San Francisco
Water Power Sewer
Services of the San Francisco Public Utilities Commission

San Francisco Water System
Impact of Lead Components on Household Lead Levels at the Tap

FINAL

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SAN FRANCISCO PUBLIC UTILITIES COMMISSION
WATER QUALITY DIVISION

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SFPUC Water Quality Division
Andrew DeGraca
Manouchehr Boozarpour
Peter Amour
Carrie Bell
Dennis Edwards
R. Galen Gonzales
Raymond Mah
Teresann Silvia
Eddy So

SFPUC Customer Services Bureau
Aleda Graham

SFPUC Communications
Suzanne Gautier
Roberto Lopez
Betsy Lauppe Rhodes

SFPUC City Distribution Division
Bill Teahan
Sean Duffy
Lynn Fong
Ryan Gabriel
Mike Gardiner
Rahul Shah
Janice Zilmar

Alan R. Wong
Project Manager
CA PE License #57024

Elaine Kawaii
Project Engineer
CA PE License #81685

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Executive Summary

The SFPUC completed a pilot study to evaluate lead levels at residences with Lead User Service Lines (LUSLs) replaced within the San Francisco Water System (SFWS). The State of California defines a user service line as "the pipe, tubing, and fittings connecting a water main to an individual water meter or service connection (California Code of Regulations Section 116885)." Since the SFPUC replaced all known lead service lines (pipes) in the late 1980s, the remaining leaded portion within SFWS LUSLs consists of a pigtail, or 1-3ft flexible lead pipe connecting the water main to the customer service lateral. These fittings are not at all residential sites, but based on SFPUC experience, may be present at service connections with galvanized steel service laterals, less than 1-inch diameter and constructed prior to 1950.

The pilot study involved:

- Identifying and recruiting study participants
- Developing customer education and outreach materials
- Sampling households for lead, LUSL replacement (LUSLR) with an all-new copper service line
- Supplying water filters
- Collecting and analyzing pre- and post-replacement lead samples

All activities were conducted in anticipation of new state and federal drinking water lead regulations.

A total of 36 participants volunteered for the study. While the San Francisco Public Utilities Commission (SFPUC) attempted to attain a goal of 50 participants to gain a statistically significant number of households, the 2020 COVID-19 Shelter-in-Place restrictions halted customer outreach in March 2020. Therefore, the SFPUC recognizes the limited number of participants in this study may reduce the accuracy of findings and analysis contained in this report. Outreach for volunteers focused on residential sites with high potential for having an LUSL. While 36 service laterals were replaced (March 2019 to December 2021), only 20 were verified to have a lead whip.

Customer lead testing involved collecting 14 to 25 1L samples at the kitchen faucet of each customer's residence after a minimum 6-hour overnight stagnation period. These samples were collected to capture lead leachate in the entirety of the customers' plumbing system from household or "premise" plumbing to the SFPUC water main in the street. The number of sample bottles per house varied based on the calculated volume of water in customer's plumbing system. This is also known as "sequential" or "profile sampling". While leading researchers have used this sampling technique, it is not exact, as latter samples traverse the entire plumbing system and may collect particulates not representative of the intended plumbing segment.

Profile samples were planned for collection before, 1-week after, 1-month after and 3-months after LUSL replacement (LUSLR). If all profile samples for a single site were low (≤2 parts per billion, or 'ppb')[1] in either the 1-week, 1-month or 3-month sampling, then the site was considered "closed" and additional sampling was discontinued. Sampling for some sites were also closed if the customer ended participation prematurely or was non-responsive. Sampling results may have been invalidated if customer failed to follow sampling instructions (e.g., if 6-hour stagnation time was not met, or customer did not sample from the kitchen faucet). The lead sampling results for the 20 confirmed LUSL sites are the primary focus of this study.

Household lead results from 18 sites[2] before LUSLR showed all profile samples less than 15ppb (a total of 320 samples). Household lead sampling 1-week after LUSLR showed 2 of 16 sites with a maximum result greater or equal the USEPA's lead Action Level of 15ppb (3 of 325 samples). No samples showed lead results >15ppb at the 1-month sampling (n=125, from 6 sites) and only one LUSL site completed 3-month samples, showing a maximum result of 1.1ppb. In total, 16 of 20 sites were closed out due to low lead results, with the remaining customers ending participation prematurely before LUSLR (2 sites) or 1-month after LUSLR (2 sites). Of the latter 2 sites, the maximum lead value after LUSLR was 13ppb which occurred in the 1-month profile set.

Results from this study show relatively higher lead levels in profile bottles 1, 2 and 7 both before and after LUSLR, but below Lead Action Level of 15ppb. Lead levels were substantially reduced by the 1-month sampling with all values <1ppb after the 2nd bottle, indicating residual lead may be contributed by kitchen faucet. The exception to these lower 1-month lead trends may be in first draw, first sample bottles where the faucet is a bigger contributor of lead. 90th percentile lead values for each sequential sample and sample event are shown on Figure ES-1 (e.g., the 90th percentile lead value from 18 first draw samples [bottle 1] collected before LUSLR was 4.4ppb).

A maximum lead value of 1400ppb was detected at Site 105 1-week after LUSLR in the 23rd bottle (representing SFPUC water main). This was the only LUSLR site where more than 20 samples were collected. For site 105, all 24 other 1-week samples were ≤11ppb and all 25 1-month samples were Non-Detect ("ND", or <1ppb). Industry research specifies that increased lead after LUSLR is most likely caused by particulate release within premise plumbing when service laterals are disturbed during replacement activities. Maximum lead values for all pilot study locations and sampling events by profile bottle are shown on Figure ES-2

The SFPUC has demonstrated, through past compliance monitoring, that the SFWS meets or exceeds drinking water standards for lead. Results from this study indicates that the SFPUC's current corrosion control strategy is effective in lowering lead concentrations below the current State and Federal Action Level of 15ppb at locations within the San Francisco Water System with a leaded component before LUSLR.

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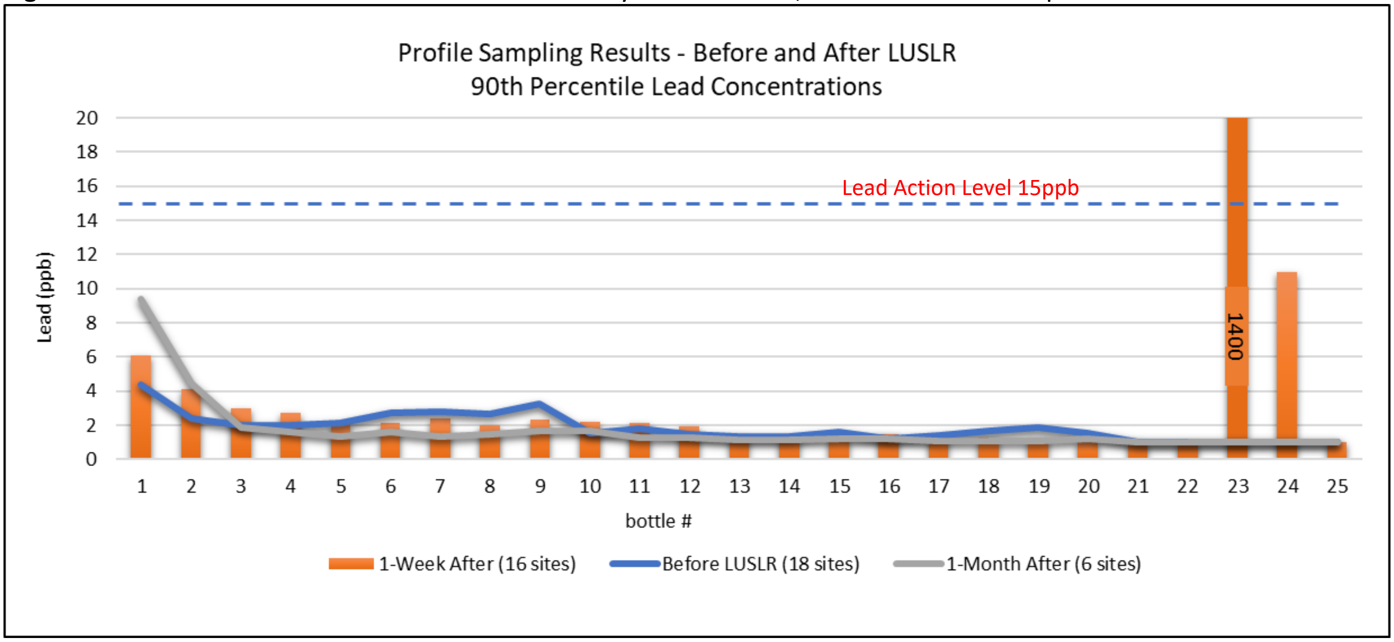
[1] Value is double the lead detection limit of 1ppb and was arbitrarily used as the cut off value.

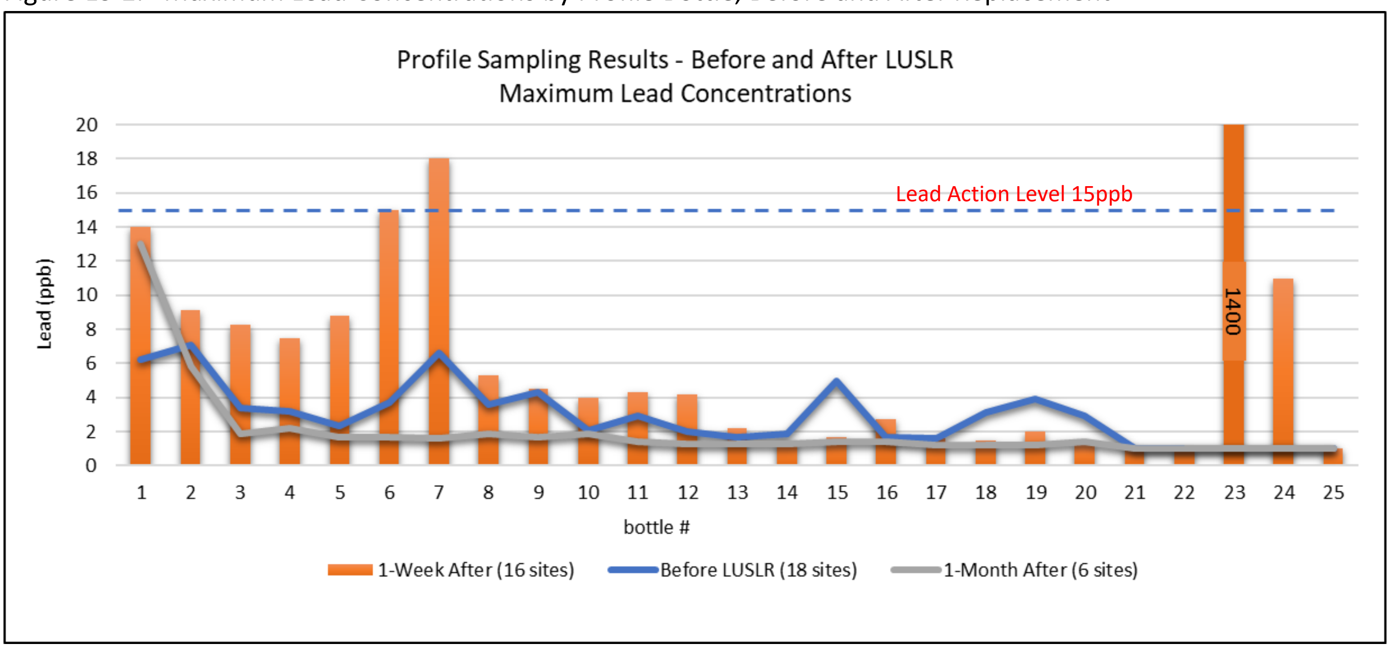
[2] The number of sample sites may not equal total number of 20 LUSL sites due to incorrect sampling, omissions or other.

Figure ES-1. 90th Percentile Lead Concentrations by Profile Bottle, Before and After Replacement



Notes:
The number of sample bottles collected for profile samples varied from 14 – 25 due to estimated plumbing lengths.
Values at <DL are shown as 1ppb.

Figure ES-2. Maximum Lead Concentrations by Profile Bottle, Before and After Replacement



Notes:
The number of sample bottles collected for profile samples varied from 14 – 25 due to estimated plumbing lengths.
Values at <DL are shown as 1ppb.

Background

San Francisco Water System and Lead Compliance

The SFPUC is permitted to provide and distribute drinking water to residents of the City and County of San Francisco by the California State Water Resources Control Board Division of Drinking Water under Permit 02-04-OIP-3810011, Nov 2001. The official title of the potable water distribution system is the San Francisco Water System (SFWS), which includes reservoirs, pump stations, distribution pipelines and conveys water to some 870,000 residents and approximately 1.5 million daytime population (Figure 1). The SFWS receives water from the San Francisco Regional Water System with 85% of water supplies from the Hetch Hetchy Watershed in Sierra Nevada mountains, supplemented with 15% of supplies from local watersheds in Alameda and San Mateo counties and less than 1% local groundwater.

As the earliest SFWS facilities were constructed before the Civil War (circa 1860), the SFPUC has been upgrading infrastructure over the last 20 years first by modernizing the water storage reservoirs, tanks, and pump stations to withstand earthquake forces and maintain water quality, and then by ramping up the main replacement program. Improvements to SFPUC drinking water also include implementation of lead reduction strategies consisting of replacing all known leaded water service laterals in the 1980s (an estimated 8,000 to 10,000 lead lines), lead-free faucet giveaways, and the Lead User Service lateral replacement program, starting July 2020.

Corrosion control strategies implemented by the SFPUC have helped SFWS meet lead and copper Action Levels specified in the Federal and State Lead and Copper Rule (beginning 1991). Triennial lead sampling for the last five monitoring cycles (2009, 2012, 2015, 2018 and 2021) at household taps show SFWS within compliance of the 0.015mg/L (15ppb) lead Action Level at the 90th percentile value (Figure 2).

Figure 1. Boundaries of the San Francisco Water System

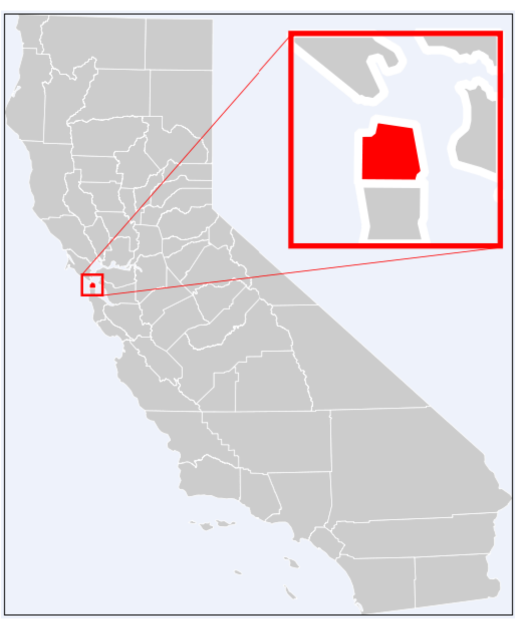
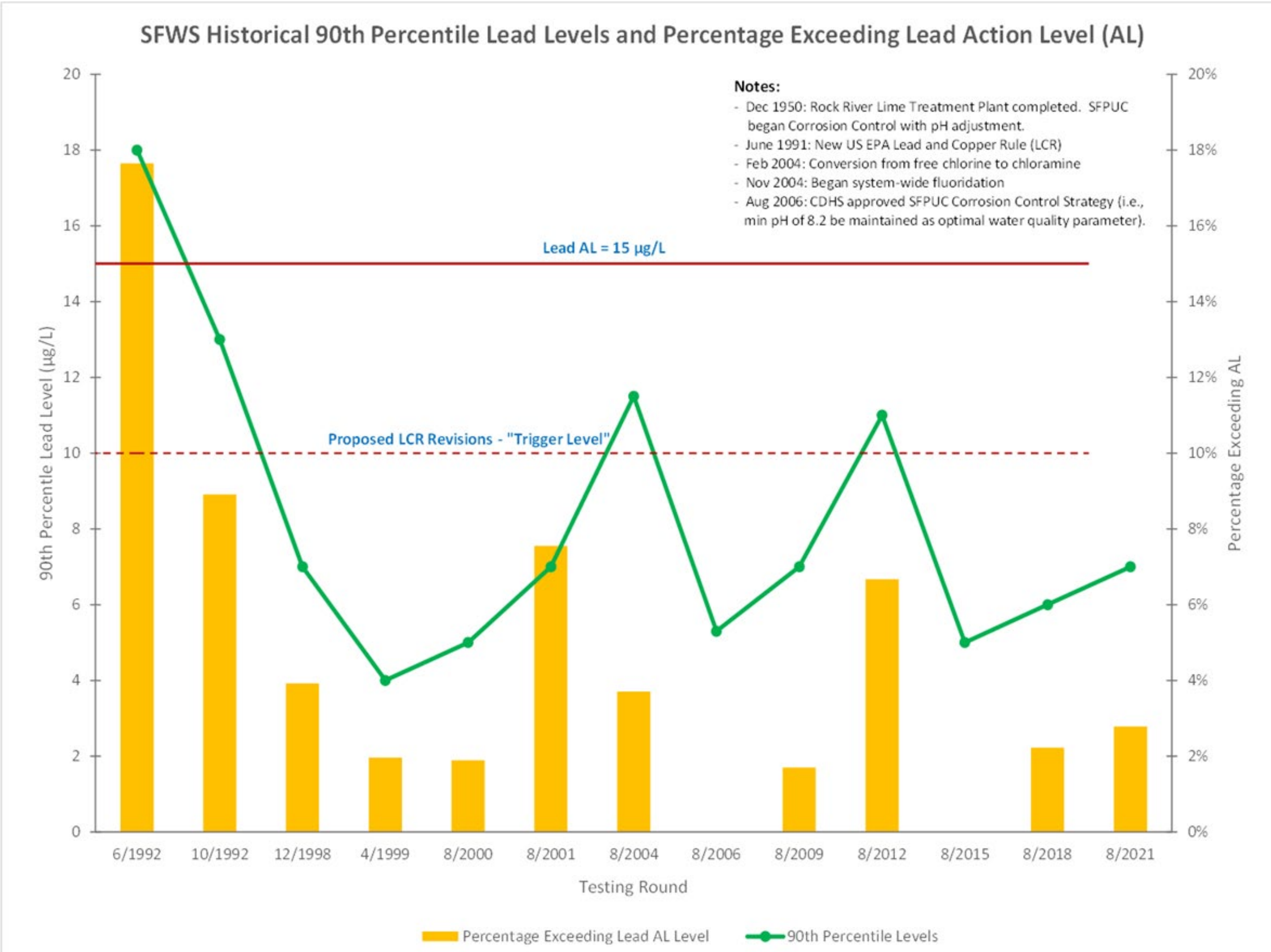


Figure 2 – SFWS Lead Compliance Sampling Results



New Regulations and SFPUC LUSL Pilot Program Development

Section 116885 of the California Health and Safety Code, Lead Service Lines in Public Water Systems, added to the Health and Safety Code by Senate Bill 1398 (2016) and amended by Senate Bill 427 (2017), required all community water systems (CWS) to compile an inventory of known partial or total lead user service lines in use in its distribution system by July 1, 2018 CWS and propose a replacement schedule by July 1, 2020. The State of California defines a user service line as "the pipe, tubing, and fittings connecting a water main to an individual water meter or service connection (California Code of Regulations Section 116885)." Since the SFPUC replaced all known lead service lines (pipes) in the late 1980s, the remaining leaded portion within SFWS LUSLs consists of a pigtail, or 1-3ft flexible lead pipe (3/4" or 1" in diameter) connecting the water main to the customer service lateral. Figure 3 shows various schematics for the location of this pigtail, along with actual photos from the SFWS. These fittings are not at all residential sites, but based on SFPUC experience, may be present at service connections with galvanized steel service laterals, less than 1-inch diameter and constructed prior to 1950.

