MITIGATING ELEVATED LEVELS OF LEAD AND COPPER IN ADAK'S DRINKING WATER SYSTEM BY REPLACING RESIDENTIAL FAUCETS

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1.0 EXECUTIVE SUMMARY

The former Naval Air Facility, Adak has measured elevated levels of lead and copper concentrations within its water system from 1993 to the present. Studies of analytical data have consistently yielded readings above applicable Alaska compliance levels.

A corrosion control study was conducted in 2000 to evaluate the effectiveness of installing a source treatment system (Ref. a, Hart Crowser December 2000). The report concluded that the introduction of calcium phosphate was the most effective treatment option for site conditions at Adak. Tested in a laboratory, calcium phosphate was shown to lower concentrations of lead by 80%; however, it was unable to achieve the State regulatory limit of 15 ug/L.

The corrosion control study also theorized that replacing the existing faucets throughout the residential areas could help to lower the elevated levels of lead and copper. This present study was performed to determine the effectiveness of replacing the existing fixtures. The results showed that replacing faucets lowered both copper and lead levels by 67% and 86%, respectively. The reduction of metal concentrations was significant; however, resultant levels were still above regulatory limits for lead and copper.

The data from the studies show that replacing faucets will be slightly more effective in reducing lead and copper concentrations than source treatment. There is a higher level of confidence in the data for the faucet study, because the study was conducted on Adak. The corrosion control study was performed within a laboratory under controlled conditions; therefore, the true effectiveness of using calcium phosphate in the field is not known. Although the corrosion control study attempted to simulate the conditions on Adak, actual conditions may vary producing different results.

Based on the results of the corrosion control study and faucet replacement study, the replacement of faucets for the active residential units on Adak is considered the superior alternative to address elevated lead and copper levels in drinking water. A few of the advantages are listed below:

- Faucet replacement will produce an immediate reduction in metal concentrations
- The installation and procurement of faucets are the only capital costs.
- Water treatment operators would not require additional certification since the water system would not be modified by an additional treatment system.
- Operations and maintenance costs are not a factor.

2.0 INTRODUCTION

Adak has experienced many modifications and changes as a naval base over the past several years. At one time, the facility was one of the larger communities in Alaska, accommodating approximately 5,000 people who were served by two water systems from three different sources. Today, Adak has closed as a military facility, and is currently using one water system and source to supply a population of approximately 100 – 300 people.

Adak is located in the Aleutian Island chain, one of the most remote and environmentally harsh locations in the world. The weather conditions are extremely hostile to equipment and materials, which degrades facilities at an accelerated rate increasing the difficulty of maintaining a working infrastructure. Equipment and materials must be brought to the facility either by sea or air, which inflates the cost of conducting work on the facility as much as threefold in comparison to that of the continental United States.

The Adak Reuse Corporation (ARC) is currently leasing the facility from the Navy with plans to transform the facility into a self-sustaining community. The current lease agreement stipulates that the ARC is responsible for maintaining the infrastructure. Ownership, however, is still retained by the Navy, pending Congressional authorization of a land exchange by which The Aleut Corporation (TAC) will become the owner of much of the former military reservation, including all of the developed areas.

Elevated levels of lead and copper have existed in Adak's drinking water system since at least 1993. Studies have been conducted to evaluate the conditions and to determine if treatment at the source would be effective in lowering the metal levels. Corrosion control was found to reduce these levels, however; the reduction was not enough to meet minimum State regulatory limits. Examination of the data obtained from the residential units suggests that the plumbing materials are contributing to the elevated levels of metals found in the drinking water. Metal levels in the samples drop off dramatically in samples taken after the faucets are allowed to run for approximately 30 seconds.

This study was conducted in an attempt to determine the plumbing source responsible for the elevated metals levels. The study attempted to determine whether the internal housing plumbing (i.e. not from main to housing unit) or the faucets are contributing factors to the elevated metals problem.

The study first developed a baseline to evaluate if elevated levels of lead and copper levels were still present within the distribution system. Samples were collected primarily from housing units that exhibited elevated metal levels in past sampling events.

Ten housing units from the baseline survey were chosen to participate in the second phase of the study. The criteria for selection was based upon the analytical results collected during the initial sampling period. A sampling scheme was devised to collect samples at various intervals throughout a 3-day period, in an effort to decipher where in the plumbing system the metals were coming from (i.e. piping or faucets).

3.0 HISTORY

In June 1991, the U. S. Environmental Protection Agency (EPA) implemented the Lead and Copper Rule (40 CFR 141.80 through 141.90). The Rule requires Group A public water systems to test and treat drinking water and make repairs to delivery systems, as necessary, to prevent delivery of water at the tap with lead and copper concentrations above the established “action levels”. The actions levels for lead and copper are 0.015 mg/l and 1.3 mg/l, respectively. If these action levels are exceeded in more than 10% of collected samples, then water system owners are required to take corrective actions.

According to the Rule, medium-sized systems (populations between 3,300 and 50,000, which included Adak at the time of the Rule implementation) were to begin a sampling program in July 1992. In March 1993, the Navy collected the first set of water samples from 40 housing units (the appropriate number of samples representative of the population). The results of the analytical tests indicated that 12 units were above the State Regulatory Level for copper. Additionally, 18 samples were found to be above the regulatory level for lead. These sampling results are shown in Appendix A. Based on the analytical information, lead and copper concentrations exceeded the regulatory levels in more than 10% of the samples, triggering the next set of actions, which included the implementation of a public education program and tests of the source water to determine its corrosiveness.

The Navy implemented a public notification program, including notices provided in housing units’ packets, articles in the base newspaper, *The Eagle’s Call*, and posted notices on the Command Television channel. In October 1993, water samples from the entry point to the distribution system at the A Tanks and at 3 points along the distribution system were collected and analyzed for the water quality parameters required by the Rule. Three additional sets of lead and copper water samples were collected in July 1993 (40 locations at base facilities other than housing units), September 1993 (40 housing units), and January 1994 (40 housing units). Subsequently, additional sampling was conducted in August 1997, March 1998, and August 1998. Each sampling event exceeded both lead and copper regulatory levels in more than 10% of the samples, except for August 1997. The results of the sampling events are summarized in Table 1. All the analytical data is provided in Appendix A.

Table 1. Analytical Data Summary				
Sampling Event	Total Number of samples collected	Elevated Cu Results ≥ 1,300 µg/l	Elevated Pb Results ≥ 1.5 µg/l	Exceed 90th Percentile
March 1993	40	12	18	Yes
July 1993	40	4	7	Yes
Sep 1993	40	1	13	Yes
Jan 1994	40	20	11	Yes
Aug 1997	10	1	1	No
March 1998	10	8	5	Yes
Aug 1998	13	6	5	Yes

In a letter to the EPA dated June 16, 1993, the Navy submitted the results of the April/May 1993 lead and copper analyses, the source water quality parameter analysis, examples of the public notices, and a discussion of source treatment alternatives. At that time, the Navy requested approval for the use of tap flushing and public education as the permanent lead and copper control measure.

In a letter dated December 22, 1993, the EPA responded to the Navy's June 16, 1993 letter stating, "We agree with your staff's assessment that the source of lead and copper is base housing plumbing, but we cannot, at this time, concur with the recommendation that flushing alone is adequate to control high lead and copper levels. EPA is requiring NAS Adak to conduct corrosion control studies. These studies need to be completed no later than June 30, 1995. We have discussed these matters with ADEC and they concur with our decision."

An Engineering Service Request (ESR) form, dated March 3, 1994 documents a request by Naval Air Facility Adak to Engineering Field Activity Northwest (EFA NW) to conduct a corrosion control study.

In 1995, the Defense Base Closure and Realignment Commission recommended that Adak be closed as a military facility. This action fundamentally changed the facility and the future of its public water system. It was not known what, if any, post-military reuse scenario for the property might emerge.

Based upon Adak's uncertain future, the Navy decided to postpone the corrosion control study. The ESR requesting the initiation of a corrosion control study was canceled on August 14, 1995. The notation on the form indicates that the study was delayed based on discussions between EFA NW and ADEC. Notes from an April 17, 1995, meeting indicated that ADEC intended to follow the general intent of the rules, but would refocus to take account of "…downsizing population and the Navy's ability to move people to other housing units."

In March 1997, Adak was closed and ceased to operate as a military facility. The population was reduced from 2,500 to less than 500 persons. The reduction in population permitted the closure of two of the three public water systems.

By May 1997, The Aleut Corporation (TAC) had expressed an interest in obtaining the facility and developing a community which would reuse portions of the base infrastructure for commercial purposes. Negotiations for a potential future property conveyance were initiated.

With the closure of Adak as a military facility, EFA Northwest assumed custody of the property for the Navy, with the responsibility for environmental restoration and disposal of Navy's interest in the property. EFA NW contacted the State Regulators and agreed to begin another round of sampling to determine if lead and copper was still an issue after the downsizing of Adak's drinking water system.

In August 1997, first-draw samples for lead and copper analysis were collected from 9 selected housing units in the Sandy Cove and Eagle Bay Housing areas as well as from the intake at Bonnie Rose dam. The results of these analyses indicated that the lead and copper concentrations at the 90th percentile did not exceed the regulatory levels. It was noted, however, that both the lead and copper action levels were exceeded in one housing unit, number Eagle Bay 323C. This unit was re-sampled because it was suspected that the unit might have been unoccupied for some time prior to sampling, thereby allowing water to remain in the pipes considerably longer than the regulated 6 to 8 hour holding time. The results of the resampling effort indicated that the lead action level was again exceeded, but that the copper concentration was below the action limit. The results of the sampling event are summarized in Table 1 and shown in their completeness in Appendix A.

In a letter dated 25 November 1997, the Caretaker Site Office (CSO) indicated to ADEC that the future status of the base was still uncertain. Turnover of the base facilities for re-use could result in a significant increase in the current base population from about 300 to several thousand, resulting in the re-occupation of many closed housing units. Under a different, but, feasible scenario, the base might be abandoned altogether. Based on these uncertainties, it was decided to further postpone corrosion control studies until more was known about the likely fate of the base. Public notices continued to be provided to all the island residents. Monitoring for lead and copper would include sampling from selected housing units on a biannual basis, with the next scheduled event set for February 1998.

In March 1998, 13 samples were collected from housing units, one from the source water. After the first-draw samples were collected, faucets were allowed to run for 30 seconds longer, an d a second set of samples were collected. The results of the analyses showed that 8 of the 13 samples contained elevated levels of lead, and 5 contained high levels of copper. The data also indicated that the metals levels decreased significantly after the faucets were allowed to run for 30 seconds. Table 1 summarizes the data, and Appendix A contains the complete analytic data.

In a letter on July 8, 1998, ADEC requested that a second set of samples be collected because the majority of samples collected were taken in vacant units.

On August 29, 1998, a second set of samples was collected from 10 housing units and 3 other locations (the medical facility, galley, and pier). After first-draw samples were collected, a second set of samples were collected after the faucets were allowed to run for 3 minutes. The results of analyses showed that copper and lead were elevated above the action levels for 6 and 5 units respectively. The data revealed that the metals levels did drop off dramatically after the 3-minute flushing. Additionally, the first-draw samples from the areas that were not in the housing units did not exceed actions levels. Table 1 summarizes the data and Appendix A shows the data in its entirety.

By mid-1999, land conveyance negotiations with TAC had proceeded to a point where there was a clear indication that TAC intended to seek conveyance of property at Adak and establish a community. Accordingly, the Navy moved ahead to obtain a corrosion control study. The contract was awarded on September 31, 1999.

The contractor conducted bench-scale treatability tests to evaluate corrosion control treatment options in addressing the problem of copper and lead in Adak's drinking water (Hart Crowser, December 2000). The objective of the test was to identify the optimal treatment option for reducing the concentration of lead and copper in Adak's drinking water. The bench-scale testing protocol conformed to the requirements and procedures mandated by 18 AAC 80. Three specific treatment methods 1) pH/alkalinity adjustment; 2) calcium hardness adjustment; and 3)corrosion inhibitor addition were used. The bench-scale study was completed by August 31, 2000. The results showed that the introduction of calcium phosphate was effective in lowering the elevated levels of lead and copper; however, it failed to lower the metals concentrations to state regulatory levels. The report indicated that the faucets within the housing units could be contributing elevated metals.

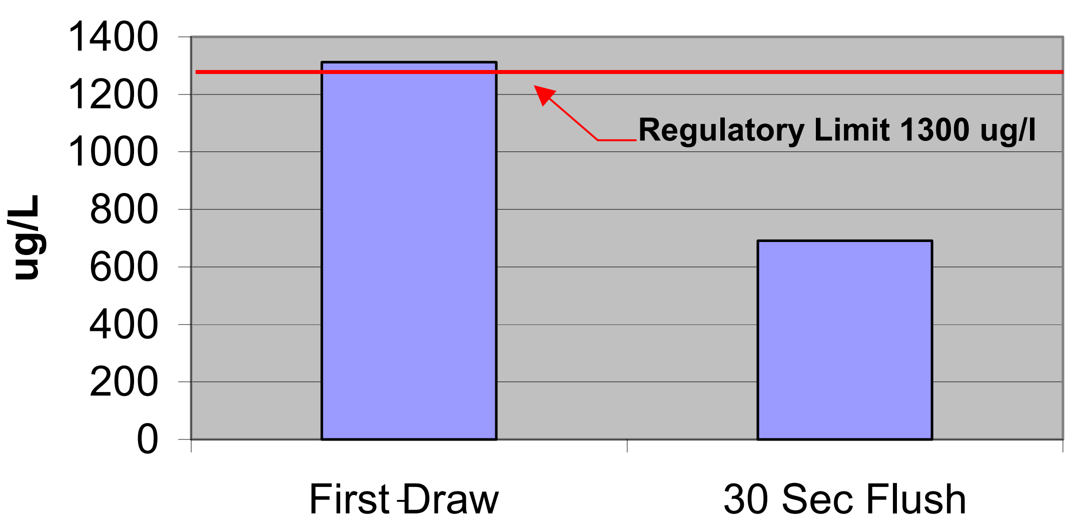
3.1 Historical Data Conclusions

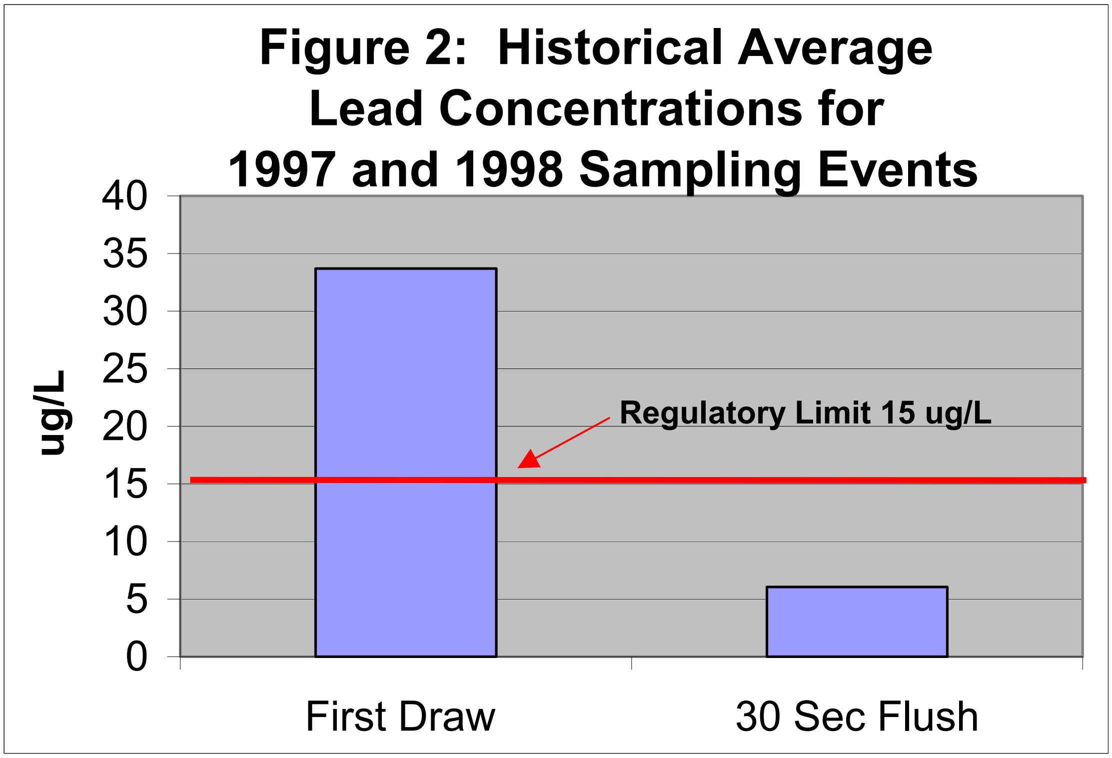
The data collected during the last two sampling events (1997 and 1998) suggest that the elevated levels of metals originate from the individual housing units themselves, and not the main distribution system. The data collected during the last two sampling events confirms this suspicion. The sampling regimen was broken into two phases, one of which measured metal concentrations from water left stagnant within the housing unit for 8 hours prior to sampling, the second of which measured water collected after the fixture was flushed for 30 to 180 seconds. This allowed the stagnant water to be removed from the piping system, and material from the mains to enter the housing unit.

