REINHOLD ENVIRONMENTAL ®

2024 Reinhold/PCUG Round Table Presentation

Hosted by LG&E/KU and Co-hosted by Southern Co. and TVA

in The Marriott Resort Lexington Griffin Gate Hotel, Lexington, KY on June 24-25, 2024

Sustainable Solutions for Air, Water and Solids

UCC Environmental
Ash Handling Systems Post ELG

Presented By: Morgan French
6/25/24

UCC Environmental

Corporate Overview

Air

- Dry Sorbent Injection
- Activated Carbon Injection
- Demonstration Testing

Water

- High Purity Water Treatment
- Water Recycle & Reuse
- Minimum Liquid Discharge
- Water Balance Optimization
- Industrial Water & Wastewater Treatment
- Stormwater Management
- Landfill Leachate Treatment
- Chemical Supply & Injection

Solids

- Pneumatic
- Mechanical
- Vibratory
- Hydraulic
- High-Wear Performance Parts
- System Components

- Established in **1920**
- **4,500+** Installations
- **60+** Countries
- **2.5B** Ton of Ash Removed
- **650M** Pounds of Pollutants Removed
- **1B** Gallons of Wastewater Treated

Locations

- US
- Germany
- India
- China

Services

- Product Development
- Technology Lab
- 3D Measurement
- Pipe Support Engineering
- Control Upgrades and Integration Services
- Electrical Power Supply Design/Supply

HEADQUARTERS:
Waukegan, IL

MANUFACTURING:
Pleasant Prairie, WI

UCC Environmental

Main Areas of Focus

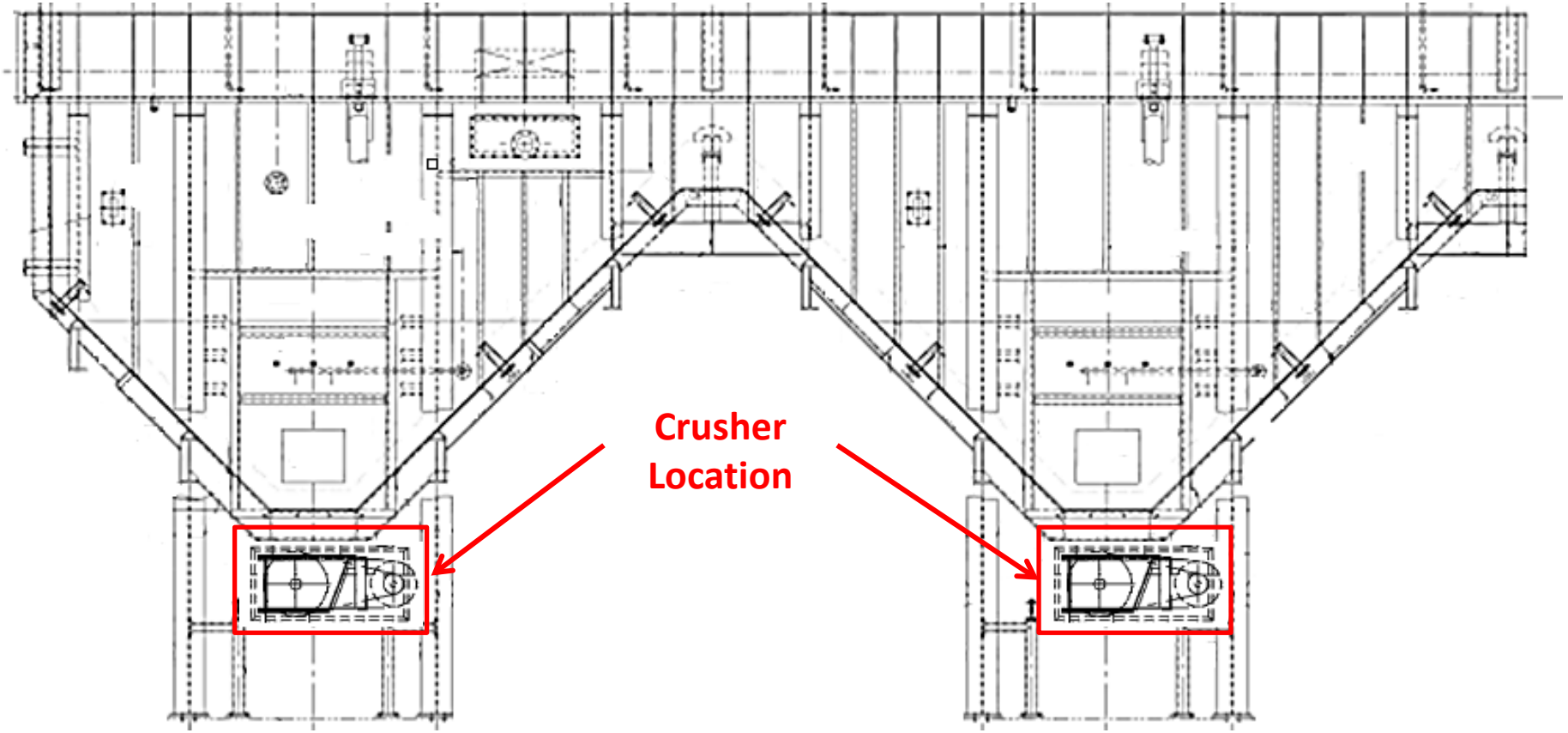
AGENDA

- Bottom Ash Systems Overview
- Typical Bottom Ash Recirculation Systems
- EPA ELG Quick Overview
- Maintenance and Operations Post ELG

