BIO-ORGANIC CATALYST
THE POWER IN NATURE®

CASE STUDY
bio-organic.com

The Green Solution for Fat, Oil & Grease Pre-Treatment Programs

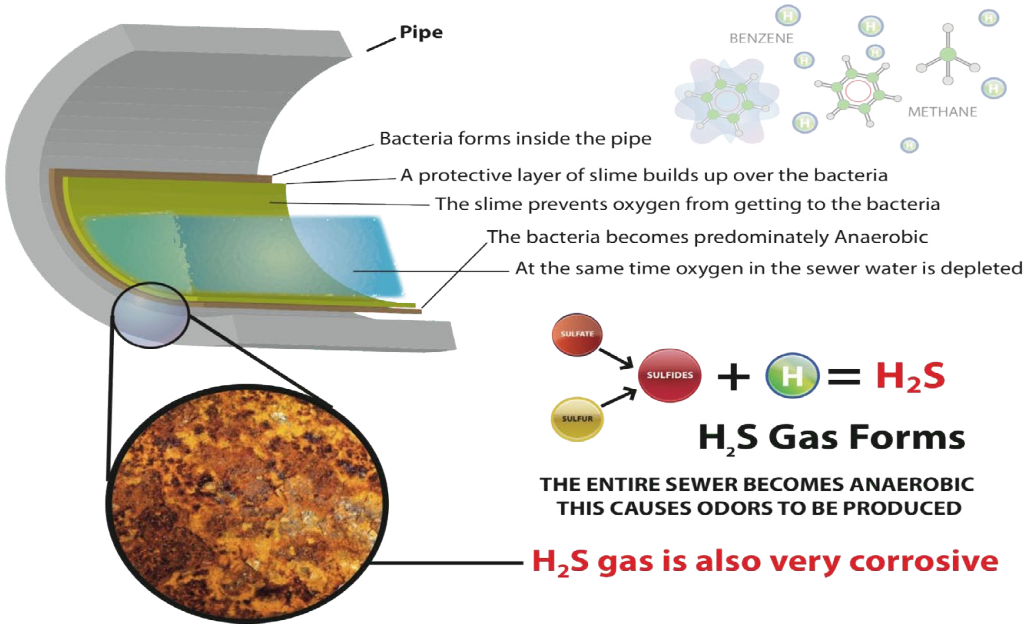
13th Annual EPA New England Pretreatment Coordinators Workshop - October 2011

BOC Pre-Treats Entire Collection System

BOC Treats Whole Collection System

- Eliminates odor & slime layers
- Controls H_2S & corrosion
- Eliminates grease blockages & fogs
- Maintains high dissolved oxygen levels
- Replaces toxic chemical treatments
- Maintains healthy biology system wide
- Offers significant cost and energy savings

Slime Layer Formation and Odor Generation



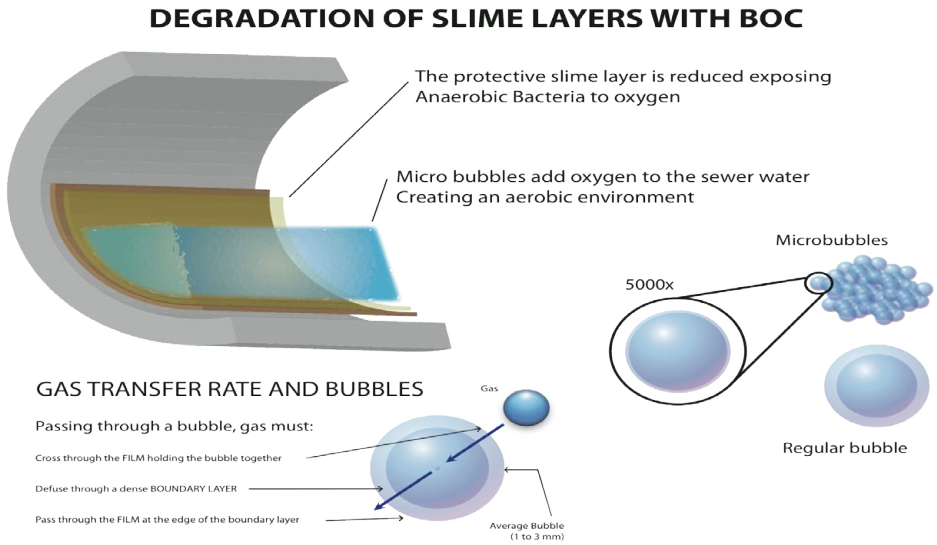
Boc's Bio-filter Eliminates Odor & Slime

Sprayed directly on wastewater BOC forms an enriched layer of dissolved oxygen on the surface of wastewater.

- Dissolved oxygen layer forms "bio-filter" that accelerates decomposition and gas transfer
- Bio-filter oxidizes noxious gases and reduces odors to minimum levels

Oxygenated bio-filter layer acts as scrubber on slime in collection pipes.

- Normal movement of wastewater surface activates BOC to degrade the slime layers BOC Odor Control and Slime Layer Degradation



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

BOC's Eliminate Grease Blockages

Oxygenated bio-filter of BOC on wastewater surface solubilizes floating grease.

BOC's solubilization is part of a sequenced process in which lipid ester bonds are instantaneously cleaved, reducing their molecular structure to both glycerol and fatty acids. Glycerol is water soluble and readily degradable by wastewater micro organisms. Essential fatty acids, released from the lipids, can then be metabolized through biological processes as a high energy food in Anaerobic Digestion, increasing biogas production and source of carbon for nitrification reduction processes.

- Normal wastewater turbulence activates BOC to break down FOGs and grease blockages. Turbulence accelerates BOC grease solubilization
- Keeps entire pipe clean, including accumulated grease at upper sections
- Breaks up grease and debris bundles forming blockages and odorous environmental conditions

Bio-Organic Catalyst - Green Chemistry Description

BOC green bio-catalytic chemistry:

- Hybrid composition of bio-surface modifying agents combined with a fermentation intermediate
- Exceptionally high enzymatic characteristics

BOC degrades the molecular structure of slime layers, fats, oils, and greases (FOGs)

- Creates bio-catalytic degradation of molecular structure

BOC raises dissolved oxygen content of wastewater

- Forms fine oxygen-rich micro-bubbles to allow greater biological oxidation

Bio-organic Catalyst A Family Of Cost Reducing Green Products

- AD-Cat ™
- AD-Cat ™
- Eccomate®
- Eco-Cat™
- Eco-Cat Green™
- EcoSystem Plus®
- Fiber-Cat™
- NONTOX®
- Phyto-Cat™

Each BOC product offers improved performance and substantial cost savings for a range of applications. The following case studies track the application of BOC from the top to the bottom of the wastewater collection system.

