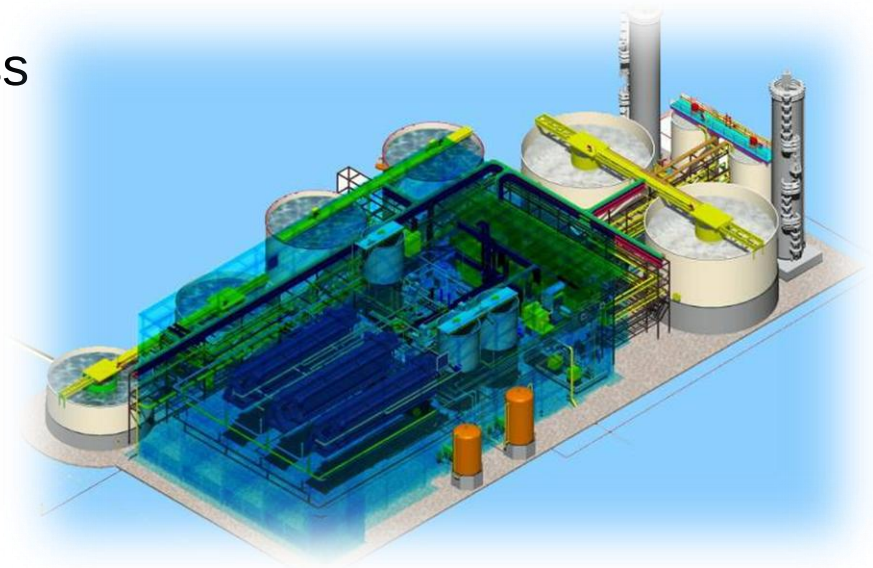
2. Eliminate, Segregate, Treat

- 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

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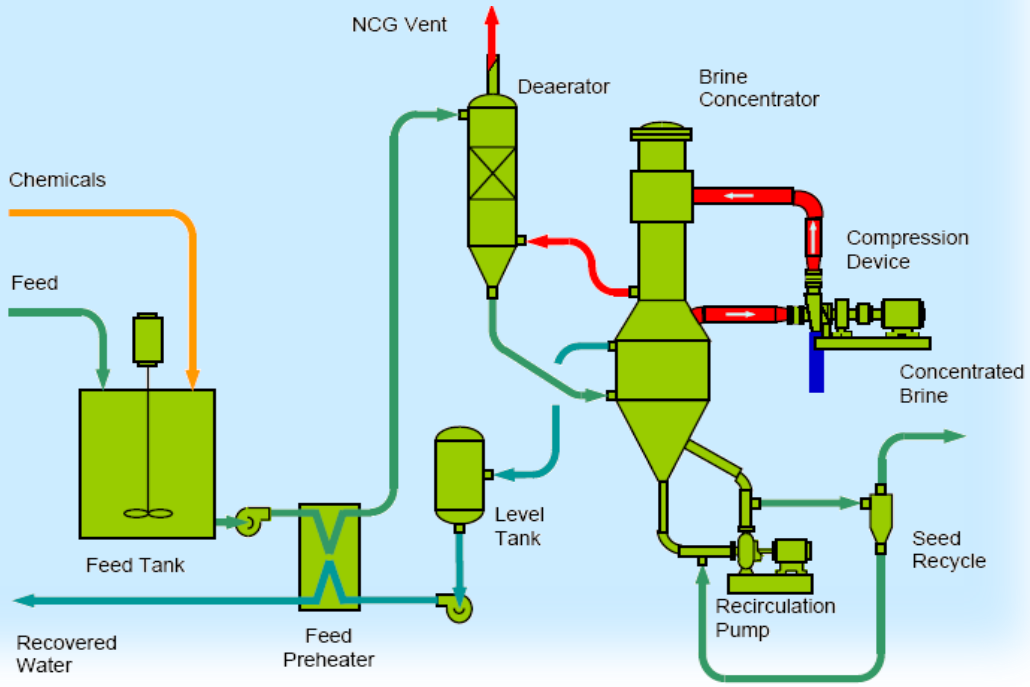
2. Eliminate, Segregate, Treat

- 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"

