

BIO-ORGANIC CATALYST  
THE POWER IN NATURE

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# Mechanism of Action and Municipal/Industrial Wastewater Treatment Applications

# Bio-Organic Catalyst Technology

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## **“Functionalized” Surfactant**

**Formed by proprietary reaction between:**

- Specialty nonionic surfactants (synthetic & biological)**
- Natural enzyme proteins**
- Organic Stabilizers & Minerals**

**No bacteria added**

**Non Toxic & biodegradable**

**Concentrated liquid product**

# Bio-Organic Catalyst Technology

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## 1. Solubilizes Organic Materials

Increases bacterial food source in wastewater  
Reduces volatile organics for odor control

## 2. Increases Aeration Efficiency

Formation of Microbubbles  
Reduces energy cost  
Increases biological activity  
Increases treatment plant capacity

## 3. Increases Ionic Interactions

Increases inorganic oxidation reactions  
Makes nutrients more available to bacteria

## 4. Activates Biomass

Rapid wastewater treatment

# Demonstrated Benefits

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**40% Energy Savings**

**17% to 30% Reduction in Sludge**

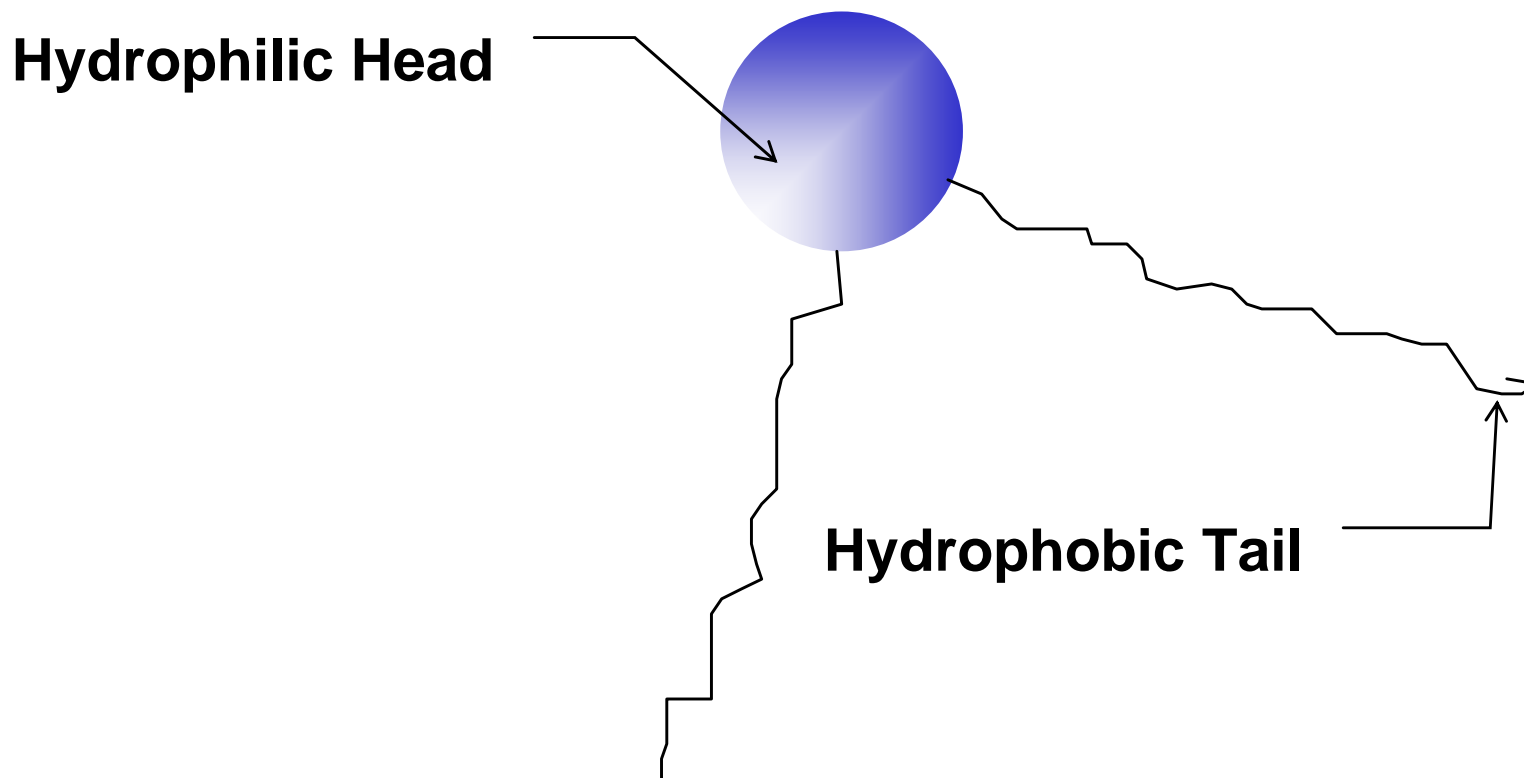
**17% Reduction in Polymer**

**Odor Elimination**

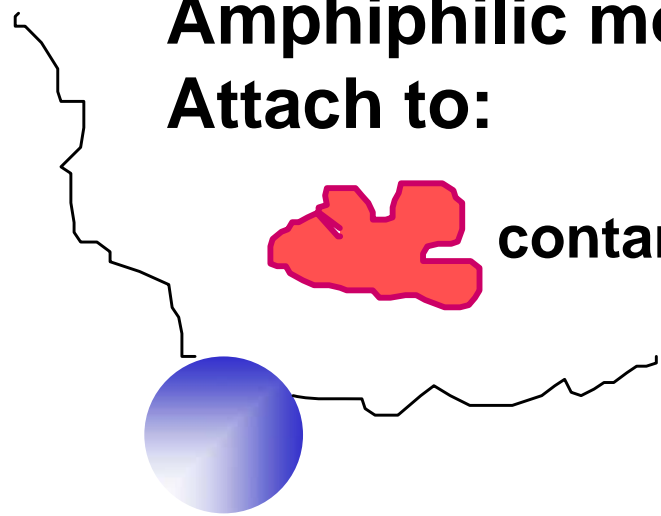
# How Does the Bio-Organic Catalyst Technology Work?

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## Amphiphilic molecule

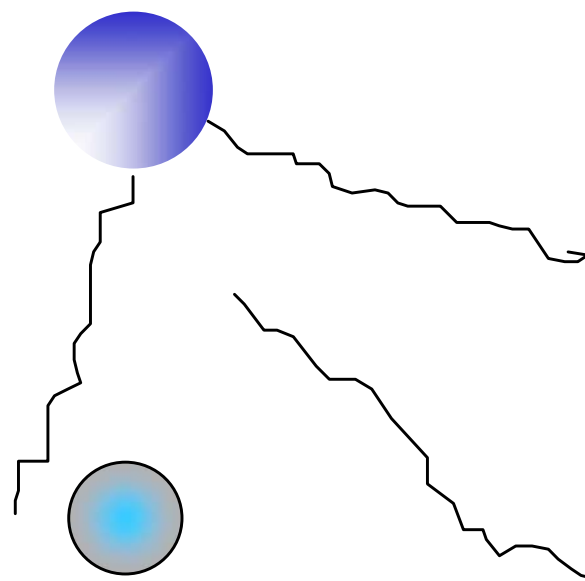
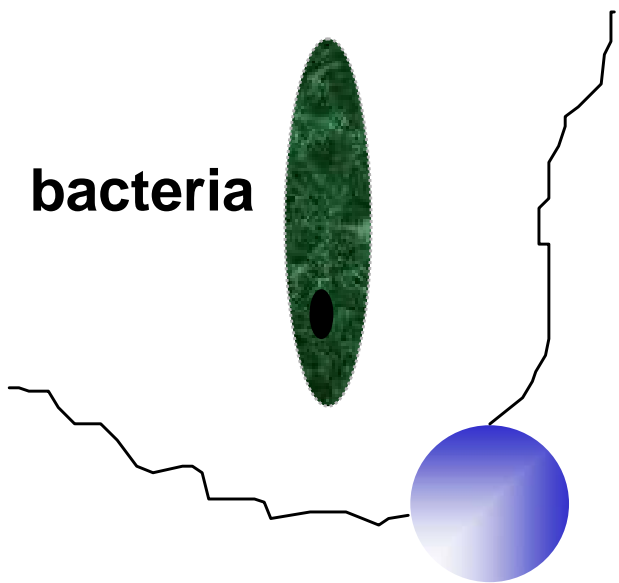


# Amphiphilic molecules Attach to:



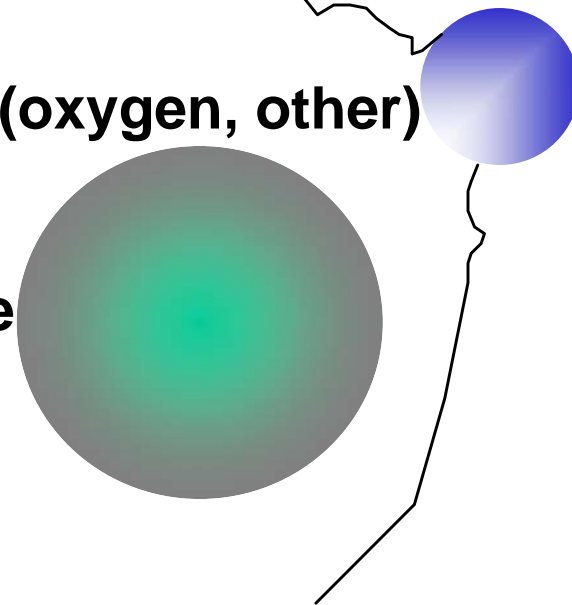
contaminants

bacteria

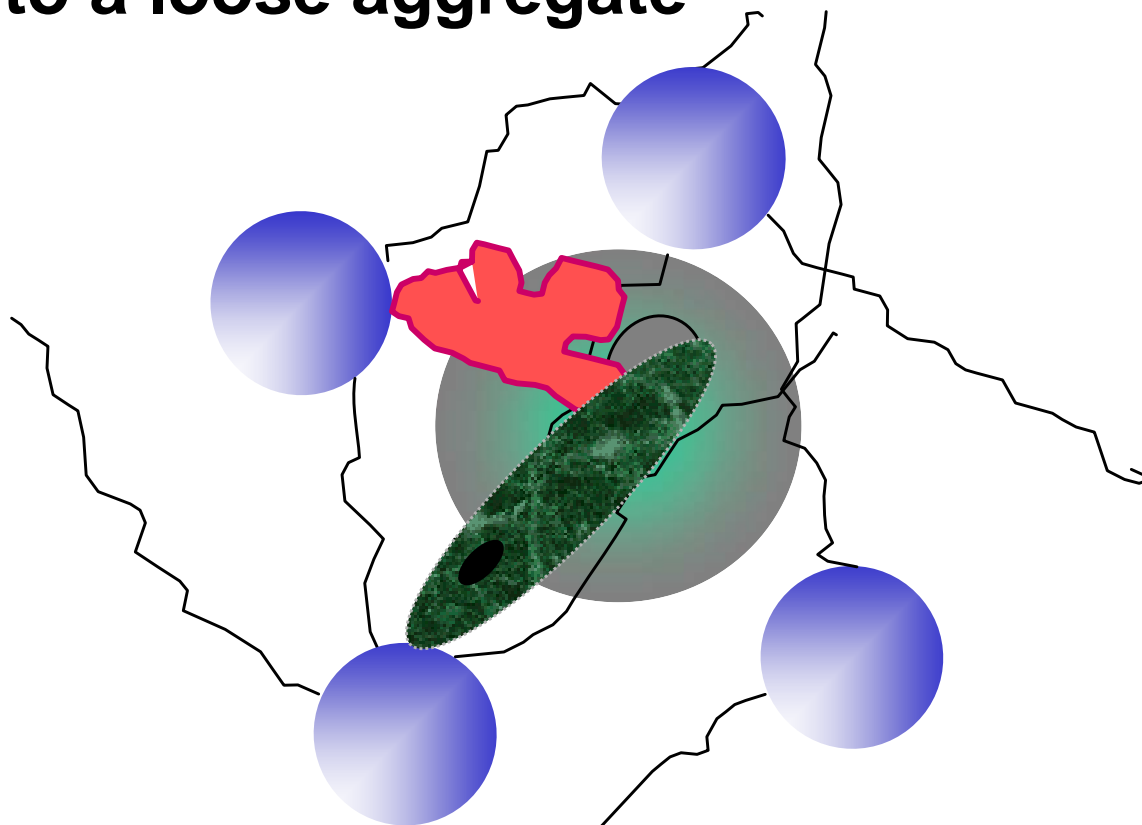


Gas (oxygen, other)