Case Study 1 - Grocery Chain Meat Rooms BOC'S Pre-treat Industrial Sources At The Beginning Of The Waste Water System

BOC provides superior cleaning and degreasing of meat rooms in the largest independent grocery store company in New England, replacing industry standard degreaser. Application of BOC resulted in:

- Better cleaning
- Increased safety for workers and consumers thru reduction of slipping on meat room floors.
- Clear drains.
- Solubilized grease throughout drain line system.
- Complete odor elimination.
- Extended life of septic systems.

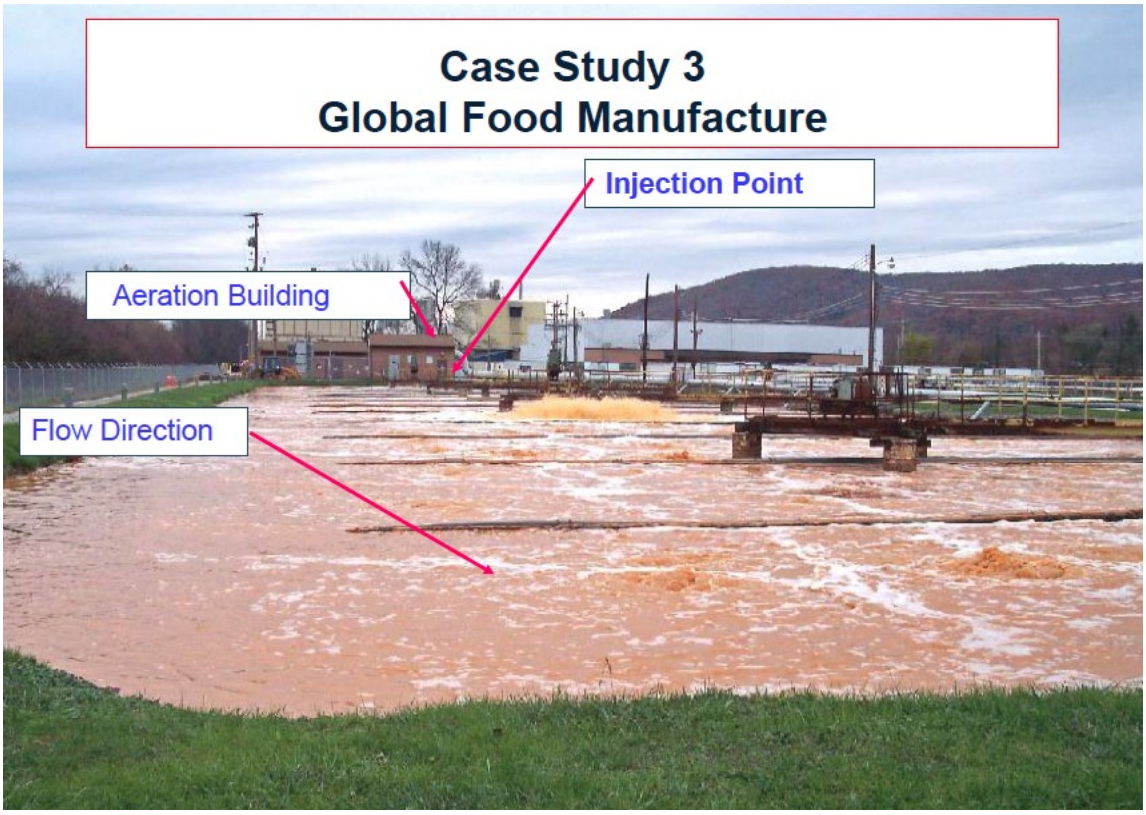
Case Study 2 - Reduction Of FOG/Sludge-Slaughterhouse, Israel

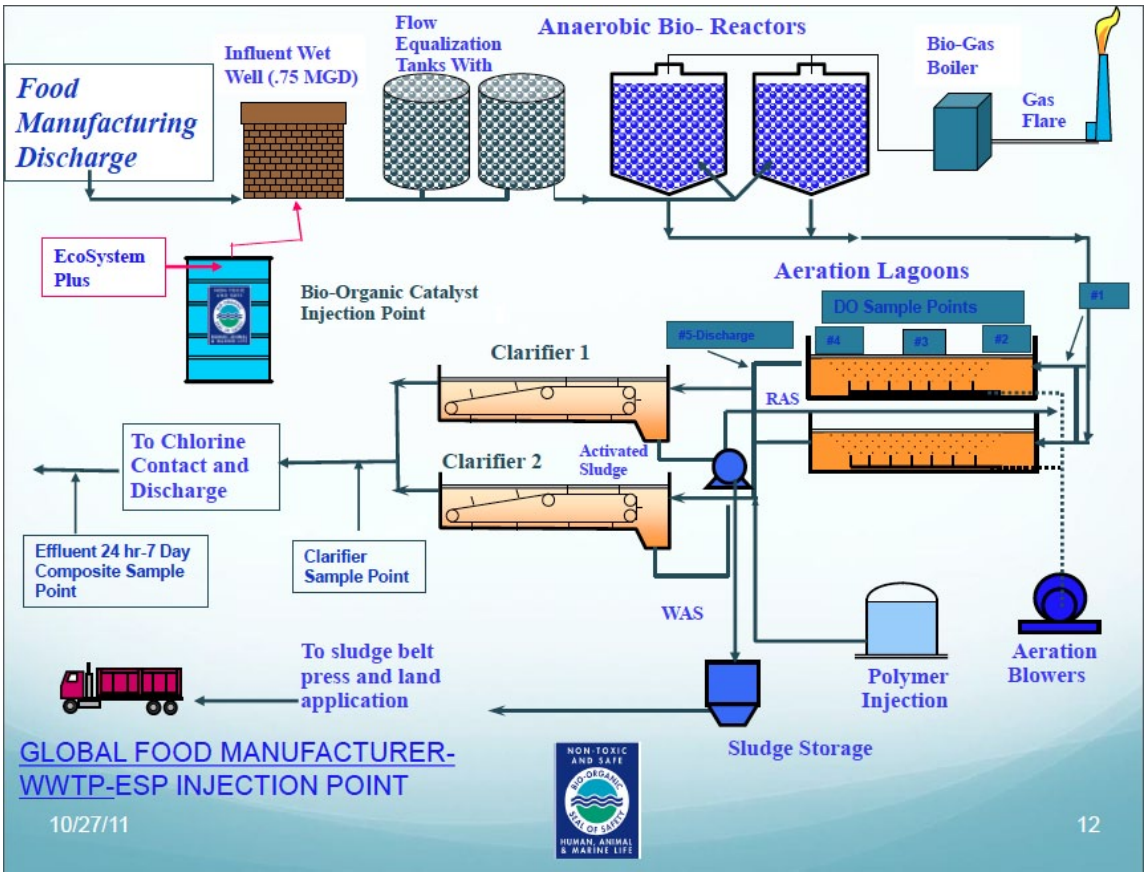
FOG Collection Pit Before A DAF Machine 50 m3 (13,200 US Gallons) BOC Treatment: 6 Gal. + Aeration

