FLY ASH PONDS AND WASTE WATER TREATMENT

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Hot Topic Hour
McIlvaine Presentation

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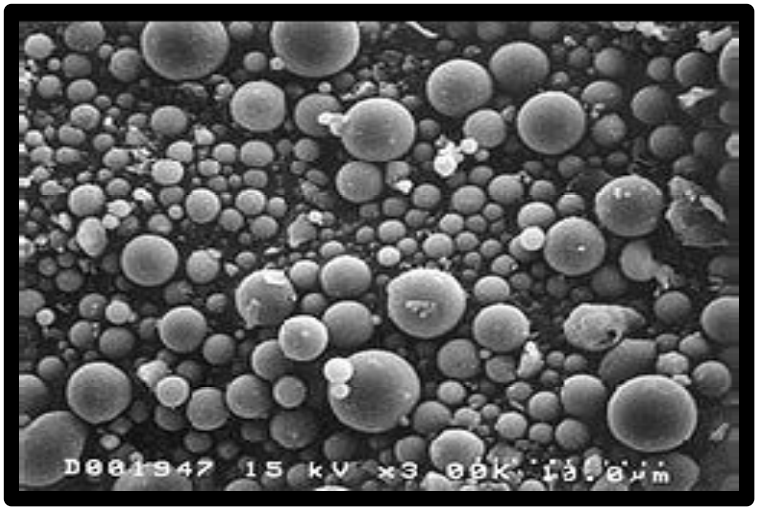
Agenda

- Fly Ash - Definition
- Fly Ash and Fly Ash Leachate Characteristics
- Why Treat?
- Treatment Options
- Benefits of Treatment
- Questions & Discussion

Fly Ash - Definition

- Fly Ash emanates from the non-combustible mineral portion of coal.
- When coal is consumed in a power plant, its fine powder is blown into the power plant boiler.
- After the carbon contributes its energy, it leaves behind molten particles rich in silica, alumina and calcium as a byproduct. This residue is further classified as Bottom Ash (~20%, not a part of our topic today) and as Fly Ash.
- ASTM defined two types of Fly Ash: Type C & Type F. Both possess Pozzolanic properties when mixed with lime, but Type C may posses enough lime to become self cementing.
- These particles solidify as microscopic, glassy spheres that are collected from the power plant's flue gas exhaust before they can "fly" away- Hence the product name: FLY ASH.

Microscopic picture of Fly Ash



Electron Microscope (SEM): Fly ash particles (Cenospheres) at 2,000 x magnification, from FHWA DOT Gov.jpg

Fly Ash Pond – Chemical Fate & Transport in the Environment

In many power plants the wet disposal of Fly Ash is the most common way. The Fly Ash is being collected and stored in ponds with the hope that the pond will properly function forever. The water that comes in direct contact with the fly ash base is called the Ash Pond Leachate.

- The leachate will carry the contaminants wherever it can, without respect to the boundaries of air water and soil.

- However, nature in its inherent drive for Steady State, will keep the elements moving. Leachate can and will, sooner or later:
  - Leak
  - Seep
  - Volatile
  - Overflow
  - Splash
  - Destroy a dike etc.

Typical Chemical Properties of Fly Ash Leachate

Chemical and physical properties will vary significantly depending on coal source, operational practices and rainfall.

Parameter*	Range (mg/L)
pH	6 - 13 S.U.
Chlorides	10 - 10,000
Hardness (as $CaCO_3$)	60 - 4100
Alkalinity (as $CaCO_3$)	1000 - 2800
Calcium	100 - 1200
TSS	100 – 11,000
Elements of Main Concern	
Arsenic	0.01 - 0.15
Barium	0.25 - 3
Cadmium	0.025 - 0.15
Chromium	0.01 - 0.1
Copper	0.04 - 0.2
Mercury	0.0002 - 0.0004
Lead	0.05 - 0.5
Selenium	0.01 - 0.6
Boron	0.3 - 0.42