In response to these new regulations, the SFPUC began replacing LUSLs in May 2017, whenever lead whips were encountered in field (e.g., typically due to pipe leaks or breaks). The SFPUC's policy included notifying the homeowner of the LUSL replacement, dropping off a water pitcher filter, and offering the homeowner tap testing for lead (a first draw lead sample). These activities were proactive in response to 2016 California State Bill SB1398 - requiring utilities to inventory all known lead user service lines by July 2018 and develop a replacement schedule by July 2020.

Further SFPUC Pilot Study program development was initiated in December 2018 after tabulations of known LUSLs were completed and reviewing additional industry guidance[3]. This included a proactive outreach to customers with a SFPUC goal of recruiting 50 LUSL volunteers, incorporating profile sampling, and additional sampling events for each participant to before and after LUSLR at 1-week, 1-month and 3-month intervals. Notably, these activities were planned and developed before proposed regulatory changes in the draft Federal LCR Revisions (Nov 2019).

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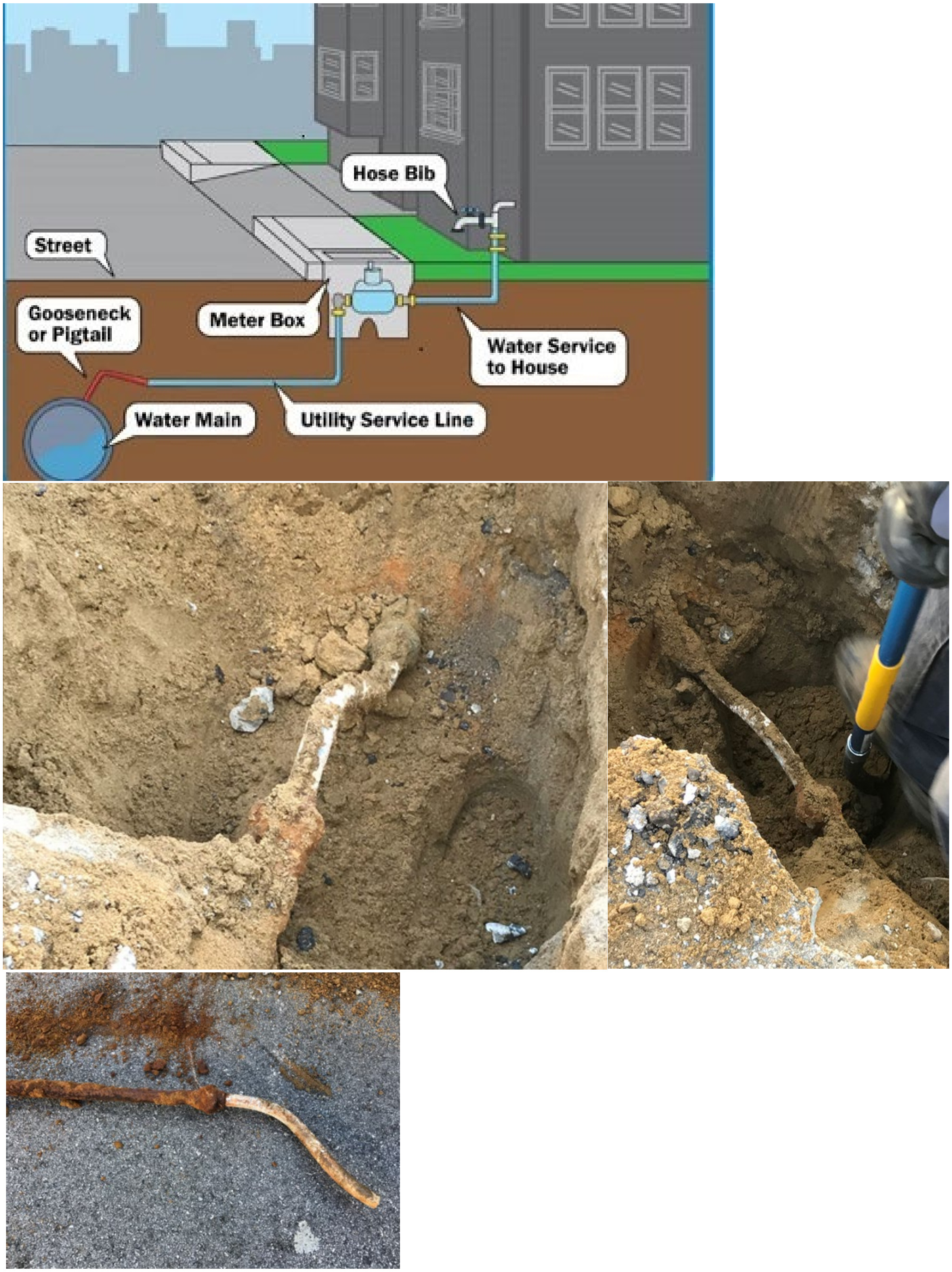
[3] Notably, *Contribution of Service lateral and Plumbing Fixtures to Lead and Copper Rule Compliance Issues*, AWWARF 2008 and *AWWA Standard Guidelines for Replacement and Flushing of Lead Service laterals*, AWWA Nov 2017).

Figure 3. Service Line Plumbing Components and Whip/Pigtail Pictures (top to bottom): a- plumbing schematic, b- flexible lead whip connecting water main to service line, c- lead whip being removed, d- removed lead whip)



Description of Pilot Study Methodology

Sample Site Selection

The SFPUC screened over 170,000 customer service accounts from SFPUC's Customer Service Bureau Customer Care and Billing database (CSB CC&B) for potential LUSL sites with the following criteria:

- Galvanized service laterals less than 1-inch in diameter
- Homes built between 1910 and 1950
- Single-family homes in residential neighborhoods.

The criteria listed are based on SFPUC staff experience for service laterals that are most likely to have a lead component (whip or pigtail) attachment. From a 2020 inventory of 4,434 galvanized service laterals extracted from CSB CC&B[4], 1,606 service laterals met the above criteria (also Figure 4).

77% of the potential 1606 LUSL sites are in predominantly residential neighborhoods in the south west part of the City, below GG park, where homes were built, and service installations occurred during 1939-1953. This includes neighborhoods of Sunset, Castro, Noe Valley, West Twin Peaks, Parkside, Lakeshore, Oceanview, Outer Mission, Crocker Amazon, Visitacion Valley, Bayview, Excelsior.

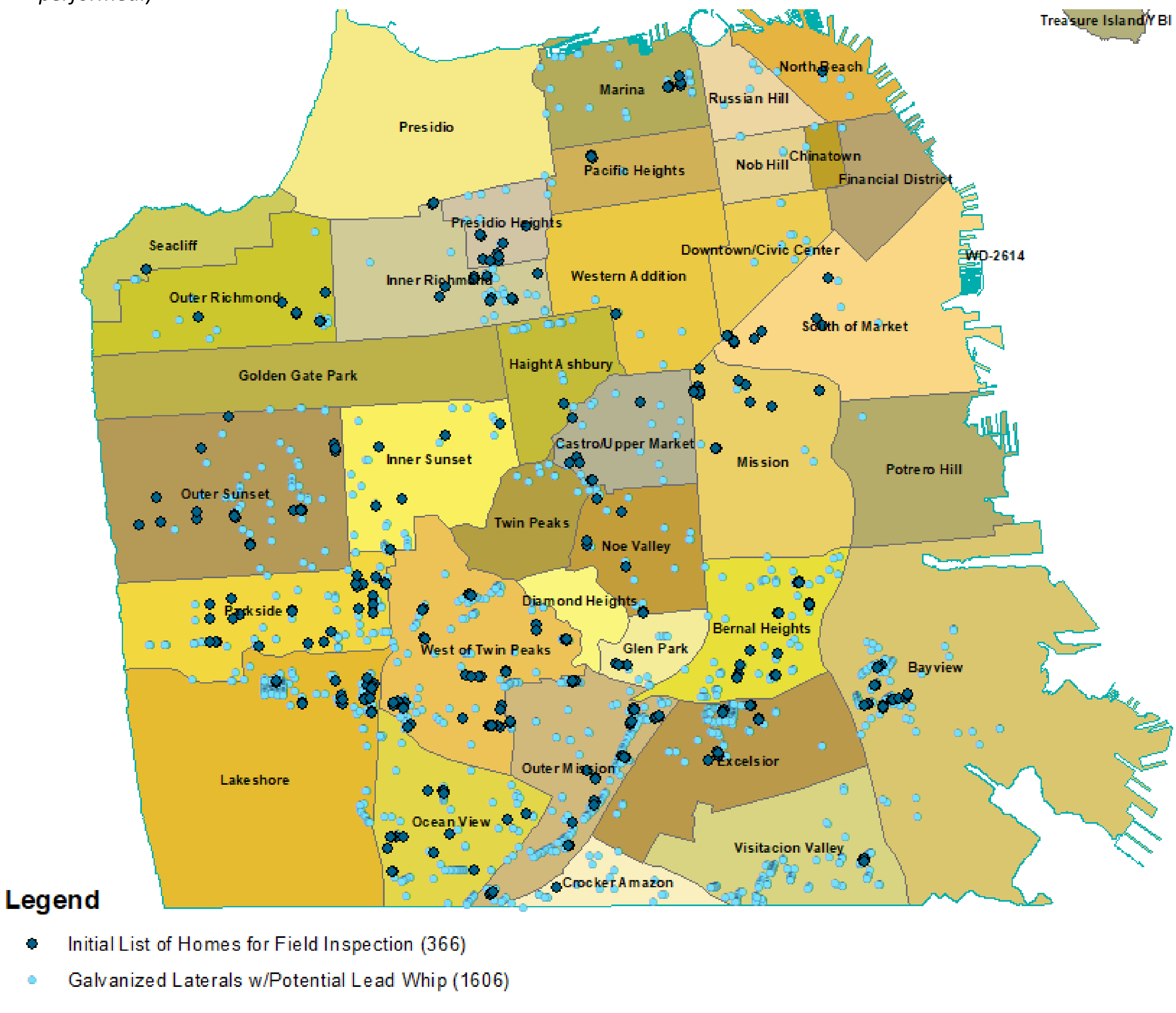
To further identify potential participants, WQD gave an initial list of 366 homes to SFPUC's City Distribution Division (CDD) to field verify galvanized service line materials, which may be an indicator of potential lead whip. This list included sites across 24 neighborhoods for inclusivity, social and economic representation (Figure 4).

Customer Outreach and Notification

CDD verified the presence of galvanized service laterals from 150 sites on the initial list of 366 homes to site inspect. Based on the confirmed list of homes with galvanized service lines, SFPUC Communications assisted in customer outreach. Customers were sent an initial outreach by letter and then contacted by phone to confirm receipt of the outreach letter and their interests in pilot study participation. 36 customers from 10 different neighborhoods volunteered to participate in the study (Presidio Heights, Outer Sunset, West Twin Peaks, Oceanview, Excelsior, Castro, Parkside, Outer Mission, Ocean View). While SFPUC accepted all volunteers, the sites were unequally distributed with 53% percent in the neighborhoods of Jordan Park (near University of San Francisco), Presidio Heights and Sunset (Figure 5). SFPUC was unable to recruit volunteers from all neighborhoods (notably the downtown and eastern portions of the city where there was a lower concentration of LUSLs). The actual existence of a lead whip could not be identified until lateral replacement. Appendix E provides additional discourse of SFPUC's outreach.

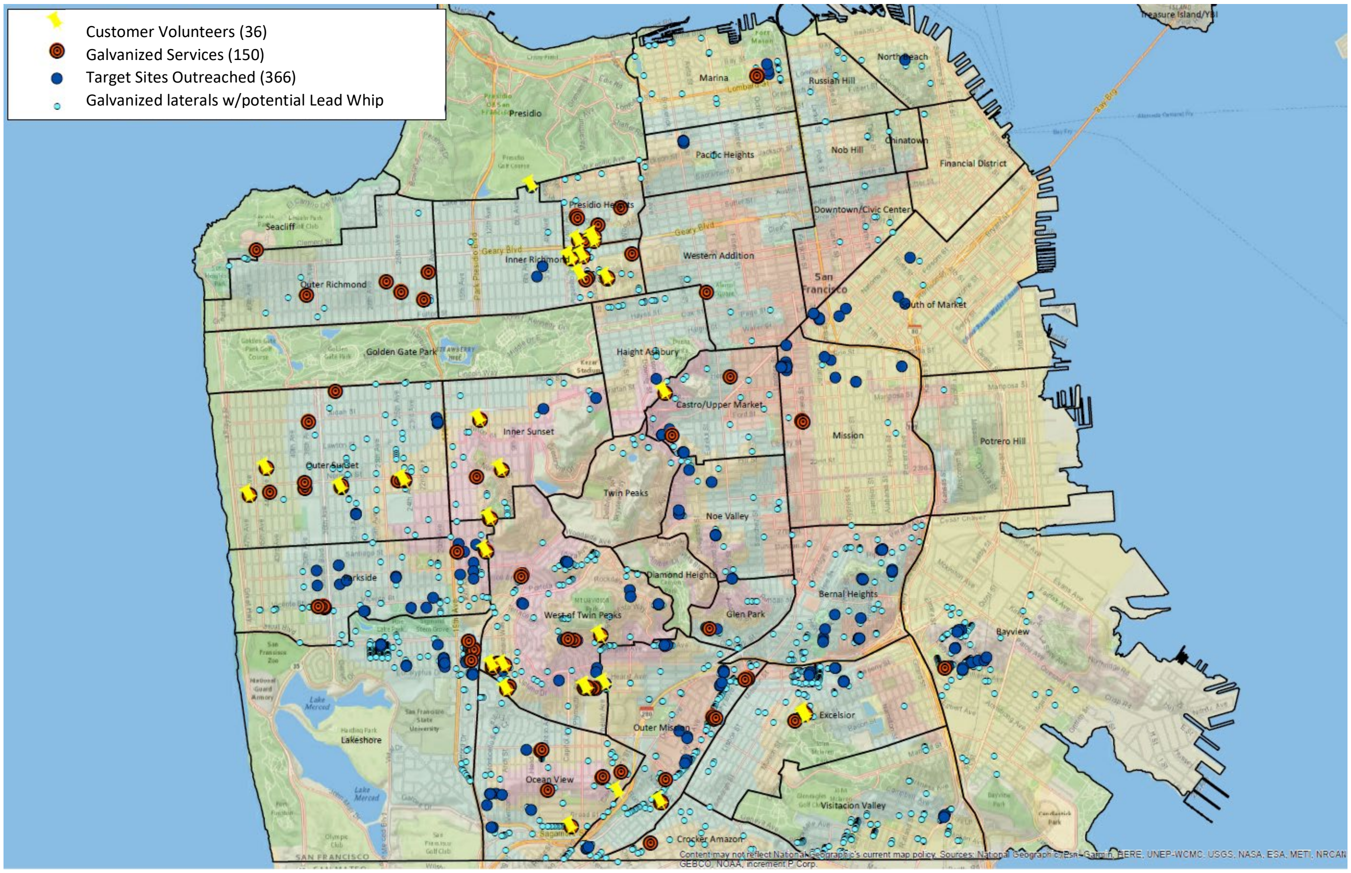
[4] Lead User Service Lateral Inventory Technical Memorandum, CDD 6/30/2020.