The results of the sampling indicated that the stagnant water would leach metal from the plumbing system and yield elevated levels of both lead and copper. Once the stagnant water was flushed from the system, the concentration of metals would drop below regulatory levels.

The two figures below show the average lead and copper concentrations that were recorded during the two separate sampling events conducted in 1997 and 1998.

Figure 1: Historical Average Copper Concentrations for 1997 and 1998 Sampling Events





As the two figures illustrate, the water leaches metal from the plumbing system if it is left standing in the interior piping for a period of time. Based only on the historical data collected prior to this faucet study, it was unknown if the source of the metal was the faucets, the internal plumbing system, or a combination of the two.

4.0 PURPOSE AND METHODOLOGY

The purpose of the faucet replacement study was to determine if the source of the metal leaching into the water system originated from faucets. The analytical results of the sampling regiment were used to determine if the faucets were contributing to the problem, and secondarily, if their replacement would improve the water quality for the consumers.

The study was conducted in two distinct phases. The first phase involved the establishment of a water quality baseline by collecting first draw samples from units within the Sandy Cove Housing area. The samples were collected from this area because this site contains the only currently occupied units and is the only residential area scheduled to be used in the foreseeable future. After the samples from the first phase of the study were analyzed, select sets of housing units were used for the second phase of the study, which involved faucet replacement in both kitchen and bathroom sinks. After faucets were replaced in these units a series of water samples were collected to test for the presence of lead and copper.

A detailed description of the two phases is provided in the following sections.

4.1 Phase I: Baseline Sampling

A total of 16 housing units within the Sandy Cover Housing Area were chosen to provide water samples to be used for testing for the presence of lead and copper. EPA protocol was implemented which allows the water to reside within the units for 8 hours undisturbed. Prior to allowing the water to stand undisturbed, the plumbing system was flushed for 15 minutes from every fixture within the housing unit. Lead and copper samples were collected from both the kitchen and bathroom fixtures after the 8-hour contact period.

The housing units selected for the baseline sampling study were chosen based upon historical analytical data collected over the past decade. Preferences for sampling was based upon the following preferences:

- 1st Preference: Housing units exhibiting elevated levels of lead and copper.
- 2nd Preference: Housing units exhibiting elevated levels of lead.
- 3rd Preference: Housing units exhibiting elevated levels of copper.
- 4th Preference: Housing units in close proximity to units that historically exhibited elevated levels of lead and/or copper.
- 5th Preference: Housing units that were vacant during the time of the study so as to gain complete access and control the unit.

Two additional samples were also collected from areas outside the residential area. These samples were taken from water faucets in the High School and water faucets in the Airport Terminal.

Housing units selected for the sampling are listed in the table below:

Table 2 Phase I: Sampling Locations	
SAMPLE NUMBER	SAMPLE LOCATION
ELEVATED LEVELS OF LEAD AND COPPER	
1	112 C Sandy Cove
2	125 B Sandy Cove
3	177A Sandy Cove
ELEVATED LEVELS OF LEAD	
4	108 A Sandy Cove
5	136 D Sandy Cove
6	126 B Sandy Cove
7	142 D Sandy Cove
8	173 B Sandy Cove
ELEVATED LEVELS OF COPPER	
9	139 A Sandy Cove
10	162 D Sandy Cove
11	184 D Sandy Cove
12	188 B Sandy Cove
UNITS IN CLOSE PROXIMITY TO AREAS WITH HIGH METAL READINGS	
13	112 A Sandy Cove
14	168 A Sandy Cove
VACANT HOUSING UNITS	
15	139 B Sandy Cove
16	182 D Sandy Cove
UNITS OUTSIDE THE HOUSING AREA	
17	High School Water Fountain
18	Airport Terminal Water Fountain

Once the initial sampling sites were located, the housing units had their lines flushed. All faucets (including hose bibs) were opened and allowed to run for 15 minutes. The water was then allowed to stand within the units for 8 hours while the house was heated to an average temperature of 65°F. A first draw sample was then collected after the 8-hour time period. Samples were collected from the kitchen and bathroom fixtures of each housing unit.

Samples from water fountains from the High School and the Airport Terminal were also collected using EPA protocol. The water was allowed to reside undisturbed within the water coolers for 8 hours. A first-draw sample was collected from each of the coolers after the time period expired.

All collected samples were analyzed for lead and copper by CT & E Environmental Services, Inc, which is a certified laboratory in the State of Alaska.

4.2 Phase II: Faucet Replacement and Water Sampling

The data from the first phase of the study was evaluated to determine which units would be included in the second phase of the study. The goal was to choose 10 housing units that exhibited elevated levels of metals. The units were chosen based upon the following criteria:

- 1st Preference: Housing units that exhibited elevated levels of lead and copper.
- 2nd Preference: Housing units that exhibited elevated levels of lead.
- 3rd Preference: Housing units that exhibited elevated levels of copper.
- 4th Preference: Housing units that are in close proximity to units that historically exhibited elevated levels of lead and/or copper.

A list of the housing units that were selected for the second phase of the study is shown below:

Table 3: Phase II Sampling Locations

SAMPLE NUMBER	SAMPLE LOCATION	RESIDENTAL STATUS
1	108 A Sandy Cove	Active: Hotel
2	112 A Sandy Cove	Active: Residential
3	125 B Sandy Cove	Inactive
4	139 B Sandy Cove	Inactive
5	142 D Sandy Cove	Active: Hotel
6	162 D Sandy Cove	Inactive
7	168 A Sandy Cove	Inactive
8	182 D Sandy Cove	Inactive
9	184 D Sandy Cove	Inactive
10	188 B Sandy Cove	Inactive

The housing units chosen for the study were brought to the same status as residential homes on Adak. The units were all heated to an ambient temperature of 65° F during the sample collection periods.

Two sets of samples were collected from each housing unit. The first set of samples was collected from the kitchen faucet. The second set was collected from the bathroom fixture. All samples were analyzed for both lead and copper concentrations.

Prior to sampling, each unit's plumbing was flushed to clear the piping of residual water. The flushing operation involved opening each faucet and hose bib, and letting the fixture run for 15 minutes.

Each set of samples was collected after allowing the water to be undisturbed within the housing unit for a prescribed period of time. The time periods that the water was allowed to remain standing were defined in groups of 8, 24 and 72 hours.

The procedure used for sample collection is described in the text below:

SAMPLE COLLECTION PROCEDURES

1. The housing unit's plumbing system shall be flushed.
    a. Each fixture, including hose bibbs shall be opened for 15 minutes.
2. The water within the housing unit shall remain stagnant for an established period of time (i.e. 8 hours).
3. After the prescribed time period has elapsed, a first draw sample measuring one liter shall be collected from both the kitchen and bathroom fixtures.
4. The housing unit's plumbing system shall again be flushed.
5. The water within the housing unit shall remain stagnant for a longer established period of time (i.e. 24 hours).
6. Repeat steps 3-5, with increasingly hourly increments up to a total of 72 hours.

5.0 SAMPLING RESULTS

Sample result from Phase I and II are described in the following sections. A summary of the data and graphical representation of the data is provided in the following tables and figures.

5.1 Phase I Sampling Results

A total of 16 housing units were sampled from the Sandy Cove Housing Area. The analytical data showed that lead and copper were present in concentrations above the regulatory limits of 15 and 1300 ug/L, respectively. Copper concentrations were recorded in the range of 1380 to 7380 ug/L, with an average of 3061 ug/L. Lead concentrations were recorded in the range of 10.4 to 5690 ug/L, with an average of 334 ug/L.

The data was fairly consistent and followed an overall trend, of increasing metal concentration directly proportional to time left undisturbed in the piping. The only anomaly was the data collected from Housing Unit 162D. The measured value for both lead and copper in this unit did not follow the overall trend of the sampling data. Lead concentrations were measured to be 5690 ug/L, which was significantly higher than the other units. Similarly, the result for copper was found to be 7380 ug/L, which was much higher than the other units. It is not known if the cause of the unusually high readings was due to a laboratory or sampling error. The high result may be an artifact of the unit being inactive for a considerable amount of time, thus allowing the water to leach a considerable amount of material from the piping system. The hydraulic action of flushing the system for 15 minutes may have loosened the particulate matter within the piping system. Subsequently, flakes of piping material may have been captured in the sampling containers yielding unusually high readings.

The table below presents the data analyzed by the laboratory. Graphical displays of the analytical results are presented in Appendix B.

Table 4: Phase I Sampling Results			
Housing Unit	**Sample Location**	**Copper ug/L**	**Lead ug/L**
SC108A	Kitchen	4170	210
SC108A	Master Bedroom	4260	76.5
SC112A	Kitchen	3290	184
SC112A	Master Bedroom	2840	102
SC112C	Kitchen	1730	64.2
SC112C	Master Bedroom	2080	100
SC126B	Kitchen	2050	33.9
SC126B	Master Bedroom	1820	27.2
SC136D	Kitchen	4430	161
SC136D	Master Bedroom	2830	85
SC139A	Kitchen	3530	10.4
SC139A	Master Bedroom	3910	17
SC139B	Kitchen	1970	16.9
SC139B	Master Bedroom	1540	55.5
SC142D	Kitchen	2640	150
SC142D	Master Bedroom	2990	43.5
SC177A	Kitchen	2490	19.7
SC177A	Master Bedroom	2660	79.4
SC182D	Kitchen	4260	399
SC182D	Master Bedroom	3110	197
SC188B	Kitchen	3950	217
SC188B	Master Bedroom	4670	269
SC184D	Kitchen	3040	195
SC184D	Master Bedroom	2830	290
SC125B	Kitchen	2170	79.4
SC125B	Kitchen	2120	65.9
SC125B	Master Bedroom	2290	59.9
SC125B	Master Bedroom	2270	68.6
SC162D	Kitchen	7380	1360
SC162D	Master Bedroom	6400	5690
SC168A	Kitchen	9080	265
SC168A	Master Bedroom	2060	137
SC173B	Kitchen	1380	124
SC173B	Master Bedroom	1840	429
	Average:	**3238**	**332**
	Median:	**2830**	**100**
	Standard Deviation:	**1680**	**976**
	Regulatory Limits	**1300**	**15**

SC Sandy Cove

5.2 Phase II Sampling Results

A total of 10 housing units were sampled from the Sandy Cove Housing Area. First draw samples were collected from the kitchen and bathroom fixtures and analyzed for both lead and copper concentrations. The fixtures from 9 housing units were all replaced. The only unit that was not replaced with new fixtures was 125B, which was used as the control for the study.

Two sets of samples were collected from each housing unit. The first set of samples was collected from the kitchen faucet. The second set was collected from the bathroom fixture. All samples were analyzed for both lead and copper concentrations. Prior to sampling, each unit's plumbing was flushed for 15 minutes to ensure standing water was cleared from the piping prior to sampling.

Each set of samples was collected after allowing the water to be undisturbed within the housing unit for a prescribed period of time. The time periods that the water was allowed to stand were defined groups of 8, 24 and 72 hours.

The analytical data showed that replacing fixtures did lower lead and copper concentrations. Again, the overall trend indicated that the longer the water was allowed to be in contact with metal, the higher the concentrations of lead and copper. Additionally, vacant housing units exhibited unusually high concentrations of the metals even after the plumbing system was flushed for 15 minutes. The next three sections describe the results from samples collected after each of the three time periods that the water was allowed remain in contact with the system.

5.2.1 Eight-Hour Contact Period

In this first round of sampling, the units were first flushed for 15 minutes and then left undisturbed for 8 hours prior to collecting a first draw sample.

The analytical data showed that lead and copper levels were lower than that of the samples collected in Phase I of the study. Copper concentrations were recorded in the range of 664 to 2530 ug/L, with an average of 1379 ug/L. Lead concentrations were recorded in the range of 8 to 171 ug/L, with an average of 64 ug/L.

The data was consistent and followed an overall pattern, which clearly indicates that replacing the fixtures with non copper and lead faucets removes a substantial source of metal substrate susceptible to leaching. The only anomalies were found in the data collected from Housing Units 168A and 184D . The measured values for both lead and copper were much higher, and did not follow the overall pattern of the sampling data. Lead concentrations for housing unit 184D were measured to be 171 ug/L, which was much higher than readings from the other units. Similarly, the result for copper in Housing Unit 168A was found to be 2530 ug/L, which was much higher than the results from the other units. It is not known if the cause of the high readings was due to laboratory or sampling error. The high result may be an artifact of the unit being inactive for a considerable amount of time thus allowing the water the opportunity to leach a considerable amount of material from the piping system. The hydraulic action of flushing the system for 15 minutes may have loosened the particulate matter within the piping system. Subsequently, flakes of piping material may have been captured in the sampling containers yielding unusually high readings.

Table 5: Phase II Sampling Results
8-Hour Contact Period

Housing Unit	Sampling Location	Copper	Lead
SC108 A	Kitchen	1740	49.6
SC108 A	Bathroom	1850	80
SC112 A	Kitchen	1180	36.3
SC112 A	Bathroom	1610	56.1
SC125 B	Kitchen	1240	99
SC125 B	Bathroom	1880	26.3
SC139B	Kitchen	664	91.7
SC139B	Bathroom	820	39.1
SC142D	Kitchen	1120	42.4
SC142D	Bathroom	923	23.5
SC162D	Kitchen	1250	96
SC162D	Bathroom	912	96
SC168A	Kitchen	1020	8.29
SC168A	Bathroom	2530	98
SC182D	Kitchen	1080	44.5
SC182D	Bathroom	1290	52.8
SC184D	Kitchen	1810	50.9
SC184D	Bathroom	2030	171
SC188B	Kitchen	1250	50.2
SC188B	Bathroom	1390	65.1
	Average:	**1379**	**64**
	Median:	**1250**	**52**
	Standard Deviation:	**472**	**37**
	Regulatory Limits	**1300**	**15**

SC-Sandy Cove

5.2.2 Twenty-Four Hour Contact Period

The 24-hour contact period samples were collected from the same 10 housing units used for the 8 hour contact samples. After the 8-hour contact period, samples were collected after the units plumbing was flushed for 15 minutes, then left undisturbed for 24 hours prior to collecting a first draw sample.