Results Before Treatment:
BOD: 900 ppm
FOG >400 mg/L

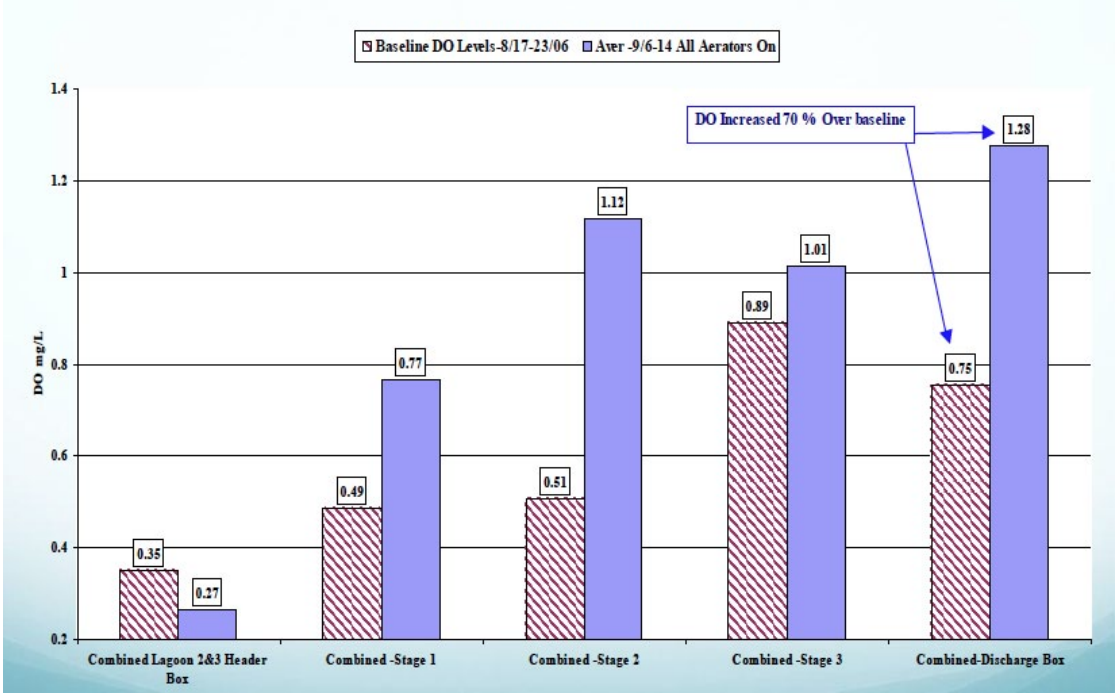
7 Days Later:
BOD:450 ppm, FOG:60 mg/L
Sludge Reduction- 75 %

