Dealing with High Strength Organic Waste

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Regional Pretreatment Coordinator

Today's focus will be on…

Overview

- Background on high strength organic waste
- Case Studies
- Strategies
  - Pollution prevention techniques
  - Side streaming
  - When to permit
  - Permit examples
  - Local Limits Development
    - MAHL
    - Allocations

Is the discharger a Significant Industrial User (SIU)?

- All Industrial Users subject to Categorical Pretreatment Standards under 40 CFR 403.6 and 40 CFR chapter I, subchapter N;
- Any other Industrial User that: discharges an average of 25,000 gallons per day or more of process wastewater to the POTW (excluding sanitary, noncontact cooling and boiler blowdown wastewater);
- Contributes a process wastestream which makes up 5 percent or more of the average dry weather hydraulic or organic capacity of the POTW Treatment plant; or
- Is designated as such by the Control Authority on the basis that the Industrial User has a reasonable potential for adversely affecting the POTW's operation or for violating any Pretreatment Standard or requirement (in accordance with 40 CFR 403.8(f)(6)).

Pretreatment Background

EPA's **National Pretreatment Program** is charged with controlling toxic, conventional, and non-conventional pollutants from nondomestic sources that discharge into sewer systems

- All industrial users—regardless of whether they are subject to any other national, state, or local pretreatment requirements—are subject to **the general and specific prohibitions** identified in 40 CFR 403.5(a) and (b), respectively. General prohibitions forbid the discharge (the regulations use the term introduction) of any pollutant(s) to a POTW that cause **pass through or interference**

Specific Discharge Prohibitions Apply

Containing pollutants that create a fire or explosion hazard in the POTW

Containing pollutants causing corrosive/structural damage @ POTW (pH < 5)

Containing pollutants in amounts causing obstruction to the flow @ POTW

Any pollutants released at a flow rate or concentration that will cause interference with the POTW

Heat in amounts that will inhibit biological activity in the POTW resulting in

interference (140°F)

Petroleum oil, non-biodegradable cutting oil, or products of mineral oil origin in amounts that will cause interference or pass through

Result in the presence of toxic gases/vapors/fumes @ POTW (worker safety)

Trucked or hauled pollutants, except at designated discharge points @ POTW

Should I permit the industry?

Questions to ask

- Do you permit your high strength waste facilities?
- Do you have technically based local limits?
- Do you have room to allocate more loading for future growth?
- Have those limits been adopted into the Sewer User Ordinance?
- Do you surcharge?
- Does this sector have any treatment in place?
- Do you understand the process and treatment if any?
- Do the facilities implement BMP's?

Approximate BOD Contributions

Raw Product	
Whole milk	104,000 mg/L
Skim milk	67,000 mg/L
Ice Cream	292,000 mg/l
Beer	100,000+ mg/l

What to expect?	
Average BOD5	2,700 mg/l

Reference: Carawan, R. E., NC State University, Water and Wastewater Management in Food Processing, 1979.

What are the impacts to the wastewater infrastructure/plant?

- High influent BOD/TSS and other pollutants
- Process upset due to organic overload
- Additional solids in the collection system/pump stations
- Odors in the collection system
- Physical deterioration of manholes & pumps
- Increased costs (electricity, chemicals, solids)
- Possible NPDES permit violations

Valley Crest Foods, Inc. (Valley Crest), a creamery in Myrtle Point, Oregon pleaded guilty to four counts of violating the Clean Water Act.

Charles River Water Pollution Control District Case Study (5 MGD Design)

NPDES Permit

- Total Phosphorus Limits
  - April – October 0.10 mg/L monthly average
  - November – March 0.30 mg/L monthly average
- Total Ammonia-Nitrogen Limits
  - Varies months April – October
  - Report only November – March
- Total Copper - 13 ug/L monthly average
- Escherichia Coli Bacteria
- Total Chlorine Residual
- Carbonaceous BOD
- Total Suspended Solids
- Dissolved Oxygen
- Whole Effluent Toxicity
- Flow

Types of Industries

- Significant Industrial Users (SIU)
  - Medical Device Manufacturer
  - Steam Electric Power Generator
  - Dairy
- Other Industrial Users
  - Metal Cleaning
  - Car Wash
  - Marijuana Grower
  - Hydroponic Farm
  - Distillery
  - Paint Manufacturer

Current Local Limits

Parameter	Limit (mg/L)
Cyanide	0.23
Arsenic	1.02
Cadmium	0.06
Chromium	3.48
Copper	1.05
Lead	0.08
Mercury	0.03
Nickel	0.79
Selenium	0.14
Silver	0.35
Zinc	1.32
Oil & Grease	150
pH	5 – 12 s.u.

Sewer Use Ordinance

No current conventional limits in SUO.

Specific Discharge Prohibitions

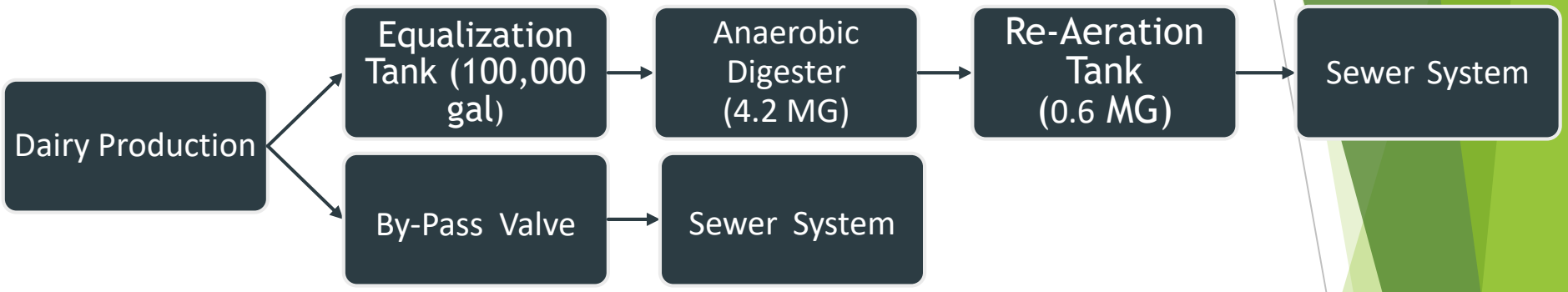
The following discharges to the Facility are specifically prohibited:

- Any pollutants, including oxygen demanding pollutants (BOD, etc.) released in a discharge at a flow rate and/or pollutant concentration which will cause Interference to the Facility.

