

# The Wastewater Insight



## COLD WEATHER IMPACT



### Wastewater in the Winter- Problems and Solutions

Wastewater treatment in itself can have many ups and downs. So many things can impact how successful the wastewater process is at removing the critical components of BOD, TSS and nutrients.

Winter, with its fluctuating temperature changes can have a significant impact on the wastewater treatment process. Snow, icing, and freezing rain can cause huge problems for some wastewater treatment plants.

Remember that temperature is one of the critical 5 components in a wastewater treatment plant. Temperature can significantly impact whether you are winning the time and numbers game. Wastewater treatment is always a time and numbers game. Since you really are limited by the time component- (in reality this is the size of the treatment plant) the only thing you can play with and change is the numbers factor. That means adjusting the numbers of bacteria or MLSS in the aeration basin.

Another thing to consider, for every ten degree °F change in the weather, the bacteria loose one logs growth of activity. If your outside weather drops 20 to 30 degrees in one day, that can significantly impact the activity in your system, if you do not have a high temperature influent consistently. That means you have to adjust the amount of RAS and WAS in your system to reflect the temperature changes. You can only adjust the MLSS as quickly as your pumping capabilities allow. Another thing to remember, the bacteria are finicky. They do not like significant changes. Any time a change of more than 10 percent is made, on any variable that is critical to them, they get temperamental

- 1.) Snow, Freezing rain
- 2.) Hydraulic washout due to excessive freezing rains from storms or melting snows
- 3.) Changes in BOD loading
- 4.) Sludge Age changes due to activity changes
- 5.) Loss in removal efficiency.
- 6.) Icing problems for equipment or freezing pipes.



## MYSTERY BUG OF THE MONTH

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



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



### Let's start with a lift station if you are a municipality.

Some lift stations have tons of grease sent to them, especially with the increase of strip malls and restaurants. Two things can happen in the lift stations with colder weather. The grease can harden with colder temperatures and start to form "turtles". These can clog up lines and cause problems with pumps, but are a bit easier to get out of the primaries. Biological products can be added to the lift stations to help with grease degradation.

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The second thing is that fall rains can cause grease to break off from the grease shelf in the lift stations or on rims along the pipes and send an overload of BOD to the wastewater treatment plant. High Grease can increase the growth of *Nocardia* and



*Microthrix parvicella* and cause serious foaming problems, especially in the winter, since these filaments thrive in colder temperatures. Watch what happens in your primaries during high rains or snow. If you have manual skimmers, make sure to clean out the grease 2-3 times a day and do not allow it to build up.

**Primary Clarification:** Another thing to keep an eye on in the Primary Clarifiers is the solids. Make sure to check the bed levels and adjust the speed of the rakes if necessary. Floating solids indicate that the primary is holding solids too long. This can generate septic conditions that again, can promote the growth of other types of filaments in the aeration basins.

Primary treatment, the lowest level of wastewater treatment, is generally defined as the physical treatment of effluent through screening and gravity settling in sedimentation tanks. It is defined by the Clean Water Act as at least 30% removal of BOD and SS.

Remove the grease off the primaries more times during the day. If you have a band of grease that is wider than 2-3 inches, go manually pull it off. All that water that washes under it as it sits there is



going to break off more or dissolve more of the grease into the influent to your aeration basin and cause the growth of *Nocardia* and *M. Parvicella*.

**Aeration Basins have issues of their own.**



As you can see, frozen corners, plugged pipes, frost on aerators or mixers can impact the efficiency of the plant.

BOD and TSS can significantly be impacted by cold weather. Luckily, some plants have seasonal permits due to limited capacity during winter months. For those of you who don't process changes need to be made, or the use of bioaugmentation to supplement the bacteria to the system.



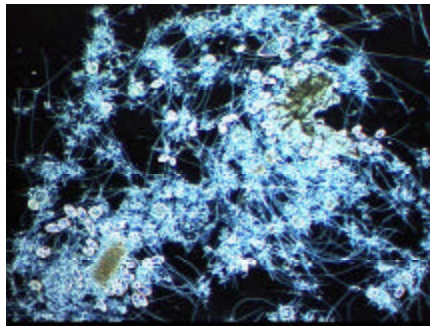
Many plants tend to increase their MLSS during the winter months in order to achieve BOD removal, since it takes more bacteria to do the same amount of work than it does during the summer warmer weather. The problem is in the calculations that some plants use. Most plants use MLSS or MCRT and use number calculations as opposed to using the microscope and really evaluating how old their system is. This can get them into trouble. By picking a fixed number as opposed to really looking at the quality of the solids, you are guessing at the age of your bacteria.

How is that possible? Filaments vs. floc can totally change any "quantity" process control measurements such as F/M, MLSS or even MCRT calculations.