Figure 4 – Initial Screening of Homes for Pilot Study Outreach, by San Francisco Neighborhood
(Sites required field inspection to confirm existence of Galvanized Service Lateral before outreach could be performed.)



Note: List of 1606 Galvanized Laterals with Potential Lead Whip obtained from "Lead User Service Lateral Inventory Technical Memorandum", CDD 6/30/2020

Figure 5 – Map of Pilot Study Volunteers by Neighborhood



Note: Neighborhood boundaries per SF Planning website.

Preliminary Site Assessment and Service Lateral Renewal

A preliminary site assessment was conducted by WQD for all 36 pilot study sites using customer participation forms, interviews, and aerial maps to determine meter location and estimate service lateral and premise plumbing lengths (See Appendix F & G for outreach forms and survey). The information was used to calculate pipe segment volume from meter to kitchen faucet. Data for premise plumbing material and kitchen faucet location were confirmed by the customer. The CSB database provided data for meter size and city main-meter service lateral length. For database management and tacking purposes, each site was assigned a Laboratory Information Management System (LIMS) folder#, Maximo Work Order#, and a unique LUSL pilot study ID (LW#).

The existence of a leaded component was not confirmed until after service lateral renewal/replacement. For those sites where a lead whip was identified and removed, the site is officially termed as an LUSLR. A total of 36 galvanized service laterals were replaced from July 2019 to

November 2020[5]. Upon service lateral replacement, 20 participating sites were confirmed LUSLRs. Of the remaining sites, 7 were found to have copper whips, and 9 sites were galvanized whips (Table 2).

Table 2 – LUSL Pilot Study Participant – Site Details

Service Line Pipe Materials					Service Description and estimated lengths				
Site ID	**Whip Material**	**City Service Line**	**Customer Service Line**	**Replacement Date**	**Service Main**	**Year Built**	**House to Meter (Ft)**	**Meter to main (Ft)**	**Premise (Ft)**
Lead Whip									
100	Lead Whip	Galvanized	Galvanized	8/26/2019	4" CI	1935	22	22	40
107	Lead Whip	Galvanized	Galvanized	9/26/2019	8" CI	1912	27	16	53
119	Lead Whip	Galvanized	Galvanized	12/9/2019	4" CI	1917	43	16	49
128	Lead Whip	Galvanized	Copper/Galv	1/14/2020	4" CI	1933	21	20	85
105	Lead Whip	Galvanized	Copper	9/20/2019	4" CI	1924	17	15	59
108	Lead Whip	Galvanized	Copper	1/13/2020	8" CI	1938	19	20	58
112	Lead Whip	Galvanized	Copper	11/15/2019	4" CI	1935	33	15	71
117	Lead Whip	Galvanized	Copper	1/13/2020	8" CI	1938	25	20	55
122	Lead Whip	Galvanized	Copper	12/10/2019	8" CI	1905	24	20	95
127	Lead Whip	Galvanized	Copper	2/15/2020	6" CI	1927	22	20	73
133	Lead Whip	Galvanized	Copper	10/9/2020	6" CI	1936	33	20	115
101	Lead Whip	Galvanized	Copper	8/27/2019	4" CI	1935	17	22	42
103	Lead Whip	Galvanized	Copper	10/1/2019	2" CI	1936	16	25	57
104	Lead Whip	Galvanized	Copper	10/2/2019	8" CI	1936	18	25	58
106	Lead Whip	Galvanized	Copper	9/12/2019	8" CI	1935	15	13	57
109	Lead Whip	Galvanized	Copper	9/20/2019	4" CI	1924	16	15	59
126	Lead Whip	Galvanized	Copper	8/26/2019	4" CI	1935	17	22	40
130	Lead Whip	Galvanized	Copper	8/26/2019	4" CI	1935	17	22	92
134	Lead Whip	Galvanized	Copper	11/6/2020	8" CI	1935	15	20	45
135	Lead Whip	Galvanized	Copper	11/6/2020	6" CI	1933	26	15	86
No Lead Whip									
113	Galvanized	Galvanized	Galvanized	11/15/2019	4" CI	1930	15	20	55
116	Galvanized	Galvanized	Galvanized	11/15/2019	4" CI	1931	18	9	89
110	Galvanized	Galvanized	Copper	12/10/2019	6" CI	1944	25	20	62
114	Galvanized	Galvanized	Copper	12/6/2021	4" CI	1954	6.5	11.5	54
115	Galvanized	Galvanized	Copper	1/24/2020	8" CI	1935	19	20	56
118	Galvanized	Galvanized	Copper	10/19/2020	6" CI	1924	65	1	61
120	Galvanized	Galvanized	Copper	12/2/2021	4" CI	1954	6.5	11.5	54
123	Galvanized	Galvanized	Copper	3/15/2020	6" CI	1924	30	2	45
131	Galvanized	Galvanized	Copper	10/8/2020	6" CI	1935	12	5	83
124	Copper	Galvanized	Galvanized	3/10/2020	12" CI	1939	38	20	50
129	Copper	Galvanized	Galvanized	3/18/2020	8" CI	1959	20	5	50
121	Copper	Galvanized	Copper	3/2/2020	4" CI	1951	23	12	48
125	Copper	Galvanized	Copper	3/16/2020	6" CI	1935	17	20	52
102	Copper	Galvanized	Copper	7/10/2019	6" CI	1941	22	22	44
111	Copper	Galvanized	Copper	12/9/2019	4" CI	1941	22	22	44
132	Copper	Galvanized	Copper	4/7/2020	8" CI	1932	33	20	115

[5] Another two sites (114 and 120) were unresponsive during pilot study eventually had their service lines replaced in Fall 2021. They were both were found to have galvanized whips.

Sampling Event Scheduling and Field Operations

Profile sampling before Lead User Service Line Replacement (i.e., LUSLR or 'pre-construction') took place within a 9-month period from March 2019 - Dec 2019 and were completed in advance of construction.

Batch lists of 4-8 pilot study addresses were submitted to CDD Construction and Operations Scheduling Team (COST) for LUSLR scheduling. Replacements typical took 2 weeks to 4 months, with longer lead times due to task prioritizations and obtaining requisite street construction permits. Sampling for 1-week after LUSLR took place in a 15-month period from August 2019 to November 2020.

The sampling kits for the 1-week after LUSLR events were delivered within 1-month prior to scheduled replacement day. These kits included drinking water pitcher with replacement filters, cooler with dry ice, sample vessels, chain of custody form and post LUSLR house flushing instructions. Residents were notified by phone within 1-week of scheduled service replacement. CDD construction crews completed a lead detection form to document the pipe material, size, length, and condition of whip and service laterals materials on both sides of the meter (see Appendix H for example of field form). If a lead component was discovered, a one-foot portion was cut and placed in double zip lock bags for documentation. Residents were informed of the existence of a leaded component immediately the same day, either directly by the field crew on site or by WQD via phone call and instructed to perform house flushing and use their provided water filter.

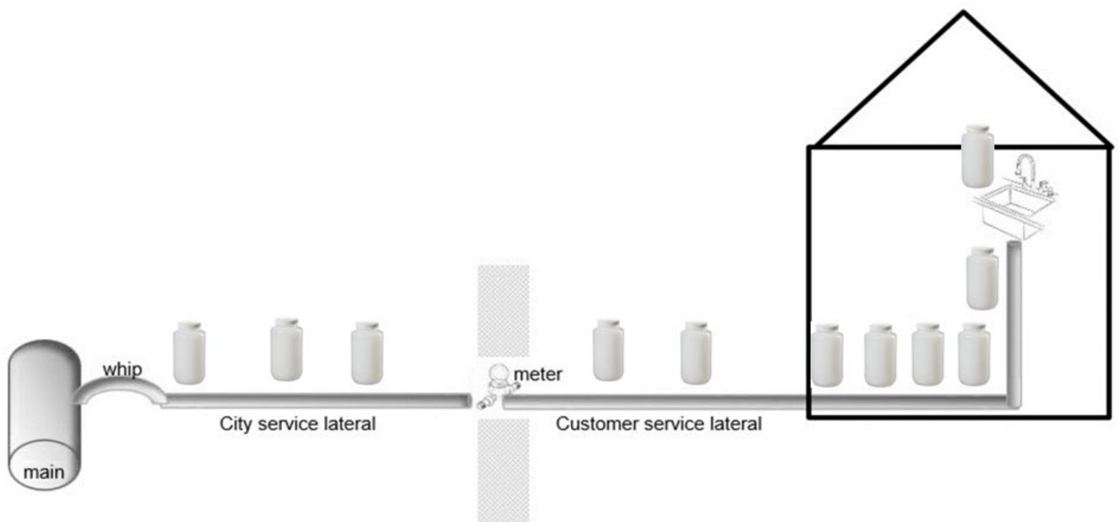
Sequential Sampling Protocol

The sequential sampling protocol consisted of collecting profile samples representing the full volume of water contained in the pipeline between the kitchen faucet and water main in 1-liter increments (Figure 6). This allowed testing for potential leaching from various plumbing segments, including faucet, premise plumbing, house to meter, and meter to main. This latter segment represents the city owned portion of the service lateral. The total number of samples varied for each site, contained in 14 to 25 1-liter bottles. Samples were collected by the residents, from the cold-water kitchen tap for each of four sampling events. Sampling instructions for homeowners also included a certification form indicating that the customer followed the instructions for all sampling events: one sampling event before LUSLR, and three events after LUSLR at approximately 1-week, 1-month, and 3-months. If any site tested ≤2ppb for an entire profile sample set after replacement, then the site was considered "closed out" or no further post replacement sampling would be needed. Sites were also closed out if the resident was unresponsive after 2 attempts of contact by phone or requested to discontinue participation. Residents were provided detailed instructions for taking samples and post-replacement flushing. All samples used the following elements:

- First Draw Sample – A single 1L sample is collected after a stagnation period of 6+ hours, per the Lead and Copper Rule. Customers were asked to suspend water use during this time.
- Sampling from Kitchen Faucet – Bottles were filled at full flow rate with the aerators attached at location where water is used for cooking and drinking. If homeowner did not follow these sampling instructions, then the lead sampling data was invalid and not used for this study.

- Sequential Sampling – Several 1L bottles are filled one after another to capture the entire volume of water in a plumbing system from tap to main.
- Survey – customers completed a certification statement indicating that they followed the sampling protocol or provided notes if procedures could not be followed (See Appendix I for sampling instructions and forms completed by participant).
- Sample Transport – Samples were immediately packed in cooler with ice for pickup by SFPUC the day of sampling. SFPUC field technicians checked the Chain of Custody forms for completeness. Samples were transported to the SFPUC's certified Southeast drinking water laboratory for analysis.

Figure 6. Schematic Representation of Profile Sampling
(number of sample vessels varies based on plumbing lengths)



The SFPUC provided Zero Water® pitcher filter, certified by National Science Foundation/American National Science Institute 42 & 43, to participants to be used after service lateral replacement[6]. Participants were also provided one 10-cup pitcher with 8 replacement filters. For tap water with total dissolved solid concentration ranging 2-250ppm, one filter is designed to provide up to 40 gallons of "zero lead" water. Filters were delivered prior to service lateral replacement.

<u>LUSLR Flushing</u>

If a lead whip was found, instructions were provided to the participant to conduct household flushing, including all fixtures and at the kitchen tap, for 30 minutes, immediately after lateral replacement followed by sampling at the kitchen tap within 1-week of replacement. Flushing protocols were developed with reference to AWWA's Standard Practice for LSL Replacement and Flushing (ANSI/AWWA C810-17). See Appendix J for customer flushing instructions.

[6] https://zerowater.com/collections/5-stage-water-filter-pitchers-dispensers/products/10-cup-water-filter-pitcher

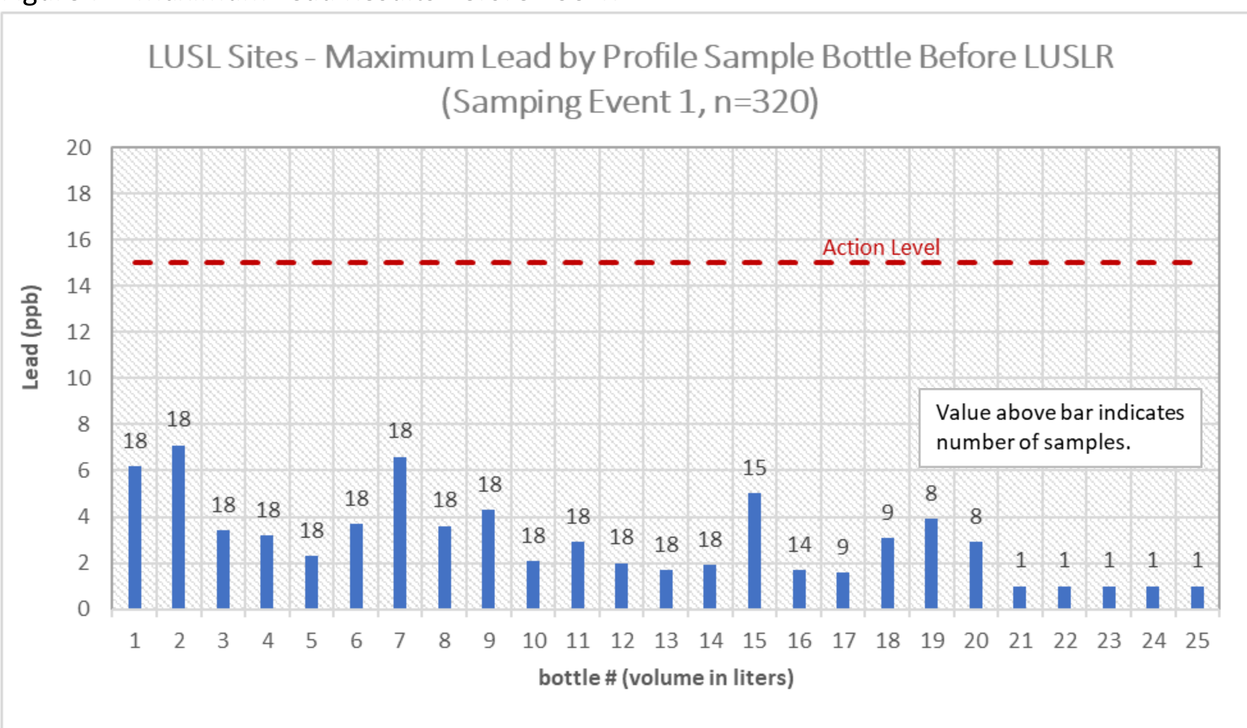
Lead Monitoring Results

Before LUSLR Construction (Sampling Event 1)

Before LUSLR monitoring included 18 total profile sets. Of the 20 LUSL participants, 1 site was recruited after LUSLR and was unable to sample before LUSLR, and another site was invalidated as it had not sampled from the kitchen faucet. Figure 7 below, shows the maximum lead result by profile bottle. For example, for profile bottle #1 there were 18 samples from 18 different participants with a maximum value of 6.2ppb.

Sampling before LUSLR at the 18 sites showed lead <15ppb in all 320 samples, including the first draw and all profile samples. Two sites showed results below detection limit (<1ppb) in all profile bottles. The maximum of all sites was 7.1ppb. These results less than USEPA's lead action level is consistent with past SFPUC Lead and Copper Rule compliance monitoring. Based on this dataset, the SFPUC's corrosion control program appears to be effective in reducing lead in drinking water at homes with LUSL prior to replacement.

Figure 7 – Maximum Lead Results Before LUSLR



Note: Values <DL reported as 1ppb

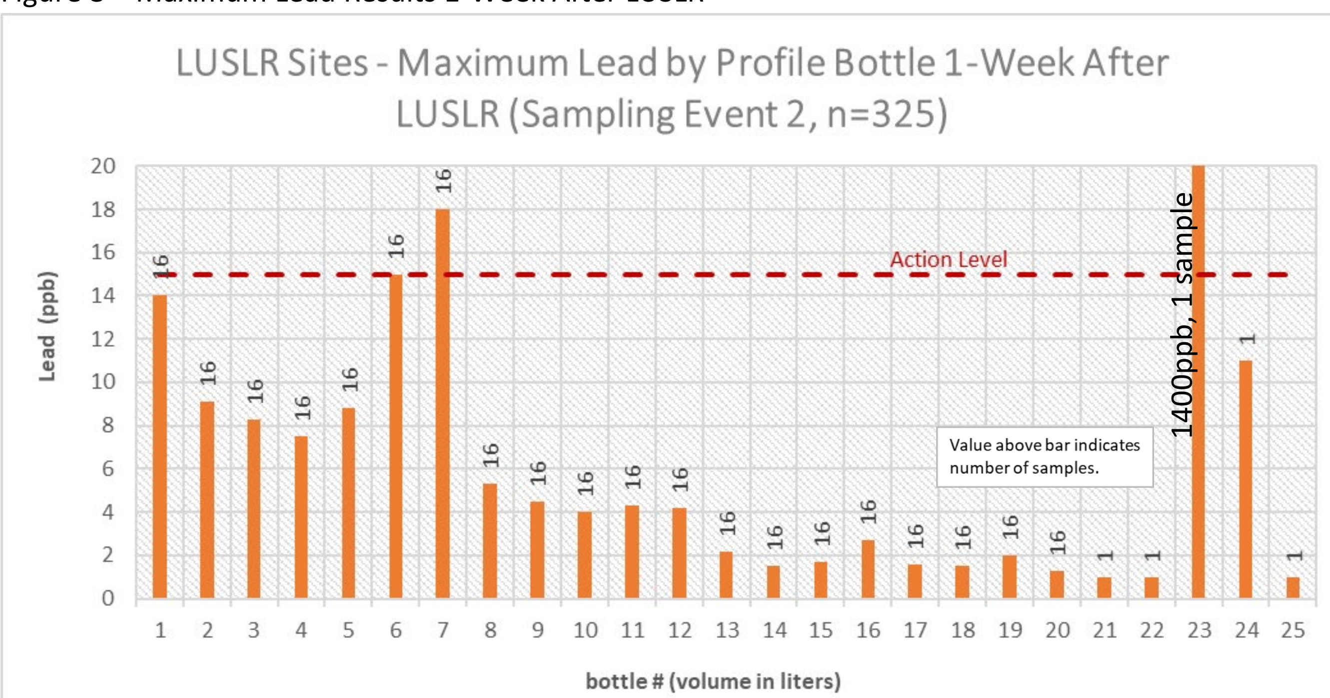
Sampling 1-Week After LUSLR (Sampling Event 2)

Of the 20 LUSL sites, two requested to end participation before 1-week sampling, while a third site was invalid as they did not suspend water use overnight, and a fourth site was unreachable for sampling. Therefore, 325 1-week samples were collected from 16 sites. There were more samples collected during Sampling Event 2 vs before LUSLR as SFPUC elected to collect more samples beyond the service lateral and well into the main at profile bottles 15-20.

