REINHOLD ENVIRONMENTAL Ltd.

2014 Wastewater-Ash Round Table & Expo Presentation

September 22, 2014, in Birmingham, AL / Hosted by Southern Company

WorleyParsons

resources & energy

Re-use and Recovery Technologies

A presentation for Wastewater – Ash/PCUG

Conference – September 22, 2014

By Dean Ritts, PE, CEM

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EcoNomics

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Effluent Limitations Guidelines EPA 40 CFR Part 423

316(b)

CCR

Se, Hg, As

ZLD

ZLD: MVC
Flue gas H2O
Biological Units
RO
DI
DAF
Chemical
Lamella Clarifiers
Circular Clarifiers
Grit Chambers
pH

Complexity - $

Case Studies

Proce$$ Improvement

I&C and Automate
Pump Seal Water
Strategies to Reduce

Water Resource Solutions for Power

E3 Approach:
Engineering
Environment
Economics

Recovery

$$$$

Re-use

Treatment

$$$

Complexity - $

Modeling
Direct
Solids -(BIG)
Oil
Organics
pH
Salts (precip)
TSS
bacteria
Metals (precip)
NH4&NO3
salts (RO)
Metals (bio or DI)

Fill the Data Gap

H_2O Engineering PFD

H_2O Chemistry, Q

Permit Restrictions

***HOW* H_2O is used for Power Production**

Power Generation Support

Pretreatment - Rocks & Rags
Primary Treatment – TSS, pH, O&G
Secondary Treatment - Metals, BOD
Advanced Treatment -TDS, Metals
RESIDUALS

Options: Re-Use, Recovery, Treatment

EcoNomics

Wastewater & Power – What? Why? How?

- Wastewaters
  - FGD Scrubber Water
  - Bottom Ash Transport
  - Boiler Blowdown
  - Cooling Tower Blowdown
  - Equipment Washwaters
  - Plant washdowns
  - Leachate
  - Coal-Pile Runoff

- **Regulations**
  - 40CFR Part 423 – ELGS for Power Plants
  - 316(a)
  - State WQBL
- **Limits on:**
  As, Hg, Se, Cd, Pb, TSS, TDS, COD, BOD, O&G, PCBs, Cu, Fe, B, pH, Temp, nutrients, NH4

- Treatment Units
  - Lamella Clarifiers
  - Circular Clarifiers
  - Chemical Precipitation organosulfide and FeCl
  - DAF Systems
  - Anaerobic Bioreactors
  - Sand Filters
  - Microfiltration
  - RO
  - Zero Liquid Discharge (MVC with Crystallizers)
  - Belt Filter Press
  - Centrifuge
  - Constructed Wetlands

Water Re-use and Recovery – Technologies and Techniques in Play

- **Recovery**
  - Blowdowns
  - Equipment Flushes
  - Seal Pump Water
  - Vacuum Exhaust Waters
  - Backwashes
  - Mill Sump water
  - Coal Pile Runoff
  - Stormwater
  - Neutralization Tanks
  - Filtrate
  - Bottom Ash Dewatering
- Re-use for
  - FGD Scrubber Water
  - Pyrite Transport
  - Bottom Ash Transport
  - Boiler Make-up
  - Cooling Tower Make-up
  - Equipment Washwater
  - Plant service water
  - Dust mitigation
  - Coal-Pile Dust Control
- Treatment Units
  - Lamella Clarifiers
  - Circular Clarifiers
  - Chemical Precipitation organosulfide and FeCl
  - DAF Systems
  - Anaerobic Bioreactors
  - Sand Filters
  - Microfiltration
  - RO
  - Zero Liquid Discharge (MVC with Crystallizers)
  - Belt Filter Press
  - Centrifuge
  - Constructed Wetlands
  - Geotubes