Microbubble



**Then self organize . . .  
Into a loose aggregate**



**With all the elements for a biological  
reaction together, reduction of the  
contaminant proceeds rapidly**

# Solubilization

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**Bacteria**

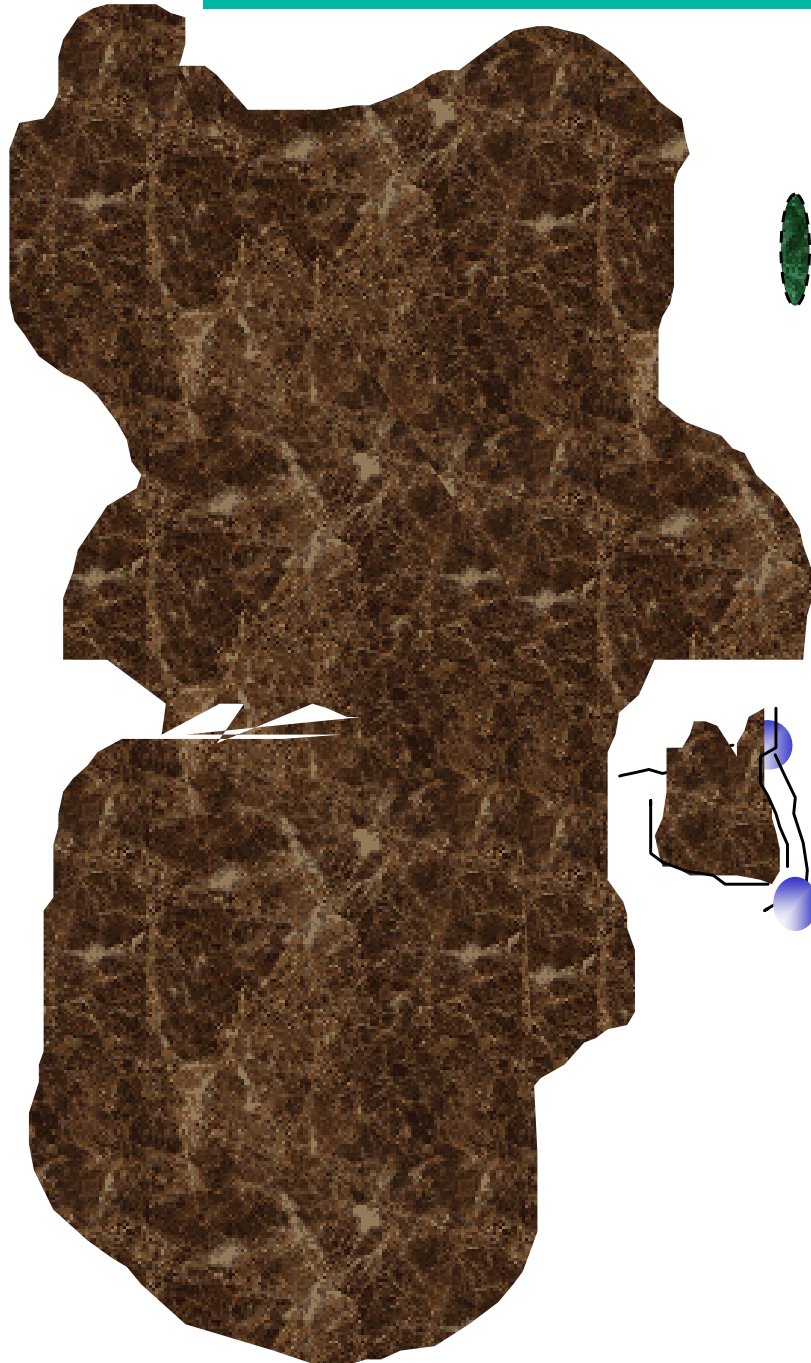
**Even a small particle of  
suspended organic matter is  
huge compared to a bacterial cell**

# Solubilization

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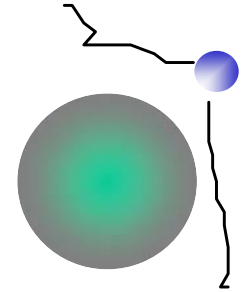
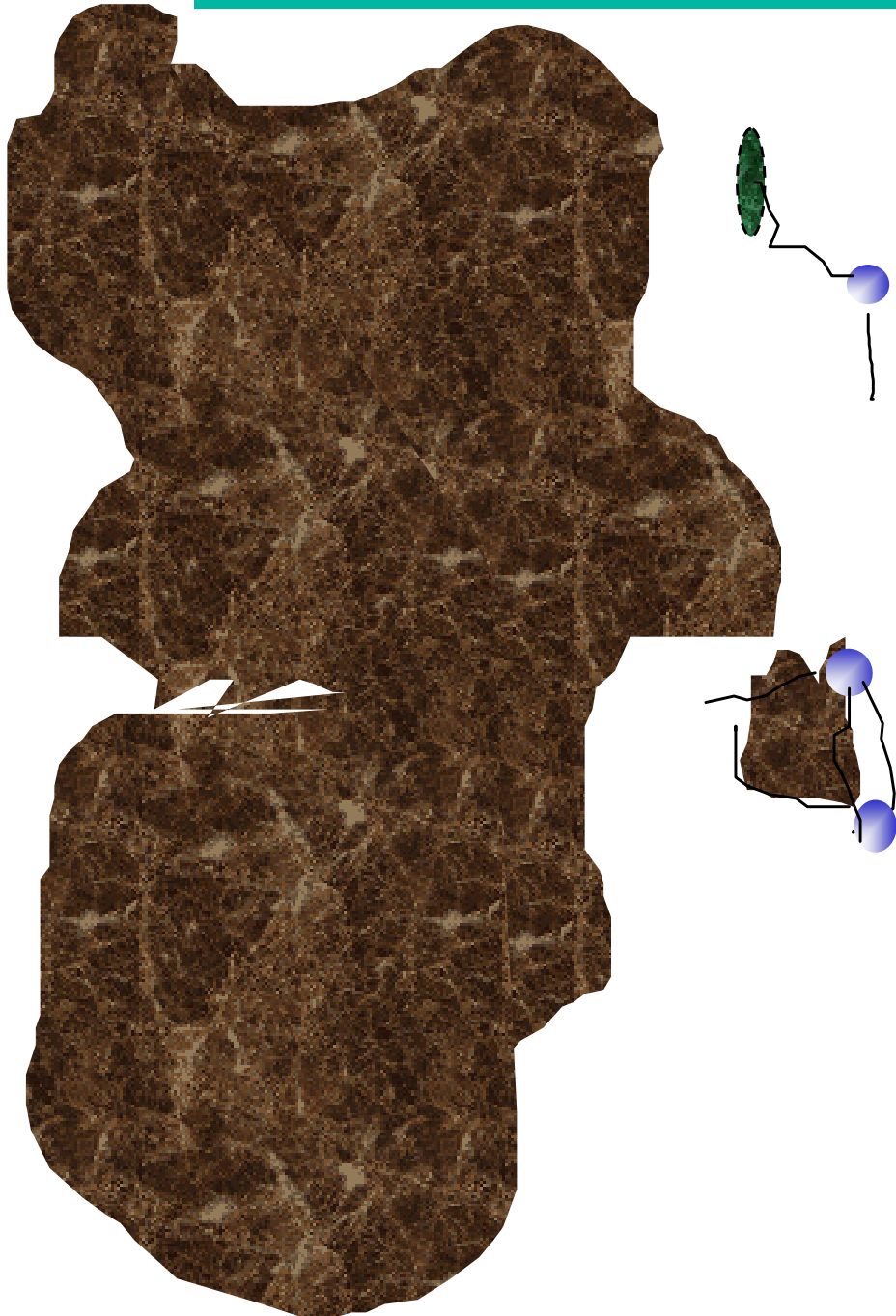


**Bacteria**

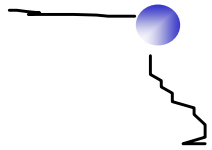


**The BOC molecule breaks off a small piece of the organic matter**

# Solubilization

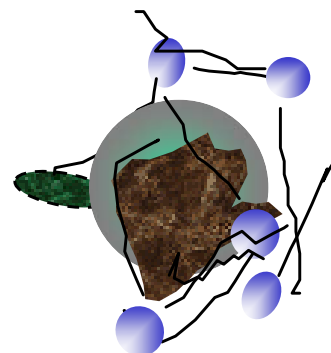
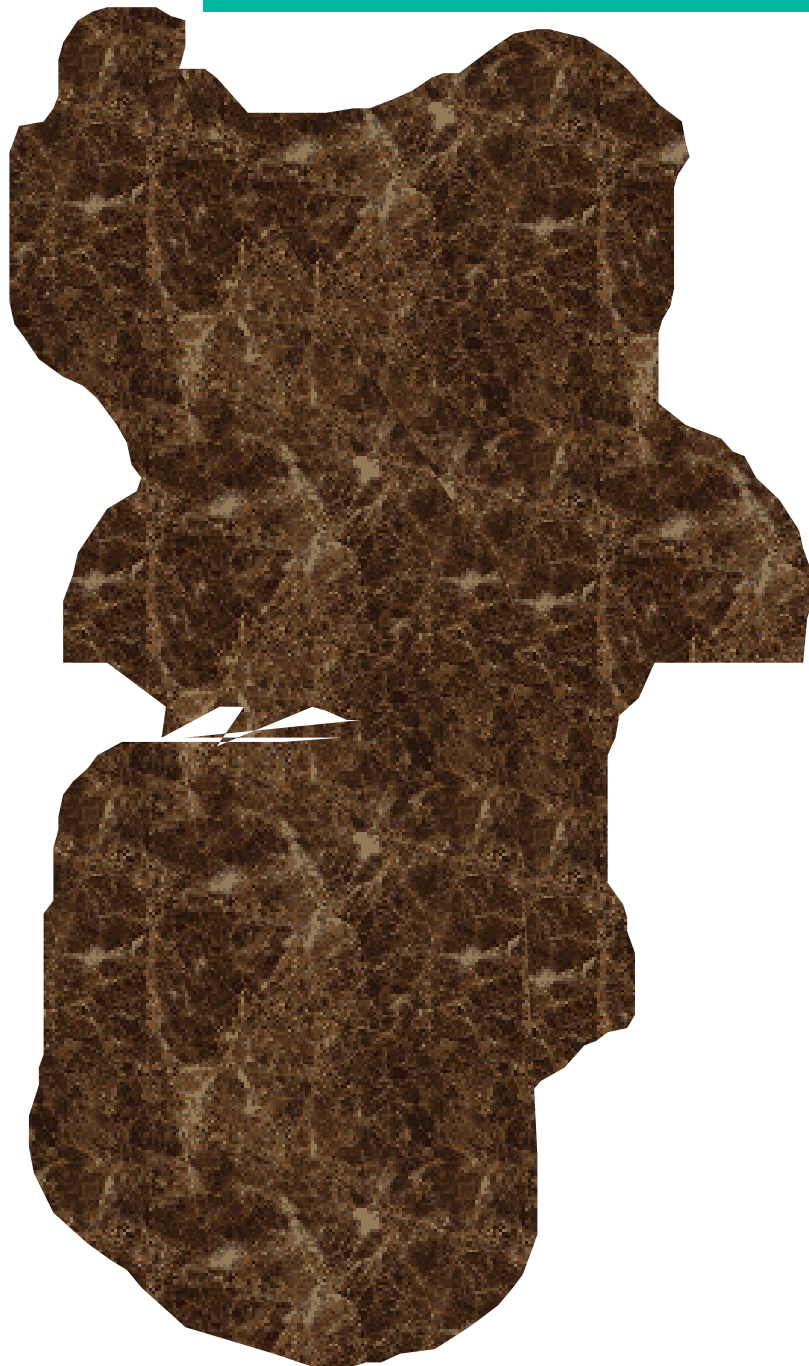


**Other BOC  
molecules attach to  
bacteria and gas**



# Solubilization

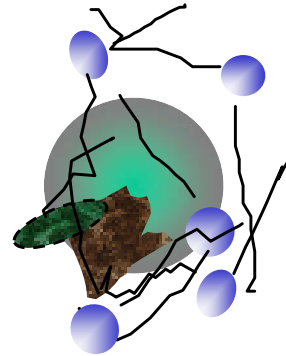
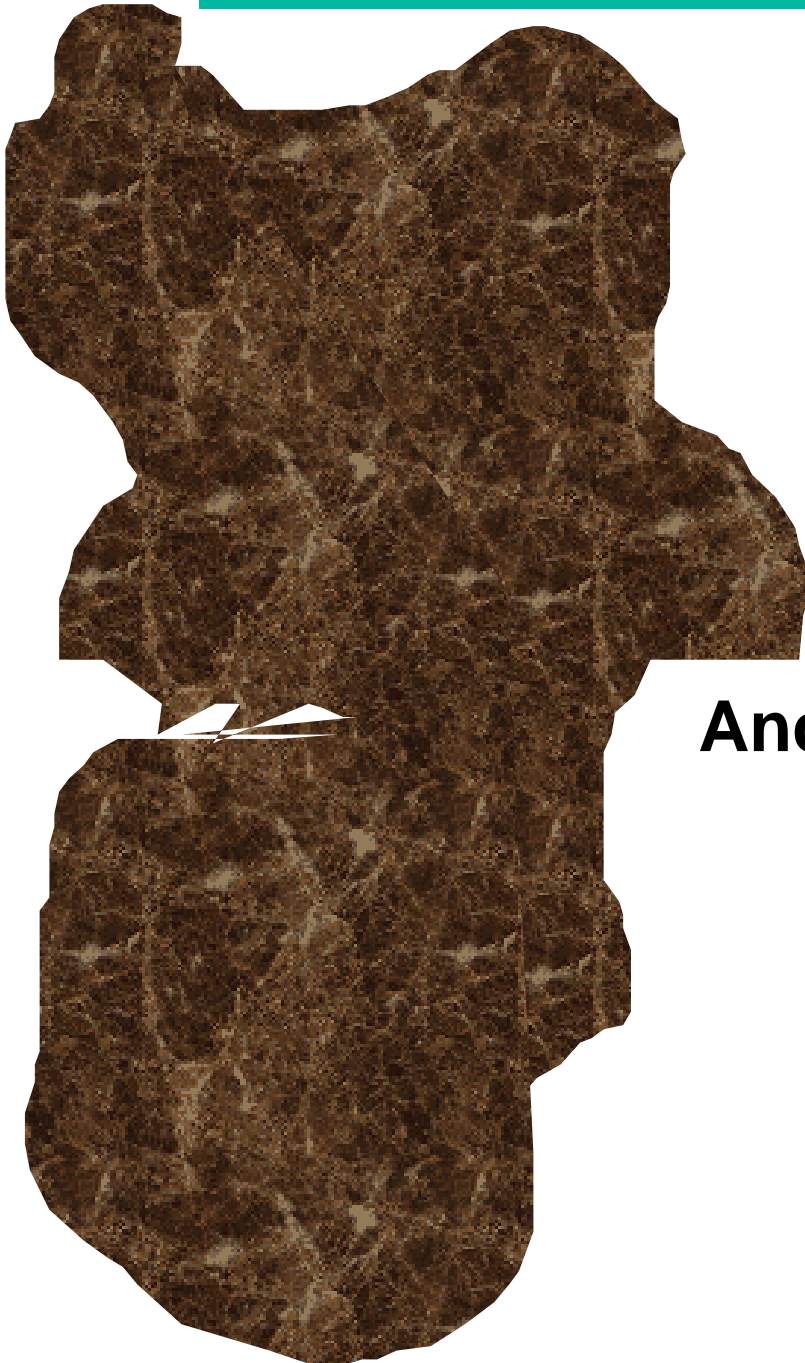
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**The BOC Aggregate forms**

