CORROSION CONTROL WITH PHOSPHATES

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The following information on this topic were taken from this website: **http://www.ameriwestwater.com/faq/testing-phosphates.**

In my recent travels this topic has come up several times and there seems to be several ideas as to how this product should be used for each system I visit. Hopefully this article can clear up some of the questions or difference of opinions I have encountered. No matter what you think after reading this, it will always be my opinion that using this form of corrosion control should be used by every system, one reason is that it is reasonably inexpensive and it will benefit both your distribution system as well as your customer's interior plumbing.

It's important to understand the different forms of phosphate that can be present in water and the methods used to chemically analyze them.

Ortho vs. Poly: Very simply put, 'ortho' phosphate in water treatment formulas is used to treat corrosive water, whereas the 'poly' phosphate portion is primarily used to sequester iron, manganese and hardness. Many water treatment formulas contain varying blends of both forms in an attempt to provide a multiple use product that offers sequestering and corrosion control.

Testing Methods:

Ortho Phosphate Testing Methods; Analytical tests are only able to detect ortho phosphate in water samples. The common test for ortho phosphate is called a "Reactive Phosphorus (Orthophosphate)" test, where phosphate in the water reacts with reagents to produce a blue color which is measured and reported as _____mg/L PO4. (Note, many laboratories when asked to analyze a sample for phosphate will report the sample results as phosphorus. When results are reported as mg/L of phosphorous, multiply the results by 3.06 to get results as mg/L orthophosphate, PO4.)

Total Phosphate Testing Methods; if organic phosphates, condensed inorganic or long chain linear polyphosphates are present, they must be converted to ortho phosphate before it can be measured. The sample is treated with heat and acid plus reagents to break apart the condensed or linear chain forms of poly phosphate to the basic reactive ortho phosphate before analysis. Water sample + acid + heat + reagents changes the condensed polyphosphate PO4 present to orthophosphate PO4 which can be measured by the reactive phosphorous method. Results are reported as total phosphorous PO4. Polyphosphates are thus determined indirectly by subtracting the result of the basic reactive phosphorus test from the total (acid hydrolyzable) phosphorus test. When you subtract the ortho PO4 from the total PO4 the difference is Poly phosphate, PO4.

In summary: Total phosphate as PO4 – ortho phosphate as PO4 = Poly phosphate as PO4. Always do both tests if you need to determine the polyphosphate concentration.

Is water chemistry important?

Water quality parameters such as pH, iron, manganese, hardness, etc. will greatly influence the final product and treatment recommendation. The following water characteristics and their effect on water quality should be part of the overall treatment evaluation:

- **Alkalinity:** As alkalinity increases corrosion decreases.
- **Calcium:** As calcium increases corrosion decreases.
- **Biofilms and microbial growth:** As biological activity increases corrosion increases.
- **Chlorides, Sulfates and Nitrates:** As part of the TDS, as these increase, corrosion increases.
- **Chlorine:** As chlorine increases, corrosion increases.
- **Dissolved Oxygen:** As dissolved oxygen increases, corrosion increases.
- **Iron & Manganese:** As Fe-Mn increases, discoloration increases & water quality decreases.
- **Flow Velocity:** Excessive flows can increase corrosion.
- **Hardness:** As hardness increases, corrosion decreases.
- **Hydrogen Sulfide (H2S):** As H2S increases, corrosion increases.
- **Phosphate:** Decreases corrosion by providing cathodic and anodic inhibition.
- **pH:** As pH increases, corrosion decreases.
- **Silicates:** As silicates increase, corrosion decreases.
- **Temperature:** As temperature increases, corrosion increases.
- **Total Dissolved Solids (TDS):** As TDS increases, corrosion increases.

Choosing the best product?

No two water systems are exactly alike; however, almost any water quality problem can be defined by chemical analysis of water in the distribution system as it compares to water at the source. There are so many variations in municipal water quality; it seems strange that some manufacturers expect a single product to be adequate to treat all water systems. Experience has shown that the specific properties of the pyros, tripolys, trimetas ▶▶▶

and hexametaphosphates allow for numerous formulations and product applications so as to achieve the desired results. It is desirable and possible to develop treatment chemicals that work on specific water quality problems. Be skeptical of any manufacturer that promotes a "one product fits all" approach.

What's the right dose?

As discussed previously, the threshold effect with these blended phosphates allows for their use at dosages far below the expected molecule to molecule level. General factors of the treated water to consider are the basic chemicals of iron, manganese and hardness, and physical concerns like temperature and pH. Most sequestering and corrosion problems can be handled by dosages less than 2 mg/L. Scale control and cleaning of the distribution system in conjunction with a thorough flushing program may require up to 5 mg/L initially but can usually be reduced and maintained at doses of 1mg/L.

This last item that I choose to share is the one that I feel is the most important one of all. As you can see this source considers 1 mg/l a good target maintaining residual. I happen to agree with this source, however I have been told by systems that they were told that a .2mg/l would be sufficient. When using a blend that both strips off and then coats (or protects) the pipes I have found in more than one system that only using the .2mg/l did more damage than good. It seems that at this low of a dose only the stripping of the pipes was taking place and no coating at all was the result. In every case, I recommended that they increase the dose to reach the 1mg/l target and have had positive results. As previously stated, each system is unique and may not have these same results, but if all other avenues have been explored, I think it would be worth a try. There is a lot more information to be found on this topic on this website as well as many others I'm sure, but if you start here, I think you will be on track to improve your distribution system and start to receive a lot less water quality complaints. Who would not want this result? 💧💧💧