

Prysby, Mike (DEQ)

From: Lytle, Darren <Lytle.Darren@epa.gov>
Sent: Monday, October 19, 2015 12:05 PM
To: Prysby, Mike (DEQ)
Cc: Schock, Michael; Kempic, Jeffrey; Busch, Stephen (DEQ)
Subject: RE: Flint WTP PH2 SEG4 - Corrosion Control

Clarify dosage as PO4 as indicated or PO4 as

Mike,

Thank-you for giving us the opportunity to review the city of Flint's corrosion control plan.

We believe it is necessary that Flint boosts orthophosphate dosage. Given that the distribution system has not received orthophosphate in over a year, we expect that orthophosphate will need to be boosted to 1) meet the demand of the distribution system, 2) reach the service lines and other lead-containing components in premise plumbing, and 3) accelerate lead reduction at the consumer's taps. Orthophosphate should preferably be added in the same form as the Detroit source which is phosphoric acid from our understanding. This is the proposed case here, however, a simple test should be performed to make sure that the pH is not impacted in a significant way at the desired target dose.

We have not been able to obtain comprehensive water quality data for the finished water characteristics of the Detroit water that will be fed to Flint, to assess ranges of major chemical characteristic fluctuations. However, based upon the email trail, Detroit water entering the Flint system appears to only contain around 0.4 PO₄/L. This concentration range is entirely too low compared to that needed in studies presented and published in the last 20+ years that have focused on lead released directly from lead pipes, and the solubility of the most likely lead orthophosphate pipes scales. We also strongly feel that targeted dose of 0.8 mg PO₄/L is also too low, for the very same reason. We would be glad to share with you numerous standard corrosion control and treatment reference works, best practices guides and published results from US and international lead corrosion control field and pilot studies. Secondly, the basis for that target (other communities using Lake Huron source use the same dose) is not scientifically derived nor does it consider water quality and the current state of Flint's distribution system. We have reviewed the original Detroit corrosion study and have seen some of the LCR monitoring data, and besides the fact that it did not directly pertain to this water source, few dosages were tested in the cited 1994 pipe loop study, and the higher dosage than the one implemented in the field currently was more effective. Based on the limited amount of data on the quality of Detroit water, what we know about the history of Detroit corrosion control, we think an orthophosphate residual of 3 to 4 mg PO₄/L should be the minimum starting test target residual for pipe passivation. It is likely that, at least initially a higher dosage will be necessary to reach the far ends of the distribution system and sufficiently reduce lead solubility and release from all lead sources. To allow flexibility, we feel the design of the chemical feed and storage systems should be able to consistently deliver a maximum dose of 5 to 6 mg PO₄/L, if substantial orthophosphate loss is observed, if the starting dose is set for the desired residual level of 3 to 4 mg/L as PO₄. We suggest that jar tests be performed in advance of orthophosphate addition to Detroit water to evaluate the impact of orthophosphate dose on turbidity that could result from interactions between orthophosphate and background Detroit water quality parameters (e.g., aluminum, calcium, etc.).

We want to stress that immediately shifting to Detroit water and adding orthophosphate will not necessarily translate to immediate improvements. Furthermore, this is a change, albeit a return to past conditions. Nonetheless, a period of system upset should be anticipated. The need for a communication strategy and a distribution system plan are critical.

Lastly, we see no mention of a water quality monitoring program. Two programs need to be put in place immediately (before return to Detroit water) to 1) identify lead sources, 2) assess treatment effectiveness against lead release from all of the simultaneously operating mechanisms (solubility, particulate release, galvanic corrosion), and 3) assess orthophosphate levels and stability of water quality in the distribution system.

There are multiple sources of lead in the Flint distribution system to the consumers' taps, such as: pipes; leaded brass; leaded solder; accumulations on old galvanized steel pipes; possibly accumulated on copper or some plastic pipes. It is critical that the fate of orthophosphate in the distribution system is understood, and how effective it is against each type of lead source, so dosing adjustment can be properly made. For this purpose, we recommend that a number of residences throughout Flint that meet the following plumbing criteria, be identified for an assessment of the contribution lead from the different potential service line and interior plumbing sources, through detailed mapping of plumbing materials, lengths, sizes, and location and type of inline devices and faucets using profile sampling. For confidence in interpretation, probably at least 5 sites from each of the configurations will be necessary. The configurations we would estimate to be most important (but should be changed or added to if local construction practice indicates it's necessary): Lead service line, galvanized steel interior plumbing; lead service line, copper with leaded solder joints; lead service line, plastic interior plumbing. It is also possible that interior plumbing may differ from the material used for the customer-side service line segment. We would be glad to discuss the specifics of this sampling effort.

