

SLUDGE MANAGEMENT

SUMMARY

BACKGROUND

*Sludge is the **solid material** that has settled in clarifiers.*

Sources:

- Primary clarifiers (TSS removed by gravity)
- Secondary clarifiers (Biomass)

CHARACTERISTICS

Primary Sludge Characteristics

- Contains both organic (BOD) and inorganic solids (sand, silt, etc.)
- Upto 5% solids (95% water)

Secondary Sludge Characteristics

- Dead bacteria
- Activated Sludge: 1% solids
- Trickling Filter & RBC: 5% solids

REGULATIONS

EPA has standards for sludge, depending on final use or disposal (CFR 503)

- Apply to agricultural use,
- compost,
- landfilling,
- incineration

Reasons for Regulation

Toxics tend to concentrate in sludge:

- Heavy metals
- PCBs
- Pesticides

Restrictions on sludge use, depending on concentration of toxics and pathogens

- Pollutant Concentration Requirements
- Pathogen Reduction Requirements (Class A and B)
- Vector Attraction Reduction Requirements

Goals of Sludge Management

- Stabilize primary and secondary sludges
- Kill pathogens
- Decrease water content
 - Untreated: 0.5 to 8 % solids
 - Treated: 6 to 12% solids

Sludge Processing

- Thickening
- Stabilization
- Disinfection
- Dewatering
- Final Disposal

Sludge Processing: *Thickening*

Objective: Remove water before stabilization, decrease volume

Processes:

- Gravity thickening (same equipment as sedimentation, but smaller)
- Dissolved air flotation (DAF)
- Centrifuge

Sludge Processing: *Stabilization*

Objective: Kill pathogens, eliminate odors, stabilize organics, and concentrate solids

Process:

- Anaerobic digestion

Anaerobic Digestion

- Most common method of stabilization
- Sludge is placed in a sealed tank
- Anaerobic bacteria grow and degrade sludge solids
- ***Produces: CH_4 (Methane), CO_2 (Carbon Dioxide), and H_2S (Hydrogen Sulfide)***

Methane Use

Methane (CH₄) can be burned as fuel

- *Heat digester*
- *Run electric generator*
- *Flare*

Wastewater Treatment Plants get about 50-100% of its electricity from burning digester gas

Types of Digesters

- **Standard**
 - 30 to 60 days digestion time
 - Not mixed or heated
- **High rate**
 - 15 to 30 days digestion time
 - Mixed and heated

Sludge Processing: Disinfection

Objective: Kill pathogens that survive stabilization process

- Physical processes:
 - Heat
- Chemical processes:
 - Chlorination
 - Lime

Sludge Processing: Dewatering

Objective: Remove water from stabilized sludge

Processes:

- Vacuum filter
- Centrifuge
- Belt press
- Drying beds

Sludge Processing: Final Disposal

Objective: Dispose of sludge in environmentally sound way

Processes:

- Landfill
- Land application
- Composting

Final Disposal Processes: LANDFILL

- Place sludge in a typical solid waste landfill
- No beneficial use with this method

Final Disposal Processes: LAND APPLICATION

- Sludge is injected or tilled into soil
- Done on either non-agricultural or agricultural land

Final Disposal Processes: **COMPOSTING**

- Sludge solids are composted with other solids
- Compost is sold or given away