***Analyses performed by DENARD laboratory out of 10 Samples at different power plants**

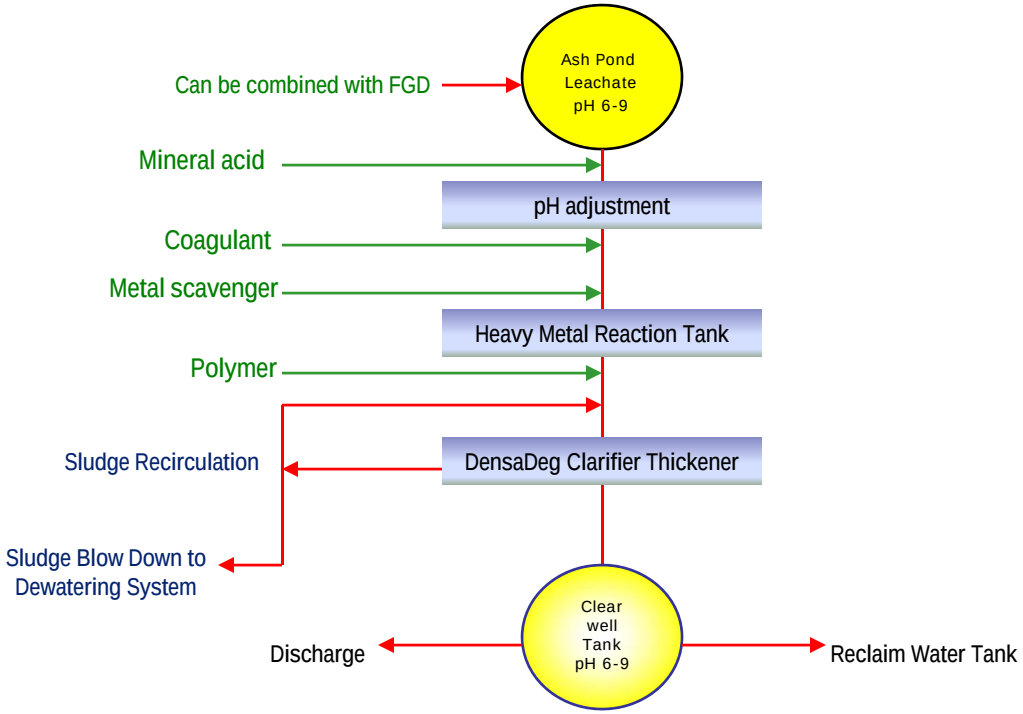
Why Treat?

- About 50% of the US electricity comes from coal, this source is here to stay for quite a while, despite the current lower gas prices.
- Unless Fly Ash Pond leachate is treated, the water will continue to remain a growing liability for the power plant.
- The relative 2008 Fly Ash slurry spill in the TVA-Kingston fossil- plant and in Oak Creek WI in late 2011 demonstrated the adverse environmental effect of Ash Pond failures.
- To minimize the amount of leachate requiring storage in the ash pond.
- Allows for reuse of the treated water.
- May be required by a lowered permit effluent limits

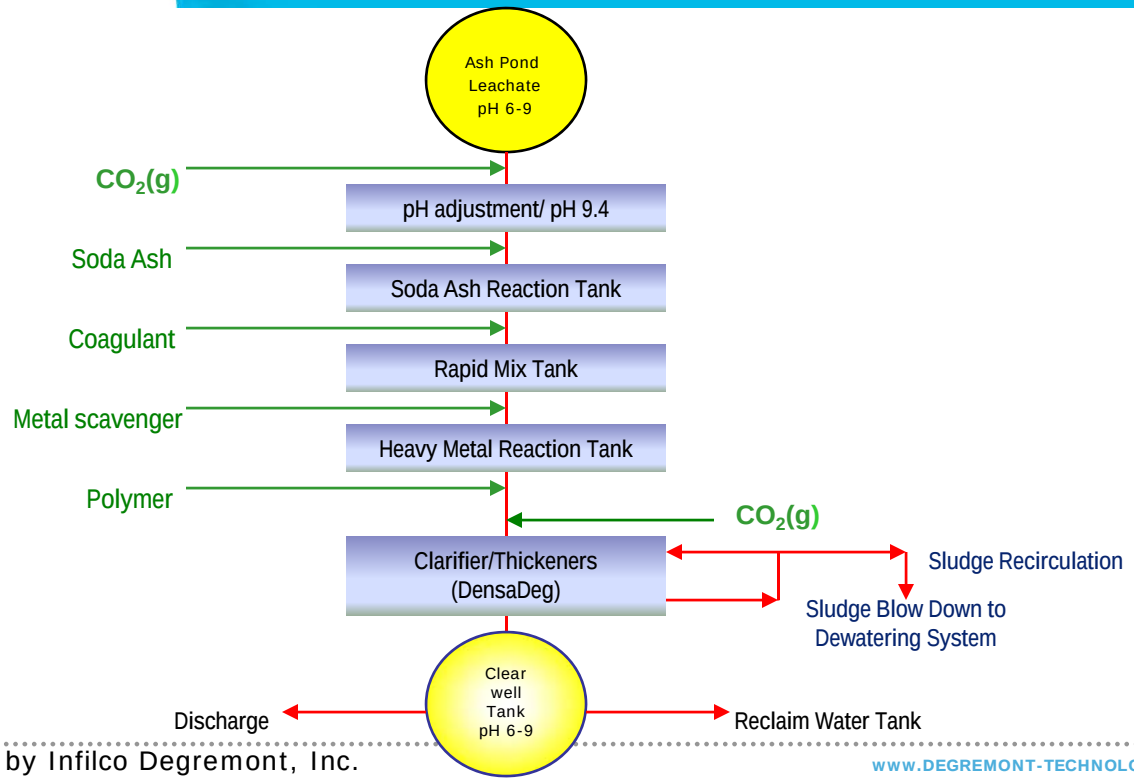
Aerial View of the TVA Fly Ash Spill Harriman, TN – Dec.23, 2008

