

REINHOLD ENVIRONMENTAL Ltd.



## **2016 NO<sub>x</sub>-Combustion-CCR Round Table Presentation**

February 1 & 2, 2016, in Orlando, FL / Hosted by OUC

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2016 NOx-Combustion-CCR  
Roundtable

**Case Studies of Water Impacts to  
Facilities from New CCR Rule**

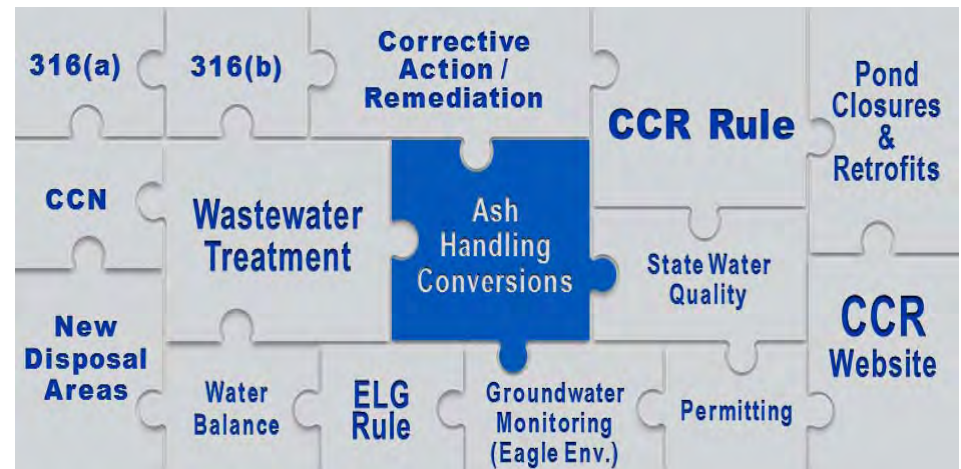
**Michael Roush, PE, MBA**

February 1, 2016



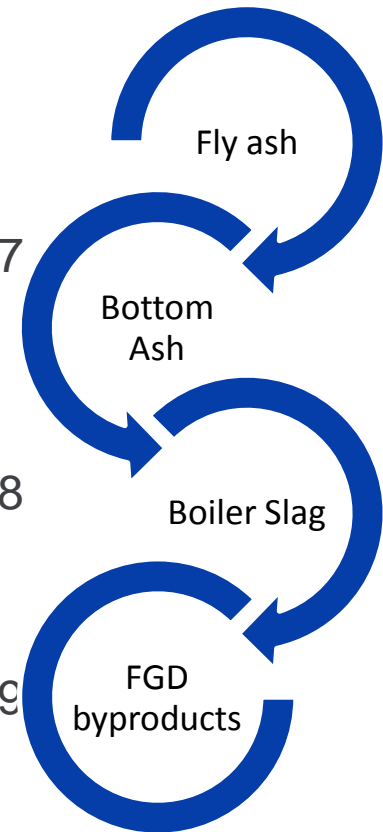
# Agenda

- ▶ CCR and ELG Basics
- ▶ Basic Bottom Ash Handling
- ▶ Available Technologies
- ▶ Case Studies
- ▶ Conclusion



# CCR Rule

- ▶ **Structural Integrity Criteria/Safety Factor Assessments**
  - 18 months/October 2016 – Closure must begin April 2017
- ▶ **Groundwater contamination from unlined ponds**
  - 30 months/October 2017 – Closure must begin April 2018
  - Liner Retrofit is also an option
- ▶ **Failure to meet location restrictions**
  - 42 months/October 2018 – Closure must begin April 2019