The analytical data showed that lead and copper levels did increase compared to the values collected during the 8-hour contact period. Copper concentrations were recorded in the range of 709 to 3510 ug/L, with an average of 1802 ug/L. Lead concentrations were recorded in the range of 17.7 to 236 ug/L, with an average of 64 ug/L.

The data was consistent and followed an overall trend. The trend noted was increased metal concentration with increased contact time. The anomalies that were encountered were found from Housing Units 162D, 168A, 182D and 184D. The measured values for both lead and copper were much higher and did not follow the overall trend of the sampling data. Copper concentrations for Housing Units 162D, 168A and 182D were measured to be in the range of 3500 ug/L, which was much higher than the other units. Similarly, the result for lead in Housing Units 168A and 184D was found to be as high as 236 ug/L, which was much higher than that of the other units. It is not known if the cause of the high readings was due to laboratory or sampling error. The high result may be an artifact of the unit being inactive for a considerable amount of time thus allowing the water the opportunity to leach a considerable amount of material from the piping system. The hydraulic action of flushing the system for 15 minutes may have loosened the particular matter within the piping system. Flakes of piping material may have been captured in the sampling containers yielding unusually high readings.

The analytical results for the samples collected after the water was allowed to be stagnant for 72 hours within the housing units are shown in the table below.

Table 6: Phase II Sampling Results 24-Hour Contact Time			
Housing Unit	**Sampling Location**	**Copper ug/L**	**Lead ug/L**
SC108 A	Kitchen	1510	33.8
SC108 A	Bathroom	1580	52.1
SC112 A	Kitchen	1260	47.9
SC112 A	Bathroom	1640	64.1
SC125 B	Kitchen	1920	17.7
SC125 B	Bathroom	1680	125
SC139B	Kitchen	709	55.3
SC139B	Bathroom	716	45
SC142D	Kitchen	947	59.8
SC142D	Bathroom	1140	34
SC162D	Kitchen	3510	87.6
SC162D	Bathroom	1090	48.2
SC168A	Kitchen	1390	40.7
SC168A	Bathroom	3460	203
SC182D	Kitchen	3510	87.6
SC182D	Bathroom	1090	48.2
SC184D	Kitchen	2160	54.2
SC184D	Bathroom	2650	236
SC188B	Kitchen	1960	56.3
SC188B	Bathroom	2120	121
	Average:	**1802**	**76**
	Median:	**1610**	**55**
	Standard Deviation:	**882**	**56**
	Regulatory Limits	**1300**	**15**

5.2.3 Seventy-two Hour Contact Period

The 72-hour contact period samples were collected from the same 10 housing units used for the 8 hour contact samples. After the 8-hour contact period, samples were collected after the units plumbing was flushed for 15 minutes, then left undisturbed for 72 hours prior to collecting a first draw sample.

The analytical data showed that lead and copper levels did increase in values compared to the values collected during the 24-hour contact period. Copper concentrations were recorded in the range of 658 to 11,100 ug/L, with an average of 2044 ug/L. Lead concentrations were recorded in the range of 23 to 500 ug/L, with an average of 121 ug/L.

The data was consistent and followed the overall trend, which instilled confidence that lead and copper concentrations would increase given the additional contact period. The anomaly that was encountered was found from Housing Unit 168A. The measured values for both lead and copper were much higher and did not follow the overall trend of the sampling data. Copper concentrations for the unit were measured to be 11,100, which were orders of magnitude higher than the other units. Similarly, the results for lead in the unit were found to be as high as 500 ug/L, which was much higher than the other units. It is not known if the cause of the high readings was due to laboratory or sampling error. The high result may be an artifact of the unit being inactive for a considerable amount of time thus allowing the water the opportunity to leach a considerable amount of material from the piping system. The hydraulic action of flushing the system for 15 minutes may have loosened the particulate matter within the piping system. Flakes of piping material may have been captured in the sampling containers yielding unusually high readings.

The analytical results for the samples collected after the water was allowed to be stagnant for 72 hours within the housing units are shown in the table below.

Table 7: Phase II Sampling Results
72-Hour Contact Period

Housing Unit	Sampling Location	Copper	Lead
SC108 A	Kitchen	1350	61.6
SC108 A	Bathroom	1350	64.8
SC112 A	Kitchen	1740	331
SC112 A	Bathroom	1480	72.4
SC125 B	Kitchen	1210	64.8
SC125 B	Bathroom	1570	185
SC139B	Kitchen	658	149
SC139B	Bathroom	777	83.6
SC142D	Kitchen	1380	70.7
SC142D	Bathroom	1370	75.6
SC162D	Kitchen	1320	25.8
SC162D	Bathroom	2350	83.7
SC168A	Kitchen	1810	136
SC168A	Bathroom	11100	500
SC182D	Kitchen	1190	22.6
SC182D	Bathroom	1470	42.5
SC184D	Kitchen	2480	84.4
SC184D	Bathroom	2550	201
SC188B	Kitchen	2010	63.8
SC188B	Bathroom	1720	106
	Average:	**2044**	**121**
	Median:	**1480**	**84**
	Standard Deviation:	**2085**	**109**
	Regulatory Limits	**1300**	**15**

6.0 CONCLUSIONS

The analytical data clearly shows that replacing the existing fixtures had a positive effect upon the water quality within the residential housing units. Both lead and copper concentrations were reduced subsequent to faucet replacement. The overall reduction of lead and copper levels was found to be 86% and 67%, respectively. Appendix B includes a graphical representation of the sampling results from each housing unit.

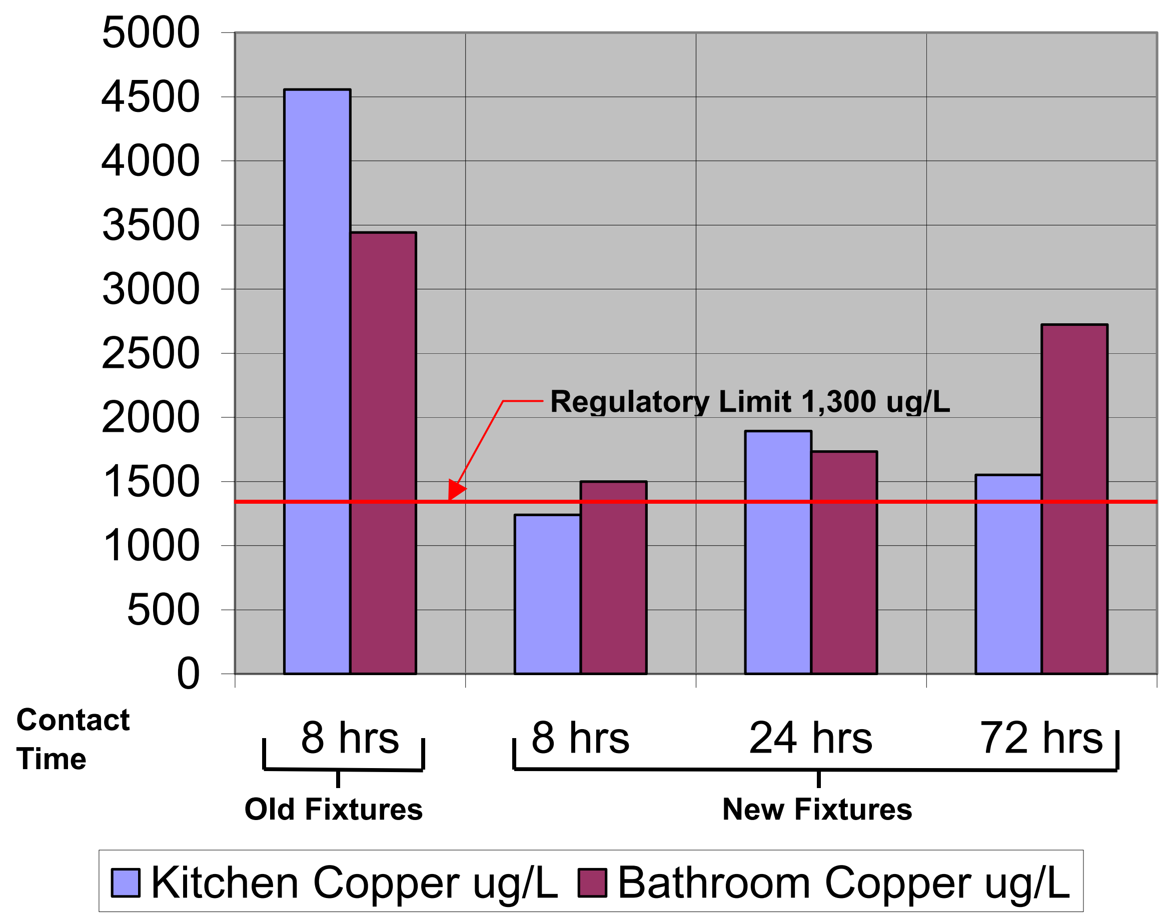
The reduction of metals was significant, but resultant concentrations were still above State regulatory limits for both lead and copper. This would indicate that the water is leaching metal from another additional source, which is most likely the internal plumbing system.

Figures 3 and 4 illustrate the average copper and lead reductions over the prescribed contact time period.

The data analyzed from the housing units that were unoccupied showed high levels of both lead and copper. Even after the unit's plumbing system was flushed for 15 minutes, there were still significant amounts of metal detected that has leached into the water. The hydraulic action of flushing the system for 15 minutes may have loosened the particular matter within the piping system. If metal flakes were collected in the one-liter water sample, acid digestion of this particulate matter prior to analysis may have produced artificially elevated results.

It should be noted that the overall effectiveness of replacing fixtures would probably be higher than is reported in this document, due to the conservative nature of the sampling site selection. The selection of sampling sites was based upon areas that historically exhibited elevated levels of lead and copper. Therefore, the study may have a bias toward the high end of possible analytical results. If the units were selected from a random basis, the results may have exhibited a wider range of analytical results, with more of the reported results falling within the limits of regulatory compliance.

Figure 3: Average Copper Concentrations



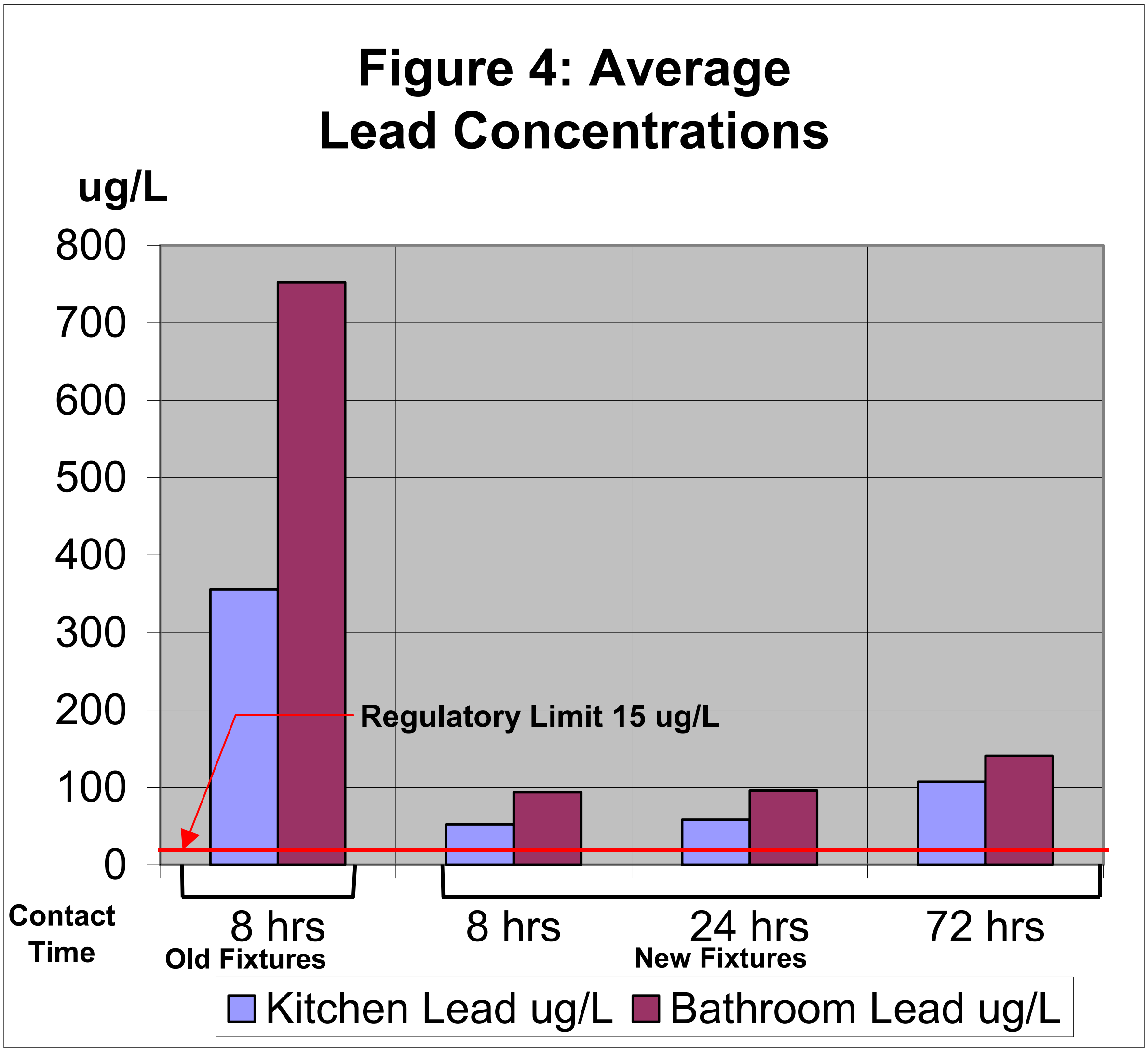


Figure 4: Average
Lead Concentrations
ug/L
800
700
600
500
400
300
200
100
0
Regulatory Limit 15 ug/L
Contact
Time
8 hrs
Old Fixtures
8 hrs
24 hrs
72 hrs
New Fixtures
Kitchen Lead ug/L
Bathroom Lead ug/L

7.0 RECOMMENDATIONS

Based upon the analytical data collected in this study it is clear that replacing the bathroom and kitchen fixtures had a dramatic effect upon the water quality within the individual housing units. The overall reduction of lead and copper was found to be 86% and 67%, respectively. The reduction of metals was significant, but the faucet replacement alone was not sufficient to consistently meet the regulatory limits for both lead and copper.

