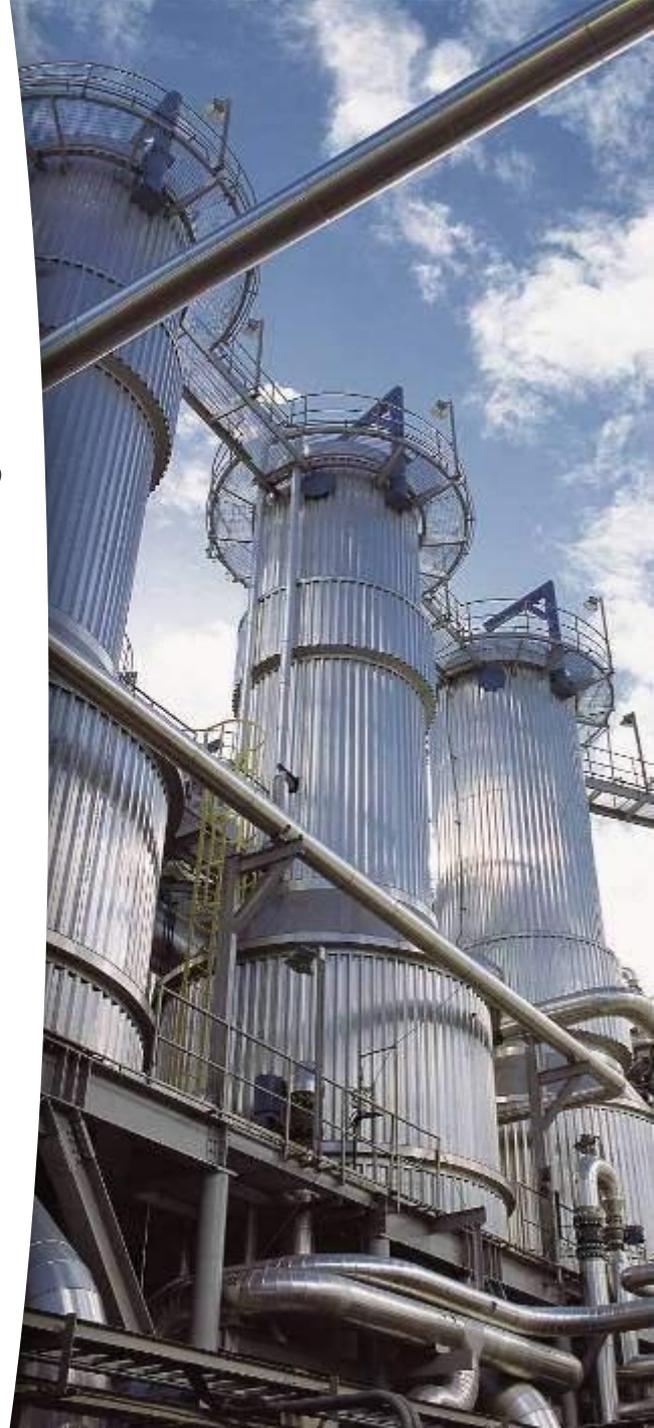


McIlvaine Hot Topic Hour
June 16, 2011

*Zero Liquid Discharge
Options for FGD
Wastewater*

HPD

Bill Shaw, P.E.





1

New Regulations Pending for Coal Power Plants

- Federal EPA – Steam Electric Water Discharge Guidelines
- Solid Waste Disposal -- stricter regulation of coal combustion residues (CCR)
- State/Regional/Watershed Regulations
 - Great Lakes
 - Monongahela River – PA
 - Delaware River Basin

Market Analysis

- ZLD will be required for some USA Power Plants – when and how many?
 - Near Term: TDS Limitations
 - Discharges into impaired river systems
 - Discharges into lakes used for recreation
 - Water-short areas
- China has more coal power capacity than USA and will continue to favor coal for power generation – will improving living standards help create a market for ZLD?
- India is Expanding its Power Sector; like China coal is cheap and abundant – will a ZLD market develop?



