WATER QUALITY PROPOSAL

ULTRA LOW-LEAD DRINKING WATER STATIONS & FAUCETS

DISTRICT-WIDE IMPLEMENTATION

2/13/2020

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PPS Water Quality Status

Portland citizens supported a health and safety bond in May 2017 that proposed $28.5M to reduce lead levels in drinking and food preparation water for all PPS schools. OSM staff have now tested over 2,500 sources of water used for these purposes and returned to service those functional fixtures that test between 0-14.9 parts per billion (ppb) for lead. During this process, over 500 drinking fixtures in these areas have been identified that test above the 15-ppb action level and several schools have a large number of drinking fixtures that test above this action level even after fixture replacement. Based on CH2M 2017 recommendations to the Board, the second step after fixture replacement would be extensive in-the-wall partial pipe replacement for fixtures not meeting standards. Such efforts would cost millions of dollars with no guarantee of success. No partial-pipe replacement projects have been started.

Nationally and locally there is growing and vocal interest in lowering the 15-ppb action level. For example, EPA no longer recommends an action level for schools and has stated that schools should "reduce their lead levels to the lowest possible concentrations", the Centers for Disease Control and Oregon Health Authority (OHA) have stated there is no safe level of blood lead, while the American Academy of Pediatrics is recommending 1 ppb. Portland Water Bureau has also indicated that the EPA is currently considering lowering their 15-ppb action level in the Lead and Copper Rule. There have been two PPS media interviews in the past where questions were asked concerning the 15-ppb action level as too high.

Because of the large number of drinking fixtures with elevated lead and the mounting national interest in reducing the 15-ppb action level, the OSM Water Quality Working Group has conducted a pilot study with the goal of potentially lowering bond capital costs while substantially lowering lead levels in our drinking water.

Pilot Study Summary

In an effort to reduce lead levels to "As Low As Reasonably Achievable" (ALARA) while also potentially reducing or even eliminating the cost of partial pipe replacement and reducing overall costs, the water team presented a recommendation to the School Board that a pilot study be conducted in six schools. Our proposal was to install a limited number (32 estimated, 36 actually installed) of strategically located PPS-engineered drinking water stations (DWS) in the six PPS schools. The six schools were selected due to the presence of large numbers of fixtures exhibiting elevated lead levels in testing prior to the pilot. Our reasoning was that if the DWS are effective in these schools, they would be effective in all district schools. Each DWS would be fitted with a highly effective point-of-use (POU) lead filter providing filtered water to a bottle filler and one or more bubblers. The goal of the pilot study is to determine the ALARA value for each school. This approach could substantially reduce the number of drinking fixtures in each school while potentially reducing the lead levels to below 1 ppb.

After setting performance criteria and conducting extensive research, we identified two highly effective NSF certified filters that can filter lead from 6,000 gallons of drinking water. This volume of water will fill 38,400 twenty-ounce bottles. Four DWS fitted with these filters in an elementary school with 425 students and staff would provide 360 twenty-ounce bottles of drinking water or 1.5 – 2 bottles of water per individual per day during a 10.5-month school year. The 228 existing drinking water fixtures in the common areas and classrooms of the six schools would be made non-accessible during the pilot testing.

In advance of the full implementation of the one-year pilot study, the PPS Water Quality Team contracted the installation of these two POU lead filters in two existing drinking water fixtures at each of the six pilot schools. The Team refers to this step as the pre-pilot project. This allowed "real world" short-term performance testing comparing the two filters prior to launching the much longer, more expensive pilot study. The pre-pilot testing established that one of these filters was superior.

During the pilot period, the drinking water stations were tested frequently to verify the published effectiveness of the selected filter. The drinking water stations were tested weekly for the first 10 weeks and will be tested every second or third week until the end of the school year. The frequent testing was to uncover possible problems or deficiencies in the overall assembly and determine the effectiveness of the filters over time when used in our aging facilities.

Pilot Project Findings

Test Results

Test results for the 36 pilot fixtures have been added to the appendix of this document for review. The goal to reduce lead levels through the use of POU filters was achieved as the overall program lead level average was 0.364-ppb after 20 weeks of testing (14 individual tests for most fixtures). The program's unofficial goal was to reduce average lead levels for each school below 1 ppb. This level would exceed the most stringent requirements for any state in the country and would meet the American Academy of Pediatrics recommendation to have all drinking water in schools test below 1-ppb. The pilot program met this goal at five of the six schools with averages between 0.2 and 0.3 ppb. The one school that did not meet this extremely low level was Duniway Elementary, with an average of 1.02-ppb.

A review of these test results shows that the pilot program was an astounding success with lead levels in all DWS averaging almost 20 times lower than the water in commissioned drinking fountains prior to the pilot programs.

Pilot Sampling School Summary

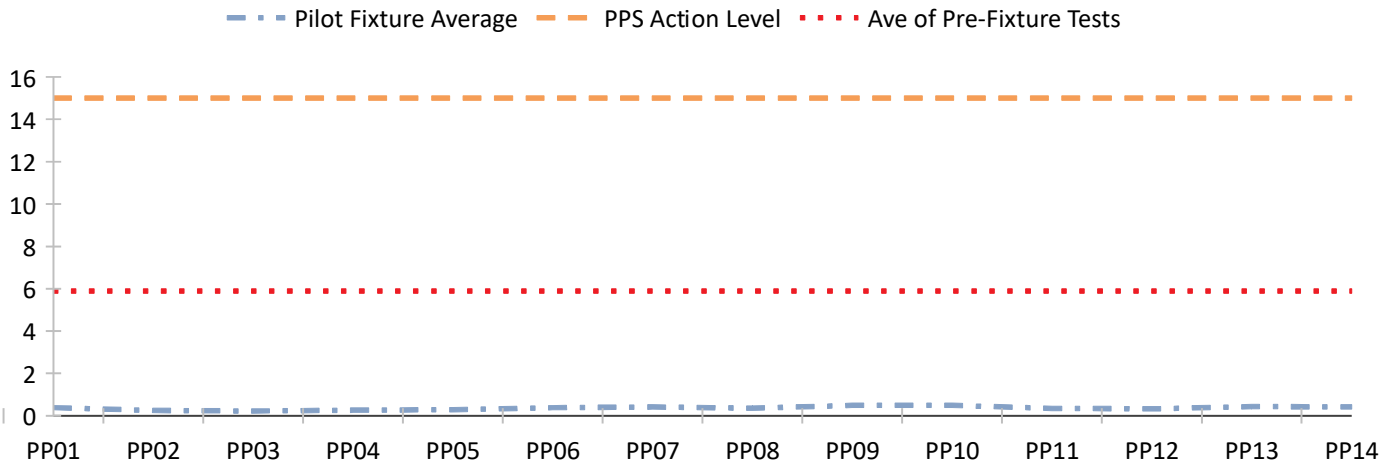
Date: January 29, 2020 (Week 23)

Notes:
1. The averages below for the schools listed are based on the "A" sample only. It includes all sample events listed in the range below. Non-detect values assigned 0.2 parts per billion (ppb).
2. Test results for these schools, prior to installing filters, had values in the following ranges:
   Low Value: ND High Value: 14.6
3. Complete sample list can be provided if requested.

Sampling Events Included: PP01 Thru PP14

All Pilot Schools (Average)

Average Sample Results (in ppb): 0.364



118 Jefferson High School

Average Sample Results (in ppb): 0.275

158 Robert Gray Middle School

Average Sample Results (in ppb): 0.203

232 Arleta K-8 School

Average Sample Results (in ppb): 0.227

244 Duniway Elementary School

Average Sample Results (in ppb): 1.020

269 Llewellyn Elementary School

Average Sample Results (in ppb): 0.254

276 Rigler Elementary School

Average Sample Results (in ppb): 0.243

Flow Volumes and DWS Distribution

Along with lead level tests, water volume statistics were a valuable metric collected and reviewed as part of the pilot. Flow meters have been installed on every DWS in order to determine the amount of water that has flowed through the fixture at any given time. This volume has been collected monthly and the team has used the averages to calculate the longevity of the 6000-gallon filters. Based on the most recent flow values, all of the pilot project filters will last the full school year and none of the them should reach their 6000-gallon capacity. The most used filter should have just over 5,000 gallons pass through it by the end of summer, when all the filters are scheduled to be replaced.

A second benefit of the flow meters is the ability to help determine if there are enough DWS in a school and if they are well distributed. By using flow values, the team is able to see which DWS are heavily used and those lightly used. Volumes may also determine if additional DWS are required in a school or in a portion of a school.

Principal Interviews

The Water Team met with each pilot school's principal after approximately 6 to 8 weeks of successful use of the DWS. The team's purpose was to obtain qualitative data about the schools use of the stations and to inquire if there were any difficulties or successes. The team also wanted to determine if there were any needs not met by the DWS. Overall the interviews were informative and based on the principals' responses, the pilot program was successful. Students, staff and the community were very receptive of the new stations.

Constructive feedback was minimal, with the main issues being access to water from modular classrooms or remote parts of the schools, access from cafeterias that never had drinking fountains, additional DWS requested and access for staff (which will be addressed in the districtwide rollout).

Districtwide Drinking Water Station Rollout

With the pilot concept proven effective, the next step is to roll it out to the entire district, including administration buildings. When implemented district wide, it should substantially reduce lead levels in drinking water while reducing the 2017 bond capital costs required to accomplish this goal. The potential also exists to reduce the number of drinking fixtures in the district by half to two thirds or more, reducing future maintenance and testing needs.

Site Surveys and Design

The Districtwide Drinking Water Station Rollout project will require work at 93 PPS owned properties. The four new schools (Faubion, Franklin, Roosevelt and Grant) will not receive any work as their plumbing is new and lead free, hence lead test levels are virtually non-detect for most tests. Benson High School is included in the budget but will most likely not be included as the school will close for renovations at the end of the next school year. Lincoln High School is in the budget and planned for DWS upgrades as the building will be used for the next two and a half years.

Each PPS Facility will be surveyed by the engineer of record and the engineer will also conduct an interview with the facility staff to determine all water needs. The engineer, in conjunction with the Water Team and the school staff, will provide recommended locations and quantities of DWS along with other drinking water locations. Once approved, the engineer of record will prepare construction drawings for bid and construction.

The 93 Facilities will be broken into 7 groups and packaged into manageable sized bid sets.

Drinking Water Components

Drinking Water Station (DWS): A durable and vandal resistant combined "Hi-Lo w/ bottle filler" assembly. To provide a low maintenance fixture, the selected Water Station does not contain refrigeration or any other electronic components.