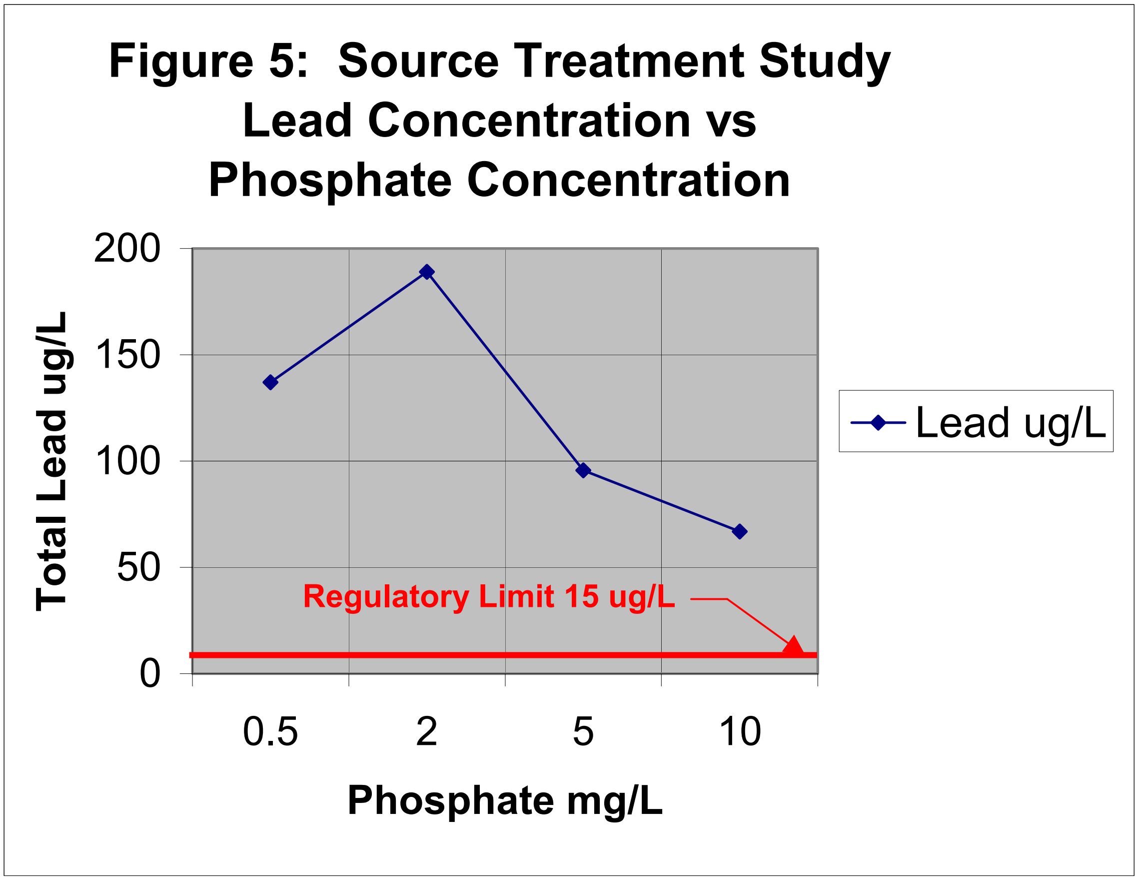
The corrosion control study performed in 2000 showed that installing a source treatment system does not reduce analytical results to compliance levels. That report concluded that the introduction of calcium phosphate was the most effective source treatment option for the site conditions on Adak. In the laboratory test calcium phosphate was found to lower concentrations of lead by 80%, however it was unable to meet the regulatory limit of 15 ug/L. Figure 5 displays the reduction of lead concentration with the introduction of phosphate.

The data from both the corrosion control study and the faucet study shows that each method has some effect in reducing metal concentrations. However, it is not known whether calcium phosphate treatment will work as effectively in Adak's distribution system as in a laboratory environment under controlled conditions. The results of the faucet replacements possess a higher degree of certainty since the data was collected directly from Adak's housing units.

Based upon the supporting data, it is recommended that the fixtures from each Sandy Cove housing unit be replaced. This will remove from service a primary source of lead and copper, thus significantly reducing the concentration of the metals in the drinking water. This passive alternative would be preferable to installing a source treatment system for the following reasons:

- faucet replacement was more effective than any active source treatment system, and it is unknown whether any active source treatment system would truly be as effective in the field as the bench studies conducted under controlled laboratory conditions
- Faucet replacement will be effective immediately, and it will take approximately 6-9 months for the chemical in a source treatment alternative to have the opportunity to be effective in forming a coating over the piping material.
- The capital cost for replacing faucets would only involve the installation, shipping, and procurement of the fixtures. Estimated cost $350,000 for all Sandy Cove Housing Units. Initial installation of source treatment is estimated at $350,000.
- Additional certification and training for the future water operators would be required for a source treatment alternative, but not for faucet replacement because the water system would not be modified.

- Source treatment would require continuing operations and maintenance costs for the future water system operator.



8.0 REFERENCES

The following references were used in the preparation of this report:

a) Hart Crowser, Corrosion Control Study Report Public Water System No: 260595 Former Naval Air Facility Adak, Alaska, December 19, 2000.

b) Hart Crowser, Corrosion Control Study Report Addendum Pipe Loop Study, Adak, Alaska, September 27, 2000.

c) Alaska Department of Environmental Conservation, 18 Alaska Administrative Code 80.

d) Environmental Protection Agency, Code of Federal Regulations, 40 CFR 141 and 143 (26 October 1999).

APPENDIX A

PAST ANALYTICAL DATA

Table 1 March 31, 1993 Data			
Num	**Sampling Location**	**Copper**	**Lead**
1	133C Sandy Cove	0.59	0.006
2	134D Sandy Cove	0.721	0.006
3	218A Moffett View	0.735	0.05
4	332D Eagle Bay	0.787	0.041
5	315D Eagle Bay	0.833	0.01
6	201B Moffett View	0.844	0.023
7	182D Sandy Cove	0.868	0.013
8	308D Eagle Bay	0.923	0.01
9	219A Moffett View	0.926	0.01
10	216D Moffett View	0.931	0.008
11	332A Eagle Bay	0.998	0.002
12	217A Moffett View	1.01	0.029
13	329B Eagle Bay	1.01	0.019
14	209B Moffett View	1.05	0.009
15	148B Sandy Cove	1.09	0.009
16	173B Sandy Cove	1.09	0.001
17	306C Eagle Bay	1.12	0.034
18	206B Moffett View	1.12	0.016
19	111B Sandy Cove	1.13	0.024
20	212A Moffett View	1.13	0.012
21	205B Moffett View	1.14	0.021
22	201D Moffett View	1.18	0.055
23	205A Moffett View	1.19	0.028
24	333A Eagle Bay	1.2	0.015
25	134B Sandy Cove	1.21	0.013
26	317B Eagle Bay	1.23	0.001
27	319C Eagle Bay	1.25	0.019
28	184D Sandy Cove	1.33	0.013
29	310A Eagle Bay	1.33	0.041
30	323C Eagle Bay	1.35	0.014
31	136D Sandy Cove	1.35	0.014
32	188B Sandy Cove	1.36	0.013
33	325C Eagle Bay	1.37	0.045
34	322D Eagle Bay	1.45	0.025
35	125B Sandy Cove	1.47	0.016
36	201C Moffett View	1.47	0.017
37	210A Moffett View	1.47	0.034
38	125B Sandy Cove	1.56	0.016
39	174B Sandy Cove	1.8	0.034
40	177A Sandy Cove	1.82	0.054

12 samples above MCL for copper; 18 samples above MCL for lead

Table 2 July 6, 1993 Data			
Num	Sampling Location	Copper	Lead
1	N205B Moffett View	0.47	0.005
2	N205B Moffett View	0.078	0.005
3	N205B Moffett View	0.075	0.005
4	E178A Roberts Kitchen	0.22	0.005
5	E198A Roberts Kitchen	0.2	0.005
6	E176B Roberts Kitchen	0.1	0.005
7	D61B Middle Amulet Kitchen	0.46	0.005
8	Birchwood North End	1.1	0.005
9	Birchwood Kitchen	0.33	0.005
10	High School Life Guard Restroom	1.3	0.005
11	High School Nurse's Kitchen	1.2	0.005
12	High School Kitchen	1.3	0.005
13	#4 Bering Bathroom	0.25	0.005
14	#7 Bering Bathroom	2.1	0.005
15	E261A Kuluk Kitchen	0.5	0.005
16	E253B Kuluk Kitchen	0.41	0.005
17	E221A Kuluk Kitchen	0.58	0.005
18	B6C Bayshore Kitchen	0.14	0.005
19	AIMD Deep Sink	0.32	0.0053
20	07B Turnkey Kitchen	0.32	0.0063
21	VP Hanger Male Restroom	0.1	0.0064
22	#6 Bering Bathroom	0.43	0.0068
23	Child Care Kitchen	0.83	0.0072
24	Child Care Bathroom	0.5	0.0073
25	#9 Bering Kitchen	0.13	0.0087
26	067A Turney Kitchen	0.46	0.0087
27	Birchwood South End	1.3	0.0092
28	AIMD Restroom	1.2	0.0094
29	E295E Artic Acres Kitchen	0.99	0.0095
30	E296B Artic Acres Kitchen	0.56	0.0098
31	072A Turney Kitchen	0.2	0.014
32	VP Hanger Female Restroom	1	0.014
33	Child Care Annex Water Fountain	1	0.015
34	E299E Artic Acres	0.23	0.025
35	#1 N205B Moffett View First Draw	0.79	0.027
36	Child Care Annex Caribou Water Fountain	1.1	0.042
37	MAC Terminal Deep Sink	0.55	0.043
38	Elementary School Kitchen	1.4	0.066
39	Elementary School Nurses' Kitchen	4.4	0.11
40	Elementary School Room #10	4.4	0.25

4 samples above MCL for Cu. 7 samples above MCL for Pb.

Table 3 September 3, 1993 Data			
Num	Sampling Location	Copper	Lead
1	212A Moffett View	0.108	0.002
2	104A Sandy Cove	0.131	0.002
3	218A Moffett View	0.137	0.002
4	134D Sandy Cove	0.331	0.003
5	329B Eagle Bay	0.335	0.008
6	173B Sandy cove	0.562	0.013
7	310C Sandy Cove	0.603	0.012
8	168A Sandy Cove	0.636	0.004
9	201D Moffett View	0.662	0.025
10	217A Moffett View	0.682	0.018
11	219A Moffett View	0.686	0.009
12	322D Eagle Bay	0.728	0.017
13	332D Eagle Bay	0.781	0.023
14	332A Eagle Bay	0.781	0.011
15	216D Moffett View	0.84	0.005
16	308D Eagle Bay	0.806	0.01
17	177A Sandy Cove	0.866	0.024
18	134B Sandy Cove	0.874	0.01
19	317B Eagle Bay	0.894	0.007
20	133C Sandy Cove	0.896	0.011
21	209A Moffett View	0.916	0.007
22	208B Moffett View	0.939	0.022
23	301A Eagle Bay	0.946	0.019
24	148B Sandy Cove	0.948	0.007
25	174B Sandy Cove	0.948	0.015
26	331B Eagle Bay	0.95	0.01
27	333A Eagle Bay	0.954	0.008
28	325C Eagle Bay	0.956	0.03
29	130A Sandy Cove	0.999	0.009
30	125B Sandy Cove	1.05	0.01
31	126B Sandy Cove	1.07	0.027
32	201C Moffett View	1.08	0.016
33	310A Eagle Bay	1.08	0.027
34	142D Sandy Cove	1.08	0.016
35	136D Sandy Cove	1.09	0.01
36	205A Moffett View	1.1	0.028
37	210D Moffett View	1.1	0.014
38	325B Eagle Bay	1.16	0.043
39	211B Moffett View	1.2	0.012
40	N205B Moffett View	1.36	0.011

1 samples above MCL for Cu. 13 samples above MCL for Pb.

Table 4 March 31, 1993 Data			
Num	**Sampling Location**	**Copper**	**Lead**
1	133C Sandy Cove	0.59	0.006
2	134D Sandy Cove	0.721	0.006
3	218A Moffett View	0.735	0.05
4	332D Eagle Bay	0.787	0.041
5	315D Eagle Bay	0.833	0.01
6	201B Moffett View	0.844	0.023
7	182D Sandy Cove	0.868	0.013
8	308D Eagle Bay	0.923	0.01
9	219A Moffett View	0.926	0.01
10	216D Moffett View	0.931	0.008
11	332A Eagle Bay	0.998	0.002
12	217A Moffett View	1.01	0.029
13	329B Eagle Bay	1.01	0.019
14	209B Moffett View	1.05	0.009
15	148B Sandy Cove	1.09	0.009
16	173B Sandy Cove	1.09	0.001
17	306C Eagle Bay	1.12	0.034
18	206B Moffett View	1.12	0.016
19	111B Sandy Cove	1.13	0.024
20	212A Moffett View	1.13	0.012
21	205B Moffett View	1.14	0.021
22	201D Moffett View	1.18	0.055
23	205A Moffett View	1.19	0.028
24	333A Eagle Bay	1.2	0.015
25	134B Sandy Cove	1.21	0.013
26	317B Eagle Bay	1.23	0.001
27	319C Eagle Bay	1.25	0.019
28	184D Sandy Cove	1.33	0.013
29	310A Eagle Bay	1.33	0.041
30	323C Eagle Bay	1.35	0.014
31	136D Sandy Cove	1.35	0.014
32	188B Sandy Cove	1.36	0.013
33	325C Eagle Bay	1.37	0.045
34	322D Eagle Bay	1.45	0.025
35	125B Sandy Cove	1.47	0.016
36	201C Moffett View	1.47	0.017
37	210A Moffett View	1.47	0.034
38	125B Sandy Cove	1.56	0.016
39	174B Sandy Cove	1.8	0.034
40	177A Sandy Cove	1.82	0.054

12 samples above MCL for Cu. 18 samples above MCL for Pb.

Table 5 January 1994 Data			
Num	Sampling Location	Copper	Lead
1	209 A Moffett View	0.185	< MDL
2	325 B Eagle Bay	0.22	0.002
3	168 A Sandy Cove	0.335	<MDL
4	310 C Eagle Bay	0.673	0.01
5	173 B Sandy Cove	0.748	0.007
6	332 D Eagle Bay	0.788	0.01
7	134 D Sandy Cove	0.841	0.006
8	308 D Eagle Bay	0.944	0.013
9	219 A Moffett View	0.953	0.006
10	134 B Sandy Cove	1.12	0.008
11	125 B Eagle Bay	1.14	0.007
12	215 A Moffett View	1.26	0.011
13	311 A Eagle Bay	1.27	0.015
14	332 A Eagle Bay	1.28	0.014
15	216 D Moffet View	1.28	0.006
16	177 A Sandy Cove	1.38	0.021
17	322 D Eagle Bay	1.44	0.022
18	315 D Eagle Bay	1.45	0.008
19	331 B Eagle Bay	1.48	0.011
20	301 A Eagle Bay	1.53	0.019
21	205 A Moffet View	1.55	0.026
22	201 D Moffett View	1.56	0.03
23	208 B Moffett View	1.58	0.033
24	139 A Sandy Cove	1.6	0.012
25	133 C Sandy Cove	1.6	0.012
26	216 B Moffett View	1.64	0.007
27	130 A Sandy Cove	1.67	0.011
28	136 D Sandy Cove	1.68	0.012
29	304 C Eagle Bay	1.7	0.068
30	218 A Moffett View	1.84	0.047
31	210 D Moffet View	1.85	0.014
32	217 D Moffet View	1.91	0.016
33	314 B Eagle Bay	1.96	0.057
34	112 D Sandy Cove	1.99	0.029
35	162 D Sandy Cove	2.04	0.013
36	323 C Eagle Bay	2.11	0.01

20 samples above MCL for Cu. 11 samples above MCL for Pb.

