

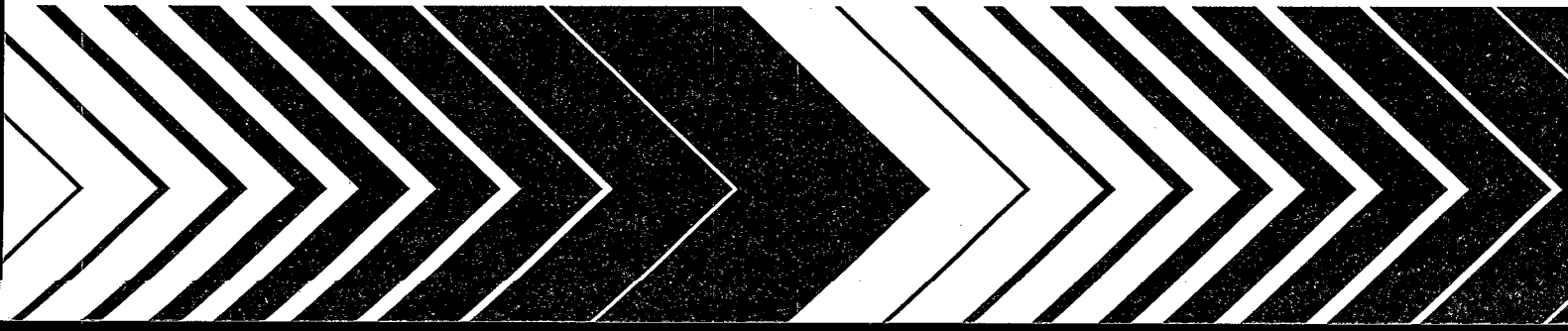
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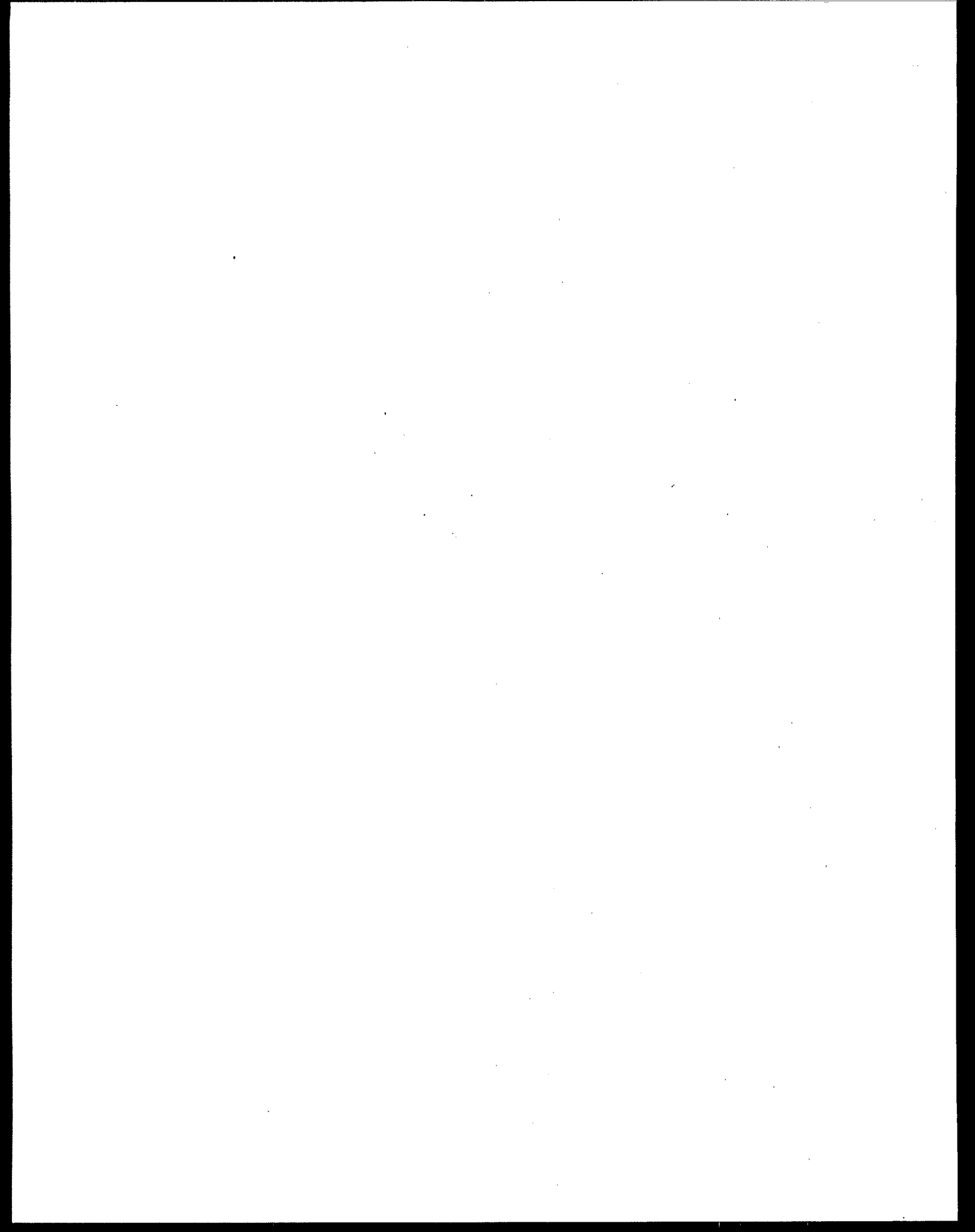
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Leaching of Metals from Household Plumbing Materials: Impact of Home Water Softeners





Leaching of Metals from Household Plumbing Materials: Impact of Home Water Softeners

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Foreword

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E. Timothy Oppelt, Director
National Risk Management Research Laboratory

Abstract

A pilot plant study was conducted by the Water Supply and Water Resources Division (WSRSD), NRMRL, Cincinnati, OH, to evaluate the effects of household ion exchange softening on the leaching of metals from home plumbing materials. The study was conducted in two phases on two different water qualities. Phase I was conducted at the Bolton Water Treatment Plant (BWTP), Cincinnati, OH using their lime softened finished tap water having a hardness of 160 mg/L (as CaCO₃) and a pH of 9.1. Phase II was conducted at the Indian Hill, OH Water Treatment Plant (IHWTP) using their raw source water; a ground water having a hardness of 300 mg/L (as CaCO₃) and pH around 7.3.

Each pilot plant consisted of two pipe loop systems, each system having duplicate loops of lead pipe, copper-solder pipe, copper tubing, and brass faucets. In Phase I, the pilot system also included duplicate galvanized pipe loops. One pipe loop system was used as a control system and was fed the source water and the second system was the test system and fed the same water softened with a household ion exchange water softener.

Pilot plant operation consisted of an intermittent water flowing period followed by a standing period each day. Approximately 105 gallons of water flowed intermittently through each pipe loop and approximately 55 gallons through each faucet. Twice per week, water samples were collected from the systems. First, a flowing water sample was collected before the control and test water system immediately prior to the standing water period to characterize the control and test waters. After a standing period, water samples were collected from each loop and faucet to determine the amount of metal leaching from the loops and faucets.

Although the pilot studies were conducted for over 16 months, the metal leaching data showed that stabilization did not occur with many of the pipe loops. Furthermore, the data from the duplicate pipe loops frequently could not be paired. For these reasons, analysis of the metal leaching data using statistical methods was limited. Data evaluation, therefore, was conducted primarily by visual examination of plotted (graphics) data.

Considering the metal leaching data as a whole, the ion exchange softened water did not show a pattern of higher metal leaching from the plumbing materials. Furthermore, the water softener did not have a detrimental effect on the significant water quality parameters that influence metallic solubility and the rate of corrosion: pH, total inorganic carbon (TIC), dissolved oxygen, chlorine, temperature and ortho-phosphate. The test results suggested, therefore, that ion exchange softening will not necessarily increase the corrosivity of the water. Because the pilot tests were conducted on only two water qualities and because many chemical and physical characteristics can affect corrosiveness, these results cannot be extrapolated to all water qualities. This report covers a period from November 1994 to March 1996, and the work was completed by September 1996.

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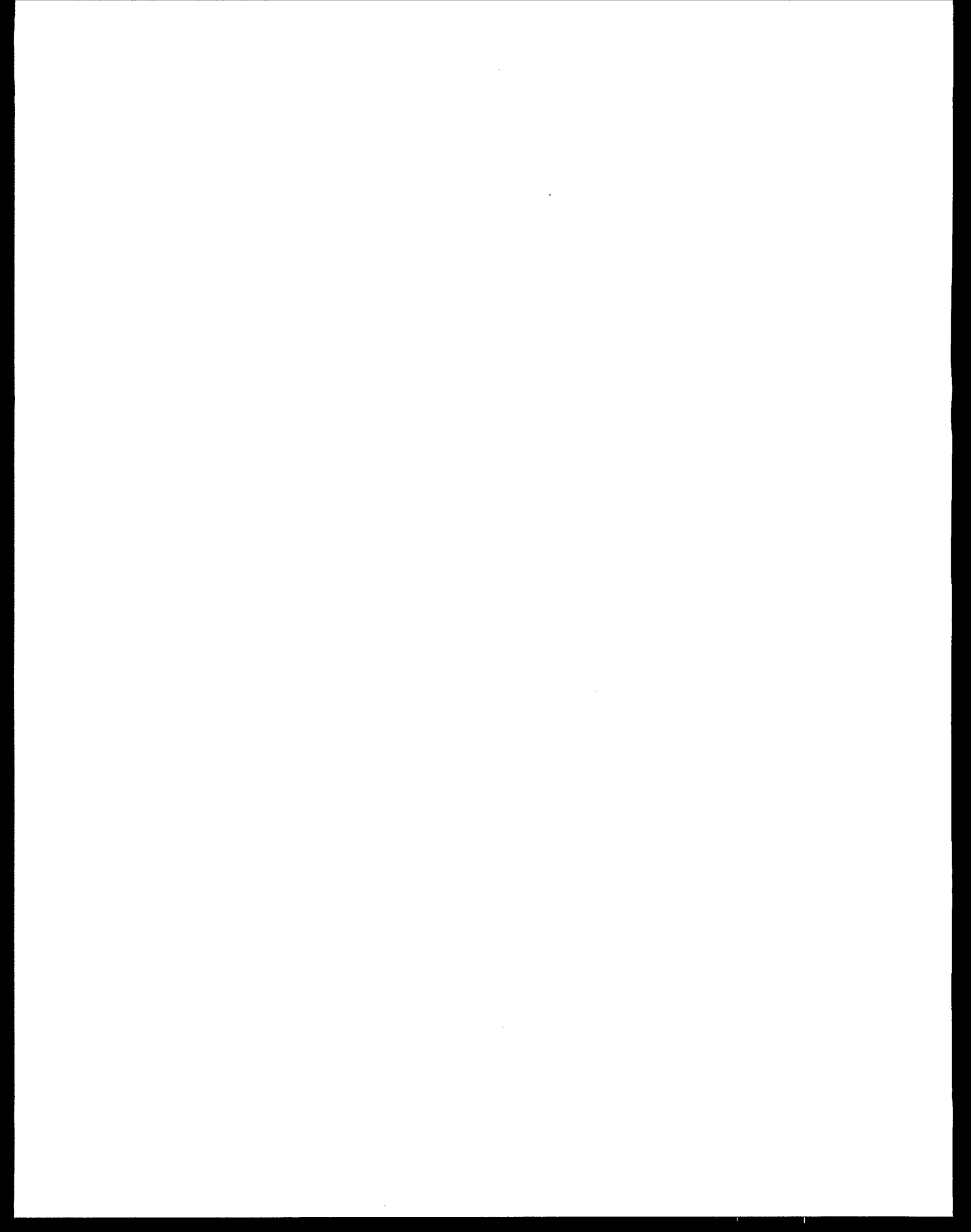
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Abbreviations and Symbols

BWTP	Bolton Water Treatment Plant
CWW	Cincinnati Water Works
DIC	Dissolved inorganic carbon
DO	Dissolved Oxygen
F-Cl ₂	Free Chlorine
gpm	Gallons per minute
IHWTP	Indian Hill Water Treatment Plant
O-PO ₄	Orthophosphate
PVC	Polyvinyl Chloride
T-Cl ₂	Total Chlorine
TDS	Total Dissolved Solids
TIC	Total Inorganic Carbon
T-PO ₄	Total Phosphate
TTEB	Treatment Technology Evaluation Branch
WQA	Water Quality Association

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1. Introduction

The occurrence of lead, copper and other metals in household tap water is primarily the result of the corrosion of metallic plumbing components.^{1,2} Lead is present in a variety of plumbing materials such as lead service lines, galvanized steel pipe, solders, and faucets. Copper is the main component of copper pipe and also the major component of the brass in faucets. Zinc occurs in galvanized steel pipe and is also a component of brass.

The leaching of metals from metallic components of household plumbing systems is strongly impacted by the quality (corrosivity) of the distribution water. The most significant factors that influence the metallic solubility and the rate of corrosion are pH, total inorganic carbon (TIC), dissolved oxygen (DO), chlorine, and temperature.¹ Other factors that also may play a role in corrosivity are calcium, silicate, organic material, ammonia, chloride, sulfate, phosphate, nitrate, and fluoride. The relative significance of each factor varies by the material and the nature of corrosion process.

Naturally soft, low mineralized [hardness <25 mg/L as CaCO₃ and total dissolved solids (TDS) <50 mg/L] waters with low pH values have been demonstrated to have a corrosive effect on most household plumbing materials. These types of waters are common in surface waters of the Pacific northwest, the New England area, and the southeastern section of the United States.^{1,3-5} Naturally soft waters contain low levels of calcium and magnesium ions, and are generally low in pH, TIC and TDS (ionic strength). Primarily because of their pH and paucity of dissolved minerals that could contribute to buffering and passivating film formation, such waters are often inherently

corrosive and frequently result in the leaching of excessive levels of lead and copper from common plumbing materials.

Moderately hard mineralized waters (hardness = 25-125 mg/L CaCO₃ and TDS = 50-300 mg/L) and hard mineralized water (hardness >125 mg/L CaCO₃ and TDS >300 mg/L) usually having a pH at or above 7 and are generally considered to be nonaggressive, although this concept does not always hold true.^{1,6-7} Hard mineralized waters are frequently scale forming, and municipalities will reduce the hardness to a moderate level by either lime softening or ion exchange. Because ion exchange softening removes essentially all of the calcium and magnesium ions, utilities using ion exchange treatment frequently will blend some source water with the treated water to provide a finished water with a low or moderate level of hardness to their consumers.

Where municipal softening is not practiced, or lower hardness water is desired, consumers commonly install home ion exchange water softeners. Because blending is not a design feature of most household water softener systems, the hardness level of this water distributed through the home is near zero. Ion exchange softened waters, however, are different in chemical characteristics from naturally soft waters. Ion exchange softened waters do not necessarily have a low mineral content, nor are they necessarily low in pH. Ion exchange softening fundamentally removes the calcium and magnesium and replaces these elements with sodium. The process, therefore, does not substantially alter the mineralization level, alkalinity or pH. In other words, ion exchange softening does not produce water with chemical characteristics commonly associated with naturally soft waters.

Because ion exchange softening does remove calcium, an element that is commonly thought to give some beneficial protective effect to corrosion, it is often portrayed as a treatment process that could increase the corrosivity of the water, thereby increasing the metals level. Some studies by Larson⁸ and others suggested some beneficial role for calcium in iron corrosion. Recently, Le'grand and Leroy⁹ have provided some theoretical framework for this but little or no data exist to confirm or disprove this hypothesis for metals, such as lead and copper.

Calcium is one of many factors that influence the rate of corrosion, but more importantly, it is not a major one. Unfortunately, calcium carbonate saturation indices have been used as a surrogate measure for "corrosivity." By erroneously using these indices as a surrogate measure for "corrosivity", much misinformation has been generated in the past. High pH and high alkalinity also produce higher (less corrosive) values for the CaCO₃ saturation state. However, that combination has been demonstrated theoretically^{6-7,10-15} by controlled experiments^{6-7,10-12,16} and by field data^{17,18} to be detrimental (enhances solubility) in some situations to lead and copper solubility.

The AWWARF Lead Control Strategies Manual¹ states "In spite of the fact that there is little evidence in the research literature that adherent, continuous CaCO₃ films actually form to seal lead pipe against leaching, calcium carbonate deposition has gained wide acceptance as a viable lead control strategy." The Manual further states that the water quality factors that have the greatest influence on lead mobilization are pH, alkalinity, and dissolved inorganic carbon (DIC). The treatment strategies

stressed in the Manual, therefore, are pH, alkalinity and DIC adjustment and the use of corrosion inhibitors such as orthophosphate and silicate compounds. The addition of calcium to form a calcium carbonate film is not considered a corrosion control treatment strategy. It can be reasoned, therefore, that the removal of calcium by ion exchange softening may not necessarily increase the corrosivity of water.

Although naturally soft waters are known to have corrosive effects on plumbing materials, the effect of ion exchange softened waters have not been extensively evaluated. Furthermore, little data exist on the fate of various water quality constituents that play an integral role in protective surface film development or the corrosion of metals, as they pass through domestic water softeners.

2. Objectives

The potential effects of ion exchange softening on the corrosion of household plumbing materials can be divided into three areas: 1) a direct increase in the metallic corrosion by-products, 2) a change in the chemical characteristics of the water that would either remove or alter film forming constituents in the water, and 3) reversible changes in passivation surface films of aged plumbing systems.

Achievement of all the objectives would require a very expansive research program, including a combination of a laboratory/pilot plant studies and a field testing program. With limited resources, a decision was made, therefore, to conduct a project that would begin to address only the first two issues. With this objective having been determined, a plan was developed to conduct a controlled pilot plant study to (1) evaluate metal leaching from metallic pipes and faucets and

(2) determine any changes of the critical chemical characteristics of the water passing through the water softener that would either remove or alter the film forming constituents in the water. Because the third issue dealing with the potential effect of reversible changes of aged plumbing materials could not be evaluated with short term testing, it did not become an objective of this study.

To achieve the two objectives, a research plan was developed to conduct two pilot studies (Phase I and II) using two different water sources available at the City of Cincinnati, Bolton Water Treatment Plant (BWTP). The two water sources proposed for use were; (1) the finished tap water from the BWTP (Phase I), and (2) the raw groundwater source of the BWTP (Phase II). Both pilot studies were to be conducted for a minimum of nine months.

Phase I began on November 12, 1992 and ran for 468 days. Phase II started in May 1993, but unfortunately, this study had to be abandoned after six months of operation because of a heavy iron and manganese coating that developed on the control pipe loops. After several unsuccessful attempts to solve the iron and manganese problem, a decision was made to conduct Phase II in Indian Hill, OH, a small community on the eastern edge of Cincinnati. The Indian Hill Water Treatment Plant (IHWTP) used a groundwater similar to the BWTP untreated groundwater except that the iron and manganese levels were very low and were not expected to be a problem. Phase II was restarted at the IHWTP on November 23, 1994 and ran for 476 days.

Phase I and Phase II studies consisted of using two pipe loop systems; one supplied with the source water (control water) and

the second one supplied with the ion exchange softened water (test water). The goal was to operate the systems daily and to measure and compare the metal leaching levels from the household plumbing materials that made up the pipe loop systems and to document and compare the chemical characteristics of the source and test water.

3. Materials and Procedures

3.1 Source Water

The source water for Phase I was finished tap water from BWTP. Using lime softening, the BWTP produces a finished tap water having a final hardness of around 160 mg/L (as CaCO_3), from a groundwater with a hardness around 330 mg/L (as CaCO_3). The lime softening process also increases the pH of the groundwater from 7.4 to about 9. Treatment also includes the addition of a low level of polyphosphate (approximately 0.4-0.5 mg PO_4 /L) for protection against calcium carbonate scaling of the filters, chlorination, and fluoridation. A summary of the major chemical constituents in the source water (control non-softened water) is shown in Table 3-1. These data show that the BWTP finished tap water used during the study period had an average hardness of 160 mg/L (as CaCO_3) and an average pH of 9.1.

The source water for Phase II was the source water (an untreated groundwater) for the IHWTP. This groundwater has a hardness around 300 mg/L (as CaCO_3) and pH around 7.3. The Phase II source water differed, therefore, from the Phase I source water by having a hardness of about twice that of the Phase I water and a pH of about two units less than the Phase I water. A summary of the major chemical constituents of the untreated ground water (control non-softened water) used for the Phase II study is shown in Table 3-2.

Table 3-1. Summary of Analyses of Control and Test Waters, Phase I Study.

Analyte mg/L except as noted	Results/ Phase I -BWTP					
	Control Water -Non Softened			Test Water- Softened		
	Mean	N *	Std Dev	Mean	N	Std Dev
Lead	<0.002	114	0.001	<0.002	114	0.001
Calcium	25.6	114	1.84	<0.01	114	0.28
Copper	<0.02	115		<0.02	115	
Iron	<0.05	115		<0.05	114	
Potassium	3.49	114	0.63	1.12	114	0.46
Magnesium	23.7	114	1.18	<0.025	114	
Manganese	<0.01	107		<0.01	107	
Sodium	26.4	114	3.14	101.4	114	6.30
Zinc	<0.01	116		<0.01	116	
pH, Units	9.09	118	0.16	9.31	118	0.15
Total Alkalinity as CaCO ₃	76.6	113	4.38	76.8	112	4.28
Hardness as CaCO ₃ **	159.8			0.28		
Sulfate	68.0	111	4.3	68.3	111	5.06
Chloride	45.9	116	4.18	46.0	116	4.21
Fluoride	0.96	78	0.20	0.89	81	0.45
Silica (SiO ₂)	9.89	108	0.70	9.87	105	0.69
Nitrate (NO ₃) as N	2.19	113	0.68	2.19	113	0.68
Ammonia (NH ₃) as N	<0.03	111	0.02	<0.3	111	0.2
Dissolved Oxygen	6.95	118	0.99	6.91	118	1.01
Total Inorganic Carbon	16.0	112	1.42	16.0	112	1.42
Total PO ₄ as PO ₄	0.40	99	0.12	0.40	99	0.12
Ortho PO ₄ as PO ₄	0.09	111	0.06	0.09	111	0.06
Total Chlorine as Cl ₂	1.12	118	0.09	1.09	118	0.01
Free Chlorine as Cl ₂	1.04	118	0.09	1.02	118	0.10
Temperature °C	15.1	118	0.94	15.2	118	0.95

* Number of samples

** Calculated from Ca and Mg concentrations

Table 3-2. Summary of Analyses of Control and Test Waters, Phase II Study.

Analyte mg/L except as noted	Results/ Phase II - IHWTP					
	Control Water -Non Softened			Test Water- Softened		
	Mean	N *	Std Dev	Mean	N	Std Dev
Lead	<0.002	115	0.001	<0.002	114	0.001
Calcium	83.6	116	1.183	0.317	107	0.111
Copper	<0.003	116	0.002	<0.003	115	0.003
Iron	0.002	116	0.018	0.002	115	0.009
Potassium	2.98	115	0.42	3.14	114	3.196
Magnesium	24.2	116	1.28	0.12	107	0.10
Manganese	0.001	116	0.002	0.001	115	0.001
Sodium	40.7	116	4.29	176.6	108	10.9
Zinc	<0.001	116	0.002	<0.001	115	0.002
pH, Units	7.33	111	0.064	7.45	110	0.081
Total Alkalinity as CaCO ₃	261.7	115	17.9	261.2	112	18.4
Hardness as CaCO ₃ **	300.2			1.3		
Sulfate	46.2	116	2.63	46.3	115	2.78
Chloride	73.5	116	11.9	73.8	114	11.0
Fluoride	0.23	53	0.019	0.23	53	0.021
Silica (SiO ₂)	7.39	116	0.74	7.28	115	0.72
Nitrate (NO ₃) as N	2.13	112	0.37	2.07	111	0.43
Ammonia (NH ₃) as N	<0.03	113	0.02	<0.3	113	0.02
Dissolved Oxygen	3.47	99	1.14	3.47	99	1.14
Total Inorganic Carbon	69.6	108	5.43	69.7	110	5.44
Total PO ₄ as PO ₄	---	---	---	---	---	---
Ortho PO ₄ as PO ₄	0.27	94	0.14	0.26	92	0.08
Total Chlorine as Cl ₂	---	---	---	---	---	---
Free Chlorine as Cl ₂	---	---	---	---	---	---
Temperature °C	13.9	110	2.44	13.9	110	2.46

* Number of samples

** Calculated from Ca and Mg concentrations.

A detailed listing of the analytical results of the chemical analyses conducted on all of the samples collected of the control (non-softened) waters and test (softened) waters for both study phases can be found in Appendix A.

3.2 Pipe Loop Systems

The pipe loop systems designed and constructed for the studies were similar to the system outlined in the American Water Works Association Research Foundation's Lead Control Strategies Manual¹ (Figure 3-1). One pipe loop system was used as a control system and was fed the source water. The second pipe loop system, used as the test system, was fed the ion exchange softened water having only a trace of hardness. Each pipe loop system contained two loops of lead pipe, copper tubing, copper pipe connected with 50:50 lead-tin solder joints and two brass faucets. For the Phase I study, each system also contained two galvanized pipe loops. Each individual pipe loop was 50 feet in length. Faucet selection was based on a previously conducted metal leaching study.¹⁹ The faucet selected had produced a rather significant level of lead during the leaching study. A summary of the plumbing materials used in the pipe loop systems is shown in Table 3-3.

All connecting pipe and other components, such as flow meters, valves and sampling ports to support the system, were made of polyvinyl chloride (PVC) or stainless steel. A water meter was installed in the main line before the control and test systems to measure the total amount of water that passed through each system. Sample taps were installed before and after the water softener and after each individual pipe loop. Manual on/off ball valves were installed

before and after each individual pipe loop. For flow control, a flow meter was installed before each individual pipe loop. Each system was pressurized by using a solenoid valve at the end of the discharge line. The faucets themselves maintained water pressure and an electrically controlled hydraulic arm attached to the faucet handle automatically opened and closed the faucets. Check valves were not installed before and after each loop as given in AWWARF design.

3.3 Piping Material and Faucets

All pipe loop materials and faucets were purchased new from local plumbing supply firms in the Cincinnati area. No special pre-cleaning procedures were performed on either the pipe loops or faucets.

3.3.1 Lead Pipe

The new lead pipe was purchased from a plumbing supply firm specializing in extruded lead products. Pipe dimensions were specified to be 1/2 inch ID with a 1/4 inch wall thickness. The pipe was 50 ft long and supplied in a loop fastened onto a plywood support with pipe straps. The pipe loops were connected to the PVC pipe using reinforced PVC tubing and hose clamps. The 50 foot pipe section provided an internal volume of 1650 mL.

3.3.2 Copper Tubing

The new copper tubing, 1/2 inch ID, was formed into continuous 50 foot section loops about 18 inches in diameter. The tubing was connected to the PVC pipe with reinforced PVC tubing and hose clamps. The 50 ft loop provided an internal volume of 2250 mL.

3.3.3 Soldered Copper Pipe

The new copper pipe, type L, 1/2 inch ID, was cut into sections to form 50 ft

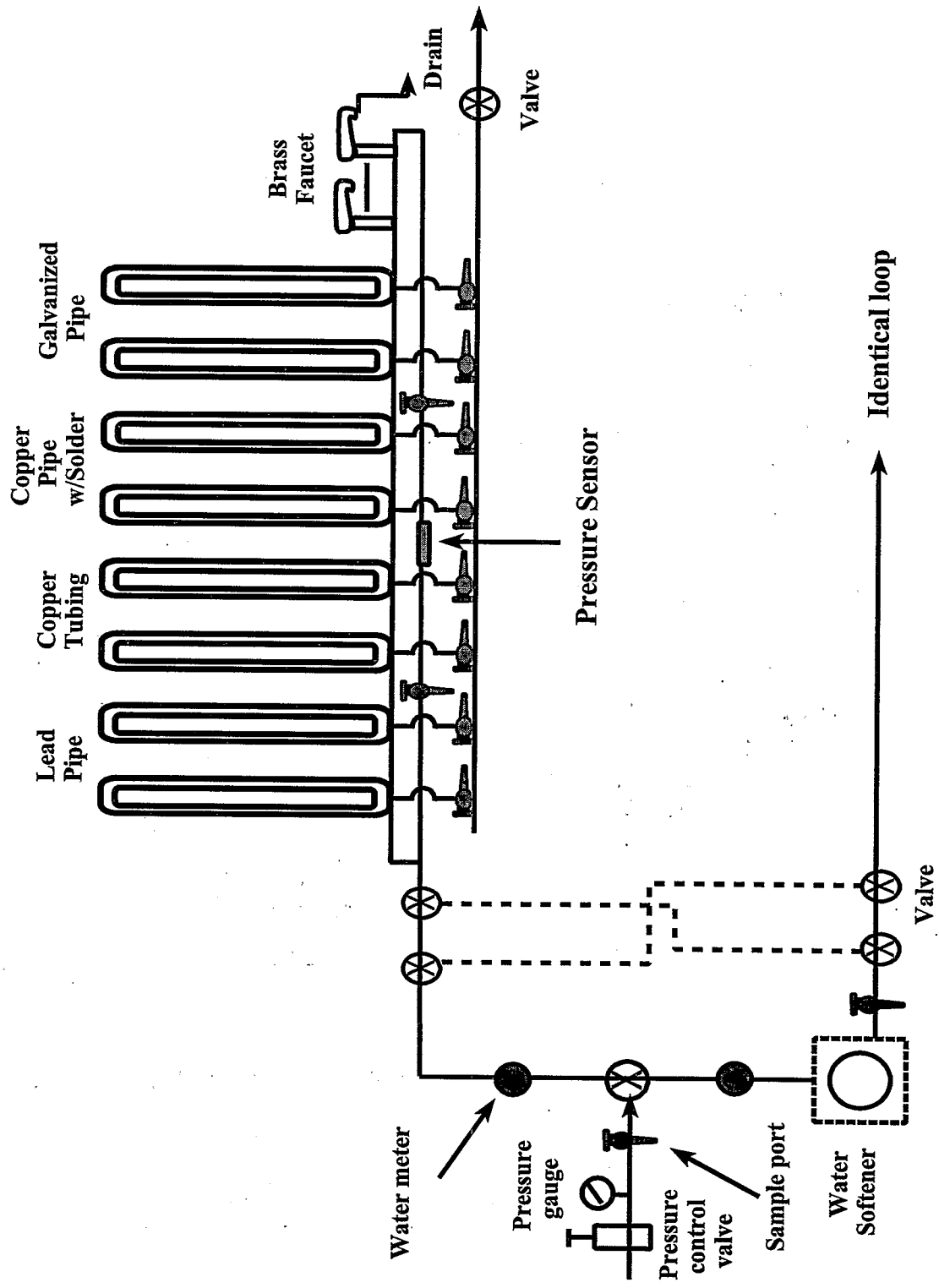


Figure 3-1. Pipe loop system

Table 3-3. Plumbing Materials for Pipe Loop Systems.

Loop	Identification (nominal size)	Dimension		Volume mL foot
		ID(in)	OD(in)	
Lead	1/2 in ID	0.46	0.95	33
Copper tubing	1/2 in ID, type L Drawn	0.54	0.65	45
Copper pipe	1/2 in ID type M, schedule 40	0.57	0.63	50
Galvanized pipe	1/2 in ID, schedule 40	0.56	0.75	48

rectangular continuous loops of about 36 inches in length and 8 inches in width. The loop sections were joined with 90 degree copper elbows by 50:50, Pb:Sn (solid core) solder by a skilled technician. Each loop contained 18 elbows and 36 soldered joints and provided an internal volume of approximately 2500 mL.

3.3.4 Galvanized Steel Pipe

New galvanized steel pipe, pre-cut threaded sections, 1/2 inch ID, schedule 40, were purchased to form a rectangular, 50 ft, continuous loops similar to the copper soldered pipe loops. The loops were 36 inches in length by 8 inches in width. The sections of the loop were connected by threaded 90 degree galvanized steel elbows. A pipe dope material was applied to the threaded joints. The tube ends were also connected to the PVC pipe with PVC reinforced flexible hose and clamps. The 50 ft pipe section provided a volume of 2400 mL.

3.3.5 Faucets

The new faucets were the same model tested by EPA in a lead leaching faucet study in 1989 (faucet number 3).¹⁹ This faucet was a single handle model with a brass interior and a volume of approximately 100 mL. The faucet was connected to the PVC pipe with a PVC threaded connection and PVC reinforced flexible tubing. The faucet was mounted to a steel L section that was attached to the plywood backboard. A hydraulic jack device was connected to the handle of the faucets to open and close them.

3.4 Water Softeners

Two water softeners were provided by two WQA member companies. For the Phase I study, a Culligan International Company softening system, MARK 512, Model 3526-

46, was used. The system is listed by NSF, International under Standard 44. This softener is a commonly used household system and its fundamental design, operation, and performance is typical of other sizes and other brands of household water softening systems. The softener was installed by a Cincinnati dealer who programmed the regeneration cycle to occur every third day. The regeneration cycle consisted of three phases: (1) backwash (15 min), (2) brine (64 min), and (3) rinse (4 min).

The second softener was used for the aborted Phase II study at the BWTP and during the first 45 days of the final Phase II study at the IHWTP. Because of a mechanical problem that resulted in regeneration problems during the early part of the Phase II study, this system was replaced by the MARK 512 system that was then used for the remainder of the study.

3.5 System Operation

Because of differences in plant facilities, operation and access, the pilot plant systems at the two facilities could not be operated in an identical manner. The control and test pipe loop systems at each facility, however, were operated in identical ways so that the results between the control and test systems at each location could be compared.

At the BWTP, the pipe loop test systems were connected to a 100 psi finished tap water source line in the basement of the BWTP. A pressure regulator provided approximately 54 psi of water pressure to the pilot systems. At the IHWTP, the system was tapped into the plant's main source water line that had a pressure of around 32-35 psi. No pressure adjustment was provided at this location.

Each individual pipe loop line and faucet had an in-line flow controller. The controllers were set to provide a flow rate of near 0.06 L/s (1 gpm) through each loop and about 0.03 L/s (0.5 gpm) through each faucet. A programmable on/off timing system was set to open and close the solenoid valves on the discharge lines and the hydraulic faucet handle system to provide 105 minutes of flow time each day through each pipe loop and faucet. The water meter installed before each pipe loop system was utilized to check and compare the total amount of flow through the control and test sides of the systems.

Although the total amount of water flow and flow time for each pipe loop and faucet for the two studies were the same, the on /off flow patterns and the standing times before sample collection were different. These differences were necessitated by limited facility access at the IHWTP. Whereas there was no limitations to the accessibility to the BWTP, the IHWTP was accessible only during the day time period of 7:30 am to 4:30 pm.

At the BWTP, the flow pattern consisted of five, 15 minute and one, 30 minute flow times separated by 1-½ to 2-½ hour standing times (Table 3-4). The flowing/standing periods started at 5:00 pm and ended at 8:30 am the following morning. A 7-¼ or 7-½ hour standing period before sample collection was programmed from each morning to late afternoon to represent "overnight" standing.

At the IHWTP, the flow pattern consisted of three 30 minute and one 15 minute flow times separated by 1-½ to 2 hour standing times (Table 3-5). The flowing periods occurred during a normal working day, 7:30

am to 3:00 pm because the plant was accessible only during the day, 7:30 am to 4:30 pm. The standing period before sample collection lasted from late afternoon to early morning, 16-¾ to 17-¼ hours, approximately twice the standing time before sample collection for the Phase I study. This standing time (rather than a short 5 hour standing time available during the day) was selected on the presumption that the longer stagnation time would result in more consistent and near equilibrium conditions.^{1-2,12}

The initial plan was to operate the systems for nine months. After nine months, the data were to be evaluated and then a decision made on whether to extend the operation. Nine month data evaluations resulted in extending the study periods to 16 months. Because of a longer term interest in the control system data by CWW, the system at the BWTP was operated an additional 5 months with sampling reduced to once a month.

3.6 Water Sampling and Data Collection

Water samples (flowing and standing) from both the control and the test system loops were collected twice a week, with some exceptions because of holidays and pilot system/facility problems. Flowing water samples of the control and test waters were collected immediately prior to the standing period to characterize the initial water quality in the loops and faucets at the onset of the standing period. The number and size of samples collected are shown in Table 3-6.

After the standing period, a one liter water sample was collected from each pipe loop and a 500 mL sample from each faucet. To isolate the loop during sampling, all valves of the test system were closed during sampling,

Table 3-4. Daily Flow Pattern of Pipe Loop System, Phase I Study.

Control System (non-softened water)	Time (minutes)	Test System (softened water)	Time (minutes)
5:00 - 5:15 pm	15	5:15 - 5:30 pm	15
8:00 - 8:15 pm	15	8:15 - 8:30 pm	15
11:00 - 11:15 pm	15	11:15 - 11:30 pm	15
2:00 - 2:15 am	15	2:15 - 2:30 am	15
5:00 - 5:15 am	15	5:00 - 5:15 am	15
8:30 - 9:00 am	30	9:00 - 9:30 am	30
Total flow time	105	Total flow time	105
Standing time (9:00 am-4:30 pm)	7.5 hrs	Standing time (9:30 am - 4:45 pm)	7.25 hrs
Sampling period 4:30 pm - 5:00 pm		Sampling period 4:45 pm - 5:15 pm	

Table 3-5. Daily Flow Pattern of Pipe Loop System, Phase II Study.

Control System (non-softened water)	Time (minutes)	Test System (softened water)	Time (minutes)
9:00 - 9:30 am	30	8:30 - 9:00 am	30
11:00 - 11:30 am	30	10:30 - 11:00 am	30
1:00 - 1:30 pm	30	12:30 - 1:00 pm	30
3:00 - 3:15 pm	15	3:00 - 3:15 pm	15
Total flow time	105	Total flow time	105
Standing time (3:15 pm - 8:30 am)	17.25 hrs	Standing time (3:15 pm - 8:00 am)	16.75 hrs
Sampling period 8:30 am - 9:00 am		Sampling period 8:00 pm - 8:30 pm	

Table 3-6. Pipe Loop System Sampling Plan.

Sample Location	Sample Time	Number of Samples & Size	Preservative
Before Softener	During last flow cycle	1 - 250 mL 1 - 1 L 2 - 60 mL	None 1.5 mL HNO ₃ No air contact
After Softener	During last flow cycle	1 - 250 mL 1 - 1 L 2 - 60 mL	None 1.5 mL HNO ₃ No air contact
Effluent from each loop	End of stagnation period	1 - 250 mL 1 - 1 L	None 1.5 mL HNO ₃
Effluent from each faucet	End of stagnation period	500 mL	0.75 mL HNO ₃

except for the influent line valve of the loop being sampled. Because of system design and sample tap location, 250 to 500 mL of water was wasted from each loop prior to collecting the liter sample. The amount wasted for each loop was predetermined by a series of sequential metal leaching tests. This two step procedure was done to assure that the liter sample was in direct contact with the pipe loop. A one liter sample was selected because it was consistent with compliance sampling required by the Lead and Copper Rule.²² A 500 mL sample size was selected for the faucets because the contact volume of the faucet was approximately 100 mL and the EPA faucet study suggested that about four to five bed volumes of water are required to collect 95-99 percent of the lead and other metals leached from the brass surfaces in a faucet.¹⁹

All water samples requiring acid preservation were preserved on site with the appropriate amount of nitric acid. All sampling information was recorded in a log book and included sampler's name, sample time, number and size of water samples and any special notes. Water meter readings from each system were recorded at the time of sampling.

At the conclusion of each study, the pilot systems were disassembled and small 6-8 inch sections of pipe were cut from each pipe loop and saved for possible internal surface examination using x-ray diffraction and electron microscopy or both techniques depending upon availability of equipment and manpower.

3.7 Analytical Procedures

3.7.1 Chemical Analyses

Because of sample instability, pH, chlorine, dissolved oxygen and temperature

measurements were conducted immediately on-site following sample collection. The results of all on-site analyses were recorded in the data log books. All other analyses were conducted at the EPA Research Center. A listing of the analytical methods, along with the observed detection limits, used for the studies is shown in Table 3-7.

Because the study was conducted over several years, some analytical procedures changed during the study with the most changes taking place during Phase I. The analytical method for most metal analyses was switched from a flame atomic absorption spectroscopy (AAS) system to a simultaneous inductively-coupled argon plasma spectroscopy (ICAP) system during August 1993, after comparability was statistically established. This change provided the opportunity to increase the number of analytical measurements and improve the detection limits of many of the metal analyses. Most significantly, the use of the ICAP system improved the detection limit and low-level precision for the copper analyses. When the ICAP lead measurement was less than 0.2 mg/L, the lead analysis was repeated using the graphite furnace AAS method and this result reported as the lead measurement. Additionally, potassium was always determined by flame AAS.

In November 1993, the silicate procedure was changed from the automated colorimetric method to ICAP (reported as SiO₂). In January 1994, the sulfur ICAP method replaced the automated turbidimetric sulfate method. These two changes were implemented primarily to reduce the analytical workload and to improve analytical throughput, rather than to improve the accuracy of the analyses. Because the presence of sulfide or other reduced sulfur

Table 3-7. Analytical Methods Used for Chemical Analysis of Water Samples

Analysis	Method	Method Number	Reference	Detection Limit (mg/L)
Metals				
Calcium	AA-Flame	7140	EPA ¹	0.1
Magnesium	AA-Flame	7450	EPA ¹	2.0
Sodium	AA-Flame	7770	EPA ¹	3.0
Potassium	AA-Flame	7610	EPA ¹	0.25
Iron	AA-Flame	7380	EPA ¹	0.05
Copper	AA-Flame	7210	EPA ¹	0.02
Lead	GFAAS	7421	EPA ¹	0.002
Zinc	AA-Flame	7950	EPA ¹	0.01
Manganese	AA-Flame	7460	EPA ¹	0.01
Calcium	ICAP	200.7	EPA ²	0.01
Magnesium	ICAP	200.7	EPA ²	0.025
Sodium	ICAP	200.7	EPA ²	0.025
Copper	ICAP	200.7	EPA ²	0.003
Lead	ICAP	200.7	EPA ²	0.02
Zinc	ICAP	200.7	EPA ²	0.001
Manganese	ICAP	200.7	EPA ²	0.0004
Silicon (as SiO ₂)	ICAP	200.7	EPA ²	0.053
Sulfur (as SO ₄)	ICAP	200.7	EPA ²	0.045
Aluminum	ICAP	200.7	EPA ²	0.025
Iron	ICAP	200.7	EPA ²	0.002
Anions				
Chloride	Automated Potentiometric Titration	4500-Cl D.	Std. Methods ³	1.0
Fluoride	Automated Standard Additions	--	Orion ⁴	<0.1
	Potentiometric ISE	340.2	EPA ⁵	0.10
Orthophosphate	Automated Colorimetric	I-2601-85	USGS ⁶	0.02 (as PO ₄)
Total Phosphate	Automated Colorimetric	I-2600-85	USGS ⁶	0.05 (as PO ₄)
Total Phosphate	ICAP	200.7	EPA ²	0.33 (as PO ₄)
Nitrate -N	Automated Colorimetric	A303-5173-00	Alpkem ⁷	0.02 (as N)
Silicate	Automated Colorimetric	A303-5220-13	Alpkem ⁷	0.4 (as SiO ₂)
Sulfate	Automated Turbidimetric	375.4	EPA ²	15 (as SO ₄)
Total Alkalinity	Automated Potentiometric	2320 B.4.6.	Std. Methods ³	~0.3 (as CaCO ₃)
	Titration to Equivalence Point			
Others				
Dissolved Oxygen	Winkler (Azide Modification)	4500-0 D.	Std. Methods ³	0.50
Ammonia	Automated Colorimetric	350.1	EPA ²	0.03
Total Inorganic Carbon	Coulometric Titration	D513-92	ASTM ⁸	< 0.5
Total Chlorine	DPD Colorimetric	8167	Hach ⁹	0.02
Free Chlorine	DPD Colorimetric	8021	Hach ⁹	0.02
pH	Closed-System Electrometric	--	EPA (DWRD) ¹⁰	--

¹ EPA SW846, Sept. 1986.² USEPA, "Methods for the Determination of Metals in Environmental Samples," EPA-600/4-91-010 (1994).³ "Standard Methods for the Examination of Water and Wastewater," 18th Edition (1992).⁴ Orion Research, Inc., Boston, MA.⁵ USEPA, "Methods for Chemical Analysis of Water and Wastes," EPA-600/14-79-020 (1983).⁶ Modified from methods for Determination of Inorganic Substances in Water & Fluvial Sediments, U.S. Geological Survey Open-File Report, (85-495) 1985.⁷ Alpkem Research, Inc., Clackamas, OR.⁸ "1994 Annual Book of ASTM Standards," section 11, volume 11.01 Water (I).⁹ Hach Company, Loveland, CO.¹⁰ Drinking Water Research Division, USEPA, Internal Method. References: *Journal AWWA* 72:5:304 (1980); Schock & Lytle, *Proc. AWWA WQTC* (1994).

species is chemically impossible or the concentrations negligible, the ICAP analysis of total sulfur is interpreted as sulfate.

TIC was analyzed directly using a coulometric method.²¹ This method has frequently been found to be more accurate and precise than deriving the concentration from two measured quantities (pH and total alkalinity), each with an analytical uncertainty²². The combined method and sampling standard deviation for TIC during the course of this study was computed using pooled data from analyses of duplicate samples, and was determined to be ± 0.1 mg C/L, with no statistically significant concentration dependence over the experimental range of 5 to 70 mg C/L.

3.7.2 Pipe Surface Analysis

The internal surfaces of several sections of pipe loops were examined by x-ray diffraction and scanning electron microscopy to determine and compare the composition of the surface films. X-ray diffraction analysis was performed on corrosion deposits from pipe samples, whenever sufficient sample volume was available. Deposits scraped from the pipe sections were finely ground by synthetic ruby or agate mortar and pestle, to pass through a 200-mesh sieve (approximately 75 μm) whenever possible. Samples were then suspended as a slurry with amyl acetate, and deposited on zero-background quartz plates by disposable pipettes for mounting in the powder diffractometer.

The instrument used was a Scintag XDS-2000 theta-theta diffractometer with a copper X-ray tube operated at 45 kV and 33 mA. Scans were usually over the range of 5 to 60 degrees 2θ , with 0.03 degree step sizes that were held for 3 seconds each. Pattern

analysis, performed with the software provided by the instrument manufacturer, generally followed procedures outlined by ASTM.²³ ASTM, 1994 #352|

3.7.3 Quality Assurance

Laboratory quality assurance practices for the instrumental analyses followed documented Treatment Technology Evaluation Branch standard operating procedures (SOP).²³ These procedures include requirements for analysis of duplicates and spikes of samples comprising more than 10% of the sample load, verification of instrument calibration, and some interference checking through external certified reference standards (USEPA, USGS reference standards) at multiple times during each analytical run. The exact location and frequency of different types of quality control spikes, standards, blanks, and duplicates, along with accuracy requirements, are specified in those documented procedures for each type of analysis. They cannot be generalized because the precision and accuracy expectations vary with the type of instrument used and the levels of the analyte encountered. If quality assurance requirements associated with standards, spikes, and duplicates were not achieved, the entire batch of samples was rerun as required in the SOP plan. When a review of the test data showed a result very inconsistent with past trends (visual outlier), the analysis was repeated to verify the initial analytical result.

3.7.4 Data Analysis

When data analysis was conducted, several statistical approaches were used, all of which were done using SigmapstatTM statistical software. Data normality was determined by the Kolomogorov Test. In most cases, the data distributions were not normal (at 95%

confidence) resulting in the use of non-parametric statistical test. Data reporting for tabulations and statistical evaluation followed the recommendations of the ASTM standard practice for low-level data (D4210-83).[^]ASTM, 1994 #353| In this practice, actual instrument results, including negative values, are reported and used in statistical calculations, to avoid inaccuracies brought about by artificial data truncation commonly used by environmental laboratories. When data was combined from two different analytical test methods and the detection methods were different, the most conservative method detection limit was used in the tabulation.

4. Test Results

4.1 Phase I Study

4.1.1 Sampling Days

Phase I began on November 2, 1992, and officially ended on February 24, 1994, the last day for bi-weekly routine sampling (468 days). The number of sampling days during the 16 month study period ranged from 6 to 10 per month as shown in Table 4-1 for a total of 114 sampling days. Because of a longer term interest in the control test loop aspect of the study by CWW and TTEB, the systems continued to operate until late August 1994. During this extended period, sampling was reduced to once per month on a non-routine basis.

4.1.2 Water Usage

The pipe loop systems provided a flow rate of approximately 1 gpm through the pipe loops and about 0.5 gpm through the faucets during the flowing periods. As mentioned in the System Operation (Section 3.5), the flow controller on each pipe loop was adjusted periodically to maintain approximately 0.06L/s (1 gpm) through each loop. The faucets, on the other hand, could

not be easily adjusted because of the use of a mechanical hydraulic arm. Short term flow measurements were occasionally taken using a stop watch and volumetric cylinder to compare and adjust flow rates through each faucet.

To determine the total flow through each pipe loop system, water meter readings were recorded on the sampling days. The total flows through the control and test pipe loop systems were 458,173 gallons (948.6 gpd) and 440,822 gallons (912.8 gpd) respectively; a difference of 35.8 gpd. Although the total flows and daily rates were not identical, they were within 4 percent of each other. Using the assumption that the difference was spread evenly among the eight loops and two faucets, the difference amounts to about 3.5 gallons per day per loop/faucet. Because of the mechanical nature of the faucet operation and the lack of the ability for fine adjustment, most of the difference in flows is actually believed to be associated with the faucets. Regardless, the difference is considered to be small and to have no or little effect on the metal leaching levels obtained.

4.1.3 Source Water Quality

Because the Phase I source water was a finished water from the BWTP, the quality did not undergo major changes during the study period. Several water quality parameters did vary slightly, however, because of seasonal temperature changes, subsurface hydrochemical changes, and variations in plant operation. The water quality parameters affected the most by these factors were water temperature, pH, hardness, chlorine, dissolved oxygen, and total ortho-phosphate. Because the water temperature is influenced by the weather temperature and DO is influenced by water

Table 4-1. Number of Sample Collection Days Per Month During Phase I and II Studies.

Month	Sample Days Per Month	
	Phase I Study	Phase II Study
1	5	2
2	9	9
3	7	8
4	6	6
5	9	9
6	8	8
7	8	7
8	6	9
9	7	7
10	8	10
11	8	8
12	6	9
13	7	6
14	9	6
15	7	8
16	4	8
17	--	3
Total	114	123

temperature, temperature and DO variation of the source water occurred through the 16 month study period. DO was also influenced by plant operation as explained in the following section (4.1.3.3) on DO. All other parameters were influenced by the softening water treatment process and chemical additions. The source water quality during the study period is summarized in Table 3-1. Specific results of all the analyses on the source water are contained in Appendix A.

4.1.3.1 pH - The pH of the source water did not vary substantially during the study, but some temporal variation was noted (Figure 4-1). Except for one measurement at 8.6, the pH of the Phase I source water ranged between 8.8 and 9.4 (mean of 9.1) and was determined by the lime softening process employed by the plant.

4.1.3.2 Temperature - The temperature of the influent source water varied from a high of near 18°C to a low of near 13°C during the winter periods. The results of the temperature measurements are shown in Figure 4-2. Temperature readings of the standing water in the pipe loops were not taken but certainly increased to room temperature during the 7+ hours standing time. Room temperature also varied with the seasons because the pipe loop systems were located underground in an area where the only supplemental heat was a space heater that ran only during the first few months of the study. Room temperature was estimated to be in the 60s °F (5-10°C).

4.1.3.3 Dissolved Oxygen - Dissolved oxygen measurement varied from a high of near 8.5 mg/L to a low of near 4.5 mg/L (Figure 4-3). The variation in the DO concentration was caused by changes in water temperature (DO solubility), but more

importantly by the operational changes of the treatment plant. The treatment plant had two upflow softening basins. The basins were fed raw well water through an open splitter box from a central supply line. When only one softening basin was operational, turbulence in the splitter box was increased and a subsequent increase in dissolved oxygen was noted.

4.1.3.4 Hardness - Hardness of the source water ranged from about 150 to 180 mg/L (as CaCO₃) and was dependent upon plant operation. Two hardness measurements were significantly lower at 110 and 130 mg/L (as CaCO₃) with no explanation. The average hardness level was calculated at 159 mg/L (as CaCO₃) and the standard deviation was 22.6. The results of the hardness tests are plotted in Figure 4-4.

4.1.3.5 Phosphate - To prevent iron precipitation in the BWTP filters, a small amount of sodium hexametaphosphate (0.8 mg/L as PO₄) is added to the water to prevent the encrustation of the sand fillers with calcium carbonate. To determine the fate and form of the phosphate, total and orthophosphate was measured. The results for the total phosphate measurements are plotted in Figure 4-5. Because of analytical problems, total phosphate was not analyzed for a short period of time (60 days) after about the 300th day of the study. Total phosphate averaged 0.4 mg/L and orthophosphate 0.09 mg/L with the specific concentrations plant operation dependent.

4.1.3.6 Chlorine - Chlorine is added to BWTP finished tap water to provide a concentration of about 1 mg/L. Both total and free chlorine were measured and the results of the total chlorine measurements are shown in Figure 4-6. Total chlorine

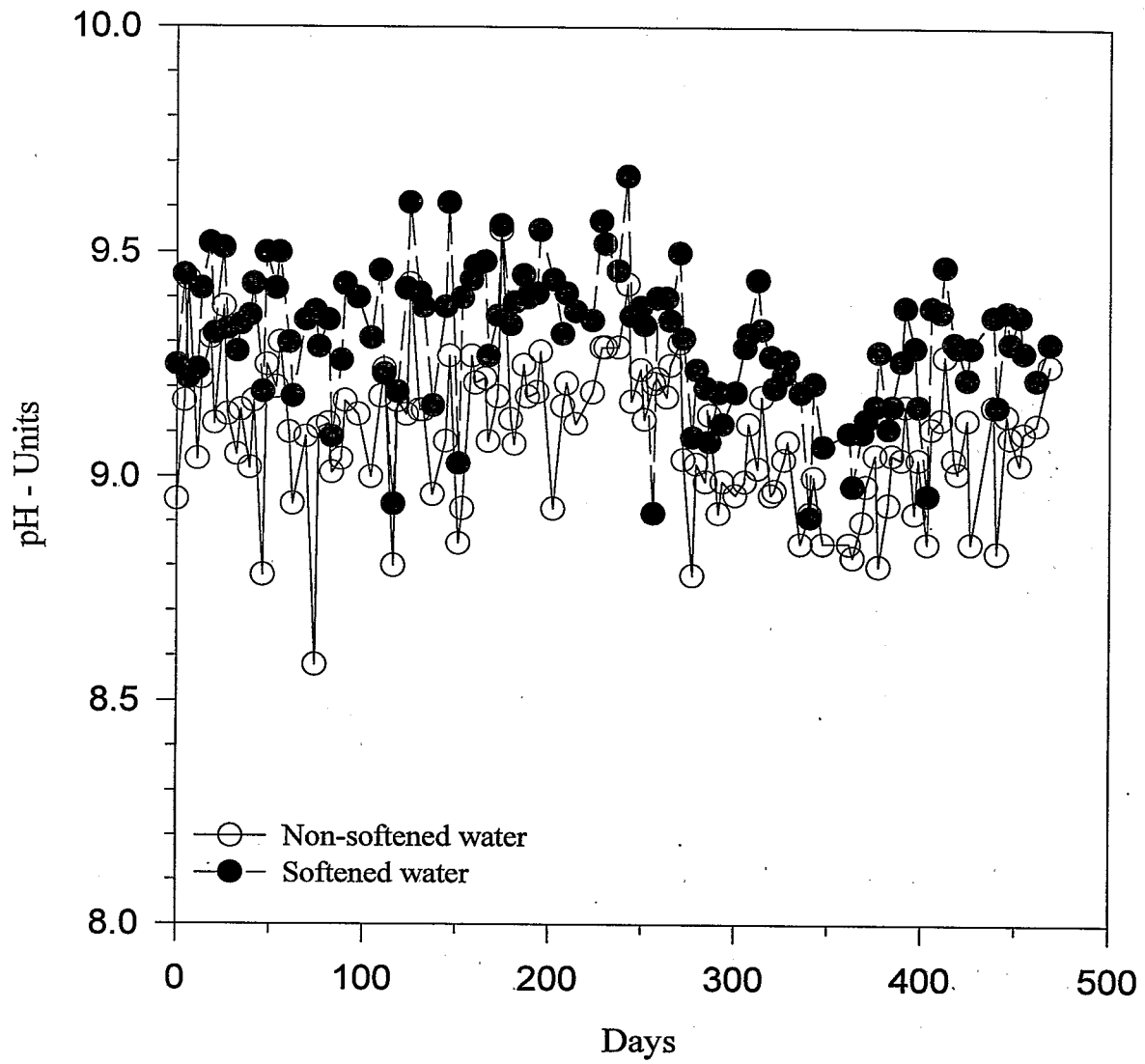


Figure 4-1. pH of the non-softened and softened waters, phase I study.

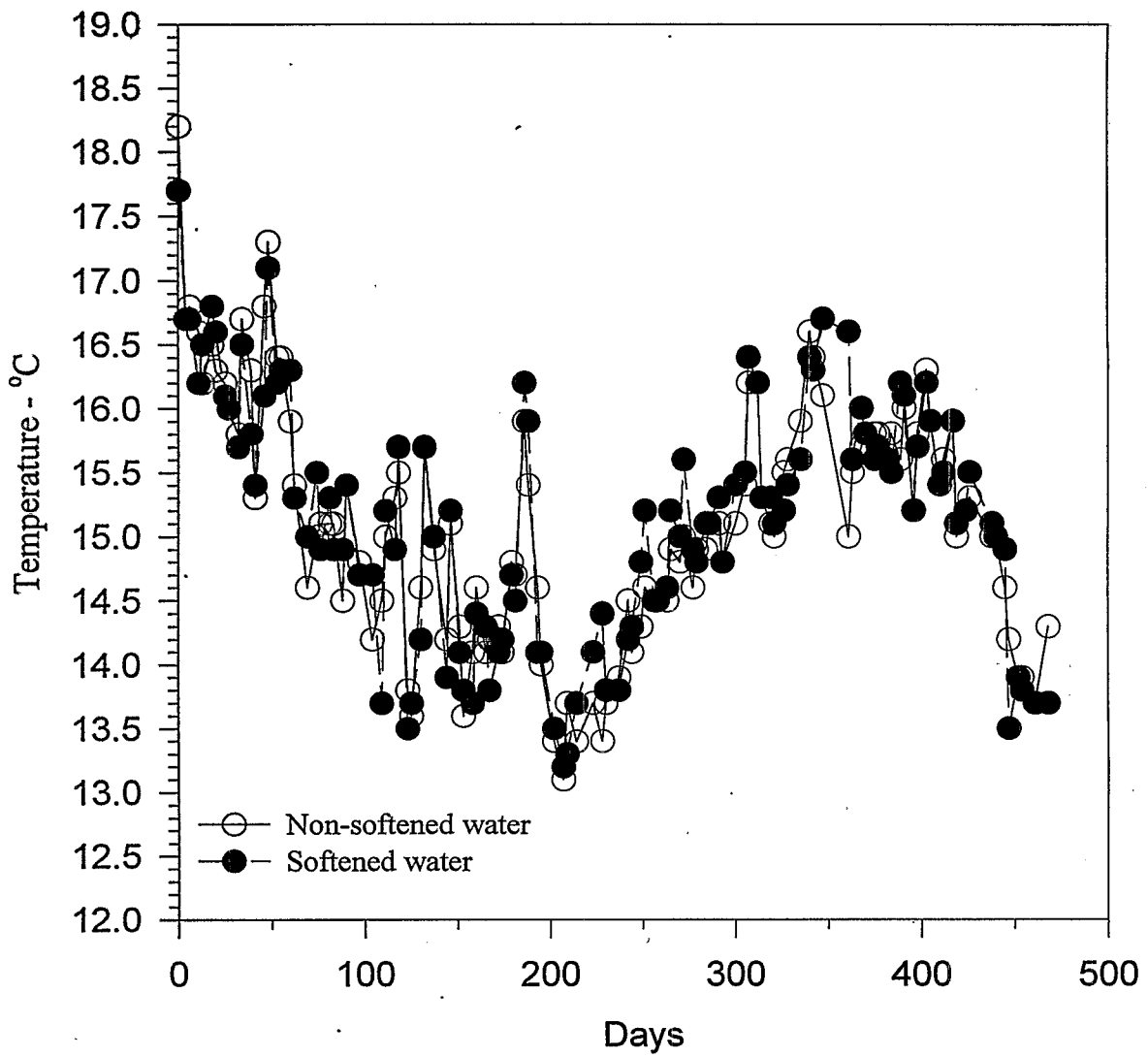


Figure 4-2. Temperature of the non-softened and softened waters, phase I study.

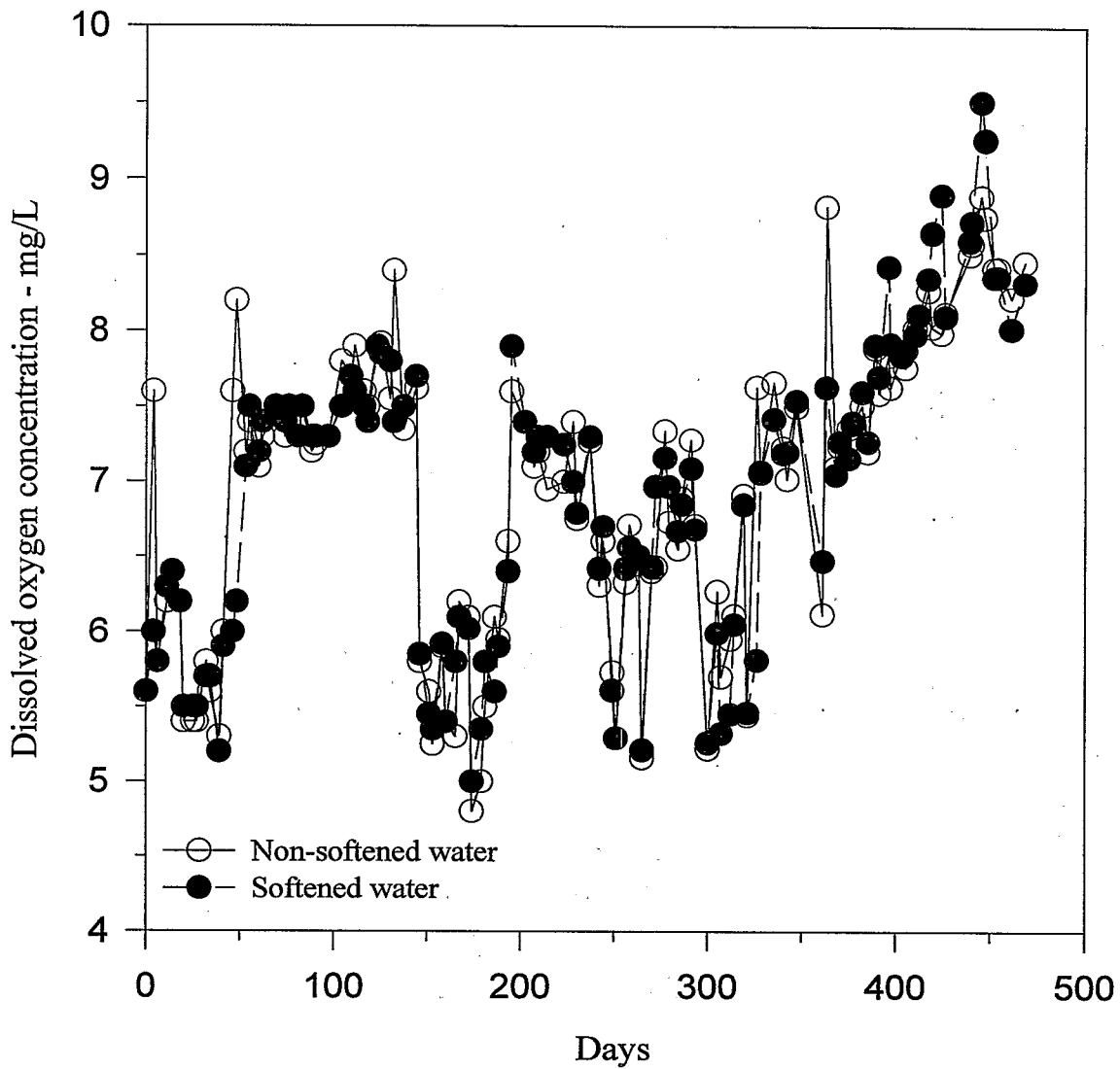


Figure 4-3. Dissolved oxygen of the non-softened and softened waters, phase I study.

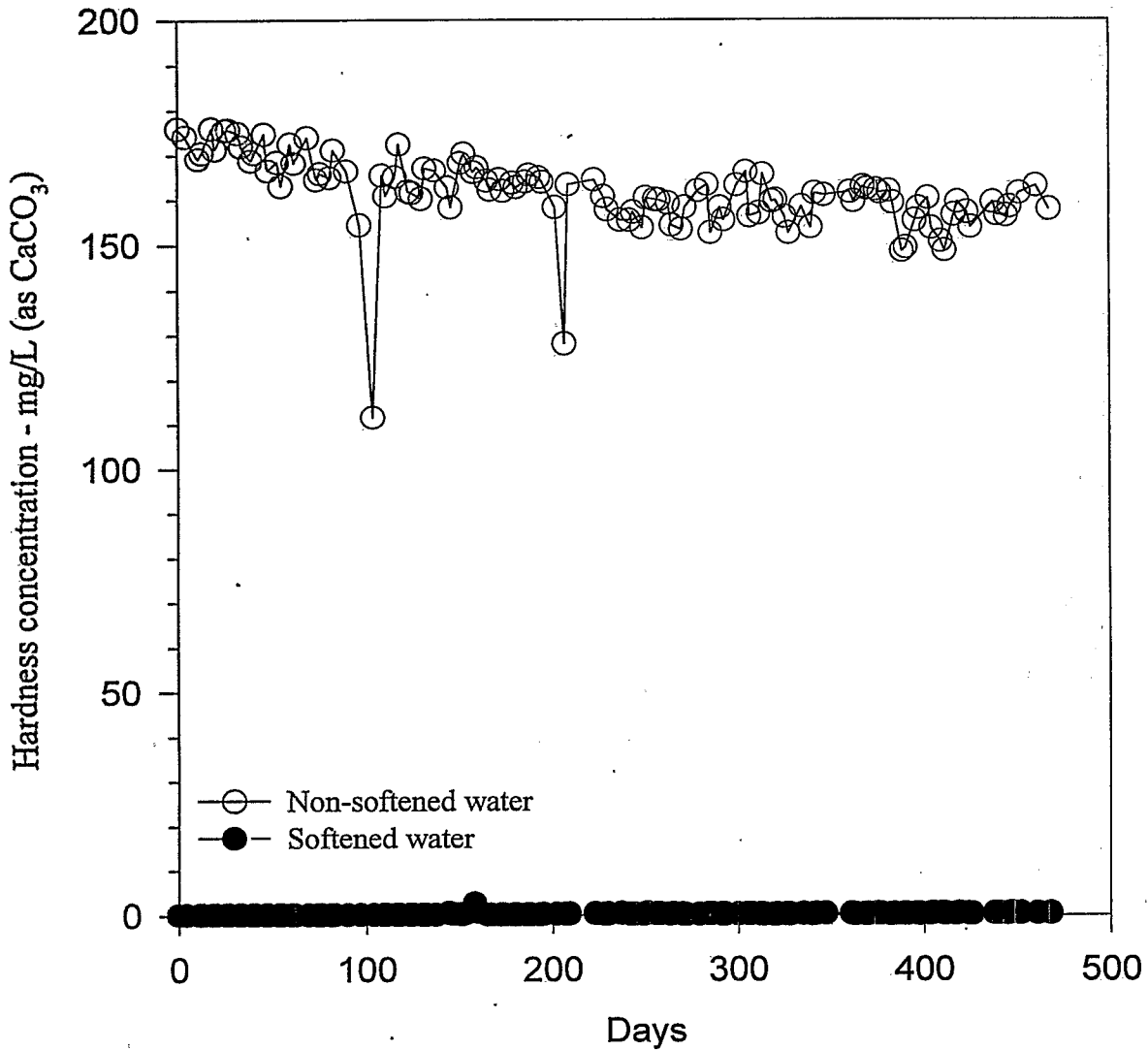


Figure 4-4. Hardness concentration of the non-softened and softened waters, phase I study.

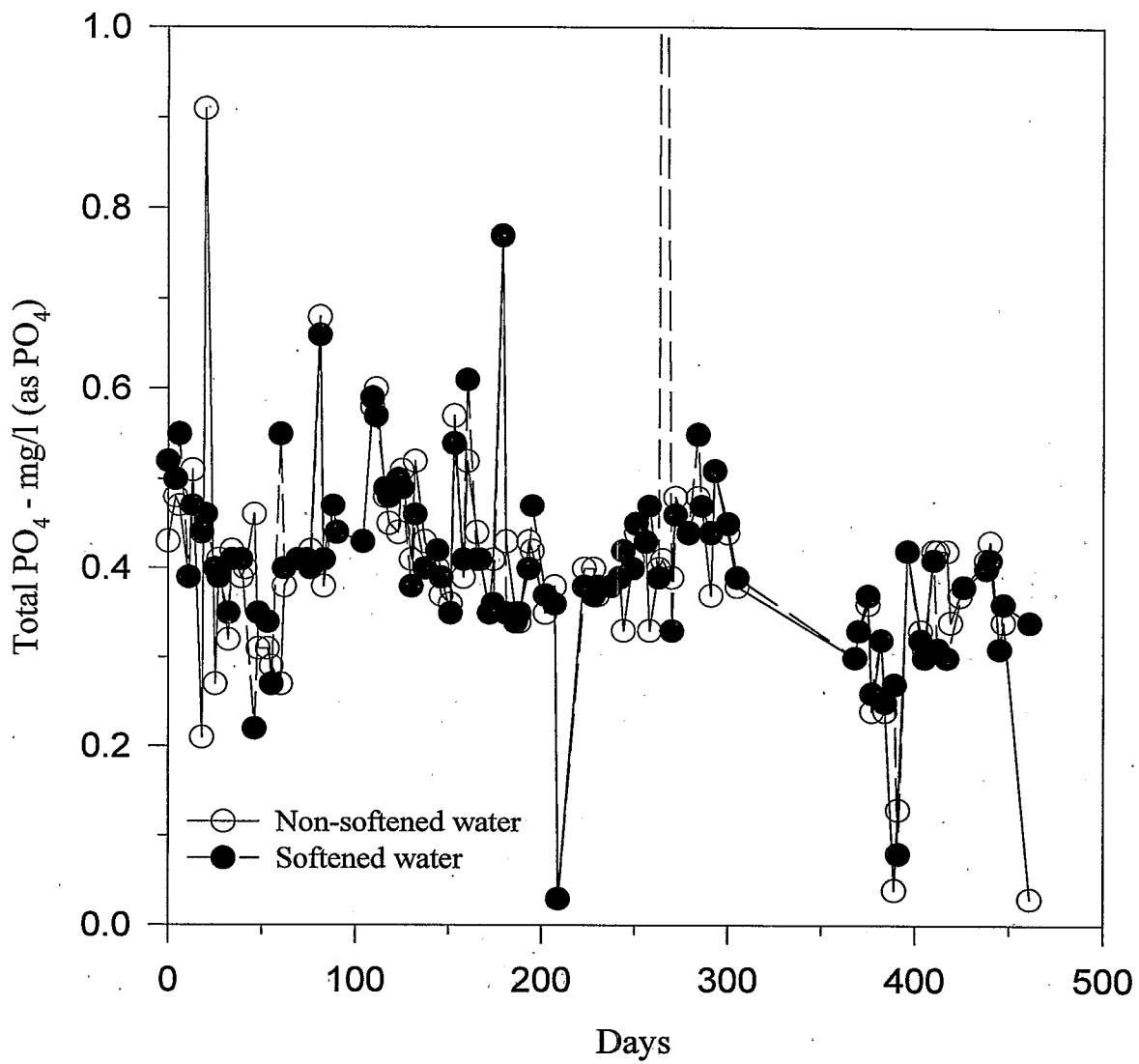


Figure 4-5. Total phosphate of the non-softened and softened waters, phase I study.

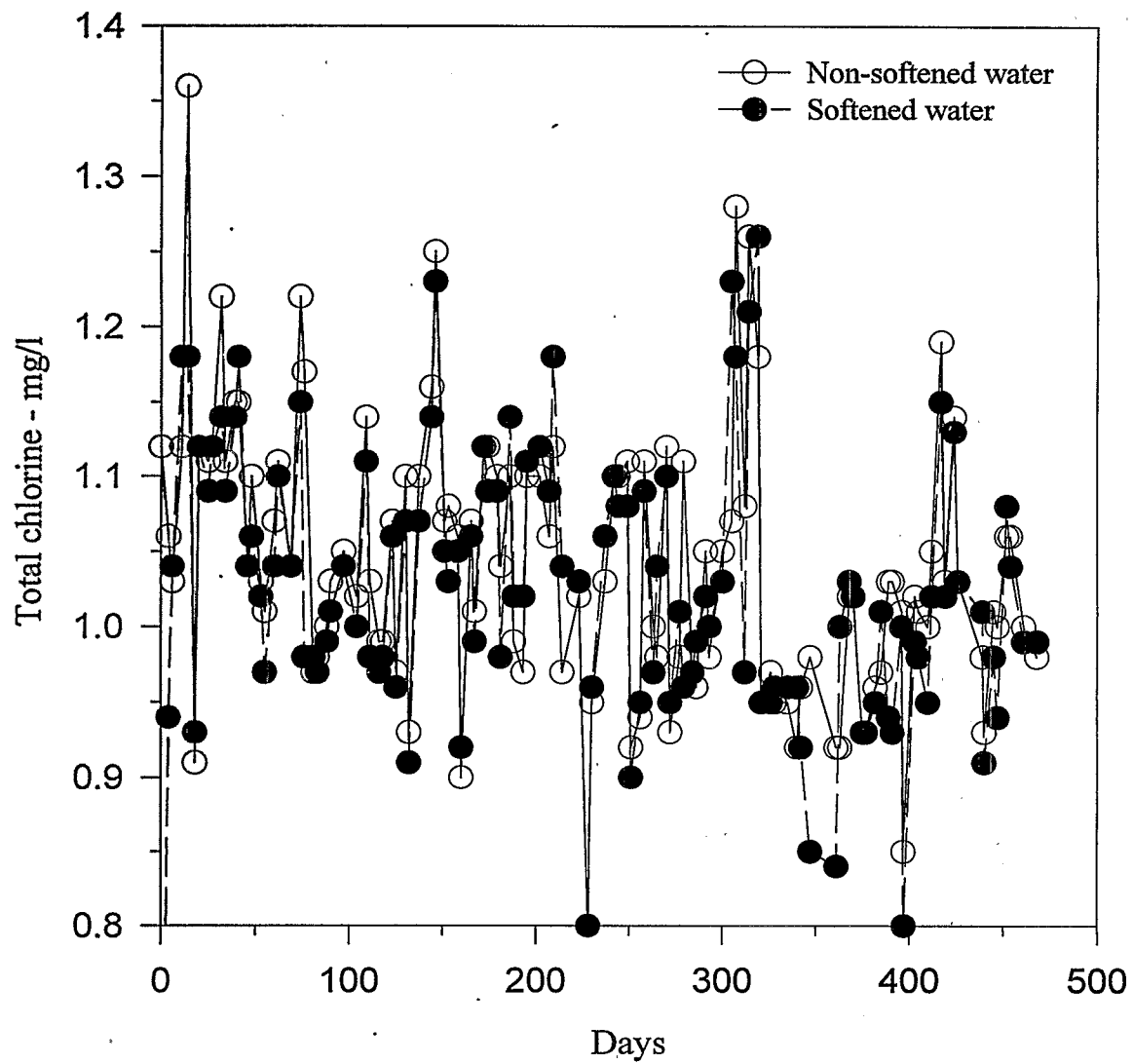


Figure 4-6. Total chlorine of the non-softened and softened waters, phase I study.

averaged 1.12 mg/L and free chlorine was only slightly less at 1.04 mg/L. The variation in concentration was dependent on plant operation.

4.1.3.7 Total Inorganic Carbon (TIC) - The TIC of the source water averaged near 16 mg/L with a range of about 13 to 19 mg/L. The results of the TIC measurements are shown in Figure 4-7.

4.1.4 Non-Softened/Softened Water Quality
A comparison of the measured water quality parameters (mean) of the non-softened (control) and the ion exchanged softened waters (test) is shown in Table 3-1. The chemical constituents that showed the largest difference between the non-softened (control) water and the softened (test) water were calcium, magnesium, potassium, sodium and to some degree pH. As expected, the ion exchange softener reduced the calcium (25.6 mg/L) and magnesium (23.7 mg/L) concentrations in the control water to near zero while increasing the sodium (24.6 mg/L) level to 101 mg/L. Potassium, a monovalent cation, (3.55 mg/L) was reduced by 68 percent to 1.13 mg/L. The pH was increased slightly from 9.1 to 9.3. A plot of the pH's of the the non-softened and softened waters is shown in Figure 4-1.