Elkay EZH2O model VRCTLR8WSK Vandal-Resistant Bottle Filling Station, & Bi-Level ADA Stainless. Link: http://www.elkay.com/vrctlr8wsk

There may be select locations within the schools where we may try to retain and reuse the existing drinking fountains. The existing fountains must include at least a drinking fountain and bottle filler supplied by a single water source. The existing fountain must also be ADA compliant and listed as a lead-free fixture. There must be sufficient room either within the existing fixture, or within the adjacent wall to install the filter in the proper location.

Standard Gooseneck: The standard gooseneck fixture will be used for all drinking water location not supported by a DWS. This cold-water only fixture, along with the selected filter, will be added to existing sinks in staffrooms and in Head Start rooms. The fixture will be placed in the back corner to provide filtered drinking water, while the existing standard faucet remains for hand washing or cleaning. Similarly, this fixture and filter will be provided in all school kitchens to provide low-lead water for food preparation.

Due to health regulations, Nurses/Health Rooms will receive the same standard gooseneck fixture and filter in one of two configurations. 1) A new 2 compartment sink with a standard faucet in one compartment and the cold-water only fixture in the second compartment. 2) The existing sink remains with a standard fixture and a new bar/prep sink will be placed adjacent to the existing sink with an added cold-water only gooseneck.

Elkay Single Hole with Single Control Faucet with 8" High Arc Spout 4" Wristblade Handle Chrome. Link: https://www.elkay.com/products/lk535ha08t4.html

Lead Filter Selection: NSF International (NSF) is an independent organization that facilitates the development of standards and certification of products that help protect food, water, consumer products and the environment. To accomplish this end, NSF performs tests on a wide variety of commercial products. This includes certification tests on hundreds of filters used to remove lead from water. The results of this testing are then published for consumers. These results are available at:

http://info.nsf.org/Certified/DWTU/listings_leadreduction.asp?ProductFunction=053|Lead+Reduction&ProductFunction=058|Lead+Reduction&ProductType=&submit2=Search .

NSF testing of lead filters uses a water solution with a standard lead concentration of 150 ppb to challenge each filter. They then certify and publish the volume of water that may be successfully filtered at this concentration. This concentration far exceeds the concentration of lead levels in the water that will be used to supply each DWS in the pilot program. Consequently, NSF certified filters selected for each DWS will likely remain effective well after the certified volume of water passes through the filter. After establishing PPS performance criteria, we used this list of NSF certified filters to select models of filters with NSF test performance data showing a reduction of the lead concentration to an average of 0.001mg/L (1 ppb).

Using the data above and through the team's testing in the Pre-Pilot and Pilot Programs, the 3MFF100 Aqua-Pure filter manufactured by 3M was chosen for the DWS and other installations used for drinking water. This NSF certified product is rated at a 6,000-gallon capacity and 2.5 gallon per minute flow and was specifically designed by 3M for schools. As presented in the Pilot Study Executive Summary section, 6,000 gallons of filtered water will fill 38,400 twenty-ounce bottles.

Testing and Commissioning

Once construction is complete and prior to use, all new fixtures will need to be sampled and tested. Single fixture assemblies, such as a single gooseneck, will have one sample taken and tested. The DWS, with two or three fixtures per station, will only have one sample taken and tested. Through testing during the pilot program, the Water Team learned that a majority of elevated test results, even if the result was under 1 ppb, was from the "A" sample. Therefore, a single sample should give an accurate determination of the state of the DWS.

After testing, all fixtures will be commissioned and will receive signage consistent with the rest of the program. All fixtures will be retested after 12 to 16 weeks of use. Based on pilot program data, this is when some test results will begin to rise. Elevated test results in the pilot program are still well under the Oregon Health Authority's lead rule (OAR 333-061-0400), but some of the fixtures did experience a slow, gradual elevation after 10-weeks.

During the pilot program, the Water Team placed a 5-ppb watch level for all fixtures. If a fixture approached 5 ppb during the weekly or bi-weekly test results, the team would closely monitor that fixture and may determine an approach to reduce the lead for future tests. During the pilot, three fixtures at Duniway Elementary approached 5-ppb around the 10-week to 12-week time period. Because of the relative high lead levels of these three fixtures compared to the other 33-fixtures, it was decided that a second filter would be added to these fixtures. If there are elevated test levels during the districtwide rollout, adding a second filter or replacing the

filter is an effective option. Elevated fixtures may receive additional tests to verify remediation efforts are working.

Schedule

The district-wide implementation of low-lead drinking water achieved through point of use filtration is planned to begin during Spring of 2020 and conclude during the Winter of 2021. Roughly two-thirds of the work is expected to take place during summer break periods, with the remaining one third planned during the academic year, performed at night and over holiday breaks.

PPS Preliminary DWS and DWF (Drinking Water Faucet) Program Schedule	2020				2021			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Water Team NTP with Design								
Recommend Locations								
WBS - OTAK Site Surveys								
Draft Design Documents								
Review Draft Design Documents								
CDs Delivered								
Contracting								
Construction/Oversight/Documentation								
Testing & Commissioning								
Closeout								

Cost Estimates

The following cost estimates are comprised of two components: Unit costs and quantities. In other words, the cost of performing certain "packages" of work are estimated first and that cost is then applied to the known quantity(ies). Additionally, please note the listed assumptions and processes for decision making listed immediately following the cost estimates.

District wide ultra-low-lead filtered drinking fixtures Cost Estimate

	Units	Unit Cost	Total
Standard Drinking Water Station (DWS)	491	$5,100	$2,504,100
Standard DWS Contingency	100	$5,100	$510,000
Standard Gooseneck	271	$2,000	$542,000
Nurses Station	91	$4,700	$427,700
Complex Installation Expenses			$886,529
Drinking Fountain Removal	784	$3,000	$2,352,000
Sink Bubbler Removal	753	$400	$301,200
Construction Sub-Total			$7,523,529

Fixture Sampling/Testing	3000	$140	$420,000
Engineering Surveys/Drawings			$400,000
Management, Oversight & Reporting			$1,627,000
Construction Contingency*		10%	$752,353
Escalation (2019-2021)*		7%	$526,647
Corporate Activity Tax*		2%	$150,471
Project Total			$11,400,000

* Please note, Construction Contingency, Escalation and Corporate Activity Tax estimates are based on a percentage of the construction sub-total. Fixture Sampling/Testing, Engineering Surveys/Drawings and Management, Oversight & Reporting estimates are not affected by these items.

Units: The unit values for this cost estimate were developed by the team looking at each individual facility and determining what their water needs would be based on the team's experience and what was learned from the pilot project's Principal interviews. The "Standard DWS Contingency" was added to account for special needs at schools that may not be evident from a plan review.

Standard Drinking Water Station (DWS) Unit Cost: The unit cost for the Drinking Water Station was determined based on the actual final construction cost for the (36) Pilot DWS. The team feels it is a strong number due to some unexpected complications on approximately 15% of the fixtures, which is what we would expect in the rollout.

Standard Gooseneck: The unit cost for the standard gooseneck fixture installation was based on the retail purchase of the specified fixture plus the contractor's cost to install. The construction cost was estimated using historical data and industry knowledge.

Nurse's Station: The unit cost for the nurse's station fixture installation is based on the retail purchase of the specified fixture plus the contractor's cost to install. The construction cost was estimated using historical data and industry knowledge.

Complex Installation Expenses: Complex installation expenses are costs above and beyond the standard unit costs above for construction that requires additional effort. This is typically the case when water lines and drains need to be brought to a location that does not have existing water.

Drinking Fountain Removal: The unit cost for drinking fountain removal is based on contractor's cost, estimated with the help of one of the programs shortlisted contractors. Scope of work includes the removal of the fountain and all exposed plumbing. Supply and drain lines will be capped behind the existing wall. Gypsum for plaster walls will be repaired to original condition. Brick, concrete, block or other similar walls will receive a panel to cover the damaged areas.

Sink Bubbler Removal: The unit cost for sink bubbler removal is based on historical data and industry knowledge.

Fixture Sampling/Testing: Extrapolated from actual costs from completed work.

Engineering Surveys/Drawings: These costs are based on an existing proposal.

Management, Oversight & Reporting: These costs are based on an existing proposal.

Construction Contingency: A 10% construction contingency is standard amongst the industry.

Escalation (2019-2021): The pilot project numbers and contractors' estimates were all based on 2019 construction costs. A 7% construction escalation has been used to account for the 2-year long project.

Corporate Activity Tax: The Corporate Activity Tax is a new tax on all business activity that took effect in January 2020. The tax rate is .57% and has certain exceptions but can also be compounded as it applies to all companies in the supply chain. Since this is a new tax, the consensus in the construction field is budget 2.0% to be safe.

Potential Water Quality Budget Surplus

Using Ultra Low-Lead Drinking Water Stations & Faucets is expected to eliminate the otherwise immediate need for pipe replacement at schools throughout the district. Without the need for the more costly and disruptive option of pipe replacement, a portion of the planned Water Quality Budget may remain at the end of the project. The following is an estimate of the possible budget surplus:

Water Quality Budget	$28,500,000
Fixture Replacement Project	- $4,500,000
DWS Filter Project (Estimate)	- $11,400,000
Remaining Water Quality Budget (estimate)	$12,600,000

Life-Cycle Cost Impact Estimates

As described previously, this project will deliver high quality drinking water throughout the district's common areas, kitchens, nursing areas and head start programs. In doing so, the total number of drinking fixtures will reduce from over 2600 to about 1000 fixtures that require filter monitoring and routine replacement. The bulk of that reduction is achieved through the elimination of classroom "bubblers", which are often mounted on the corners of classroom sinks. The remaining reduction is realized by placing drinking water where occupants use it the most coupled with the provision of water bottle filling stations throughout the common areas.

By reducing the total number of drinking water locations to what each building needs, the cost of testing and maintenance are minimized while the cost for bottled water service is virtually eliminated. For the purposes of this program, the life expectancy of a drinking fixture is assumed to be 30 years.

Testing: PPS is required by State law to test all of its drinking fixture every 6 years, which comes at a significant cost. The State of OR will reimburse the district for an amount meant to offset the laboratory testing cost, but not the cost of collecting or labeling the samples. The amounts listed in the table below for testing are based on the following assumptions:

- A sample will be collected from every drinking fixture, labeled and shipped to the laboratory by a contracted vendor once every six years.
    - Approximately 1/6 of the district's drinking water fixtures will be tested annually to meet the frequency requirement.
- PPS will submit for reimbursement from the State of OR for $26/ test.
- Existing PPS staff will post the testing results publicly.