Bottom Ash Systems Overview

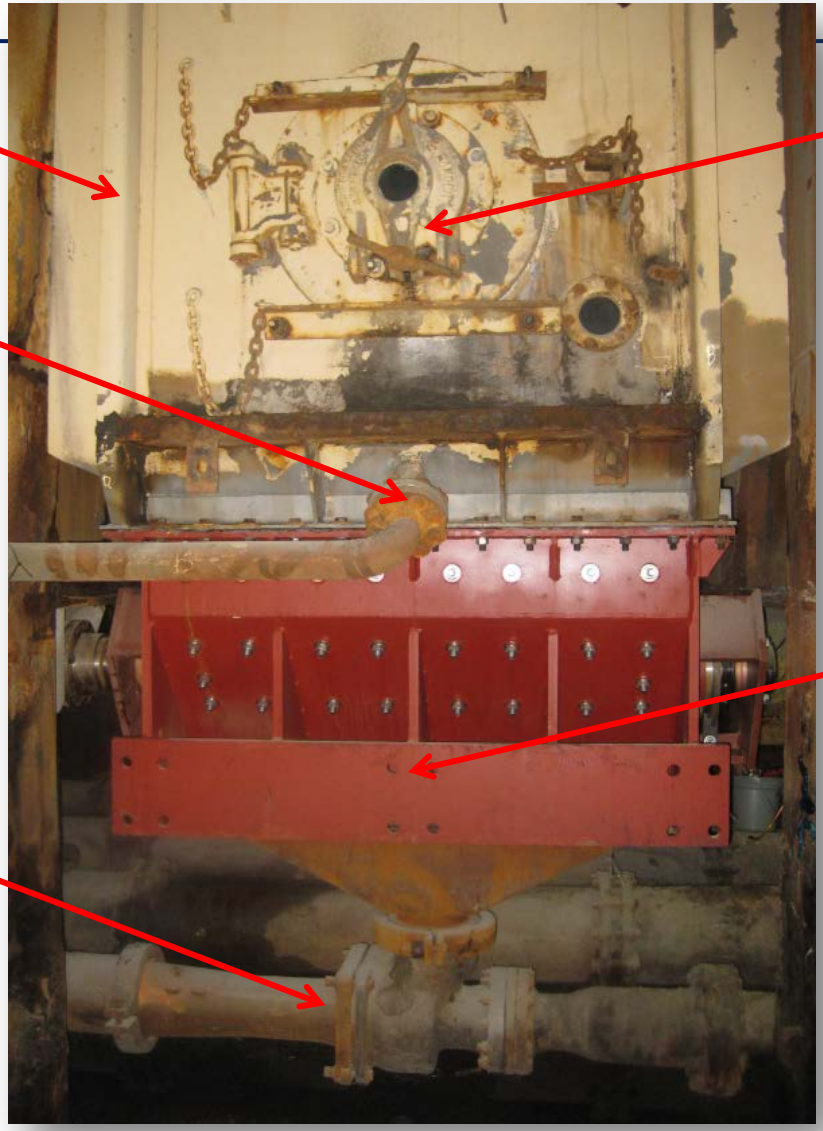
Bottom Ash Hopper

Water Impounded Bottom Ash Hopper



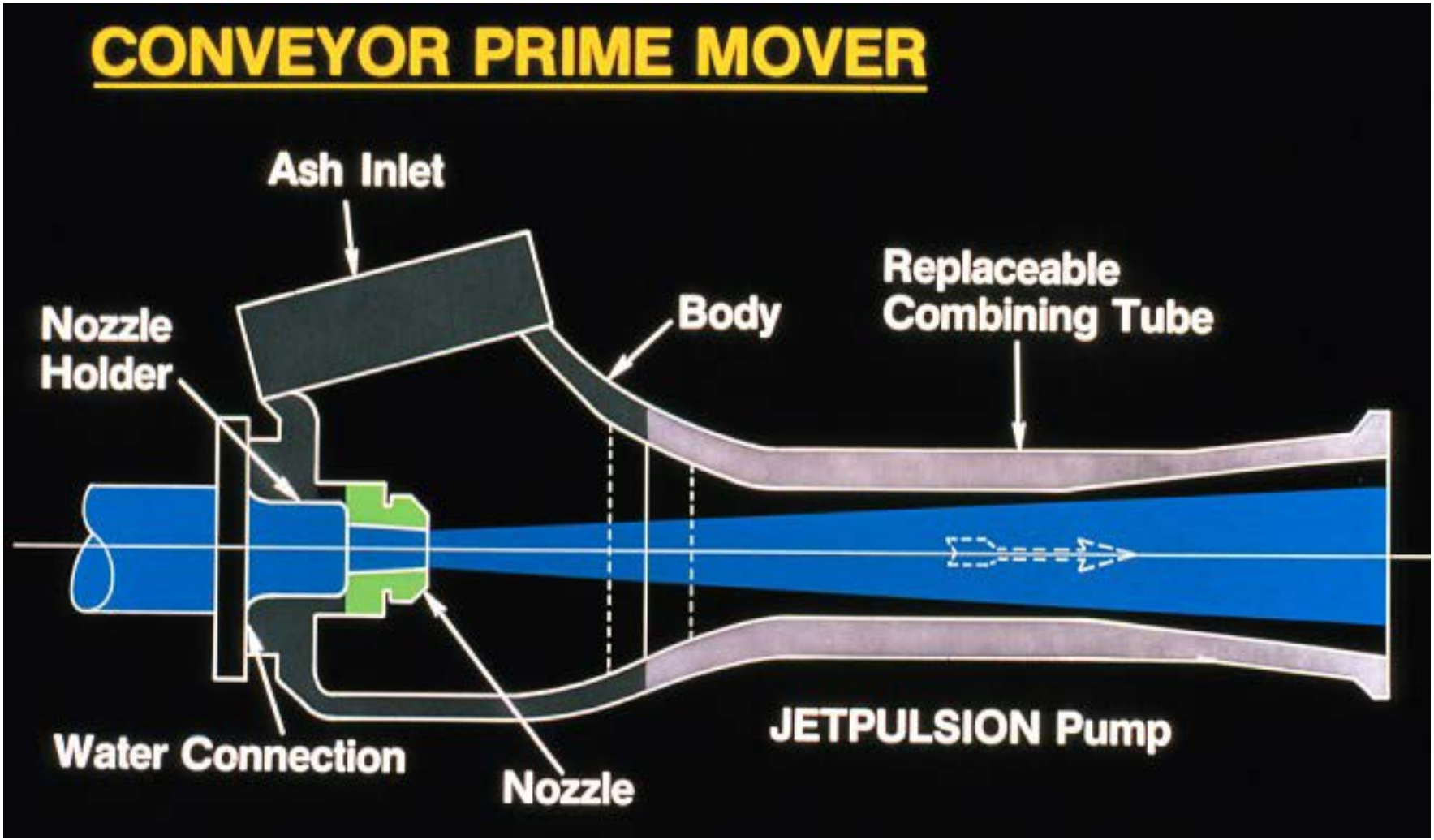
UCC EXCEN-CRUSHER® FAMILY

