Environmental Leverage Inc.
Turning Liabilities into Leverage

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Are you overdosing nutrients at your plant?

Here is a scenario we come across occasionally in industrial facilities. Many industrial plants have to add N and P for the carbonaceous bacteria to consume as a nutrient source because there are insufficient levels in the process water.

Sometimes plants overdose the nitrogen feed. They do not see residuals in the final effluent, so they continue to increase the ammonia levels. They keep adding more and more each day. They end up getting into a bad cycle and pretty soon, they can never see any in the final effluent and start to panic. Overdoses are often common in this scenario.

The rule of thumb for typical dosing of nitrogen in the past has been suggested that dosing of nutrients is controlled so that there is a residual of 1-2 ppm in the final effluent. Part of the reason this rule of thumb guide is used is because final effluent residuals almost always have to be tested for permit levels. This saves on additional testing of influent parameters and the numbers are easily available.

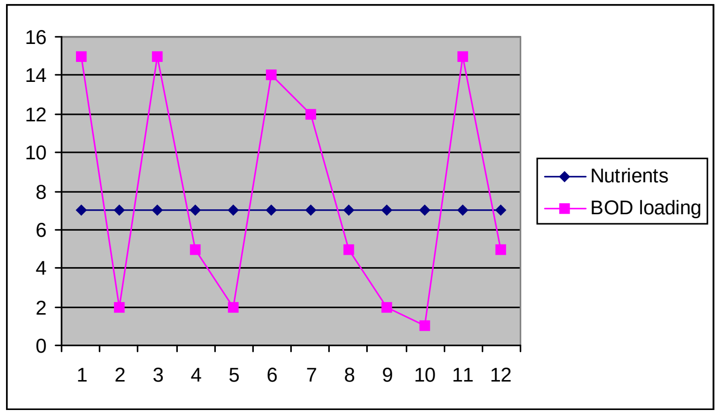
The problem with this scenario is that sometimes, plants overdose nutrients and create an excess in the system (by the way it is very rare, usually many plants are often under dosed). By having an excess in the system, a nitrification population starts to develop. As the plant adds more and more ammonia, the nitrifiers will continue to consume the excess nutrients. They grow, they thrive and they multiply. A large amount of money is spent on unnecessary nitrogen. Sometimes nutrients can cost up to 17% of the budget at a wastewater treatment plant. This is not a situation you want to get into. If you do not have to nitrify, don't. It is an expensive process.

Another thing we see quite often at paper mills or chemical plants that indicates this type of condition exists is the presence of bristleworms. These little pink worms almost always indicate an overabundance of nitrates. Unless you have nitrates in your influent, you should not see these organisms growing in your plant. If you do, it means you are overdosing nitrogen, have purposely caused the development of a nitrification population and are wasting money. Cut back on your nitrogen dosing.

How do you figure out if you are overdosing? One simple test to run is nitrates on the influent & effluent. If you do not have nitrates in the incoming process water, no change should be in the effluent levels. If you have a large increase & it changes daily based upon your nitrogen feed, you are overdosing ammonia and have created unnecessary nitrification in your system.

How do you solve this problem? Actually quite easy. You need to start feeding based upon front loading of carbon. There is now a quick easy way to test TOC onsite in two hours. If you have testing equipment for COD, you can easily run TOC instead. This is a better measure of the total carbons that bacteria will see as a food source. Hach makes test N tube reagents that make it easy to run an onsite test for TOC. When you get the results, do the math calculation on N loading. As long as you do not have final effluent permits that are extremely low, typical loadings are 100-5-1 of Carbon-nitrogen to phosphorus. The same equipment you use for your COD testing can be used for TOC testing, you just

order different chemicals. The COD Program runs at 150°C, for120 minutes, while the TOC Program is105°C, for 120 minutes. Also TOC has no mercury, so no hazardous waste.
You are then feeding the bacteria the correct amount of nutrients instead of overdosing them and wasting a ton of money.



Another typical mistake plants make with nutrients is the time they dose. Some plants slug feed or use a continuous feed rate. You really need to feed nutrients based upon the influent loading. If your plant runs 24/7 and has continual consistent feed, a slow, continuous feed of nutrients is recommended. If, on the other hand, your plant runs only shifts, or tends to have batch dumps of high loadings, you need to slug feed your nutrients again based upon your feed loading.

A typical loading of nutrients is 100-5-1 of Carbon, to nitrogen to phosphorus in order for optimal bacterial growth. During wide swing loads, nutrients should be increased. Nutrient deficiency can cause serious problems. It is already harder for the floc forming bacteria to work when high organic instant BOD swings come through, but add the stress of nutrient deficiency and this increases the problems. This creates a climate that is difficult for the floc forming biomass to grow in, but enables filamentous bacteria to take over.

Think of it this way, if I gave you 5 hamburgers for breakfast, but nothing for lunch or dinner, you would be hungry by nighttime. Why, you had tons of food? It is the same with the bacteria. Think of this, many of the bacteria in the wastewater treatment plant have a life span of 20 minutes to 2 hours. If they are in the late shift, they never saw the nutrients that were loaded earlier.

Check your nutrients - Base loading on influent - Adjust feed rate based upon influent loading - If necessary, test nitrates at back end a few times to get a baseline and determine if overdosing. Most importantly, make sure the bacteria are getting the right amount of nutrients at the right time. Too much and you are wasting money and running the plant inefficiently, too little and you can get zooglea or filamentous bacteria problems and create worse problems!

But I am doing that and it still is a problem?

Have you taken into the calculation your supernatant off your digestor, belt press or sludge dewatering unit? Many plants have digestors and sludge dewatering units. The supernatant off these units is returned to the front of the plant. This stream is almost always high in N and P. Run tests on this stream. Make a calculation on how many nutrients you are returning to the front of the system, and make sure to take that portion out of your math calculation when you are figuring out front loading dosing of nutrients. This is often a very important source of nutrients that is overlooked at many plants. Optimization of a plant's costs can be significant if this variable is considered.
You can always do a Nitrogen balance across your system. Contact us for help at Elfenvironmental@aol.com by email.