Case Study 3 - Global Food Manufacture

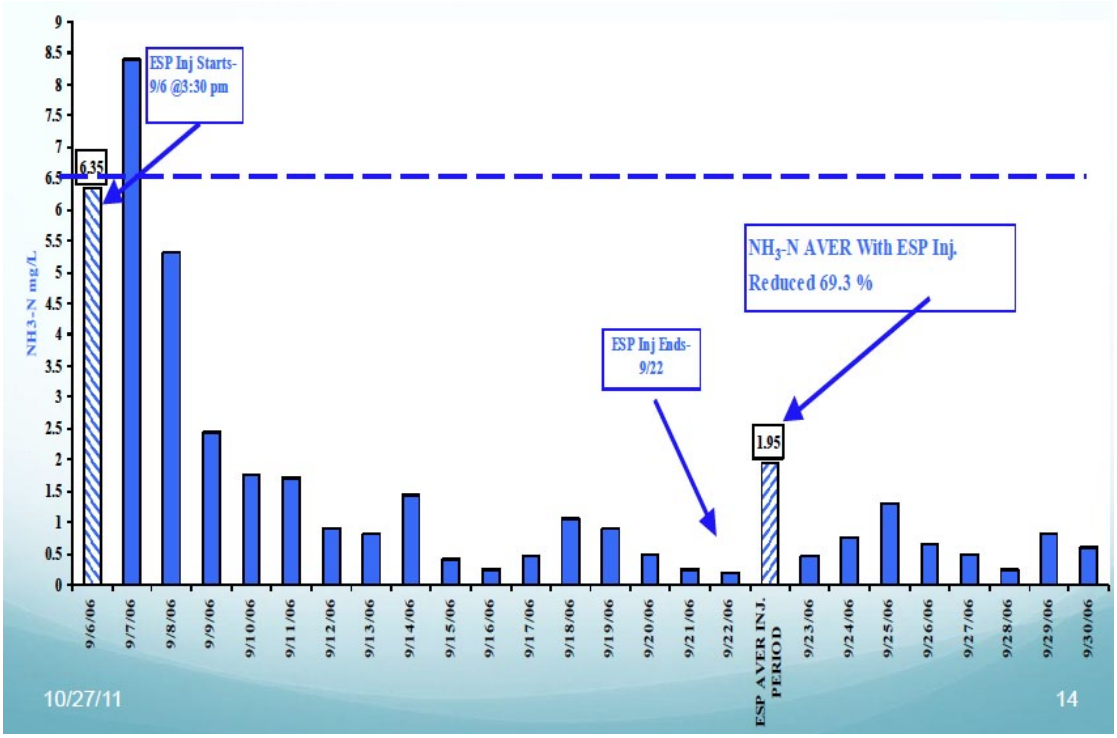




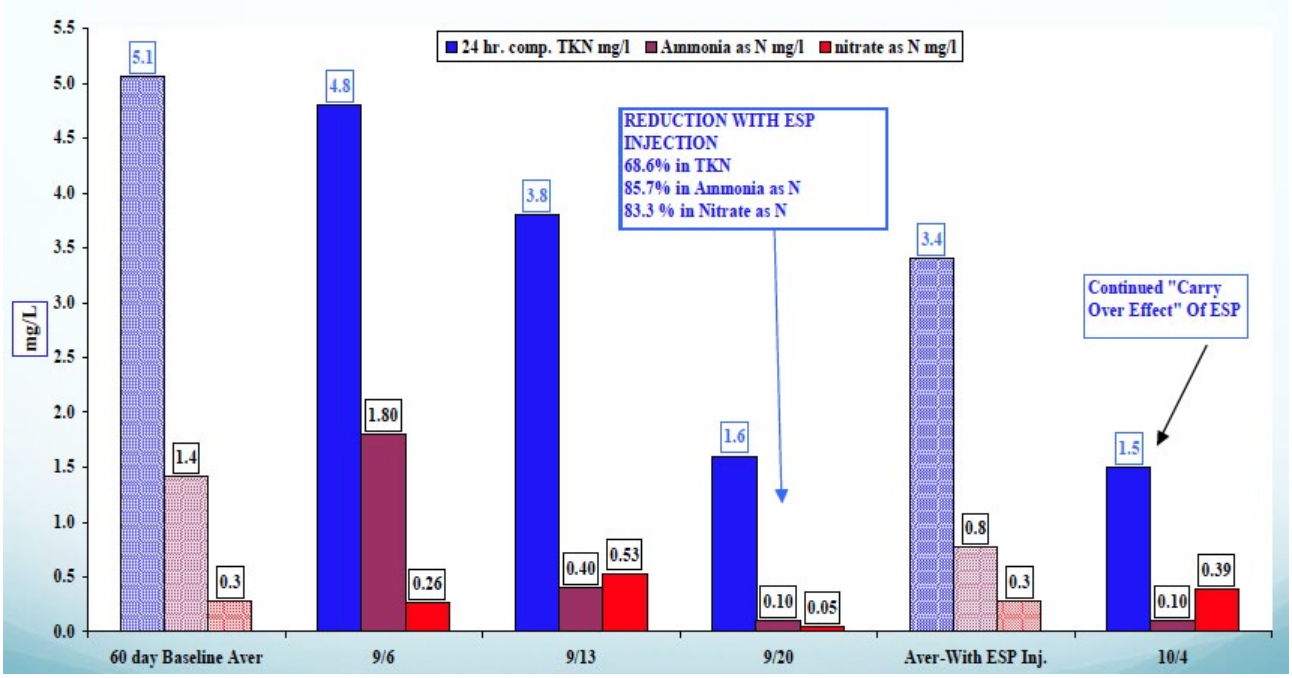
BOC Improves Dissolved Oxygen Levels



BOC Reduces NH3 –N Discharges By 70%



BOC Improves Effluent Discharges



Case Study 4 - Large NE Bio-Processing Facility Reduction Of FOG's & TSS To Regional Wastewater Facility Breakdown and Solubilization of FOGs MWRA, Deer Island, Boston Secondary Clarifier Influent Channel

- The facility processes 250,000 GPD of grease fats, oils, septage, and bio-solids.
- Trucks arriving, discharge into grit, septage ,FOG into receiving tanks. The influent is pumped into a 500,000 gallon mixing/storage tank. From the storage tank, it is pumped into the belt press facility for dewatering. The filtrate from the dewatering operation is pumped to a clarifier tank.
- From the clarifier tank it is pumped into the final tank which then is discharged into the regional sewage authority.

73% Reduction In FOG's levels in Sludge Holding /Mixing Tank:

- Reduced From 98,300 To 26,800- mg/Kg-Dry

69% Reduction in FOG's in Belt Press Cake:

- Reduced From 180,000 To 55,600- mg/Kg-Dry.

76% Reduction In FOG's- Belt Press Filtrate:

- Reduced 67 to 15.8- mg/Kg-Dry.

62% Reduction In FOG's- Effluent Discharge:

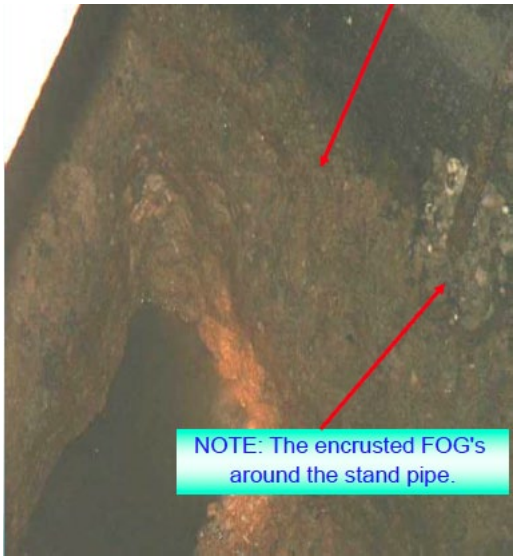
- Reduced 67 to 15.8- mg/Kg-Dry.