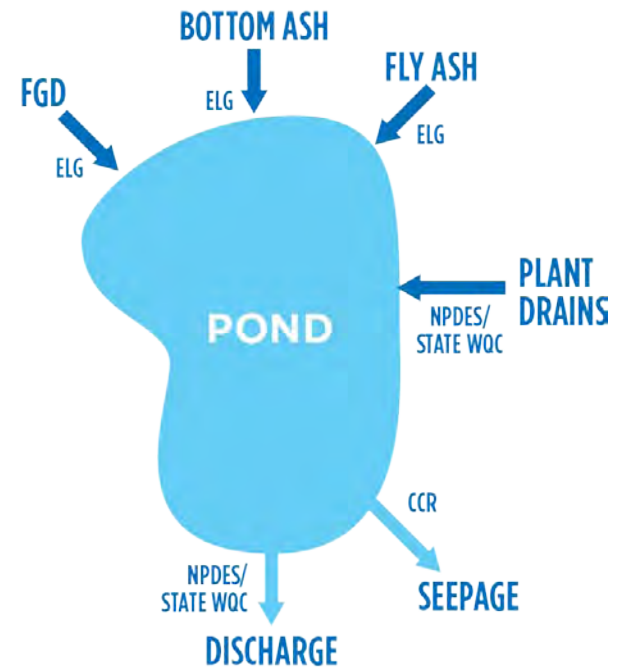


# Effluent Limitation Guidelines

- ▶ Bottom ash must be closed loop (for all units >50MW)
  - Transport water cannot be discharged
- ▶ Underboiler drag chain conveyor water???
- ▶ Blowdown to FGD
- ▶ Fly Ash must be dry
  - Dry system powered by a wet ejector?
- ▶ States can impose tighter limits

# What does this mean?

- ▶ Pond Closure
  - Leachate
  - FGD blowdown
  - Ash transport water
- ▶ Redirecting/treating wastewater streams
- ▶ Bottom Ash Conversion



# Pond Closure

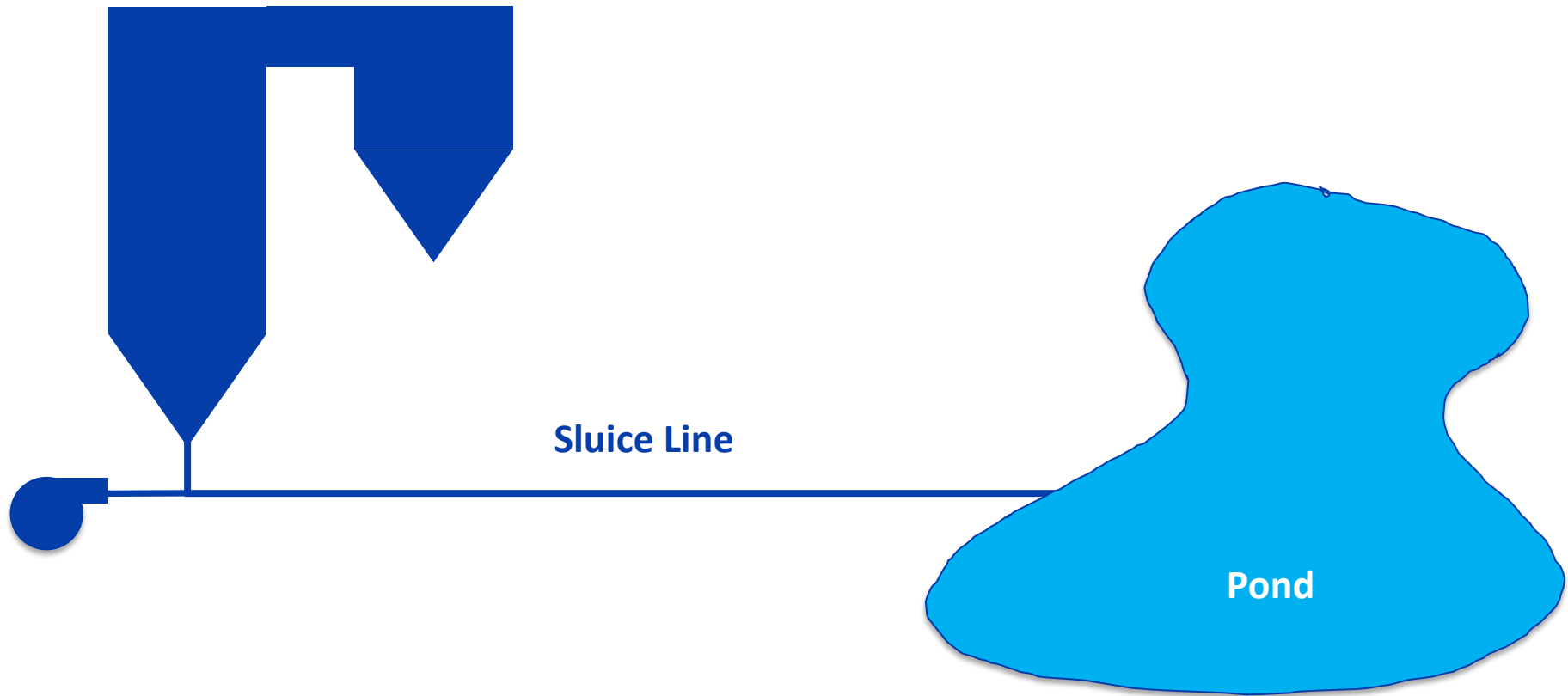
- ▶ Dewatering
  - Removal of free surface water
  - Removal of pore water
- ▶ NPDES permit may or may not allow discharge
- ▶ Clean closure
  - Material dewatered / removed
- ▶ Cap in place closure
  - Material consolidated and capped in place

