REINHOLD ENVIRONMENTAL Ltd.

2018 APC & Wastewater Round Table & Expo Presentation

July 23 & 24, 2018 in Lexington, KY / Hosted by East Kentucky Power Coop

Handling Water from Cleaning Air Preheaters and ESP

Presented by:
Max Swoboda, Business Development, Power
July 24, 2018

TRANSFORMING WATER. ENRICHING LIFE.

Agenda

1. Air Preheater
2. Electrostatic Precipitator
3. Effluent Guidelines
4. Wastewater Characteristics
5. Typical Treatment Design
6. Case Studies

Non-Chemical Metal Cleaning Waste

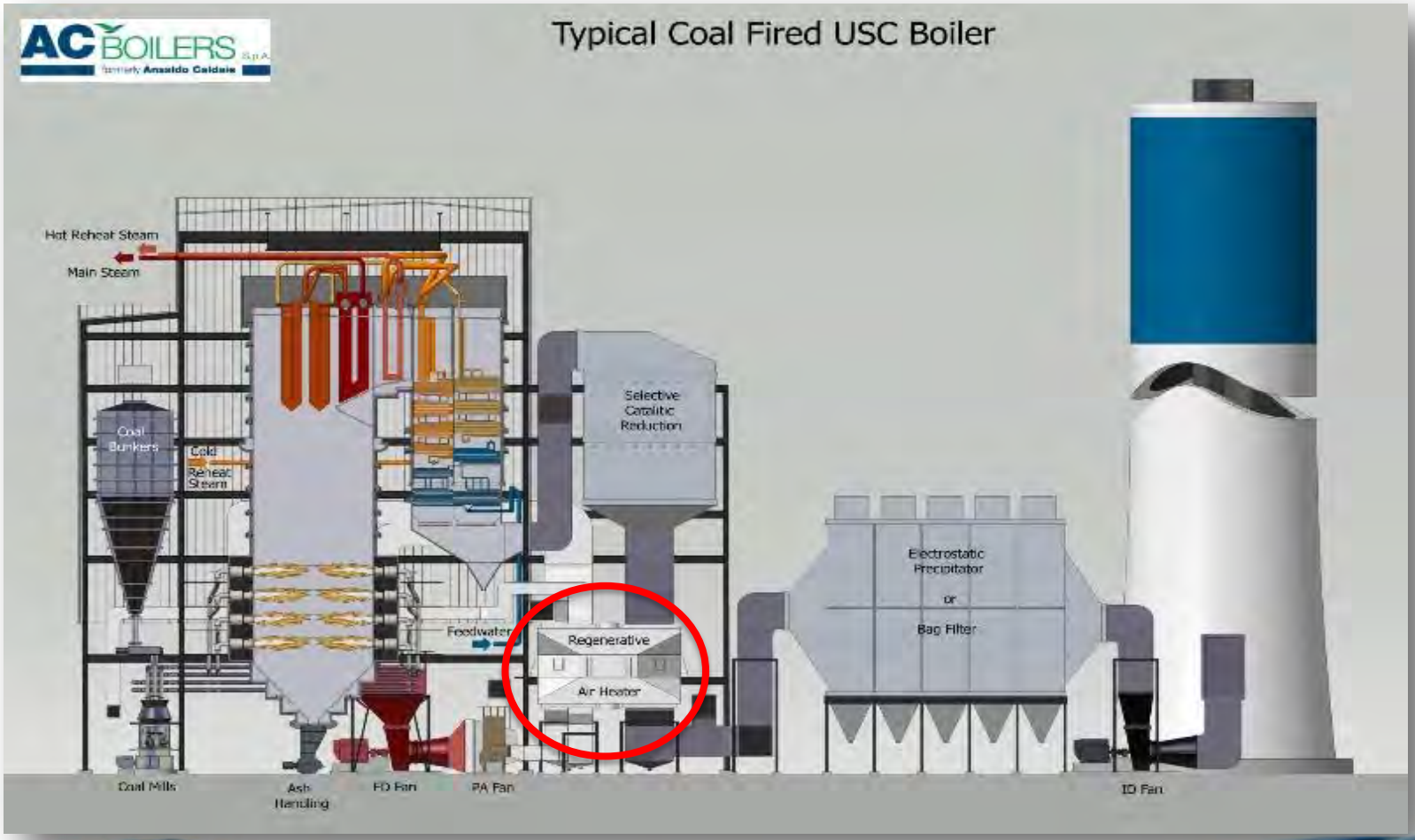


Image source: AC Boilers

Air Preheater Basics

- Heat transfer process for air before combustion
- Flue gas heat is used to increase the ambient air temperature
- Process greatly reduces fuel consumption

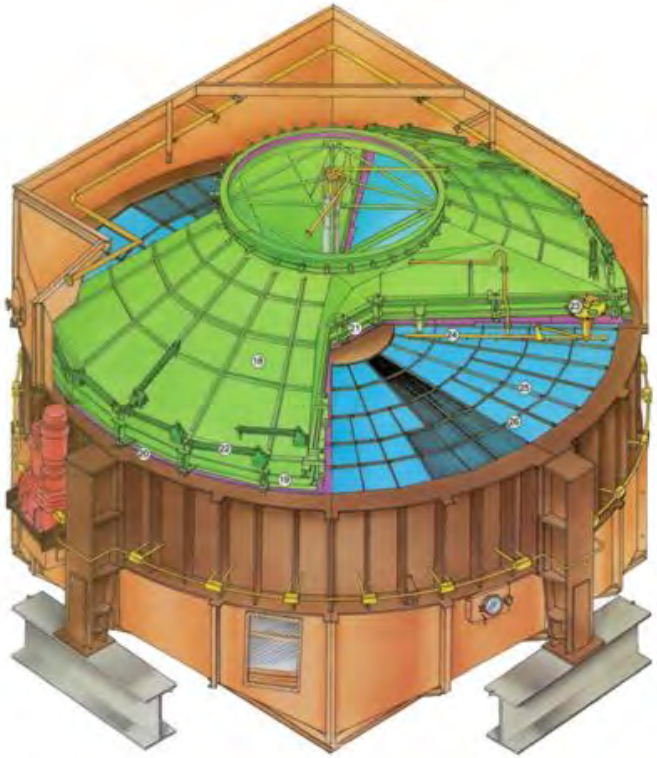
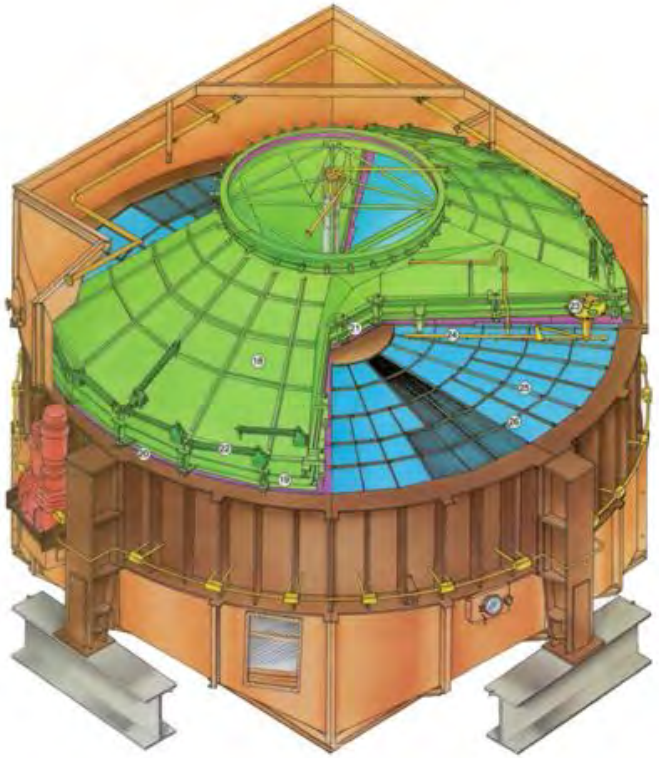


Image source: Siemens ESS

Air Preheater Cleaning

- The surfaces of the air preheater come in contact with contaminates such as humidity from the cool air. On the hot side there are combustion byproducts such as flue gases and fly ash.
- Sootblowers remove most of these contaminates.
- Eventually the air preheater is removed from services and mechanically cleaned with water.
- The cleaning water is subject to treatment standards under ELG regulations.