Polyphosphate and orthophosphate species passed through the ion exchanger essentially unchanged indicating that they were in anionic or unchanged complex form. The results of the total phosphate (poly) measurements for both the non-softened and softened waters are shown in Figure 4-5. Additionally, the ion exchanger did not effect the temperature (Figure 4-2), DO (Figure 4-3), chlorine (Figure 4-6), or TIC (Figure 4-7).

4.1.5 Metal Leaching

4.1.5.1 Data Analysis - All of the metal leaching data from Phase I were examined visually (plotted graphs) and statistically to determine whether the ion exchange softened water produced higher metal levels than the non-softened water using a three step process. The first step consisted of determining whether metal leaching from the loops and faucets stabilized. This was determined by visually estimating a point in time, or several possible points in time, when the slopes of the metal leaching curves for each loop type achieved zero and then linear regression tests (95% confidence) were used for confirmation. If visual examination of the data set showed one or several outliers (judgement), the process was repeated on the data set with the outliers removed. Using this process, no complete data sets of either loops/faucets for Phase I were determined to reach stabilization. For all sets, at least one of the four curves did not test for zero slope.

True "stabilization" times may range from weeks to years, depending upon the nature of the surficial passivation films formed for a given material. For example, recent research has indicated that with copper, initial $\text{Cu}(\text{OH})_2$ films will "age" into less soluble $\text{Cu}_2(\text{OH})_2\text{CO}_3$ or CuO over periods of perhaps more than 15 to 20 years.⁶ Stabilization is also difficult to achieve for materials such as soldered joints and brass, where physical depletion of source material, such as lead, occurs. Long term slow drift may be present even for the sets of loops that had appeared to stabilize. Another factor that is likely to have interfered with the stabilization tests was the variation in the leaching data caused by the changes in water quality.

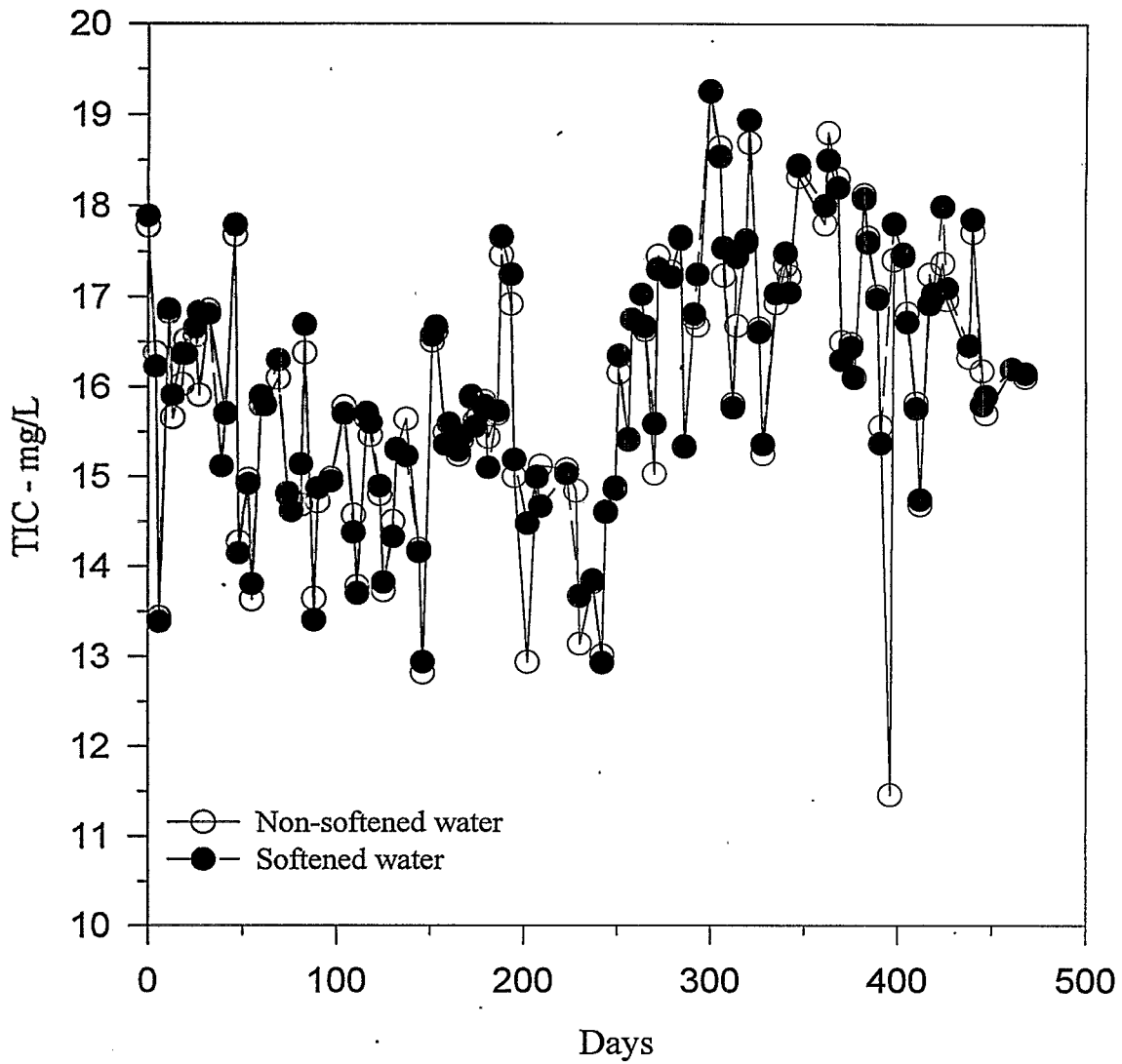


Figure 4-7. Total inorganic carbon of the non-softened and softened waters, phase I study.

The second step in the data evaluation process was to determine if duplicate loops of the same materials exposed to the same water source agreed statistically. Because the linear regression tests did not show a point in time when all four leaching curves for each loop/faucet type stabilized, a stabilization time was selected from a visual inspection of the curves in order to complete the statistical analysis. In most cases, the time selected was about half way through the study period (Table 4-2). Using the metal leaching data from the selected stabilization time to the end of the study (means or median values of Table 4-3), statistical tests (paired t-test or non-parametric equivalent tests) were conducted on each duplicate loop with and without the outliers (based upon a visual review and judgement) to determine whether the two data sets could be paired (averaged). The results of these tests showed that only three sets could be paired (Tables 4-2) and that the outlier data had no impact on the results. All other sets were considered statistically different. Visual examination of the data suggests that pair testing of many of the loops failed because of increases in metal levels for short periods of time of at least one loop. These short term increases cannot be explained, but are common to pipe loop testing. Each data set was also tested for normality in order to select the proper statistical test (parametric or non-parametric) determining the existence of possible significant differences of metal leaching between softened and non-softened conditions for the same type of loops/faucets.

The final step in the three step evaluation process compared the metal leaching results (mean or median values) of the loops/faucets exposed to the non-softened water and softened water. Because of the lack of

statistical comparison of many of the paired loops, t-tests (normal data sets) or non-parametric equivalent tests (non-normal data sets) were conducted on all possible pairs (4) of loops used to determine whether the metal leaching levels between the non-softened and softened conditions were statistically different. When duplicate sets of loop data could be paired, the tests were repeated using the average values of the paired loops and faucets against the other two individual loops and faucets. Conducting the tests using paired data and the outlier data did not impact the outcome of the tests.

The results of the statistical tests showed very mixed results and no consistent pattern. An argument can be made that when the leaching data of paired loops cannot be averaged (statistically), comparing the non-softened to the softened water data, as was attempted, is not a valid procedure and thus no statistical significance could be attributed to the results of the analysis. The exercise was conducted, however, for the purpose of determining whether a general pattern occurred without attempting to attach any statistical significance to it. Consequently, the presentation of results and conclusions are based almost solely upon visual interpretations of a graphical presentation of the data.

4.1.5.2 Lead Leaching -

4.1.5.2.1 Lead Pipe - The results of the lead sampling data (Appendix B, Tables B-1, B-1a) from the lead pipe loops are shown in Figure 4-8. A visual review of the data and the mean values of the lead levels of the individual pipe loops from day 69 (selected stabilization period) suggests that the lead levels of the non-softened water pipe loops were slightly higher (0.05-0.06 mg/L) than the lead levels of the softened water pipe

Table 4-2 Results of Statistical Analysis of Pipe Loop Data, Phase I Study.

Loops	Metal	Stabilization - day selected as start of stabilization period	Non-softened water (control loops 1 & 2)		Softened water (test loops 1 & 2)	
			Duplication test	Normality test	Duplication test	Normality test
Lead	Pb	69	Passed	Non-normal	Failed	Non-normal
Copper/Solder	Pb	41	Failed	Non-normal	Failed	Non-normal
Faucet	Pb	151	Failed	Non-normal	Passed	Normal
Copper/Solder	Cu	251	Failed	Normal	Passed	Normal
Copper/Tubing	Cu	251	Failed	Normal	Failed	Normal
Faucet	Cu	251	Failed	Non-normal	Failed	Non-normal
Galvan.	Zn	251	Failed	Non-normal	Failed	Non-normal

Table 4-3. Summary of Metal Leaching Data of Estimated Stabilization Period, Phase I Study.*

Loops	Metal	Non-softened water (control loops 1 & 2)				Softened water (test loops 1 & 2)			
		Loop 1		Loop 2		Loop 1		Loop 2	
		Mean	Median	Mean	Median	Mean	Median	Mean	Median
Lead	Pb	0.260	0.259	0.261	0.258	0.212	0.208	0.201	0.199
Copper/Solder	Pb	<DL	<DL	0.003	<DL	<DL	<DL	<DL	<DL
Faucet	Pb	0.003	0.003	0.004	0.004	0.006	0.006	0.006	0.007
Copper/Solder	Cu	0.085	0.084	0.075	0.073	0.089	0.086	0.085	0.086
Copper Tubing	Cu	0.090	0.090	0.098	0.100	0.115	0.114	0.112	0.111
Faucet	Cu	0.015	0.013	0.011	0.011	0.015	0.016	0.014	0.015
Galvan.	Zn	4.13	3.97	1.75	1.77	4.97	4.68	6.80	6.93

* All units in mg/L
DL=Detectable Limit

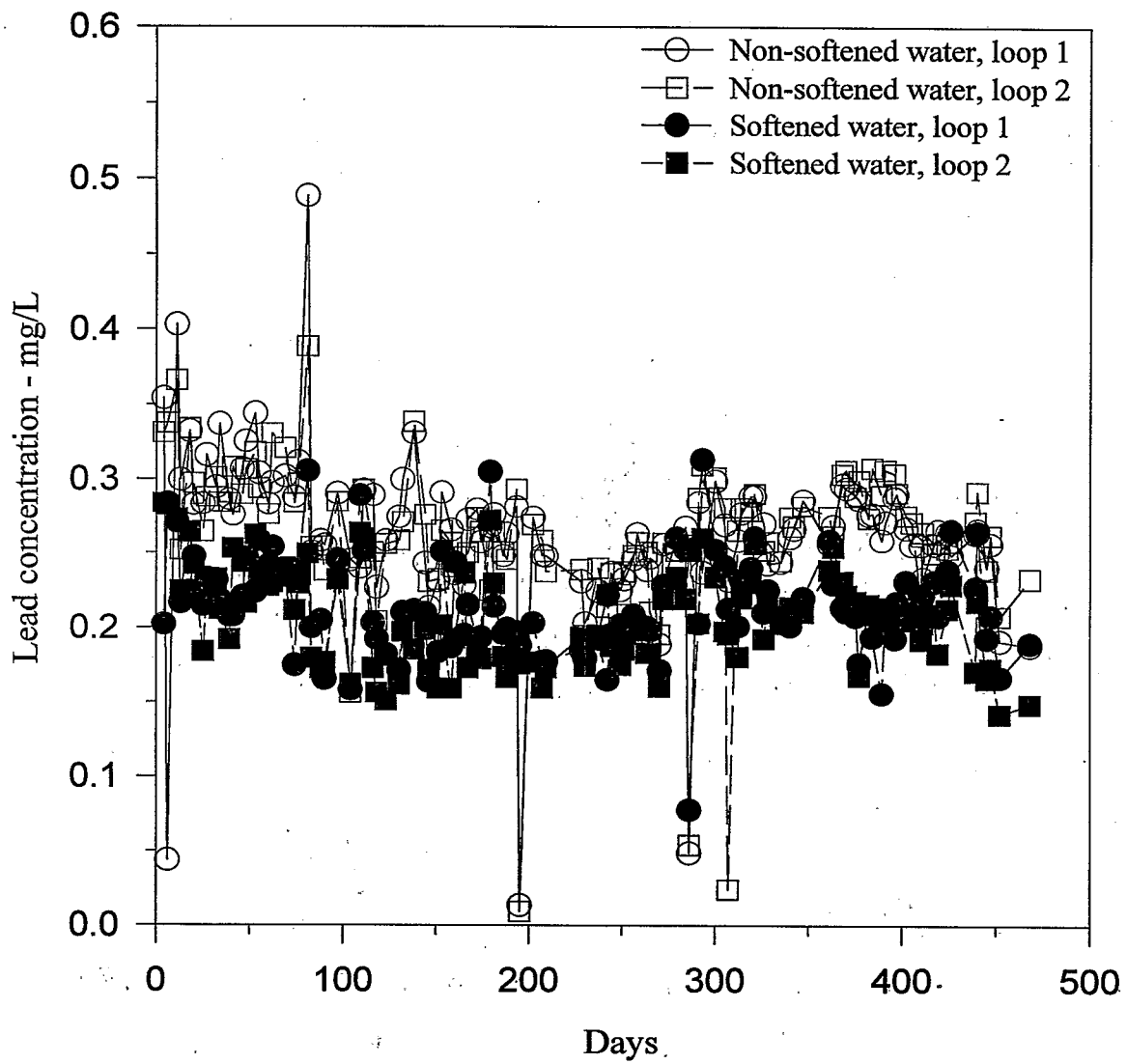


Figure 4-8. Lead leaching from lead pipe loops, phase I study.

loops. The slightly higher lead levels of the non-softened water exposed loops were observed from the beginning of the test period to about the last 20-30 days when the levels appear to converge. The lead levels for all loops were significantly above the USEPA lead action level (0.050 mg/L) and little or no decrease appeared to occur during the study.

4.1.5.2.2 Copper Soldered Pipe - The results of the lead leaching data (Appendix B, Tables B-2, B-2a) of the copper soldered pipes are shown in Figure 4-9. The majority of the lead levels of all loops were at or below the detectable level of 0.002 mg/L except for some lead increases with several pipes that occurred between the 8 and 16 months. During the first 225 days, there appears to be essentially no difference between the lead levels for all four pipes. After the short disturbance period, the lead levels for one of the non-softened loops appears to be higher through the end of the study. This trend, however, must be interpreted with caution because at such low levels, minor differences in workmanship, exposed surface areas of joints, and sampling and analytical variations can account for differences among loops.

4.1.5.2.3 Faucets - The results of the lead leaching (Appendix B, Tables B-3, B-3a) from the faucets are plotted in Figure 4-10. Visual examination of the faucet plotted data indicates that the lead leaching from the softened water exposed faucets were slightly higher than the non-softened exposed faucets from the very start of the study. The calculated means for the last 310 days (Table 4-3) also showed the same result. However, because the lead levels for both conditions were very low, 0.003 to 0.008 mg/L, the differences probably have little practical

importance as was proposed for the copper soldered loops. Furthermore, the faucet results show that during the last three months, the lead levels from the two systems were within 0.002 mg/L of each other. The results suggest, therefore, that the softened water had no practical effect on increased lead levels.

4.1.5.3 Copper Leaching -

4.1.5.3.1 Copper Tubing. The results of copper levels (Appendix B, Tables B-4, B-4a) from the copper tubing loops are shown in Figure 4-11. A review of data suggests little or no difference between the copper levels of the non-softened and softened water exposed tubing during the first 250 days. During the last 210 days, the copper levels of the softened water exposed tubing appears to be slightly higher by about 0.003 mg/L which is supported by the mean values (Table 4-3). Copper levels from all loops were within a range of 0.05 to 0.15 mg/L which is about 13 times lower than the USEPA copper action level of 1.3 mg/L.

4.1.5.3.2 Copper Soldered Pipe - The copper leaching data (Appendix B, Tables B-2, B-2a) of the soldered pipes are shown in Figure 4-12. The copper levels show more variability among the loops, particularly during the first 250 days as compared to the copper levels of the copper tubing loops. Moreover, the levels are higher than the copper tubing loops during this period and show a decreasing trend in copper levels with time. No explanation can be made for the difference in behavior of the two types of copper pipe loops. During the last 210 days, the copper levels are similar to the copper tubing loop levels and there appears to be little or no difference between the non-softened and softened exposed water loops.

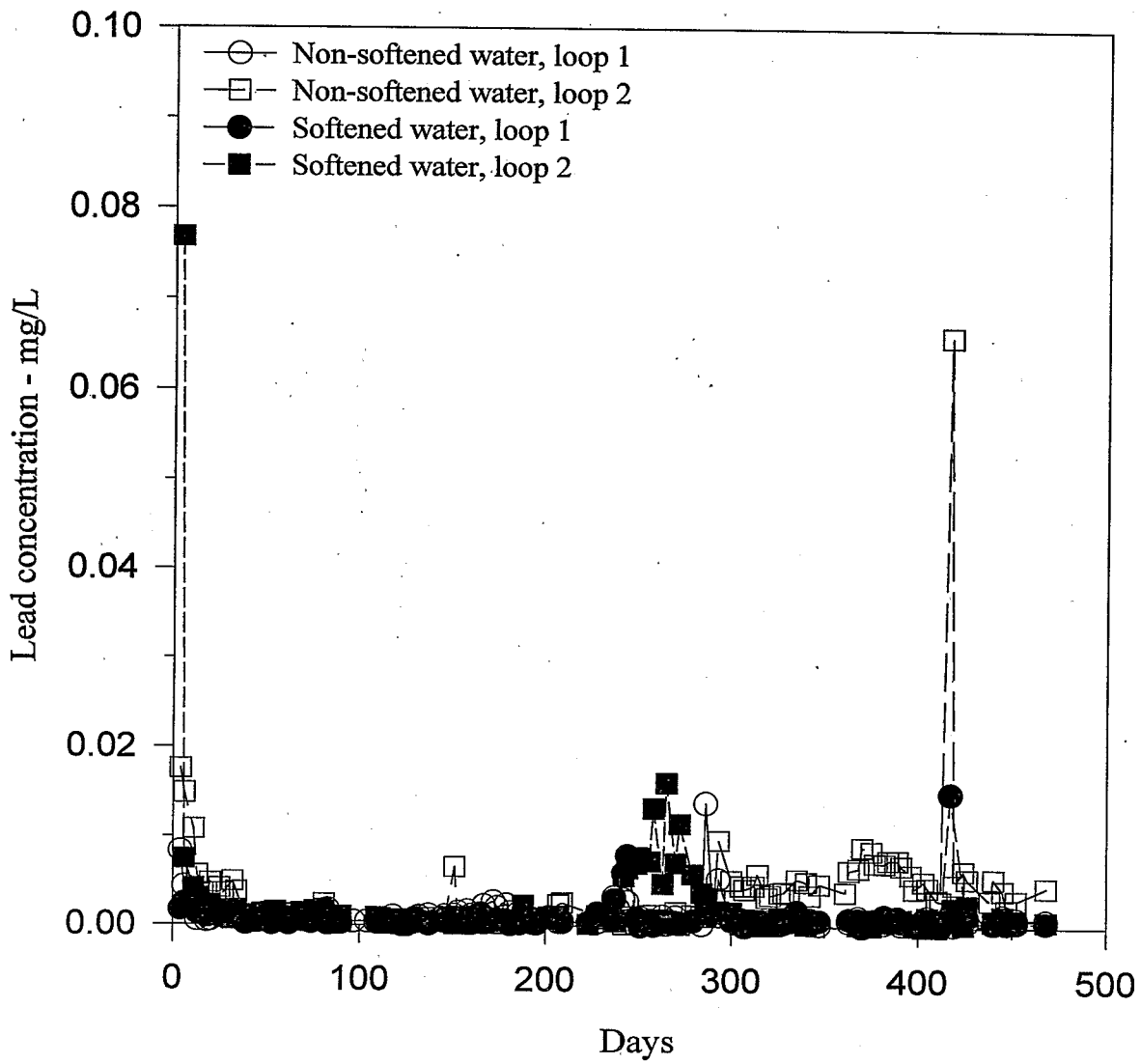


Figure 4-9. Lead leaching from copper/solder pipes, phase I study.

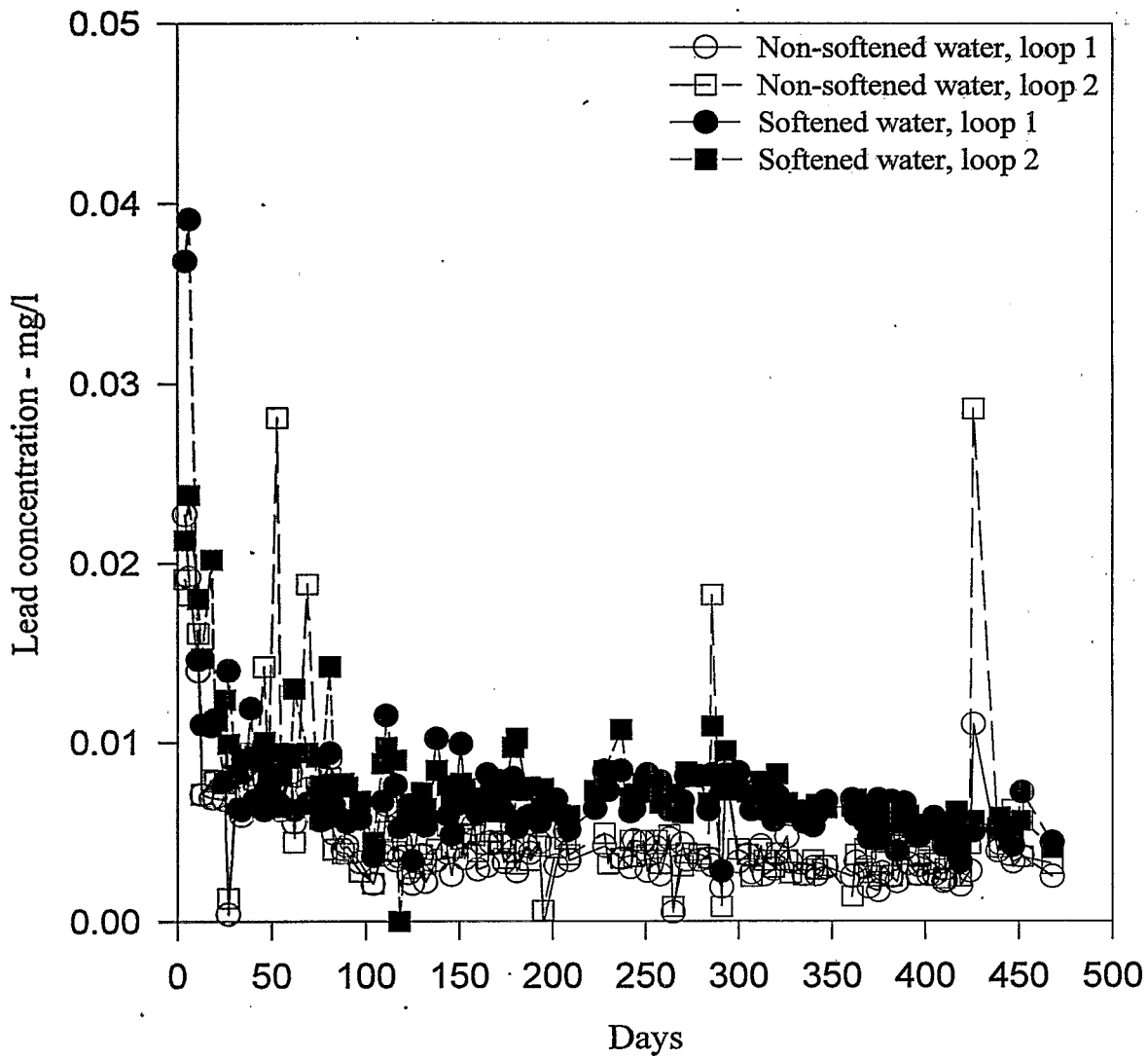


Figure 4-10. Lead leaching from faucets, phase I study.

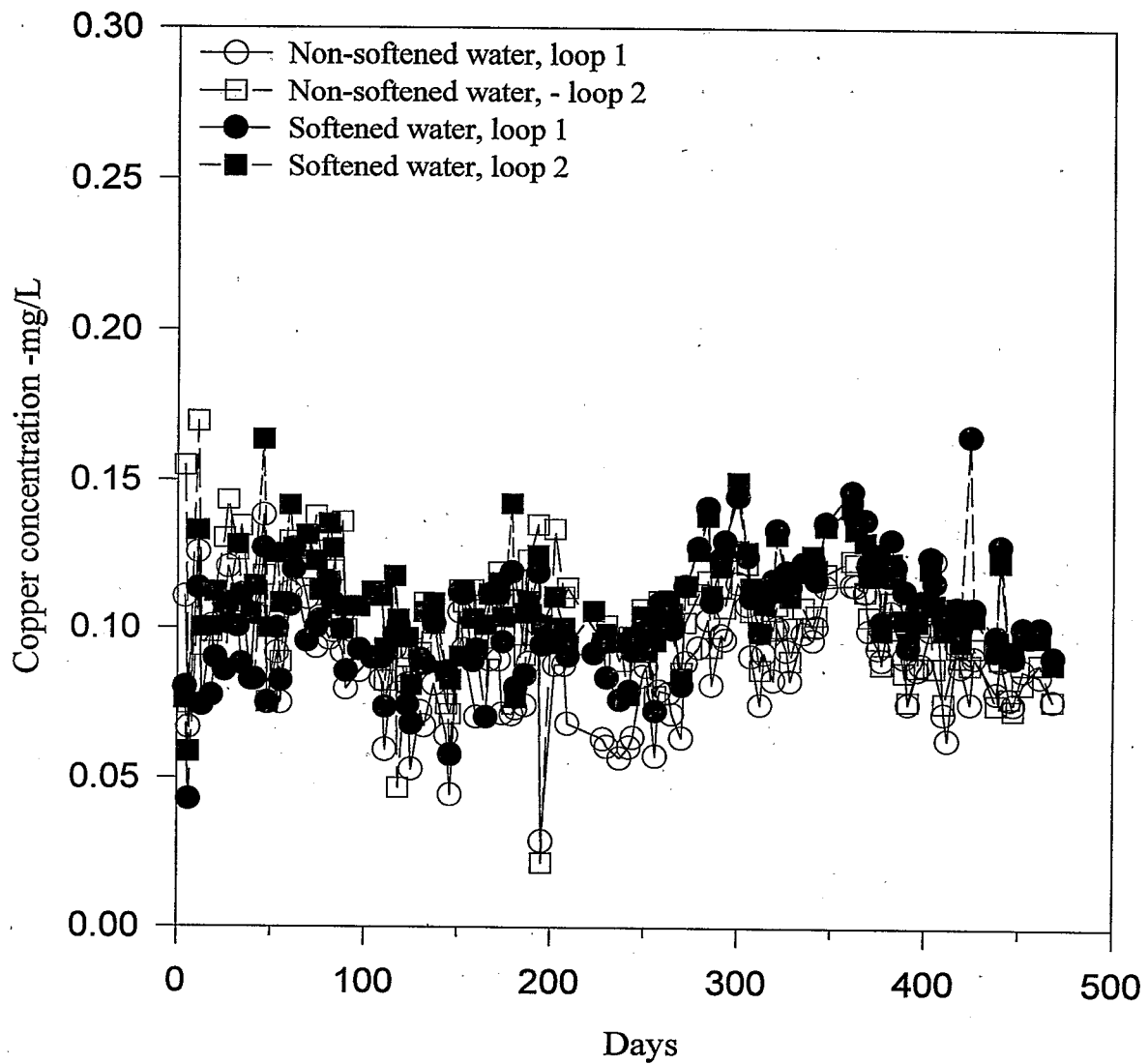


Figure 4-11. Copper leaching from copper tubing loops, phase I study.

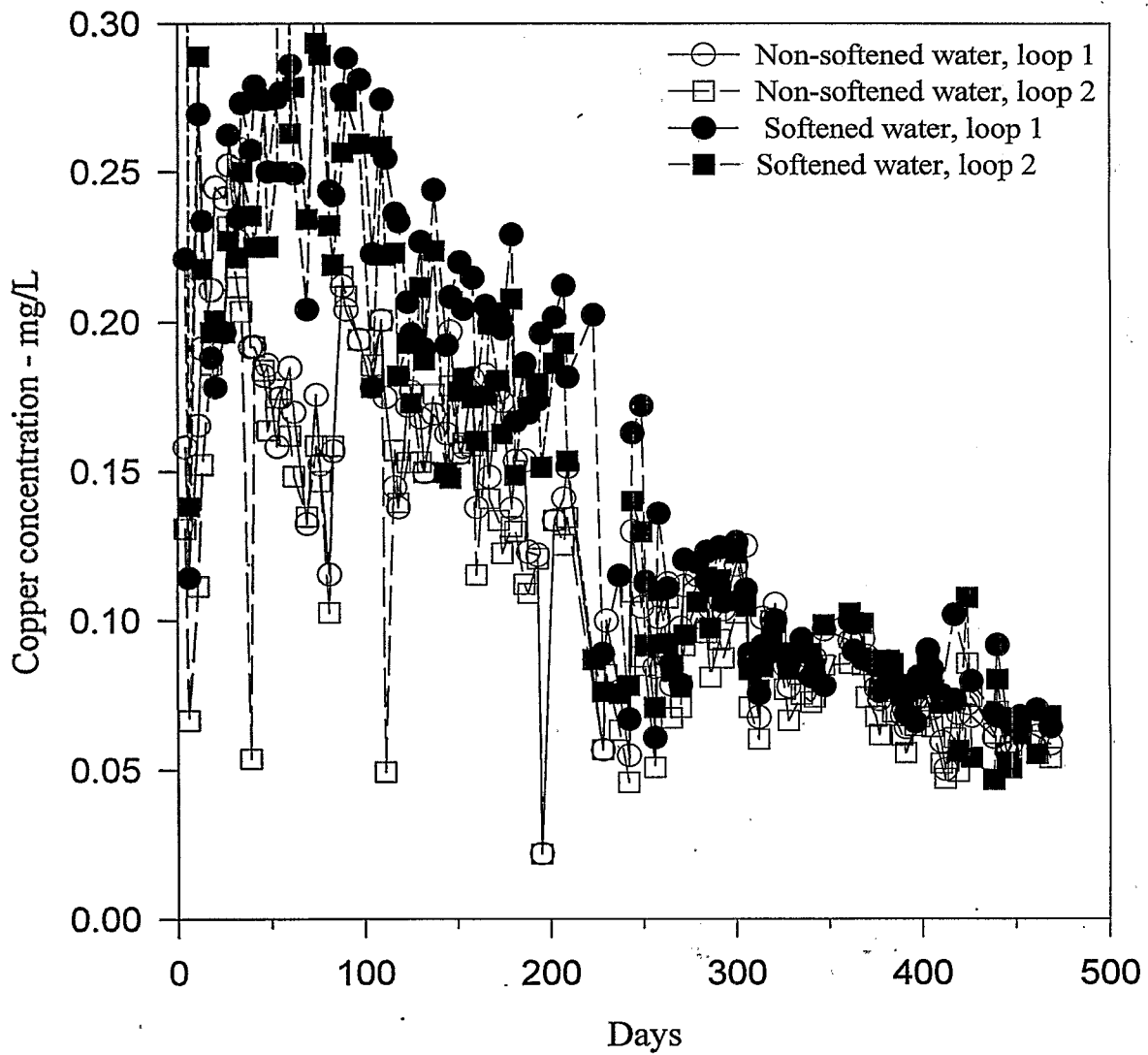


Figure 4-12. Copper leaching from copper/solder pipe loops, phase I study.

4.1.5.3.3 Faucets - The copper leaching data (Appendix B, Tables B-3, B-3a) of the faucets are shown in Figure 4-13. Visual examination of plotted data and the mean concentrations of the copper levels during the last 210 days show that of both sets were very low, 0.01-0.05 mg/L and essentially no difference between the non-softened and softened water exposed faucets. Furthermore, the levels were significantly lower than the copper action of 1.3 mg/L, by a factor of about 25.

4.1.5.4 Zinc Leaching -

4.1.5.4.1 Galvanized Loops - The zinc leaching data (Appendix B, Tables B-5, B-5a) from the galvanized loops are shown in Figure 4-14. Examination of the plotted data show zinc levels to be in the 1 to 30 mg/L range and highly variable, particularly during the first 100 days. The data also show the zinc levels of one non-softened water pipe loop and the two softened water pipe loops to be somewhat similar while the other non-softened water pipe loop had zinc levels consistently lower than the other three loops. The variability and the extremely high levels are very suggestive of the sloughing off of particulate material, non-uniform corrosion and passivating film development. Because of the poor reproducibility of the duplicate loops and high variability of day to day zinc concentrations, no conclusions can be drawn about the impact of softening on the galvanized steel.

4.1.6 Pipe Surface Analyses

Optical microscopic and X-Ray diffraction analyses of the lead pipe specimens showed almost no film formation for either the non-softened or the softened water exposed pipes. On the non-softened water lead pipes, a very small amount of $Pb_3(CO_3)(OH)_2$ (hydrocerussite) and a trace of $PbCO_3$

(cerussite) were found. No lead orthophosphate solids were apparent. Additionally, X-ray diffraction analyses of the copper pipe specimens did not show normal film formation of Cu(II) solids, such as CuO or $Cu(OH)_2$, expected at high pH under the controlled conditions. The only identifiable solid on either the soft copper tubing or the soldered copper pipe was Cu_2O (cuprite), which was present in small amounts on the pipes from both the test and control systems. More importantly, there was also no trace of calcium containing solids on any pipe specimens or any crystalline solids on the galvanized pipe specimens.

4.2 Phase II Study

4.2.1 Sampling Days

Phase II began on November 23, 1995, and officially ended on March 13, 1996, the last day for bi-weekly routine sampling (476 days). The number of sampling days during the 17 month study period ranged from 2 to 10 per month as shown in Table 4-1 for a total of 123 sampling days.

4.2.2 Water Usage

The pipe loop systems provided a flow rate of approximately 1 gpm through the pipe loops and about 0.5 gpm through the faucets during the flowing periods. As mentioned in the System Operation section (3.5), the flow controller on each pipe loop was adjusted periodically to maintain approximately 0.06L/s (1 gpm) through each loop. The faucets, on the other hand, could not be easily adjusted because of the use of a mechanical hydraulic arm. Short term flow measurements were occasionally taken using a stop watch and a volumetric cylinder to compare the flow rates of each individual faucet and to adjust as necessary.

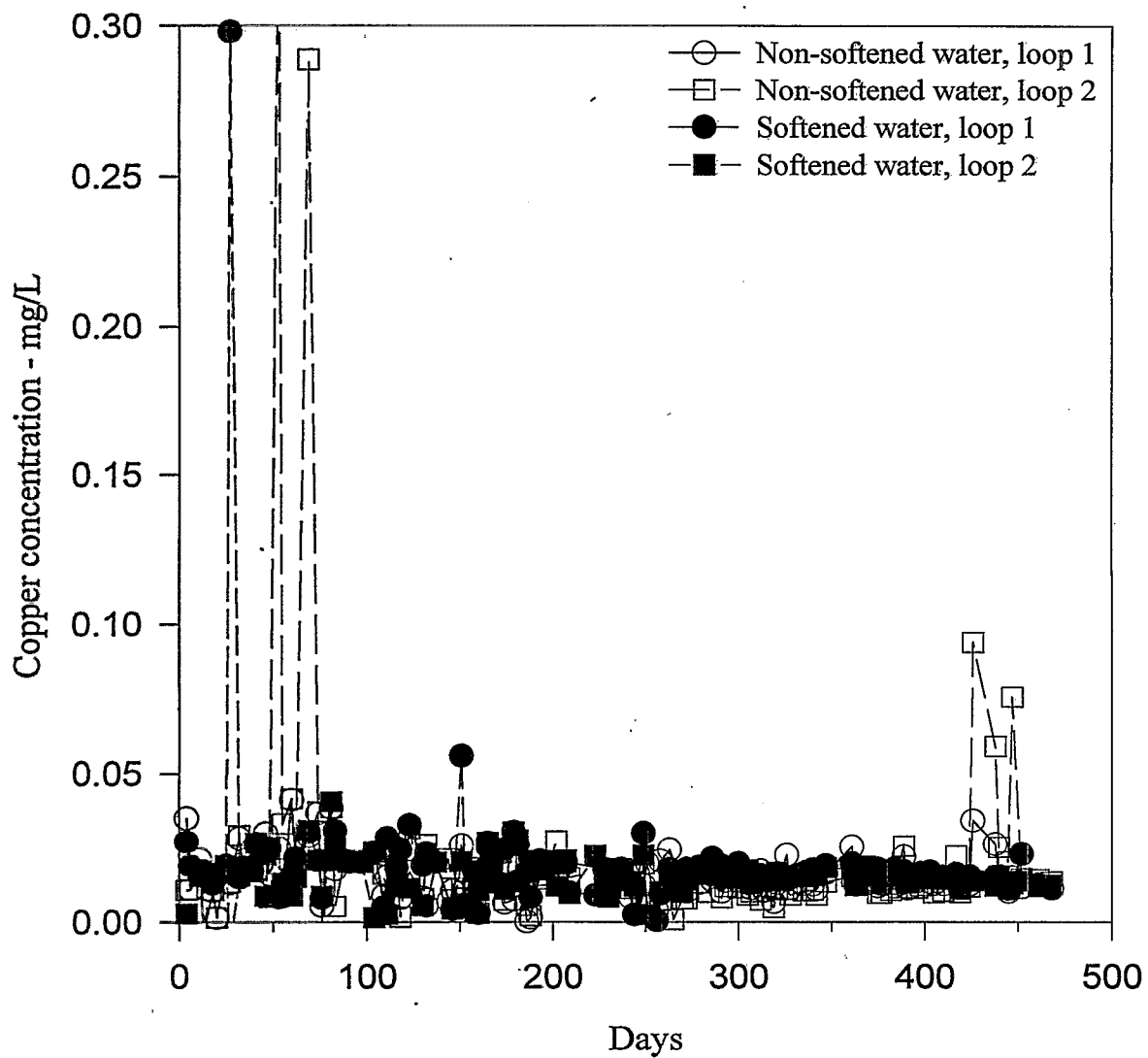


Figure 4-13. Copper leaching from faucets, phase I study.

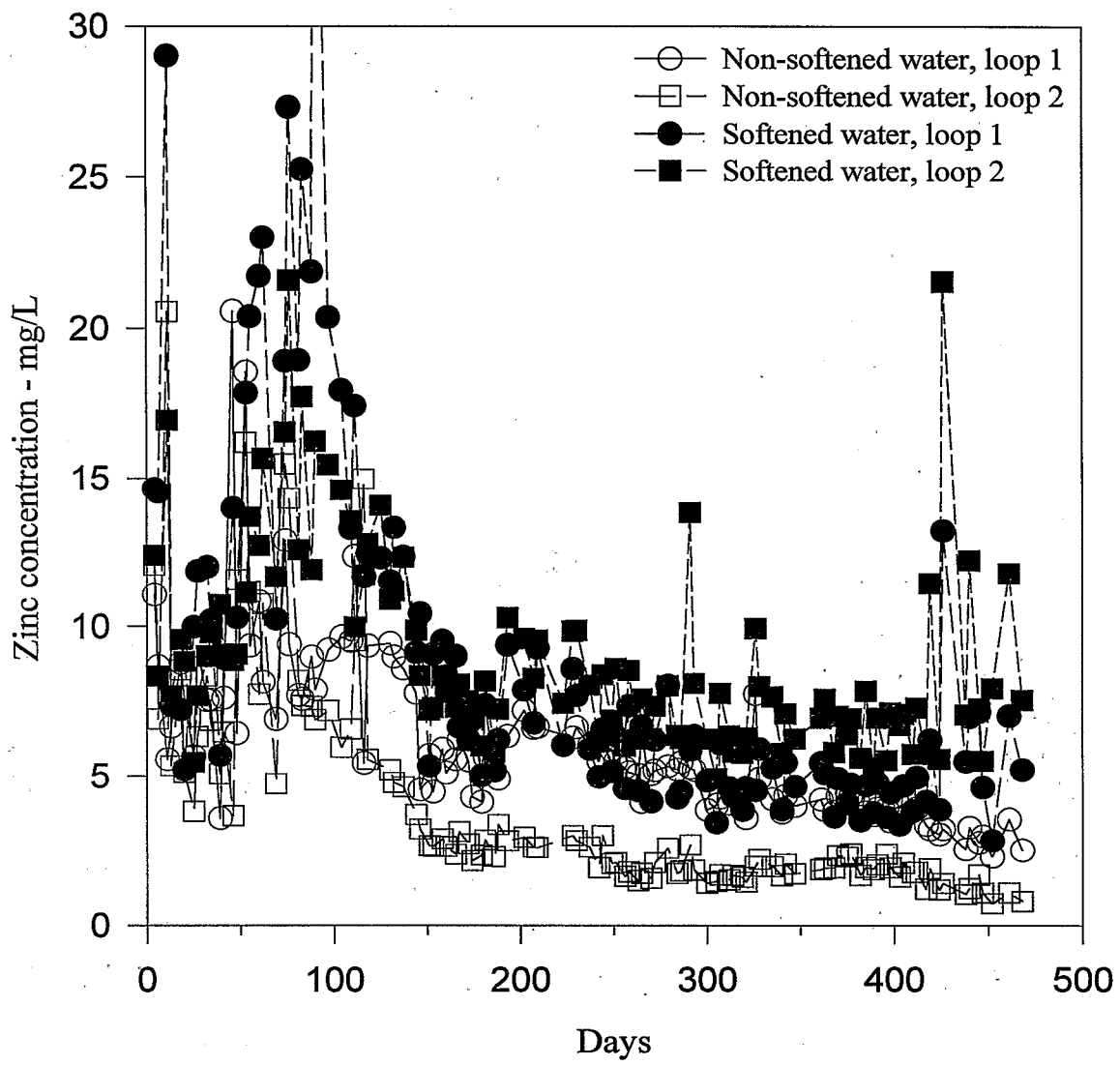


Figure 4-14. Zinc leaching from galvanize pipe loops, phase I study.

To determine the total flow through each pipe loop system, which contained two less loops than for the Phase I study, water meter readings were recorded on the sampling days. The total flow through the control pipe loop system was 366,075 gallons (769.1 gpm) and for the test pipe loop system it was 363,481 gallons (763.6 gpm). Although the total flows and daily rates are not identical, they were less than 1 percent of each other. The difference is so small that it is not considered any effect on the metal leaching levels obtained.

4.2.3 Source Water Quality

Because the source water for the Phase II study was an untreated ground water, most of the water quality parameters did not undergo significant changes during the study period. Seasonal temperature changes and several environmental effects did produce, however, some variation of several water quality parameters. The water quality parameters affected the most significantly by these factors were temperature, dissolved oxygen and chloride. The source water quality during the study period is summarized in Table 3-2. Specific results of all the analyses on the source water are contained in Appendix A.

4.2.3.1 Temperature - The temperature of the source water varied from a high of near 19 °C to a low of near 9°C (Figure 4-15).

4.2.3.2 Dissolved Oxygen - The dissolved oxygen concentration varied inversely with temperature and ranged from a high of near 6 mg/L to a low of near 1.8 mg/L as shown in Figure 4-16. The variation in DO was due to DO solubility that is temperature dependent. This relationship between the source water temperature and DO is shown in Figure 4-17.

4.2.3.3 Chloride - The chloride level varied from a low of near 60 mg/L to a high of slightly above 100 mg/L as shown in (Figure 4-18). The increases in the chloride level occurred primarily during the winter season and were attributed to the impact of surface water runoff shortly after road salt applications for snow control. Although the source water was a ground water, this ground water is influenced by a surface water stream.

4.2.4 Non-Softened/Softened Water Quality

A comparison of the mean values of measured water parameters of non-softened (control) and ion exchanged softened waters (test) is shown in Table 3-1. The most significant differences between the two waters occurred with four constituents; calcium, magnesium, potassium, and sodium. In addition, as was observed during Phase I, the pH of the source water increased slightly by about 0.3 units as it passed through the ion exchanger (Figure 4-19).

Except for a period of time at the beginning of the study when the initial water softener experience a mechanical regeneration problem, the ion exchange softener reduced the source (control) water calcium (84 mg/L) and magnesium (24 mg/L) concentrations to nearly zero, while increasing the sodium concentration from 40 mg/L to 177 mg/L (Figure 4-20).

The potassium concentration in the ion exchange softened water exhibited an unusual pattern during the first 200 days of the study when it both increased and decreased as the source water passed through the ion exchanger as seen in Figure 4-21. After this time period, the potassium concentration was reduced from an average of 3.12 mg/L to 1.13 mg/L, 64 percent,

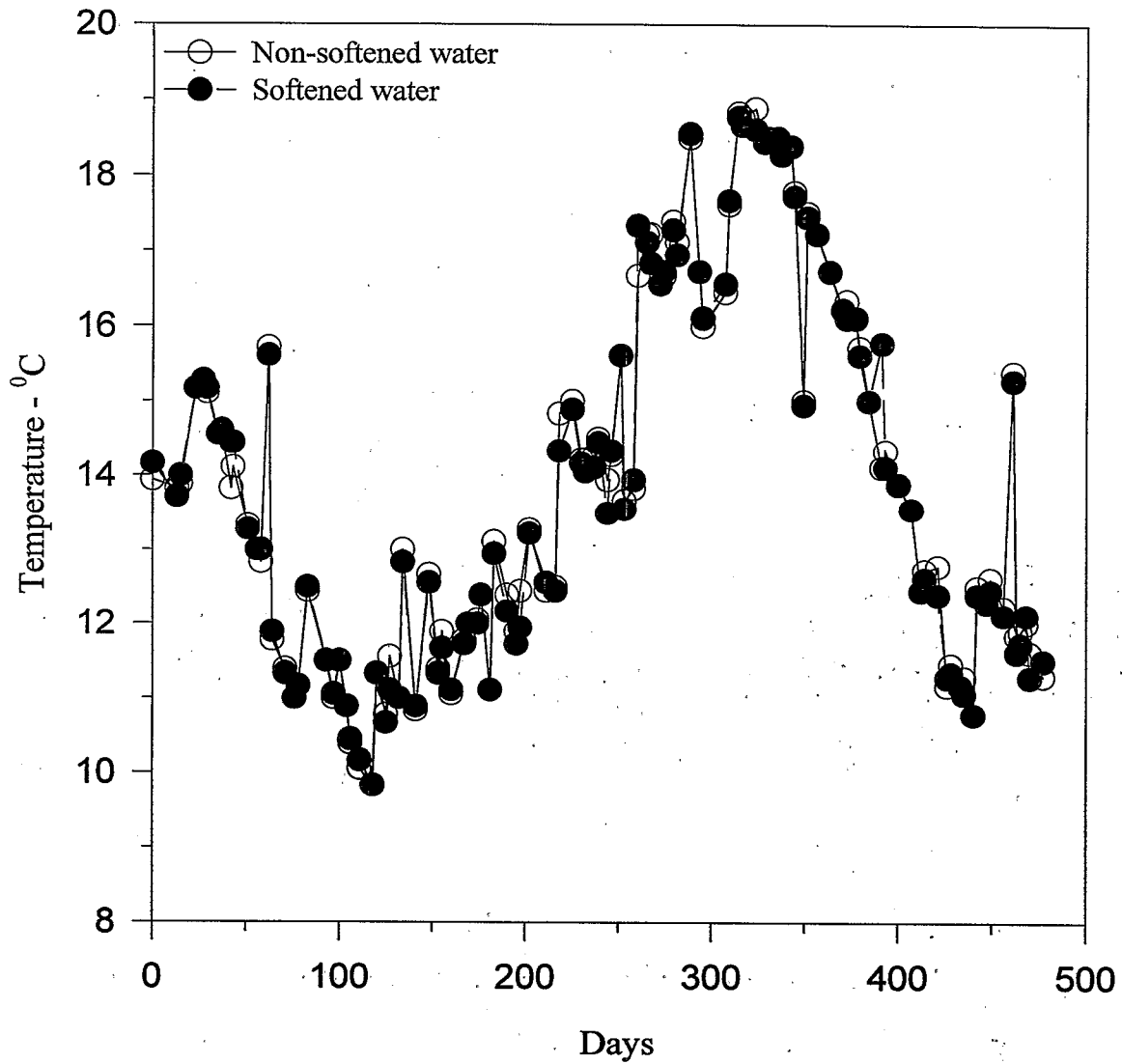


Figure 4-15. Temperature of non-softened and softened waters, phase II study.

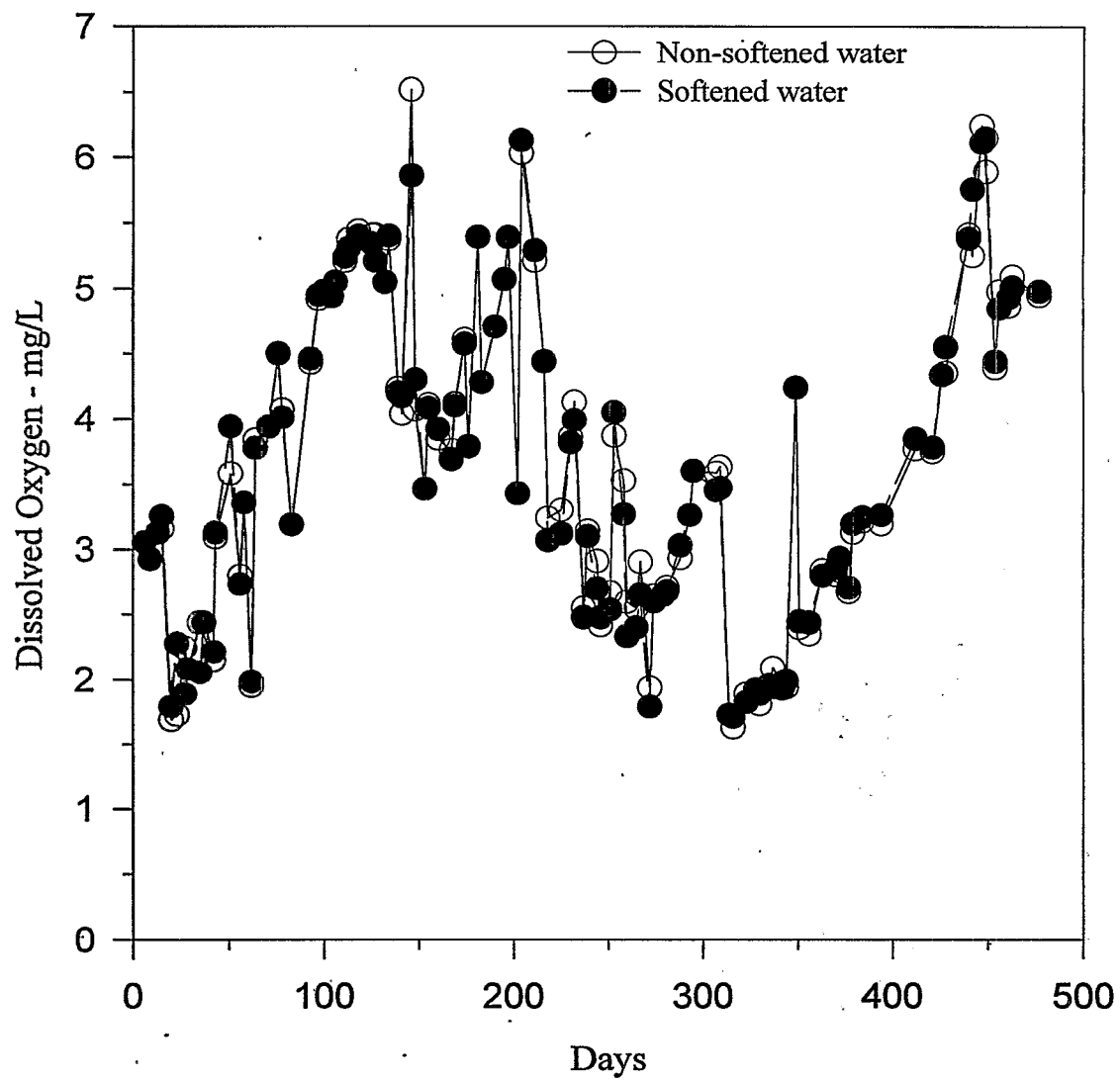


Figure 4-16. Dissolved oxygen of non-softened water and softened waters, phase II study.

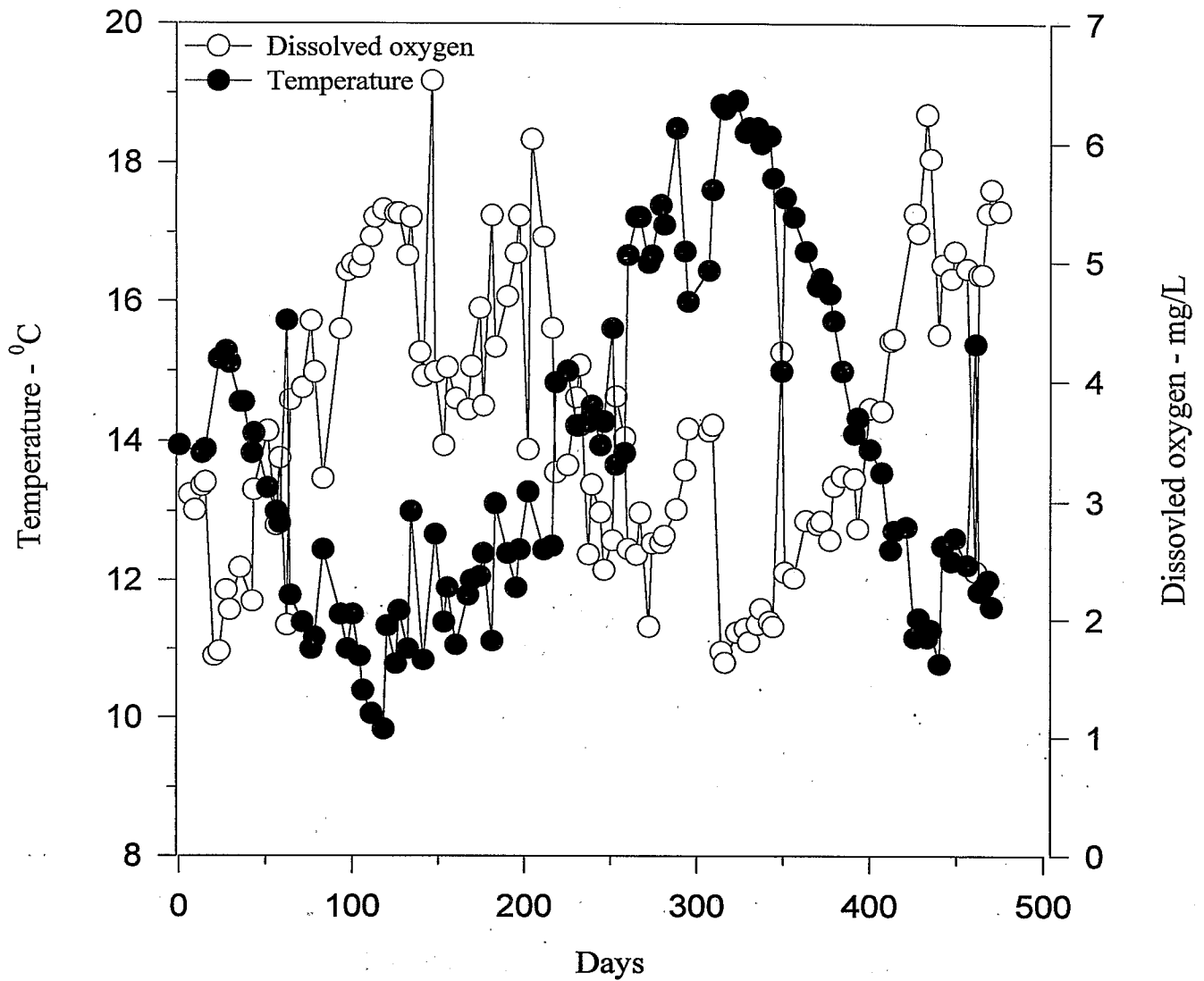


Figure 4-17. Temperature and dissolved oxygen of the non-softened (source) water, phase II study.

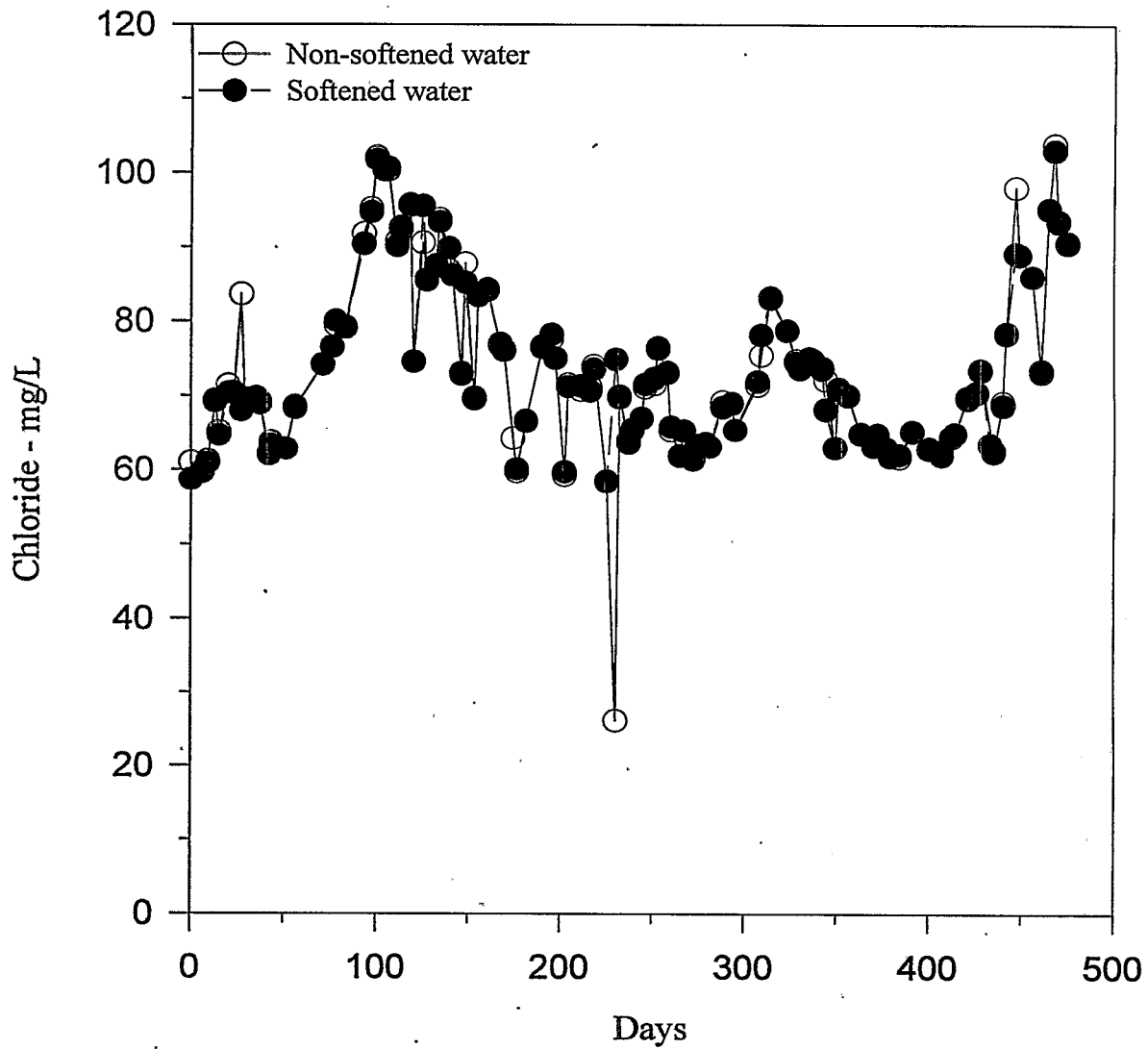


Figure 4-18. Chloride concentration of non-softened and softened waters, phase II study.

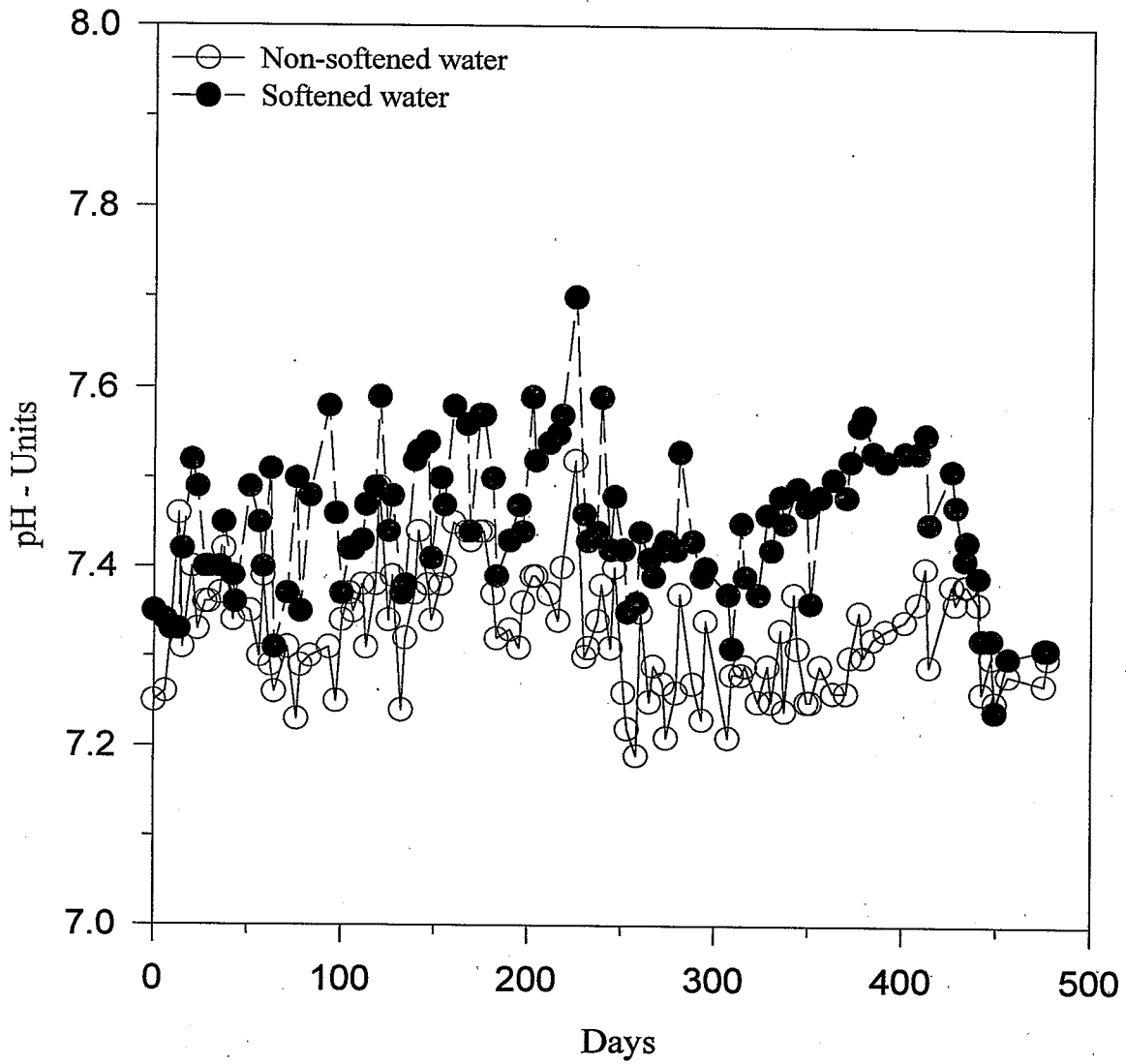


Figure 4-19. pH of non-softened water and softened waters, phase II study.

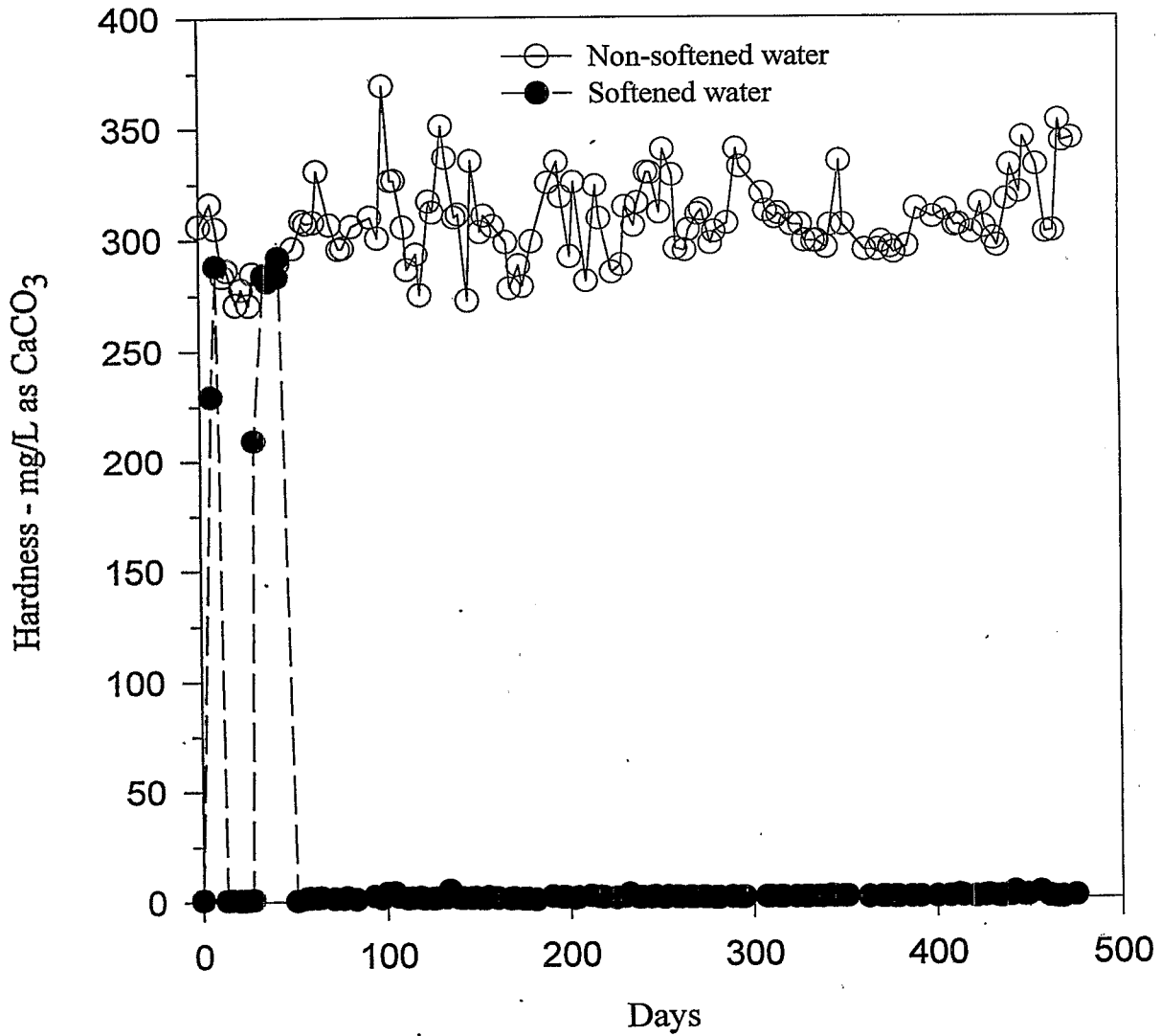


Figure 4-20. Hardness concentration of non-softened and softened waters, phase II study.

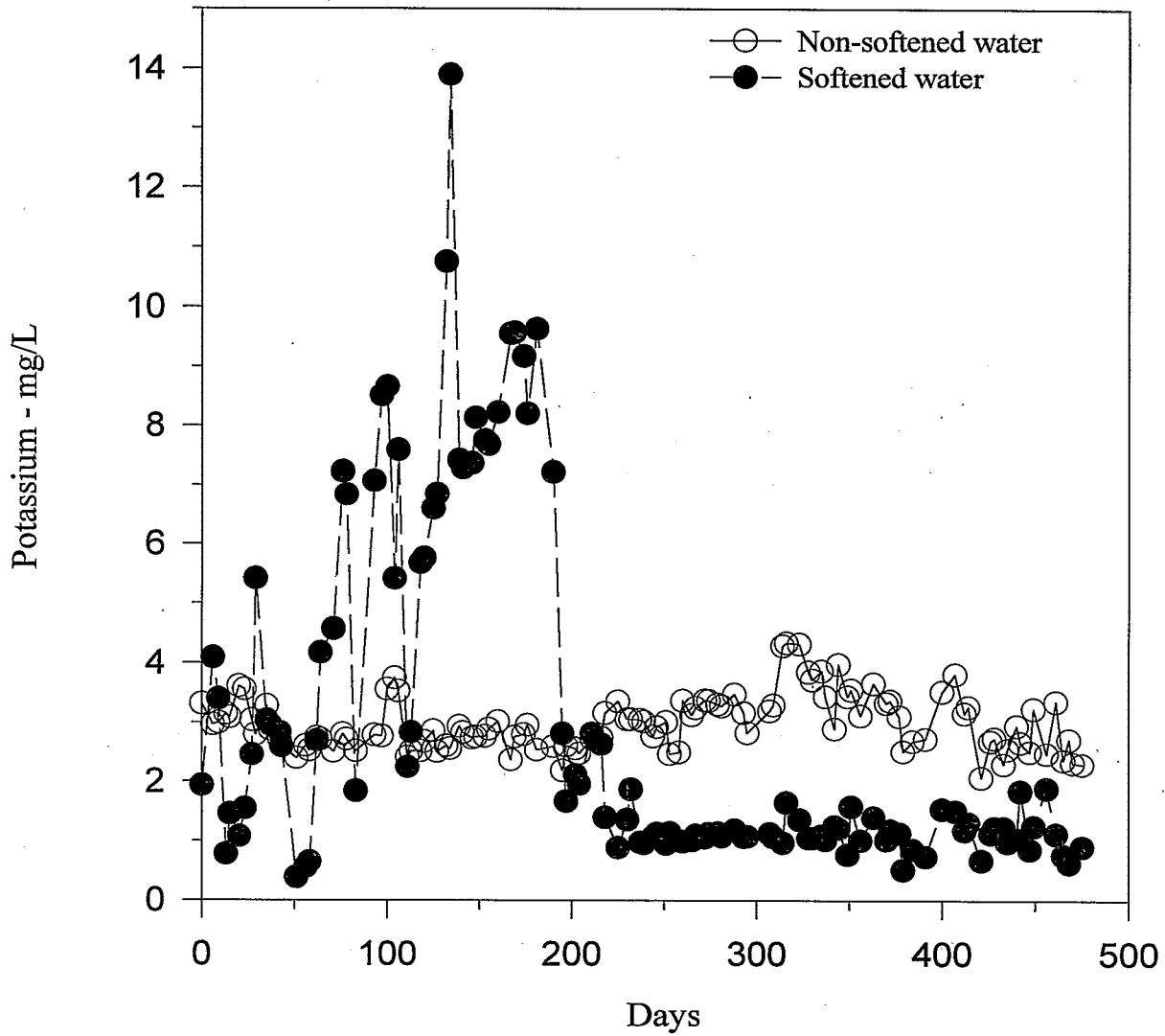


Figure 4-21. Potassium concentration of non-softened and softened waters, phase II study.

similar to that which occurred during Phase I. During the first 50 days, the unusual behavior might be explained by the regeneration problem experienced with the first ion exchanger. The sizable increase during the 75 to 200 day period when the ion exchanger seemed to working well is not explainable, however. Several brands of regeneration salt were used during the study, but analyses of the salt did not indicate any potassium contamination.

4.2.5 Metal Leaching

4.2.5.1 Data Analysis - All of the metal leaching data from Phase II were plotted in graphical formats similar to the data presentation of Phase I. Because most the metal leaching data showed cyclic fluctuations which were observed to be dependent upon the temperature and dissolved oxygen concentration of the source water, statistical analysis of the data was considered to be of no value and, therefore, not conducted. Data presentation and evaluation were done solely by visual examination of the plotted data.

4.2.5.2 Lead Leaching -

4.2.5.2.1 Lead Pipe - The metal leaching data for the lead pipe loops are shown in Figure 4-22. A visual examination of the plotted data indicates that the lead leaching from all of the pipes varied with the dissolved oxygen and temperature of the source water and that stabilization did not occur. During the first 300 days, the plotted data indicates little difference between the non-softened and softened water exposed pipes, while during the last 160 days the softened water results appear to be slightly higher.

4.2.5.2.2 Copper Soldered Pipe - The lead leaching data for the copper soldered pipes

are presented in Figure 4-23. The lead data showed the softened water loops to have slightly higher levels (0.005 to 0.010 mg/L) than the non-softened water results. Because of the low levels and potential variations in materials (soldered joints), however, any differences in quality that may exist can not necessarily be attributed to the differences of the two exposure waters, particularly because the pattern occurred from the outset of the study.

4.2.5.2.3 Faucets - The lead leaching data for the faucets are shown in Figure 4-24. The lead data were somewhat similar to the copper soldered pipe results in that the lead of the softened water faucets appear to be slightly higher than the non-softened water results. Because of the low lead levels and potential variations in materials (internal faucets surfaces), however, the slight differences that may exist can not necessarily be attributed to the differences of the two exposure waters.

