

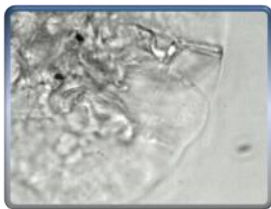


Turning Liabilities into Leverage

December 2013

## The Wastewater Insight

### MYSTERY BUG OF THE MONTH



We started this month out with a new **Mystery Bug of the month!**

More of a challenge this month.

Check out our website for more photos of our new mystery bug!!!!

[EnvironmentalLeverage.com](http://EnvironmentalLeverage.com)

### Cold Weather and Nitrification- two items that don't mix well!

Nitrification is a very finicky process even under best conditions. Nitrifiers have exact conditions that they like and if anything changes, they protest and go on strike. Unfortunately, temperature is one of those critical parameters that can easily impact the success of a nitrification program.



#### Temperature

Nitrification is inhibited at lower wastewater temperatures. Up to five times as much detention time may be needed in the winter versus the summer months since the activity drops significantly. During winter months, increasing MLVSS, MCRT will help as well as lowering wasting. A desired range is 60° to 95° degrees F. Below 40° nitrification will probably not occur. By carrying more sludge in your system, you have increased the amount of nitrifiers present. So even though the nitrifiers are at a reduced "rate of nitrification" you have more players and the end result comes out the same. You are still able to meet permit due to the extra helpers despite their sluggish rate.

The larger the system and the more surface area you have, the easier it is for the colder weather to impact nitrification.

Large lagoons in climates where temperatures drop significantly can even freeze over.

Large **once through lagoons** have a very difficult time since they are not returning any activated sludge back to the front of the system. It is harder to increase the amount of bacteria in the system. You can easily use bioaugmentation in large lagoons systems for carbonaceous bacteria as well as nitrifiers but temperature always becomes a factor. Nitrifiers will slow down regardless of the type of system or the number of product you supplement. There are no strains of nitrifiers capable of withstanding extreme temperatures. Bioaugmentation though can help increase the amount of carbonaceous bacteria so that the organic compounds are sufficiently degraded with floc formers and a higher uptake of nutrients is utilized by floc formers vs. filaments.



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**Clarifiers** in activated sludge systems also can impact nitrification. Usually influent is relatively warm if it comes from an industry and is at a higher temperature at the head of the system. If there is a large system, by the time the water and MLSS makes its way to the end of the system and to the clarifier, the temperature has cooled off quite a bit. If the nitrifiers get too cold in the clarifier they may shut down or even die off in extreme cases like shown below when the clarifier starts to freeze.

Since it takes nitrifiers a long time to grow, it is safe to assume it takes a bit of time to recover when they are slowed down significantly by extreme temperatures.

Make sure your clarifiers are not freezing over.

Ofentimes systems that have high levels of *Nocardia* and *M. parvicella* or any type of filaments that can cause foaming and floating sludge tend to be more susceptible to freezing. The MLSS is suspended close to the surface and thus has an easier chance of freezing.

Address the issues as to why your system has foaming. Is it due to filaments from grease and oils such as *Nocardia* and *M. parvicella*? These two filaments due tend to cause floating sludge.

Is foaming and frozen sludge due to **septicity**? Some filaments can make a thick blanket that traps air and floats to the surface. If temperatures drop too low, this foam can freeze .



These photos show a plant that had issues with septicity. Once addressed not only did the filaments go away but their Nitrification problems were lower as well. Septicity can also consume high levels of oxygen, as well as lower the pH and impact nitrification significantly.

#### Typical Oxygen requirements in a wastewater plant

- 5 lbs. oxygen oxidizes 1 lb. nitrogen
- 3 lbs. oxygen oxidizes 1 lb. carbon
- 1-1.5 lbs. oxygen oxidizes 1 lb. B.O.D.
- 1 lb. oxygen oxidizes 1 lb. hydrogen sulfide
- .67 lb. oxygen oxidizes 1 lb. manganese
- .4 lb. oxygen oxidizes 1 lb. iron

High levels of sulfur compounds can also inhibit nitrification if too extreme.