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Non-Chemical Metal Cleaning Waste

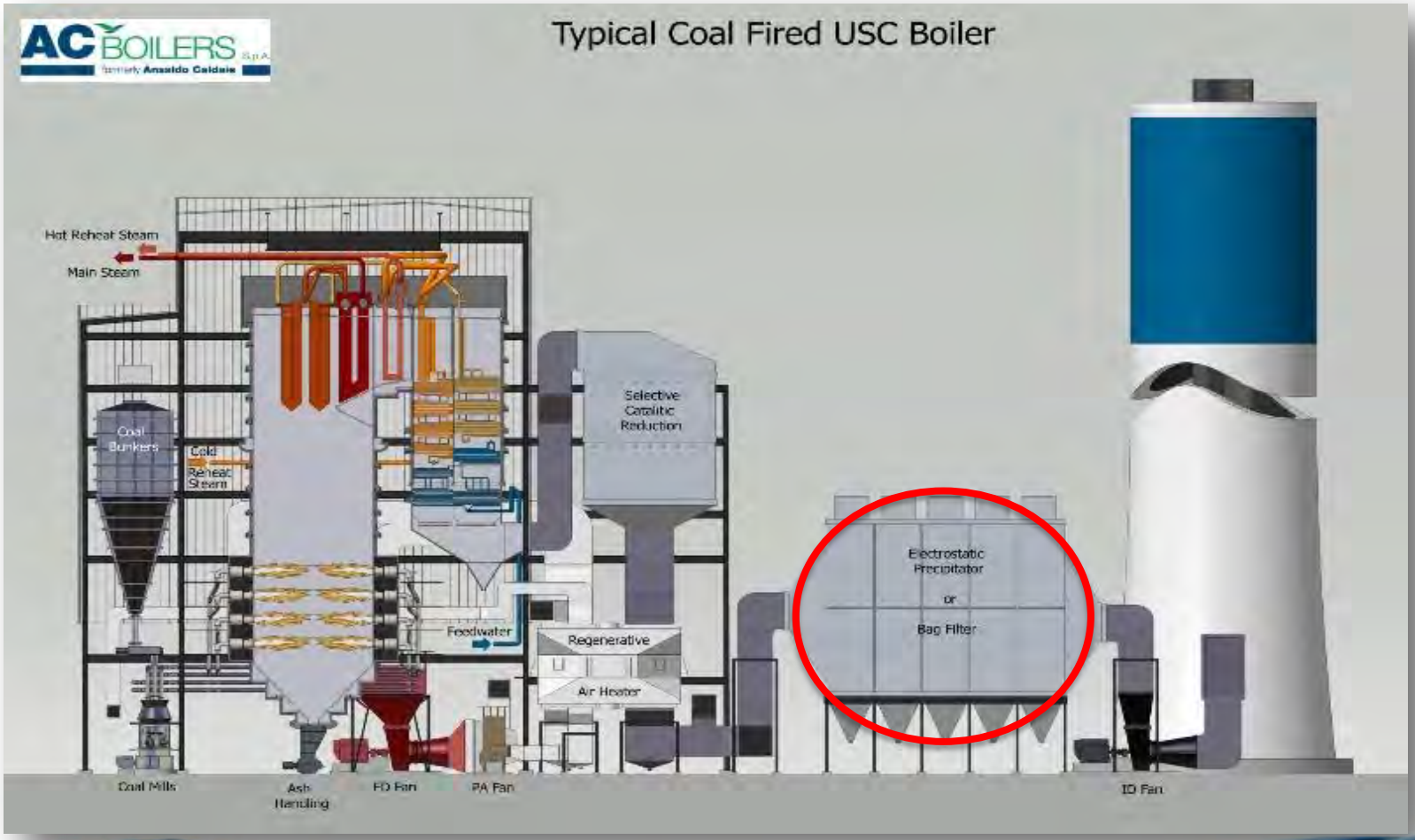


Image source: AC Boilers

Electrostatic Precipitator Basics

- An electrostatic field is created to give ash particles a charged surface
- Collector plates hold the ash particles
- Rapping separates the collected ash and it falls into the bottom hoppers
- An ash handling system conveys the ash out of the hoppers

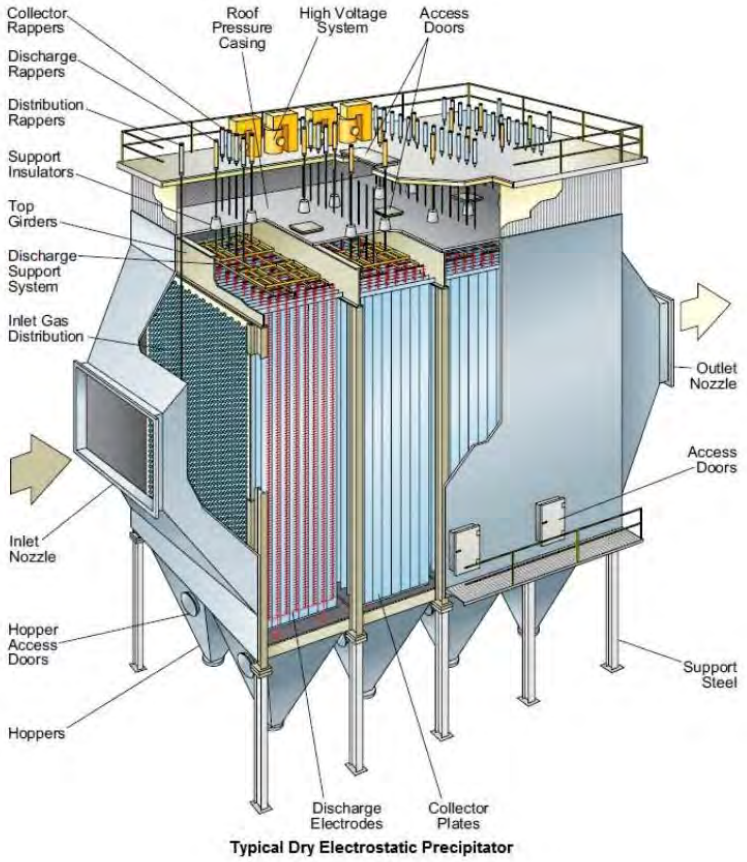


Image source: Babcock and Wilcox

Electrostatic Precipitator Cleaning

- Rapping is not 100% effective, so the system is eventually mechanically cleaned
- Ash accumulates on structural surfaces that rapping does not loosen
- The cleaning water is subject to treatment standards under ELG regulations.