For the purpose of assessing stability of water quality in the distribution system and to inform on orthophosphate residual adjustment, we suggest that 8 to 10 locations in the distribution system be selected to measure pH, alkalinity, orthophosphate, turbidity and iron on a weekly basis. These could be collected from TCR sampling locations, or other readily-accessible buildings, should be located at a distribution of locations in the distribution system and should be collected after a flush sufficiently long to assure that "fresh" distribution system water is being measured. Research has shown that over time, orthophosphate can reduce disinfectant demand associated with corroding metallic distribution system materials. These measurements need to be performed in the field and can simply be done with a portable HACH test kit or spectrophotometer.

A lead sampling plan needs to be in place to access the effectiveness of water change and treatment boost. LCR monitoring sites with confirmed lead service lines can be in the sampling pool. Sampling should consist of a 1 liter first draw sample (LCR sample without 5 minute pre-flush), followed by an additional flushed sample or two depending on profile sample results which is intended to capture major lead source(s). The specific details of this effort need to be worked out by the technical committee as soon as possible. We would gladly work with Flint on establishing a water sampling program to identify and verify lead service line sites. The plan and initial sampling effort should be performed before the switch so that one baseline sample set is collected.

Lastly, our strength does not fall under full-scale pump and chemical feed delivery systems. We would only say that the systems need to be scaled-up in size to accommodate our suggested dosing needs. Also, there is some discussion about diverting water to the Dort reservoir and an associated orthophosphate feed system. We are not familiar with the reservoir but are wondering if it is an open reservoir?

Of course this is a lot of information to share and we would gladly be available to discuss the technical and scientific basis for our suggestions.

Let us know if you have any questions and thanks again,

Darren and Mike

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From: Prysby, Mike (DEQ) [mailto:PRYSBYM@michigan.gov]

Sent: Friday, October 16, 2015 1:32 PM

To: Lytle, Darren <Lytle.Darren@epa.gov>; Schock, Michael <Schock.Michael@epa.gov>
Cc: Busch, Stephen (DEQ) <BUSCHS@michigan.gov>
Subject: FW: Flint WTP PH2 SEG4 - Corrosion Control

Darren, Michael

We have received Flint's corrosion control proposal from their consultant. If you have comments, please provide them to me by Monday morning.

Michael Prysby, P.E.
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From: Matta, Samir [<mailto:SFMatta@lan-inc.com>]
Sent: Friday, October 16, 2015 12:02 AM
To: Prysby, Mike (DEQ)
Subject: Flint WTP PH2 SEG4 - Corrosion Control

Hi Mike,

Please see attached plans for the Corrosion Control Plan for the City of Flint. I will have the official submittal package to you tomorrow afternoon after I get Brent or Mike's signature on the permit application. I will call you when I get back in Lansing to drop the package. Is three sets of full size plans adequate? Would you like some half size plans? Let me know.

Basis of Design

Given that Flint will require lead and copper corrosion control and given that Detroit utilizes orthophosphate for their corrosion control methodology, and that Flint will be receiving Detroit water for the immediate future, orthophosphate is the appropriate corrosion control methodology for Flint. A dosage of 0.8 mg/l as PO_4 has been recommended for the Detroit water. Numerous utilities utilizing Lake Michigan water have a target dosage of 0.9 mg/l as PO_4 . Therefore, a target dosage in the range of 0.8 to 0.9 mg/l appears appropriate.

It is expected that, at least initially, there will be a significant PO_4 demand in the system. This will require a significantly higher dosage until this demand is satisfied and the target residual can be maintained. We are therefore designing for capability of a maximum dosage of 1.5 mg/l.

The arriving Detroit water will likely have some residual PO_4 when it arrives at Flint. It has been reported that this residual will be approximately 0.4 mg/l. The system must therefore be capable of a minimum dosage of 0.4 mg/l.

Based upon the usage of 75% Phosphoric Acid and a flow range of 4 MGD to 25 MGD, with an average day of 16 MGD, the expected feed rate will be 1.35 to 32 gpd. Average Phosphoric Acid feed is expected to be 10.8 gpd, requiring 30 days storage of 325 gal.

Orthophosphate will need to be applied at two locations. Detroit water will enter the Flint system at Control Station CS2, and supplementary phosphate will be applied there. However, on occasion some incoming water may need to be diverted to the Dort Reservoir, bypassing CS2. This water would then be introduced to the system through High Service Pump Station PS4 and phosphate would be introduced at this location.

Please let me know if the information is adequate or you require additional information.

Thanks.

Samir F. Matta, PE

Team Leader



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& Newnam, Inc.**

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