



BOC Hydrogen Sulfide Odor Control Reduction Program

GILLETTE STADIUM WWTP COMPLEX

Executive Summary-Conditions

A modified SBR with membranes waste water plant is operated by NSU-Applied Water Management, at Gillette Stadium complex. They have been receiving community odor complaints. NSU have been using Bioxide and VX-456 to control odors. The products are injected into two separate wet wells to control the odors that are emanating from the wet wells or flow equalization tanks.

Jay Johnston and Sean O'Donovan of BOC were invited to visit the site on 6/20/12, to meet with Joe Dias, Operations Supervisor, Christine Thornton, Project Engineer and Andy Zinkevich, PE, Executive V.P. of NSU-Applied Water Management.



The purpose of this meeting was to observe and offer recommendations on how to resolve the community odor complaints.

We Offer Our Observations And Comments Below:

1. Based on our climbing to the top of the 400,000 gallon flow equalization tank, the majority of the H₂S odors on site are coming from the 12" vent cap.(which is the main ventilation point). This is a problem because of the close proximity of stores and restaurant's in the area.
2. We believe that there is a major biofilm build up on the sidewalls of the flow equalization tanks (400,00 & 600,000 gallons), which are interconnected hydraulically and by a 20" fiberglass vent line.
3. The tanks, are aerated from 2 to 4 am daily. (This is done to mix-stir the tanks)
4. We believe, based on the changing liquid levels, that the sulfides are being released and are evolving into H₂S gases. This in turn allows, the gas to be pushed out or in case of prevailing winds drawn out of the 12" vent cap.
5. FOG accumulations are evident in the treatment processes.

Executive Summary-Conditions Flows, Loading, & Odor Control Chemical Usage-2012

Flow:

1. Daily Influent flows are 90,161 GPD average, with peak flows of 318,881 GPD.

Loading:

1. BOD 5-Day is 320 mg/L average, with peak of 390 mg/L
2. TSS: 196 mg/L average, with peak of 240 mg/L
3. Ammonia as N: 62 mg/L average, with peak of 91 mg/L

Odor Control Chemical Usage:

4. VX-456- annual average daily usage based on 2011 (2012 usage not supplied). 38.7 lbs. @ \$ 57.24/day.
(~\$ 20,836/year)
5. Bioxide Usage: As increased from 17 gpd in 2009 to 26 gpd, @ \$ 74.00/day. prorated on 2012 usage.
(~\$ 26,936/Year)
6. Total Odor Control Cost Per Year = ~ \$ 50,000

WWTP is operated by NSU-Applied Water Management



A Comprehensive Technology Model

The use of a Bio-Organic Catalyst (BOC) offers a new green chemistry tool to solving the chronic and systemic challenges of nearly all collection systems, including:

- Biofilm Slime Layers
- Noxious Odors
- Grease Build up Blockages
- Low Dissolved Oxygen Levels in Sewage Wastewater
- Corrosion of Infrastructure

