

REINHOLD ENVIRONMENTAL Ltd.



## **2015 Wastewater-Ash Round Table Presentation**

September 22, 2015, in Charlotte, NC / Hosted by Duke Energy

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# Temporary Effluent Treatment for Coal Ash Basins

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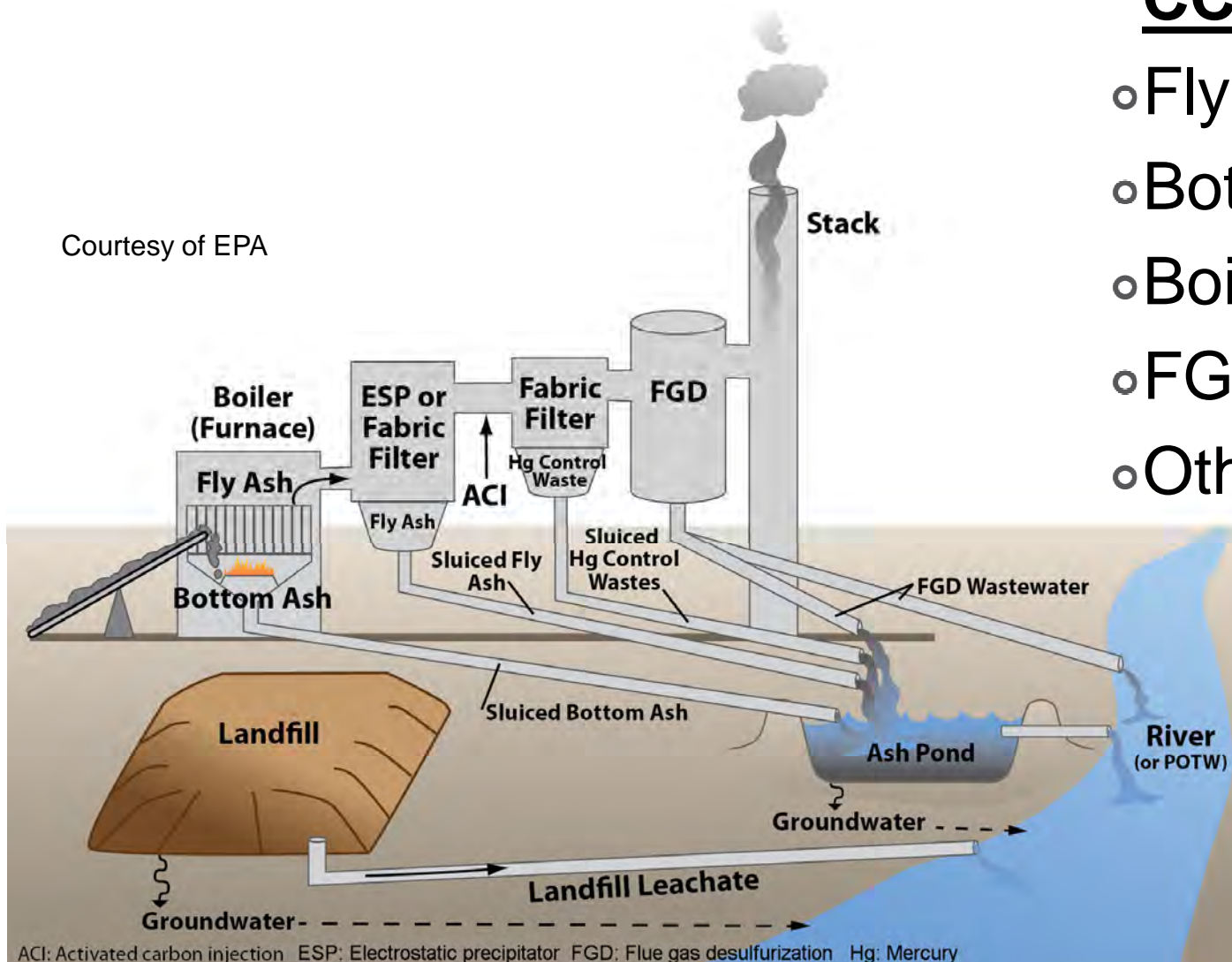
# Topics

- Background
- Basin Closures
- Ash - Considerations
- Water – Challenges
- Integrated Approach
- Discussion
- References & Useful Links

# Background - CCRs

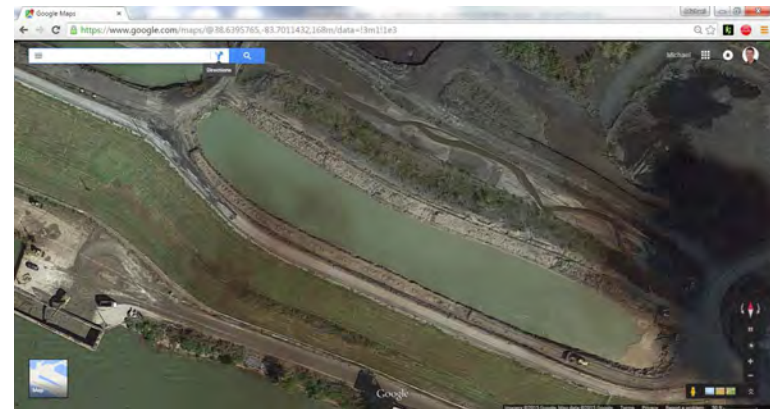
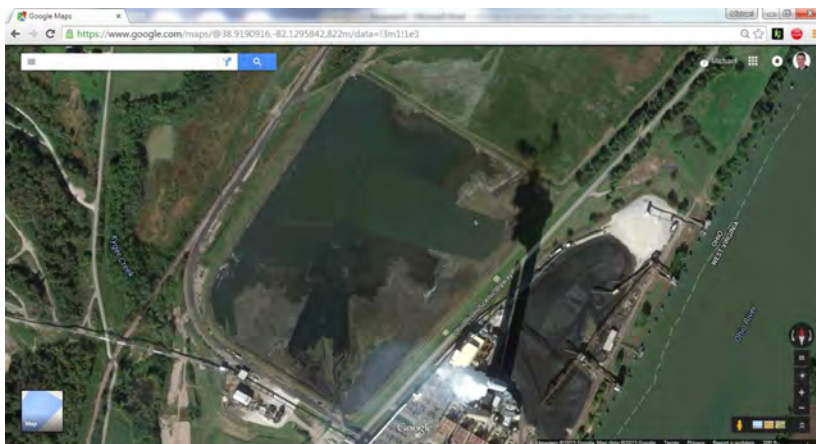
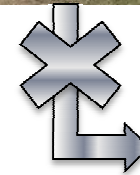
## CCRs

- Fly Ash
- Bottom Ash
- Boiler Slag
- FGD Materials
- Other by-products



# Background - Ash Basins

- CCRs Depository
- Storm Water
- Cooling Tower Blowdown
- Other Wastewater Streams



# Background – Basic Statistics

- CCR is one of the largest waste streams generated in the U.S.
- In 2012, over 470 coal fired facilities burned over 800 million tons of coal, generating ~ 110 million tons of CCR in 47 states and Puerto Rico
- CCR may be generated wet or dry
- CCR is sent off-site for disposal or beneficial use or disposed onsite in landfills and surface impoundments
- In 2012, 40% of CCR was beneficially used with 60% disposed, mostly onsite.
- There are over 310 active CCR landfills and 735 active CCR surface impoundments.
- The average size of a CCR landfill is slightly over 120 acres, with an average depth of 40'; CCR surface impoundments average slightly over 50 acres with an average depth of 20 feet. (337 M GL)

Courtesy of EPA



# Ash - What to do with it?

- Beneficial Re-use
- Depository
  - *Onsite*
  - *Offsite*
- Resource Recovery!