SIU Information

- Company: Industry G
  - Located in Franklin, MA
- Primary Concern of Business: Dairy
- Permit Information
  - Permitted Flow (GPD): 450,000 gpd
  - Average Recent Flow Rate (GPD): 280,000 gpd
- Permit Effluent Limits
  - Local Limits (shown previously)
  - cBOD
    - 2,000 ppd daily max
    - 1,000 ppd weekly average

Industry G Pretreatment System



- By-Pass Valve
  - Ability to open “bypass” valve to 100% bypass the pretreatment system and send untreated waste to sewer system

Timeline of Events

- August 2018, Identical plant across State closed and merged with Franklin plant
- September 2018, District started to see an impact at plant due to increased influent loadings from Industry G
  - District issued a compliance schedule to reduce loadings
- October 2018, Industry G had issues with pretreatment system. The Town of Franklin received numerous odor complaints from residents surrounding Industry G
- November 2018, MassDEP inspected Industry G due to odor complaints. Industry G digester had settling and gas build-up problems and requested several bypasses to provide relief as floating membrane on digester was filled with gas

Timeline of Events (continued)

- November 19, 2018 Industry G requested to open "bypass" valve for up to three days, the District could not handle untreated wastewater and denied the request
- November 21, 2018 Industry G digester membrane ripped, causing sludge to overflow the digester tank and requiring them to fully open the "bypass" valve and send raw dairy to the District

An estimated 167,000 gallons of wastewater from digester was released following the cover rise of 6 feet and subsequent tear.

Why did this happen?

- Industry G failed to investigate the effects the merger would have on pretreatment system
  - Industry G started processing heavy whipping cream that used to be sent to the Lynn facility – increase in organics to the pretreatment system
- Equalization tank was offline for maintenance
  - All wastewater sent directly to anaerobic digester, lost ability to buffer the loading to the pretreatment system
- Untrained staff was not properly sealing caps to silos filled with cream. The silos would empty and flow directly into the anaerobic digester causing slug loads that the digester could not handle
  - Dairy staff did not notify pretreatment operator of this
  - Days before "event" there were multiple large spills on consecutive days
- Opening the by-pass valve allowed Industry G to temporarily relieve the gas build-up, after the District denied request for bypass, it only took 2 days for their digester cover to fail

Impact at the POTW During Bypass

- Aeration capacity maxed out with all blowers at full speed and all aeration tanks online –having trouble maintaining 2.0 mg/L DO - $$$$$$$$$$
- District increased wasting from the Primary and Secondary Clarifiers which resulted in extra sludge trucks and added additional ferric chloride and hydrated lime - $$$$$$$$$$$
- Loading to the plant was exceeding the plant design capacity for max monthly BOD
  - BOD ~ 148% of design capacity
- District was able to remain in compliance with NPDES permit
  - Less stringent winter permit limits in effect

Loading at POTW During Bypass

Parameter	Industry G Loading (ppd)	District Design Loading* (ppd)
BOD	17,000 – Daily Max 15,250 – Monthly Avg	16,517 – Daily Max 13,533 – Monthly Avg
Total Suspended Solids	24,078 – Daily Max 7,115 – Monthly Avg	20,040 – Daily Max 14,807 – Monthly Avg
Total Phosphorus	200 – Daily Max 136 – Monthly Avg	587 – Daily Max 526 – Monthly Avg
Total Ammonia	450 – Daily Max 261 – Monthly Avg	1733 – Daily Max 1539 – Monthly Avg

* 2035 Future Design Loading

Timeline (continued)

- November 28, 2018 District amended permit to reflect new sampling location (at “bypass” valve) and to increase sampling to daily for cBOD and O&G
- December 11, 2018 Industry G received DEP/District approval to start adding hydrogen peroxide to aid in DO consumption
- December 26, 2018 Industry G closed “bypass” valve and returned to sending 100% of its raw dairy to its pretreatment system
- December 28, 2018 District amended permit back to original monitoring point (post pretreatment)
- April 1, 2019 District amended permit back to original sampling frequency

Local Pretreatment Violations

- 76 IP Permit violations during the period of November 2018- January 2019
  - cBOD (44), O&G (30), flow (2)
- Industry G in SNC for 4th period 2018 and 1st period 2019 evaluations
- Notification Violations
  - Failed to notify POTW of an unintentional discharge (slug load) that “has potential to cause a problem” at the POTW.
  - Failed to provide notification to the District of merger with Lynn facility which had significantly changed the quantity and quality of wastewater being discharged

Timeline – Enforcement and Settlement

- April 2, 2019 District issued a NOV and Notice of SNC for 4th quarter 2018 which included a fine for $360,000 and compliance schedule
  - Based upon the 4th period evaluation of 72 violations at $5,000/day/violation

- June 13, 2019 Final settlement was $215,000

Enforcement Discussion

- POTW worked tirelessly with District's Board of Commissioners and legal counsel to issue and negotiate fine
  - NOTE: Counsel relied heavily on the District's IP Permit, Sewer Use Ordinance and Enforcement Response Plan
- POTW used EPA and MADEP as assets when Industry G was by-passing and while working through the enforcement case

Current Actions Taken by Industry G as Result of Event

- Updated SCADA and added inline monitoring of pretreatment
- Retrained and licensed staff
- Added additional chemical injection points to their pretreatment system in case of emergency
- Added additional valves to be able to bypass digester only and send raw dairy through aeration tank for partial treatment
- Improved communication protocol with District
- Added signage to ensure properly sealed tanks

Actions Taken by POTW

- Developed Conventional Local Limits and obtained EPA approval
  - BOD, TSS, Phosphorus, Ammonia
- Added provisions to Industry G IPP Permit
  - Incorporate language on by-pass valve: Specific monitoring requirements during by-pass and obtaining permission from District to open valve
  - Strengthen language to notify District when portions of the pretreatment system are offline and when large amounts of product are discharged directly to digester

Lessons Learned

- Always evaluate the Need for Conventional Pollutant Local Limits
- Having a strong and updated Enforcement Response Plan and Sewer Use Ordinance are essential to a pretreatment program
- Need to have clear language in IP Permit about Penalties
- Make sure you have detailed and thorough Notice of Violation letters
- Keep detailed notes for phone calls, inspections, etc

  Just the facts…….. No opinions
- POTW should have trained employees on the IP Program should an absence occur
- Look for language on use of “bypass” valve and separate monitoring point when using “bypass” valve OR the physical valve on your inspection

What's the big deal with breweries?

