Biosolids Dewatering and Disposal Options

2011 BIOSOLIDS SPECIALTY WORKSHOP
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Overview of Presentation

- Dewatering Options & Disposal Options Consideration
  - Design & Capital Costs
  - O & M Cost
  - Logistical
  - Employee
  - NPDES Permit
  - Electrical Costs
  - Centrate Loadings
  - Storage Issues
  - Plus Much More

Case Studies

- Clark County, OH
  - New installation and their choices
- Greene County, OH
  - Beavercreek WRRF
  - Sugarcreek WRRF
  - Cedarville WRRF
- Greene County, OH *(Comparison of Options)*
  - Sludge Profile
  - Aeration
  - Holding Time
  - Centrifuge
  - Polymer

My Goals of Presentation

- Give you some real number and real situations of Biosolids Dewatering and Disposal Options
- Not to bore you with definitions or a sales pitch
- Treat Biosolids as anything done with solids after they leave the treatment system
- Better understanding of your energy demands related to Biosolids
- Not to insult any engineer's who may have worked on any of the case studies
- Do not want drop any F- Bombs or offensive language during this talk

My Idea of Biosolids

- Any thing done to ***Solids*** after they are wasted out of the biological treatment process, this includes:
  - Transfer of solids to a storage tank or digester
  - Aeration or mixing involved in handling these solids
  - Probes or controls associated with these tanks
  - Anaerobic digesters
  - Onsite Dewatering of the solids
  - Offsite transfer of the solids
  - Disposal of the solids (Land apply/landfill/incineration)
  - Any chemical usage or addition, electrical usage, electrical demand required to dewater and disposal of solids out of your hands
  - Any recycle of nutrients back through your plant

My Idea of Biosolids, Cont.

- Must also consider the following:
  - In-house labor cost to your Biosolids option
  - Any contracted labor and services
  - Polymer costs and logistics
  - Lime addition costs and logistics
  - Transportation costs and logistics of disposal
  - OEPA paperwork associated with your 503 Regulation options
  - Lab Testing and costs (Internal & Contracted)

  - ***I am sure there are a lot more that you can think of***

Dewatering Options, First Step

- Does my plant even need Onsite Dewatering?
  - Under 2 MG ADF Flow you have some other options
  - Take Inventory of what you have onsite already
    - Drying beds
    - Days of liquid sludge holding
    - Distance to other WWTP's
    - Current methods for meeting 503 Regulations
  - Haul to a larger WWTP with Dewatering Facilities
    - Might get a good price
      - Other plants might have capacity and need a revenue stream
    - Some tracking of paperwork
    - Fuel costs and capital for tanker truck
  - Contract a Mobile Belt Filter Press (Cradle to Grave)
    - No capital costs and very little employee hours involved
    - Costs more, but very few headaches

Case Study # 1

CLARK COUNTY UTILITIES

- ADDITION OF ONSITE DEWATERING
- UPGRADE OF DIGESTER INFRASTRUCTURE

Clark County Utilities (2.0 MG ADF)
Contracted Mobile Dewatering

PROS

- Minimal Effort
  - Had 9 months drying bed storage onsite
  - Had 45 days digester storage when decanting
- Electrical Savings
  - Heavy Decanting (Blower Off)
  - Want ATAP (as thick as possible)
  - Not worried how it dewaters
- Little Paperwork
  - Contractor did land apply paperwork
  - Data for Sludge Report

CONS

- $0.0433 per gallon
  - Included all costs associated with the process
  - Could do for less $$ if spend capital
- Loading on Plant
  - Will see large volume of centrate in a short period of time
  - 500,000 gal in a couple days (high TP)
- Keep them on schedule
  - If mobile press gets behind, so does your plant
  - They have other clients and equipment issues
- Plug wasting
  - Will not be able to waste steady stream to digesters

Clark County Utilities

- Had problems with getting Mobile Press Onsite in the winter (other clients want it too)
- Aerate Digesters at night (off peak demand)
  - Saved $2,000 a month on electric bill
  - 200 HP Blower running OFF PEAK
- Decant during the day when staffed
  - Decant, decant, decant some more
  - Charged by the gallon so we got it thick
  - As thick as 24,000 mg/l - spin around 30
  - Staged sludge over the three digesters – when valves worked
  - Had limited option due to decaying infrastructure
    - Many Diffusers broken or plugged
    - Air piping was leaking everywhere

Clark County Upgrades
Goal of 3.2/4.0 MG ADF

Kept	New

• Kept Current Blowers
  ○ Re-evaluate in 5 years
• Kept Current Tanks
• Kept Drying Beds
• Kept Land Apply as main disposal method
• Landfill as backup
• Coarse Bubble Diffusers
  ○ New style to promote mixing
	• Replace neglected valves and piping
	• Huber Incline Screw
	• Repair concrete as needed
	• Biosolids Processing Building
	• New Coarse Bubble Diffusers and air piping