# Ash – How to get it out of the water?

- Dry Handling
- Rim Ditching and/or Excavation
  - *“Yellow Iron” – scoop, spread, & stack*
  - *(active basin or in situ ash )*
- Dewatering Technologies
  - *Dredge basin & press*  
*(active basin or in situ ash )*
  - *Capture before basin & press*  
*(wet transport & closed basin)*
- Then what?
  - *Truck, rail, conveyor, ship transport*

Rectangular Basin

Square Basin

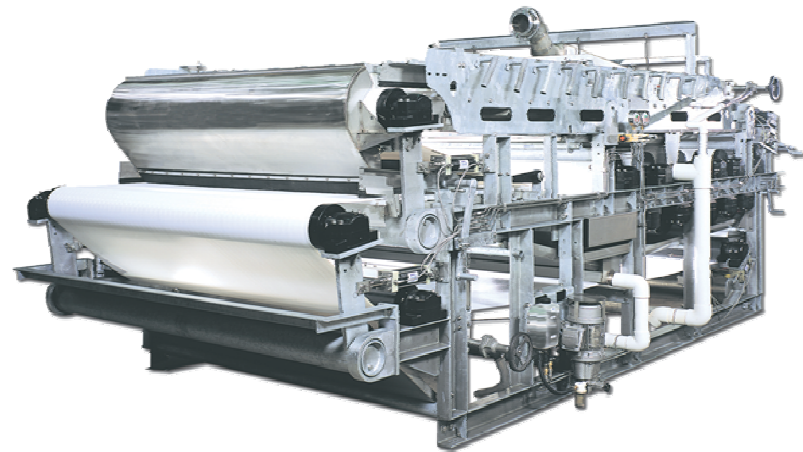
# Ash – Dewatering Technologies

- Dewatering Technologies

- *Knock Down Cone Bottom Tanks*
- *Thickener/Clarifiers*
- *Drag Chains*
- *Filter Press*
- *Belt Filters*
- *Centrifuges*
- *Shaker screens and finer meshes*

- Considerations

- *Type of solids*
  - Bottom ash, fly ash, misc, combinations?
- *Type of coal*
- *Material of construction*
- *Abrasiveness*



Picture courtesy of Alfa Laval



Picture courtesy of UCC

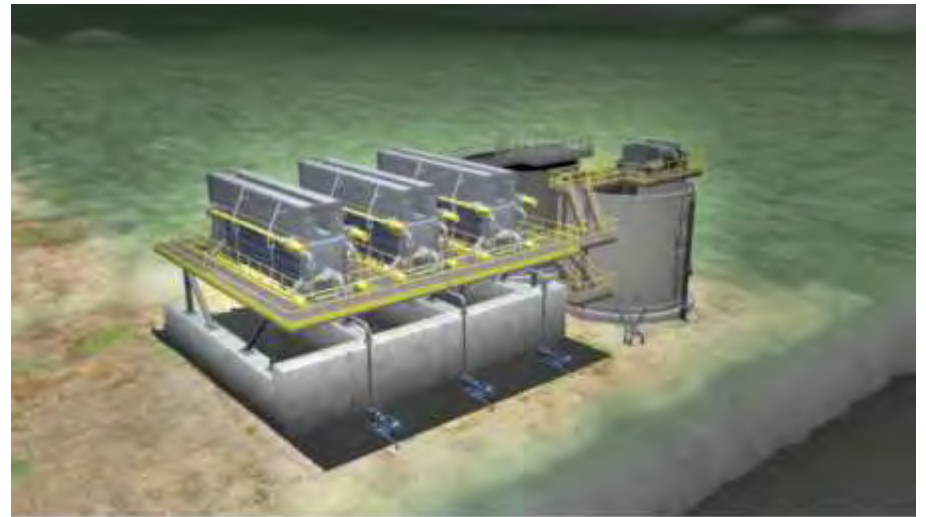
# Ash – Dewatering Technologies, Considerations

- Controlled Engineered Systems Solution
- Less Volume – Drier Material to customer specification
  - *3 to 1 Ratio*
  - *Enables Vertical Stackability*
  - *Dramatically Reduces Transport Cost > 50+% Carbon Reduction*
- Less Restrictions on Grab Reach or Basin Accessibility
- No Ground Water Contamination Vs. Natural Drying
  - *Control of Contaminated Water*
- Overall Risk Reduction
  - *Less risk than traditional methods*
- Greater Reuse and Recycle Opportunities
  - *Beneficial Reuse – COST NEUTRAL/REDUCTION*
  - *On Site Recycle, Structural Fill – COST NEUTRAL/REDUCTION*
  - *Complete Water Recycle – WATER 'NEUTRAL' (Limited FW Extraction)*



# Ash – Dewatering Technologies

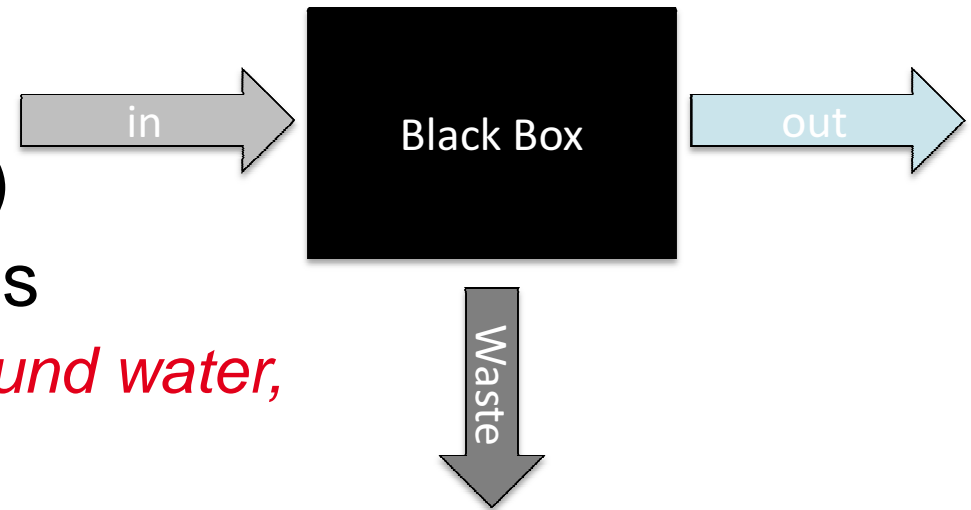
- Capture and convert wet fly ash into dry ash, while simultaneously emptying one or more lagoons
- **Allows basins to be kept in service** while capacity is being recovered
- Can be used for pond closure
- Dried ashes ready for beneficial use or disposal
- Filtrate can be coupled with ballasted clarification for heavy metals removal and water recovery/reuse. Solids returned ahead of DryAsh™.
- Existing coal fired site: excellent results; operations contract renewed in 2014. NO chemicals required
- PRB (Powder River Basin) Coal can be handled as well (thixotropic tendencies)