Table 6 August 29, 1997 Data			
Num	Sampling Location	Copper	Lead
1	Bonnie Rose	0.02	<MDL
2	301A Eagle Bay	0.119	0.002
3	311A Eagle Bay	0.113	0.003
4	112D Sandy Cove	0.796	0.015
5	130A Sandy Cove	0.095	0.004
6	136D Sandy Cove	0.072	0.004
7	134D Sandy Cove	0.086	<MDL
8	173B Sandy Cove	0.084	<MDL
9	322D Eagle Bay	1.3	0.012
10	323C Eagle Bay	1.48	0.021

20 samples above MCL for Cu. 11 samples above MCL for Pb.

Table 7August 29, 1997 Data				
Num	Sampling Location	Copper	Lead	Comments
1	104A	0.808	0.0092	1st draw
2	104A	0.0491	0.005	3 min run
3	167B Sandy Cove	1.23	0.0066	1st draw
4	167B Sandy Cove	0.148	0.005	3 min run
5	181D	1.4	0.0152	1st draw
6	181D	0.92	0.005	3 min run
7	Medical	0.947	0.005	1st draw
8	Medical	0.47	0.005	3 min run
9	Galley	0.991	0.005	1st draw
10	Galley	0.107	0.005	3 min run
11	Pier	0.0135	0.005	1st draw
12	Pier	0.01	0.005	3 min run
13	111C Sandy Cove	1.07	0.0133	1st draw
14	111C Sandy Cove	0.0782	0.005	3 min run
15	184A Sandy Cove	1.54	0.005	1st draw
16	184A Sandy Cove	0.0598	0.005	3 min run
17	112C	1.54	0.0505	1st draw
18	112C	0.0706	0.005	3 min run
19	163C	1.88	0.046	1st draw
20	163C	0.111	0.005	3 min run
21	126A Sandy Cove	1.49	0.0148	1st draw
22	126A Sandy Cove	0.0991	0.005	3 min run
23	108A	1.15	0.0183	1st draw
24	108A	0.124	0.005	3 min run
25	113D	1.58	0.0114	1st draw
26	113D	0.124	0.005	3 min run

20 samples above MCL for Cu. 11 samples above MCL for Pb.

Table 8 March 31, 1998				
Num	**Sampling Location**	**Copper**	**Lead**	**Comments**
1	Bonnie Rose	<MRL	<MRL	
2	Eagle Bay 323C	0.799	0.111	1st draw
3	Eagle Bay 323C	1.8	<MRL	30 sec flush
4	Eagle Bay 322D	2.37	0.036	Vacant
5	Eagle Bay 322D	1.83	0.005	30 sec flush
6	Sandy Cove 173B	1.2	0.05	Vacant
7	Sandy Cove 173B	1.49	0.007	30 sec flush
8	Sandy Cove 134D	1.22	0.01	1st draw
9	Sandy Cove 134D	0.624	0.012	30 sec flush
10	Sandy Cove 136D	1.27	0.095	1st draw
11	Sandy Cove 136D	1.69	0.016	30 sec flush
12	Sandy Cove 130A	1.1	0.086	1st draw
13	Sandy Cove 130A	0.738	0.009	30 sec flush
14	Sandy Cove 112D	1.39	0.018	1st draw
15	Sandy Cove 112D	0.339	0.003	30 sec flush
16	Eagle Bay 311A	1.71	0.026	Vacant
17	Eagle Bay 311A	1.14	0.004	30 sec flush
18	Eagle Bay 301A	1.74	0.028	1st draw
19	Eagle Bay 301A	1.15	0.008	30 sec flush

8 samples above MCL for Cu. 9 samples above MCL for Pb. Only for 1st draw.

APPENDIX B

GRAPHICAL DATA

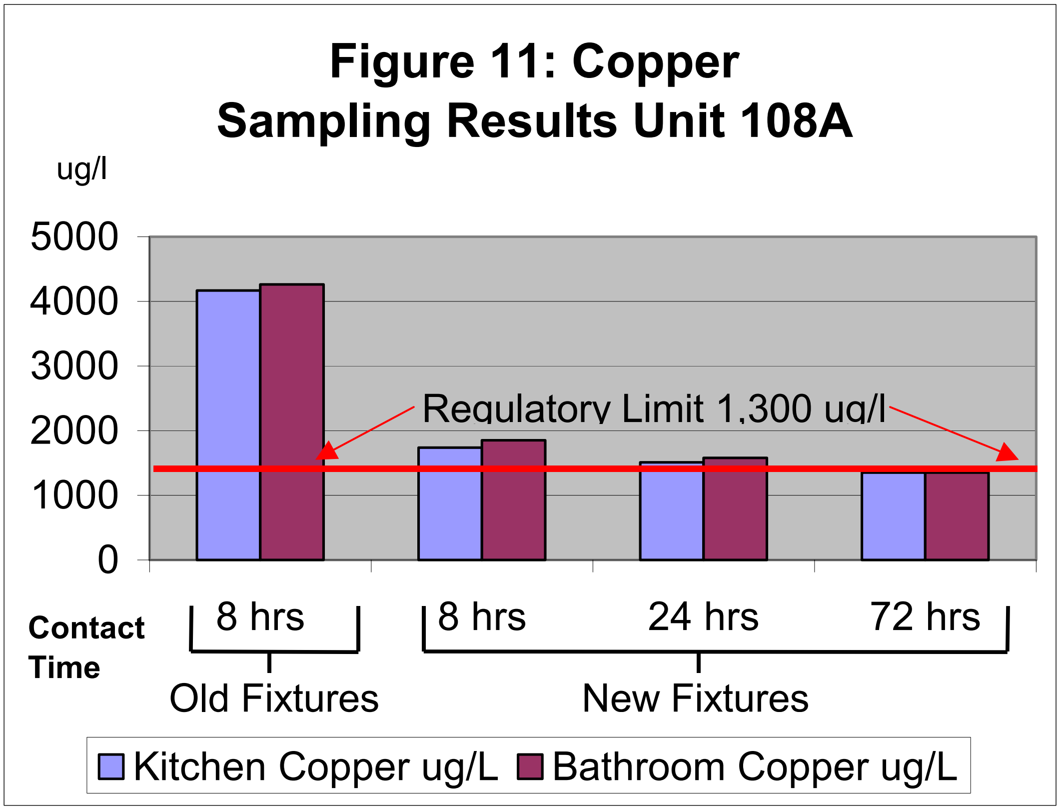


Figure 11: Copper
Sampling Results Unit 108A
ug/l
5000
4000
3000
2000
1000
0
Regulatory Limit 1,300 ug/l
Contact
Time
8 hrs
8 hrs
24 hrs
72 hrs
Old Fixtures
New Fixtures
Kitchen Copper ug/L
Bathroom Copper ug/L

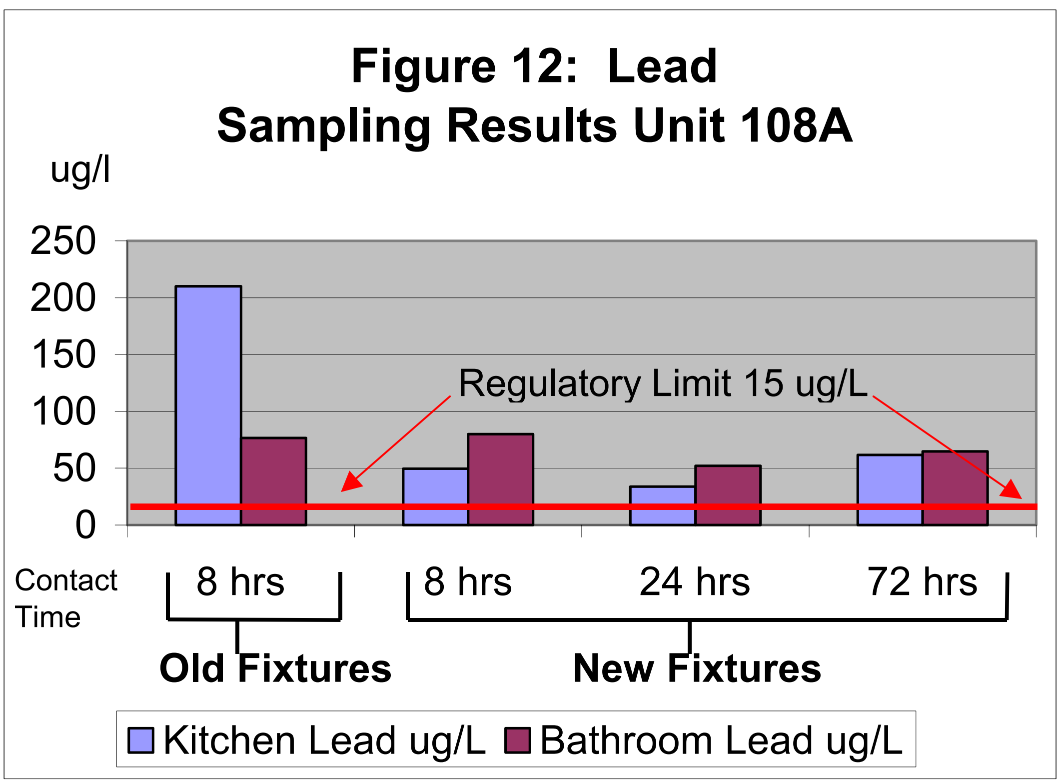


Figure 12: Lead
Sampling Results Unit 108A
ug/l
250
200
150
100
50
0
Regulatory Limit 15 ug/L
Contact
Time
8 hrs
8 hrs
24 hrs
72 hrs
Old Fixtures
New Fixtures
Kitchen Lead ug/L
Bathroom Lead ug/L

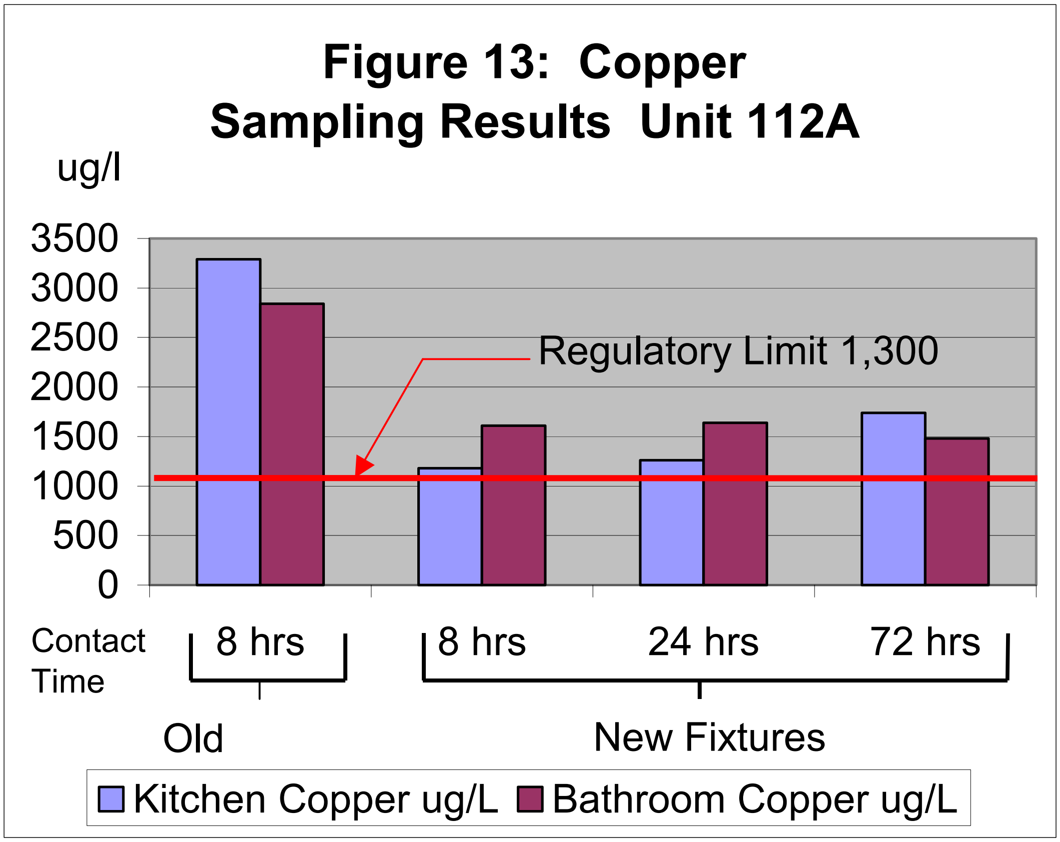


Figure 13: Copper
Sampling Results Unit 112A
ug/l
3500
3000
2500
2000
1500
1000
500
0
Regulatory Limit 1,300
Contact
Time
8 hrs
8 hrs
24 hrs
72 hrs
Old
New Fixtures
Kitchen Copper ug/L
Bathroom Copper ug/L

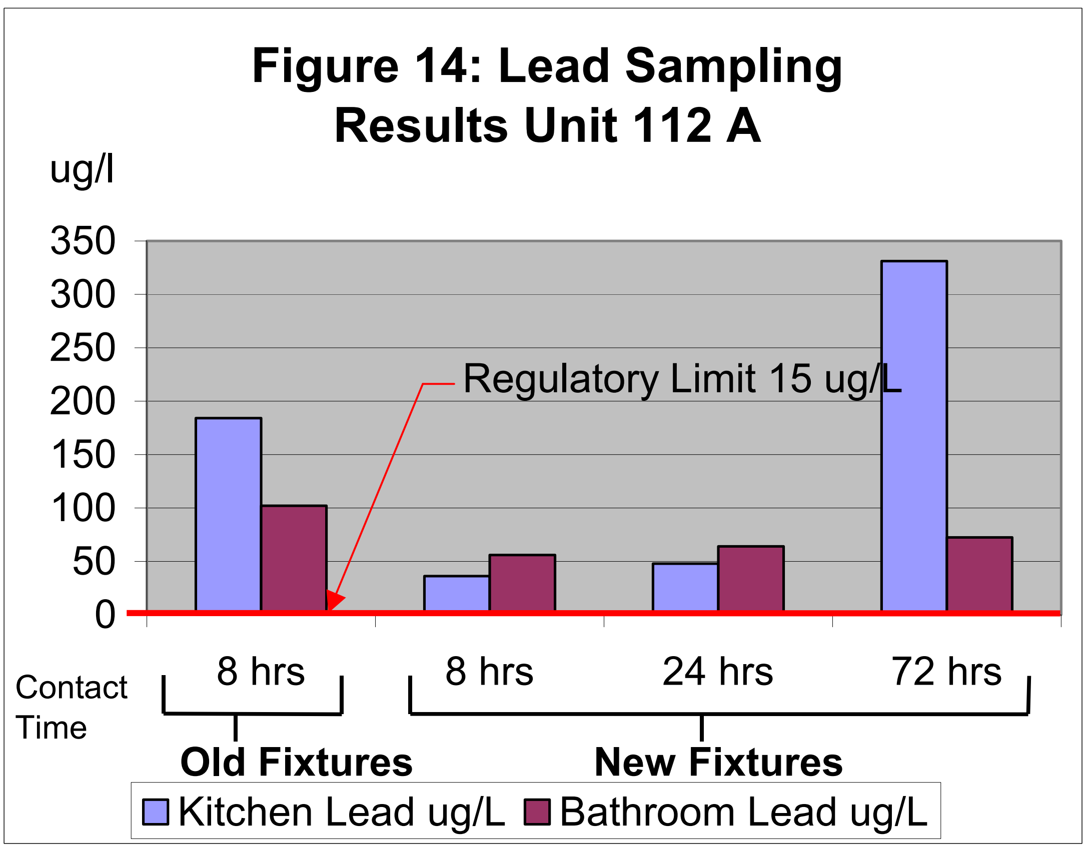


Figure 14: Lead Sampling
Results Unit 112 A
ug/l
350
300
250
200
150
100
50
0
Regulatory Limit 15 ug/L
Contact
Time
8 hrs
8 hrs
24 hrs
72 hrs
Old Fixtures
New Fixtures
Kitchen Lead ug/L
Bathroom Lead ug/L