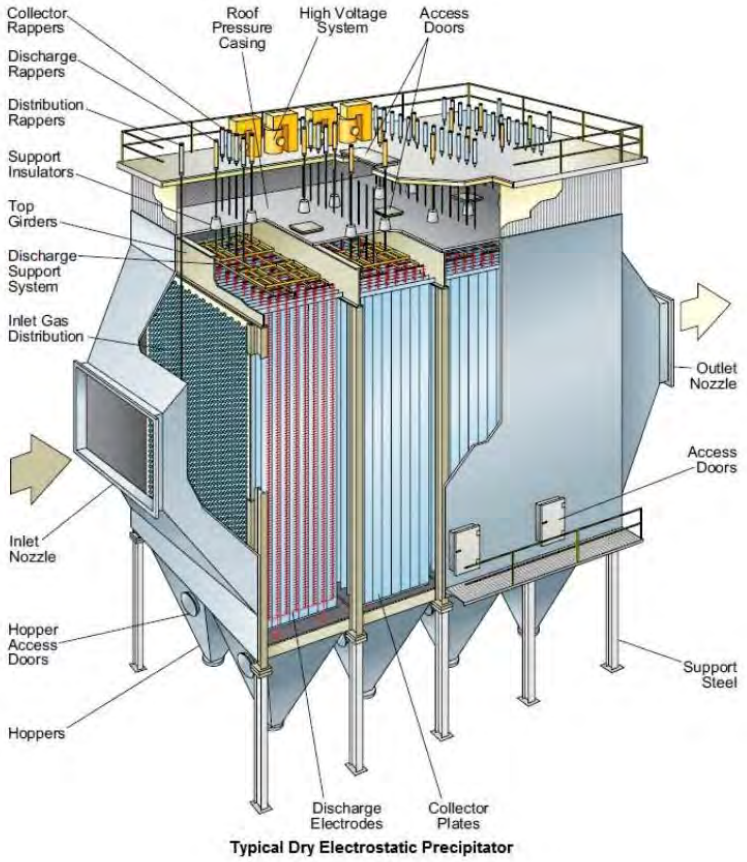


Image source: Babcock and Wilcox

Impact of EPA Regulations Non Chemical Metal Cleaning Waste

EPA 40 CFR Part 423
XVI. 5. Non-Chemical Metal Cleaning Wastes

"By reserving BAT and NSPS for non-chemical metal cleaning wastes in this final rule, the permitting authority must continue to establish such requirements based on BPJ for any steam electric power plant discharging this wastestream."

- Why Reserved? Survey responses were skewed due to nomenclature differences
- No current BAT (Best Available Technology Economically Achievable) limits
- BPJ (Best Professional Judgment) and permitting authority and historical record

Effluent Guidelines - Reserved

Chemical Metal Cleaning Wastewater Effluent Quality Limits		
Constituent	**30 Day Average, ppm**	**Daily Maximum, ppm**
Copper	1.0	1.0
Iron	1.0	1.0
TSS	30.0	100.0
Oil & Grease	15.0	20.0

- Best Available Technology based on Best Professional Judgement
- No less stringent than Best Practical Technology
- New Source Performance Standard
- NPDES Permit
- Impact on LVWW System

Treatment Design Considerations

- Cleaning Frequency
- Location, Space
- Changing Water Quality and Volume
- Coordination
- Solid Estimating
- Permitted Discharge Requirements

Effects of Coal Type on Wash Water Characteristic

	ILB	PRB	CAPP
Type	Bituminous	Sub-bituminous	Bituminous
pH	Low 3-4	High 7-8	Low 3-4
Ions	Cl, Hg, Fe, Cr, S	Cu	As, Cr, Cu, Hg, Se

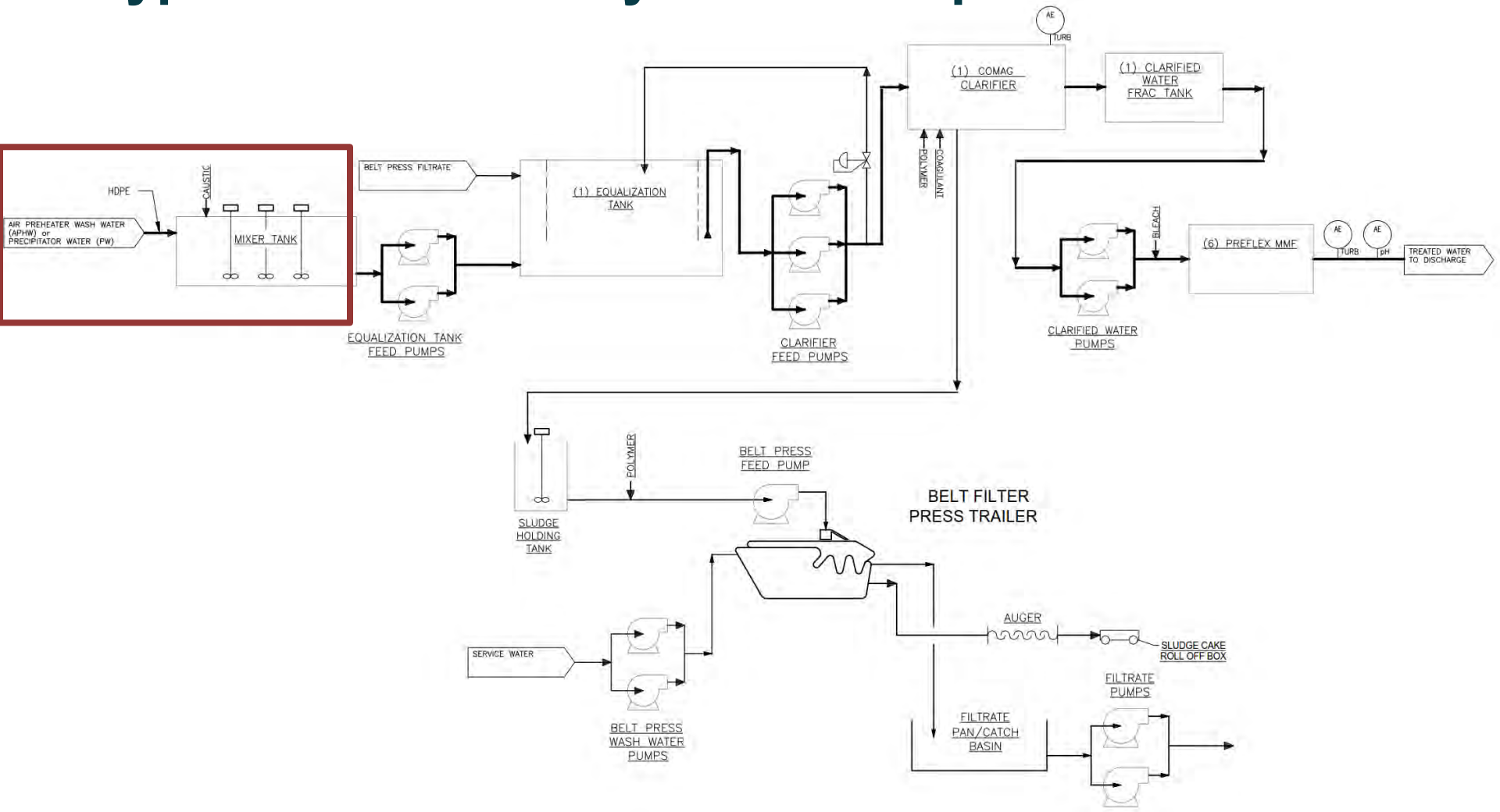
Air Preheater Wash Water Characteristic

Parameter	Low	High
TSS, ppm	3,500	5,000
Oil & Grease	0	4
Copper, ppm	0.25	1.5
Iron, ppm	200	2,100
pH	2.5	5.5

Electrostatic Precipitator Wash Water Characteristics

Parameter	Low	High
TSS	15,000	60,000
Oil & Grease	0	0
Copper	0.2	4.0
Iron	500	1,500
pH	4.0	8.0

Typical Treatment System Example



Equalization

- Mixed Influent
- Surge Capacity
- Solids and Hydraulic Fluctuations
- Minimum – 5 hours

