Staff Operations Item 1

ERIE COUNTY WATER AUTHORITY

INTEROFFICE MEMORANDUM

July 2, 2024

To: Terrence D. McCracken, Secretary to the Authority

From: Leonard F. Kowalski, PE Executive Engineer
Michael W. Wymer, PE, Senior Production Engineer
Sabrina Figler, Water Quality Director

Subject: Contract HS-002
Corrosion Control Treatment Program – Pipe Loop Demonstration Project
ECWA Project No. 202100152
Project Update

The Erie County Water Authority and our consulting engineers, Hazen and Sawyer, with assistance from faculty and students from Washington University and the State University of New York at Buffalo, are conducting a pipe loop study to evaluate optimal corrosion control treatment for lead. The pipe loop study will help the Authority to proactively reduce lead release to drinking water and prepare for compliance with the Lead and Copper Rule (LCR) Revisions and forthcoming Lead and Copper Rule Improvements (LCRI).

The LCR Improvements introduce a lower lead action level of 10 ppb. If the Authority's 90th percentile lead levels exceed the action level, the Authority would be required to evaluate orthophosphate doses of 1.0 mg/L as PO4 and 3.0 mg/L as PO4 and implement treatment.

This memorandum provides the Board with an update on the progress of this study.

1. Pipe Loop Demonstration Study Work Plan

A Work Plan for the pipe loop study was developed to address a series of objectives related to optimal corrosion control treatment and included the approach, test conditions, and pipe materials for the pipe loop study. The Work Plan was submitted and approved by the Erie County Department of Health.

The primary objectives of the pipe loop study detailed in the Work Plan include the evaluation of the impacts of orthophosphate on lead release from harvested lead service lines (LSLs) and copper pipe with lead solder, determination of the orthophosphate dose necessary to minimize lead release (while meeting other water quality objectives), determination of the effects of a reduced pH (i.e., 7.5 to 7.8) on existing pipe scales in combination with orthophosphate addition, and the assessment of the potential impacts of intermittent blending of Buffalo water in the Authority's distribution system on lead release.

2. Pipe Loop Demonstration – Washington University

The demonstration study conducted at Washington University utilizes 18 pipe loop assemblies, each with a 30-inch length of lead pipe (one 18-inch segment and three 4-inch segments for scale analysis) harvested

from the Authority distribution system. Water matching the chemical characteristics of the Authority's finished water is circulated through each loop. This study consists of three main tasks:

- *Task 1 – Impacts of Chlorine Residual/Stagnation Time on Scale Stability (completed):* This task began with a conditioning period in which water was circulated through each loop for approximately 10 months until the dissolved lead concentrations in each loop converged to a consistent concentration across all segments. Following conditioning, chlorine residuals were modified to test concentration ranges of 0.5 to 3.0 mg/L with stagnation time ranges of 15 minutes to two days. Testing of scales on the interior of the lead pipe segments at the end of this task indicated the plattnerite lead scale (most desirable as it is the least soluble) is prevalent at chlorine residuals above 0.5 mg/L and a pH of 8.0, which are the conditions consistent with the Authority's water quality parameter goals.

  Subsequent lowering the chlorine residual through the loops resulted in the prevalence of more soluble scales, which will result is higher lead concentrations. Increasing the chlorine residual back to the 0.5 mg/L minimum concentration resulted in the reformation of the less soluble scales.

- *Task 2 Orthophosphate Addition Effect on Lead Scale Stability (in progress):* This task will examine the effect of the addition of orthophosphate (1 to 3 mg/L concentration as PO4) on lead concentrations. An orthophosphate addition of 1 mg/L at a continuous water flow through the pipe loops began in early May 2024. It is anticipated this conditioning phase will continue through September at which time the orthophosphate concentration and stagnation times will be varied between loops.

- *Task 3 Orthophosphate Addition Effect on Lead Scale Stability with Blending (future task):* This task will be similar to Task 2 and examine the effect of the addition of orthophosphate (1 to 3 mg/L concentration as PO4) on lead concentrations but at variable blends of Authority and City of Buffalo water sources. The loops will be operated in a manner to simulate the blending of distribution water that occurs at our Pine Hill interconnection with the City of Buffalo system.