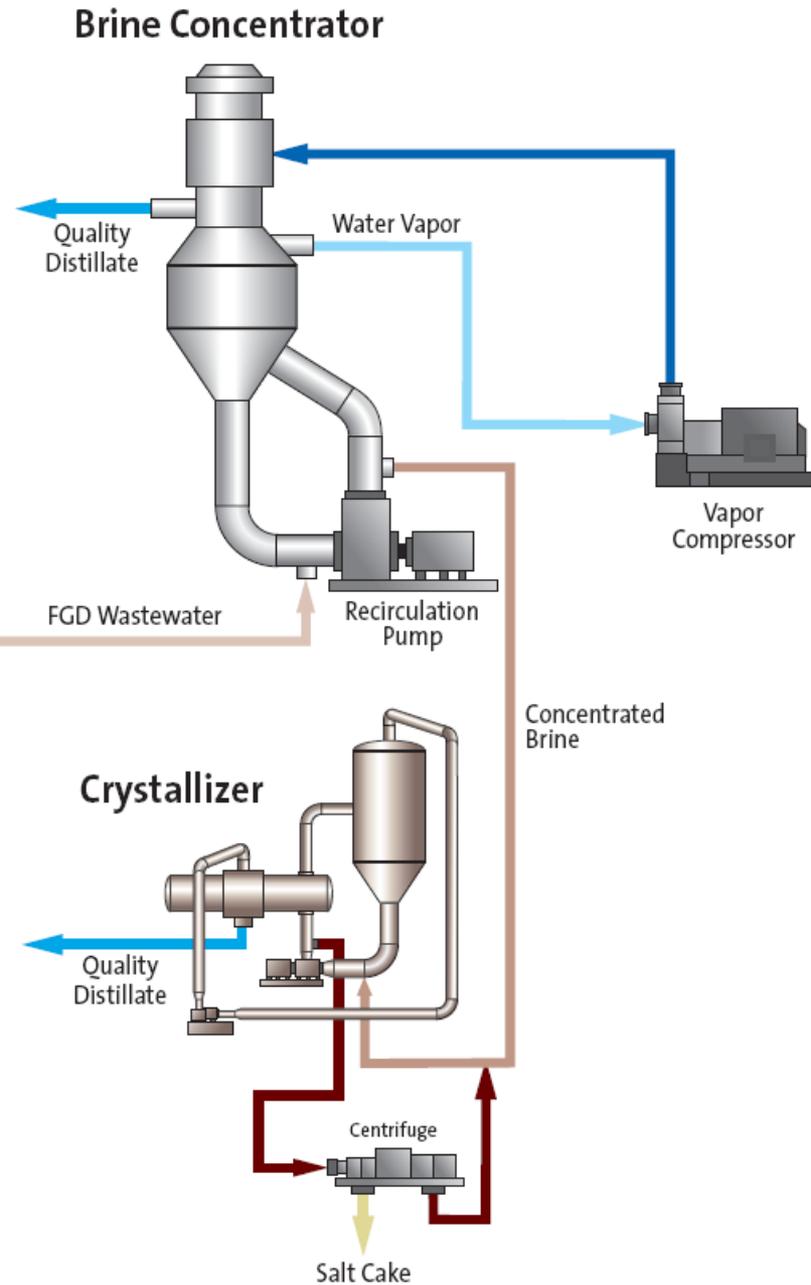
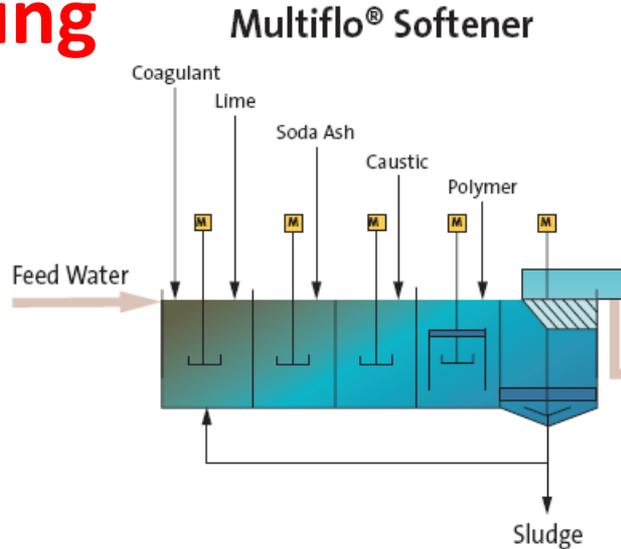
2