4.2.5.3 Copper Leaching -

4.2.5.3.1 Copper Tubing - The copper leaching levels from the copper tubing are shown in Figure 4-25. As can be seen in this figure, copper leaching was extremely variable ranging from low concentrations of the detectable limit of 0.003 mg/L to highs above 6 mg/L on several occasions. Moreover, variations in the copper levels seemed to be highly influenced by the dissolved oxygen content of the source water. These large fluctuations masked any differences that may be related to the differences of the two exposure waters. Twice during the Phase II study, special sets of samples were collected at different standing times from the pipe loops to characterize system equilibrium and to examine redox interactions between the pipe

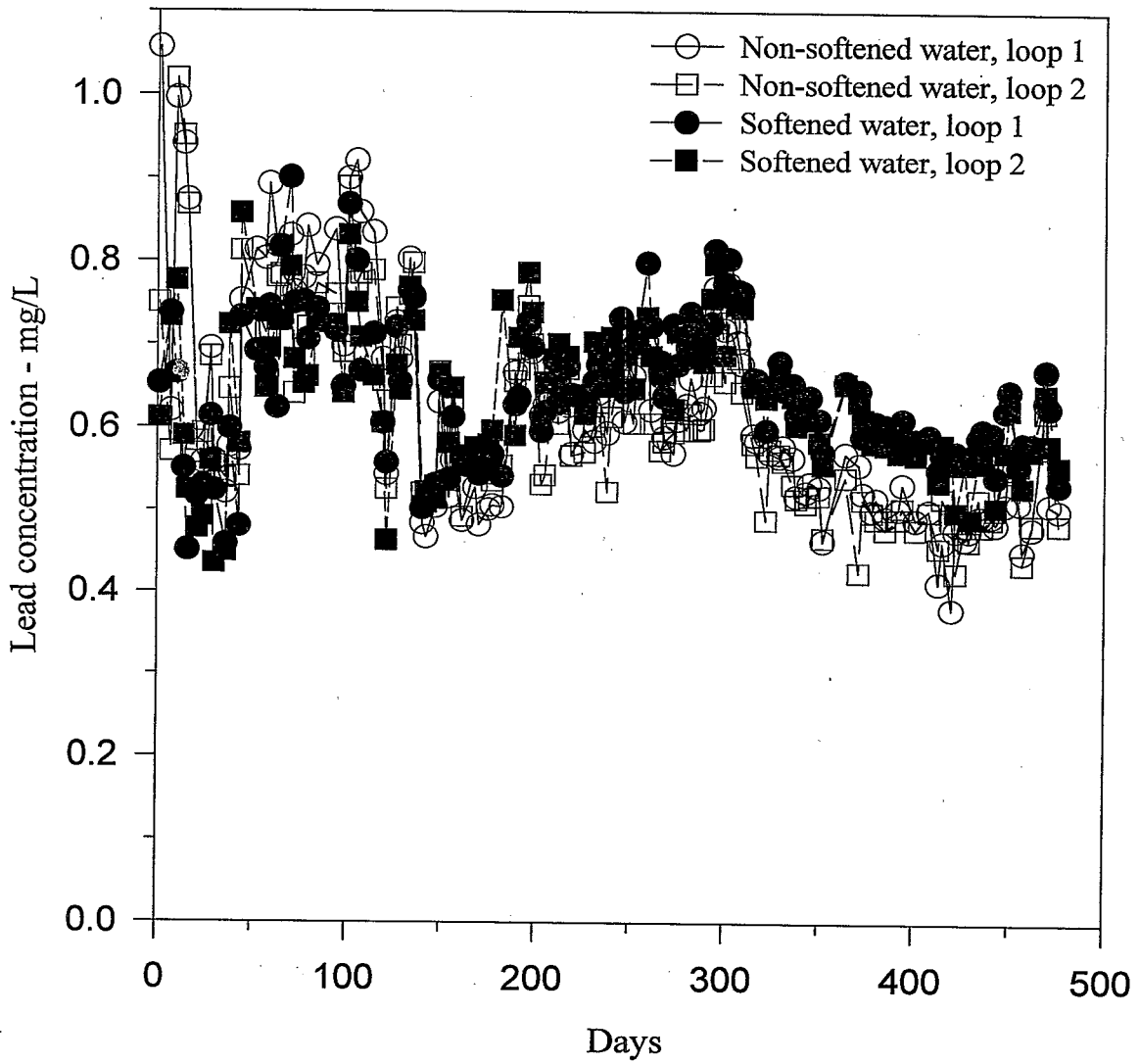


Figure 4-22. Lead leaching from lead pipe loops, phase II study

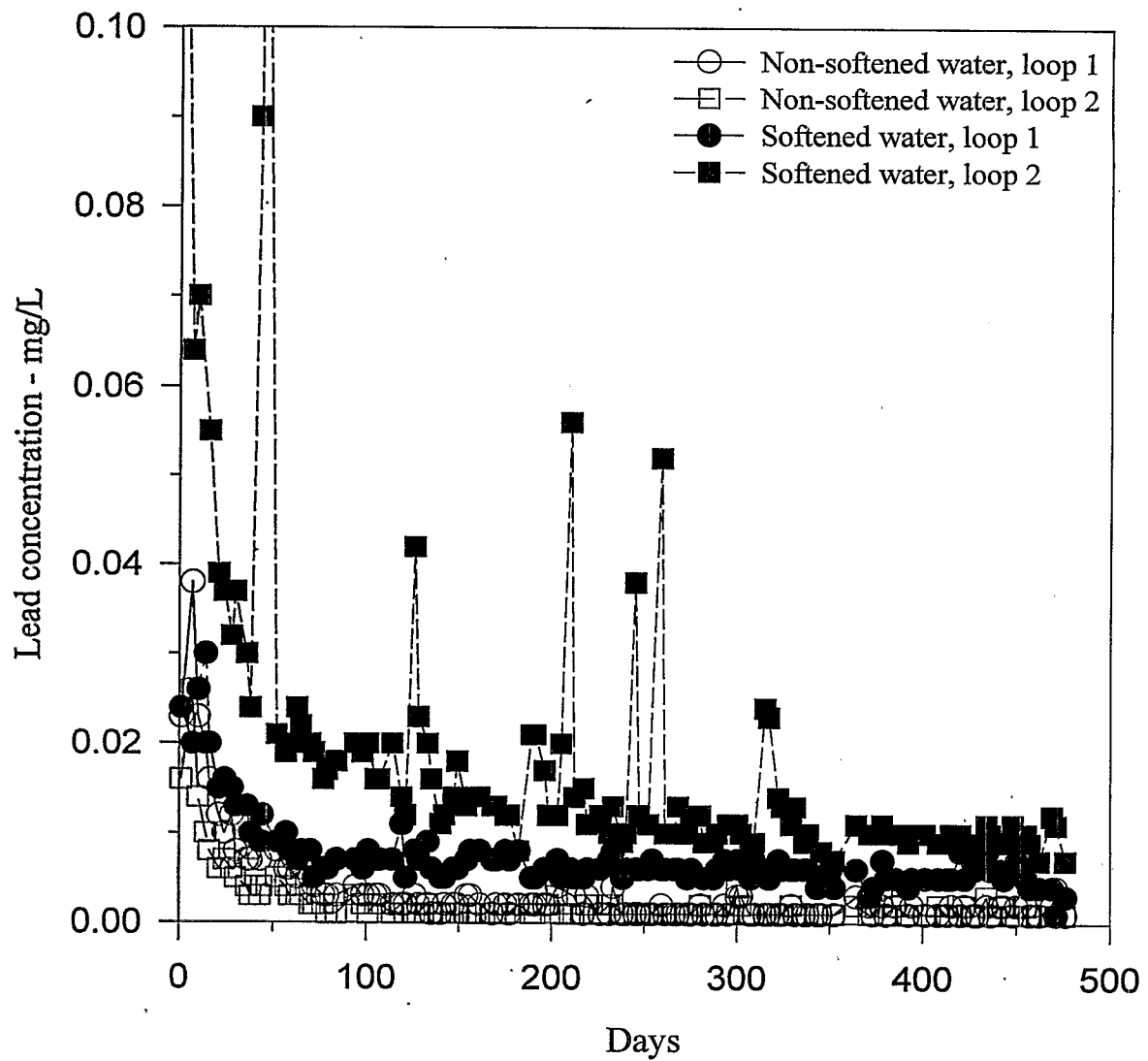


Figure 4-23. Lead leaching from copper/solder pipe loops, phase II study.

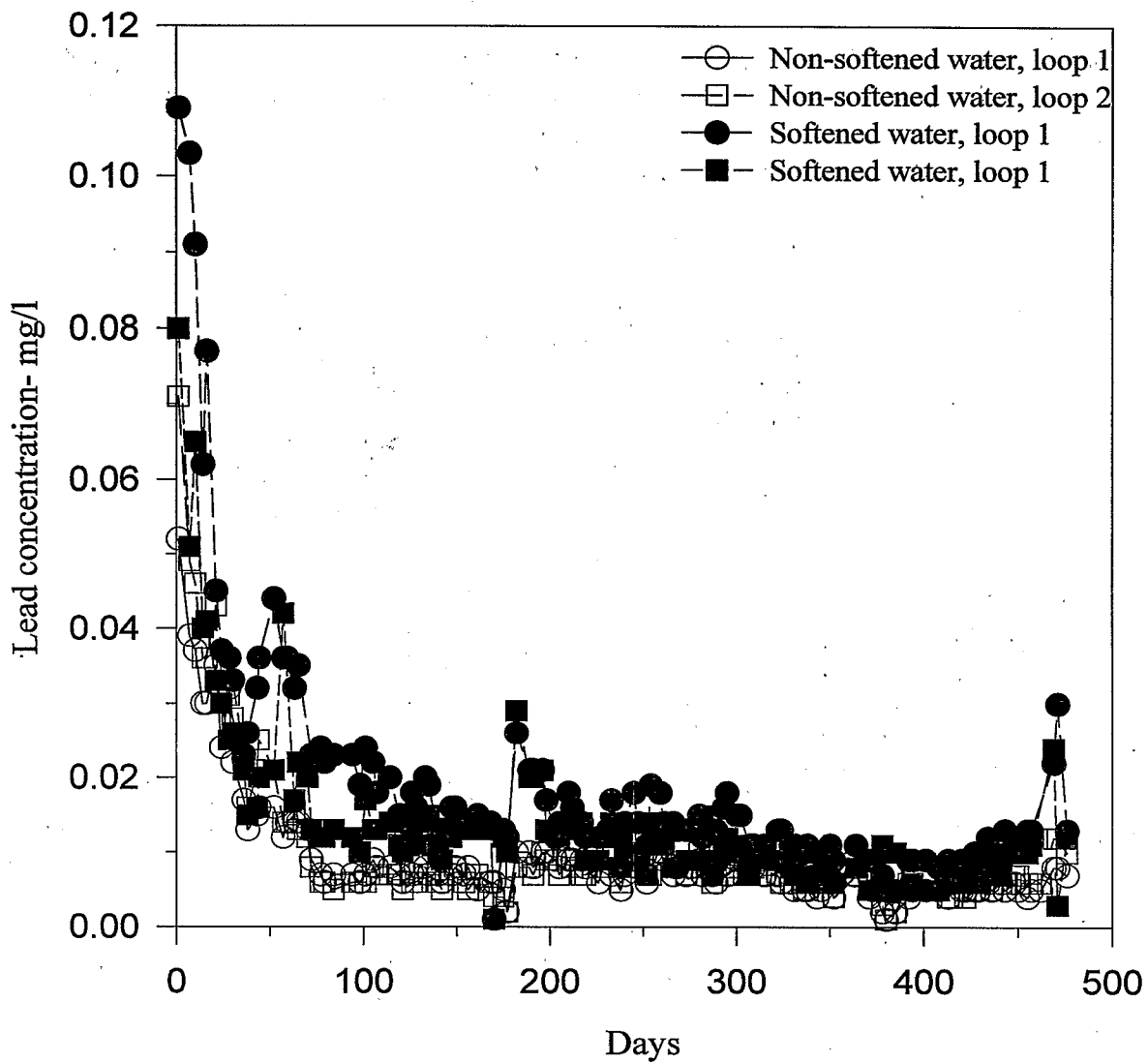


Figure 4-24. Lead leaching from faucets, phase II study.

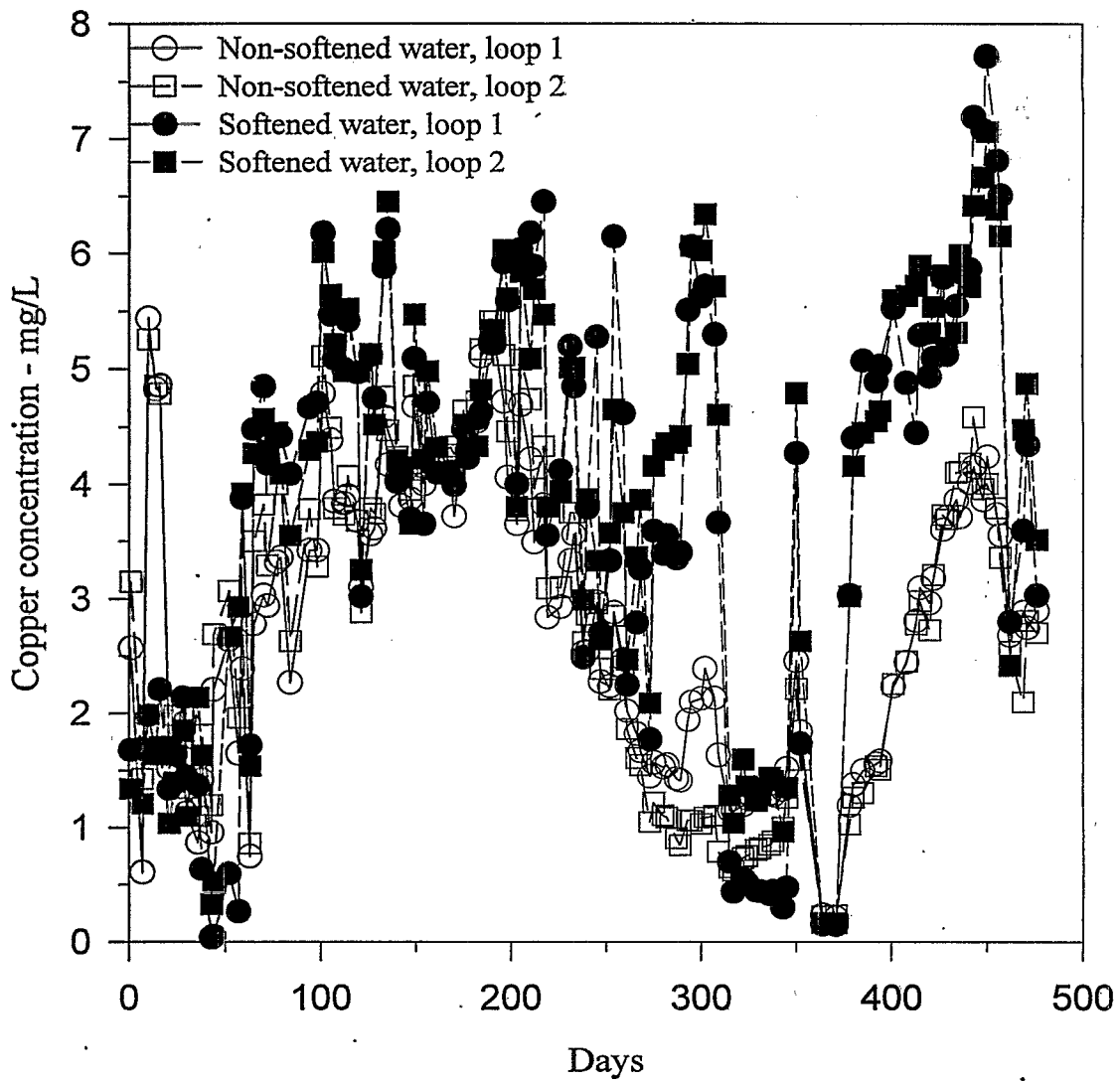


Figure 4-25. Copper leaching from copper tubing pipe loops, phase II study

surfaces and the dissolved oxygen of the exposure water. The results and discussion of these tests are given in the following section on Special Studies (4.2.7).

4.2.5.3.2 Copper/Soldered Pipe - The copper leaching levels from the copper soldered pipes are shown in Figure 4-26. As can be seen in this figure, the copper leaching pattern was somewhat similar to pattern of the copper tubing loops except that the variations in copper concentrations were not as extreme. Also, no stable periods were achieved with any of the loops and copper leaching seemed to be highly influenced by the dissolved oxygen content of the source water. The discussion of the impact of standing time on the interaction of the pipe surfaces and DO in the following Special Studies section (4.2.7) also applies to the copper soldered pipe loops.

4.2.5.3.3 Faucets - The copper leaching levels from the faucets are shown in Figure 4-27. Once again, as can be seen in this figure, the copper leaching pattern was, in some degree, similar to the pattern of both the copper tubing pipe loops and the copper soldered pipe loops. The copper levels were extremely variable with no stable periods achieved with any of the faucets. During the first 225 days, the copper levels of the faucets exposed to the softened water show extreme variation and levels consistently higher than the copper levels from the non-softened water faucets. The reason for this is not known. After this period, the copper levels of all of the loops were somewhat similar, and at times the levels from the softened water exposed faucets were even lower than those of the non-softened water exposed faucets. During the last 50-60 days, little difference is seen between any of the faucets. Once again, the

discussion of the impact of standing time on the interaction of the pipe surfaces and DO in the following Special Studies section (4.2.7) also applies to faucets.

4.2.6 Pipe Surface Analyses

The internal surfaces of several sections of pipe loops were examined by x-ray diffraction to determine and compare the composition of the surface films. Although the tests were far from being comprehensive and the results showed no major film formation on any of the pipe sections, some small differences were noted between the non-softened and softened water exposed pipes. For the lead pipe, both non-softened water exposed pipes showed major peaks of Pb and PbO and minor peaks of PbCO_3 (cerussite) and $\text{Pb}_3(\text{CO}_3)_2(\text{OH})_2$ (hydrocerussite). The softened water exposed pipe showed the identical four solids to be the major ones. PbO seemed to be a more pronounced component for the non-softened water. The PbCO_3 was not uniformly distributed on the surface of the pipes from the softened water.

Comparing the test results of two copper/soldered pipes, the softened water exposed pipe had very little film formation; Cu_2O was the only crystalline solid. The non-softened water exposed pipe had major peaks of $\text{Cu}_2(\text{CO}_3)(\text{OH})_2$ (malachite), and CuO_2 (tenorite). Both specimens from the soft copper tubing showed only Cu_2O present at the surface, whether the water was softened or not. None of the pipe section surfaces examined, lead or copper, showed any calcium based film compounds. Overall, the deposits reflect surface conditions indicating cycling between a relatively anoxic and slightly oxic environments. The anoxic conditions appear to be very significant to the nature of the solids formed.

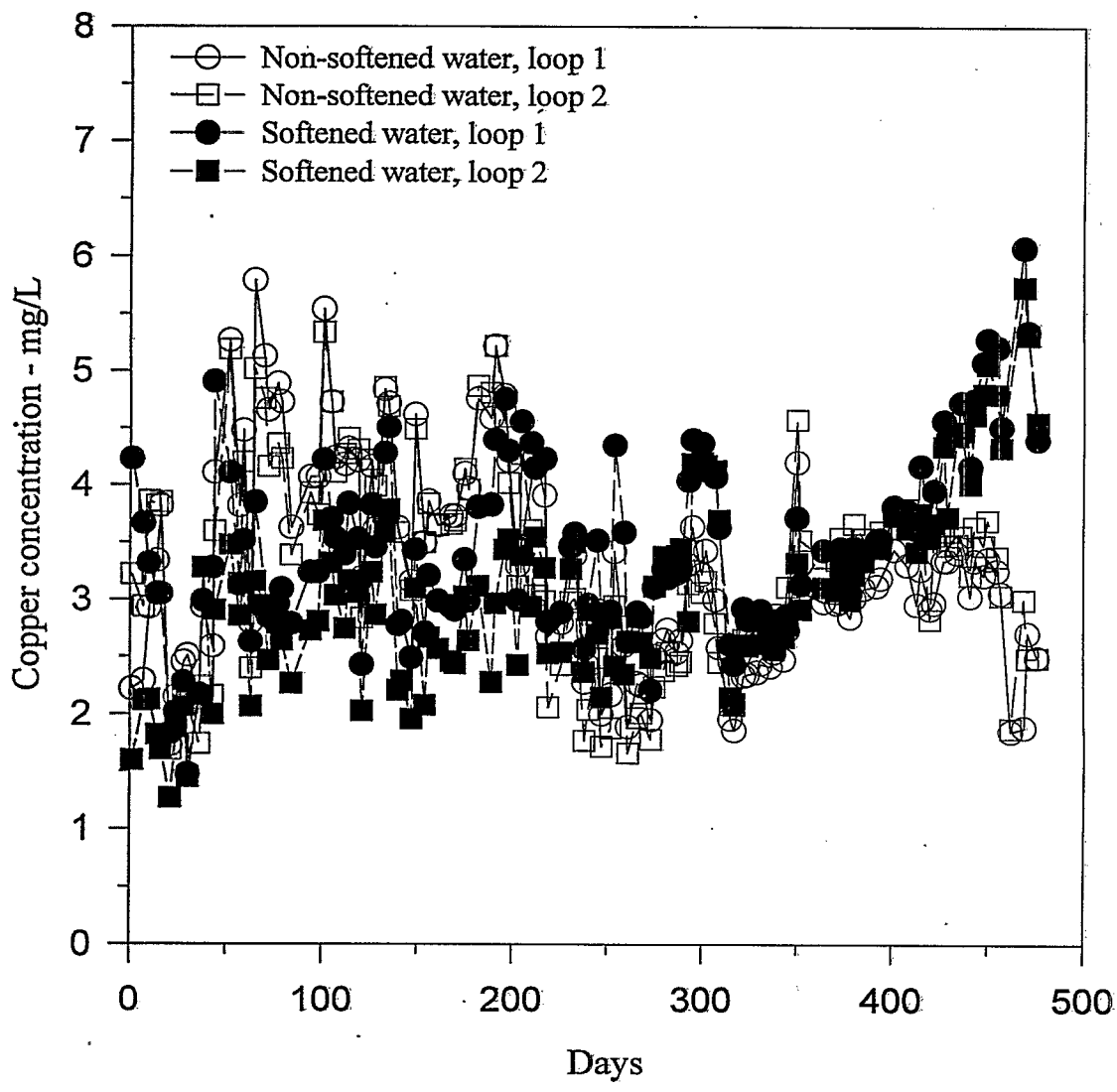


Figure 4-26. Copper leaching from copper/solder pipe loops, phase study II.

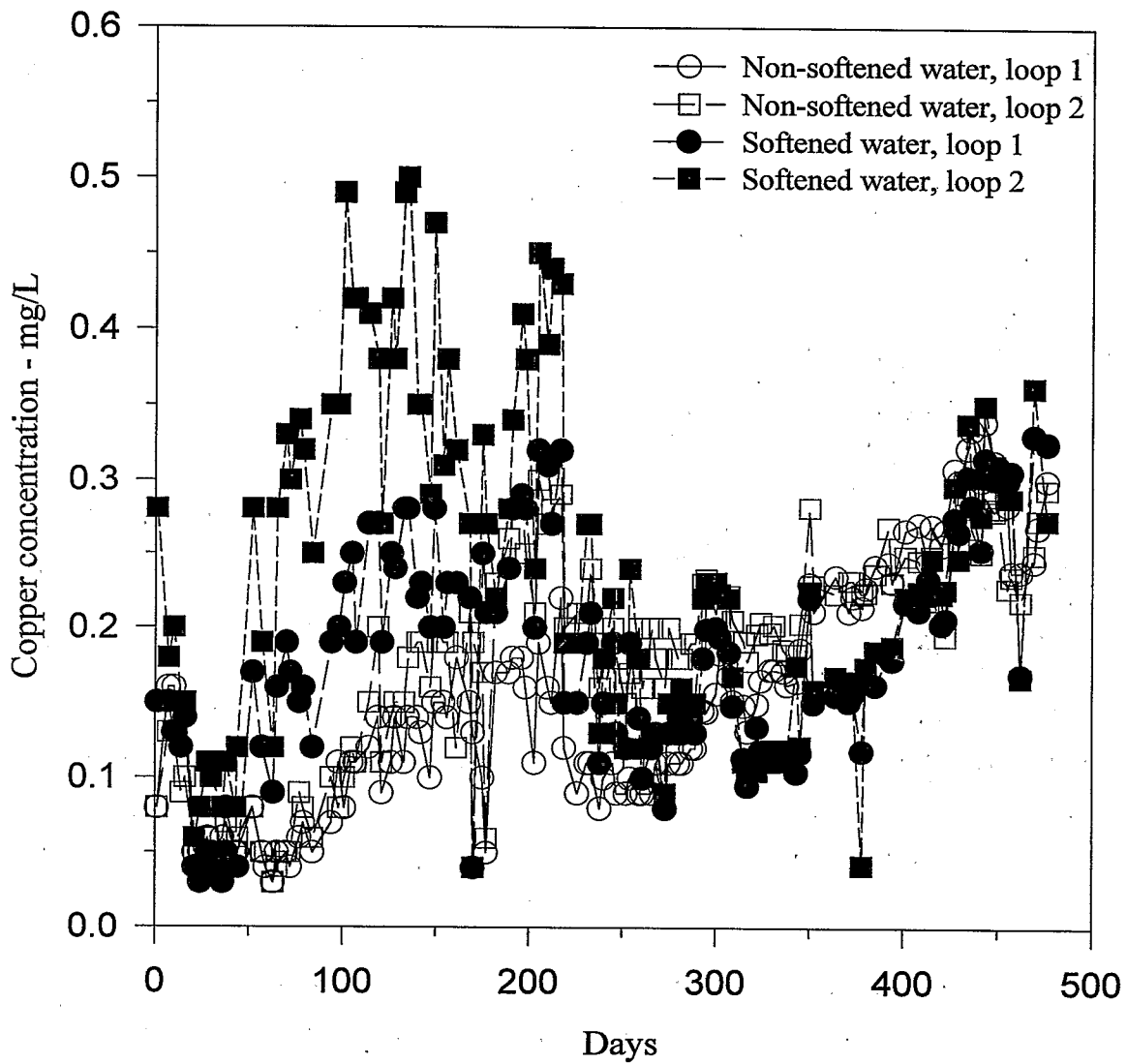


Figure 4-27. Copper leaching from faucets, phase II study.

4.2.7 Special Studies

Twice during the Phase II study (during 161-184 day period and during 455-462 day period), special sets of samples were collected from the lead and copper tubing pipe loops to characterize system equilibrium and to examine redox interactions between the pipe surfaces and dissolved oxygen. During each time period, standing times were varied before sample collection to establish a relationship between standing time and metal leaching and dissolved oxygen. For lead pipe, both the non-softened and softened water exposed pipes, the shape of the stagnation curves as well as the peak lead levels appeared to be similar and independent of pipe age and exposure water (Figure 4-28). The stagnation profiles were exponential in form, rising rapidly over the first 10 hours, and then followed by a gradual leveling off. Lead levels continued to increase up to about 90 hours and the dissolved oxygen decreased almost linearly with time.

In contrast to the lead pipe results, the copper leaching stagnation profile results of the copper tubing showed a difference between the pipes exposed to non-softened and softened water. For the pipes exposed to the softened water, the shape of the copper stagnation profile was independent of pipe age as shown for the copper tubing results in Figure 4-29. A difference in the maximum concentration of the two test sets did occur, however. Copper levels increased to maximum levels (4.4 and 6.8 mg/L) after approximately 20 to 25 hours of standing time before dropping to less than 0.5 mg/L by 72 to 92 hours (161-184 day tests). Peak copper levels corresponded to the time when the dissolved oxygen was reduced to below 1 mg/L in the standing water. These results

are assumed to reflect the redox chemistry interaction between dissolved oxygen, metallic copper, cuprous (Cu^{1+}) ions, and cupric (Cu^{2+}) ions.^{13,14}

The copper leaching levels and dissolved oxygen profiles for the pipes exposed to the non-softened water were different from those of the softened water. For the non-softened water exposed pipes, copper levels increased more sharply reaching maximum levels in less than 8 hours. After peaking, the copper levels decreased gradually to approximately 2 mg/L after 72 to 92 hours (161-184 day tests). Once again, the shift in direction in copper concentration corresponded to the point where dissolved oxygen dropped to approximately 1 mg/L in the standing water. The results of these tests showed that the dissolved oxygen decreased more rapidly in the non-softened water than in the softened water pipe loops, falling to undetectable levels after only 6 to 8 hours.

During the second testing period, 455-462 days, a set of samples was also collected from the copper/soldered pipe loops. The results of tests are plotted in Figure 4-30 and as would be expected, the results show a pattern similar to the copper tubing test results of Figure 4-29 for the same period of time.

The results of these special copper pipe tests showed that 17 hours standing time for the study did not represent equilibrium conditions during the periods of time these sample were collected. Also, although the copper levels were similar in magnitude at 17 hours, non-softened and softened water copper results did not fall on the same point on their respective stagnation curves. At 17 hours, the sampling point for the non-softened water fell on the down swing while

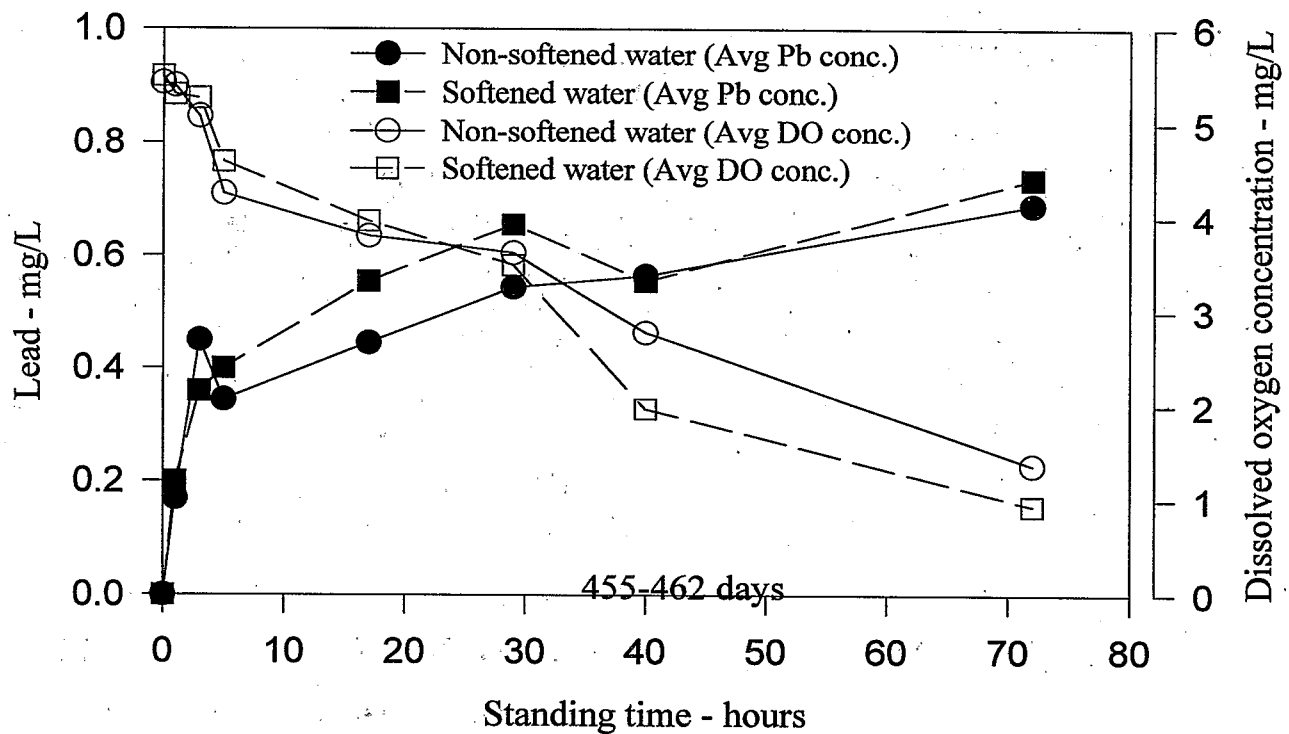
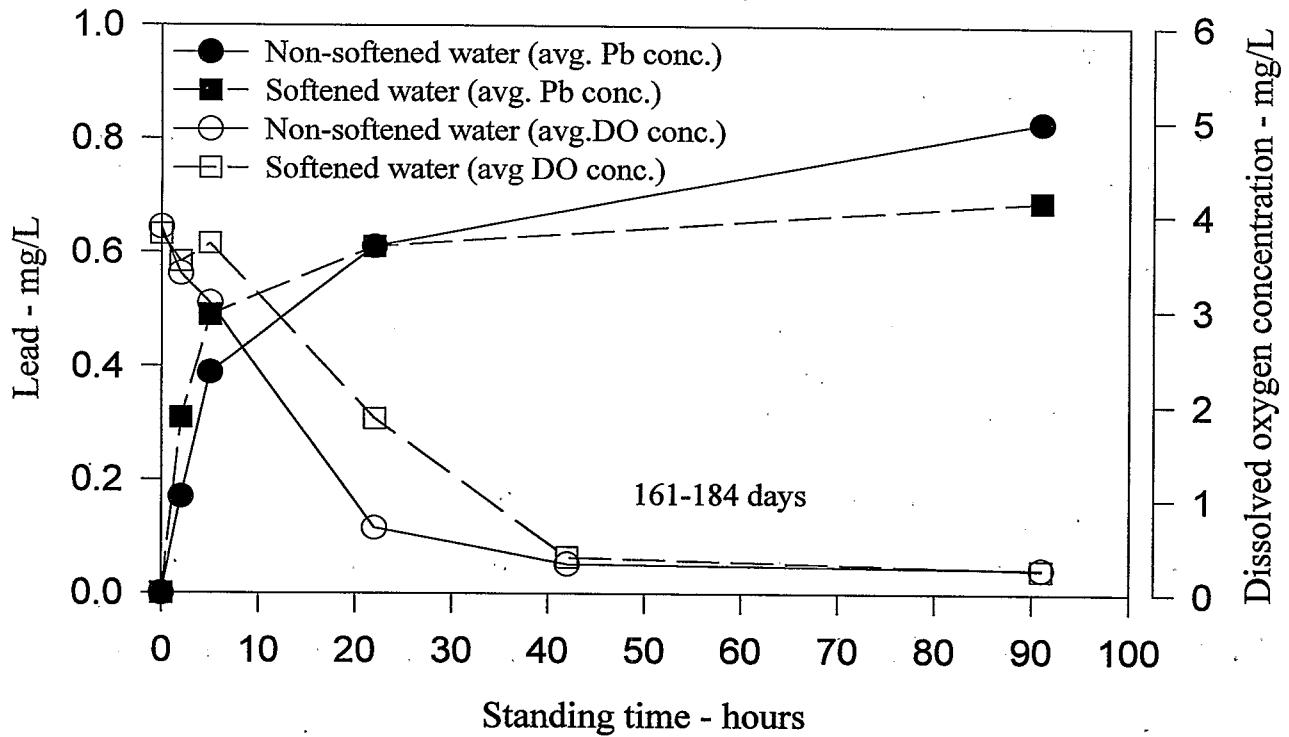


Figure 4-28. Effect of stagnation time on lead leaching and dissolved oxygen of lead pipes, phase II study.

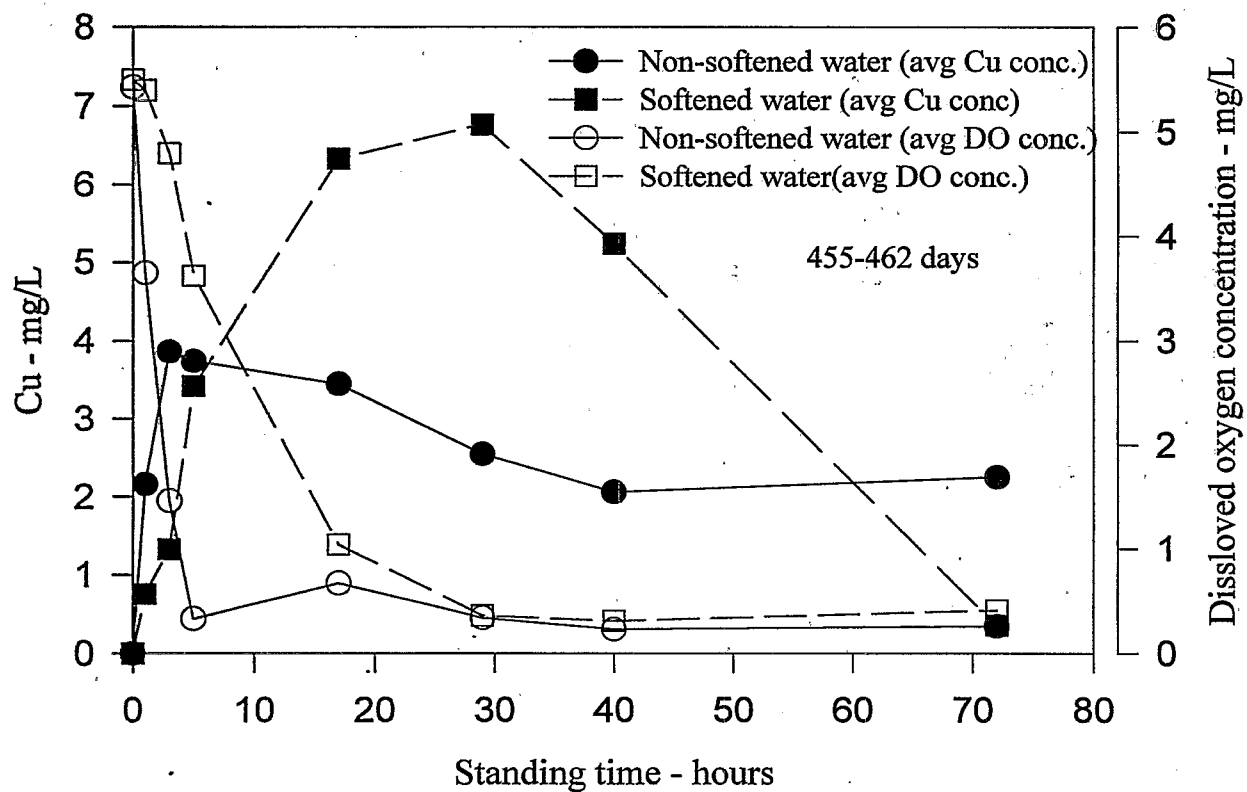
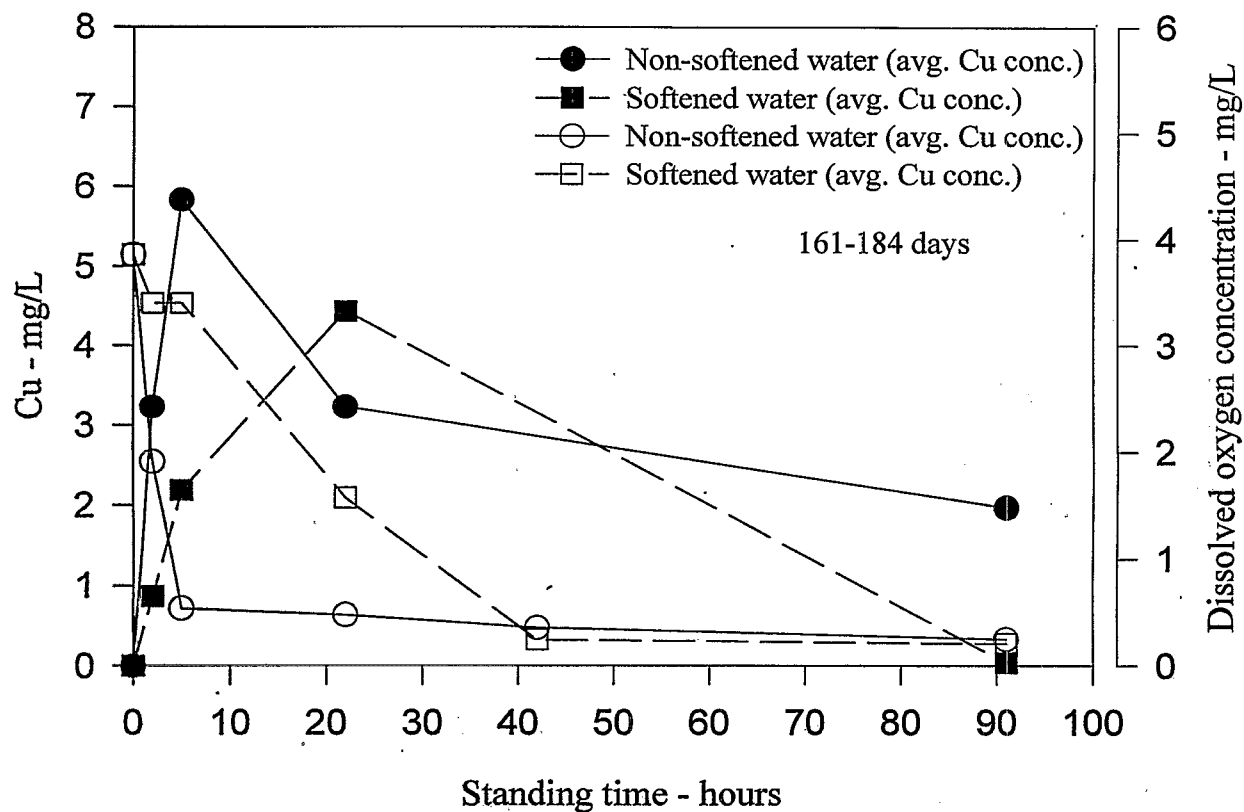


Figure 4-29. Effect of stagnation time on copper leaching and dissolved oxygen of copper tubing, phase II study.

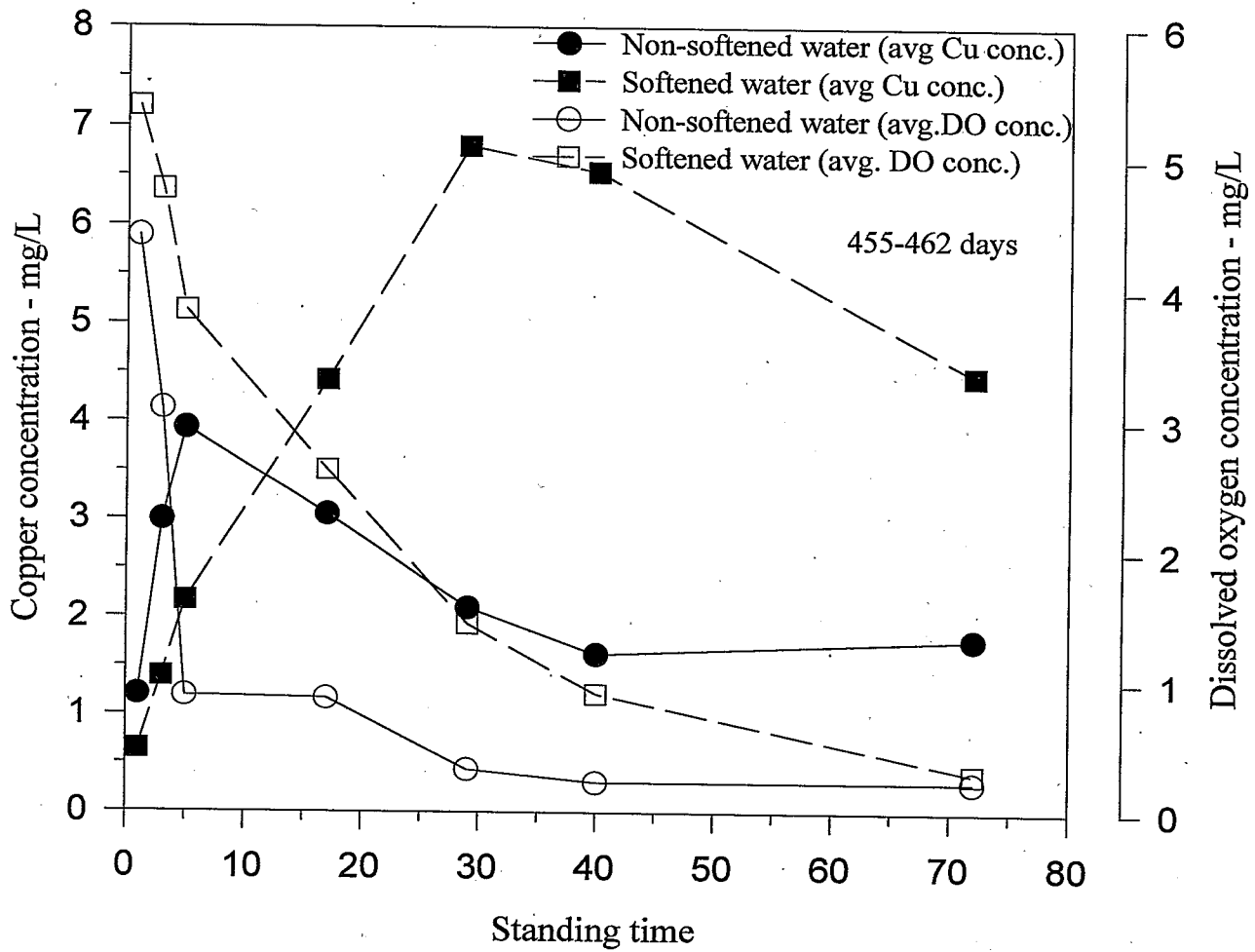


Figure 4-30. Effect of stagnation time on copper leaching and dissolved oxygen of copper/solder pipe loops, phase II study.

the softened water point fell on the upswing of the curves. The difference in profile shapes suggest that the difference in the hardness concentration may have had some indirect impact on the copper dissolved oxygen reaction that took place during the stagnation time. There is no physical evidence from the pipe surfaces, however, to confirm or reject such a hypothesis. These large fluctuations masked any differences that may be related to the differences in hardness of the two exposure waters.

The extremely high levels of copper in all the copper loops are mainly attributable to the water quality (pH, DIC, and DO). Although the sample standing time of 17 hours (that was about twice the standing time of the Phase I) plays some role, copper(II) solubility determined by pH and DIC is likely to be more significant. Based upon the Copper (II) equilibrium solubility diagram of Schock et al¹², copper(II) solubility of the Phase II water is about 3 mg/L in contrast to only about 0.02 mg/L for Phase I. The observed difference is of similar magnitude to that predicted based upon system chemistry differences, being approximately 3 mg/L compared to approximately 0.1 mg/l. Because of the highly non-equilibrium nature of the loop systems in this water, however, comparisons to theoretical models should not be taken very literally.

5. Discussion and Conclusions

Cyclical variations and the relatively short duration of the study prevented achieving constant metal levels, or reproducible cycling in response to background water chemistry changes. Physical differences in the initial pipe surfaces or exposed metal areas (e.g., solders) caused enough variability between loops that the duplicates could not be paired for statistical evaluations. Moreover, lead

leaching levels of the soldered copper loops and faucets were very low and therefore most of the test data did not lend itself to the statistical tests generally applied to the evaluation corrosion control test results. Consequently, the general conclusions drawn from the study were based primarily upon visual examination of the plotted test data.

5.1 Phase I

Visual examination of the Phase I data (Figures 4-8 to 4-14) suggests little difference in metal levels between the two systems and where differences were apparent, there was no pattern of the softened water metal levels being higher than the non-softened water levels. The only observed data to have consistent differences in metal levels throughout the study were the lead levels from the lead pipe loops where the levels of the non-softened water loops were always 0.05 to 0.06 mg/L higher than the softened levels.

The lead levels observed for the lead pipe are higher by a factor of three than would be expected for a water of the same pH and DIC.¹⁰⁻¹² Therefore, the behavior of lead in this study suggests the presence of an interferant to normal passivation film formation. X-ray diffraction analyses of pipe specimens showed almost no film formation, and no significant amounts of basic lead carbonate as would be expected. At this DIC/pH combination, the difference in lead solubility for the small pH difference between the softened and non-softened water should be minimal. Therefore, some surface reaction not directly resulting from hydroxide or carbonate ion probably occurred.

The lead levels from the faucets were observed to be slightly higher in the softened

water system, but the absolute levels were very low, less than 0.007 mg/L. The lead levels from the copper solder pipe were both near the detection limit of 0.002 mg/L except for several spikes during the last eight months of the study. This concentration range can be accounted for by differences in joint surface exposure as well as corrosivity, so it suggests little or no difference.

During the last six months of the study, the copper levels of the copper tubing loops were about 0.01 to 0.02 mg/L higher in the softened water loops while there was essentially no difference between the copper levels of copper pipes or faucets of the two systems. Additionally, copper levels from soft and hard copper pipe are higher than would be expected based on current experimental and theoretical work.^{6,7,13-16} X-ray diffraction analyses of pipe specimens from this project did not show normal film formation of Cu(II) solids, such as $\text{Cu}_2(\text{CO}_3)(\text{OH})_2$, CuO_2 , or $\text{Cu}(\text{OH})_2$ under controlled conditions. Abnormally higher copper levels have been previously observed in presence of 60-120 mg/L sulfate at pH 8.1-8.8⁶. However, this study water also contains, in addition to significant sulfate, appreciable polyphosphate and polyphosphate is known to increase lead solubility at least at pH 8 and above.^{17,24-26} Similar effects on copper would be expected.

5.2 Phase II

Visual examination of the data (Figures 4-22 to 4-27) from Phase II reveals that the absolute metal levels from all of the plumbing materials to be significantly higher than the results of Phase I. The higher levels are attributed to several factors, but most importantly to the differences in water quality (pH, DIC and DO) and in some cases in standing times, 17 hours verses 7+ hours.

The general outcome of Phase II, however, was very similar to the overall results of Phase I where there was no pattern of the softened water metal levels being higher than the non-softened water levels.

The copper levels from the copper soldered pipes, the soft copper tubing and faucets show extreme variability and have a great dependency on the DO content of the water initially and at the time of sampling. Standing time tests conducted on the copper pipes showed copper levels differed over the course of stagnation. The rate of increase and subsequent decrease were in direct relationship to the DO level of the water and also differed between the copper pipes exposed to the non-softened and softened waters. All of these factors were observed to have such a great influence on the copper levels that any potential impact of hardness could not be measured on these test systems.

In summary, considering all of the lead, copper, and zinc leaching data from all loops and faucets from both studies, there is no clear evidence of a pattern that the ion exchange softened waters systematically produced higher metal levels than the non-softened waters under otherwise identical conditions. Copper (especially) and lead displayed relationships to water oxidant level that appeared to differ between non-softened and softened waters and, therefore, the effect of hardness could not be isolated.

Except for the decrease in calcium levels, the softened water did not change any of the significant water quality corrosion parameters that would cause a prediction of higher metals leaching in the softened water system. The ion exchange softening process increased the pH of the control waters by 0.2 to 0.3 units which could have a slight

beneficial effect on metal leaching. Corrosion inhibitor anions, such as HPO_4^{-2} and PO_4^{-3} , can pass through the system, so ion exchange should not impact them adversely.

These studies involved only two water qualities and many chemical and physical characteristics can affect corrosiveness, so the results cannot be extrapolated to all water qualities. These results do indicate, however, that ion exchanged softened water will not necessarily produce higher metal levels.

6. References

1. *Lead Control Strategies*. AWWA Research Foundation, Denver, CO. (1990).
2. Schock, M. R. Causes of Temporal Variability of Lead in Domestic Plumbing Systems. *Environmental Monitoring and Assessment*. 15:59 (1990).
3. Karalekas, P. C., Jr. Lead and Other Trace Metals in Drinking Water in the Boston Metropolitan Area, *JNEWWA* 90:150 (1976).
4. Murrell, N. E. Impact of Lead and Other Metallic Solders on Water Quality. EPA/600/S2-90/056, ORD, USEPA, Cincinnati, OH (February 1991).
5. Reiber, S.H., et al. Corrosion in Water Distribution Systems of the Pacific Northwest. EPA/600/S2-87/042, ORD USEPA, Cincinnati, OH (November 1987).
6. Schock, M. R., Lytle, D. A. and Clement, J. A. Effect of pH, DIC, Orthophosphate and Sulphate on Drinking Water Cuprosolvency. EPA/600/R-95/085, USEPA, ORD, National Risk Management Lab, Cincinnati, Ohio. (June 1995).
7. Edwards, M., Schock, M. R. & Meyer, T.E. and. Alkalinity, pH and Copper Corrosion By-Product Release. *JAWWA*, 88:3:81 (March 1996).
8. Larson, T.E. *Corrosion by Domestic Waters*. Bulletin 59, Illinois State Water Survey, Urbana, IL (1995).
9. Le'grand, L. & LeRoy, P. *Pr'evention de la Corrosion et de l'Entarage dans les R'eseaux de Distribution d'Eau*. CIEEC, Neuilly-sur-Seine, France, (1995)
10. Schock, M. R. Response of Lead solubility to Dissolved Carbonate in Drinking Water. *JAWWA*, 72:12:965 (December 1980).
11. Schock, M. R. Response of Lead Solubility to Dissolved Carbonate in Drinking Water. *JAWWA*, 73:3:36 (March 1981).
12. Schock, M. R. and Gardels, M. C. Plumbsolvency Reduction by High and Low Carbonate-Solubility Relationships. *JAWWA*, 75:2:87 (February 1983).
13. Schock, M. R. Understanding Corrosion Control Strategies for Lead. *JAWWA*, 81:7:88 (July 1989).
14. Schock, M. R., Lytle, D. A. and Clement, J. A. Modeling Issues of Copper Solubility in Drinking Water. Proceedings ASCE National Conference on Environmental Engineering, Boulder, CO (July 11-13, 1994).

15. Schock, M. R., Lytle, D. A. and Clement, J. A. Effects of pH Carbonate, Orthophosphate and Redox Potential on Cuprosolvency. NACE Corrosion/95, Orlando, FL. (March 20-24, 1995).
16. Meyer, T. E. and Edwards, M. Effect of Alkalinity on Copper Corrosion. Proceedings ASCE National Conference on Environmental Engineering, Boulder, CO. (July 11-13, 1994).
17. Dodrill, D. M. and Edwards, M. Corrosion Control on the Basis of Utility Experience. *JAWWA*, 87:7:74 (July 1995).
18. Marshall, W. Copper in Drinking Water: What the Lead and Copper Rule Tells Us and What it Doesn't Tell Us. Proceedings AWWA Water Quality Technology Conference, San Francisco, CA. (November 6-10, 1994).
19. Gardels, M.C. and Sorg, T.J. A Laboratory Study of the Leaching of Lead from Water Faucets. *JAWWA*, 81:7:101 (July 1989).
20. Drinking Water Regulations: Maximum Contaminant Level Goals and National Primary Drinking Water Regulations for Lead and Copper. Final Rule. *Fed. Reg.*, 56:110:26460 (June 1991).
21. ASTM D513-92
22. Schock, M. R. & George, G. K. Comparison of Methods for Determination of Dissolved Inorganic Carbonate (DIC). Proceedings: AWWA Water Quality Technology Conference, Orlando, FL, (1991).
23. Quality Assurance Plan: Laboratory Operation and Standard Operating Procedures for Analysis and Quality Assurance. Inorganics and Particulates Control Branch, DWRD, RREL, USEPA, Cincinnati, OH (1994 draft).
24. Holm, T. R. and Smothers, S. H. Characterizing the Lead-Complexing Properties of Polyphosphate Water Treatment Products by Competing-Ligand Spectrophotometry Using 4-(2-Pyridylazo) Resorcinol. *Int. Environ. Anal. Chem.*, 41:71. (1990).
25. Holm, T. R. and Schock, M. R. Potential Effects of Polyphosphate Products on Lead Solubility in Plumbing Systems. *JAWWA*, 83:7:76 (July 1991).
26. Holm, T.R. and Schock, M. R. Polyphosphate Debate (Reply to Comment). *JAWWA*, 83:12:10, (December 1991).

Appendix A

Table A-1. Results of analyses of non-softened water, phase I study.*

Date	Days	pH	DO	Temp	FCI2	TCI2	Cu	Pb	Zn	Ca	Cl	Fe	F	K	Mg	Mn	Na
11/12/92	0	8.95	5.60	18.2	1.12	1.19	-0.005	0.000	0.003	29.4	53.1	0.003	1.00	3.88	24.9	0.0074	33.1
11/16/92	4	9.17	7.60	16.7	1.06	1.10	-0.005	0.000	-0.007	28.4	56.0	0.003	1.10	3.94	25.1	0.0069	34.7
11/18/92	6	9.44	5.80	16.8	1.03	1.11	-0.005	0.000	-0.011		50.9	-0.008	0.96			0.0040	
11/23/92	11	9.04	6.20	16.6	1.12	1.20	-0.004	0.000	-0.009	27.9	49.2	0.001	1.00	3.68	24.2	-0.0088	30.2
11/26/92	13	9.22	6.40	16.2	1.36	1.43	-0.006	0.000	-0.007	29.1	47.6	0.011	1.11	3.51	23.7	-0.0023	28.6
11/30/92	18	9.31	6.20	16.5	0.91	0.97	-0.008	0.000	-0.009	30.0	52.5	-0.022	0.80	3.78	24.6	-0.0018	30.2
12/02/92	20	9.12	5.40	16.3	1.12	1.17	0.001	-0.001	-0.010	29.1	51.9	0.017	0.92	3.84	24.0	-0.0003	31.8
12/07/92	25	9.38	5.30	16.2	1.11	1.16	-0.003	0.001	-0.006	29.4	52.4	0.023	1.12	3.82	24.8	0.0001	31.8
12/09/92	27	9.14	5.40	16.0	1.20	1.20	0.010	0.001	-0.016	29.6	51.7	-0.007	0.93	3.86	24.7	-0.0038	31.0
12/14/92	32	9.05	5.80	15.8	1.22	1.30	-0.005	0.001	-0.011	29.1	50.0	0.004	0.96	3.70	24.9		32.5
12/16/92	34	9.15	5.60	16.7	1.11	1.19	0.002	0.000	-0.007	28.7	49.9	0.000	1.02	3.70	24.4		30.6
12/21/92	39	9.02	5.30	16.3	1.15	1.23	0.005	0.000	-0.004	27.9	49.7	0.000	0.94	3.67	24.1		29.6
12/23/92	41	9.17	6.00	15.3	1.15	1.21	0.007	0.000	-0.011	29.0	48.8	-0.010	0.86	3.51	23.8		29.6
12/28/92	46	8.78	7.60	16.8	1.04	1.23	0.000	0.000	-0.008	28.9	49.8	-0.020	1.03	3.72	24.9		32.5
12/30/92	48	9.25	8.20	17.3	1.10	1.17	0.003	0.000	-0.011	28.8	48.9	-0.010	0.92	3.56	23.0		30.6
01/04/93	53	9.20	7.20	16.4	1.03	1.12	-0.003	0.000	-0.013	26.5	49.4	-0.001	2.45	3.52	24.9	-0.0032	29.6
01/06/93	55	9.30	7.40	16.4	1.01	1.07	-0.003	0.000	-0.009	25.2	49.7	0.003	0.89	3.46	24.3	-0.0032	29.6
01/11/93	60	9.10	7.10	15.9	1.07	1.14	-0.003	0.000	-0.009	26.6	54.6	-0.004	1.19	3.72	25.8	-0.0032	34.1
01/13/93	62	8.94	7.30	15.4	1.11	1.18	-0.003	0.000	-0.012	26.9	47.3	-0.009	1.13	3.63	24.5	-0.0032	28.5
01/20/93	69	9.09	7.50	14.6	1.04	1.12	-0.003	0.001	-0.010	27.3	50.2	-0.008	1.00	3.69	25.7	-0.0032	29.6
01/25/93	74	8.58	7.30	15.0	1.22	1.29	0.001	0.000	-0.012	26.6	45.6	0.004	0.89	3.53	23.8	-0.0010	27.1
01/27/93	76	9.11	7.40	15.1	1.17	1.27	0.002	0.000	-0.013	26.6	46.3	-0.006	1.04	3.62	24.2	-0.0003	27.1
02/01/93	81	9.12	7.30	15.1	0.97	1.04	0.003	0.000	-0.013	25.5	46.9	-0.006	0.90	3.71	24.6	0.0000	27.1
02/03/93	83	9.01	7.50	15.1	0.98	1.04	0.003	0.001	-0.011	26.6	48.5	-0.006		3.62	25.5	0.0003	28.8
02/08/93	88	9.04	7.20	14.5	1.00	1.05	-0.007	0.000	-0.001		45.7	0.018	0.88			-0.0002	
02/10/93	90	9.17	7.25	15.4	1.03	1.10	-0.005	0.000	0.002	26.2	47.6	0.033	1.07	3.64	24.5	0.0006	28.8
02/17/93	97	9.14	7.30	14.8	1.05	1.09	-0.004	0.000	-0.001	24.7	45.1	0.010		3.31	22.5	0.0015	28.0
02/24/93	104	9.00	7.80	14.2	1.02	1.10	-0.008	-0.001	-0.004	17.4	40.5	0.010	0.99	2.39	16.5	0.0032	19.0
03/01/93	109	9.18	7.70	14.5	1.14	1.21	0.001	0.000	-0.009	26.7	47.0	0.002	0.95	3.42	24.0	-0.0016	27.7
03/03/93	111	9.24	7.90	15.0	1.03	1.09	0.001	0.000	-0.011	26.4	46.3	0.029	0.96	3.45	23.1	-0.0016	26.7
03/08/93	116	8.80	7.60	15.3	0.99	1.04	0.001	0.001	-0.009	27.3	44.8	0.006	0.91	3.40	23.6	-0.0016	26.8
03/10/93	118	9.17	7.50	15.5	0.99	1.06	0.001	0.000	-0.010	26.9	48.5	0.019	1.01	3.38	25.6	-0.0016	30.6
03/15/93	123	9.14	7.90	13.8	1.07	1.11	0.001	0.000	-0.012	25.5	46.8	0.012	0.82	3.52	23.8	-0.0016	27.5
03/17/93	125	9.43	7.92	13.6	0.97	1.04	0.001	0.000	-0.011	24.5	46.1	-0.006	0.94	3.44	24.4	-0.0016	26.9
03/22/93	130	9.15	7.55	14.6	1.10	1.10	0.001	0.000	-0.009	25.5	45.8		1.05	3.50	23.4	-0.0048	26.3
03/24/93	132	9.15	8.40	15.7	0.93	1.00	0.001	-0.001	-0.009	26.6	45.5	-0.015	1.06	3.45	24.5	-0.0067	25.6
03/29/93	137	8.96	7.35	14.9	1.10	1.16	0.001	0.000	-0.007	25.5	46.9	-0.018	1.06	3.53	25.0	-0.0085	25.8
04/05/93	144	9.08	7.62	14.2	1.16	1.21	0.001	0.000	-0.006	26.7	43.9	0.131	0.72	3.07	23.3	0.0133	25.3
04/07/93	146	9.27	5.80	15.1	1.25	1.31	0.001	0.000	-0.007	26.4	45.5	-0.010	0.87	3.16	22.5	0.0008	25.2
04/12/93	151	8.85	5.60	14.3	1.07	1.12	0.004	0.000	-0.003	26.7	42.4	0.003	0.91	2.96	24.7		25.2
04/14/93	153	8.93	5.25	13.6	1.08	1.14	0.004	0.000	-0.003	28.0	47.1	0.003	1.00	3.14	24.4		27.8
04/19/93	158	9.27	5.90	14.1	1.06	1.13	0.003	0.000	0.000	27.0	46.7	-0.006	0.93	3.13	24.0	-0.0056	27.1
04/21/93	160	9.21	5.40	14.6	0.90	0.97	-0.003	0.000	-0.005	26.7	43.5	-0.006	1.06	2.99	24.4	-0.0064	26.4
04/26/93	165	9.22	5.30	14.1	1.07	1.13	-0.008	-0.001	-0.005	25.0	43.6	-0.006	0.82	3.35	24.7	-0.0007	26.1
04/28/93	167	9.08	6.20	14.2	1.01	1.07	0.006	0.001	-0.003	26.1	43.1	-0.006	0.85	3.13	23.6	0.0021	24.7
05/03/93	172	9.18	6.10	14.3	1.12	1.18	0.000	0.000	-0.004	26.4	42.7	-0.004	1.01	3.14	24.0	0.0006	25.7
05/05/93	174	9.55	4.80	14.1	1.12	1.21	-0.005	0.000	-0.003	24.7	41.6	-0.012	0.88	3.13	24.4	0.0000	24.5
05/10/93	179	9.13	5.00	14.8	1.10	1.16	-0.008	0.001	-0.005	24.7	42.6	-0.001	0.90	3.25	24.8	-0.0005	25.5
05/12/93	181	9.07	5.50	19.7	1.04	1.10	0.006	0.000	-0.006	26.4	44.4	0.029	1.05	3.05	23.5	-0.0047	24.1
05/17/93	186	9.25	6.10	15.9	1.10	1.18	0.004	0.000	-0.007	24.7	41.4	0.019	0.98	3.22	24.9	-0.0047	24.4
05/19/93	188	9.18	5.95	15.4	0.99	1.07	0.010	-0.001	-0.007	25.8	41.5	0.029	0.79	2.92	24.6	-0.0047	23.0
05/24/93	193	9.19	6.60	14.6	0.97	1.05	-0.001	0.000	-0.010	24.3	41.6	0.001	1.07	3.15	25.3	-0.0073	23.0
05/26/93	195	9.28	7.60	14.0	1.10	1.17	-0.001	-0.001	-0.012	25.3	41.8	0.007	0.90	3.28	24.5	0.0015	22.5
06/02/93	202	8.93	7.40	13.4	1.10	1.16	-0.001	0.000	-0.010	24.5	41.1	-0.002	0.90	3.17	23.6	-0.0033	22.9
06/07/93	207	9.16	7.10	13.1	1.06	1.13	-0.001	0.000	-0.009	20.6	41.3	0.022	0.92	3.05	18.6	-0.0022	18.5
06/09/93	209	9.21	4.20	13.7	1.12	1.21	-0.001	0.000	-0.008	24.9	40.3	-0.004	0.47	3.12	24.6	0.0052	22.4
06/14/93	214	9.21	6.95	13.4	0.97	1.04											
06/23/93	223	9.19	7.00	13.7	1.02	1.10		0.000	0.006	24.5	41.2	0.002	1.18	3.35	25.1		23.8
06/28/93	228	9.29	7.40	13.4	0.80	0.89	-0.001	0.001	0.003	24.1	40.0	-0.001	0.87	3.12	24.4	-0.0004	22.8

* All units in mg/L, except for pH in units and temperature in °C

Table A-1. Results of analyses of non-softened water, phase I study.*

Date	Days	pH	DO	Temp	FCI2	TCI2	Cu	Pb	Zn	Ca	Cl	Fe	F	K	Mg	Mn	Na
06/30/93	230	9.29	6.75	13.7	0.95	1.02	0.001	0.001	0.006	25.9	42.0	0.001	0.93	3.14	22.7	-0.0003	23.5
07/07/93	237	9.29	7.27	13.9	1.03	1.11	0.000	0.000	0.005	25.6	40.5	0.001	1.01	3.22	22.3	-0.0003	22.3
07/12/93	242	9.43	6.31	14.5	1.10	1.16	0.000	0.000	0.006	23.7	41.3	0.007	0.87	3.28	23.4	0.0003	23.8
07/14/93	244	9.17	6.60	14.1	1.10	1.15	0.001	0.000	0.006	25.1	39.4	0.009	0.86	3.11	23.0	-0.0004	21.3
07/19/93	249	9.24	5.73	14.3	1.11	1.20	0.000	0.000	0.013	23.9	39.5	0.006	0.82	3.04	22.9	-0.0006	22.4
07/21/93	251	9.13	5.29	14.6	0.92	1.01	0.001	0.000	0.006	24.5	38.9	0.001	1.03	3.33	24.1	0.0000	22.2
07/26/93	256	9.21	6.33	14.5	0.94	1.01	0.000	0.000	0.012	24.5	39.5	-0.002	1.03	3.25	24.1	-0.0006	23.8
07/28/93	258	9.22	6.71	14.5	1.11	1.17	0.000	0.000	0.006	25.2	39.2	0.002	1.02	3.23	23.6	-0.0002	22.2
08/02/93	263	9.18	6.45	14.5	1.00	1.06	0.000	0.000	0.007	25.0	39.0	0.002	0.95	3.23	23.5	-0.0007	23.0
08/04/93	265	9.25	5.16	14.9	0.98	1.06	0.002	0.001	0.004	24.1	37.5	0.002	0.88	3.27	22.9	-0.0005	21.2
08/09/93	270	9.30	6.40	14.8	1.12	1.21	0.001	0.000	0.010	24.2	39.8	0.001		3.22	22.6	-0.0001	22.2
08/11/93	272	9.04	6.93	15.0	0.93	1.07	-0.001	0.000	0.005	25.5	39.1	-0.002		3.17	23.0	-0.0006	21.8
08/16/93	277	8.78	7.34	14.6	0.98	1.10											
08/18/93	279	9.03	6.73	14.9	1.11	1.20	0.001	0.000	0.006	25.7	38.7	0.004		3.03	23.7	0.0001	21.4
08/23/93	284	8.99	6.55	14.9	0.97	1.06	0.002	-0.001	0.006	25.9	41.6	0.213		3.15	24.0	0.0004	23.0
08/25/93	286	9.14	6.89	15.1	0.96	1.04	0.002	0.001	0.020	23.8	41.2	0.002		3.23	22.7	-0.0001	23.2
08/30/93	291	8.92	7.28	15.1	1.05	1.16	-0.001	0.000	0.005	25.6	42.6	0.001		3.25	22.9	-0.0005	24.8
09/01/93	293	8.99	6.71	14.8	0.98	1.05	0.002	-0.001	0.006	25.6	40.3	0.002		3.16	22.3	-0.0006	23.1
09/08/93	300	8.96	5.22	15.1	1.05	1.11	0.002	0.000	0.072	26.4	42.1	0.006		3.49	23.6	-0.0002	25.2
09/13/93	305	8.99	6.27	15.4	1.07	1.18	0.001	0.001	0.004	26.6	43.2	0.002		3.55	24.2	-0.0005	23.9
09/15/93	307	9.12	5.70	16.2	1.28	1.36	0.001	-0.001	0.006	25.7	47.7	0.004		3.50	22.9	-0.0002	25.4
09/20/93	312	9.02	5.95	16.2	1.08	1.15	0.002	0.000	0.013	25.2	47.1	0.001		3.61	22.9	-0.0004	27.4
09/22/93	314	9.18	6.11	15.3	1.26	1.34	0.001	0.000	0.006	26.5	43.9	0.000		3.64	24.2	-0.0007	25.8
09/27/93	319	8.96	6.91	15.1	1.18	1.26	-0.005	0.000	0.011	25.0	41.1	-0.003		3.43	23.6	-0.0008	21.9
09/29/93	321	8.97	5.44	15.0	0.95	1.05	0.001	0.001	-0.001	24.2	45.2	0.000		3.50	24.1	-0.0006	27.3
10/04/93	326	9.04	7.63	15.5	0.97	1.06	0.001	0.000	0.003	23.6	49.1	0.001		3.58	23.6	-0.0003	27.4
10/06/93	328	9.08	7.07	15.6	0.95	1.04	0.001	0.000	0.003	22.9	49.9	0.001		4.16	23.2	0.0000	27.9
10/13/93	335	8.85	7.66	15.9	0.95	1.04	0.001	-0.001	0.001	24.7	46.6	0.004		3.21	23.5	0.3924	25.0
10/18/93	340	8.92	7.23	16.6	0.92	1.02	0.002	0.000	0.000	23.1	49.6	-0.001		3.69	23.4	-0.0009	26.4
10/20/93	342	9.00	7.02	16.4	0.96	1.04	0.001	0.000	0.000	24.3	49.0	-0.001		3.48	24.5	-0.0004	27.6
10/25/93	347	8.85	7.50	16.1	0.98	1.06	0.002	-0.001	0.000	25.2	49.0	0.001		3.17	23.8	0.0001	27.5
11/08/93	361	8.85	7.06	15.0	0.92	1.00	0.000	0.000	0.001	25.0	51.9	0.003		5.44	24.1	0.0001	28.0
11/10/93	363	8.02	8.02	15.5	0.92	1.00	0.001	0.000	0.000	26.0	50.3	0.001		4.00	23.0	-0.0004	25.9
11/15/93	368	8.90	7.10	15.7	1.02	1.12	0.000	0.001	0.000	26.2	50.0	0.001		4.05	23.7	-0.0004	27.6
11/17/93	370	8.98	7.24	15.8	1.02	1.11	0.000	0.000	0.000	25.1	51.4	0.001		4.20	24.2	-0.0005	29.7
11/22/93	375	9.05	7.36	15.8	0.97	1.04	0.000	0.000	0.000	25.5	55.1	0.003		4.94	24.0	-0.0006	31.2
11/24/93	377	8.80	7.40	15.8	0.93	1.04	0.000	0.000	-0.001	25.1	56.1	0.000		4.96	24.1	-0.0007	32.9
11/29/93	382	8.94	7.51	15.6	0.96	1.08	0.000	0.000	-0.003	25.6	49.6	0.002		4.61	23.8	-0.0007	26.2
12/01/93	384	9.05	7.20	15.8	0.97	1.06	0.002	-0.001	0.000	24.7	52.0	0.010		5.08	23.8	0.0005	29.9
12/06/93	389	9.04	7.89	15.6	1.03	1.12	0.001	-0.001	0.000	23.4	49.5	0.002		4.74	21.9	-0.0001	25.7
12/08/93	391	9.16	7.59	16.0	1.03	1.13	0.000	0.000	0.000	23.4	47.1	-0.001		2.93	22.1	-0.0004	25.3
12/13/93	396	8.92	7.84	15.2	1.01	1.09	0.001	0.000	-0.001	24.6	48.0	0.001		3.06	22.8	-0.0006	26.6
12/15/93	398	9.04	7.63	15.8	0.85	0.92	0.000	-0.001	0.000	24.0	46.4	0.000		2.97	23.8	-0.0006	26.6
12/20/93	403	8.85	7.86	16.3	1.02	1.10	0.002	0.000	-0.001	24.7	48.0	0.002		2.84	24.0	-0.0001	28.5
12/22/93	405	9.11	7.76	15.9	1.01	1.09	0.002	0.001	0.000	23.4	46.8	0.002		3.06	23.2	-0.0003	27.0
12/27/93	410	9.13	8.02	15.4	1.00	1.07	0.002	0.001	-0.001	23.6	46.6	0.004		2.94	22.3	-0.0001	25.8
12/29/93	412	9.27	8.03	15.6	1.05	1.10	0.003	0.000	0.000	23.3	46.4	0.003	0.99	3.65	22.0	-0.0004	26.1
01/03/94	417	9.27	8.27	19.9	1.19	1.26	0.001	0.000	0.001	24.1	45.4	0.022	0.89	3.72	23.4	0.0008	25.8
01/05/94	419	9.01	8.03	15.0	1.03	1.10	0.001	0.000	-0.001	25.3	45.1	0.001	0.87	3.48	23.4	-0.0004	24.3
01/10/94	424	9.13	7.99	15.2	1.14	1.19	0.002	0.000	0.000	24.3	45.1	0.042		3.62	23.5	0.0003	26.6
01/12/94	426	8.85	8.12	15.3	1.03	1.09	0.001	-0.001	0.000	23.8	44.5	0.003	0.90	3.34	23.0	-0.0002	26.3
01/24/94	438	9.16	8.51	15.0	0.98	1.04	-0.002	0.000	0.000	24.5	45.6	0.003	0.89	6.39	23.9	0.0001	27.0
01/26/94	440	8.83	8.58	15.0	0.93	1.01	0.000	0.000	0.000	24.1	46.1	0.008	0.85	3.96	23.5	-0.0001	25.7
01/31/94	445	9.14	8.89	14.6	1.01	1.10	0.001	0.001	0.000	24.8	47.2	0.001	0.82	3.74	23.0	-0.0002	26.7
02/02/94	447	9.09	8.75	14.2	1.00	1.10	0.003	0.000	0.000	25.2	47.8	0.002	0.81	3.78	23.2	-0.0005	27.5
02/07/94	452	9.03	8.22	13.9	1.06	1.12	0.000	0.001	0.002	25.0	47.2	0.001	0.94	3.73	24.0	-0.0005	26.5
02/09/94	454	9.10	8.42	13.9	1.06	1.13											
02/16/94	461	9.12	8.22	13.7	1.00	1.07	0.001		-0.002	25.9	47.4	0.001	0.91	3.68	23.9	-0.0001	26.3
02/23/94	468	9.25	8.46	14.3	0.98	1.05	0.002	0.000	0.000	25.1	46.9	0.001	0.88	3.61	23.2	-0.0004	26.4

* All units in mg/L, except for pH in units and temperature in °C

Table A-1. Results of analyses of non-softened water, phase I study.*

Date	NH3	NO3	P	PO4	T-PO4	Si	SiO2	Sn	S	SO4	T-alk	TIC
11/12/92	-0.05	1.63		0.11	0.43		11.12			72.6	80.9	17.78
11/16/92	-0.05	1.81		0.11	0.48		11.38			72.6	79.0	16.38
11/18/92	-0.05	1.57		0.07	0.47		10.87			69.2	69.2	13.43
11/23/92	-0.05	1.48		0.06	0.39		11.63			72.6	76.8	16.83
11/26/92	-0.05	1.48		0.08	0.51		11.89			72.6	74.5	15.66
11/30/92	-0.06	1.60		0.08	0.21		10.56			72.6	77.4	16.03
12/02/92	-0.03	1.45		0.08	0.91		10.55			77.1	75.3	16.52
12/07/92	-0.03	1.52		0.06	0.27		10.56			74.3	79.2	16.57
12/09/92	-0.03	1.42		0.08	0.41					76.1	75.8	15.91
12/14/92	-0.03	1.64		0.07	0.32		9.92			75.2	78.8	16.85
12/16/92	-0.02	1.63		0.08	0.42		9.92			73.3	79.1	
12/21/92	-0.03	1.64		0.08	0.39		9.65			72.4	74.8	
12/23/92	-0.03	1.39		0.08	0.40		10.20			75.0	75.8	15.71
12/28/92	-0.03	1.58		0.10	0.46		9.92			75.0	80.4	17.68
12/30/92	-0.03	1.50		0.11	0.31		9.50			76.5	70.3	14.27
01/04/93	-0.03	1.83		0.12	0.31		9.90			76.5	72.0	14.97
01/06/93	-0.03	1.55		0.08	0.29		9.72			73.9	67.6	13.63
01/11/93	-0.03	1.44		0.08	0.27		9.63			77.0	75.8	15.80
01/13/93	-0.03	1.44		0.07	0.38		10.76			72.9	72.6	15.80
01/20/93	-0.03	1.96		0.08	0.41		10.47			71.0	76.2	16.10
01/25/93	-0.03	1.66		0.07	0.41		10.91			70.2	71.1	14.81
01/27/93	-0.03	2.77		0.07	0.42		9.59			71.4	70.3	14.74
02/01/93	-0.03	2.94			0.68		10.36			69.1	71.3	14.68
02/03/93	-0.01	2.91		0.54	0.38		10.23			72.7	75.8	16.38
02/08/93	0.00	2.73		0.09	0.47		9.82			72.3	67.5	13.64
02/10/93	0.00	2.91		0.07	0.44		10.09			71.0	73.0	14.72
02/17/93	0.00			0.13			9.16			65.7	66.5	14.98
02/24/93	0.00	2.51		0.08	0.43		8.51			61.6	70.7	15.78
03/01/93	-0.01	2.55		0.09	0.58		11.70			71.9	73.0	14.57
03/03/93	-0.01	2.64		0.10	0.60		11.14			71.9	67.4	13.77
03/08/93	-0.01	2.58		0.09	0.48		11.42			69.5	75.0	15.65
03/10/93	0.01	2.62		0.09	0.45		11.45			72.6	75.5	15.46
03/15/93	0.01	3.15		0.08	0.44		11.16			67.1	73.4	14.80
03/17/93	0.01	2.81		0.09	0.51		11.16			69.2	71.2	13.73
03/22/93	0.01	2.45		0.08	0.41		11.74			70.3	70.4	14.50
03/24/93	0.00	2.69		0.08	0.52		10.29			70.2	73.8	15.31
03/29/93	0.00	2.35		0.08	0.43		10.22			68.8	74.9	15.64
04/05/93	0.00	2.69			0.40		10.22			66.0	72.8	14.19
04/07/93	0.00	2.84		0.08	0.37		9.96			66.2	69.2	12.82
04/12/93	0.00	3.15		0.06	0.36		9.75			67.2	79.0	16.51
04/14/93	-0.01	2.68		0.11	0.57		9.78			66.2	80.2	16.62
04/19/93	0.00	2.94		0.39	0.39		9.38			65.2	76.7	15.49
04/21/93	0.00			0.10	0.52		10.04			67.2	76.5	15.59
04/26/93	0.00	2.86		0.06	0.44		9.51			65.2	77.3	15.24
04/28/93	0.00	2.12		0.08	0.41		10.18			66.2	74.1	15.42
05/03/93	0.00	3.23		0.08	0.35		9.98			66.2	76.5	15.90
05/05/93	0.04	3.07		0.07	0.41		9.46			61.7	78.2	15.62
05/10/93	0.02	2.06		0.20	0.77		9.43			65.6	77.9	15.84
05/12/93	0.00	2.22		0.08	0.43		9.71			68.8	73.6	15.44
05/17/93	-0.03	3.28		0.07	0.35		9.43			63.7	77.5	15.70
05/19/93	-0.03	2.91		0.07	0.34		9.43			62.3	84.2	17.46
05/24/93	-0.09	3.46		0.06	0.43					60.6	81.5	16.92
05/26/93	-0.09	3.09	0.152	0.06	0.42	4.29	10.07	0.0	22.3	64.1	76.1	15.00
06/02/93	-0.07	3.18	0.129	0.06	0.35	4.34	10.43	0.0	22.1	63.3	71.7	12.94
06/07/93	-0.09	3.51	0.075	0.06	0.38	3.59	10.66	0.0	18.6	66.6	72.6	15.00
06/09/93	-0.01	2.86	0.120	0.06	0.03	4.37	10.19	0.0	23.2	65.2	74.3	15.12
06/14/93												
06/23/93	-0.01	2.86	0.157	0.06	0.40	4.45	10.25	0.0	24.0	65.5	73.8	15.08
06/28/93	-0.01	3.07	0.166	0.07	0.40	4.48	10.51	0.0	22.2	64.5	73.2	14.84