Breweries make 5-10 times more wastewater than beer

Brewery wastewater – compared to domestic influent:

- Higher BOD
- Higher TSS
- pH variability (low and high)
- Higher nutrients
  - (nitrogen and phosphorous)

https://www.brewersassociation.org/wp-content/uploads/2017/05/Wastewater_Management_Guidance_Manual.pdf

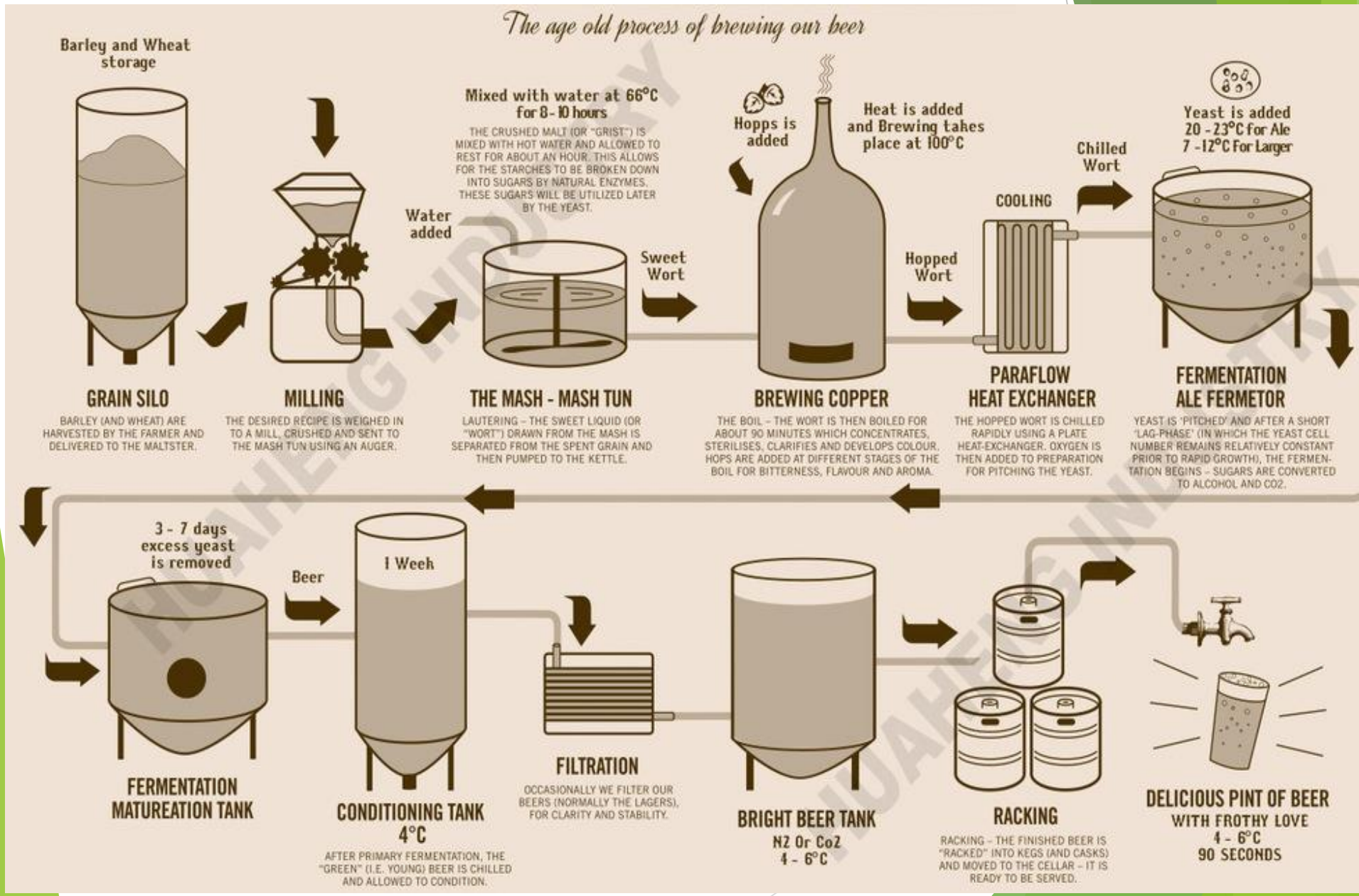
The average craft brewer brews less than 700 barrels a year, with the vast majority producing less than 10,000 barrels annually.

“That brewhouse above makes some damn good beer. But what happens when we aren't 100% satisfied with the final product? Watch the video. It brings a tear to our eyes every time we watch it. Better to dump than serve crap though. “

Grist Brewhouse on-line advertising. Highlands Ranch, CO

https://www.gristbrewingcompany.com/

Step by Step Brew Process



Main Areas Of W

SOURCE	CHARACTERISTICS
Mash Tun	Cellulose, sugars, amino acids. ~3,000 ppm BOD
Lauter Tun	Cellulose, sugars, spent grain. SS ~3,000 ppm, BOD ~10,000 ppm
Spent Grain	Cellulose, nitrogenous material. Very high in SS (~30,000 ppm). Up to 100,000 ppm BOD
Boil Kettle	Nitrogenous residue. BOD ~2,000 ppm
Whirlpool	Proteins, sludge and wort. High in SS (~35,000 ppm). BOD ~85,000 ppm
Fermenters	Yeast SS ~6,000 ppm, BOD up to 100,000 ppm
Storage tanks	Beer, yeast, protein. High SS (~4,000 ppm). BOD ~80,000 ppm
Filtration	Excessive SS (up to 60,000 ppm). Beer, yeast, proteins. BOD up to 135,000 ppm
Beer spills	1,000 ppm BOD
Bottle washer	High pH due to chemical used. Also high SS and BOD, especially thru load of paper pulp.
Keg washer	Low in SS (~400 ppm). Higher BOD.
Miscellaneous	Relatively low on SS and BOD. Problem is pH due to chemicals being used.

Waste Strengths
- courtesy of brewerywastewater.com

	pH	COD, mg/L		*BOD, mg/L		TSS, mg/L	
		Low	High	Low	High	Low	High
Wort	5.5	250,000	400,000	150,000	240,000		
Beer	4.5	125,000	300,000	75,000	180,000		
Trub							
Yeast	4.5	120,000	200,000	72,000	120,000	60,000	100,000
Propylene glycol	7	600,000		360,000			
Label glue		50,000		30,000			
Defoamer		700,000		420,000			

Waste Strengths – Side-Streaming – courtesy of brewerywastewater.com

	pH	COD, mg/L		*BOD, mg/L		TSS, mg/L	
		Low	High	Low	High	Low	High
Domestic wastewater	7	210	1,100	100	500	20	300
Brewery wastewater without sidestreaming	4.5	4,000	17,000	2,400	12,000	1,500	8,000
Brewery wastewater with sidestreaming	4.5	1,800	9,000	1,080	5,400	400	1,000
Side stream wastewater	4.5	5,000	40,000	3,000	24,000	200	7,000

Waste Strengths – courtesy of Warwick, RI

Pollutant - Parameter	Fermenter Wastewater Results (mg/L)	Mash Tun/Kettle Results (mg/L)
pH-1	4.46 s.u.	5.55 s.u.
Ammonia (NH_3)	2.43	2.33
Total Phosphorus (TP)	285.9	168.9
Nitrate (NO_3)	76.4	88.6
Nitrite (NO_2)	0.66	0.47
Total Suspended Solids (TSS)		
Chemical Oxygen Demand (COD)	156,592	94,793
Biochemical Oxygen Demand (BOD)	93,000	56,000
Carbonaceous Biochemical Oxygen Demand (CBOD)	84,000	52,000