Keep in mind nitrification also occurs 3-4 times slower than carbonaceous oxidation. Upsets to a plant can take nitrifiers weeks to recover for nitrification as opposed to days or hours for carbon bacteria. For each 1-gram of NH<sub>3</sub>-N oxidized to NO<sub>3</sub>, 0.15 grams of new bacteria cells are formed. Sludge generation from nitrifiers is minimal in a system.

### Additional Critical Parameters for Nitrification

#### Controlling Factors for Nitrification:

Dissolved Oxygen  
Alkalinity (pH)  
Wastewater Temperature  
Nitrogenous Food  
Detention Time  
MCRT, F/M, or Sludge Age  
Toxic Materials

<b>Permissible pH range (95%)</b>	<b>7.2 - 9.5</b>
<b>Permissible Temp (95%)</b>	<b>60 - 95 degrees F</b>
<b>Optimum Temp</b>	<b>85 degrees F</b>
<b>DO level at peak flow</b>	<b>&gt;1.0 mg/L</b>
<b>Heavy Metals</b>	<b>&lt;5 mg/L</b>
<b>Toxic Organics</b>	
<b>Halogenated Solvents</b>	<b>0 mg/L</b>
<b>Phenol and Cresol</b>	<b>&lt;20 mg/L</b>
<b>Cyanides</b>	<b>&lt;20 mg/L</b>
<b>Oxygen Requirements</b>	<b>4.5 lb O<sub>2</sub>/lb NH<sub>3</sub>-N</b>

### Do you have amines in your system?

**Amines** - Municipalities are not used to measuring amines. Many industrial facilities such as chemical or refineries usually already measure TKN. Amines are often overlooked and can sometimes be a contributing factor to problems with nitrification and violations of final effluent permits. Amines can be inhibitive, in particular to nitrification. Even at low levels if the nitrifiers are not acclimated to the particular amine species. Usually though, nitrifiers are not killed by amines, but the time required to stabilize and break down the amine byproduct by the carbonaceous bacteria into ammonia can be severely extended. Oftentimes, amines are overlooked in the nitrogen balance and will finally break down in the clarifier. This causes break through ammonia in the final effluent. Since sufficient time or air is not present and thus not allowing the nitrifiers sufficient time to degrade the ammonia. Violations occur on ammonia not due to toxicity, but due to the time and numbers game. Most of the time, there are not enough bacteria or too short of a time in a given system to degrade the amine compounds sufficiently before it passes out the end of the system.

Cold weather can limit your carbonaceous bacteria as well as your nitrifiers. For every 10 degree change in temperature, a logs growth of activity will drop. If the carbon bacteria do not break down the amines quickly enough, the nitrifiers that are present again do not have time to react to the ammonia sufficiently to degrade it properly before discharge.

Adjusting sludge age in the colder temperatures will help to increase carbonaceous bacteria as well as nitrifiers in activated sludge systems. Bioaugmentation can be used if necessary to assist in cold weather. Lagoon systems usually need a little boost in winter and bioaugmentation can easily help.

### Does the onset of Cold Weather have to mean the coming of winter problems? Do Low Temperatures make meeting your wastewater effluent limits more difficult?

Each year as Fall slips into Winter, wastewater operators are challenged with making sufficient adjustments to their treatment plant to deal with the difficulties faced with dropping temperatures.

Lower temperatures not only have an impact on equipment but on the bacteria in the system as well.

Treatment efficiency for BOD removal as well as Nitrification drops off drastically the lower the temperatures crawl. Many times lower temperatures can push the limits to achieve final effluent permit levels.

We are pleased to announce a new solution to help deal with Colder temperatures. Brand new specially patented in 2013 – Cold Weather Bacterial formulations.

## MicroClear® MicroChill

**For Use in Cold Weather Temperatures**



**MicroClear® MicroChill** is a high potency, bacteria-laden, powdered formulation specifically designed for Cold weather applications for use in degrading many types of waste. **MicroClear® MicroChill** contains a specially isolated blend of microorganisms, micro/macronutrients, and surface tension suppressants/penetrants.