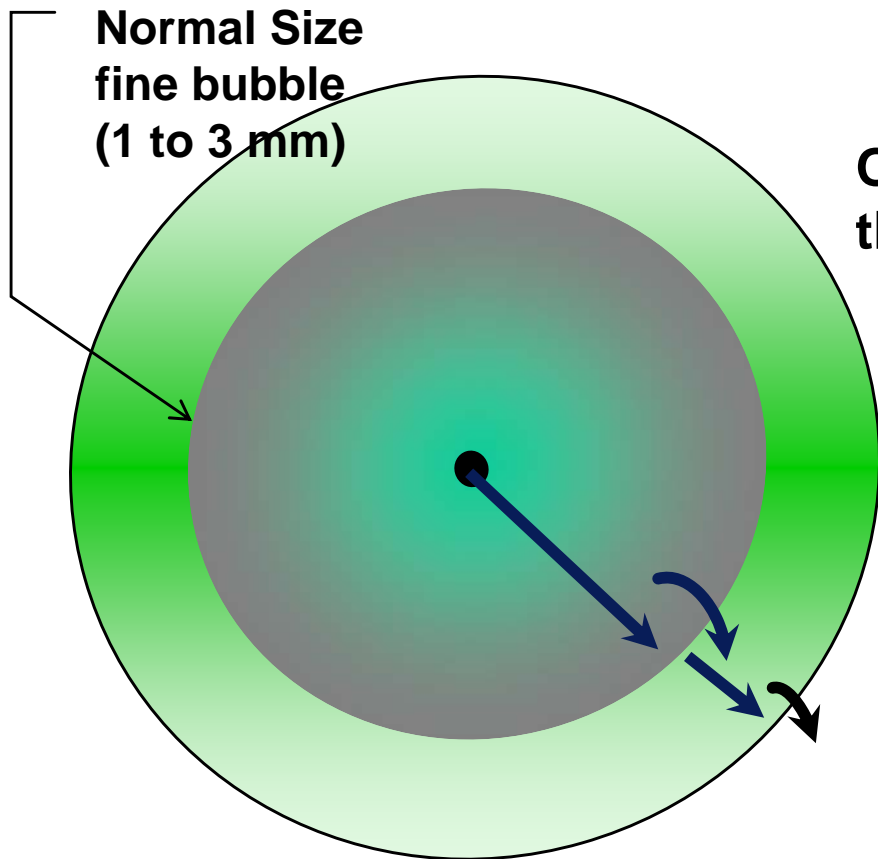
# Solubilization

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**And the organic matter is broken down**

# Increased Aeration Efficiency

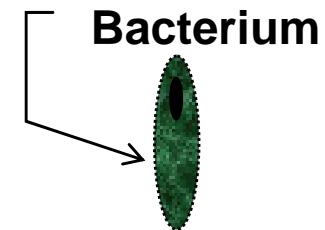


Oxygen must first move through the bubble.

Then it must cross through the film holding the bubble together

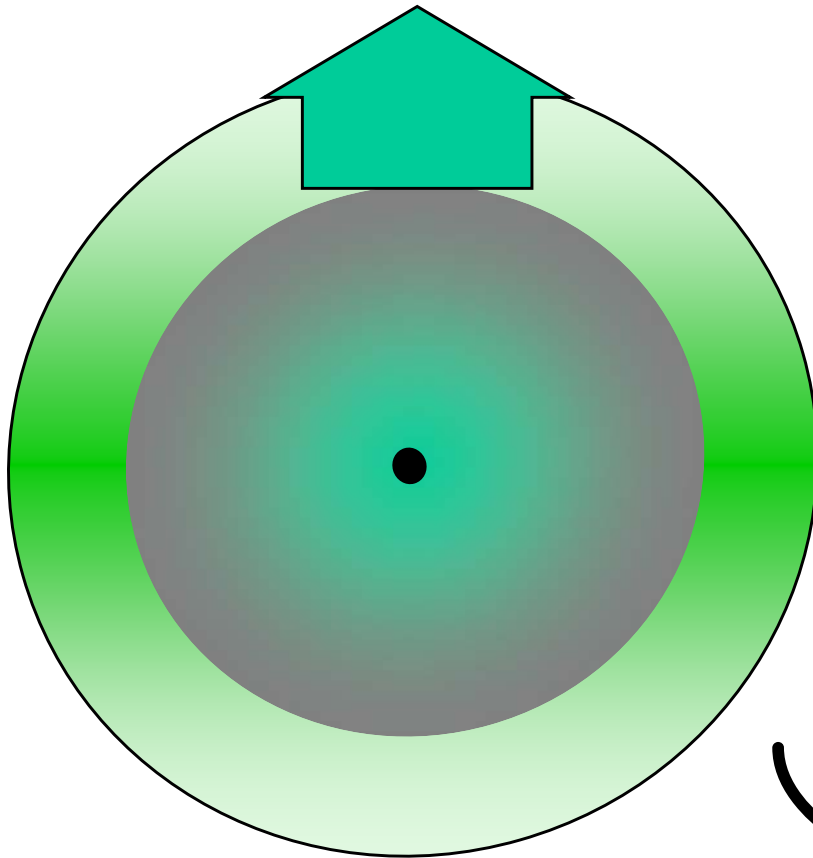
Then it must diffuse through a dense boundary layer surrounding the bubble.

Then it must pass through the film at the edge of the boundary layer.



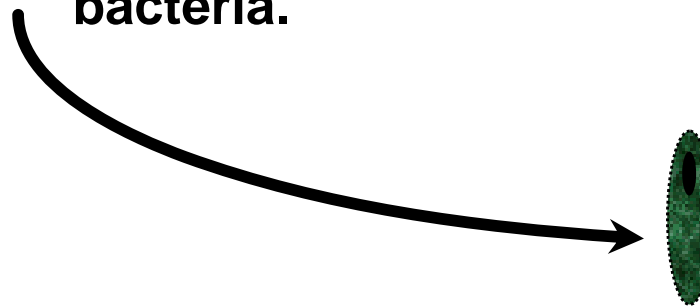
# Increased Aeration Efficiency

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All this must take place while the bubble rises quickly through the water.

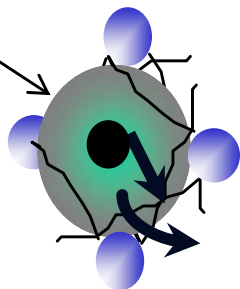
Once out of the bubble, oxygen still has to travel through the water to the bacteria.



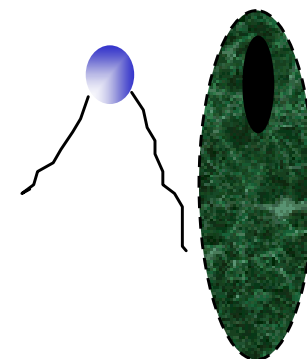
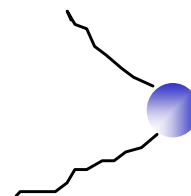
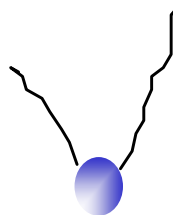
# Increased Aeration Efficiency

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Microbubble  
(25 microns)



Oxygen diffusion is enhanced because the distance from the center to the surface of the microbubble is short.



Also, the surface of the bubble is not a rigid film, but a loose structure that oxygen can pass easily through.

# Increased Aeration Efficiency

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Once outside the microbubble, other BOC molecules increase oxygen availability by aggregating with the bacteria and oxygen.



All while rising very slowly

# Accelerated Ionic Interactions

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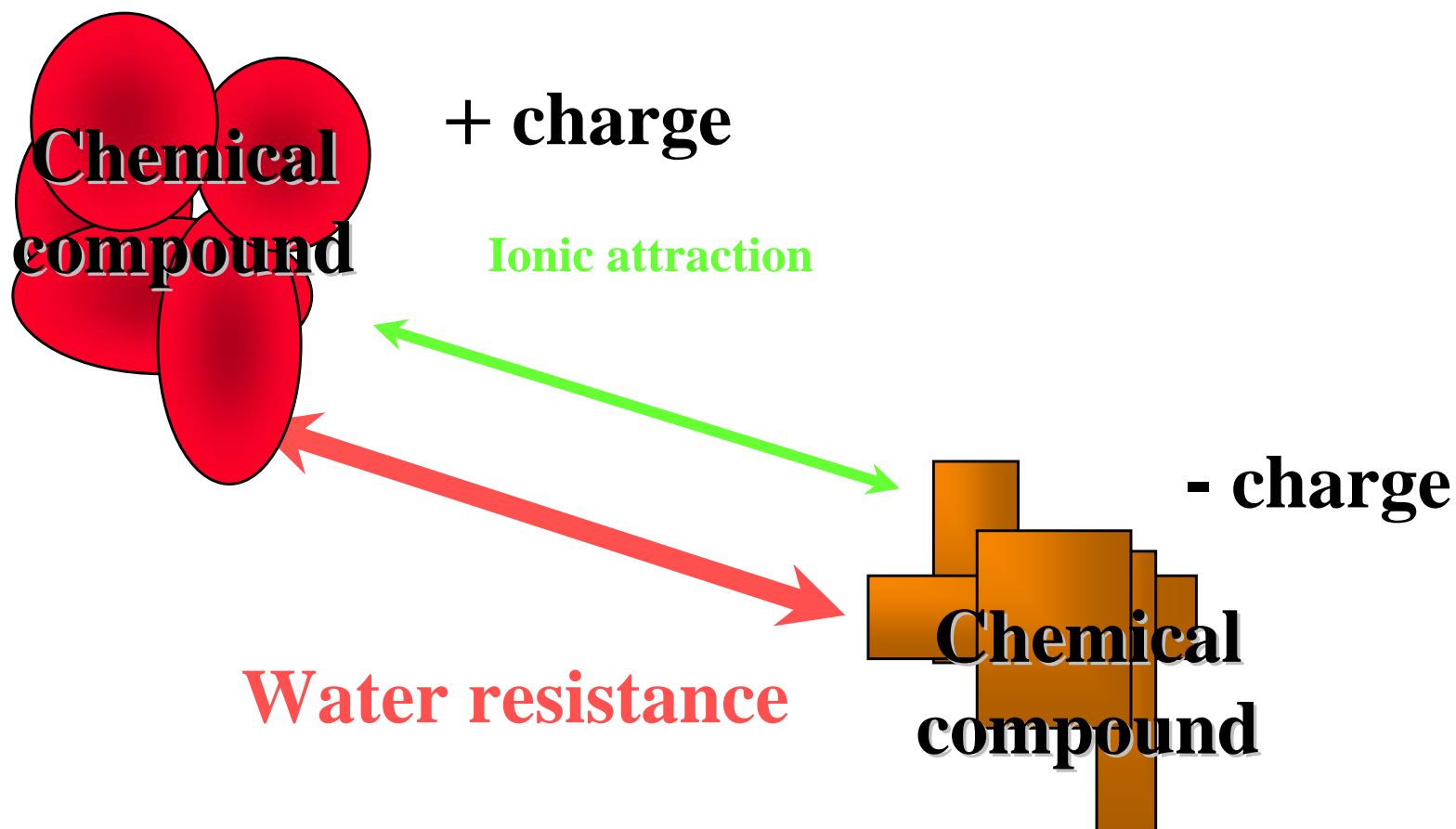
**Ionic interactions involve unlike charges. This is similar in many ways to opposite magnetic charges attracting each other.**