Figure 8 below shows maximum lead results by profile bottle. For example, for profile bottle #1, there were 16 samples with a maximum value of 14ppb. Testing results for these sites show an increase in lead levels compared to before LUSLR. Two sites exceeded Lead Action level (15ppb), while another site measured lead above future LCRR trigger level of 10ppb. None of the first draw tap samples (Bottle 1) exceeded Action Level.

Greater variability in lead levels occur after 1 week of the LUSLR compared to results before LUSLR. Maximum lead concentrations after LUSLR increased up to 2.4 times before LUSLR results in the first four bottles and by a factor of 2.7 - 4.1 in bottles 5 thru 7. Remaining bottles (8 thru 25) were all <6ppb in both 1-week and before LUSLR samples, except for Site 105 showing 1-week lead values of 1400 and 11ppb in the 23rd and 24th bottles, respectively.

Figure 8 – Maximum Lead Results 1-Week After LUSLR



Notes: Values <DL reported as 1ppb

While profile samples are collected to represent lead leaching in specific pipe segments, lead may be captured in each profile bottle from other downstream pipe segments due to sloughing of scale deposits. The water sample representing a specific segment flows through other portions of the pipe and may pick up detritus or debris on the way to the faucet. Industry research asserts that removal of full lead service lines reduced lead in sequential samples after 2 months (*Contribution of Service Lateral and Plumbing Fixtures to Lead and Copper Rule Compliance Issues, AWWARF/USEPA 2008).* This is suspected of Site 105 high values at the 23rd bottle as the other 24 bottles for that profile sample were ≤11ppb, and all 1-month sample values were non-detect.

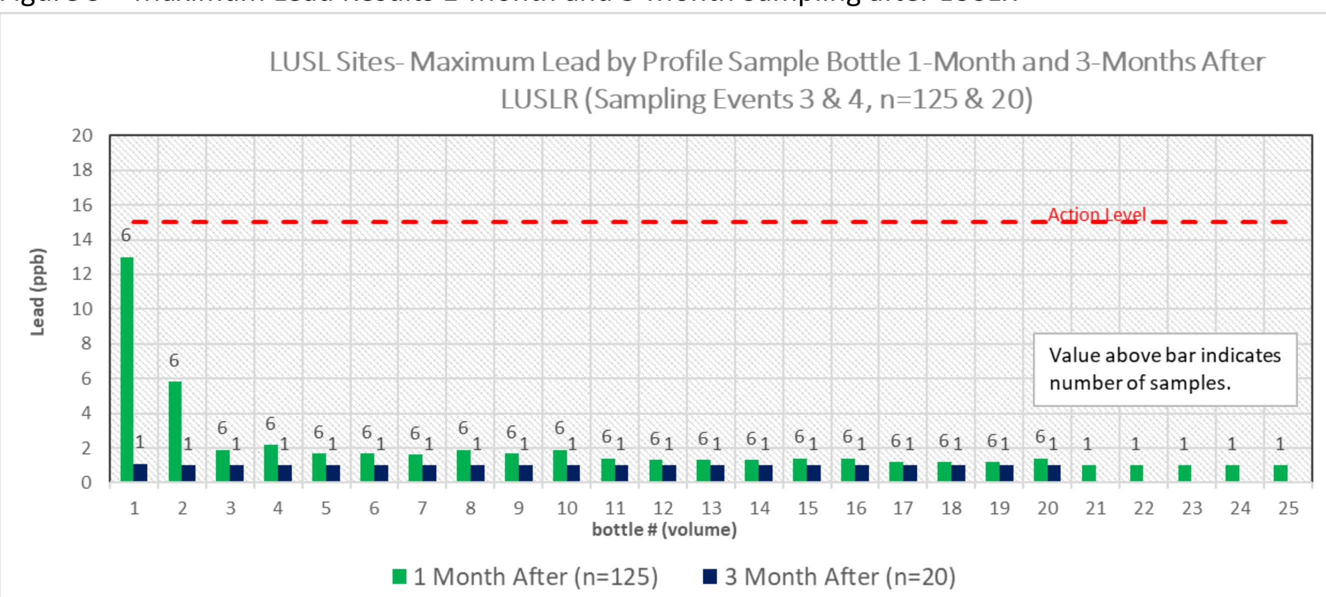
Sampling 1- and 3-Months After LUSLR (Sampling Events 3 & 4)

Eight sites remained at the 1-month monitoring event. Ten sites were closed out after 1-week due to low lead levels and 2 participants discontinued participation prematurely. For the 1-month sampling event, 2 sites sampled incorrectly leaving a representative 6 profile sample sets (125 total samples).

Lead results for 1-month sampling showed all results less than lead action level, with only one site exceeding trigger level of 10ppb. Two sites were all ND with another two sites all ND except for the first draw sample (which were both <2ppb). The remaining 2 sites showed relatively higher lead in the first two bottles (3.1 – 13ppb) followed by samples ≤2.2ppb.

The Pilot Study plan called for closing out the final 2 sites with additional 3-month sampling due to 1-month results >2ppb. Only one site was able to complete 3-month sampling and all results were ≤1.1ppb (19 of 20 sample bottles were ND). Figure 9 shows maximum lead values from each profile bottle for sampling 1-month and 3 months after LUSLR.

Figure 9 – Maximum Lead Results 1-Month and 3-Month Sampling after LUSLR



Notes: Values <DL reported as 1ppb

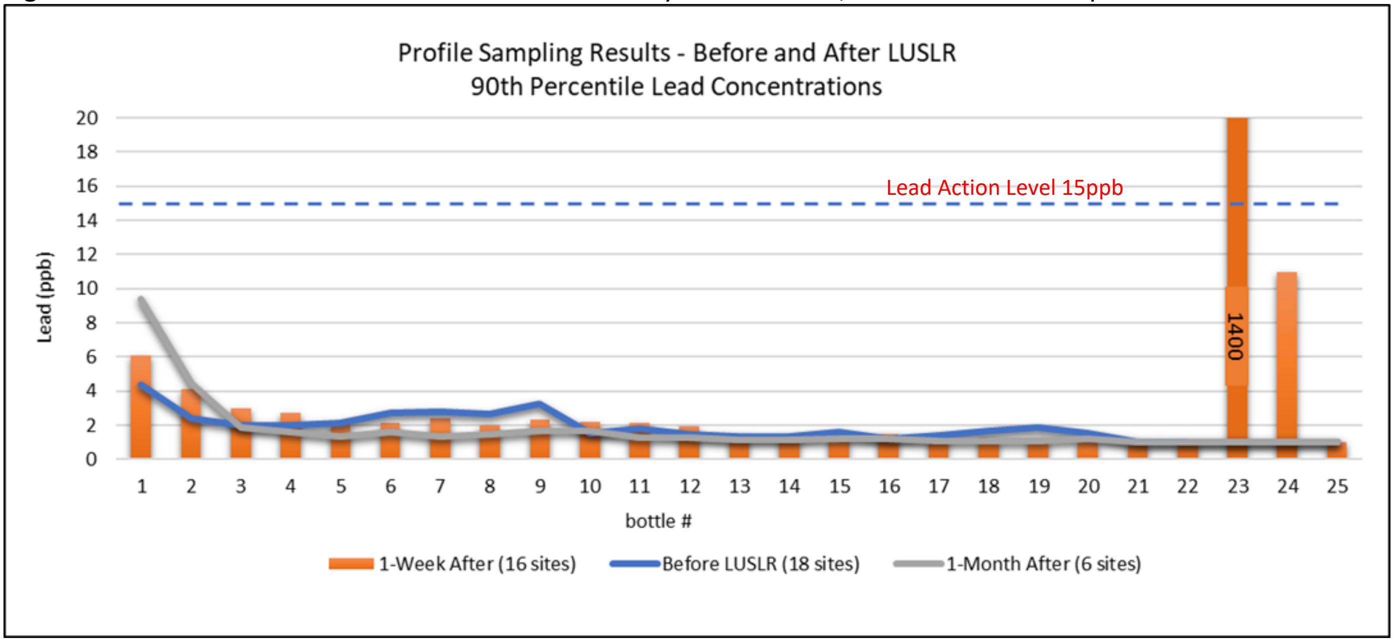
A summary of pilot study lead sampling results for 20 LUSL sites are shown in Table 3 below. Maximum and minimum results from each site from profile sample sets collected before and after LUSLR are listed. Also listed are the reason the volunteer ended participation, typically due to low results or requests to end participation. Graphics showing 90th percentile and maximum lead results for each sample bottle and each sampling event are shown on Figures 10a and 10b. All LUSL pilot study data are in Appendix B. Trends clearly show 1-month lead results are lower than both 1-week and before LUSLR samples. The exception to these lower 1-month lead trends may be in first draw, first sample bottles where the faucet is a bigger contributor of lead.

Table 3. LUSL Pilot Study Profile Monitoring Results

Count	Study Location	Before		After LUSLR Profiles (ug/l)						Closure Justification / Comments
				1 week		1 month		3 month		
		n=18		n=16		n=6		n=1		
		Min	Max	Min	Max	Min	Max	Min	Max	
1	100	1.3	4.4	<1	1.5	Invalid samples		closed		Site closed out due to low 1 week results 1mo samples at Bath sink
2	101	<1	1.6	<1	<1	closed				Site closed out due to low 1 week results
3	103	<1	1.3	<1	<1	closed				Site closed out due to low 1 week results
4	104	<1	1.5	<1	1.5	closed				Site closed out due to low 1 week results
5	105	<1	3.3	<1	1,400	<1	<1	closed		resampled 1wk event. Resample results used. Site closed out due to low 1 month results
6	106	<1	<1	<1	<1	closed				Site closed out due to low 1 week results
7	107	<1	3.2	<1	2.8	<1	1.4	closed		Site closed out due to low 1 month results
8	108	<1	<1	<1	<1	closed				Site closed out due to low 1 week results
9	109	<1	2.3	closed, per customer request						customer request to end participation
10	112	<1	3.9	closed, per customer request						customer request to end participation
11	117	<1	5	<1	1.5	closed				Site closed out due to low 1 week results
12	119	1.2	6.2	<1	14	1.2	13	closed, per cust		customer request to end participation
13	122	<1	3.9	<1	1.3	closed				Site closed out due to low 1 week results
14	126	enrolled after LUSLR		<1	<1	closed				Pb whip found during neighbors replacement. Customer agreed to 1wk sampling
15	127	<1	7.1	<1	5.2	<1	5.8	closed, per cust		customer request to end participation
16	128	<1	6.6	1.1	18	<1	1.6	closed		Site closed out due to low 1 month results
17	130	<1	3.6	NA		<1	<1	closed		Site closed out due to low 1 month results
18	133	<1	<1	<1	<1	closed				Site closed out due to low 1 week results
19	134	Invalid samples		Invalid samples		Invalid samples		<1	1.1	All copper water line. PC/1wk samples at garage faucet. 3-mo sample at kitchen faucet. Site closed out due to low 3 month results.
20	135	<1	2.9	<1	2	closed				Site closed out due to low 1 week results

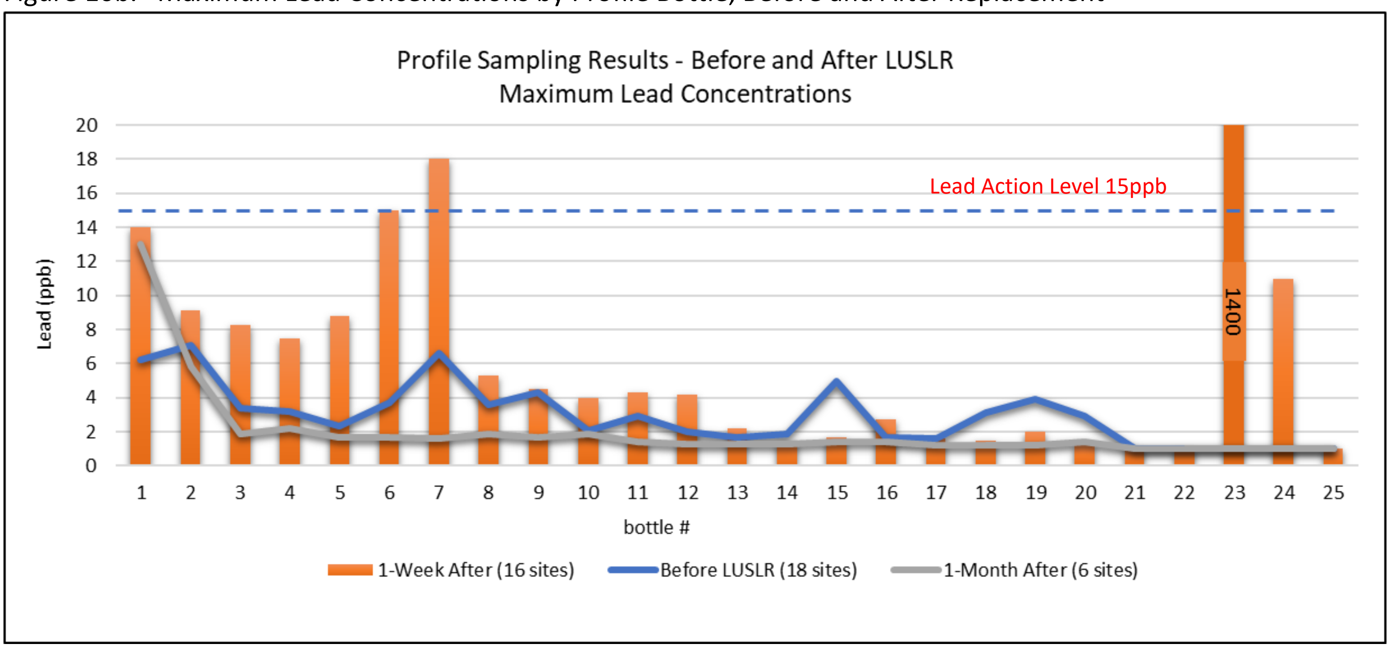
Notes:
n=number of sites sampled

Figure 10a. 90th Percentile Site Lead Concentrations by Profile Bottle, Before and After Replacement



Notes:
The number of sample bottles collected for profile samples varied from 14 – 25 due to estimated plumbing lengths.
Values at <DL are shown as 1ppb.

Figure 10b. Maximum Lead Concentrations by Profile Bottle, Before and After Replacement



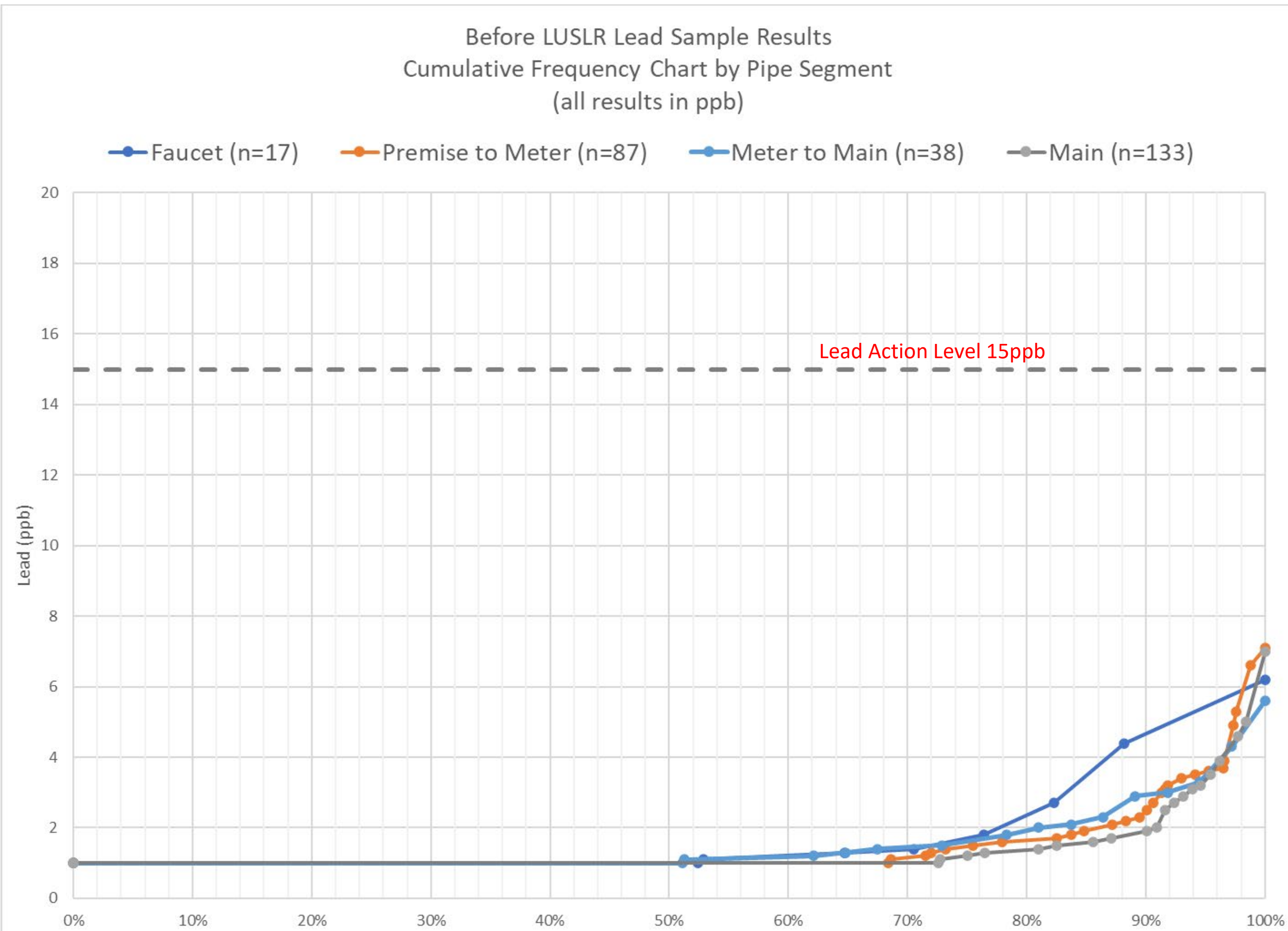
Notes:
The number of sample bottles collected for profile samples varied from 14 – 25 due to estimated plumbing lengths.
Values at <DL are shown as 1ppb.