* All units in mg/L, except for pH
in units and temperature in °C

Table A-1. Results of analyses of non-softened water, phase I study.*

Date	NH3	NO3	P	PO4	T-PO4	Si	SiO2	Sn	S	SO4	T-alk	TIC
06/30/93	-0.02	2.03	0.155	0.07	0.37	4.50	10.35	0.0	24.0	69.5	69.8	13.14
07/07/93	-0.01	2.14	0.120	0.07	0.38	4.31	9.84	0.0	22.7	63.6	70.0	13.82
07/12/93	-0.02	1.88	0.166	0.07	0.39	4.46	10.09	0.0	23.2	65.4	70.2	13.01
07/14/93		1.77	0.161	0.06	0.33	4.50	9.84	0.0	22.8	65.4	72.5	14.60
07/19/93	-0.02	2.74	0.168	0.07	0.41	4.23	9.59	0.0	22.3	65.4	72.9	14.86
07/21/93	-0.02		0.155	0.07	0.44	4.44	9.76	0.0	21.0	62.0	78.5	16.16
07/26/93	-0.02	5.00	0.136	0.06	0.43	4.41	9.76	0.0	21.5	62.9	78.0	15.42
07/28/93	-0.02	2.31	0.156	0.07	0.33	4.42	9.90	0.0	21.0	62.0	80.8	16.75
08/02/93	-0.02	2.33	0.147	0.08	0.40	4.45	9.76	0.0	21.0	62.9	80.9	16.68
08/04/93	-0.02	2.22	0.112	0.07	0.41	4.26	9.76	0.0	20.0	59.5	80.0	16.63
08/09/93	-0.02	2.39	0.151	0.07	0.39	4.43	9.71	0.0	21.7	62.9	75.8	15.03
08/11/93	-0.02	2.79	0.150	0.09	0.48	4.36	9.71	0.0	20.7	61.3	82.2	17.45
08/16/93												
08/18/93	-0.02	3.95	0.160	0.11	0.44	4.63	9.97	0.0	22.3	63.9	80.1	17.28
08/23/93	-0.02	2.03	0.197	0.13	0.48	4.59	9.71	0.0	22.2	64.1	81.8	17.64
08/25/93	-0.02	3.22	0.185	0.11	0.47	4.42	9.71	0.0	21.7	64.1	72.8	15.33
08/30/93	-0.02	2.06	0.141	0.07	0.37	4.44	9.44	0.0	22.4	65.9	77.1	16.77
09/01/93	-0.02	2.26	0.154	0.08	0.51	4.46	9.61	0.0	21.9	64.6	78.3	16.68
09/08/93	-0.01	3.11	0.157	0.10	0.44	4.01	9.64	0.0	21.0	62.8	87.1	19.26
09/13/93	-0.01	1.89	0.188	0.08	0.38	4.52	9.54	0.0	23.0	64.4	84.9	18.64
09/15/93	-0.01	1.56	0.183	0.08		4.21	9.16	0.0	21.9	64.5	81.0	17.24
09/20/93	-0.01	1.46	0.127	0.08		4.40	9.42	0.0	22.3	64.9	77.6	15.81
09/22/93	-0.01	1.29	0.135	0.09		4.54	9.42	0.0	22.6	64.9	84.7	16.68
09/27/93	-0.01	1.89	0.161	0.13		4.42	9.38	0.0	21.4	64.0	83.4	17.62
09/29/93	-0.02	1.28	0.196	0.09		4.28	9.63	0.0	21.5	65.9	86.5	18.69
10/04/93	-0.02	1.10	0.108	0.07		4.38	9.63	0.0	22.3	65.9	78.0	16.65
10/06/93	-0.02	1.19	0.138	0.09		4.34	9.38	0.0	22.7	67.1	72.9	15.25
10/13/93	-0.02	1.84	0.152	0.08		4.40	9.78	0.0	22.8	68.1	78.7	16.93
10/18/93	-0.03	1.84	0.124	0.08		4.15	9.52	0.0	21.0	66.1	80.6	17.35
10/20/93	-0.03	1.55	0.103	0.09		4.39	9.47	0.0	22.8	65.8	79.0	17.23
10/25/93	-0.03	1.36	0.139	0.07		4.37	9.71	0.0	23.4	67.8	82.8	18.32
11/08/93	-0.01	2.05	0.174	0.11		4.33	9.23	0.0	22.7	69.5	81.8	17.80
11/10/93	-0.02	1.60	0.163	0.09		4.27	9.71	0.0	22.3	71.6		18.80
11/15/93	-0.02	1.38	0.141	0.08	0.30	4.40	9.47	0.0	23.6	69.5		18.30
11/17/93	-0.02	1.71	0.126		0.33	4.45	9.17	0.0	23.9	73.6		16.50
11/22/93	-0.02	1.42	0.129		0.36	4.39	9.39	0.0	23.9	73.6	76.7	16.48
11/24/93	-0.02	1.23	0.108		0.24	4.32	9.25	0.0	24.7	77.5	75.6	16.10
11/29/93	-0.02	1.82	0.160	0.09	0.32	4.45	9.53	0.0	23.4	69.9	83.3	18.12
12/01/93	-0.02	1.65	0.158	0.08	0.24	4.32	9.25	0.0	23.5	71.6	81.1	17.65
12/06/93	-0.02	1.65	0.105	0.08	0.04	4.09	8.76	0.0	22.2	70.5	79.5	17.01
12/08/93	-0.02	1.84	0.135	0.08	0.13	4.18	8.95	0.0	22.6	68.4	73.9	15.56
12/13/93	-0.02	1.56	0.145	0.09	0.42	4.30	9.20	0.0	23.6	69.8	77.7	11.46
12/15/93	-0.02	2.18	0.133	0.08		4.32	9.25	0.0	23.3	66.4	82.4	17.41
12/20/93		2.18	0.128	0.08	0.33	4.44	9.50	0.0	22.7	65.7	81.5	17.45
12/22/93		2.32	0.141	0.08	0.31	4.26	9.12	0.0	22.2	65.7	79.5	16.82
12/27/93		1.61	0.150	0.11	0.42	4.21	9.01	0.0	22.5	67.6	76.2	15.82
12/29/93		1.71	0.157	0.13	0.42	4.18	8.93	0.0	22.5	65.7	74.1	14.68
01/03/94	-0.01	2.15	0.147	0.07	0.42	4.30	9.19	0.0	21.5	64.7	79.5	17.25
01/05/94	-0.01	1.99	0.143	0.07	0.34	4.35	9.31	0.0	23.2	64.7	80.3	17.01
01/10/94	-0.01	2.15	0.130	0.09	0.37	4.15	8.87	0.0	21.1	62.9	81.4	17.37
01/12/94	-0.01	1.96	0.122	0.08	0.38	4.17		0.0	21.2	63.8	80.3	16.97
01/24/94	-0.02	2.11	0.167	0.08	0.41	4.30		0.0	22.4		77.8	16.33
01/26/94	-0.02	1.96	0.192	0.12	0.43	4.14		0.0	21.3		80.3	17.71
01/31/94	-0.02	1.85	0.127	0.08	0.31	4.15		0.0	23.7		76.7	16.18
02/02/94	-0.02	2.11	0.148	0.07	0.34	4.22		0.0	22.8		76.5	15.70
02/07/94	-0.02	2.29	0.091	0.06		4.26		0.0	22.4		81.7	
02/09/94												
02/16/94	0.01	2.00	0.090	0.06	0.03	4.39	9.42	0.0	24.9	74.7	78.7	16.20
02/23/94	-0.02	2.13	0.125	0.07		4.21	9.01	0.0	21.8	65.5	78.2	16.11

* All units in mg/L, except for pH in units and temperature in °C

Table A-2. Results of analyses of the softened water, phase I study.*

Date	Days	pH	DO	Temp	FCI2	TCI2	Cu	Pb	Zn	Ca	Cl	Fe	F	K	Mg	Mn	Na
11/12/92	0	9.25	5.66	17.7			-0.005	0.0	-0.007	-0.5	53.3	-0.007	1.01	0.97	-0.3	0.0064	116.8
11/16/92	4	9.45	6.00	16.7	0.94	0.99	-0.005	0.0	-0.006	-0.4	55.9	0.012	1.07	1.28	-0.4	0.0059	116.0
11/18/92	6	9.22	5.80	16.7	1.04	1.10	-0.005	0.0	-0.015		51.3	-0.007	0.83			0.0025	
11/23/92	11	9.24	6.30	16.2	1.18	1.24	-0.004	0.0	-0.007	-0.9	49.2	0.018	0.90	0.50	-0.3	-0.0012	111.6
11/26/92	13	9.42	6.40	16.5	1.18	1.23	-0.006	0.0	-0.007	-0.6	47.3	0.003	0.96	0.55	-0.4	-0.0021	107.3
11/30/92	18	9.52	6.20	16.8	0.93	0.98	-0.002	0.0	-0.011	-0.5	52.5	0.002	0.93	0.73	-0.3	-0.0016	111.3
12/02/92	20	9.32	5.50	16.6	1.12	1.19	-0.006	0.0	-0.013	-0.2	56.9	0.008	0.90	0.57	-0.3	-0.0001	110.5
12/07/92	25	9.51	5.50	16.1	1.09	1.17	-0.003	0.0	-0.006	-0.7	52.2	0.001	1.09	0.71	-0.4	-0.0004	112.9
12/09/92	27	9.33	5.50	16.0	1.12	1.19	0.010	0.0	-0.016	-0.3	51.4	-0.006	0.85	0.56	-0.4	-0.0039	111.7
12/14/92	32	9.28	5.70	15.7	1.14	1.23	-0.005	0.0	-0.011	-0.7	50.0	0.004	-3.03	1.02	-0.3		111.5
12/16/92	34	9.34	5.70	16.5	1.09	1.15	0.003	0.0	-0.008	0.1	50.0	-0.010	0.90	0.98	-0.3		113.4
12/21/92	39	9.36	5.20	15.8	1.14	1.20	-0.001	0.0	-0.010	-0.3	49.7	-0.010	0.90	0.92	-0.3		111.5
12/23/92	41	9.43	5.90	15.4	1.18	1.22	0.000	0.0	-0.011	-0.8	48.9	-0.010	0.89	0.64	-0.4		112.4
12/28/92	46	9.19	6.00	16.1	1.04	1.12	0.001	0.0	-0.011	-0.1	49.7	-0.010	0.92	0.40	-0.3		107.5
12/30/92	48	9.50	6.20	17.1	1.06	1.12	0.003	0.0	-0.011	-0.1	49.0	-0.010	0.96	0.44	-0.5		111.5
01/04/93	53	9.42	7.10	16.2	1.02	1.12	-0.003	0.0	-0.011	-0.6	49.4	0.010	0.94	0.71	-0.5	-0.0032	111.5
01/06/93	55	9.50	7.50	16.3	0.97	1.04	-0.003	0.0	-0.009	-0.1	49.6	0.004	0.98	0.64	-0.5	-0.0032	106.8
01/11/93	60	9.30	7.20	16.3	1.04	1.11	-0.003	0.0	-0.008	0.2	55.2	0.006	1.12	2.91	-0.5	-0.0032	115.9
01/13/93	62	9.18	7.40	15.3	1.10	1.17	-0.003	0.0	-0.010	-0.1	47.4	-0.018	1.02	1.63	-0.5	-0.0032	105.9
01/20/93	69	9.35	7.50	15.0	1.03	1.09	-0.002	0.0	-0.012	0.2	50.3	0.004	0.98	1.45	-0.5	-0.0030	107.2
01/25/93	74	9.37	7.40	15.5	1.16	1.23	0.001	0.0	-0.009	0.2	45.8	0.014	0.90	1.44	-0.5	-0.0008	103.5
01/27/93	76	9.29	7.50	14.9	1.15	1.23	0.002	0.0	-0.014	-0.1	46.2	-0.006	0.94	1.44	-0.5	-0.0002	101.7
02/01/93	81	9.35	7.30	15.3	0.98	1.04	0.003	0.0	-0.011	-0.1	46.9	-0.006	0.97	1.62	-0.5	0.0001	103.5
02/03/93	83	9.09	7.50	14.9	0.97	1.03	-0.003	0.0	-0.011	-0.1	41.1	-0.016	0.98	1.80	-0.5	0.0005	107.0
02/08/93	88	9.26	7.30	14.9	0.99	1.05	-0.006	0.0	-0.001		45.7	0.031	0.93			0.0001	
02/10/93	90	9.43	7.30	15.4	1.01	1.06	-0.005	0.0	-0.001	-0.5	47.7	0.007	1.09	1.52	-0.5	0.0010	104.4
02/17/93	97	9.40	7.30	14.7	1.04	1.09	-0.010	0.0	-0.005	-0.4	49.3	0.031	0.90	1.92	-0.2	0.0019	104.5
02/24/93	104	9.31	7.50	14.7	1.00	1.07	-0.005	0.0	-0.005	-0.4	46.8	0.028	0.98	1.58	-0.2	-0.0069	100.1
03/01/93	109	9.46	7.70	13.7	1.11	1.16	0.001	0.0	-0.009	-0.4	46.9	0.022	0.97	0.82	-0.2	-0.0016	105.7
03/03/93	111	9.23	7.60	15.2	0.98	1.05	0.001	0.0	-0.011	-0.4	46.1	0.018	0.89	1.51	-0.2	-0.0016	102.3
03/08/93	116	8.94	7.50	14.9	0.97	1.05	0.001	0.0	-0.009	-0.3	44.9	0.007	0.88	1.24	0.0	-0.0016	107.6
03/10/93	118	9.19	7.40	15.7	0.98	1.04	0.001	0.0	-0.008	-0.3	48.5	0.019	1.15	1.27	-0.1	-0.0016	112.3
03/15/93	123	9.42	7.90	13.5	1.06	1.12	0.001	0.0	-0.012	-0.3	46.6	-0.008	1.15	1.51	-0.1	-0.0016	102.2
03/17/93	125	9.61	7.85	13.7	0.96	1.04	0.001	0.0	-0.009	-0.3	46.0	-0.006	0.85	1.56	-0.1	0.0025	100.8
03/22/93	130	9.41	7.80	14.2	1.07	1.12	0.001	0.0	-0.010	-0.3	45.7	-0.009	1.01	1.63	-0.1	-0.0053	98.6
03/24/93	132	9.38	7.40	15.7	0.91	0.99	0.001	0.0	-0.007	-0.3	45.6	-0.004	1.05	1.51	-0.1	0.0009	101.1
03/29/93	137	9.16	7.50	15.0	1.07	1.12	0.001	0.0	-0.007	-0.6	46.9	-0.006	0.92	2.56	-0.1	-0.0009	100.5
04/05/93	144	9.38	7.70	13.9	1.14	1.19	0.001	0.0	-0.006	0.5	43.8	0.030	0.93	1.26	-0.2	0.0008	99.3
04/07/93	146	9.61	5.85	15.2	1.23	1.30	0.001	0.0	-0.008	0.5	44.7	-0.010	0.88	1.35	-0.2	0.0008	99.1
04/12/93	151	9.03	5.45	14.1	1.05	1.11	0.004	0.0	-0.005	0.5	42.4	0.003	0.82	1.37	-0.2		102.7
04/14/93	153	9.40	5.35	13.8	1.03	1.08	0.004	0.0	-0.003	0.5	47.1	0.004	0.95	1.38	-0.2		105.3
04/19/93	158	9.44	5.92	13.7	1.05	1.11	0.003	0.0	-0.005	1.1	46.5	-0.006	0.73	0.96	0.0	-0.0022	103.7
04/21/93	160	9.47	5.40	14.4	0.92	1.00	0.004	0.0	-0.010	0.5	43.6	-0.006	0.94	0.88	-0.1	-0.0030	103.1
04/26/93	165	9.48	5.80	14.3	1.06	1.12	0.006	0.0	0.003	0.1	44.1	-0.016	0.87	1.40	0.0	0.0026	100.5
04/28/93	167	9.27	6.10	13.8	0.99	1.06	0.013	0.0	-0.005	0.1	43.1	-0.005	0.89	1.28	-0.1	0.0013	98.4
05/03/93	172	9.36	6.02	14.1	1.12	1.17	-0.008	0.0	-0.006	0.1	42.9	-0.003	0.85	1.15	-0.1	0.0004	100.9
05/05/93	174	9.56	5.00	14.2	1.09	1.16	0.008	0.0	0.002	0.1	41.7	-0.001	0.88	1.16	-0.1	-0.0002	99.7
05/10/93	179	9.34	5.35	14.7	1.09	1.15	-0.002	0.0	-0.005	0.1	42.6	0.000	0.93	1.15	-0.1	-0.0006	100.7
05/12/93	181	9.39	5.80	14.5	0.98	1.05	-0.002	0.0	-0.009	0.1	41.4		0.92	1.07	-0.1	-0.0047	98.5
05/17/93	186	9.45	5.60	16.2	1.14	1.20	0.003	0.0	-0.008	0.1	41.6	0.010	0.79	1.05	-0.1	-0.0047	101.3
05/19/93	188	9.40	5.90	15.9	1.02	1.10	0.010	0.0	-0.007	0.1	41.6		0.90	0.93	-0.1	-0.0047	99.3
05/24/93	193	9.41	6.40	14.1	1.02	1.09	-0.001	0.0	-0.008	0.1	41.8	0.002	0.90	1.18	-0.1	0.0003	97.0
05/26/93	195	9.55	7.90	14.1	1.11	1.20	-0.001	0.0	-0.009	0.1	41.4	-0.002	1.01	1.47	0.0	0.0017	96.5
06/02/93	202	9.44	7.40	13.5	1.12	1.18	-0.008	0.0	-0.008	0.1	40.9	0.008	1.03	1.36	0.0	0.0043	92.9
06/07/93	207	9.32	7.20	13.2	1.09	1.17	-0.008	0.0	-0.010	0.1	41.1	-0.006	0.77	1.03	0.0	-0.0022	94.4
06/09/93	209	9.41	7.30	13.3	1.18	1.23	-0.001	0.0	-0.011	0.1	40.3	-0.004	0.94	0.91	0.0	0.0052	94.6
06/14/93	214	9.37	7.30	13.7	1.04	1.08											
06/23/93	223	9.35	7.25	14.1	1.03	1.10		0.0	0.004	0.1	41.4	0.003	0.86	1.44	0.1		95.4
06/28/93	228	9.57	7.00	14.4	0.80	0.85	0.000	0.0	0.005	0.1	40.1	0.001	1.34	1.23	0.0	0.0000	93.5
06/30/93	230	9.52	6.79	13.8	0.96	1.02	0.000	0.0	0.004	0.1	42.0	0.001	0.96	1.10	0.1	0.0002	92.2
07/07/93	237	9.46	7.30	13.8	1.06	1.10	0.000	0.0	0.006	0.1	40.6	0.003	1.14	1.18	0.1	0.0007	91.9
07/12/93	242	9.67	6.42	14.2	1.10	1.16	0.000	0.0	0.005	0.1	41.3	0.000	0.93	0.94	0.0	0.0006	90.7

* All units in mg/L, except for pH in units and temperature in °C.

Table A-2. Results of analyses of the softened water, phase I study.*

Date	Days	pH	DO	Temp	FCI2	TCI2	Cu	Pb	Zn	Ca	Cl	Fe	F	K	Mg	Mn	Na
07/14/93	244	9.36	6.70	14.3	1.08	1.14	-0.001	0.0	0.006	0.1	39.9	0.011	0.81	0.89	0.0	0.0004	90.8
07/19/93	249	9.38	5.61	14.8	1.08	1.13	0.001	0.0	0.004	0.1	39.6	0.003	0.82	0.83	0.0	0.0001	92.5
07/21/93	251	9.34	5.29	15.2	0.90	0.97	0.003	0.0	0.007	0.1	38.9	0.001	0.99	0.90	0.1	0.0006	92.9
07/26/93	256	8.92	6.42	14.5	0.95	1.02	0.000	0.0	0.013	0.1	39.4	0.002	0.86	0.74	0.1	0.0010	94.4
07/28/93	258	9.40	6.56	14.5	1.09	1.15	0.001	0.0	0.006	0.0	39.1	0.001	1.16	0.74	0.1	0.0008	89.6
08/02/93	263	9.40	6.50	14.6	0.97	1.04	0.002	0.0	0.010	0.1	38.9	0.003	0.90	0.87	0.0	0.0002	93.9
08/04/93	265	9.35	5.21	15.2	1.04	1.10	0.000	0.0	0.005	0.1	43.4	0.001	1.01	0.90	0.1	0.0025	90.9
08/09/93	270	9.50	6.43	15.0	1.10	1.18	0.000	0.0	0.006	0.0	39.6	0.001		0.70	0.0	0.0003	91.5
08/11/93	272	9.31	6.97	15.6	0.95	1.02	-0.001	0.0	0.005	0.0	39.3	-0.001		0.61	0.0	-0.0003	95.4
08/16/93	277	9.09	7.16	14.9	1.01	1.09											
08/18/93	279	9.24	6.97	14.8	0.96	1.03	0.002	0.0	0.006	0.0	38.5	0.002		0.46	0.0	0.0007	95.4
08/23/93	284	9.20	6.67	15.1	0.97	1.06	0.001	0.0	0.006	0.1	41.5	0.007		0.65	0.1	0.0006	100.4
08/25/93	286	9.08	6.85	15.1	0.99	1.07	0.002	0.0	0.007	0.1	41.1	0.002		0.73	0.1	0.0005	97.1
08/30/93	291	9.19	7.09	15.3	1.02	1.11	0.000	0.0	0.005	0.0	42.9	0.002		0.61	0.0	0.0004	100.0
09/01/93	293	9.12	6.68	14.8	1.00	1.07	0.001	0.0	0.005	0.1	40.1	0.003		0.58	0.0	0.0003	93.3
09/08/93	300	9.19	5.26	15.4	1.03	1.09	0.001	0.0	0.006	0.1	42.1	0.002		0.96	0.0	0.0003	103.9
09/13/93	305	9.29	5.99	15.5	1.23	1.33	0.002	0.0	0.003	0.0	43.2	0.000		1.11	0.1	0.0004	102.0
09/15/93	307	9.32	5.32	16.4	1.18	1.27	0.003	0.0	0.001	0.1	47.7	0.002		1.09	0.1	0.0007	97.9
09/20/93	312	9.44	5.45	16.2	0.97	1.05	0.000	0.0	0.000	0.0	47.1	0.000		0.95	0.0	-0.0001	99.9
09/22/93	314	9.33	6.05	15.3	1.21	1.27	0.003	0.0	0.000	0.0	44.0	0.000		1.01	0.0	0.0002	107.0
09/27/93	319	9.27	6.85	15.3	1.26	1.32	-0.005	0.0	-0.002	0.0	41.2	-0.003		1.09	0.1	-0.0003	94.6
09/29/93	321	9.20	5.46	15.1	0.95	1.03	0.001	0.0	0.000	0.0	45.1	-0.001		1.18	0.0	-0.0001	107.4
10/04/93	326	9.23	5.81	15.2	0.95	1.03	0.000	0.0	-0.001	0.0	48.7	0.001		1.09	0.0	0.0001	99.2
10/06/93	328	9.26	7.06	15.4	0.96	1.01	0.002	0.0	0.000	0.0	49.8	0.000		1.05	0.0	0.0002	99.4
10/13/93	335	9.19	7.42	15.6	0.96	1.05	0.001	0.0	0.002	0.0	46.6	0.004		1.08	0.1	0.0009	97.2
10/18/93	340	8.91	7.19	16.4	0.96	1.03	0.001	0.0	0.000	0.0	49.8	-0.001		1.01	0.0	-0.0001	97.5
10/20/93	342	9.21	7.20	16.3	0.92	1.00	0.002	0.0	0.001	0.0	49.0	-0.001		0.93	0.1	0.0005	100.0
10/25/93	347	9.07	7.54	16.7	0.85	0.93	0.001	0.0	0.003	0.1	49.1	0.000		1.09	0.1	0.0004	104.4
11/08/93	361	9.10	6.47	16.6	0.84	0.95	0.002	0.0	0.001	0.1	51.7	0.003		1.45	0.1	0.0010	102.4
11/10/93	363	8.98	7.63	15.6	1.00	1.10	0.000	0.0	0.001	0.1	50.1	0.001		1.37	0.0	0.0000	98.8
11/15/93	368	9.10	7.05	16.0	1.03	1.11	0.001	0.0	0.001	0.1	50.1	0.001		1.27	0.0	0.0004	103.4
11/17/93	370	9.13	7.27	15.8	1.02	1.12	0.002	0.0	0.001	0.1	51.3	0.000		1.34	0.0	0.0001	105.4
11/22/93	375	9.16	7.16	15.6	0.93	1.06	0.001	0.0	-0.001	0.1	55.0	0.002		1.60	0.1	0.0007	104.2
11/24/93	377	9.28	7.39	15.7	0.93	1.00	-0.001	0.0	-0.001	0.1	56.0	0.000		1.67	0.0	0.0005	108.8
11/29/93	382	9.11	7.60	15.6	0.95	1.03	0.000	0.0	-0.003	0.0	49.5	0.001		1.27	0.0	-0.0003	104.4
12/01/93	384	9.16	7.27	15.5	1.01	1.09	0.001	0.0	0.000	0.0	51.9	0.000		1.68	0.0	0.0001	107.4
12/06/93	389	9.26	7.91	16.2	0.94	1.03	0.001	0.0	0.001	0.1	49.5	0.002		1.62	0.0	0.0004	96.6
12/08/93	391	9.38	7.70	16.1	0.93	1.03	0.000	0.0	0.001	0.0	47.5	0.000		0.97	0.0	0.0003	90.1
12/13/93	396	9.29	8.43	15.2	1.00	1.08	0.002	0.0	0.003	0.0	47.6	0.001		0.73	0.1	0.0003	99.3
12/15/93	398	9.16	7.92	15.7	0.80	0.88	0.001	0.0	0.003	0.0	46.5	0.002		0.64	0.0	0.0005	100.7
12/20/93	403	8.96	7.84	16.2	0.99	1.05	0.002	0.0	0.000	0.0	48.1	0.001		0.80	0.0	0.0008	103.0
12/22/93	405	9.38	7.88	15.9	0.98	1.04	0.002	0.0	0.001	0.1	46.6	0.002		0.87	0.1	0.0022	96.3
12/27/93	410	9.37	7.98	15.4	0.95	1.01	0.002	0.0	0.001	0.1	46.4	0.002		3.30	0.1	0.0009	95.0
12/29/93	412	9.47	8.11	15.5	1.02	1.09	0.003	0.0	0.000	0.0	46.5	0.013	0.96	0.80	0.1	0.0007	94.8
01/03/94	417	9.30	8.35	15.9	1.15	1.21	0.000	0.0	0.004	0.1	45.6	0.010	0.89	1.05	0.0	0.0008	98.2
01/05/94	419	9.29	8.65	15.1	1.02	1.09	0.002	0.0	0.000	0.1	44.7	0.001	0.88	1.16	0.1	0.0008	97.3
01/10/94	424	9.22	8.90	15.2	1.13	1.20	0.002	0.0	0.000	0.0	45.1	0.008	0.91	0.81	0.1	0.0003	100.0
01/12/94	426	9.29	8.10	15.5	1.03	1.10	0.001	0.0	0.001	0.1	44.6	0.004	0.88	0.83	0.0	0.0018	100.5
01/24/94	438	9.36	8.60	15.1	1.01	1.08	-0.001	0.0	0.001	0.1	45.7	0.002	0.90	1.77	0.1	0.0011	101.9
01/26/94	440	9.16	8.72	15.0	0.91	1.01	0.000	0.0	0.001	0.1	46.1	0.002	0.85	1.08	0.1	0.0009	99.6
01/31/94	445	9.37	9.51	14.9	0.98	1.06	0.000	0.0	0.001	0.1	47.2	0.006	0.83	1.13	0.1	0.0009	95.9
02/02/94	447	9.30	9.26	13.5	0.94	1.02	0.002	0.0	0.001	0.1	47.7	0.001	0.85	1.14	0.1	0.0010	100.7
02/07/94	452	9.36	8.36	13.9	1.08	1.17	0.002	0.0	0.001	0.1	47.1	0.000	0.94	0.85	0.1	0.0006	99.5
02/09/94	454	9.28	8.36	13.8	1.04	1.11											
02/16/94	461	9.22	8.02	13.7	0.99	1.04	0.000		-0.001	0.1	47.4	0.001	0.88	1.14	0.1	0.0006	102.3
02/23/94	468	9.30	8.32	13.7	0.99	1.05	0.002	0.0	0.000	0.1	47.1	0.002	0.88	0.78	0.1	0.0037	104.4

* All units in mg/L, except for pH in units and temperature in °C.

Table A-2. Results of analyses of the softened water, phase I study.*

Date	NH3	NO3	P	PO4	T-PO4	Si	SiO2	Sn	S	SO4	T-Alk	TIC
11/12/92	-0.05	1.63		0.13	0.52		11.38			75.2	80.6	17.89
11/16/92	-0.05	1.80		0.11	0.50		11.38			72.6	79.0	16.23
11/18/92	-0.05	1.39		0.07	0.55		10.87			70.3	69.3	13.39
11/23/92	-0.05	1.45		0.06	0.39		11.63			72.6	77.0	16.86
11/26/92	-0.06	1.48		0.07	0.47		11.04			73.9	74.4	15.91
11/30/92	-0.06	1.61		0.08	0.44		10.56			72.6	77.1	16.37
12/02/92	-0.03	1.45		0.08	0.46		10.44			77.1	76.0	16.37
12/07/92	-0.03	1.52		0.06	0.40		10.32			75.4	79.6	16.66
12/09/92	-0.03	1.42		0.08	0.39					77.6	75.8	16.83
12/14/92	0.11	1.63		0.08	0.35		9.65			74.6	78.7	16.81
12/16/92	-0.02	1.60		0.08	0.41		9.92			74.6	78.9	
12/21/92	-0.03	1.76		0.08	0.41		9.65			72.4	74.7	15.12
12/23/92	-0.03	1.36		0.08			9.92			75.0	75.9	15.70
12/28/92	-0.03	1.57		0.07	0.22		9.92			75.0	80.5	17.79
12/30/92	-0.03	1.47		0.08	0.35		9.90			76.5	70.7	14.15
01/04/93	-0.03	1.71		0.12	0.34		9.90			76.5	71.8	14.92
01/06/93	-0.03	1.54		0.08	0.27		9.63			74.9	67.6	13.80
01/11/93	-0.03	1.29		0.08	0.55		9.63			77.0	75.9	15.90
01/13/93	-0.03	1.54		0.07	0.40		10.32			72.9	71.9	15.80
01/20/93	-0.03	1.82		0.08	0.41		10.47			71.9	75.1	16.30
01/25/93		1.66		0.07	0.41		10.47			71.4	71.2	14.80
01/27/93	-0.03	2.73		0.07	0.40		10.76			72.6	70.4	14.62
02/01/93	-0.03	3.09			0.66		9.82			70.2	71.4	15.14
02/03/93	-0.05			0.08	0.41		10.09			71.4	76.3	16.69
02/08/93	0.00	2.73		0.10	0.47		10.09			72.3	67.4	13.41
02/10/93	0.00	2.73		0.07	0.44		10.09			72.3	73.4	14.87
02/17/93	0.00	2.19		0.16						74.8	73.8	14.95
02/24/93	0.00	3.16		0.10	0.43		10.05			67.3	76.8	15.70
03/01/93	-0.01	2.55		0.09	0.59		11.70			73.2	72.9	14.38
03/03/93	-0.01	2.55		0.09	0.57		11.14			73.2	69.5	13.70
03/08/93	-0.01	2.52		0.09	0.49		11.28			69.5	74.9	15.71
03/10/93	0.01	2.64		0.05	0.48		11.45			72.6	75.2	15.60
03/15/93	0.01	2.88		0.08	0.50		11.45			68.1	73.3	14.89
03/17/93	0.01	2.69		0.09	0.49		11.16			69.8	71.1	13.82
03/22/93	0.01	2.29		0.07	0.38		11.45			70.3	70.4	14.33
03/24/93	0.00	1.84		0.09	0.46		10.29			70.2	74.0	15.30
03/29/93	0.00	2.23		0.08	0.40		10.35			69.1	75.0	15.23
04/05/93	0.00	2.63		0.07	0.42		9.96			66.4	72.4	14.16
04/07/93	0.00	2.68		0.08	0.39		9.83			66.2	69.8	12.94
04/12/93	-0.01	2.82		0.06	0.35		9.75			66.2	79.0	16.57
04/14/93	-0.01	2.58		0.11	0.54		9.64			67.2	80.1	16.67
04/19/93	0.00			0.41	0.41		9.59			39.3	77.0	15.36
04/21/93	0.00			0.11	0.61		10.04			66.9	76.7	15.59
04/26/93	0.00	3.07		0.06	0.41		9.38			66.2	77.2	15.29
04/28/93	0.00	2.50		0.08	0.41		9.91			66.0	74.1	15.46
05/03/93	0.00	2.74		0.07	0.35		9.46			67.2	76.3	15.88
05/05/93	0.04	2.79		0.06	0.36		9.33			62.6	78.0	15.56
05/10/93	-0.03	2.10		0.20	0.77		9.43			65.6	77.3	15.79
05/12/93	-0.03	1.78		0.08	0.35		9.71			67.7	73.7	15.10
05/17/93	-0.03	3.09		0.07	0.34		9.43			64.7	77.6	15.73
05/19/93	-0.02	2.91		0.07	0.35		9.71			62.3	84.1	17.66
05/24/93	-0.12	3.46		0.06	0.40					61.4	81.6	17.25
05/26/93	-0.12	2.72	0.123	0.06	0.47	4.27	9.95	0.003	22.5	64.1	76.1	15.19
06/02/93	-0.07	2.53	0.137	0.07	0.37	4.32	10.19	0.000	22.4	65.2	71.8	14.48
06/07/93	-0.09	2.53	0.105	0.06	0.36	4.42	10.66	0.004	23.2	66.1	72.8	14.99
06/09/93	-0.01	2.64	0.099	0.06	0.03	4.27	10.19	0.005	23.1	65.2	74.2	14.67
06/14/93												
06/23/93	-0.01	2.96	0.107	0.06	0.38	4.38	10.51	0.012	23.9	65.5	73.9	15.03
06/28/93	-0.01	2.45	0.105	0.07	0.37	4.40	10.51	-0.002	22.1	64.5	73.2	
06/30/93	-0.02	2.03	0.133	0.07	0.38	4.43	10.35	0.008	24.0	69.7	69.7	13.67
07/07/93	-0.01	2.03	0.109	0.07	0.38	4.27		0.007	22.8	64.5	69.9	13.84
07/12/93	-0.02	2.85	0.136	0.06	0.39	4.39	10.09	0.001	23.1	65.1	70.0	12.93

* All units in mg/L, except for pH in units and temperature in °C.

Table A-2. Results of analyses of the softened water, phase I study.*

Date	NH3	NO3	P	PO4	T-PO4	Si	SiO2	Sn	S	SO4	T-Alk	TIC
07/14/93		2.20	0.112	0.07	0.42	4.45		0.002	22.8	65.4	72.3	14.61
07/19/93	-0.02	2.68	0.125	0.07	0.40	4.35	9.34	0.008	22.1	66.4		14.88
07/21/93	-0.02		0.080	0.07	0.45	4.37	9.76	0.030	20.9	62.0	76.8	16.35
07/26/93	-0.02	2.74	0.107	0.08	0.43	4.38	9.76	0.008	21.5	62.9	77.9	15.41
07/28/93	-0.02	2.68	0.132	0.07	0.47	4.39	9.76	0.007	21.2	63.4	80.6	16.75
08/02/93	-0.02	1.93	0.115	0.07	0.39	4.41	9.76	0.015	21.1	62.9	80.9	17.03
08/04/93	-0.02	2.28	0.109	0.26	1.82	4.17	10.03	0.009	19.8	61.2	86.8	16.67
08/09/93	-0.02	2.33	0.102	0.09	0.33	4.38	9.71	0.010	21.7	63.1	76.8	15.59
08/11/93	-0.02	2.74	0.109	0.10	0.46	4.32	9.71	0.006	20.7	61.3	82.0	17.31
08/16/93												
08/18/93	-0.02	2.79	0.145	0.12	0.44	4.57	10.10	0.011	22.4	64.9	80.0	17.22
08/23/93	-0.02	2.32	0.147	0.17	0.55	4.53	9.71	0.013	22.2	65.9	81.5	17.66
08/25/93	-0.02	2.06	0.133	0.11	0.47	4.40	9.71	0.015	21.9	65.0	72.8	15.34
08/30/93	-0.02	2.06	0.150	0.10	0.44	4.39	9.44	0.009	22.4	68.2	76.9	16.81
09/01/93	-0.02	2.16	0.148	0.08	0.51	4.39	9.87	0.007	21.8	64.6	78.4	17.25
09/08/93	-0.01	2.30	0.131	0.10	0.45	4.00	9.64	0.016	21.2	63.5	87.1	19.26
09/13/93	-0.01	1.69	0.183	0.08	0.39	4.49	9.67	0.022	23.1	66.4	84.8	18.54
09/15/93	-0.01	1.40	0.118	0.09		4.24	9.41	0.016	21.9	64.5	81.2	17.54
09/20/93	-0.01	1.19	0.117	0.09		4.30	9.66	0.013	22.1	65.9	77.3	15.77
09/22/93	-0.01	1.20	0.103	0.09		4.46	9.42	0.026	22.6	65.9	84.6	17.44
09/27/93	-0.01	1.89	0.167	0.14		4.36	9.50	0.024	21.4	64.9	83.3	17.60
09/29/93	-0.02	1.37	0.147	0.09		4.20	9.63	0.017	21.4	67.0	86.5	18.94
10/04/93	-0.02	1.02	0.070	0.08		4.26	9.63	0.030	21.9	67.0	78.0	16.61
10/06/93	-0.02	1.19	0.146	0.09		4.28	9.27	0.019	22.7	68.1	73.0	15.36
10/13/93	-0.02	1.26	0.127	0.08		4.32	9.78	0.022	22.3	69.2	78.5	17.04
10/18/93	-0.03	1.84	0.086	0.10		4.06	9.52	0.026	20.9	67.1	80.5	17.48
10/20/93	-0.03	1.67	0.102	0.09		4.35	9.47	0.018	22.9	66.8	78.9	17.05
10/25/93	-0.03	1.26	0.124	0.07		4.36	9.95	0.028	23.7	68.2	82.9	18.44
11/08/93	-0.01	1.78	0.126	0.09		4.30	9.23	0.023	22.9	70.1	81.2	18.00
11/10/93	-0.02	1.38	0.151	0.08		4.24	9.47	0.018	22.4	68.4		18.50
11/15/93	-0.02	1.38	0.133	0.08	0.30	4.34	9.23	0.030	23.6	70.5		18.20
11/17/93	-0.02	1.71	0.114		0.33	4.40	8.93	0.014	23.8	73.1		16.30
11/22/93	-0.02	1.33	0.124		0.37	4.32	9.23	0.017	23.8	73.2	76.7	16.44
11/24/93	-0.02	1.13	0.081		0.26	4.25	9.08	0.016	24.7	77.5	75.6	16.11
11/29/93	-0.02	1.72	0.109	0.09	0.32	4.43	9.48	0.021	23.6	69.3	83.3	18.08
12/01/93	-0.02	1.56	0.090	0.08	0.25	4.29	9.18	0.019	23.6	72.8	81.1	17.60
12/06/93	-0.02	1.60	0.101	0.08	0.27	4.17	8.92	0.015	23.0	70.5	79.3	16.98
12/08/93	-0.02	1.65	0.083	0.09	0.08	4.09	8.75	0.019	22.6	69.4	72.0	15.37
12/13/93	-0.02	1.52	0.146	0.10	0.42	4.25	9.09	0.015	23.6	70.5	77.6	
12/15/93	-0.02	1.85	0.111	0.08		4.30	9.19	0.021	23.5	66.4	82.3	17.80
12/20/93		2.08	0.087	0.08	0.32	4.39	9.38	0.012	22.8	66.6	80.6	17.47
12/22/93		1.99	0.078	0.08	0.30	4.12	8.81	0.014	21.3	65.7	79.6	16.72
12/27/93		1.61	0.105	0.11	0.41	4.15	8.88	0.015	22.4	67.6	76.2	15.76
12/29/93		1.61	0.108	0.14	0.31	4.11	8.79	0.015	22.5	66.6	74.0	14.74
01/03/94	-0.01	2.21	0.091	0.08	0.30	4.21	9.02	0.018	21.5	64.7	79.5	16.92
01/05/94	-0.01	1.99	0.104	0.07		4.30	9.20	0.008	23.5	64.7	80.0	17.04
01/10/94	-0.01	2.23	0.138	0.09		4.07	8.70	0.024	21.0	63.8	81.6	17.99
01/12/94	-0.02	1.96	0.108	0.08	0.38	4.10		0.011	21.2	64.7	80.1	17.10
01/24/94	-0.02	2.01	0.118	0.08	0.40	4.25		0.016	22.5		77.8	16.46
01/26/94	-0.02	1.96	0.171	0.12	0.41	4.12		0.018	21.5		80.6	17.85
01/31/94	-0.02	1.75	0.082	0.01	0.31	4.02		0.017	21.5		76.8	15.80
02/02/94	-0.02	2.17	0.100	0.07	0.36	4.15		0.019	22.8		76.6	15.90
02/07/94	-0.02	2.19	0.084	0.07		4.18		0.014	21.6		81.8	
02/09/94												
02/16/94	0.01	1.94	0.096	0.06	0.34	4.37	9.37	0.016	25.1	75.4	78.9	16.20
02/23/94	-0.02	2.13	0.135	0.08		4.18	8.96	0.018	22.0	66.1	76.6	16.15

* All units in mg/L, except for pH in units and temperature in °C.

Table A-3. Results of analyses of non-softened water, phase II study.*

Date	Days	pH	DO	Temp	Cu	Pb	Zn	Ca	Cl	Fe	F	K	Mg	Mn	Na	NH3
11/22/94	0	7.25		13.94	0.007	0.000	-0.002	82.5	61.0	0.026	0.24	3.32	24.3	0.003	42.4	0.02
11/28/94	6	7.26	3.06		0.002	0.000	0	87.3	59.7	0.002	0.22	2.98	23.8	0.001	39.8	0.00
12/01/94	9	7.33	2.93		0.003	-0.001	-0.001	83.9	61.3	0.006	0.24	3.00	23.2	0	41.4	0.00
12/05/94	13	7.46	3.13	13.83	0.005	-0.001	-0.001	77.4	69.3	0.03	0.25	3.14	21.9	0.002	48.2	0.00
12/07/94	15	7.31	3.16	13.89	0.003	-0.001	-0.001	78.7	65.2	0.005	0.24	3.09	21.8	0.001	43.5	0.00
12/12/94	20	7.40	1.69		0.006	-0.002	0	71.7	71.5	0.003	0.26	3.61	22.3	0.007	43.7	0.00
12/15/94	23	7.33	1.73	15.17	0.006	0.000	-0.001	73.6	70.3	0.005	0.26	3.56	22.8	0.005	43.4	0.00
12/19/94	27	7.36	2.25	15.28	0.003	-0.001	-0.001	71.6	83.6	0.002	0.25	3.04	22.3	0.004	41.7	0.00
12/21/94	29	7.36	2.08	15.11	0.004	0.000	-0.003	75.2	69.5	0.003	0.25	2.81	23.6	0.004	44.5	0.00
12/27/94	35	7.37	2.44	14.56	0.009	0.000	-0.001	71.3	69.6	0	0.26	3.28	25.6	0.004	46.3	0.00
12/29/94	37	7.42		14.56	0.005	0.000	-0.001	74.9	69.0	0.004	0.26	2.88	23.4	0.004	42.0	0.00
01/03/95	42	7.34	2.15	13.83	0.006	0.000	0.005	74.5	62.1	0.011	0.25	2.72	23.7	0.003	38.2	0.01
01/04/95	43	7.36	3.10	14.11	0.007	0.000	0.007	79.0	63.8	0.013	0.24	2.60	22.5	0.003	41.0	0.02
01/12/95	51	7.35	3.58	13.33	0.004	-0.001	0.003	80.5	62.9	0.007	0.22	2.40	23.0	0.003	39.6	0.04
01/17/95	56	7.30	2.80	13.00	0.005	0.001	-0.003	82.4	68.5	0.003	0.22	2.61	25.0	0.003	40.6	0.06
01/19/95	58	7.39	3.36	12.83	0.003	0.000	-0.001	83.2	72.7	0.002	0.21	2.53	24.1	0.002	40.7	0.01
01/23/95	62	7.29	1.95	15.72	0.005	0.000	0.002	81.5	69.9	0	0.23	2.75	25.3	0	40.8	0.01
01/25/95	64	7.26	3.84	11.78	0.003	0.001	-0.001	90.4	61.8	0.001	0.19	2.72	25.5	0.001	34.2	0.01
02/01/95	71	7.31	3.94	11.39	0.006	-0.001	0	82.1	74.2	0.011	0.22	2.51	24.7	0.003	42.4	
02/06/95	76	7.23	4.50	11.00	0.002	0.000	-0.001	79.1	76.6	0.004	0.20	2.81	23.8	0.001	46.5	0.00
02/08/95	78	7.29	4.07	11.17	0.006	0.000	-0.003	80.2	79.5	0.015	0.20	2.72	23.3	0.003	44.4	0.00
02/13/95	83	7.30	3.19	12.44	0.005	0.000	-0.001	82.8	79.3	0	0.21	2.52	24.0	0.003	41.8	0.00
02/23/95	93	7.31	4.43	11.50	0.005	0.000	-0.003	85.0	91.8	0.002	0.22	2.80	25.9	0.003	47.2	0.02
02/27/95	97	7.25	4.92	11.00	0.003	0.000	-0.002	83.6	95.2	0.005	0.24	2.77	25.1	0.004	48.8	
03/02/95	100	7.34	4.98	11.50	0.004	0.000	-0.002	100.6	102.1	0.007	0.20	3.56	28.7	0	45.2	-0.02
03/06/95	104	7.37	4.95	10.89	0.005	0.000	-0.002	88.6	100.3	0	0.21	3.75	25.5	0	48.1	0.02
03/08/95	106	7.35	5.05	10.39	0.006	-0.001	-0.002	88.3	100.3	0.003	0.21	3.53	25.7	0.001	49.1	0.02
03/13/95	111	7.38	5.21	10.06	0.003	-0.001	-0.003	82.9	90.8	0.002	0.21	2.42	23.8	0.001	49.4	0.01
03/15/95	113	7.31	5.38		0.005	0.001	-0.005	78.9	92.3	0.003	0.23	2.50	21.7	0	43.0	0.03
03/20/95	118	7.38	5.44	9.83	0.003	-0.001	0	80.4	95.6	0.004	0.22	2.56	22.5	0.001	48.7	0.01
03/22/95	120	7.49		11.33	0.006	-0.001	-0.001	73.1	74.6	0.002	0.27	2.68	22.4	0.003	42.4	0.01
03/27/95	125	7.34	5.41	10.78	0.004	-0.001	0.002	86.0	90.6	0.006	0.24	2.87	24.8	0.002	46.8	0.01
03/29/95	127	7.39	5.41	11.56	0.003	-0.001	-0.001	85.1	85.5	0.004	0.24	2.51	24.1	0.002	41.3	0.00
04/03/95	132	7.24	5.05	11.00	0.003	-0.001	-0.001	95.9	87.6	0.001	0.19	2.61	27.1	0	43.9	0.00
04/05/95	134	7.32	5.38	13.00	0.004	-0.001	-0.003	92.9	93.7	0.002	0.22	2.56	25.5	0	47.0	0.00
04/10/95	139	7.37	4.24		0.009	0.000	0	81.0	86.9	0.001	0.25	2.94	26.1	0.002	43.3	0.00
04/12/95	141	7.44	4.04	10.83	0.003	0.000	0.004	82.3	86.3	0.002	0.24	2.83	25.6	0.002	42.2	-0.01
04/17/95	146	7.38	6.52		0.006	0.000	-0.001	71.6	72.9	0.006	0.25	2.74	22.8	0.002	36.8	-0.01
04/19/95	148	7.34	4.07	12.67	0.014	0.000	0.004	91.3	87.8	0.187	0.25	2.76	26.0	0.002	44.4	-0.01
04/24/95	153	7.38	3.46	11.39	0.006	0.001	-0.001	80.7	69.6	0.003	0.25	2.77	24.7	0.002	35.9	0.00
04/26/95	155	7.40	4.11	11.89	0.005	-0.001	-0.001	84.1	83.4	0.002	0.23	2.89	24.4	0.001	43.7	0.00
05/01/95	160	7.45	3.85	11.06	0.005	0.003	-0.001	81.4	84.3	0.002	0.25	3.02	24.9	0.002	44.2	0.00
05/08/95	167	7.44	3.76	11.78	0.004	0.002	-0.001	80.0	77.0	0.003	0.23	2.37	24.0	0.002	38.4	0.00
05/10/95	169	7.43	4.12	12.00	0.007	0.002	-0.001	74.9	76.2	0.004	0.27	2.76	22.0	0.002	35.4	0.00
05/15/95	174	7.44	4.61	12.06	0.004	0.000	-0.001	77.2	64.3	0.002	0.26	2.80	23.2	0.002	36.7	0.01
05/17/95	176	7.44	3.79	12.39	0.004	0.002	0.001	75.4	59.8	0.001	0.23	2.96	22.0	0.002	33.4	0.01
05/22/95	181	7.37	5.39	11.11	0.005	0.003	-0.001	81.5	66.7	0.003	0.24	2.55	23.1	0.002	40.9	0.01
05/24/95	183	7.32	4.28	13.11												
05/31/95	190	7.33	4.71	12.39	0.02	0.012	-0.001	89.2	76.5	0.003	0.23	2.60	24.8	0	46.0	0.02
06/05/95	195	7.31	5.07	11.89	0.006	0.001	-0.001	93.0	77.7	0	0.21	2.19	24.9	-0.001	42.4	0.02
06/07/95	197	7.36	5.39	12.44	0.006	0.002	-0.001	88.4	75.1	0.002	0.21	2.60	23.8	0	45.0	0.02
06/12/95	202	7.39	3.43	13.28	0.004	-0.001	-0.001	79.7	59.3	0.003		2.56	22.6	0.002	30.2	0.00
06/14/95	204	7.39	6.03		0.004	0.000	-0.002	89.5	71.6	0.002	0.23	2.49	24.7	0.001	40.4	0.00
06/21/95	211	7.37	5.21		0.007	0.001	-0.002	77.0	70.8	0.001	0.25	2.74	21.5	0.001	30.8	0.00
06/26/95	216	7.34	4.44	12.44	0.004	0.000	-0.001	87.8	71.3	0	0.22	2.76	25.4	0.001	42.7	0.00
06/28/95	218	7.40	3.24	12.50	0.005	0.001	-0.001	83.4	74.1	0.003		3.17	24.5	0.002	39.2	0.02
07/05/95	225	7.52	3.30	14.83	0.005	0.000	-0.001	76.0	58.5	0.005		3.36	23.1	0.004	38.4	0.02
07/10/95	230	7.30	3.86	15.00	0.002	0.001	-0.001	79.0	26.1	0.002		3.06	22.1	0.001	36.6	0.02
07/12/95	232	7.31	4.13	14.22	0.005	0.000	-0.002	86.2	70.0	0.019		3.06	24.1	0.005	39.0	0.02
07/17/95	237	7.34	2.55	14.22	0.005	0.000	-0.002	83.1	64.1	0.002		3.05	23.9	0.002	35.1	-0.08
07/19/95	239	7.38	3.14	14.28	0.006	0.000	-0.001	85.3	65.6	0.014		3.02	25.0	0.004	37.1	-0.08
07/24/95	244	7.31	2.91	14.50	0.006	0.000	-0.001	88.7	67.4	0.001		2.77	26.3	-0.001	38.1	0.01

* All units in mg/L, except for pH in units and temperature in °C.

Table A-3. Results of analyses of non-softened water, phase II study.*

Date	Days	pH	DO	Temp	Cu	Pb	Zn	Ca	Cl	Fe	F	K	Mg	Mn	Na	NH3
07/26/95	246	7.40	2.42	13.94	0.006	0.000	-0.001	89.6	71.2	0.001		2.93	25.7	0	38.7	0.01
07/31/95	251	7.26	2.67	14.28	0.003	-0.003	-0.001	84.4	71.6	0		3.01	24.5	0.002	38.9	0.01
08/02/95	253	7.22	3.87	15.61	0.006	0.000	0.006	98.2	76.3	0.007		2.47	26.7	0	43.7	0.00
08/07/95	258	7.19	3.53	13.67	-0.001	0.001	-0.002	92.3	73.1	0.002		2.50	23.9	-0.001	38.7	0.04
08/09/95	260	7.35	2.60	13.83	0.009	0.001	-0.001	80.8	65.4	0.002		3.37	22.8	0.004	36.6	0.04
08/14/95	265	7.25	2.55	16.67	0.003	-0.001	-0.001	80.1	61.9	0.002		3.13	23.0	0.002	36.5	0.03
08/16/95	267	7.29	2.91	17.22	0.006	0.000	-0.001	82.7	65.4	0		3.25	23.6	0.002	38.6	0.01
08/21/95	272	7.27	1.94	17.22	0.003	-0.001	-0.001	84.7	61.5	0.002		3.38	24.1	0.002	34.9	-0.01
08/23/95	274	7.21	2.65	16.56	0.008	-0.001	-0.001	86.0	63.3	0.002		3.37	23.8	0.002	36.0	0.01
08/28/95	279	7.26	2.65	16.67	0.004	0.000	-0.001	82.0	63.7	0.004		3.31	22.6	0.002	35.5	0.01
08/30/95	281	7.37	2.71	17.39	0.003	0.000	-0.001	83.2	63.2	0.002		3.28	23.1	0.002	34.4	0.00
09/06/95	288	7.27	2.93	17.11	0.004	0.000	-0.001	84.5	69.2	0.004		3.49	23.2	0.002	36.8	0.01
09/11/95	293	7.23	3.26	18.50	0.005	-0.001	0	94.3	69.0	0.004		3.17	25.4	0	41.8	-0.05
09/13/95	295	7.34	3.60	16.72	0.007	0.001	0.001	91.7	65.5	0.003		2.83	25.1	0	41.6	-0.01
09/25/95	307	7.21	3.59	16.00	0.006	0.000	0	87.8	71.4	0.001		3.20	24.5	-0.001	43.0	0.01
09/27/95	309	7.28	3.63	16.44	0.006	0.001	-0.001	86.7	75.5	0.003		3.29	23.2	0.001	48.0	0.01
10/02/95	314	7.28	1.73	17.61	0.005	0.000	-0.001	82.9	83.2	0.002		4.09	24.8	-0.001	48.9	0.02
10/04/95	316	7.29	1.63	18.83	0.008	0.000	0	83.8	64.5	0.001		4.01	24.7	-0.001	44.9	0.00
10/11/95	323	7.25	1.89	18.78	0.007	0.000	-0.002	82.5	78.9	0.002		3.98	24.2	0	45.2	0.02
10/16/95	328	7.29	1.92	18.89	0.006	0.001	-0.001	82.5	74.8	0.002		3.66	24.2	-0.001	43.7	0.02
10/18/95	330	7.25	1.81	18.44	0.006	0.000	-0.001	80.5	73.7	0.002		3.66	23.7	0	43.3	0.06
10/23/95	335	7.33	1.96	18.50	0.005	0.000	0.004	81.6	75.0	0.002		3.77	23.0	-0.001	41.9	0.02
10/25/95	337	7.24	2.09	18.50	0.007	0.000	0.002	80.9	74.8	0.007		3.80	23.4	0.001	42.1	0.00
10/30/95	342	7.37	1.98	18.28	0.004	0.001	0.004	79.9	73.8	0.003		3.81	23.4	0	42.5	0.01
11/01/95	344	7.31	1.94	18.39	0.006	0.000	-0.001	82.6	72.2	0.002		3.48	24.1	0	41.8	0.01
11/06/95	349	7.25	4.24	17.78	0.006	0.000	0.002	91.3	63.1	0.002		3.10	25.9	0.001	38.7	0.00
11/08/95	351	7.25	2.40	15.00	0.005	0.001	0	82.4	71.0	0.001		3.50	24.3	0.001	42.7	
11/13/95	356	7.29	2.35	17.50	0.004	0.001	0.002	83.0	70.1	0.001		3.36	24.0	-0.001	38.9	0.04
11/20/95	363	7.26	2.84	17.22	0.005	0.001	-0.001	79.7	65.0	0.001		3.24	23.2	-0.001	37.7	0.04
11/27/95	370	7.26	2.80	16.72	0.006	0.000	0.007	79.5	63.3	0.002		3.15	23.3	-0.001	37.0	0.04
11/29/95	372	7.30	2.84	16.22	0.005	0.000	0.002	81.1	63.8	0.017		3.15	23.2	0	36.0	-0.02
12/04/95	377	7.35	2.67	16.33	0.006	0.002	0.003	79.8	63.0	0.001		3.31	23.4	0.001	37.5	0.02
12/06/95	379	7.30	3.13	16.11	0.005	0.000	-0.001	79.5	61.9	0.003		3.15	23.0	-0.001	34.9	0.00
12/11/95	384	7.32	3.21	15.72	0.005	0.000	0.002	80.1	61.7	0.001		2.97	23.3	-0.001	35.9	0.00
12/18/95	391	7.33	3.19	15.00	0.007	0.000	-0.001	84.1	65.2	0.002		2.96	25.0	0	38.7	0.00
12/20/96	394		2.77	14.11												
12/28/95	401	7.34	3.77	14.33	0.005	0.000	0.008	82.7	62.9	0.001		3.01	24.9	0.001	40.0	0.00
01/04/96	408	7.36	3.75	13.89	0.008	0.001	0.003	83.3	62.6	0.003		2.89	25.3	0.002	36.4	0.00
01/08/96	412	7.40	4.34	13.56	0.004	0.000	0	82.3	64.5	0.001		2.78	24.2	0	37.4	0.00
01/10/96	414	7.29	4.35	12.44	0.009	-0.001	-0.004	82.3	65.0	0.003		2.83	24.3	0	37.5	-0.01
01/17/96	421			12.72	0.003	0.001	-0.001	80.9	69.9	0.003		2.80	24.3	-0.001	35.4	-0.01
01/22/96	426	7.38	5.41	12.78	0.006	0.000	0	85.5	70.5	0		2.76	24.7	0	35.8	-0.01
01/24/96	428	7.36	5.25	11.17	0.005	0.000	-0.001	81.7	73.5	0.001		2.68	24.4	-0.001	37.4	-0.01
01/29/96	433	7.38	6.24	11.44	0.004	0.007	0.002	81.1	63.6	0		2.53	23.5	-0.001	33.0	-0.01
01/31/96	434	7.38	5.87	11.17	0.006	0.001	0.004	80.6	62.5	0.001		4.07	23.0	0	32.2	0.00
02/05/96	440	7.36	4.39	11.28	0.006	0.001	0	86.7	69.2	0.008		2.53	24.4	0.001	35.7	0.00
02/07/96	442	7.26	4.98	10.78	0.008	0.000	-0.002	90.1	78.5	0.002		2.80	26.1	0.001	39.5	0.00
02/12/96	447	7.30	4.86	12.50	0.004	0.000	-0.001	88.3	89.1	0.002		2.96	24.2	0.001	41.4	-0.01
02/14/96	449	7.25	5.09	12.28	0.006	0.001	-0.001	94.4	89.0	0.003		2.72	26.5	0.001	46.5	0.00
02/21/96	456	7.28	4.94	12.61	0.004	-0.001	-0.004	91.9	86.0	0.002		2.73	25.0	0.001	44.8	0.00
02/26/96	461		2.41	12.22	0.011		0.004	80.1	73.4	0.009		3.55	24.9	0.009	38.0	0.00
02/28/96	463		4.90	15.39												
03/04/96	468		5.42	11.83	0.006	0.001	0.002	82.6	95.1	0.005		2.67	23.4	0	41.0	-0.02
03/06/96	470		5.61	12.00	0.005	0.001	0.002	98.0	103.8	0.001			26.2	-0.001	45.0	-0.01
03/11/96	475	7.27	5.69	11.61	0.005	0.000	-0.001	94.8	93.4	0.003		2.32	25.9	-0.001	44.4	-0.01

* All units in mg/L, except for pH in units and temperature in °C.

Table A-3. Results of analyses of non-softened water, phase II study.*

Date	NO3	P	PO4	Si	SiO2	Sn	S	SO4	T-alk	TIC
11/22/94	1.11	0.124		3.40	7.28	0.058	14.2	42.7	279.8	75.31
11/28/94	1.50	0.066		3.60	7.72	0.041	14.8	44.5	278.6	70.33
12/01/94	1.52	0.044		3.52	7.54	0.072	14.6	43.9	273.0	74.32
12/05/94	1.70	0.116		3.20	6.85	0.072	14.9	44.6	255.4	68.76
12/07/94	1.68	0.083		3.33	7.13	0.078	14.4	43.2	258.1	68.16
12/12/94	1.84	0.162		3.12	6.69	0.088	16.5	49.5	234.0	60.94
12/15/94	1.77	0.145		3.05	6.53	0.081	15.9	47.6	233.5	61.13
12/19/94	1.85	0.140		3.30	7.08	0.068	15.6	46.8	234.1	61.85
12/21/94	1.77	0.163		3.32	7.12	0.084	16.7	50.1	230.8	60.24
12/27/94	1.90	0.159		3.03	6.50	0.077	16.4	49.1	235.4	64.18
12/29/94	1.90	0.139		3.25	6.96	0.052	16.4	49.3	237.2	63.99
01/03/95	2.13	0.144		3.10	6.65	0.054	15.6	46.7	242.7	64.18
01/04/95	1.74	0.122		3.54	7.58	0.070	15.4	46.1	252.4	67.50
01/12/95	2.02	0.122		3.44	7.37	0.074	15.6	46.7	253.7	69.47
01/17/95	2.10	0.155		3.38	7.23	0.038	16.4	49.3	253.9	67.96
01/19/95	2.07	0.095		3.39	7.27	0.060	15.9	47.7	256.1	68.43
01/23/95	2.15	0.074		3.61	7.73	0.080	14.9	44.6	268.5	
01/25/95	1.70	0.052		3.63	7.78	0.085	14.7	44.1	291.6	
02/01/95	2.24	0.113		3.16	6.77	0.067	15.6	46.8	263.9	69.06
02/06/95	2.34	0.094	0.31	3.24	6.93	0.058	16.0	47.9	260.7	68.49
02/08/95	2.30	0.111	0.29	3.06	6.56	0.085	15.3	45.8	256.2	
02/13/95	2.59	0.129	0.29	3.34	7.15	0.048	16.6	49.8	233.5	61.03
02/23/95	2.70	0.095	0.32	3.21	6.88	0.029	17.0	51.0	241.4	63.28
02/27/95	2.70	0.135	0.36	2.90	6.22	0.022	16.4	49.1	235.7	61.56
03/02/95	1.84	0.046		3.85	8.25	0.045	16.4	49.3	278.1	74.41
03/06/95	2.22	0.155	0.26	3.24	6.93	0.056	15.9	47.7	259.6	68.59
03/08/95	1.14	0.143	0.27	3.20	6.85	0.075	16.0	48.0	250.9	66.16
03/13/95	2.61	0.158	0.28	3.21	6.87	0.069	15.7	47.2	248.5	65.34
03/15/95	2.45	0.125	0.22	3.31	7.08	0.070	16.7	50.1	253.5	67.37
03/20/95	2.61	0.138	0.33	2.96	6.34	0.086	15.5	46.5	240.8	62.18
03/22/95	3.12	0.141	0.34	2.69	5.77	0.038	15.4	46.3	220.8	57.09
03/27/95	3.23	0.108	0.25	3.16	6.78	0.069	15.8	47.3	241.2	63.46
03/29/95	2.65	0.108		3.04	6.52	0.076	15.7	47.1	238.8	62.95
04/03/95	1.90	0.046	0.20	3.66	7.85	0.091	15.2	45.6	286.6	76.62
04/05/95	1.90	0.099	0.19	3.55	7.61	0.108	15.4	46.2	279.6	75.33
04/10/95	2.64	0.129	0.36	2.75	5.90	0.074	16.5	49.4	238.2	61.65
04/12/95	2.79	0.138	0.36	2.81	6.03	0.085	17.4	52.3	240.5	61.68
04/17/95	2.52	0.161	0.34	2.91	6.23	0.100	17.4	52.2	243.7	63.37
04/19/95	2.04	0.097	0.23	3.38	7.23	0.092	16.2	48.7	267.7	70.12
04/24/95	2.38	0.079	0.34	2.93	6.28	0.077	15.3	45.9	248.5	64.47
04/26/95	2.11	0.071	0.31	3.02	6.48	0.071	15.7	47.0	258.4	67.62
05/01/95	2.32	0.141	0.39	2.84	6.09	0.069	16.3	48.8	246.2	62.92
05/08/95	2.39	0.156	0.37	2.84	6.08	0.081	15.7	47.2	244.5	
05/10/95	2.41	0.165	0.38	2.85	6.10	0.095	17.0	51.1	243.7	63.38
05/15/95	2.26	0.120	0.37	2.93	6.27	0.068	15.1	45.2	239.4	62.38
05/17/95	2.32	0.143	0.37	2.87	6.14	0.087	14.0	41.9	233.3	60.78
05/22/95	2.06	0.117	0.34	3.03	6.49	0.085	14.7	44.0	259.3	67.96
05/24/95										
05/31/95	1.75	0.084	0.19	3.70	7.92	0.103	15.7	47.2	288.6	77.91
06/05/95	1.80	0.009	0.13	3.83	8.21	0.095	15.1	45.3	289.8	79.80
06/07/95	1.80	0.104	0.00	3.57	7.64	0.096	14.9	44.8	282.5	77.69
06/12/95		0.148		3.11	6.67	0.089	13.1	39.4		63.91
06/14/95	2.03	0.072	0.25	3.56	7.63	0.094	14.2	42.7	283.0	75.84
06/21/95	2.13	0.088	0.24	3.47	7.43	0.106	16.6	49.9	272.6	72.70
06/26/95	1.72	0.100	0.24	3.63	7.78	0.123	14.3	42.9	281.8	77.91
06/28/95	2.19	0.078	0.38	3.44	7.36	0.083	13.8	41.3	255.7	69.70
07/05/95	2.19	0.184	0.43	3.31	7.09	0.082	14.1	42.3	256.0	67.31
07/10/95	2.09	0.022	0.27	3.66	7.85	0.103	15.4	46.2	281.2	75.05
07/12/95	2.08	0.076	0.29	3.53	7.55	0.082	14.3	43.0	275.3	73.32
07/17/95	2.29	0.156	0.30	3.46	7.42	0.134	14.1	42.4	268.8	71.47
07/19/95	2.08	0.094	0.31	3.55	7.60	0.080	14.9	44.8	266.2	71.80
07/24/95	2.08	0.039	0.16	3.81	8.16	0.085	14.8	44.4	282.8	76.47

* All units in mg/L, except for pH in units and temperature in °C.

Table A-3. Results of analyses of non-softened water, phase II study.*

Date	NO3	P	PO4	Si	SiO2	Sn	S	SO4	T-alk	TIC
07/26/95	2.08	0.112	0.23	3.74	8.02	0.086	15.1	45.3	287.1	74.17
07/31/95	2.19	0.136	0.32	3.61	7.73	0.114	15.1	45.2	270.4	70.65
08/02/95	1.64	0.053	0.09	4.31	9.24	0.087	16.3	48.9	311.2	83.09
08/07/95	1.64	0.032	0.09	4.05	8.68	0.114	15.7	47.0	295.2	79.35
08/09/95	1.96	0.109	0.31	3.77	8.07	0.115	15.3	45.9	263.1	70.53
08/14/95	2.15	0.048	0.31	3.70	7.92	0.092	14.0	41.9	261.2	69.63
08/16/95	1.71	0.087	0.34	3.66	7.85	0.094	14.5	43.6	260.8	70.66
08/21/95		0.089	0.27	3.77	8.08	0.071	15.0	45.0	263.4	70.40
08/23/95	2.09	0.041	0.25	3.82	8.19	0.104	14.6	43.9	269.4	71.98
08/28/95	1.74	0.129	0.33	3.69	7.90	0.089	14.2	42.7	259.7	69.32
08/30/95	1.70	0.112	0.30	3.70	7.92	0.059	14.4	43.2	260.7	69.88
09/06/95	1.90	0.057	0.30	3.76	8.05	0.074	14.9	44.6	264.7	70.85
09/11/95	1.84	0.109	0.19	4.31	9.24	0.021	16.5	49.6	282.9	76.17
09/13/95	2.07	0.056	0.13	4.27	9.15	0.024	15.8	47.3	286.6	77.26
09/25/95	2.12	0.037	0.23	4.06	8.71	0.088	15.7	47.2	278.2	74.74
09/27/95	2.17	0.055	0.22	3.98	8.52	0.036	16.5	49.6	273.3	73.36
10/02/95	2.55	0.070	0.32	3.84	8.22	0.074	17.4	52.2	256.5	68.69
10/04/95	2.45	0.112	0.28	3.86	8.27	0.037	16.4	49.3	256.0	68.09
10/11/95	2.41	0.109	0.29	3.84	8.22	0.042	16.3	49.0	255.6	68.21
10/16/95	2.20	0.089	0.29	3.82	8.19	0.045	16.0	47.9	253.3	67.01
10/18/95	2.09	0.131	0.29	3.72	7.97	0.047	15.8	47.3	252.6	67.40
10/23/95	2.30	0.113	0.35	3.58	7.67	0.099	15.8	47.4	251.5	66.76
10/25/95	2.23	0.107	0.34	3.60	7.71	0.039	15.8	47.3	252.8	66.86
10/30/95	2.30	0.143	0.30	3.53	7.57	0.027	16.0	47.9	254.7	67.91
11/01/95	2.35	0.058	0.27	3.61	7.73	0.041	15.9	47.6	256.5	68.54
11/06/95		0.106	1.39	3.96	8.48	0.043	15.4	46.1	301.4	81.07
11/08/95		0.174	0.30	3.79	8.12	0.047	15.7	47.1	262.9	70.03
11/13/95	2.04	0.091	0.24	3.77	8.07	0.060	15.7	47.2	255.1	68.94
11/20/95	1.94	0.125	0.23	3.69	7.91	0.049	15.5	46.4	254.1	69.16
11/27/95	1.94	0.088	0.23	3.59	7.70	0.063	14.7	44.2	254.0	68.74
11/29/95	1.99	0.145	0.24	3.59	7.69	0.071	14.8	44.3	255.6	68.81
12/04/95	2.08	0.106	0.31	3.43	7.36	0.072	14.5	43.5	262.7	
12/06/95	2.03	0.080	0.24	3.47	7.44	0.065	14.5	43.6	256.9	70.39
12/11/95	2.03	0.083	0.23	3.47	7.44	0.094	14.9	44.7	258.5	69.00
12/18/95	2.09	0.102	0.25	3.36	7.21	0.035	16.1	48.3	259.4	69.50
12/20/96										
12/28/95	2.35	0.128	0.31	3.33	7.12	0.106	15.5	46.4	262.6	70.60
01/04/96	2.30	0.151	0.29	3.38	7.24	0.050	15.5	46.6	261.7	70.30
01/08/96	2.51	0.050	0.25	3.18	6.82	0.084	14.9	44.7	256.3	68.50
01/10/96	2.30	0.087	0.26	3.24	6.94	0.054	15.4	46.2	256.5	69.10
01/17/96	2.46	0.047	0.21	3.19	6.85	0.059	15.1	45.2	246.4	66.00
01/22/96	2.83	0.138	0.23	3.15	6.74	0.070	15.4	46.3	253.9	
01/24/96	2.89	0.129	0.20	3.10	6.64	0.066	14.9	44.7	245.0	64.51
01/29/96	2.82	0.087	0.20	3.16	6.77	0.065	14.2	42.6	249.8	67.19
01/31/96	2.72	0.050	0.22	3.13	6.71	0.080	13.5	40.6	248.9	66.19
02/05/96	2.64	0.088	0.25	3.10	6.65	0.072	14.5	43.5	263.2	70.22
02/07/96	1.79	0.083	0.20	3.74	8.01	0.102	13.9	41.8	295.2	79.48
02/12/96	1.71	0.068	0.21	3.68	7.90	0.094	15.9	47.8	291.2	78.28
02/14/96	1.58	0.055	0.19	3.72	7.97	0.075	14.8	44.5	292.8	78.30
02/21/96	1.67	0.042	0.18	3.46	7.42	0.079	14.7	44.1	287.6	76.29
02/26/96	1.80	0.092	0.25	3.51	7.52	0.075	14.3	42.9	254.1	
02/28/96										
03/04/96	1.85	0.098	0.15	3.70	7.92	0.072	16.7	50.0	282.6	75.44
03/06/96	1.70	0.055	0.08	3.82	8.19	0.044	14.6	43.9	293.2	79.16
03/11/96	2.11	0.035	0.10	3.76	8.05	0.041	14.7	44.0	285.7	76.59

* All units in mg/L, except for pH in units and temperature in °C.