Vapor Compression Evaporator (VCE) Brine Concentrator

PFD from alternatives evaluation for FGD wastewater from plant in SE



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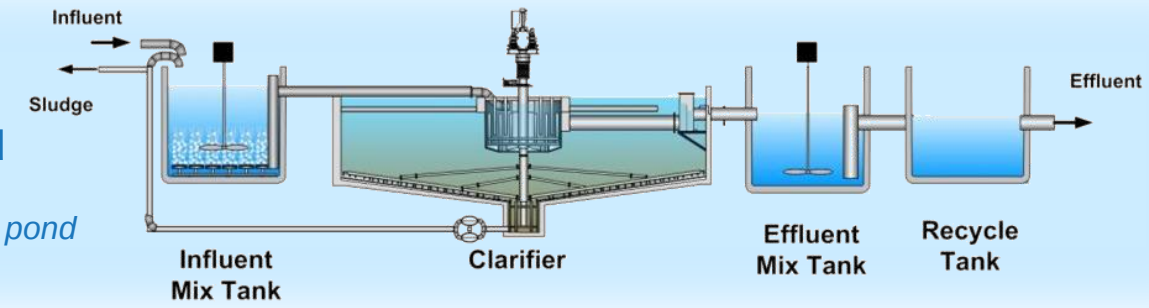
2. Eliminate, Segregate, Treat

- 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

Process Flow - Liquid

PFD from detailed design of treatment plant to replace ash pond



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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.

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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.

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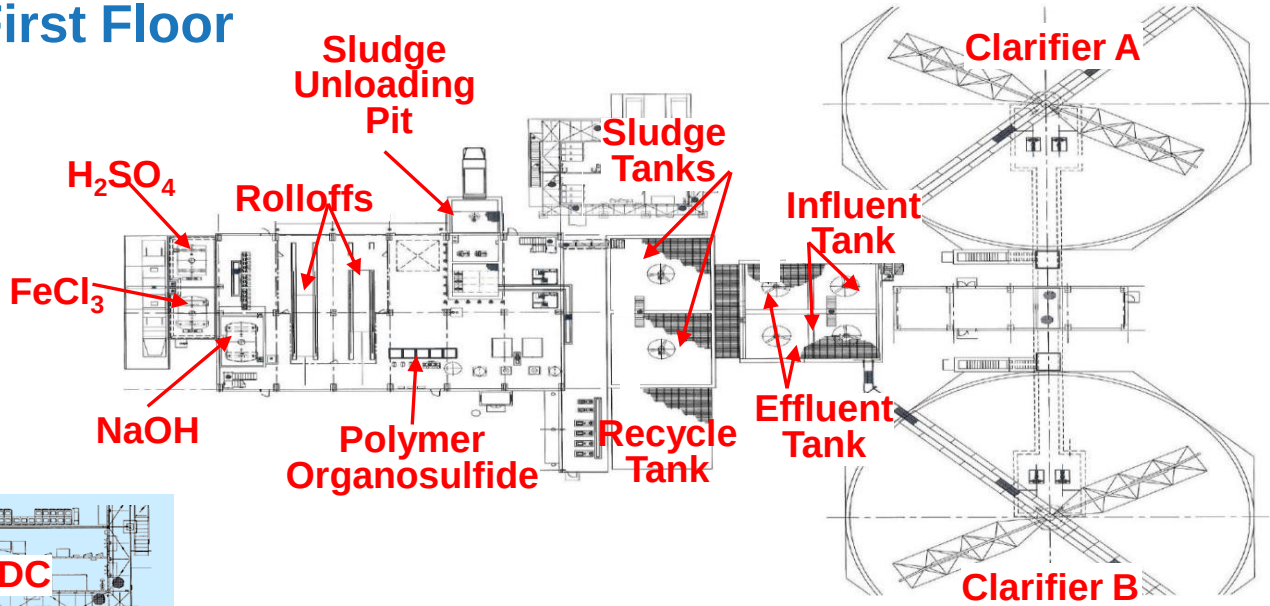
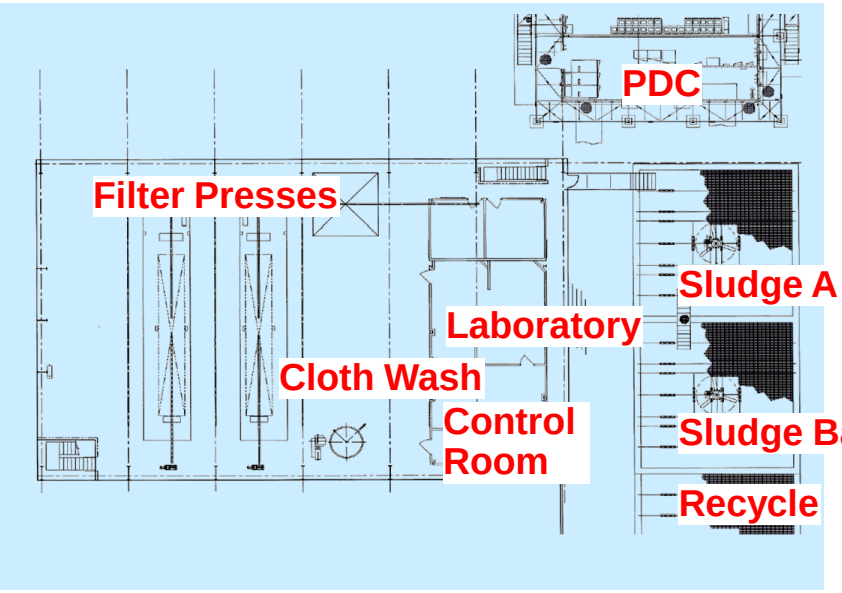
Ash Pond Replacement – Tips for Treatment