55% Reduction In TSS- Effluent Discharge:

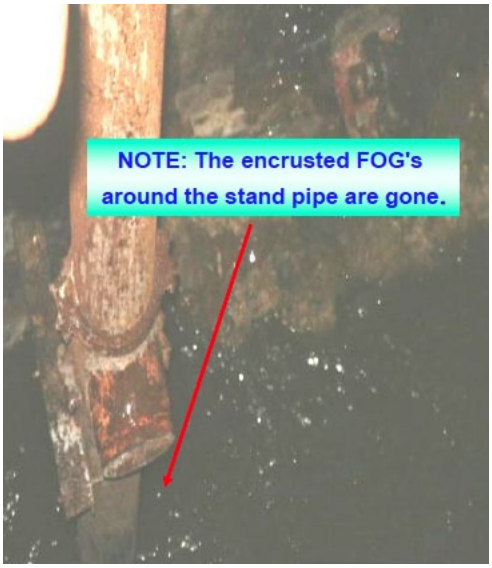
- Reduced from 250 TO 113 mg/L

Case Study 5 - 60 MGD WWTP Influent Wet Well Clogged With FOG

The "Before", Fog's Coating The Walls, 14" To 18" Thick And 24 To 30" Deep.



Progress In Wet Well Four Days later

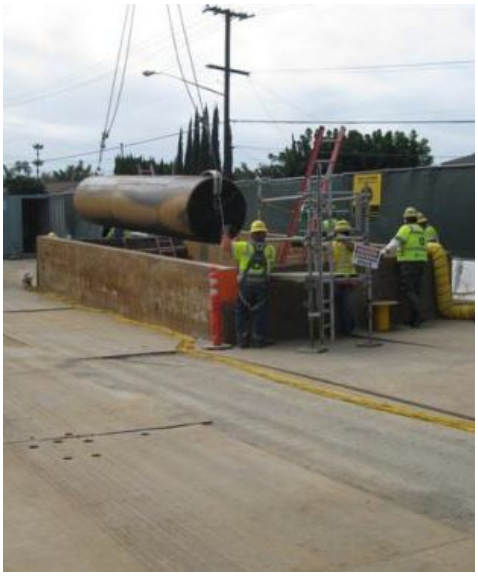


Progress In Wet Well After 4 & 7 Days

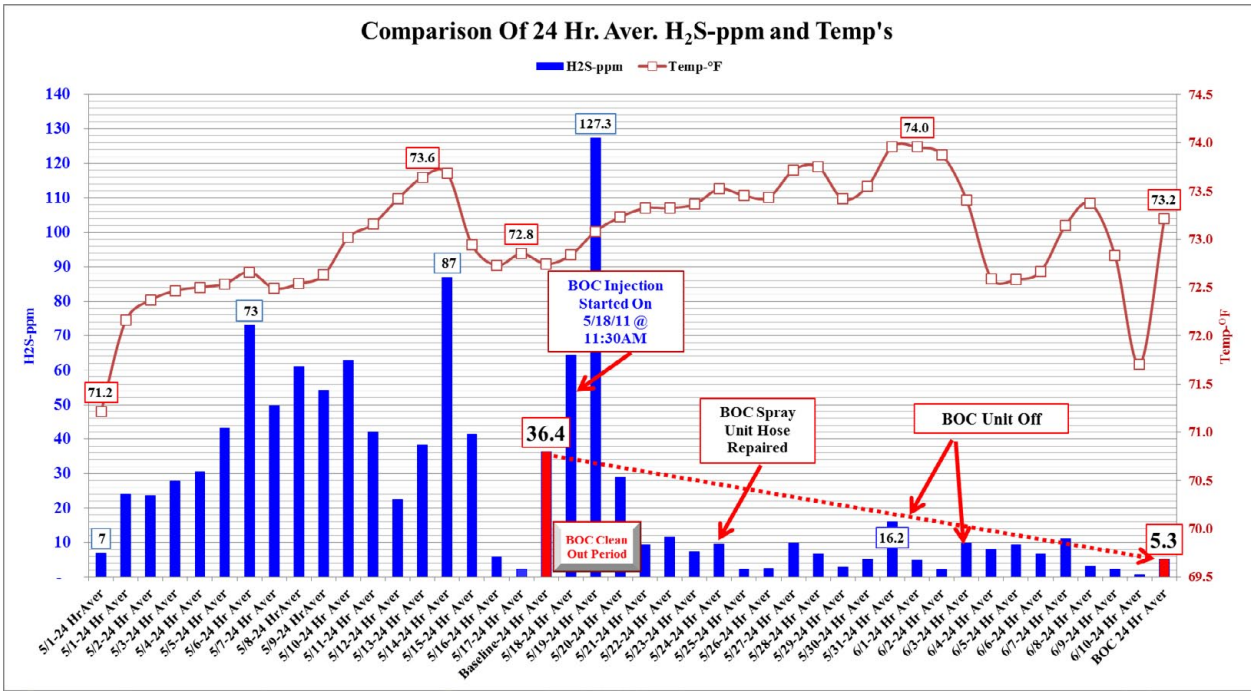