3. Pipe Loop Demonstration – Van de Water Treatment Plant

The demonstration study conducted at the Van de Water Treatment Plant involves three racks of nine pipe loop assemblies, each with a 72-inch length of lead pipe harvested from the Authority distribution system. Treatment plant filter effluent water at a target chlorine residual of 0.5 mg/L, adjusted at the pipe loop rig to a pH of 8.0, is circulated through each loop.

- *Conditioning Phase (completed):* As with the Washington University study, the Van de Water pipe loops were subject to a conditioning period to allow the harvested pipe segments to re-acclimate to the current water quality conditions in the system. Following an initial high flow conditioning period of approximately 30 weeks, the daily flow duration was decreased to the regular flow regime with stagnation periods mimicking a typical residential daily usage pattern.

- *Orthophosphate Impact Testing Phase, pH 8.0 (in progress):* The orthophosphate testing phase of the Van de Water study began on May 8, 2024. The pilot-scale corrosion inhibitor feed systems began metering orthophosphate into the pipe loop at the target doses of 1.5 mg/L and 3.0 mg/L (as PO4). Chlorine residuals will be held at the target of 0.5 mg/L and the pH will continue to be adjusted to a target of 8.0. The pipe loop will continue to operate according to the Work Plan for an anticipated duration of approximately 52 weeks. The testing program, with sampling conducted

twice weekly by Hazen/UB students, will capture cold water and warm water conditions during this test phase.

- *Orthophosphate/Reduced pH Testing Phase (future task):* Following completion of the orthophosphate test phase, the pH through the loops will be decreased to approximately 7.6-7.7 to simulate a "pH float" condition in which the pH of the water leaving Van de Water is not adjusted to a pH of 8.0 (i.e. no addition of sodium hydroxide). This will evaluate the impacts of orthophosphate at lower pH levels on water quality including scale stability, lead concentrations, chlorine residuals, and disinfection byproduct formation potential.

4. Orthophosphate Impacts on Wastewater Treatment

The potential addition of an orthophosphate-based corrosion inhibitor at the Authority's two water treatment plants would incrementally increase the phosphorus concentration in wastewater conveyed to wastewater treatment facilities (WWTFs) within the Authority's water service area. Many of the WWTFs have existing permit limits for phosphorus, and higher influent phosphorus loads may affect treatment needs to maintain permit compliance. Thus, by proactively evaluating the effects of orthophosphate on wastewater treatment, the Authority can assist wastewater treatment entities including the Erie County Department of Environment and Planning - Division of Sewerage Management (ECDEP-DSM), Town of Amherst, Town of Clarence, etc. prepare for and mitigate the potential for impacts from higher influent phosphorus loading.

An analysis was performed focusing on ECDEP-DSM's four largest WWTFs. The purpose of the analysis was to estimate the increased phosphorus loads at ECDEP-DSM's facilities, quantify increased coagulant doses for chemical phosphorus removal, and estimate the costs of increased coagulant usage by ECDEP-DSM. Dosages of orthophosphate of 1.0, 2.0, and 3.0 mg/L (as PO4) were evaluated. Additionally, the evaluation identified potential wastewater treatment operational impacts and described steps all WWTFs may need to complete to prepare for the potential increased phosphorus loading.

The analysis concluded that to maintain equivalent effluent phosphorus levels without a net increase in phosphorus discharge to receiving waters, ECDEP-DSM would need to add higher doses of chemical coagulants to precipitate and remove soluble phosphorus.

If the Authority were to add an orthophosphate-based corrosion inhibitor, the following impacts to ECDEP-DSM wastewater treatment facilities would be anticipated:

- Total phosphorus loads entering ECDSM's four largest facilities could increase by approximately 7 to 30% depending on the corrosion inhibitor dose.
- Coagulant usage at WWTFs would increase between 14% and 150% to maintain equivalent effluent phosphorus levels.

Hazen also estimated the total (Sturgeon and Van de Water WTPs) average additional chemical cost for orthophosphate addition to range from $1,336,000 to $2,671,000 annually. In a separate analysis, Arcadis estimated the capital cost to construct an orthophosphate feed systems at each plant to be a minimum of $5,000,000.

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Attachments
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