**MicroClear® MicroChill** contains a unique and proprietary blend of psychrophilic microorganisms that are naturally occurring bacteria with the ability to grow at 4°C, and lower. Because of the diversity of the microorganisms and enzyme systems, incorporated into this product, it is excellent for use in *Cold Weather Wastewater applications*. The safe, naturally occurring bacteria are present in high numbers to handle difficult to treat wastewater problems in lower temperatures.

This product is designed for facilities that face extreme cold weather issues that test the limits of their equipment and treatment plant. Call today to discuss how we can help you with your facility to beat the cold weather blues!

Last Month's

### MYSTERY BUG OF THE MONTH



### Mystery Bug of the month!

#### Last Month's Bug of the Month

Did you guess what this was? This is a free swimming ciliate- Litonotus

Usually when free swimming ciliates are dominant, you have a young to medium sludge age.

[November 2013 - Litonotus](#)

Check out our website for more photos of our new mystery bug!!!!

[EnvironmentalLeverage.com](http://EnvironmentalLeverage.com)

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Turning Liabilities Into Leverage!

# MicroClear® MicroChill™

## For Use in Cold Weather Temperatures

### Product Bulletin

*Environmental Leverage has Lab Analysis Service Available*



1-lb. Water Soluble Bio-Pouch

### Degrades

- Fats, Oil & Grease
- Complex Organics
- Starches
- Proteins, Animal Fats
- Triglycerides
- Soaps, Surfactants
- Sludge Volume
- Foaming
- BTEX
- Phenols
- Ammonia, Amines

- Increased Permit Compliance
- Reduces Foaming
- Increases BOD reduction
- Decrease Excess Sludge Volume
- Increase TSS reduction

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**MicroClear® MicroChill™** is a high potency, bacteria-laden, powdered formulation specifically designed for Cold Weather applications for use in degrading many types of waste. **MicroClear® MicroChill™** contains a specially isolated blend of microorganisms, micro/macronutrients, and surface tension suppressants/penetrants. **MicroClear® MicroChill™** contains a unique and **newly patented** proprietary blend of psychrophilic microorganisms that are naturally occurring bacteria with the ability to grow at 4°C, and lower. Because of the diversity of the microorganisms and enzyme systems, incorporated into this product, it is excellent for use in *Municipal and Industrial Wastewater applications*. The safe, naturally occurring bacteria are present in high numbers to handle difficult to treat wastewater problems in lower temperatures.

### Product Advantages

- Increases system efficiency in Cold Weather
- Reduction in filamentous bulking
- Increase BOD and TSS removal efficiency
- Greatly reduces labor time
- Enable Permit Compliance easier
- Reduces hydrogen sulfide
- Degrades a wide range of complex organics
- Cost effective/Easy to use
- Reduces sludge build-up
- No special equipment needed
- Breaks down fat & grease build-up
- Increase Amine breakdown
- Eliminates malodors at their source
- Contains no chemicals
- Changes biomass dynamics
- Discharge compliance is maintained
- Reduction in polymer and dewatering costs



### Application

- WASTEWATER PLANTS
- LIFT STATIONS
- COLLECTION SYSTEMS
- HOLDING TANKS
- WETWELLS
- WASTE SUMPS
- MEMBRANE REACTORS
- OXIDATION DITCHES
- RBC'S
- ACTIVATED SLUDGE
- FACULTATIVE LAGOONS
- REMEDICATION
- LAKES AND PONDS
- DIGESTERS



### Packaging of Product

**MicroClear® MicroChill™** comes in  
 1-lb. water soluble pouches.  
 Packaged in 25-lb. plastic pails.  
 Bulk packaging upon request.





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- Increased Permit Compliance
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### Environmental Leverage® Inc.

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### Typical Properties of Product

- Appearance.....light tan
- Fragrance.....mild-earthly
- Form.....powder
- pH.....6.8-8.5
- Shelf-Life.....2 years/u.o.c.
- Flash Point.....none

### Performance Properties

- Effective pH range.....5.2 - 9.5
- Effective Temperature .....35 - 130°F
- Bacterial Enzyme Production –  
Protease, Lipase, Amylase, Urease,  
Cellulase



### Storage & Handling

- Storage.....Store in a cool, dry place. Do Not Freeze
- Container.....Keep lid closed on plastic pail.
- Do not store water soluble pouches out of plastic container.