# Redirecting/Treating Wastewater Streams

- ▶ Most impoundments are a “catch all” for plant waters
- ▶ Reroute or treat these streams
- ▶ Leachate
- ▶ FGD Blowdown
- ▶ Ash Transport Water



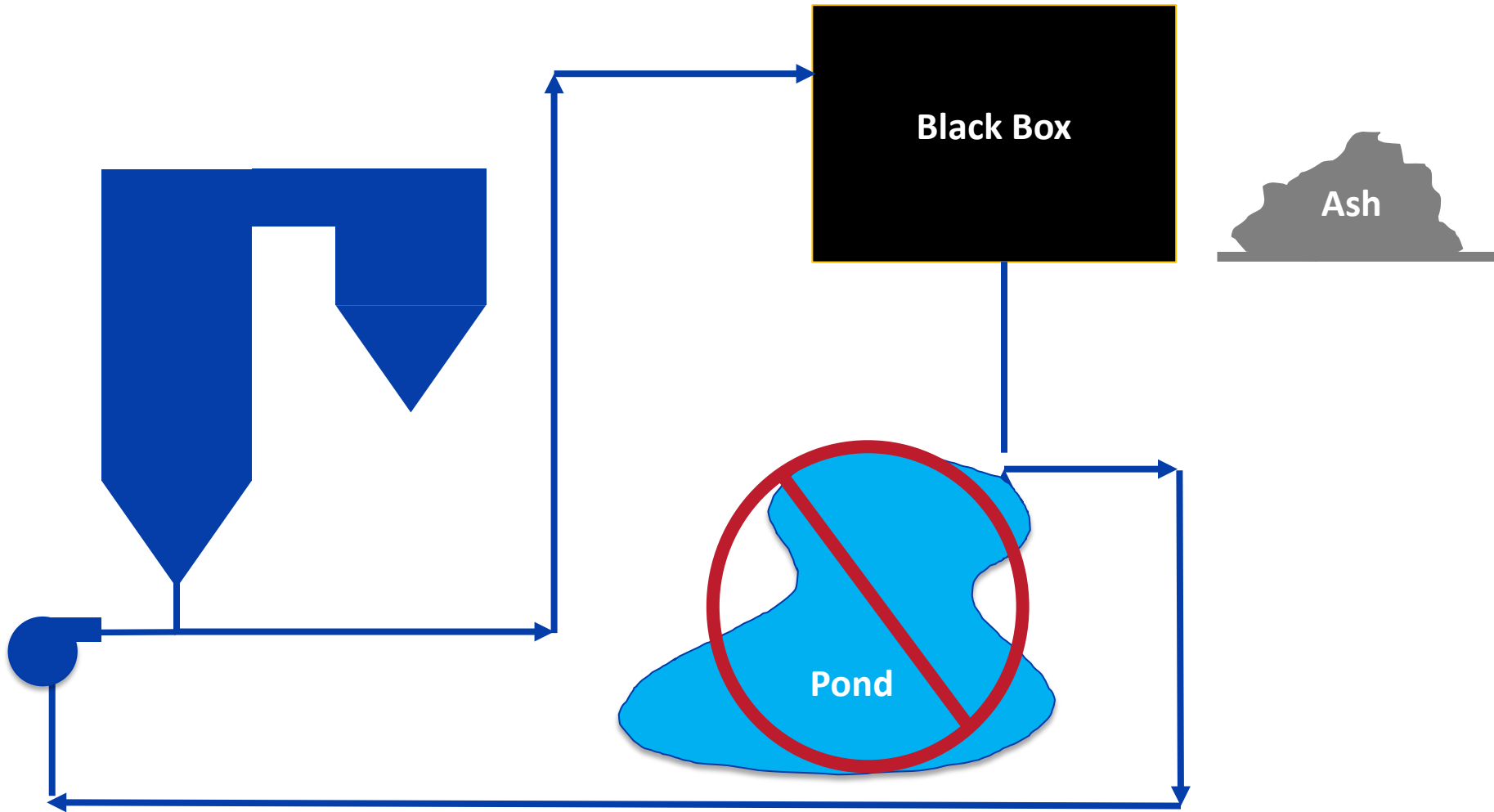
# Typical Sluice System



# Local/Underboiler System



# Remote System



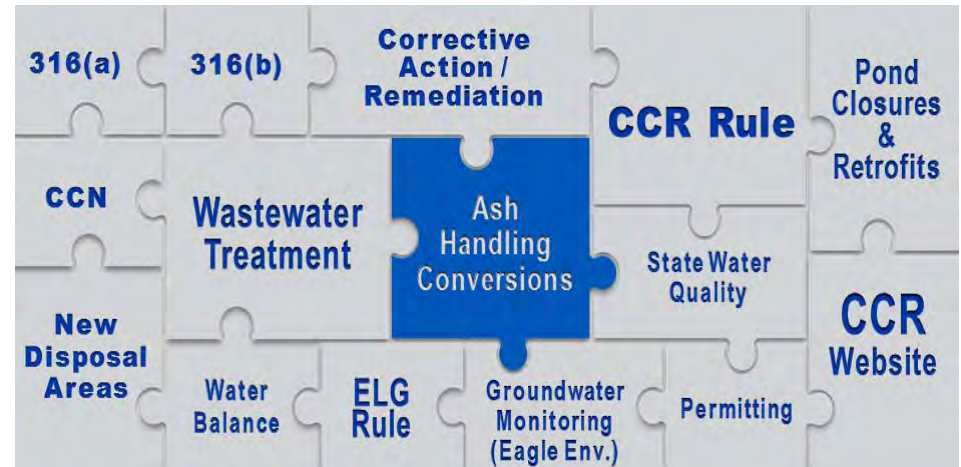
# Available Technologies

## ► Underboiler Technologies

- Underboiler Drag Chain Conveyor
- Pneumatic Conveying System
