the Rain events

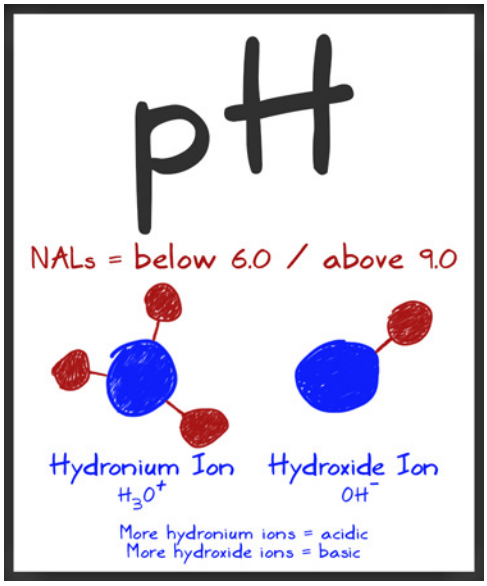
December 2017

phosphorus	oxygen	lutetium	tantalum	nitrogen	tennessine
15	8	71	73	7	117
P	O	Lu	Ta	N	Ts
30.974	15.999	174.97	180.95	14.007	[294]

*Part 7 of a 12-part **exclusive series** on understanding storm water pollutants*

This month, we're going back to the basics. Or, more specifically, back to the bases and acids. If you have been around storm water testing for any amount of time, you've probably had to test for pH. While most of us know that pH has to do with how acidic or basic the water is; we may be unsure of what pH is actually measuring and how the changes in pH affect storm water.

The term "pH" stands for "Potential of Hydrogen," and measures the concentration of hydrogen ions. The International Encyclopedia of Chemical Science defines it as a "specific property of many diverse materials that possess some acidic or basic [alkaline] character." A solution with a pH of 7 is considered neutral; pH readings less than 7 are acidic, and readings higher than 7 are basic or alkaline.



Pure water has a pH of 7, which is considered neutral. Surprisingly, rain water typically has a slightly acidic pH of 5.6, due to the carbon dioxide gas in the atmosphere. The normal pH of a stream is between 6.0 and 8.0. The pH of seawater is about 8.1. Though we commonly refer to water as H_2O, pure water is actually made up of equal parts of hydronium ions (H_3O^+) and hydroxide ions (OH^-). The more hydronium ions, the more acidic (lower pH) the water is. Conversely, a greater amount of hydroxide ions will turn the water basic (higher pH). When chemicals or pollutants are mixed with water, the chemical reaction changes the hydronium/hydroxide ratio, and the water becomes either acidic or basic – for instance, storm water that comes into contact with lime (calcium **hydroxide**) or freshly poured cement can have a pH as high as 10 or 11.

We've all heard about acid rain – a phenomenon caused by natural sources (lighting strikes and volcanic activity) and by manmade sources (sulfur dioxide and nitrogen oxides from combustion of fossil fuels). Acid rain typically has a pH of 4.3, and can erode statues, buildings, and other manmade structures. There is also some evidence to show that acid rain can harm aquatic organisms, insects, and vegetation.

The pH scale is logarithmic, which means that each whole step in pH values is 10 times more acidic or basic. For instance, a pH of 5 is ten times more acidic than a pH of 6, and *a hundred times* more acidic than a pH of 7. Similarly, a pH of 8 is ten times more basic than a pH of 7.

So, you've got a pH problem at your facility – what to do? Well, one of the best ways to control pH is to prevent exposure of pH-affecting materials in the first place. This is called *source control*, and some of our frequent readers are probably getting tired of us talking about it. But for pollutants that are hard to treat, like pH, the best way to make sure you don't have NAL exceedances is to keep those industrial pollutants inside enclosed buildings, or at least under cover. Many pH-affecting materials are in powder or liquid form (concrete, lime, or liquid acids/bases), so make sure your buildings are sealed as much as possible to prevent those materials from escaping and mixing with rain water. Say you've done all the source control possible. Now, don't forget the next most important part of your BMP arsenal – good housekeeping. Sweep! Sweep! Sweep!!! Seriously, possibly the most effective thing you can do to improve your storm water numbers is to run a clean shop. Keep your yard area spotless, and make sure your employees clean up after themselves. Just keep things neat and tidy. It's much cheaper than paying for treatment BMPs, and in many cases, it works better.

