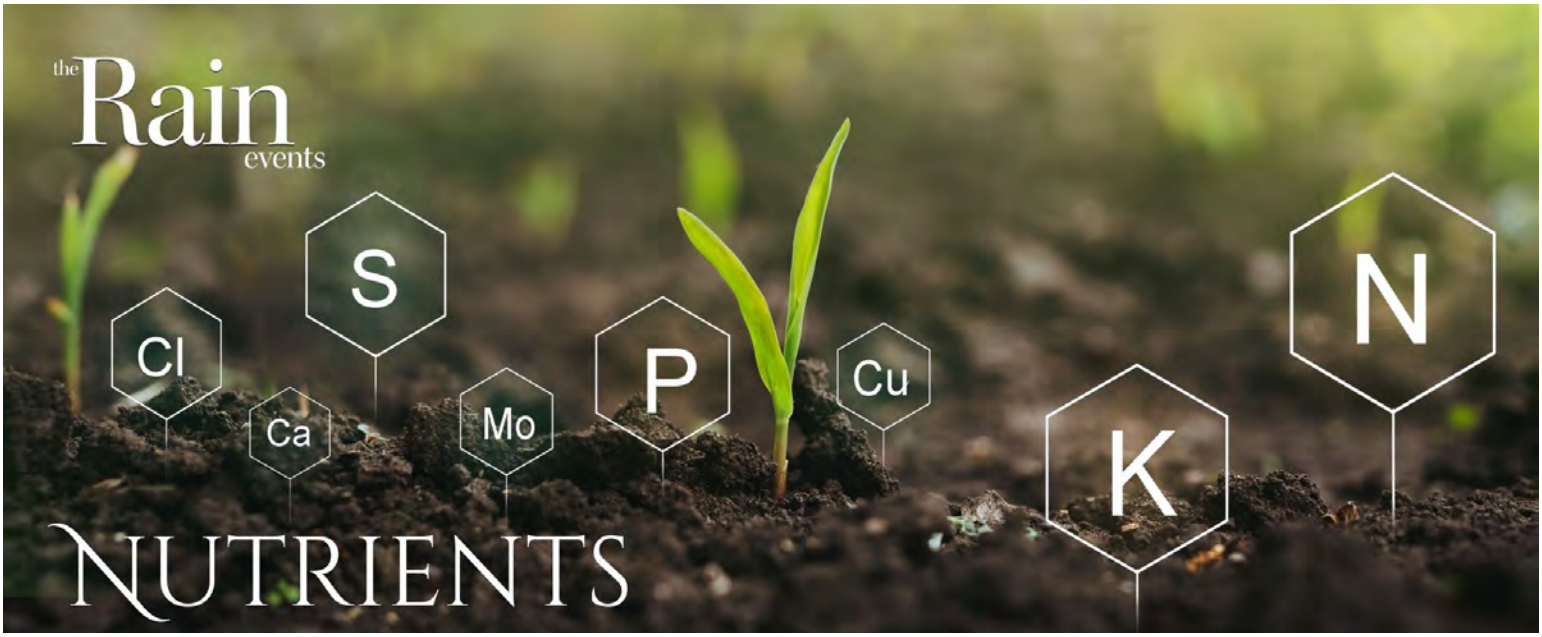


Storm water shouldn't be nutrient dense.

Spring is here and new life is growing and the world is turning green. If you're an avid gardener, your thoughts are probably occupied with garden plans and plants. And while nutrients in soil and water are great for healthy gardens, the same is not true for storm water leaving your site. Nutrients in storm water are some of the most common yet most difficult pollutants to eradicate – specifically N+N and its friends. These nutrients, once in contact with storm water, are hard to remove, so the only real way to control these pollutant levels is source control – for some dischargers this task is easier than for others (not every facility has sources of these pollutants on site). In this month's edition of **The Rain Events**, we will be learning about N+N (Nitrites + Nitrates as Nitrogen), ammonia, and phosphates. While nutrients are helpful for making plants grow, they are definitely not beneficial to storm water.

Why are nutrients so detrimental to storm water? Nutrients, used to aid in rapid growth of vegetation (think fertilizers), can also accelerate *eutrophication* in waterways which can lead to dangerous algal blooms, reduced levels of oxygen, increased toxicity to humans and aquatic organisms. Culprits of nutrient density in runoff can be traced to things such as pet waste, fertilizers, nitrogen used in farming, green waste (especially decaying organic materials), wastewater, production byproducts or additives, and waste from animal feedlots.