Additional Discussions

LUSL Lead Analysis at Faucet, Premise and Lateral

Lead sampling results for all sites in this pilot study are shown on cumulative frequency charts showing data broken into pipe segments (faucet, premise to meter, meter to main and main) for pre-replacement sampling (Figure 11). Again, all data is below the lead action level of 15ppb, and each segment shows similar trends with most levels in each segment of the pipe below 15ppb.

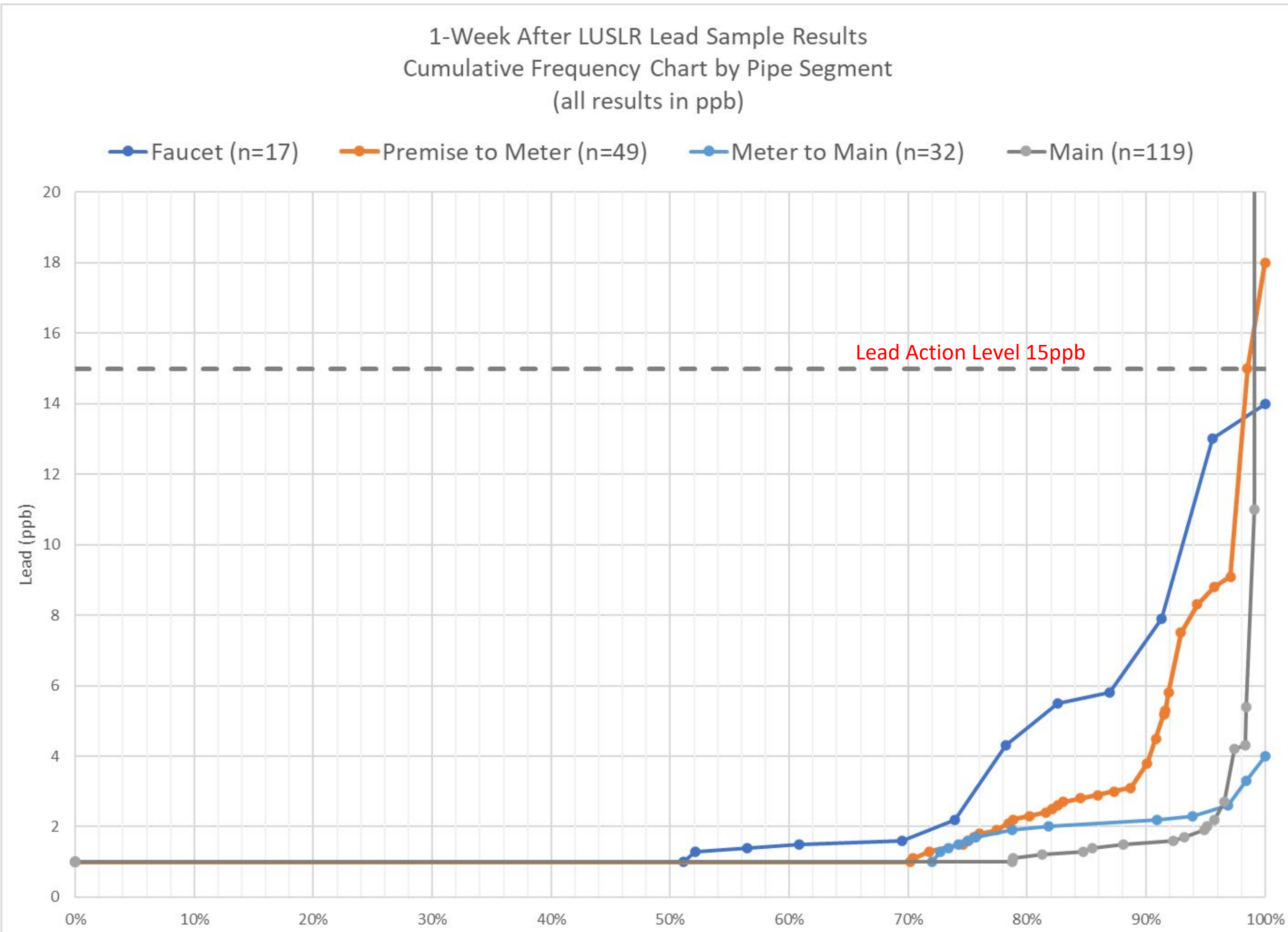
Figure 11 – Lead Results by Pipe Segment, Before LUSLR



Note: Values at <DL are shown as 1ppb.

Post replacement sampling at the 1-week interval shows all faucet results below 15ppb (17 samples) and less than 8ppb at the 90th Percentile. 90th percentiles for premise plumbing (49 samples), service lateral (meter to main, 32 samples), and main (119 samples) are all below 4ppb (Figure 12).

Figure 12 – Lead Sampling by Segment of Pipe, All 1-week After LUSLR



Note: Values at <DL are shown as 1ppb.

Investigation and findings at high lead sites

SFPUC assisted customers with elevated lead results by providing a courtesy inspection of premise plumbing and recommended activities to reduce lead. From 1-week sampling results, 5 of 16 sites showed relatively higher detections (>2ppb), with three exceeding trigger level of 10ppb in at least one profile sample. These sites all had galvanized service laterals, though some did not have a lead whip.

Site investigations and analysis of the lead results showed that contributions of elevated lead are likely from premise plumbing, at the faucet up to portions near the hose bibb (or just outside the building). This is apparent from 1-week maximum sampling results, as shown previously on Figure 8. Appendix C contains case studies of three of these sites and each site appeared to have site specific contributions of lead (apparently one due to faucet, one due to interface of service line and premise plumbing, and one errant detritus capture).

For Site 105 (detritus capture), an uncharacteristically high lead concentration of 1400ppb occurred at the 23rd liter bottle 1-week after LUSLR. The 23rd liter bottle represents water from the main, however, sequential sampling is not exact representation of water from a specific main segment, as the water traverses the entire service lateral, house plumbing and faucet prior to sample collection. Given that 24 other sequential samples representative for Site 105 showed lower lead levels (≤11ppb) and 1-month sampling showed all 25 bottles non-detect (including those representing the main), the high reading may be caused from an incidental lead particulate sloughed from deposits within the service lateral or household plumbing. Specifications for this site are discussed in more detail in the Appendix C.

Non LUSL Sites – Galvanized or Copper Whips

While LUSL sites are the focus of this study, lead samples were collected at some sites with galvanized and copper whips. CDD could not identify whip material until construction, at which point the galvanized laterals were replaced with copper. Therefore all non-LUSL sites completed preconstruction profile sampling, but only a few completed post replacement sampling as follow-up and commitment to the homeowner.

For eight of nine sites with galvanized whip sampled before lateral replacement (one site unable to sample), the maximum lead was 7.3ppb in the first draw/faucet sample (Site 116), while all remaining samples were ≤2.8ppb (138 total samples). The 1-week maximum lead result from 4 sites peaked at 16ppb (80 total samples) while 1-month and 3-month maximum results were 7.1ppb and 12ppb, respectively (20 samples from 1 site, and 40 samples 2 sites).

For sites with copper whips, the maximum lead concentration before service line replacement, was 1.7ppb (faucet sample) with 150 of 152 samples at or below DL (1ppb, n=112 from 6 sites). The 1-week maximum lead result peaked at 3.0ppb (faucet sample) with all non-faucet samples non-detect for lead (40 samples, 2 sites). 1-month and 3-month maximum results were 2.3ppb and 3.0ppb (both faucet samples), respectively (1 site, 20 samples), where all non-faucet samples were non-detect for lead.

Conclusions / Recommendations

The SFPUC completed this LUSL pilot study to evaluate the impacts of lead whip components on customer lead levels at customer kitchen faucet. During 2019 – 2020, the SFPUC recruited 36 participants, of which 20 were confirmed to have homes with a lead whip component (also known as Lead User Service Line, or LUSL). Results from this study show:

- All 320 lead samples collected at SFWS LUSL sites prior to LUSL replacement (LUSLR) were below USEPA Action Levels (15ppb). These lower levels are the result of the SFPUC's optimized corrosion control treatment.

- Lead at the tap slightly increased after LUSL replacement, typically in the first 7 liters in the 1-week post-replacement sampling, representing faucet and premise plumbing.
    - 2 of 325 samples were above Lead Action Level of 15ppb.
    - 90^{th} percentile values representing faucet were approximately <8ppb, while 90^{th} percentiles for premise plumbing, meter to main and main were all <4ppb.
    - Industry research asserts that removal of full lead service lines reduced lead in sequential samples after 2 months (*Contribution of Service Lateral and Plumbing Fixtures to Lead and Copper Rule Compliance Issues, AWWARF/USEPA 2008).* Findings from this study, while focusing on LUSL removal, are consistent with this industry research. The exception to these lower trends may be in first draw, first sample bottles where the faucet is a bigger contributor of lead.

- The highest lead value (1400ppb) was observed from a sample week after LUSLR. The second highest result was 18ppb. The high elevated sample is likely from particulate sloughing that was captured as water sample travelled through the entire length of the customers service line and household plumbing. Consequently,
    - Internal pipe deposits or scales are disturbed during construction activity.
    - Water filters which remove lead should be used by customers during and after LUSL replacement, since flushing immediately after LUSLR may not dislodge all loose pipe scale. This will provide added safety and protection for the customer against lead intake.

- After LUSL replacement, 16 of 20 sites were closed out due to low lead results, 2 did not complete post replacement sampling, and 2 ended prematurely with elevated lead results. Of the sites that ended prematurely, the maximum lead result was 13ppb in 1-month after LUSLR sampling.

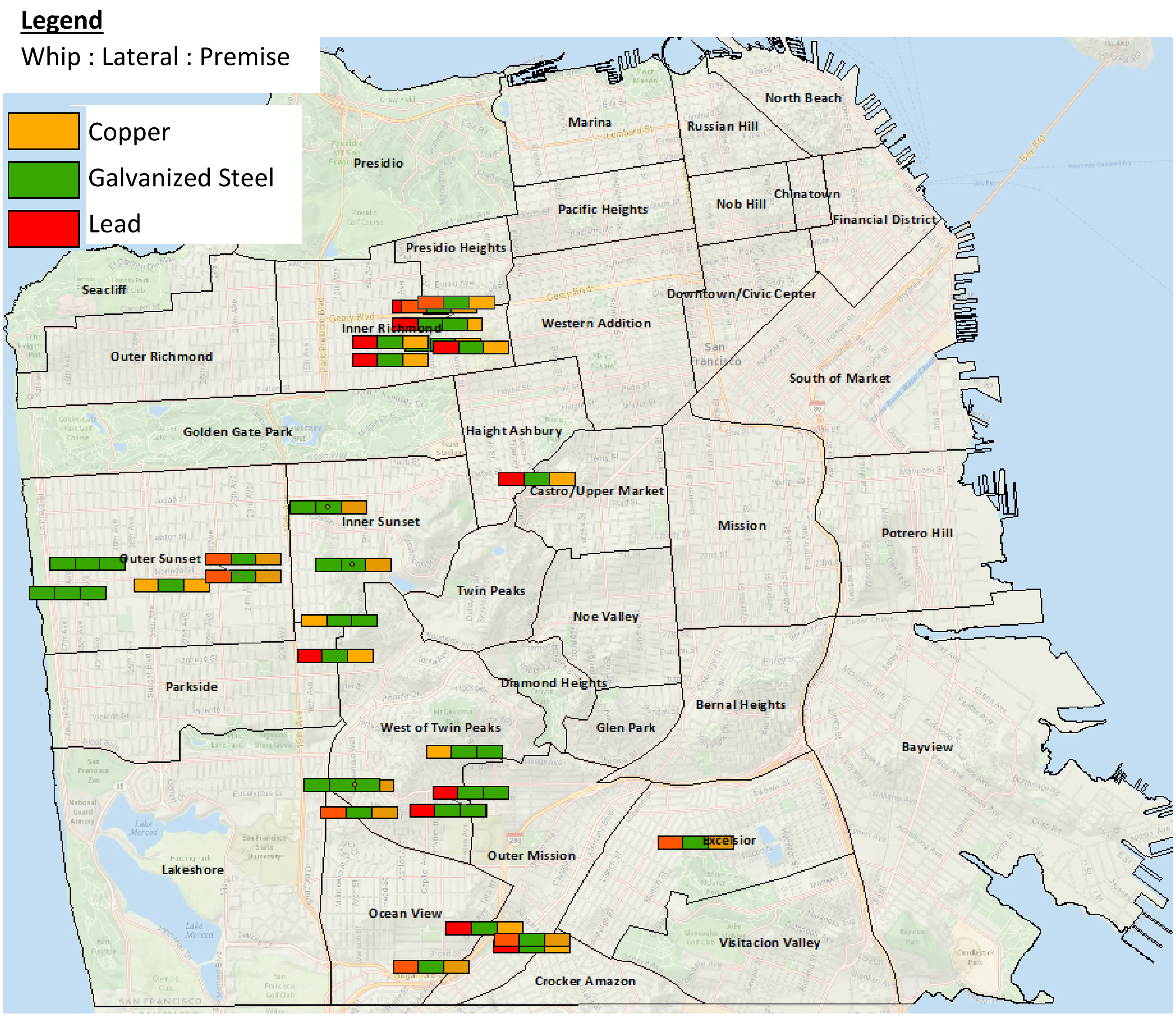
- SFPUC's LUSLR program will benefit from comprehensive and thorough record keeping for pipe materials (whips, laterals, and customer service line material) in anticipation of future regulations.

APPENDICES

Appendix A – Service-line pipe material findings and description for Pilot Study Sites

Service Line Pipe Materials					Service Description and estimated lengths				
Site ID	Whip Material	City Service Line	Customer Service Line	Replacement Date	Service Main	Year Built	House to Meter (Ft)	Meter to main (Ft)	Premise (Ft)
Lead Whip									
100	Lead Whip	Galvanized	Galvanized	8/26/2019	4" CI	1935	22	22	40
107	Lead Whip	Galvanized	Galvanized	9/26/2019	8" CI	1912	27	16	53
119	Lead Whip	Galvanized	Galvanized	12/9/2019	4" CI	1917	43	16	49
128	Lead Whip	Galvanized	Copper/Galv	1/14/2020	4" CI	1933	21	20	85
105	Lead Whip	Galvanized	Copper	9/20/2019	4" CI	1924	17	15	59
108	Lead Whip	Galvanized	Copper	1/13/2020	8" CI	1938	19	20	58
112	Lead Whip	Galvanized	Copper	11/15/2019	4" CI	1935	33	15	71
117	Lead Whip	Galvanized	Copper	1/13/2020	8" CI	1938	25	20	55
122	Lead Whip	Galvanized	Copper	12/10/2019	8" CI	1905	24	20	95
127	Lead Whip	Galvanized	Copper	2/15/2020	6" CI	1927	22	20	73
133	Lead Whip	Galvanized	Copper	10/9/2020	6" CI	1936	33	20	115
101	Lead Whip	Galvanized	Copper	8/27/2019	4" CI	1935	17	22	42
103	Lead Whip	Galvanized	Copper	10/1/2019	2" CI	1936	16	25	57
104	Lead Whip	Galvanized	Copper	10/2/2019	8" CI	1936	18	25	58
106	Lead Whip	Galvanized	Copper	9/12/2019	8" CI	1935	15	13	57
109	Lead Whip	Galvanized	Copper	9/20/2019	4" CI	1924	16	15	59
126	Lead Whip	Galvanized	Copper	8/26/2019	4" CI	1935	17	22	40
130	Lead Whip	Galvanized	Copper	8/26/2019	4" CI	1935	17	22	92
134	Lead Whip	Galvanized	Copper	11/6/2020	8" CI	1935	15	20	45
135	Lead Whip	Galvanized	Copper	11/6/2020	6" CI	1933	26	15	86
No Lead Whip									
113	Galvanized	Galvanized	Galvanized	11/15/2019	4" CI	1930	15	20	55
116	Galvanized	Galvanized	Galvanized	11/15/2019	4" CI	1931	18	9	89
110	Galvanized	Galvanized	Copper	12/10/2019	6" CI	1944	25	20	62
114	Galvanized	Galvanized	Copper	12/6/2021	4" CI	1954	6.5	11.5	54
115	Galvanized	Galvanized	Copper	1/24/2020	8" CI	1935	19	20	56
118	Galvanized	Galvanized	Copper	10/19/2020	6" CI	1924	65	1	61
120	Galvanized	Galvanized	Copper	12/2/2021	4" CI	1954	6.5	11.5	54
123	Galvanized	Galvanized	Copper	3/15/2020	6" CI	1924	30	2	45
131	Galvanized	Galvanized	Copper	10/8/2020	6" CI	1935	12	5	83
124	Copper	Galvanized	Galvanized	3/10/2020	12" CI	1939	38	20	50
129	Copper	Galvanized	Galvanized	3/18/2020	8" CI	1959	20	5	50
121	Copper	Galvanized	Copper	3/2/2020	4" CI	1951	23	12	48
125	Copper	Galvanized	Copper	3/16/2020	6" CI	1935	17	20	52
102	Copper	Galvanized	Copper	7/10/2019	6" CI	1941	22	22	44
111	Copper	Galvanized	Copper	12/9/2019	4" CI	1941	22	22	44
132	Copper	Galvanized	Copper	4/7/2020	8" CI	1932	33	20	115

Figure A-1:
Plumbing Materials at Pilot Study Participant Sites



Note:
Left Bar is Whip material; middle bar is service lateral material prior to meter; right bar is customer service lateral material.
Note: Neighborhood boundaries per SF Planning website. Numbers shown are supervisory districts.