**Water between particles adds resistance to the attraction.**

**The BOC Aggregate reduces this resistance and brings particles closer together.**

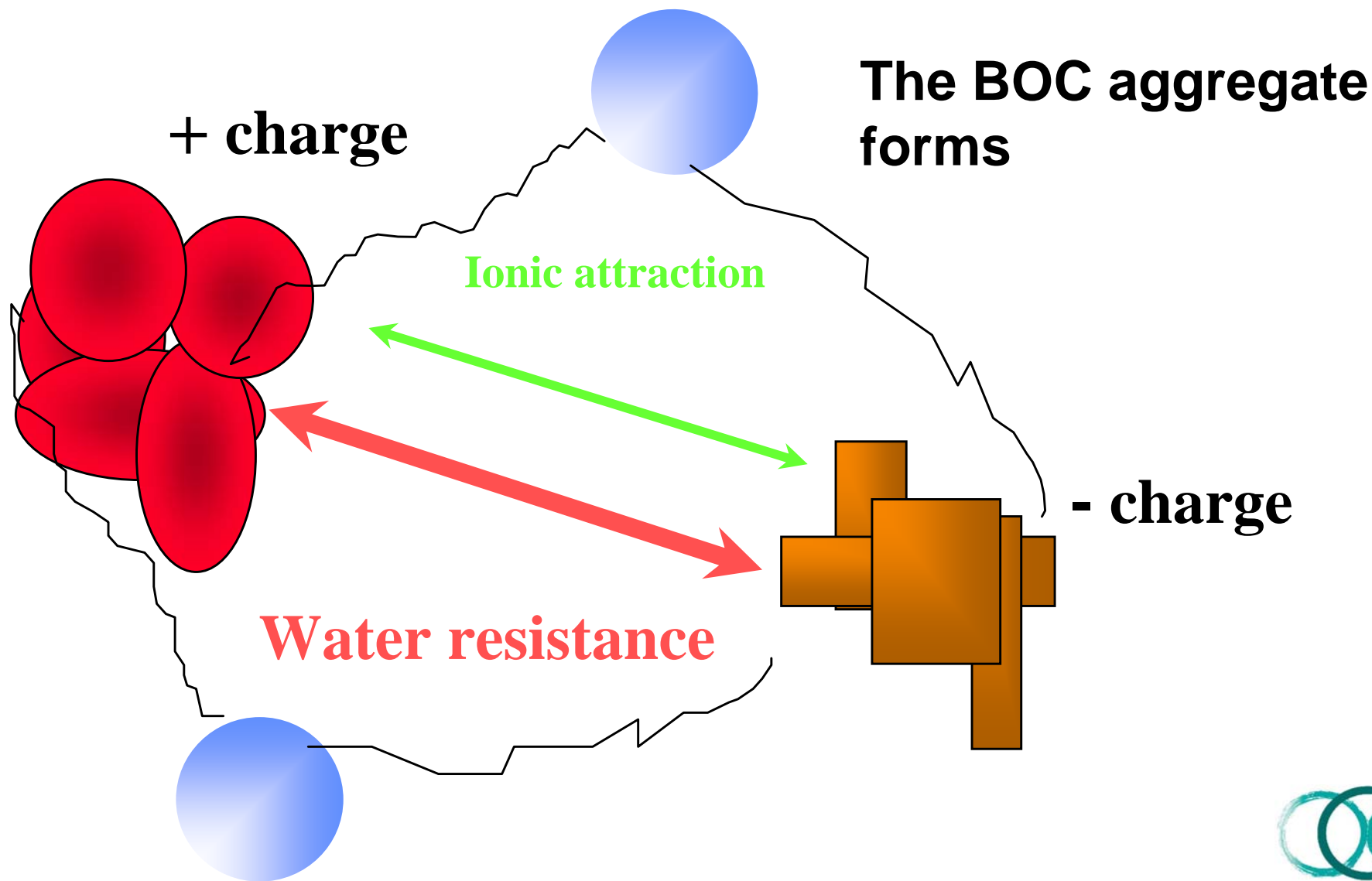
# Accelerated Ionic Interactions

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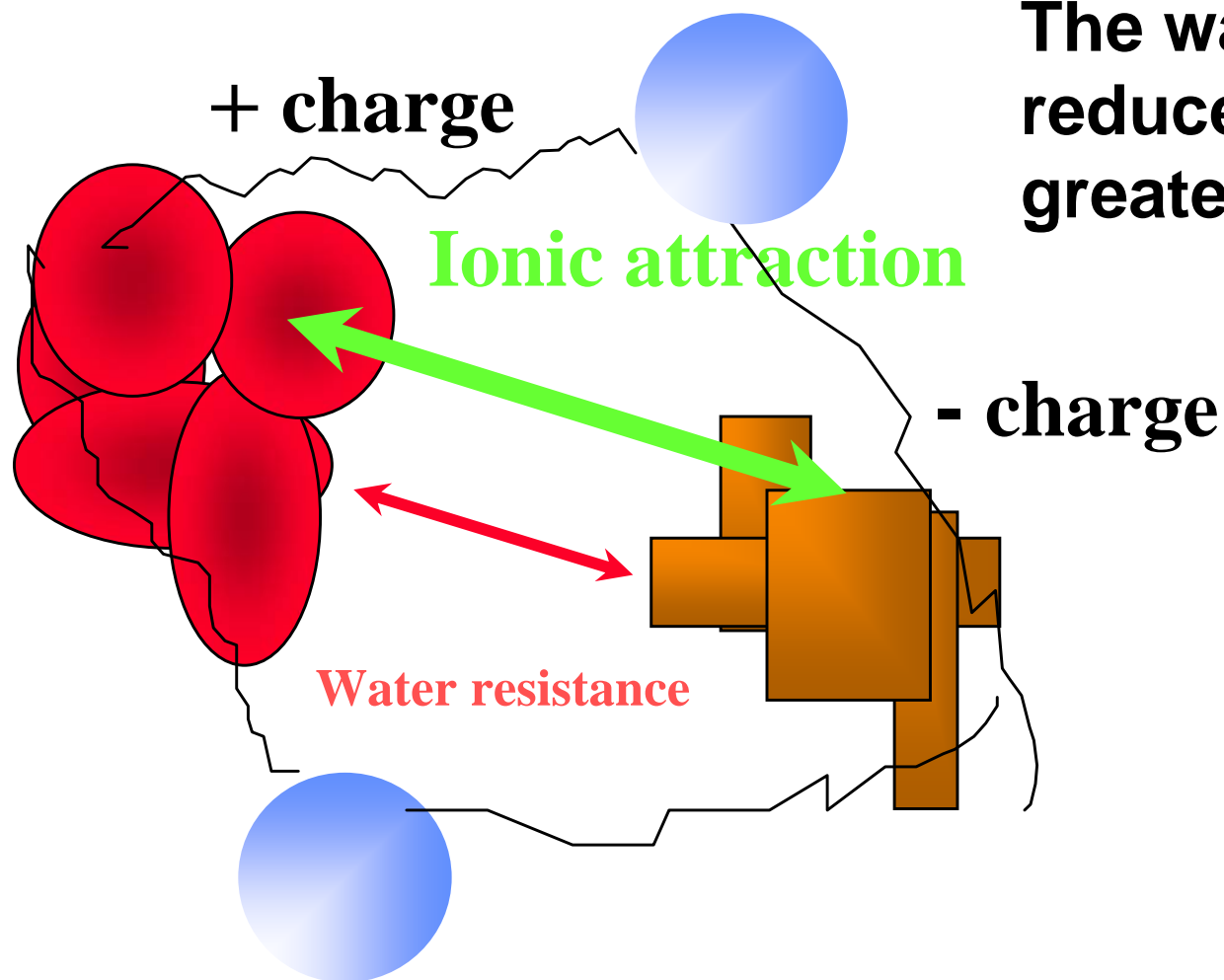
# Accelerated Ionic Interactions

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# Accelerated Ionic Interactions

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The water resistance is reduced, leading to greater ionic attraction

# Activates Biomass

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**Controlled Laboratory Test**

**Independent Laboratory\***

**Microorganisms from Municipal Wastewater Plant**

**100 ppm Bio-organic Catalyst**

**48% increase in biodegradation in 24 hours**

**Compared to untreated control**

**\*TUV Rheinland Institute for Environmental Protection and Energy Technology**

# Comparison with Similar Products

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## BOC

- Reactive with many substances
- Can work alone
- Stable
- Performs Chemical and Biological reactions
- Combines easily with other organics
- Forms Microbubbles
- Adds oxygen

## Enzyme Products

- Extremely specific
- Needs co-enzymes
- Unstable
- Limited to biological systems
- Can be irritating
- No Microbubbles
- No increase in Oxygen

# **Municipal Application: U.S.A.**

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**Fontana-Walworth, Wisconsin**

**1.0 MGD, residential/industrial wastewater**

**Very efficient, well-run plant**

**52 - week Trial**

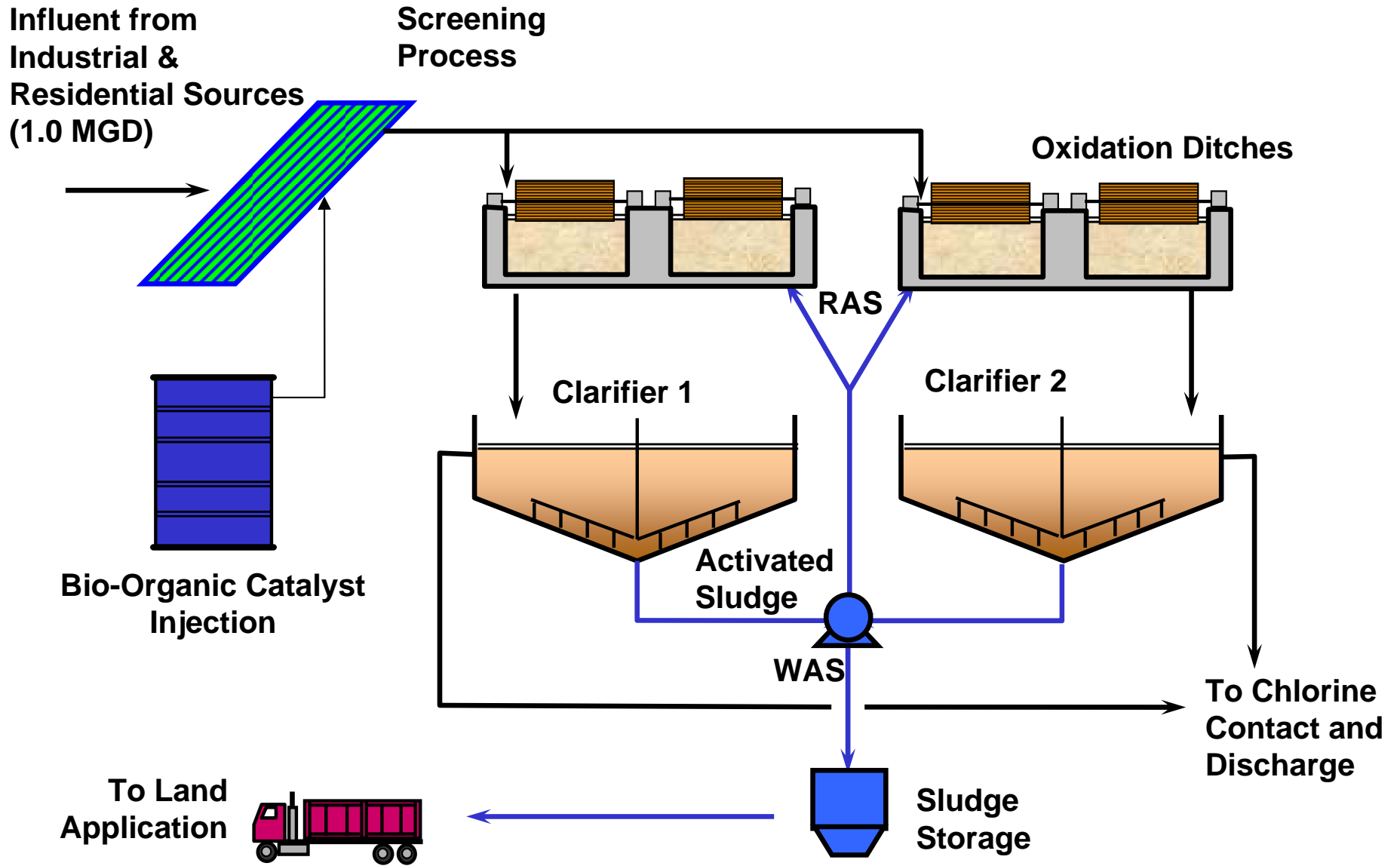
**2 ppm Bio-organic Catalyst**

**28% reduction in Wasted Sludge**

**16% reduction in BOD (34% during peaks)**

**Odor Elimination**

**Saved \$3 million for expansion**

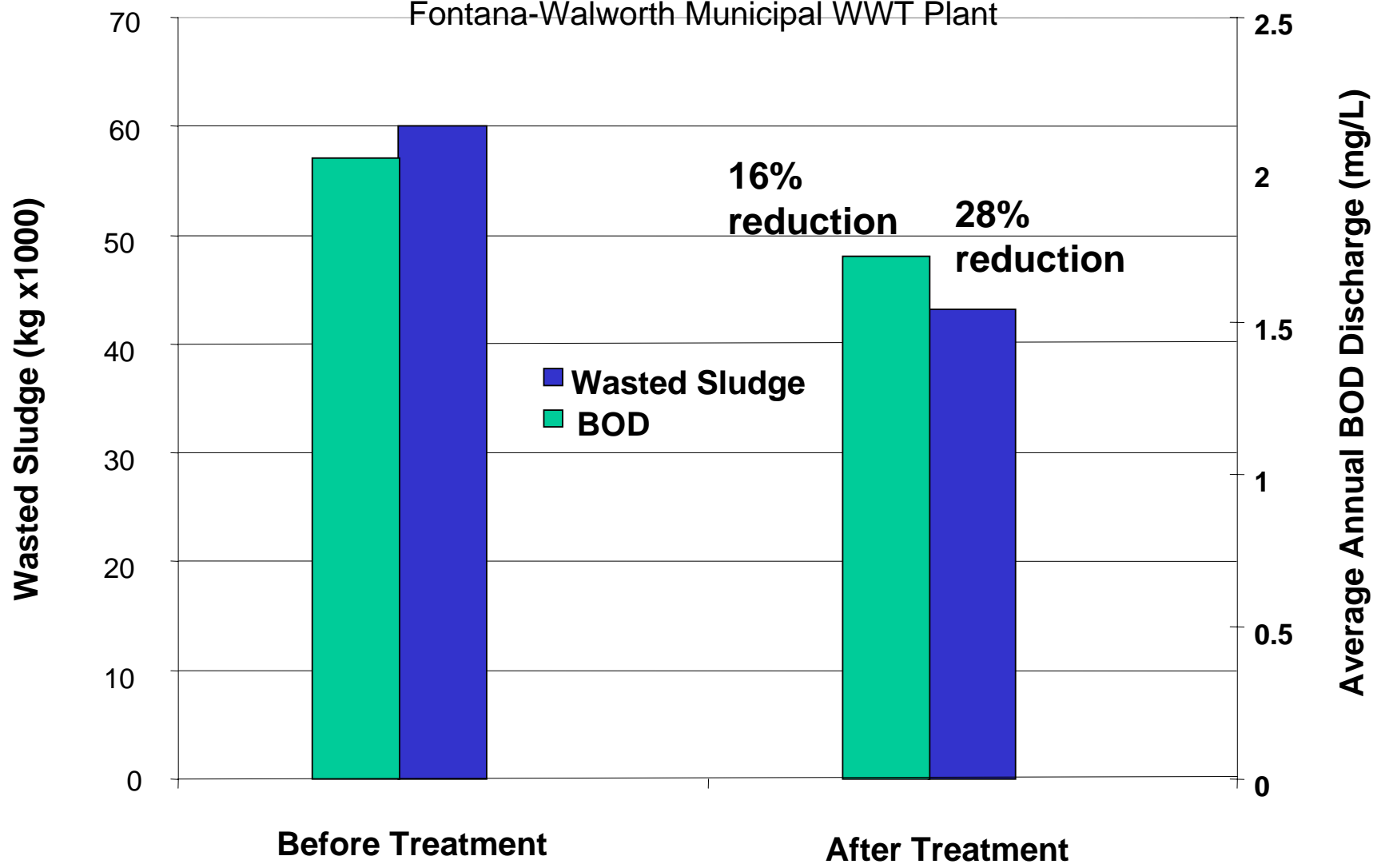


# Fontana-Walworth Municipal WWT Plant

Trial Treatment Arrangement

# Treatment Results

Fontana-Walworth Municipal WWT Plant



# **Municipal Application: U.S.A.**

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**Westerly, RI (AquaSource, Inc.)**