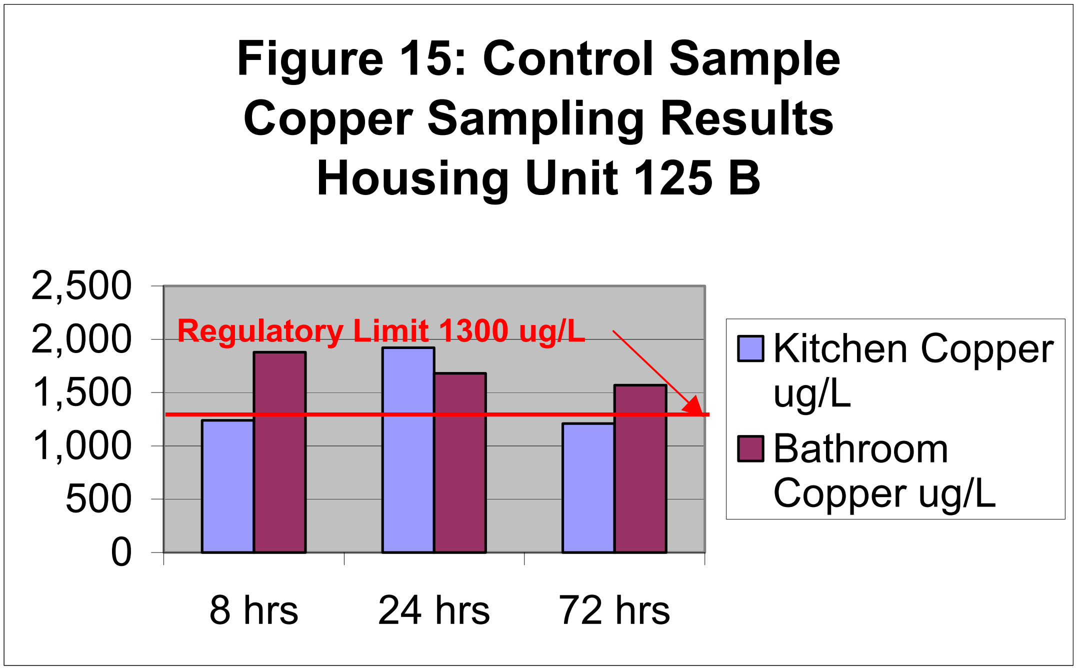


Figure 15: Control Sample
Copper Sampling Results
Housing Unit 125 B
2,500
2,000
1,500
1,000
500
0
Regulatory Limit 1300 ug/L
8 hrs
24 hrs
72 hrs
Kitchen Copper ug/L
Bathroom Copper ug/L

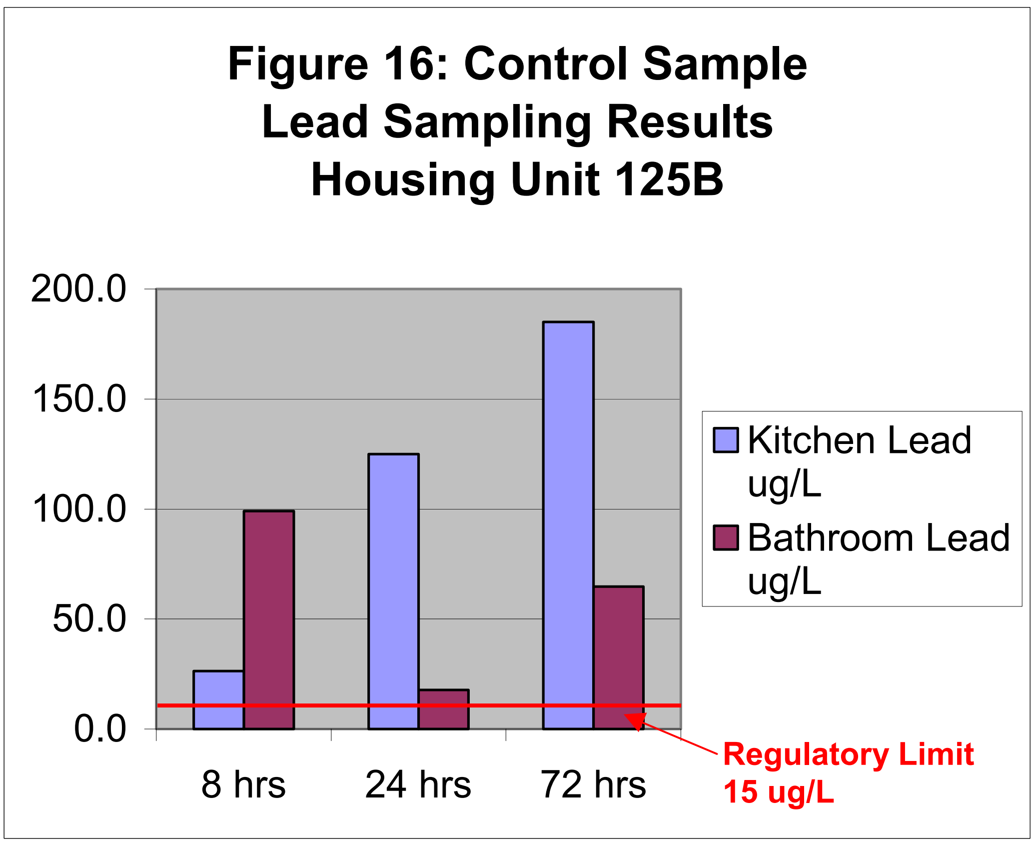


Figure 16: Control Sample
Lead Sampling Results
Housing Unit 125B
200.0
150.0
100.0
50.0
0.0
8 hrs
24 hrs
72 hrs
Kitchen Lead ug/L
Bathroom Lead ug/L
Regulatory Limit 15 ug/L

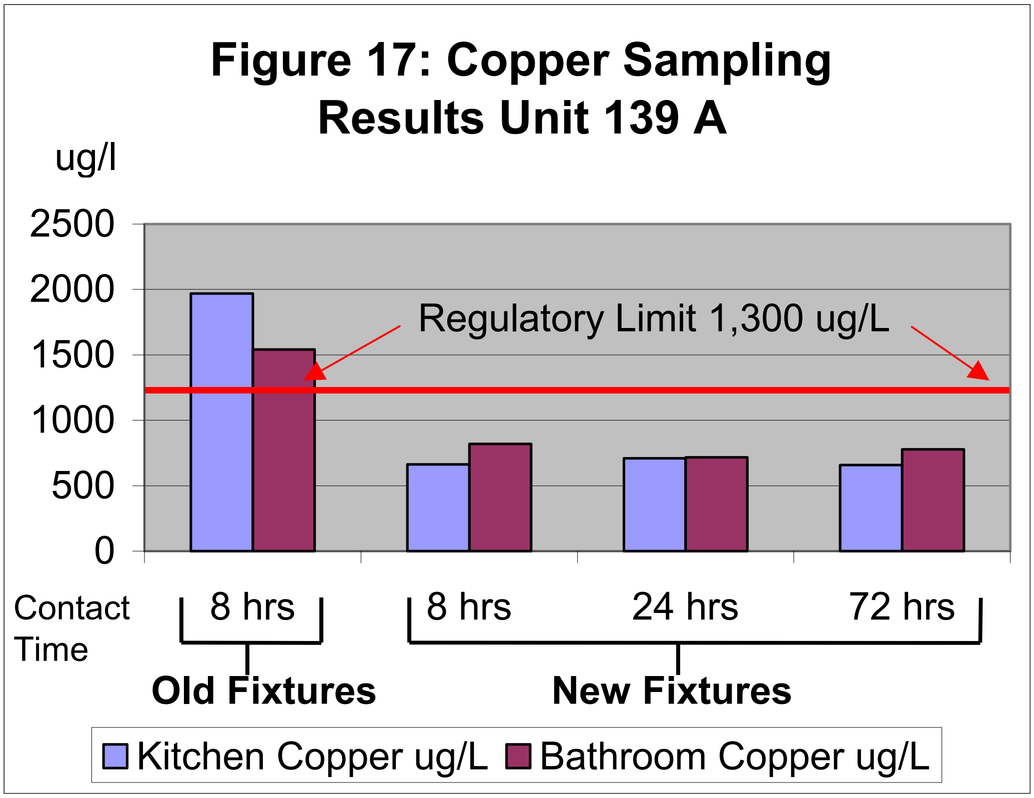


Figure 17: Copper Sampling Results Unit 139 A
ug/l
2500
2000
1500
1000
500
0
Regulatory Limit 1,300 ug/L
Contact Time
8 hrs
8 hrs
24 hrs
72 hrs
Old Fixtures
New Fixtures
Kitchen Copper ug/L
Bathroom Copper ug/L

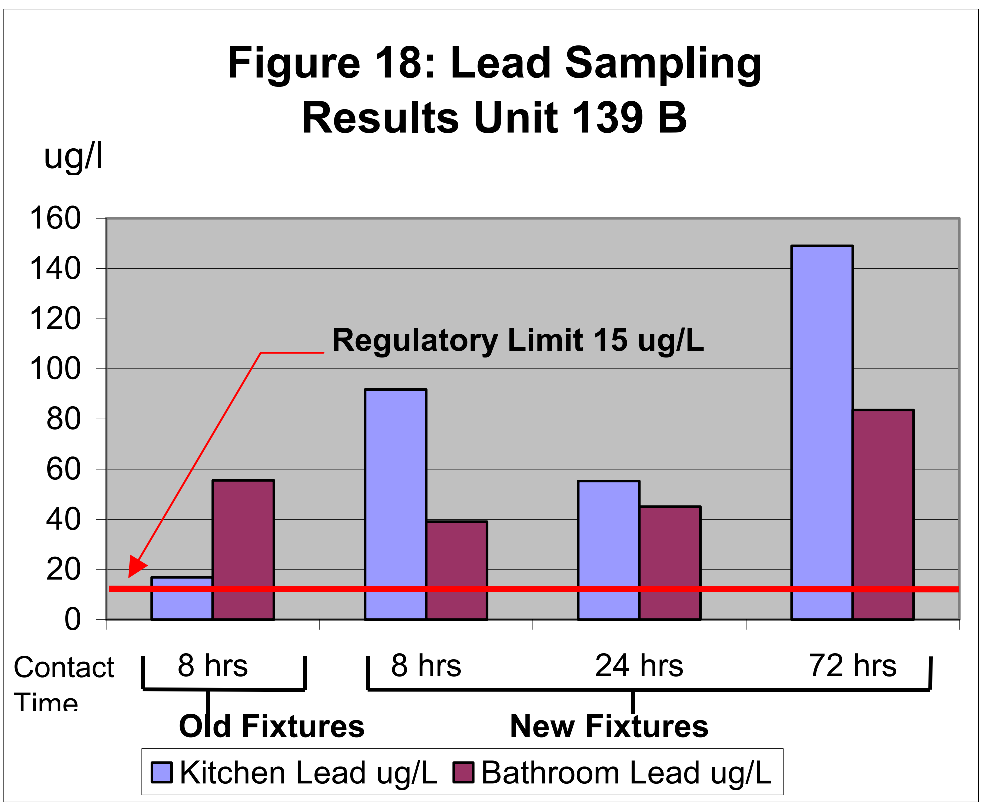


Figure 18: Lead Sampling Results Unit 139 B
ug/l
160
140
120
100
80
60
40
20
0
Regulatory Limit 15 ug/L
Contact Time
8 hrs
8 hrs
24 hrs
72 hrs
Old Fixtures
New Fixtures
Kitchen Lead ug/L
Bathroom Lead ug/L

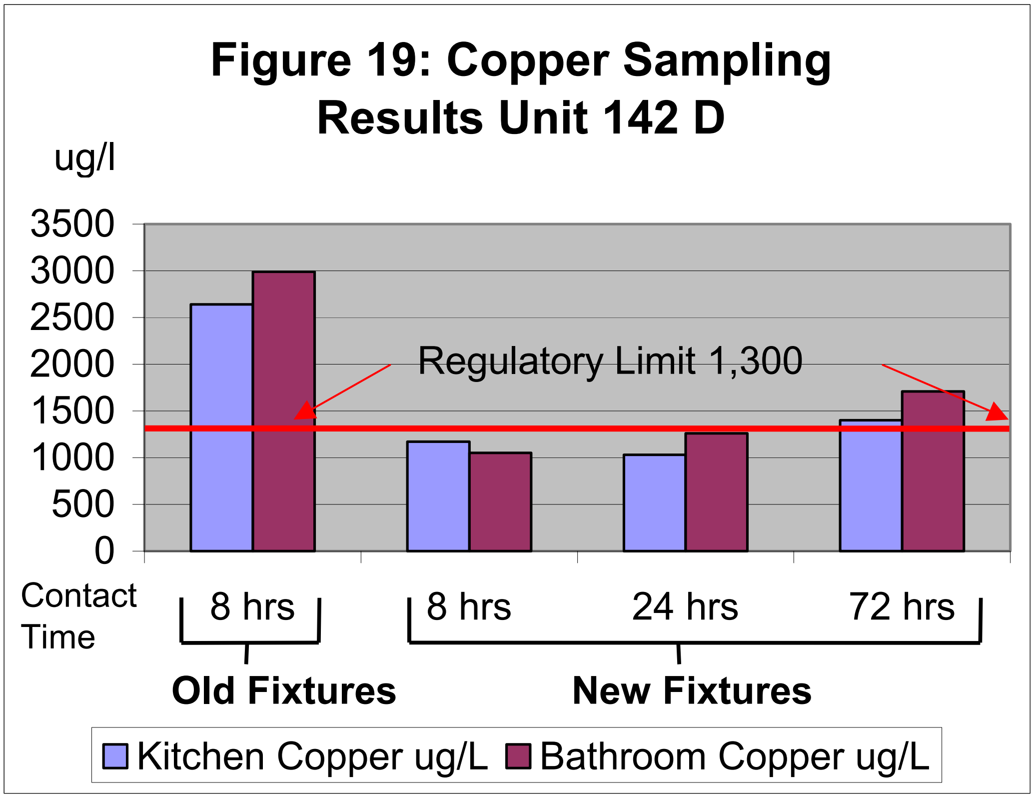


Figure 19: Copper Sampling Results Unit 142 D
ug/l
3500
3000
2500
2000
1500
1000
500
0
Regulatory Limit 1,300
Contact Time
8 hrs
8 hrs
24 hrs
72 hrs
Old Fixtures
New Fixtures
Kitchen Copper ug/L
Bathroom Copper ug/L