Wastewater Treatment for Power Plant - Secondary

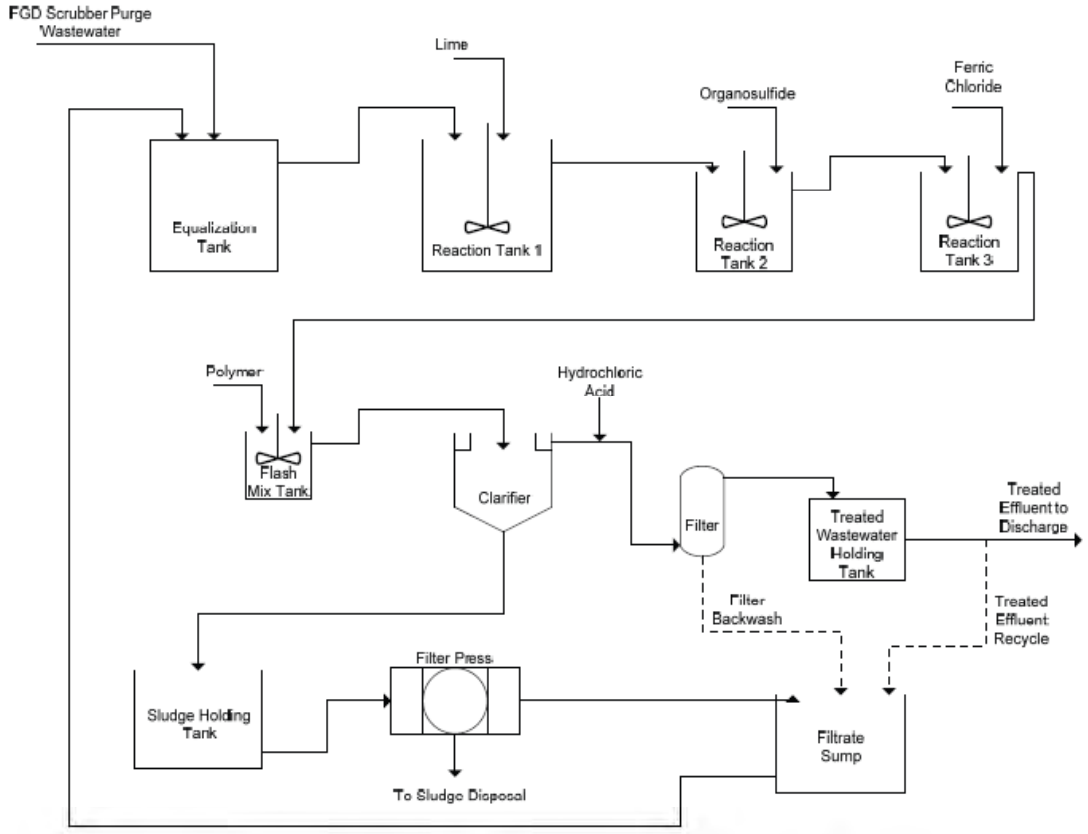

Figure 4-6. Process Flow Diagram for a Hydroxide and Sulfide Chemical Precipitation System

Wastewater Treatment for Power Plant – Advanced Secondary

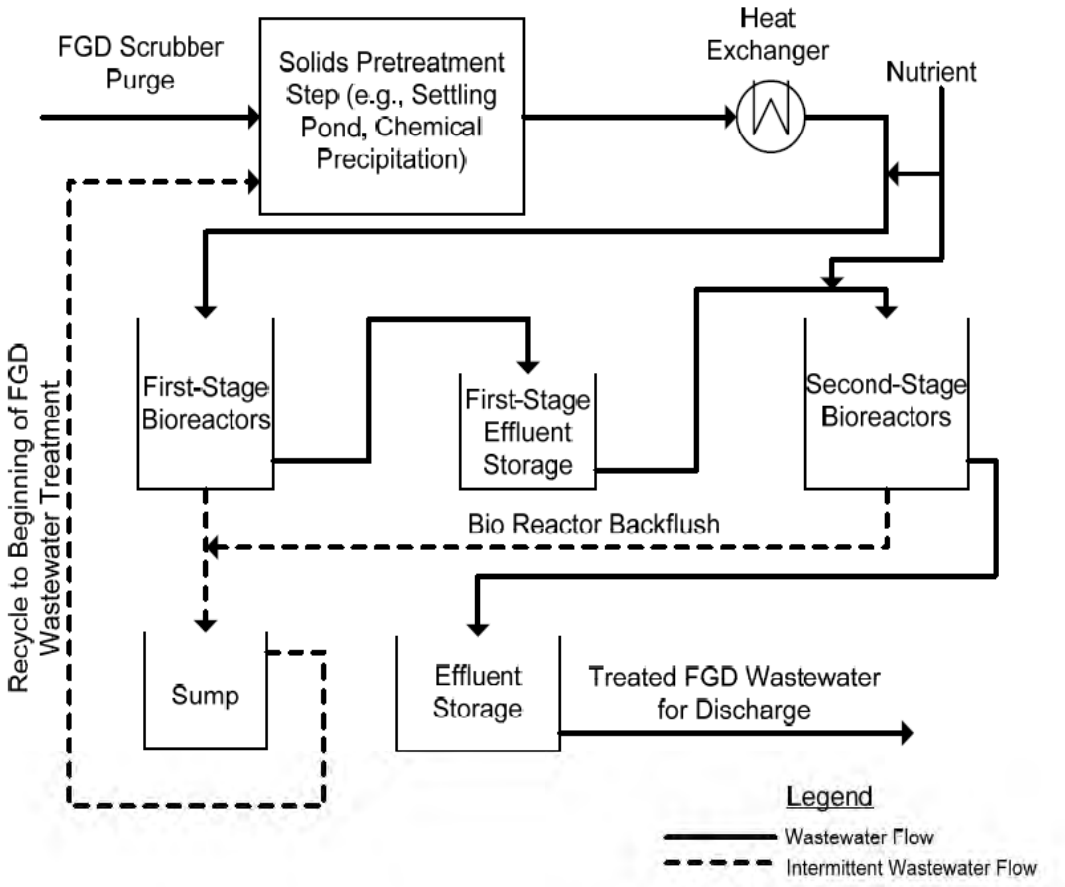

Figure 4-7. Process Flow Diagram for an Anoxic/Anaerobic Biological Treatment System

Wastewater Treatment & Approaches to Sustainability

- Recycle & Re-use – How clean to make the water for recycle and re-use?
  - What level of treatment required? Softening, disinfection, pH adjustment, solids removal, etc..
- Minimization – reduce the amount of water you treat to minimize chemicals, footprint, materials, energy
- Technology Selection – choice of technology is important to sustainable design: ZLD vs Chemical Precipitation
- Sustainable Engineering Design – require design to have proven methods of energy efficiency, material conservation, etc.
- Process Modifications – what changes in process can minimize or eliminate need for wastewater treatment

Techniques & Technologies - Examples

- Water re-use for cooling towers (boiler blowdowns, contact stormwater, DI backwashes, etc)
- Water re-use for boilers (seal pump water, non-chemical metal cleaning washwaters)
- Water recycle for wetting coal piles
- Water recycle for dust control
- Treatment system automation (I&C)
- Process Automation (I&C)
- Solids dewatering (I&C)
- VFDs – variable frequency drives
- Water and wastewater metering
- Wet bottom ash to dry bottom ash conversion or to recycle water bottom ash

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Dean Ritts, PE, CEM — dean.ritts@worleyparsons.com
T: 832-858-6498

Ken Burris — ken.burris@worleyparsons.com
T: 832-713-5236