Progress In Wet Well After Day 4

Progress In Wet Well After Day 7

Case Study 6 - Kiewit Construction Sewer Relining Project

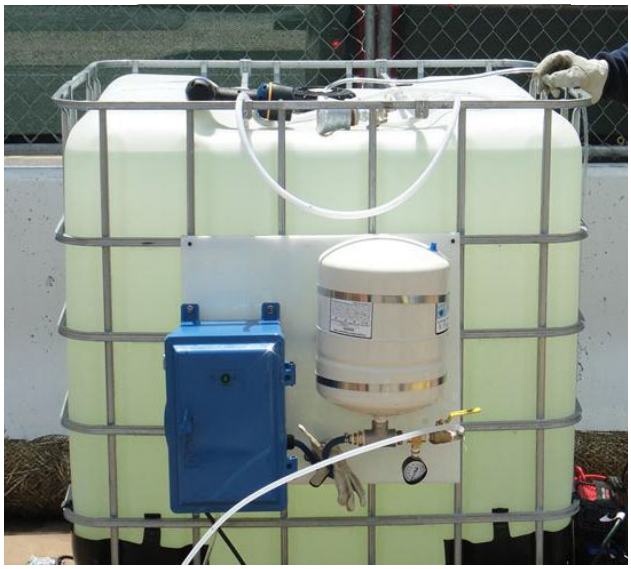


BOC Significantly Lowers H_2S Levels

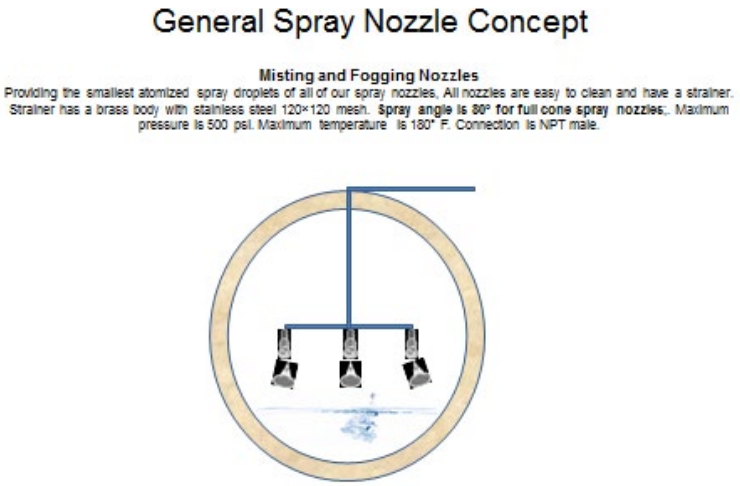


Portable Dispensing System for Odor and H_2S Control

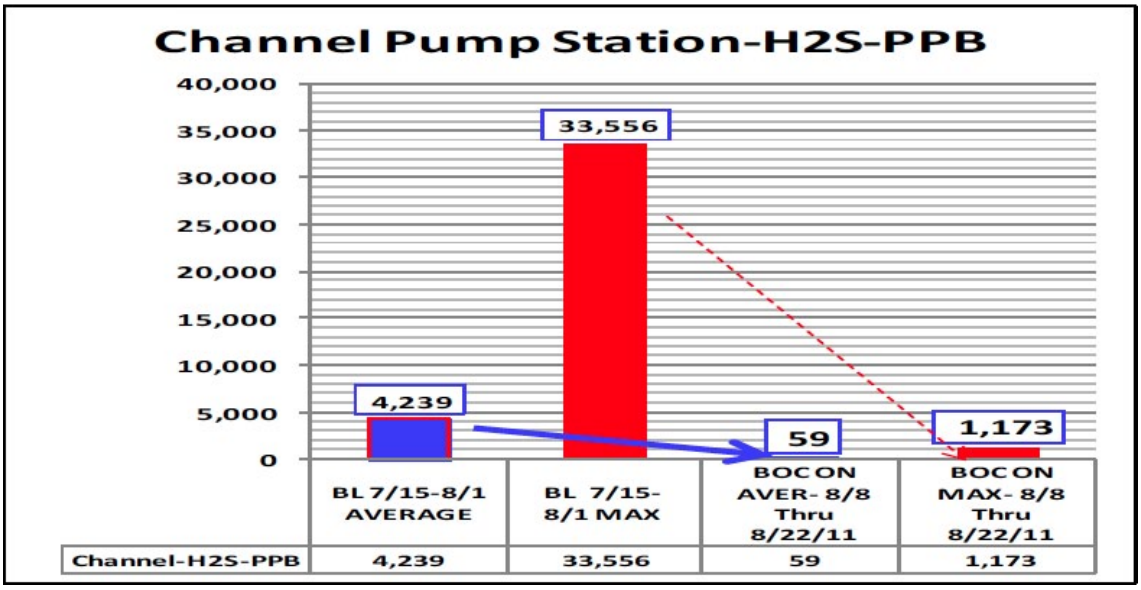
1,000 Liter ESP Solution Tote Bin