Product Overview



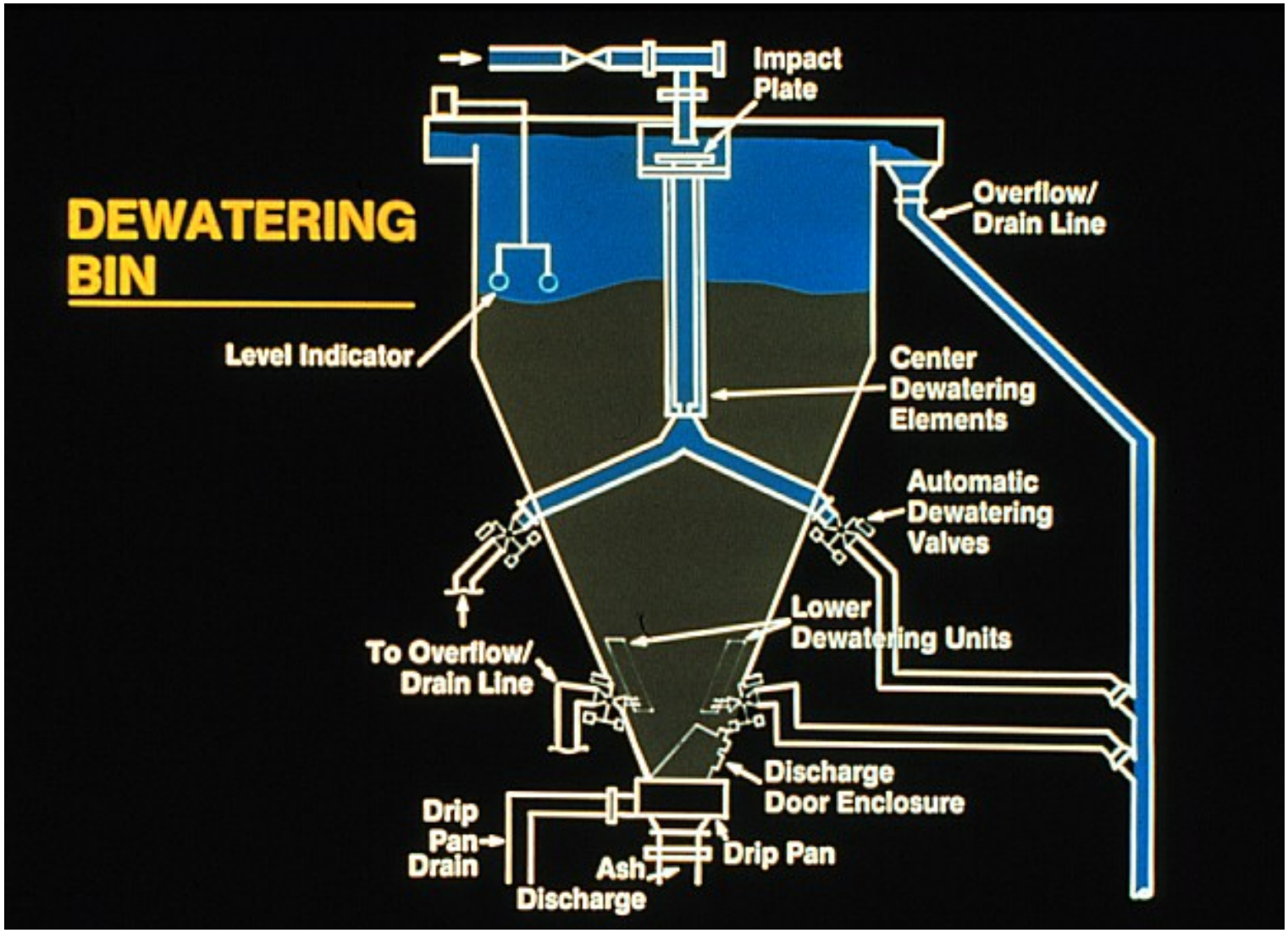
Bottom Ash Systems Overview

JETPULSION Pump



Bottom Ash Systems Overview

Dewatering Bin

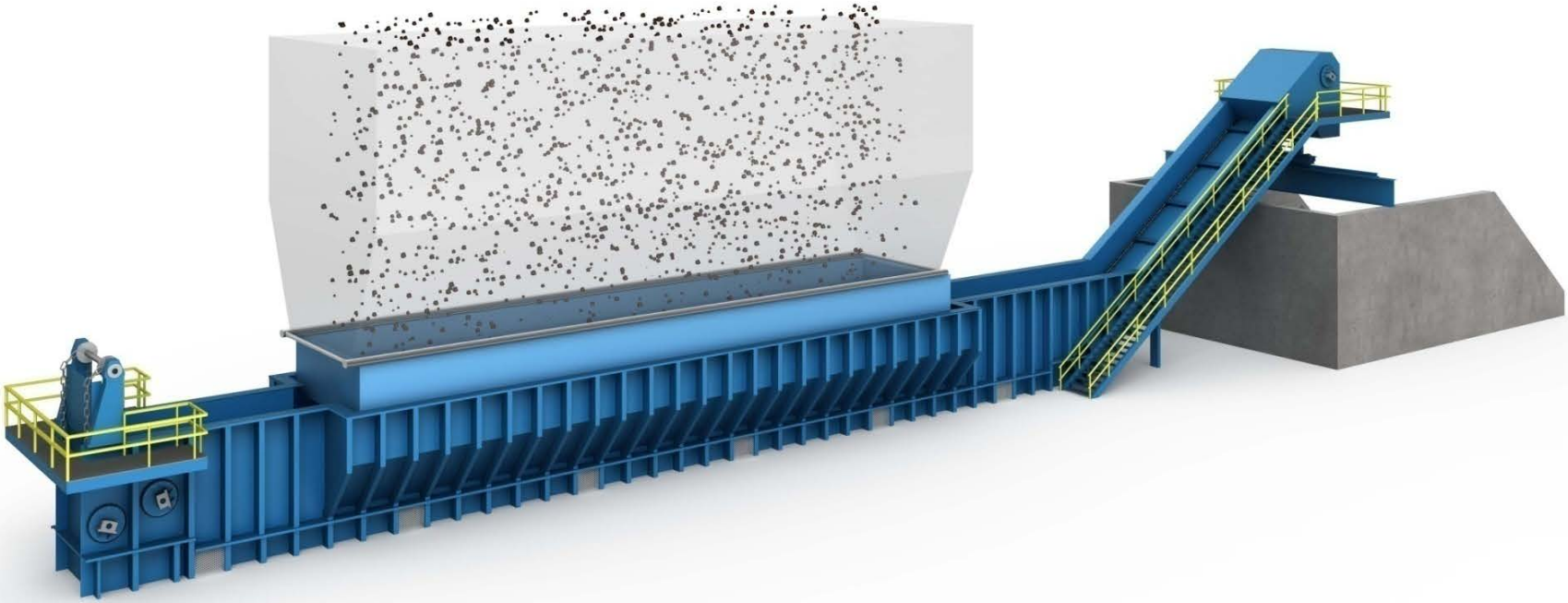