Appendix B - All LUSL Pilot Study Data (by 1L profile bottle)

site id	whip material	samp event	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
100	Lead Whip	Before	4.4	1.8	1.9	1.6	1.6	1.9	1.8	1.4	1.3	1.6	1.5	1.5	1.7	1.9											
101	Lead Whip	Before	<1	<1	<1	<1	1.5	1.6	1.1	<1	<1	<1	<1	<1	<1	<1											
103	Lead Whip	Before	<1	<1	<1	<1	<1	<1	<1	<1	<1	1.3	1.1	<1	<1	<1	<1	<1									
104	Lead Whip	Before	1.3	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	1.3	1.5	<1	<1										
105	Lead Whip	Before	Repeat sample set collected.																								
105	Lead Whip	Before - Resampled	<1	<1	1.3	<1	2.1	3.3	<1	<1	<1	<1	<1	1.3	<1	<1	<1	<1	<1	<1	<1	<1					
106	Lead Whip	Before	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1											
107	Lead Whip	Before	1.1	<1	<1	3.2	2.3	2.5	2.2	1	<1	<1	<1	<1	<1	<1	<1	<1									
108	Lead Whip	Before	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1									
109	Lead Whip	Before	1	<1	<1	<1	<1	<1	1.1	2.3	1.2	<1	<1	<1	<1	<1	<1	<1									
112	Lead Whip	Before	1.4	1.6	1.1	1.1	<1	1	1.2	2.2	3.9	1.4	<1	<1	1.1	<1	<1	<1	1	<1	<1	<1					
117	Lead Whip	Before	<1	<1	<1	<1	<1	<1	<1	<1	4.3	1.1	<1	<1	<1	<1	5	<1									
119	Lead Whip	Before	6.2	3.5	1.4	1.3	1.3	1.4	3	2.5	3	2.1	1.7	2	1.3	1.3	1.4	1.3	1.2	1.3							
122	Lead Whip	Before	1.8	1.5	<1	<1	<1	1.1	1.6	1	<1	1.2	2	1.5	1.2	<1	<1	<1	1.6	3.1	3.9	2.9					
127	Lead Whip	Before	4.4	7.1	3.4	2.7	2.2	3.7	2.7	1.9	1.6	1.5	1.1	<1	1.1	1.5	1.7	1.7	1.4	1	<1	<1					
128	Lead Whip	Before	2.7	1.9	2.3	1.7	1.4	1.6	6.6	3.1	1.5	1.3	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
130	Lead Whip	Before	<1	<1	<1	<1	<1	<1	1.5	3.6	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1					
133	Lead Whip	Before	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1					
134	Lead Whip	Before	Invalid - Incorrectly sampled																								
135	Lead Whip	Before	<1	<1	<1	<1	<1	<1	<1	<1	<1	1.2	2.9	1.1	<1	<1	<1	<1	<1	<1	<1	<1					
100	Lead Whip	1 week	<1	1.1	1.3	<1	<1	1.1	<1	<1	<1	<1	<1	<1	<1	1.2	1.4	1.5	1.4	1.3	<1	<1					
101	Lead Whip	1 week	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1					
103	Lead Whip	1 week	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1					
104	Lead Whip	1 week	<1	1.5	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1					

site id	whip material	samp event	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
105	Lead Whip	1 week	Repeat sample set collected.																								
105	Lead Whip	1week-resampled	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	4.3	4.2	<1	<1	<1	<1	<1	<1	1.5	<1	<1	<1	1400	11	<1
106	Lead Whip	1 week	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1					
107	Lead Whip	1 week	1.5	<1	1.9	2.8	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1					
108	Lead Whip	1 week	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1					
117	Lead Whip	1 week	1.5	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1					
119	Lead Whip	1 week	14	3	2.9	2.7	2.4	2.1	2.6	1.8	1.7	1.9	1.5	1.4	1.1	1	1.7	2.7	1.6	1.5	2	1.3					
122	Lead Whip	1 week	1.3	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1					
126	Lead Whip	1 week	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1					
127	Lead Whip	1 week	4.3	5.2	3.1	2.4	1.8	2.2	2.2	2.2	4.5	4	2.3	1.9	1.7	1.5	1.2	<1	1.1	1	<1	<1					
128	Lead Whip	1 week	7.9	9.1	8.3	7.5	8.8	15	18	5.3	3	2.5	2	2	2.2	1.4	1.3	1.5	1.4	1.2	1.1	1.2					
133	Lead Whip	1 week	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1					
134	Lead Whip	1 week	Invalid - Incorrectly sampled																								
135	Lead Whip	1 week	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	2	1.3	<1	<1	<1	<1	<1	<1	<1	<1					
100	Lead Whip	1 month	Invalid - Incorrectly sampled																								
105	Lead Whip	1 month	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
107	Lead Whip	1 month	1.4	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1					
119	Lead Whip	1 month	13	3.1	1.9	2.2	1.7	1.7	1.6	1.9	1.6	1.5	1.2	1.3	1.3	1.3	1.4	1.4	1.2	1.2	1.2	1.4					
127	Lead Whip	1 month	5.8	5.8	1.9	1	<1	1.5	1.1	1.1	1.7	1.9	1.4	1.2	<1	<1	<1	<1	<1	<1	<1	<1					
128	Lead Whip	1 month	1.6	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1					
130	Lead Whip	1 month	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1					
134	Lead Whip	3 month	1.1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1					

LUSL results - 90th Percentile Lead Values, ppb - by Profile Bottle, Before and After LUSLR

# Samples	# Sites	90%	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
320	18	Before	4.4	2.4	2.0	2.0	2.1	2.7	2.8	2.7	3.3	1.5	1.8	1.5	1.4	1.4	1.6	1.2	1.4	1.7	1.9	1.6	1.0	1.0	1.0	1.0	1.0
325	16	1 week	6.1	4.1	3.0	2.8	2.1	2.2	2.4	2.0	2.4	2.2	2.2	2.0	1.4	1.3	1.4	1.5	1.4	1.3	1.3	1.1	1.0	1.0	1400.0	11.0	1.0
125	6	1 month	9.4	4.5	1.9	1.6	1.4	1.6	1.4	1.5	1.7	1.7	1.3	1.3	1.2	1.2	1.2	1.2	1.1	1.1	1.1	1.2	1.0	1.0	1.0	1.0	1.0
20	1	3 month	1.1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	0	0	0	0	0

LUSL results - Maximum Lead Values, ppb - by Profile Bottle, Before and After LUSLR

# Samples	Count	Max	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
320	18	Before	6.2	7.1	3.4	3.2	2.3	3.7	6.6	3.6	4.3	2.1	2.9	2.0	1.7	1.9	5.0	1.7	1.6	3.1	3.9	2.9	1.0	1.0	1.0	1.0	1.0
325	16	1 week	14.0	9.1	8.3	7.5	8.8	15.0	18.0	5.3	4.5	4.0	4.3	4.2	2.2	1.5	1.7	2.7	1.6	1.5	2.0	1.3	1.0	1.0	1400.0	11.0	1.0
125	6	1 month	13.0	5.8	1.9	2.2	1.7	1.7	1.6	1.9	1.7	1.9	1.4	1.3	1.3	1.3	1.4	1.4	1.2	1.2	1.2	1.4	1.0	1.0	1.0	1.0	1.0
20	1	3 month	1.1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	0	0	0	0	0

site id	whip material	samp event	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
110	Galvanized	Before	1.1	2.8	1.1	<1	<1	1.3	1	<1	<1	<1	<1	<1	<1	1.1	<1	1.6	<1	<1							
113	Galvanized	Before	1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	1.5								
115	Galvanized	Before	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1									
116	Galvanized	Before	7.3	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1					
118	Galvanized	Before	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1					
120	Galvanized	Before	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1											
123	Galvanized	Before	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1											
131	Galvanized	Before	1.8	<1	<1	<1	<1	<1	<1	<1	<1	NA	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1					
115	Galvanized	1 week	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1					
118	Galvanized	1 week	5.5	<1	<1	<1	1.3	1	<1	1.3	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1					
123	Galvanized	1 week	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1					
131	Galvanized	1 week	2.4	16	5.6	3.1	3.3	2.5	2.6	2.1	1.8	1.5	1.5	1.4	1.3	1.2	1.1	1.2	1.2	1.1	1.1	1.1					
110	Galvanized	1 month	1.5	<1	1.1	1.8	7.1	<1	<1	5.4	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1					
110	Galvanized	3 month	<1	1	1.4	2.2	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1					
131	Galvanized	3 month	12	2.8	1.9	1.3	1.2	<1	<1	<1	<1	1	<1	<1	1	<1	<1	<1	<1	<1	1.1	<1					
111	Copper	Before	1.4	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1					
121	Copper	Before	1.7	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1											
124	Copper	Before	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1							
125	Copper	Before	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1										
129	Copper	Before	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
132	Copper	Before	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1					
111	Copper	1 week	2.8	1.1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1					
121	Copper	1 week	3	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1					
111	Copper	1 month	2.3	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1					
121	Copper	3 month	3	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1					

Appendix C – Evaluation of individual Sites with High Lead

Further investigation of premise plumbing was conducted by a water quality inspector at increased lead sites (>2ppb) and are discussed in this appendix. Because this analysis is based on a limited number of sites, and some other sites with similar service lateral materials showed very low lead levels, these findings should not be applied to all sites with similar construction.

Table C1 summarizes the 5 pipeline segment combinations, maximum lead concentrations, corresponding sample event, and sample bottle at which the maximum result occurred. Eight sites with lead results <2ppb, for all profile bottles, are not included in this summary.

Table C1 – Maximum Lead Values for Differing Service lateral Materials.

Whip material	City serviceline	Customer serviceline	Site	Pb (ppb) max	sample event	bottle #	pipe segment location of detected max Pb bottle
Lead whip	Galvanized	Copper	105	**1400**	1wk	20	main to distribution system (city)
			117	5	PC	15	
			122	3.9	PC	19	
			112	3.9	PC	9	meter to main (city)
			127	7.1	PC	2	faucet to premise (customer)
		Galvanized	128	**18**	1wk	7	premise to meter (customer)
			107	3.2	PC	4	
			119	**14**	1wk	1	faucet to premise (customer)
			100	4.4	PC	1	
Galvanized	Galvanized	Copper	110	7.1	**1mo**	5	premise to meter (customer)
		Galvanized	116	7.3	PC	1	faucet to premise (customer)
Copper	Galvanized	Copper	118	5.5	1wk	1	
			121	3.3	**3 mo**	1	

Note: PC = Pre-construction, or before LUSLR. Red values are those above future LCRR trigger level of 10ppb. Blue data is from non-LUSL sites.

For sites showing elevated lead results, all sites did not correlate to have a lead whip – but did have galvanized service lateral material. Four of five sites, where the pipeline segment combination is *lead whip—galvanized (city line)—copper (customer line)*, the maximum lead concentration occurred after the 9^{th} liter bottle which represents the service lateral from the meter to city main. Conversely, at sites with no lead whip, the max lead occurred in first draw samples in 3 of 4 sites representing faucet samples. For these latter sites lead value was 3.3 - 7.3ppb.

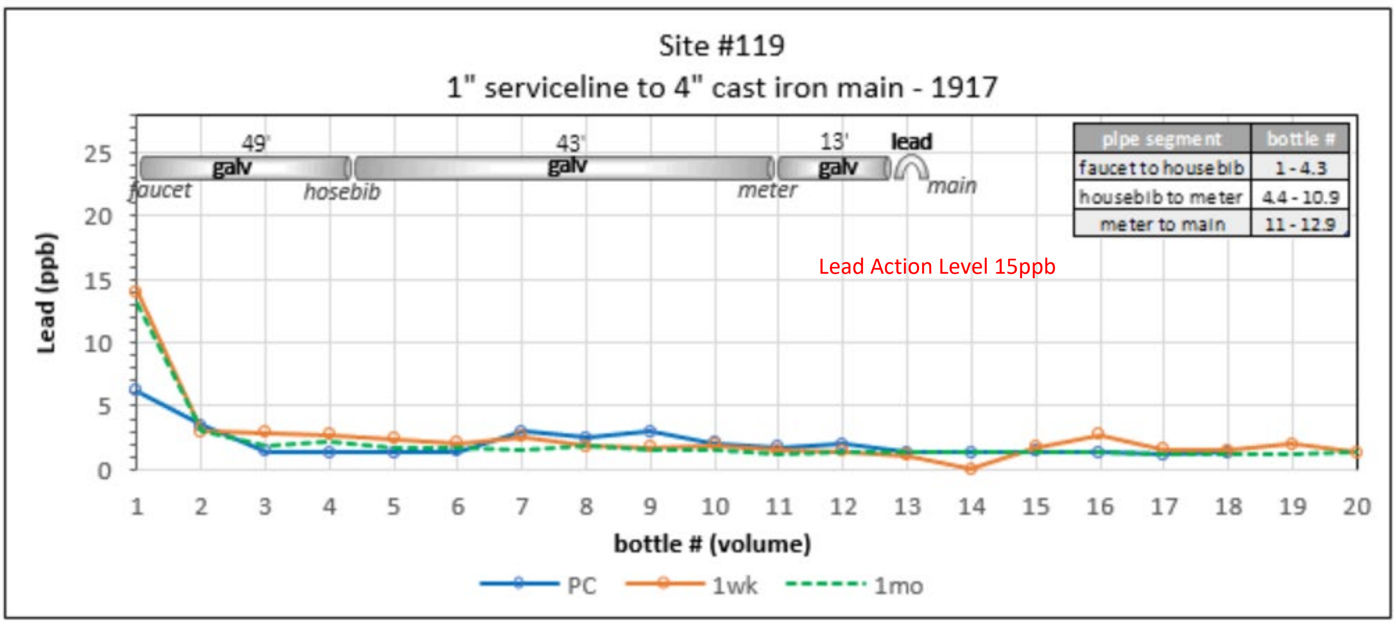
Sites 105, 119 and 128

These three sites are characterized by having a lead whip, served by a 4-inch cast iron main line installed between 1917-1933, and service lateral condition, observed by the construction team, as 'rust/discolored corrosion'.

Site 119

Maximum lead concentration at site #119 occurred in the 1st liter bottle for all monitoring events (Before,1-week, and 1-month after LUSLR), where the distance from meter to house was measured at 43 feet. The highest lead concentrations, for before, 1-week and 1-month events, were detected at 6.2, 14, and 13ppb in the 1st liter bottle with all other profile bottles detected at < 3.5ppb. The 13ppb Pb detected in the 1st liter 1-month after LUSLR indicates that the source of lead is most likely caused by kitchen faucet (e.g., brass/chrome plated brass faucets).