Filter Replacement: The addition of approximately 1000 filtered drinking water locations comes with a long-term cost and maintenance commitment. They need to be monitored and systematically replaced to perform as expected. The amounts listed in the table below are based on the following assumptions:

- Annual replacement of every filter. (The 6000-gallon minimum filtration capacity of the 3MFF100 filter is expected to be more than sufficient to supply nearly all locations for a full year).
- Maintenance and monitoring of the drinking water station filter database will be performed by existing PPS staff.
- Annual Replacement of the filters, including the filter purchase, will be performed by contracted vendors.

Annual cost of filter replacement is estimated at approximately $200,000 per year. This includes the cost of the filter and the vendor required to replace it and document the process. This cost works out to be less than $3.50 per person, per year based on the current number of students and staff using the schools. This cost is also similar to the annual cost the district is already paying for bottled water in the schools, which can be eliminated at the end of this process.

Repair and Maintenance: With an assumed life span of 30 years for every drinking filtered fixture comes a cost for repair and maintenance during that life span. The amounts listed in the table below include the following assumptions:

- 75% of drinking water locations will require one (1) repair event during 30 years of service.

- Each service/ repair event will cost the district $125.
- The cost of eventual replacement is ignored in the calculations, though understood to be greater than zero.

Bottled Water Service: PPS has been providing bottled water service throughout the district since 2016, with peak average expenditures in 2017 and a reduction to the current amount. Without this long-term solution for drinking water, this cost will be ongoing. The amounts listed in the table below include the following assumptions:

- The current level of service will be maintained with the same or similar vendor without another solution in place.
- The average expenditure realized by the district between 9/1/19 and 12/31/19 of $20,500 will continue. $20,500 was applied to the calculations and the following values are for reference:
    - Average monthly bottled water cost 9/1/16 – 8/30/17: $64,349
    - Average monthly bottled water cost 9/1/17 – 8/30/18: $58,247
    - Average monthly bottled water cost 9/1/18 – 8/30/19: $32,923

Date: Feb 13, 2020	Total Drinking Water Fixtures	PPS filter replacement cost 30 years ($)	PPS testing cost 30 years ($)	Repair/ Maint cost 30 years ($)	Bottled Water Cost 30 years ($)	Totals
Existing (Current)	2600	$ -	$ 572,000.00	$ 162,500.00	$ 7,380,000.00	$ 8,114,500.00
Post - Implementation	1000	$ 6,000,000.00	$ 220,000.00	$ 62,500.00	$ -	$ 6,282,500.00
Difference/ Savings	1600	$ (6,000,000.00)	$ 352,000.00	$ 100,000.00	$ 7,380,000.00	**$ 1,832,000.00**

Life Cycle Cost Impacts Conclusion: District-wide implementation of the low-lead, point-of-use filtered DWS will save PPS approximately $1.8M over the expected 30-year service life of the equipment installed and/or removed.

Appendix

Comparison of Select POU Lead-Filters

Pilot Sampling Summary – Arleta

Pilot Sampling Summary – Duniway

Pilot Sampling Summary – Gray

Pilot Sampling Summary – Jefferson

Pilot Sampling Summary – Llewellyn

Pilot Sampling Summary – Rigler

Portland Public Schools

Water Quality Pilot – Comparison of Select POU Lead-Filters

Pentair EVERPURE EF-6000 and 3M Aqua-Pure 3MFF100

Introduction

Portland Public Schools (PPS) is planning to conduct a six-school, one-year water quality pilot study beginning in school year 2019/2020. The pilot study will evaluate the operational and economic feasibility of replacing all existing drinking water fixtures with point-of-use (POU) lead-filtered, custom-engineered drinking water stations to substantially reduce lead levels. This requires carefully researching POU filters for use in the pilot study based on specific performance criteria.

Hundreds of POU lead filters for existing drinking water fixtures are available. Drinking water stations (DWS) are also available with DWS manufacturer-installed POU lead filters. POU lead filters for these applications exhibit a wide range of performance specifications regarding their effectiveness for lead removal and filter capacity volume. Also, DWS manufacturer-installed POU filters are limited to filters supplied by the DWS manufacturer.

One of the first steps taken by PPS to create high-performance, custom-engineered DWS for the pilot study was to establish primary filter performance criteria. The early criteria established was to select only those lead filters that have the capability to reduce lead levels to 1 part per billion (ppb) when challenged with 6000 gallons of water containing 150 ppb lead, tested using NSF/ANSI Standard 53. The drivers/goals for setting these performance criteria were: 1) maximum reduction of lead and; 2) minimum maintenance costs. These two goals are central to the pilot study being successful. Although additional selection criteria were added as we researched available filters, these primary performance criteria reduced the number of available filters from several hundred down to only two. Those two POU filters are the Pentair EVERPURE EF-6000 and the 3M Aqua-Pure 3MFF100.

In advance of the full implementation of the one-year pilot study, the PPS Water Quality Team contracted the installation of these two POU lead filters in two existing drinking water fixtures at each of the six pilot schools. The Team refers to this step as the pre-pilot project. This allowed “real world” short-term performance testing comparing the two filters prior to launching the much longer, more expensive pilot study. Following is a direct comparison of

the two POU filters for each of eight specific PPS performance criteria and after conducting the pre-pilot project.

Filter Performance Criteria

The following eight performance criteria have been developed over the past several months to select high performance POU lead filters for the PPS water quality pilot study. These criteria are used here to conduct a direct comparison of the two selected filters for each performance criteria.

NSF Certification

Filters **must** be NSF certified. The National Sanitation Foundation (NSF) is the recognized leader for certifying products for food, water and consumer goods used to minimize adverse health effects and protect the environment. All NSF certified lead filters are tested using NSF/ANSI Standards 42 and 53 for particulate and lead reduction, respectively.

EF-6000

The EF-6000 is NSF/ANSI certified, see attached EF-6000 performance data sheet, using NSF/ANSI Standards 42 and 53.

3MFF100

The 3MFF100 is NSF/ANSI certified, see attached 3MFF100 performance data sheet, using NSF/ANSI Standards 42 and 53.

Conclusion

EF-6000 and 3MFF100 are equivalent.

Filter Capacity Volume

Filter capacity volume represents the volume of water in gallons from which each NSF tested filter is certified to reduce lead levels as specified in NSF/ANSI Standard 53. This capacity is critical in PPS schools to minimize maintenance costs. At the same time, there are space limitations that limit the secure space in DWS to install high-performance filters, see Filter Size and Installation criteria. This inherently sets an upper limit on filter capacity volume due to filter cartridge size. The minimum acceptable filter capacity volume was set at 6000 gallons, which provides sufficient water to fill 38,400 twenty-ounce water bottles while requiring minimal installation effort.

EF-6000

The EF-6000 is NSF/ANSI certified for a filter capacity volume of 6000 gallons.

3MFF100

The 3MFF100 is NSF/ANSI certified for a filter capacity volume of 6000 gallons.

Conclusion

The EF-6000 and 3MFF100 are equivalent based on NSF/ANSI testing.

Percentage Lead Reduction

Filters must reduce lead levels a minimum of 99.3% at pH 6.5 when challenged with 6000 gallons of potable water containing 150 ppb lead. This criteria far exceeds NSF/ANSI Standard 53 and effectively requires filters to reduce lead levels to 1 ppb for the entire filter capacity volume. To our knowledge, there are no commercially available, filtered drinking water stations that meet this criteria.

EF-6000

The EF-6000 is NSF/ANSI certified to reduce lead levels 99.3% (1.0 ppb) at pH 6.5 when challenged with 6000 gallons of water containing 150 ppb lead. This is a certified laboratory test using NSF/ANSI Standard 53. During the six school pre-pilot project the EF-6000 exceeded 1.0 ppb 18 times out of 24 weekly tests during a five week period.

3MFF100

The 3MFF100 is NSF/ANSI certified to reduce lead levels 99.3% (1.0 ppb) at pH 6.5 when challenged with 6000 gallons of water containing 150 ppb lead. This is a certified laboratory test using NSF/ANSI Standard 53. During the six school pre-pilot project the 3MFF100 exceeded 1.0 ppb one time out of 23 weekly tests during a five week period.

Conclusion

Although NSF/ANSI performance data indicates that the EF-6000 and 3MFF100 are equivalent, pre-pilot field application indicates that the 3MFF100 is more effective for lead level reduction.

Particulate Reduction

Because of the age of many of our schools, there is higher potential for sediment and corrosion particulates in our plumbing. Filters must at a minimum meet or preferably exceed the particulate filtration requirements in NSF/ANSI Standard 42. This is critical because excessive plugging of POU lead filters will shorten filter life and increase maintenance costs.

EF-6000

The EF-6000 is NSF/ANSI Standard 42 certified to reduce Class 1 particles ($\geq$0.5 to <1.0 µm) 99.9% when challenged with $\geq$10,000 particles/ml.

3MFF100

The 3MFF100 is NSF/ANSI Standard 42 certified to reduce Class 1 particles ($\geq$0.5 to <1.0 µm) 99.9% when challenged with $\geq$10,000 particles/ml.

Conclusion

The EF-6000 and 3MFF100 are equivalent based on NSF/ANSI Standard 42 testing.

Filter Size and Installation

The DWS of choice is the Elkay EZH2O Model VRCTLR8WSK Vandal-Resistant Bottle Filling Station & Bi-Level ADA Stainless. This DWS was selected because it provides a bottle filling station and bubbler assembly along with an additional attached bubbler. In addition, a secure, enclosed compartment is available below the attached bubbler. The dimensions of the lead filter must allow installation within this enclosed compartment (Figure 1).

Figure 1

The dimensions of this enclosed compartment are 18”W x 20”H x 6.75”(min) – 10”(max)D. The filter must allow sufficient clearance to easily be installed while also providing adequate space for installation of a flow meter assembly. After installing the filter and flow meter, sufficient space must remain to allow easy removal and replacement of the filter for routine maintenance. See attached engineering drawings by WBS Whole Building Solutions.

EF-6000

The dimensions of the EF-6000 are 5”W x 22”H x 5”D. The dimensions of the preferred Elkay DWS attached bubbler enclosed compartment will not allow the EF-6000 to be fully enclosed within the compartment. Installation of the EF-6000 in this compartment will require that a hole be cut in the base of the compartment.

3MFF100

The dimensions of the 3MFF100 are 4.5”W x 16”H x 4.5”D. These dimensions allow the complete enclosure of the 3MFF100 within the attached bubbler enclosed compartment.