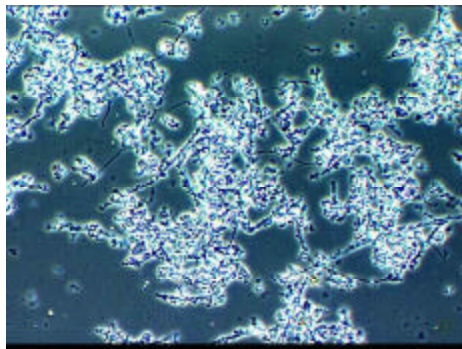


Here are some plants with tons of Nocardia foaming due to grease and high solids handling in the clarifier.



Floc that has

filaments is going to take up 3-5 times the volume of mass that floc formers take up. You are not getting 3-5 times the treatment, there are



holes and spaces in the volume. Imaging a sponge- so if you use volume or mass balance as a way of measuring MLSS, keep that in mind. Check under the microscope. You may need more mass to do the same amount of work!

Use your microscope daily, it is more accurate than any numbers can ever get close to! The bugs will change quickly in hours and react to any spill, and will tell you long before there are major problems. Think about it, their life span is many times 20 minutes to 2 hours. They will react quickly and indicate changes needed. If you need to keep a medium to older sludge age, instead look at your floc structures, whether you have stalked ciliates and rotifers vs. rotifers and worms. Base your solids and wasting schedule on what the bacteria are telling you as opposed to what a calculator is telling you! The bacteria could care less what the numbers say on your calculator. Use the microscope! Then make adjustments!

This way of running a plant goes for any biological unit, lagoons, oxidation ditches, activated sludge, etc.

Don't forget any channels. Since these areas are relatively small and it is easier for temperature loses, ice or frozen sludge can cause block ups or clog the channel. This can cause the floc to freeze, and die off. This can also cause filamentous problems also.

Channels or collection pits prior to clarifiers or after clarifiers are also areas to check for solids build-up and frozen sludge.



Walk through the plant, make sure you do not have frozen sludge, if so, move it or hose it down with warm water to get it out of the channels, back into the system or out in the sludge dewatering.



**Oxidation Ditches-** These units may have more issues than aeration basins. Due to the fact that many of these are mechanically aerated by a paddle wheel or brush aeration rotor, they do not get some of the heat generated by mechanical aerators.

Some oxidation ditches have old, poorly performing fixed brush aerators, which provide poor mixing and poor oxygen transfer. These mechanical brushes during the mixing process entrain oxygen into the mixed liquor to foster microbial growth, the bad thing is that it also exposes the MLSS to more of the cooled surface air during the mixing and aeration process. This type of mixing introduces large amounts of the already cooled air into the MLSS and water, thus lowering the temperature even more than just surface cooling.



The basin volume and footprint required for oxidation ditch plants have traditionally been very large compared with other secondary treatment processes. This usually means more surface is then

exposed to the colder air temperatures.



Oxidation ditches typically operate in an extended aeration mode with long solids retention times (SRTs). This also promotes the growth of some of the filaments, mainly *Microthrix parvicella* that thrive on older sludge and colder temperatures.

Some plants have to be concerned about protecting the rotor unit(s) from excessive ice buildup during **cold weather** operation

This would not be fun to run! Even though below the ice cover the water is moving, this ice can still impact the activity of the biological system!

**Trickling filters** need to worry about frost, frozen or clogged pipes and lowered BOD activity in their system due to cold weather.

**Clarifiers-** Winter is especially hard on clarifiers.



Poor Floc Formation  
Slow impact on



Coagulation  
More surface air if very large clarifiers and cooler temperatures  
Reduced Settling Time in Clarifiers due to higher solids inventory  
Here you can see ice on cables, we

have seen ice on scrapers and weirs also, snow on floating scum, which then makes the scum even harder to get off the surface of the clarifier.



**With extremely cold temperatures, there is a potential for damage to your plumbing.** Pipes and meters can freeze

when the temperature remains below 25 degrees for extended periods.

Here is a plant with a digester cover that exploded when the pipes froze and the gas built up in the digester.



#### **Dewatering-**

Did you know that cold could impact the activity in your polymer usage during dewatering?

Polymers require water to unwind the polymer chains. Cold make-up water slows the polymer preparation by impeding the unwinding process. In the case of very cold water, (just above freezing) the polymer chain will not unwind at all.



Use warm water if possible or at least room temperature water for polymer preparation tanks. If this is not possible, then a portable heater should be placed in the polymer addition tank. A dramatic improvement will be observed if room



temperature water is used for polymer additions.

**Drying Beds**

Some plants have solids drying beds. As solids are stabilized and dried, they are applied to farm fields. Typically digested sludge from aerobic digesters flows by gravity to exterior



drying beds. Any inclement weather such as rain, snow or cold temperatures slows the drying process. Removal of solids that are frozen is impossible in winter, and sometimes can limit the amount of dewatering or solids

that can be drawn off the system. This in turn makes the sludge older, many times more filaments grow due to an older solids retention time. Filaments take up more space, and then the system gets even more stressed.

Try to make sure you select for floc vs. filaments to avoid this. Use your microscope, and adjust the parameters involved with your plants and the filaments you have growing in order to optimize



your system if you have this situation. Check our troubleshooting guide and operations suggestions, since there are too many variables to cover all areas for this situation

in this newsletter.