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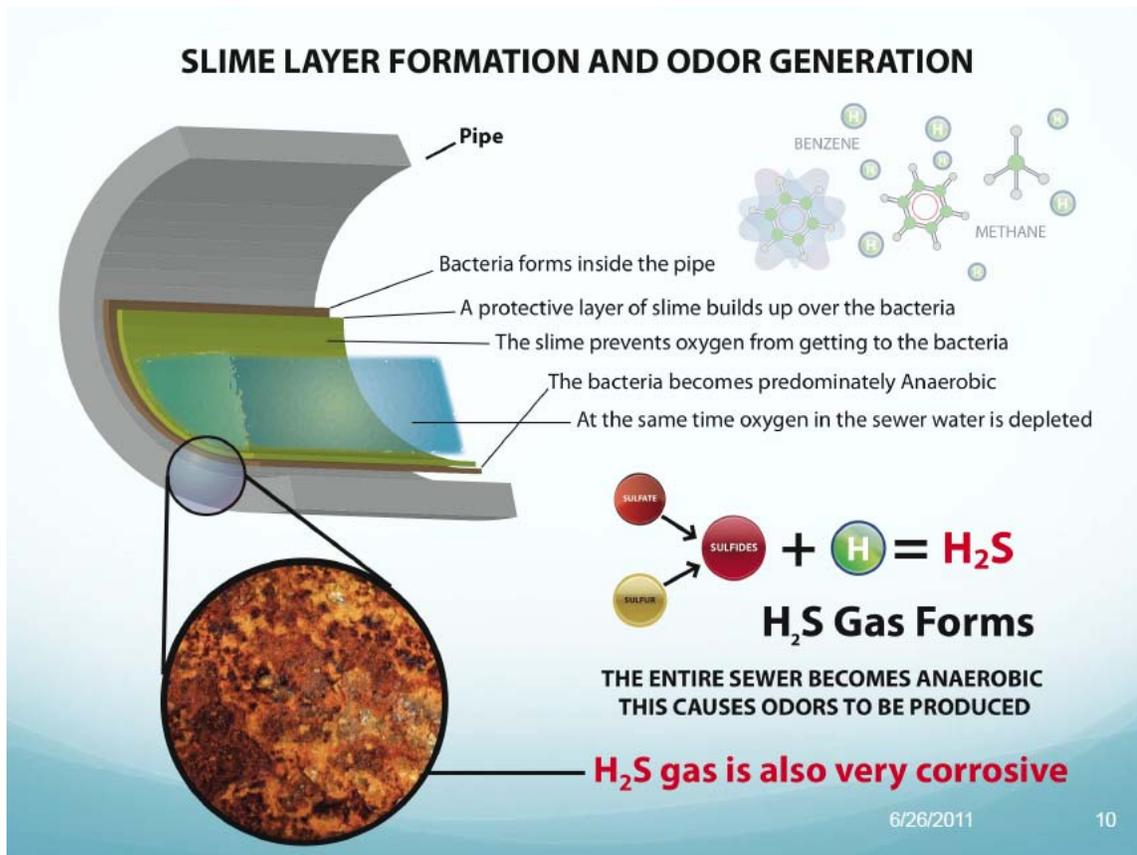
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Collection System-EQ Tank Maintenance

The formation of slime layers and grease build-up within collection systems and EQ tanks are chronic in most systems and sewers.

The degree of severity will be determined by numerous factors, including; grease interceptors, system design and flow restrictions, pump stations, forced mains, hydraulic retention times and climate conditions.

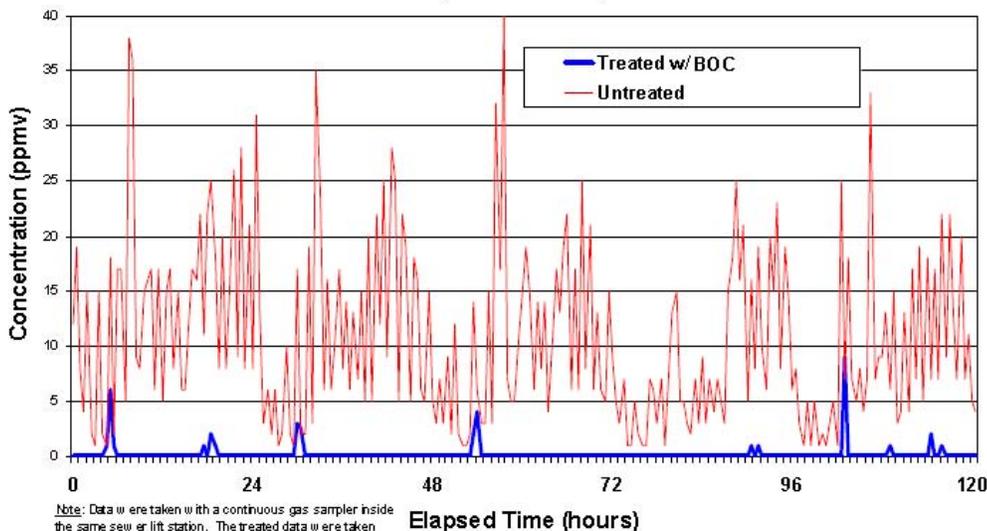
- Changes in hydraulic dynamics, such as sewage water dropping into a well, will release noxious odors (H_2S), and eventually, cause corrosion within the collection system infrastructure.
- If dissolved oxygen (DO) levels can be maintained at greater than 1.0 mg/L, this H_2S gas release will be minimized.



HYDROGEN SULFIDE GAS CONCENTRATION

Municipal Sewer System

(30 - minute intervals)



Note: Data were taken with a continuous gas sampler inside the same sewer lift station. The treated data were taken during a five-day period on the same days of the week (Friday through Wednesday) as the untreated data after a four-week purge and acclimation period.