Conclusion

The EF-6000 requires modification of the DWS attached bubbler compartment to fit within the enclosed compartment. This adds time and expense to the installation of the EF-6000. No modification of the compartment is required for the 3MFF100.

Full Flow Rate

Full flow rate is the gallons per minute (gpm) that can be passed through the lead filter while lead removal continues to meet percentage lead reduction criteria. Minimum filter full flow rate criteria was set at 1.1 gpm to accommodate the minimum flow rate required by our selected DWS, although a higher full flow rate is preferred. Because the selected DWS has three drinking outlets, full flow rate can be a significant factor during heavy use such as athletic events.

EF-6000

The EF-6000 performance data sheet indicates that the full flow rate is 1.67 gpm.

3MFF100

The 3MFF100 performance data sheet indicates that the full flow rate is 2.5 gpm.

Conclusion

The 3MFF100 exhibits higher full flow rate than the EF-6000.

Removal of Non-Lead Contaminants

Many lead filters use multifunctional adsorbents and hybrid combinations of adsorbents to reduce non-lead contaminants in addition to lead. This includes chlorine taste and odor, organic and biological contaminants. This is a desirable characteristic when comparing filters.

EF-6000

The EF-6000 performance data sheet states that average chlorine reduction is 97.4% and that the average reduction of Cyst is 99.99%. No other non-lead contaminants are listed.

3MFF100

The 3MFF100 performance data sheet states that average chlorine reduction is 97.5% and the average reduction of Cyst is 99.99%. In addition, the sheet states that average reduction of benzene is >97.1%, p-Dichlorobenzene is 99.7% and Toxaphene is >93.9%.

Conclusion

The two filters are equivalent for the reduction of chlorine and Cyst. However, based solely on the NSF performance data sheets, the 3MFF100 is also effective for the reduction of toxic organic contaminants.

Filter Maintenance Cost

Initial filter cost impacts implementation and maintenance costs. Maintenance costs are also directly impacted by filter performance. For example, high initial filter cost can be justified if the life cycle of a filter is sufficiently extended compared to a less expensive filter. One of the primary goals of the pilot study is to quantify and minimize maintenance costs. Maintenance cost/filter/school year and maintenance cost/student/school year will be quantified periodically and after the completion of the pilot. Clearly, annual maintenance cost for each of the two filters selected for the pilot is a critical value. Although no annual maintenance dollar value has been set in advance, one goal is that individual filters meet or exceed the selection criteria in this document for one entire school year, requiring only annual replacement.

Overall Conclusion

The EF-6000 and 3MFF100 are equivalent for performance criteria NSF Certification, Filter Capacity Volume and Particulate Reduction. 3MFF100 is superior for performance criteria Percentage Lead Reduction, Filter Size and Installation, Full Flow Rate and Removal of Non-Lead Contaminants. Performance criteria Filter Maintenance Cost can be measured only after completion of the pilot study.

Of greatest concern is the performance of the EF-6000 during the pre-pilot project. The EF-6000 tested below the 99.3% (above 1 ppb) Percentage Lead Reduction criteria 75% of the time, whereas the 3MFF100 tested below the 99.3% (above 1 ppb) Percentage Lead Reduction criteria only 4% of the time. Important, but of less concern, is the need to modify the DWS attached bubbler enclosed compartment for installation of the EF-6000. The 3MFF100 also exceeded the full flow rate of the EF-6000 and is reported to remove a wider range of non-lead contaminants.

The PPS Water Quality Team had hoped to have two or more POU lead filters to test in the six school, one year pilot. However, based on our established performance criteria, the 3MFF100 is a clear choice to use exclusively in the pilot.

Pilot Sampling Summary

Date: January 27, 2020 (Week 23)

Notes: 1. Test results reported as "ND" are "Not Detected". This means the analyte result is between 0 and the reporting limit, which is 0.2 for these reports.

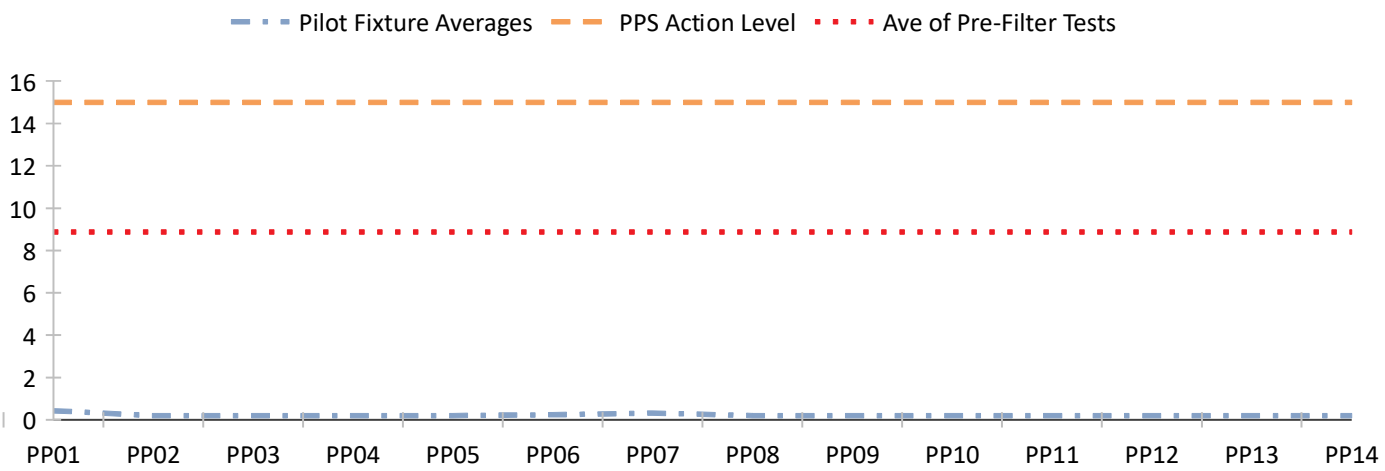
2. Test results for this school, prior to installing filters, had values in the following ranges:

Low Value: ND High Value: 13.2

232 Arleta K-8 School

Average Sample Results (in ppb): 0.227

See Fixture Numbers Below



Fixture No	Sample	Sample Date	Flow Volume	Test Result	Flow Issue	Sampling Comments
CH-5220 A	PP01	8/21/2019		ND	☐	
CH-5225 A	PP01	8/21/2019		ND	☐	
CH-5234 A	PP01	8/21/2019		0.874	☐	
CH-5238 A	PP01	8/21/2019		0.206	☐	
CH-5702 A	PP01	8/23/2019		0.648	☐	
CH-5220 A	PP02	9/6/2019		0.2	☐	
CH-5225 A	PP02	9/6/2019		ND	☐	
CH-5234 A	PP02	9/6/2019		ND	☐	
CH-5238 A	PP02	9/6/2019		ND	☐	
CH-5702 A	PP02	9/6/2019		ND	☐	
CH-5220 A	PP03	9/13/2019		ND	☐	
CH-5225 A	PP03	9/13/2019		ND	☐	

Arleta K-8 School (Cont)

Fixture No	Sample	Sample Date	Flow Volume	Test Result	Flow Issue	Sampling Comments
CH-5234 A	PP03	9/13/2019		ND	☐	
CH-5238 A	PP03	9/13/2019		ND	☐	
CH-5702 A	PP03	9/13/2019		ND	☐	
CH-5220 A	PP04	9/20/2019		ND	☐	
CH-5225 A	PP04	9/20/2019		ND	☐	
CH-5234 A	PP04	9/20/2019		ND	☐	
CH-5238 A	PP04	9/20/2019		ND	☐	
CH-5702 A	PP04	9/20/2019		ND	☐	
CH-5220 A	PP05	9/27/2019		ND	☐	
CH-5225 A	PP05	9/27/2019		ND	☐	
CH-5234 A	PP05	9/27/2019		ND	☐	
CH-5238 A	PP05	9/27/2019		ND	☐	
CH-5702 A	PP05	9/27/2019		ND	☐	
CH-5220 A	PP06	10/4/2019	0	ND	☐	
CH-5225 A	PP06	10/4/2019	0	ND	☐	
CH-5234 A	PP06	10/4/2019	0	ND	☐	
CH-5238 A	PP06	10/4/2019	0	0.38	☐	
CH-5702 A	PP06	10/4/2019	0	ND	☐	
CH-5220 A	PP07	10/11/2019	70	ND	☐	
CH-5225 A	PP07	10/11/2019	44	ND	☐	
CH-5234 A	PP07	10/11/2019	64	0.81	☐	
CH-5238 A	PP07	10/11/2019	43	ND	☐	
CH-5702 A	PP07	10/11/2019	16	ND	☐	
CH-5220 A	PP08	10/18/2019		ND	☐	
CH-5225 A	PP08	10/18/2019		ND	☐	
CH-5234 A	PP08	10/18/2019		ND	☐	
CH-5238 A	PP08	10/18/2019		ND	☐	
CH-5702 A	PP08	10/18/2019		ND	☐	
CH-5220 A	PP09	10/25/2019		ND	☐	
CH-5225 A	PP09	10/25/2019		ND	☐	
CH-5234 A	PP09	10/25/2019		ND	☐	
CH-5238 A	PP09	10/25/2019		ND	☐	
CH-5702 A	PP09	10/25/2019		ND	☐	
CH-5220 A	PP10	11/1/2019		ND	☐	
CH-5225 A	PP10	11/1/2019		ND	☐	
CH-5234 A	PP10	11/1/2019		ND	☐	
CH-5238 A	PP10	11/1/2019		ND	☐	
CH-5702 A	PP10	11/1/2019		ND	☐	

Arleta K-8 School (Cont)

Fixture No	Sample	Sample Date	Flow Volume	Test Result	Flow Issue	Sampling Comments
CH-5220 A	PP11	11/15/2019	419	ND	☐	
CH-5225 A	PP11	11/15/2019	270	ND	☐	
CH-5234 A	PP11	11/15/2019	381	ND	☐	
CH-5238 A	PP11	11/15/2019	248	ND	☐	
CH-5702 A	PP11	11/15/2019	97	ND	☐	
CH-5220 A	PP12	12/6/2019		ND	☐	
CH-5225 A	PP12	12/6/2019		ND	☐	
CH-5234 A	PP12	12/6/2019		ND	☐	
CH-5238 A	PP12	12/6/2019		ND	☐	
CH-5702 A	PP12	12/6/2019		ND	☐	
CH-5220 A	PP13	12/20/2019	705	ND	☐	
CH-5225 A	PP13	12/20/2019	690	ND	☐	
CH-5234 A	PP13	12/20/2019	674	ND	☐	
CH-5238 A	PP13	12/20/2019	449	ND	☐	
CH-5702 A	PP13	12/20/2019	176	ND	☐	
CH-5220 A	PP14	1/10/2020		ND	☐	
CH-5225 A	PP14	1/10/2020		ND	☐	
CH-5234 A	PP14	1/10/2020		0.205	☐	
CH-5238 A	PP14	1/10/2020		ND	☐	
CH-5702 A	PP14	1/10/2020		ND	☐	

Pilot Sampling Summary

Date: January 27, 2020 (Week 23)

Notes: 1. Test results reported as "ND" are "Not Detected". This means the analyte result is between 0 and the reporting limit, which is 0.2 for these reports.