Some plants take in tankers and septic haulers. Make sure they are not bringing in frozen, dead sludge to your plant, higher levels of amines, which can impact your nitrification or chunks of grease that break off during colder months.

**What are some additional ways to help your plant with weather changes?**

**Winter Bioaugmentation**

**Upset Recovery Programs-** Some plants keep a small amount of bacterial products on hand for upset conditions. Temperature swings can impact a plant if the weather changes significantly. Loading swings can also impact the plant more in the fall and winter months.

For many industrial plants, if a significantly high loading comes through the plant, bioaugmentation can be used to instantly get the plant up to speed and beat the time and numbers game without delay or impact to the final



effluent quality. Since many plants can only return so much RAS to the front end and are limited by pumping speed, or even the amount of bacteria in the current system, the use of biological products is a quick and easy way to help increase the activity instantly.

Remember it does not take a ton of product to instantly bump up the system. A typical maintenance dosage is only 1 lb of product for every 1MGD a day if the typical flow is around 2-300 parts of BOD. You can do the math, if your flow is lower, but the BOD higher, make adjustments. See our Math calculations where in 24 hours 6.7 lbs of product equal the equivalent of trucking in a 4000 gallons of MLSS from the neighboring plant!

Sometimes being prepared for an upset is better than waiting for it to happen and scrambling. The bacteria products usually have a pretty long shelf life- 6 months to a year, so having a small



amount on hand can be a good idea if your plant has the potential for upset conditions or wide swings in influent loading. Lagoon systems, especially in Papermills, typically have a harder time meeting BOD permits in winter, They almost always use

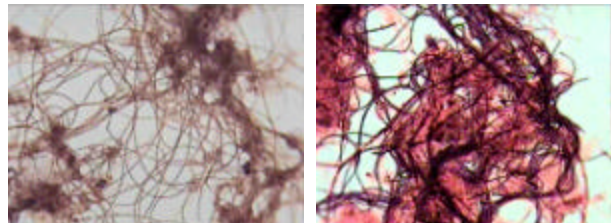
some type of bioaugmentation program Ask about our Dual Programs today.

**Winter Filaments, Nocardia, Microthrix parvicella and 1863**

There is nothing worse than having a filamentous problem that is ten times worse during the winter months. Who wants to worry about frozen foam and scum on clarifiers that can break rakes, pumps, or may be a mess to clean up.

What causes these filaments to grow worse in the winter? What types are they usually?

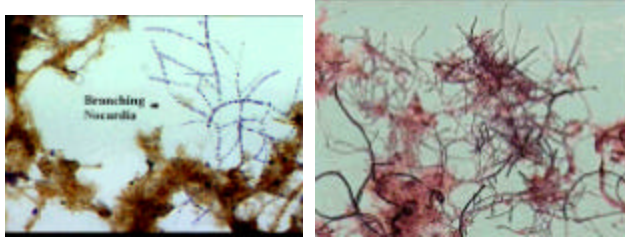
**M. parvicella** typically grow and thrive in the colder months. Microthrix parvicella is usually caused by low F : M and high wastewater grease and fat, or colder temperatures. This filament, since it grows internally, can be overlooked.



This filament can cause serious settling problems, make it harder to dewater and increase polymer consumption as well as solids handling costs. This filament is easy to identify as it is Gram positive and has like spaghetti like tangles.

**Nocardia is** a filament that typically likes also a longer MCRT, excess grease, oils and fats and usually warmer temperatures, yet we have seen a significant increase in this plant in municipalities and food plants during the winter. Since biological activity is slower in the winter, it may be that the normal carbonaceous floc forming bacteria have not consumed the grease as effectively, thus the Nocardia takes over. Frozen

foam, as you have seen in the earlier pictures on a clarifier is not fun or easy to remove.



This filament is easy to identify as it is gram positive, but the only filament with real branching.

These filaments are very easy to identify if you blow up the sample. If you just look at low power, 40x or 100x, you may overlook these filaments. Use 400x, use instant stains, Lactophenol cotton blue if necessary even use Gram and Neisser stains. Make a process change, adjust the grease removal in your primaries and if needed, bioaugmentation upstream to help with elimination of the grease. Make sure to adjust the sludge age based upon higher life forms not volume and mass balance numbers. Fluffy, filamentous bulking sludge will take up more room than floc formation, and will give you false numbers as far as MCRT and F/M rations.

## Misc. websites

**Environmental Leverage Inc.** offers consulting services, beneficial reuse, training and bioaugmentation programs that can help reduce your surcharges.

**Contact our office today to find out how you can start saving money and become more efficient at your plant!!!**

Many times we have suggested articles for the next months issues. Sometimes we change what we will be featuring based upon critical issues that surface during our contacts with our customers. We hope this does not inconvenience you. If you have a specific topic you are interested and do not want to wait to see if it shows up in our newsletters, call us direct. We do have over 20 gigabytes of information on file on every subject around on water and waste issues.

**COMING IN THE NEXT MONTHS . . . . .**

[Oil in new construction, causes of Nocardia and M parvicella](#)