- Dry Belt/Tray Conveying System
- Vibratory Ash Conveyor

## ► Remote Technologies

- Remote Drag Chain Conveyors
- Remote Dewatering Bins
- Dewatering/Settling Basins



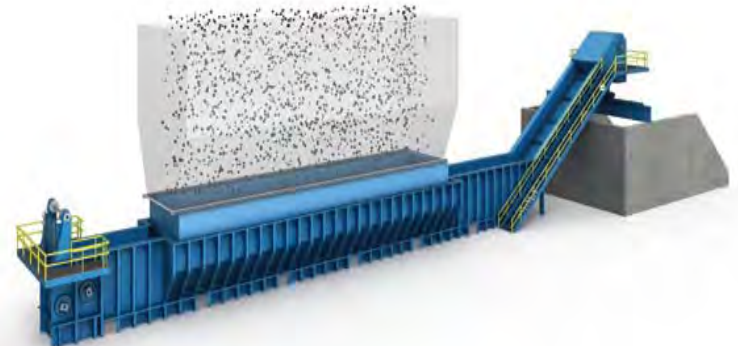
# Local Drag Chain Conveyor

## Advantages

- ▶ Proven Reliability
- ▶ Hundreds of installations
- ▶ Robust Design
- ▶ Low Cost

## Disadvantages

- ▶ Extended installation outage
- ▶ Large footprint required at bottom of boiler
- ▶ Closed cooling loop may be needed