Photo courtesy of United Mountain Defense

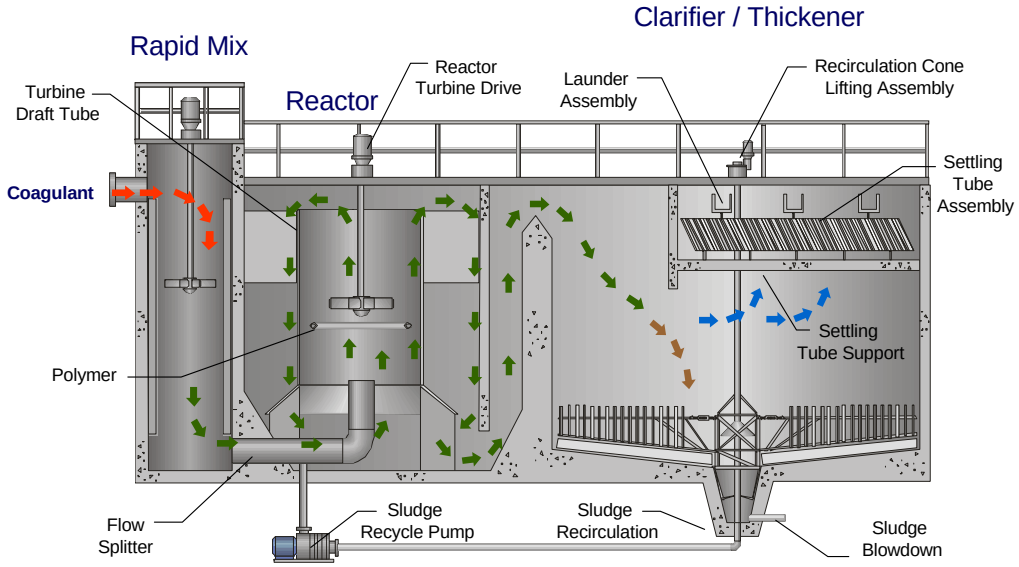
Ash Pond Leachate Treatment Block Diagram Option 1



Ash Pond Leachate Treatment Block Diagram Option 2



Process Overview DensaDeg Clarifier / Thickener



Why a DensaDeg?

- Superior Quality of the effluent
- The Rise Rate is very high, resulting in a smaller foot print. A space savings of 1:10 can be expected relative to a conventional clarifier
- The bottom sludge is dense, resulting in significant savings on sludge handling and dewatering cost
- Separate sludge thickener is not required
- Can tolerate upsets and contaminant fluctuation
- Lower chemical consumption
- Hundreds of long term successful installations worldwide

Benefits of Treating the Ash Pond Leachate

Economic:

- Supplemental source of service water
- Can potentially yield more storage capacity

Environmental:

- Reuse resources
- Saves water bodies from contaminants
- Reduce water foot print

Regulatory:

- Regulation labeling coal ash as hazardous waste are currently under discussion between the EPA and the power industry.

Perception:

- The public will recognize the efforts that the water is being reused/recycled and treated.

Design Basis – Flexibility Emphasis

Overcoming Potential Issues

- More Stringent Regulations
- Environmental Damage
- Public Perception

Benefits of Additional External Treatment

- pH Adjustment
- Coagulation
- Heavy Metal Removal
- Flocculation
- Dewatering
- Cleaner Leachate Effluent Stream

Questions – Discussion?