Table A-4. Results of analyses of softened water, phase II study.*

Date	Days	pH	DO	Temp	Cu	Pb	Zn	Ca	Cl	Fe	F	K	Mg	Mn	Na	NH3
11/22/94	0	7.35		14.17	0.004	0.000	-0.001	0.2	58.8	-0.001	0.22	1.94	0.1	-0.001	178.5	-0.02
11/28/94	6	7.34	3.06		0.015	0.000	-0.001	51.0	59.9	-0.002	0.23	4.09	24.8	0.003	78.4	-0.02
12/01/94	9	7.33	2.93		0.009	-0.001	0.000	72.1	61.0	0.000	0.22	3.40	26.3	0.002	49.3	0.00
12/05/94	13	7.33	3.13	13.72	0.003	-0.001	0.000	0.1	69.4	0.001	0.25	0.78	0.0	0.000	174.3	0.00
12/07/94	15	7.42	3.26	14.00	0.003	0.000	0.000	0.2	64.8	0.000	0.23	1.47	0.1	0.000	170.3	-0.02
12/12/94	20	7.52	1.79		0.006	-0.002	0.001	0.1	70.4	-0.001	0.26	1.08	0.0	0.000	175.3	0.00
12/15/94	23	7.49	2.28	15.17	0.004	-0.001	0.000	0.1	70.5	0.001	0.26	1.55	0.0	0.000	171.5	0.00
12/19/94	27	7.40	1.89	15.28	0.004	-0.001	0.000	0.3	68.1	0.000	0.25	2.46	0.1	0.000	167.3	0.00
12/21/94	29	7.40	2.08	15.17	0.021	0.000	-0.002	40.0	69.6	0.004	0.25	5.43	26.6	0.004	77.2	0.00
12/27/94	35	7.40	2.06	14.56	0.021	-0.001	0.000	74.1	69.8	0.003	0.26	3.04	24.1	0.005	45.5	0.00
12/29/94	37	7.45	2.44	14.61	0.008	0.000	-0.002	72.5	69.2	0.002	0.26	2.96	24.4	0.004	42.1	0.00
01/03/95	42	7.39	2.22	14.44	0.009	-0.001	0.012	75.3	62.3	0.090	0.25	2.83	23.1	0.005	37.8	0.02
01/04/95	43	7.36	3.13	14.44	0.005	-0.001	0.007	79.8	63.5	0.013	0.23	2.60	22.5	0.003	40.8	0.02
01/12/95	51	7.49	3.94	13.28	0.003	-0.001	0.004	0.1	62.9	0.004	0.21	0.39	0.0	0.005	170.2	0.04
01/17/95	56	7.45	2.74	13.00	0.002	0.001	-0.003	0.3	68.6	-0.001	0.21	0.56	0.1	0.002	176.3	0.06
01/19/95	58	7.40	3.36	13.00	0.001	0.000	0.000	0.4	72.8	-0.001	0.21	0.65	0.1	0.001	180.3	0.01
01/23/95	62	7.51	1.98	15.61	0.006	0.000	0.001	0.4	69.8	-0.002	0.22	2.70	0.2	0.001	174.7	0.01
01/25/95	64	7.31	3.78	11.89	0.002	0.000	-0.001	0.4	61.5	-0.001	0.20	4.17	0.2	0.000	176.5	0.01
02/01/95	71	7.37	3.94	11.33	0.003	-0.001	0.000	0.4	74.2	0.000	0.21	4.57	0.1	0.000	172.5	0.00
02/06/95	76	7.50	4.50	11.00	0.003	-0.001	-0.001	0.3	76.6	-0.002	0.21	7.23	0.1	-0.001	174.8	0.00
02/08/95	78	7.35	4.01	11.17	0.004	-0.001	0.002	0.4	80.0	0.002	0.21	6.84	0.2	0.001	180.2	0.00
02/13/95	83	7.48	3.19	12.50	0.005	0.000	-0.001	0.3	79.2	0.000	0.21	1.84	0.1	0.003	175.7	0.00
02/23/95	93	7.58	4.46	11.50	0.006	0.000	0.000	0.4	90.5	0.002	0.23	7.07	0.1	0.000	181.9	0.02
02/27/95	97	7.46	4.95	11.06	0.004	0.000	-0.001	0.3	94.7	0.000	0.24	8.51	0.1	0.000	186.3	
03/02/95	100	7.37	4.98	11.50	0.005	0.000	0.001	0.7	101.8	0.000	0.19	9.81	0.5	0.000	200.2	0.02
03/06/95	104	7.42	4.94	10.89	0.004	0.000	-0.001	0.7	100.4	0.000	0.22	6.45	0.5	-0.001	182.4	0.02
03/08/95	106	7.42	5.05	10.44	0.005	-0.001	-0.002	0.6	100.7	-0.004	0.22	7.59	0.4	0.000	190.6	0.03
03/13/95	111	7.43	5.24	10.17	0.004	-0.001	-0.001	0.4	90.3	-0.002	0.23	2.25	0.1	0.000	180.3	0.01
03/15/95	113	7.47	5.31		0.005	0.000	-0.003	0.4	92.7	0.000	0.23	2.84	0.1	0.000	160.7	0.01
03/20/95	118	7.49	5.40	9.83	0.003	-0.001	0.000	0.4	95.7	-0.003	0.22	5.68	0.2	0.000	174.7	0.01
03/22/95	120	7.59		11.33	0.004	0.000	-0.001	0.3	74.6	-0.002	0.26	5.76	0.1	0.000	161.7	0.01
03/27/95	125	7.44	5.34	10.67	0.007	0.000	0.005	0.3	95.5	0.001	0.23	6.60	0.1	0.000	188.5	0.01
03/29/95	127	7.48	5.21	11.11	0.003	0.001	0.003	0.4	85.7	0.002	0.23	6.85	0.1	0.000	175.0	0.00
04/03/95	132	7.37	5.05	11.00	0.003	-0.001	-0.004	0.4	87.4	-0.001	0.20	10.75	0.1	0.000	189.8	0.00
04/05/95	134	7.38	5.40	12.83	0.005	-0.001	-0.002	0.8	93.4	-0.002	0.20	13.89	0.7	0.000	183.7	0.00
04/10/95	139	7.52	4.20		0.004	0.000	0.001	0.4	89.9	0.000	0.24	7.42	0.1	0.000	180.6	0.00
04/12/95	141	7.53	4.17	10.89	0.005	0.000	0.003	0.3	86.2	0.002	0.25	7.29	0.1	0.000	166.8	-0.01
04/17/95	146	7.54	5.86		0.006	0.000	0.000	0.3	73.1	0.000	0.25	7.37	0.1	0.000	162.4	-0.01
04/19/95	148	7.41	4.30	12.56	0.005	0.000	0.002	0.4	85.2	0.006	0.22	8.13	0.1	0.000	178.9	-0.03
04/24/95	153	7.50	3.46	11.33	0.007	0.000	-0.003	0.3	69.8	0.002	0.25	7.75	0.1	0.000	161.1	0.00
04/26/95	155	7.47	4.09	11.67	0.005	-0.001	0.000	0.4	83.5	0.002	0.23	7.68	0.1	0.000	174.2	0.00
05/01/95	160	7.58	3.92	11.11	0.006	0.002	0.000	0.3	84.1	0.002	0.25	8.22	0.1	0.000	174.2	0.00
05/08/95	167	7.56	3.69	11.72	0.004	0.000	-0.002	0.2	76.8	0.002	0.23	9.55	0.1	0.000	161.7	0.00
05/10/95	169	7.44	4.10	12.00	0.005	0.000	0.000	0.3	76.1	0.001	0.26	9.57	0.1	0.000	153.1	0.00
05/15/95	174	7.57	4.58	12.00	0.005	0.000	0.000	0.2		0.002	0.24	9.17	0.1	-0.001	162.5	0.01
05/17/95	176	7.57	3.79	12.39	0.006	0.001	0.000	0.2	60.1	0.001	0.26	8.20	0.1	0.000	152.6	0.01
05/22/95	181	7.50	5.39	11.11	0.003	0.001	0.000	0.1	66.6	0.001	0.24	9.63	0.0	0.000	166.3	0.01
05/24/95	183	7.39	4.28	12.94												
05/31/95	190	7.43	4.71	12.17	0.005	0.001	0.000	0.4	76.7	0.000	0.22	7.22	0.2	0.000	187.5	0.02
06/05/95	195	7.47	5.07	11.72	0.003	0.001	0.000	0.5	78.2	0.002	0.20	2.82	0.1	-0.001	186.7	0.02
06/07/95	197	7.44	5.39	11.94	0.002	0.001	0.000	0.4	75.0	0.001	0.21	1.68	0.1	0.000	182.8	0.00
06/12/95	202	7.59	3.43	13.22	0.003	-0.001	0.000	0.3	59.7	0.000		2.12	0.1	-0.001	164.2	0.00
06/14/95	204	7.52	6.13		0.002	0.000	-0.001	0.3	71.3	0.000	0.22	1.96	0.1	0.000	178.0	0.00
06/21/95	211	7.54	5.29	12.56	0.005	0.001	-0.001	0.5	71.3	0.015	0.24	2.82	0.1	0.000	178.0	0.00
06/26/95	216	7.55	4.44	12.44	0.004	0.000	0.000	0.3	70.7	-0.001	0.22	2.64	0.2	0.000	196.3	0.00
06/28/95	218	7.57	3.07	14.33	0.005	0.000	0.000	0.3	73.6	-0.001		1.40	0.1	0.000	180.9	0.02
07/05/95	225	7.70	3.12	14.89	0.006	0.000	0.001	0.3	58.5	0.002		0.89	0.1	0.000	172.2	0.02
07/10/95	230	7.46	3.82	14.17	0.003	0.001	0.000	0.4	74.9	-0.001		1.36	0.2	-0.001	186.2	0.02
07/12/95	232	7.43	3.99	14.06	0.005	0.001	0.000	0.5	69.8	0.000		1.88	0.4	0.000	182.0	0.02
07/17/95	237	7.44	2.48	14.11	0.005	0.000	-0.001	0.3	63.7	0.002		0.98	0.1	0.000	171.5	-0.08
07/19/95	239	7.59	3.10	14.44	0.006	0.000	0.000	0.3	65.4	0.005		0.96	0.1	0.000	180.3	-0.08
07/24/95	244	7.42	2.70	13.50	0.005	0.000	0.000	0.3	67.0	0.000		1.07	0.1	0.000	189.6	0.01

* All units in mg/L, except for pH in units and temperature in °C.

Table A-4. Results of analyses of softened water, phase II study.*

Date	Days	pH	DO	Temp	Cu	Pb	Zn	Ca	Cl	Fe	F	K	Mg	Mn	Na	NH3
07/26/95	246	7.48	2.48	14.33	0.006	0.000	0.000	0.4	71.6	0.000		1.13	0.2	0.000	185.2	0.01
07/31/95	251	7.42	2.54	15.61	0.004	-0.001	0.000	0.3	72.4	-0.002		0.95	0.1	0.000	166.1	-0.01
08/02/95	253	7.35	4.05	13.56	0.006	0.000	0.000	0.4	76.5	0.002		1.14	0.1	0.001	200.7	0.00
08/07/95	258	7.36	3.27	13.94	-0.003	0.000	-0.001	0.3	73.1	0.000		1.01	0.1	0.000	178.9	0.02
08/09/95	260	7.44	2.34	17.33	0.010	0.001	0.000	0.3	65.9	0.001		0.99	0.1	0.000	173.5	0.04
08/14/95	265	7.41	2.40	17.11	0.006	-0.001	0.000	0.3	62.1	0.000		1.01	0.1	0.000	170.4	0.03
08/16/95	267	7.39	2.66	16.83	0.006	0.000	0.000	0.3	65.4	0.003		1.10	0.1	0.000	178.4	-0.01
08/21/95	272	7.42	1.79	16.56	0.008	-0.001	0.000	0.3	61.6	0.003		1.06	0.1	0.000	171.3	-0.01
08/23/95	274	7.43	2.60	16.72	0.007	-0.001	0.000	0.3	63.4	0.000		1.13	0.1	0.000	172.2	0.01
08/28/95	279	7.42	2.65	17.28	0.005	0.001	0.000	0.3	63.5	0.000		1.14	0.1	0.000	164.1	0.01
08/30/95	281	7.53	2.68	16.94	0.004	0.000	0.000	0.2	63.2	0.001		1.08	0.1	-0.001	163.7	0.00
09/06/95	288	7.43	3.03	18.56	0.003	0.000	0.000	0.3	68.5	0.004		1.19	0.1	0.000	161.8	0.01
09/11/95	293	7.39	3.26	16.72	0.004	0.000	0.000	0.3	69.0	0.000		1.07	0.1	0.000	181.4	-0.05
09/13/95	295	7.40	3.60	16.11	0.005	0.001	0.000	0.3	65.5	0.000		1.08	0.1	0.000	191.8	-0.05
09/25/95	307	7.37	3.46	16.56	0.007	0.000	0.000	0.3	72.0	0.001		1.13	0.1	0.000	186.2	0.01
09/27/95	309	7.31	3.47	17.67	0.006	0.001	0.000	0.3	78.2	0.007		1.07	0.1	0.000	199.3	0.01
10/02/95	314	7.45	1.73	18.78	0.006	0.000	0.000	0.3	83.1	0.001		1.07	0.1	0.000	195.9	0.02
10/04/95	316	7.39	1.71	18.67	0.008	0.000	0.000	0.3	80.7	0.000		1.02	0.1	0.000	184.8	0.00
10/11/95	323	7.37	1.83	18.61	0.006	0.001	-0.005	0.3	78.8	0.001		1.20	0.1	0.000	180.3	0.02
10/16/95	328	7.46	1.92	18.44	0.005	0.001	-0.005	0.3	74.5	0.000		0.96	0.1	0.000	188.8	0.02
10/18/95	330	7.42	1.89	18.50	0.006	0.000	-0.005	0.3	73.7	0.001		1.02	0.1	0.000	184.6	0.00
10/23/95	335	7.48	1.96	18.50	0.006	0.000	0.000	0.3	75.1	0.001		1.15	0.1	0.000	173.9	0.00
10/25/95	337	7.45	1.94	18.28	0.007	0.000	-0.002	0.3	74.7	-0.001		1.14	0.1	0.000	179.8	0.04
10/30/95	342		1.93	18.39	0.006	0.001	0.004	0.3	73.6	0.001		1.41	0.1	0.000	171.4	0.01
11/01/95	344	7.49	1.99	17.72	0.005	0.002	-0.005	0.3	68.2	0.001		1.16	0.1	0.000	179.8	0.01
11/06/95	349	7.47	4.24	14.94	0.005	0.000	0.000	0.3	63.1	0.002		1.14	0.1	0.000	187.6	0.00
11/08/95	351	7.36	2.45	17.44	0.007	0.001	0.000	0.3	70.9	0.001		1.03	0.1	0.000	180.7	
11/13/95	356	7.48	2.44	17.22	0.005	0.000	0.000	0.3	70.0	0.001		1.13	0.1	0.000	169.5	0.04
11/20/95	363	7.50	2.80	16.72	0.005	0.001	0.000	0.2	64.9	0.001		0.99	0.1	0.000	168.9	0.04
11/27/95	370	7.48	2.85	16.22	0.004	-0.001	0.000	0.2	63.4	0.000		1.01	0.1	0.000	171.2	0.04
11/29/95	372	7.52	2.93	16.11	0.005	0.000	0.000	0.2	64.9	0.000		1.03	0.1	0.000	166.7	0.00
12/04/95	377	7.56	2.71	16.11	0.005	0.002	-0.002	0.2	62.8	0.000		1.08	0.1	0.000	171.2	0.00
12/06/95	379	7.57	3.19	15.61	0.003	0.001	-0.005	0.2	61.9	0.000		1.04	0.1	0.000	163.5	0.00
12/11/95	384	7.53	3.24	15.00	0.004	0.001	0.001	0.2	62.1	0.000		0.96	0.1	0.000	161.2	0.00
12/18/95	391	7.52	3.26	15.78	0.005	0.000	0.000	0.2	65.3	0.000		1.15	0.1	0.000	180.1	0.00
12/20/95	393		2.77	14.11												
12/28/95	400	7.53	3.85	13.89	0.006	0.000	0.000	0.3	63.0	0.001		1.01	0.1	0.000	182.4	0.00
01/04/96	407	7.53	3.78	13.56	0.007	0.000	0.001	0.3	62.0	0.002		0.95	0.1	0.000	174.0	0.00
01/08/96	412	7.55	4.34	12.44	0.007	0.000	-0.002	0.3	64.4	0.000		1.12	0.2	0.000	176.6	0.00
01/10/96	414	7.45	4.55	12.61	0.006	-0.002	-0.003	0.3	65.0	0.002		1.02	0.1	0.000	177.7	-0.01
01/17/96	421			12.39	0.003	0.001	0.000	0.2	69.7	0.000		0.97	0.0	-0.001	173.8	-0.01
01/22/96	426	7.51	5.38	11.28	0.005	0.000	0.000	0.3	70.5	0.001		1.05	0.1	0.000	171.6	-0.01
01/24/96	428	7.47	5.75	11.33	0.005	0.000	0.000	0.3	73.5	0.000		1.20	0.2	0.000	173.0	-0.01
01/29/96	433	7.41	6.11	11.17	0.006	0.004	0.000	0.2	63.5	0.002		0.98	0.1	0.000	167.1	0.00
01/31/96	435	7.43	6.15	11.06	0.004	0.001	0.000	0.2	62.7	0.002		0.99	0.1	0.000	165.2	0.00
02/05/96	440	7.39	4.44	10.78	0.004	0.001	0.000	0.3	68.8	0.002		1.03	0.1	0.000	172.0	0.00
02/07/96	442	7.32	4.85	12.39	0.005	0.001	-0.003	0.5	78.3	0.000		2.25	0.5	0.000	181.3	-0.01
02/12/96	447	7.32	4.93	12.28	0.004	0.001	0.001	0.4	89.2	0.000		1.05	0.1	0.000	200.8	-0.01
02/14/96	449	7.24	5.01	12.44	0.005	0.001	0.000	0.4	89.0	0.001		0.99	0.1	0.000	198.8	0.00
02/21/96	456	7.30	4.98	12.11	0.004	-0.001	-0.003	0.5	86.1	0.000		1.86	0.4	0.000	186.2	0.00
02/26/96	461		2.49	15.28	0.006		0.000	0.3	73.2	0.001		0.85	0.1	0.000	174.0	0.00
02/28/96	463		5.01	11.61												
03/04/96	468		5.42	12.11	0.004	0.000	0.001	0.1	103.0	0.001			0.0	0.000	191.2	-0.01
03/06/96	470		5.58	11.28	0.027	0.000	-0.001	13.5	93.5	0.002		15.02	23.4	0.006	136.6	0.00
03/11/96	475	7.31	5.77		0.003	-0.001	0.000	0.3	90.6	0.002		0.90	0.1	-0.001	190.3	-0.01

* All units in mg/L, except for pH in units and temperature in °C.

Table A-4. Results of analyses of softened water, phase II study.*

Date	NO3	P	PO4	Si	SiO2	Sn	S	SO4	T-alk	TIC
11/22/94	1.03	0.064		3.46	7.42	0.069	14.2	42.6	283.5	77.71
11/28/94	1.52	0.060		3.61	7.74	0.035	14.9	44.8	278.7	76.08
12/01/94	1.52	0.075		3.53	7.57	0.069	14.6	43.9	273.0	62.41
12/05/94	1.68	0.094		3.20	6.86	0.069	15.0	45.1	255.3	69.37
12/07/94	1.65	0.059		3.29	7.04	0.083	14.4	43.3	257.9	67.98
12/12/94	1.81	0.162		3.08	6.60	0.090	15.9	47.7	233.9	60.16
12/15/94	1.77	0.118		3.02	6.48	0.084	15.8	47.5	233.3	59.84
12/19/94	1.82	0.106		3.24	6.94	0.073	15.0	45.0	234.1	62.03
12/21/94	1.80	0.158		3.33	7.13	0.089	16.7	50.2	230.7	60.25
12/27/94	1.90	0.176		3.04	6.52	0.088	16.4	49.1	235.2	61.40
12/29/94	1.95	0.148		3.13	6.71	0.059	16.5	49.4	237.8	69.47
01/03/95	2.16	0.130		3.10	6.64	0.047	15.6	46.8	242.7	64.82
01/04/95	1.74	0.112		3.56	7.64	0.058	15.5	46.6	252.3	67.74
01/12/95	1.99	0.074		3.39	7.27	0.081	15.5	46.5	253.5	69.78
01/17/95	2.10	0.094		3.29	7.05	0.061	16.2	48.7	253.8	68.16
01/19/95	2.10	0.042		3.34	7.15	0.045	16.0	48.0	257.1	
01/23/95	2.15	0.057		3.54	7.59	0.082	14.8	44.5	268.3	
01/25/95	1.70	0.051		3.57	7.65	0.080	14.6	43.8	291.4	
02/01/95	2.24	0.121		3.12	6.69	0.053	15.8	47.3	263.3	68.83
02/06/95	2.34	0.084	0.31	3.17	6.79	0.070	15.9	47.8	260.6	68.14
02/08/95	2.30	0.133	0.29	3.05	6.53	0.084	15.4	46.2	256.1	67.50
02/13/95	2.59	0.099	0.27	3.28	7.02	0.047	16.7	50.0	233.6	61.33
02/23/95	2.64	0.091	0.29	3.15	6.75	0.025	17.0	50.9	241.6	63.30
02/27/95	2.70	0.083	0.34	2.89	6.19	0.031	16.4	49.3	236.0	62.17
03/02/95	1.90	0.041		3.79	8.12	0.049	16.4	49.2	278.5	74.64
03/06/95	2.22	0.098	0.26	3.15	6.76	0.064	15.8	47.3	259.4	68.67
03/08/95	1.14	0.084	0.26	3.15	6.74	0.067	16.0	47.9	250.5	66.31
03/13/95	2.53	0.133	0.28	3.12	6.68	0.066	15.7	47.0	248.2	65.74
03/15/95	2.40	0.087	0.22	3.26	6.98	0.069	17.1	51.4	253.2	67.26
03/20/95	2.59	0.103	0.33	2.93	6.28	0.082	15.9	47.6	240.6	64.25
03/22/95	3.17	0.129	0.34	2.63	5.63	0.053	15.3	45.8	220.6	57.22
03/27/95	3.17	0.054	0.23	3.14	6.73	0.070	15.7	47.2	241.1	63.67
03/29/95	2.60	0.086		3.00	6.42	0.072	15.8	47.4	235.5	62.79
04/03/95	1.90	0.054	0.21	3.55	7.61	0.093	15.0	44.9	286.0	77.31
04/05/95	1.85	0.063	0.19	3.52	7.53	0.108	15.5	46.4	279.7	75.22
04/10/95	2.54	0.153	0.37	2.80	5.99	0.079	16.4	49.1	241.6	64.55
04/12/95	2.60	0.097	0.36	2.78	5.95	0.090	18.2	54.5	240.4	63.97
04/17/95	2.52	0.138	0.34	2.89	6.19	0.096	17.2	51.6	243.5	62.51
04/19/95	2.04	0.073	0.24	3.23	6.92	0.091	16.3	48.9	261.8	68.71
04/24/95	2.32	0.073	0.36	2.89	6.20	0.071	15.9	47.8	248.5	64.72
04/26/95	2.11	0.079	0.31	2.98	6.39	0.078	15.6	46.9	258.2	66.30
05/01/95	2.38	0.126	0.39	2.79	5.98	0.080	16.3	48.8	246.0	64.80
05/08/95	2.29	0.108	0.37	2.79	5.98	0.091	16.0	48.0	244.5	63.81
05/10/95	2.35	0.141	0.37	2.80	6.00	0.101	17.2	51.6	243.6	63.49
05/15/95	2.26	0.088	0.37	2.89	6.18	0.076	15.1	45.3	239.5	62.50
05/17/95	2.32	0.142	0.37	2.85	6.12	0.085	14.3	42.9	233.5	60.95
05/22/95	1.47	0.116	0.34	2.94	6.31	0.091	14.5	43.4	255.1	67.95
05/24/95										
05/31/95	1.75	0.066	0.20	3.65	7.82	0.118	15.7	47.2	292.2	78.48
06/05/95	1.75	0.014	0.12	3.77	8.08	0.093	15.1	45.3	293.1	79.66
06/07/95	1.59	0.051	0.00	3.48	7.45	0.132	14.8	44.3	284.3	75.17
06/12/95		0.092		3.08	6.60	0.073	13.2	39.7		66.34
06/14/95	2.03	0.082	0.26	3.45	7.40	0.103	14.2	42.6	281.7	75.61
06/21/95	2.03	0.069	0.24	3.42	7.33	0.098	14.6	43.8	269.3	72.72
06/26/95	1.72	0.086	0.24	3.55	7.60	0.108	14.2	42.6	280.7	77.62
06/28/95	2.14	0.087	0.37	3.39	7.26	0.079	13.9	41.7	256.8	69.71
07/05/95	2.14	0.200	0.43	3.26	6.98	0.085	14.2	42.5	253.5	67.47
07/10/95	2.03	0.014	0.27	3.59	7.69	0.116	14.0	41.9		75.43
07/12/95	2.17	0.109	0.29	3.49	7.47	0.076	14.4	43.1		73.21
07/17/95	2.24	0.107	0.29	3.44	7.36	0.140	14.2	42.7	267.1	71.81
07/19/95	2.03	0.059	0.30	3.49	7.49	0.084	14.9	44.8	270.5	71.62
07/24/95	2.03	0.072	0.17	3.78	8.09	0.085	15.1	45.3	287.0	76.89

* All units in mg/L, except for pH in units and temperature in °C.

Table A-4. Results of analyses of softened water, phase II study.*

Date	NO3	P	PO4	Si	SiO2	Sn	S	SO4	T-alk	TIC
07/26/95	2.08	0.052	0.23	3.70	7.94	0.084	15.3	45.9	286.3	74.64
07/31/95	2.08	0.129	0.40	3.59	7.70	0.098	17.0	51.1	275.6	70.92
08/02/95	1.75	0.052	0.11	4.31	9.24	0.079	17.3	51.8	309.7	82.83
08/07/95	1.64	0.024	0.10	4.00	8.58	0.103	15.8	47.5	300.3	79.30
08/09/95	2.01	0.066	0.30	3.74	8.00	0.111	15.1	45.3	263.2	70.74
08/14/95	2.15	0.082	0.31	3.63	7.78	0.059	14.0	42.0	261.1	69.69
08/16/95	1.71	0.071	0.33	3.63	7.79	0.068	14.8	44.4	260.6	69.46
08/21/95		0.145	0.28	3.73	7.98	0.081	15.0	45.0	263.4	70.40
08/23/95	1.89	0.045	0.28	3.81	8.17	0.072	14.9	44.7	268.9	72.03
08/28/95	1.74	0.139	0.33	3.66	7.84	0.089	14.3	42.8	259.3	69.40
08/30/95	1.75	0.108	0.29	3.62	7.75	0.088	14.2	42.7	261.2	70.04
09/06/95	1.85	0.033	0.29	3.69	7.92	0.078	15.2	45.5	263.8	70.74
09/11/95	1.85	0.069	0.19	3.97	8.51	0.091	15.1	45.4	283.1	76.50
09/13/95	1.85	0.070	0.13	4.18	8.96	0.028	15.8	47.4	284.5	77.05
09/25/95	1.85	0.072	0.21	4.01	8.59	0.039	16.0	48.1	278.1	74.78
09/27/95	2.12	0.070	0.22	3.95	8.46	0.036	16.4	49.2	273.1	73.46
10/02/95	2.50	0.076	0.32	3.79	8.12	0.049	17.6	52.9	256.3	68.55
10/04/95	2.23	0.136	0.28	3.77	8.08	0.039	16.4	49.3	255.7	68.25
10/11/95	2.20	0.092	0.29	3.75	8.04	0.043	16.3	49.0	255.8	68.31
10/16/95	2.15	0.060	0.29	3.78	8.10	0.036	16.0	48.1	253.4	67.67
10/18/95	2.20	0.110	0.29	3.70	7.93	0.041	15.9	47.7	252.8	67.64
10/23/95	2.30	0.130	0.35	3.58	7.67	0.044	16.3	48.8	251.4	67.70
10/25/95	2.30	0.071	0.33	3.56	7.62	0.035	15.9	47.6	252.5	67.17
10/30/95	2.23	0.123	0.35	3.49	7.48	0.030	16.0	47.9	254.0	67.71
11/01/95	0.00	0.056		3.56	7.62	0.038	15.9	47.7	256.3	68.40
11/06/95		0.072	0.23	3.90	8.36	0.041	15.4	46.2	300.1	80.78
11/08/95		0.144	0.29	3.73	8.00	0.053	15.8	47.3	263.0	70.02
11/13/95	2.04	0.064	0.23	3.68	7.88	0.055	15.6	46.8	255.2	68.95
11/20/95	1.94	0.151	0.23	3.65	7.83	0.048	15.7	47.1	254.0	66.62
11/27/95	1.50	0.050	0.24	3.52	7.55	0.064	14.7	44.1	254.2	68.72
11/29/95	1.99	0.115	0.24	3.54	7.59	0.067	14.8	44.5	255.3	69.42
12/04/95	2.13	0.067	0.31	3.39	7.25	0.084	14.6	43.7	262.8	71.80
12/06/95	2.03	0.035	0.23	3.42	7.34	0.067	14.6	43.9	257.0	70.89
12/11/95	2.03	0.065	0.24	3.38	7.23	0.087	14.8	44.4	257.9	68.50
12/18/95	2.09	0.074	0.26	3.33	7.12	0.016	16.3	48.8	259.2	70.40
12/20/95										
12/28/95	2.35	0.108	0.31	3.30	7.08	0.043	15.9	47.6	262.6	71.40
01/04/96	2.51	0.101	0.28	3.30	7.08	0.050	15.4	46.3	261.5	71.20
01/08/96	2.51	0.081	0.23	3.17	6.79	0.042	15.2	45.7	256.5	68.90
01/10/96	2.30	0.063	0.25	3.19	6.83	0.050	15.4	46.2	256.4	69.11
01/17/96	2.46	0.046	0.21	3.20	6.85	0.053	15.3	46.0	246.9	67.50
01/22/96	2.89	0.056	0.22	3.06	6.55	0.091	15.3	45.9	253.0	
01/24/96	2.89	0.070	0.20	3.04	6.50	0.066	14.9	44.8	244.6	63.68
01/29/96	2.80	0.071	0.21	3.11	6.67	0.071	14.2	42.7	249.5	68.32
01/31/96	2.70	0.061	0.21	3.09	6.61	0.076	13.6	40.7	248.9	65.96
02/05/96	2.65	0.052	0.25	3.03	6.49	0.100	14.3	43.0	263.1	70.22
02/07/96	1.76	0.087	0.18	3.70	7.92	0.088	15.0	45.1	295.3	80.92
02/12/96	1.72	0.043	0.21	3.61	7.73	0.096	14.9	44.8	291.8	79.11
02/14/96	1.58	0.037	0.18	3.64	7.81	0.092	15.0	45.0	292.9	78.43
02/21/96	1.65	0.038	0.18	3.41	7.31	0.078	15.1	45.4	288.8	76.75
02/26/96	1.80	0.078	0.24	3.48	7.45	0.086	14.3	42.9	254.2	
02/28/96										
03/04/96	1.70	0.030	0.08	3.73	8.00	0.035	14.6	43.7	295.3	79.20
03/06/96	2.11	0.097	0.10	3.76	8.07	0.036	14.8	44.3	285.4	76.44
03/11/96	2.26	0.030	0.13	3.62	7.76	0.047	14.6	43.8	281.2	76.10

* All units in mg/L, except for-pH in units and temperature in °C.

Appendix B

Table B-1. Results of analyses of non-softened standing water samples of lead pipe loops, phase I study.*

Loop 1	Date	Days	Cu	Pb	Zn	Ca	Mg	Na	Loop 2	Date	Days	Cu	Pb	Zn	Ca	Mg	Na
	11/12/92	0								11/12/92	0						
	11/16/92	4	0.015	0.354	-0.010					11/16/92	4	-0.002	0.331	0.007			
	11/18/92	6	0.043	0.044	0.124					11/18/92	6	-0.005	0.338	-0.003			
	11/23/92	11	-0.027	0.403	-0.001					11/23/92	11		0.366	-0.010			
	11/26/92	13	-0.023	0.300	-0.007					11/26/92	13	-0.022	0.252	-0.007			
	11/30/92	18	-0.019	0.332	-0.010					11/30/92	18	-0.012	0.334	-0.001			
	12/02/92	20	-0.014	0.283	-0.008					12/02/92	20	0.001	0.297	-0.008			
	12/07/92	25	-0.009	0.283	-0.005					12/07/92	25	-0.009	0.264	-0.007			
	12/09/92	27	-0.009	0.316	-0.010					12/09/92	27	-0.009	0.288	-0.008			
	12/14/92	32	-0.009	0.295	-0.009					12/14/92	32	0.002	0.301	-0.009			
	12/16/92	34	0.009	0.337	-0.007					12/16/92	34	0.003	0.284	-0.005			
	12/21/92	39	-0.004	0.286	-0.012					12/21/92	39	-0.004	0.284	-0.010			
	12/23/92	41	-0.004	0.276	-0.013					12/23/92	41	-0.004	0.308	-0.004			
	12/28/92	46	0.005	0.307	-0.009					12/28/92	46	0.006	0.290	0.001			
	12/30/92	48	-0.006	0.326	-0.012					12/30/92	48	-0.013	0.307	-0.009			
	01/04/93	53	0.000	0.344	-0.011					01/04/93	53	0.000	0.318	0.013			
	01/06/93	55	0.000	0.304	-0.007					01/06/93	55	0.007	0.294	-0.001			
	01/11/93	60	0.014	0.283	-0.006					01/11/93	60	0.008	0.276	0.001			
	01/13/93	62	-0.003	0.298	-0.004					01/13/93	62	-0.003	0.331	-0.002			
	01/20/93	69	0.001	0.302	0.001					01/20/93	69	0.004	0.321	0.001			
	01/25/93	74	0.011	0.288	-0.014					01/25/93	74	0.014	0.284	-0.007			
	01/27/93	76	0.001	0.312	-0.010					01/27/93	76	0.003	0.297	-0.005			
	02/01/93	81	0.000	0.488	-0.009					02/01/93	81	0.000	0.389	0.001			
	02/03/93	83	0.002	0.251	-0.015					02/03/93	83	0.004	0.254	-0.007			
	02/08/93	88	0.013	0.258	-0.016					02/08/93	88	0.004	0.254	-0.013			
	02/10/93	90	0.001	0.255	-0.017					02/10/93	90	0.001	0.238	-0.008			
	02/17/93	97	-0.001	0.290	-0.011					02/17/93	97	-0.001	0.285	-0.004			
	02/24/93	104	0.001	0.245	-0.019					02/24/93	104	0.001	0.156	-0.015			
	03/01/93	109	0.001	0.240	-0.009					03/01/93	109	0.001	0.246	-0.006			
	03/03/93	111	-0.003	0.293	-0.006					03/03/93	111	-0.007	0.293	-0.001			
	03/08/93	116	-0.004	0.289	-0.013					03/08/93	116	-0.010	0.250	-0.007			
	03/10/93	118	-0.001	0.227	-0.006					03/10/93	118	0.000	0.205	-0.005			
	03/15/93	123	0.004	0.258	-0.014					03/15/93	123	0.006	0.256	-0.007			
	03/17/93	125	0.011	0.239	-0.013					03/17/93	125	0.010	0.234	-0.008			
	03/22/93	130	-0.010	0.274	-0.009					03/22/93	130	-0.011	0.258	-0.007			
	03/24/93	132	-0.008	0.300	-0.010					03/24/93	132	-0.008	0.271	-0.004			
	03/29/93	137	0.000	0.331	-0.008					03/29/93	137	0.000	0.339	0.000			
	04/05/93	144		0.243	-0.010					04/05/93	144	0.000	0.276	-0.002			
	04/07/93	146	-0.013	0.214	-0.013					04/07/93	146	-0.015	0.231	-0.009			
	04/12/93	151	0.004	0.231	-0.003					04/12/93	151	0.004	0.232	0.004			
	04/14/93	153	0.006	0.291	-0.005					04/14/93	153	0.008	0.265	-0.002			
	04/19/93	158	-0.002	0.265	-0.006					04/19/93	158	-0.009	0.257	-0.002			
	04/21/93	160	0.003	0.236	-0.004					04/21/93	160	0.003	0.240	-0.006			
	04/26/93	165	0.003	0.229	-0.006					04/26/93	165	0.003	0.247	-0.004			
	04/28/93	167	0.001	0.272	-0.008					04/28/93	167	0.001	0.250	-0.006			
	05/03/93	172	0.001	0.279	-0.006					05/03/93	172	0.001	0.274	-0.004			
	05/05/93	174	-0.009	0.257	-0.008					05/05/93	174	-0.001	0.264	-0.005			
	05/10/93	179	0.005	0.268	-0.005					05/10/93	179	-0.009	0.225	-0.004			
	05/12/93	171	0.008	0.276	-0.001					05/12/93	171	0.006	0.264	-0.004			
	05/17/93	186	-0.005	0.248	-0.008					05/17/93	186	-0.010	0.251	-0.004			
	05/19/93	188	-0.001	0.263	-0.009					05/19/93	188	-0.001	0.246	-0.007			
	05/24/93	193	-0.002	0.281	-0.011					05/24/93	193	0.003	0.293	-0.009			
	05/26/93	195	0.022	0.013	-0.008					05/26/93	195	0.022	0.009	-0.008			
	06/02/93	202	-0.003	0.274	-0.003					06/02/93	202	-0.003	0.269	-0.002			
	06/07/93	207	-0.003	0.248	-0.006					06/07/93	207	0.005	0.258	-0.007			
	06/09/93	209		0.248	-0.007					06/09/93	209		0.237	-0.004			
	06/14/93	214								06/14/93	214						
	06/23/93	223								06/23/93	223						
	06/28/93	228	-0.001	0.231	-0.006					06/28/93	228	-0.001	0.239	-0.005			
	06/30/93	230	0.002	0.203	-0.007					06/30/93	230	0.003	0.195	-0.004			
	07/07/93	237	0.005	0.225	-0.009					07/07/93	237	-0.001	0.240	-0.005			
	07/12/93	242	0.020	0.222	-0.015					07/12/93	242	0.004	0.214	-0.009			

* All units in mg/L.

Table B-1. Results of analyses of non-softened standing water samples of lead pipe loops, phase I study.*

Loop 1	Date	Days	Cu	Pb	Zn	Ca	Mg	Na	Loop 2	Date	Days	Cu	Pb	Zn	Ca	Mg	Na
	07/14/93	244	0.004	0.237	-0.009					07/14/93	244	-0.017	0.236	-0.012			
	07/19/93	249	-0.002	0.225	-0.007					07/19/93	249	-0.005	0.223	-0.007			
	07/21/93	251	-0.008	0.233	-0.008					07/21/93	251	0.003	0.237	-0.003			
	07/26/93	256	-0.009	0.246	-0.006					07/26/93	256	-0.016	0.248	-0.006			
	07/28/93	258	-0.003	0.263	-0.007					07/28/93	258	0.007	0.257	-0.007			
	08/02/93	263	-0.016	0.239	-0.005					08/02/93	263	0.001	0.251	0.005	25.1	23.5	22.7
	08/04/93	265	0.001	0.247	0.004	24.1	22.9	21.4		08/04/93	265	0.000	0.211	0.005	24.3	23.1	21.7
	08/09/93	270	0.000	0.189	0.004	24.1	22.5	22.0		08/09/93	270	0.000	0.196	0.005	24.1	22.4	21.6
	08/11/93	272	0.000	0.256	0.004	25.4	23.3	21.4		08/11/93	272	0.000	0.257	0.004	25.3	23.3	21.5
	08/16/93	277								08/16/93	277						
	08/18/93	279	0.002	0.252	0.005	25.9	23.8	21.5		08/18/93	279	0.002	0.251	0.005	25.8	23.9	22.1
	08/23/93	284	0.000	0.267	0.005	25.8	24.1	23.6		08/23/93	284	0.001	0.256	0.006	25.9	23.7	22.8
	08/25/93	286	0.005	0.049	0.006	23.9	22.7	23.1		08/25/93	286	0.000	0.054	0.005	23.6	22.9	24.2
	08/30/93	291	0.000	0.284	0.005	26.0	23.0	25.0		08/30/93	291	-0.001	0.288	0.006	26.0	23.0	24.8
	09/01/93	293	0.001	0.237	0.004	25.6	21.8	21.7		09/01/93	293	0.003	0.309	0.005	25.9	22.3	22.8
	09/08/93	300	0.001	0.299	0.005	26.5	23.9	25.3		09/08/93	300	0.001	0.301	0.005	26.5	23.8	25.2
	09/13/93	305	0.002	0.269	0.003	26.5	24.4	24.4		09/13/93	305	0.002	0.281	0.002	25.6	23.8	23.7
	09/15/93	307	0.001	0.232	0.000	25.8	23.1	27.4		09/15/93	307	0.002	0.024	-0.001	25.8	22.8	26.6
	09/20/93	312	0.002	0.258	-0.001	25.2	22.7	27.0		09/20/93	312	0.001	0.265	-0.001	25.2	22.8	27.7
	09/22/93	314	0.001	0.277	-0.001	26.3	24.1	26.9		09/22/93	314	0.001	0.280	-0.001	26.1	24.4	27.5
	09/27/93	319	-0.005	0.289	-0.002	24.1	23.3	22.8		09/27/93	319	-0.005	0.278	-0.002	23.7	23.0	23.2
	09/29/93	321	0.001	0.289	-0.001	24.4	23.8	26.6		09/29/93	321	0.001	0.290	0.001	25.8	23.9	24.9
	10/04/93	326	0.000	0.270	-0.002	23.5	23.6	27.5		10/04/93	326	0.000	0.252	-0.002	23.4	23.6	26.5
	10/06/93	328	0.000	0.243	0.000	22.7	23.2	28.4		10/06/93	328	0.001	0.258	0.002	22.6	22.6	27.5
	10/13/93	335	0.002	0.244	0.000	24.6	23.3	24.9		10/13/93	335	0.002	0.245	0.000	24.7	23.7	25.2
	10/18/93	340	0.000	0.260	-0.001	22.6	23.0	26.0		10/18/93	340	0.002	0.274	0.000	23.2	23.9	27.2
	10/20/93	342	0.002	0.266	-0.001	24.6	24.2	26.5		10/20/93	342	0.000	0.268	0.000	24.3	23.9	26.3
	10/25/93	347	0.002	0.286	-0.001	25.3	23.9	27.0		10/25/93	347	0.002	0.282	0.001	25.3	24.0	27.0
	11/08/93	361	0.002	0.256	0.000	25.1	24.1	27.8		11/08/93	361	0.002	0.275	0.000	25.4	24.2	27.9
	11/10/93	363	0.001	0.268	-0.001	26.2	23.0	25.9		11/10/93	363	0.002	0.262	0.000	26.0	23.0	25.8
	11/15/93	368	0.002	0.297	-0.001	25.6	23.0	26.5		11/15/93	368	0.000	0.303	0.000	26.0	23.5	27.2
	11/17/93	370	0.000	0.294	0.000	25.2	24.2	29.4		11/17/93	370	0.001	0.306	-0.001	25.2	23.6	28.0
	11/22/93	375	0.000	0.290	-0.001	25.4	23.9	30.9		11/22/93	375	0.001	0.288	0.003	25.5	24.1	31.5
	11/24/93	377	0.001	0.286	-0.001	25.0	23.7	32.4		11/24/93	377	0.000	0.299	0.004	24.7	23.6	31.9
	11/29/93	382	0.000	0.275	-0.004	24.9	23.7	27.1		11/29/93	382	0.000	0.274	-0.004	24.5	23.8	27.4
	12/01/93	384	0.000	0.276	-0.001	24.7	24.0	30.9		12/01/93	384	0.000	0.308	0.000	25.0	23.9	29.8
	12/06/93	389	0.004	0.259	0.000	23.7	22.7	27.5		12/06/93	389	0.005	0.289	0.000	23.9	22.4	26.4
	12/08/93	391	0.000	0.271	0.001	23.4	22.7	26.1		12/08/93	391	0.001	0.306	-0.001	23.9	22.2	25.8
	12/13/93	396	0.002	0.288	0.001	24.7	23.0	26.6		12/13/93	396	0.001	0.304	0.001	24.6	23.2	27.2
	12/15/93	398	0.000	0.290	0.000	24.3	23.8	26.1		12/15/93	398	0.002	0.291	0.000	23.8	23.6	26.5
	12/20/93	403	0.017	0.267	-0.001	24.6	24.4	29.5		12/20/93	403	0.002	0.275	-0.001	24.6	24.0	28.5
	12/22/93	405	0.002	0.255	0.000	23.2	23.0	26.6		12/22/93	405	0.002	0.271	0.002	23.5	23.2	26.7
	12/27/93	410	0.002	0.255	0.000	23.7	22.5	26.3		12/27/93	410	0.002	0.220	-0.001	24.1	23.2	26.8
	12/29/93	412	0.003	0.233	-0.001	23.4	22.0	26.2		12/29/93	412	0.003	0.264	0.000	23.4	21.9	26.0
	01/03/94	417	0.001	0.256	-0.001	24.0	23.5	26.0		01/03/94	417	0.002	0.250	0.003	24.8	23.5	25.4
	01/05/94	419	0.000	0.265	-0.001	25.1	23.6	24.8		01/05/94	419	0.000	0.257	-0.001	25.2	23.7	24.9
	01/10/94	424	0.002	0.264	0.000	24.5	23.9	27.2		01/10/94	424	0.001	0.253	0.000	22.6	22.6	26.3
	01/12/94	426	0.000	0.248	0.000	23.8	22.6	25.0		01/12/94	426	0.000	0.258	0.000	23.8	22.4	24.5
	01/24/94	438	0.001	0.263	-0.001	24.9	24.2	27.5		01/24/94	438	-0.001	0.271	0.000	25.0	24.2	26.9
	01/26/94	440	0.000	0.265	0.000	24.4	23.5	25.6		01/26/94	440	0.002	0.292	0.000	24.8	23.9	25.8
	01/31/94	445	0.000	0.240	0.000	24.9	22.3	25.1		01/31/94	445	-0.002	0.239	0.000	24.4	22.3	25.5
	02/02/94	447	0.002	0.256	-0.001	25.3	23.2	27.4		02/02/94	447	0.003	0.262	0.000	25.2	23.2	27.5
	02/07/94	452	0.000	0.191	-0.001	25.3	23.6	25.4		02/07/94	452	-0.001	0.208	0.001	25.2	23.8	25.7
	02/09/94	454								02/09/94	454						
	02/16/94	461	0.002		0.001	26.1	23.7	25.9		02/16/94	461	0.000		-0.002	26.1	24.3	27.1
	02/23/94	468	0.002	0.188	0.000	25.1	23.3	27.4		02/23/94	468	0.004	0.233	0.000	25.5	23.0	26.5

* All units in mg/L.

Table B-1a. Results of analyses of softened standing water samples of lead pipe loops, phase I study.*

Loop 1	Date	Days	Cu	Pb	Zn	Ca	Mg	Na	Loop 2	Date	Days	Cu	Pb	Zn	Ca	Mg	Na
	11/12/92	0								11/12/92	0						
	11/16/92	4	0.010	0.202	0.001					11/16/92	4	0.006	0.284	0.003			
	11/18/92	6	-0.005	0.284	-0.013					11/18/92	6	-0.005	0.282	-0.002			
	11/23/92	11	0.003	0.271	-0.009					11/23/92	11	-0.004	0.273	-0.011			
	11/26/92	13	-0.021	0.217	-0.007					11/26/92	13	-0.020	0.225	-0.007			
	11/30/92	18	-0.016	0.224	-0.008					11/30/92	18	-0.015	0.264	-0.006			
	12/02/92	20	-0.012	0.247	-0.009					12/02/92	20	-0.011	0.242	-0.011			
	12/07/92	25	-0.009	0.215	-0.010					12/07/92	25	-0.009	0.184	-0.010			
	12/09/92	27	-0.009	0.233	-0.010					12/09/92	27	-0.009	0.224	-0.003			
	12/14/92	32	0.007	0.232	-0.008					12/14/92	32	0.010	0.232	-0.002			
	12/16/92	34	-0.005	0.219	-0.008					12/16/92	34	-0.005	0.212	-0.010			
	12/21/92	39	-0.004	0.208	-0.012					12/21/92	39	-0.004	0.192	-0.010			
	12/23/92	41	-0.004	0.208	-0.014					12/23/92	41	-0.004	0.253	-0.008			
	12/28/92	46	0.008	0.221	-0.005					12/28/92	46	0.001	0.244	-0.008			
	12/30/92	48	-0.017	0.247	-0.009					12/30/92	48	0.000	0.217	0.004			
	01/04/93	53	0.000	0.224	-0.006					01/04/93	53	0.000	0.262	0.011			
	01/06/93	55	0.009	0.258	-0.007					01/06/93	55	0.011	0.238	0.007			
	01/11/93	60	0.010	0.241	-0.009					01/11/93	60	0.012	0.228	0.056			
	01/13/93	62	-0.003	0.254	-0.007					01/13/93	62	-0.003	0.230	-0.009			
	01/20/93	69	-0.006	0.235	-0.005					01/20/93	69	0.008	0.240	-0.011			
	01/25/93	74	0.004	0.175	-0.009					01/25/93	74	-0.001	0.212	0.001			
	01/27/93	76	-0.006	0.237	-0.013					01/27/93	76	-0.003	0.230	0.010			
	02/01/93	81	0.000	0.306	-0.012					02/01/93	81	0.000	0.249	-0.012			
	02/03/93	83	0.006	0.200	-0.010					02/03/93	83	0.008	0.180	-0.002			
	02/08/93	88	0.001	0.205	-0.018					02/08/93	88	0.001	0.173	0.001			
	02/10/93	90	-0.001	0.166	-0.009					02/10/93	90	-0.001	0.177	0.016			
	02/17/93	97	-0.001	0.245	-0.007					02/17/93	97	-0.001	0.232	0.006			
	02/24/93	104	0.001	0.158	-0.016					02/24/93	104	0.001	0.162	-0.004			
	03/01/93	109	0.001	0.289	-0.011					03/01/93	109	0.002	0.263	-0.009			
	03/03/93	111	-0.004	0.251	-0.014					03/03/93	111	-0.004	0.260	-0.006			
	03/08/93	116	-0.001	0.204	-0.011					03/08/93	116	-0.001	0.173	-0.003			
	03/10/93	118	-0.011	0.192	-0.009					03/10/93	118	0.004	0.157	-0.004			
	03/15/93	123	0.004	0.182	-0.013					03/15/93	123	0.014	0.151	-0.011			
	03/17/93	125	-0.006	0.177	-0.006					03/17/93	125	0.000	0.156	0.001			
	03/22/93	130	-0.006	0.172	-0.014					03/22/93	130	-0.014	0.162	-0.004			
	03/24/93	132	-0.015	0.210	-0.012					03/24/93	132	0.003	0.198	-0.002			
	03/29/93	137	0.000	0.212	-0.011					03/29/93	137	0.000	0.186	0.005			
	04/05/93	144		0.210	-0.009					04/05/93	144		0.199	-0.003			
	04/07/93	146	-0.002	0.164	-0.012					04/07/93	146	-0.004	0.172	-0.002			
	04/12/93	151	0.004	0.184	-0.004					04/12/93	151	-0.010	0.159	-0.002			
	04/14/93	153	-0.011	0.251	-0.005					04/14/93	153	-0.002	0.202	-0.003			
	04/19/93	158	-0.019	0.187	-0.008					04/19/93	158	-0.004	0.159	0.001			
	04/21/93	160	0.003	0.244	-0.008					04/21/93	160	0.003	0.193	-0.001			
	04/26/93	165	0.003	0.195	-0.005					04/26/93	165	0.004	0.237	0.001			
	04/28/93	167	0.001	0.216	-0.006					04/28/93	167	0.001	0.173	-0.008			
	05/03/93	172	0.001	0.193	-0.007					05/03/93	172	0.006	0.184	-0.008			
	05/05/93	174	0.008	0.194	-0.004					05/05/93	174	0.009	0.179	-0.004			
	05/10/93	179	0.009	0.305	-0.007					05/10/93	179	0.010	0.272	-0.008			
	05/12/93	171	0.011	0.215	-0.006					05/12/93	171	-0.010	0.230	-0.005			
	05/17/93	186	-0.024	0.196	-0.008					05/17/93	186	-0.004	0.181	-0.007			
	05/19/93	188	0.003	0.200	-0.009					05/19/93	188	0.005	0.167	-0.008			
	05/24/93	193	0.008	0.197	-0.013					05/24/93	193	0.007	0.186	-0.009			
	05/26/93	195		0.188	-0.008					05/26/93	195		0.176	-0.003			
	06/02/93	202	-0.003	0.203	-0.007					06/02/93	202	-0.011	0.177	-0.007			
	06/07/93	207	-0.001	0.177	-0.008					06/07/93	207	0.009	0.160	-0.005			
	06/09/93	209		0.177	-0.005					06/09/93	209	-0.003	0.174	-0.008			
	06/14/93	214								06/14/93	214						
	06/23/93	223	0.000	0.202	-0.006					06/23/93	223	0.001	0.142	0.000			
	06/28/93	228	-0.001	0.185	-0.005					06/28/93	228	-0.001	0.194	0.002			
	06/30/93	230	-0.001	0.180	-0.014					06/30/93	230	-0.006	0.174	-0.006			
	07/07/93	237	-0.001	0.192	-0.009					07/07/93	237	-0.001	0.195	-0.003			
	07/12/93	242	0.012	0.165	-0.012					07/12/93	242	-0.003	0.222	-0.009			

* All units in mg/L.

Table B-1a. Results of analyses of softened standing water samples of lead pipe loops, phase I study.*

Loop 1	Date	Days	Cu	Pb	Zn	Ca	Mg	Na	Loop 2	Date	Days	Cu	Pb	Zn	Ca	Mg	Na
	07/14/93	244	-0.012	0.195	-0.014					07/14/93	244	-0.008	0.188	-0.010			
	07/19/93	249	0.001	0.202	-0.006					07/19/93	249	-0.004	0.175	-0.007			
	07/21/93	251	-0.013	0.192	-0.004					07/21/93	251	-0.010	0.185	-0.005			
	07/26/93	256	-0.023	0.209	-0.007					07/26/93	256	-0.013	0.198	-0.007			
	07/28/93	258	-0.006	0.204	-0.007					07/28/93	258	0.002	0.199	-0.004			
	08/02/93	263	0.001	0.201	0.006	0.0	0.0	94.5		08/02/93	263	0.002	0.183	0.006	0.1	0.0	97.0
	08/04/93	265	0.000	0.198	0.006	0.0	0.0	90.6		08/04/93	265	0.001	0.183	0.006	0.1	0.0	91.8
	08/09/93	270	0.001	0.171	0.005	0.1	0.1	85.7		08/09/93	270	0.000	0.161	0.005	0.0	0.0	92.1
	08/11/93	272	0.002	0.228	0.005	0.0	0.1	89.6		08/11/93	272	0.000	0.219	0.007	0.0	0.0	89.9
	08/16/93	277								08/16/93	277						
	08/18/93	279	0.001	0.260	0.006	0.0	0.0	95.6		08/18/93	279	0.001	0.234	0.007	0.0	0.0	95.0
	08/23/93	284	0.000	0.252	0.006	0.1	0.0	100.2		08/23/93	284	0.001	0.220	0.006	0.0	0.0	95.5
	08/25/93	286	0.000	0.077	0.007	0.1	0.1	96.0		08/25/93	286	0.002	0.251	0.007	0.0	0.0	94.1
	08/30/93	291	-0.001	0.203	0.005	0.0	0.0	98.7		08/30/93	291	-0.002	0.203	0.005	0.0	0.0	99.1
	09/01/93	293	0.002	0.313	0.005	0.1	0.0	94.6		09/01/93	293	0.002	0.260	0.006	0.0	0.0	93.2
	09/08/93	300	0.001	0.252	0.005	0.0	0.0	100.6		09/08/93	300	0.002	0.234	0.007	0.0	0.0	99.5
	09/13/93	305	0.001	0.241	0.003	0.0	0.0	102.4		09/13/93	305	0.000	0.198	0.002	0.0	0.0	103.2
	09/15/93	307	0.001	0.213	0.000	0.0	0.0	108.8		09/15/93	307	0.000	0.196	0.000	0.1	0.1	96.8
	09/20/93	312	0.000	0.201	0.000	0.0	0.0	100.5		09/20/93	312	0.002	0.181	0.000	0.0	0.1	99.6
	09/22/93	314	0.002	0.232	0.000	0.0	0.0	106.7		09/22/93	314	0.000	0.220	0.000	0.0	0.1	99.7
	09/27/93	319	-0.004	0.240	-0.002	0.0	0.0	92.1		09/27/93	319	-0.005	0.230	-0.002	0.0	0.1	96.5
	09/29/93	321	0.001	0.261	0.002	0.0	0.0	99.4		09/29/93	321	0.001	0.256	0.003	0.1	0.1	99.2
	10/04/93	326	-0.001	0.211	-0.001	0.0	0.0	97.5		10/04/93	326	0.000	0.193	-0.001	0.0	0.0	101.6
	10/06/93	328	0.001	0.225	0.000	0.0	0.1	101.7		10/06/93	328	0.001	0.220	0.000	0.0	0.0	92.8
	10/13/93	335	0.001	0.207	0.002	0.0	0.0	101.1		10/13/93	335	0.001	0.203	0.002	0.0	0.0	97.7
	10/18/93	340	0.000	0.201	0.003	0.0	0.0	103.1		10/18/93	340	0.000	0.214	0.001	0.0	0.0	104.9
	10/20/93	342	0.002	0.212	0.000	0.0	0.0	94.6		10/20/93	342	0.002	0.212	0.000	0.0	0.1	97.7
	10/25/93	347	0.003	0.220	0.002	0.0	0.0	102.5		10/25/93	347	0.001	0.211	0.001	0.0	0.0	103.8
	11/08/93	361	0.004	0.258	0.002	0.1	0.1	102.8		11/08/93	361	0.001	0.239	0.000	0.1	0.0	105.3
	11/10/93	363	0.000	0.230	0.001	0.0	0.0	101.0		11/10/93	363	-0.002	0.254	0.003	0.1	0.1	101.5
	11/15/93	368	0.001	0.214	0.002	0.0	0.0	101.9		11/15/93	368	0.002	0.231	0.001	0.0	0.1	102.7
	11/17/93	370	0.002	0.211	0.001	0.0	0.0	103.4		11/17/93	370	0.003	0.222	0.000	0.0	0.1	99.2
	11/22/93	375	0.002	0.208	0.003	0.1	0.1	108.5		11/22/93	375	0.002	0.218	0.000	0.1	0.1	105.6
	11/24/93	377	0.001	0.176	0.003	0.0	0.0	102.6		11/24/93	377	0.001	0.168	0.002	0.0	0.0	104.1
	11/29/93	382	0.002	0.212	0.001	0.0	0.0	105.0		11/29/93	382	0.000	0.216	0.000	0.0	0.0	96.5
	12/02/93	384	0.003	0.194	0.005	0.1	0.0	106.9		12/02/93	384	0.000	0.209	0.000	0.1	0.0	107.0
	12/06/93	389	0.002	0.156	-0.002	0.0	0.1	86.9		12/06/93	389	0.002	0.209	0.001	0.1	0.0	101.8
	12/08/93	391	0.001	0.201	0.004	0.0	0.0	95.6		12/08/93	391	0.002	0.214	0.003	0.0	0.0	98.0
	12/13/93	396	0.003	0.193	0.005	0.0	0.0	101.1		12/13/93	396	0.001	0.212	-0.002	0.0	0.0	100.3
	12/15/93	398	0.002	0.217	0.002	0.0	0.1	99.5		12/15/93	398	0.013	0.210	0.001	0.0	0.1	97.3
	12/20/93	403	0.001	0.231	-0.001	0.0	0.0	103.8		12/20/93	403	0.001	0.206	-0.001	0.1	0.0	105.2
	12/22/93	405	0.002	0.212	0.001	0.1	0.1	100.5		12/22/93	405	0.002	0.205	0.002	0.0	0.1	101.3
	12/27/93	410	0.002	0.222	0.003	0.0	0.0	99.8		12/27/93	410	0.001	0.192	0.002	0.0	0.0	100.5
	12/29/93	412	0.002	0.222	0.000	0.0	0.1	95.2		12/29/93	412	0.003	0.203	0.000	0.0	0.1	93.6
	01/03/94	417	0.001	0.231	0.002	0.1	0.0	95.3		01/03/94	417	0.000	0.210	0.002	0.1	0.0	93.2
	01/05/94	419	-0.001	0.208	0.000	0.1	0.1	94.0		01/05/94	419	-0.001	0.183	-0.001	0.1	0.1	87.6
	01/10/94	424	0.001	0.238	0.000	0.0	0.0	96.4		01/10/94	424	0.001	0.213	0.000	0.0	0.0	95.7
	01/12/94	426	0.000	0.265	0.000	0.1	0.1	95.4		01/12/94	426	0.001	0.229	0.001	0.1	0.1	96.9
	01/24/94	438	0.000	0.227	0.001	0.1	0.1	90.0		01/24/94	438	0.002	0.171	0.001	0.0	0.1	89.9
	01/26/94	440	0.002	0.264	0.001	0.1	0.1	97.0		01/26/94	440	-0.001	0.218	0.001	0.1	0.1	102.1
	01/31/94	445	0.000	0.193	0.001	0.1	0.1	97.5		01/31/94	445	0.000	0.166	0.002	0.1	0.1	99.5
	02/02/94	447	0.002	0.208	0.000	0.1	0.1	95.0		02/02/94	447	0.002	0.173	0.000	0.1	0.1	96.0
	02/07/94	452	0.000	0.167	0.001	0.1	0.1	98.7		02/07/94	452	0.000	0.142	0.000	0.1	0.0	103.8
	02/09/94	454								02/09/94	454						
	02/16/94	461	0.000		-0.004	0.1	0.0	102.5		02/16/94	461	0.000		-0.004	0.1	0.0	99.8
	02/23/94	468	0.002	0.190	0.000	0.1	0.1	97.5		02/23/94	468	0.001	0.149	0.000	0.1	0.0	97.6

* All units in mg/L.

Table B-2. Results of analyses on non-softened standing water samples of copper tubing pipe loops, phase I study.*

Loop 1	Date	Days	Cu	Pb	Zn	Ca	Mg	Na	Loop 2	Date	Days	Cu	Pb	Zn	Ca	Mg	Na
	11/12/93	0								11/12/93	0						
	11/16/92	4	0.110	0.001	0.253					11/16/92	4	0.155	0.003	-0.004			
	11/18/92	6	0.067	0.006	0.197					11/18/92	6	0.075	0.002	0.304			
	11/23/92	11	0.125	0.000	0.067					11/23/92	11	0.170	0.002	-0.010			
	11/26/92	13	0.074	0.000	-0.007					11/26/92	13	0.094	0.001	-0.005			
	11/30/92	18	0.101	0.000	-0.012					11/30/92	18	0.098	0.000	-0.009			
	12/02/92	20	0.090	0.000	-0.013					12/02/92	20	0.112	0.001	-0.010			
	12/07/92	25	0.108	0.000	-0.003					12/07/92	25	0.130	0.001	-0.004			
	12/09/92	27	0.120	0.000	-0.016					12/09/92	27	0.143	0.000	-0.009			
	12/14/92	32	0.109	0.000	-0.009					12/14/92	32	0.126	0.001	-0.010			
	12/16/92	34	0.111	0.000	-0.008					12/16/92	34	0.134	0.001	-0.007			
	12/21/92	39	0.083	0.000	-0.013					12/21/92	39	0.105	0.001	-0.013			
	12/23/92	41	0.105	0.000	-0.009					12/23/92	41	0.105	0.000	-0.011			
	12/28/92	46	0.138	0.000	-0.011					12/28/92	46	0.117	0.000	-0.009			
	12/30/92	48	0.075	0.001	-0.014					12/30/92	48	0.075	0.000	-0.011			
	01/04/93	53	0.092	0.000	-0.012					01/04/93	53	0.100	0.000	-0.009			
	01/06/93	55	0.075	0.000	-0.008					01/06/93	55	0.089	0.001	0.083			
	01/11/93	60	0.112	0.000	-0.011					01/11/93	60	0.129	0.001	-0.008			
	01/13/93	62	0.127	0.000	-0.002					01/13/93	62	0.127	0.001	-0.005			
	01/20/93	69	0.110	0.001	0.000					01/20/93	69	0.120	0.002	-0.001			
	01/25/93	74	0.093	0.000	-0.011					01/25/93	74	0.138	0.000	-0.012			
	01/27/93	76	0.104	0.000	-0.012					01/27/93	76	0.126	0.000	-0.010			
	02/01/93	81	0.096	0.000	-0.012					02/01/93	81	0.115	0.001	-0.002			
	02/03/93	83	0.099	0.001	-0.014					02/03/93	83	0.119	0.001	-0.012			
	02/08/93	88	0.092	0.000	-0.016					02/08/93	88	0.136	0.000	-0.016			
	02/10/93	90	0.080	0.000	-0.015					02/10/93	90	0.100	0.000	-0.016			
	02/17/93	97	0.086	0.000	-0.009					02/17/93	97	0.107	0.000	-0.011			
	02/24/93	104	0.090	0.000	-0.019					02/24/93	104	0.112	-0.001	-0.016			
	03/01/93	109	0.083	0.000	-0.009					03/01/93	109	0.112	0.000	-0.009			
	03/03/93	111	0.059	0.000	-0.009					03/03/93	111	0.082	0.001	-0.009			
	03/08/93	116	0.093	0.001	-0.011					03/08/93	116	0.117	0.000	-0.009			
	03/10/93	118	0.078	0.001	-0.006					03/10/93	118	0.047	0.001	-0.011			
	03/15/93	123	0.081	-0.001	-0.015					03/15/93	123	0.090	0.000	-0.013			
	03/17/93	125	0.053	0.000	-0.013					03/17/93	125	0.093	0.000	-0.009			
	03/22/93	130	0.072	0.000	-0.013					03/22/93	130	0.092	0.001	-0.013			
	03/24/93	132	0.067	-0.001	-0.010					03/24/93	132	0.109	0.000	-0.009			
	03/29/93	137	0.081	0.000	-0.010					03/29/93	137	0.102	0.000	-0.011			
	04/05/93	144	0.064	0.000	-0.010					04/05/93	144	0.075	0.001	-0.010			
	04/07/93	146	0.045	0.000	-0.015					04/07/93	146	0.071	0.001	-0.013			
	04/12/93	151	0.105	0.000	0.000					04/12/93	151	0.113	0.001	-0.002			
	04/14/93	153	0.093	0.000	-0.005					04/14/93	153	0.109	0.001	-0.005			
	04/19/93	158		0.000						04/19/93	158	0.113	0.001	-0.007			
	04/21/93	160	0.070	0.000	-0.006					04/21/93	160	0.093	0.000	-0.005			
	04/26/93	165	0.070	0.000	-0.005					04/26/93	165	0.108	0.000	-0.006			
	04/28/93	167	0.089	0.000	-0.006					04/28/93	167	0.111	0.001	-0.006			
	05/03/93	172	0.089	0.000	-0.006					05/03/93	172	0.119	0.000	-0.005			
	05/05/93	174	0.071	0.000	-0.007					05/05/93	174	0.108	0.000	-0.007			
	05/10/93	179	0.071	0.000	-0.005					05/10/93	179	0.116	0.000	-0.007			
	05/12/93	171	0.073	0.000	-0.006					05/12/93	171	0.116	0.000	-0.006			
	05/17/93	186	0.074	0.000	-0.008					05/17/93	186	0.091	0.001	-0.005			
	05/19/93	188	0.088	0.000	-0.007					05/19/93	188	0.123	0.001	-0.010			
	05/24/93	193	0.101	0.000	-0.012					05/24/93	193	0.135	0.001	-0.012			
	05/26/93	195	0.029	-0.001	-0.011					05/26/93	195	0.022	0.000	-0.008			
	06/02/93	202	0.088	0.000	-0.005					06/02/93	202	0.133	0.000	-0.004			
	06/07/93	207	0.088	0.001	-0.006					06/07/93	207	0.111	0.001	-0.007			
	06/09/93	209	0.068	0.000	-0.007					06/09/93	209	0.114	0.000	-0.005			
	06/14/93	214								06/14/93	214						
	06/23/93	223								06/23/93	223						
	06/28/93	228	0.063	0.000	-0.005					06/28/93	228	0.095	0.001	-0.005			
	06/30/93	230	0.061	0.000	-0.007					06/30/93	230	0.101	0.000	-0.009			
	07/07/93	237	0.057	0.001	-0.009					07/07/93	237	0.089	0.001	-0.008			
	07/12/93	242	0.060	0.000	-0.012					07/12/93	242	0.097	0.000	-0.011			

* All units in mg/L.

Table B-2. Results of analyses on non-softened standing water samples of copper tubing pipe loops, phase I study.*

Loop 1	Date	Days	Cu	Pb	Zn	Ca	Mg	Na	Loop 2	Date	Days	Cu	Pb	Zn	Ca	Mg	Na
	07/14/93	244	0.064	0.001	-0.011					07/14/93	244	0.095	0.001	-0.011			
	07/19/93	249	0.084	0.000	-0.008					07/19/93	249	0.107	0.000	-0.009			
	07/21/93	251	0.087	0.000	-0.007					07/21/93	251	0.098	0.000	-0.006			
	07/26/93	256	0.057	0.000	-0.007					07/26/93	256	0.078	0.001	-0.005			
	07/28/93	258	0.079	0.000	-0.007					07/28/93	258	0.109	0.000	-0.007			
	08/02/93	263	0.078	0.000	-0.007					08/02/93	263	0.100	0.001	0.005	25.1	23.2	22.7
	08/04/93	265	0.071	0.000	0.004	24.2	23.0	21.5		08/04/93	265	0.102	0.001	0.004	24.5	22.8	21.2
	08/09/93	270	0.064	0.001	0.003	23.2	22.0	22.1		08/09/93	270	0.085	0.001	0.003	24.1	22.5	21.7
	08/11/93	272	0.089	0.000	0.004	25.3	23.3	21.6		08/11/93	272	0.102	0.000	0.004	25.4	23.1	21.0
	08/16/93	277								08/16/93	277						
	08/18/93	279	0.094	0.000	0.005	26.0	23.7	21.7		08/18/93	279	0.112	0.000	0.008	25.9	23.7	21.1
	08/23/93	284	0.103	-0.001	0.005	25.6	24.0	23.7		08/23/93	284	0.116	0.000	0.005	25.8	23.8	23.3
	08/25/93	286	0.081	0.013	0.005	23.9	22.6	22.7		08/25/93	286	0.094	0.006	0.006	23.8	22.4	22.9
	08/30/93	291	0.098	0.000	0.004	26.0	22.9	24.5		08/30/93	291	0.114	-0.001	0.005	25.8	22.6	23.9
	09/01/93	293	0.096	-0.001	0.004	26.1	22.5	23.0		09/01/93	293	0.107	0.004	0.004	25.6	22.3	22.5
	09/08/93	300	0.115	0.000	0.004	26.6	23.9	25.0		09/08/93	300	0.126	0.000	0.004	26.7	23.9	22.9
	09/13/93	305	0.108	-0.001	0.002	26.6	24.6	24.7		09/13/93	305	0.122	-0.001	0.003	26.0	24.1	23.9
	09/15/93	307	0.091	-0.001	-0.001	25.9	23.1	27.1		09/15/93	307	0.106	-0.001	-0.001	25.8	22.8	26.5
	09/20/93	312	0.075	0.000	-0.001	25.1	22.9	27.9		09/20/93	312	0.086	0.001	-0.001	25.3	22.8	28.0
	09/22/93	314	0.092	-0.001	-0.001	26.4	23.9	25.7		09/22/93	314	0.108	0.000	-0.001	26.2	24.3	26.7
	09/27/93	319	0.083	-0.001	-0.003	23.9	22.8	22.5		09/27/93	319	0.100	0.000	-0.003	23.7	23.0	22.8
	09/29/93	321	0.101	0.000	-0.001	24.5	23.5	25.4		09/29/93	321	0.108	0.000	0.002	26.0	23.9	25.1
	10/04/93	326	0.093	0.000	-0.002	23.4	23.7	27.4		10/04/93	326	0.101	0.000	-0.002	23.4	23.7	27.0
	10/06/93	328	0.083	0.000	0.002	23.0	23.2	28.0		10/06/93	328	0.089	0.000	0.002	22.7	22.7	27.6
	10/13/93	335	0.099	-0.001	0.000	24.6	23.5	25.2		10/13/93	335	0.107	-0.001	-0.001	24.7	23.9	26.2
	10/18/93	340	0.096	0.000	-0.001	23.1	24.1	27.4		10/18/93	340	0.101	0.000	0.001	22.8	23.9	27.2
	10/20/93	342	0.101	-0.001	-0.001	24.6	24.1	26.5		10/20/93	342	0.105	0.000	-0.001	24.6	24.0	26.4
	10/25/93	347	0.114	0.000	0.001	25.2	24.0	27.7		10/25/93	347	0.118	-0.001	0.002	25.1	23.9	26.7
	11/08/93	361	0.115	-0.001	0.000	25.2	24.1	27.7		11/08/93	361	0.123	-0.001	0.000	25.3	24.3	28.3
	11/10/93	363	0.115	0.000	-0.001	25.8	23.0	25.8		11/10/93	363	0.122	0.000	-0.001	25.9	22.7	25.5
	11/15/93	368	0.113	0.001	-0.001	25.6	23.2	26.9		11/15/93	368	0.113	0.000	-0.001	25.2	22.6	26.2
	11/17/93	370	0.100	0.000	-0.001	25.4	23.7	28.6		11/17/93	370	0.104	0.000	-0.001	25.1	23.8	28.0
	11/22/93	375	0.094	-0.001	-0.002	25.5	24.1	31.2		11/22/93	375	0.097	0.000	-0.002	25.3	24.1	31.9
	11/24/93	377	0.090	0.000	-0.001	25.0	23.7	31.9		11/24/93	377	0.088	0.000	0.001	24.9	23.1	30.6
	11/29/93	382	0.106	0.000	-0.004	24.3	23.4	27.3		11/29/93	382	0.109	-0.001	-0.004	24.5	23.5	26.6
	12/01/93	384	0.101	-0.001	-0.001	24.8	24.2	30.7		12/01/93	384	0.103	-0.001	-0.001	25.0	24.2	30.4
	12/06/93	389	0.091	-0.001	0.000	23.9	22.8	27.1		12/06/93	389	0.086	0.000	-0.001	24.0	22.6	26.6
	12/08/93	391	0.075	0.000	0.000	23.8	22.3	25.8		12/08/93	391	0.076	0.000	0.000	23.8	22.1	26.1
	12/13/93	396	0.087	0.000	0.001	24.5	23.0	26.9		12/13/93	396	0.087	0.000	0.002	24.3	22.8	26.6
	12/15/93	398	0.088	0.000	-0.001	24.0	23.6	26.2		12/15/93	398	0.106	0.000	0.000	23.3	22.8	25.2
	12/20/93	403	0.100	0.000	-0.001	24.8	24.3	28.7		12/20/93	403	0.101	0.000	-0.001	24.7	24.1	28.5
	12/22/93	405	0.123	0.001	-0.001	23.3	23.1	26.8		12/22/93	405	0.087	0.000	-0.001	23.5	23.0	26.3
	12/27/93	410	0.072	0.000	0.000	23.5	22.5	26.6		12/27/93	410	0.075	0.000	0.000	24.0	23.2	26.9
	12/29/93	412	0.063	0.000	-0.001	23.2	21.9	25.9		12/29/93	412	0.065	0.000	0.000	23.3	22.0	26.3
	01/03/94	417	0.095	0.002	0.000	24.2	23.7	26.3		01/03/94	417	0.094	0.001	0.003	25.5	23.7	25.4
	01/05/94	419	0.088	-0.003	-0.001	25.3	23.8	25.3		01/05/94	419	0.091	0.000	-0.001	25.3	24.1	25.5
	01/10/94	424	0.075	0.001	-0.001	23.8	22.8	25.4		01/10/94	424	0.088	0.001	0.000	23.7	22.8	25.4
	01/12/94	426	0.090	0.000	-0.001	23.8	22.8	25.3		01/12/94	426	0.094	0.000	0.000	23.9	22.6	24.7
	01/24/94	438	0.079	-0.001	-0.001	24.7	24.2	27.2		01/24/94	438	0.075	-0.001	0.000	24.4	23.6	26.3
	01/26/94	440	0.090	0.000	-0.001	24.5	23.6	25.6		01/26/94	440	0.090	0.000	-0.001	24.5	23.4	24.9
	01/31/94	445	0.077	0.001	-0.001	24.9	22.2	24.8		01/31/94	445	0.077	0.001	0.000	24.8	22.5	25.5
	02/02/94	447	0.075	0.000	0.000	25.3	23.3	27.3		02/02/94	447	0.073	0.000	0.000	25.2	23.2	27.4
	02/07/94	452	0.086	0.000	0.000	25.1	23.6	25.5		02/07/94	452	0.082	0.000	-0.001	25.2	23.7	25.6
	02/09/94	454								02/09/94	454						
	02/16/94	461	0.084		-0.001	26.1	24.1	26.7		02/16/94	461	0.088		-0.001	26.1	24.0	26.2
	02/23/94	468	0.076	0.000	0.000	25.1	23.3	27.2		02/23/94	468	0.076	0.000	-0.001	25.0	22.7	26.8

* All units in mg/L.