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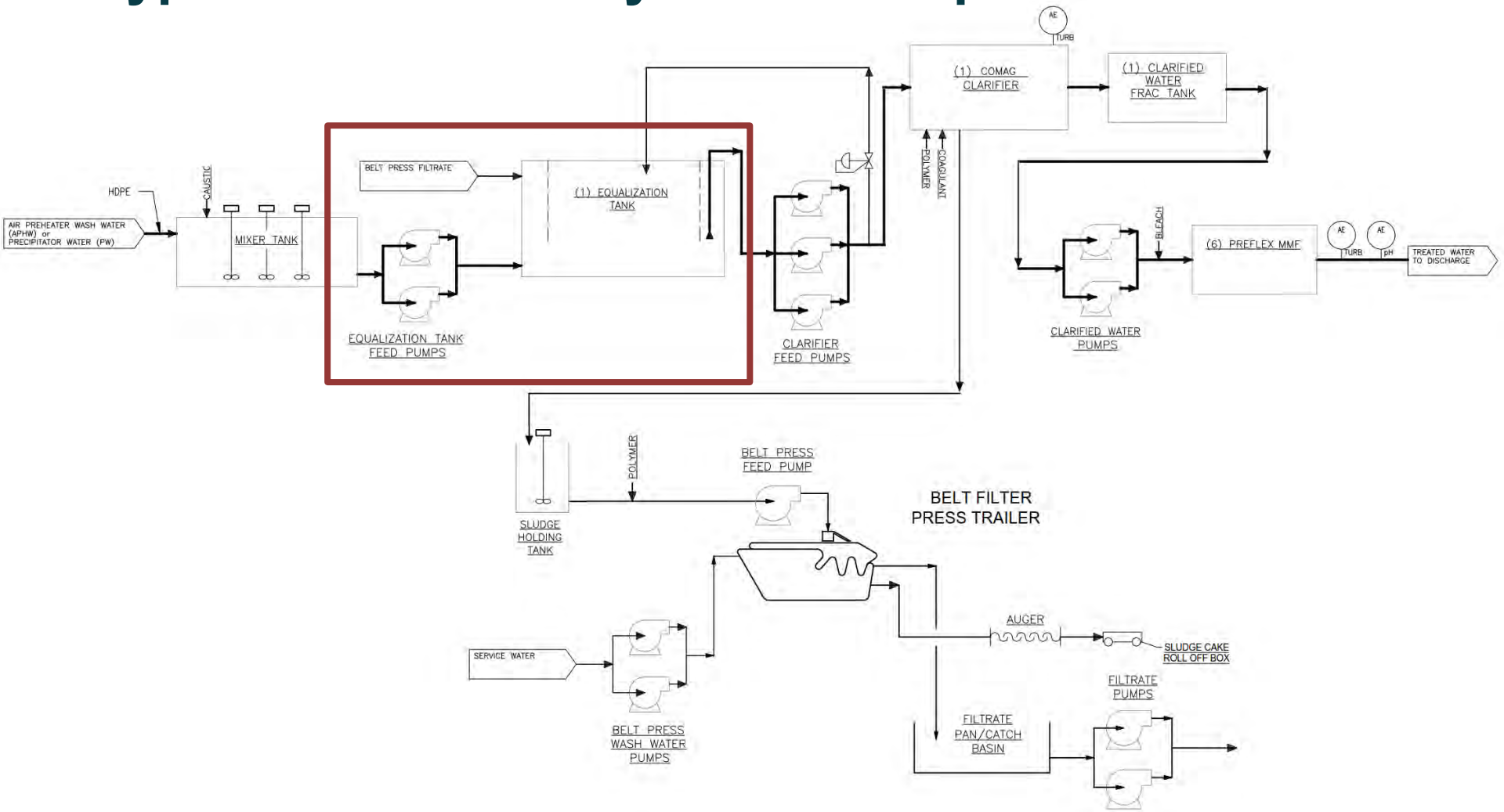