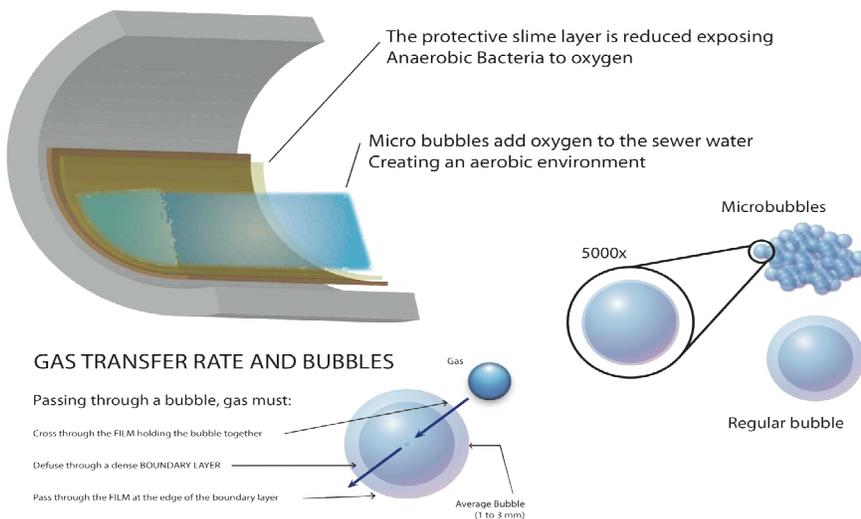
Green Chemistry - Bio-Organic Catalyst

- The BOC green bio-catalytic chemistry is a hybrid composition of bio-surface modifying agents combined with a fermentation intermediate that has exceptionally high enzymatic characteristics.
- This proprietary composition rapidly degrades the molecular structure of slime layers, fats, oils, and greases (FOGs) through a bio-catalytic degradation of their molecular structure.
- Simultaneously, BOC raises the dissolved oxygen content of the sewage wastewater through the formation of fine oxygen-rich micro-bubbles which allow greater biological oxidation potential in the wastewater.

Air/Water Surface Dynamics in Odor Control and Slime Layer Degradation

- Spraying BOC directly onto the wastewater surface creates a highly enriched layer of dissolved oxygen that oxidizes noxious gases that are released out of solution. This exceptional bio-filter will immediately reduce noxious odors to minimum levels.
- This highly oxygenated zone of BOC acts as a scrubbing mechanism on the slime layers within the inside of the collection pipes. The constant agitation of the moving wastewater surface activates the degradation of the slime layers.
- This same scrubbing and degradation action also breaks down floating grease (Solubilization) which accumulates within the pipes or siphon boxes. The movement and turbulence of the wastewater will help rapidly break down grease blockages.

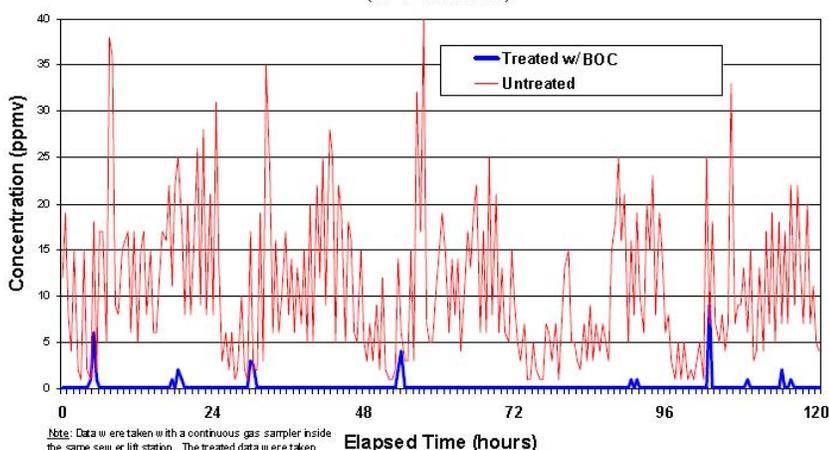
DEGRADATION OF SLIME LAYERS WITH BOC



With continuous use of BOC the pipe is cleaned and flow is increased, eliminating the possibility of odor blooms at the same time preventing corrosion