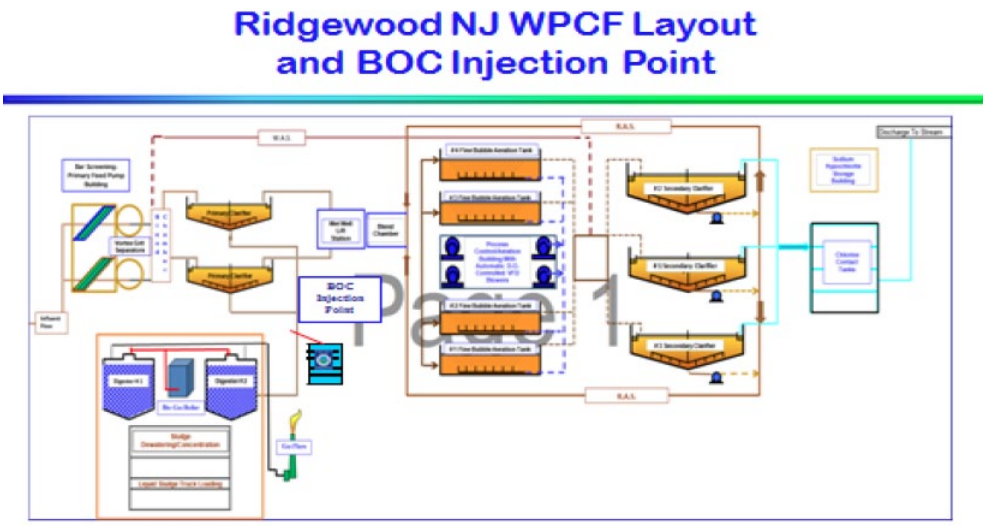
Spray Nozzle



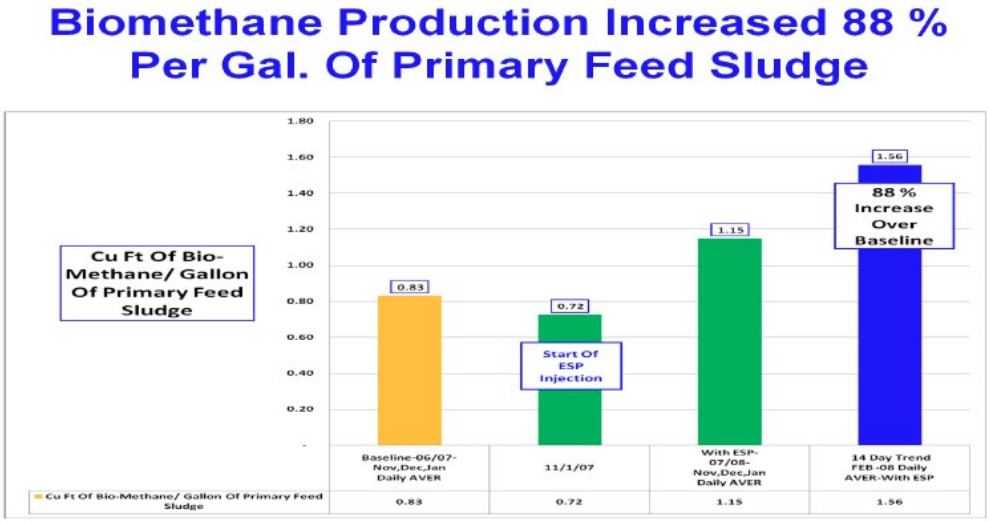
Case Study 7 - BOC Reduces H_2S In San Francisco Collection System 5 Miles From Pump Station Injection Point



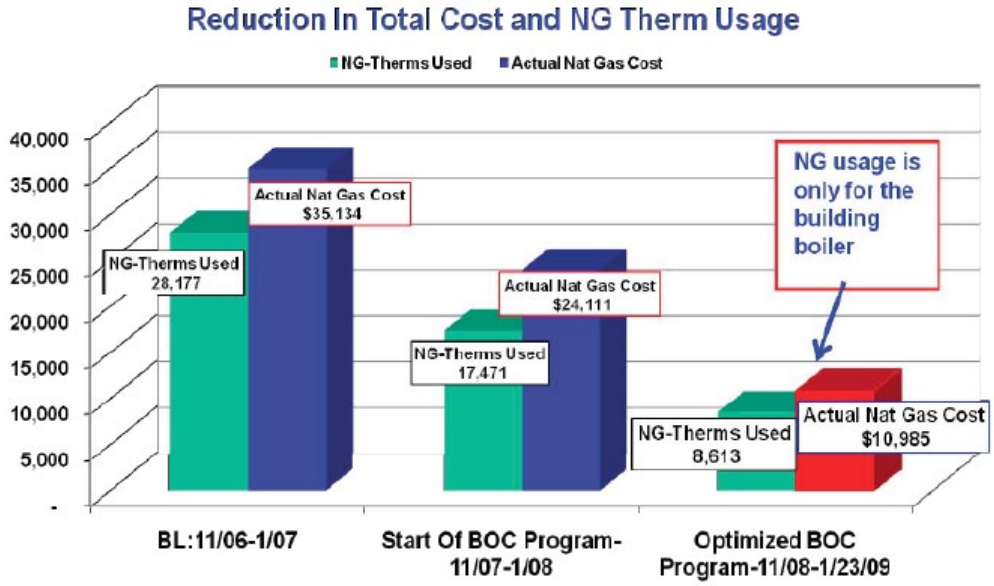
Case Study 8 - BOC Treats Entire Wastewater System-3.0 MGD, 25,000 People



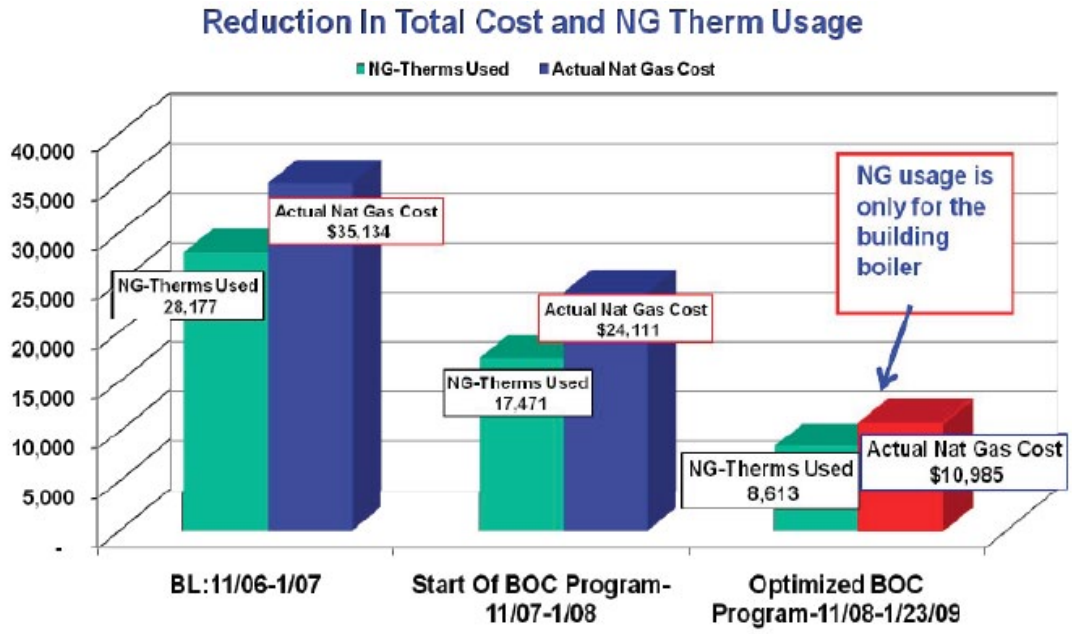
Increased Biogas Production-Municipal AD Systems