Bottom Ash System Overview

Traditional Bottom Ash Dewatering and Recirculation System

Bottom Ash System Overview

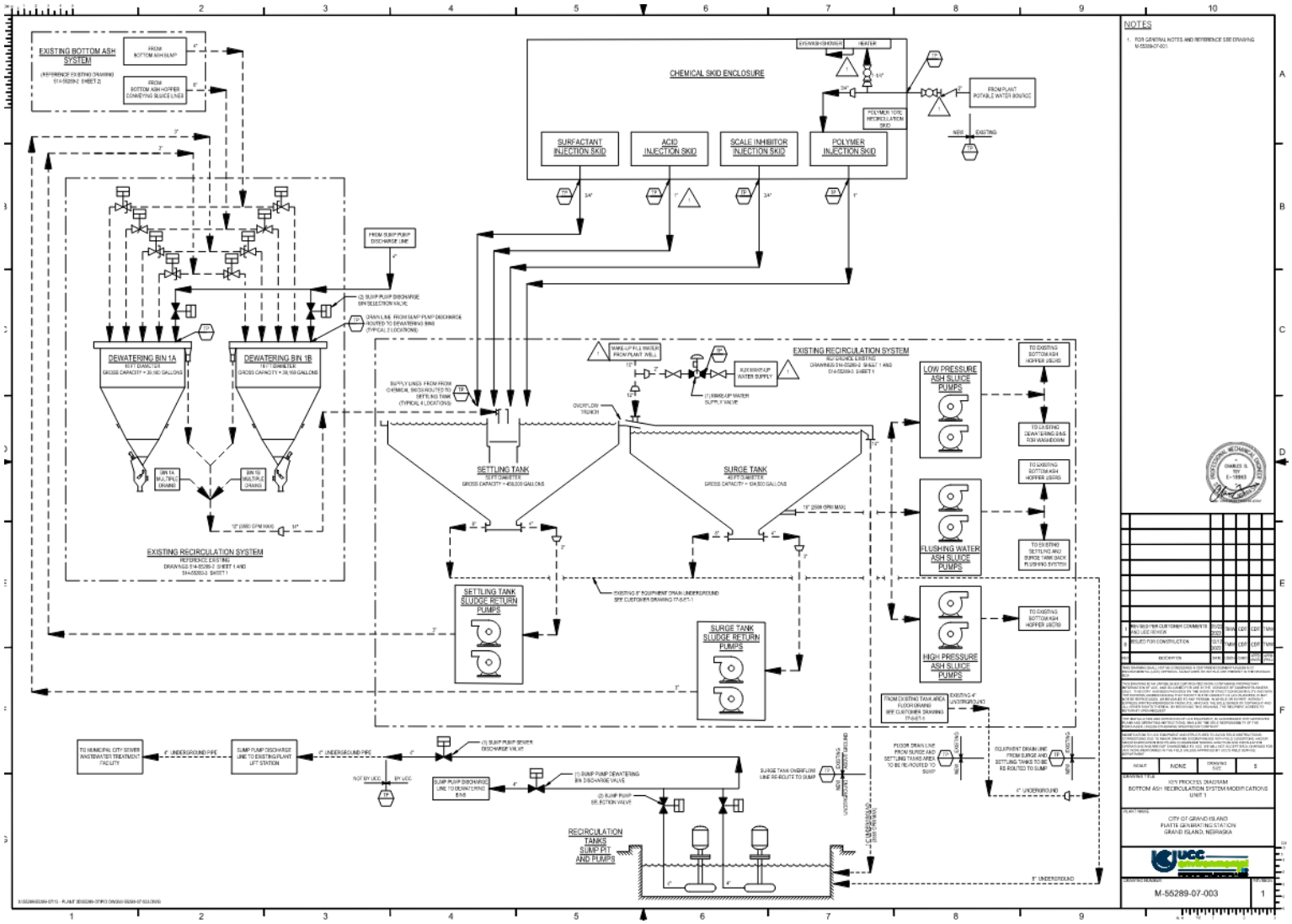
Traditional Submerged Flight Conveyor (SFC)