**2.1 MGD, residential/industrial wastewater**

**Primary/Secondary Treatment**

**Mechanical Aerators**

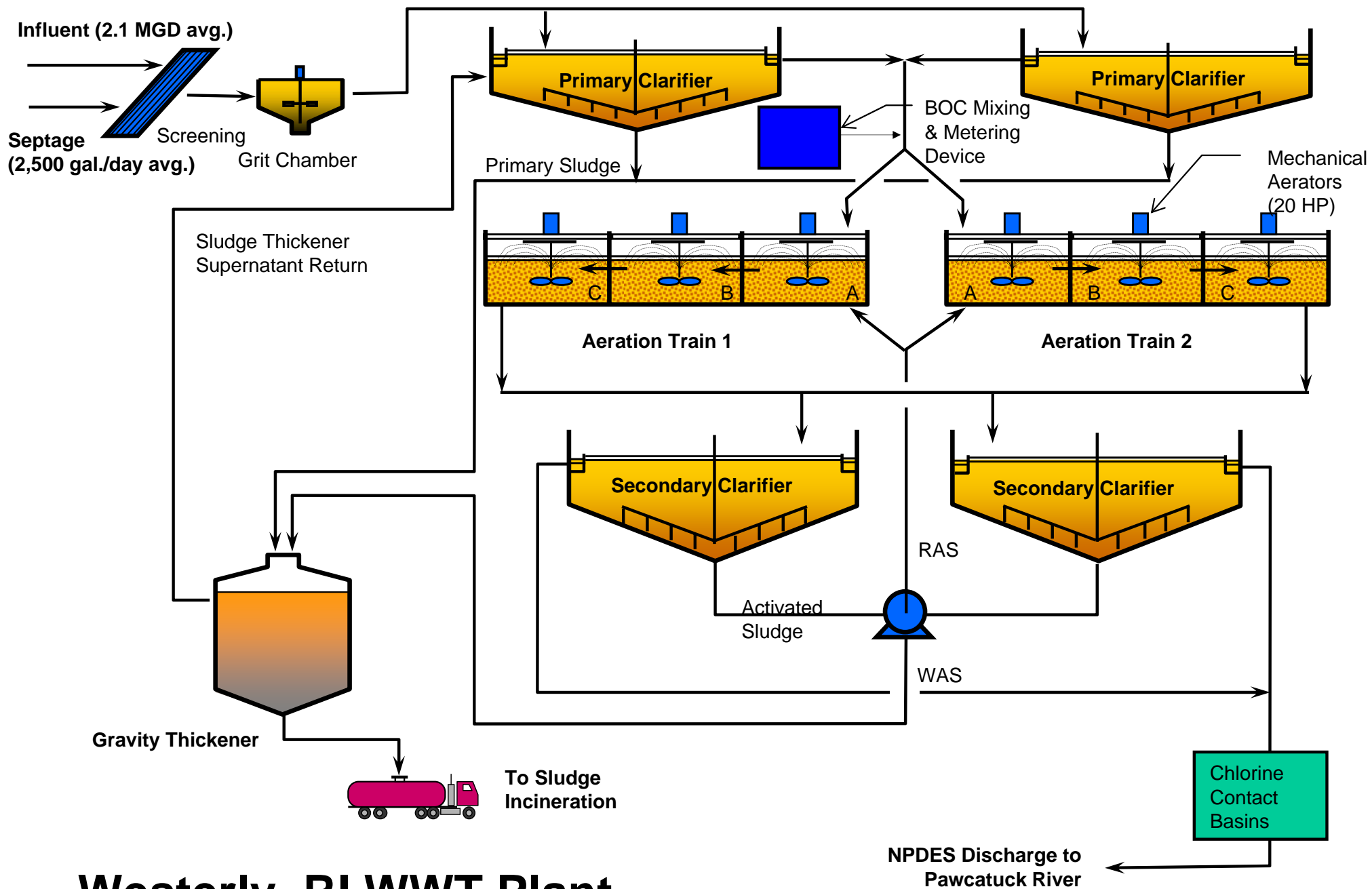
**6 - week Trial**

**2.5 ppm Bio-organic Catalyst**

**Higher DO with better dispersion**

**38% to 50% reduction in aeration energy**

**39% to 43% reduction in WAS**



# Westerly, RI WWT Plant

## Treatment Arrangement

# Municipal Application: Sweden

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**Tjustvik**

**0.62 MGD, residential/industrial wastewater**

**Sequencing Batch Reactor (SBR)**

**8 - week Trial**

**1.5 ppm Bio-organic Catalyst (average)**

**40% reduction in aeration energy**

**25% reduction in phosphorus**

**Compared to untreated control**

# Municipal Application: Sweden

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**Karlstad** (Southwest, 5,300 PE)

**0.32 MGD, residential/industrial wastewater**

**Activated Sludge**

**12 - week Trial**

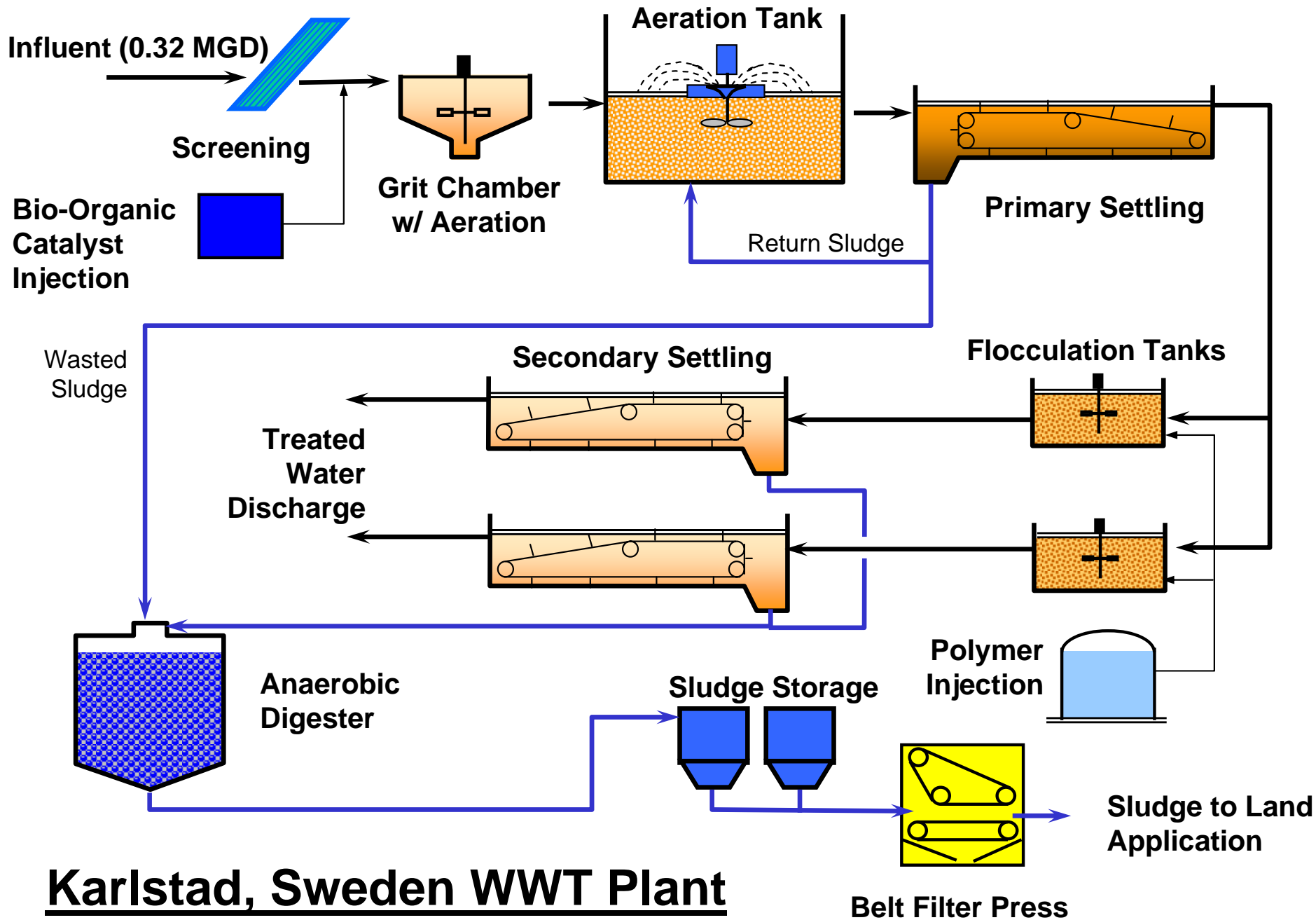
**3.1 ppm Bio-organic Catalyst (average)**

**42% increase in dissolved oxygen**

**19% reduction in BOD**

**17% reduction in Polymer usage**

**17% reduction in sludge volume**



# Karlstad, Sweden WWT Plant Trial Treatment Arrangement

# Municipal Application: Germany

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**Herten-Westerholt** (Ruhr Region, West Central, 40,000 PE)

**1.59 MGD, residential/industrial wastewater**

**Activated Sludge w/ Anaerobic Sludge Digester**

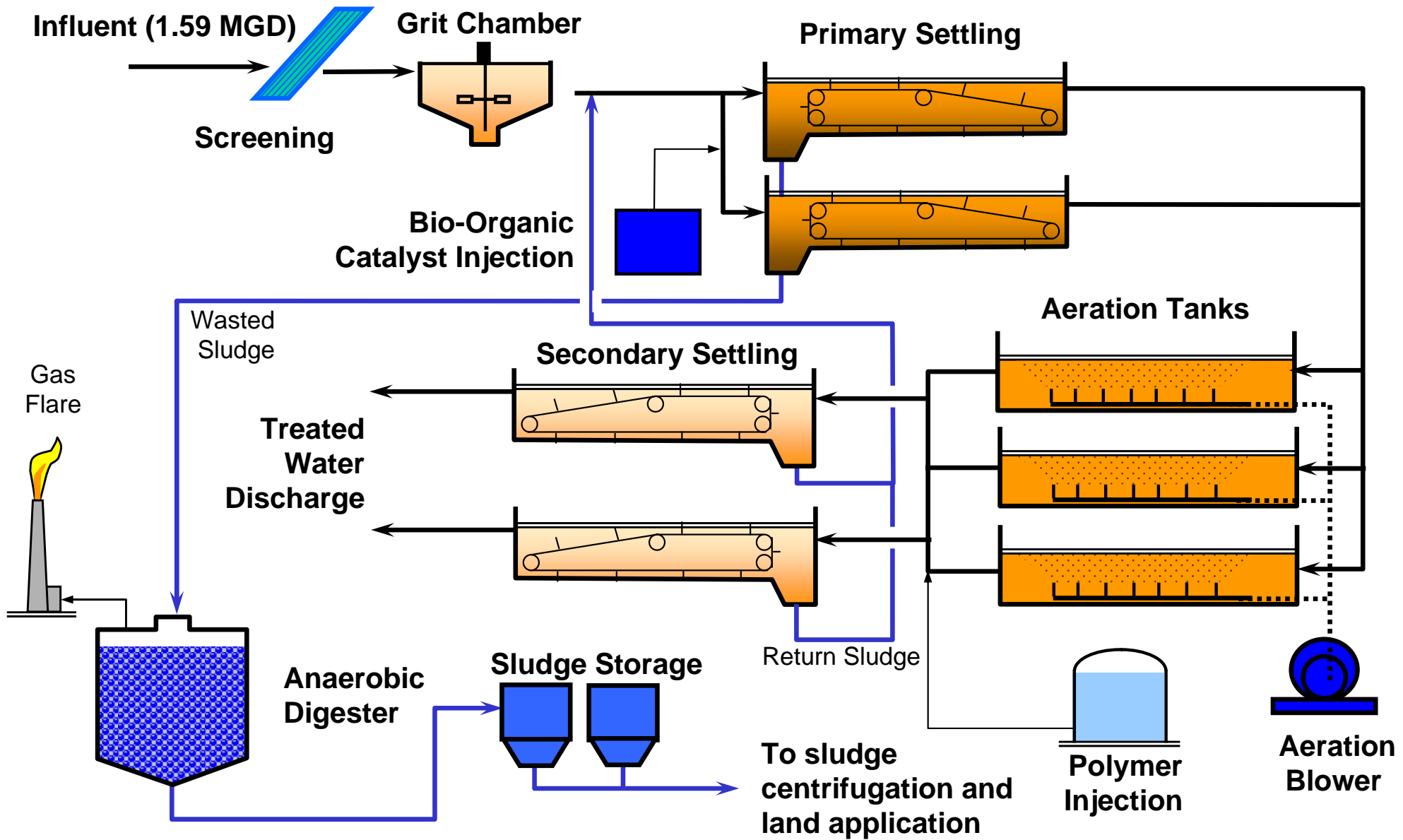
**5 - week Trial**

**5 ppm Bio-organic Catalyst (reduced to 2.8 ppm)**

**40% reduction in aeration energy**

**30% reduction in sludge**

**No reduction in methane production**



# Herten-Westerholt, Germany WWT Plant

Trial Treatment Arrangement

# Food Processing Application

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**Kikkoman Soy Sauce Brewery**