# Bottom Ash Conversion

## Major Technologies Available

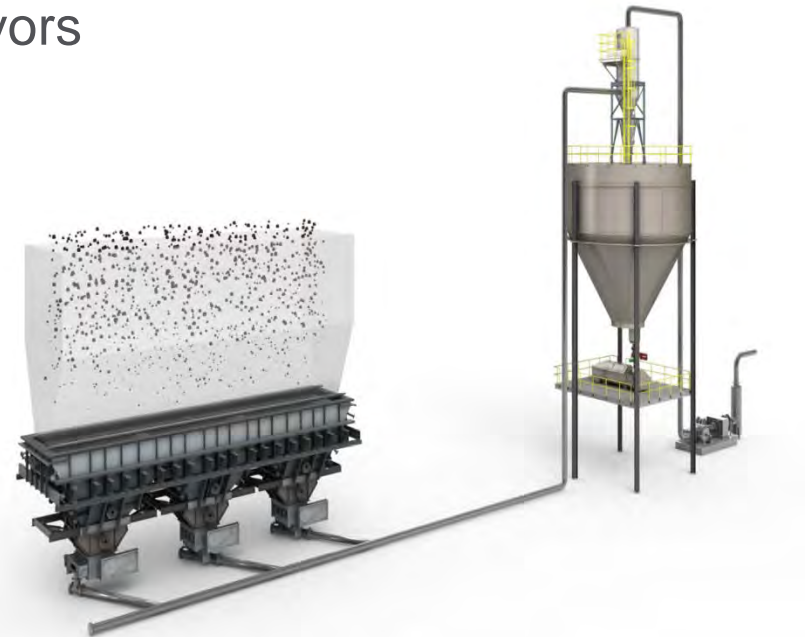
### Pneumatic Bottom Ash System

#### Advantages:

- ▶ Completely dry system
- ▶ Local or remote storage silo
- ▶ Piping more easily routed than conveyors

#### Disadvantages:

- ▶ Cost
- ▶ Major demolition
- ▶ Longer outage
- ▶ Higher O&M cost (Pipe Wear)
- ▶ Permitting Concerns
- ▶ Only PC boilers



# Bottom Ash Conversion Major Technologies Available

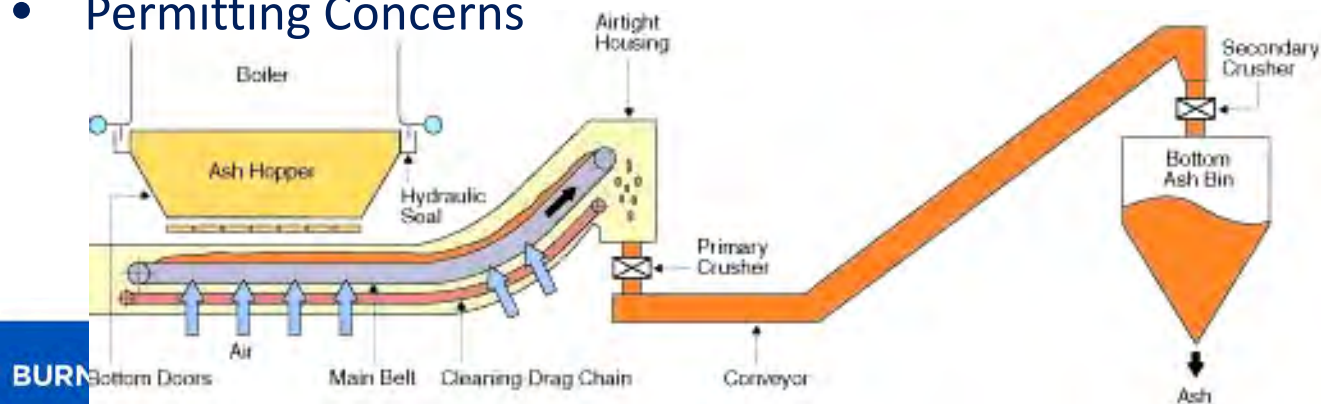
## Dry Belt / Tray Conveying

### Advantages:

- Completely dry system
- Local or remote storage silo

### Disadvantages:

- Cost
- Boiler space requirements
- Major demolition
- Longer outage
- Only PC boilers
- Permitting Concerns