N+N: "Nitrite" refers to the nitrite ion, which has the chemical formula NO_2. One of its more common forms is sodium nitrite, or $NaNO_2$. Sodium nitrite is a salt that is commonly used in the food industry to preserve foods and prevent botulism (think bacon, sausage, cold cuts, and corned beef). When dissolved in water, nitrites will rapidly convert into nitrates. "Nitrate" also refers to an ion and has the chemical formula NO_3. Nitrates are commonly found in salt form, the most common of which being potassium nitrate, or saltpeter. When analyzing for nitrogen in storm water runoff, the results for both nitrate and nitrite ions are added together and reported as Nitrogen, essentially counting the nitrogen atoms and hence the name—Nitrate + Nitrite Nitrogen, or N+N as N. Nitrates and nitrites are both commonly found in fertilizers, wastewater, and waste from animal feedlots. So, if your industrial facility handles any of those materials, your storm water could potentially contain traces of nitrates or nitrites. Nitrates can also be used as an oxidizing agent, and is sometimes used in glass, metal, and plastic production, as well as in the use of production of explosives, and concrete manufacturing. And remember that even if nitrites or nitrates are used indoors, they can still impact storm water by escaping through roof vents in particle (such as fertilizer dust) or gas (such as fumes from oxidizing reactions) forms.

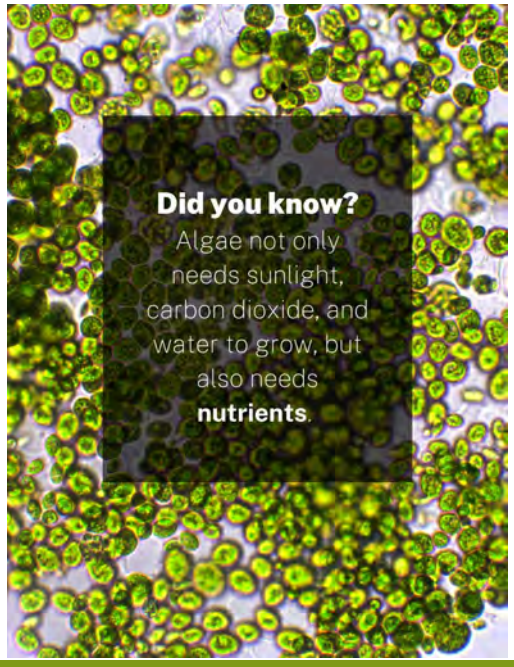
Ammonia: Ammonia is a compound of nitrogen and hydrogen with the formula of NH_3. It is a colorless gas with a recognizable pungent smell. Although very common in nature as a waste product and widely used as a chemical, ammonia is both caustic and hazardous in concentrated form. Ammonia gas is very soluble in water, and aqueous solutions of ammonia are commonly used for household cleaning tasks. However, the largest use of ammonia (up to 88% in 2014) is in fertilizers – either in salt form, solutions, or anhydrously. Roughly a third of agricultural nitrogen applied in the United States is in the form of anhydrous (literally: "without water") ammonia. But aside from a sewer leak, where might ammonia come from on an industrial facility? Table 1 in the Industrial General Permit only lists two industries that are required to sample for ammonia – hazardous waste facilities, and air transportation facilities (potentially; see footnote 16 on page 42 of the IGP). It's probably not a surprise that there could be ammonia at a hazardous waste facility, but an airport? Well, that's where our second chemical comes in. Up until very recently, urea was used as a pavement deicer at many airports. However, because of its propensity to

336X	Nonferrous Foundries (Castings)	Cu; Zn
34XX	Fabricated Metal Products (Except 3479)	Zn; N+N; Fe; Al
3479	Coating and Engraving	Zn; N+N
4953	Hazardous Waste Facilities	NH3; Mg; COD; Ag; Cn; Fe; HC; Se; Al;
44XX	Water Transportation	Al; Fe; Pb; Zn
45XX	Air Transportation Facilities[16]	BOD; COD; NH3
4911	Steam Electric Power Generating Facilities	Fe
4953	Landfills and Land Application Facilities	Fe
5015	Dismantling or Wrecking Yards	Fe; Pb; Al
5093	Scrap and Waste Materials (not including source-separated recycling)	Fe; Pb; Al; Zn; COD

*Table 1 Parameter Reference	
Ag – Silver	**Mg** – Magnesium
Al – Aluminum	**N+N** - Nitrate & Nitrite Nitrogen
As – Arsenic	**NH** – Ammonia
BOD – Biochemical Oxygen Demand	**Ni** – Nickel
Cd - Cadmium	**P** – Phosphorus
Cn – Cyanide	**Se** – Selenium
COD – Chemical Oxygen Demand	**TSS** – Total Suspended Solids
Cu – Copper	**Zn** – Zinc
Fe – Iron	**Pb** – Lead
Hg – Mercury	

decompose into ammonia, the EPA has prohibited the use of urea at most airports in the United States. The largest use of ammonia and urea is in fertilizer, but there are many other potential sources of ammonia at an industrial facility – look for ammonia and urea used in laboratories, in cleaning chemicals, in refrigeration systems, in automotive systems (as Diesel Exhaust Fluid), wood working manufacturing practices, and in pharmaceuticals.