Picture of DryAsh™

# Water – How to treat it?

- Dry conversion (if not..)
- Establish a design basis
  - *Existing basin water, ground water, or active transport water*
  - *Discharge and/or recycle*
  - *Sampling – the more the better*
  - *Flow & mass balance*
- Permits
  - *Existing, future, or predicted NPDES permit; federal, state, and local`*



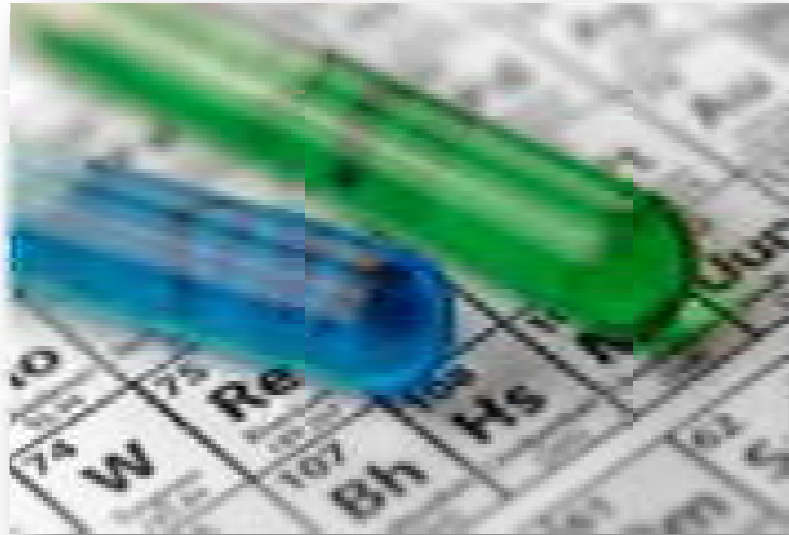
# Water – How to treat it?

- Perform feasibility testing
  - *Jar testing*
  - *Onsite piloting if necessary*
  - *Long laboratory turnarounds*

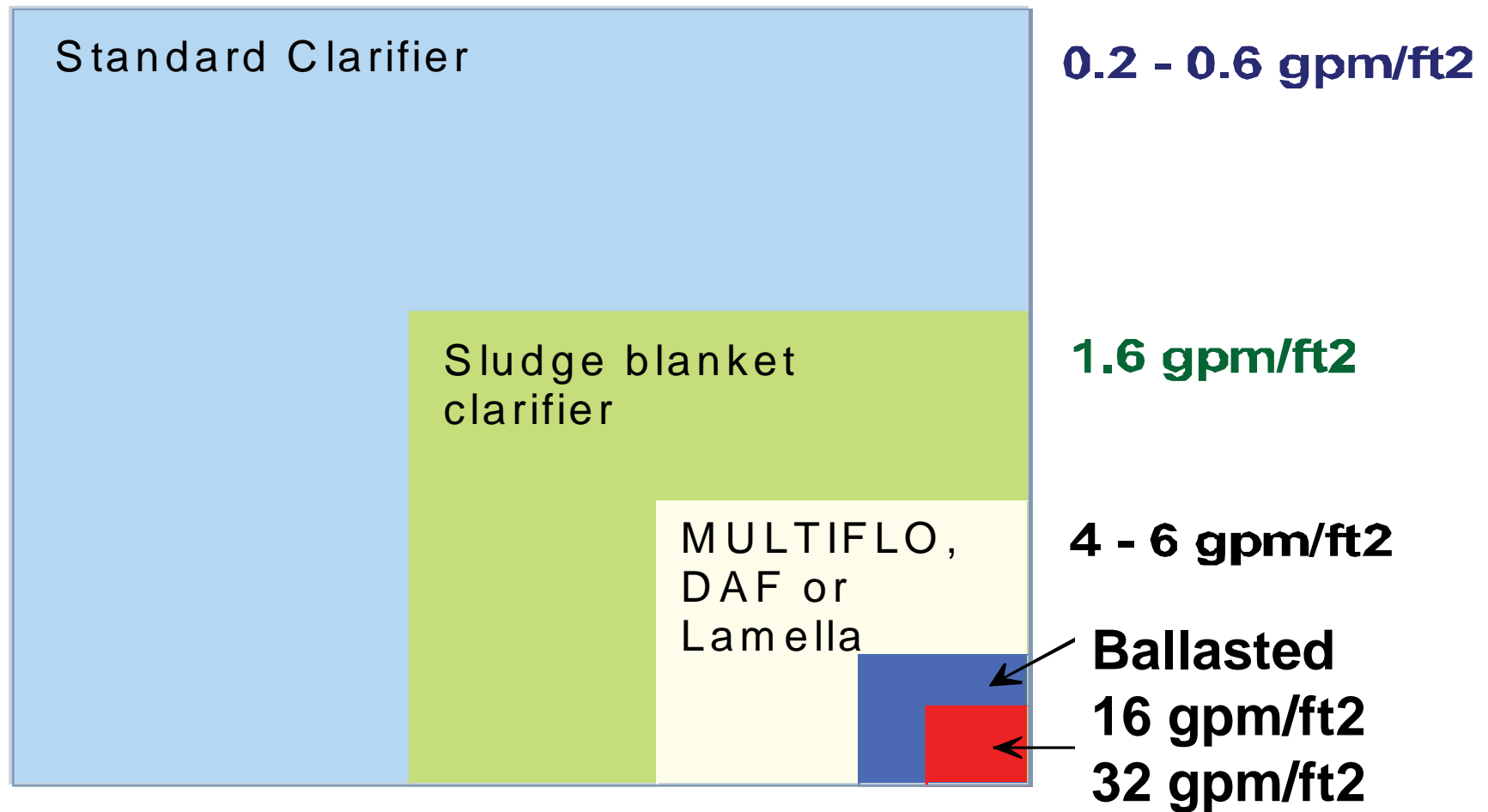


# Water Characteristics

- pH
- Total Suspended Solids
- Aluminum
- Arsenic
- Iron
- Nitrate
- Mercury
- Selenium
- Other various metals, etc.
- **Very helpful to have valence / oxidation state / speciation in design basis**