**185,000 gallons/day**

**52 - week Trial**

**24 ppm Bio-organic Catalyst**

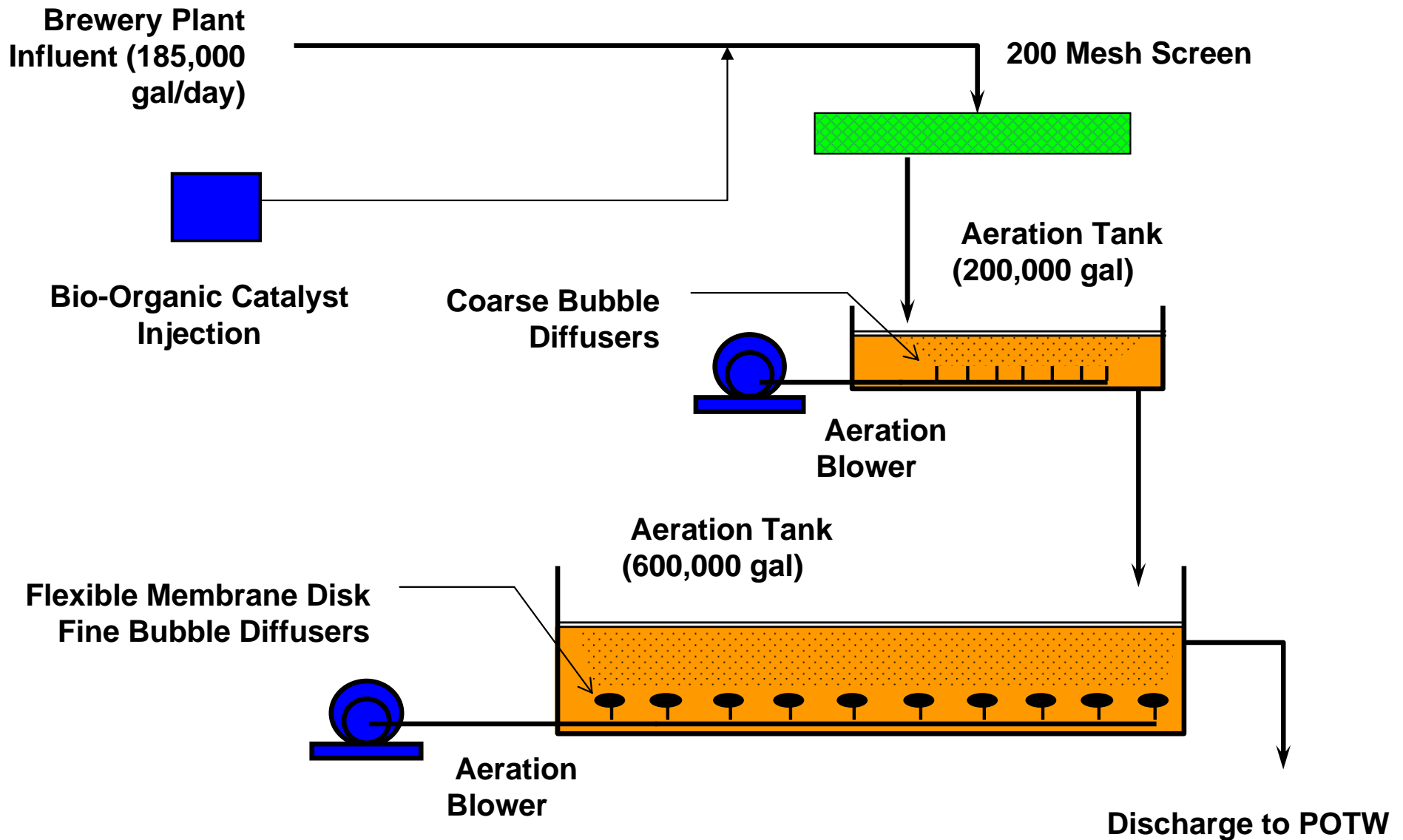
**Six-fold increase in Dissolved Oxygen**

**51% reduction in Suspended Solids**

**48% reduction in BOD**

**Odor Elimination**

**Saved \$1 million for expansion**

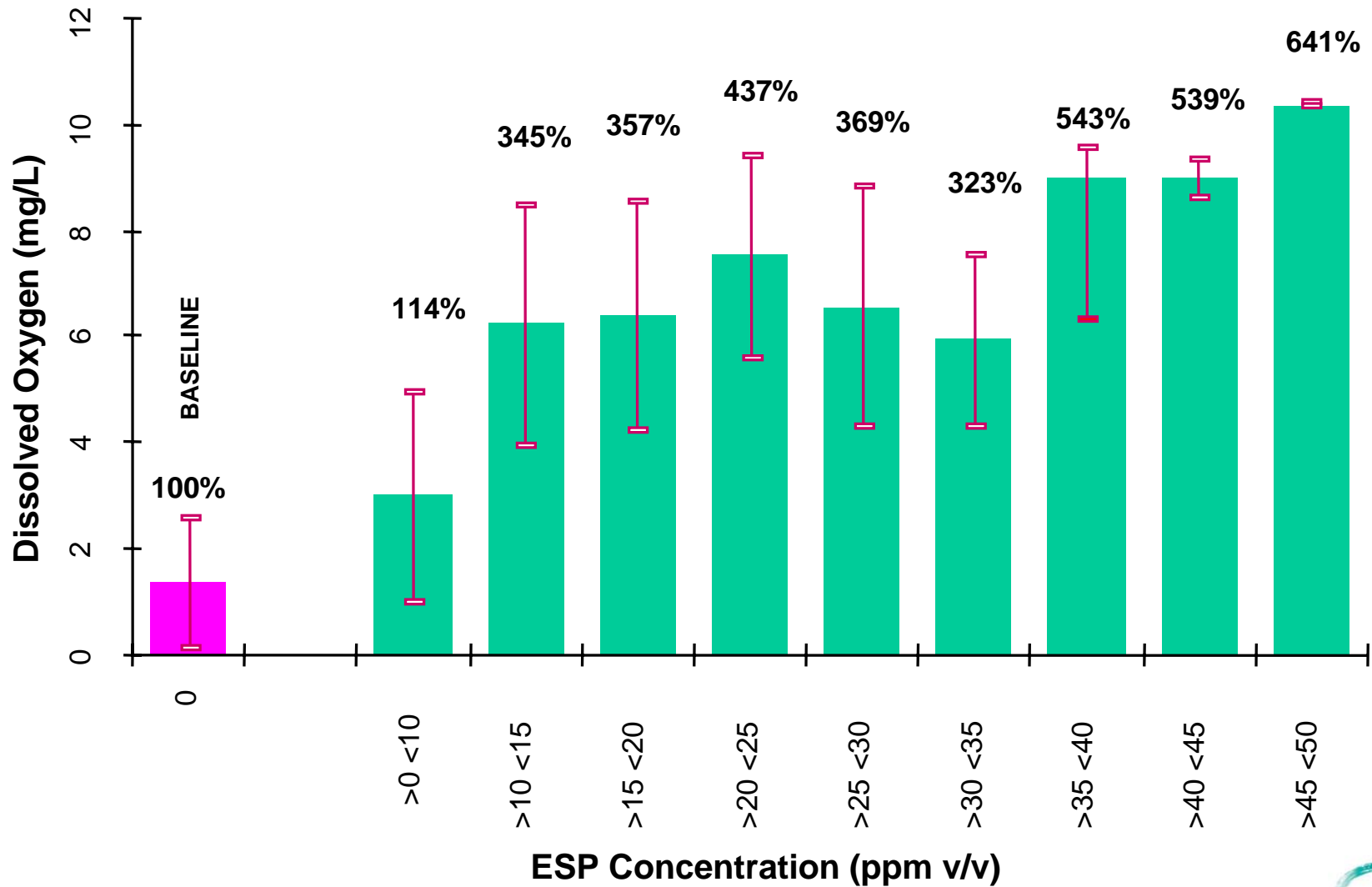


# Kikkoman Soy Sauce WWT Plant

## Trial Treatment Arrangement

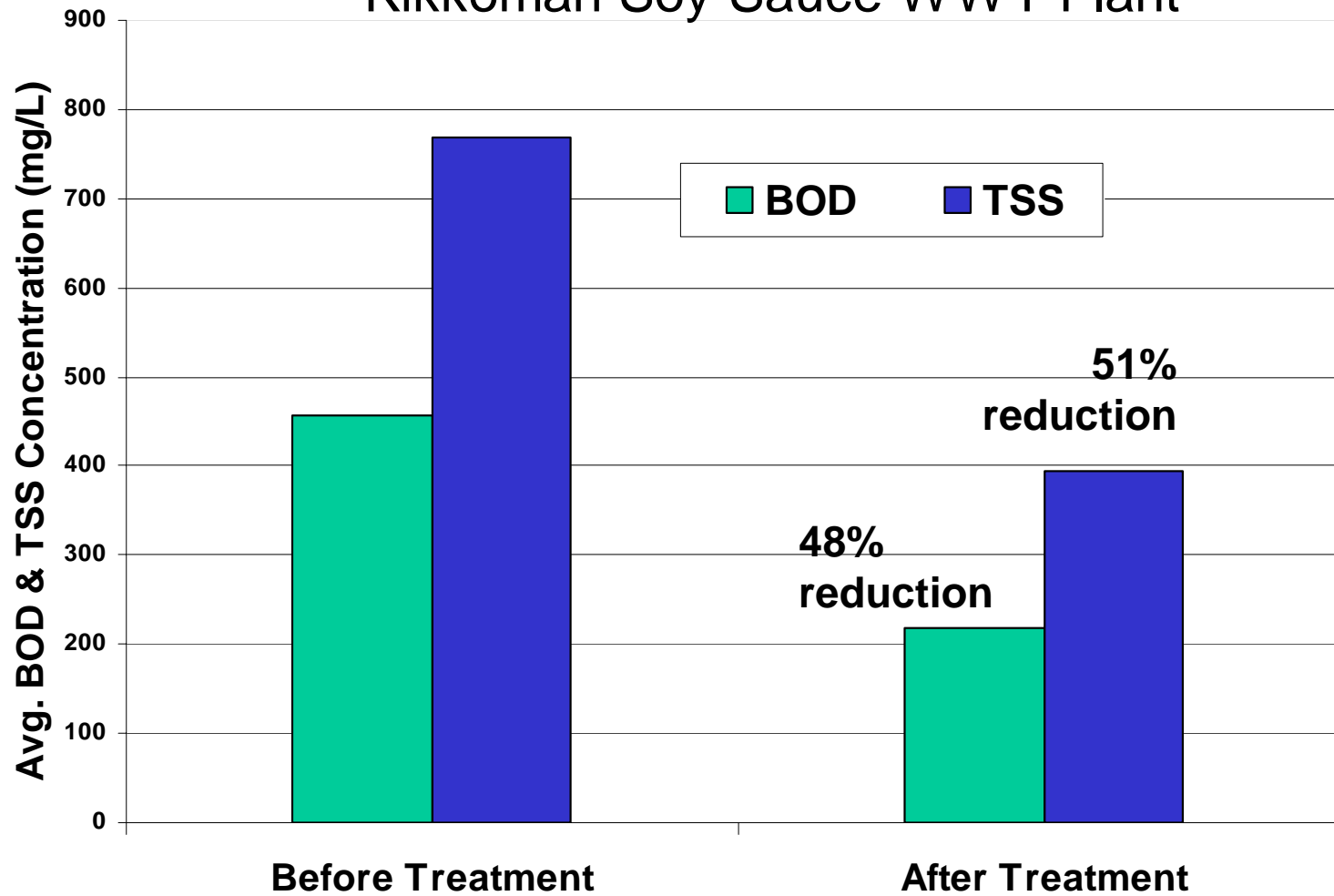
# Increase in D.O. with Treatment

## Kikkoman Soy Sauce WWT Plant



# Treatment Results

## Kikkoman Soy Sauce WWT Plant



# Hydrogen Sulfide Control Application

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**Reduce H<sub>2</sub>S gas Concentration**