# Bottom Ash Conversion

## Major Technologies Available

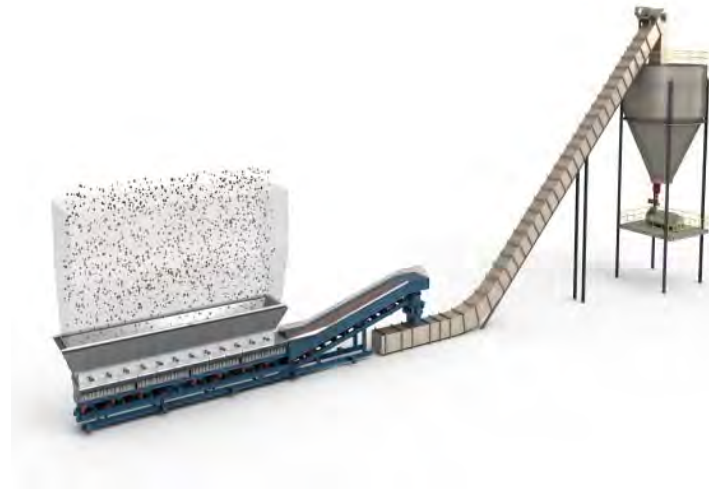
### Vibratory Conveying

#### Advantages:

- Completely dry system
- Local or remote storage silo

#### Disadvantages:

- Cost
- First of a kind in power market
- Boiler space requirements
- Major demolition
- Longer outage
- Only PC boilers
- Permitting Concerns



# Remote Drag Chain Conveyor

## Advantages

- ▶ Minimal outage & demo
- ▶ Minimal impact on boiler footprint
- ▶ Fully redundant system possible
- ▶ No water discharge

## Disadvantages

- ▶ High Capital Cost
- ▶ Regulatory uncertainty (ELG)
- ▶ Aging sluice system remains a part of the system
- ▶ Distance from the plant makes O&M difficult
- ▶ Manual loading of ash
- ▶ Potential risks associated with TSS carryover
- ▶ New application of a technology



# Dewatering Bin System

## Advantages

- ▶ Minimal outage & demo
- ▶ Minimal impact on boiler footprint
- ▶ No water discharge
- ▶ System loads directly to truck

## Disadvantages

- ▶ High Capital Cost
- ▶ Maintenance intensive with poor history
- ▶ Chemical addition required
- ▶ Regulatory uncertainty (ELG)
- ▶ Aging sluice system remains a part of the system
- ▶ Distance from the plant makes O&M difficult
- ▶ Potential risks associated with TSS carryover



# Settling Basin Option

## Advantages

- ▶ Minimal outage & demo
- ▶ Minimal impact on boiler footprint
- ▶ Fully redundant system
- ▶ No water discharge
- ▶ Low Cost
- ▶ Few moving parts
- ▶ Large volume for extended ash storage

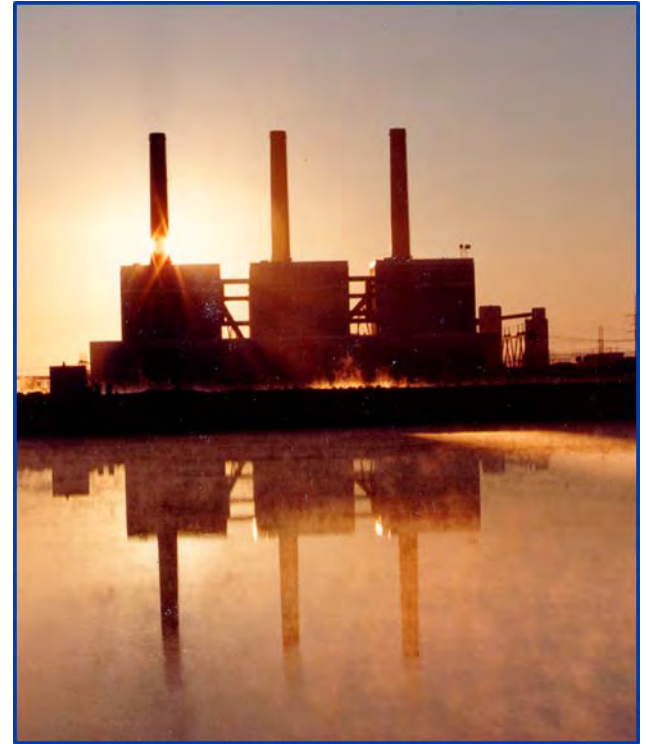
## Disadvantages

- ▶ Short track history
- ▶ Chemical addition may be required
- ▶ Regulatory uncertainty (ELG) with excess water
- ▶ Aging sluice system remains a part of the system
- ▶ Distance from the plant makes O&M difficult
- ▶ TSS carryover risks
- ▶ Large footprint
- ▶ Ability to dewater the ash
- ▶ Potential for double handling
- ▶ Loadout to trucks
- ▶ Winter freezing issues with slope