HYDROGEN SULFIDE GAS CONCENTRATION

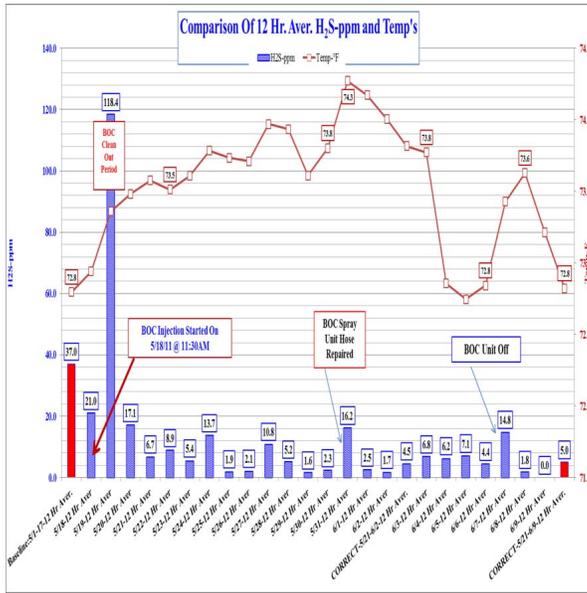
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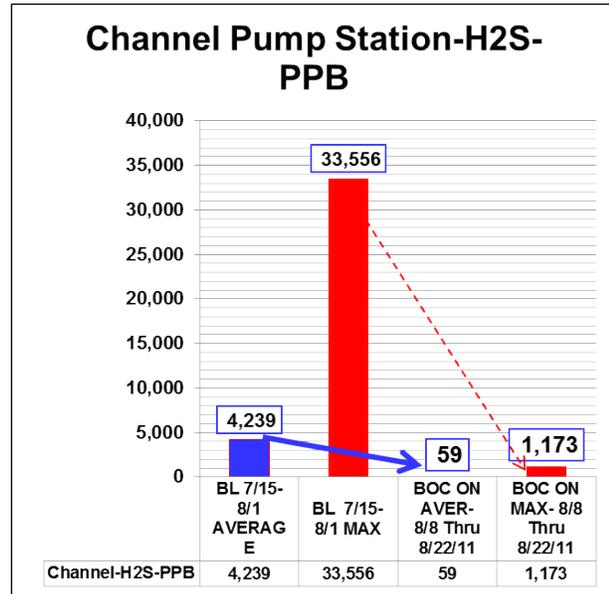
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Example of H₂S Reduction in Sewers

BOC H₂S Reduction Program For Kiewit Infrastructure West



San Francisco - Pump Station (5 Miles from BOC injection point)



Portable Dispensing System For Sewer-EQ Tank Odor Control

1,000 Liter ESP Solution Tote Bin



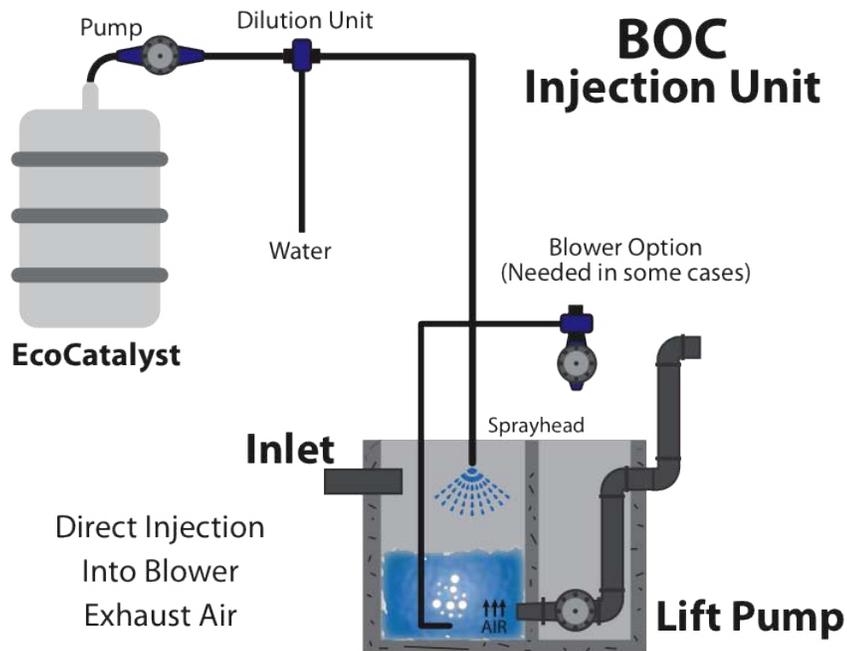
General Spray Nozzle Concept

Misting and Fogging Nozzles

Providing the smallest atomized spray droplets of all of our spray nozzles, All nozzles are easy to clean and have a strainer. Strainer has a brass body with stainless steel 120x120 mesh. Spray angle is 90° for full cone spray nozzles. Maximum pressure is 500 psi. Maximum temperature is 180° F. Connection is NPT male.