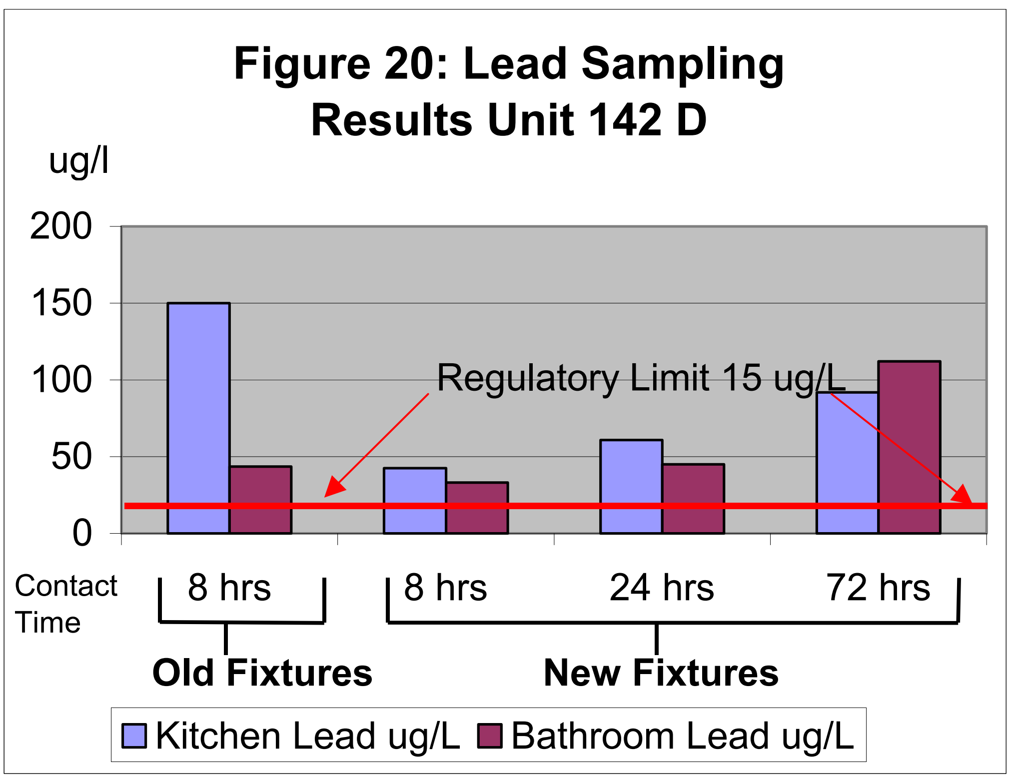


Figure 20: Lead Sampling Results Unit 142 D
ug/l
200
150
100
50
0
Regulatory Limit 15 ug/L
Contact Time
8 hrs
8 hrs
24 hrs
72 hrs
Old Fixtures
New Fixtures
Kitchen Lead ug/L
Bathroom Lead ug/L

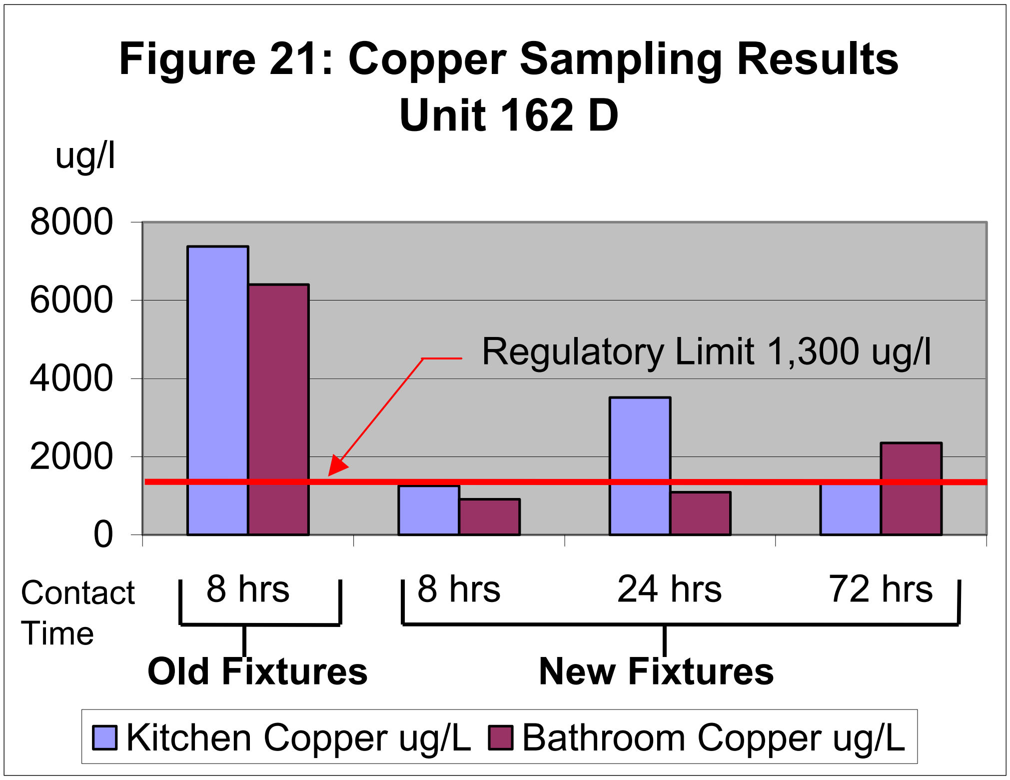


Figure 21: Copper Sampling Results Unit 162 D
ug/l
8000
6000
4000
2000
0
Regulatory Limit 1,300 ug/l
Contact Time
8 hrs
8 hrs
24 hrs
72 hrs
Old Fixtures
New Fixtures
Kitchen Copper ug/L
Bathroom Copper ug/L

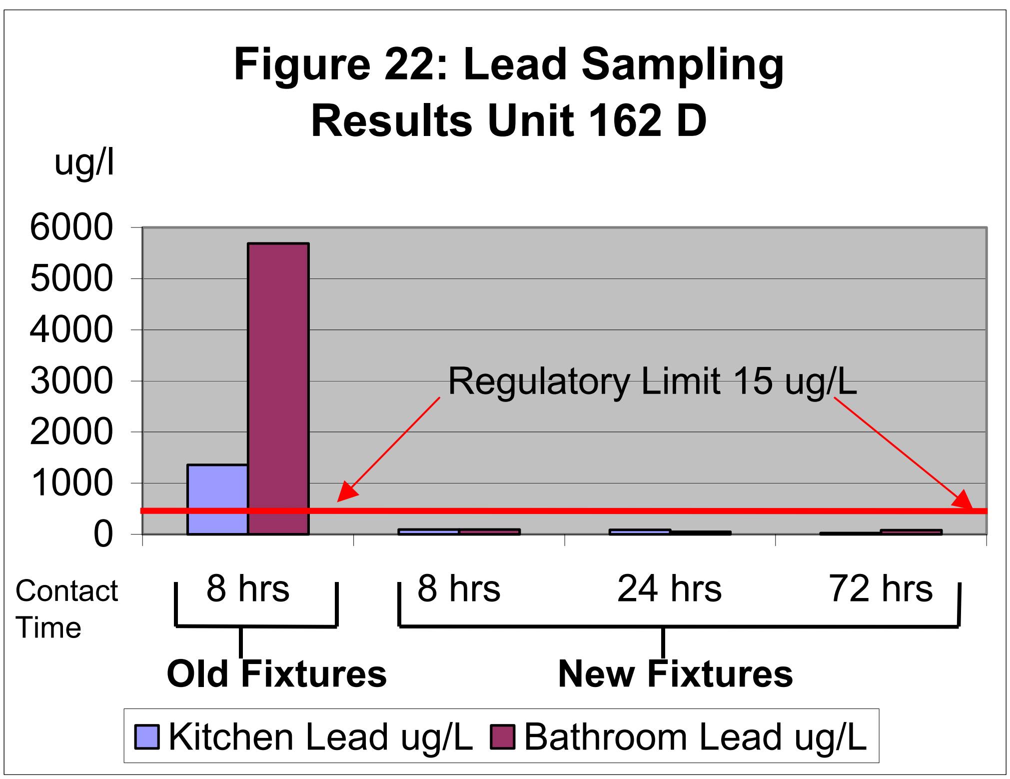


Figure 22: Lead Sampling Results Unit 162 D
ug/l
6000
5000
4000
3000
2000
1000
0
Regulatory Limit 15 ug/L
Contact Time
8 hrs
8 hrs
24 hrs
72 hrs
Old Fixtures
New Fixtures
Kitchen Lead ug/L
Bathroom Lead ug/L

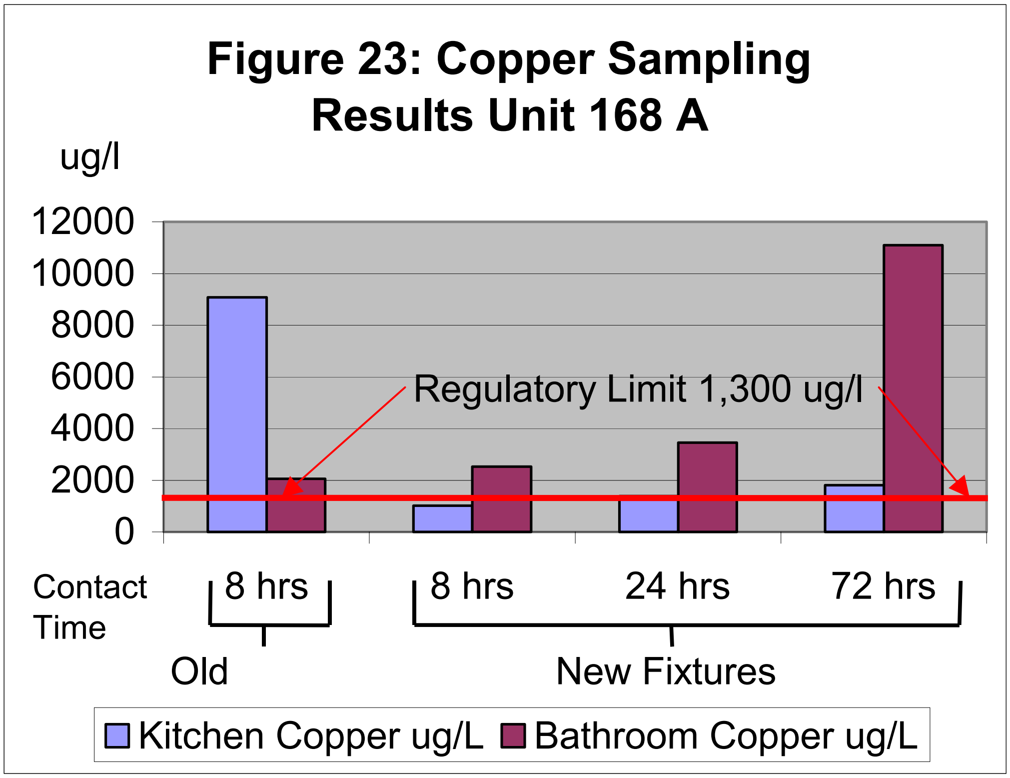


Figure 23: Copper Sampling Results Unit 168 A
ug/l
12000
10000
8000
6000
4000
2000
0
Regulatory Limit 1,300 ug/l
Contact Time
8 hrs
8 hrs
24 hrs
72 hrs
Old
New Fixtures
Kitchen Copper ug/L
Bathroom Copper ug/L

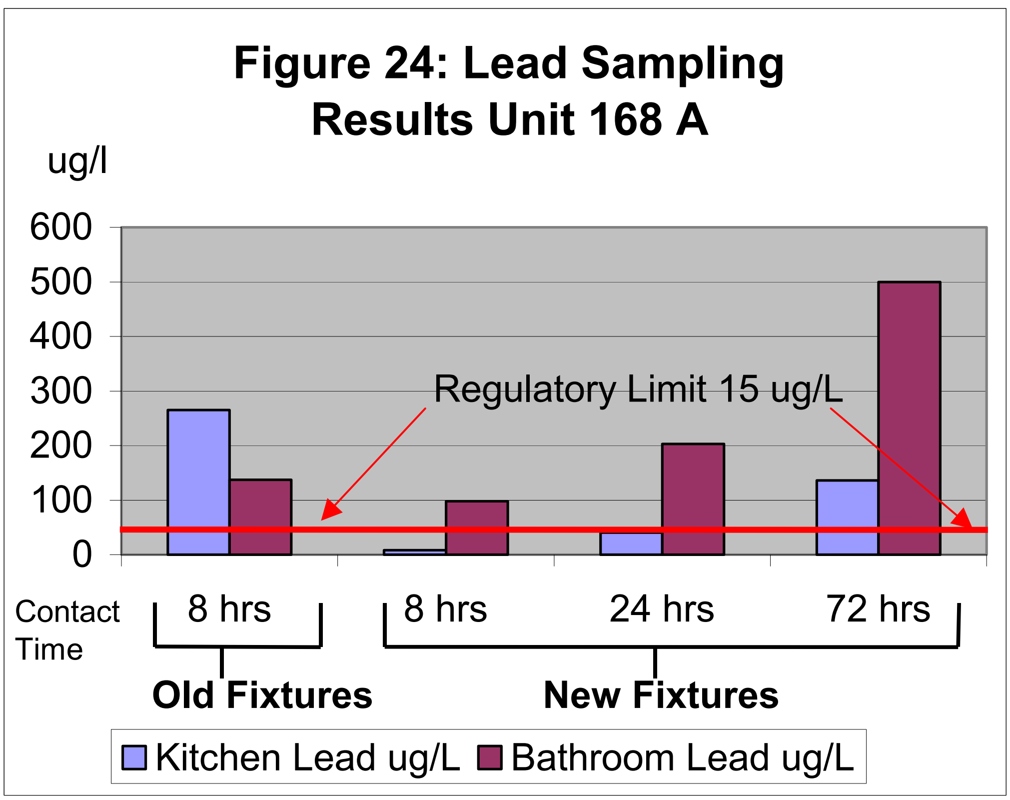


Figure 24: Lead Sampling Results Unit 168 A
ug/l
600
500
400
300
200
100
0
Regulatory Limit 15 ug/L
Contact Time
8 hrs
8 hrs
24 hrs
72 hrs
Old Fixtures
New Fixtures
Kitchen Lead ug/L
Bathroom Lead ug/L