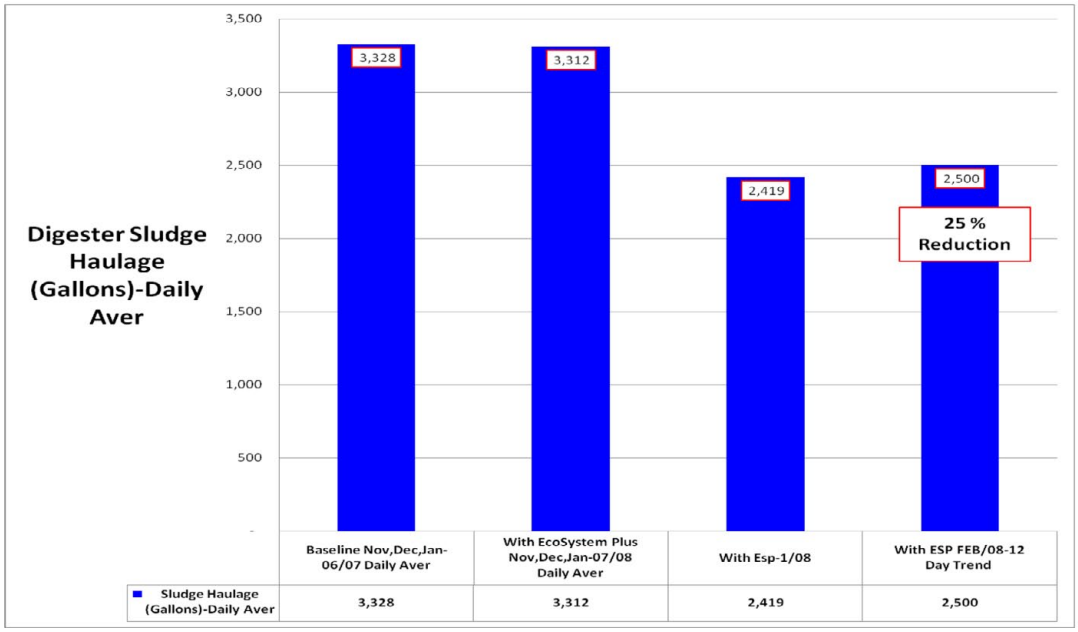
BOC Treatment Lowers Natural Gas Usage



Reduces Secondary Aeration Cost By 30%



WWTP Sludge Hauling Volume Reduced 25 %



- Eliminate Odor & Slime Layers
- Control H_2S & Corrosion
- Eliminate Grease Blockages & Fogs
- Maintain High Dissolved Oxygen Levels
- Replace Toxic Chemical Treatments
- Maintain Healthy Biology System Wide
- Achieve Significant Cost And Energy Savings

Tell us about your specific needs and we will design a BOC solution for your system.

Technical Discussion: Fats, Oils, and Grease (FOG) Wastes

The fats and oils produced by plants and animals are described as lipids. The term lipids describe all substances that are:

- Relatively insoluble in water but soluble in organic solvents such as benzene, chloroform, acetone, and ether.
- Related either actually or potentially to organic compounds such fatty acid esters, fatty alcohols, sterols and waxes.
- Can be used as a source of energy and carbon to support the metabolism of a variety of different organisms.

The most common group of lipids encountered in nature are neutral fats (acylgycerols), which serve as the major components of energy storage in plants and animals, especially in vertebrate animals as a adipose (fat) tissue. A neutral fat or lipid molecule consists of a glycerol ($CH_2OHCH_2OHCH_2OH$) molecule to which fatty acid (RCOOH) chains have been attached by esterification to form fatty esters (RCOOR').

The most abundant neutral fats in nature are the triglycerols (triacylglycerol) with a fatty acid attached to each of the three hydroxyl (OH) group of glycerol. Triacylgylcerol is very insoluble in water and as a consequence cannot be degraded by wastewater treatment micro organisms until it is broken down into its components; glycerol and fatty acids. The ester bond linking glycerol to fatty acids is subject to cleavage by hydrolysis, which can be accomplished by very low pH, very high pH, or by the activity of BOCs which are also capable of cleaving ester bonds.

Lipases are a specific group of enzymes, which initiate the first step in the breakdown of lipids by cleaving the ester linkage between glycerol and fatty acids. There are also non-specific esterase's that can attach the ester bonds present in a variety of organic molecules, including some lipids.

A few substances with an esterase activity are not enzyme in the conventional sense, but still have the ability to reduce the energy required to cleave an ester bond by hydrolysis. These substances are called bio-organic catalysts (BOCs), and are thought of to function by several distinct mechanisms.

After lipids have been broken down into glycerol and fatty acids, microbial degradation of these two lipids components can take place even though they have markedly different characteristics. Once glycerol is released from a lipid it becomes very miscible in water and will not be detected by the analytical methods used for the quantitative analysis of fats, oils and greases (FOG, TOG). Due to its high solubility in water, glycerol is rapidly metabolized by wastewater micro organisms.

Concentrations of FOG contributed by the remaining fatty acids will be reduced, as the fatty acids are metabolized by micro organisms. It's currently believed that the primary mechanism for the breakdown of fatty acids is the "Beta Oxidation Sequence" (beta oxidation) or the Leloir Reaction. In beta oxidation, the beta methylene group (second from the end) is oxidized to a ketone group, followed by the removal of the two carbon fragments from the fatty acid chain. The enzyme system involved in the splitting of these two carbon fragments is Coenzyme A (CoA). The removal of the two carbon units is achieved by the formation for acetyl-CoA and an acid-CoA complex. The acetyl-CoA enters into microbial metabolism through the Krebs Tricarboxylic Acid Cycle, which eventually releases the CoA for additional reactions.

BOC will stimulate beta oxidation by

- Beta oxidation is an aerobic process and BOCs have been shown to increase the mass transfer of oxygen into fluids;
- BOCs contain some of biochemical precursors required by micro organisms to synthesize factors used in beta oxidation; and
- BOCs contain small, but detectible, concentrations of CoA.

In conclusion, the treatment of fats, oils, and greases (FOG) components, the lipids, and other non-solubilized organic wastes in wastewater with EcoCatalyst can have a number of beneficial effects. First, lipids are solubilized, preventing their accumulation on surfaces. This solubilization is part of a sequenced process in which lipid ester bonds are instantaneously cleaved, reducing the molecular structure to glycerol and fatty acids. Glycerol is water soluble and readily degradable by wastewater micro organisms. Essential fatty acids, released from the lipids, can then be metabolized through the biological processes as a high energy food in Anaerobic Digestion, increasing biogas production and source of carbon for nitrification reduction processes.

The authors would like to thank the 13th ANNUAL EPA NEW ENGLAND PRETREATMENT COORDINATORS WORKSHOP for the opportunity to present this program on BIO-ORGANIC CATALYST (BOC)-The Green Solution for Fat, Oil & Grease Pre-Treatment Programs.

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