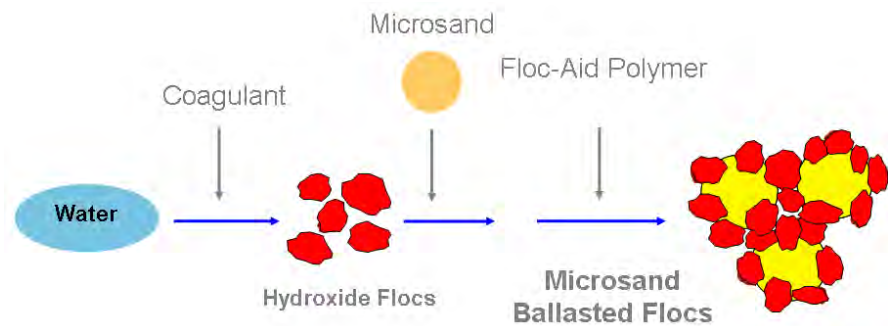
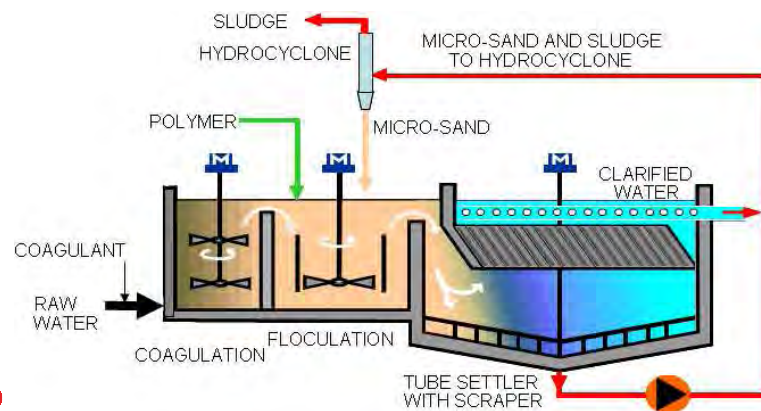
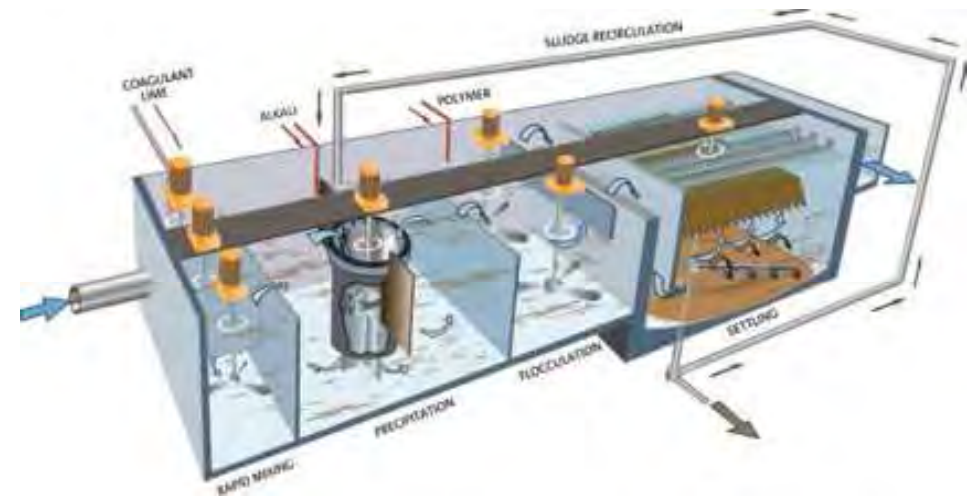
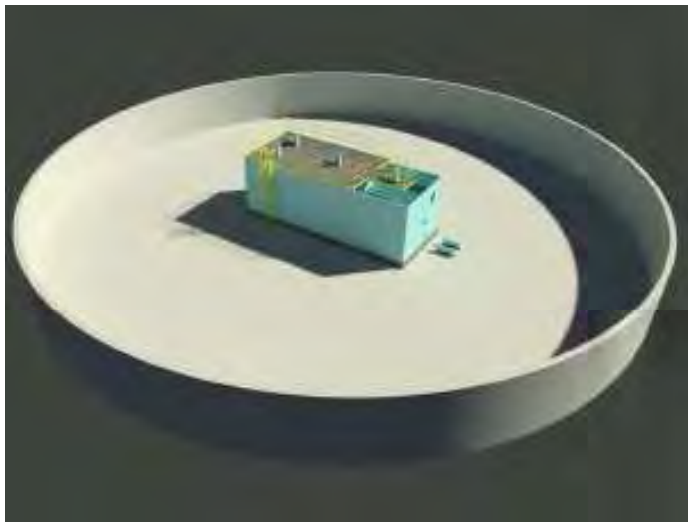


# Water Technologies - Clarification



# Water Technologies - Clarification

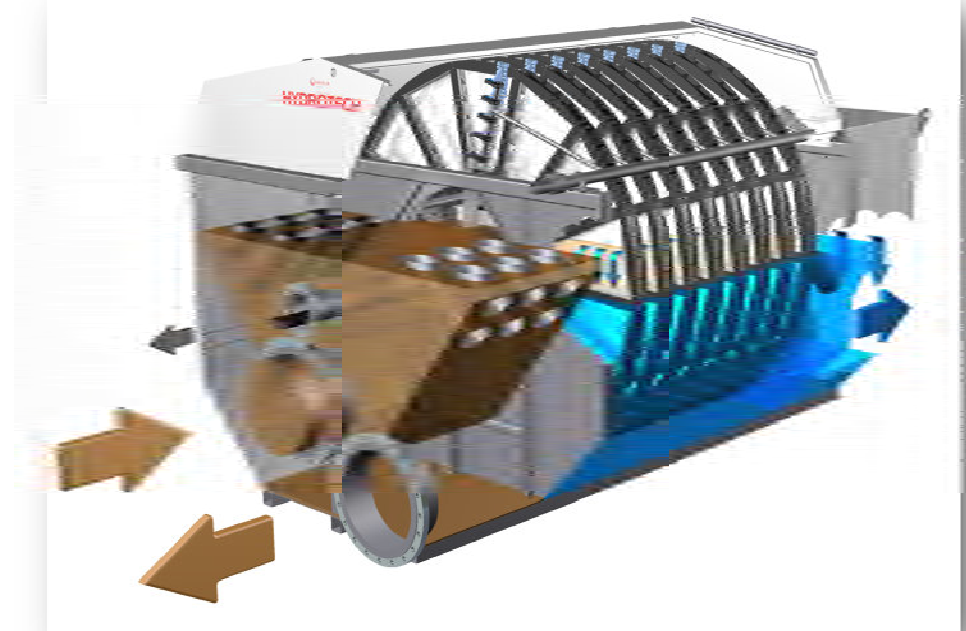
## Conventional, Sludge Recirculation, or Ballasted Clarification