Clarification Step

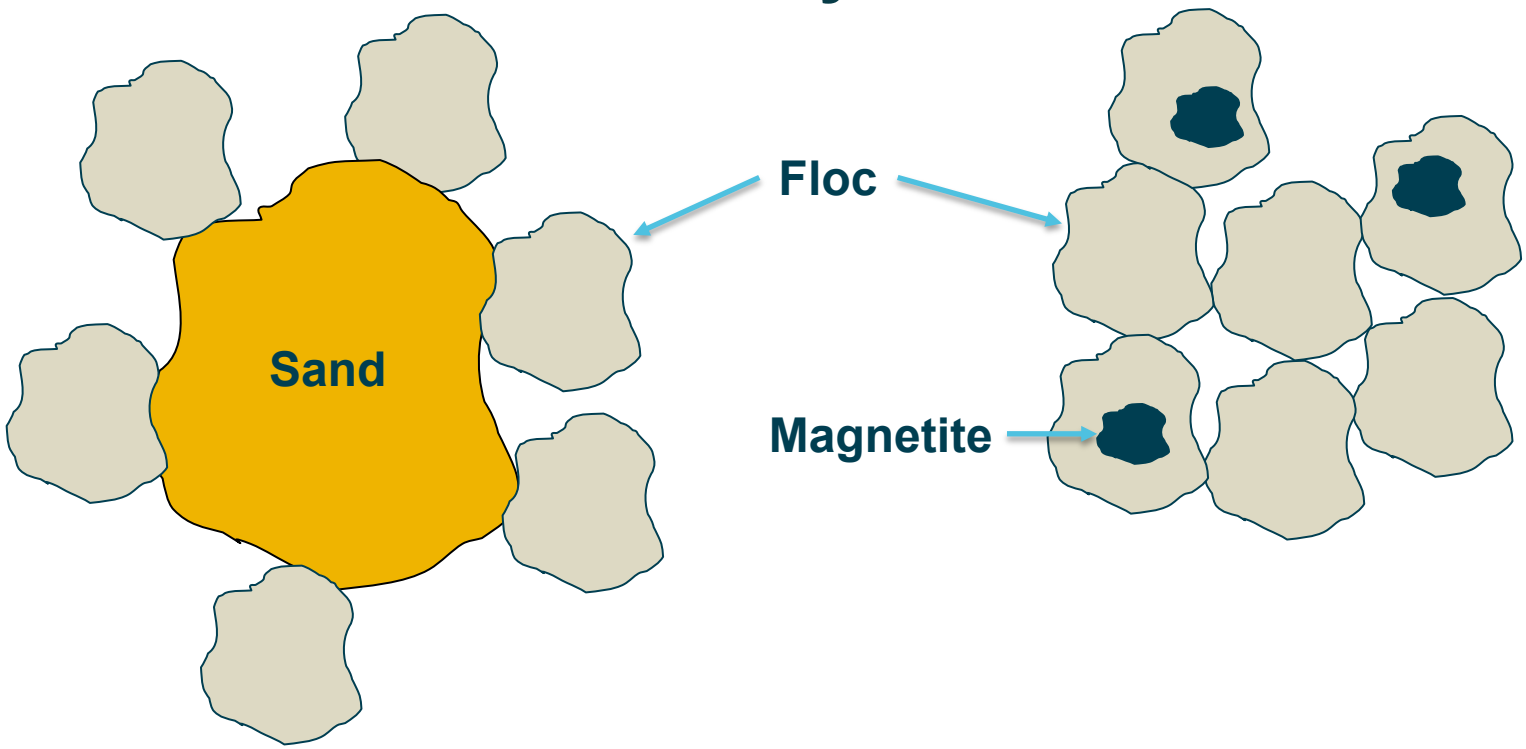
Design

- Select operational flowrate
- TSS up to 2,000 ppm
- Final pH adjustment

Options

- Ballasted flocculation clarifier

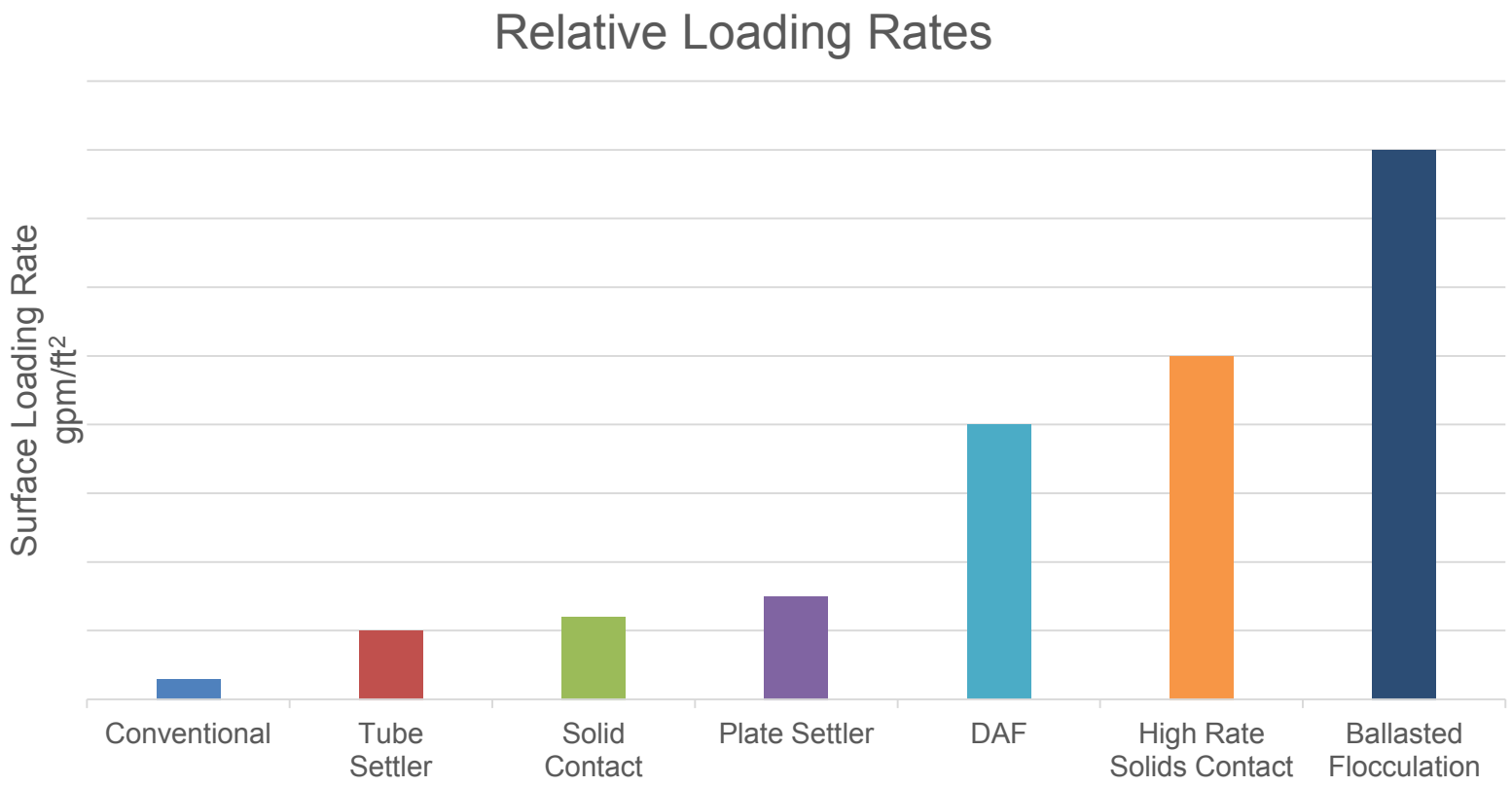
Ballasted Flocculation Key to Mobile Clarification



- Floc is forced to grow on the surface of the sand
- Specific gravity is 2.6

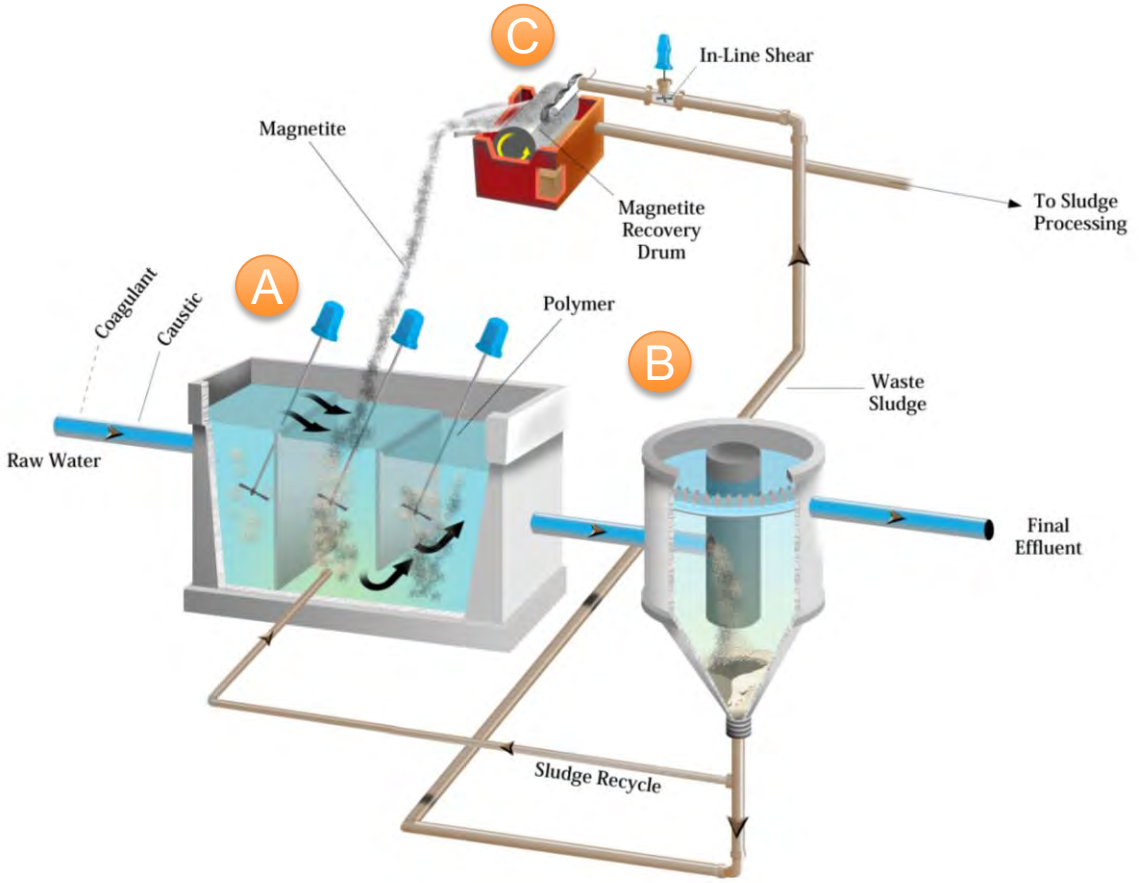
- Magnetite is infused into the floc
- Internal sludge recycle – promotes nucleation
- Specific gravity is 5.2 – settles faster!

Clarification Technologies



Higher Loading Rate = More Capacity for a Given Footprint

CoMag® Ballasted Flocculation



Mobile Ballasted Flocculation Clarifier

- CoMag® Process
- 53’ drop deck trailer
- Up to 1,500 gpm capacity
- Design to reduce 1000 NTU to < 5 NTU