Table B-2a Results of analyses of softened standing water samples of copper tubing pipe loops, phase I study.*

Loop1	Date	Days	Cu	Pb	Zn	Ca	mg	Na	Loop 2	Date	Days	Cu	Pb	Zn	Ca	Mg	Na
	11/12/92	0								11/12/93	0						
	11/16/92	4	0.080	0.002	-0.002					11/16/92	4	0.076	0.000	-0.007			
	11/18/92	6	0.043	0.000	-0.011					11/18/92	6	0.059	0.000	-0.012			
	11/23/92	11	0.113	0.000	-0.010					11/23/92	11	0.133	0.000	-0.008			
	11/26/92	13	0.074	0.000	-0.010					11/26/92	13	0.100	0.000	-0.003			
	11/30/92	18	0.077	0.000	-0.011					11/30/92	18	0.100	0.000	-0.007			
	12/02/92	20	0.090	0.000	-0.009					12/02/92	20	0.112	0.001	-0.002			
	12/07/92	25	0.086	0.001	-0.007					12/07/92	25	0.108	0.000	0.003			
	12/09/92	27	0.101	0.000	-0.014					12/09/92	27	0.109	0.000	-0.010			
	12/14/92	32	0.100	0.000	-0.009					12/14/92	32	0.128	0.000	-0.008			
	12/16/92	34	0.088	0.000	-0.008					12/16/92	34	0.111	0.000	-0.015			
	12/21/92	39	0.083	-0.001	-0.012					12/21/92	39	0.105	0.000	-0.015			
	12/23/92	41	0.083	0.000	-0.012					12/23/92	41	0.114	0.000	-0.010			
	12/28/92	46	0.127	0.000	-0.010					12/28/92	46	0.164	0.000	-0.009			
	12/30/92	48	0.075	0.000	-0.013					12/30/92	48	0.100	0.000	-0.010			
	01/04/93	53	0.100	-0.001	-0.012					01/04/93	53	0.125	-0.001	-0.010			
	01/06/93	55	0.082	0.000	-0.012					01/06/93	55	0.108	0.001	-0.010			
	01/11/93	60	0.108	0.000	-0.014					01/11/93	60	0.141	0.000	-0.008			
	01/13/93	62	0.120	0.000	-0.006					01/13/93	62	0.127	0.000	-0.014			
	01/20/93	69	0.096	0.000	-0.007					01/20/93	69	0.131	0.001	-0.013			
	01/25/93	74	0.100	0.000	-0.007					01/25/93	74	0.122	0.000	-0.009			
	01/27/93	76	0.103	0.000	-0.012					01/27/93	76	0.113	0.000	-0.011			
	02/01/93	81	0.115	0.000	-0.009					02/01/93	81	0.135	0.001	-0.012			
	02/03/93	83	0.108	0.000	-0.009					02/03/93	83	0.127	0.000	-0.015			
	02/08/93	88	0.100	0.000	-0.018					02/08/93	88	0.100	0.001	-0.012			
	02/10/93	90	0.086	0.000	-0.012					02/10/93	90	0.107	0.000	-0.008			
	02/17/93	97	0.093	0.000	-0.008					02/17/93	97	0.107	0.000	-0.007			
	02/24/93	104	0.090	-0.001	-0.015					02/24/93	104	0.112	-0.001	-0.012			
	03/01/93	109	0.090	0.001	-0.011					03/01/93	109	0.111	0.000	-0.006			
	03/03/93	111	0.074	0.000	-0.014					03/03/93	111	0.093	0.000	-0.012			
	03/08/93	116	0.098	0.000	-0.008					03/08/93	116	0.117	0.000	-0.005			
	03/10/93	118	0.101	0.000	-0.012					03/10/93	118	0.103	0.000	-0.013			
	03/15/93	123	0.074	-0.001	-0.012					03/15/93	123	0.097	0.000	-0.013			
	03/17/93	125	0.068	0.002	-0.014					03/17/93	125	0.081	0.000	-0.011			
	03/22/93	130	0.089	0.000	-0.010					03/22/93	130	0.088	0.000	-0.011			
	03/24/93	132	0.088	-0.001	0.072					03/24/93	132	0.105	0.000	-0.011			
	03/29/93	137	0.102	0.000	-0.011					03/29/93	137	0.108	0.000	-0.009			
	04/05/93	144	0.085	0.000	-0.009					04/05/93	144	0.085	0.000	-0.009			
	04/07/93	146	0.058	0.001	-0.011					04/07/93	146	0.083	0.000	-0.011			
	04/12/93	151	0.112	0.001	-0.006					04/12/93	151	0.091	0.001	-0.007			
	04/14/93	153	0.111	0.000	-0.006					04/14/93	153	0.113	0.000	-0.006			
	04/19/93	158	0.089	0.000	-0.007					04/19/93	158	0.103	0.000	-0.008			
	04/21/93	160	0.093	0.000	0.021					04/21/93	160	0.093	0.000	-0.007			
	04/26/93	165	0.070	-0.001	-0.007					04/26/93	165	0.101	-0.001	-0.005			
	04/28/93	167	0.111	0.000	-0.010					04/28/93	167	0.111	0.000	-0.008			
	05/03/93	172	0.111	0.001	-0.007					05/03/93	172	0.115	0.000	-0.008			
	05/05/93	174	0.095	0.000	-0.002					05/05/93	174	0.104	0.000	-0.004			
	05/10/93	179	0.119	0.000	-0.007					05/10/93	179	0.142	0.000	-0.006			
	05/12/93	171	0.080	-0.001	-0.007					05/12/93	171	0.077	0.000	-0.007			
	05/17/93	186	0.084	0.000	-0.008					05/17/93	186	0.105	0.001	-0.008			
	05/19/93	188	0.107	0.001	-0.006					05/19/93	188	0.109	0.000	-0.008			
	05/24/93	193	0.119	0.000	-0.014					05/24/93	193	0.124	0.000	-0.013			
	05/26/93	195	0.094	0.000	-0.009					05/26/93	195	0.101	-0.001	-0.010			
	06/02/93	202	0.095	0.000	-0.006					06/02/93	202	0.111	0.000	-0.009			
	06/07/93	207	0.098	0.001	-0.007					06/07/93	207	0.100	0.001	-0.010			
	06/09/93	209	0.091	0.001	-0.007					06/09/93	209	0.094	0.000	-0.009			
	06/14/93	214								06/14/93	214						
	06/23/93	223								06/23/93	223						
	06/28/93	228	0.092	0.000	-0.008					06/28/93	228	0.106	0.000	-0.003			
	06/30/93	230	0.095	0.001	-0.004					06/30/93	230	0.095	0.001	-0.001			
	07/07/93	237	0.084	0.000	-0.012					07/07/93	237	0.098	0.001	-0.015			
	07/12/93	242	0.076	0.001	-0.009					07/12/93	242	0.096	0.001	-0.008			

* All units in mg/L.

Table B-2a Results of analyses of softened standing water samples of copper tubing pipe loops, phase I study.*

Loop1	Date	Days	Cu	Pb	Zn	Ca	mg	Na	Loop 2	Date	Days	Cu	Pb	Zn	Ca	Mg	Na
	07/14/93	244	0.079	0.001	-0.011					07/14/93	244	0.078	0.000	-0.012			
	07/19/93	249	0.093	0.001	-0.012					07/19/93	249	0.097	0.001	-0.017			
	07/21/93	251	0.100	0.000	-0.007					07/21/93	251	0.104	0.001	-0.005			
	07/26/93	256	0.094	0.000	-0.006					07/26/93	256	0.092	0.000	-0.005			
	07/28/93	258	0.073	0.000	-0.009					07/28/93	258	0.096	0.000	-0.009			
	08/02/93	263	0.108	0.000	-0.005					08/02/93	263	0.103	0.000	-0.008			
	08/04/93	265	0.107	0.000	0.005	0.0	0.0	95.3		08/04/93	265	0.110	0.000	0.005	0.0	0.0	98.4
	08/09/93	270	0.100	0.000	0.005	0.0	0.0	92.8		08/09/93	270	0.105	0.000	0.005	0.0	0.0	93.5
	08/11/93	272	0.081	0.001	0.004	0.0	0.0	87.4		08/11/93	272	0.083	0.001	0.005	0.0	0.0	88.4
	08/16/93	277								08/16/93	277						
	08/18/93	279	0.114	0.001	0.006	0.1	0.0	89.6		08/18/93	279	0.114	0.001	0.005	0.0	0.0	88.7
	08/23/93	284	0.127	0.000	0.007	0.1	0.0	95.4		08/23/93	284	0.126	0.000	0.006	0.1	0.0	92.1
	08/25/93	286	0.141	-0.001	0.006	0.1	0.1	95.1		08/25/93	286	0.138	0.000	0.006	0.1	0.0	93.8
	08/30/93	291	0.109	0.002	0.006	0.0	0.0	95.7		08/30/93	291	0.111	0.016	0.006	0.0	0.0	95.7
	09/01/93	293	0.123	-0.002	0.017	0.0	0.0	99.6		09/01/93	293	0.121	-0.002	0.006	0.0	0.0	99.9
	09/08/93	300	0.130	0.002	0.005	0.0	0.0	93.9		09/08/93	300	0.127	0.001	0.005	0.0	0.0	92.7
	09/13/93	305	0.145	0.000	0.007	0.0	0.0	101.1		09/13/93	305	0.150	0.000	0.005	0.0	0.0	108.2
	09/15/93	307	0.124	0.000	0.002	0.0	0.0	102.7		09/15/93	307	0.126	0.000	0.003	0.1	0.0	103.0
	09/20/93	312	0.111	0.000	0.000	0.1	0.0	102.7		09/20/93	312	0.114	0.000	0.000	0.0	0.1	100.8
	09/22/93	314	0.099	0.000	0.000	0.0	0.1	99.0		09/22/93	314	0.099	0.000	-0.001	0.1	0.0	100.1
	09/27/93	319	0.110	0.000	0.000	0.0	0.0	106.5		09/27/93	319	0.109	0.000	0.000	0.0	0.0	99.3
	09/29/93	321	0.116	0.000	-0.002	0.0	0.0	90.2		09/29/93	321	0.113	0.000	-0.002	0.0	0.0	89.9
	10/04/93	326	0.133	0.000	0.003	0.1	0.1	97.4		10/04/93	326	0.132	0.000	0.002	0.0	0.0	98.3
	10/06/93	328	0.119	0.000	-0.001	0.0	0.0	99.4		10/06/93	328	0.116	0.001	-0.001	0.0	0.0	99.2
	10/13/93	335	0.114	0.000	0.000	0.0	0.0	100.1		10/13/93	335	0.111	0.000	0.000	0.0	0.1	99.5
	10/18/93	340	0.122	0.000	0.000	0.0	0.0	101.8		10/18/93	340	0.119	0.000	0.001	0.0	0.1	100.7
	10/20/93	342	0.124	0.000	-0.001	0.0	0.0	101.8		10/20/93	342	0.125	0.000	0.000	0.0	0.1	103.0
	10/25/93	347	0.116	0.000	0.000	0.0	0.0	92.3		10/25/93	347	0.120	0.000	0.000	0.0	0.0	97.0
	11/08/93	361	0.136	-0.001	0.002	0.0	0.1	101.8		11/08/93	361	0.135	-0.001	0.002	0.0	0.0	103.8
	11/10/93	363	0.147	-0.002	0.001	0.1	0.1	102.1		11/10/93	363	0.141	-0.002	0.000	0.1	0.1	103.2
	11/15/93	368	0.137	0.000	0.000	0.1	0.0	100.4		11/15/93	368	0.133	0.000	0.002	0.1	0.1	102.3
	11/17/93	370	0.137	0.000	0.000	0.0	0.0	102.2		11/17/93	370	0.129	-0.001	0.000	0.0	0.0	102.3
	11/22/93	375	0.122	-0.001	0.000	0.0	0.1	101.3		11/22/93	375	0.118	-0.001	0.000	0.0	0.0	99.3
	11/24/93	377	0.125	0.000	-0.001	0.1	0.1	111.0		11/24/93	377	0.118	-0.001	-0.001	0.1	0.1	103.7
	11/29/93	382	0.102	0.000	0.002	0.1	0.1	100.6		11/29/93	382	0.099	0.000	0.002	0.0	0.1	101.6
	12/01/93	384	0.130	0.000	-0.004	0.0	0.0	103.5		12/01/93	384	0.122	0.000	0.000	0.0	0.0	102.0
	12/06/93	389	0.121	0.000	-0.001	0.1	0.0	108.6		12/06/93	389	0.117	0.000	-0.001	0.1	0.1	106.5
	12/08/93	391	0.113	0.000	0.001	0.0	0.0	102.2		12/08/93	391	0.103	0.001	0.000	0.0	0.1	97.9
	12/13/93	396	0.094	0.000	0.001	0.0	0.0	94.1		12/13/93	396	0.096	0.000	0.001	0.0	0.0	94.6
	12/15/93	398	0.107	0.000	0.002	0.0	0.1	99.5		12/15/93	398	0.102	0.000	-0.001	0.0	0.0	96.2
	12/20/93	403	0.109	-0.001	0.000	0.0	0.1	96.4		12/20/93	403	0.108	-0.001	0.002	0.0	0.0	98.2
	12/22/93	405	0.124	0.000	-0.001	0.0	0.0	103.6		12/22/93	405	0.120	0.000	-0.001	0.0	0.0	104.1
	12/27/93	410	0.116	0.000	0.001	0.1	0.1	100.1		12/27/93	410	0.108	0.000	0.000	0.0	0.1	96.2
	12/29/93	412	0.104	0.000	0.002	0.0	0.0	100.6		12/29/93	412	0.100	0.000	0.002	0.0	0.0	100.1
	01/03/94	417	0.094	0.000	0.000	0.0	0.1	96.8		01/03/94	417	0.088	0.000	0.000	0.0	0.1	93.7
	01/05/94	419	0.107	0.001	0.001	0.1	0.0	96.6		01/05/94	419	0.107	0.000	0.001	0.1	0.0	93.8
	01/10/94	424	0.101	0.000	0.000	0.1	0.1	95.0		01/10/94	424	0.096	0.000	-0.001	0.1	0.0	90.7
	01/12/94	426	0.165	0.001	0.000	0.0	0.0	96.7		01/12/94	426	0.106		0.000	0.0	0.1	96.8
	01/24/94	438	0.107	0.000	0.000	0.1	0.0	94.7		01/24/94	438	0.104	0.000	0.001	0.1	0.0	96.9
	01/26/94	440	0.098	-0.001	0.000	0.1	0.0	94.8		01/26/94	440	0.093	-0.001	0.000	0.1	0.1	90.5
	01/31/94	445	0.128	0.000	0.000	0.1	0.1	102.7		01/31/94	445	0.122	0.000	0.001	0.1	0.1	104.1
	02/02/94	447	0.093	0.001	0.001	0.1	0.1	96.0		02/02/94	447	0.091	0.000	0.001	0.1	0.0	96.5
	02/07/94	452	0.091	0.000	0.000	0.1	0.0	94.9		02/07/94	452	0.091	0.000	0.000	0.1	0.1	96.6
	02/09/94	454								02/09/94	454						
	02/16/94	461	0.101	0.001	0.001	0.1	0.1	100.1		02/16/94	461	0.097	0.001	0.000	0.1	0.1	101.4
	02/23/94	468	0.101		-0.004	0.1	0.1	100.7		02/23/94	468	0.097		-0.004	0.1	0.1	101.9

* All units in mg/L.

Table B-3. Results of analyses of non-softened standing water samples of copper soldered pipe loops, phase I study.*

Loop 1	Date	Days	Cu	Pb	Zn	Ca	Mg	Na	Loop 2	Date	Days	Cu	Pb	Zn	Ca	Mg	Na
	11/12/92	0								11/12/92	0						
	11/16/92	4	0.158	0.008	1.355					11/16/92	4	0.131	0.018	3.268			
	11/18/92	6	0.114	0.004	1.394					11/18/92	6	0.067	0.015	3.085			
	11/23/92	11	0.166	0.003	1.005					11/23/92	11	0.111	0.011	3.068			
	11/26/92	13	0.191	0.001	-0.009					11/26/92	13	0.152	0.006	-0.002			
	11/30/92	18	0.211	0.000	-0.007					11/30/92	18	0.186	0.004	-0.007			
	12/02/92	20	0.245	0.001	-0.012					12/02/92	20	0.201	0.005	-0.007			
	12/07/92	25	0.241	0.001	-0.006					12/07/92	25	0.197	0.004	-0.004			
	12/09/92	27	0.252	0.001	-0.011					12/09/92	27	0.232	0.004	-0.011			
	12/14/92	32	0.227	0.001	-0.007					12/14/92	32	0.212	0.005	-0.005			
	12/16/92	34	0.258	0.001	-0.007					12/16/92	34	0.204	0.004	-0.007			
	12/21/92	39	0.192	0.001	0.763					12/21/92	39	0.054	0.001	0.074			
	12/23/92	41	0.192	0.001	1.059					12/23/92	41	0.192	0.001	1.133			
	12/28/92	46	0.182	0.001	0.993					12/28/92	46	0.184	0.001	1.276			
	12/30/92	48	0.186	0.001	1.163					12/30/92	48	0.164	0.001	1.431			
	01/04/93	53	0.158	0.000	0.194					01/04/93	53	0.175	0.001	1.654			
	01/06/93	55	0.175	0.001	0.068					01/06/93	55	0.178	0.001	1.570			
	01/11/93	60	0.185	0.001	0.073					01/11/93	60	0.162	0.001	1.888			
	01/13/93	62	0.170	0.000	0.106					01/13/93	62	0.148	0.001	1.936			
	01/20/93	69	0.132	0.001	0.078					01/20/93	69	0.135	0.001	1.791			
	01/25/93	74	0.176	0.001	0.123					01/25/93	74	0.159	0.001	2.207			
	01/27/93	76	0.152	0.001	0.106					01/27/93	76	0.147	0.001	11.089			
	02/01/93	81	0.115	0.002	0.058					02/01/93	81	0.103	0.002	1.878			
	02/03/93	83	0.157	0.002	-0.014					02/03/93	83	0.158	0.001	-0.007			
	02/08/93	88	0.212	0.000	-0.016					02/08/93	88	0.215	0.001	-0.017			
	02/10/93	90	0.204	0.000	-0.012					02/10/93	90	0.209	0.000	-0.009			
	02/17/93	97	0.194	0.000	-0.009					02/17/93	97	0.194	0.000	-0.007			
	02/24/93	104	0.178	0.000	-0.018					02/24/93	104	0.186	-0.001	-0.015			
	03/01/93	109	0.201	0.000	-0.011					03/01/93	109	0.201	0.001	-0.011			
	03/03/93	111	0.175	0.001	-0.011					03/03/93	111	0.049	0.000	-0.009			
	03/08/93	116	0.145	0.001	-0.011					03/08/93	116	0.157	0.000	-0.007			
	03/10/93	118	0.138	0.001	-0.009					03/10/93	118	0.139	0.001	-0.010			
	03/15/93	123	0.172	0.000	-0.013					03/15/93	123	0.153	0.000	-0.012			
	03/17/93	125	0.177	0.000	-0.011					03/17/93	125	0.176	0.000	-0.011			
	03/22/93	130	0.168	0.000	-0.012					03/22/93	130	0.153	0.001	-0.010			
	03/24/93	132	0.150	0.001	-0.011					03/24/93	132	0.150	0.000	-0.010			
	03/29/93	137	0.169	0.001	-0.009					03/29/93	137	0.176	0.001	-0.007			
	04/05/93	144	0.163	0.001	-0.010					04/05/93	144	0.150	0.001	-0.006			
	04/07/93	146	0.197	0.001	-0.013					04/07/93	146	0.179	0.001	-0.012			
	04/12/93	151	0.156	0.001	-0.002					04/12/93	151	0.156	0.007	-0.001			
	04/14/93	153	0.158	0.002	-0.006					04/14/93	153	0.159	0.001	-0.007			
	04/19/93	158	0.181	0.002	-0.006					04/19/93	158	0.159	0.001	-0.006			
	04/21/93	160	0.138	0.001	-0.006					04/21/93	160	0.115	0.001	-0.006			
	04/26/93	165	0.183	0.001	-0.008					04/26/93	165	0.160	0.000	-0.006			
	04/28/93	167	0.148	0.002	-0.006					04/28/93	167	0.141	0.001	-0.008			
	05/03/93	172	0.177	0.003	-0.006					05/03/93	172	0.133	0.001	-0.003			
	05/05/93	174	0.173	0.002	-0.007					05/05/93	174	0.122	0.000	-0.002			
	05/10/93	179	0.137	0.002	-0.005					05/10/93	179	0.131	0.001	-0.007			
	05/12/93	171	0.154	0.002	-0.004					05/12/93	171	0.130	0.000	-0.008			
	05/17/93	186	0.154	0.002	-0.008					05/17/93	186	0.112	0.000	-0.005			
	05/19/93	188	0.123	0.001	-0.009					05/19/93	188	0.109	0.001	-0.005			
	05/24/93	193	0.122	0.001	-0.010					05/24/93	193	0.121	0.000	-0.010			
	05/26/93	195	0.022	0.000	-0.008					05/26/93	195	0.022	0.000	-0.008			
	06/02/93	202	0.133	0.001	-0.003					06/02/93	202	0.133	0.001	-0.005			
	06/07/93	207	0.141	0.000	-0.006					06/07/93	207	0.125	0.002	-0.007			
	06/09/93	209	0.152	0.000	-0.007					06/09/93	209	0.134	0.003	-0.008			
	06/14/93	214								06/14/93	214						
	06/23/93	223								06/23/93	223						
	06/28/93	228	0.057	0.000	-0.005					06/28/93	228	0.057	0.001	-0.004			
	06/30/93	230	0.100	0.001	-0.010					06/30/93	230	0.082	0.001	-0.010			
	07/07/93	237	0.076	0.003	-0.008					07/07/93	237	0.063	0.001	-0.008			
	07/12/93	242	0.055	0.003	-0.012					07/12/93	242	0.046	0.000	-0.011			

* All units in mg/L.

Table B-3. Results of analyses of non-softened standing water samples of copper soldered pipe loops, phase I study.*

Loop 1	Date	Days	Cu	Pb	Zn	Ca	Mg	Na	Loop 2	Date	Days	Cu	Pb	Zn	Ca	Mg	Na
	07/14/93	244	0.130	0.003	-0.011					07/14/93	244	0.109	0.001	-0.012			
	07/19/93	249	0.104	0.001	-0.008					07/19/93	249	0.088	0.000	-0.006			
	07/21/93	251	0.112	0.001	-0.007					07/21/93	251	0.085	0.001	-0.003			
	07/26/93	256	0.084	0.000	-0.008					07/26/93	256	0.051	0.001	-0.006			
	07/28/93	258	0.101	0.000	-0.009					07/28/93	258	0.091	0.000	-0.007			
	08/02/93	263	0.112	0.001	-0.009					08/02/93	263	0.107	0.001	0.005	25.1	23.5	23.1
	08/04/93	265	0.078	0.000	0.004	24.1	22.6	21.1		08/04/93	265	0.067	0.001	0.005	24.4	22.9	20.8
	08/09/93	270	0.097	0.001	0.003	23.4	21.9	21.4		08/09/93	270	0.071	0.002	0.004	23.9	22.2	21.5
	08/11/93	272	0.112	0.000	0.004	25.5	23.3	21.1		08/11/93	272	0.092	0.000	0.005	25.5	23.1	21.0
	08/16/93	277								08/16/93	277						
	08/18/93	279	0.115	0.001	0.006	25.8	23.7	21.6		08/18/93	279	0.101	0.001	0.006	26.0	23.7	21.1
	08/23/93	284	0.113	0.000	0.011	26.0	23.7	22.8		08/23/93	284	0.096	0.001	0.006	25.0	23.3	22.8
	08/25/93	286	0.104	0.014	0.006	24.0	22.7	23.0		08/25/93	286	0.081	0.001	0.005	23.8	22.8	23.2
	08/30/93	291	0.111	0.000	0.002	25.7	23.0	25.8		08/30/93	291	0.093	0.003	0.005	25.6	22.8	24.4
	09/01/93	293	0.103	0.005	0.004	26.0	22.3	22.7		09/01/93	293	0.087	0.010	0.005	25.9	22.0	21.5
	09/08/93	300	0.119	0.001	0.004	26.4	24.2	26.1		09/08/93	300	0.102	0.005	0.006	26.7	24.0	25.1
	09/13/93	305	0.125	-0.001	0.002	26.3	24.4	24.9		09/13/93	305	0.108	0.005	0.003	26.3	24.5	25.1
	09/15/93	307	0.086	0.000	-0.001	25.9	23.1	27.6		09/15/93	307	0.071	0.004	-0.001	25.8	22.8	26.9
	09/20/93	312	0.068	0.001	-0.001	25.2	22.7	27.4		09/20/93	312	0.060	0.005	-0.001	25.2	22.5	26.8
	09/22/93	314	0.101	0.000	-0.001	26.4	24.1	26.8		09/22/93	314	0.090	0.006	-0.001	26.3	24.2	26.8
	09/27/93	319	0.100	0.000	-0.002	23.7	23.0	23.5		09/27/93	319	0.100	0.003	-0.003	24.6	23.6	23.1
	09/29/93	321	0.105	0.000	-0.001	24.6	23.8	26.3		09/29/93	321	0.093	0.004	0.003	25.8	23.8	25.0
	10/04/93	326	0.085	0.000	-0.002	23.4	23.4	27.1		10/04/93	326	0.077	0.004	-0.002	23.4	23.7	27.4
	10/06/93	328	0.078	0.001	0.000	22.6	23.3	28.6		10/06/93	328	0.066	0.004	0.002	22.5	22.7	27.7
	10/13/93	335	0.092	0.000	0.000	24.6	23.5	25.0		10/13/93	335	0.075	0.005	0.000	24.8	23.4	25.2
	10/18/93	340	0.087	0.001	0.001	22.9	23.9	27.2		10/18/93	340	0.073	0.005	0.000	22.5	23.8	27.6
	10/20/93	342	0.087	0.000	-0.001	24.3	23.8	25.8		10/20/93	342	0.074	0.004	-0.001	24.4	23.8	26.2
	10/25/93	347	0.097	0.000	-0.001	25.1	23.9	28.1		10/25/93	347	0.085	0.005	0.002	25.2	24.2	27.7
	11/08/93	361	0.093	-0.002	0.000	25.2	24.0	27.6		11/08/93	361	0.085	0.004	0.000	25.3	24.1	27.8
	11/10/93	363	0.099	0.001	-0.001	25.5	22.5	25.3		11/10/93	363	0.093	0.006	0.000	25.9	22.9	25.6
	11/15/93	368	0.094	0.001	-0.001	25.4	23.1	26.8		11/15/93	368	0.085	0.007	0.000	25.8	23.3	27.2
	11/17/93	370	0.088	0.001	-0.001	25.2	23.4	27.9		11/17/93	370	0.074	0.009	-0.001	25.4	23.7	28.2
	11/22/93	375	0.077	0.000	-0.002	25.5	24.0	30.8		11/22/93	375	0.068	0.009	-0.002	25.4	24.1	31.5
	11/24/93	377	0.073	0.001	0.000	24.8	23.6	32.0		11/24/93	377	0.062	0.007	0.001	24.7	23.2	31.4
	11/29/93	382	0.086	0.000	-0.004	24.8	23.9	27.8		11/29/93	382	0.080	0.007	-0.004	25.0	24.3	27.6
	12/01/93	384	0.080	-0.001	-0.001	24.7	24.2	31.2		12/01/93	384	0.069	0.008	0.003	25.0	23.7	29.3
	12/06/93	389	0.068	0.000	-0.001	23.7	22.2	26.0		12/06/93	389	0.062	0.008	0.000	23.9	22.5	26.4
	12/08/93	391	0.064	0.000	-0.001	23.8	22.1	25.6		12/08/93	391	0.056	0.007	-0.001	23.8	21.9	25.2
	12/13/93	396	0.074	0.000	0.001	24.8	23.1	26.3		12/13/93	396	0.065	0.006	0.002	24.4	22.9	26.7
	12/15/93	398	0.070	0.000	0.000	24.2	23.6	25.7		12/15/93	398	0.068	0.004	0.000	23.6	23.4	26.3
	12/20/93	403	0.083	0.001	-0.001	24.8	24.1	28.7		12/20/93	403	0.073	0.005	-0.002	24.7	24.0	28.4
	12/22/93	405	0.070	0.001	-0.001	23.4	22.8	25.9		12/22/93	405	0.064	0.004	-0.001	23.4	22.7	25.9
	12/27/93	410	0.059	0.001	0.000	23.7	22.6	26.4		12/27/93	410	0.052	0.003	0.000	24.0	23.3	26.8
	12/29/93	412	0.050	0.000	-0.001	23.2	21.9	26.2		12/29/93	412	0.047	0.003	0.000	23.2	22.1	26.7
	01/03/94	417	0.073	0.001	0.004	25.2	23.7	25.4		01/03/94	417	0.061	0.066	0.003	25.6	23.9	25.7
	01/05/94	419	0.069	0.000	-0.001	25.1	23.6	24.8		01/05/94	419	0.049	0.005	0.017	25.4	24.1	25.6
	01/10/94	424	0.072	0.002	-0.001	23.4	22.7	25.7		01/10/94	424	0.086	0.006	-0.001	23.8	22.8	25.5
	01/12/94	426	0.068	0.001	0.000	23.8	22.7	24.8		01/12/94	426	0.074	0.005	0.000	23.9	22.6	25.3
	01/24/94	438	0.061	0.000	0.000	24.9	24.1	27.3		01/24/94	438	0.062	0.003	0.023	23.3	22.2	24.9
	01/26/94	440	0.068	0.000	-0.001	24.5	23.5	25.5		01/26/94	440	0.069	0.005	-0.001	24.4	23.6	25.5
	01/31/94	445	0.056	0.001	0.000	24.8	22.2	24.8		01/31/94	445	0.056	0.004	0.000	24.9	22.4	25.4
	02/02/94	447	0.059	0.001	-0.002	25.2	23.5	28.0		02/02/94	447	0.058	0.002	0.000	24.9	22.9	27.0
	02/07/94	452	0.064	0.001	0.000	25.4	23.7	25.5		02/07/94	452	0.066	0.003	0.000	25.5	23.9	25.8
	02/09/94	454								02/09/94	454						
	02/16/94	461	0.061		-0.002	25.9	23.8	26.7		02/16/94	461	0.066		0.003	26.2	23.9	26.4
	02/23/94	468	0.059	0.001	0.001	25.4	22.9	25.9		02/23/94	468	0.054	0.005	0.001	25.0	22.4	26.1

* All units in mg/L.

Table B-3a. Results of analyses of softened standing water samples of copper soldered pipe loops, phase I study.*

Loop 1	Date	Days	Cu	Pb	Zn	Ca	Mg	Na	Loop 2	Date	Days	Cu	Pb	Zn	Ca	Mg	Na
	11/12/92	0								11/12/92	0						
	11/16/92	4	0.221	0.002	0.000					11/16/92	4	0.500	0.077	0.173			
	11/18/92	6	0.114	0.002	-0.012					11/18/92	6	0.138	0.007	-0.006			
	11/23/92	11	0.270	0.002	-0.010					11/23/92	11	0.289	0.004	0.000			
	11/26/92	13	0.234	0.001	-0.009					11/26/92	13	0.218	0.003	-0.007			
	11/30/92	18	0.188	0.001	-0.009					11/30/92	18	0.197	0.002	-0.008			
	12/02/92	20	0.178	0.002	-0.006					12/02/92	20	0.201	0.002	-0.006			
	12/07/92	25	0.197	0.001	-0.006					12/07/92	25	0.197	0.002	-0.005			
	12/09/92	27	0.263	0.001	-0.011					12/09/92	27	0.227	0.002	-0.008			
	12/14/92	32	0.235	0.001	-0.005					12/14/92	32	0.222	0.001	-0.006			
	12/16/92	34	0.273	0.001	-0.007					12/16/92	34	0.250	0.002	-0.012			
	12/21/92	39	0.257	0.000	-0.008					12/21/92	39	0.235	0.001	-0.012			
	12/23/92	41	0.279	0.001	0.010					12/23/92	41	0.225	0.000	-0.010			
	12/28/92	46	0.274	0.000	-0.010					12/28/92	46	0.274	0.001	-0.010			
	12/30/92	48	0.250	0.001	0.000					12/30/92	48	0.225	0.001	-0.009			
	01/04/93	53	0.275	0.000	-0.007					01/04/93	53	0.250	0.001	-0.008			
	01/06/93	55	0.277	0.001	-0.006					01/06/93	55	0.869	0.002	0.114			
	01/11/93	60	0.286	0.000	-0.010					01/11/93	60	0.263	0.001	0.000			
	01/13/93	62	0.249	0.000	-0.009					01/13/93	62	0.279	0.001	-0.003			
	01/20/93	69	0.204	0.001	-0.007					01/20/93	69	0.234	0.001	-0.024			
	01/25/93	74	0.327	0.000	-0.009					01/25/93	74	0.294	0.001	-0.011			
	01/27/93	76	0.327	0.001	-0.014					01/27/93	76	0.289	0.002	-0.008			
	02/01/93	81	0.244	0.002	-0.009					02/01/93	81	0.232	0.002	-0.014			
	02/03/93	83	0.242	0.000	-0.016					02/03/93	83	0.219	0.001	-0.014			
	02/08/93	88	0.276	0.000	-0.015					02/08/93	88	0.257	0.001	-0.012			
	02/10/93	90	0.288	0.000	-0.014					02/10/93	90	0.274	0.001	-0.012			
	02/17/93	97	0.281	0.000	-0.008					02/17/93	97	0.259	0.000	-0.005			
	02/24/93	104	0.223	-0.001	-0.014					02/24/93	104	0.178	-0.001	-0.009			
	03/01/93	109	0.274	0.001	-0.011					03/01/93	109	0.258	0.001	-0.008			
	03/03/93	111	0.255	0.000	-0.014					03/03/93	111	0.222	0.001	-0.010			
	03/08/93	116	0.236	0.000	-0.011					03/08/93	116	0.223	0.000	-0.008			
	03/10/93	118	0.233	0.000	-0.011					03/10/93	118	0.182	0.001	-0.010			
	03/15/93	123	0.207	0.000	-0.012					03/15/93	123	0.193	0.000	-0.013			
	03/17/93	125	0.196	0.000	-0.014					03/17/93	125	0.183	0.001	-0.009			
	03/22/93	130	0.227	0.001	-0.002					03/22/93	130	0.212	0.001	-0.013			
	03/24/93	132	0.191	0.000	-0.012					03/24/93	132	0.188	0.000	-0.010			
	03/29/93	137	0.244	0.000	-0.010					03/29/93	137	0.224	0.000	-0.009			
	04/05/93	144	0.192	0.001	-0.009					04/05/93	144	0.150	0.001	-0.010			
	04/07/93	146	0.208	0.000	-0.013					04/07/93	146	0.148	0.001	-0.011			
	04/12/93	151	0.220	0.001	-0.008					04/12/93	151	0.177	0.000	-0.007			
	04/14/93	153	0.204	0.001	-0.005					04/14/93	153	0.181	0.001	-0.006			
	04/19/93	158	0.215	0.000	-0.008					04/19/93	158	0.175	0.001	-0.006			
	04/21/93	160	0.175	0.000	-0.007					04/21/93	160	0.160	0.001	-0.007			
	04/26/93	165	0.205	0.001	-0.005					04/26/93	165	0.176	0.000	-0.005			
	04/28/93	167	0.199	0.000	-0.008					04/28/93	167	0.199	0.000	-0.008			
	05/03/93	172	0.203	0.001	-0.008					05/03/93	172	0.181	0.001	-0.008			
	05/05/93	174	0.198	0.001	-0.004					05/05/93	174	0.163	0.001	-0.006			
	05/10/93	179	0.229	0.000	-0.007					05/10/93	179	0.208	0.001	-0.003			
	05/12/93	171	0.167	0.000	-0.008					05/12/93	171	0.149	0.001	-0.005			
	05/17/93	186	0.186	0.000	-0.008					05/17/93	186	0.185	0.001	-0.008			
	05/19/93	188	0.170	0.001	-0.008					05/19/93	188	0.172	0.002	-0.009			
	05/24/93	193	0.174	0.000	-0.013					05/24/93	193	0.180	0.000	-0.012			
	05/26/93	195	0.196	0.000	-0.009					05/26/93	195	0.151	0.001	-0.005			
	06/02/93	202	0.202	0.001	-0.006					06/02/93	202	0.186	0.001	-0.004			
	06/07/93	207	0.212	0.001	-0.007					06/07/93	207	0.193	0.001	-0.007			
	06/09/93	209	0.182	0.001	-0.007					06/09/93	209	0.153	0.000	-0.010			
	06/14/93	214								06/14/93	214						
	06/23/93	223								06/23/93	223						
	06/28/93	228	0.202	0.000	-0.050					06/28/93	228	0.087	0.000	-0.029			
	06/30/93	230	0.089	0.002	-0.002					06/30/93	230	0.076	0.001	-0.004			
	07/07/93	237	0.104	0.001	-0.011					07/07/93	237	0.086	0.001	-0.012			
	07/12/93	242	0.115	0.000	-0.009					07/12/93	242	0.075	0.001	-0.008			

* All units in mg/L.

Table B-3a. Results of analyses of softened standing water samples of copper soldered pipe loops, phase I study.*

Loop 1	Date	Days	Cu	Pb	Zn	Ca	Mg	Na	Loop 2	Date	Days	Cu	Pb	Zn	Ca	Mg	Na
	07/14/93	244	0.067	0.001	-0.011					07/14/93	244	0.078	0.006	-0.011			
	07/19/93	249	0.163	0.001	-0.013					07/19/93	249	0.140	0.007	-0.017			
	07/21/93	251	0.172	0.001	-0.007					07/21/93	251	0.130	0.007	-0.006			
	07/26/93	256	0.113	0.000	-0.005					07/26/93	256	0.092	0.008	-0.005			
	07/28/93	258	0.061	0.001	-0.007					07/28/93	258	0.071	0.007	-0.007			
	08/02/93	263	0.136	0.000	-0.007					08/02/93	263	0.110	0.013	-0.007			
	08/04/93	265	0.111	0.000	0.006	0.0	0.0	93.5		08/04/93	265	0.092	0.005	0.005	0.0	0.0	101.2
	08/09/93	270	0.086	0.000	0.006	0.0	0.0	93.8		08/09/93	270	0.083	0.016	0.005	0.0	0.0	93.1
	08/11/93	272	0.078	0.000	0.005	0.0	0.1	85.4		08/11/93	272	0.078	0.007	0.005	0.0	0.0	88.2
	08/16/93	277								08/16/93	277						
	08/18/93	279	0.120	0.000	0.006	0.0	0.1	86.2		08/18/93	279	0.095	0.012	0.005	0.0	0.0	89.7
	08/23/93	284	0.119	0.001	0.006	0.0	0.0	94.7		08/23/93	284	0.106	0.006	0.006	0.0	0.0	95.5
	08/25/93	286	0.123	0.000	0.005	0.0	0.1	93.9		08/25/93	286	0.114	0.004	0.006	0.0	0.0	98.1
	08/30/93	291	0.112	0.002	0.006	0.0	0.0	94.6		08/30/93	291	0.097	0.003	0.006	0.0	0.1	95.4
	09/01/93	293	0.124	-0.001	0.005	0.0	0.0	98.0		09/01/93	293	0.114	-0.001	0.006	0.1	0.1	94.1
	09/08/93	300	0.106	0.002	0.006	0.0	0.0	93.5		09/08/93	300	0.106	0.002	0.005	0.1	0.0	94.7
	09/13/93	305	0.126	0.001	0.005	0.0	0.0	103.2		09/13/93	305	0.122	0.002	0.005	0.0	0.0	104.1
	09/15/93	307	0.110	0.001	0.003	0.0	0.0	103.4		09/15/93	307	0.105	0.000	0.002	0.0	0.0	100.1
	09/20/93	312	0.089	0.000	0.000	0.0	0.1	103.6		09/20/93	312	0.083	0.001	0.000	0.1	0.1	97.2
	09/22/93	314	0.075	0.000	0.000	0.0	0.0	99.1		09/22/93	314	0.077	0.001	0.000	0.0	0.0	98.4
	09/27/93	319	0.091	0.001	0.000	0.0	0.0	106.1		09/27/93	319	0.084	0.001	0.000	0.0	0.0	102.1
	09/29/93	321	0.091	0.000	-0.002	0.0	0.1	92.7		09/29/93	321	0.095	0.000	-0.002	0.0	0.0	90.5
	10/04/93	326	0.100	0.001	0.003	0.1	0.1	97.4		10/04/93	326	0.099	0.001	0.002	0.0	0.1	99.9
	10/06/93	328	0.089	0.000	-0.002	0.0	0.0	97.4		10/06/93	328	0.089	0.001	-0.002	0.0	0.0	100.0
	10/13/93	335	0.085	0.000	0.001	0.0	0.0	101.9		10/13/93	335	0.084	0.001	0.000	0.0	0.0	100.1
	10/18/93	340	0.094	0.002	0.006	0.0	0.0	99.5		10/18/93	340	0.090	0.001	0.001	0.0	0.1	98.3
	10/20/93	342	0.081	0.001	0.002	0.0	0.0	101.2		10/20/93	342	0.089	0.000	-0.001	0.0	0.1	99.9
	10/25/93	347	0.081	0.001	0.000	0.0	0.1	94.0		10/25/93	347	0.084	0.001	0.000	0.0	0.0	91.7
	11/08/93	361	0.078	0.001	0.006	0.0	0.1	102.5		11/08/93	361	0.098	0.000	0.002	0.0	0.0	105.3
	11/10/93	363	0.100	-0.001	0.004	0.1	0.1	103.6		11/10/93	363	0.102	-0.001	0.000	0.1	0.1	102.2
	11/15/93	368	0.090	0.001	0.004	0.1	0.1	103.0		11/15/93	368	0.099	0.000	0.003	0.1	0.1	101.9
	11/17/93	370	0.087	0.001	0.001	0.0	0.0	99.7		11/17/93	370	0.099	0.000	0.001	0.0	0.0	104.6
	11/22/93	375	0.087	0.000	0.000	0.0	0.0	101.3		11/22/93	375	0.087	0.001	0.000	0.0	0.0	98.4
	11/24/93	377	0.085	0.000	0.003	0.1	0.1	108.1		11/24/93	377	0.086	0.000	0.000	0.1	0.0	105.6
	11/29/93	382	0.076	0.001	0.003	0.0	0.1	108.2		11/29/93	382	0.077	-0.001	0.001	0.0	0.1	103.6
	12/01/93	384	0.079	0.001	0.003	0.0	0.0	104.1		12/01/93	384	0.087	0.001	0.000	0.0	0.0	95.4
	12/06/93	389	0.080	0.001	0.005	0.0	0.0	107.2		12/06/93	389	0.085	0.000	0.000	0.1	0.0	106.3
	12/08/93	391	0.074	0.001	0.002	0.0	0.1	97.3		12/08/93	391	0.078	0.001	0.001	0.0	0.0	101.9
	12/13/93	396	0.069	0.001	0.002	0.0	0.0	93.0		12/13/93	396	0.077	0.001	0.003	0.0	0.0	94.3
	12/15/93	398	0.066	0.000	0.005	0.0	0.0	101.2		12/15/93	398	0.077	0.000	0.000	0.0	0.0	94.2
	12/20/93	403	0.081	-0.001	0.001	0.0	0.1	96.3		12/20/93	403	0.078	0.000	0.000	0.0	0.0	94.0
	12/22/93	405	0.090	0.001	-0.001	0.0	0.0	103.6		12/22/93	405	0.088	0.000	-0.001	0.0	0.0	103.8
	12/27/93	410	0.084	0.001	0.001	0.0	0.1	98.6		12/27/93	410	0.078	0.001	0.000	0.0	0.1	100.0
	12/29/93	412	0.075	0.000	0.002	0.0	0.0	99.8		12/29/93	412	0.072	0.000	0.002	0.0	0.0	100.3
	01/03/94	417	0.070	0.000	0.000	0.0	0.1	94.5		01/03/94	417	0.070	0.001	0.000	0.0	0.1	96.0
	01/05/94	419	0.102	0.015	0.001	0.1	0.0	96.4		01/05/94	419	0.073	0.001	0.004	0.1	0.0	96.3
	01/10/94	424	0.080	0.001	0.004	0.0	0.0	97.5		01/10/94	424	0.057	0.002	0.031	0.1	0.1	91.7
	01/12/94	426	0.069	-0.001	0.000	0.1	0.1	92.9		01/12/94	426	0.108	0.000	0.049	0.0	0.1	97.0
	01/24/94	438	0.092	0.000	0.001	0.1	0.1	102.6		01/24/94	438	0.054	0.003	0.014	0.0	0.0	98.2
	01/26/94	440	0.067	0.001	0.000	0.1	0.1	98.1		01/26/94	440	0.047	0.000	0.008	0.1	0.0	94.2
	01/31/94	445	0.065	0.000	0.000	0.1	0.1	98.8		01/31/94	445	0.080	0.001	0.006	0.1	0.1	107.4
	02/02/94	447	0.068	0.001	0.002	0.1	0.1	97.9		02/02/94	447	0.053	0.001	0.007	0.1	0.1	98.2
	02/07/94	452	0.070		-0.004	0.1	0.1	99.8		02/07/94	452	0.050	-0.001	0.005	0.1	0.1	95.5
	02/09/94	454								02/09/94	454						
	02/16/94	461	0.064	0.001	0.001	0.1	0.1	102.2		02/16/94	461	0.062	0.001	0.004	0.1	0.0	102.2
	02/23/94	468	0.062		0.000	0.1	0.1	97.5		02/23/94	468	0.055		0.006	0.1	0.1	103.7

* All units in mg/L.

Table B-4. Results of analyses of non-softened standing water samples of galvanized pipe loops, phase I study.*

Loop 1	Date	Days	Cu	Pb	Zn	Ca	Mg	Na	Loop 2	Date	Days	Cu	Pb	Zn	Ca	Mg	Na
	11/12/92	0								11/12/92	0						
	11/16/92	4	0.040	0.014	11.059					11/16/92	4	0.036	0.013	12.059			
	11/18/92	6	0.019	0.010	8.678					11/18/92	6	0.019	0.008	6.924			
	11/23/92	11	0.048	0.007	5.573					11/23/92	11	0.073	0.014	20.562			
	11/26/92	13	-0.010	0.004	6.662					11/26/92	13	-0.010	0.003	5.349			
	11/30/92	18	0.011	0.003	8.792					11/30/92	18	0.009	0.004	8.554			
	12/02/92	20	0.001	0.003	7.638					12/02/92	20	0.001	0.004	5.130			
	12/07/92	25	-0.003	0.003	5.680					12/07/92	25	-0.003	0.002	3.831			
	12/09/92	27	0.011	0.003	9.362					12/09/92	27	0.013	0.003	6.335			
	12/14/92	32	-0.025	0.003	7.537					12/14/92	32	0.004	0.005	8.344			
	12/16/92	34	-0.005	0.002	7.559					12/16/92	34	0.011	0.003	6.872			
	12/21/92	39	0.032	0.003	3.598					12/21/92	39	0.032	0.002	5.086			
	12/23/92	41	0.039	0.003	7.616					12/23/92	41	0.039	0.001	6.482			
	12/28/92	46	0.050	0.006	20.570					12/28/92	46	0.052	0.002	3.682			
	12/30/92	48	0.031	0.002	6.440					12/30/92	48	0.031	0.004	11.557			
	01/04/93	53	0.025	0.005	18.534					01/04/93	53	0.050	0.007	16.194			
	01/06/93	55	0.015	0.003	9.360					01/06/93	55	0.033	0.004	11.163			
	01/11/93	60	0.015	0.003	10.825					01/11/93	60	0.049	0.003	7.740			
	01/13/93	62	0.019	0.004	8.150					01/13/93	62	0.040	0.003	10.756			
	01/20/93	69	0.003	0.003	6.912					01/20/93	69	0.027	0.002	4.748			
	01/25/93	74	0.033	0.003	12.877					01/25/93	74	0.057	0.002	15.482			
	01/27/93	76	0.023	0.002	9.397					01/27/93	76	0.045	0.003	14.310			
	02/01/93	81	0.019	0.002	7.710					02/01/93	81	0.032	0.003	8.197			
	02/03/93	83	0.003	0.001	7.576					02/03/93	83	0.005	0.001	7.363			
	02/08/93	88	0.010	0.001	8.990					02/08/93	88	0.019	0.000	7.326			
	02/10/93	90	0.001	0.001	7.895					02/10/93	90	-0.001	0.000	6.892			
	02/17/93	97	-0.001	0.000	9.220					02/17/93	97	-0.001	0.000	7.195			
	02/24/93	104	0.001	0.000	9.644					02/24/93	104	0.001	-0.001	5.973			
	03/01/93	109	0.001	0.000	9.505					03/01/93	109	0.001	0.000	6.582			
	03/03/93	111	0.000	0.001	12.345					03/03/93	111	-0.004	0.002	9.523			
	03/08/93	116	-0.004	0.001	5.446					03/08/93	116	-0.001	0.000	14.964			
	03/10/93	118	-0.006	0.001	9.351					03/10/93	118	-0.005	0.001	5.567			
	03/15/93	123	0.006	0.000						03/15/93	123	0.008	0.000				
	03/17/93	125	-0.003	0.000						03/17/93	125	0.002	0.000				
	03/22/93	130	0.003	0.000	9.426					03/22/93	130	-0.012	0.000	5.211			
	03/24/93	132	-0.001	0.000	8.989					03/24/93	132	-0.008	0.000	4.790			
	03/29/93	137	0.000	0.000	8.592					03/29/93	137	0.000	0.000	4.648			
	04/05/93	144	0.000	0.001	7.782					04/05/93	144		0.001	3.714			
	04/07/93	146	-0.002	0.001	4.548					04/07/93	146	-0.012	0.001	3.240			
	04/12/93	151	0.004	0.001	5.711					04/12/93	151	0.004	0.001	2.674			
	04/14/93	153	0.008	0.001	4.481					04/14/93	153	0.009	0.001	2.647			
	04/19/93	158	-0.002	0.001	5.905					04/19/93	158	-0.002	0.001	2.905			
	04/21/93	160	0.003	0.000	5.114					04/21/93	160	-0.004	0.000	2.645			
	04/26/93	165	0.003	0.000	5.559					04/26/93	165	0.003	0.000	2.388			
	04/28/93	167	0.001	0.001	6.233					04/28/93	167	0.001	0.001	3.143			
	05/03/93	172	0.001	0.001	5.516					05/03/93	172	0.001	0.001	2.734			
	05/05/93	174	0.006	0.000	4.312					05/05/93	174	0.006	0.000	2.163			
	05/10/93	179	0.006	0.001	4.140					05/10/93	179	0.007	0.000	2.356			
	05/12/93	171	0.007	0.000	5.629					05/12/93	171	0.012	0.000	2.861			
	05/17/93	186	-0.015	0.001	5.195					05/17/93	186	0.002	0.000	2.309			
	05/19/93	188	-0.001	0.001	4.914					05/19/93	188	-0.008	0.002	3.388			
	05/24/93	193	-0.003	0.000	6.340					05/24/93	193	-0.004	0.001	2.833			
	05/26/93	195	0.022	0.000	0.077					05/26/93	195		0.000	0.177			
	06/02/93	202	-0.003	0.000	7.198					06/02/93	202	0.005	0.001	2.951			
	06/07/93	207	0.005	0.000	6.615					06/07/93	207	0.005	0.001	2.626			
	06/09/93	209		0.001	6.640					06/09/93	209		0.000	2.599			
	06/14/93	214								06/14/93	214						
	06/23/93	223								06/23/93	223						
	06/28/93	228	-0.001	0.000	6.292					06/28/93	228	-0.001	0.002	3.016			
	06/30/93	230	0.003	0.000	6.631					06/30/93	230	0.004	0.001	2.849			
	07/07/93	237	0.005	0.001	6.025					07/07/93	237	-0.001	0.000	2.618			
	07/12/93	242	0.003	0.001	5.507					07/12/93	242	0.007	0.000	1.936			

* All units in mg/L.

Table B-4. Results of analyses of non-softened standing water samples of galvanized pipe loops, phase I study.*

Loop 1	Date	Days	Cu	Pb	Zn	Ca	Mg	Na	Loop 2	Date	Days	Cu	Pb	Zn	Ca	Mg	Na
	07/14/93	244	-0.004	0.001	6.178					07/14/93	244	-0.015	0.001	3.008			
	07/19/93	249	0.001	0.000	5.863					07/19/93	249	-0.001	0.000	2.071			
	07/21/93	251	-0.003	0.001	5.506					07/21/93	251	-0.012	0.000	2.101			
	07/26/93	256	-0.023	0.001	5.274					07/26/93	256	-0.016	0.000	1.639			
	07/28/93	258	-0.001	0.000	5.127					07/28/93	258	0.012	0.000	1.791			
	08/02/93	263	0.001	0.001	5.050	25.2	23.3	22.6		08/02/93	263	0.001	0.000	1.503	25.3	23.0	22.2
	08/04/93	265	-0.001	0.000	4.135	24.3	23.2	21.7		08/04/93	265	0.000	0.000	1.744	24.3	23.1	21.9
	08/09/93	270	0.000	0.001	5.069	24.1	22.2	21.6		08/09/93	270	0.001	0.001	1.570	24.3	22.3	21.5
	08/11/93	272	0.000	0.000	5.189	25.6	22.8	20.2		08/11/93	272	0.000	0.001	2.102	25.7	23.4	21.5
	08/16/93	277								08/16/93	277						
	08/18/93	279	0.002	0.001	5.329	25.8	23.8	22.4		08/18/93	279	0.001	0.001	2.583	25.9	23.7	21.1
	08/23/93	284	0.007	0.000	5.218	25.6	23.5	23.1		08/23/93	284	0.001	0.000	1.745	25.7	23.5	22.6
	08/25/93	286	0.001	0.001	5.461	23.9	22.4	23.2		08/25/93	286	0.001	0.004	1.820	23.8	22.5	23.7
	08/30/93	291	0.000	-0.001	5.277	25.9	22.9	25.1		08/30/93	291	0.003	0.000	2.702	26.0	23.0	24.9
	09/01/93	293	0.002	0.003	5.212	26.0	22.3	22.9		09/01/93	293	0.003	0.005	1.850	25.9	22.3	21.7
	09/08/93	300	0.001	0.000	3.871	26.7	23.9	25.6		09/08/93	300	0.000	0.000	1.415	26.8	24.0	24.8
	09/13/93	305	0.001	0.000	4.035	26.3	24.3	24.4		09/13/93	305	0.002	-0.001	1.472	26.0	24.0	24.1
	09/15/93	307	0.001	-0.001	4.279	25.7	22.6	26.8		09/15/93	307	0.000	0.000	1.696	25.7	22.8	27.5
	09/20/93	312	0.000	0.001	4.075	25.0	22.7	27.6		09/20/93	312	0.001	0.001	1.525	25.1	22.6	26.7
	09/22/93	314	0.003	0.000	4.320	26.6	23.9	26.3		09/22/93	314	0.002	0.000	1.674	26.4	23.9	26.2
	09/27/93	319	-0.005	0.000	4.481	24.2	23.1	23.1		09/27/93	319	-0.005	-0.001	1.613	24.0	22.8	21.9
	09/29/93	321	0.001	0.000	3.595	25.8	23.8	25.0		09/29/93	321	0.001	0.001	1.457	25.8	23.6	25.3
	10/04/93	326	0.001	0.002	7.743	23.0	23.4	28.6		10/04/93	326	-0.001	0.001	1.983	23.1	23.8	28.1
	10/06/93	328	0.002	0.000	4.919	22.7	23.3	28.4		10/06/93	328	0.002	0.000	2.211	22.4	22.7	27.9
	10/13/93	335	0.001	0.000	4.233	24.7	23.4	25.0		10/13/93	335	0.001	0.000	1.975	24.5	23.6	26.1
	10/18/93	340	0.001	0.000	3.787	22.7	23.1	25.9		10/18/93	340	0.000	0.000	1.676	22.7	23.4	26.7
	10/20/93	342	0.001	0.000	4.350	24.2	23.9	26.6		10/20/93	342	0.000	0.001	2.054	24.3	23.5	25.4
	10/25/93	347	0.003	0.000	4.009	25.3	23.7	27.2		10/25/93	347	0.001	0.000	1.731	26.3	24.0	27.1
	11/08/93	361	0.002	-0.001	4.223	25.3	24.0	27.8		11/08/93	361	0.002	-0.001	1.876	25.2	24.0	27.9
	11/10/93	363	0.000	0.000	3.872	25.8	22.9	26.1		11/10/93	363	0.000	0.000	1.918	25.0	22.1	25.0
	11/15/93	368	0.000	0.000	3.813	26.0	23.4	27.4		11/15/93	368	0.002	0.001	1.928	25.6	23.0	26.4
	11/17/93	370	0.004	0.000	4.348	25.1	23.7	28.3		11/17/93	370	0.001	-0.001	2.344	25.8	24.1	29.3
	11/22/93	375	-0.001	0.000	4.432	25.7	23.9	31.2		11/22/93	375	0.000	0.000	2.294	25.6	24.0	31.5
	11/24/93	377	0.000	0.000	4.345	24.5	24.0	34.0		11/24/93	377	0.001	0.000	2.404	24.9	23.1	31.0
	11/29/93	382	-0.001	-0.001	3.646	24.7	23.5	27.3		11/29/93	382	0.000	-0.001	1.686	24.8	23.9	27.6
	12/02/93	384	0.000	-0.001	3.790	24.8	24.1	31.3		12/02/93	384	0.000	0.000	1.949	25.2	23.9	29.6
	12/06/93	389	0.003	0.000	3.707	23.6	22.1	26.3		12/06/93	389	0.000	0.000	1.874	24.1	22.5	26.3
	12/08/93	391	0.000	0.000	3.918	24.0	22.1	25.8		12/08/93	391	0.000	0.000	2.029	24.0	22.2	25.6
	12/13/93	396	0.002	0.000	3.910	24.5	22.6	25.9		12/13/93	396	0.002	0.000	2.393	24.3	22.5	26.2
	12/15/93	398	0.001	-0.001	3.490	24.4	23.8	26.5		12/15/93	398	0.002	0.000	1.933	23.8	23.3	25.7
	12/20/93	403	0.002	0.000	3.570	24.7	23.9	28.6		12/20/93	403	0.001	0.000	1.625	24.9	24.0	28.5
	12/22/93	405	0.003	0.001	3.644	23.4	22.8	26.2		12/22/93	405	0.003	0.001	2.077	23.6	23.0	26.3
	12/27/93	410	0.000	0.001	3.843	24.1	22.9	27.0		12/27/93	410	0.002	-0.001	1.787	24.3	23.3	27.0
	12/29/93	412	0.003	0.000	3.934	23.4	21.8	26.1		12/29/93	412	0.002	0.000	1.785	23.4	22.2	26.7
	01/03/94	417	0.001	0.003	3.370	24.9	23.5	25.5		01/03/94	417	0.001	0.001	1.229	26.1	23.9	25.2
	01/05/94	419	0.001	0.001	3.224	25.2	23.5	24.5		01/05/94	419	0.000	0.000	1.899	24.5	22.8	23.3
	01/10/94	424	0.001	0.000	3.049	23.9	22.7	25.6		01/10/94	424	0.000	0.000	1.197	23.8	22.7	25.5
	01/12/94	426	0.001	0.001	3.229	23.9	22.2	24.3		01/12/94	426	-0.001	0.001	1.414	24.1	22.6	25.0
	01/24/94	438	-0.001	0.000	2.550	25.0	24.1	27.1		01/24/94	438	0.001	0.000	1.046	23.9	23.0	24.7
	01/26/94	440	0.000	0.001	3.277	24.7	23.6	25.8		01/26/94	440	0.039	0.015	0.056	77.1	26.0	24.9
	01/31/94	445	-0.002	0.001	2.768	24.3	22.3	25.6		01/31/94	445	0.000	0.000	1.236	24.5	23.5	25.5
	02/02/94	447	0.002	0.000	2.989	25.1	23.0	27.3		02/02/94	447	0.000	0.002	1.690	24.6	22.0	24.9
	02/07/94	452	0.000	0.001	2.302	25.4	23.6	25.4		02/07/94	452	0.002	0.000	1.095	25.0	23.3	27.9
	02/09/94	454								02/09/94	454						
	02/16/94	461	0.002		3.559	26.2	23.8	26.5		02/16/94	461	0.000	0.001	0.735	25.2	23.5	25.4
	02/23/94	468	0.003	0.000	2.521	25.5	22.7	26.1		02/23/94	468	0.002		1.089	26.2	24.1	27.0

* All units in mg/L.

Table B-4a. Results of analyses of softened standing water samples of galvanized pipe loops, phase I study.*

Loop 1	Date	Days	Cu	Pb	Zn	Ca	Mg	Na	Loop 2	Date	Days	Cu	Pb	Zn	Ca	Mg	Na
	11/12/92	0								11/12/92	0						
	11/16/92	4	0.008	0.014	14.640					11/16/92	4	0.004	0.024	12.385			
	11/18/92	6	-0.005	0.015	14.513					11/18/92	6	-0.005	0.014	8.348			
	11/23/92	11	-0.004	0.023	29.026					11/23/92	11	-0.004	0.029	16.928			
	11/26/92	13	-0.002	0.004	7.371					11/26/92	13	-0.004	0.006	7.694			
	11/30/92	18	-0.011	0.003	7.227					11/30/92	18	0.005	0.009	9.559			
	12/02/92	20	0.001	0.013	5.222					12/02/92	20	0.001	0.007	8.847			
	12/07/92	25	-0.003	0.006	9.979					12/07/92	25	-0.003	0.003	5.470			
	12/09/92	27	-0.009	0.005	11.845					12/09/92	27	-0.009	0.010	7.687			
	12/14/92	32	0.009	0.010	11.989					12/14/92	32	-0.001	0.005	9.035			
	12/16/92	34	-0.005	0.006	10.197					12/16/92	34	-0.005	0.007	9.796			
	12/21/92	39	-0.004	0.001	5.704					12/21/92	39	-0.004	0.009	10.723			
	12/23/92	41	-0.004	0.001	8.931					12/23/92	41	0.004	0.002	9.081			
	12/28/92	46	0.001	0.005	13.980					12/28/92	46	0.009	0.003	8.874			
	12/30/92	48	0.000	0.005	10.294					12/30/92	48	0.000	0.003	9.078			
	01/04/93	53	0.000	0.007	17.848					01/04/93	53	0.000	0.005	11.128			
	01/06/93	55	0.011	0.010	20.390					01/06/93	55	0.012	0.006	13.679			
	01/11/93	60	0.011	0.013	21.722					01/11/93	60	-0.009	0.004	12.717			
	01/13/93	62	-0.003	0.012	23.004					01/13/93	62	-0.002	0.007	15.655			
	01/20/93	69	-0.011	0.005	10.236					01/20/93	69	0.009	0.004	11.661			
	01/25/93	74	0.013	0.009	18.900					01/25/93	74	0.000	0.008	16.534			
	01/27/93	76	-0.011	0.021	27.325					01/27/93	76	-0.015	0.017	21.584			
	02/01/93	81	0.000	0.011	18.927					02/01/93	81	0.002	0.006	12.564			
	02/03/93	83	0.007	0.014	25.259					02/03/93	83	0.010	0.012	17.707			
	02/08/93	88	0.001	0.012	21.867					02/08/93	88	0.001	0.003	11.895			
	02/10/93	90	-0.001	0.027	43.970					02/10/93	90	-0.001	0.007	16.213			
	02/17/93	97	-0.001	0.013	20.361					02/17/93	97	-0.001	0.008	15.451			
	02/24/93	104	0.001	0.004	17.927					02/24/93	104	0.001	0.003	14.587			
	03/01/93	109	0.001	0.004	13.274					03/01/93	109	-0.007	0.005	13.544			
	03/03/93	111	-0.010	0.008	17.403					03/03/93	111	-0.004	0.005	9.966			
	03/08/93	116	-0.001	0.006	11.661					03/08/93	116	-0.008	0.003	11.724			
	03/10/93	118	-0.016	0.003	12.425					03/10/93	118	-0.002	0.003	12.776			
	03/15/93	123	0.013	0.005						03/15/93	123	0.005	0.002				
	03/17/93	125	0.000	0.003	12.290					03/17/93	125	0.000	0.004	14.067			
	03/22/93	130	-0.014	0.004	11.510					03/22/93	130	-0.015	0.003	10.903			
	03/24/93	132	0.003	0.008	13.313					03/24/93	132	0.003	0.005	11.173			
	03/29/93	137	0.000	0.005	12.331					03/29/93	137	0.000	0.005	12.308			
	04/05/93	144		0.003	9.133					04/05/93	144		0.003	9.870			
	04/07/93	146	-0.004	0.007	10.426					04/07/93	146	0.004	0.004	8.363			
	04/12/93	151	-0.003	0.003	5.346					04/12/93	151	0.005	0.003	7.210			
	04/14/93	153	-0.002	0.008	9.075					04/14/93	153	-0.002	0.006	7.295			
	04/19/93	158	-0.013	0.005	9.515					04/19/93	158	0.000	0.004	8.363			
	04/21/93	160	0.003	0.007	8.334					04/21/93	160	0.003	0.004	7.806			
	04/26/93	165	0.004	0.007	9.012					04/26/93	165	0.004	0.002	7.301			
	04/28/93	167	0.009	0.001	6.644					04/28/93	167	0.001	0.002	8.078			
	05/03/93	172	-0.001	0.002	6.227					05/03/93	172	0.006	0.003	7.517			
	05/05/93	174	0.001	0.006	6.884					05/05/93	174	-0.005	0.004	7.224			
	05/10/93	179	0.009	0.002	5.022					05/10/93	179	0.009	0.002	6.010			
	05/12/93	171	-0.002	0.004	7.380					05/12/93	171	0.008	0.004	8.171			
	05/17/93	186	-0.004	0.001	5.179					05/17/93	186	-0.005	0.002	5.799			
	05/19/93	188	0.004	0.004	6.221					05/19/93	188	0.000	0.005	7.238			
	05/24/93	193	-0.007	0.006	9.383					05/24/93	193	0.000	0.006	10.289			
	05/26/93	195	0.007	0.003						05/26/93	195	-0.003	0.004				
	06/02/93	202	-0.003	0.003	7.879					06/02/93	202	-0.003	0.003	9.598			
	06/07/93	207	0.008	0.002	6.777					06/07/93	207	0.004	0.003	8.268			
	06/09/93	209		0.007	9.277					06/09/93	209		0.007	9.539			
	06/14/93	214								06/14/93	214						
	06/23/93	223								06/23/93	223						
	06/28/93	228	-0.056	0.004	6.038					06/28/93	228	0.089	0.006	7.431			
	06/30/93	230	-0.014	0.005	8.591					06/30/93	230	-0.008	0.007	9.838			
	07/07/93	237	-0.013	0.004	7.687					07/07/93	237	-0.012	0.008	9.870			
	07/12/93	242	0.005	0.003	5.909					07/12/93	242	-0.001	0.004	8.046			

* All units in mg/L.

Table B-4a. Results of analyses of softened standing water samples of galvanized pipe loops, phase I study.*

Loop 1	Date	Days	Cu	Pb	Zn	Ca	Mg	Na	Loop 2	Date	Days	Cu	Pb	Zn	Ca	Mg	Na
	07/14/93	244	0.009	0.002	4.985					07/14/93	244	0.000	0.002	6.178			
	07/19/93	249	-0.022	0.005	6.565					07/19/93	249	-0.005	0.006	8.399			
	07/21/93	251	0.003	0.002	5.164					07/21/93	251	-0.002	0.003	6.874			
	07/26/93	256	-0.022	0.004	6.353					07/26/93	256	-0.018	0.007	8.599			
	07/28/93	258	-0.008	0.002	4.596					07/28/93	258	-0.008	0.003	6.012			
	08/02/93	263	-0.005	0.008	7.354					08/02/93	263	-0.011	0.008	8.534			
	08/04/93	265	0.002	0.002	4.521	0.0	0.0	95.6		08/04/93	265	0.001	0.003	6.230	0.0	0.1	96.2
	08/09/93	270	0.001	0.005	6.676	0.0	0.0	92.3		08/09/93	270	0.000	0.006	7.585	0.0	0.0	91.2
	08/11/93	272	0.000	0.001	4.155	0.0	0.0	84.2		08/11/93	272	0.000	0.004	6.262	0.0	0.0	91.3
	08/16/93	277								08/16/93	277						
	08/18/93	279	0.000	0.005	6.209	0.0	0.0	87.5		08/18/93	279	0.000	0.006	7.341	0.1	0.0	89.1
	08/23/93	284	0.002	0.008	8.028	0.0	0.0	92.8		08/23/93	284	0.002	0.006	8.019	0.0	0.0	93.4
	08/25/93	286	0.001	0.000	4.282	0.1	0.0	95.3		08/25/93	286	0.000	0.001	6.378	0.1	0.1	94.2
	08/30/93	291	0.000	0.002	4.498	0.0	0.0	94.1		08/30/93	291	0.001	0.002	6.260	0.0	0.0	92.6
	09/01/93	293	0.001	0.003	5.878	0.0	0.0	97.0		09/01/93	293	0.003	0.012	13.808	0.1	0.0	95.7
	09/08/93	300	0.002	0.007	6.342	0.0	0.0	96.4		09/08/93	300	0.003	0.008	8.096	0.1	0.0	93.1
	09/13/93	305	0.002	0.005	4.847	0.0	0.0	102.1		09/13/93	305	0.002	0.008	6.243	0.0	0.1	101.6
	09/15/93	307	0.001	0.002	3.450	0.1	0.0	103.4		09/15/93	307	0.000	0.003	4.925	0.0	0.0	102.8
	09/20/93	312	0.001	0.006	6.090	0.0	0.0	105.6		09/20/93	312	0.001	0.008	7.767	0.0	0.0	98.0
	09/22/93	314	0.000	0.003	4.600	0.0	0.0	98.5		09/22/93	314	0.001	0.005	6.357	0.0	0.0	100.0
	09/27/93	319	0.001	0.003	4.350	0.0	0.0	107.9		09/27/93	319	0.000	0.004	5.798	0.0	0.0	97.0
	09/29/93	321	-0.005	0.000	3.868	0.0	0.0	91.1		09/29/93	321	0.000	0.001	5.767	0.0	0.1	96.3
	10/04/93	326	0.001	0.004	4.614	0.1	0.1	98.7		10/04/93	326	0.001	0.005	6.297	0.1	0.1	99.3
	10/06/93	328	0.000	0.002	4.536	0.0	0.0	101.5		10/06/93	328	0.000	0.010	9.924	0.0	0.0	100.6
	10/13/93	335	0.002	0.002	5.909	0.0	0.1	96.7		10/13/93	335	0.001	0.005	7.992	0.0	0.1	105.1
	10/18/93	340	0.000	0.003	5.280	0.0	0.0	100.9		10/18/93	340	0.003	0.005	7.655	0.0	0.1	97.8
	10/20/93	342	0.000	0.001	3.884	0.0	0.0	105.1		10/20/93	342	0.002	0.001	5.772	0.0	0.1	100.5
	10/25/93	347	0.003	0.004	5.458	0.0	0.1	95.0		10/25/93	347	0.000	0.005	7.082	0.0	0.0	94.7
	11/08/93	361	0.001	0.000	4.647	0.0	0.0	101.9		11/08/93	361	0.000	0.002	6.256	0.0	0.0	104.4
	11/10/93	363	0.002	0.001	5.446	0.1	0.1	103.8		11/10/93	363	0.002	0.004	6.936	0.1	0.1	102.7
	11/15/93	368	-0.001	0.003	5.089	0.1	0.1	102.1		11/15/93	368	-0.002	0.005	7.567	0.1	0.1	105.7
	11/17/93	370	0.001	0.002	3.651	0.1	0.0	102.5		11/17/93	370	0.001	0.003	5.804	0.0	0.0	106.1
	11/22/93	375	0.003	0.003	4.918	0.0	0.1	96.4		11/22/93	375	0.003	0.006	7.008	0.0	0.0	99.6
	11/24/93	377	0.000	0.000	4.074	0.1	0.1	110.5		11/24/93	377	0.001	0.002	6.408	0.1	0.0	103.4
	11/29/93	382	-0.001	0.002	4.731	0.0	0.0	101.1		11/29/93	382	0.000	0.004	6.927	0.0	0.0	106.9
	12/02/93	384	0.000	0.001	3.524	0.0	0.0	98.7		12/02/93	384	0.000	0.003	5.613	0.0	0.0	105.3
	12/06/93	389	0.002	0.003	4.690	0.1	0.0	107.2		12/06/93	389	0.001	0.007	7.843	0.1	0.0	103.2
	12/08/93	391	0.005	0.001	3.778	0.1	0.0	93.3		12/08/93	391	0.001	0.002	5.303	0.1	0.1	102.5
	12/13/93	396	0.000	0.003	4.761	0.0	0.0	99.4		12/13/93	396	0.001	0.008	6.938	0.0	0.0	92.8
	12/15/93	398	0.002	0.001	3.627	0.0	0.1	102.3		12/15/93	398	0.003	0.001	5.535	0.1	0.0	96.7
	12/20/93	403	0.002	0.003	4.443	0.0	0.1	99.4		12/20/93	403	0.003	0.006	7.127	0.0	0.1	98.6
	12/22/93	405	0.001	0.001	3.381	0.0	0.0	105.9		12/22/93	405	0.002	0.004	6.717	0.0	0.1	104.6
	12/27/93	410	0.002	0.004	4.676	0.0	0.1	99.0		12/27/93	410	0.003	0.005	7.070	0.0	0.1	99.6
	12/29/93	412	0.002	0.002	3.850	0.0	0.0	100.7		12/29/93	412	0.003	0.001	5.743	0.0	0.0	100.0
	01/03/94	417	0.003	0.005	4.964	0.0	0.1	96.3		01/03/94	417	0.003	0.005	7.284	0.1	0.1	95.5
	01/05/94	419	0.001	0.003	4.162	0.1	0.1	95.9		01/05/94	419	0.000	0.002	5.746	0.1	0.0	96.0
	01/10/94	424	0.000	0.012	6.211	0.1	0.1	93.3		01/10/94	424	0.001	0.020	11.434	0.1	0.1	87.1
	01/12/94	426	0.000	0.004	3.877	0.0	0.0	97.6		01/12/94	426	0.003	0.002	5.569	0.0	0.1	95.9
	01/24/94	438	0.004	0.034	13.195	0.1	0.1	98.6		01/24/94	438	0.005	0.047	21.545	0.1	0.0	97.9
	01/26/94	440	0.000	0.007	5.488	0.1	0.0	94.6		01/26/94	440	0.003	0.007	7.051	0.1	0.1	94.3
	01/31/94	445	0.002	0.009	6.982	0.1	0.1	103.7		01/31/94	445	0.029	0.020	0.117	75.1	26.7	26.0
	02/02/94	447	0.001	0.013	7.156	0.1	0.1	97.6		02/02/94	447	0.001	0.016	12.200	0.1	0.1	105.2
	02/07/94	452	0.002	0.003	4.629	0.1	0.1	96.2		02/07/94	452	0.000	0.008	7.261	0.1	0.0	97.8
	02/09/94	454								02/09/94	454						
	02/16/94	461	0.000	0.001	2.843	0.1	0.1	100.6		02/16/94	461	0.002	0.001	5.517	0.1	0.1	96.3
	02/23/94	468	0.001		7.019	0.1	0.1	102.8		02/23/94	468	0.000	0.008	7.937	0.1	0.1	103.0

* All units in mg/L.