# Packaged or Mobile Clarification

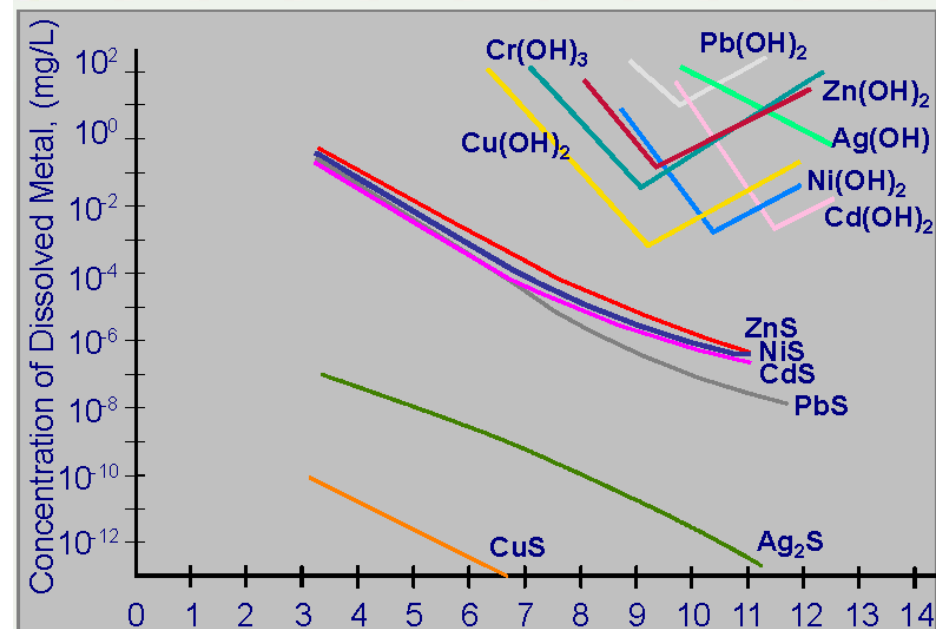


# Water Technologies - Filtration



# Water Technologies – Low Levels Metals & Nitrate

- Current State of the Art Metal Treatment Technologies
  - *Hydroxide/Carbonate/Sulfide Precipitation*
  - *Coprecipitation/Adsorption With Aluminum or Iron Salts*
  - *Ballasted Flocculation*
  - *Ion Exchange (Selective)*
- Emerging Technologies
  - *Membrane Systems*
  - *Biological Reactors*
  - *Fixed Bed Adsorption Process:*
    - Zero Valent or Sulfur Modified Iron*
    - Aluminum based media;*
    - Iron-Aluminum composite media*
- Membrane Technologies



# Thermal Treatment

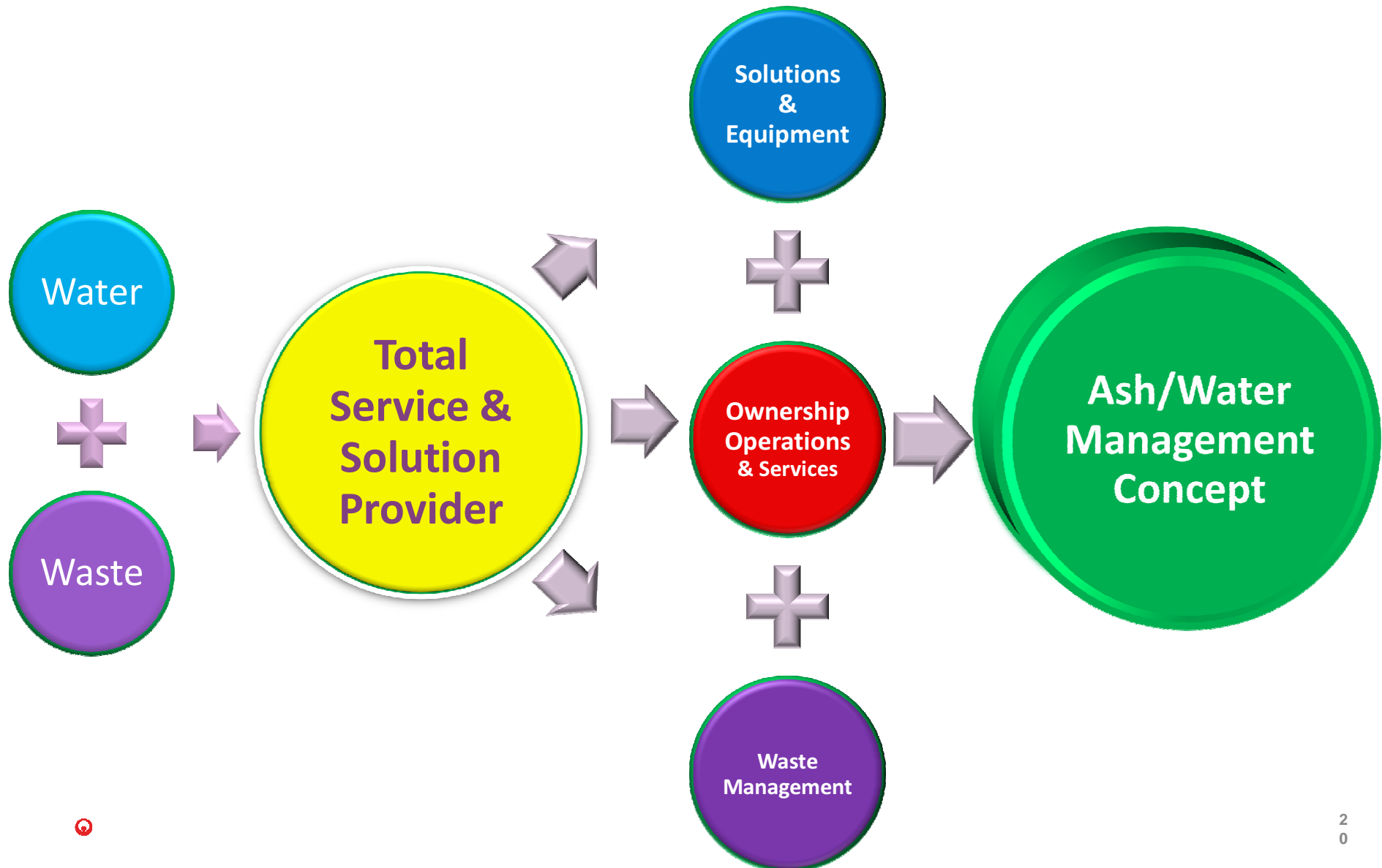
## Monfalcone Power Plant, Italy

- ▶ 336 MW Coal-Fired
- ▶ LSFO Scrubber (MHI)
- ▶ ZLD Operational Summer 2008
- ▶ Dry Cake for Landfill Disposal

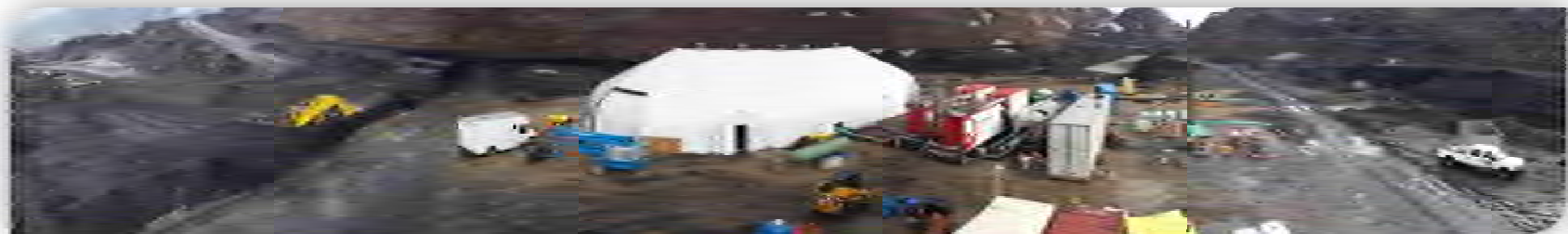
**Pretreatment  
: Lime-Soda  
Ash  
Softening**