First Floor



Second Floor



Ash Pond Replacement – Tips for Treatment

Lessons Learned Example

Avoid temperature and flow swings

- Intermittent high flow and/or high temperature can cause washout or thermal currents
- Maintain <10ºF/hr temperature rise and <1,000 gpm/hr flow variation
  - Influent equalization or
  - Effluent recycle

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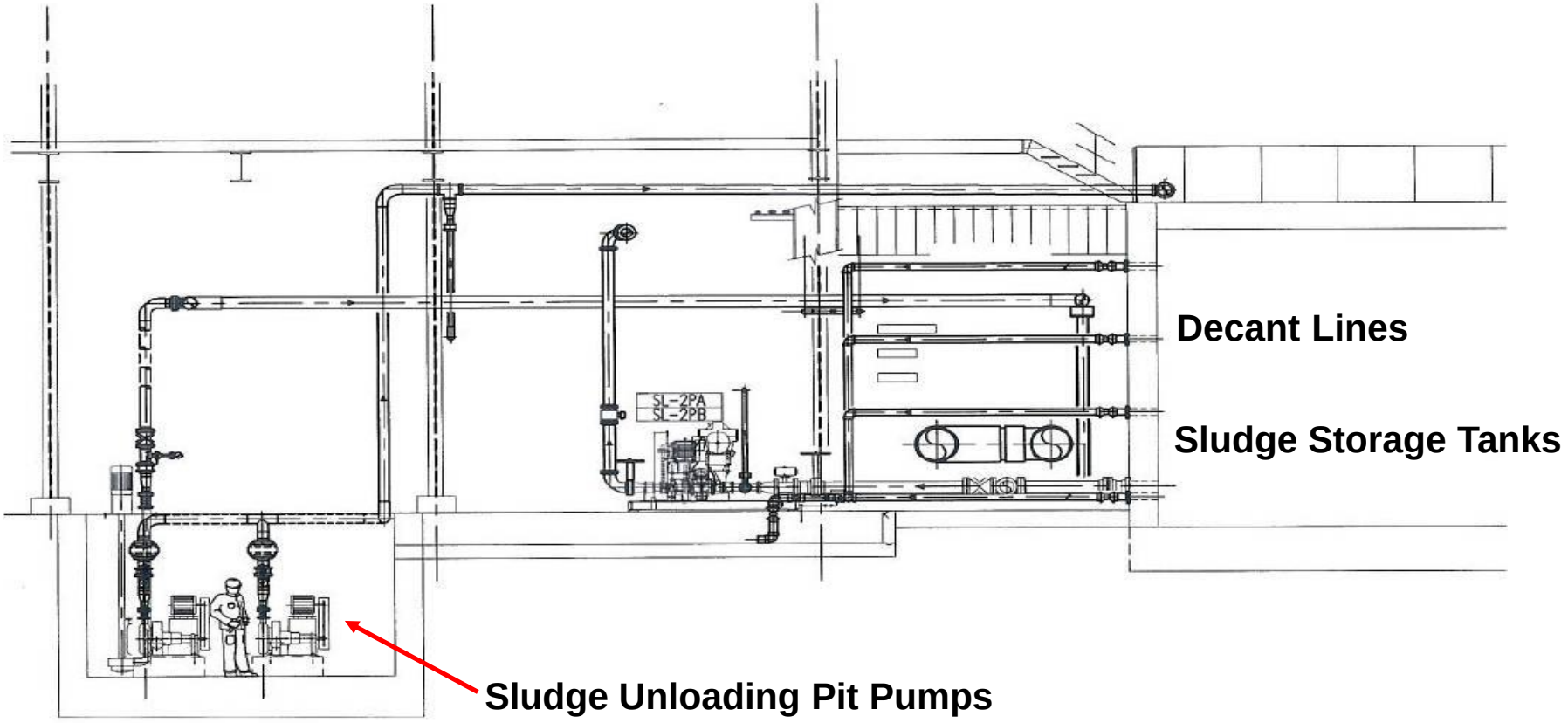
Ash Pond Replacement – Tips for Treatment

Lessons-Learned Example

Provide means to dewater solids from other sources



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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

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