BOCs Wet Well Hydrogen Sulfide Odor Control Program



BOC Treatment Approach To Control Odors At

Step #1:

- Install an automatic BOC spray system into the 12" Vent on the 400,000 gallon flow equalization tank. Spraying BOC directly into the headspace below the vent and onto wastewater surface creates a highly enriched layer of dissolved oxygen that will oxidize noxious gases that are released out of solution. This exceptional bio-filter will immediately reduce noxious odors to minimum levels. BOC will design/build and ship automatic control-spray system for the EQ tank vent. Price quote to follow.

Step #2

- Inject ESP into flow equalization tanks directly @ 3 ppm/ 100 BOD/ Million gallons of Flow. (If the tanks are 1/2 full, pretreat this volume ~ 500,000 gallons). Then treat the daily flow for 5 days. This will allow the product to breakdown the Biofilms that have accumulated on the sidewalls of the tanks. On day # 3, Increase aeration time into the tanks to 24 hours per day.

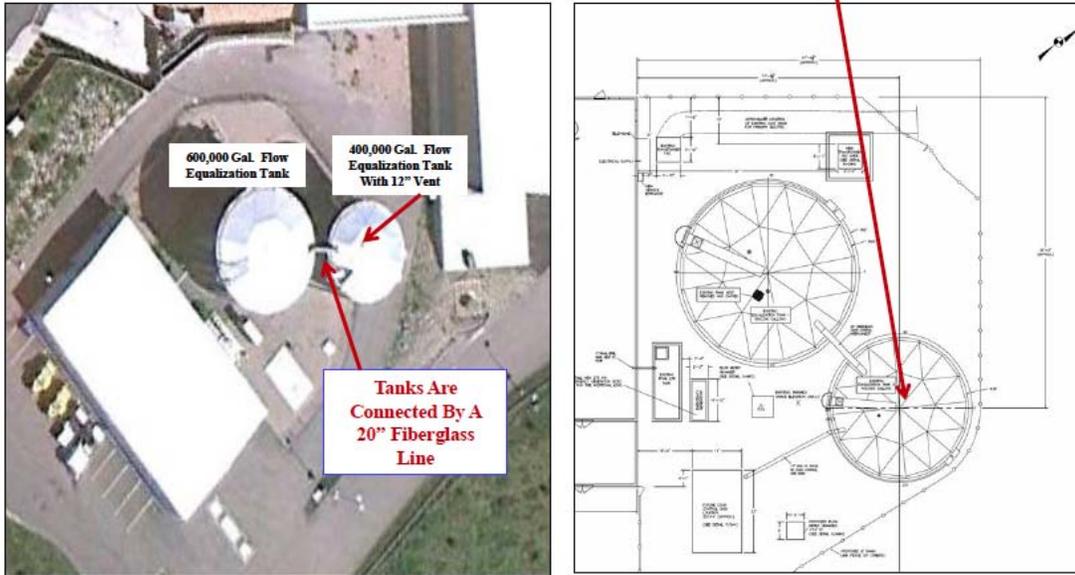
Step #3

- Potential BOC injection point is located near the two meter chambers on site near the EQ tanks. NSU has identified one that contains both a 16" and 4" force main – both of which branch to the two EQ tanks. Joe noted that the 4" line flows more regularly and that the 16" is used for big event days at the stadium. However, please note this will not eliminate odors that maybe originating at the wet wells.