Video on Best Management Practices

https://www.youtube.com/watch?v=wdoPk-3H-6g

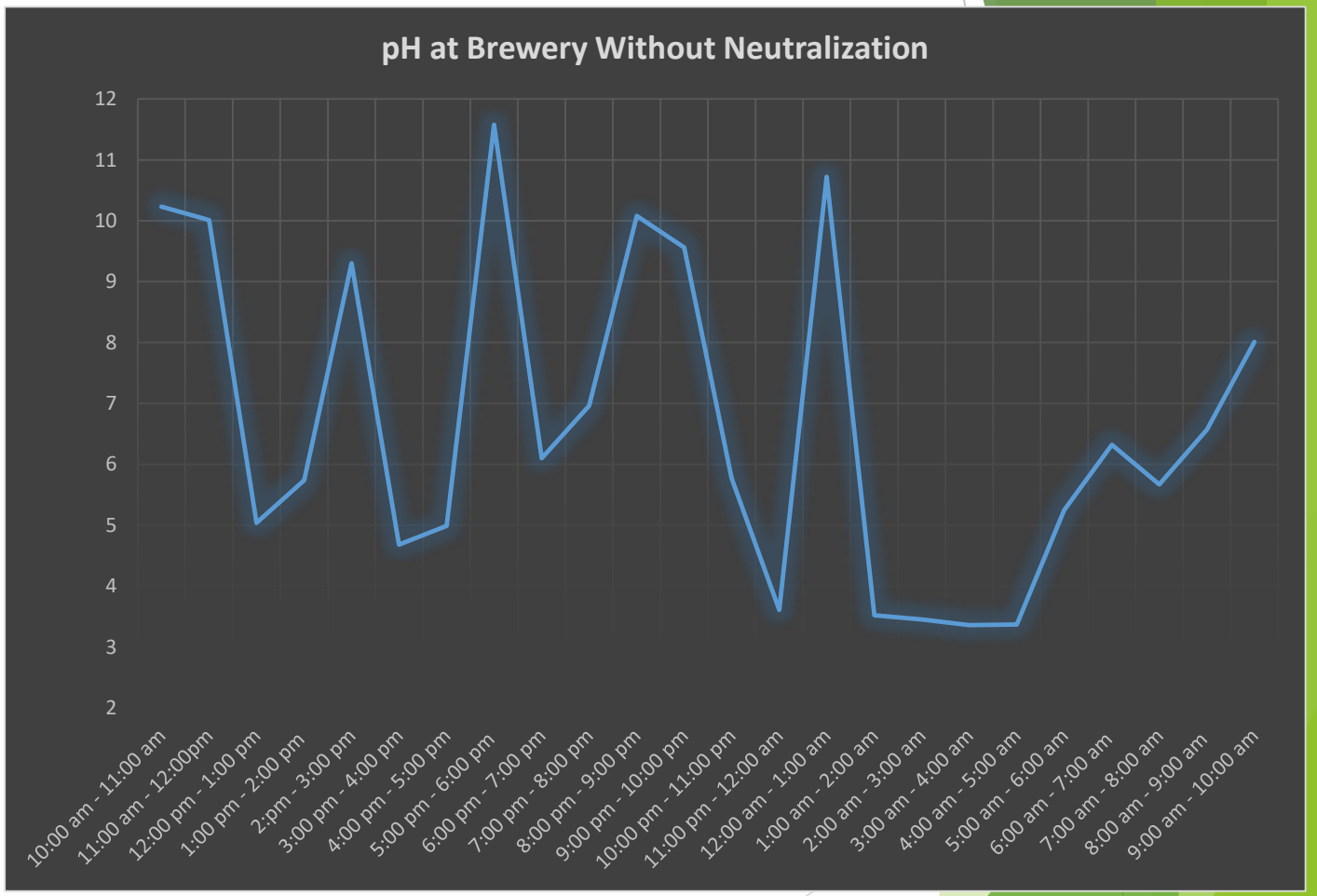
Pollution Prevention Measures

Brewery wastewater make-up

- Cleaning of tanks, equipment, and floors.
- Caustic and acid discharges from clean in place (CIP) process
- Spent grains, hops, and/or yeast solutions.
- Non-contact heat exchanger cooling water.
- Keg washing, and bottling cleaning.

pH From Brewery Without Treatment

Time	pH
10:00 am - 11:00 am	10.2
11:00 am - 12:00pm	10.0
12:00 pm - 1:00 pm	5.0
1:00 pm - 2:00 pm	5.7
2:00 pm - 3:00 pm	9.3
3:00 pm - 4:00 pm	4.6
4:00 pm - 5:00 pm	4.9
5:00 pm - 6:00 pm	11.5
6:00 pm - 7:00 pm	6.1
7:00 pm - 8:00 pm	6.9
8:00 pm - 9:00 pm	10.0
9:00 pm - 10:00 pm	9.5
10:00 pm - 11:00 pm	5.7
11:00 pm - 12:00 am	3.6
12:00 am - 1:00 am	10.7
1:00 am - 2:00 am	3.5
2:00 am - 3:00 am	3.4
3:00 am - 4:00 am	3.3
4:00 am - 5:00 am	3.3
5:00 am - 6:00 am	5.2
6:00 am - 7:00 am	6.3
7:00 am - 8:00 am	5.6
8:00 am - 9:00 am	6.5
9:00 am - 10:00 am	8.0



Permitting Strategies

- **Permit as an SIU**
  - Must comply with Local Limits
    - BOD
    - TSS
    - pH
    - Other pollutants….
- **Require BMPs**
  - Side Streaming High-Strength Wastes
  - Solids Management
- **Agreements or Allocations**

Maximum Allowable Headworks Loading (MAHL)

- Treatment plant data are used to calculate removal efficiencies for each pollutant to back-calculate the MAHLs before applying the most stringent criteria (i.e., water quality, sludge quality, NPDES permit, or pollutant inhibition levels). Subtracting contributions from unpermitted sources, the available industrial loading is then either evenly distributed among the IUs or allocated on an as-needed basis to those IUs discharging the pollutant above background levels.

Maximum Allowable Industrial Loading (MAIL)

- The total daily mass that a POTW can accept from all permitted IUs and still ensure that the POTW is protecting against pass through and interference

BOD/TSS MAHL's

USE DESIGN LOADING AT THE POTW

Setting Local Limits

Local limits are developed for pollutants that could cause interference, pass through, sludge contamination, or worker health and safety problems if discharged in excess of the receiving POTW treatment plant's capabilities or receiving water quality standards.

Typically, local limits are developed to regulate the discharge from all SIUs, not just CIUs, and they are usually imposed at the end-of-pipe discharge from an IU (i.e., at the point of connection to the POTW's collection system).