Handling.....Wash hands thoroughly with warm, soapy water

### Bacterial Count

MicroClear® MicroChill™ .....>1x10<sup>9</sup> (Billion per gram)





March 2010

## The Wastewater Insight

The wastewater insight

### MYSTERY BUG OF THE MONTH



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### Inside this issue:

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**Cold, Oil and Grease- one way to make your wastewater plant difficult! 49 out of 50 states recently had snow on the ground!**



Cold, oil and grease can be three nightmares for wastewater plants. How does cold impact oil and grease in your plant, and how do each of these directly impact your plant?

Grease is a general classification for grouping fats, oils, waxes, and soaps according to their effect on wastewater collection and treatment systems. The acronym "FOG" will be used as a general term for fats, oil, and grease.

For Municipalities- some of the issues include:

Temperature  
 Food Grease  
 Lubricating Oils-  
 Industrial Equipment  
 Soaps and Detergents  
 Hydrocarbon Oils



Most blockages and sanitary sewer overflows in wastewater collection systems are caused by grease. As the temperature cools down in the winter, wastewater from toilets, kitchen sinks, and other sources flow more slowly to the wastewater treatment plant. As a result, grease and other household products tend to harden and collect in cold sewer pipes, causing blockages and occasional

freezing. As these blockages build, the sewer line can back up into homes and businesses, causing an unsightly and smelly mess.

Grease comes from many sources- houses, hotels, hospitals, schools, business cafeterias, food preparation, industries and many restaurants.



Grease traps or interceptors are the main way to try to keep some of the grease out of the collection system.

There are three important criteria in order for a grease trap to be successful.

- 1) *Time*. The grease trap or interceptor device must provide sufficient retention time for emulsified grease and oil to cool, separate and float to the surface of the chamber.
- 2) *Temperature*. The separation device must provide adequate volume to allow the wastewater to cool sufficiently for emulsified grease to separate.
- 3) *Turbulence*. Turbulence through the grease traps must be controlled so that grease and solids are not kept in suspension in the wastewater. Turbulence must be controlled, especially during high discharge rates associated with draining a triple sink or multiple fixtures simultaneously.

Temperature, time, and the emulsion properties of the FOG in the wastewater affect the grease trap performance, and may cause poor performance or failure of a downstream treatment process.





Grease trap sizing criteria are typically based upon old regulations written when animal fat was the main form of cooking oil used in kitchens. Nowadays there are modern oils or liquid oils that remain liquid at room temperature, and may be more

difficult to separate from the wastewater than animal fats used in the past such as lard and suet.

In order for fats, oil and grease to float it must be lighter than water. Congealed FOG tends to be lighter than water, and the grease needs to cool to congeal and separate from the water carrying the grease away from the kitchen. Some of the considerations for allowing the FOG to separate and float include the temperature of the water entering the grease trap, the temperature of the grease trap, and the length of time the wastewater is allowed to stay in the grease trap (detention time) to cool before passing onto the next wastewater collection or treatment process. A longer detention time allows the contents of the grease trap to cool, and the FOG to separate.

The size of the grease trap depends largely on how much waste your business produces and how often you perform trap maintenance. Outside grease traps will operate differently in winter versus summer and are more prone to clogging during cold weather.

Grease traps are not very effective if the temperature is too high therefore, the temperature of the grease trap effluent should be less than 85°F in order to facilitate the separation of the oil fraction from the water. Unfortunately, newer federal regulations for temperatures in dishwashers have raised the temperatures up around 180° - 210° F, thus many grease traps are not sufficiently capturing the grease.

Nationwide, health inspectors require that dish machine rinse temperatures be verified to reach between 170° - 212°F, the range sure to kill bacteria.

Many dishwashers utilize an internal water recycling system and, therefore, do not discharge a large volume of hot (180° F) water. The smallest commercial dishwashers discharge 1.6 gallons/rack (up to 85 gallons/hour). The largest commercial dishwashers run continuously and use 7 gallons/min (420 gallons/hour).