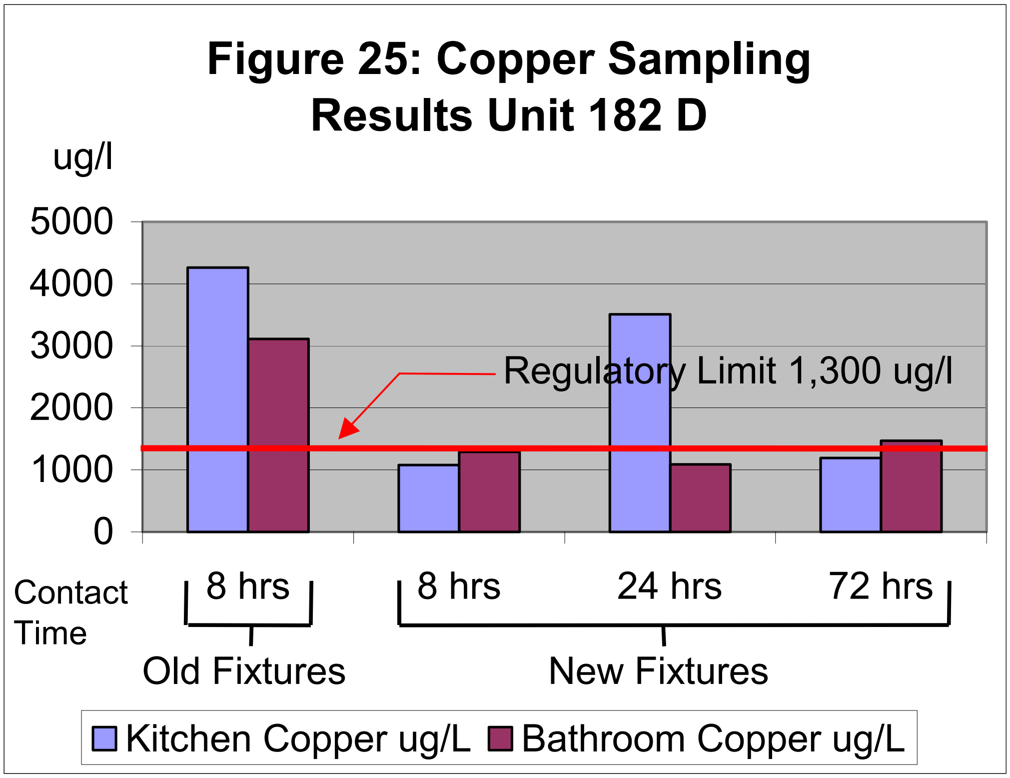


Figure 25: Copper Sampling Results Unit 182 D
ug/l
5000
4000
3000
2000
1000
0
Regulatory Limit 1,300 ug/l
Contact Time
8 hrs
8 hrs
24 hrs
72 hrs
Old Fixtures
New Fixtures
Kitchen Copper ug/L
Bathroom Copper ug/L

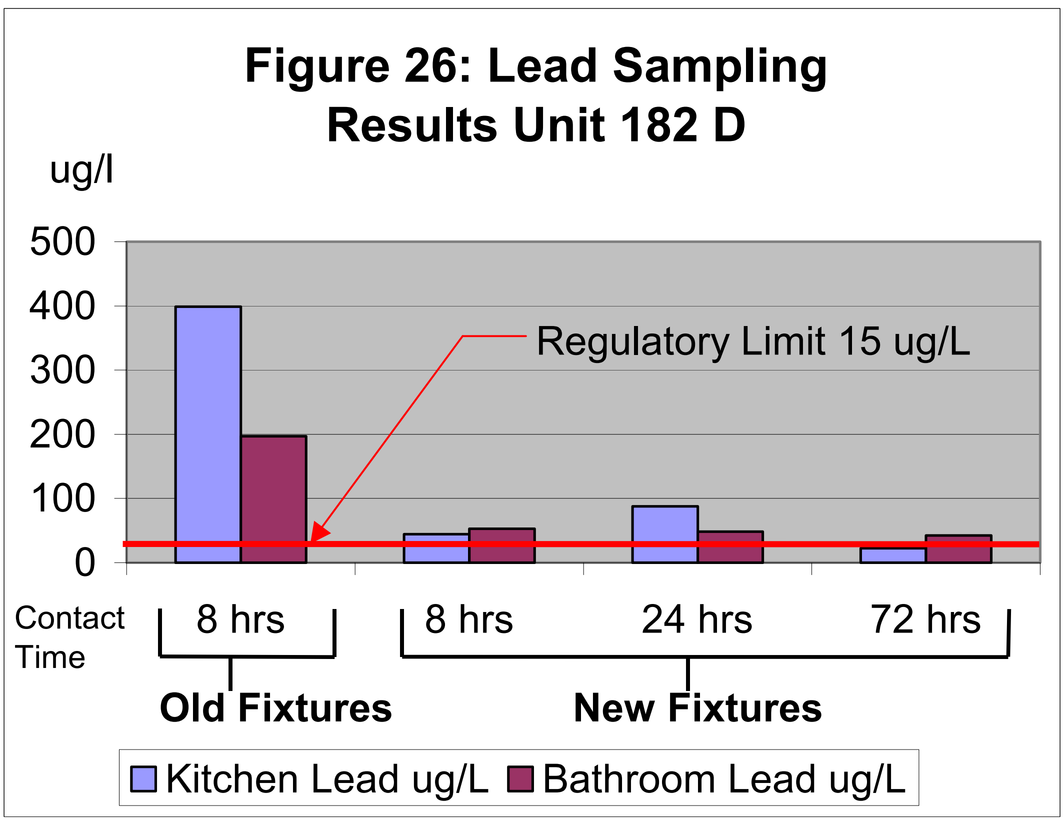


Figure 26: Lead Sampling Results Unit 182 D
ug/l
500
400
300
200
100
0
Regulatory Limit 15 ug/L
Contact Time
8 hrs
8 hrs
24 hrs
72 hrs
Old Fixtures
New Fixtures
Kitchen Lead ug/L
Bathroom Lead ug/L

Figure 27: Copper Sampling Results Unit 184 D

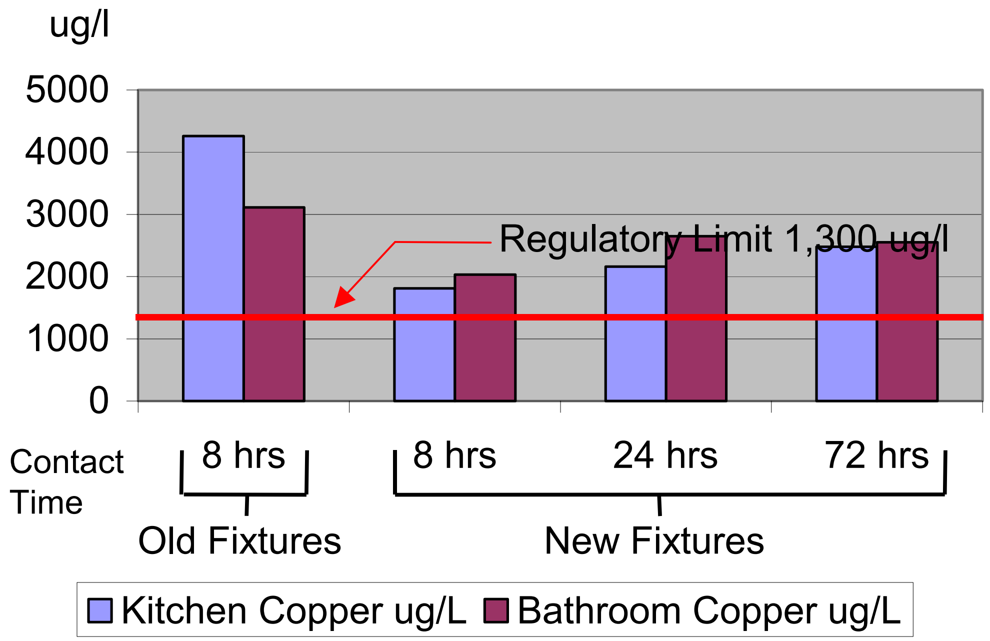
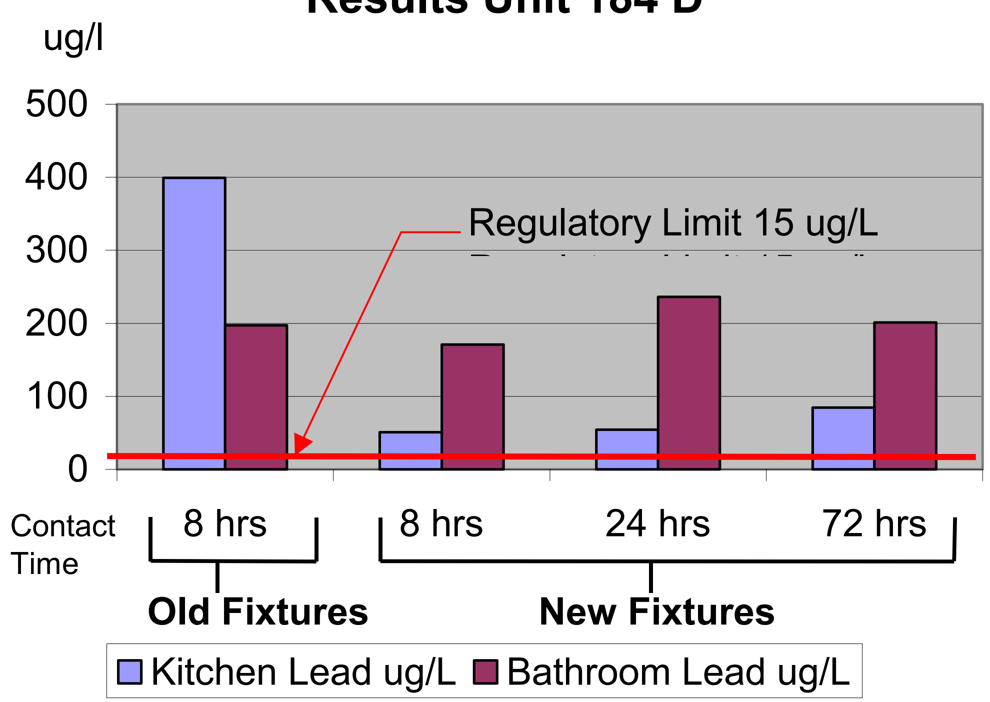


Figure 28: Lead Sampling Results Unit 184 D



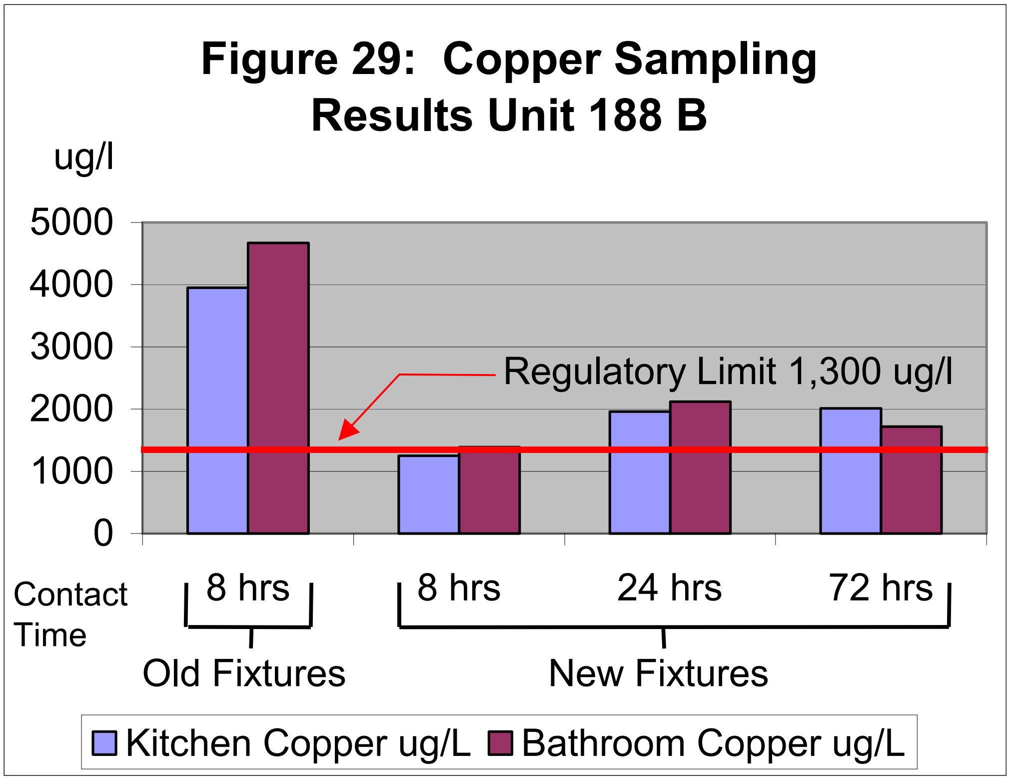


Figure 29: Copper Sampling Results Unit 188 B
ug/l
5000
4000
3000
2000
1000
0
Regulatory Limit 1,300 ug/l
Contact Time
8 hrs
8 hrs
24 hrs
72 hrs
Old Fixtures
New Fixtures
Kitchen Copper ug/L
Bathroom Copper ug/L

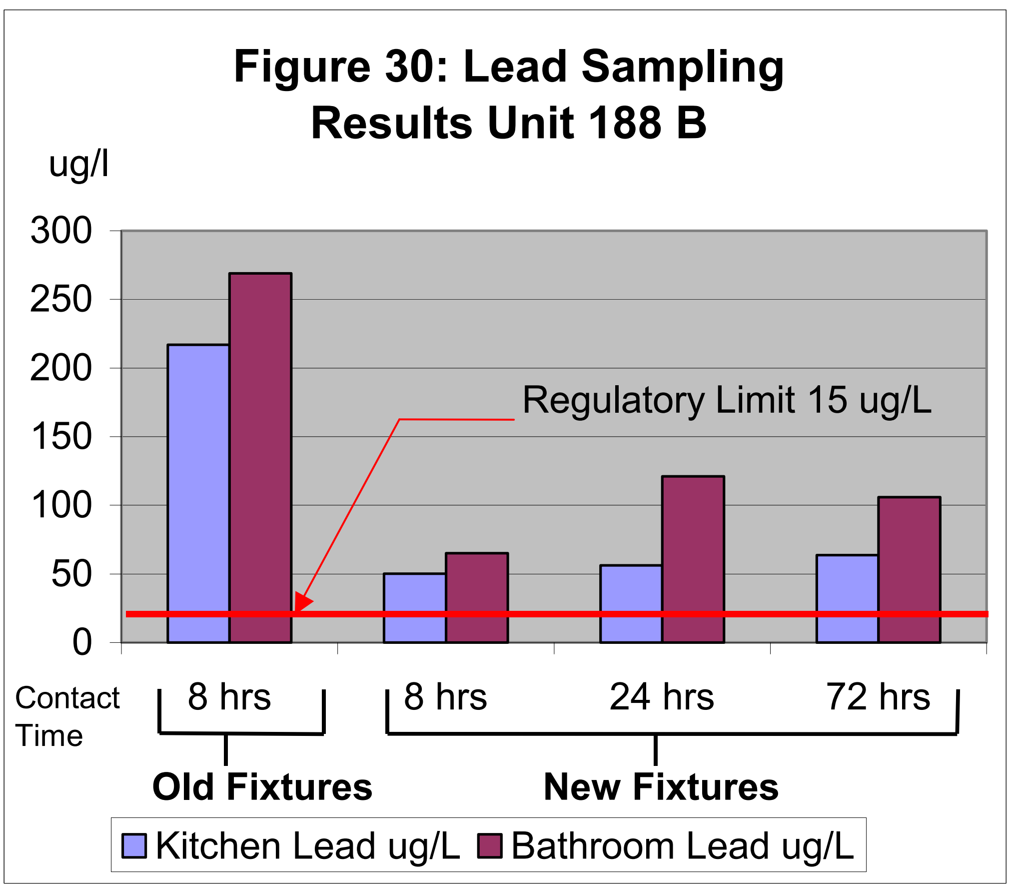


Figure 30: Lead Sampling Results Unit 188 B
ug/l
300
250
200
150
100
50
0
Regulatory Limit 15 ug/L
Contact Time
8 hrs
8 hrs
24 hrs
72 hrs
Old Fixtures
New Fixtures
Kitchen Lead ug/L
Bathroom Lead ug/L