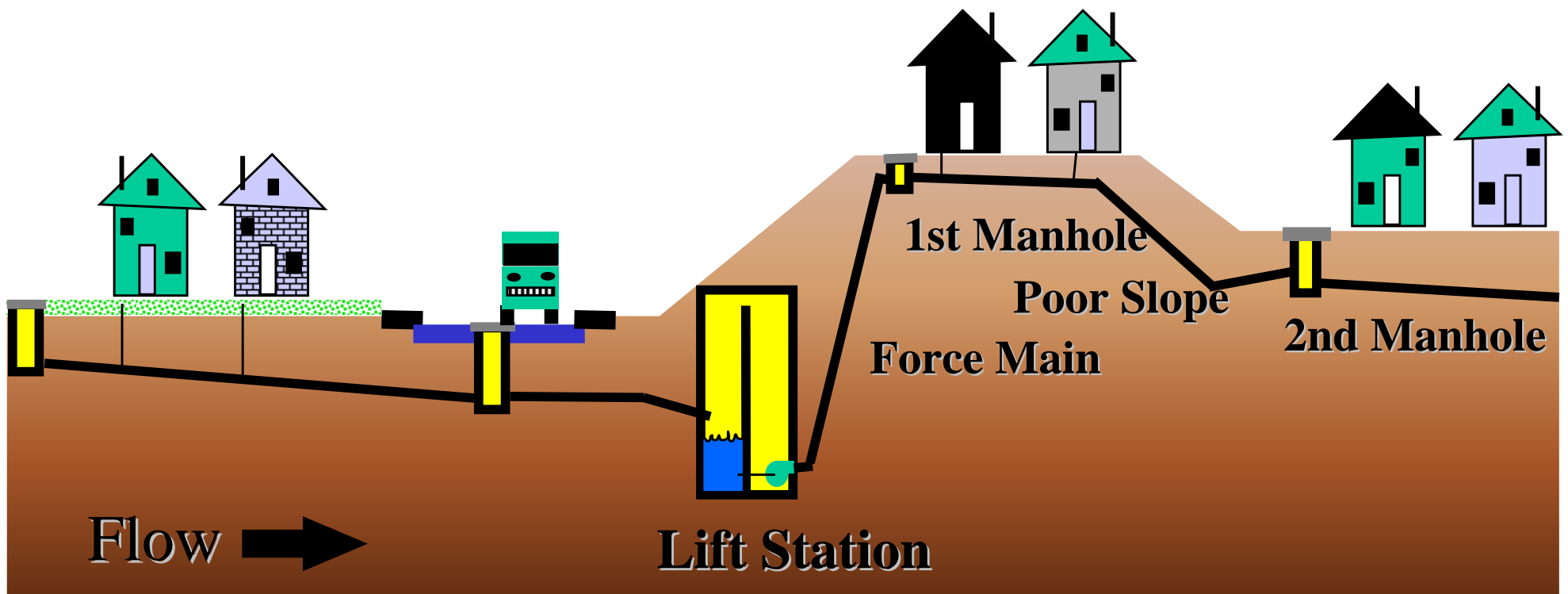
**Reduce Odor**

**Reduce Corrosion**

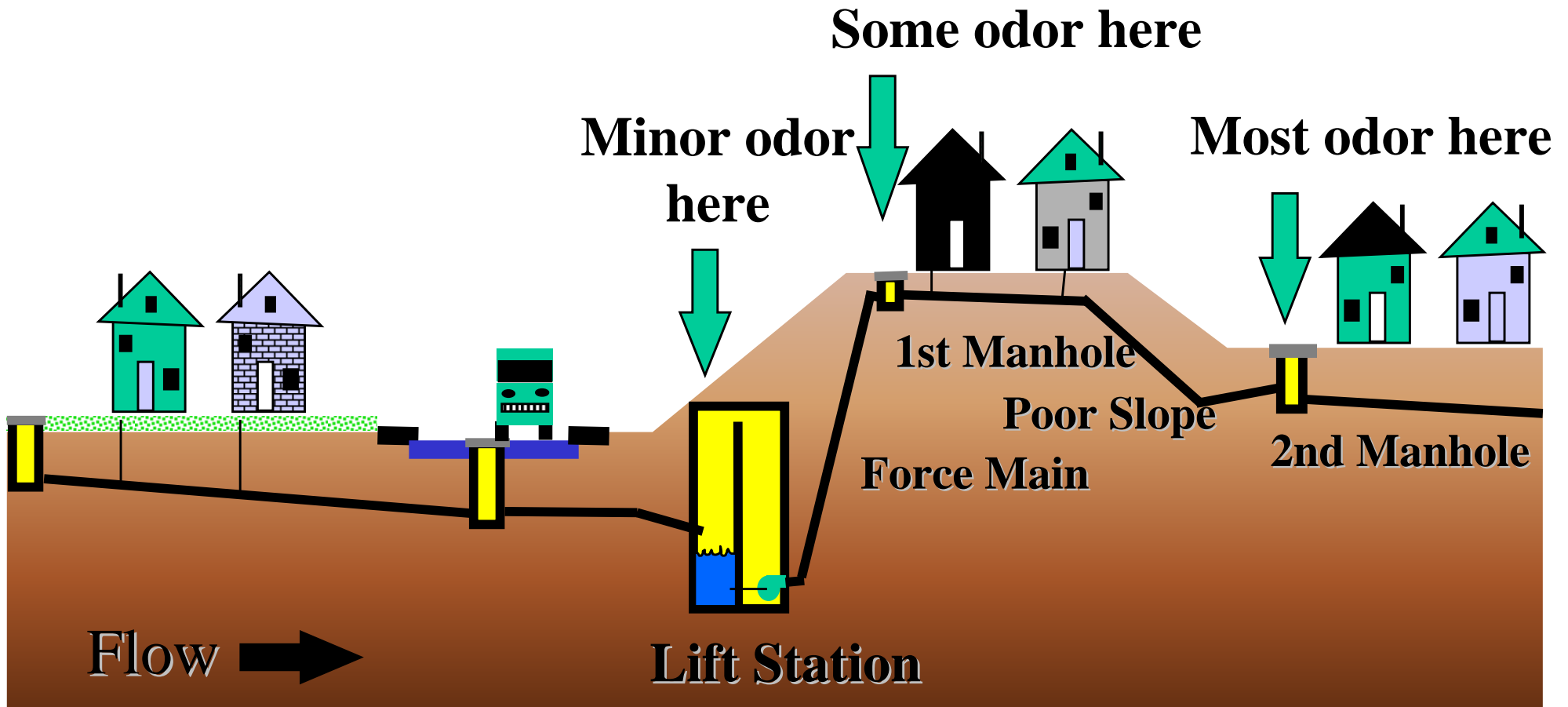
**Change environment within sewer pipe**

# Hydrogen Sulfide Control Case Study

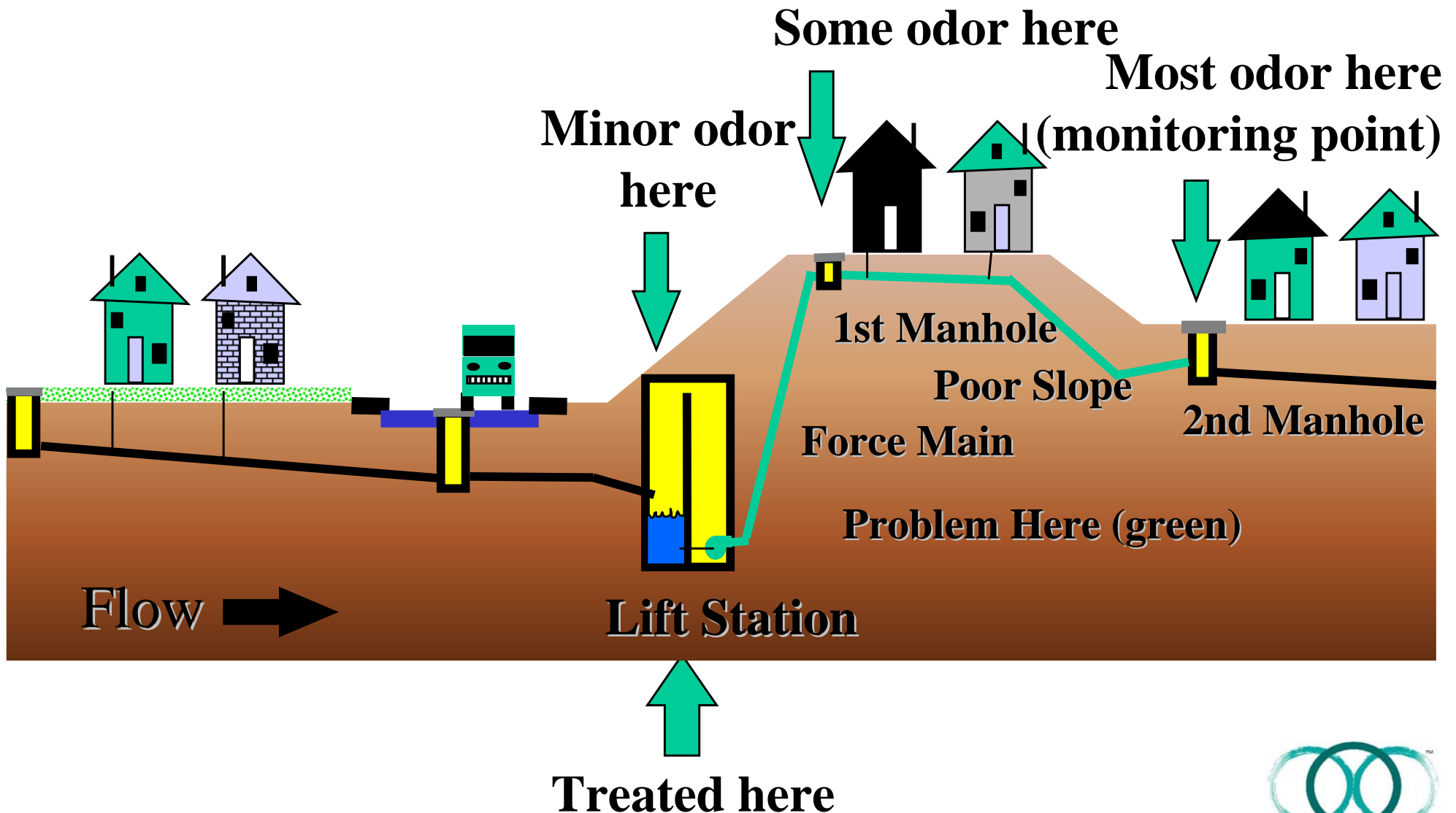
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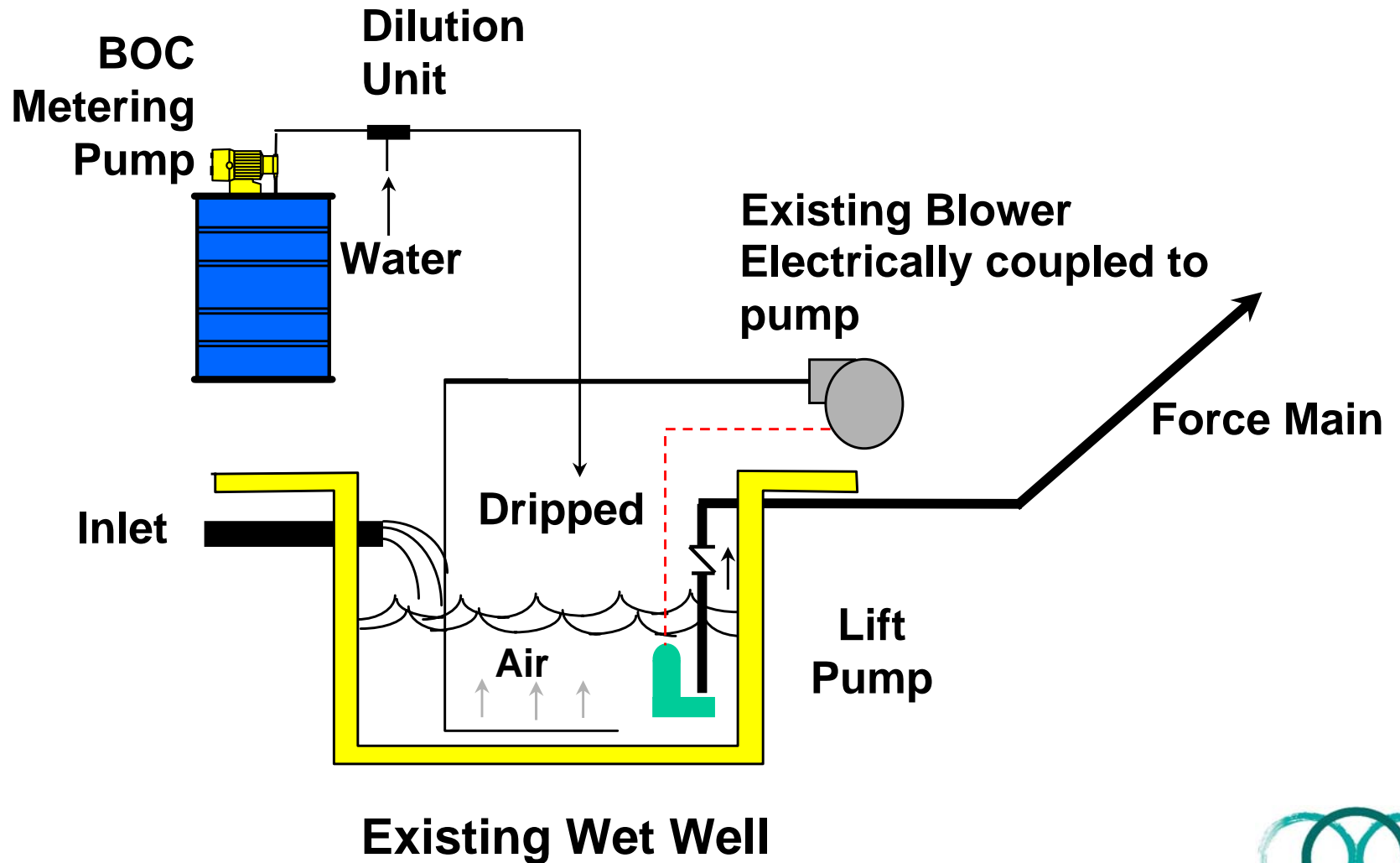
# Hydrogen Sulfide Control Case Study