### Controlling grease at hospitals, schools, hotels, restaurants, etc-

Restaurants and other food service businesses generate literally tons of cooking oil, grease and food wastes every day. Dishwashing detergents may have the effect of keeping the FOG suspended or emulsified in the waste stream, allowing the FOG to pass through the grease trap with the water.

**Fryer oil** means oil that is used and/or reused in fryers for the preparation of foods such as fried chicken and French fries. Discharge of fryer oil into the county sewer system is often prohibited. Unfortunately, studies have shown that at many fast food restaurants- the help has often poured the fryer grease down the drain assuming the grease trap would collect it.

At hospitals, periodically, the hospital kitchen staff was pouring 250 gallons or more of boiling water into the floor drains. The kitchen staff was unaware that the drains were connected to the grease interceptors. The boiling water prevented grease from separating from the liquid before discharging into the sewer line.

### Additional Sources of Oil

Other commercial sources include food manufacturers, food processors, and large-volume lipid lubricant users (canning, bottlers, etc.). Control Authorities should also keep in mind food providers in schools, hospitals, hotels, correctional facilities, churches, nursing homes, and other facilities such as these can also contribute high levels of oils and grease.

Raw milk has a BOD5 concentration of approximately 100,000 mg/L, and FOG of 90-500. Any type of dairy processing such as cheese, milk, yogurt, ice cream, etc usually has some type of oils present.

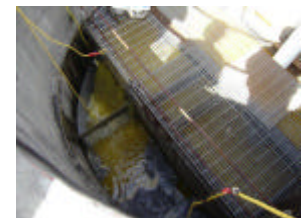
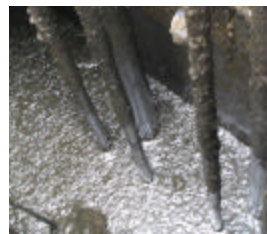
Grease in the Food Industry comes from butter, lard, vegetable fats and oils, meats, nuts and cereals.

Laundry effluent may have oils present depending upon the types of clothing treated.

Food retailing- many types of food processing have high levels of oils.

Oil from equipment maintenance found in lift station.

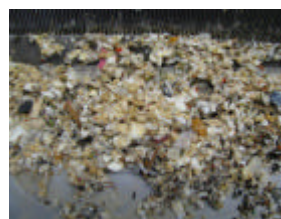
Production of butters and margarine, dairy, cheese, etc  
Processing of vegetables



Oil at juice plant



Lubricating oils on machines in beverage plant



Grease from meat processing

Sauces from food processing



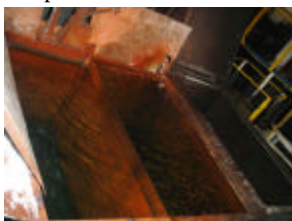


Sewer slime from metal cutting plant- many oils used in cutting steel parts

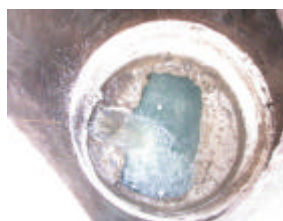


Hydrocarbon oil can also be found at many municipalities. The main sources of oil and grease are leakage from engines in parking lots and streets, construction on roads, spills at fueling stations, overfilled tanks, restaurant grease traps, and waste oil disposal. Rain and infiltration can wash the oils down into the sewers and drains and make their ways into the treatment plant. We found extremely high levels of hydrocarbon oils in a lift station at a beverage plant.

Papermill-



Metal finishing and metal cutting  
Petroleum refining, steel and petrochemical, papermills all have high levels of oils



Blocked sewer with oil build-up Oil leaking off machines



Very good case study by the EPA

<http://www.worldstoneinc.com/newstory.ccm1?8.25,2266,ws2266,..Doc.news.html>



Refinery Oil



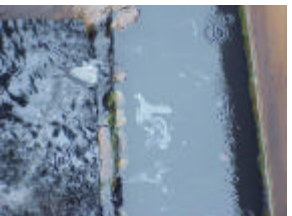
Natural Gas Plant



Steel Mill



Municipality - oil sheen after high rains



Since obviously, there are many sources of oils and grease, focus on primary treatment and keeping the oils from making their way into the treatment plant is the best option. Use of upstream treatment such as booms, bioaugmentation, API, DAF or primaries will make it easier for the bacteria to work once you are in the wastewater plant in the MLSS.