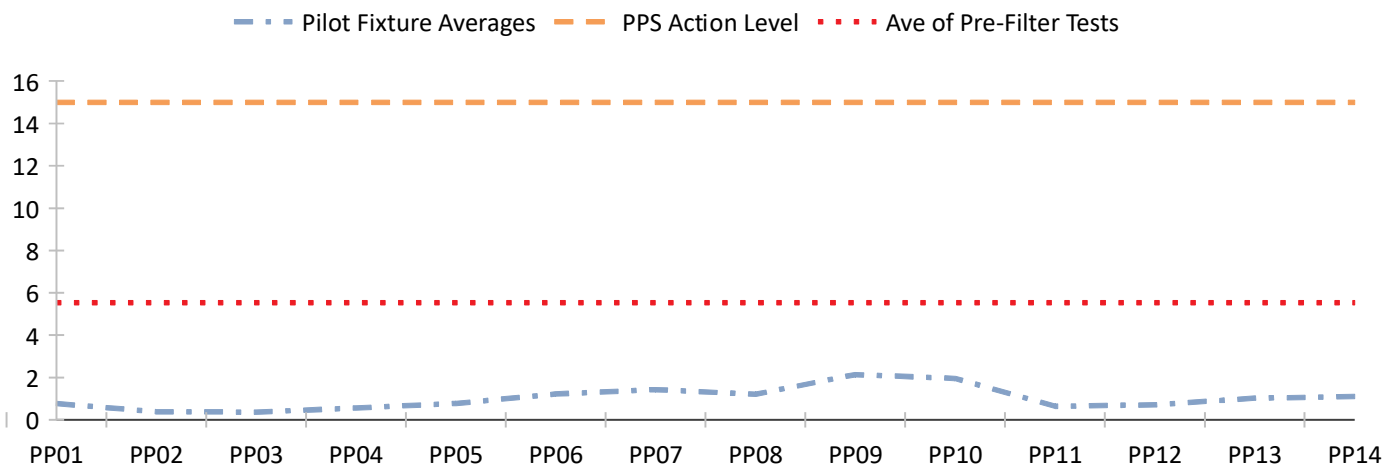
2. Test results for this school, prior to installing filters, had values in the following ranges:

Low Value: 0.375 High Value: 13.1

244 Duniway Elementary School

Average Sample Results (in ppb): 1.020

See Fixture Numbers Below



Fixture No	Sample	Sample Date	Flow Volume	Test Result	Flow Issue	Sampling Comments
CH-1068 A	PP01	8/19/2019		2.8	☐	
CH-1088 A	PP01	8/19/2019		ND	☐	
CH-1094 A	PP01	8/19/2019		ND	☐	
CH-1096 A	PP01	8/19/2019		0.421	☐	
CH-1098 A	PP01	8/19/2019		0.226	☐	
CH-1068 A	PP02	9/6/2019		0.381	☐	
CH-1088 A	PP02	9/6/2019		ND	☐	
CH-1094 A	PP02	9/6/2019		ND	☐	
CH-1096 A	PP02	9/6/2019		ND	☐	
CH-1098 A	PP02	9/6/2019		0.946	☐	
CH-1068 A	PP03	9/13/2019		0.342	☐	
CH-1088 A	PP03	9/13/2019		ND	☐	

Duniway Elementary School (Cont)

Fixture No	Sample	Sample Date	Flow Volume	Test Result	Flow Issue	Sampling Comments
CH-1094 A	PP03	9/13/2019		0.7	☐	
CH-1096 A	PP03	9/13/2019		ND	☐	
CH-1098 A	PP03	9/13/2019		0.38	☐	
CH-1068 A	PP04	9/20/2019		1.14	☐	
CH-1088 A	PP04	9/20/2019		ND	☐	
CH-1094 A	PP04	9/20/2019		0.864	☐	
CH-1096 A	PP04	9/20/2019		ND	☐	
CH-1098 A	PP04	9/20/2019		0.393	☐	
CH-1068 A	PP05	9/27/2019		1.39	☐	
CH-1088 A	PP05	9/27/2019		ND	☐	
CH-1094 A	PP05	9/27/2019		1.42	☐	
CH-1096 A	PP05	9/27/2019		ND	☐	
CH-1098 A	PP05	9/27/2019		0.654	☐	
CH-1068 A	PP06	10/4/2019	0	1.75	☐	
CH-1088 A	PP06	10/4/2019		ND	☐	
CH-1094 A	PP06	10/4/2019	0	1.4	☐	
CH-1096 A	PP06	10/4/2019	0	ND	☐	
CH-1098 A	PP06	10/4/2019	0	2.56	☐	
CH-1068 A	PP07	10/11/2019	22	2.21	☐	
CH-1088 A	PP07	10/11/2019		ND	☐	Flow Meter Not Working
CH-1094 A	PP07	10/11/2019	33	3.01	☐	
CH-1096 A	PP07	10/11/2019	23	ND	☐	
CH-1098 A	PP07	10/11/2019	43	1.52	☐	
CH-1068 A	PP08	10/18/2019		3.07	☐	
CH-1088 A	PP08	10/18/2019	0	ND	☐	
CH-1094 A	PP08	10/18/2019		1.7	☐	
CH-1096 A	PP08	10/18/2019		ND	☐	
CH-1098 A	PP08	10/18/2019		0.859	☐	
CH-1068 A	PP09	10/25/2019		4.89	☐	
CH-1088 A	PP09	10/25/2019		ND	☐	
CH-1094 A	PP09	10/25/2019		4.55	☐	
CH-1096 A	PP09	10/25/2019		ND	☐	
CH-1098 A	PP09	10/25/2019		0.846	☐	
CH-1068 A	PP10	11/1/2019		4.67	☐	
CH-1088 A	PP10	11/1/2019		ND	☐	
CH-1094 A	PP10	11/1/2019		4.12	☐	
CH-1096 A	PP10	11/1/2019		ND	☐	
CH-1098 A	PP10	11/1/2019		0.599	☐	

Duniway Elementary School (Cont)

Fixture No	Sample	Sample Date	Flow Volume	Test Result	Flow Issue	Sampling Comments
CH-1068 A	PP11	11/15/2019	143	ND	☐	
CH-1088 A	PP11	11/15/2019	100	ND	☐	
CH-1094 A	PP11	11/15/2019	164	1.35	☐	
CH-1096 A	PP11	11/15/2019	123	0.282	☐	
CH-1098 A	PP11	11/15/2019	211	1.16	☐	
CH-1068 A	PP12	12/6/2019		ND	☐	
CH-1088 A	PP12	12/6/2019		0.238	☐	
CH-1094 A	PP12	12/6/2019		0.951	☐	
CH-1096 A	PP12	12/6/2019		0.215	☐	
CH-1098 A	PP12	12/6/2019		1.95	☐	
CH-1068 A	PP13	12/20/2019	251	ND	☐	
CH-1088 A	PP13	12/20/2019	221	0.334	☐	
CH-1094 A	PP13	12/20/2019	274	0.826	☐	
CH-1096 A	PP13	12/20/2019	233	ND	☐	
CH-1098 A	PP13	12/20/2019	373	3.58	☐	
CH-1068 A	PP14	1/10/2020		ND	☐	
CH-1088 A	PP14	1/10/2020		ND	☐	
CH-1094 A	PP14	1/10/2020		1.01	☐	
CH-1096 A	PP14	1/10/2020		0.328	☐	
CH-1098 A	PP14	1/10/2020		3.76	☐	

Pilot Sampling Summary

Date: January 27, 2020 (Week 23)

Notes: 1. Test results reported as "ND" are "Not Detected". This means the analyte result is between 0 and the reporting limit, which is 0.2 for these reports.

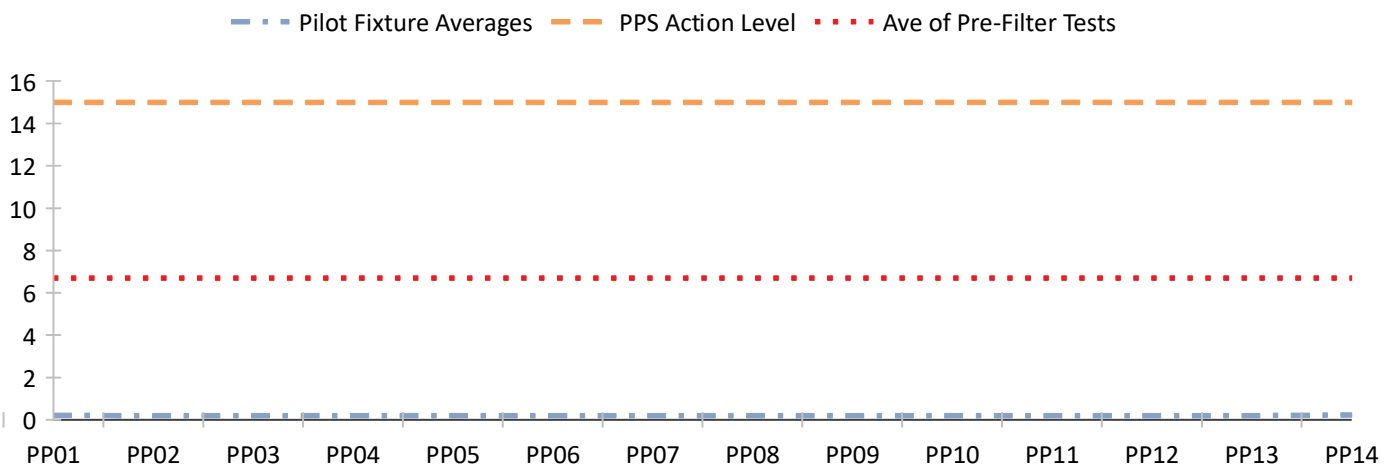
2. Test results for this school, prior to installing filters, had values in the following ranges:

Low Value: 1.0 High Value: 13.0

158 Robert Gray Middle School

Average Sample Results (in ppb): 0.203

See Fixture Numbers Below



Fixture No	Sample	Sample Date	Flow Volume	Test Result	Flow Issue	Sampling Comments
CH-4405 A	PP01	8/21/2019		ND	☐	
CH-4414 A	PP01	8/21/2019		ND	☐	
CH-4417 A	PP01	8/21/2019		ND	☐	
CH-4424 A	PP01	8/21/2019		ND	☐	
CH-4443 A	PP01	8/21/2019		ND	☐	
CH-4449 A	PP01	8/21/2019		0.254	☐	
CH-4405 A	PP02	9/6/2019		ND	☐	
CH-4414 A	PP02	9/6/2019		ND	☐	
CH-4417 A	PP02	9/6/2019		ND	☐	
CH-4424 A	PP02	9/6/2019		ND	☐	
CH-4443 A	PP02	9/6/2019		ND	☐	
CH-4449 A	PP02	9/6/2019		ND	☐	

Robert Gray Middle School (Cont)

Fixture No	Sample	Sample Date	Flow Volume	Test Result	Flow Issue	Sampling Comments
CH-4405 A	PP03	9/13/2019		ND	☐	
CH-4414 A	PP03	9/13/2019		ND	☐	
CH-4417 A	PP03	9/13/2019		ND	☐	
CH-4424 A	PP03	9/13/2019		ND	☐	
CH-4443 A	PP03	9/13/2019		ND	☐	
CH-4449 A	PP03	9/13/2019		ND	☐	
CH-4405 A	PP04	9/20/2019		ND	☐	
CH-4414 A	PP04	9/20/2019		ND	☐	
CH-4417 A	PP04	9/20/2019		ND	☐	
CH-4424 A	PP04	9/20/2019		ND	☐	
CH-4443 A	PP04	9/20/2019		ND	☐	
CH-4449 A	PP04	9/20/2019		ND	☐	
CH-4405 A	PP05	9/27/2019		ND	☐	
CH-4414 A	PP05	9/27/2019		ND	☐	
CH-4417 A	PP05	9/27/2019		ND	☐	
CH-4424 A	PP05	9/27/2019		ND	☐	
CH-4443 A	PP05	9/27/2019		ND	☐	
CH-4449 A	PP05	9/27/2019		ND	☐	
CH-4405 A	PP06	10/4/2019	0	ND	☐	
CH-4414 A	PP06	10/4/2019	0	ND	☐	
CH-4417 A	PP06	10/4/2019	0	ND	☐	
CH-4424 A	PP06	10/4/2019	0	0.222	☐	
CH-4443 A	PP06	10/4/2019	0	ND	☐	
CH-4449 A	PP06	10/4/2019	0	ND	☐	
CH-4405 A	PP07	10/11/2019	52	ND	☐	
CH-4414 A	PP07	10/11/2019	22	ND	☐	
CH-4417 A	PP07	10/11/2019	69	ND	☐	
CH-4424 A	PP07	10/11/2019	68	ND	☐	
CH-4443 A	PP07	10/11/2019	51	ND	☐	
CH-4449 A	PP07	10/11/2019	7	ND	☐	
CH-4405 A	PP08	10/18/2019		ND	☐	
CH-4414 A	PP08	10/18/2019		ND	☐	
CH-4417 A	PP08	10/18/2019		ND	☐	
CH-4424 A	PP08	10/18/2019		ND	☐	
CH-4443 A	PP08	10/18/2019		ND	☐	
CH-4449 A	PP08	10/18/2019		ND	☐	
CH-4405 A	PP09	10/25/2019		ND	☐	
CH-4414 A	PP09	10/25/2019		ND	☐	

Robert Gray Middle School (Cont)

Fixture No	Sample	Sample Date	Flow Volume	Test Result	Flow Issue	Sampling Comments
CH-4417 A	PP09	10/25/2019		ND	☐	
CH-4424 A	PP09	10/25/2019		ND	☐	
CH-4443 A	PP09	10/25/2019		ND	☐	
CH-4449 A	PP09	10/25/2019		ND	☐	
CH-4405 A	PP10	11/1/2019		ND	☐	
CH-4414 A	PP10	11/1/2019		ND	☐	
CH-4417 A	PP10	11/1/2019		ND	☐	
CH-4424 A	PP10	11/1/2019		ND	☐	
CH-4443 A	PP10	11/1/2019		ND	☐	
CH-4449 A	PP10	11/1/2019		ND	☐	
CH-4405 A	PP11	11/15/2019	315	ND	☐	
CH-4414 A	PP11	11/15/2019	156	ND	☐	
CH-4417 A	PP11	11/15/2019	381	ND	☐	
CH-4424 A	PP11	11/15/2019	308	ND	☐	
CH-4443 A	PP11	11/15/2019	287	ND	☐	
CH-4449 A	PP11	11/15/2019	32	ND	☐	
CH-4405 A	PP12	12/6/2019		ND	☐	
CH-4414 A	PP12	12/6/2019		ND	☐	
CH-4417 A	PP12	12/6/2019		ND	☐	
CH-4424 A	PP12	12/6/2019		ND	☐	
CH-4443 A	PP12	12/6/2019		ND	☐	
CH-4449 A	PP12	12/6/2019		ND	☐	
CH-4405 A	PP13	12/20/2019	216	ND	☐	
CH-4414 A	PP13	12/20/2019	360	ND	☐	
CH-4417 A	PP13	12/20/2019	685	ND	☐	
CH-4424 A	PP13	12/20/2019	590	ND	☐	
CH-4443 A	PP13	12/20/2019	479	ND	☐	
CH-4449 A	PP13	12/20/2019	53	0.224	☐	
CH-4405 A	PP14	1/10/2020		ND	☐	
CH-4414 A	PP14	1/10/2020		ND	☐	
CH-4417 A	PP14	1/10/2020		ND	☐	
CH-4424 A	PP14	1/10/2020		ND	☐	
CH-4443 A	PP14	1/10/2020		ND	☐	
CH-4449 A	PP14	1/10/2020		0.36	☐	

Pilot Sampling Summary

Date: January 27, 2020 (Week 23)

Notes: 1. Test results reported as "ND" are "Not Detected". This means the analyte result is between 0 and the reporting limit, which is 0.2 for these reports.

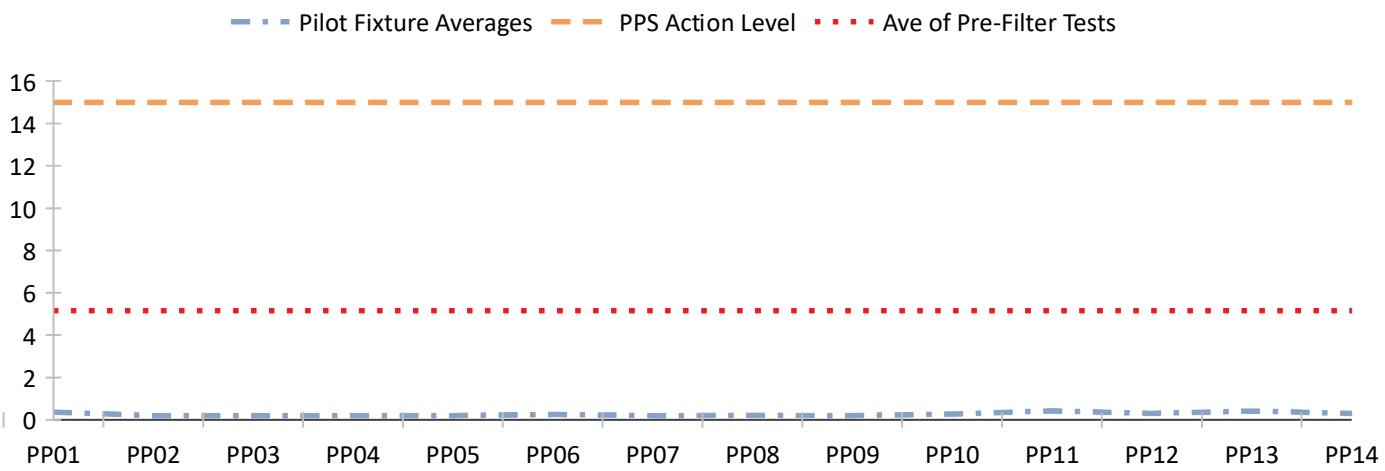
2. Test results for this school, prior to installing filters, had values in the following ranges:

Low Value: 0.815 High Value: 14.5

118 Jefferson High School

Average Sample Results (in ppb): 0.275

See Fixture Numbers Below



Fixture No	Sample	Sample Date	Flow Volume	Test Result	Flow Issue	Sampling Comments
CH-3606 A	PP01	8/23/2019		ND	☐	
CH-3616 A	PP01	8/26/2019		ND	☐	
CH-3628 A	PP01	8/26/2019		0.582	☐	
CH-3640 A	PP01	8/26/2019		ND	☐	
CH-3654 A	PP01	8/23/2019		ND	☐	
CH-3659 A	PP01	8/23/2019		0.503	☐	
CH-3661 A	PP01	8/26/2019		ND	☐	
CH-3662 A	PP01	8/26/2019		1.16	☐	
CH-3667 A	PP01	8/23/2019		ND	☐	
CH-3989 A	PP01	8/26/2019		0.208	☐	
CH-3606 A	PP02	9/6/2019		ND	☐	
CH-3616 A	PP02	9/6/2019		ND	☐	

Jefferson High School (Cont)