Bells and Whistles Left Out

- Three Digester Tank Mixers
- New Blower or Blowers
- No additional Tanks
- Fine Bubble Diffusers
  - Felt fixing coarse bubbles would show improvement
- ORP and DO control in Digesters
  - Did not feel the payback on VS destruction was worth the capital investment FBD/ORP/DO/PLC/SCADA
- Help keep HVAC upgrades (code) to a minimum by reusing Blowers and minimizing new electrical control components
  - Did not have to retrofit the current building – all new equipment in new Solids Processing Building

Huber Incline Screw

Final Goal and Costs

- Final Goal is to have day-to-day control over the solids processing at facility
- OEPA Blessing as first step of 3.2/4.0 Re-rating
- Keep consistent biological system
- Keep as much of infrastructure as possible to help minimize new equipment/install/engineering costs
- Keep recent reduced energy usage and demand at the plant
- Easy to operate dewatering device, possibly unmanned (like Canal Winchester WRRF)
- Continue Land Apply Option
- Total out the door $1.9 Million

I Need Dewatering, What Kind

- Determined that you need Dewatering for plant control and Biosolids Handling
- What are your Options – Not all but common
  - Belt Filter Press - Press it
  - Centrifuge - Spin it fast
  - Incline Screw/ Rotary Press – New methods on market – Spin it slow

Belt Filter Press

Pro's

- Dependable
- Reasonable cost compared to spinning it
- Long Track Record
- Low O & M Costs
  - Slow Moving Parts
  - Less wear and tear
- 17-19% Solids at best
- Low Electrical Usage
- Low Electrical Demand
- Can see changes you make to it

Con's

- Labor Intensive
  - Babysit BFP when sludge conditions are changing
  - Constant Tweaking to get ADAP
- Centrifuge's can get a drier solid
- Lower GPM throughput than a centrifuge
- May have to contract out some Preventative Maintenance
  - Changing Belts and Bearings

Centrifuge

Pro's

- Driest Solids – Can see 19-25 % solids on regular basis
- Lower Disposal Fees
- Less Onsite Storage Needed
- High GPM throughput
- Minimal Odor
- Run by SCADA and computer controls
  - Can be precise and track your changes and results for future use

Con's

- Very high upfront costs
- Complicated controls
- Lots of things to go wrong and watch from O & M outlook
- Might no be able to fix in-house
  - $2,000 a day on repairs
- High Electrical Usage
- High Electrical Demand
  - Can be 20-25% of your entire plants electrical usage and demand

300 gpm Centrifuge

Polymer Addition

Incline Screw

Pro's

- Low electrical usage
- Minimal man hours needed
  - Manly at startup and shutdown
- Low electrical demand
- Slow moving and less wear and tear
- Comparable to BFP in % solids
- If running great might be able to let run over night unmanned

Con's

- Lowest throughput per device footprint
- Lower % Solids than centrifuge
- It is just different
  - And most people do not like change or learning new processes
- Unproven
  - Very few installation in Ohio and in the US
  - Seen some onsite demo's that look great, but things can be made to look great for a couple days

Advantages of the ROTAMAT®Screw Press RoS 3Q

- Insensitive to coarse material due to the wide gap between the screw conveyor and sieve
- No permanent sieve cleaning required, low wash water consumption
- Pneumatically controlled pressure cone system
- Defined sludge residence time
- No filter cake production, minimized filter resistances
- Minimum wear due to the low speed of the compacting screw
- Minimized noise
- Low energy consumption
- High dewatering degrees with fibrous sludge

Van Kleeck Equation???
Volatile Solids Reduction (VSR)

$$VSR = \frac{VS_{in} - VS_{our}}{VS_{in} - (VS_{in} * VS_{out})}$$

VS_{in} = Fractional VS in feed stream

VS_{out} = Fraction of VS from bottom stream

Fractional VS = Fraction of VS vs. Total Solids

- VS into digester = 0.80 VS out of digester = 0.70
- To me this is a **10% reduction** in VS of your sludge
- To Van Kleeck and EPA this a 41.66 % reduction in solids
- VSR = (0.80-0.70)/ 0.80-(0.80*0.70) =
- VSR = 0.10/(0.80-0.56)
- **VSR** = 0.10/0.24 = **41.66%**

Case Study #2

CEDARVILLE WRRF

SOLIDS HAULING SUCCESS STORY
0.562 MGD BNR PLANT
GREENE COUNTY SANITARY ENGINEERING

Cedarville WRRF Sludge Load out

Minimize Hauling and Aeration Costs

In regards to Solids Storage and Transfer

- **Minimize Aeration of Aerobic Digesters**
- **Thicken Aerobic Digesters by Decanting**
- **Minimize Hauling of Liquid Sludge to an as needed basis**
- **Turn off Aerobic Digester Blower during high flow events**