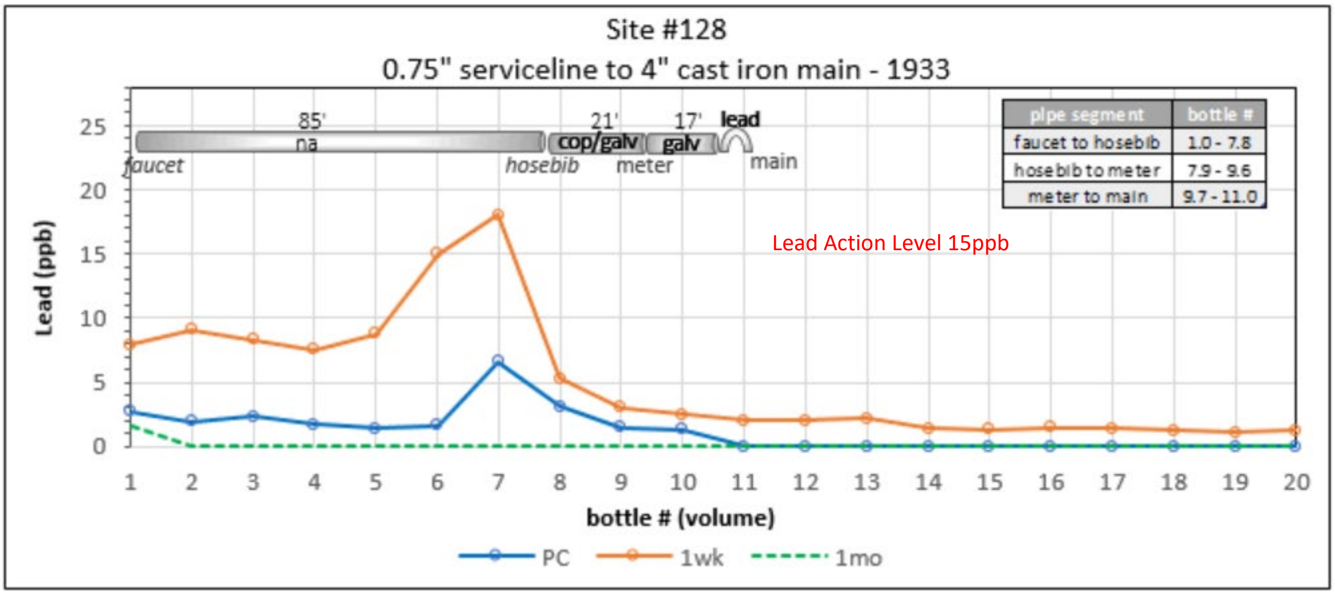
As charted in Figure C2, for all sites pilot study sites, the average length of pipe measured from meter to house is 24 feet. For this site, the longer than average galvanized pipe length from meter to house of 43 feet may create a higher surface area for settleable materials to deposit.



Values less than detection limit are shown as 0.

Site 128

This service lateral is characterized by a lead whip attachment, galvanized service lateral and brass pipe from meter to hose bib, with a measured distance of 21 feet. Brass pipe material is composed mainly of copper and zinc with some brasses containing up to 3.8% lead. The max lead concentration occurred in the 7th liter bottle before and 1-week after LUSLR. This represents water from the brass segment. Lead concentrations detected, during 1-week monitoring, showed elevated lead values ranging from 7.5ppb-18ppb in the first seven liters peaking in the 6th and 7th liter at 15/18ppb. Pb concentration detected after the 10th liter bottle remained at <2ppb for 1week and 1-month after LUSLR. As shown in the chart below, the source of lead increases near the hose bib, corresponding to the galvanized--brass service lateral.



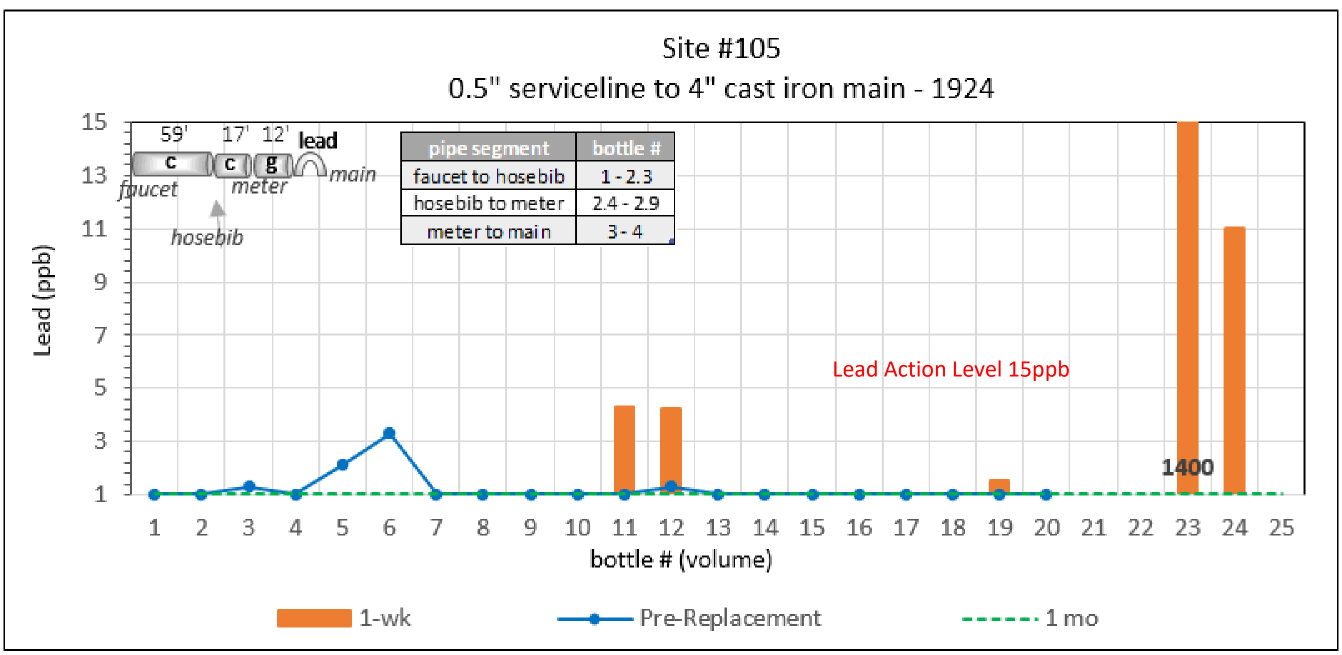
Note: No 3-month sampling due to closeout after 1month sampling showed all low lead levels.
Values less than detection limit are shown as 0.

Site 105

An uncharacteristically high Pb concentration of 160ppb, occurred in the 20th liter bottle during the 1-week after LUSLR monitoring. The customer was informed of the lead analysis results, conduct house flushing and were instructed to continue using the provided water filters. A second set of profile sampling was conducted, two weeks after the service lateral was replaced, with a maximum lead concentration detected at 1400ppb after the 23rd liter bottle, and 11ppb in the 24th bottle. All other profile bottles, during the pre-construction and 1-week monitoring for the first and second sample sets, remained below 5.6ppb. The lead concentrations during the 1-month monitoring were non-detect for all profile bottles because of the residents immediately replacing the premise plumbing fixtures. The second, repeat 1-week sample set (with max of 1400ppb) was used for pilot study reporting.

The 23rd liter bottle represents water from the main, however, sequential sampling is not exact representation of water from a specific main segment, as the water traverses the entire service lateral, house plumbing and faucet prior to sample collection. Given that 23 other sequential samples representative for Site 105 showed lower lead levels, the high reading may be caused from an incidental lead particulate sloughed from deposits within the service lateral or household plumbing.

This site is characterized by a 0.5-inch diameter copper service line where the distance from meter to house was measured at 17 ft. The average meter to house length, based on all pilot study sites, is 24 feet. This is the only site with a 0.5-inch diameter service line. The shorter pipe length coupled with 0.5-inch pipe diameter may have contributed to higher velocity flows and shorter settling time allowing for larger lead particles loosened from construction activity to flow into the premise plumbing.

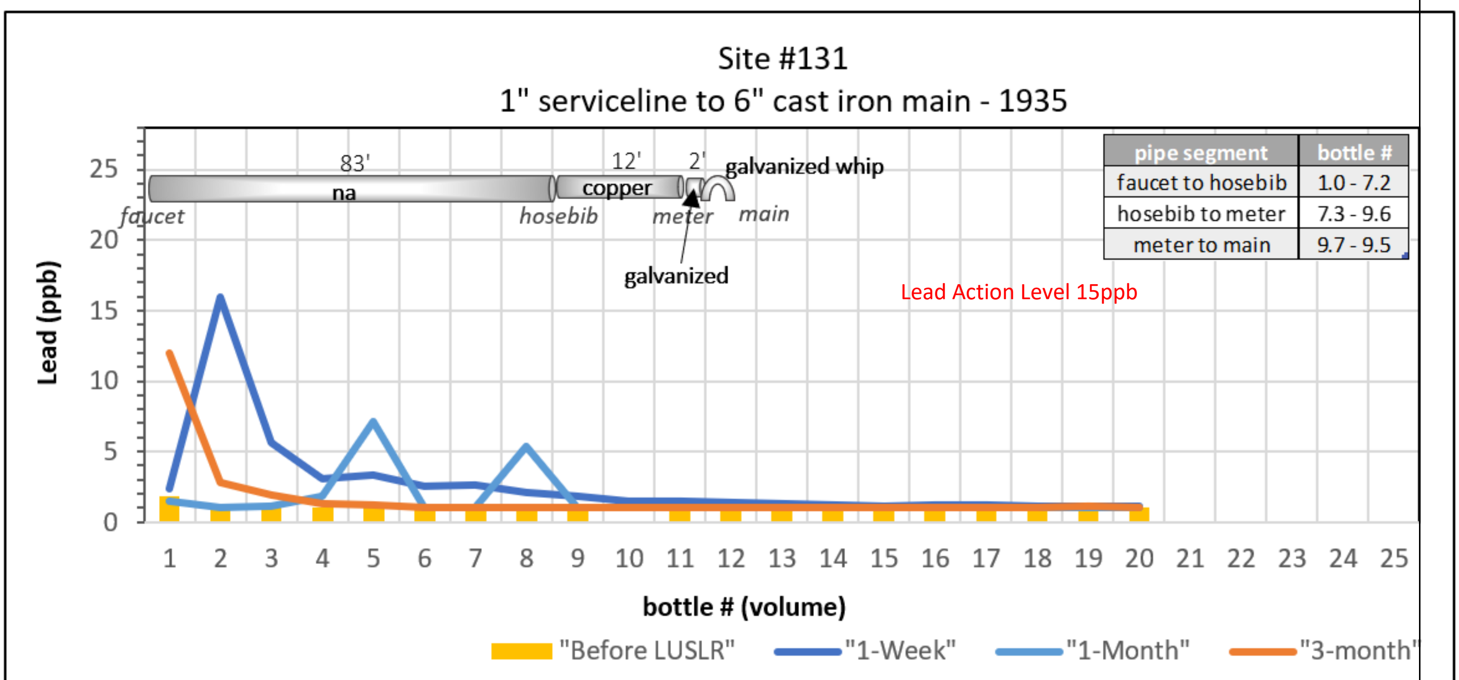


Values less than detection limit are shown as 0.

Site 131 – Galvanized Whip (non LUSL site)

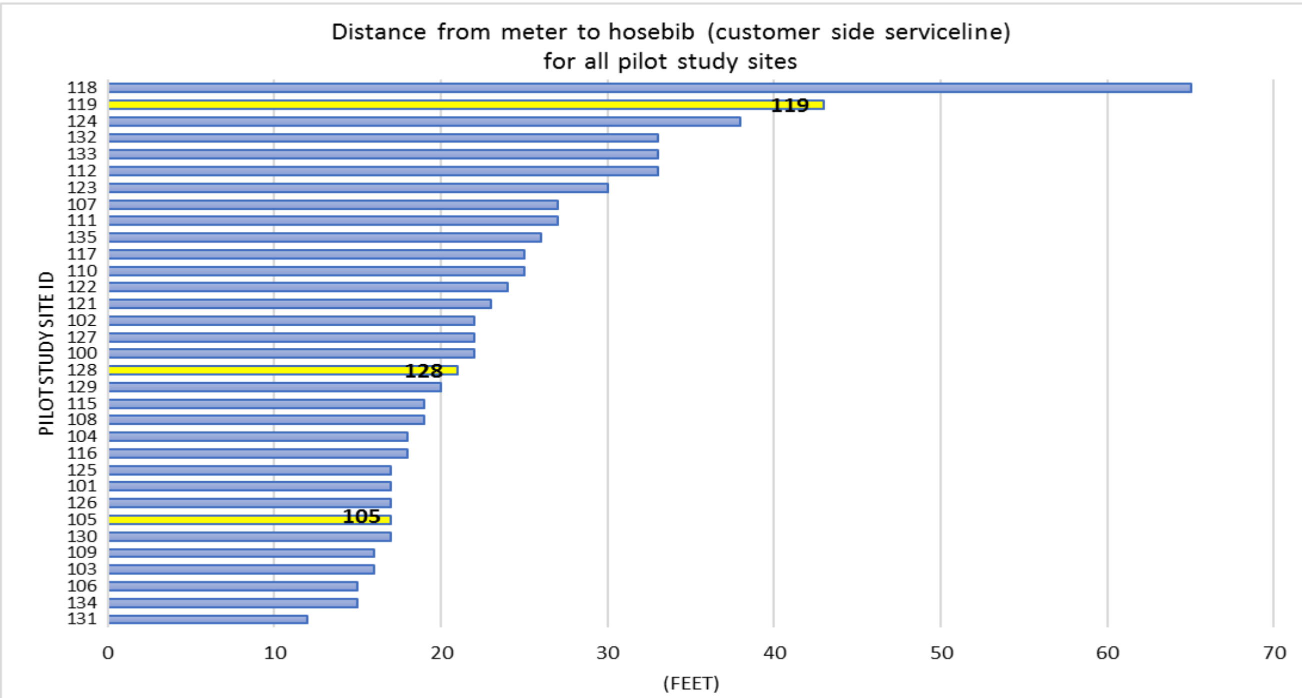
Site 131, is characterized by a *galvanized whip attached to a short, galvanized service lateral, and a 1" copper (customer line)*, where the length from hose bib to kitchen faucet (premise plumbing) is 83 ft. Maximum lead concentrations during the 1-week and 3-month monitoring peaked at 16 and 12ppb in the 1st and 2nd bottles with lead values <2ppb after the 9th liter. Lead concentrations before LUSLR were non detected for all profile bottles.

The lead detected at 1-week, 1-month, and 3 months after galvanized service lateral replacement, with the absence of a lead whip attachment, indicates that the source of leadppb is from components within the premise pipeline configuration lead-based solder used to join copper pipe, brass and chrome plated brass faucets.



Values less than detection limit are shown as 1ppb.

Figure C-2 – Distances meter to Hosebib for Pilot Study Sites, with highlighed sites 119, 128, 105



Appendix D – Summary of Industry Research

Contribution of Service lateral and Plumbing Fixtures to Lead and Copper Rule Compliance Issues, AWWARF/USEPA 2008

This 2008 study compiles findings of several utilities. Industry research has focused on contribution and reduction of lead from various plumbing sections within the water distribution system, including premise plumbing, kitchen faucet, meter, and service lateral. These studies indicate that full leaded service laterals are the biggest contributor to lead tap levels, and that removing these piping will require construction best management practices to control particulate release, post replacement flushing and 2-month period to allow pipe conditions to stabilize until consistently low lead levels are achieved. Notes from AWWARF study which presents the findings of several utility studies are provided below.

- The results of numerous studies are summarized in this report. Field studies include Cities of Portland Oregon, Philadelphia Pennsylvania, Madison Wisconsin, Toronto Ontario, Framingham Massachusetts, and utilities District of Columbia Water and Sewer Authority, Boston Water and Sewer Commission, Metropolitan District Hartford Connecticut (MDC). Additional shared experience for lead service lateral replacement were from Cincinnati, East Bay Municipal Utilities District, SFPUC, Louisville, Portland Water Bureau among others.
- Various studies of impacts of lead service laterals on household tap lead levels. Sequential samples were collected to determine lead contribution from premise (in-house) plumbing, water meters, faucets, vs service laterals.
- Found that lead service laterals were highest contributor of lead at the faucet (50-75% of total)
- Observes that it is difficult to characterize the sources of lead in samples representing further distance from tap, as it can pick up lead thru scouring, erosion on way to tap.
- Water treatment (orthophosphates) were successful at reducing tap lead from all sources.
- Lead Particulates – result in high lead levels after full and partial line replacement because of disturbance. Flushing for 60min may help to reduce this.
- Full service lateral replacement reduced tap lead levels in sequential samples after 2 months.
- Reducing lead levels is recommended through lead service lateral replacements, LCR compliance, construction BMPs to limit pipe disturbance, flushing and faucet replacement.

Appendix E - LUSL Pilot Study Inclusivity Assessment

The following map and statistics summarize demographics of San Francisco neighborhoods, including percent of family households/with children, lower income level, as well as the density of galvanized services with likely lead component (LUSL). Data was obtained from the SF Planning Department website. This assessment was completed to ensure outreach and participation across a wide range of neighborhoods with differing demographics. However, not all SF neighborhoods were represented in the Pilot Study as the LUSLs were not dispersed evenly throughout the city. Also site inspections for several neighborhoods suspected of having an LUSL did not confirm galvanized steel service lines.

The neighborhoods of Bayview, Visitacion Valley, Excelsior, Outer Mission, Crocker Amazon, Ocean View, Twin Peaks and Parkside, all in the south part of the city, are characterized as having the largest percentage of Family households with children (70 - 80%) and occupy 50% of potential LUSL sites. Bayview and Visitacion Valley rank above the 77th percentile for percentage of population classified in lower household income. Outreach was conducted for these neighborhoods, however, not all had volunteers. The breakdown of LUSL discoveries per neighborhood is shown on the table below.

Schools/daycare facilities and households having service renewals after Capital Improvement Project main replacements are not represented by this pilot study.