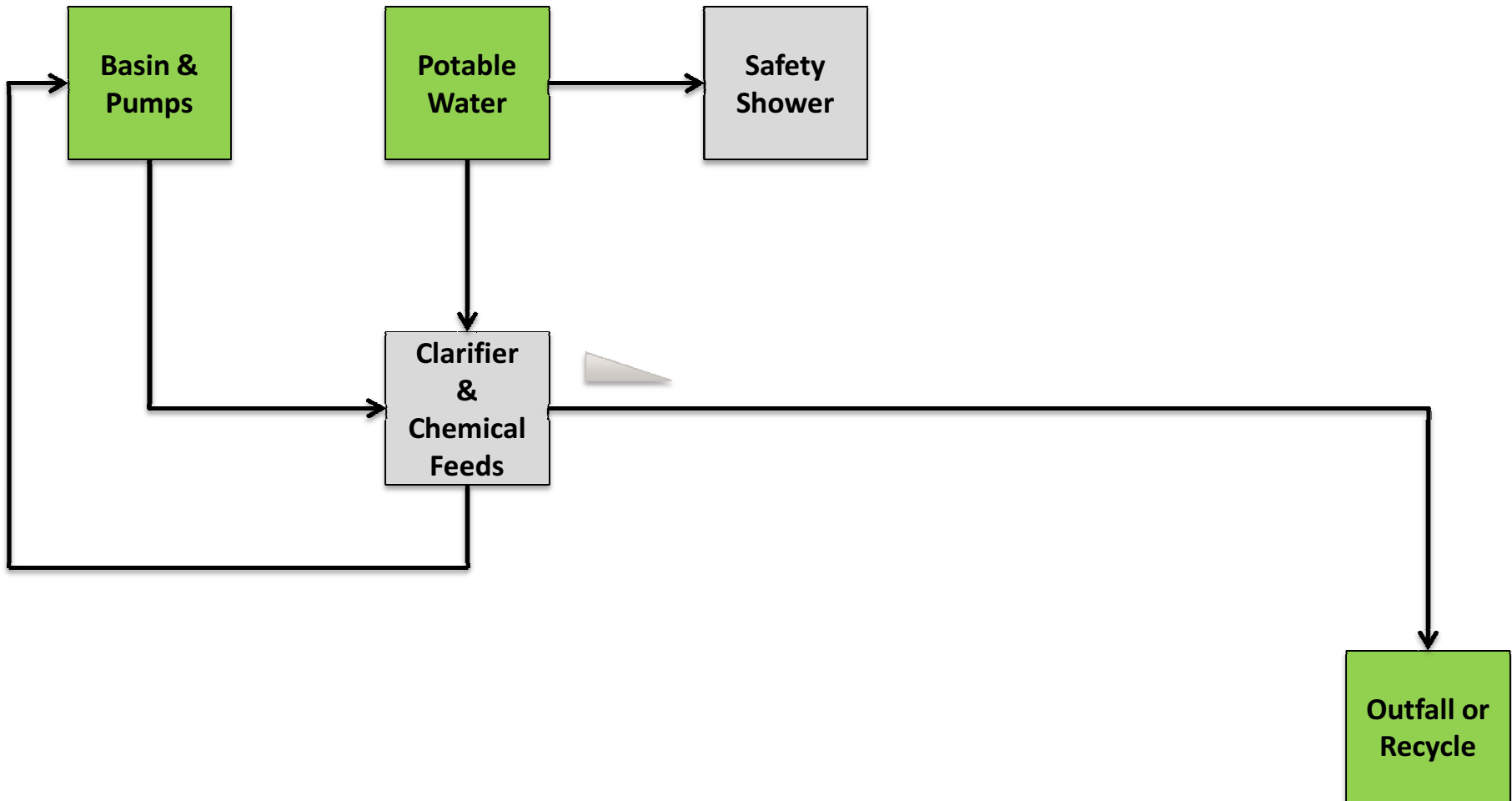
# Integrated Approach: Ash + Water -> DBOOM