- Provide site-specific protection for a POTW and its receiving waters.
- Local limits can be found in the local sewer use ordinance

Case Study for a 5.7 MGD Design

POTW Design Loadings: BOD – 16,500 pounds

TSS – 20,000 pounds

Known Wastes

Uncontrolled Waste: BOD – 10,000 pounds

TSS - 10,000 pounds

Hauled Waste: BOD - 1,500 pounds

TSS – 3,200 pounds

Calculating a limit so how much BOD do industries get?

16,500 MAHL x (10% safety factor) – 10,000 (uncontrolled waste) – 1,500 (hauled waste)=

3,350 pounds to ALL industries

Potential Loading Allocation

Industry A – Brewery has requested BOD of:

2,400 pounds or 72% of the 3,350 pounds and

TSS of:

4,000 pounds or 83% of the 4,800 pounds which would leave the POTW with:

BOD of 950 pounds

TSS of 800 pounds

For all remaining industries

Given that, if using the 10,000 mg/l concentrations - as quoted from brewerywastewater.com - then only 12,000 gallons of flow could be accepted from all industries (including fellow breweries) in the system

Example concentrations and Flow

BOD (mg/l)	Flow (gallons/day)	Pounds
10,000	40,167	3,475
20,000	1,000	167
3,000	5,000	125
10,000	4,000	333

Mooresville, Vermont POTW

POTW average flow of 0.237 MGD

Rock Art Brewery -

Permitted for 3,300 gpd

BOD Local Limit of 310 lb/day

Equivalent of 11,263 mg/l at max flow

At 1500 gpd, SIU could discharge ~25,000 mg/l of BOD

Stowe, Vermont

POTW Average flow of 0.293 MGD

Alchemist Brewery

Permitted for 4,460 gpd

BOD 11.5 lb/day – Equivalent of 309 mg/l

At current 5 mg/l discharge = 0.2 lbs/day to the POTW

Middlebury, Vermont POTW

POTW average flow of ~1 MGD

Vermont Hard Cider

Permitted for 70,000 gpd

BOD – 2,500 lb/day – Equivalent of 4,283 mg/l

Surcharge system at $0.40 per pound – they would be paying $1,000/day or ~$261,000/year if weekday discharge only

High Strength Organic Waste

Al Garcia
EPA Region 8
Regional Pretreatment Coordinator

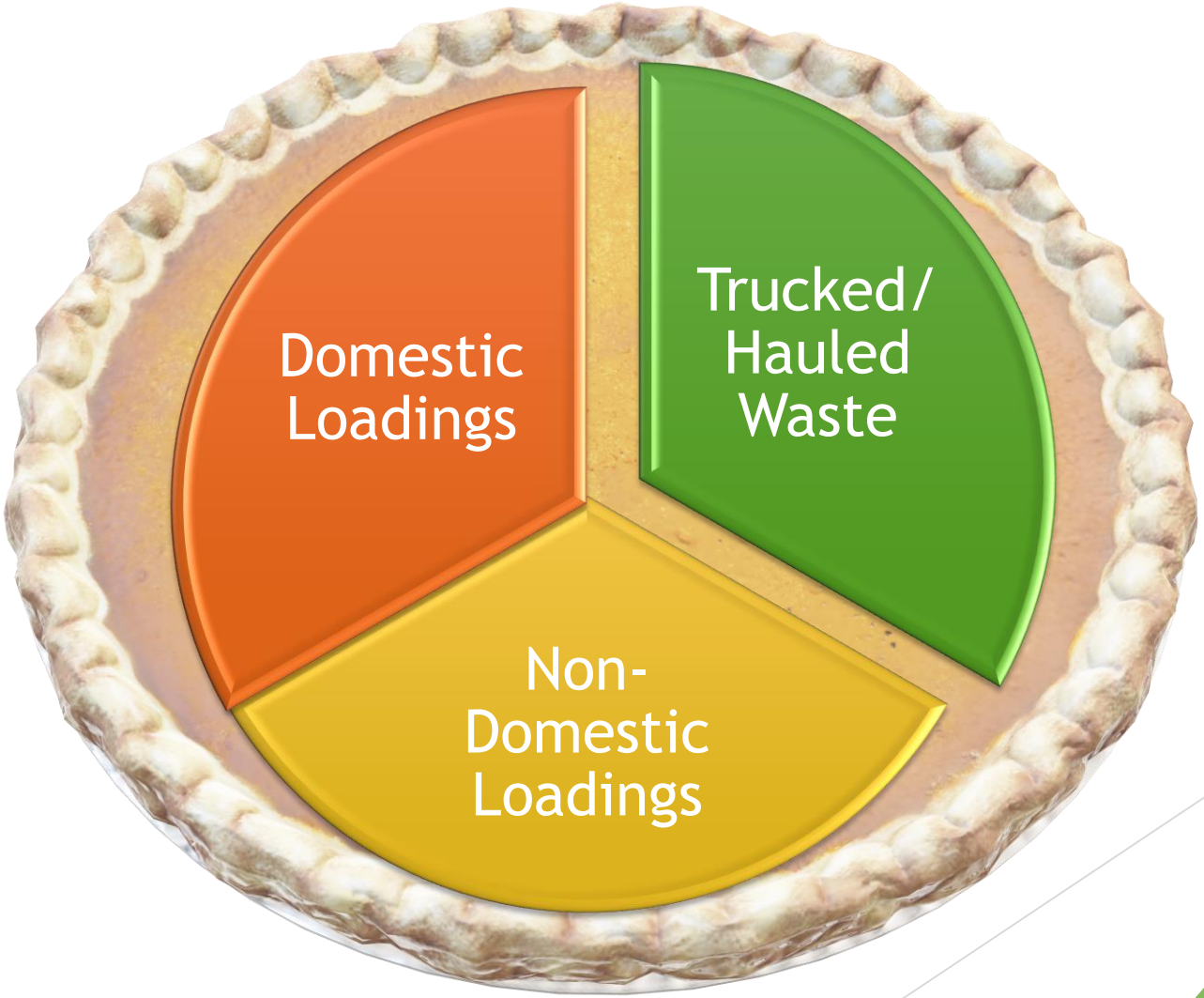
High Strength Waste (HSW)
Conventional/Non-Conventional Pollutants

- BOD, TSS, pH, fecal coliform, Fats, Oils and Greases (FOG), phosphorus, nitrogen, sulfides
- Food Processing
  - Slaughterhouses
  - Dairies
  - Breweries
- Restaurants
- Trucked/Hauled Waste

POTW Design Capacity

- Biochemical Oxygen Demand(BOD)
- Three Considerations:
  - Determine the POTW's design capacity for BOD removal
  - Determine the Total BOD loading in pounds per day received from the service area
  - Determine what percentage of the BOD Loading is available to non-domestic sources