ZLD Process Alternatives for FGD Wastewater

- Softening/Falling Film Evaporation/Forced Circ Crystallization
- Falling Film Evaporation/Brine Disposal
- Falling Film Evaporation/CoLD™ Crystallization

FGD ZLD Alternatives

Softening



Requires:

- chemicals
- power and/or steam
- produces sludge in addition to salts

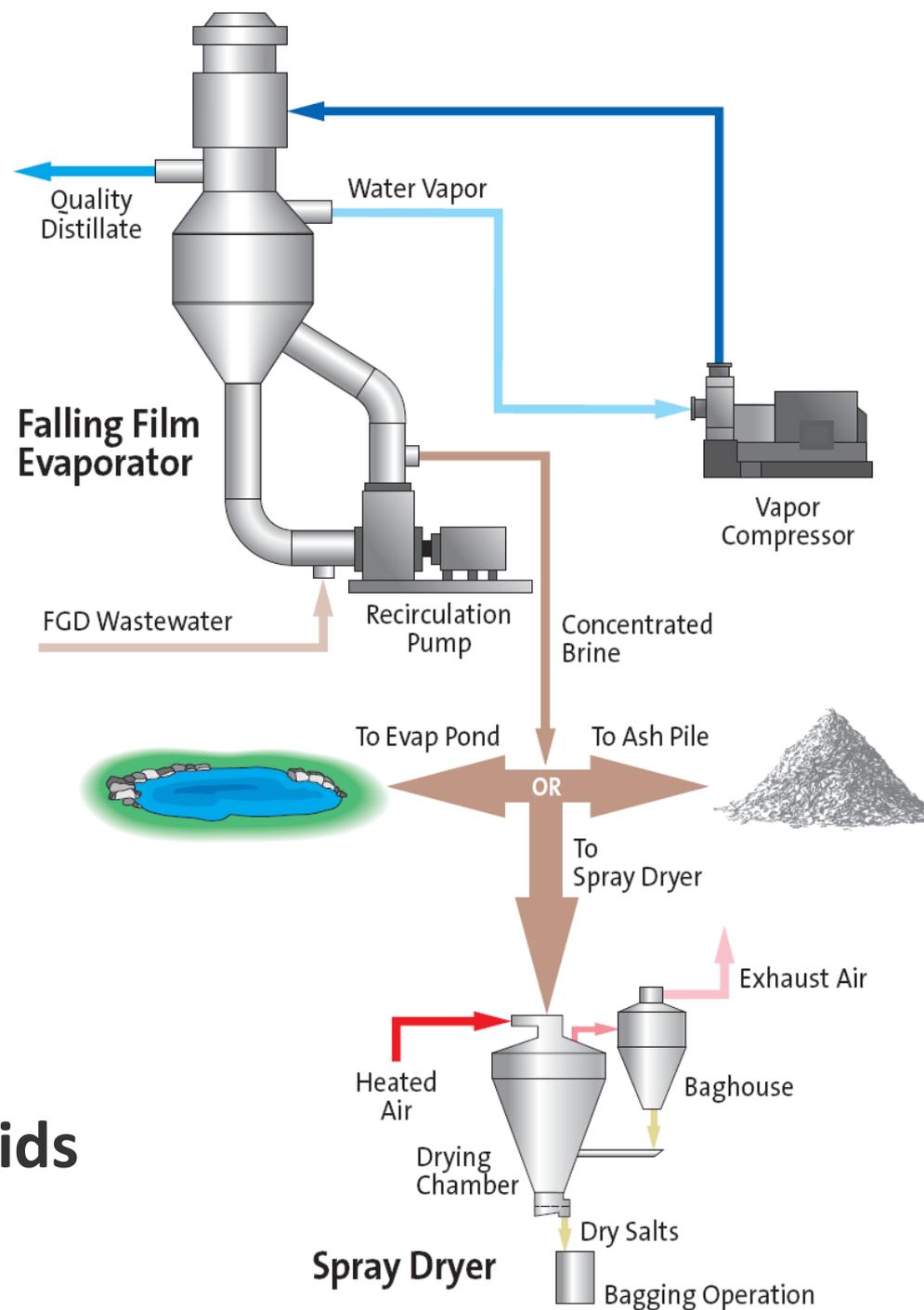


FGD ZLD Alternatives

Brine Disposal

Requires:

- no chemicals
- power and heat
- produces less solids

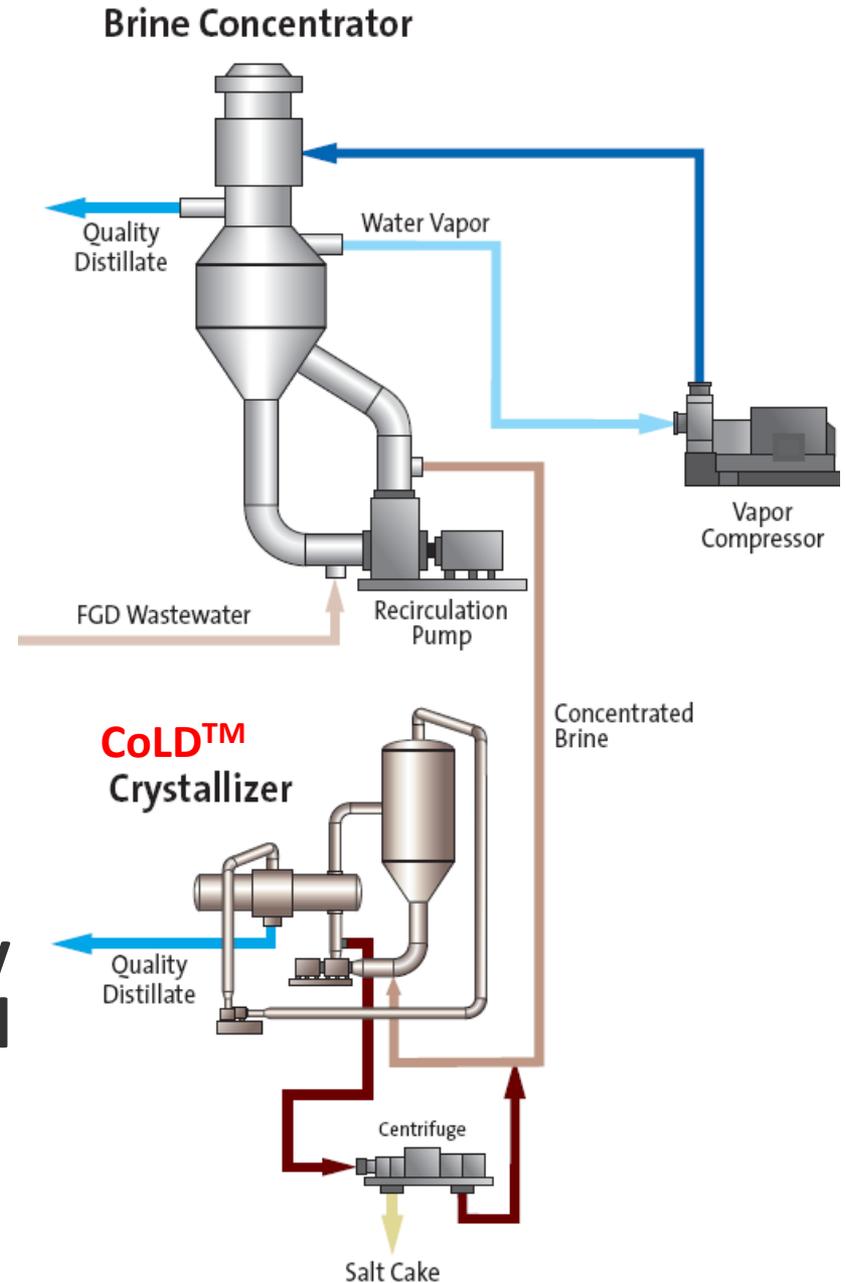