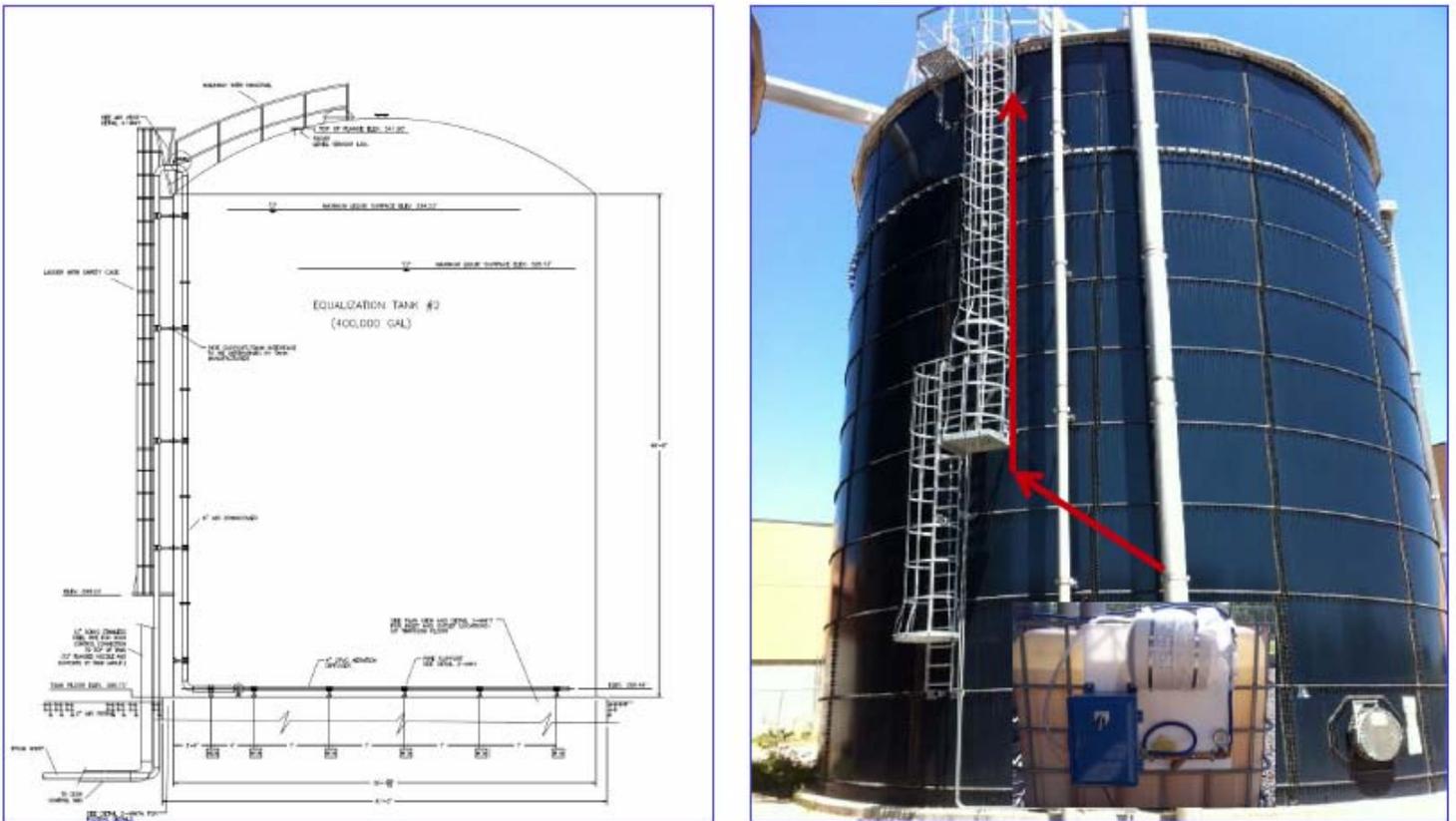
Step #4

- Install BOC injection points at the two wet wells to replace Bioxide and or VX-456. to eliminate odors at the two wet wells based on flow and BOD loading with two small regenerative blowers. (See Slide # 18) .NSU to provide chemical feed pumps and or regenerative blowers.

Install BOC Spray Assembly Into 12" Vent



Install BOC Spray Assembly Into 12" Vent and Tote Bin Location





275 Gallon ESP Solution Tote Bin With 120 Volt Pump



Spray Nozzle Assembly Inserted Thru Top Of 12" Vent Cap



BOC Dosage Amounts

Automatic BOC Dosage Calculator

Instructions: Insert Influent BOD loading-mg/L and Flow (GPD or LPD)

US Dosage Formula is BOC (1 ppm) per 100 mg/L of BOD loading (mg/L) per 1 MGD (1,000,000 US gallons) of Flow