### Cold Weather-Heavy rains, snows and melting snows



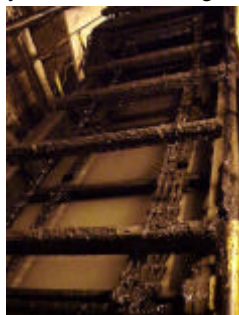
As heavy rainfall runs over the surface of roofs and the ground, it may pick up various contaminants including soil particles and other sediment, heavy metals, organic compounds, animal waste, and oil and grease.

Snow can also pick up sediments. Melting snow runoff can easily infiltrate into the sewer systems.

Heavy rains can knock off chunks of grease that have solidified in pipes and send them down to the wastewater treatment plant. This has been a bad winter in many locations, and the extra cold as well as heavy rains and snows have made it hard for many municipalities as well as industrial plants to run. We have had many plants call for help with issues at their plants.

### Road salt and salt around offices, parking lots, etc.

Road salt, sodium chloride and calcium chloride, are used to maintain safe roads, highways, and parking lots under icy conditions during winter months. Cyanide compounds are often added to reduce clumping.



The runoff from the paved surfaces carrying the chloride and cyanide compounds can result in surface and ground water contamination. High levels of salt in the collection system can raise the temperatures which can help break away more grease along with heavy rains and melting snows. Another impact salt can have if levels are too high and a plant is very small is to impact the biomass and floc formation.

### Detergents vs. soaps

By definition, soap is a cleansing product created through the chemical process of combining fat or natural oil with an alkali (such as wood ashes or lye) under controlled conditions. Detergent substitutes are now more common due to biodegradability issues. Below are some of the substitutions that are commonly used:

- Ethoxylated alcohol's instead of nonylphenols
- Biodegradable organic solvents
- EDTA instead of phosphates

### So, what does all this do to my plant?

Winter can be brutal on a Wastewater treatment plant, especially if you live in the Northern areas.

Frozen scum on clarifiers is no picnic to remove!

Optimizing your primaries, then your aeration basin can help eliminate scum on the clarifier and make these types of issues permanently disappear.

We have had numerous customers with issues with frozen clarifier and scum this winter and we still have a few more months of cold to deal with.



If you have high levels of oils and grease that are causing foaming, SVI issues, or frozen solids, use the microscope to see what you have in your system. If you have filaments or Zooglea, find out what type of filaments. If you have Nocardia and M. parvicella, which are the most common types found with high oils and grease, focus on grease control. Use bioaugmentation if necessary short term to help reduce the oils and grease and out compete the filaments. A small amount of bioaugmentation is cheaper in the long run than foaming, TSS, BOD and high polymer costs or solids handling issues.

More information can be found in our troubleshooting pages and newsletters on our website

<http://www.environmentalleverage.com/newsletters.htm>

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Please call us if you need help with identification of filaments, or are interested in short term use of bioaugmentation.

### Last Month's MYSTERY BUG OF THE MONTH



Did you guess?

No those are not stains used. Those actually are pink dots. This is a bristle or aleosoma worm.

He usually indicates an older sludge with high levels of nitrates.

### Mystery Bug of the month!

Check out our website for more photos of our new mystery bug!!!!  
[WWW.EnvironmentalLeverage.com](http://WWW.EnvironmentalLeverage.com)



Coming Soon:

Preconference workshop  
IAWPCO Springfield IL  
April 19-22nd  
Bugs and Sludge

*The pre-conference workshop will be on Monday, April 19. The workshop runs from 10 am to 3 pm with an hour break for lunch. The workshop title is "Bugs and Sludge" presented by the talented Tracy Finnegan of Environmental Leverage. The program centers on the microscopic examination of sludge. The variety and species is an indicator of the quality of the treatment. If you can, send one of your newer operators to take advantage of this training. The bulk of the program is topics near and dear to our hearts.*

<http://www.iawpco.org/>

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