Remote SFC with Clarifiers

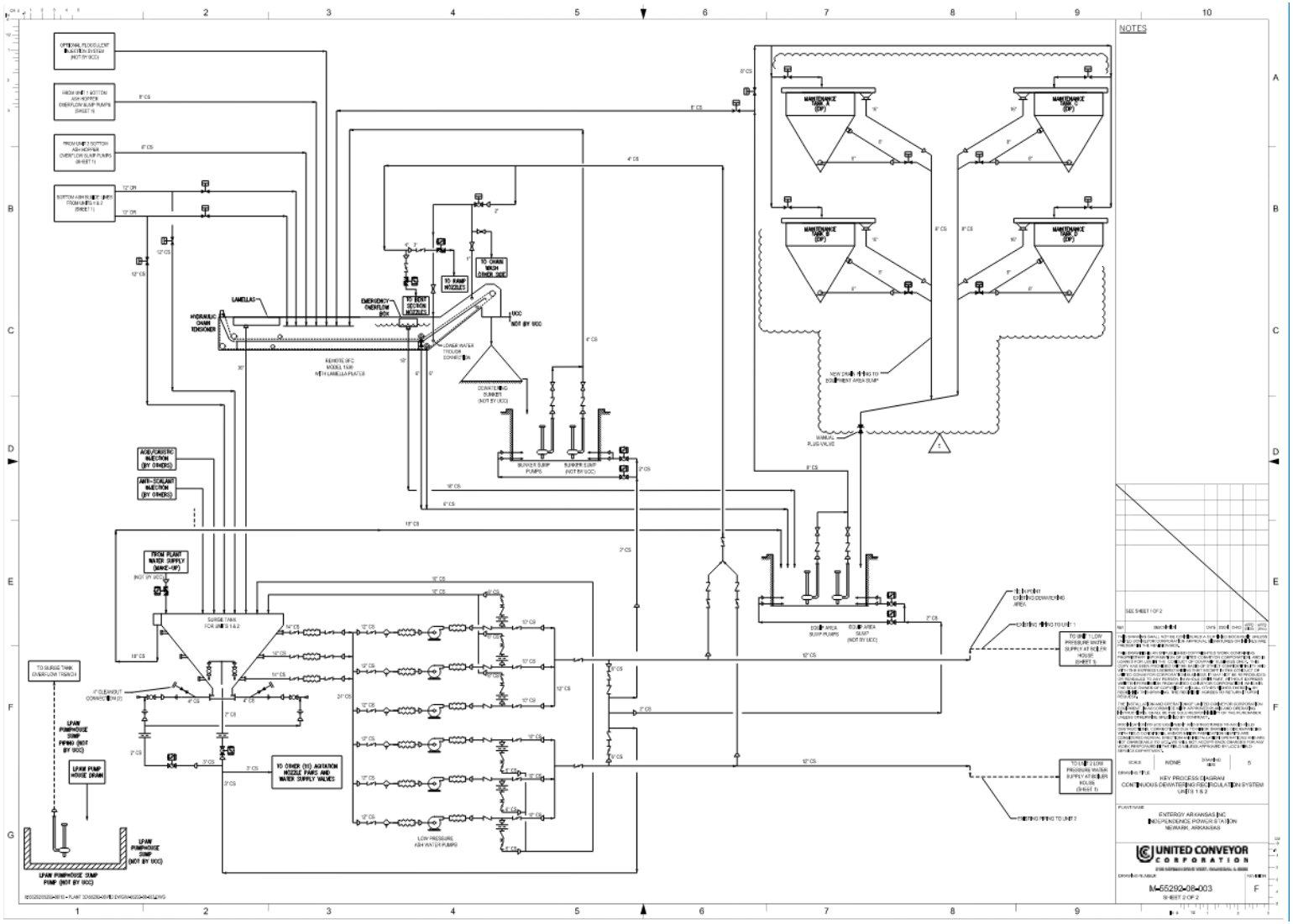
Typical Bottom Ash Recirculation PFD

Traditional Bottom Ash Recirculation System (Tank Farm)



Typical Bottom Ash Recirculation PFD

Continuous Dewatering and Recirculation (Remote SFC)



Bottom Ash Transport Water (BATW)

2024 Steam Electric Effluent Limitations Guidelines (ELGs)

Steam Electric Effluent Limitations Guidelines

2024 ELG ZLD Rule: Bottom Ash Transport Water (BATW)

*"The EPA is identifying the **zero-discharge systems** of dry-handling or closed-loop systems as the technology basis for establishing BAT limitations to control pollutants discharged in BA transport water."*

– EPA's 2024 ELG Revision date April 25th, 2024 (pg. 88/417)

"For all the foregoing reasons, the EPA finds that the record indicates that dry-handling or closed-loop systems are technologically available for control of discharges in BA transport water."

– EPA's 2024 ELG Revision date April 25th, 2024 (pg. 97/417)

Steam Electric Effluent Limitations Guidelines

2024 ELG ZLD Rule: Bottom Ash Transport Water (BATW)

Bottom Ash Transport Water (BATW)

- Zero Liquid Discharge **(ZLD) will be required for all Bottom Ash Transport Water** no later than **December 31, 2029**

