Industrial Dewatering

Dave Lewis – BioVelocity, LLC
Basic Overview of Biosolids Regulations

- Solids produced during the treatment of industrial wastewaters must be disposed of properly, 40 CFR Part 503
- Landfill disposal; Land Application; Surface Disposal; Incineration; Pathogen and Vector Attraction Reduction.
- Based on Metals Content, one of these options must be selected to dispose of in accordance with 40 CFR Part 503
- If Metals Concentration is too high: Further Treatment and/or Hazardous Disposal – Hazardous Disposal is extremely expensive!
# 40 CFR Part 503 Metals MAX Concentration

**Note:** Concentration units = mg/Kg

<table>
<thead>
<tr>
<th>Metal</th>
<th>MAX Concentration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arsenic</td>
<td>75</td>
</tr>
<tr>
<td>Cadmium</td>
<td>85</td>
</tr>
<tr>
<td>Copper</td>
<td>4300</td>
</tr>
<tr>
<td>Lead</td>
<td>840</td>
</tr>
<tr>
<td>Mercury</td>
<td>57</td>
</tr>
<tr>
<td>Molybdenum</td>
<td>75</td>
</tr>
<tr>
<td>Nickel</td>
<td>420</td>
</tr>
<tr>
<td>Selenium</td>
<td>100</td>
</tr>
<tr>
<td>Zinc</td>
<td>7500</td>
</tr>
</tbody>
</table>

- Metals Concentration must be **LESS THAN** the Max Concentrations to be disposed of via Landfill, Land Application, Surface Disposal, or Incineration.
- If not, lets treat the solids further!
- Compost!
- Blending Facilities often mix OM with solids to produce a viable compost product.
Pathogen and Vector Attraction Reduction

• Not as common with Industrial Wastewater, however, 40 CFR Part 503 also requires Pathogen and VAR.
• 7 grab samples are collected and must have a geometric mean of LESS THAN 2 Million Fecal Coliform Units
• Vector Attraction Reduction must be GREATER THAN 38%
• Industrial Sludge usually does not have elevated levels of Fecal Coliform
• 38% VAR Reduction is easy when 95% of the Industrial Wastewater is Inorganic!
The FUN Stuff: Dewatering Technologies
Plate and Frame Press
Plate and Frame Press
Belt Filter Press
Belt Filter Press
Centrifuge
Centrifuge

- https://www.youtube.com/watch?v=HdE6POOZkZ8
Sludge Storage

• Many facilities store solids in lagoons or tanks to be dewatered
• Dewatering often is completed as needed within the facility, but often needs to be contracted out followed by disposal.
• This presentation will discuss site specific projects that were contracted for dewatering and disposal.
Site #1: Gold Mine Dewatering Project

- The Gold Mine Project was an existing mine claim that was abandoned in the early 1980’s. The shaft is 790 feet deep with multiple laterals off the main shaft which were mined from the early 1900’s with older technology.
- New technology and ability to extract finer gold resulted in the mine being re-opened in 2010.
- Facility owns and operates a Plate and Frame press 24/7 to remove approximately 20 MG of ground water that has seeped into the mine shaft since the 80’s.
- Contracted dewatering service to expedite the process
Gold Mine Project

- Treatment Plant consists of a series of pumps in the mine shaft – Pumping Rate 50,000 to 80,000 GPD with pH of 3-4.
- Pumped into Mine Water Tank where lime is dosed to bring the pH to 10.2 for metals precipitation.
- Pumped from Mine Water Tank to Flash Mix Chamber where polymer is added to floc before pumping to Slant Plate Clarifier, where solids settle and effluent is discharged to effluent tank where sulfuric acid is dosed to bring the pH back to 7.0, prior to discharge to creek (NPDES Permitted).
- Solids are pumped to solids holding tank where Plate and Frame is operated at ~50 gpm throughput.
Sludge Jar Test
Gold Mine Project – Centrate and Cake Solids
Centrifuge Performance

- Feed Sludge – 1- 2%
- Feed Sludge Flow to Centrifuge – 120 gpm
- Centrate – 95 mg/L Average
- Polymer Consumption – 1.3 lbs/DT
- Cake Solids – 43.3% Average
Dewatered Solids Disposal

• Gold Mine – What do you think might have been the limiting factor for disposal?

• Did you notice the Green and Orange color of the solids on the previous slide?