Quantify Loadings Available to Non-Domestic Sources



Tools to Control HWS Non-Domestic Sources

- Surcharges – cost of treating HSW
  - EPA recommends the POTW determine surcharge ceiling
- Limits or allocations for HSW sources
- Diversion or Alternative POTW Operational Methods/Strategies

Diverting High Strength Wastes

- Protect treatment and collection system from slug loads
- Actively manage influent loading
- Manage cost for wastewater treatment
- Compliance with regulatory requirements
- May allow acceptance of waste to provide a benefit to the local community

Case Studies

- Mechanical POTWs:
  - Colorado Springs
  - Fort Collins
- Trucked/Hauled Waste
  - Pueblo
  - Casper


Colorado Springs, CO
Mark Dabling Blvd
© 2012 Google
Google earth

Colorado Springs, CO 2009

- A local dairy – evaluating alternatives to high surcharges
  - Cottage cheese manufacturing rinse water (whey waste)
- POTW-carbon limited
- Whey – good carbon source (lactic and acetic acids)

Colorado Springs, CO Pilot Study

- Bench Testing
- Pilot Study – contracted with dairy
  - Offline grit basin tank (underground)
  - Dairy – 5,000-gallon loads
- Surge dosing to aeration basins – 300 gallon/hour, pumped in 2-3 minutes

Colorado Springs, CO

- Fermentation Discovery
- Lactic acid to acetic acid

- Lab fermentation bench testing
  - Fermentation and pH adjustment(3.5 - 5.0)
  - Volatile Fatty Acids – 20,000 mg/L

Colorado Springs, CO

- Full Scale – two 35,000 underground dosing tanks (50,000 gallons/week)
- Benefits
  - Replace cost of buying acetic acid as a carbon source
  - Dairy-alternative to disposal costs
  - City-stable source of carbon

Colorado Springs, CO Covid-19

- Dairy – decreased production
  - From 20 trucks/week to 3-4
- Supplement carbon source ($800/day)

- Long Term/Future:
  - Brewery waste
  - Fermenting sludge blankets


Fort Collins, CO
Drake POTW
Environmental Learning Center walking trail
Fort Collins Wastewater Treatment
CSU Environmental Learning Center
Sempuran Capitol Building
Cache la Poudre River
Aggregate Industries
S County Rd 9
Google

Fort Collins, CO

- CO Nutrient Regulations
- Carbon as a Fuel Source for the BNR Retrofit
- Search
- Results

Colorado Nutrient Regulations

Parameter	Parameter Limitations	
	Annual Median[1]	95th Percentile[2]
Total Phosphorus	1.0 mg/l	2.5 mg/l
Total Inorganic Nitrogen[3]	15 mg/l	20 mg/l

[1]Running Annual Median: The median of all samples taken in the most recent 12 calendar months.

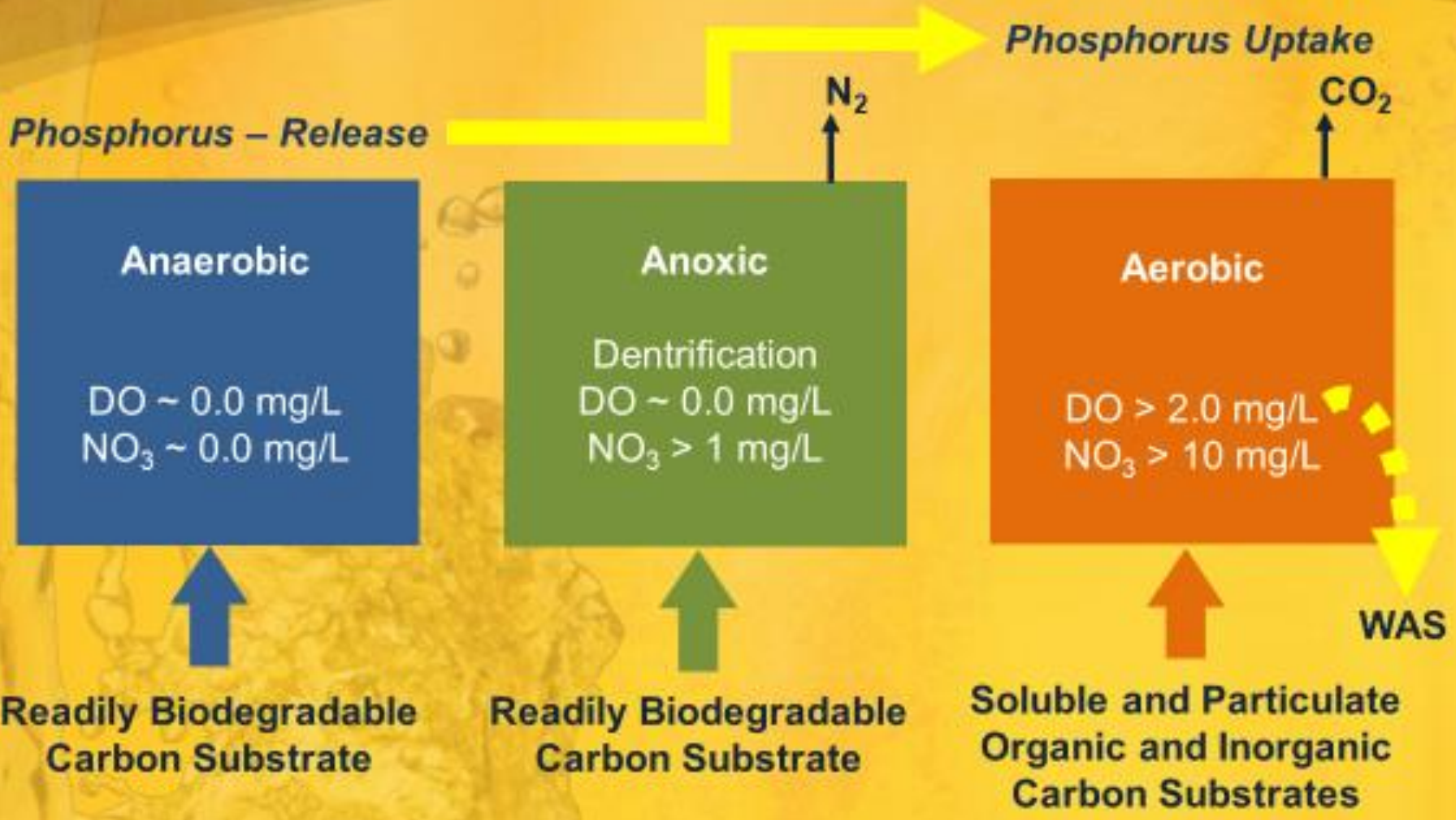
[2]The 95th percentile of all saamples taken in the most recent 12 calendar months.

[3]Determined as the sum of nitrate as N, nitrite as N, and ammonia as N.