FGD ZLD Alternatives

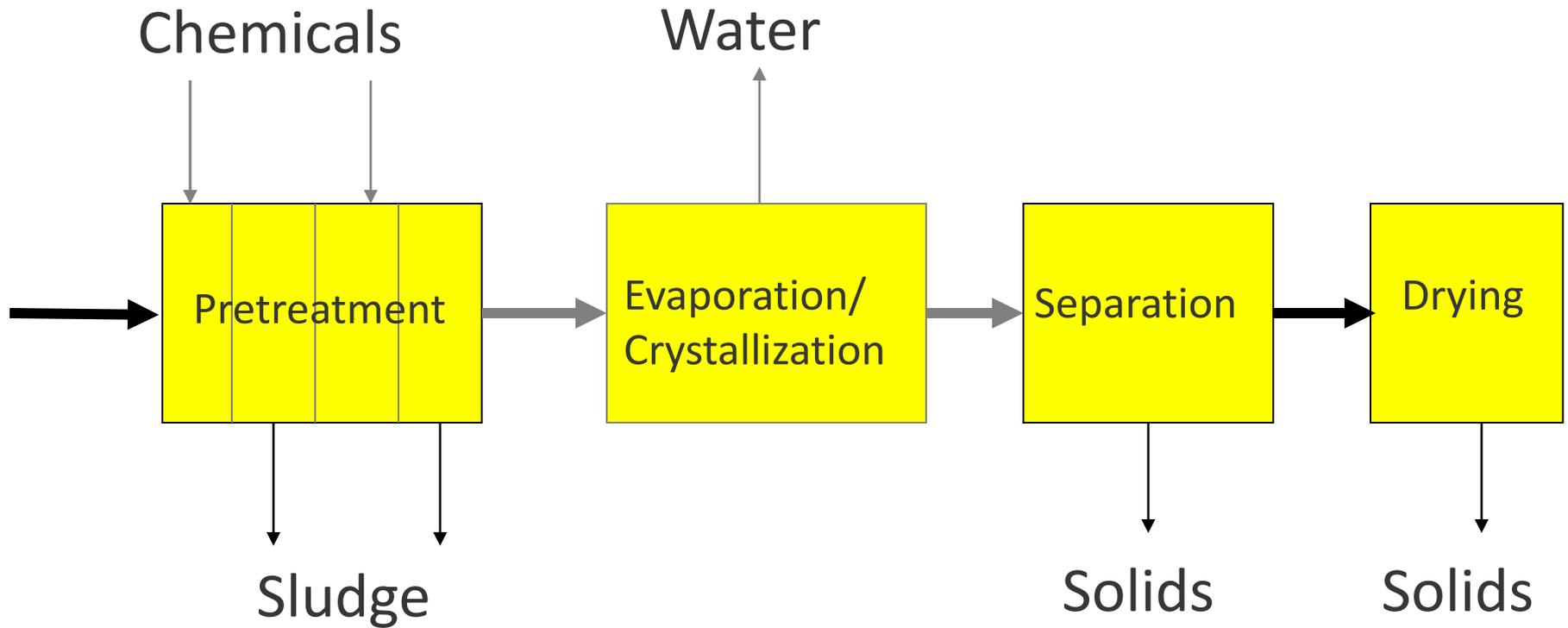
CoLD™ Crystallization

Requires:

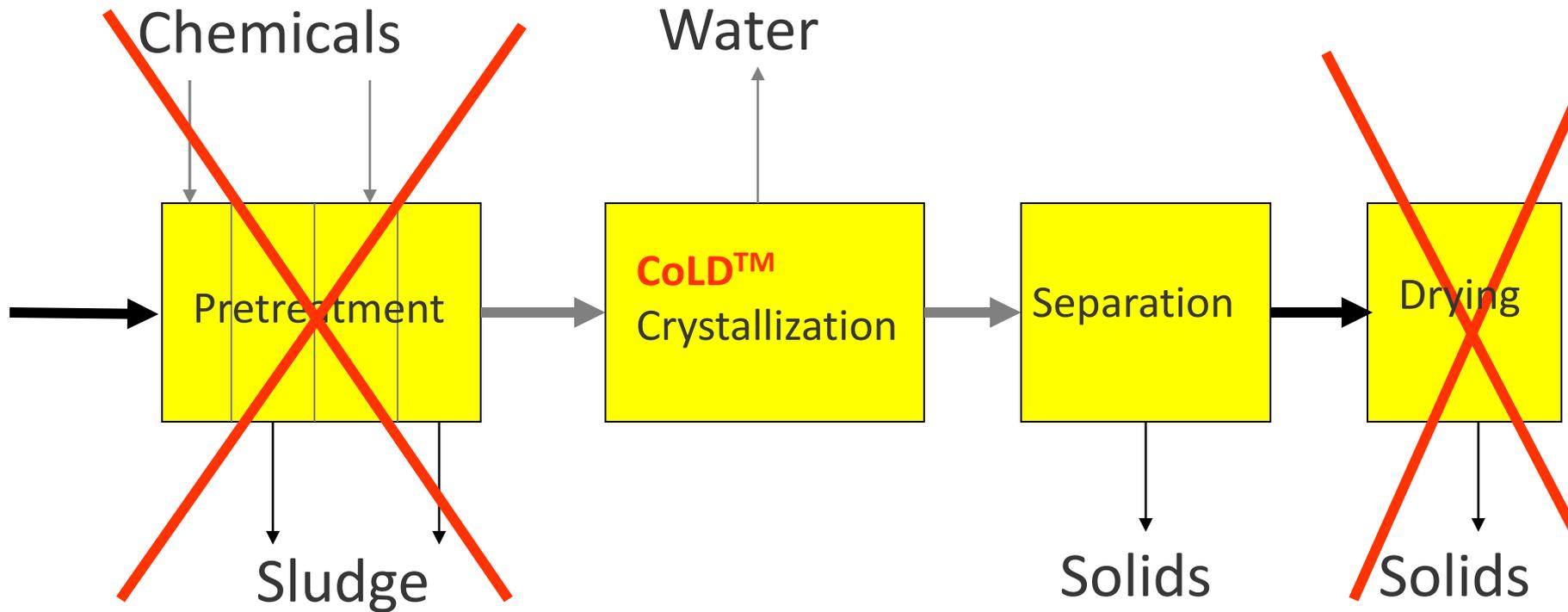
- no chemicals
- power
- produces only the quantity of solids present in original wastewater



Basic Flowsheet for ZLD



CoLD™ Crystallization Process



Result of CoLD™ Process ZLD



FGD Scrubber Blowdown



Clean Water for Recycle and
Stable Solid for Landfill Disposal



Advantages of CoLD™ Process

- No softening required => No chemicals required, no sludge produced.
- A stable, solid product is produced directly using only electric power.
- Chemical costs are eliminated and solids disposal costs are greatly reduced.
- Energy costs are still low.
- Complexity and footprint of equipment are greatly reduced.
- Materials of construction can be reduced