# Hydrogen Sulfide Control Case Study



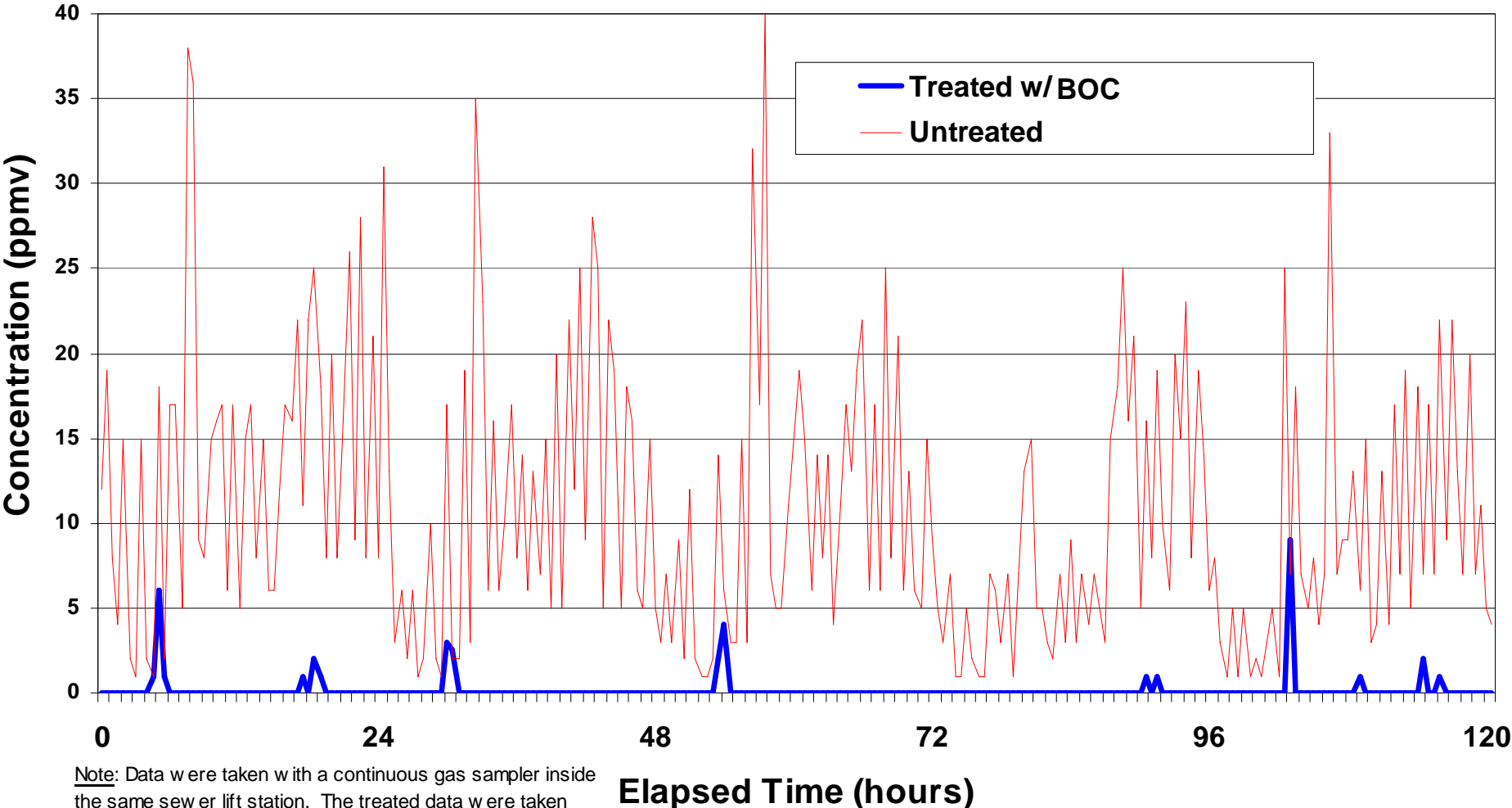
# Hydrogen Sulfide Control Case Study



# 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.



# Results of Hydrogen Sulfide Control Case Study

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## Major reduction in H<sub>2</sub>S gas Concentration

- Peak H<sub>2</sub>S reduced from 40 ppm to 8 ppm
- Most H<sub>2</sub>S after treatment was 0 ppm

Results lasted several days after test

Low Cost installation

# Ammonia Reduction with BOC

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## **TWO MECHANISMS:**

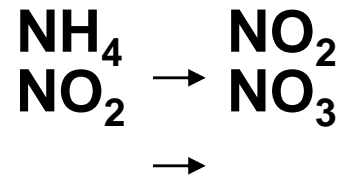
- 1. Increased Biological Nitrification**  
Increased DO from Microbubbles
- 2. Increased Chemical Oxidation**  
BOC Aggregates

# Increased Biological Nitrification

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**Maintain conditions suitable for growth of nitrifying organisms:**

Nitrosomonas  
Nitrobacter



**Sufficient Ammonia and Nitrite**

**Low BOD<sub>5</sub> / TKN Ratio**

**pH 7.2 to 9.0**

**Minimum DO of 2.0 ppm**

# Increased Chemical Oxidation

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**Woodridge-Green Valley WWT Plant  
(DuPage County, IL)**

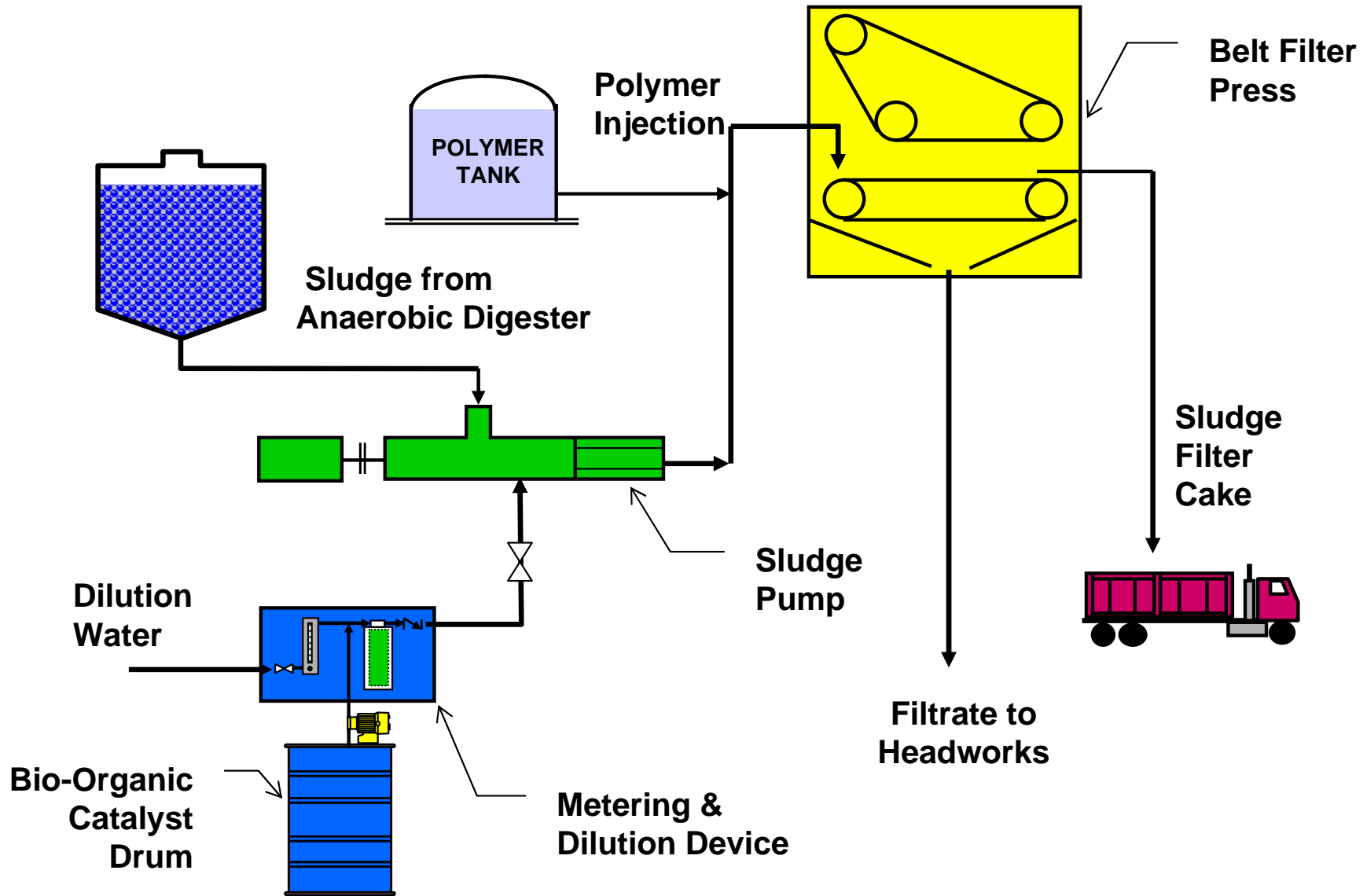
**150 ppm Bio-organic Catalyst**

**Injection into Sludge Pump**

**1 to 2 minutes contact time**

**24% to 44% reduction in Ammonia**

**Compared to untreated control**



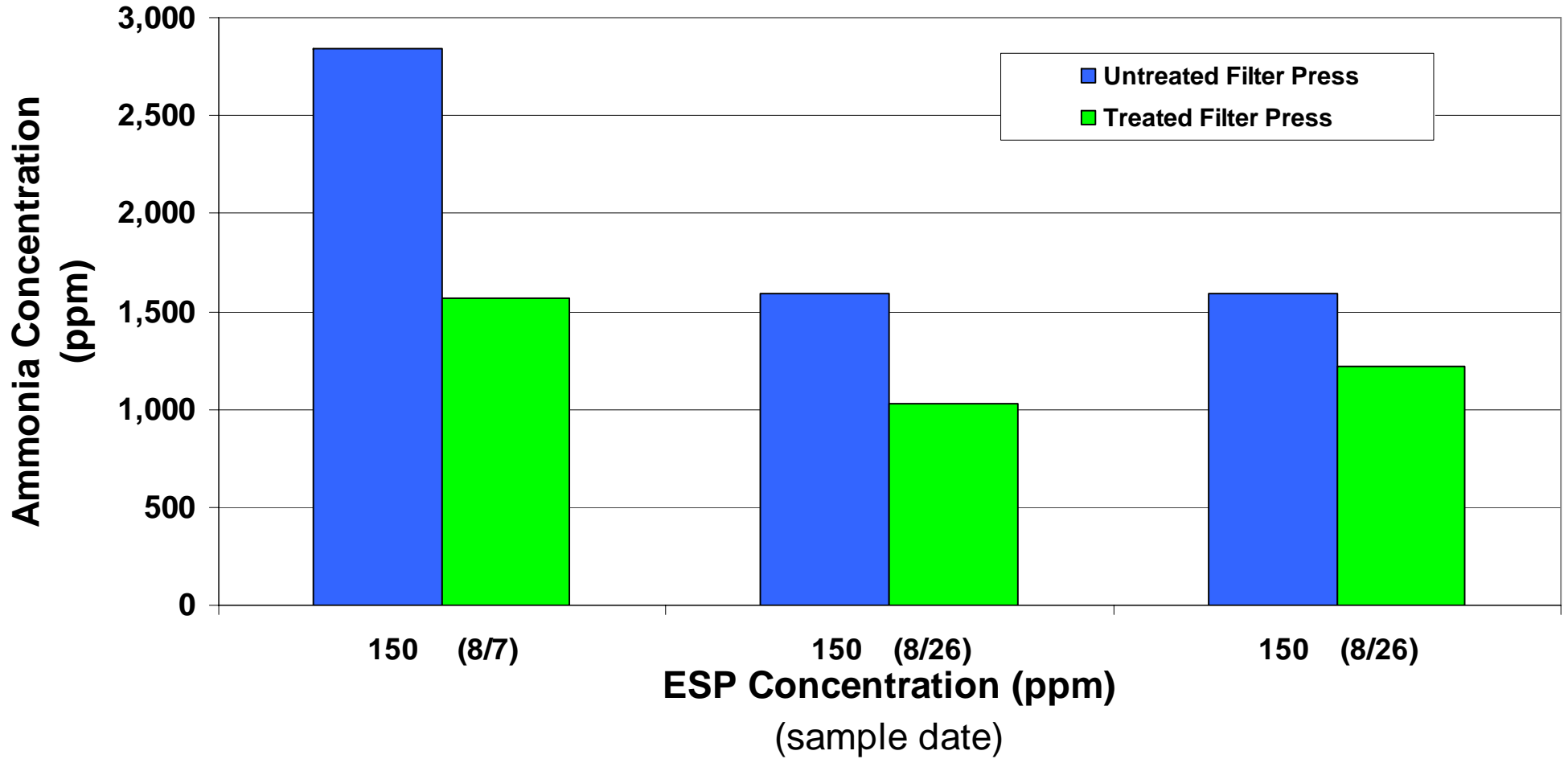
# Woodridge-Green Valley WWT Plant

## Trial Treatment Arrangement

# Ammonia Reduction Trials

(8/7/97 and 8/26/97)

Woodridge-Green Valley WWT Plant  
Filtrate Samples (at Filter Press)



# Summary

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**Bio-Organic Catalyst Aggregate**

**Solubilizes Organics**

**Increases Aeration Efficiency: Microbubbles**

**Increases Ionic Reactions: Oxidation**

**Applications:**

**Reduced Power Cost (increased DO)**

**Reduced Sludge Quantity**

**Reduced Ammonia, BOD**

**Odor & Corrosion Control in Plant, Sludge, Collection  
Systems**