Fort Collins, CO

- Converted both POTWs from a traditional trickling filter-activated sludge process
- Biological Nutrient Removal
  - Anaerobic/Anoxic/Oxic (A^2O)

3-Stage BNR


Phosphorus Uptake
Phosphorus – Release
N_2
CO_2
Anaerobic
DO ~ 0.0 mg/L
NO_3 ~ 0.0 mg/L
Anoxic
Dentrification
DO ~ 0.0 mg/L
NO_3 > 1 mg/L
Aerobic
DO > 2.0 mg/L
NO_3 > 10 mg/L
WAS
Readily Biodegradable Carbon Substrate
Readily Biodegradable Carbon Substrate
Soluble and Particulate Organic and Inorganic Carbon Substrates

Need for Carbon

- Drake POTW carbon-limited during certain times of the year.

Parameter	Carbon Ratio	MWRF	DWRF
COD:BOD	>2:1	1.92:1	1.76:1
COD:TKN	>12:1 for sufficient denitrification	16.7:1	10:1
COD:TP	>40:1 for efficient Bio-P removal	50:1	51:1

Search for Carbon

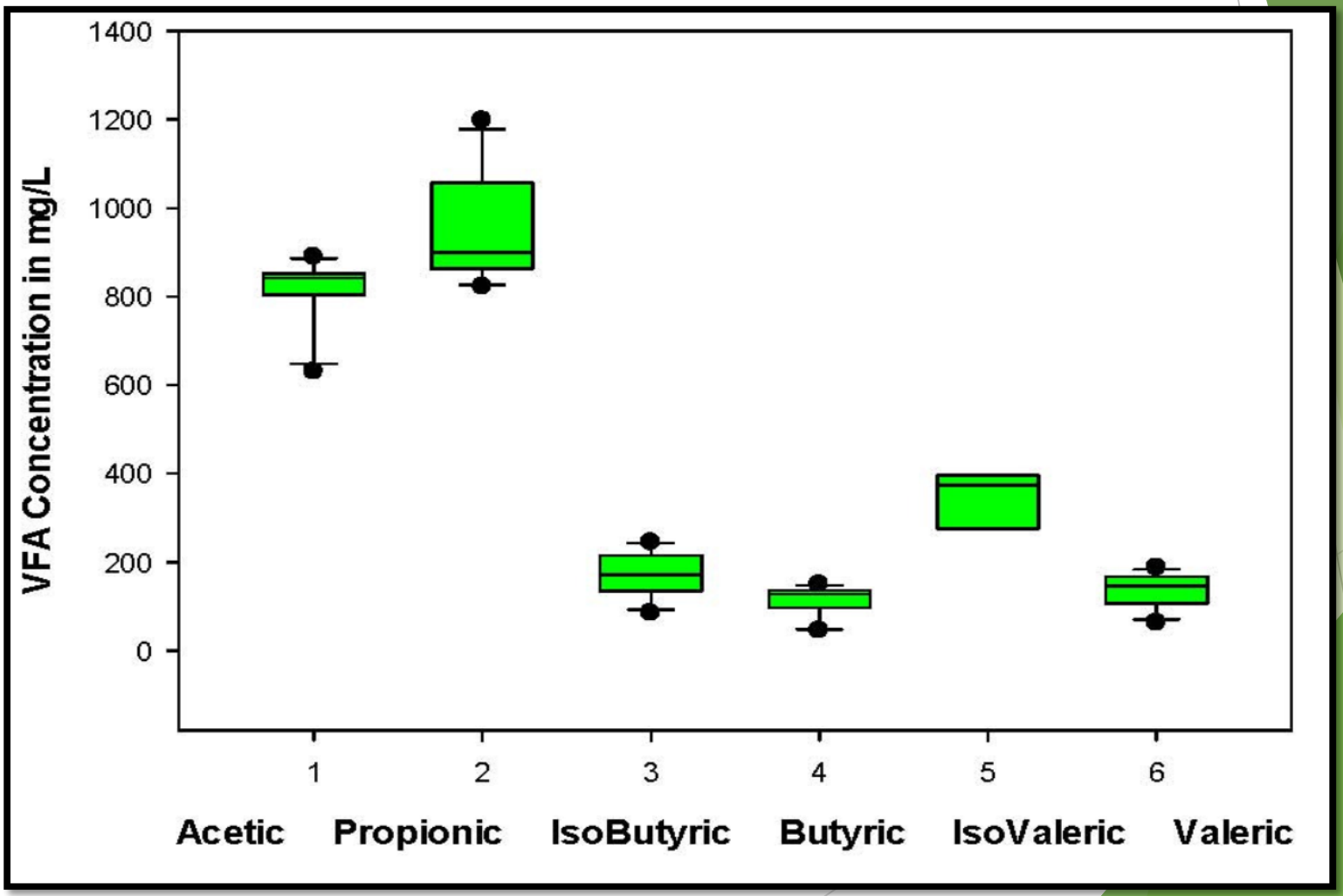
- Evaluated Carbon Procurement
  - Methanol, Ethanol, other sources
- Evaluated IUs for high strength BOD waste
- Breweries

Search for Carbon

Brewery No.	Waste Type	BOD_5 (mg/L)	sBOD (mg/L	COD (mg/L)	COD mg/L)	ffCOD (mg/L)	TKN (mg/L	NH_3 (mg/L)	NO_2 mg/L)	NO_3 (mg/L)	OPO_4 (mg/L)	SS (mg/L)	TPO_4 (mg/L)	VSS (mg/L)
Standard Method		5210B	5210E	5220D	5220D	5220D	351.2	350.1	353.2	353.2	365.1	2540D	365.1	160.4
1	Post Anaerobic Waste	126	26.15	1,223	224	192	73	60.5	0.1	<0.05	46	870	53	460
1	Treatment Inlet	5,239	>4,116	8,851	664	678	60	2.2	0.09	16.25	29	1420	46	940
1	Spent Yeast	88,092	45,649	171,949	20,636	NA	105	10.7	0.11	0.80	270	72,500	897	68,500
2	Truck Waste trub/spent yeast	49,992	38,349	84,674	5,575	>50000	174	19.4	0.44	1.48	113	19,900	205	17,600
2	Sanitary/Drains	1,236	1,599	2,162	NA	>1000	22	1.3	0.09	<0.05	3	1,180	7	425
3	Spent Grain	37,094		89,670		15,652	32	4.1	0.05	1.24		51,400	419	49,800
3	Still Bottom	14,587	9,247	34,339	20,609	13,912	105	23.2	<0.05	0.11	132	15,230	294	14,620
3	Spent Yeast	110,500	51,750	341,632			95	49.7	<0.05	1.05		139,600	2,074	127,500
3	Truck Waste	91,250	60,500	245,133				0.5	<0.01	<0.01			3	