- **GOAL – Lower electric costs and make less tanker trips (solids) to BC WRRF**

Results in months…

Before	After
• 62,018 kWh per month	• 46,782 kWh per month
• 122 KW demand per month	• 97 KW demand
• $5,553.87 electric bill	• $4,282.35 electric bill
• Solids at 1.01%	• Solids at 1.78%
• 32 trips per month with tanker	• 8 trips per month
• 224 gallons of diesel	• 56 gallons of diesel
• 11,743 lbs solids to process	• 3,843 lbs solids to process
• 3.91 days of BC Centrifuge	• 0.73 days of BC Centrifuge
• $2,080 disposal costs	• $389 disposal costs
• $918.85 polymer cost	• $ 171.55 polymer costs

Other Savings, Cedarville WRRF

- **Saved 52 driver hours per month**
  - **Drivers began to take on some of the Plant Mowing Operations**
  - **Help out with Maintenance Issues**
  - **Helped allow one maintenance worker to keep up with all four GCSE WRRF's**
- **720 miles per month wear and tear on trucks and tankers**
- **Saved 15.9 operator hours per month (centrifuge)**
- **Saved 15.9 hours per month in centrifuge electricity and wear**
- **Direct savings of over $4300 a month**
- **Hidden savings will be just as much going forward**

Case Study # 3

BEAVERCREEK WRRF
VS.
SUGARCREEK WRRF

GREENE COUNTY SANITARY ENGINEERING

Sugarcreek WRRF Digester

Coarse Bubble Diffusers

Sugarcreek WRRF

Empty vs. Full

Sugarcreek WRRF

Aerzen Digester Blowers

Trailer Load-out Zone

Beavercreek vs. Sugarcreek Biosolids
Similar Sized Plants

Beavercreek	Sugarcreek
• Primary & Secondary Comingled sludge	• Secondary Sludge Only
• WAS 2.5% about 23,000 gpd	• WAS 1.5% about 78,000 gpd
• More than 1.0 MG Storage	• 450,000 gal storage Max
• 30-40 days SRT	• 6 days SRT
• Coarse Bubble Diffusers	• Coarse Bubble Diffusers
• In @ 80% VS down to 68% VS	• In @ 82% VS down to 80% VS
• Cake Solids 21-24%	• Cake Solids 18-19.5%
• 244 Truck Loads per year to LF	• 299 Truck Loads per year to LF

Beavercreek vs. Sugarcreek Biosolids
Similar Sized Plants

Beavercreek (6.5 MG ADF)	Sugarcreek (5.0 MG ADF)
• Two Centrifuges running 100-120 gpm • Two 150 HP Blowers running year round – no mixers • No decanting • Strong odor of sludge and digesters (especially if behind on air)	• Two Centrifuge's running 150+ gpm • Two 40 HP Blowers running year round – no mixers • Decant when digesters get to thin • Little odor even if digesters behind on air

Disposal Options
Follow 503 Biosolids Regulations

- Landfill
  - **Toxicity characteristic leaching procedure** (TCLP)
  - Trucking Coordination
  - Loading of Trucks
- Create Class A Product - Chemical Addition or Heat Treatment
  - ATAD – Middletown, OH – Thermophilic Treatment
  - Enviro – Fairborn, OH - Fly ash and lime addition ***(No longer in use, cheaper and easier to landfill)***
- Land Apply – Class B
- Incinerate –Dewater and Burn Largest Facilities
- Chemical Addition and Land Apply
  - Lime Addition

Landfill Things to Think About

- More expensive but you get rid of the Biosolids
- Hauling and Fuel costs are an unknown going forward
- Tipping Fees are going to go up
- Hard to get money to put in storage a couple of years after you designed your operations to go to landfill
- You are at the mercy of the Landfill
  - When they are closed, so are you
  - Weather conditions
  - If EPA shuts them down then what
  - They tell you know more loads, then what

Class A Product Things to Think About

- Lime and Fly Ash are messy and wear down equipment
  - Your Operators will probably hate you for the decision
- May not be as easy to give away as you think
  - Do not get illusions of grandeur and think you will make money on the stuff
  - We do have basic soils in most of Ohio
- By adding lime or fly ash you just increased your volume of product to get rid of
  - Associated fuel costs and lime and fly ash costs can rise

Land Apply Things to Think About

- You are at the mercy of the weather, farmer's , and future EPA Land Application Regulations
- Considered a Green Use of Resources your city council or commissioners can brag about
- When fields are ready to go you will need to move a lot of solids in a short period of time
- Most likely to be contracting this work out
- Short windows to land apply
  - Short period between crops – Mid July
  - And after the fall harvest before the weather gets nasty and ground frozen

Incinerate Things to Think About

- Changing air permit regulations – everything gets tighter and tighter and tighter
- If you do not have it already, you are to small to even think about it
- Huge capital expenses
- Huge natural gas expense to heat
- Specialized worker to run these things, can not just hire an old operator or engineer off the street

Questions

NOW

OR IN THE FUTURE

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