



September 24, 2024

VIA EMAIL

Elin Betanzo
Safe Water Engineering
elin@safewaterengineering.com

Re: Response to Particulate Aluminum Phosphate Concerns from Elin Betanzo on Behalf of Highland Park

Dear Ms. Betanzo:

Thank you for contacting Great Lakes Water Authority (GLWA). This letter is our response to the following inquiring that was received.

I've been working with Highland Park for several years and we have been finding particulate aluminum orthophosphate in water quality parameter samples consistently over several years. After collecting several orthophosphate results at 2 mg/L and greater, sometimes nearing 6 mg/L, we filtered samples and did additional analysis to identify the source of the high orthophosphate. We measured aluminum orthophosphate particulate, and I think this comes from orthophosphate reacting with alum from the treatment process. ~ Elin Betanzo

The intent of the corrosion control study was to determine whether GLWA needs to change its corrosion dosage to meet the new Michigan action level exceedance change for lead to 12 ppb (parts per billion).

1. *Has GLWA studied how/whether the increased orthophosphate dose might result in more particulate orthophosphate in member system distribution systems?*
 - a. No, however, the Lead and Copper Rule (LCR) requires that reactive *ortho*-phosphate be measured at the treatment plant and the distribution system. [Michigan R325.10710a & b and EPA 816-F-08-018]
 - b. Measurement is for any reactive *ortho*-phosphate and the reactive *ortho*-phosphate reacts with the molybdate and antimony ions in an acidic solution to form an antimonyl phosphomolybdate complex, which is reduced by ascorbic acid to phosphomolybdenum blue. It is then measured photometrically against a standard curve and reported as what is available as

reactive *ortho*-phosphate. Use of other methods may alter the results by hydrolyzing other forms of phosphorus to reactive *ortho*-phosphate and give erroneous results. However, inherent on the reactive *ortho*-phosphate measurement there is some hydrolyzing of phosphorus, but it is considered minimal.

- c. Any aluminum phosphate is considered insoluble in water and is supported by its solubility constant on the order of 10^{-20} moles per liter ($\sim 1.2 \times 10^{-15}$ mg/L). Meaning aluminum phosphate should not significantly contribute to the available reactive *ortho*-phosphate.
 - d. In summary, GLWA measures reactive *ortho*-phosphate (the available *ortho*-phosphate) in accordance with compliance monitoring for drinking water using an approved ascorbic acid drinking water method. [Michigan R325.10710a & b and EPA 815-B-24-002 method SM4500-P E]
2. *Did the corrosion control study evaluate strategies that can be used at the water treatment plant to reduce the possibility of creating aluminum orthophosphate particulate?*
- a. No, during this latest study, it was not necessary to re-evaluate where to put the dose in the treatment chain because it was established in the original 1990s study. The *ortho*-phosphate is added after sedimentation and filtration, therefore very little aluminum is available to react with the *ortho*-phosphate.
 - b. Measured values from the plant taps that serve Highland Park (Water Works Park and Springwells water treatment plants) indicate that at the plant taps, the average contribution to the *ortho*-phosphate as combined with aluminum is 0.2 mg/L. This indicates that GLWA's average plant tap measured reactive *ortho*-phosphate to be (1.2 ± 0.2) mg/L well within the current GLWA required standards set by the Michigan Department of Environment, Great Lakes, and Energy (EGLE) in a letter sent to GLWA requiring a minimum reactive *ortho*-phosphate measured in the distribution system to be 0.9 mg/L.
3. *When orthophosphate is in particulate form it is not available to provide corrosion control, potentially making the additional dose irrelevant.*
- a. If you are referring to aluminum *ortho*-phosphate as the particulate form, your statement would be correct if all the additional reactive *ortho*-phosphate were to react with aluminum and form aluminum phosphate. Having all the reactive *ortho*-phosphate react with aluminum is not expected, because it currently does not happen as is evident by measured reactive *ortho*-phosphate in the plants and distribution system.

- b. GLWA must follow regulatory requirements and measure reactive *ortho*-phosphate. The reactive *ortho*-phosphate is measured in the five GLWA water treatment plants on a daily basis and in the member partner's distribution system at over 750 locations each quarter in accordance with GLWA's and their member partner's monitoring schedules which prescribe the frequency, quantities, and timelines of required samples to meet the requirements of the LCR. [*Michigan R325.10710a & b and EPA 816-F-08-018*]
4. *Can GLWA and member partners add filtered and unfiltered ortho-P samples to the water quality parameter sampling, especially during early implementation, to explore the magnitude of particulate formation?*
- a. Yes, member partners can measure filtered and unfiltered samples for comparison purposes but must report the results from the approved method. GLWA's Water Quality team will be monitoring reactive *ortho*-phosphate as required by EGLE and the U.S. EPA. [*Michigan R325.10710a & b and EPA 815-B-24-002 method SM4500-P E*] The Water Quality team has been directed to analyze samples with a filtered duplicate when they detect a higher than normal reactive *ortho*-phosphate result from the distribution system. However, GLWA must report the values that are measured using the certified method for reactive *ortho*-phosphate.
 - b. GLWA's Water Quality team will collect investigatory samples from the five GLWA water treatment plant taps and representative sites in GLWA member partner distribution systems to analyze for *ortho*-phosphate using both filtered and unfiltered samples for comparison. The results obtained should provide definitive information as to the baseline of available reactive *ortho*-phosphate to unavailable *ortho*-phosphate for corrosion control. GLWA will use a third party certified drinking water laboratory to perform several of the analyses to ensure that any potential bias is addressed.
5. *It will be important to get a baseline quantification of particulate ortho-P throughout the GLWA system before the treatment change starts and to monitor whether there is an increase in particulate with the increased ortho-P dose. The data collected would be very relevant and informative for the wastewater treatment concerns raised during the webinar.*
- a. GLWA analyzes samples using the aforementioned criteria and will take appropriate action to ensure that the distribution system and its corrosion treatment meets the high standards that we hold ourselves to deliver drinking water of unquestionable quality.

Please feel free to contact me should you have additional questions at (313) 926-8127 or Patrick.Williford@glwater.org.

Sincerely,

Patrick Williford
Water Quality Manager

cc: Cheryl Porter, GLWA
Terry Daniel, GLWA