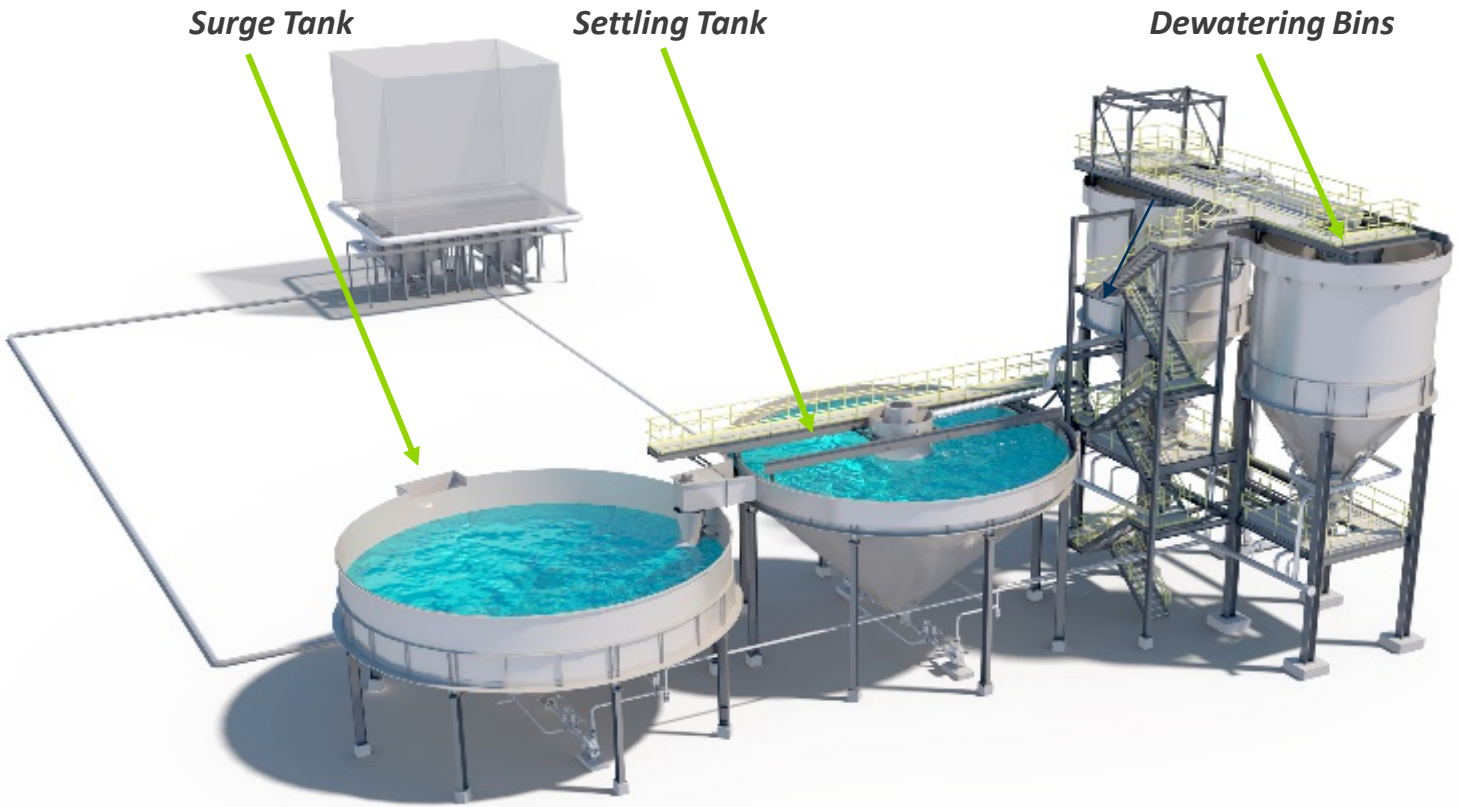
- "**Cessation of Coal Combustion**" subcategory adopters may continue to operate under the 2020 ELG requirements until **December 31, 2034**

- **No regulatory relief** for water balance considerations or maintenance events – the 10% purge is eliminated

- **Legacy Wastewater** will be subject to Best Practical Judgement (BPJ) and regulated at the state NPDES level on a case-by-case basis

Steam Electric Effluent Limitations Guidelines

2024 ELG ZLD Rule: Bottom Ash Transport Water (BATW)



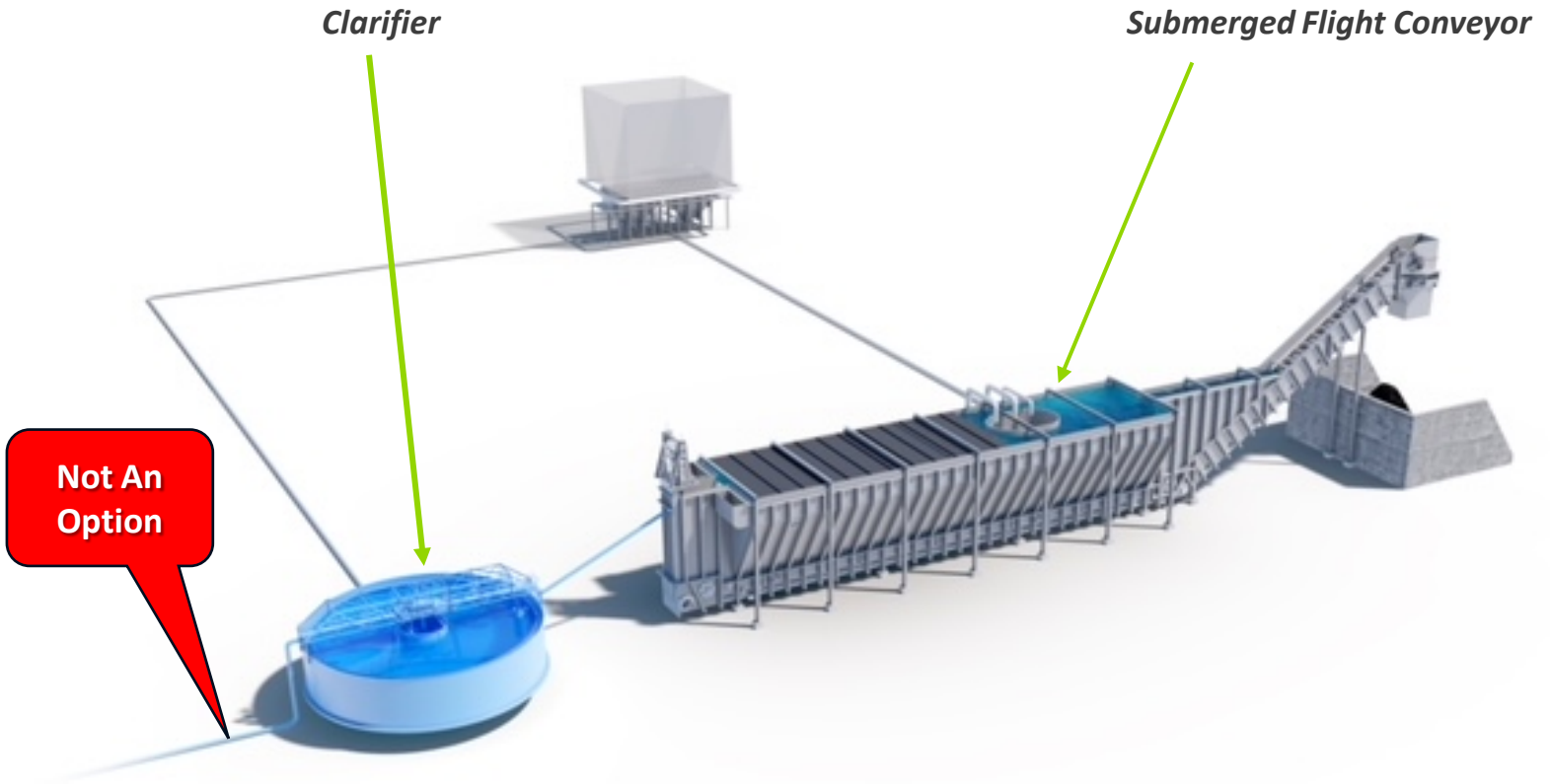
Traditional Dewatering Bins with Surge/Settling Tanks