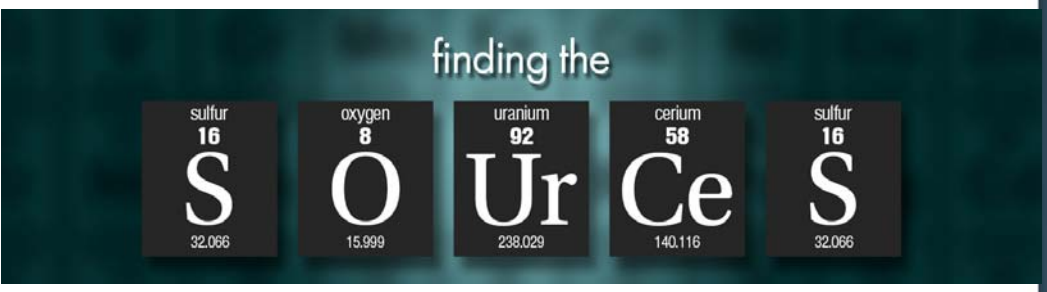
The reason for all this emphasis on source control and good housekeeping is this – you don't want to try to treat for high or low pH. It's labor intensive, requires a lot of coordination with your Regional Water Board, and it's not going to be cheap. Basically, the only way you can neutralize pH is by adding a chemical to push the pH in the opposite direction. So, if your water has a high pH, you add an acid (or a buffer) to bring the pH back to neutral. But be careful! You can't just start adding random chemicals to your storm water runoff – that's a sure way to get yourself in trouble. It's much easier to prevent pH-affecting materials from coming in contact with storm water than to try to correct pH problems after the fact.

But if you're left with no other choice than to treat for pH, you may want to look into a technique called CO_2 sparging. Instead of adding a mineral acid like sulfuric acid to lower pH, this technique bubbles CO_2 gas through the water, which forms carbonic acid (H_2CO_3), which further dissociates into a proton (H^+) and a bicarbonate anion (HCO_3^-). The carbonic acid is a weak acid that lowers pH. CO_2 sparging is safer than mineral acids for a couple reasons: 1) it's virtually non-toxic, and 2) it's actually a buffer, not an acid or a base. Because it is a buffer, it would be difficult to overdose the CO_2 and create harmfully low pH levels. There are a few companies that manufacture CO_2 sparging systems specifically designed for wastewater and storm water applications – check out Fortrans Inc. and Praxair Inc. Keep in mind that chemical-based treatment BMPs are subject to the requirements in IGP Section X.H.6 concerning design storm standards for treatment control BMPs. CO_2 sparging is a complicated and technical procedure, and should not be performed without proper engineering and equipment.

pH – it's the measure of water acidity or alkalinity, and unless you like spending money, the best way to prevent pH from becoming a problem is by keeping your pH-affecting materials away from storm water, and by practicing good housekeeping.

Sources:

1. *Wikipedia*, s.v. "pH," last modified December 2, 2017, https://en.wikipedia.org/w/index.php?title=PH&oldid=813214263.
2. John Teravskis, "Basic or Acidic?," *The Rain Events*, June 2010. http://www.wgr-sw.com/SW-newsletters/RainEventsNewsletter-June2010-CA.pdf.
3. BMP C252: High pH Neutralization using CO_2, *Washington State Department of Ecology*, http://www.ecy.wa.gov/programs/wq/stormwater/wwstormwatermanual/co2_bmp_c252.pdf



So, what could be affecting pH on your facility? Here's a few common culprits:

- Sodium hydroxide (very common strong base; pH of 14)
- Hydrochloric acid (very common strong acid; pH <0)
- Sulfuric acid (strong acid; pH of 1)
- Ammonia (moderate base; pH of 12)
- Lime, quicklime, concrete, cement, etc. (moderate bases; pH of 12)

Have questions about the Industrial General Permit?
Give us a call at (209) 334-5363, ext. 114

"To Do List" for December:

- Perform the December monthly inspection
- Get those Level 1 ERA and Level 2 ERA reports finished!
- December is the last month to get samples for the first half of the 2017-18 storm water year.

Breaking News

If your industrial facility is at Level 2 ERA status, you probably received a very interesting email from the State Water Resources Control Board talking about a proposed amendment to the Industrial General Permit.

According to the email dated November 21, 2017, the proposed amendment would "incentivize storm water capture to enhance and augment local water supply and quality."

What does this mean? We don't know, and they don't really say. But apparently, facilities that install a capture device that can capture and hold storm water from consecutive, daily, 85th percentile storm events, may be offered incentives to use, infiltrate, or evapotranspirate the captured water.

The public notice and comment period should be coming soon, so stay tuned for updates. In the meantime, make sure you're signed up for the State Water Board email list – which you can do here:

https://www.waterboards.ca.gov/resources/email_subscriptions/swrcb_subscribe.html

Please contact us if you have any questions …

The Rain Events

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Your friends at The Rain Events wish you a Merry Christmas and a wonderful new year full of **clear** *storm water samples!*

...and there were shepherds living out in the fields nearby,
keeping watch over their flocks at night....

- the **Christ***mas story*

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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 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. Last month's question was:

Who is required to be covered under the EPA's Multi-Sector General Permit?

Congrats, **Lon Kitagawa,** you're correct! The Multi-Sector General Permit provides storm water permit coverage in areas where the EPA is the NPDES permitting authority. This includes industrial facilities that are located in U.S. territories, reservations, and in areas that don't have NPDES storm water permitting programs.

This Month's Contest Question:

If storm water mixes with hydrochloric acid, will the resulting pH be higher or lower?

By December 31, 2017, submit your response to the above question by sending an email to jteravskis@wgr-sw.com. All persons submitting the correct answer will be placed in a drawing. The winner will receive a $25 gift card to Amazon.com.