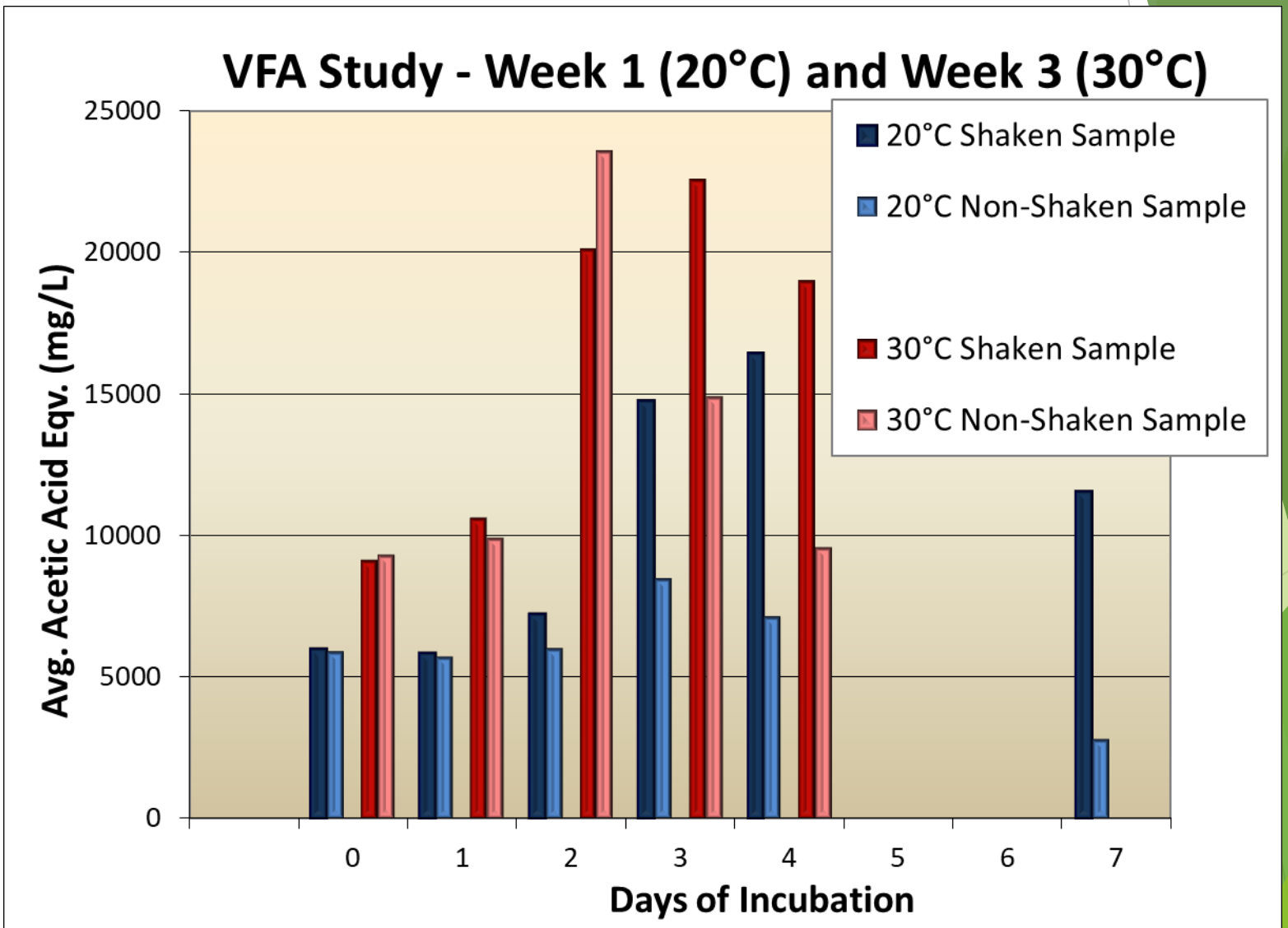
Search for Carbon

- Determine Volatile Fatty Acids (VFA) in brewery waste



Search for Carbon

- Fermentation study on VFA Concentrations



Conclusions

- Brewery Waste - ethanol and complex VFAs
  - Helps with denitrification
  - Good carbon source for PAOs
- Fermentation of brewery waste for 3-4 days at 30°C is optimal for VFA production

Future

- Full-Scale Piloting
  - Fermentation optimization
- Surcharge Fees
- Researching Other HSW
  - Determining benefits


Pueblo, CO
All Truck Parts
Auto parts store
S Queens Ave
mo & Sons
Stockyard Rd
Stockyard Rd
Stockyard Rd
Booth-Orchard
Google

Pueblo, CO

- Trucked and Hauled Waste Program
- Pretreatment issues 1-year hauler permits, manifests required
- Mixed loads allowed of grey grease/septic allowed
  - Septic – designated discharge station
  - FSE grey grease – report to office
  - Loads charged by the gallon


City of Pueblo Septic
Receiving Station

Pueblo, CO

- Sand Interceptors (Car washes/ automotive shops)
- Not limited to service area
- Manifests to office
- Unloaded to drying beds (4 cells), $60 per load
- Evaporation/dredging of solids to landfill


Casper, WY
North Platte River
Berts Truck &
Auto Repair
Bryan-Evansville Rd
Bryan-Evansville Rd

Casper, WY

- 1988 – initiated acceptance of industrial waste within County boundaries
  - Car washes, oil and gas facility sumps
- ~75 sources, Annual TCLP tests and issue manifest #
- POTW – verify manifest
- 1 drying bed, 2,000 gpd

Casper, WY

- 2008 – opened a total of 12 beds for acceptance of industrial waste.
  - 12,000 gpd
  - Rotate beds for drying and evaporation
- 2019 – accepted 365,000 gallons of industrial waste
- 2011 – accepted FOG (grease interceptor)
- $300 per 1,000 gallons

Casper, WY

Oil and Grease Program

- FSE grease accepted outside of County
- Office – visual sample and pH test
- 6 drying beds
- Rotate beds and lime to stabilize
- Mix, dry and landfill
- 450,000 gallons of FOG annually


Designated nonhazardous industrial sump drying beds.
Designated "FOG" drying beds

Off-loading 1500 gallons of non-hazardous sump waste from local car wash into drying bed.


Active "FOG" drying bed.

View of the 6 non-hazardous industrial drying beds looking North.


Drying bed designated for FSE" FOG". Post lime treatment and evaporation.

Disposal of dried industrial solids to landfill, looking west.

Other Methods/Strategies for High Strength Wastes

- FOG and HSW in anaerobic Digesters – (Co-Digestion)
  - Reduce impacts in collection system (FOG) and upstream POTW processes
- Concerns:
  - Organic and hydraulic loading rates due to variability of the hauled waste loads
  - Foaming

POTW Contacts

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Questions??
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