Fixture No	Sample	Sample Date	Flow Volume	Test Result	Flow Issue	Sampling Comments
CH-3628 A	PP02	9/6/2019		ND	☐	
CH-3640 A	PP02	9/6/2019		ND	☐	
CH-3654 A	PP02	9/6/2019		ND	☐	
CH-3659 A	PP02	9/6/2019			☐	Not Sampled
CH-3661 A	PP02	9/6/2019		ND	☐	
CH-3662 A	PP02	9/6/2019		ND	☐	
CH-3667 A	PP02	9/6/2019			☐	Not Sampled
CH-3989 A	PP02	9/6/2019		ND	☐	
CH-3606 A	PP03	9/12/2019		ND	☐	
CH-3616 A	PP03	9/12/2019		ND	☐	
CH-3628 A	PP03	9/12/2019		ND	☐	
CH-3640 A	PP03	9/12/2019		ND	☐	
CH-3654 A	PP03	9/12/2019		ND	☐	
CH-3659 A	PP03	9/12/2019			☐	Not Sampled
CH-3661 A	PP03	9/12/2019		ND	☐	
CH-3662 A	PP03	9/12/2019		ND	☐	
CH-3667 A	PP03	9/12/2019			☐	Not Sampled
CH-3989 A	PP03	9/12/2019		ND	☐	
CH-3606 A	PP04	9/19/2019		ND	☐	
CH-3616 A	PP04	9/19/2019		ND	☐	
CH-3628 A	PP04	9/19/2019		ND	☐	
CH-3640 A	PP04	9/19/2019		ND	☐	
CH-3654 A	PP04	9/19/2019		ND	☐	
CH-3659 A	PP04	9/19/2019			☐	Not Sampled
CH-3661 A	PP04	9/19/2019		ND	☐	
CH-3662 A	PP04	9/19/2019		ND	☐	
CH-3667 A	PP04	9/19/2019			☐	Not Sampled
CH-3989 A	PP04	9/19/2019		ND	☐	
CH-3606 A	PP05	9/26/2019		ND	☐	
CH-3616 A	PP05	9/26/2019		ND	☐	
CH-3628 A	PP05	9/26/2019		ND	☐	
CH-3640 A	PP05	9/26/2019		ND	☐	
CH-3654 A	PP05	9/26/2019		ND	☐	
CH-3659 A	PP05	9/26/2019			☐	Not Sampled
CH-3661 A	PP05	9/26/2019		ND	☐	
CH-3662 A	PP05	9/26/2019		ND	☐	
CH-3667 A	PP05	9/26/2019			☐	Not Sampled
CH-3989 A	PP05	9/26/2019		ND	☐	

Jefferson High School (Cont)

Fixture No	Sample	Sample Date	Flow Volume	Test Result	Flow Issue	Sampling Comments
CH-3606 A	PP06	10/3/2019		ND	☐	
CH-3616 A	PP06	10/3/2019		ND	☐	
CH-3628 A	PP06	10/3/2019		ND	☐	
CH-3640 A	PP06	10/3/2019		ND	☐	
CH-3654 A	PP06	10/3/2019		ND	☐	
CH-3659 A	PP06	10/3/2019			☐	Not Sampled
CH-3661 A	PP06	10/3/2019	0	ND	☐	
CH-3662 A	PP06	10/3/2019	0	ND	☐	
CH-3667 A	PP06	10/3/2019			☐	Not Sampled
CH-3989 A	PP06	10/3/2019	0	0.609	☐	
CH-3606 A	PP07	10/10/2019		ND	☐	
CH-3616 A	PP07	10/10/2019		ND	☐	
CH-3628 A	PP07	10/10/2019		ND	☐	
CH-3640 A	PP07	10/10/2019		ND	☐	
CH-3654 A	PP07	10/10/2019		ND	☐	
CH-3659 A	PP07	10/10/2019			☐	Not Sampled
CH-3661 A	PP07	10/10/2019		ND	☐	
CH-3662 A	PP07	10/10/2019		ND	☐	
CH-3667 A	PP07	10/10/2019			☐	Not Sampled
CH-3989 A	PP07	10/10/2019		ND	☐	
CH-3606 A	PP08	10/17/2019	3	ND	☐	
CH-3616 A	PP08	10/17/2019	6	ND	☐	
CH-3628 A	PP08	10/17/2019	1	ND	☐	
CH-3635 A	PP08	10/17/2019	6	0.288	☐	
CH-3640 A	PP08	10/17/2019	0	ND	☐	
CH-3654 A	PP08	10/17/2019	0	ND	☐	
CH-3659 A	PP08	10/17/2019		ND	☐	
CH-3661 A	PP08	10/17/2019	33	ND	☐	
CH-3662 A	PP08	10/17/2019	19	ND	☐	
CH-3667 A	PP08	10/17/2019	5	ND	☐	
CH-3989 A	PP08	10/17/2019	24	ND	☐	
CH-3606 A	PP09	10/24/2019		ND	☐	
CH-3616 A	PP09	10/24/2019		ND	☐	
CH-3628 A	PP09	10/24/2019		ND	☐	
CH-3635 A	PP09	10/24/2019		ND	☐	
CH-3640 A	PP09	10/24/2019		ND	☐	
CH-3654 A	PP09	10/24/2019		ND	☐	
CH-3659 A	PP09	10/24/2019			☐	

Jefferson High School (Cont)

Fixture No	Sample	Sample Date	Flow Volume	Test Result	Flow Issue	Sampling Comments
CH-3661 A	PP09	10/24/2019		ND	☐	
CH-3662 A	PP09	10/24/2019		ND	☐	
CH-3667 A	PP09	10/24/2019		ND	☐	
CH-3989 A	PP09	10/24/2019		ND	☐	
CH-3606 A	PP10	10/24/2019		ND	☐	
CH-3616 A	PP10	10/24/2019		ND	☐	
CH-3628 A	PP10	10/24/2019		ND	☐	
CH-3635 A	PP10	10/24/2019		ND	☐	
CH-3640 A	PP10	10/24/2019		0.856	☐	
CH-3654 A	PP10	10/24/2019		0.252	☐	
CH-3659 A	PP10	10/24/2019			☐	Not Sampled
CH-3661 A	PP10	10/24/2019		ND	☐	
CH-3662 A	PP10	10/24/2019		ND	☐	
CH-3667 A	PP10	10/24/2019		ND	☐	
CH-3989 A	PP10	10/24/2019		ND	☐	
CH-3606 A	PP11	11/14/2019	22	ND	☐	
CH-3616 A	PP11	11/14/2019	40	ND	☐	
CH-3628 A	PP11	11/14/2019	6	ND	☐	
CH-3634 A	PP11	11/14/2019		1.94	☐	
CH-3635 A	PP11	11/14/2019	63	ND	☐	
CH-3640 A	PP11	11/14/2019	74	0.7	☐	
CH-3654 A	PP11	11/14/2019	94	0.327	☐	
CH-3659 A	PP11	11/14/2019			☐	Not Sampled
CH-3661 A	PP11	11/14/2019	121	0.248	☐	
CH-3662 A	PP11	11/14/2019	187	ND	☐	
CH-3667 A	PP11	11/14/2019	5	ND	☐	
CH-3989 A	PP11	11/14/2019	139	0.31	☐	
CH-3606 A	PP12	12/5/2019		ND	☐	
CH-3616 A	PP12	12/5/2019		ND	☐	
CH-3628 A	PP12	12/5/2019		ND	☐	
CH-3634 A	PP12	12/5/2019		0.514	☐	
CH-3635 A	PP12	12/5/2019		ND	☐	
CH-3640 A	PP12	12/5/2019		0.323	☐	
CH-3654 A	PP12	12/5/2019		0.522	☐	
CH-3659 A	PP12	12/5/2019		ND	☐	Not Sampled
CH-3661 A	PP12	12/5/2019		0.248	☐	
CH-3662 A	PP12	12/5/2019		ND	☐	
CH-3667 A	PP12	12/5/2019		ND	☐	

Jefferson High School (Cont)

Fixture No	Sample	Sample Date	Flow Volume	Test Result	Flow Issue	Sampling Comments
CH-3989 A	PP12	12/5/2019		0.502	☐	
CH-3606 A	PP13	12/19/2019	54	ND	☐	
CH-3616 A	PP13	12/19/2019	83	0.203	☐	
CH-3628 A	PP13	12/19/2019	20	ND	☐	
CH-3634 A	PP13	12/19/2019		0.474	☐	No Flow Meter
CH-3635 A	PP13	12/19/2019	120	ND	☐	
CH-3640 A	PP13	12/19/2019	256	1.65	☐	
CH-3654 A	PP13	12/19/2019	239	0.576	☐	
CH-3659 A	PP13	12/19/2019			☐	Not Sampled
CH-3661 A	PP13	12/19/2019	300	0.264	☐	
CH-3662 A	PP13	12/19/2019	410	ND	☐	
CH-3667 A	PP13	12/19/2019	5	ND	☐	
CH-3989 A	PP13	12/19/2019	265	0.383	☐	
CH-3606 A	PP14	1/9/2020		ND	☐	
CH-3616 A	PP14	1/9/2020		0.356	☐	
CH-3628 A	PP14	1/9/2020		ND	☐	
CH-3634 A	PP14				☐	Not Sampled
CH-3635 A	PP14	1/9/2020		ND	☐	
CH-3640 A	PP14	1/9/2020		0.599	☐	
CH-3654 A	PP14	1/9/2020		0.696	☐	
CH-3659 A	PP14				☐	Not Sampled
CH-3661 A	PP14	1/9/2020		ND	☐	
CH-3662 A	PP14	1/9/2020		ND	☐	
CH-3667 A	PP14	1/9/2020		ND	☐	
CH-3989 A	PP14	1/9/2020		0.258	☐	

Pilot Sampling Summary

Date: January 27, 2020 (Week 23)

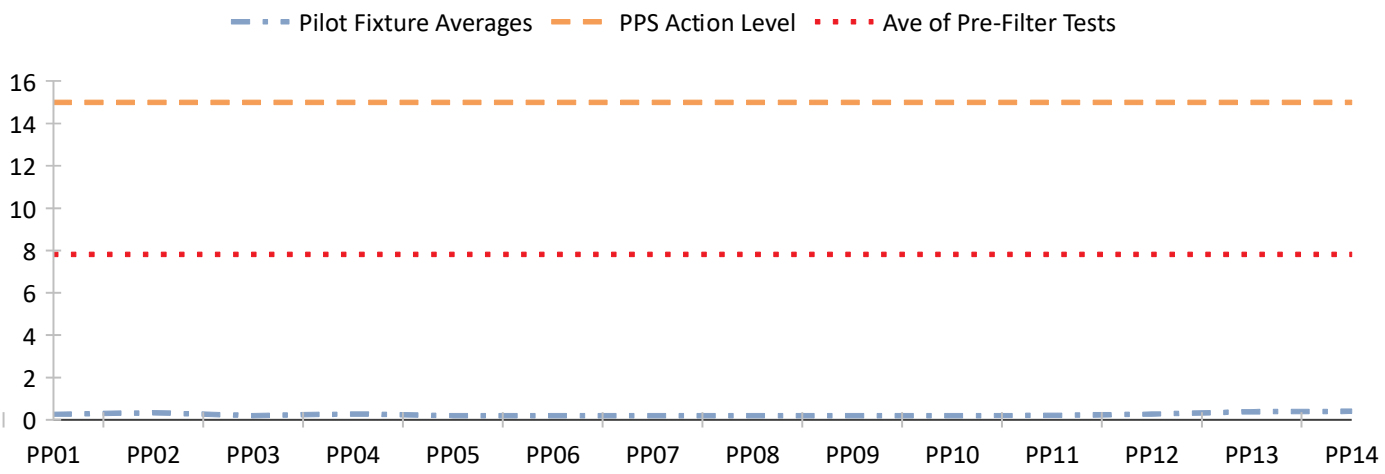
Notes: 1. Test results reported as "ND" are "Not Detected". This means the analyte result is between 0 and the reporting limit, which is 0.2 for these reports.