Table B-5. Results of analyses of non-softened water samples of facuets, phase I study.*

Loop 1	Date	Days	Cu	Pb	Zn	Ca	mg	Na	Loop 2	Date	Days	Cu	Pb	Zn	Ca	Mg	Na
	11/12/92	0								11/12/92	0						
	11/16/92	4	0.035	0.023	1.619					11/16/92	4	0.011	0.019	1.727			
	11/18/92	6	0.011	0.019	1.233					11/18/92	6	0.011	0.018	1.418			
	11/23/92	11	0.021	0.014	1.033					11/23/92	11	0.015	0.016	1.955			
	11/26/92	13	-0.004	0.007	0.019					11/26/92	13	-0.004	0.007	0.019			
	11/30/92	18	0.010	0.007	0.013					11/30/92	18	0.011	0.008	0.037			
	12/02/92	20	0.001	0.007	0.010					12/02/92	20	0.001	0.008	0.021			
	12/07/92	25	0.019	0.007	0.014					12/07/92	25	0.019	0.008	0.010			
	12/09/92	27	0.013	0.000	-0.009					12/09/92	27	0.013	0.001	-0.011			
	12/14/92	32	0.028	0.008	0.022					12/14/92	32	0.029	0.009	0.006			
	12/16/92	34	0.019	0.006	0.015					12/16/92	34	0.019	0.008	0.008			
	12/21/92	39	0.025	0.008	0.689					12/21/92	39	0.017	0.009	0.668			
	12/23/92	41	0.017	0.009	0.990					12/23/92	41	0.017	0.008	0.924			
	12/28/92	46	0.030	0.009	1.226					12/28/92	46	0.023	0.014	1.409			
	12/30/92	48	0.016	0.008	1.067					12/30/92	48	0.025	0.008	0.831			
	01/04/93	53	0.025	0.008	1.338					01/04/93	53	0.350	0.028	1.414			
	01/06/93	55	0.009	0.006	1.327					01/06/93	55	0.033	0.007	1.146			
	01/11/93	60	0.041	0.008	1.451					01/11/93	60	0.042	0.008	1.317			
	01/13/93	62	0.019	0.006	1.584					01/13/93	62	0.019	0.004	1.267			
	01/20/93	69	0.029	0.007	1.487					01/20/93	69	0.289	0.019	1.146			
	01/25/93	74	0.037	0.007	1.093					01/25/93	74	0.037	0.008	1.190			
	01/27/93	76	0.005	0.008	1.349					01/27/93	76	-0.001	0.006	1.401			
	02/01/93	81	0.038	0.009	0.893					02/01/93	81	0.038	0.008	0.910			
	02/03/93	83	0.018	0.005	0.056					02/03/93	83	0.005	0.004	0.007			
	02/08/93	88	0.021	0.004	-0.006					02/08/93	88	0.021	0.004	-0.005			
	02/10/93	90	0.020	0.004	0.010					02/10/93	90	0.020	0.004	0.002			
	02/17/93	97	0.020	0.003	0.029					02/17/93	97	0.020	0.003	0.001			
	02/24/93	104	0.024	0.002	-0.005					02/24/93	104	0.024	0.002	-0.010			
	03/01/93	109	0.009	0.004	0.003					03/01/93	109	0.016	0.004	-0.004			
	03/03/93	111	0.016	0.007	0.018					03/03/93	111	0.003	0.006	-0.002			
	03/08/93	116	0.025	0.003	0.013					03/08/93	116	0.018	0.004	0.000			
	03/10/93	118	0.008	0.004	0.001					03/10/93	118	0.002	0.005	-0.002			
	03/15/93	123	0.017	0.003	-0.005					03/15/93	123	0.032	0.004	-0.003			
	03/17/93	125	0.008	0.002	-0.001					03/17/93	125	0.008	0.003	-0.005			
	03/22/93	130	0.008	0.004	0.009					03/22/93	130	0.008	0.004	-0.003			
	03/24/93	132	0.005	0.002	0.000					03/24/93	132	0.026	0.003	-0.007			
	03/29/93	137	0.020	0.003	0.009					03/29/93	137	0.020	0.004	0.001			
	04/05/93	144	0.007	0.004	0.001					04/05/93	144	0.021	0.005	0.002			
	04/07/93	146	0.011	0.003	-0.003					04/07/93	146	0.012	0.004	-0.001			
	04/12/93	151	0.026	0.006	0.022					04/12/93	151	0.011	0.005	-0.008			
	04/14/93	153	0.017	0.004	0.003					04/14/93	153	0.010	0.005	0.003			
	04/19/93	158	0.008	0.005	0.012					04/19/93	158	0.018	0.005	0.003			
	04/21/93	160	0.003	0.003	0.002					04/21/93	160	0.003	0.004	0.008			
	04/26/93	165	0.025	0.003	0.010					04/26/93	165	0.018	0.004	0.008			
	04/28/93	167	0.023	0.004	0.009					04/28/93	167	0.016	0.005	-0.001			
	05/03/93	172	0.023	0.004	0.012					05/03/93	172	0.023	0.004	0.003			
	05/05/93	174	0.006	0.003	0.001					05/05/93	174	0.007	0.004	0.003			
	05/10/93	179	0.007	0.004	0.007					05/10/93	179	0.030	0.004	0.002			
	05/12/93	171	0.026	0.003	0.007					05/12/93	171	0.026	0.003	0.000			
	05/17/93	186	0.000	0.004	0.006					05/17/93	186	0.006	0.004	-0.004			
	05/19/93	188	0.001	0.004	-0.003					05/19/93	188	0.002	0.003	0.004			
	05/24/93	193	0.016	0.004	0.004					05/24/93	193	0.016	0.004	-0.007			
	05/26/93	195		0.000	-0.007					05/26/93	195	0.015	0.001	-0.002			
	06/02/93	202	0.020	0.003	0.005					06/02/93	202	0.027	0.004	-0.002			
	06/07/93	207	0.020	0.005	0.013					06/07/93	207	0.021	0.005				
	06/09/93	209		0.003	0.003					06/09/93	209	0.015	0.004	-0.002			
	06/09/93	214								06/09/93	214						
	06/23/93	223								06/23/93	223						
	06/28/93	228	0.018	0.004	0.014					06/28/93	228	0.018	0.005	0.003			
	06/30/93	230	0.011	0.003	-0.002					06/30/93	230	0.011	0.003	-0.009			
	07/07/93	237	0.018	0.004	0.006					07/07/93	237	0.018	0.004	0.000			
	07/12/93	242	0.008	0.003	-0.005					07/12/93	242	0.011	0.005	-0.001			

* All units in mg/L.

Table B-5. Results of analyses of non-softened water samples of facuets, phase I study.*

Loop 1	Date	Days	Cu	Pb	Zn	Ca	mg	Na	Loop 2	Date	Days	Cu	Pb	Zn	Ca	Mg	Na
	07/14/93	244	-0.007	0.005	-0.007					07/14/93	244	-0.006	0.004	0.000			
	07/19/93	249	0.012	0.004	0.015					07/19/93	249	0.020	0.005	0.001			
	07/21/93	251	0.020	0.003	0.005					07/21/93	251	0.007	0.004	0.001			
	07/26/93	256	0.004	0.004	0.004					07/26/93	256	-0.016	0.005	-0.004			
	07/28/93	258	0.021	0.003	0.007					07/28/93	258	0.007	0.003	-0.002			
	08/02/93	263	0.024	0.005	0.119	25.2	23.2	22.6		08/02/93	263	0.014	0.005	0.013	25.2	23.2	22.3
	08/04/93	265	0.000	0.001	0.006	24.5	23.0	21.0		08/04/93	265	0.001	0.001	0.006	24.5	23.0	21.2
	08/09/93	270	0.013	0.004	0.019	24.3	22.2	21.2		08/09/93	270	0.008	0.003	0.009	24.3	22.2	21.1
	08/11/93	272	0.010	0.003	0.014	25.6	23.1	21.5		08/11/93	272	0.008	0.004	0.011	25.6	22.9	20.8
	08/16/93	277								08/16/93	277						
	08/18/93	279	0.013	0.003	0.017	25.8	23.5	21.1		08/18/93	279	0.013	0.004	0.011	26.0	23.5	20.7
	08/23/93	284	0.019	0.004	0.025	26.0	23.7	22.9		08/23/93	284	0.010	0.004	0.014	25.9	23.6	22.9
	08/25/93	286	0.016	0.003	0.020	24.0	22.7	23.6		08/25/93	286	0.017	0.018	0.011	23.8	22.8	24.1
	08/30/93	291	0.010	0.002	0.019	25.9	22.8	24.2		08/30/93	291	0.008	0.001	0.007	25.7	23.2	25.0
	09/01/93	293	0.014	0.008	0.020	26.1	22.4	22.3		09/01/93	293	0.012	0.008	0.007	25.9	22.5	22.5
	09/08/93	300	0.014	0.003	0.019	26.9	23.7	24.1		09/08/93	300	0.011	0.004	0.010	26.7	23.7	24.3
	09/13/93	305	0.016	0.004	0.017	26.8	24.3	23.4		09/13/93	305	0.009	0.004	0.005	26.7	23.9	23.8
	09/15/93	307	0.011	0.003	0.012	25.6	22.8	28.0		09/15/93	307	0.010	0.003	0.005	25.8	22.9	27.2
	09/20/93	312	0.017	0.004	0.016	24.5	22.4	26.6		09/20/93	312	0.007	0.004	0.005	22.3	20.7	25.8
	09/22/93	314	0.011	0.003	0.006	26.5	24.0	25.8		09/22/93	314	0.012	0.003	0.005	26.2	24.2	26.1
	09/27/93	319	0.007	0.003	0.011	24.9	24.0	23.6		09/27/93	319	0.005	0.003	0.004	25.0	23.8	23.3
	09/29/93	321	0.013	0.004	0.014	25.7	23.7	25.5		09/29/93	321	0.011	0.004	0.010	25.8	23.8	25.2
	10/04/93	326	0.023	0.005	0.021	23.3	23.5	27.3		10/04/93	326	0.011	0.003	0.005	23.0	23.1	26.5
	10/06/93	328	0.011	0.003	0.012	22.6	22.7	27.9		10/06/93	328	0.009	0.003	0.006	22.6	22.8	28.3
	10/13/93	335	0.013	0.003	0.013	24.7	23.8	26.0		10/13/93	335	0.011	0.003	0.006	24.6	23.6	26.0
	10/18/93	340	0.013	0.003	0.025	21.8	22.6	25.9		10/18/93	340	0.011	0.003	0.006	23.2	24.1	27.9
	10/20/93	342	0.011	0.003	0.011	24.2	23.5	25.6		10/20/93	342	0.009	0.003	0.005	23.8	23.1	25.1
	10/25/93	347	0.017	0.003	0.026	26.2	24.3	27.6		10/25/93	347	0.014	0.003	0.008	26.2	24.0	26.7
	11/08/93	361	0.025	0.003	0.050	25.2	24.0	27.7		11/08/93	361	0.015	0.001	0.010	25.1	24.3	28.3
	11/10/93	363	0.015	0.003	0.012	26.0	22.8	25.7		11/10/93	363	0.012	0.004	0.007	26.0	23.3	26.5
	11/15/93	368	0.016	0.003	0.016	26.2	23.6	27.1		11/15/93	368	0.013	0.004	0.007	26.1	23.4	26.9
	11/17/93	370	0.014	0.002	0.014	24.6	23.6	28.6		11/17/93	370	0.014	0.003	0.006	24.8	23.7	28.6
	11/22/93	375	0.012	0.002	0.016	25.5	24.1	31.2		11/22/93	375	0.010	0.003	0.006	25.5	24.2	31.9
	11/24/93	377	0.013	0.003	0.012	24.7	22.9	30.5		11/24/93	377	0.010	0.003	0.007	24.8	23.1	30.9
	11/29/93	382	0.015	0.003	0.014	25.7	24.8	28.6		11/29/93	382	0.011	0.003	0.003	25.6	24.9	28.7
	12/02/93	384	0.012	0.002	0.013	25.1	24.1	29.8		12/02/93	384	0.013	0.004	0.006	25.3	23.7	29.0
	12/06/93	389	0.022	0.004	0.019	23.8	22.1	25.6		12/06/93	389	0.026	0.005	0.005	23.7	21.6	24.8
	12/08/93	391	0.011	0.003	0.012	23.8	22.2	26.0		12/08/93	391	0.012	0.004	0.004	23.9	22.3	26.3
	12/13/93	396	0.014	0.003	0.017	23.5	21.9	25.2		12/13/93	396	0.011	0.003	0.001	24.1	22.5	25.8
	12/15/93	398	0.017	0.003	0.008	23.5	23.3	26.1		12/15/93	398	0.012	0.004	0.047	23.8	23.5	25.9
	12/20/93	403	0.013	0.003	0.013	24.7	23.8	27.7		12/20/93	403	0.015	0.003	0.005	24.8	23.9	27.9
	12/22/93	405	0.013	0.003	0.016	23.5	23.6	28.1		12/22/93	405	0.010	0.003	0.004	23.2	23.1	26.5
	12/27/93	410	0.013	0.002	0.010	24.2	23.5	27.1		12/27/93	410	0.010	0.002	0.003	24.1	23.5	27.4
	12/29/93	412	0.011	0.002	0.011	23.3	22.4	27.1		12/29/93	412	0.016	0.003	0.004	23.4	22.1	26.4
	01/03/94	417	0.015	0.005	0.016	26.0	23.7	24.8		01/03/94	417	0.022	0.006	0.010	26.3	23.7	24.7
	01/05/94	419	0.011	0.002	0.010	24.6	23.0	23.5		01/05/94	419	0.010	0.003	0.005	24.6	22.9	23.8
	01/10/94	424	0.013	0.003	0.012	23.8	22.6	25.1		01/10/94	424	0.012	0.004	0.021	23.9	22.8	25.4
	01/12/94	426	0.034	0.011	0.032	24.0	22.6	24.9		01/12/94	426	0.094	0.029	0.153	24.0	22.8	25.3
	01/24/94	438	0.026	0.004	0.012	23.8	22.7	24.1		01/24/94	438	0.059	0.005	0.010	23.9	22.9	24.3
	01/26/94	440	0.013	0.004	0.011	24.6	23.6	25.7		01/26/94	440	0.025	0.004	0.007	24.7	23.8	25.8
	01/31/94	445	0.010	0.004	0.008	24.6	22.4	25.4		01/31/94	445	0.020	0.005	0.006	24.4	22.3	25.6
	02/02/94	447	0.015	0.003	0.018	25.4	23.1	26.9		02/02/94	447	0.076	0.006	0.011	25.4	23.0	26.7
	02/07/94	452	0.012	0.004	0.016	25.1	23.7	25.6		02/07/94	452	0.015	0.004	0.003	25.4	24.1	26.3
	02/09/94	454								02/09/94	454						
	02/16/94	461	0.013		0.008	25.1	23.5	26.0		02/16/94	461	0.014		0.004	25.1	23.7	26.3
	02/23/94	468	0.011	0.003	0.008	25.5	23.0	25.9		02/23/94	468	0.014	0.003	0.007	25.0	23.1	26.7

* All units in mg/L.

Tables B-5a. Results of analyses of softened water samples of faucets, phase I study.*

Loop 1	Date	Days	Cu	Pb	Zn	Ca	Mg	Na	Loop 2	Date	Days	Cu	Pb	Zn	Ca	Mg	Na
	11/12/92	0								11/12/92	0						
	11/16/92	4	0.027	0.037	0.018					11/16/92	4	0.003	0.021	0.010			
	11/18/92	6	0.019	0.039	0.006					11/18/92	6	-0.005	0.024	0.003			
	11/23/92	11	0.016	0.015	0.011					11/23/92	11	0.016	0.018	0.014			
	11/26/92	13	0.017	0.011	0.012					11/26/92	13	0.017	0.015	0.015			
	11/30/92	18	0.013	0.011	0.021					11/30/92	18	0.013	0.020	0.123			
	12/02/92	20	0.016	0.011	0.014					12/02/92	20	0.016	0.011	0.008			
	12/07/92	25	0.019	0.008	0.011					12/07/92	25	0.019	0.012	0.015			
	12/09/92	27	0.298	0.014	0.170					12/09/92	27	-0.009	0.010	0.009			
	12/14/92	32	0.015	0.006	0.011					12/14/92	32	0.016	0.008	0.013			
	12/16/92	34	0.019	0.006	0.003					12/16/92	34	0.019	0.009	0.008			
	12/21/92	39	0.017	0.012	0.014					12/21/92	39	0.017	0.006	0.004			
	12/23/92	41	0.026	0.007	0.013					12/23/92	41	0.027	0.009	0.011			
	12/28/92	46	0.024	0.006	0.012					12/28/92	46	0.009	0.010	0.036			
	12/30/92	48	0.025	0.007	0.022					12/30/92	48	0.008	0.008	0.009			
	01/04/93	53	0.008	0.006	0.019					01/04/93	53	0.000	0.009	0.012			
	01/06/93	55	0.012	0.007	0.015					01/06/93	55	0.013	0.008	0.018			
	01/11/93	60	0.016	0.009	0.023					01/11/93	60	0.009	0.009	0.015			
	01/13/93	62	0.022	0.006	0.025					01/13/93	62	0.015	0.013	0.033			
	01/20/93	69	0.030	0.007	0.013					01/20/93	69	0.031	0.009	0.013			
	01/25/93	74	0.021	0.006	0.040					01/25/93	74	0.021	0.009	0.010			
	01/27/93	76	0.008	0.006	0.032					01/27/93	76	0.009	0.008	0.015			
	02/01/93	81	0.021	0.009	0.044					02/01/93	81	0.041	0.014	0.150			
	02/03/93	83	0.031	0.007	0.016					02/03/93	83	0.025	0.008	-0.002			
	02/08/93	88	0.021	0.006	0.034					02/08/93	88	0.021	0.008	-0.002			
	02/10/93	90	0.020	0.006	0.022					02/10/93	90	0.020	0.008	0.008			
	02/17/93	97	0.020	0.006	0.021					02/17/93	97	0.020	0.007	0.069			
	02/24/93	104	0.024	0.004	0.015					02/24/93	104	0.001	0.004	0.010			
	03/01/93	109	0.005	0.007	0.013					03/01/93	109	0.004	0.009	0.031			
	03/03/93	111	0.028	0.012	0.209					03/03/93	111	0.003	0.010	0.008			
	03/08/93	116	0.018	0.008	0.044					03/08/93	116	0.012	0.009	0.008			
	03/10/93	118	0.025	0.005	0.018					03/10/93	118	0.016	0.006	0.004			
	03/15/93	123	0.033	0.007	0.033					03/15/93	123	0.012	0.006	0.002			
	03/17/93	125	0.020	0.003	0.022					03/17/93	125	0.020	0.006	0.005			
	03/22/93	130	0.019	0.006	0.036					03/22/93	130	0.005	0.007	0.010			
	03/24/93	132	0.023	0.005	0.020					03/24/93	132	0.023	0.006	0.005			
	03/29/93	137	0.020	0.010	0.051					03/29/93	137	0.020	0.008	0.009			
	04/05/93	144		0.006	0.017					04/05/93	144		0.008	0.008			
	04/07/93	146	0.004	0.005	0.015					04/07/93	146	0.004	0.007	0.011			
	04/12/93	151	0.056	0.010	0.040					04/12/93	151	0.020	0.008	0.022			
	04/14/93	153	0.006	0.007	0.017					04/14/93	153	-0.002	0.007	0.007			
	04/19/93	158	0.017	0.006	0.028					04/19/93	158	0.018	0.007	0.010			
	04/21/93	160	0.003	0.006	0.012					04/21/93	160	0.010	0.007	0.029			
	04/26/93	165	0.027	0.008	0.037					04/26/93	165	0.027	0.007	0.014			
	04/28/93	167	0.023	0.006	0.016					04/28/93	167	0.016	0.007	0.010			
	05/03/93	172	0.013	0.006	0.017					05/03/93	172	0.013	0.008	0.010			
	05/05/93	174	0.025	0.006	0.009					05/05/93	174	0.011	0.007	0.010			
	05/10/93	179	0.030	0.008	0.015					05/10/93	179	0.030	0.010	0.012			
	05/12/93	171	0.014	0.005	0.003					05/12/93	171	0.028	0.010	0.587			
	05/17/93	186	0.017	0.006	0.011					05/17/93	186	0.016	0.007	0.011			
	05/19/93	188	0.008	0.006	0.012					05/19/93	188	0.021	0.008	0.011			
	05/24/93	193	0.021	0.006	0.009					05/24/93	193	0.021	0.007	0.007			
	05/26/93	195	0.018	0.007	0.017					05/26/93	195	0.018	0.007	0.010			
	06/02/93	202	0.020	0.007	0.019					06/02/93	202	0.012	0.006	0.015			
	06/07/93	207	0.020	0.006	0.018					06/07/93	207	0.020	0.006	0.008			
	06/09/93	209	0.010	0.005	0.013					06/09/93	209	0.010	0.006	0.008			
	06/09/93	214								06/09/93	214						
	06/23/93	223								06/23/93	223						
	06/28/93	228	0.009	0.006	0.019					06/28/93	228	0.022	0.007	0.008			
	06/30/93	230	0.018	0.008	0.133					06/30/93	230	0.012	0.008	0.059			
	07/07/93	237	0.015	0.007	0.012					07/07/93	237	0.008	0.007	-0.004			
	07/12/93	242	0.018	0.008	0.098					07/12/93	242	0.017	0.011	0.338			

* All units in mg/L.

Tables B-5a. Results of analyses of softened water samples of faucets, phase I study.*

Loop 1	Date	Days	Cu	Pb	Zn	Ca	Mg	Na	Loop 2	Date	Days	Cu	Pb	Zn	Ca	Mg	Na
	07/14/93	244	0.013	0.006	0.004					07/14/93	244	0.014	0.007	-0.001			
	07/19/93	249	0.003	0.006	0.002					07/19/93	249	0.012	0.007	-0.012			
	07/21/93	251	0.030	0.007	0.015					07/21/93	251	0.023	0.008	-0.001			
	07/26/93	256	-0.004	0.008	0.015					07/26/93	256	0.003	0.007	0.002			
	07/28/93	258	0.001	0.007	0.006					07/28/93	258	-0.004	0.008	-0.003			
	08/02/93	263	0.010	0.008	0.012					08/02/93	263	0.010	0.007	0.002			
	08/04/93	265	0.018	0.006	0.020	0.1	0.1	100.9		08/04/93	265	0.015	0.007	0.013	0.1	0.1	99.8
	08/09/93	270	0.013	0.007	0.018	0.0	0.1	93.0		08/09/93	270	0.013	0.007	0.014	0.1	0.0	93.2
	08/11/93	272	0.012	0.007	0.018	0.0	0.0	93.3		08/11/93	272	0.010	0.006	0.011	0.0	0.0	93.2
	08/16/93	277								08/16/93	277						
	08/18/93	279	0.018	0.008	0.021	0.0	0.1	92.5		08/18/93	279	0.014	0.008	0.012	0.1	0.1	94.1
	08/23/93	284	0.019	0.008	0.022	0.1	0.0	94.1		08/23/93	284	0.016	0.008	0.014	0.1	0.0	94.5
	08/25/93	286	0.019	0.006	0.021	0.0	0.0	98.8		08/25/93	286	0.017	0.007	0.014	0.0	0.0	95.2
	08/30/93	291	0.022	0.008	0.204	0.0	0.1	93.1		08/30/93	291	0.017	0.011	0.127	0.0	0.0	91.9
	09/01/93	293	0.019	0.003	0.028	0.0	0.1	98.2		09/01/93	293	0.016	0.007	0.019	0.1	0.1	97.5
	09/08/93	300	0.017	0.008	0.021	0.0	0.1	101.2		09/08/93	300	0.015	0.010	0.015	0.0	0.0	102.3
	09/13/93	305	0.020	0.008	0.020	0.1	0.1	114.1		09/13/93	305	0.018	0.007	0.014	0.1	0.1	111.4
	09/15/93	307	0.015	0.007	0.016	0.0	0.0	107.1		09/15/93	307	0.018	0.007	0.012	0.0	0.1	107.1
	09/20/93	312	0.014	0.006	0.014	0.1	0.1	95.4		09/20/93	312	0.013	0.007	0.014	0.1	0.0	97.8
	09/22/93	314	0.016	0.007	0.080	0.1	0.1	112.8		09/22/93	314	0.014	0.008	0.014	0.1	0.1	108.3
	09/27/93	319	0.014	0.006	0.013	0.1	0.1	108.9		09/27/93	319	0.014	0.008	0.013	0.1	0.1	105.8
	09/29/93	321	0.016	0.006	0.013	0.0	0.1	94.8		09/29/93	321	0.016	0.007	0.012	0.0	0.1	94.5
	10/04/93	326	0.017	0.007	0.016	0.0	0.0	106.7		10/04/93	326	0.017	0.008	0.006	0.0	0.0	105.3
	10/06/93	328	0.014	0.006	0.023	0.1	0.1	112.3		10/06/93	328	0.016	0.007	0.021	0.1	0.1	109.0
	10/13/93	335	0.015	0.006	0.022	0.1	0.1	116.1		10/13/93	335	0.016	0.006	0.010	0.1	0.1	111.7
	10/18/93	340	0.017	0.006	0.020	0.1	0.1	99.3		10/18/93	340	0.015	0.006	0.027	0.0	0.1	99.3
	10/20/93	342	0.018	0.005	0.020	0.1	0.1	115.9		10/20/93	342	0.017	0.006	0.012	0.1	0.1	112.0
	10/25/93	347	0.018	0.006	0.019	0.1	0.1	114.3		10/25/93	347	0.016	0.007	0.012	0.1	0.1	113.2
	11/08/93	361	0.019	0.007	0.023	0.0	0.1	102.8		11/08/93	361	0.018	0.006	0.029	0.0	0.1	104.3
	11/10/93	363	0.020	0.007	0.018	0.1	0.1	103.6		11/10/93	363	0.018	0.006	0.013	0.1	0.1	104.5
	11/15/93	368	0.013	0.006	0.026	0.1	0.1	103.9		11/15/93	368	0.013	0.007	0.020	0.1	0.1	103.2
	11/17/93	370	0.017	0.006	0.015	0.1	0.1	113.8		11/17/93	370	0.019	0.006	0.020	0.1	0.1	112.9
	11/22/93	375	0.017	0.005	0.015	0.1	0.1	107.2		11/22/93	375	0.016	0.005	0.014	0.1	0.1	106.4
	11/24/93	377	0.018	0.007	0.021	0.1	0.1	103.4		11/24/93	377	0.018	0.006	0.013	0.1	0.1	102.5
	11/29/93	382	0.015	0.005	0.017	0.1	0.1	103.3		11/29/93	382	0.013	0.005	0.010	0.1	0.0	99.5
	12/02/93	384	0.017	0.007	0.017	0.1	0.1	116.9		12/02/93	384	0.017	0.006	0.012	0.1	0.1	112.2
	12/06/93	389	0.018	0.004	0.017	0.2	0.1	109.6		12/06/93	389	0.017	0.005	0.008	0.1	0.1	109.0
	12/08/93	391	0.017	0.007	0.015	0.1	0.0	101.8		12/08/93	391	0.017	0.006	0.011	0.1	0.1	103.0
	12/13/93	396	0.014	0.005	0.016	0.0	0.0	89.0		12/13/93	396	0.013	0.006	0.010	0.0	0.0	94.6
	12/15/93	398	0.016	0.005	0.015	0.1	0.1	108.8		12/15/93	398	0.015	0.005	0.010	0.1	0.1	104.9
	12/20/93	403	0.017	0.005	0.013	0.1	0.1	106.8		12/20/93	403	0.016	0.005	0.013	0.1	0.1	106.0
	12/22/93	405	0.017	0.005	0.016	0.0	0.1	102.2		12/22/93	405	0.015	0.005	0.013	0.1	0.0	103.0
	12/27/93	410	0.016	0.006	0.014	0.1	0.1	100.4		12/27/93	410	0.015	0.006	0.009	0.1	0.1	103.0
	12/29/93	412	0.015	0.004	0.016	0.1	0.1	109.3		12/29/93	412	0.014	0.005	0.015	0.0	0.1	111.8
	01/03/94	417	0.014	0.004	0.013	0.1	0.1	105.8		01/03/94	417	0.015	0.004	0.011	0.1	0.1	104.0
	01/05/94	419	0.016	0.006	0.015	0.1	0.1	98.0		01/05/94	419	0.015	0.006	0.017	0.1	0.0	101.6
	01/10/94	424	0.011	0.003	0.016	0.1	0.1	96.8		01/10/94	424	0.011	0.004	0.016	0.1	0.1	91.2
	01/12/94	426	0.016	0.005	0.012	0.1	0.1	102.2		01/12/94	426	0.014	0.005	0.013	0.1	0.1	100.4
	01/24/94	438	0.014	0.005	0.015	0.1	0.1	105.4		01/24/94	438	0.014	0.006	0.014	0.1	0.1	107.3
	01/26/94	440	0.015	0.005	0.013	0.1	0.1	100.0		01/26/94	440	0.012	0.005	0.028	0.1	0.1	100.2
	01/31/94	445	0.016	0.005	0.015	0.1	0.1	111.6		01/31/94	445	0.016	0.006	0.026	0.1	0.1	106.4
	02/02/94	447	0.011	0.005	0.010	0.1	0.0	95.8		02/02/94	447	0.011	0.005	0.007	0.1	0.1	94.9
	02/07/94	452	0.013	0.004	0.011	0.1	0.1	95.0		02/07/94	452	0.013	0.005	0.025	0.1	0.1	96.8
	02/09/94	454								02/09/94	454						
	02/16/94	461	0.023	0.007	0.246	0.1	0.1	109.7		02/16/94	461	0.014	0.006	0.015	0.1	0.1	105.6
	02/23/94	468	0.012		0.020	0.1	0.1	102.8		02/23/94	468	0.012		0.015	0.1	0.1	99.9

* All units in mg/L.

Appendix C

Table C-1. Results of analyses of non-softened standing water samples of lead pipe loops, phase II study.*

Loop 1	Date	Days	Cu	Pb	ZN	Ca	Mg	Na	Loop 2	Date	Days	Cu	Pb	Zn	Ca	Mg	Na
	11/23/94	1	0.006	1.057	0.001	86.0	24.8	42.9		11/23/94	1	0.002	0.750	0.001	84.4	24.5	42.7
	11/29/94	7	0.001	0.620	-0.001	74.6	21.3	37.7		11/29/94	7	0.001	0.571	-0.001	77.6	22.1	38.6
	12/02/94	10	0.004	0.996	0.000	80.1	22.0	39.4		12/02/94	10	0.002	1.019	0.000	82.9	23.2	41.8
	12/06/94	14	0.003	0.941	0.000	70.5	19.9	44.1		12/06/94	14	0.002	0.951	0.000	71.2	20.1	45.1
	12/08/94	16	0.003	0.874	0.000	65.2	18.7	38.0		12/08/94	16	0.002	0.868	-0.001	66.5	19.2	39.9
	12/13/94	21	0.002	0.570	0.000	64.4	20.2	38.8		12/13/94	21	0.002	0.583	0.000	62.5	19.7	38.6
	12/16/94	24	0.002	0.558	0.000	62.3	19.5	37.0		12/16/94	24	0.002	0.593	0.000	63.1	20.0	38.8
	12/20/94	28	0.003	0.696	0.000	70.8	21.7	40.0		12/20/94	28	0.002	0.685	0.000	66.4	20.6	38.2
	12/22/94	30	0.002	0.560	-0.002	62.3	19.9	38.0		12/22/94	30	0.001	0.557	-0.002	57.7	18.5	35.2
	12/28/94	36	0.003	0.521	0.000	68.6	22.0	41.4		12/28/94	36	0.002	0.539	-0.001	68.0	22.2	42.8
	12/30/94	38	0.001	0.577	-0.001	70.8	21.8	39.5		12/30/94	38	0.001	0.646	-0.001	73.7	23.2	41.6
	01/04/95	43	0.003	0.573	0.011	63.5	19.8	33.5		01/04/95	43	0.003	0.541	0.010	58.9	19.0	32.7
	01/05/95	44	0.004	0.753	0.010	69.3	20.2	36.5		01/05/95	44	0.003	0.813	0.005	76.0	22.3	40.2
	01/13/95	52	0.003	0.814	0.003	78.7	22.2	37.3		01/13/95	52	0.002	0.740	0.003	72.5	20.7	34.5
	01/18/95	57	0.003	0.803	-0.005	80.5	24.3	41.1		01/18/95	57	0.001	0.718	-0.005	74.8	22.8	39.1
	01/20/95	59	0.002	0.893	-0.002	82.1	24.2	42.2		01/20/95	59	0.001	0.716	-0.001	70.3	20.9	36.9
	01/24/95	63	0.002	0.818	0.002	80.5	25.0	41.0		01/24/95	63	0.002	0.781	0.002	78.9	24.7	40.8
	01/26/95	65	0.003	0.817	0.000	76.3	22.5	31.6		01/26/95	65	0.000	0.784	-0.001	79.3	22.7	31.3
	01/31/95	70	0.001	0.831	-0.001	82.9	23.4	35.4		01/31/95	70	0.000	0.769	0.000	78.0	22.2	32.1
	02/02/95	72	0.004	0.763	-0.001	69.6	21.5	38.1		02/02/95	72	0.003	0.641	-0.001	68.5	21.3	38.6
	02/07/95	77	0.003	0.780	-0.001	73.1	21.3	39.5		02/07/95	77	0.002	0.681	-0.001	75.3	22.2	41.8
	02/09/95	79	0.003	0.842	0.000	81.8	23.9	45.5		02/09/95	79	0.002	0.721	-0.001	81.8	24.0	45.4
	02/14/95	84	0.003	0.795	-0.001	82.5	23.7	40.9		02/14/95	84	0.002	0.773	-0.002	80.2	24.0	42.4
	02/24/95	94	0.005	0.838	-0.001	84.1	25.1	48.3		02/24/95	94	0.003	0.760	-0.001	84.3	25.0	46.7
	02/28/95	98	0.007	0.823	-0.001	84.4	25.9	49.1		02/28/95	98	0.004	0.740	0.000	84.9	26.0	49.7
	03/03/95	101	0.001	0.900	-0.005	99.5	27.9	44.1		03/03/95	101	0.002	0.890	-0.002	98.2	28.4	46.8
	03/07/95	105	0.006	0.921	-0.002	92.9	26.6	49.4		03/07/95	105	0.002	0.774	-0.001	87.2	25.0	47.4
	03/08/95	107	0.004	0.859	-0.003	86.8	25.2	48.7		03/08/95	107	0.002	0.785	-0.003	85.5	25.5	49.1
	03/14/95	112	0.006	0.774	-0.004	80.9	23.2	47.5		03/14/95	112	0.003	0.711	-0.004	81.1	23.7	48.7
	03/16/95	114	0.005	0.835	-0.004	83.4	23.4	47.9		03/16/95	114	0.002	0.789	-0.005	84.8	23.6	48.2
	03/21/95	119	0.006	0.682	-0.005	81.5	22.9	51.7		03/21/95	119	0.004	0.656	-0.004	81.2	22.7	50.6
	03/23/95	121	0.004	0.544	-0.001	66.8	20.1	37.8		03/23/95	121	0.003	0.526	-0.001	68.5	20.7	40.0
	03/28/95	126	0.003	0.728	0.003	87.1	24.1	43.0		03/28/95	126	0.001	0.744	0.001	89.2	24.2	41.8
	03/30/95	128	0.005	0.682	0.000	84.7	24.1	41.2		03/30/95	128	0.002	0.699	-0.001	84.3	23.9	41.0
	04/04/95	133	0.005	0.803	-0.004	97.4	26.1	42.0		04/04/95	133	0.001	0.760	-0.004	99.3	27.2	44.2
	04/06/95	135	0.005	0.758	0.000	92.5	26.1	48.3		04/06/95	135	0.004	0.798	0.000	91.5	25.8	49.3
	04/11/95	140	0.004	0.484	-0.003	82.3	26.6	43.2		04/11/95	140	0.003	0.521	-0.003	82.8	26.2	40.9
	04/13/95	142	0.005	0.467	-0.001	78.0	24.5	40.5		04/13/95	142	0.002	0.509	0.002	81.2	25.1	41.2
	04/18/95	147	0.007	0.504	-0.001	76.4	23.6	36.8		04/18/95	147	0.005	0.530	-0.001	78.0	24.4	38.4
	04/20/95	149	0.005	0.632	0.005	87.7	24.8	40.8		04/20/95	149	0.004	0.667	0.004	88.1	24.7	39.8
	04/25/95	154	0.003	0.516	0.002	80.3	24.8	36.3		04/25/95	154	0.002	0.536	-0.001	78.7	24.2	34.5
	04/27/95	156	0.005	0.561	0.001	81.1	23.7	42.9		04/27/95	156	0.004	0.635	0.001	84.3	24.3	43.7
	05/02/95	161	0.005	0.172	-0.001	81.6	24.7	44.9		05/02/95	161	0.003	0.492	-0.003	81.3	24.7	44.1
	05/09/95	168	0.003	0.528	-0.003	80.7	24.4	40.2		05/09/95	168	0.003	0.553	-0.003	79.7	24.2	39.9
	05/11/95	170	0.005	0.483	0.000	82.9	24.2	38.4		05/11/95	170	0.006	0.556	-0.001	83.7	24.1	37.9
	05/16/95	175	0.000	0.501	-0.001	78.6	22.6	35.7		05/16/95	175	0.003	0.545	-0.001	76.0	22.7	37.3
	05/18/95	177	0.004	0.506	-0.001	74.4	22.2	34.4		05/18/95	177	0.004	0.536	-0.001	74.7	22.2	34.3
	05/23/95	182	0.005	0.504	-0.001	79.8	22.9	41.6		05/23/95	182	0.004	0.555	-0.001	80.5	23.0	41.0
	05/30/95	189	0.004	0.666	-0.001	89.5	24.6	46.0		05/30/95	189	0.002	0.656	-0.001	89.8	24.5	45.4
	06/01/95	191	0.005	0.636	-0.001	86.6	24.6	47.3		06/01/95	191	0.003	0.670	-0.001	88.0	24.8	46.6
	06/06/95	196	0.004	0.719	-0.001	93.6	25.0	43.2		06/06/95	196	0.004	0.747	-0.001	94.0	24.9	43.4
	06/08/95	198	0.004	0.691	-0.001	89.6	23.2	43.5		06/08/95	198	0.003	0.702	-0.001	88.7	23.2	43.2
	06/13/95	203	0.003	0.616	0.005	78.7	22.1	29.9		06/13/95	203	0.004	0.532	-0.001	78.9	22.1	29.8
	06/15/95	205	0.008	0.628	-0.001	88.1	24.7	41.3		06/15/95	205	0.003	0.643	-0.002	88.2	24.3	38.6
	06/20/95	210	0.006	0.681	-0.001	86.6	23.9	40.7		06/20/95	210	0.007	0.678	-0.001	86.5	23.7	40.2
	06/22/95	212	0.007	0.620	-0.002	81.9	23.6	34.5		06/22/95	212	0.006	0.605	-0.002	78.7	22.8	31.9
	06/27/95	217	0.004	0.627	-0.002	89.9	24.2	37.1		06/27/95	217	0.005	0.671	-0.002	91.6	23.6	35.1
	06/29/95	219	0.005	0.569	-0.002	83.1	23.5	35.9		06/29/95	219	0.006	0.567	-0.001	80.5	23.7	37.3
	07/06/95	226	0.005	0.598	-0.002	78.9	22.3	35.9		07/06/95	226	0.005	0.571	-0.001	78.3	22.5	36.4
	07/11/95	231	0.005	0.585	-0.001	78.6	21.1	35.3		07/11/95	231	0.004	0.602	-0.001	83.9	22.2	36.1
	07/13/95	233	0.004	0.642	-0.001	82.9	23.4	37.4		07/13/95	233	0.004	0.631	-0.001	84.7	23.3	38.0
	07/18/95	238	0.005	0.594	-0.001	78.6	23.0	34.7		07/18/95	238	0.003	0.523	-0.001	70.6	20.7	31.4

* All units in mg/L.

Table C-1. Results of analyses of non-softened standing water samples of lead pipe loops, phase II study.*

Loop 1	Date	Days	Cu	Pb	ZN	Ca	Mg	Na	Loop 2	Date	Days	Cu	Pb	Zn	Ca	Mg	Na
	07/20/95	240	0.005	0.666	-0.001	86.2	24.4	36.0		07/20/95	240	0.005	0.614	-0.001	83.6	23.7	35.2
	07/25/95	245	0.004	0.662	-0.001	79.4	23.7	35.5		07/25/95	245	0.004	0.683	-0.001	84.7	24.2	35.4
	07/27/95	247	0.004	0.608	-0.001	77.5	23.1	35.1		07/27/95	247	0.005	0.650	-0.001	80.4	23.7	36.3
	08/01/95	252	0.004	0.622	-0.001	80.7	23.2	36.5		08/01/95	252	0.002	0.606	-0.001	84.0	23.5	37.3
	08/03/95	254	0.007	0.712	-0.001	84.9	23.7	37.9		08/03/95	254	0.006	0.709	0.001	84.7	23.2	37.5
	08/08/95	259	0.003	0.724	-0.002	85.7	23.3	39.5		08/08/95	259	0.000	0.697	-0.002	85.4	23.3	39.8
	08/10/95	261	0.007	0.622	-0.001	78.9	23.0	37.7		08/10/95	261	0.009	0.606	-0.001	77.1	22.3	36.4
	08/15/95	266	0.003	0.663	-0.001	82.2	24.2	40.9		08/15/95	266	0.004	0.573	-0.001	70.8	20.9	35.7
	08/17/95	268	0.007	0.589	-0.001	75.2	21.5	35.6		08/17/95	268	0.006	0.584	-0.001	74.2	21.6	36.3
	08/22/95	273	0.005	0.570	-0.001	76.2	21.0	31.1		08/22/95	273	0.004	0.595	-0.001	81.2	22.6	33.6
	08/24/95	275	0.006	0.610	-0.001	78.4	21.9	32.7		08/24/95	275	0.005	0.623	-0.001	84.2	23.5	35.2
	08/29/95	280	0.003	0.629	-0.001	81.4	23.0	37.1		08/29/95	280	0.004	0.598	-0.001	80.2	22.6	36.8
	08/31/95	282	0.004	0.660	-0.001	83.5	23.4	35.3		08/31/95	282	0.003	0.618	-0.001	83.2	23.7	35.9
	09/05/95	287	0.006	0.619	-0.001	83.2	23.5	38.4		09/05/95	287	0.006	0.598	-0.001	82.7	23.4	37.8
	09/07/95	289	0.004	0.625	-0.001	84.1	23.7	38.4		09/07/95	289	0.004	0.600	-0.001	82.8	23.5	37.8
	09/12/95	293	0.006	0.725	-0.001	86.3	23.8	39.6		09/12/95	293	0.005	0.664	-0.001	87.3	23.7	40.9
	09/14/95	295	0.007	0.769	0.001	90.6	24.7	41.6		09/14/95	295	0.006	0.736	0.001	90.3	24.7	41.5
	09/19/95	300	0.008	0.719	0.000	88.9	25.1	44.7		09/19/95	300	0.006	0.657	0.000	89.4	25.0	44.6
	09/21/95	302	0.006	0.774	-0.004	89.8	24.9	42.7		09/21/95	302	0.005	0.729	-0.004	89.9	24.9	42.4
	09/26/95	307	0.008	0.704	-0.001	86.3	25.0	45.3		09/26/95	307	0.007	0.684	-0.001	87.0	24.9	44.9
	09/28/95	309	0.005	0.677	-0.001	86.2	23.2	49.0		09/28/95	309	0.005	0.644	-0.001	85.5	23.1	48.7
	10/03/95	315	0.005	0.592	0.002	82.4	24.3	47.9		10/03/95	315	0.007	0.582	0.003	83.5	24.4	47.6
	10/05/95	317	0.003	0.585	0.002	83.0	24.0	43.0		10/05/95	317	0.004	0.567	0.003	82.3	23.7	42.8
	10/10/95	322	0.008	0.592	0.004	84.1	24.0	43.3		10/10/95	322	0.007	0.488	0.001	71.1	20.6	38.8
	10/12/95	324	0.004	0.571	-0.002	83.0	24.0	44.4		10/12/95	324	0.007	0.575	-0.002	83.7	24.5	45.7
	10/17/95	329	0.006	0.566	0.004	80.4	22.6	41.3		10/17/95	329	0.007	0.569	0.003	81.9	23.5	43.2
	10/19/95	331	0.007	0.578	-0.001	81.4	23.9	44.2		10/19/95	331	0.007	0.561	-0.001	81.3	23.9	44.6
	10/24/95	336	0.007	0.565	0.006	81.1	23.4	42.9		10/24/95	336	0.005	0.532	0.006	80.7	23.4	43.3
	10/26/95	338	0.006	0.518	0.002	80.2	23.6	43.6		10/26/95	338	0.005	0.515	0.000	79.8	23.5	43.6
	10/31/95	343	0.007	0.523	0.002	79.3	23.3	43.3		10/31/95	343	0.006	0.509	-0.003	79.4	23.5	43.3
	11/02/95	345	0.006	0.534	-0.002	81.7	24.3	43.8		11/02/95	345	0.007	0.518	0.002	81.8	24.0	43.0
	11/07/95	350	0.005	0.529	-0.001	91.1	24.7	35.9		11/07/95	350	0.006	0.517	-0.001	91.1	24.9	36.7
	11/09/95	352	0.007	0.463	0.003	82.8	24.0	41.5		11/09/95	352	0.006	0.467	0.002	83.0	24.1	41.9
	11/21/95	364	0.004	0.570	0.002	79.8	23.1	37.6		11/21/95	364	0.004	0.541	-0.001	79.2	23.3	38.3
	11/28/95	371	0.006	0.557	-0.001	79.9	22.9	35.8		11/28/95	371	0.004	0.452	-0.001	67.8	20.0	31.9
	11/30/95	373	0.004	0.522	-0.001	79.3	23.5	37.4		11/30/95	373	0.004	0.514	-0.001	78.7	23.4	37.4
	12/05/95	378	0.005	0.500	-0.003	77.8	23.5	38.6		12/05/95	378	0.005	0.498	0.002	78.2	23.3	37.9
	12/07/95	380	0.005	0.515	-0.001	77.3	22.8	35.4		12/07/95	380	0.005	0.490	-0.001	76.1	22.5	35.3
	12/12/95	385	0.006	0.493	0.003	76.9	23.0	36.4		12/12/95	385	0.004	0.477	0.002	77.2	22.6	35.2
	12/19/95	392	0.003	0.502	-0.003	83.4	24.7	39.5		12/19/95	392	0.008	0.490	-0.001	81.5	25.3	40.8
	12/21/95	394	0.007	0.533	-0.001	85.0	25.2	39.0		12/21/95	394	0.005	0.504	-0.001	84.3	25.0	38.9
	12/29/95	401	0.006	0.490	-0.001	83.5	25.0	39.6		12/29/95	401	0.007	0.477	-0.001	83.7	24.8	38.9
	01/05/96	408	0.005	0.501	-0.001	83.4	25.2	36.9		01/05/96	408	0.008	0.499	0.000	83.0	25.3	36.7
	01/09/96	413	0.007	0.412	0.005	70.2	20.2	31.4		01/09/96	413	0.006	0.455	0.004	79.6	23.1	35.4
	01/11/96	415	0.007	0.462	0.001	75.5	22.4	35.2		01/11/96	415	0.007	0.516	0.001	82.2	23.8	36.4
	01/16/96	420	0.005	0.380	0.005	64.2	19.4	30.6		01/16/96	420	0.007	0.488	-0.001	79.6	23.6	36.4
	01/18/96	422	0.004	0.476	0.000	80.6	24.0	35.4		01/18/96	422	0.003	0.425	-0.001	74.6	22.5	33.6
	01/23/96	427	0.007	0.466	0.003	81.2	23.4	34.0		01/23/96	427	0.006	0.482	0.002	84.6	24.6	35.9
	01/25/96	429	0.006	0.476	0.005	79.5	23.8	37.3		01/25/96	429	0.005	0.464	-0.001	78.1	23.6	37.2
	01/30/96	434	0.004	0.493	0.002	80.7	23.1	32.7		01/30/96	434	0.005	0.516	-0.001	79.7	23.4	33.6
	02/01/96	436	0.005	0.493	-0.001	77.0	22.9	33.4		02/01/96	436	0.006	0.482	0.004	77.3	22.8	32.9
	02/06/96	441	0.005	0.494	-0.002	85.2	23.6	35.2		02/06/96	441	0.005	0.491	-0.002	84.8	23.8	35.8
	02/08/96	443	0.005	0.484	0.000	84.6	23.9	35.5		02/08/96	443	0.006	0.502	-0.004	88.0	25.3	38.2
	02/13/96	448	0.006	0.508	-0.001	85.2	23.4	39.8		02/13/96	448	0.005	0.553	-0.001	92.4	25.3	43.5
	02/15/96	450	0.006	0.562	0.004	93.5	25.7	45.1		02/15/96	450	0.006	0.549	0.000	93.1	25.5	44.4
	02/20/96	455	0.006	0.510	-0.001	85.8	24.3	46.1		02/20/96	455	0.007	0.557	-0.001	91.7	26.1	49.5
	02/22/96	457	0.004	0.450	-0.004	79.6	22.7	42.3		02/22/96	457	0.004	0.436	-0.004	79.8	22.3	41.0
	02/27/96	462	0.007	0.480	0.002	78.4	24.2	37.5		02/27/96	462	0.007	0.484	0.004	80.2	24.1	36.4
	03/05/96	469	0.007	0.633	0.003	98.6	25.6	50.3		03/05/96	469	0.006	0.621	0.000	97.4	25.5	50.2
	03/07/96	471	0.007	0.508	0.001	79.1	21.5	37.6		03/07/96	471	0.006	0.578	-0.001	86.5	23.6	41.5
	03/12/96	476	0.004	0.501	-0.001	83.1	22.3	39.6		03/12/96	476	0.003	0.484	-0.001	80.3	21.5	38.1

* All units in mg/L.

Table C-1a. Results of analyses of softened standing water samples of lead pipe loops, phase II study.*

Loop 1	Date	Days	Cu	Pb	Zn	Ca	Mg	Na	Loop-2	Date	Days	Cu	Pb	Zn	Ca	Mg	Na
	11/23/94	1	0.134	0.653	0.001	0.3	0.1	179.1		11/23/94	1	0.001	0.612	0.001	0.2	0.1	177.6
	11/29/94	7	0.004	0.738	0.000	45.9	23.2	69.3		11/29/94	7	0.004	0.733	-0.001	45.4	22.9	68.8
	12/02/94	10	0.013	0.665	0.001	63.6	22.9	43.2		12/02/94	10	0.005	0.777	0.001	72.0	25.9	48.5
	12/06/94	14	0.062	0.551	0.001	0.2	0.0	159.0		12/06/94	14	0.002	0.590	0.001	0.1	0.0	161.1
	12/08/94	16	0.045	0.451	0.001	0.2	0.0	143.6		12/08/94	16	0.002	0.525	0.001	0.1	0.0	151.4
	12/13/94	21	0.008	0.518	0.001	0.1	0.0	165.5		12/13/94	21	0.002	0.477	0.002	0.1	0.0	154.8
	12/16/94	24	0.002	0.530	0.000	0.1	0.0	146.3		12/16/94	24	0.002	0.493	0.001	0.1	0.0	147.1
	12/20/94	28	0.003	0.615	0.001	0.3	0.1	163.4		12/20/94	28	0.003	0.560	0.001	0.3	0.1	158.3
	12/22/94	30	0.002	0.524	-0.003	37.7	25.2	70.1		12/22/94	30	0.003	0.435	-0.002	33.4	22.8	65.3
	12/28/94	36	0.012	0.458	0.002	65.7	23.5	41.7		12/28/94	36	0.018	0.449	0.000	65.2	23.6	43.4
	12/30/94	38	0.122	0.599	-0.001	72.1	24.0	42.0		12/30/94	38	0.075	0.724	-0.001	71.9	24.2	42.6
	01/04/95	43	0.070	0.480	0.011	60.8	18.9	32.8		01/04/95	43	0.004	0.582	0.011	63.5	19.3	33.1
	01/05/95	44	0.172	0.734	0.012	79.1	22.3	39.6		01/05/95	44	0.004	0.858	0.009	78.2	22.3	41.0
	01/13/95	52	0.008	0.692	0.003	0.1	0.0	159.9		01/13/95	52	0.005	0.742	0.004	0.1	0.0	166.2
	01/18/95	57	0.008	0.671	-0.003	0.3	0.2	177.0		01/18/95	57	0.003	0.647	-0.003	0.3	0.2	173.7
	01/20/95	59	0.006	0.746	0.000	0.4	0.2	178.7		01/20/95	59	0.003	0.695	-0.001	0.4	0.2	173.1
	01/24/95	63	0.014	0.624	0.071	0.3	0.2	166.8		01/24/95	63	0.005	0.728	0.001	0.4	0.2	178.3
	01/26/95	65	0.011	0.818	-0.001	0.4	0.2	157.2		01/26/95	65	0.003	0.729	-0.001	0.4	0.2	153.9
	01/31/95	70	0.007	0.901	0.001	0.3	0.1	157.8		01/31/95	70	0.003	0.793	0.000	0.3	0.1	160.0
	02/02/95	72	0.012	0.750	0.001	0.3	0.1	169.4		02/02/95	72	0.004	0.682	0.001	0.3	0.1	159.2
	02/07/95	77	0.007	0.753	0.000	0.4	0.2	172.5		02/07/95	77	0.007	0.653	0.001	0.3	0.2	159.1
	02/09/95	79	0.007	0.706	0.001	0.4	0.2	169.5		02/09/95	79	0.005	0.661	0.000	0.3	0.2	173.6
	02/14/95	84	0.008	0.742	-0.001	0.3	0.1	175.0		02/14/95	84	0.004	0.726	0.000	0.3	0.1	178.6
	02/24/95	94	0.008	0.717	0.000	0.3	0.1	185.3		02/24/95	94	0.006	0.722	-0.001	0.3	0.1	184.6
	02/28/95	98	0.009	0.708	0.000	0.4	0.1	187.6		02/28/95	98	0.004	0.649	-0.001	0.3	0.1	181.0
	03/03/95	101	0.008	0.869	0.001	0.8	0.7	201.1		03/03/95	101	0.006	0.832	0.000	0.8	0.7	200.5
	03/07/95	105	0.008	0.801	0.002	1.0	0.9	187.6		03/07/95	105	0.008	0.751	0.000	1.0	0.9	186.8
	03/08/95	107	0.005	0.668	-0.001	0.6	0.5	173.9		03/08/95	107	0.006	0.709	-0.002	0.6	0.5	178.6
	03/14/95	112	0.012	0.646	-0.004	0.3	0.1	174.4		03/14/95	112	0.007	0.641	-0.003	0.3	0.1	183.5
	03/16/95	114	0.019	0.713	-0.003	0.4	0.1	191.3		03/16/95	114	0.005	0.662	-0.002	0.3	0.1	177.3
	03/21/95	119	0.005	0.607	-0.001	0.4	0.2	173.4		03/21/95	119	0.005	0.606	-0.001	0.4	0.2	165.8
	03/23/95	121	0.005	0.558	0.000	0.3	0.1	156.9		03/23/95	121	0.003	0.463	0.000	0.2	0.1	140.2
	03/28/95	126	0.003	0.721	0.002	0.3	0.1	175.8		03/28/95	126	0.003	0.675	0.003	0.3	0.1	170.5
	03/30/95	128	0.007	0.654	0.003	0.3	0.1	174.0		03/30/95	128	0.006	0.646	0.002	0.3	0.1	175.9
	04/04/95	133	0.005	0.765	0.001	0.4	0.2	198.5		04/04/95	133	0.005	0.769	-0.002	0.4	0.2	190.3
	04/06/95	135	0.010	0.756	0.000	0.9	0.9	191.1		04/06/95	135	0.007	0.729	0.000	0.9	0.9	190.8
	04/11/95	140	0.008	0.502	0.000	0.3	0.1	173.3		04/11/95	140	0.007	0.505	0.000	0.3	0.1	180.2
	04/13/95	142	0.006	0.507	0.005	0.3	0.1	169.4		04/13/95	142	0.005	0.523	0.002	0.3	0.1	174.3
	04/18/95	147	0.011	0.533	0.000	0.3	0.2	163.4		04/18/95	147	0.008	0.514	0.000	0.3	0.2	173.7
	04/20/95	149	0.008	0.657	0.005	0.4	0.1	176.0		04/20/95	149	0.006	0.665	0.005	0.3	0.1	170.4
	04/25/95	154	0.012	0.538	-0.003	0.3	0.1	167.0		04/25/95	154	0.007	0.582	-0.003	0.3	0.1	159.7
	04/27/95	156	0.008	0.613	0.002	0.3	0.1	168.9		04/27/95	156	0.006	0.648	0.002	0.3	0.1	170.6
	05/02/95	161	0.008	0.565	0.000	0.3	0.1	174.3		05/02/95	161	0.007	0.554	0.000	0.3	0.1	175.4
	05/09/95	168	0.007	0.565	-0.002	0.3	0.1	168.0		05/09/95	168	0.007	0.577	0.000	0.3	0.1	169.8
	05/11/95	170	0.012	0.544	0.000	0.3	0.1	167.4		05/11/95	170	0.007	0.565	0.002	0.3	0.1	166.9
	05/16/95	175	0.006	0.561	0.000	0.2	0.1	162.8		05/16/95	175	0.005	0.580	0.000	0.2	0.1	157.7
	05/18/95	177	0.009	0.568	0.000	0.2	0.1	157.5		05/18/95	177	0.007	0.597	0.000	0.2	0.1	156.0
	05/23/95	182	0.029	0.542	0.000	0.1	0.0	172.6		05/23/95	182	0.005	0.754	0.000	3.9	1.2	174.3
	05/30/95	189	0.009	0.629	0.000	0.4	0.2	171.5		05/30/95	189	0.005	0.591	0.000	0.4	0.2	175.7
	06/01/95	191	0.026	0.637	0.000	0.4	0.3	188.2		06/01/95	191	0.005	0.703	0.000	0.5	0.2	189.3
	06/06/95	196	0.011	0.728	0.000	0.4	0.1	192.2		06/06/95	196	0.003	0.787	0.000	0.4	0.1	188.6
	06/08/95	198	0.006	0.697	0.000	0.4	0.1	176.7		06/08/95	198	0.006	0.739	0.000	0.4	0.1	180.4
	06/13/95	203	0.008	0.596	0.000	0.3	0.1	159.2		06/13/95	203	0.006	0.608	0.000	0.3	0.1	162.7
	06/15/95	205	0.021	0.620	0.009	0.4	0.2	172.6		06/15/95	205	0.006	0.655	0.016	0.4	0.2	174.3
	06/20/95	210	0.171	0.656	0.000	0.3	0.1	179.4		06/20/95	210	0.006	0.683	0.000	0.3	0.1	175.6
	06/22/95	212	0.015	0.630	-0.001	0.3	0.1	163.2		06/22/95	212	0.006	0.702	-0.001	0.3	0.1	175.1
	06/27/95	217	0.017	0.675	0.001	0.4	0.2	205.5		06/27/95	217	0.007	0.687	0.001	0.4	0.2	201.5
	06/29/95	219	0.007	0.640	0.000	0.3	0.2	173.4		06/29/95	219	0.006	0.637	0.000	0.3	0.1	178.5
	07/06/95	226	0.012	0.634	0.001	0.3	0.1	172.2		07/06/95	226	0.006	0.617	0.001	0.3	0.1	169.5
	07/11/95	231	0.007	0.656	0.000	0.4	0.3	165.7		07/11/95	231	0.006	0.704	0.000	0.5	0.3	176.3
	07/13/95	233	0.006	0.676	0.000	0.7	0.6	176.7		07/13/95	233	0.005	0.693	-0.001	0.7	0.6	177.6
	07/18/95	238	0.007	0.674	0.000	0.3	0.1	159.4		07/18/95	238	0.006	0.650	0.000	0.3	0.1	154.2

* All units in mg/L.

Table C-1a. Results of analyses of softened standing water samples of lead pipe loops, phase II study.*

Loop 1	Date	Days	Cu	Pb	Zn	Ca	Mg	Na	Loop-2	Date	Days	Cu	Pb	Zn	Ca	Mg	Na
	07/20/95	240	0.008	0.669	0.000	0.3	0.1	157.7		07/20/95	240	0.007	0.710	0.000	0.3	0.1	173.9
	07/25/95	245	0.060	0.733	0.000	0.3	0.1	185.7		07/25/95	245	0.006	0.691	0.000	0.3	0.1	173.0
	07/27/95	247	0.013	0.644	0.000	0.3	0.2	163.3		07/27/95	247	0.005	0.689	0.000	0.4	0.2	167.9
	08/01/95	252	0.010	0.701	0.000	0.3	0.1	178.6		08/01/95	252	0.005	0.648	0.000	0.3	0.1	173.1
	08/03/95	254	0.217	0.717	-0.001	0.3	0.1	182.0		08/03/95	254	0.005	0.703	0.000	0.3	0.1	181.4
	08/08/95	259	0.090	0.799	-0.001	0.4	0.1	186.9		08/08/95	259	-0.002	0.734	0.000	0.3	0.1	178.0
	08/10/95	261	0.009	0.723	0.000	0.3	0.1	169.4		08/10/95	261	0.007	0.688	0.000	0.3	0.1	163.9
	08/15/95	266	0.009	0.680	0.000	0.3	0.1	166.1		08/15/95	266	0.004	0.667	0.000	0.3	0.1	170.8
	08/17/95	268	0.009	0.638	0.000	0.3	0.1	159.9		08/17/95	268	0.005	0.665	0.000	0.3	0.1	167.3
	08/22/95	273	0.006	0.725	0.000	0.3	0.1	165.7		08/22/95	273	0.005	0.624	0.000	0.2	0.1	151.3
	08/24/95	275	0.007	0.676	0.000	0.3	0.1	160.9		08/24/95	275	0.007	0.716	0.000	0.3	0.1	176.2
	08/29/95	280	0.005	0.685	0.000	0.3	0.0	166.3		08/29/95	280	0.004	0.706	0.000	0.3	0.1	166.7
	08/31/95	282	0.004	0.739	0.000	0.3	0.0	169.8		08/31/95	282	0.004	0.696	0.000	0.3	0.1	170.3
	09/05/95	287	0.008	0.725	0.000	0.3	0.2	178.4		09/05/95	287	0.007	0.690	0.000	0.3	0.2	173.3
	09/07/95	289	0.005	0.702	0.000	0.3	0.1	172.5		09/07/95	289	0.004	0.679	0.000	0.3	0.1	169.6
	09/12/95	293	0.110	0.727	0.000	0.3	0.1	177.3		09/12/95	293	0.005	0.757	0.000	0.3	0.1	189.8
	09/14/95	295	0.009	0.815	-0.002	0.3	0.1	192.1		09/14/95	295	0.005	0.798	-0.003	0.3	0.1	194.1
	09/19/95	300	0.007	0.774	-0.003	0.4	0.1	196.1		09/19/95	300	0.006	0.689	-0.002	0.3	0.1	196.4
	09/21/95	302	0.005	0.804	0.000	0.4	0.2	181.0		09/21/95	302	0.005	0.759	-0.003	0.4	0.2	185.7
	09/26/95	307	0.008	0.766	0.000	0.4	0.1	185.4		09/26/95	307	0.006	0.749	0.000	0.4	0.1	185.3
	09/28/95	309	0.007	0.764	0.000	0.4	0.1	179.8		09/28/95	309	0.006	0.745	0.000	0.4	0.1	184.8
	10/03/95	315	0.010	0.659	0.001	0.3	0.1	187.2		10/03/95	315	0.007	0.650	0.000	0.3	0.1	193.2
	10/05/95	317	0.028	0.658	0.000	0.3	0.1	185.1		10/05/95	317	0.005	0.650	0.000	0.3	0.1	178.9
	10/10/95	322	0.015	0.598	0.000	0.3	0.1	178.8		10/10/95	322	0.007	0.637	0.000	0.3	0.1	189.5
	10/12/95	324	0.015	0.647	-0.005	0.3	0.1	185.4		10/12/95	324	0.006	0.652	-0.005	0.3	0.1	183.9
	10/17/95	329	0.007	0.680	0.000	0.3	0.1	177.2		10/17/95	329	0.006	0.660	-0.004	0.3	0.1	185.2
	10/19/95	331	0.011	0.647	-0.005	0.3	0.1	183.7		10/19/95	331	0.006	0.649	0.000	0.3	0.1	177.0
	10/24/95	336	0.006	0.653	0.000	0.3	0.1	178.7		10/24/95	336	0.006	0.640	0.000	0.3	0.1	177.8
	10/26/95	338	0.007	0.617	-0.002	0.3	0.1	178.8		10/26/95	338	0.006	0.604	-0.002	0.3	0.1	181.3
	10/31/95	343	0.006	0.632	0.000	0.5	0.2	173.9		10/31/95	343	0.006	0.613	0.000	0.4	0.2	176.4
	11/02/95	345	0.007	0.638	-0.001	0.4	0.1	173.1		11/02/95	345	0.005	0.611	-0.005	0.4	0.1	176.6
	11/07/95	350	0.006	0.611	-0.002	0.4	0.1	189.3		11/07/95	350	0.007	0.584	0.000	0.4	0.1	186.8
	11/09/95	352	0.007	0.571	0.000	0.3	0.1	179.4		11/09/95	352	0.007	0.558	0.001	0.3	0.1	177.0
	11/21/95	364	0.007	0.656	0.000	0.3	0.1	169.5		11/21/95	364	0.007	0.654	0.000	0.3	0.1	169.6
	11/28/95	371	0.007	0.647	0.000	0.3	0.1	171.2		11/28/95	371	0.006	0.633	0.000	0.3	0.1	168.9
	11/30/95	373	0.004	0.591	0.000	0.3	0.1	160.9		11/30/95	373	0.005	0.611	0.000	0.3	0.1	168.7
	12/05/95	378	0.007	0.597	0.000	0.3	0.1	172.5		12/05/95	378	0.006	0.584	0.000	0.3	0.1	169.3
	12/07/95	380	0.004	0.608	-0.001	0.3	0.1	158.6		12/07/95	380	0.005	0.595	-0.004	0.3	0.0	161.5
	12/12/95	385	0.007	0.605	0.004	0.3	0.1	161.7		12/12/95	385	0.006	0.581	0.004	0.3	0.1	158.6
	12/19/95	392	0.006	0.599	0.000	0.3	0.1	180.0		12/19/95	392	0.007	0.572	0.000	0.3	0.1	188.2
	12/21/95	394	0.007	0.611	0.000	0.3	0.1	181.0		12/21/95	394	0.006	0.589	0.000	0.3	0.1	179.8
	12/29/95	401	0.008	0.587	0.003	0.3	0.1	180.4		12/29/95	401	0.006	0.569	0.000	0.3	0.1	178.3
	01/05/96	408	0.008	0.592	0.000	0.3	0.1	175.1		01/05/96	408	0.008	0.585	0.001	0.3	0.1	172.5
	01/09/96	413	0.007	0.551	0.000	0.4	0.2	174.3		01/09/96	413	0.006	0.537	-0.002	0.4	0.2	176.7
	01/11/96	415	0.007	0.569	-0.003	0.3	0.1	171.8		01/11/96	415	0.011	0.582	0.004	0.3	0.2	172.3
	01/16/96	420	0.007	0.571	0.000	0.3	0.1	170.6		01/16/96	420	0.007	0.558	0.000	0.3	0.1	170.8
	01/18/96	422	0.005	0.572	0.000	0.3	0.1	170.8		01/18/96	422	0.005	0.499	0.000	0.2	0.0	155.4
	01/23/96	427	0.008	0.566	0.000	0.3	0.2	170.4		01/23/96	427	0.006	0.558	0.000	0.3	0.2	171.5
	01/25/96	429	0.006	0.569	0.000	0.4	0.2	174.7		01/25/96	429	0.007	0.491	0.000	0.3	0.2	159.8
	01/30/96	434	0.007	0.590	0.000	0.3	0.1	167.0		01/30/96	434	0.009	0.562	0.000	0.3	0.1	165.8
	02/01/96	436	0.007	0.599	0.000	0.3	0.1	172.0		02/01/96	436	0.006	0.561	0.000	0.2	0.1	165.3
	02/06/96	441	0.006	0.595	0.000	0.3	0.1	177.0		02/06/96	441	0.006	0.584	0.001	0.3	0.1	174.9
	02/08/96	443	0.007	0.543	-0.003	0.8	0.8	182.6		02/08/96	443	0.005	0.505	-0.003	0.7	0.8	170.3
	02/13/96	448	0.004	0.623	0.000	0.4	0.1	189.0		02/13/96	448	0.006	0.573	0.000	0.4	0.1	180.1
	02/15/96	450	0.007	0.646	0.000	0.4	0.1	199.8		02/15/96	450	0.007	0.624	0.000	0.4	0.1	206.1
	02/20/96	455	0.007	0.557	0.000	0.6	0.5	177.7		02/20/96	455	0.006	0.573	0.000	0.6	0.5	190.8
	02/22/96	457	0.006	0.584	-0.003	0.7	0.6	180.9		02/22/96	457	0.005	0.531	-0.003	0.6	0.5	176.4
	02/27/96	462	0.012	0.582	0.008	0.3	0.1	164.3		02/27/96	462	0.006	0.576	0.000	0.3	0.0	174.1
	04/13/01	469	0.010	0.669	0.000	0.1	0.0	203.0		03/05/96	469	0.007	0.642	0.000	0.1	0.0	198.3
	03/07/96	471	0.018	0.626	-0.001	18.0	29.1	105.5		03/07/96	471	0.018	0.582	-0.001	17.5	28.5	105.2
	03/12/96	476	0.004	0.533	0.000	0.3	0.1	172.1		03/12/96	476	0.004	0.556	0.000	0.3	0.0	176.1

* All units in mg/L.

