Zero Liquid Discharge Options for FGD Wastewater

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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?
ZLD Process Alternatives for FGD Wastewater

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

1. Pretreatment
2. Evaporation/Crystallization
3. Separation
4. Drying

- Chemicals
- Water
- Sludge
- Solids
- Solids
CoLD™ Crystallization Process

- Pretreatment
- CoLD™ Crystallization
- Separation
- Drying

Chemicals
Water
Solids
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