2. Test results for this school, prior to installing filters, had values in the following ranges:
   Low Value: 2.17 High Value: 14.2

269 Llewellyn Elementary School

Average Sample Results (in ppb): 0.254

See Fixture Numbers Below



Fixture No	Sample	Sample Date	Flow Volume	Test Result	Flow Issue	Sampling Comments
CH-1277 A	PP01	8/19/2019			☐	Not Sampled
CH-1278 A	PP01	8/19/2019		ND	☐	
CH-1279 A	PP01	8/19/2019		0.391	☐	
CH-1280 A	PP01	8/19/2019		ND	☐	
CH-1277 A	PP02	9/10/2019		0.678	☐	
CH-1278 A	PP02	9/6/2019		0.247	☐	
CH-1279 A	PP02	9/6/2019		ND	☐	
CH-1280 A	PP02	9/6/2019		ND	☐	
CH-1277 A	PP03	9/13/2019			☐	Not Sampled
CH-1278 A	PP03	9/13/2019		ND	☐	
CH-1279 A	PP03	9/13/2019		ND	☐	
CH-1280 A	PP03	9/13/2019		ND	☐	

Llewellyn Elementary School (Cont)

Fixture No	Sample	Sample Date	Flow Volume	Test Result	Flow Issue	Sampling Comments
CH-1277 A	PP04	9/20/2019		0.508	☐	
CH-1278 A	PP04	9/20/2019		0.203	☐	
CH-1279 A	PP04	9/20/2019		ND	☐	
CH-1280 A	PP04	9/20/2019		ND	☐	
CH-1277 A	PP05	9/27/2019		ND	☐	
CH-1278 A	PP05	9/27/2019		ND	☐	
CH-1279 A	PP05	9/27/2019		ND	☐	
CH-1280 A	PP05	9/27/2019		ND	☐	
CH-1277 A	PP06	10/4/2019		ND	☐	
CH-1278 A	PP06	10/4/2019		ND	☐	
CH-1279 A	PP06	10/4/2019		ND	☐	
CH-1280 A	PP06	10/4/2019	0	ND	☐	
CH-1277 A	PP07	10/11/2019		ND	☐	No Flow Meter
CH-1278 A	PP07	10/11/2019		ND	☐	Flow Meter Not Working
CH-1279 A	PP07	10/11/2019		ND	☐	Flow Meter Not Working
CH-1280 A	PP07	10/11/2019	22	ND	☐	
CH-1277 A	PP08	10/18/2019		ND	☐	
CH-1278 A	PP08	10/18/2019		ND	☐	
CH-1279 A	PP08	10/18/2019		ND	☐	
CH-1280 A	PP08	10/18/2019		ND	☐	
CH-1277 A	PP09	10/25/2019		ND	☐	
CH-1278 A	PP09	10/25/2019		ND	☐	
CH-1279 A	PP09	10/25/2019		ND	☐	
CH-1280 A	PP09	10/25/2019		ND	☐	
CH-1277 A	PP10	10/25/2019		ND	☐	
CH-1278 A	PP10	10/25/2019		ND	☐	
CH-1279 A	PP10	10/25/2019		ND	☐	
CH-1280 A	PP10	10/25/2019		ND	☐	
CH-1277 A	PP11	11/15/2019		0.242	☐	
CH-1278 A	PP11	11/15/2019		ND	☐	
CH-1279 A	PP11	11/15/2019		ND	☐	
CH-1280 A	PP11	11/15/2019	118	ND	☐	
CH-1277 A	PP12	12/6/2019		0.357	☐	
CH-1278 A	PP12	12/6/2019		0.257	☐	
CH-1279 A	PP12	12/6/2019		ND	☐	
CH-1280 A	PP12	12/6/2019		0.278	☐	
CH-1277 A	PP13	12/20/2019		0.641	☐	No Flow Meter
CH-1278 A	PP13	12/20/2019		ND	☐	

Llewellyn Elementary School (Cont)

Fixture No	Sample	Sample Date	Flow Volume	Test Result	Flow Issue	Sampling Comments
CH-1279 A	PP13	12/20/2019		ND	☐	
CH-1280 A	PP13	12/20/2019	224	0.483	☐	
CH-1277 A	PP14	1/10/2020		0.487	☐	
CH-1278 A	PP14	1/10/2020		0.32	☐	
CH-1279 A	PP14	1/10/2020		ND	☐	
CH-1280 A	PP14	1/10/2020		0.612	☐	

Pilot Sampling Summary

Date: January 27, 2020 (Week 23)

Notes: 1. Test results reported as "ND" are "Not Detected". This means the analyte result is between 0 and the reporting limit, which is 0.2 for these reports.

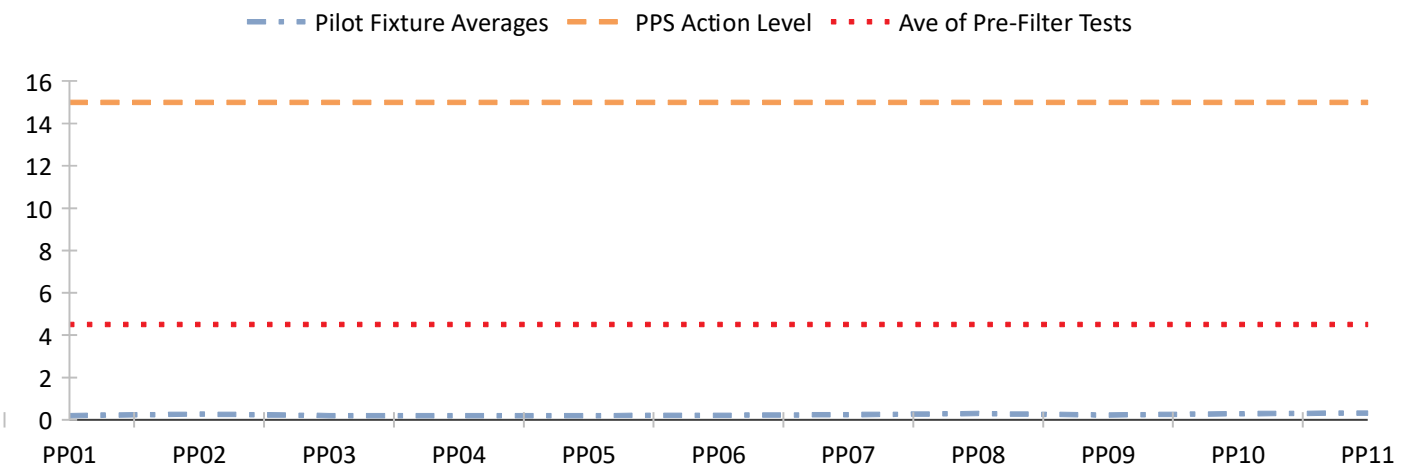
2. Test results for this school, prior to installing filters, had values in the following ranges:

Low Value: 0.29 High Value: 14.6

276 Rigler Elementary School

Average Sample Results (in ppb): 0.243

See Fixture Numbers Below



Fixture No	Sample	Sample Date	Flow Volume	Test Result	Flow Issue	Sampling Comments
CH-1634 A	PP01	10/8/2019		ND	☐	
CH-1643 A	PP01	10/8/2019		ND	☐	
CH-1733 A	PP01	10/8/2019		ND	☐	
CH-1634 A	PP02	10/11/2019	5	ND	☐	
CH-1643 A	PP02	10/11/2019	5	0.414	☐	
CH-1733 A	PP02	10/11/2019	5	ND	☐	
CH-1631 A	PP03	10/17/2019	5	ND	☐	
CH-1634 A	PP03	10/17/2019		ND	☐	
CH-1643 A	PP03	10/17/2019		ND	☐	
CH-1733 A	PP03	10/17/2019		ND	☐	
CH-1631 A	PP04	10/24/2019		ND	☐	
CH-1634 A	PP04	10/24/2019		ND	☐	

Rigler Elementary School (Cont)

Fixture No	Sample	Sample Date	Flow Volume	Test Result	Flow Issue	Sampling Comments
CH-1643 A	PP04	10/24/2019		ND	☐	
CH-1733 A	PP04	10/24/2019		ND	☐	
CH-1631 A	PP05	10/24/2019		ND	☐	
CH-1634 A	PP05	10/24/2019		ND	☐	
CH-1643 A	PP05	10/24/2019		ND	☐	
CH-1733 A	PP05	10/24/2019		ND	☐	
CH-1631 A	PP06	11/8/2019		ND	☐	
CH-1634 A	PP06	11/8/2019		0.265	☐	
CH-1643 A	PP06	11/8/2019		ND	☐	
CH-1733 A	PP06	11/8/2019		ND	☐	
CH-1631 A	PP07	11/14/2019	802	0.388	☐	
CH-1634 A	PP07	11/14/2019	189	ND	☐	
CH-1643 A	PP07	11/14/2019	94	ND	☐	
CH-1733 A	PP07	11/14/2019	141	ND	☐	
CH-1631 A	PP08	11/22/2019		ND	☐	
CH-1634 A	PP08	11/22/2019		ND	☐	
CH-1643 A	PP08	11/22/2019		0.576	☐	
CH-1733 A	PP08	11/22/2019		ND	☐	
CH-1631 A	PP09	12/5/2019		0.314	☐	
CH-1634 A	PP09	12/5/2019		ND	☐	
CH-1643 A	PP09	12/5/2019		ND	☐	
CH-1733 A	PP09	12/5/2019		ND	☐	
CH-1631 A	PP10	12/19/2019	887	ND	☐	
CH-1634 A	PP10	12/19/2019	382	ND	☐	
CH-1643 A	PP10	12/19/2019	153	0.558	☐	
CH-1733 A	PP10	12/19/2019	276	ND	☐	
CH-1631 A	PP11	1/9/2020		ND	☐	
CH-1634 A	PP11	1/9/2020		ND	☐	
CH-1643 A	PP11	1/9/2020		0.689	☐	
CH-1733 A	PP11	1/9/2020		ND	☐	