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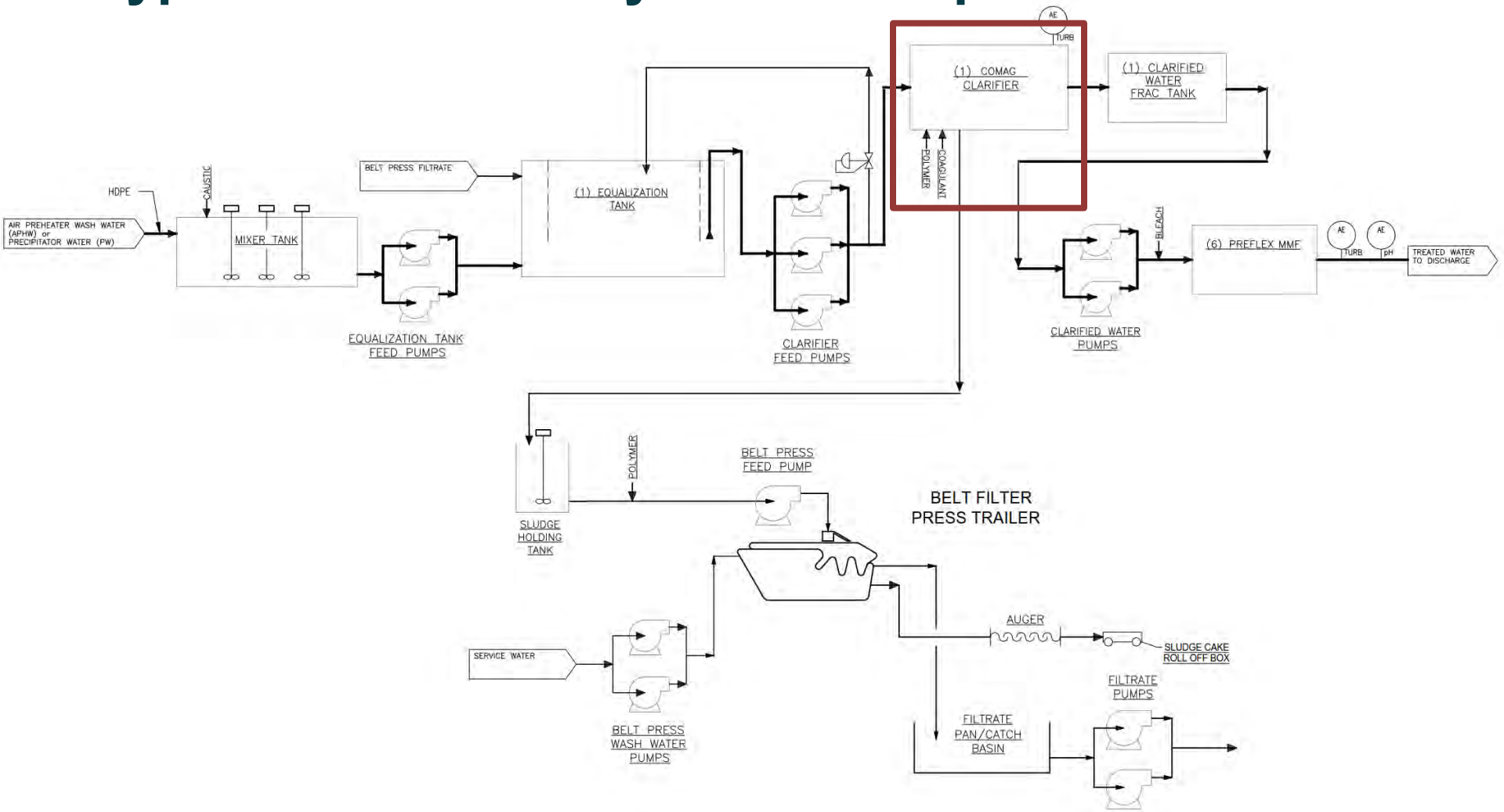
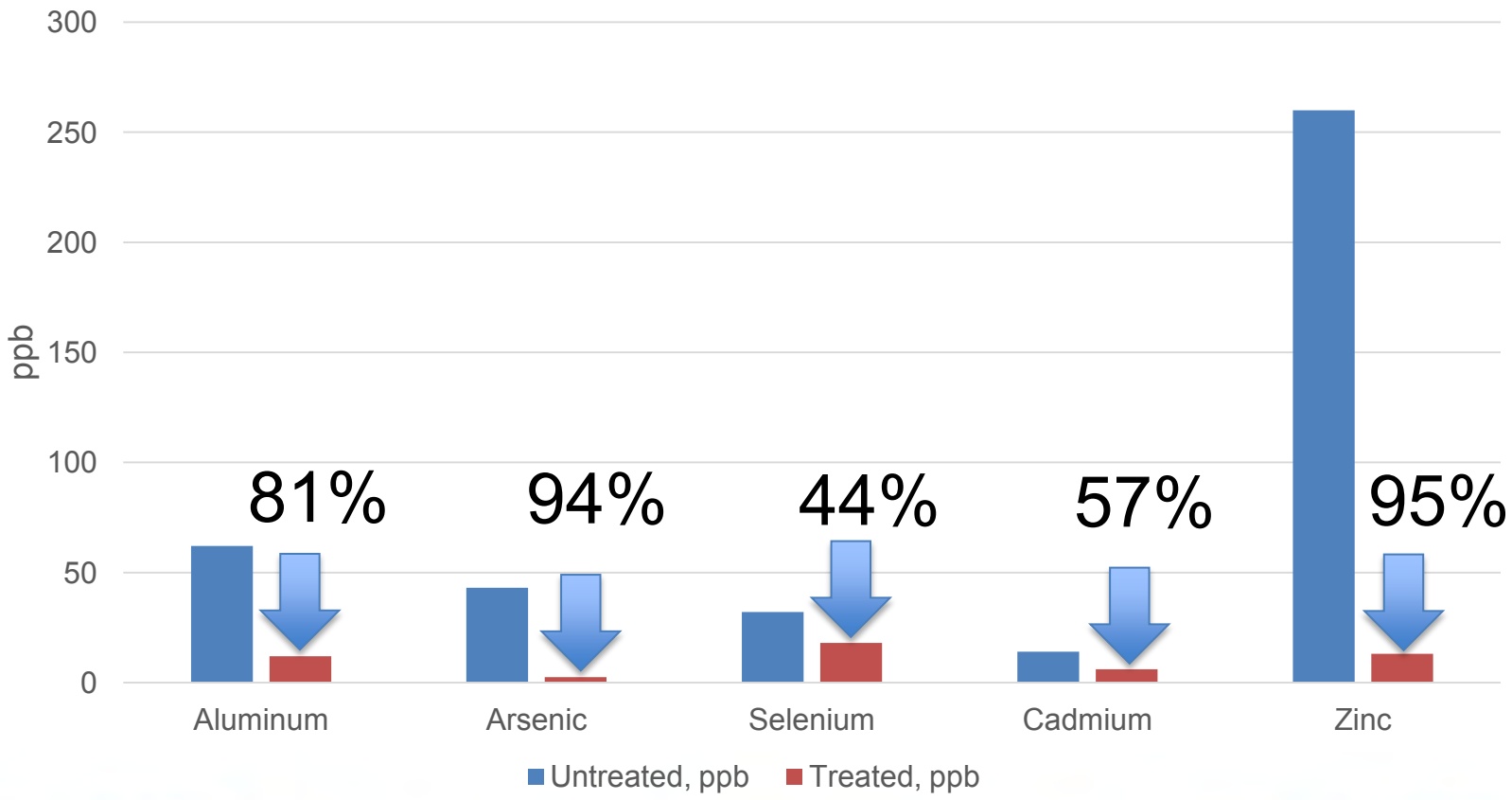


Metals Removal by Co-Precipitation

Co-precipitation can eliminate the need for polishing technologies!