# Case Study 1

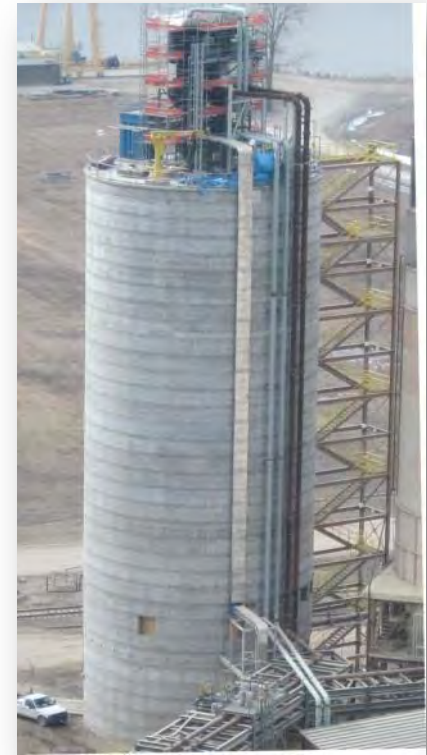
- ▶ 3 PC boilers – 725 MW total
- ▶ Project Drivers
  - Bottom ash pond full
  - Overfill recently constructed
  - Secondary ash pond filling quickly
- ▶ Secondary ash pond only a short term option Fly ash, bottom ash and gypsum all sluiced to pond
- ▶ ~\$60MM project
- ▶ ~2.5 years from concept to completion



# Case Study 1

## ► Fly ash

- Conversion to dry needed for largest unit
- Smaller units are retirement targets
- Vacuum system selected
- Economizer ash pulled into new vacuum system
- Silo capable of handling input from pressure system
- Cease sluicing to pond



# Case Study 1

## ► Gypsum

- Gypsum sluiced to pond or to existing dewatering belt
- Redundancy needed
- Added a new 2x50% dewatering belt system
- Cease sluicing to pond
- FGD wastewater (minus solids) still going to pond



# Case Study 1

## ▶ Bottom Ash

- Considered dewatering settling basins and remote drag chain conveyors
- Remote drag chain conveyors selected
- 2x100% system
- Located indoors
- 3 day storage bunkers
- Cease sluicing to pond



# Case Study 2

- ▶ 2 PC boilers – 750 MW each
- ▶ Midwest
- ▶ 1 unit equipped with underboiler drag chain
- ▶ Project Drivers
  - CCR Rule and proposed ELG Rule
- ▶ Planned closure of all impoundments
- ▶ Bottom Ash Conversion needed
- ▶ Dry scrubber and dry fly ash handling in place
- ▶ \$20MM for bottom ash



# Case Study 2

## ▶ Bottom Ash

- Considered pneumatic, local and remote drag chain conveyors
- Underboiler drag chain selected
- Pneumatic ruled out due to cost and permitting
- Remote ruled out due to cost
- Cease sluicing to pond



# Case Study 2

- ▶ Waste Streams
  - Air heater wash
  - Plant drains
- ▶ Study underway for selection of technology
  - Water treatment including clarifiers
  - New treatment pond

# Case Study 3

- ▶ 3 PC boilers – 50 MW and 150 MW
- ▶ Midwest
- ▶ 1 unit equipped with pneumatic
- ▶ Project Drivers
  - CCR Rule, proposed ELG Rule, state requirements
- ▶ Planned clean closure of all ponds
- ▶ Bottom Ash Conversion needed
- ▶ Dry fly ash handling already in place
- ▶ ~\$14MM project



# Case Study 3

## ▶ Bottom Ash

- Considered remote drag chain, settling basins and pneumatic conveying
- Pneumatic conveying chosen
  - ▶ Plant familiarity (1 unit already has this technology)
- New steel silo installed

# Case Study 3

## ▶ Wastewater Reroutes

- Plant drains
  - ▶ Being redirected to a surge tank
  - ▶ Sampled, tested and then released to NPDES discharge location
- Coal pile runoff and stormwater being redirected

# Conclusion

- ▶ System are not one size fits all
- ▶ Every plant is unique
- ▶ Start planning now
- ▶ Schedules will be tight



**Questions???**