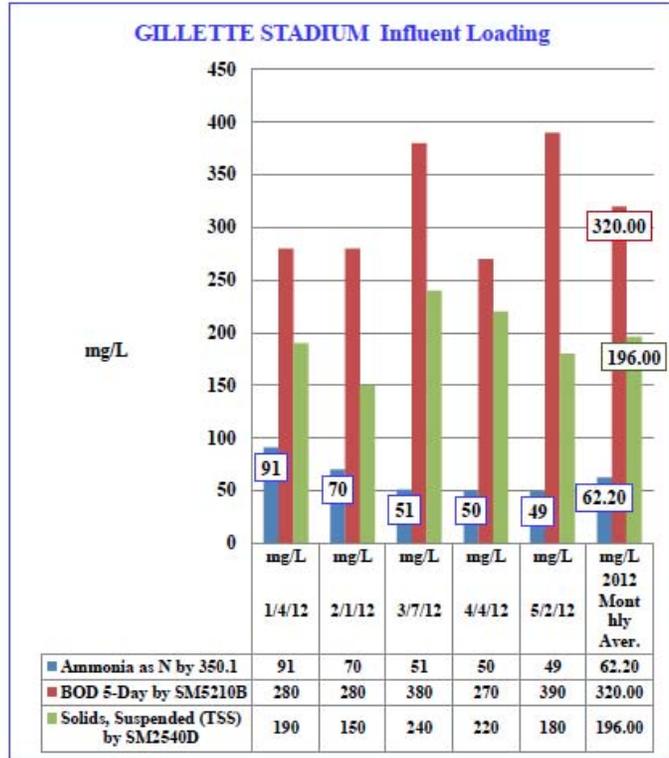
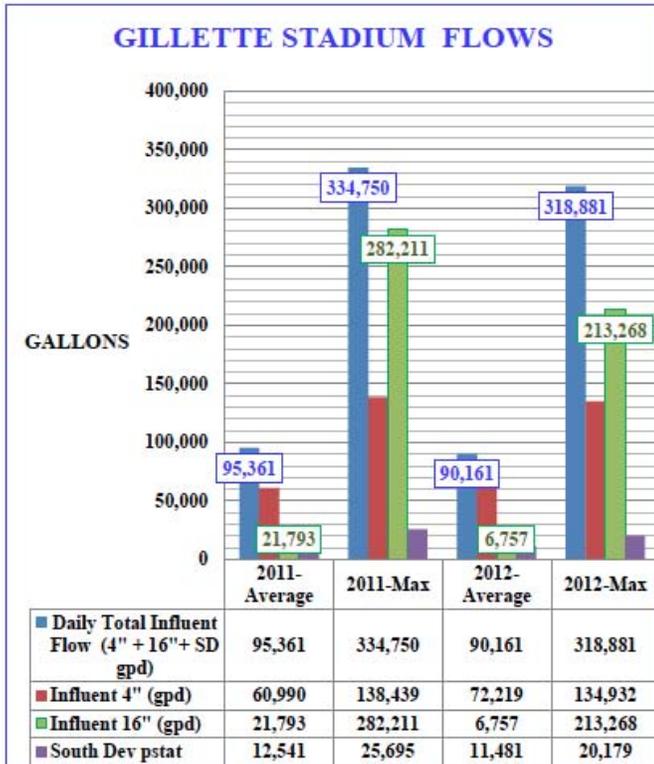
	BOC-ppm	BOD loading-mg/L	Influent Flow-GPD	BOC Required-GPD (US)	\$/Day	Based on Discounted Tote Bin Pricing @ \$ 40.22/gallon
US Dosage Formula	1	100	1,000,000	1.000		
Example- WTPP	1	300	1,000,000	3.000		
Gillette Stadium						
Day One: Pretreat EQ Tanks	3	320	500,000	4.800	\$193.06	\$40.22
5 Day Dosage: Into Influent Flow	3	320	92,000	0.883	\$35.52	\$40.22
Decrease Daily Dosage on 6 th Day	2	320	92,000	0.589	\$23.68	\$40.22