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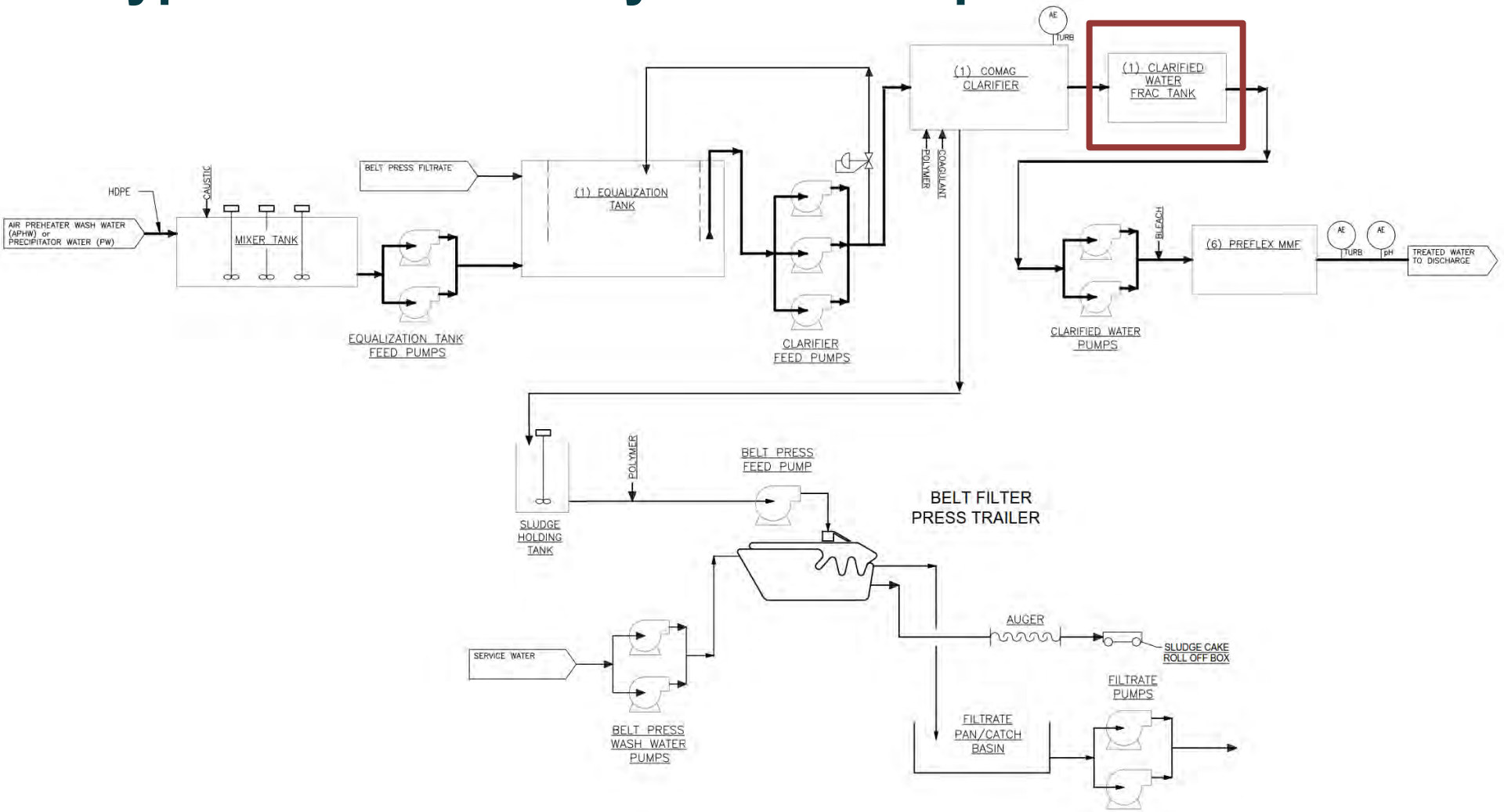

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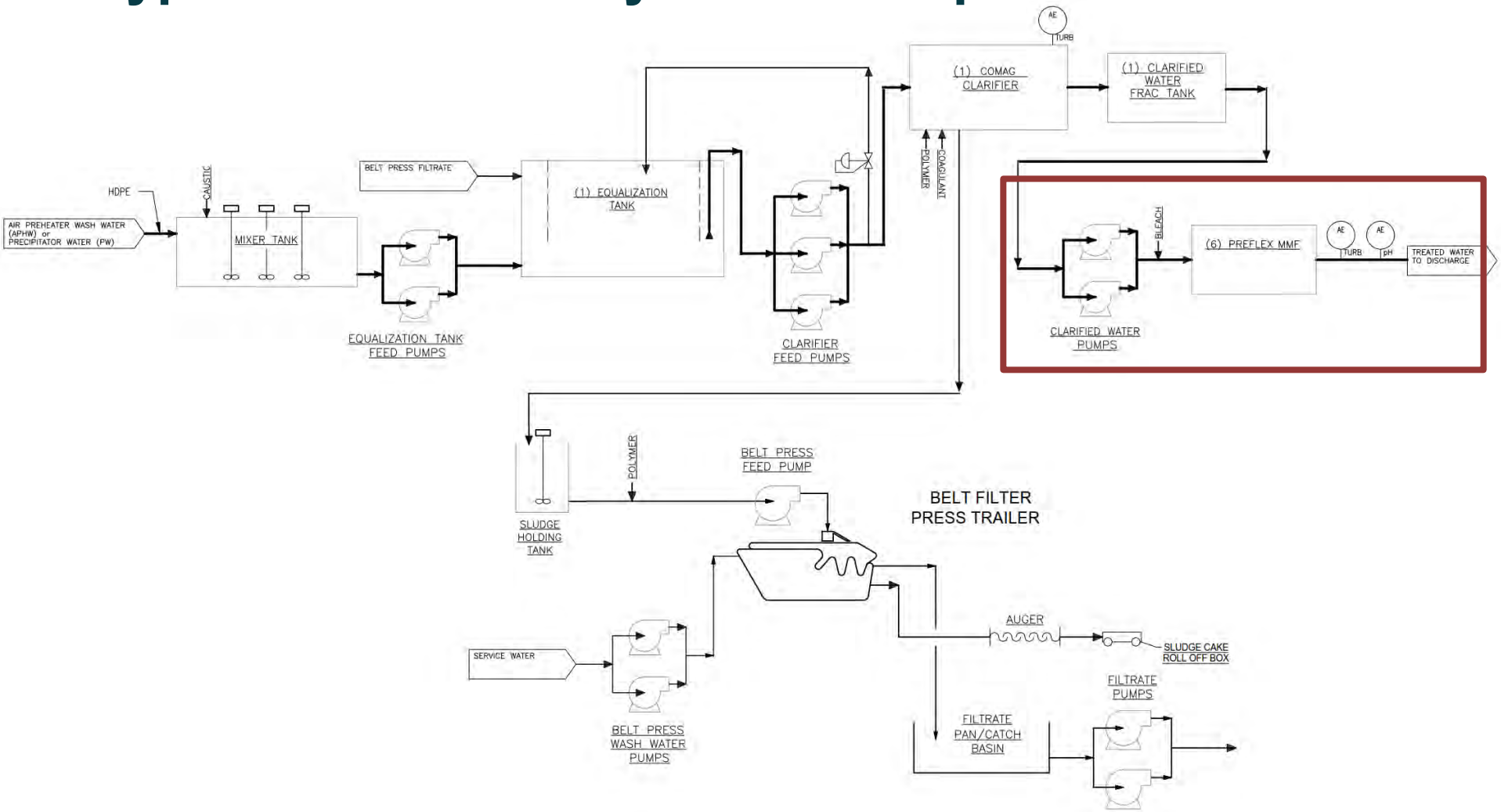


Sludge Dewatering Step

Design

- X gpm of 1-3% solids
- Thickening to 5-25% solids
- Dewatering to 25-50% solids
- Tons per day
- Tons per hour