• MAX Concentration of Copper is 4,300 mg/Kg (Actual = 7,200 mg/Kg)

• Arsenic, Selenium and TENORM were also very high

• No limit on Iron per 40 CFR Part 503

• These solids were disposed of at a Special Waste Hazardous Landfill $$$
Site #2: Lagoon Storage Industrial Wastewater Sludge

- Site #2 was an Industrial Wastewater Treatment Facility with wastewater treatment lagoons.
- The lagoons were not been cleaned out in many years and the accumulated sludge was causing violations with NPDES permit conditions (Ammonia).
- This project required dredging and dewatering of the solids within the lagoon.
Dredge Process

- Dredge is a “Pontoon Boat with a Snow Blower” on the front of it.
- Capable of removing sludge from lagoons without disturbing top water
- Fully remote controlled
- Shoring Cable and Dredge Cable set up
- Consistent sludge concentration...with the right dredge operator
- Capable of removing sludge down to 2 inches with attached wheels
- Wheels provide a barrier between cutter head and liner material
Dredge Configuration
Dredging of Lagoon
Dewatering Set-Up

- Dredge placed in Lagoon via Crane
- Shoring and Dredge Traverse Cable set
- Dredge discharge float-hose attached and run to 18,000 gallon holding tank
- Sludge from holding tank pumped through centrifuge
- Centrate pumped back to process lagoons
- Cake discharged to roll off containers for disposal
Dewatering Set-Up
Centrifuge Performance

- Feed Sludge – 2.1% Average
- Feed Sludge Flow – 150 gpm Average
- Centrate – 300 mg/L Average
- Polymer Consumption – 0.9 lbs./DT
- Cake – 48.16% Average
- Total Solids Removed – 876 Tons
Feed Sludge: Centrate: Cake
Dewatered Solids Disposal

• The solids were disposed of at a landfill for top cover of household trash
• Top cover provides OM layer to increase degradation of trash
• Industrial Wastewater Facility is in the process of working to gain approval to land apply dewatered solids from EPA and CDPHE as lab results indicate within limits of Reg. 503
Dewatered Solids
Why Dewater Solids?

- Reduce Volume of sludge holding and potentially prevent NDPES violations. Accumulated sludge can have adverse effects to effluent.
- Precipitation; Release of Nutrients (Ammonia, Phosphorus, etc.)
- Bulking and foul odors
- Any others you can think of?
Benefits of Dewatering vs. Liquid Hauling

• **COST!** Number one reason to dewater is the cost of hauling liquid!
• Average cost for non-hazardous liquid hauling and disposal is dependent on where the liquid is hauled to and cost for disposal.
• **EXAMPLE:**
  • $120/HR Hauling and $0.20 per gallon disposal at MOST landfills
  • Assume Denver area hauled to Tower Landfill near DIA = 4 Hr Round Trip = $480.00
  • Typical tanker is 6,000 gallons = $1,200 per tanker disposal
Benefits of Dewatering vs. Liquid Hauling

• Let's assume you have 500,000 gallons of sludge you need to remove
• We already know it costs $1,680.00 per 6,000 gallons hauled and disposed
  • $480 for hauling and $1,200 for the 6,000 gallons disposed
• 500,000 gallons = 83 Loads or $139,440.00!
• Keep in mind that the driver does not care what concentration of sludge they are hauling, as long as they are hauling something!
Benefits of Dewatering vs. Liquid Hauling

- Dewatering sludge on site allows the operator to control the budget
- Initial capital costs with purchasing equipment – Determine ROI
- Dewatering also allows operator to determine sludge feed concentration by making process control changes to optimize dewatering
- Major Costs with onsite dewatering are power, polymer consumption and disposal.
- All of these variables, and others, play a significant role in determining if on site dewatering makes financial sense.
Benefits of Dewatering vs. Liquid Hauling

- **On-Site or Contract Dewatering**: Let’s assume the same 500,000 gallons to be removed and disposed of at the same landfill.
- **Mobilization Costs**
- **Polymer Jar Testing** to select appropriate polymer and dose
- **Hauling and Disposal Costs**
Benefits of Dewatering vs. Liquid Hauling

- Numbers from Site #2 indicate 90,000 gallons = ~ 15 DT Dewatered
- Therefore: 500,000 gals = 82.5 DT Dewatered
- Polymer Consumption = 0.9 lbs/DT = 74.25 Lbs of Polymer @ $1.40/Lb = $103.95
- 1 Roll-Off Container (30 Yard) can hold ~ 15 Tons of Solids = 5.5 Containers
- 6 Loads Hauled = $480.00 = $2,880.00
- Disposal at Landfill = $45/Ton = $3,712.50
- Total Hauling and Disposal = $6,592.50 + $103.95 Polymer = $6,696.45
Benefits of Dewatering vs. Liquid Hauling
Summary for Removal & Disposal of 500,000 Gals.

- Liquid Hauling and Disposal = $139,440.00
- On-Site Dewatering = $6,694.45 plus Equipment and Staff to Operate
- Liquid = $0.28/Gallon Total Cost
- Dewatered = $0.013/Gallon Total Cost
- Liquid – 4 loads/Day = 21 Days to Haul 83 Loads
- Dewatered – 150 gpm (8 Hr Day) = 7 days to dewater 500,000 gals
Disadvantages to Dewatering On-Site

• Equipment and Polymer Costs
• Side Stream Flow
• Centrate from dewatering can inhibit plant process based on the soluble content of the dewatered sludge.
• If dewatering is not operated efficiently, TSS may cause issues within the treatment process.
• Hydraulic Loading to the facility may inhibit treatment
Thank You For Your Time

• Dave Lewis – BioVelocity, LLC
  303-619-7692     dave@biovelocity.net