Phosphates: Pure phosphorous is not common - typically it combines with oxygen to form phosphate molecules (PO_{-3}). When phosphates are combined with carbon-based molecules they are classified as organic and bind to things like sewage, foods or even organic pesticides. Inorganic phosphates, on the other hand, are those not associated with organic material. While animals can utilize both types of phosphates, plants can only use inorganic phosphates—which can be tricky since farmers or landscapers have to apply exact amounts to prevent excessive runoff. Both organic and inorganic phosphates can be dissolved in water which frees them to attach to fine particles. Free inorganic phosphates dissolved in water can be used directly by plants—including plants which don't need fertilizer to help them be healthy and prolific, mainly algae. During rain events, uncontrolled runoff flowing from fertilized areas have the potential to contain high levels of dissolved inorganic phosphates, and if this nutrient-dense runoff enters a waterbody, it can create an influx of nutrients which would assist in the rapid growth of algae, which in turn results in low dissolved oxygen and block sunlight infiltration.



Not Intended for Storm Water Runoff: Assuming that your facility has nutrient sources on-site, what are some ways that you can prevent them from getting into your storm water runoff? Well, a good BMP strategy uses a combination of source reduction, pollution prevention, and treatment. Since nitrates and nitrites are not easy to remove from storm water runoff, the best approach is to keep it out of the storm water in the first place. The first thing you'll want to consider is whether the nitrate-containing materials at your facility are necessary. Is there another non-nitrate-based material you can use that will have the same effect? This is source reduction. But in some cases, such as animal feedlots, nitrates are inescapable since they occur naturally in the waste products. Secondly, practice good pollution prevention strategies, such as good housekeeping and discharge reduction. Keep all fertilizers and animal feedlot wastes contained onsite, and where possible, under cover. If feasible, direct your storm water runoff into a bioretention pond where plants can utilize the nutrients, and try to minimize your storm water discharges as much as possible. Make sure fertilizers are applied correctly and your irrigation program is not creating a nitrate-charged runoff situation. *Keep in mind that neglecting source reduction and pollution prevention strategies will create a problem that is not easily treatable.* However, if you have reduced your pollutant source as much as possible and have good pollution prevention measures in place, treatment BMPs can help lower your numbers even further. Most treatment options will not completely remove nitrates from your storm water – depending on how much money you spend, you should only expect between 25-90% reduction. The more expensive treatment systems may be more towards the 90% side of the spectrum, while less expensive options may remove less than 50% of the pollutant. The same applies for phosphates. *Keeping it out of storm water runoff from the start will save a lot of hassle and NAL exceedances in the end.*

Ammonia, surprisingly, is not as hard as you think to remove from storm water. Again, the best way to remove a pollutant from storm water is to not let it come in contact with storm water in the first place – use good housekeeping and containment to keep your industrial materials and waste out of your storm water runoff. But if it did come in contact with runoff there are a variety of ways to effectively remove ammonia from storm water runoff: amended compost socks, active treatment systems, passive treatment systems, bioswales, and more. Other ways of reducing nutrient loads in runoff is to implement green infrastructure into your storm water system. Low impact development (LID) not only slows and infiltrates the flow thereby reducing the overall amount of runoff, but it also acts like a filter – plants need and uptake nutrients and other pollutants filtering the water by phytoremediation or infiltration.

While it *may* be possible to remove nutrients from storm water, the best method is to check your facility's nutrient potential and reduce sources *before* they become a problem.

The Rain Events

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Storm Water Contest...

Each month, we invite our readers to participate in a contest to test their knowledge of the Industrial General Permit and show their storm water compliance program. We enter all submittals to our monthly newsletter question into a drawing and one person is selected at random to receive a $25 gift card.

What type of pathogens are coliform bacteria?

Congratulations to Lucas who answered, *" Fecal coliform bacteria are used to indicate the presence of sewage or fecal matter in the water column, which could be a potential source of pathogens; strictly speaking "opportunistic pathogens". Fecal coliform bacteria include a handful of bacteria genera, such as: Escherichia coli, Enterobacter, Klebsiella, and Citrobacter."* We hope you enjoy your next Amazon shopping trip on us!

...This Month's Contest

What does N+N as N stand for?

We need industrial storm water sleuths to help us with this month's question. Submit your answers by Friday, April 11th. Email your answer to jteravskis@wgr-sw.com. One winner will be selected by a random drawing to receive a $25 gift card to Starbucks.

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