Figure – Screening and Outreach for Potential Pilot Study Participants

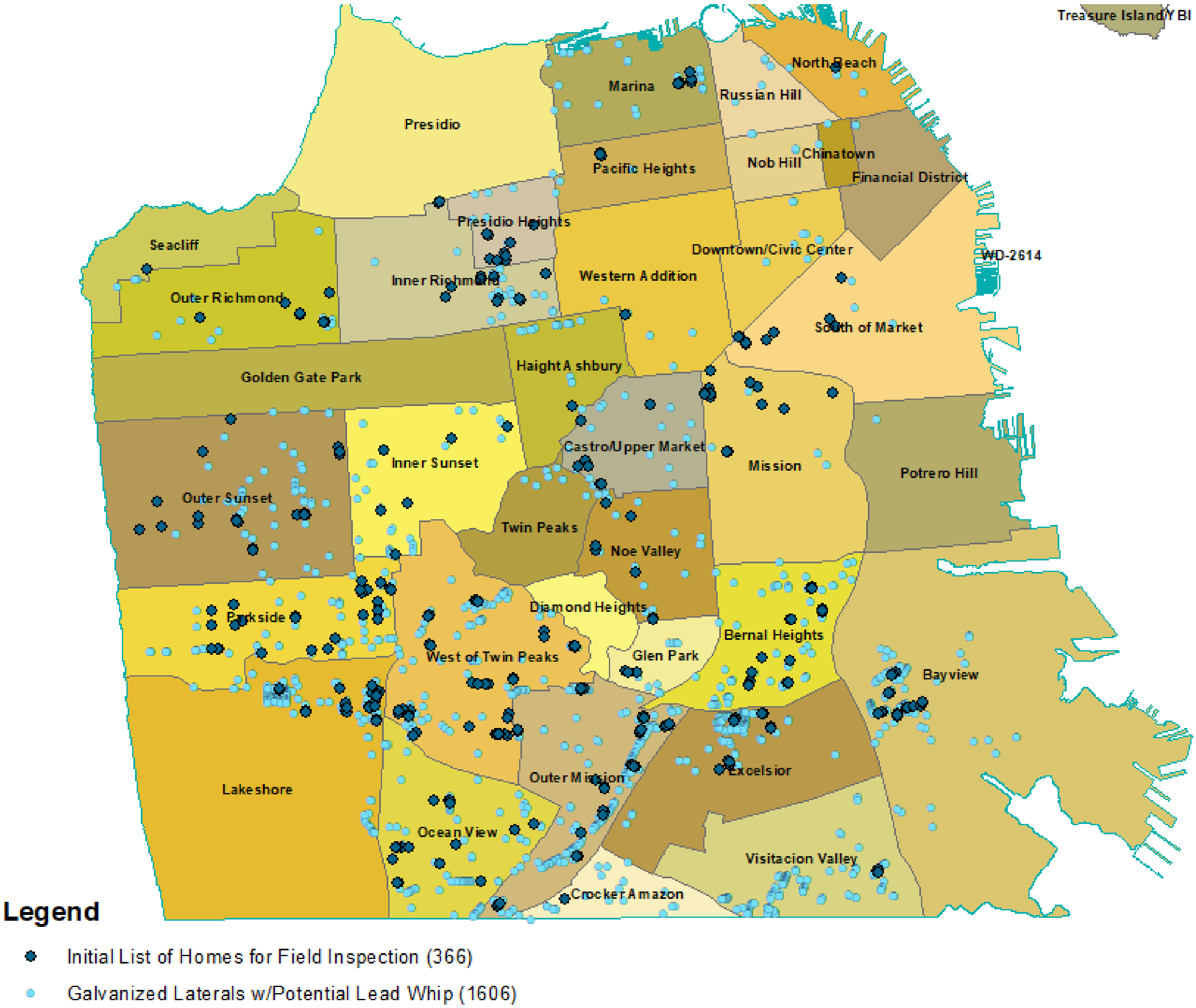


Table - Neighborhoods Represented by Pilot Study Volunteers

	Demographics			Pilot Study Findings			
Neighborhoods	Family Households	Households w/ Children	Low Income	% Galv service potential	# Galv potential LUSL	# Galv visually verified	# LUSL found
West of Twin Peaks	66%	28%	6%	7%	117	30	4
Inner Richmond	46%	21%	12%	1%	24	21	5
Outer Sunset	62%	28%	7%	4%	57	18	2
Outer Mission	70%	34%	6%	15%	240	16	2
Presidio Heights	43%	15%	5%	1%	13	11	3
Ocean View	70%	30%	10%	5%	75	8	2
Parkside	68%	28%	8%	6%	92	8	1
Inner Sunset	46%	15%	8%	2%	28	10	
Excelsior	75%	38%	9%	10%	162	5	1
Outer Richmond	55%	23%	7%	1%	15	6	
Lakeshore	47%	18%	19%	10%	161	4	
Castro/Upper Market	22%	9%	7%	1%	24	4	1
Bayview	73%	43%	20%	9%	142	1	
Visitacion Valley	79%	43%	15%	10%	158		
Mission	37%	17%	13%	2%	25	3	
Seacliff	69%	30%	3%	0%	5	1	
Crocker Amazon	78%	31%	7%	1%	20	1	
Marina	27%	7%	6%	2%	34	2	
Glen Park	51%	24%	9%	1%	11	1	
Western Addition	28%	9%	14%	0%	8	-	-
Twin Peaks	31%	16%	7%	1%	9	-	-
South of Market	27%	7%	20%	1%	9	-	-
Russian Hill	29%	9%	11%	0%	7	-	-
Presidio	51%	23%	6%	0%	2	-	-
Potrero Hill	43%	18%	11%	0%	1	-	-
Pacific Heights	30%	10%	6%	0%	6	-	-
North Beach	34%	7%	15%	0%	5	-	-
Noe Valley	41%	18%	5%	1%	24	-	-
Nob Hill	28%	9%	14%	0%	2	-	-
Haight Ashbury	31%	13%	11%	1%	20	-	-
Financial District	29%	7%	30%	0%	2	-	-
Downtown/Civic Center	21%	6%	28%	1%	10	-	-
Chinatown	50%	15%	32%	0%	2	-	-
Bernal Heights	53%	29%	8%	6%	95	-	-

Demographics source: SFPlanning.org website

Appendix F - Customer Outreach Materials

San Francisco
Water Power Sewer
Services of the San Francisco Public Utilities Commission

525 Golden Gate Avenue, 13th Floor
San Francisco, CA 94102
T 415.554.3155
F 415.554.3161
TTY 415.554.3488

Free Lead Testing: Voluntary Program to Participate in a Water Quality Study

Dear Neighbor,

San Francisco's high-quality drinking water is routinely tested and shows lead levels in our water system are below any regulatory action level. To further ensure consumer protection, the SFPUC is conducting a pilot water quality sampling program for residents where a lead fitting is suspected. This lead fitting is a pipe segment that connects the water main (pipe) in the street to the water meter box in the sidewalk.

Your property was selected to participate in the study because there is a possibility that your water service line is attached to a lead fitting. We based the selection on similar building construction, year built, and geographical proximity. By participating in this study, we will provide free lead testing of your tap water and a set of water filters to use during the study period (approximately 6 months).

San Francisco's high-quality drinking water meets and exceeds all drinking water regulations for health and safety. This study is one part of our ongoing lead remediation and education program.

Households with pregnant women and young children are encouraged to participate in this program.

If you would like to participate, please contact our office, **1-415-920-4063.**

For information about lead and drinking water, visit our website at www.sfwater.org/lead

OUR MISSION: To provide our customers with high-quality, efficient and reliable water, power and sewer services in a manner that values environmental and community interests and sustains the resources entrusted to our care.

Appendix G - Customer Information Form

LEAD USER SERVICE LINE REPLACEMENT STUDY

PARTICIPATION FORM

LW#________

LIMS Folder#______________

Maximo WO#______________

Filter Delivered ☐YES ☐NO

NAME_____________________________________

ADDRESS__________________________________

PHONE#___________________________________

FILTER DESIRED ☐YES ☐NO

1. Where is kitchen located? ☐ 1st floor ☐ 2nd floor ____________

2. Does your home have in-line water filter or other water treatment devices of any type? ☐YES ☐ NO
   If so, please describe. ____

3. What kind of plumbing does your home have?
   ☐ Copper ☐ Lead ☐ Galvanized Iron ☐ Plastic ☐ Unknown

4. If you have copper plumbing, how old is it?
   ☐ Installed in 1982 or earlier ☐ Installed after 1982 ☐ Unknown

Site Assessment Criteria
from CCB Database

Meter Size________

Service Lateral Length (Main to Meter)__________

Service Lateral Material__________

Appendix H - Field Form for Lead Detection

CDD Support Workgroup
Water Quality Engineering

Lead Detection Procedure Field Form

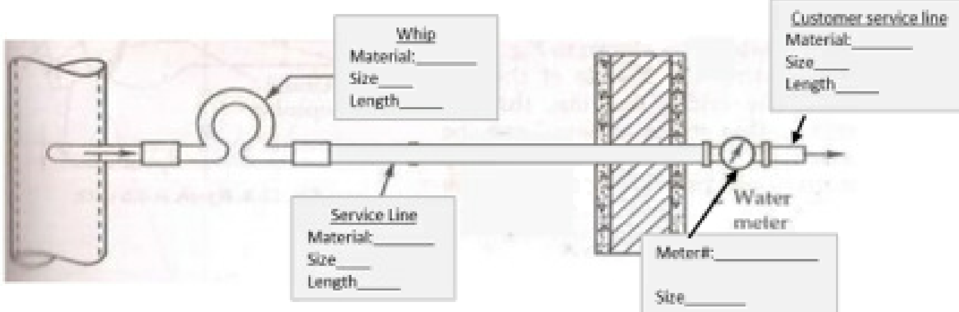
☐ Service Renewal Planned ☐ Service Renewal Emergency ☐ Other_____________

Location/Address	
Reported By	
Date and Time	
Crew	

Service Line Description

Full Lead service line?	Yes	No
Lead Whip service line?	Yes	No
Service Line Material		

**If Lead found, call 415-920-4063 ASAP, cut 1ft piece and deliver with form to Water Quality at CDD



Condition of service line interior

☐ Clean
☐ Rust/Discolored
☐ Corrosion
☐ Tuberculated
☐ Thick slime/Internal

Action Completed

☐ Still in service Reason:_____________
☐ Abandoned
☐ Replaced
☐ Flushed Line
☐ Other ____________

Verify service line material adjacent to property (2 houses on left and 2 houses on right)

Address	Material	Size	unidentifiable/ needs follow-up
			☐
			☐
			☐
			☐

Engineering Entry from CCB Database

Main size__________
Meter size__________
Meter #__________
lateral length_______
lateral material_______

Appendix I – Volunteer Packet and Customer Sampling Instruction

San Francisco Water Power Sewer
Services of the San Francisco Public Utilities Commission

Water Quality Division
1657 Rollins Road
Burlingame, CA 94010

LEAD FITTING REPLACEMENT PILOT STUDY

Thank you for participating in the SFPUC's pilot study of residences with service lines suspected of having lead fittings. The lead-containing fitting is a short, flexible pipe segment that connects the water main to the service line. If not done so already, the SFPUC will replace this fitting with a lead-free fitting.

San Francisco's high-quality drinking water meets and exceeds all drinking water regulations. Within our water system, lead levels are consistently below regulatory action levels. While there is no evidence that replacing a lead fitting will change the lead levels in the water at your tap, we are offering free lead testing and a courtesy lead water filter to ensure that lead levels remain consistently low. We request your assistance to test lead from your kitchen faucet for 4 sampling events: prior to fitting replacement, 1 week, 1 month and 6 months after lead fitting replacement. We will contact you to schedule delivery and pickup for the additional sampling events.

Please complete the attached form and follow the sampling instructions when collecting the water samples from your sink. We will notify you with the results of the lead tests. If the testing shows that the drinking water in your unit has levels of lead that require action, we will alert you immediately and take steps to address the problem.

Please complete sampling within 5 business days. If you have any questions, please call (415) 920-4063.

Thank you for your participation in this pilot study.

Here are some practices to ensure the best quality drinking water comes from your tap:

- Use cold water for drinking and cooking only from your kitchen faucet.
- When your water has been sitting for several hours, flush your tap until it feels colder, for 30 seconds to 2 minutes.
- Replace drinking water faucets and indoor plumbing with "lead-free" components.
- Periodically clean your kitchen faucet aerator of debris and buildup.

The SFPUC takes pride in being a model utility in lead abatement. We removed all known lead pipes and services lines in San Francisco in the 1980s, and our excellent corrosion control practices eliminate exposure to these minor lead surfaces. To learn more about our water quality data, visit sfwater.org/quality matters.

San Francisco Water Power Sewer
Services of the San Francisco Public Utilities Commission

Water Quality Division
1657 Rollins Road
Burlingame, CA 94010

Lead User Service Line Pilot Study: Sample Collection Instructions
PLEASE COMPLETE WITHIN 5 BUSINESS DAYS

1. **Refrain from water use from any tap (such as flushing, showering, garden watering, etc.) for at least 6 hours, but no more than 12 hours before sampling. Do not intentionally flush the water line before the start of the 6-hour period.** ***This is the most important step to achieve accurate results***

2. Best time to collect samples is early in the morning before household members use the water. Collect samples from the kitchen sink.

3. Before retiring to bed, remove any water filter devices from the kitchen sink. Place the attached "DO NOT USE" sign over the kitchen faucet to prevent accidental water use. Do not reattach drinking water filters until after sampling has been conducted.

4. After the (minimum) 6 hour holding time:
   a. Do not remove the faucet aerator prior to sampling.
   b. Locate the "Sample #" on the upper left corner of each bottle label. Open the bottles and set aside, in number order next to kitchen faucet. **Fill bottles in number order (Sample #1, Sample #2, Sample #3 …)** *** important step for accurate results***
   c. Place a bottle below the kitchen water faucet. Open the cold water to full flow rate. Fill as close to the top of the bottle without overflowing. DO NOT OVERFILL. Turn off water. Tightly cap the sample bottle.
   d. Repeat "step c." for remaining bottles. **Fill bottles in number order (Sample #1, Sample #2, Sample #3 …)** *** important step for accurate results***
   e. Put the bottles of water sample and the completed form into the provided SFPUC cooler along with the blue ice packs. It is important the filled water bottles are kept in cold.

- Place blue ice packs, that were provided in the SFPUC coolers, in your freezer the night before sampling. Please sample during a business day (not on Saturday or Sunday), as the filled bottles of water require to be picked up for laboratory analysis the same day as sampling. The day before you plan to take your samples, please call 415-920-4063 (Monday-Friday), to schedule pick up for the following morning.

- Fill out the requested information on the "Lead Sample Collection Information Form". If any plumbing repair or replacement has been done recently, note this information in the comment section of the form. Also, if your sample was collected from a tap with a water softener, note this as well.

- Results from this sample will be provided to you after the laboratory notifies us of lead analysis results within the next 2-4 weeks. However, if lead levels are above the action level, notification will be provided within 1-2 working days of the tap monitoring results.

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Complete the form below and return with the sample

SFPUC Lead Sample Collection Information Form

TO BE COMPLETED BY RESIDENT

Resident's Name: ____________________________ Phone: _____________(Mobile/Home/Work)
(Please circle one)

Street Address: ____________________________ Unit: _____________

Cross Street: ____________________________

Zip Code: ____________________________

Sample collection Date: _____________ Sample Collection Time: _____________

Water Last Use Date/time: _____________

Sample Collection Point [ ] Kitchen [ ] Other – Please specify Below:

____

____

I have followed the sampling instructions and collected the water sample from the kitchen tap in the morning? [ ] Yes [ ] No

I have not used any of my household taps (including toilet flushing) for at least 6 hours but not more than 12 hours before sample collection in the morning. [ ] Yes [ ] No

Comments/ Suggestions:

____

____

I have read the attached sampling instructions and have taken the tap samples in accordance with these instructions.

Signature: ____ Date: _____________

Appendix J – Flushing Instruction

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Replacement of Water Service Line Scheduled
Instructions for Flushing Household Plumbing After Replacement

The SFPUC is scheduled to install a new water service line to your home. Your original service line may include a lead fitting. When the new service line is installed, the construction crews will verify if a lead fitting exists. As a precaution against potential distribution of internal pipe scale, which may contain some lead, please take the following steps to minimize exposure to lead that may be released. Also, **please call** at your earliest convenience so that we can schedule a time to drop off the water quality sampling cooler before your water service line is replaced.

1. Begin using the water filter provided by the SFPUC for all drinking water and cooking.

2. After construction, provide an initial flush of your household plumbing
   a. Find all the faucets, including the basement and all floors in your house.
   b. Remove aerators and screens whenever possible, including the shower heads, from all faucets you plan to flush.
   c. Include the kitchen faucet, laundry tubs, hose bibbs, bathtubs, & showers as flushing points.
   d. After all aerators are off, open the faucets in the basement or lowest floor in the house. Leave all faucets open full, using cold water.
   e. After the faucets are all open in the lowest floor, open the faucets on the next highest floor of the house. Continue until faucets are open on all floors.
   f. After all faucets are opened, leave the water running for at least 30 minutes.
   g. After 30 minutes, turn off the first faucet you opened and continue to turn off other faucets in the same order you turned them on.
   h. Clean aerators/screens at each faucet. You may need to replace screens/aerators if too old or worn.

3. Within 2-3 days of service line replacement, after you have completed the flushing steps in item 2 above, collect water samples at your kitchen faucet. Follow the sampling instructions in your sample kit.

4. After 1-month and 6-months of service line replacement, SFPUC will drop off another sample kit for water testing. This will conclude your participation in the study. The potential for elevated lead associated with pipe replacement generally goes away after a month.

Thank you for your participation in this program. We will provide results of your sampling after the 1-month and 6-month sampling events.