All Transport Water (water that hydraulically conveys bottom ash out of the power house) will need to be recycled under Final Rule.

Steam Electric Effluent Limitations Guidelines

2024 ELG ZLD Rule: Bottom Ash Transport Water (BATW)

Submerged Flight Conveyor with Optional Clarifier



Remote SFCs have Transport Water that will be subject to ZLD
NOTE: Under-boiler SFCs employ "Quench Water," not Transport Water and are not subject to the Final Rule

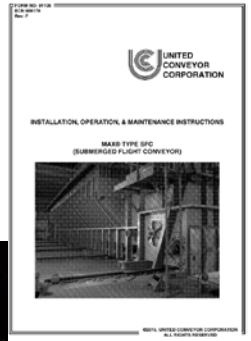
Maintenance and Operations Items

- Small oversights can lead to BIG problems

Chain Wear and Maintenance

SFC CHAIN PROBLEMS:

- An elongated chain can be caused by normal chain wear
- Replace the chain strand in pairs or remove chain links as needed



Chain Replacement on SFC

- SFC Wear Parts need to be replaced at regular intervals
- Chain, Flight bars, Bottom plates all wear over time
- Chain should be replaced after a maximum of 5% wear
- During wet side maintenance activities the water must be stored

Worn Plates and Flight bars

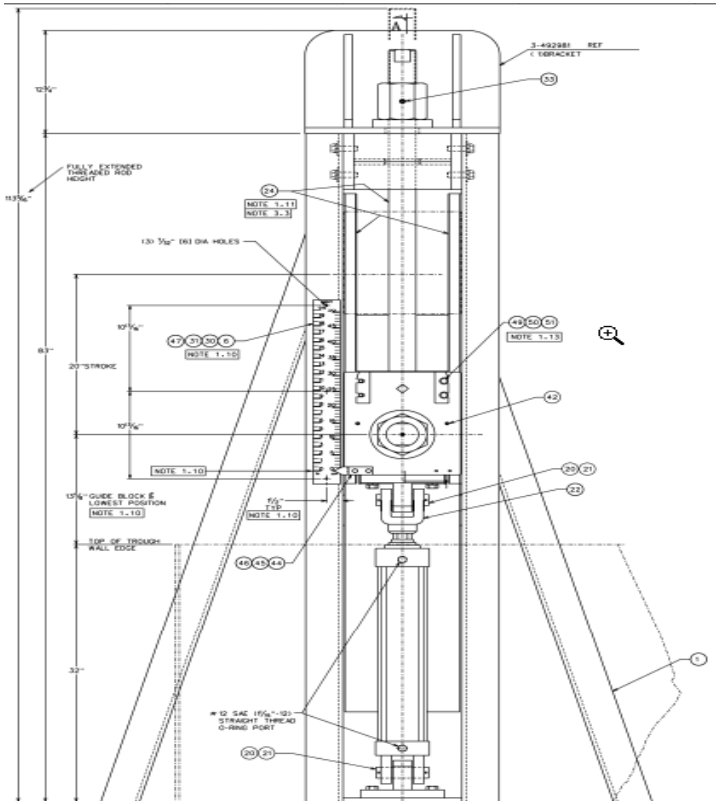
Conveying Flights issues

- Bent, damaged, or excessively worn Conveying Flights must be replaced.
- Broken Horns Can cause chain binding and SFC damage
- Worn plates can cause leaks and poor material loading on flights

Chain Tensioners

SFC CHAIN TENSIONER PROBLEMS:

- A chain tensioner uneven can be caused by uneven wear of the chain and should replace the chain strand in pairs or remove chain links.
- Fouling and dirty HPY Fluid can cause uneven tension on tail-end cylinders