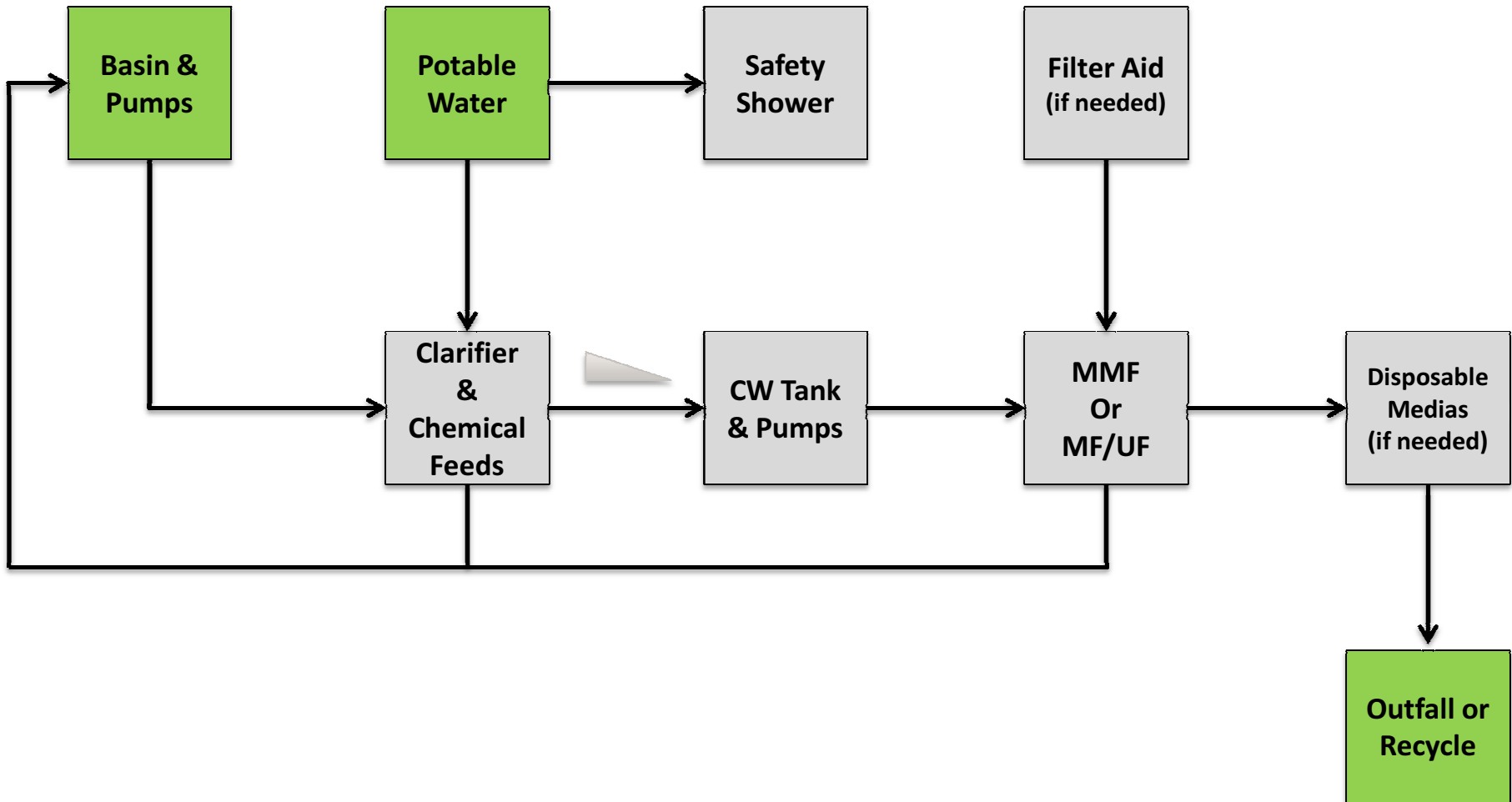
# BLOCK FLOW SCENARIOS



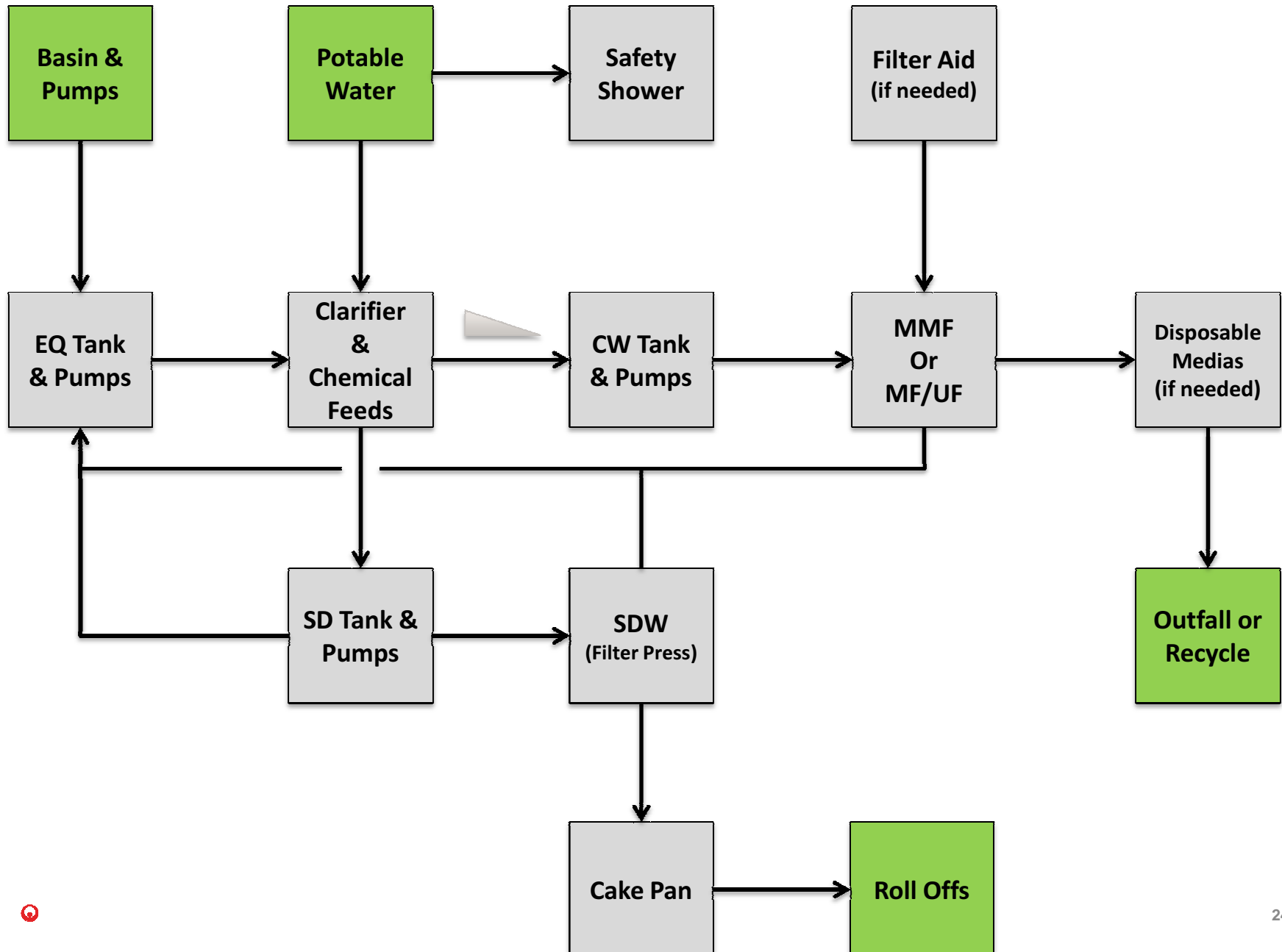
# Clarification



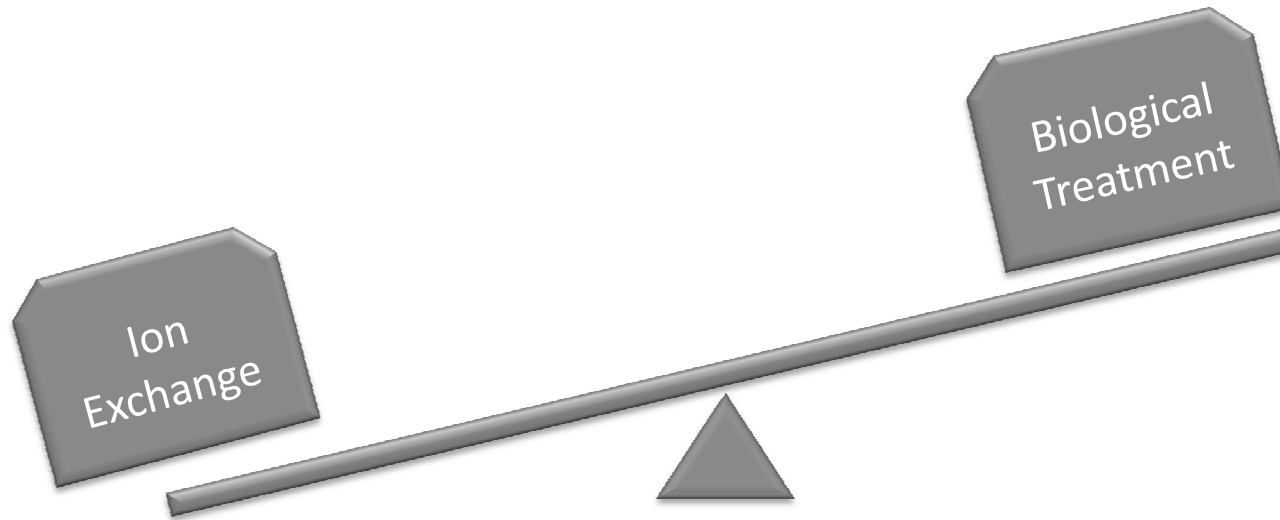
## Clarification + Filtration



# Clarification + Filtration + SDW



# What about low level Nitrates?

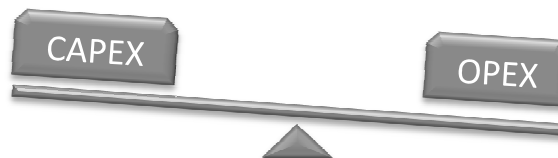


## Ion Exchange

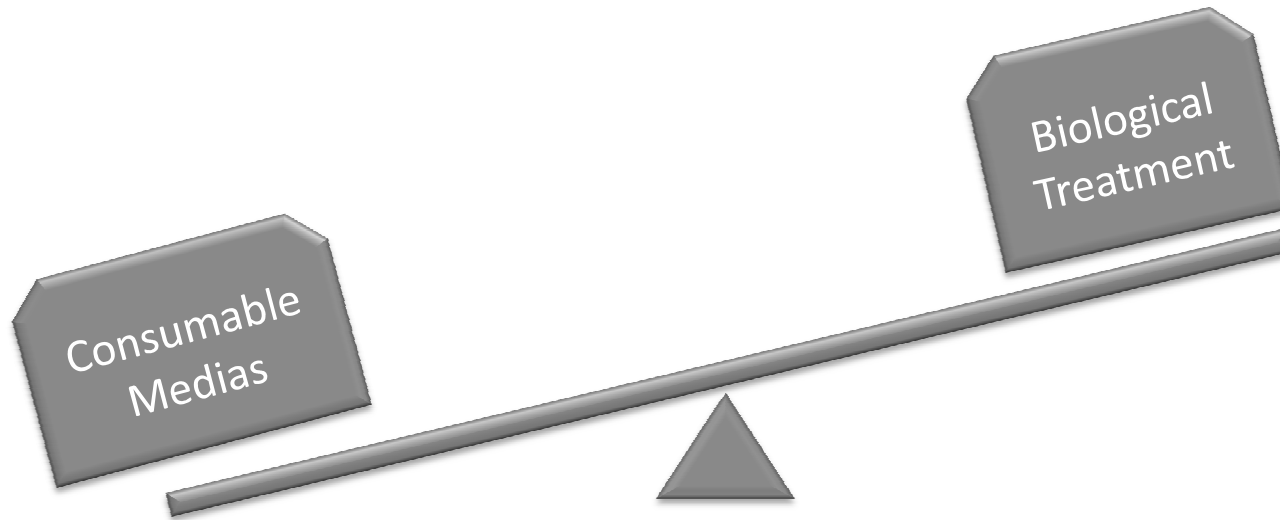
- More availability & short lead times
- Less operator attention needed
- More practical for short term jobs
- More chemical handling
- **What to do with the regenerant waste?**

## Biological Treatment

- Longer Delivery
- More Sensitive to Upsets
- Larger Footprint
- Typical of permanent systems
- Start up time availability?
- Starts & Stops?



# What about total Selenium & Selenate?

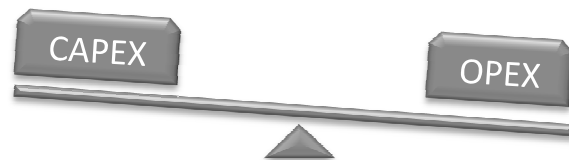


## Consumable Medias

- More availability & short lead times
- Less operator attention needed
- More practical for short term jobs
- Polishing needs of iron throw

## Biological Treatment

- Longer Delivery
- More Sensitive to Upsets
- Larger Footprint
- Typical of permanent systems
- Start up time availability?
- Starts & Stops



# Survey & Discussion

- How many of you work at Stations who have already closed ash basins/ponds? If yes, experiences to share here?
- ...who has detailed plans on closing them, including stopping flows to the basin?
- ...still in the study mode? Volume of water and ash, water analyses, etc.
- Who will be collecting and treating storm water separately in the future?
- Your priorities?: stop wastewater flows to ponds by rule effective date ('inactive' classification); those near water sources; those without liners; high water volume, decommissioned plants, ...

# Quick Survey

- How many mobile service providers do you know for....
  - *Excavation & Rim Ditching*
  - *Dewatering Technologies*
    - Conventional Knockdown
    - Belt Filters
    - Filter Presses
  - *Water Treatment*
    - High Rate Clarification
    - Filtration
    - Membrane
    - Specialty Ion Exchange & Medias
    - Biological Treatment