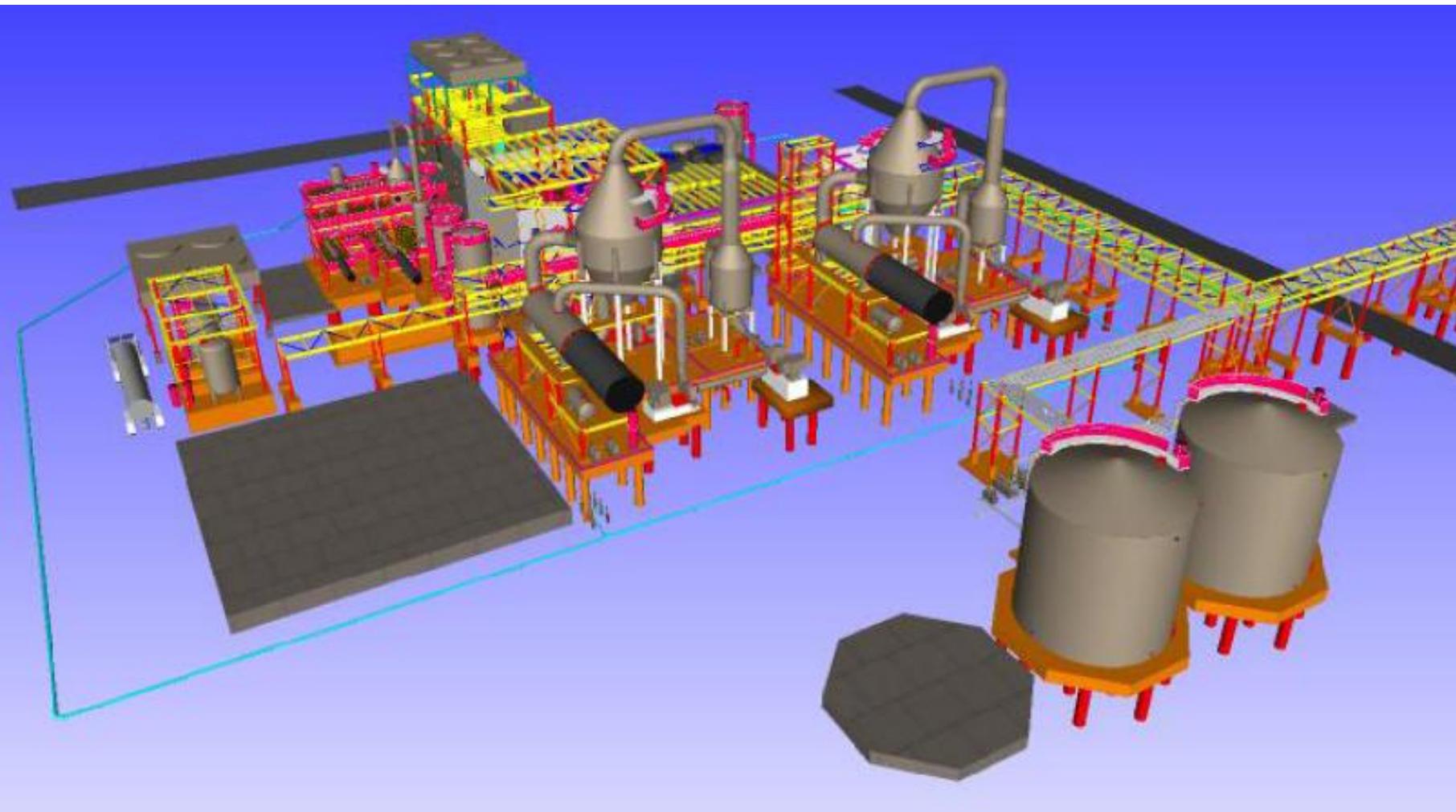


A2A S.p.A., Italy

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



Duke Edwardsport – Two CoLD™ Crystallizers





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