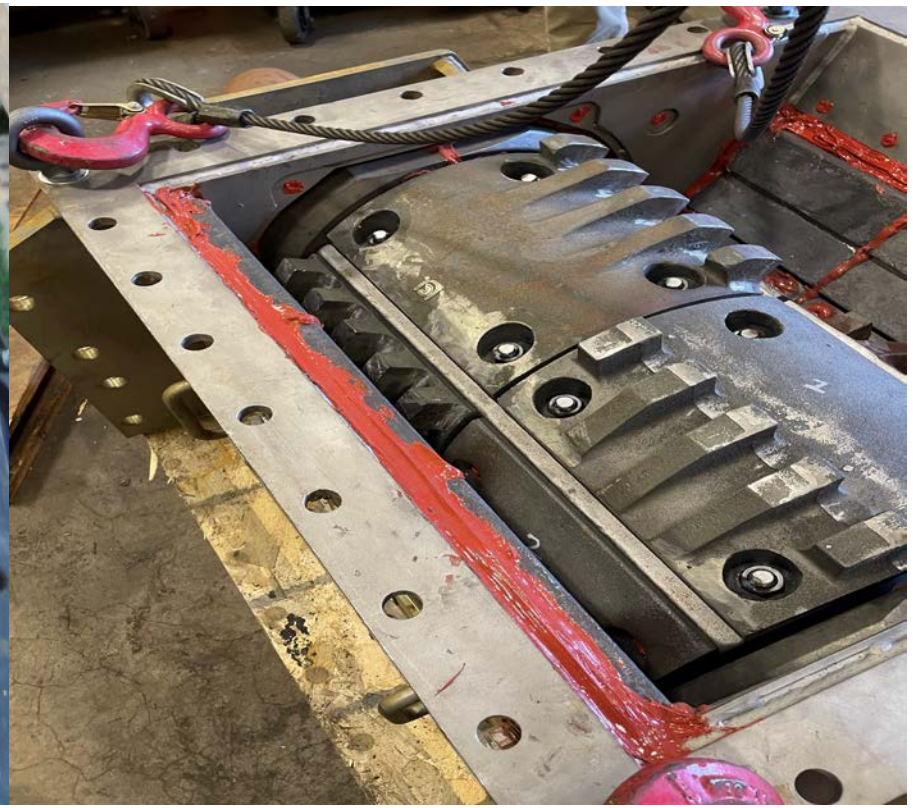
Dirty HPU Fluid- Tensioner needle valve fouling

SFC Idler Wear

- Bent section submerged idle not turning.
- May be caused by overloading the SFC or in some cases it has been found that the idlers were not being greased or greased with the wrong kind of grease.

Crusher wear and Issues

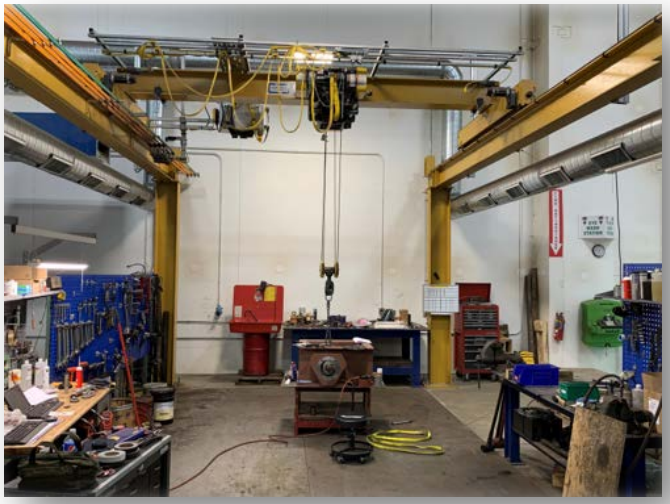
- Damaged clinker grinders can cause poor material sluicing and shut downs
- Seals and gaskets can leak severely if not greased and maintained which can cause significant leaks and water management issues



Component Rebuild Programs

Product Rebuild Programs

- Rebuild Crushers, SFC Idlers, SFC Head Shafts, Coal Crushing Screens, Coal Crushing Rotors, DSI VIPER Mill Rotors, Mixers (Pug Mills)
- Rebuilds are performed in-house at our Pleasant Prairie Facility
- Prior to rebuilding the item, it will be torn down and a condition report will be provided with a final rebuild quote
- Rebuilt items are returned with a new, full standard parts warranty



UCC Environmental Reference Highlights

Chemistry Case Study

PROJECT OVERVIEW

- Eastern USA, Coal Fired Plant
- Year Executed: 2020
- Solution Type: ACCU Brand WWT Chemical Injection for Bottom Ash

CUSTOMER CHALLENGE

Upset conditions required the utility to simultaneously convey multiple sluice lines into a single (R-SFC) which was outside of the recommended sequential operation. This led to higher flow rates and increased TSS carryover during operation, causing unexpected wear to recirc pumps and pump seals.

SOLUTION

UCC executed a pilot Chemical Injection effort to demonstrate the performance of ACCUFLOC polymer. The chemistry program tested the treatment of flows from a variety of plant bottom ash system operating conditions. The one week pilot proved TSS carryover reduction by over 80%.

RESULTS

After observing the improved performance, the plant proceeded with a permanent UCC chemical injection system and ACCUFLOC WWT polymer commitment. This enabled the Customer to better control effluent TSS and reduce downstream component wear.

DISCHARGE WITH UCC FLOCCULANT
(during atypical operating conditions)

DISCHARGE WITHOUT UCC FLOCCULANT
(during atypical operating conditions)

SCOPE OF WORK

- Demo design, demo skid supply, chemical supply
- Demo operations
- Permanent system design & engineering
- Project management
- Permanent injection skid supply
- Startup & commissioning
- Ongoing supply of ACCUFLOC WWT polymer

Open Discussion / Q&A

Open Discussion

Bottom Ash System Overview

Continuous Dewatering and Recirculation System (CDR) With Lamella Plates

Typical Performance Guarantees

Design Considerations: Sluicing System Typical Water Flowrates

- High Pressure Sluice Conveying Water = 2,500-7,000 gpm
- Low Pressure Cooling Water/Seal Trough Flushing/Make-Up Water Supply/Pyrites = 150-1,000 gpm/unit (typical)
- Can vary greatly depending on plant operations