# Conclusion

- Pump and treat solutions may be needed to drain and close ash basins
- Treatment may be needed to divert water from entering the ash basins
- Treatment equipment may be ready to go in a mobile rental platform
- Customized solutions may be required for unique applications
  - Start / continue compiling water analysis
  - Bench and / or pilot test
  - Plan ahead for customized solutions
  - Plan years ahead for potential low supply and high demand in the market place

# Reference & Use Links

- Federal Register – EPA – 40 CFR Parts 257 and 261 – Hazardous and Solid Waste Management System; Disposal of Coal Combustion Residuals From Electric Utilities; Final Rule (April 17, 2015, 201 pages)
  - <http://www.gpo.gov/fdsys/pkg/FR-2015-04-17/pdf/2015-00257.pdf>
- Understanding the 2014 EPA Coal Ash Rule (2 min. video)
  - <https://www.youtube.com/watch?v=tS9mwqvvl5I>
- Overview of Final EPA Rule on Coal Ash Disposal (1.5 hr. video)
  - [https://www.youtube.com/watch?v=MV7vRM\\_4bss&feature=youtube](https://www.youtube.com/watch?v=MV7vRM_4bss&feature=youtube)
- Disposal of CCR from Electric Utilities and IPP – Overview of Final Rule (PPT)
  - [http://www2.epa.gov/sites/production/files/2015-03/documents/ccr\\_webinar\\_slides\\_508.pdf](http://www2.epa.gov/sites/production/files/2015-03/documents/ccr_webinar_slides_508.pdf)
- “*Planning for the Wastewater Impacts of the CCR Rule and Effluent Limitation Guidelines*”, by Thomas E Higgins, Dennis Fink, Kristen Jenkins, and Julianne Schucker, CH2M - Power Engineering® Magazine, May 2015
  - <http://www.power-eng.com/articles/print/volume-119/issue-5/features/planning-for-the-wastewater-impacts-of-the-ccr-rule-and-effluent-limitation-guidelines.html>
- “Managing CCRs and Process Water” Why Handling Bottom Ash Wet May Remain The Best Option”, by Craig Schuettpelz, Ron Jorgenson, and Jason Obermeyer, Golder Associates, Inc. - Power Engineering® Magazine, May 2015
  - <http://digital.power-eng.com/power-eng/201505?pg=55#pg53>



# Considerations and Challenges for Ash Basin Closure



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**WATER TECHNOLOGIES**