Options

- Plate and frame filter press
- Belt filter press
- Centrifuge
- GeoTubes

Belt Filter Press

Source: Bright Technologies

Alternate Dewatering

Source: Tencate

It's a Question of Mass Balance

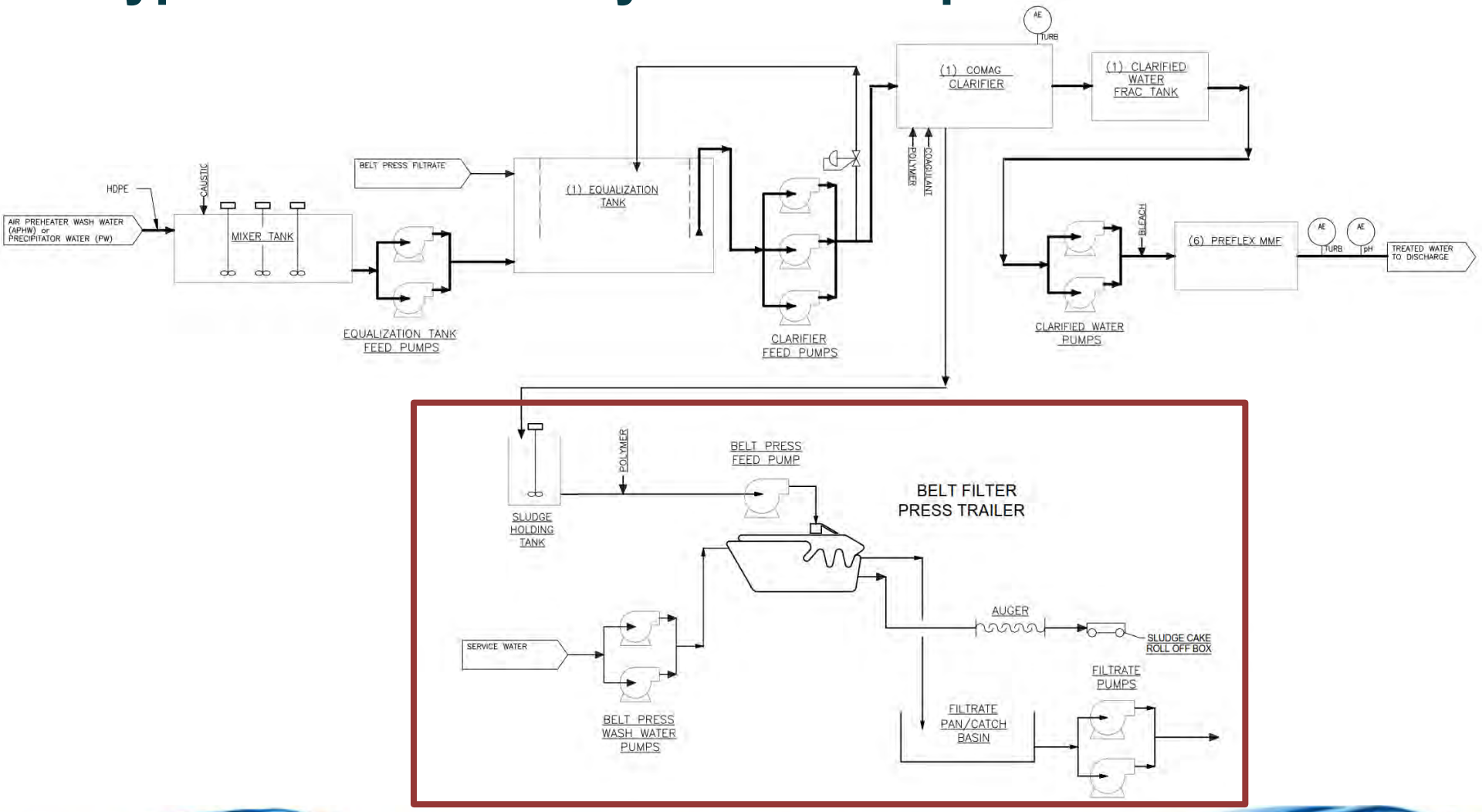
Flow	GPD	Solids %	PPD	Cu. Ft.
400	480,000	5	200,160	2,859
1,000	1,200,000	2	200,160	2,859
2,000	2,400,000	13	2,602,080	37,173

- Rental filter press – 100 cu ft.
- Cycle time – Bituminous coal ash – 3 hrs.
- 800 – 1,600 cu ft. per day per press

Lessons Learned

- Uneven flow during water blasting
- Rapid settling in weir tanks
- Sludge take off
- Long dewatering in filter boxes

Typical Treatment System Example



Case Study 1: Boiler and Air Preheater

Conditions

- Existing settling basin
- On-site clarifier for 200 gpm – needed flow up to 900 gpm
- Illinois Basin Coal
- pH adjustment by lime addition in settling basin
- Two outages from 5 to 10 days each
- Turbidity up to 1200 NTU

Solution

- One mobile clarifier

Results

- Turbidity less than 10 NTU
- Total iron less than 1.0 ppm

Case Study 2: Air Preheater

Conditions

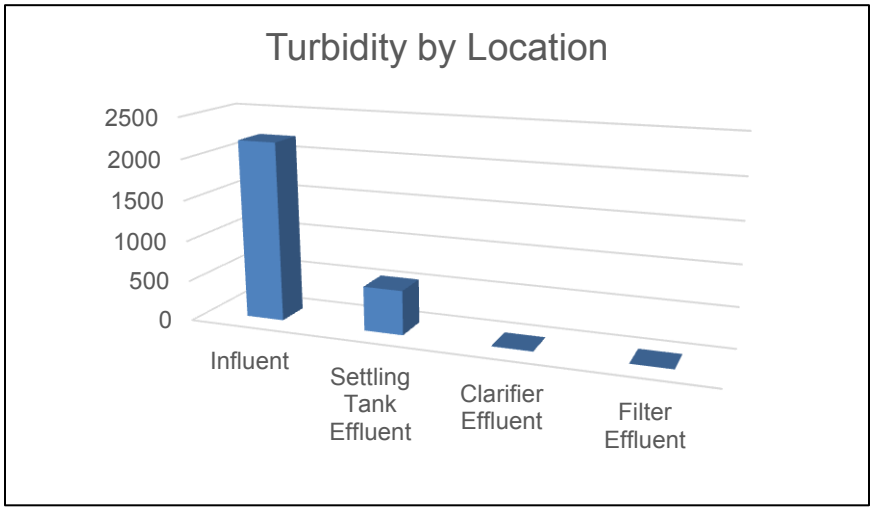
- Flow 900-2,000 gpm
- Illinois Basin Coal
- pH adjustment by caustic addition
- Outage for only 5 days
- Turbidity up to 2,200 NTU
- 2% solids

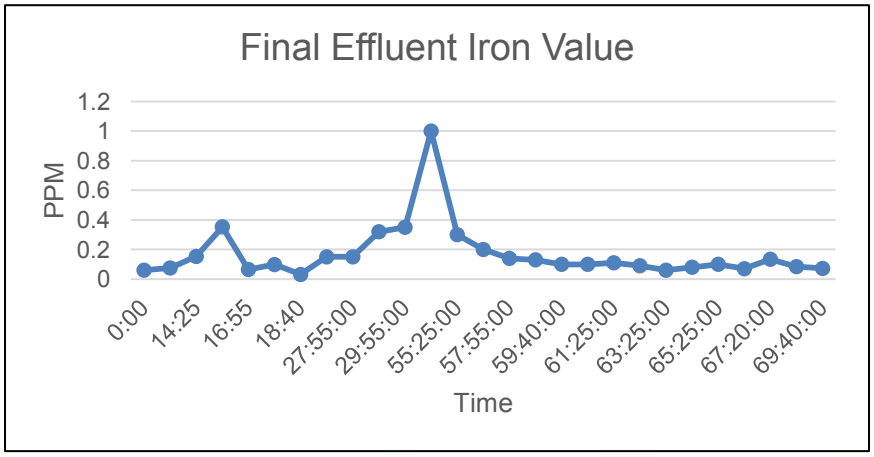
Solution

- Complete system

Results

- Turbidity less than 5 NTU
- Total iron less than 1.0 ppm





Summary

- Analytical data collection
- Timing
- Plan of attack – Engineering
- Identify key assets
- Execution with trusted partners

For More Information

Visit:

http://www.evoqua.com/en/brands/IPS/Pages/ELG-and-CCR-Solutions-for-Coal-Fired-Plants.aspx

Contact:
Max Swoboda, Business Development, Power

max.swoboda@evoqua.com

205-266-8491