Application Rate For BOC Automated Application Equipment Into EQ Tank Vent

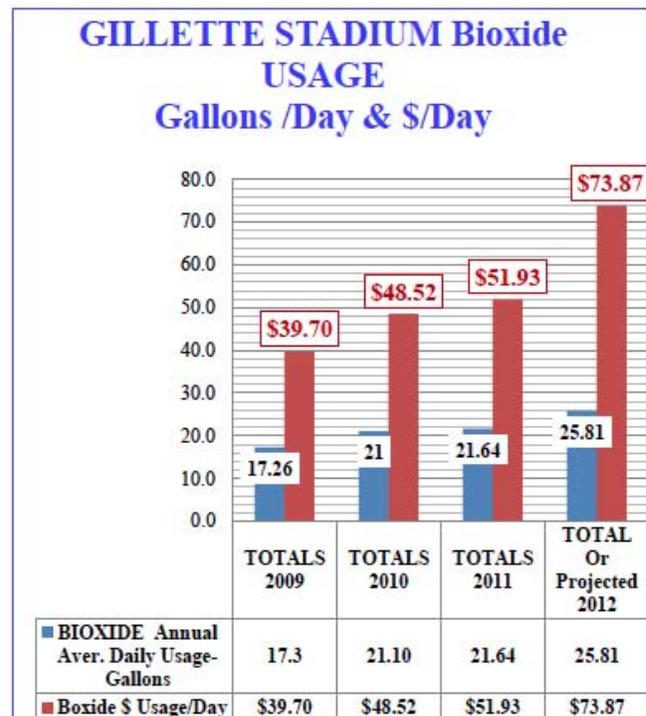
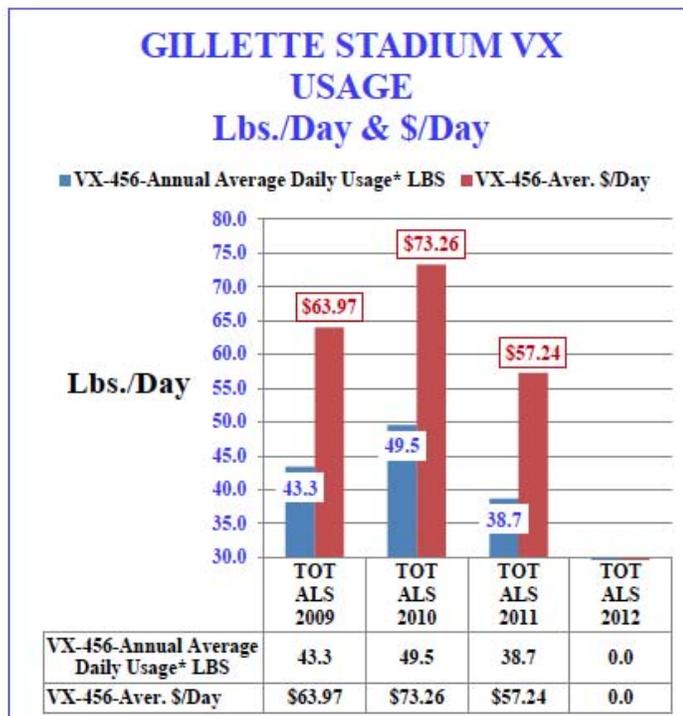
Dosage Application Rate Automatic BOC Spray Unit

Hours Of Application Rate	ESP Amount Per Tote Bin <i>(This amount will be reduced after Biofilms have been reduced on the EQ side walls</i>	Tote Bin Capacity Gallons	GPD-24 Hrs Of ESP Solution	Spray Nozzle @ ~ 80 to 100 psi-GPH	Spray Nozzles	Days Of Operation Before Tote Bin Refill
24 Hr Application Rate	30	300	48	1.00	2	6.35
16 Hr Application Rate- (6 AM To 10 PM)	30	300	32	1.00	2	9.35

Gillette Stadium Influent Flows-Loading



Gillette Stadium Current or Projected Odor Control Chemical Usage



Examples of Current Collection System Installations

- City of San Francisco
- Kiewit Infrastructure West-Magnolia Trunk Sewer Rehabilitation Project, CA
- Kiewit Infrastructure West-Salt Lake City, UT
- Village of Ridgewood Regional Waste Water Facility, Ridgewood, NJ
- Brewster, NY WWTP
- Tri-Municipal WWTP Wappinger's Falls, NY, (Severn Trent)
- Carmel, NY WWTP, (Severn Trent)

BOC Would Like To Thank: Joe Dias, Operations Supervisor Christine Thornton, Project Engineer Andy Zinkevich, PE, Executive V.P. of NSU-Applied Water Management. For The Opportunity To Present The Of BOC Odor Treatment Control For GILLETTE STADIUM WWTP

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