Table C-2. Results of analyses of non-softened standing water samples of copper tubing pipe loops, phase II study.*

Loop 1	Date	Days	Cu	Pb	Zn	Ca	Mg	Na	loop 2	Date	Days	Cu	Pb	Zn	Ca	Mg	Na
	11/23/94	1	2.566	0.011	0.009	86.7	24.7	42.7		11/23/94	1	3.154	0.011	0.016	85.8	24.4	41.6
	11/29/94	7	0.608	0.005	-0.002	77.7	22.2	39.3		11/29/94	7	1.429	0.007	0.001	79.3	22.5	39.8
	12/02/94	10	5.439	0.004	0.005	76.0	21.2	38.7		12/02/94	10	5.255	0.002	0.000	80.4	22.2	39.8
	12/06/94	14	4.829	0.001	0.001	67.9	19.4	43.2		12/06/94	14	4.863	0.001	0.001	75.5	21.3	46.5
	12/08/94	16	4.862	0.000	0.001	62.1	18.1	37.8		12/08/94	16	4.788	0.000	0.001	64.2	18.4	37.8
	12/13/94	21	1.520	-0.001	0.001	64.3	20.2	39.6		12/13/94	21	1.659	-0.001	0.002	65.2	20.4	39.5
	12/16/94	24	1.693	0.000	0.001	62.0	19.5	37.2		12/16/94	24	1.983	0.000	0.001	61.6	19.6	37.9
	12/20/94	28	1.606	-0.001	0.001	67.9	20.6	37.7		12/20/94	28	2.030	0.001	0.001	69.6	21.5	39.7
	12/22/94	30	1.127	0.001	-0.004	62.0	19.9	38.0		12/22/94	30	1.351	0.001	-0.005	58.6	18.9	36.9
	12/28/94	36	0.873	0.000	-0.001	68.6	22.2	41.8		12/28/94	36	1.100	0.000	-0.002	71.7	23.1	43.5
	12/30/94	38	1.419	0.000	-0.002	74.1	23.1	40.9		12/30/94	38	1.812	0.000	0.002	74.2	23.0	41.2
	01/04/95	43	0.957	0.000	0.010	65.5	21.1	36.4		01/04/95	43	1.196	0.000	0.009	74.6	23.2	38.1
	01/05/95	44	2.214	0.000	0.012	76.4	22.1	39.7		01/05/95	44	2.686	0.000	0.012	75.8	22.0	39.7
	01/13/95	52	2.641	0.000	0.006	78.5	22.2	37.4		01/13/95	52	3.068	0.000	0.004	77.2	21.8	36.4
	01/18/95	57	1.651	0.001	-0.005	81.6	24.4	39.8		01/18/95	57	1.958	0.001	-0.003	79.5	24.0	40.8
	01/20/95	59	2.390	0.000	-0.001	82.1	24.0	41.3		01/20/95	59	2.769	0.001	-0.003	75.5	22.2	38.6
	01/24/95	63	0.747	0.000	0.026	80.8	25.3	41.2		01/24/95	63	0.875	0.000	-0.001	80.4	25.4	41.8
	01/26/95	65	2.785	0.000	0.000	79.9	22.7	30.9		01/26/95	65	3.501	0.000	0.003	78.2	22.7	31.7
	01/31/95	70	3.031	0.000	-0.001	78.9	22.6	34.2		01/31/95	70	3.822	0.001	0.002	81.6	23.2	33.7
	02/02/95	72	2.944	0.000	-0.001	72.2	22.1	38.9		02/02/95	72	3.293	0.000	-0.002	68.7	21.6	38.6
	02/07/95	77	3.325	0.000	0.002	73.2	21.4	40.0		02/07/95	77	3.998	0.001	0.002	79.4	22.8	41.6
	02/09/95	79	3.356	0.000	-0.003	77.8	22.7	42.9		02/09/95	79	4.092	0.000	-0.001	81.7	23.9	45.3
	02/14/95	84	2.274	0.000	0.000	81.5	23.7	41.5		02/14/95	84	2.623	-0.001	0.000	81.0	23.7	41.6
	02/24/95	94	3.422	0.001	0.001	84.0	24.9	47.1		02/24/95	94	3.776	0.000	0.001	83.0	25.2	48.2
	02/28/95	98	3.551	0.000	-0.005	84.7	25.8	48.8		02/28/95	98	3.845	0.000	-0.006	85.0	26.0	49.8
	03/03/95	101	4.794	0.000	0.000	99.4	28.5	46.5		03/03/95	101	5.110	0.000	-0.001	99.7	28.2	44.0
	03/07/95	105	4.387	0.001	0.001	91.7	26.7	50.9		03/07/95	105	4.488	0.000	0.000	92.7	26.6	49.9
	03/08/95	107	3.853	0.000	-0.001	87.7	25.3	48.9		03/08/95	107	3.788	0.000	-0.001	83.0	24.2	46.2
	03/14/95	112	3.832	0.000	-0.004	79.9	23.6	48.8		03/14/95	112	3.734	0.000	-0.004	77.1	22.7	47.1
	03/16/95	114	3.904	0.000	-0.002	84.1	23.4	47.9		03/16/95	114	4.073	0.000	-0.002	85.5	23.8	48.8
	03/21/95	119	3.677	0.000	-0.005	82.3	23.3	51.5		03/21/95	119	3.682	0.000	-0.005	83.2	22.9	49.4
	03/23/95	121	3.103	-0.001	0.000	74.1	22.6	42.8		03/23/95	121	2.884	-0.001	0.001	66.2	20.2	39.5
	03/28/95	126	3.563	0.000	-0.001	86.8	23.8	42.3		03/28/95	126	3.789	0.000	-0.002	88.3	24.3	42.8
	03/30/95	128	3.610	0.000	-0.001	84.0	24.1	41.4		03/30/95	128	3.740	-0.001	-0.002	84.1	24.1	41.5
	04/04/95	133	4.587	0.000	-0.001	96.9	26.4	43.0		04/04/95	133	4.762	0.000	0.000	95.3	26.3	42.9
	04/06/95	135	4.177	0.000	-0.002	92.6	25.8	48.2		04/06/95	135	4.467	-0.001	0.001	92.2	26.0	48.6
	04/11/95	140	4.054	0.000	-0.007	83.0	26.5	41.7		04/11/95	140	4.236	0.000	-0.007	81.6	26.3	41.5
	04/13/95	142	3.807	0.000	0.005	80.1	24.7	40.6		04/13/95	142	4.117	0.000	0.002	84.3	25.5	41.2
	04/18/95	147	3.871	0.001	0.005	75.5	24.4	39.3		04/18/95	147	3.954	0.001	0.005	77.4	24.2	38.1
	04/20/95	149	4.677	0.000	0.008	87.0	24.8	40.8		04/20/95	149	4.853	0.000	0.008	85.7	24.5	40.0
	04/25/95	154	4.000	0.001	0.002	80.8	24.6	35.6		04/25/95	154	4.176	0.001	0.003	79.8	24.4	35.3
	04/27/95	156	4.205	0.000	0.003	83.8	24.4	44.0		04/27/95	156	4.149	0.001	0.005	77.6	22.7	40.6
	05/02/95	161		0.487	-0.002	82.0	24.8	43.9		05/02/95	161	4.239	0.001	-0.004	81.4	24.9	44.3
	05/09/95	168	4.066	0.000	0.003	80.4	24.4	40.7		05/09/95	168	4.329	0.000	0.002	78.8	24.0	39.3
	05/11/95	170	3.720	0.001	0.005	83.1	24.0	37.5		05/11/95	170	4.258	0.001	0.004	83.7	24.1	37.9
	05/16/95	175	4.485	0.000	0.005	76.1	22.6	36.3		05/16/95	175	4.641	0.001	0.004	75.8	22.4	35.7
	05/18/95	177	4.297	0.000	0.004	74.0	22.4	35.1		05/18/95	177	4.427	0.000	0.003	74.2	22.2	34.5
	05/23/95	182	4.550	0.001	0.003	80.8	23.0	40.3		05/23/95	182	4.719	0.001	0.002	80.8	23.1	40.8
	05/30/95	189	5.113	0.001	0.007	89.4	24.5	45.6		05/30/95	189	5.172	0.001	0.008	89.9	24.5	45.8
	06/01/95	191	5.246	0.001	0.006	88.0	24.8	47.4		06/01/95	191	5.407	-0.001	0.007	88.5	24.8	46.1
	06/06/95	196	4.723	0.001	0.003	94.6	24.7	42.8		06/06/95	196	5.124	0.001	0.007	94.4	24.9	43.2
	06/08/95	198	4.061	0.000	0.005	88.0	23.1	42.9		06/08/95	198	4.460	0.002	0.004	88.0	22.9	42.3
	06/13/95	203	3.650	0.002	0.005	78.6	22.3	30.3		06/13/95	203	3.769	0.002	0.004	77.7	22.5	30.8
	06/15/95	205	4.693	-0.001	0.002	87.2	24.5	40.4		06/15/95	205	5.076	-0.001	0.002	89.1	24.5	39.8
	06/20/95	210	4.222	0.000	0.005	86.9	23.6	39.2		06/20/95	210	4.744	0.000	0.003	86.7	23.9	40.9
	06/22/95	212	3.495	0.000	0.003	74.1	21.2	28.5		06/22/95	212	3.961	0.000	0.004	76.5	21.7	29.9
	06/27/95	217	3.822	0.000	0.005	90.0	24.0	36.6		06/27/95	217	4.326	0.000	0.004	90.2	24.3	37.2
	06/29/95	219	2.840	0.001	-0.001	83.6	23.2	35.2		06/29/95	219	3.088	0.001	0.002	83.2	23.5	36.1
	07/06/95	226	2.925	0.000	-0.001	77.0	21.9	35.5		07/06/95	226	3.099	0.000	0.000	78.4	22.2	35.5
	07/11/95	231	3.325	0.001	0.005	78.7	21.3	35.6		07/11/95	231	3.748	0.003	0.006	82.4	22.2	36.6
	07/13/95	233	3.561	0.001	0.005	83.8	23.4	37.6		07/13/95	233	3.745	0.001	0.005	82.1	22.9	36.6
	07/18/95	238	2.527	0.000	0.001	74.6	22.0	33.3		07/18/95	238	2.622	0.000	0.000	80.1	23.0	34.5

* All units in mg/L

Table C-2. Results of analyses of non-softened standing water samples of copper tubing pipe loops, phase II study.*

Loop 1	Date	Days	Cu	Pb	Zn	Ca	Mg	Na	loop 2	Date	Days	Cu	Pb	Zn	Ca	Mg	Na
	07/20/95	240	2.538	0.000	0.001	71.7	21.1	33.4		07/20/95	240	2.856	0.000	0.005	86.4	23.8	35.0
	07/25/95	245	2.967	0.000	-0.001	83.6	25.1	37.9		07/25/95	245	2.957	0.000	0.006	81.6	24.3	35.9
	07/27/95	247	2.278	0.000	0.001	74.8	22.0	33.2		07/27/95	247	2.394	0.000	0.001	78.6	23.4	36.3
	08/01/95	252	2.243	0.000	0.002	79.9	22.6	35.0		08/01/95	252	2.207	0.000	0.002	81.3	23.4	37.1
	08/03/95	254	2.883	-0.001	0.000	84.9	23.8	38.6		08/03/95	254	2.852	-0.001	0.005	83.8	23.2	37.0
	08/08/95	259	2.477	0.000	0.000	85.9	23.0	38.3		08/08/95	259	2.412	0.000	0.001	84.6	22.8	38.2
	08/10/95	261	2.018	0.001	0.009	78.6	22.7	37.1		08/10/95	261	1.859	0.001	0.002	80.0	22.9	37.6
	08/15/95	266	1.817	0.000	0.002	74.7	21.9	38.3		08/15/95	266	1.608	0.001	0.002	73.1	21.8	37.4
	08/17/95	268	1.673	0.000	0.003	72.8	20.7	34.0		08/17/95	268	1.546	-0.001	0.002	75.2	21.7	36.0
	08/22/95	273	1.448	-0.002	0.004	84.9	23.1	33.4		08/22/95	273	1.045	-0.001	0.003	74.3	20.9	31.5
	08/24/95	275	1.579	-0.001	0.004	80.2	22.5	33.8		08/24/95	275	1.225	0.000	0.004	80.6	22.6	33.8
	08/29/95	280	1.533	0.001	0.003	79.6	22.6	36.4		08/29/95	280	1.106	0.001	0.002	80.2	22.7	36.8
	08/31/95	282	1.550	-0.001	0.003	81.2	23.2	35.5		08/31/95	282	1.089	-0.001	0.002	79.8	23.0	35.3
	09/05/95	287	1.432	0.000	0.002	82.5	23.4	37.6		09/05/95	287	0.908	-0.001	0.000	81.8	23.1	37.3
	09/07/95	289	1.413	-0.001	0.002	82.8	23.3	37.6		09/07/95	289	0.848	0.000	-0.003	83.3	23.2	37.0
	09/12/95	293	1.940	0.000	0.001	84.9	23.3	38.8		09/12/95	293	1.066		0.004	91.6	25.0	41.5
	09/14/95	295	2.100	-0.001	0.001	90.0	24.6	41.2		09/14/95	295	1.062	-0.001	0.001	90.2	24.7	41.5
	09/19/95	300	2.130	0.002	-0.001	89.3	24.9	43.9		09/19/95	300	1.033	0.002	0.001	88.5	25.1	45.0
	09/21/95	302	2.393	0.002	0.001	90.6	25.2	42.9		09/21/95	302	1.190	0.002	0.001	90.5	24.6	41.3
	09/26/95	307	2.133	0.000	0.002	87.9	24.6	43.3		09/26/95	307	1.106	0.001	0.003	86.3	25.1	45.8
	09/28/95	309	1.634	0.000	0.003	86.2	23.0	48.2		09/28/95	309	0.790	0.000	0.002	84.8	22.8	47.9
	10/03/95	315	1.155	0.001	0.004	81.7	23.8	46.6		10/03/95	315	0.652	0.001	0.003	80.9	24.4	49.2
	10/05/95	317	1.149	0.000	0.004	82.9	24.4	44.0		10/05/95	317	0.623	0.000	0.004	83.2	23.9	42.6
	10/10/95	322	1.198	0.000	0.004	83.4	24.1	44.2		10/10/95	322	0.735	0.001	0.004	83.4	24.1	43.6
	10/12/95	324	1.259	0.000	-0.002	83.2	23.8	43.8		10/12/95	324	0.753	0.000	-0.001	82.3	23.8	44.3
	10/17/95	329	1.283	0.001	0.003	81.8	23.3	42.2		10/17/95	329	0.805	0.001	0.004	80.6	23.4	43.5
	10/19/95	331	1.318	0.001	-0.001	81.1	23.6	43.7		10/19/95	331	0.822	0.001	0.000	81.8	23.5	42.8
	10/24/95	336	1.300	0.000	0.004	81.5	23.5	43.1		10/24/95	336	0.849	0.000	0.004	81.4	23.3	42.7
	10/26/95	338	1.287	0.000	0.002	80.0	23.5	43.3		10/26/95	338	0.883	-0.001	0.003	80.4	23.3	42.7
	10/31/95	343	1.336	0.000	0.002	78.8	23.4	43.5		10/31/95	343	1.003	0.000	0.002	78.6	23.2	43.1
	11/02/95	345	1.517	0.001	0.001	81.5	24.0	42.9		11/02/95	345	1.263	0.001	0.002	80.7	24.1	43.6
	11/07/95	350	2.458	0.000	-0.003	91.3	24.8	36.3		11/07/95	350	2.216	0.000	0.000	91.1	24.9	36.6
	11/09/95	352	1.837	0.000	0.000	81.8	24.1	41.9		11/09/95	352	1.595	0.001	0.001	82.4	24.3	42.5
	11/21/95	364	1.509	0.001	0.003	80.2	23.3	38.1		11/21/95	364	1.123	0.001	0.003	72.6	21.5	35.6
	11/28/95	371	1.238	0.001	0.004	70.2	20.2	31.5		11/28/95	371	1.018	0.002	0.004	69.0	20.2	32.1
	11/30/95	373	1.444	0.000	0.003	78.1	23.1	36.8		11/30/95	373	1.218	0.000	0.003	78.9	23.1	36.7
	12/05/95	378	1.195	0.002	0.002	79.8	23.6	38.1		12/05/95	378	1.030	0.002	0.002	78.2	23.7	39.0
	12/07/95	380	1.379	0.000	-0.002	76.3	22.4	34.6		12/07/95	380	1.267	0.000	-0.001	77.5	22.8	35.5
	12/12/95	385	1.420	0.001	0.003	75.3	22.2	34.8		12/12/95	385	1.307	0.001	0.003	76.0	22.2	34.5
	12/19/95	392	1.559	0.000	-0.003	82.9	24.3	39.0		12/19/95	392	1.537	0.000	-0.003	82.1	24.6	40.1
	12/21/95	394	1.582	0.000	0.003	84.0	25.0	38.7		12/21/95	394	1.510	0.000	0.003	84.5	25.0	38.9
	12/29/95	401	2.238	0.000	0.000	83.6	25.0	39.2		12/29/95	401	2.258	0.000	0.000	83.5	25.1	39.6
	01/05/96	408	2.445	0.000	-0.001	82.6	25.0	36.9		01/05/96	408	2.454	0.000	0.005	81.9	25.0	36.7
	01/09/96	413	2.807	-0.001	0.004	82.6	23.7	35.8		01/09/96	413	2.775	-0.001	0.006	82.2	23.9	36.6
	01/11/96	415	3.095	0.001	0.002	79.8	23.7	37.0		01/11/96	415	2.978	0.001	0.003	80.0	23.2	35.9
	01/16/96	420	2.962	0.001	0.004	78.6	23.6	36.2		01/16/96	420	2.726	0.001	0.004	72.6	21.8	34.0
	01/18/96	422	3.174	0.001	0.005	80.0	24.0	35.5		01/18/96	422	3.205	0.001	0.004	79.0	24.1	36.1
	01/23/96	427	3.601	0.000	0.004	77.6	22.9	33.9		01/23/96	427	3.728	0.000	0.004	82.7	24.0	35.1
	01/25/96	429	3.712	0.001	0.003	80.0	24.4	38.6		01/25/96	429	3.690	0.000	0.004	80.8	24.3	38.1
	01/30/96	434	3.858	0.001	0.003	78.7	22.8	32.4		01/30/96	434	4.099	0.001	0.002	79.3	23.6	34.2
	02/01/96	436	3.710	0.001	0.003	68.0	20.8	31.0		02/01/96	436	4.110	0.001	0.002	79.6	23.4	33.8
	02/06/96	441	4.010	0.001	0.003	84.8	23.4	34.6		02/06/96	441	4.181	0.001	0.003	82.8	23.9	37.0
	02/08/96	443	4.149	0.001	-0.001	82.2	23.4	35.2		02/08/96	443	4.585	0.001	0.001	91.0	26.0	39.5
	02/13/96	448	3.861	0.000	0.004	84.5	23.8	41.4		02/13/96	448	3.956	0.000	0.004	92.2	25.1	42.9
	02/15/96	450	4.240	0.001	0.002	91.6	25.9	46.4		02/15/96	450	4.002	0.001	0.003	92.9	25.5	44.5
	02/20/96	455	3.736	0.001	0.004	85.9	24.4	46.4		02/20/96	455	3.790	0.001	0.004	90.4	25.9	49.7
	02/22/96	457	3.551	0.001	0.001	76.1	21.8	40.6		02/22/96	457	3.355	0.001	0.001	83.4	23.1	41.9
	02/27/96	462	2.677	0.001	0.005	78.3	23.9	36.5		02/27/96	462	2.538	0.001	0.005	79.3	23.9	36.1
	03/05/96	469	2.882	-0.001	0.003	97.9	25.4	49.8		03/05/96	469	2.697	0.003	0.004	97.6	25.8	50.9
	03/07/96	471	2.744	-0.001	0.007	83.7	22.9	39.8		03/07/96	471	2.807	-0.002	0.004	89.5	24.4	41.7
	03/12/96	476	2.896	0.001	0.004	95.5	25.1	42.8		03/12/96	476	2.702	0.001	0.004	93.9	24.9	43.0

* All units in mg/L

Table C-2a. Analyses of softened standing water samples of copper tubing pipe loops, phase II study.*

Loop 1	Date	Days	Cu	Pb	Zn	Ca	Mg	Na	Loop 2	Date	Days	Cu	Pb	Zn	Ca	Mg	Na
	11/23/94	1	1.677	0.001	0.013	0.2	0.1	175.4		11/23/94	1	1.341	0.000	0.010	0.2	0.1	177.8
	11/29/94	7	1.686	0.000	0.003	48.5	24.2	71.4		11/29/94	7	1.207	0.000	0.001	43.8	22.4	67.5
	12/02/94	10	1.977	0.000	0.003	64.0	23.1	43.4		12/02/94	10	1.991	0.000	0.002	71.1	25.6	48.3
	12/06/94	14	1.655	-0.001	0.003	0.1	0.0	156.1		12/06/94	14	1.639	0.000	0.003	0.1	0.0	155.6
	12/08/94	16	2.212	-0.001	0.003	0.1	0.0	147.2		12/08/94	16	1.706	0.001	0.003	0.1	0.0	144.5
	12/13/94	21	1.344	-0.001	-0.001	0.1	0.0	159.2		12/13/94	21	1.036		0.000	0.1	0.0	154.5
	12/16/94	24	1.640	0.000	0.002	0.1	0.0	143.3		12/16/94	24	1.400	-0.001	0.003	0.1	0.0	145.2
	12/20/94	28	2.143	-0.001	0.002	0.3	0.1	154.6		12/20/94	28	1.839	0.000	0.002	0.3	0.1	163.6
	12/22/94	30	1.447	0.001	-0.005	32.1	22.4	63.7		12/22/94	30	1.099	0.000	-0.005	33.2	22.6	64.0
	12/28/94	36	1.370	0.000	-0.003	65.5	23.9	43.7		12/28/94	36	2.139	-0.001	0.001	68.6	24.8	44.9
	12/30/94	38	0.645	0.000	-0.001	72.0	23.9	42.8		12/30/94	38	1.629	0.000	0.003	72.1	24.1	42.1
	01/04/95	43	0.044	0.000	0.011	73.9	22.4	37.6		01/04/95	43	0.326	0.008	0.011	75.2	22.7	37.6
	01/05/95	44	0.050	0.000	0.008	76.5	22.5	40.1		01/05/95	44	0.525	0.020	0.012	79.1	22.3	40.5
	01/13/95	52	0.600	0.000	0.004	0.1	0.0	170.7		01/13/95	52	2.673	-0.001	0.006	0.1	0.0	164.3
	01/18/95	57	2.757	0.001	-0.003	0.3	0.2	173.4		01/18/95	57	2.928	0.001	0.001	0.3	0.2	178.1
	01/20/95	59	3.880	0.001	-0.001	0.4	0.2	171.9		01/20/95	59	3.916	0.000	-0.002	0.4	0.2	181.3
	01/24/95	63	1.723	0.000	0.002	0.4	0.2	180.5		01/24/95	63	1.543	0.004	-0.001	0.3	0.2	176.5
	01/26/95	65	4.479	0.002	0.001	0.4	0.2	158.9		01/26/95	65	4.273	0.001	0.002	0.4	0.2	159.1
	01/31/95	70	4.847	0.000	0.002	0.3	0.1	159.2		01/31/95	70	4.571	0.001	0.003	0.3	0.1	158.4
	02/02/95	72	4.175	0.000	0.003	0.3	0.1	158.4		02/02/95	72	4.296	0.001	0.003	0.3	0.1	162.0
	02/07/95	77	4.406	-0.001	0.002	0.3	0.2	164.7		02/07/95	77	4.452	0.000	0.002	0.3	0.2	179.4
	02/09/95	79	4.419	0.000	0.002	0.4	0.2	174.9		02/09/95	79	4.094	0.000	0.000	0.3	0.2	168.3
	02/14/95	84	4.091	0.000	0.001	0.3	0.1	180.6		02/14/95	84	3.554	0.003	-0.002	0.3	0.1	176.1
	02/24/95	94	4.665	0.000	0.002	0.3	0.1	185.8		02/24/95	94	4.300	0.001	0.002	0.3	0.1	183.2
	02/28/95	98	4.748	0.000	-0.001	0.3	0.1	183.6		02/28/95	98	4.402	0.000	0.001	0.3	0.1	183.3
	03/03/95	101	6.186	-0.001	-0.001	0.7	0.7	205.1		03/03/95	101	6.012	0.000	-0.001	0.8	0.7	197.3
	03/07/95	105	5.467	0.001	0.001	1.0	0.9	185.1		03/07/95	105	5.637	0.000	0.001	0.9	0.9	189.5
	03/08/95	107	5.092	0.002	0.000	0.6	0.5	179.9		03/08/95	107	5.225	-0.001	0.000	0.6	0.5	185.7
	03/14/95	112	5.003	0.000	-0.001	0.3	0.1	185.1		03/14/95	112	4.985	-0.001	-0.001	0.3	0.1	185.6
	03/16/95	114	5.421	0.000	-0.002	0.3	0.1	174.6		03/16/95	114	5.524	0.002	-0.001	0.3	0.1	188.0
	03/21/95	119	4.972	0.000	0.003	0.4	0.2	179.9		03/21/95	119	4.981	0.000	0.002	0.4	0.2	179.7
	03/23/95	121	3.023	-0.001	0.001	0.2	0.1	135.2		03/23/95	121	3.250	-0.001	0.000	0.2	0.1	144.3
	03/28/95	126	5.121	0.000	0.003	0.3	0.1	174.3		03/28/95	126	5.128	0.000	0.003	0.3	0.1	170.1
	03/30/95	128	4.747	-0.001	0.003	0.3	0.1	171.6		03/30/95	128	4.523	0.003	0.003	0.3	0.1	173.5
	04/04/95	133	5.884	-0.001	-0.002	0.4	0.2	194.4		04/04/95	133	6.016	-0.001	-0.003	0.4	0.2	197.9
	04/06/95	135	6.209	0.000	-0.004	0.9	0.9	191.2		04/06/95	135	6.451	0.000	-0.001	0.9	0.9	194.9
	04/11/95	140	4.021	0.000	-0.005	0.3	0.1	174.5		04/11/95	140	4.212	0.000	-0.004	0.3	0.1	172.8
	04/13/95	142	4.086	0.000	0.005	0.3	0.1	180.7		04/13/95	142	4.150	0.000	0.002	0.3	0.1	171.9
	04/18/95	147	3.703	0.000	0.006	0.3	0.2	168.2		04/18/95	147	3.646	0.000	0.006	0.3	0.2	163.1
	04/20/95	149	5.094	0.000	0.012	0.3	0.1	178.3		04/20/95	149	5.461	0.000	0.008	0.3	0.2	180.9
	04/25/95	154	3.653	0.001	0.003	0.2	0.1	151.5		04/25/95	154	4.220	0.000	0.004	0.3	0.1	168.1
	04/27/95	156	4.707	-0.001	0.005	0.3	0.1	177.2		04/27/95	156	4.983	-0.001	0.004	0.3	0.1	174.8
	05/02/95	161	4.104	0.002	-0.001	0.3	0.1	175.6		05/02/95	161	4.319	0.001	0.002	0.3	0.1	174.2
		168	3.990	0.001	0.006	0.3	0.1	165.7		05/11/95	168	4.120	0.001	0.005	0.3	0.1	163.3
	05/09/95	170	4.062	0.000	0.004	0.3	0.1	170.6		05/09/95	170	4.113	0.000	0.004	0.3	0.1	163.0
	05/16/95	175	4.485	0.001	0.006	0.2	0.1	159.5		05/16/95	175	4.523	0.001	0.005	0.2	0.1	156.8
	05/18/95	177	4.232	0.001	0.005	0.2	0.1	160.0		05/18/95	177	4.352	0.000	0.005	0.2	0.1	160.0
	05/23/95	182	4.574	0.001	0.004	0.1	0.0	172.1		05/23/95	182	4.335	0.002	0.005	0.1	0.0	170.0
	05/30/95	189	4.630	0.000	0.004	0.3	0.2	183.9		05/30/95	189	4.824	0.002	0.008	0.4	0.2	171.5
	06/01/95	191	5.217	0.000	0.007	0.4	0.2	183.1		06/01/95	191	5.337	0.002	0.006	0.4	0.2	188.8
	06/06/95	196	5.918	0.001	0.008	0.4	0.1	187.4		06/06/95	196	6.026	0.001	0.008	0.4	0.1	189.6
	06/08/95	198	5.587	0.002	0.008	0.4	0.1	179.6		06/08/95	198	5.609	0.002	0.008	0.3	0.1	178.6
	06/13/95	203	4.002	0.002	0.005	0.3	0.1	159.6		06/13/95	203	3.795	0.000	0.006	0.3	0.1	157.4
	06/15/95	205	6.043	-0.001	0.008	0.3	0.2	177.1		06/15/95	205	5.824	0.002	0.040	0.4	0.2	179.6
	06/20/95	210	6.184	0.000	0.008	0.3	0.1	175.0		06/20/95	210	5.095	0.018	0.003	0.3	0.1	176.0
	06/22/95	212	5.892	0.000	0.005	0.3	0.1	166.4		06/22/95	212	5.693	0.001	0.006	0.3	0.1	166.1
	06/27/95	217	6.455	0.000	0.009	0.4	0.2	202.1		06/27/95	217	5.742	0.002	0.010	0.3	0.2	202.9
	06/29/95	219	3.550	0.001	0.004	0.3	0.1	173.4		06/29/95	219	3.800	0.001	0.004	0.3	0.1	177.0
	07/06/95	226	4.122	0.000	0.004	0.2	0.1	173.9		07/06/95	226	3.938	0.001	0.005	0.2	0.1	176.1
	07/11/95	231	5.199	0.001	0.013	0.4	0.3	176.9		07/11/95	231	5.011	0.001	0.003	0.4	0.3	172.0
	07/13/95	233	4.852	0.001	0.004	0.6	0.5	161.2		07/13/95	233	5.009	0.001	0.003	0.6	0.6	172.1
	07/18/95	238	2.488	0.000	0.001	0.3	0.1	157.9		07/18/95	238	2.987	0.000	0.000	0.3	0.1	154.3

* All units in mg/L.

Table C-2a. Analyses of softened standing water samples of copper tubing pipe loops, phase II study.*

Loop 1	Date	Days	Cu	Pb	Zn	Ca	Mg	Na	Loop 2	Date	Days	Cu	Pb	Zn	Ca	Mg	Na
	07/20/95	240	3.793	0.000	0.005	0.3	0.1	163.3		07/20/95	240	3.873	0.000	0.004	0.3	0.1	163.5
	07/25/95	245	5.275	0.000	0.003	0.3	0.1	180.0		07/25/95	245	3.333	0.029	-0.001	0.3	0.1	179.3
	07/27/95	247	2.696	0.001	0.001	0.3	0.2	171.6		07/27/95	247	2.635	0.003	0.001	0.3	0.2	165.1
	08/01/95	252	3.327	0.000	0.005	0.3	0.1	170.6		08/01/95	252	3.570	0.000	0.005	0.3	0.1	171.5
	08/03/95	254	6.151	0.000	0.008	0.3	0.1	180.0		08/03/95	254	4.649	0.012	0.006	0.3	0.1	175.2
	08/08/95	259	4.623	0.001	0.005	0.3	0.1	173.5		08/08/95	259	3.748	0.007	0.005	0.3	0.1	168.8
	08/10/95	261	2.252	0.001	0.003	0.3	0.1	169.3		08/10/95	261	2.474	0.001	0.002	0.3	0.1	172.7
	08/15/95	266	2.794	0.000	0.001	0.2	0.1	185.2		08/15/95	266	3.365	-0.001	0.002	0.2	0.1	181.9
	08/17/95	268	3.263	0.000	-0.001	0.2	0.0	169.9		08/17/95	268	3.863	0.000	0.005	0.2	0.1	174.1
	08/22/95	273	1.771	-0.001	0.004	0.2	0.1	162.0		08/22/95	273	2.094	-0.001	0.003	0.3	0.1	154.0
	08/24/95	275	3.589	-0.001	0.005	0.3	0.1	168.8		08/24/95	275	4.162	0.000	0.005	0.3	0.1	174.0
	08/29/95	280	3.391	0.001	0.005	0.2	0.0	167.6		08/29/95	280	4.295	0.002	0.006	0.2	0.1	169.8
	08/31/95	282	3.548	0.000	0.006	0.2	0.0	167.6		08/31/95	282	4.358	0.000	0.006	0.2	0.0	169.1
	09/05/95	287	3.350	0.000	0.003	0.3	0.2	174.4		09/05/95	287	4.360	-0.001	0.006	0.3	0.2	177.2
	09/07/95	289	3.401	0.001	-0.001	0.3	0.1	173.2		09/07/95	289	4.422	0.000	0.005	0.3	0.1	172.2
	09/12/95	293	5.512	0.001	0.001	0.3	0.1	171.7		09/12/95	293	5.043	0.004	0.003	0.3	0.1	176.2
	09/14/95	295	6.064	0.001	0.004	0.3	0.1	191.8		09/14/95	295	6.067	0.002	0.004	0.3	0.1	191.6
	09/19/95	300	5.626	0.001	0.004	0.3	0.1	196.9		09/19/95	300	6.028	0.001	0.003	0.3	0.1	200.6
	09/21/95	302	5.718	0.002	0.004	0.4	0.2	186.6		09/21/95	302	6.342	0.002	0.001	0.4	0.2	195.9
	09/26/95	307	5.300	0.000	0.006	0.3	0.1	189.2		09/26/95	307	5.715	0.000	0.009	0.3	0.1	188.0
	09/28/95	309	3.663	0.001	0.005	0.3	0.1	182.0		09/28/95	309	4.606	0.001	0.003	0.3	0.1	183.5
	10/03/95	315	0.702	0.001	0.003	0.3	0.1	196.0		10/03/95	315	1.284	0.002	0.004	0.3	0.1	194.0
	10/05/95	317	0.438	-0.001	0.003	0.3	0.1	179.0		10/05/95	317	1.042	0.001	0.004	0.3	0.1	182.2
	10/10/95	322	0.561	0.000	0.004	0.3	0.1	183.4		10/10/95	322	1.597	0.001	0.003	0.3	0.1	184.5
	10/12/95	324	0.520	0.000	0.001	0.3	0.1	179.6		10/12/95	324	1.364	0.002	-0.001	0.3	0.1	188.0
	10/17/95	329	0.449	0.001	0.004	0.3	0.1	184.2		10/17/95	329	1.236	0.002	0.004	0.3	0.1	177.0
	10/19/95	331	0.444	0.001	0.000	0.3	0.1	181.4		10/19/95	331	1.288	0.000	0.000	0.3	0.1	186.7
	10/24/95	336	0.417	0.001	0.004	0.3	0.1	178.7		10/24/95	336	1.439	0.000	0.004	0.3	0.1	175.5
	10/26/95	338	0.446	0.000	0.002	0.3	0.1	174.2		10/26/95	338	1.414	-0.001	0.002	0.3	0.1	179.1
	10/31/95	343	0.303	0.001	0.000	0.4	0.2	176.7		10/31/95	343	0.966	0.001	0.005	0.4	0.2	172.0
	11/02/95	345	0.475	0.001	-0.001	0.3	0.1	177.2		11/02/95	345	1.353	0.000	-0.001	0.3	0.1	175.1
	11/07/95	350	4.271	0.001	-0.001	0.3	0.1	179.1		11/07/95	350	4.793	0.001	0.005	0.3	0.1	186.2
	11/09/95	352	1.734	0.000	0.001	0.3	0.1	177.5		11/09/95	352	2.630	0.000	0.003	0.3	0.1	178.8
	11/21/95	364	2.431	0.001	0.001	0.2	0.1	167.8		11/21/95	364	3.079	0.001	0.004	0.2	0.1	172.2
	11/28/95	371	3.263	0.000	0.004	0.2	0.1	171.4		11/28/95	371	3.585	-0.001	0.004	0.2	0.1	175.0
	11/30/95	373	3.627	0.000	0.005	0.2	0.1	167.4		11/30/95	373	3.703	0.000	0.007	0.2	0.1	168.4
	12/05/95	378	3.029	0.002	0.005	0.2	0.1	164.9		12/05/95	378	3.022	0.002	0.004	0.2	0.1	169.6
	12/07/95	380	4.406	0.000	0.002	0.2	0.0	157.5		12/07/95	380	4.146	0.000	-0.003	0.2	0.1	156.3
	12/12/95	385	5.071	0.001	0.006	0.2	0.1	167.7		12/12/95	385	4.451	0.001	0.007	0.2	0.1	157.8
	12/19/95	392	4.893	0.001	0.002	0.2	0.1	181.2		12/19/95	392	4.550	0.000	0.003	0.2	0.1	180.8
	12/21/95	394	5.029	0.000	0.001	0.2	0.1	179.7		12/21/95	394	4.640	0.000	0.002	0.2	0.1	180.4
	12/29/95	401	5.527	0.000	0.005	0.3	0.1	181.4		12/29/95	401	5.599	0.000	0.006	0.3	0.1	179.2
	01/05/96	408	4.881	-0.001	0.006	0.3	0.1	176.0		01/05/96	408	5.632	-0.001	0.006	0.3	0.1	176.4
	01/09/96	413	4.447	0.000	0.000	0.3	0.2	155.4		01/09/96	413	5.722	0.000	0.004	0.3	0.2	172.5
	01/11/96	415	5.294	0.001	0.004	0.3	0.1	172.1		01/11/96	415	5.895	0.001	0.004	0.3	0.2	171.8
	01/16/96	420	4.936	0.002	0.006	0.2	0.1	170.5		01/16/96	420	5.309	0.001	0.006	0.2	0.1	166.2
	01/18/96	422	5.097	0.001	0.005	0.2	0.0	169.3		01/18/96	422	5.539	0.001	0.006	0.2	0.1	170.6
	01/23/96	427	5.793	0.001	0.006	0.3	0.2	171.4		01/23/96	427	5.812	0.004	0.006	0.3	0.2	172.0
	01/25/96	429	5.124	0.001	0.005	0.3	0.2	160.6		01/25/96	429	5.186	0.000	0.005	0.4	0.2	177.1
	01/30/96	434	5.547	0.003	0.006	0.2	0.1	159.8		01/30/96	434	5.314	0.003	0.006	0.2	0.1	153.1
	02/01/96	436	5.837	0.001	0.005	0.2	0.1	166.3		02/01/96	436	5.989	0.001	0.005	0.2	0.1	172.4
	02/06/96	441	5.863	0.002	0.005	0.3	0.1	175.8		02/06/96	441	5.714	0.001	0.007	0.3	0.1	173.4
	02/08/96	443	7.191	0.001	0.003	0.7	0.8	181.8		02/08/96	443	6.417	0.001	0.001	0.7	0.8	178.5
	02/13/96	448	7.077	0.001	0.008	0.4	0.1	187.5		02/13/96	448	6.662	0.001	0.005	0.4	0.1	189.3
	02/15/96	450	7.719	0.001	0.006	0.4	0.1	197.5		02/15/96	450	7.062	0.001	0.002	0.4	0.1	199.5
	02/20/96	455	6.809		0.006	0.5	0.5	174.4		02/20/96	455	6.384	0.001	0.007	0.6	0.5	181.4
	02/22/96	457	6.504	0.001	0.003	0.6	0.5	166.1		02/22/96	457	6.153	-0.001	0.004	0.6	0.5	171.4
	02/27/96	462	2.799	0.001	0.006	0.2	0.1	164.3		02/27/96	462	2.417	0.000	0.001	0.2	0.1	168.9
	03/05/96	469	3.592	0.000	0.005	0.1	0.0	204.2		03/05/96	469	4.474	0.001	0.007	0.1	0.0	198.6
	03/07/96	471	4.342	0.000	0.002	17.9	29.2	106.7		03/07/96	471	4.873	0.001	0.010	19.3	31.2	112.4
	03/12/96	476	3.028	0.001	0.005	0.3	0.1	187.6		03/12/96	476	3.512	0.001	0.006	0.3	0.1	182.8

* All units in mg/L.

Table C-3. Results of analyses of non-softened standing water samples of copper soldered pipe loops, phase II study.*

Loop 1	Day	Days	Cu	Pb	Zn	Ca	Mg	Na	Loop 2	Date	Days	Cu	Pb	Zn	Ca	Mg	Na
	11/23/94	1	2.221	0.022	0.303	86.8	24.3	40.5		11/23/94	1	3.214	0.016	0.351	86.8	24.7	41.4
	11/29/94	7	2.289	0.038	0.235	73.7	20.9	36.8		11/29/94	7	2.942	0.026	0.315	76.6	21.6	37.4
	12/02/94	10	2.927	0.023	0.186	78.7	21.9	40.5		12/02/94	10	3.863	0.014	0.252	78.1	21.6	39.0
	12/06/94	14	3.336	0.020	0.136	69.1	19.7	44.3		12/06/94	14	3.825	0.010	0.181	69.6	20.0	44.7
	12/08/94	16	3.821	0.016	0.107	65.6	18.9	38.6		12/08/94	16	3.851	0.008	0.144	64.6	18.8	39.3
	12/13/94	21	1.733	0.012	0.088	66.6	20.3	38.5		12/13/94	21	1.694	0.006	0.109	65.5	20.5	40.0
	12/16/94	24	2.154	0.010	0.067	63.2	19.7	37.7		12/16/94	24	1.917	0.007	0.091	61.7	19.4	36.9
	12/20/94	28	2.447	0.012	0.076	70.2	21.1	38.4		12/20/94	28	2.176	0.006	0.103	68.7	20.9	38.3
	12/22/94	30	2.512	0.008	0.054	73.6	23.6	45.6		12/22/94	30	2.091	0.005	0.093	73.8	23.4	44.1
	12/28/94	36	2.144	0.007	0.044	68.9	22.5	43.2		12/28/94	36	1.737	0.004	0.067	67.0	21.9	41.5
	12/30/94	38	2.941	0.007	0.048	74.2	23.1	41.2		12/30/94	38	2.241	0.003	0.062	67.1	20.7	38.6
	01/04/95	43	2.586	0.007	0.053	75.3	23.2	38.8		01/04/95	43	2.163	0.004	0.063	71.1	22.2	36.5
	01/05/95	44	4.112	0.009	0.056	77.3	22.6	40.9		01/05/95	44	3.596	0.004	0.067	75.2	21.9	40.4
	01/13/95	52	5.277	0.008	0.049	79.3	22.6	39.4		01/13/95	52	5.193	0.005	0.058	79.6	22.7	38.6
	01/18/95	57	3.822	0.006	0.029	81.5	24.5	40.4		01/18/95	57	3.406	0.004	0.031	80.8	24.2	40.2
	01/20/95	59	4.476	0.006	0.028	82.1	23.8	40.6		01/20/95	59	4.199	0.004	0.035	81.7	24.1	42.2
	01/24/95	63	2.798	0.005	0.036	81.0	25.5	41.6		01/24/95	63	2.396	0.003	0.038	80.8	25.1	40.9
	01/26/95	65	5.795	0.006	0.036	87.5	25.1	34.3		01/26/95	65	5.017	0.003	0.042	83.6	23.7	32.2
	01/31/95	70	5.137	0.005	0.036	78.5	22.4	33.2		01/31/95	70	4.764	0.002	0.036	78.5	22.1	33.2
	02/02/95	72	4.658	0.004	0.027	80.9	24.3	42.4		02/02/95	72	4.162	0.002	0.022	75.2	23.1	40.4
	02/07/95	77	4.889	0.003	0.023	83.0	23.9	43.4		02/07/95	77	4.360	0.002	0.019	79.1	22.8	41.1
	02/09/95	79	4.728	0.003	0.018	82.5	23.8	44.9		02/09/95	79	4.234	0.001	0.012	77.0	22.9	44.2
	02/14/95	84	3.633	0.003	0.018	82.5	23.7	40.8		02/14/95	84	3.387	0.001	0.016	81.7	24.1	43.4
	02/24/95	94	4.070	0.004	0.014	84.3	25.1	47.6		02/24/95	94	3.927	0.003	0.013	84.1	25.1	47.0
	02/28/95	98	4.187	0.003	0.008	84.6	25.9	49.1		02/28/95	98	3.945	0.002	0.009	84.2	25.6	48.3
	03/03/95	101	5.540	0.003	0.018	99.5	28.1	45.5		03/03/95	101	5.345	0.001	0.022	99.9	28.1	45.4
	03/07/95	105	4.727	0.003	0.012	92.4	26.5	49.3		03/07/95	105	4.728	0.002	0.013	92.3	26.6	49.9
	03/08/95	107	4.244	0.003	0.013	84.8	25.2	48.2		03/08/95	107	4.114	0.002	0.013	84.8	24.9	47.9
	03/14/95	112	4.184	0.003	0.011	79.2	23.4	48.7		03/14/95	112	4.268	0.001	0.012	82.4	24.2	49.9
	03/16/95	114	4.323	0.002	0.010	80.5	22.7	46.4		03/16/95	114	4.412	0.001	0.010	87.0	23.7	48.0
	03/21/95	119	4.213	0.003	0.006	82.7	23.0	50.8		03/21/95	119	4.306	0.002	0.009	84.7	23.4	51.6
	03/23/95	121	3.191	0.002	0.008	73.8	22.3	41.5		03/23/95	121	2.844	0.000	0.007	65.5	20.0	38.5
	03/28/95	126	4.160	0.003	0.008	87.5	24.5	44.3		03/28/95	126	4.220	0.001	0.014	87.5	24.2	42.5
	03/30/95	128	3.623	0.002	0.008	79.2	22.3	37.8		03/30/95	128	3.988	0.000	0.007	82.5	23.7	40.6
	04/04/95	133	4.842	0.002	0.010	94.9	26.5	43.0		04/04/95	133	4.863	0.002	0.010	96.4	26.5	43.5
	04/06/95	135	4.719	0.001	0.010	93.4	25.7	47.0		04/06/95	135	4.690	0.000	0.010	93.1	25.7	47.9
	04/11/95	140	3.627	0.001	0.005	79.5	25.6	39.6		04/11/95	140	3.594	0.001	0.004	82.4	25.8	40.0
	04/13/95	142	3.603	0.002	0.013	82.8	25.6	41.8		04/13/95	142	3.544	0.000	0.014	83.5	25.5	41.8
	04/18/95	147	3.158	0.002	0.013	72.0	23.3	38.1		04/18/95	147	3.082	0.001	0.011	72.5	23.4	37.7
	04/20/95	149	4.621	0.002	0.017	87.9	25.3	41.6		04/20/95	149	4.487	0.000	0.018	86.5	24.8	40.9
	04/25/95	154	3.498	0.003	0.013	80.5	24.6	36.0		04/25/95	154	3.500	0.000	0.012	80.4	24.5	35.5
	04/27/95	156	3.864	0.003	0.011	84.7	24.3	43.7		04/27/95	156	3.838	0.001	0.008	83.3	23.8	42.8
	05/02/95	161	3.652	0.002	0.006	81.9	25.1	44.7		05/02/95	161	3.648	0.001	0.006	81.6	24.9	44.5
	05/09/95	168	3.727	0.001	0.010	80.8	24.3	39.4		05/09/95	168	3.656	0.000	0.011	79.6	24.0	39.2
	05/11/95	170	3.732	0.002	0.012	83.1	24.0	38.3		05/11/95	170	3.689	0.001	0.012	82.1	23.8	37.5
	05/16/95	175	4.103	0.002	0.010	78.4	22.5	35.1		05/16/95	175	4.137	0.001	0.006	75.8	22.3	35.0
	05/18/95	177	3.972	0.002	0.011	74.9	22.5	34.8		05/18/95	177	3.961	0.001	0.011	74.9	22.4	34.6
	05/23/95	182	4.757	0.002	0.012	80.1	22.5	38.8		05/23/95	182	4.873	0.002	0.012	81.3	22.9	39.6
	05/30/95	189	4.588	0.002	0.013	89.5	24.3	44.9		05/30/95	189	4.813	0.001	0.013	87.7	24.0	44.4
	06/01/95	191	5.218	0.002	0.011	88.5	24.7	46.1		06/01/95	191	5.219	0.001	0.018	88.7	24.6	45.8
	06/06/95	196	4.791	0.002	0.013	93.3	24.8	42.9		06/06/95	196	4.596	0.002	0.014	94.2	24.5	42.3
	06/08/95	198	4.214	0.002	0.015	89.3	23.3	43.7		06/08/95	198	4.018	0.002	0.015	89.3	23.3	43.8
	06/13/95	203	3.303	0.004	0.009	78.9	22.6	30.9		06/13/95	203	3.106	0.003	0.013	79.5	22.3	30.0
	06/15/95	205								06/15/95	205	4.268	0.000	0.011	87.6	24.6	39.3
	06/20/95	210								06/20/95	210	3.611	0.000	0.013	88.0	23.6	39.4
	06/22/95	212	4.248	0.003	0.011	75.8	22.2	31.8		06/22/95	212	3.044	0.001	0.008	76.2	21.6	30.2
	06/27/95	217	3.906	0.001	0.012	90.9	23.5	35.1		06/27/95	217	2.986	0.000	0.009	86.4	22.7	34.0
	06/29/95	219	2.677	0.003	0.009	83.8	23.5	36.3		06/29/95	219	2.062	0.002	0.010	80.4	22.7	35.3
	07/06/95	226	2.802	0.001	0.010	79.4	22.5	35.9		07/06/95	226	2.430	0.000	0.009	78.6	22.4	36.3
	07/11/95	231	3.462	0.001	0.008	82.5	22.5	38.0		07/11/95	231	2.984	0.002	0.010	81.5	21.9	35.9
	07/13/95	233	3.392	0.004	0.008	82.5	23.1	36.7		07/13/95	233	3.010	0.002	0.009	83.1	23.2	36.8
	07/18/95	238	2.278	0.001	0.009	76.4	22.8	34.4		07/18/95	238	1.775	0.001	0.009	69.7	20.9	31.9

* All units in mg/L.

Table C-3. Results of analyses of non-softened standing water samples of copper soldered pipe loops, phase II study.*

Loop 1	Day	Days	Cu	Pb	Zn	Ca	Mg	Na	Loop 2	Date	Days	Cu	Pb	Zn	Ca	Mg	Na
	07/20/95	240	2.418	0.001	0.010	75.3	22.0	33.9		07/20/95	240	2.041	0.001	0.010	74.0	21.4	33.5
	07/25/95	245	2.918	0.001	0.010	79.5	23.5	35.2		07/25/95	245	2.487	0.001	0.011	76.6	23.1	34.8
	07/27/95	247	2.007	0.001	0.012	75.8	22.2	33.1		07/27/95	247	1.719	0.000	0.011	74.8	21.7	32.4
	08/01/95	252	2.170	0.001	0.012	80.4	23.4	37.0		08/01/95	252	1.877	0.000	0.011	77.6	22.8	36.9
	08/03/95	254	3.419	0.000	0.016	94.7	25.9	41.4		08/03/95	254	2.954	0.000	0.011	88.8	24.7	40.0
	08/08/95	259	2.601	0.002	0.011	86.4	23.4	39.4		08/08/95	259	2.354	0.001	0.012	91.8	24.3	40.5
	08/10/95	261	1.890	0.001	0.009	77.4	22.6	37.2		08/10/95	261	1.660	0.001	0.010	79.8	23.0	37.4
	08/15/95	266	2.268	0.001	0.010	75.5	22.6	39.9		08/15/95	266	1.974	0.001	0.010	73.1	22.0	39.1
	08/17/95	268	2.246	0.001	0.010	74.5	21.9	35.8		08/17/95	268	2.013	0.000	0.010	74.1	21.7	35.9
	08/22/95	273	1.949	0.000	0.013	85.1	23.3	33.6		08/22/95	273	1.781	-0.001	0.013	84.7	23.3	33.8
	08/24/95	275	2.508	0.000	0.011	76.6	22.1	34.3		08/24/95	275	2.239	0.000	0.012	75.2	21.5	32.4
	08/29/95	280	2.652	0.002	0.011	82.2	22.7	36.1		08/29/95	280	2.380	0.002	0.012	79.6	22.2	35.6
	08/31/95	282	2.739	0.001	0.010	82.6	23.6	35.9		08/31/95	282	2.539	0.000	0.011	83.7	23.6	35.8
	09/05/95	287	2.540	0.001	0.010	81.1	23.0	37.1		09/05/95	287	2.426	0.000	0.010	83.1	23.4	37.7
	09/07/95	289	2.645	0.001	0.011	84.4	23.6	38.1		09/07/95	289	2.457	0.000	0.010	83.3	23.5	38.3
	09/12/95	293	3.308	0.002	0.008	85.2	23.2	38.2		09/12/95	293	3.142	0.001	0.009	85.1	23.4	38.6
	09/14/95	295	3.638	0.001	0.011	91.2	24.9	41.6		09/14/95	295	3.434	-0.001	0.011	90.9	24.7	41.4
	09/19/95	300	3.224	0.003	0.011	89.6	25.1	44.3		09/19/95	300	3.065	0.004	0.008	89.6	25.0	44.2
	09/21/95	302	3.431	0.003	0.011	91.5	25.9	44.5		09/21/95	302	3.165	0.002	0.008	89.5	25.0	42.8
	09/26/95	307	3.006	0.001	0.013	87.8	25.1	44.6		09/26/95	307	2.797	0.000	0.007	88.2	24.5	42.7
	09/28/95	309	2.583	0.001	0.010	86.8	23.3	49.3		09/28/95	309	2.455	0.001	0.010	86.1	23.2	49.3
	10/03/95	315	1.957	0.002	0.010	82.5	24.6	48.4		10/03/95	315	2.087	0.001	0.010	82.9	24.8	49.2
	10/05/95	317	1.860	0.001	0.011	84.2	24.2	42.5		10/05/95	317	2.080	0.001	0.010	83.1	24.6	44.6
	10/10/95	322	2.334	0.001	0.010	84.1	24.6	45.0		10/10/95	322	2.655	0.000	0.013	83.8	24.6	45.2
	10/12/95	324	2.347	0.001	0.005	83.2	24.2	44.9		10/12/95	324	2.732	0.001	0.007	83.4	24.4	45.4
	10/17/95	329	2.367	0.002	0.010	82.1	23.2	41.4		10/17/95	329	2.778	0.002	0.011	82.5	23.2	41.7
	10/19/95	331	2.438	0.001	0.013	83.3	23.3	41.4		10/19/95	331	2.837	0.001	0.010	82.9	23.4	42.1
	10/24/95	336	2.413	0.001	0.004	79.5	23.5	43.7		10/24/95	336	2.879	0.001	0.002	78.3	23.9	45.7
	10/26/95	338	2.539	0.000	0.009	81.1	23.8	44.4		10/26/95	338	2.780	0.000	0.007	80.7	23.6	43.5
	10/31/95	343	2.476	0.001	0.007	79.5	23.6	43.6		10/31/95	343	2.741	0.001	0.006	79.8	23.3	42.7
	11/02/95	345	2.735	0.001	0.006	82.3	24.2	43.1		11/02/95	345	3.113	0.001	0.008	82.3	24.2	42.8
	11/07/95	350	4.201	0.000	0.001	92.0	25.0	36.1		11/07/95	350	4.576	0.000	0.001	91.8	25.0	36.4
	11/09/95	352	3.077	0.001	0.006	82.2	24.0	41.7		11/09/95	352	3.523	0.001	0.009	82.2	24.0	41.4
	11/21/95	364	2.984	0.003	0.007	78.6	23.0	37.4		11/21/95	364	3.372	0.002	0.005	77.0	22.5	36.7
	11/28/95	371	2.969	0.002	0.007	79.6	22.9	35.9		11/28/95	371	3.351	0.001	0.005	77.1	22.2	34.8
	11/30/95	373	2.984	0.001	0.007	77.3	22.2	34.7		11/30/95	373	3.547	0.001	0.006	80.4	23.3	36.4
	12/05/95	378	2.846	0.002	0.005	79.7	23.6	37.9		12/05/95	378	3.255	0.003	0.003	79.7	23.6	38.0
	12/07/95	380	3.013	0.001	0.001	74.4	22.5	35.2		12/07/95	380	3.665	0.000	0.002	76.0	23.1	36.1
	12/12/95	385	3.099	0.002	0.006	77.2	22.7	35.2		12/12/95	385	3.542	0.002	0.006	77.6	22.7	35.1
	12/19/95	392	3.121	0.001	0.001	83.8	24.8	39.7		12/19/95	392	3.480	0.000	-0.001	83.1	24.7	40.0
	12/21/95	394	3.188	0.002	0.007	84.6	25.1	38.7		12/21/95	394	3.602	0.001	0.005	83.7	25.4	39.6
	12/29/95	401	3.442	0.001	0.005	84.2	25.2	39.4		12/29/95	401	3.761	0.001	0.004	83.9	25.0	39.0
	01/05/96	408	3.302	0.001	0.006	83.4	25.7	37.8		01/05/96	408	3.797	0.002	0.004	82.0	25.7	38.7
	01/09/96	413	2.957	0.000	0.006	68.6	20.3	32.0		01/09/96	413	3.659	-0.001	0.009	78.7	22.8	34.8
	01/11/96	415	3.265	0.002	0.004	81.5	24.3	37.6		01/11/96	415	3.719	0.001	0.005	80.5	23.7	36.4
	01/16/96	420	2.919	0.001	0.006	77.4	23.1	35.6		01/16/96	420	2.828	0.001	0.005	64.7	19.6	30.6
	01/18/96	422	2.971	0.002	0.006	80.9	24.0	35.1		01/18/96	422	3.567	0.002	0.004	80.1	24.2	36.0
	01/23/96	427	3.344	0.001	0.005	78.6	23.0	34.1		01/23/96	427	3.601	0.001	0.004	79.0	23.1	34.1
	01/25/96	429	3.343	0.001	0.005	81.1	24.6	37.9		01/25/96	429	3.479	0.001	0.004	77.8	23.8	37.9
	01/30/96	434	3.412	0.002	0.005	81.0	23.0	32.2		01/30/96	434	3.488	0.003	0.004	81.1	23.0	32.2
	02/01/96	436	3.460	0.001	0.004	79.1	23.3	33.7		02/01/96	436	3.559	0.001	0.004	77.5	23.2	34.0
	02/06/96	441	3.029	0.002	0.006	84.0	23.5	35.6		02/06/96	441	3.215	0.002	0.005	84.1	23.5	35.6
	02/08/96	443	3.342	0.002	0.002	82.6	24.0	36.4		02/08/96	443	3.640	0.002	0.001	87.1	24.5	36.4
	02/13/96	448	3.212	0.001	0.006	91.4	25.4	43.6		02/13/96	448	3.475	0.001	0.005	90.2	25.3	43.9
	02/15/96	450	3.358	0.002	0.005	94.3	26.3	46.5		02/15/96	450	3.696	0.001	0.004	94.2	26.4	47.2
	02/20/96	455	3.253	0.002	0.006	88.6	25.0	47.2		02/20/96	455	3.379	0.002	0.006	90.6	25.5	48.2
	02/22/96	457	3.058	0.001	0.003	86.3	24.2	44.4		02/22/96	457	3.038	0.001	0.004	77.2	21.6	39.5
	02/27/96	462	1.851	0.001	0.007	79.0	24.1	36.9		02/27/96	462	1.878	0.001	0.007	80.6	24.1	36.3
	03/05/96	469	1.885	0.002	0.009	91.6	25.5	43.5		03/05/96	469	3.004	0.001	0.005	99.0	25.7	49.9
	03/07/96	471	2.706	0.004	0.007	88.7	24.2	41.4		03/07/96	471	2.488	0.000	0.007	89.9	24.1	40.7
	03/12/96	476	2.496	0.001	0.006	93.3	24.7	42.5		03/12/96	476	2.492	0.001	0.009	94.8	25.1	42.7

* All units in mg/L.

Table C-3a. Results of analyses of softened standing water samples of copper soldered pipe loops, phase II study.*

Loop 1	Date	Days	Cu	Pb	Zn	Ca	Mg	Na	Loop 2	Date	Days	Cu	Pb	Zn	Ca	Mg	Na
	11/23/94	1	4.230	0.0	0.234	0.2	0.1	173.1		11/23/94	1	1.602	0.138	0.137	0.3	0.1	173.4
	11/29/94	7	3.670	0.0	0.180	51.1	25.8	73.7		11/29/94	7	2.119	0.064	0.149	46.1	23.1	68.4
	12/02/94	10	3.322	0.0	0.161	68.8	24.6	45.3		12/02/94	10	2.134	0.003	0.118	64.9	23.6	43.8
	12/06/94	14	3.048	0.0	0.128	0.1	0.0	153.7		12/06/94	14	1.818	0.097	0.085	0.2	0.0	161.7
	12/08/94	16	3.046	0.0	0.111	0.1	0.0	154.9		12/08/94	16	1.693	0.055	0.075	0.2	0.0	141.0
	12/13/94	21	1.831	0.0	0.101	0.1	0.0	161.9		12/13/94	21	1.271	0.039	0.080	0.1	0.0	148.1
	12/16/94	24	2.021	0.0	0.074	0.1	0.0	150.0		12/16/94	24	1.886	0.037	0.075	0.1	0.0	151.2
	12/20/94	28	2.275	0.0	0.072	0.2	0.1	152.2		12/20/94	28	2.066	0.032	0.081	0.2	0.1	156.3
	12/22/94	30	1.481	0.0	0.055	33.1	22.5	63.3		12/22/94	30	1.455	0.037	0.068	32.5	22.6	65.1
	12/28/94	36	2.174	0.0	0.043	69.0	24.7	44.9		12/28/94	36	2.159	0.030	0.056	65.9	23.9	44.6
	12/30/94	38	2.990	0.0	0.038	65.9	22.2	41.7		12/30/94	38	3.275	0.024	0.058	71.5	24.0	42.9
	01/04/95	43	3.281	0.0	0.038	74.4	22.3	37.2		01/04/95	43	1.998	0.090	0.036	76.0	22.9	38.0
	01/05/95	44	4.907	0.0	0.043	76.5	22.3	41.8		01/05/95	44	2.911	0.164	0.033	76.5	22.4	40.7
	01/13/95	52	4.111	0.0	0.030	0.1	0.0	172.2		01/13/95	52	3.480	0.021	0.033	0.1	0.0	157.7
	01/18/95	57	3.135	0.0	0.025	0.3	0.2	178.0		01/18/95	57	2.852	0.019	0.019	0.3	0.1	179.8
	01/20/95	59	3.519	0.0	0.027	0.4	0.2	180.4		01/20/95	59	3.143	0.020	0.029	0.4	0.2	183.0
	01/24/95	63	2.632	0.0	0.030	0.4	0.2	177.4		01/24/95	63	2.071	0.025	0.039	0.4	0.2	182.3
	01/26/95	65	3.845	0.0	0.031	0.4	0.3	174.7		01/26/95	65	3.165	0.022	0.026	0.4	0.2	159.8
	01/31/95	70	3.469	0.0	0.025	0.3	0.1	160.0		01/31/95	70	2.953	0.020	0.028	0.3	0.1	160.2
	02/02/95	72	2.847	0.0	0.017	0.3	0.1	154.3		02/02/95	72	2.469	0.019	0.021	0.3	0.1	159.8
	02/07/95	77	2.958	0.0	0.015	0.3	0.2	160.0		02/07/95	77	2.788	0.017	0.017	0.3	0.2	168.8
	02/09/95	79	3.088	0.0	0.013	0.4	0.2	173.9		02/09/95	79	2.641	0.017	0.019	0.3	0.2	169.6
	02/14/95	84	2.792	0.0	0.014	0.3	0.1	178.6		02/14/95	84	2.269	0.018	0.020	0.3	0.1	179.5
	02/24/95	94	3.235	0.0	0.015	0.3	0.1	185.4		02/24/95	94	2.726	0.020	0.019	0.3	0.1	185.7
	02/28/95	98	3.336	0.0	0.008	0.3	0.1	186.9		02/28/95	98	2.893	0.019	0.011	0.3	0.1	187.1
	03/03/95	101	4.215	0.0	0.017	0.7	0.7	202.8		03/03/95	101	3.694	0.020	0.021	0.8	0.7	196.5
	03/07/95	105	3.713	0.0	0.014	1.0	0.9	187.9		03/07/95	105	3.321	0.016	0.016	0.9	0.9	185.7
	03/08/95	107	3.542	0.0	0.009	0.6	0.5	183.1		03/08/95	107	3.040	0.016	0.014	0.6	0.5	178.7
	03/14/95	112	3.397	0.0	0.006	0.4	0.1	172.4		03/14/95	112	2.749	0.026	0.017	0.3	0.1	184.9
	03/16/95	114	3.838	0.0	0.008	0.4	0.1	181.8		03/16/95	114	3.166	0.020	0.014	0.3	0.1	184.4
	03/21/95	119	3.528	0.0	0.010	0.4	0.2	180.4		03/21/95	119	3.060	0.014	0.010	0.4	0.2	170.1
	03/23/95	121	2.427	0.0	0.004	0.2	0.1	152.5		03/23/95	121	2.028	0.012	0.004	0.2	0.1	140.3
	03/28/95	126	3.829	0.0	0.009	0.3	0.1	182.5		03/28/95	126	3.239	0.042	0.017	0.3	0.1	178.8
	03/30/95	128	3.464	0.0	0.010	0.3	0.1	170.5		03/30/95	128	2.872	0.023	0.017	0.3	0.1	170.4
	04/04/95	133	4.280	0.0	0.009	0.4	0.2	193.7		04/04/95	133	3.603	0.020	0.016	0.4	0.2	196.5
	04/06/95	135	4.509	0.0	0.013	0.9	0.9	192.0		04/06/95	135	3.790	0.016	0.019	0.9	0.9	188.0
	04/11/95	140	2.779	0.0	0.007	0.3	0.1	177.0		04/11/95	140	2.211	0.011	0.013	0.3	0.1	173.6
	04/13/95	142	2.813	0.0	0.012	0.3	0.1	179.3		04/13/95	142	2.291	0.012	0.020	0.3	0.1	176.4
	04/18/95	147	2.490	0.0	0.011	0.3	0.2	170.1		04/18/95	147	1.963	0.014	0.019	0.3	0.2	167.8
	04/20/95	149	3.440	0.0	0.016	0.3	0.1	175.1		04/20/95	149	3.100	0.018	0.019	0.3	0.1	177.4
	04/25/95	154	2.714	0.0	0.014	0.3	0.1	165.1		04/25/95	154	2.082	0.013	0.017	0.3	0.1	161.9
	04/27/95	156	3.214	0.0	0.014	0.3	0.1	173.7		04/27/95	156	2.670	0.014	0.016	0.3	0.1	173.3
	05/02/95	161	2.987	0.0	0.019	0.3	0.1	175.3		05/02/95	161	2.570	0.014	0.013	0.3	0.1	172.4
	05/09/95	168	2.936	0.0	0.012	0.3	0.1	166.9		05/09/95	168	2.462	0.013	0.016	0.2	0.1	169.2
	05/11/95	170	2.907	0.0	0.011	0.3	0.1	161.3		05/11/95	170	2.446	0.013	0.018	0.3	0.1	169.6
	05/16/95	175	3.345	0.0	0.013	0.2	0.1	159.5		05/16/95	175	3.030	0.012	0.011	0.2	0.1	162.6
	05/18/95	177	2.990	0.0	0.009	0.2	0.1	150.2		05/18/95	177	2.637	0.012	0.017	0.2	0.1	154.0
	05/23/95	182	3.816	0.0	0.007	0.1	0.0	168.7		05/23/95	182	3.109	0.016	0.016	0.1	0.0	173.2
	05/30/95	189	3.837	0.0	0.015	0.4	0.2	187.9		05/30/95	189	2.281	0.021	0.019	0.3	0.2	189.3
	06/01/95	191	4.395	0.0	0.015	0.4	0.3	193.6		06/01/95	191	2.969	0.023	0.018	0.4	0.3	187.2
	06/06/95	196	4.757	0.0	0.015	0.4	0.1	187.8		06/06/95	196	3.443	0.017	0.019	0.4	0.1	186.7
	06/08/95	198	4.302	0.0	0.016	0.3	0.1	176.7		06/08/95	198	3.534	0.012	0.018	0.4	0.1	175.6
	06/13/95	203	3.006	0.0	0.010	0.3	0.1	165.5		06/13/95	203	2.433	0.012	0.012	0.3	0.1	157.1
	06/15/95	205	4.558	0.0	0.035	0.4	0.2	176.3		06/15/95	205	3.388	0.020	0.020	0.4	0.2	176.7
	06/20/95	210	4.375	0.0	0.015	0.3	0.1	179.8		06/20/95	210	2.937	0.056	0.012	0.3	0.1	178.3
	06/22/95	212	4.155	0.0	0.012	0.3	0.1	166.4		06/22/95	212	3.553	0.014	0.014	0.3	0.1	171.1
	06/27/95	217	4.235	0.0	0.014	0.4	0.2	199.4		06/27/95	217	3.284	0.015	0.017	0.4	0.2	198.0
	06/29/95	219	2.809	0.0	0.011	0.3	0.1	169.4		06/29/95	219	2.531	0.011	0.012	0.3	0.1	177.0
	07/06/95	226	2.891	0.0	0.011	0.3	0.1	167.4		07/06/95	226	2.541	0.012	0.013	0.2	0.1	174.7
	07/11/95	231	3.479	0.0	0.014	0.4	0.3	167.2		07/11/95	231	3.272	0.011	0.010	0.4	0.3	165.0
	07/13/95	233	3.583	0.0	0.008	0.6	0.5	170.5		07/13/95	233	3.500	0.013	0.009	0.7	0.6	174.8
	07/18/95	238	2.570	0.0	0.012	0.3	0.1	165.9		07/18/95	238	2.368	0.009	0.010	0.3	0.1	157.3

* All units in mg/L.

Table C-3a. Results of analyses of softened standing water samples of copper soldered pipe loops, phase II study.*

Loop 1	Date	Days	Cu	Pb	Zn	Ca	Mg	Na	Loop 2	Date	Days	Cu	Pb	Zn	Ca	Mg	Na
	07/20/95	240	2.957	0.0	0.011	0.3	0.1	162.7		07/20/95	240	2.911	0.010	0.011	0.3	0.1	169.5
	07/25/95	245	3.524	0.0	0.015	0.3	0.1	184.2		07/25/95	245	2.696	0.038	0.012	0.3	0.1	181.9
	07/27/95	247	2.877	0.0	0.011	0.4	0.2	180.4		07/27/95	247	2.145	0.013	0.014	0.3	0.2	166.2
	08/01/95	252	2.898	0.0	0.011	0.3	0.1	171.1		08/01/95	252	2.838	0.011	0.011	0.3	0.1	172.9
	08/03/95	254	4.351	0.0	0.018	0.3	0.1	190.0		08/03/95	254	2.423	0.144	0.014	0.3	0.1	178.2
	08/08/95	259	3.593	0.0	0.015	0.3	0.1	174.9		08/08/95	259	2.352	0.052	0.013	0.3	0.1	174.5
	08/10/95	261	2.634	0.0	0.012	0.3	0.1	173.2		08/10/95	261	2.647	0.010	0.012	0.3	0.1	173.2
	08/15/95	266	2.890	0.0	0.011	0.3	0.1	174.8		08/15/95	266	2.854	0.010	0.011	0.2	0.1	170.2
	08/17/95	268	2.857	0.0	0.011	0.3	0.1	161.6		08/17/95	268	2.632	0.013	0.012	0.2	0.0	168.5
	08/22/95	273	2.206	0.0	0.013	0.3	0.1	155.6		08/22/95	273	2.489	0.011	0.012	0.3	0.1	159.0
	08/24/95	275	3.110	0.0	0.011	0.3	0.1	170.9		08/24/95	275	3.123	0.012	0.011	0.3	0.1	172.6
	08/29/95	280	3.270	0.1	0.010	0.2	0.0	172.0		08/29/95	280	3.375	0.013	0.010	0.2	0.1	169.7
	08/31/95	282	3.189	0.0	0.010	0.2	0.1	169.8		08/31/95	282	3.321	0.010	0.009	0.2	0.0	169.4
	09/05/95	287	3.234	0.0	0.011	0.4	0.2	176.6		09/05/95	287	3.392	0.009	0.010	0.3	0.2	177.5
	09/07/95	289	3.284	0.0	0.010	0.3	0.1	170.7		09/07/95	289	3.449	0.010	0.010	0.3	0.1	173.1
	09/12/95	293	4.042	0.0	0.014	0.3	0.0	188.8		09/12/95	293	2.814	0.090	0.012	0.3	0.1	175.4
	09/14/95	295	4.401	0.0	0.009	0.3	0.1	193.6		09/14/95	295	4.189	0.011	0.015	0.3	0.1	194.7
	09/19/95	300	4.368	0.0	0.009	0.4	0.1	197.1		09/19/95	300	4.200	0.011	0.010	0.3	0.1	191.7
	09/21/95	302	4.132	0.0	0.009	0.4	0.2	183.7		09/21/95	302	4.174	0.010	0.009	0.4	0.2	186.6
	09/26/95	307	4.074	0.0	0.013	0.3	0.1	188.5		09/26/95	307	4.128	0.009	0.013	0.3	0.1	191.1
	09/28/95	309	3.633	0.0	0.014	0.4	0.1	184.1		09/28/95	309	3.699	0.009	0.013	0.3	0.1	182.3
	10/03/95	315	2.609	0.0	0.009	0.3	0.1	197.2		10/03/95	315	2.149	0.024	0.014	0.3	0.1	198.2
	10/05/95	317	2.432	0.0	0.016	0.3	0.1	176.8		10/05/95	317	2.098	0.023	0.020	0.3	0.1	178.5
	10/10/95	322	2.925	0.0	0.016	0.3	0.1	184.8		10/10/95	322	2.611	0.014	0.018	0.3	0.1	182.5
	10/12/95	324	2.828	0.0	0.009	0.3	0.1	181.0		10/12/95	324	2.594	0.013	0.012	0.3	0.1	181.5
	10/17/95	329	2.895	0.0	0.013	0.3	0.1	180.1		10/17/95	329	2.814	0.011	0.015	0.3	0.1	183.5
	10/19/95	331	2.907	0.0	0.008	0.3	0.1	184.9		10/19/95	331	2.618	0.013	0.011	0.3	0.1	182.0
	10/24/95	336	2.791	0.0	0.009	0.3	0.1	176.5		10/24/95	336	2.727	0.009	0.009	0.3	0.1	174.0
	10/26/95	338	2.820	0.0	0.011	0.3	0.1	174.0		10/26/95	338	2.564	0.010	0.013	0.3	0.1	173.1
	10/31/95	343	2.779	0.0	0.008	0.4	0.2	173.7		10/31/95	343	2.672	0.011	0.008	0.4	0.2	178.2
	11/02/95	345	2.871	0.0	0.011	0.3	0.1	181.4		11/02/95	345	2.782	0.008	0.007	0.3	0.1	180.7
	11/07/95	350	3.719	0.0	0.008	0.3	0.1	182.9		11/07/95	350	3.326	0.010	0.009	0.3	0.1	181.3
	11/09/95	352	3.134	0.0	0.011	0.3	0.1	174.0		11/09/95	352	2.919	0.008	0.012	0.3	0.1	174.4
	11/21/95	364	3.433	0.0	0.006	0.2	0.1	171.7		11/21/95	364	3.109	0.011	0.011	0.3	0.1	163.4
	11/28/95	371	3.425	0.0	0.006	0.3	0.1	165.7		11/28/95	371	3.083	0.010	0.007	0.2	0.1	154.5
	11/30/95	373	3.452	0.0	0.006	0.2	0.1	169.6		11/30/95	373	3.264	0.010	0.007	0.2	0.1	167.7
	12/05/95	378	3.061	0.0	0.005	0.2	0.1	173.6		12/05/95	378	3.000	0.011	0.005	0.2	0.1	172.5
	12/07/95	380	3.458	0.0	0.002	0.2	0.1	167.1		12/07/95	380	3.218	0.010	0.003	0.2	0.1	158.5
	12/12/95	385	3.394	0.0	0.006	0.2	0.1	164.4		12/12/95	385	3.337	0.010	0.014	0.3	0.1	167.1
	12/19/95	392	3.517	0.0	0.007	0.2	0.1	181.2		12/19/95	392	3.459	0.009	0.007	0.2	0.1	184.1
	12/21/95	394	3.532	0.0	0.006	0.2	0.1	178.4		12/21/95	394	3.456	0.010	0.006	0.3	0.1	178.3
	12/29/95	401	3.816	0.0	0.005	0.3	0.1	179.1		12/29/95	401	3.737	0.010	0.005	0.3	0.1	182.6
	01/05/96	408	3.781	0.0	0.004	0.3	0.1	176.3		01/05/96	408	3.625	0.009	0.005	0.3	0.1	175.8
	01/09/96	413	3.618	0.0	0.003	0.3	0.2	158.5		01/09/96	413	3.422	0.009	0.009	0.3	0.2	159.4
	01/11/96	415	4.169	0.0	0.005	0.3	0.2	172.2		01/11/96	415	3.756	0.010	0.005	0.3	0.1	169.5
	01/16/96	420	3.643	0.0	0.005	0.2	0.1	161.5		01/16/96	420	3.544	0.010	0.006	0.2	0.1	164.0
	01/18/96	422	3.953	0.0	0.004	0.2	0.0	168.9		01/18/96	422	3.669	0.009	0.005	0.2	0.0	164.6
	01/23/96	427	4.568	0.0	0.007	0.3	0.2	177.2		01/23/96	427	4.382	0.009	0.007	0.3	0.2	177.0
	01/25/96	429	4.426	0.0	0.008	0.3	0.2	172.6		01/25/96	429	3.722	0.008	0.004	0.3	0.2	153.1
	01/30/96	434	4.452	0.0	0.008	0.2	0.1	158.0		01/30/96	434	4.436	0.011	0.008	0.2	0.1	166.0
	02/01/96	436	4.728	0.0	0.009	0.2	0.1	167.5		02/01/96	436	4.474	0.010	0.007	0.2	0.1	165.1
	02/06/96	441	4.161	0.0	0.004	0.3	0.1	174.7		02/06/96	441	4.013	0.009	0.004	0.3	0.1	175.9
	02/08/96	443	4.752	0.0	0.006	0.7	0.8	177.4		02/08/96	443	4.621	0.009	0.004	0.7	0.8	179.6
	02/13/96	448	5.081	0.0	0.010	0.4	0.1	192.9		02/13/96	448	4.806	0.011	0.010	0.4	0.1	188.9
	02/15/96	450	5.279	0.0	0.009	0.4	0.1	197.0		02/15/96	450	5.061	0.009	0.009	0.4	0.1	196.6
	02/20/96	455	5.212	0.0	0.009	0.6	0.5	197.8		02/20/96	455	4.804	0.010	0.009	0.6	0.5	191.5
	02/22/96	457	4.511	0.0	0.007	0.6	0.5	171.2		02/22/96	457	4.330	0.009	0.007	0.6	0.5	174.7
	02/27/96	462	2.674	0.0	0.008	0.2	0.1	163.7		02/27/96	462	2.598	0.007	0.009	0.2	0.1	164.9
	03/05/96	469	6.078	0.0	0.013	0.1	0.0	204.1		03/05/96	469	5.735	0.012	0.013	0.1	0.0	201.7
	03/07/96	471	5.342	0.0	0.008	19.4	31.3	112.1		03/07/96	471	5.317	0.010	0.008	18.8	30.8	112.4
	03/12/96	476	4.401	0.0	0.012	0.3	0.1	171.0		03/12/96	476	4.554	0.007	0.012	0.3	0.1	177.5

* All units in mg/L.

Table C-4. Results of analyses of non-softened standing water samples of faucets, phase II study.*

Faucet 1	Date	Days	Cu	Pb	Zn	Ca	Mg	Na	Faucet 2	Date	Days	Cu	Pb	Zn	Ca	Mg	Na
	11/23/94	1	0.081	0.071	0.097	87.8	25.1	41.1		11/23/94	1	4.230	0.024	0.234	0.2	0.1	173.1
	11/29/94	7	0.129	0.049	0.155	83.4	24.2	41.3		11/29/94	7	3.670	0.020	0.180	51.1	25.8	73.7
	12/02/94	10	0.132	0.046	0.284	85.8	24.0	41.8		12/02/94	10	3.322	0.029	0.161	68.8	24.6	45.3
	12/06/94	14	0.091	0.036	0.446	71.8	20.7	45.0		12/06/94	14	3.048	0.019	0.128	0.1	0.0	153.7
	12/08/94	16	0.102	0.034	0.514	74.6	21.5	43.0		12/08/94	16	3.046	0.020	0.111	0.1	0.0	154.9
	12/13/94	21	0.046	0.043	0.525	75.2	23.2	45.1		12/13/94	21	1.831	0.015	0.101	0.1	0.0	161.9
	12/16/94	24	0.046	0.033	0.457	68.1	21.8	42.3		12/16/94	24	2.021	0.016	0.074	0.1	0.0	150.0
	12/20/94	28	0.057	0.031	0.611	70.7	22.2	41.4		12/20/94	28	2.275	0.015	0.072	0.2	0.1	152.2
	12/22/94	30	0.052	0.028	0.651	74.1	23.8	44.7		12/22/94	30	1.481	0.013	0.055	33.1	22.5	63.3
	12/28/94	36	0.053	0.024	0.709	73.7	23.9	45.2		12/28/94	36	2.174	0.013	0.043	69.0	24.7	44.9
	12/30/94	38	0.065	0.016	0.691	74.6	23.5	41.9		12/30/94	38	2.990	0.010	0.038	65.9	22.2	41.7
	01/04/95	43	0.054	0.021	0.855	75.9	24.0	39.8		01/04/95	43	3.281	0.009	0.038	74.4	22.3	37.2
	01/05/95	44	0.061	0.025	1.079	76.2	23.1	43.6		01/05/95	44	4.907	0.012	0.043	76.5	22.3	41.8
	01/13/95	52	0.081	0.021	0.917	81.8	23.2	38.0		01/13/95	52	4.111	0.009	0.030	0.1	0.0	172.2
	01/18/95	57	0.050	0.014	0.877	81.8	24.9	41.9		01/18/95	57	3.135	0.010	0.025	0.3	0.2	178.0
	01/20/95	59	0.047	0.014	1.007	82.2	24.6	43.0		01/20/95	59	3.519	0.008	0.027	0.4	0.2	180.4
	01/24/95	63	0.034	0.015	0.787	81.6	25.7	41.8		01/24/95	63	2.632	0.007	0.030	0.4	0.2	177.4
	01/26/95	65	0.044	0.013	1.065	80.6	23.2	31.0		01/26/95	65	3.845	0.009	0.031	0.4	0.3	174.7
	01/31/95	70	0.046	0.012	1.240	90.7	25.7	36.1		01/31/95	70	3.469	0.008	0.025	0.3	0.1	160.0
	02/02/95	72	0.051	0.008	0.970	68.0	21.3	38.4		02/02/95	72	2.847	0.005	0.017	0.3	0.1	154.3
	02/07/95	77	0.086	0.006	1.160	79.9	23.4	43.8		02/07/95	77	2.958	0.006	0.015	0.3	0.2	160.0
	02/09/95	79	0.082	0.006	1.137	83.0	24.3	45.5		02/09/95	79	3.088	0.006	0.013	0.4	0.2	173.9
	02/14/95	84	0.058	0.005	0.858	80.8	24.6	43.5		02/14/95	84	2.792	0.007	0.014	0.3	0.1	178.6
	02/24/95	94	0.096	0.006	1.119	83.9	25.9	48.6		02/24/95	94	3.235	0.007	0.015	0.3	0.1	185.4
	02/28/95	98	0.088	0.006	1.594	85.6	26.3	49.9		02/28/95	98	3.336	0.006	0.008	0.3	0.1	186.9
	03/03/95	101	0.099	0.006	1.386	99.2	29.0	48.2		03/03/95	101	4.215	0.008	0.017	0.7	0.7	202.8
	03/07/95	105	0.113	0.008	1.237	92.6	26.3	47.5		03/07/95	105	3.713	0.007	0.014	1.0	0.9	187.9
	03/08/95	107	0.110	0.007	1.161	86.8	25.9	49.1		03/08/95	107	3.542	0.007	0.009	0.6	0.5	183.1
	03/14/95	112	0.153	0.007	1.205	85.3	24.0	48.3		03/14/95	112	3.397	0.007	0.006	0.4	0.1	172.4
	03/16/95	114	0.155	0.007	1.228	84.8	23.8	49.2		03/16/95	114	3.838	0.007	0.008	0.4	0.1	181.8
	03/21/95	119	0.198	0.007	1.332	85.7	23.8	51.2		03/21/95	119	3.528	0.011	0.010	0.4	0.2	180.4
	03/23/95	121	0.115	0.005	0.838	69.6	21.3	41.6		03/23/95	121	2.427	0.005	0.004	0.2	0.1	152.5
	03/28/95	126	0.139	0.006	0.945	87.2	24.1	42.4		03/28/95	126	3.829	0.008	0.009	0.3	0.1	182.5
	03/30/95	128	0.152	0.006	1.068	84.8	24.0	40.8		03/30/95	128	3.464	0.007	0.010	0.3	0.1	170.5
	04/04/95	133	0.155	0.007	1.161	96.7	27.0	45.2		04/04/95	133	4.280	0.009	0.009	0.4	0.2	193.7
	04/06/95	135	0.181	0.007	1.191	91.5	25.9	48.4		04/06/95	135	4.509	0.006	0.013	0.9	0.9	192.0
	04/11/95	140	0.190	0.006	0.854	81.4	26.4	42.4		04/11/95	140	2.779	0.005	0.007	0.3	0.1	177.0
	04/13/95	142	0.190	0.005	0.868	82.2	26.2	43.8		04/13/95	142	2.813	0.005	0.012	0.3	0.1	179.3
	04/18/95	147	0.159	0.007	0.762	77.2	24.6	40.2		04/18/95	147	2.490	0.007	0.011	0.3	0.2	170.1
	04/20/95	149	0.200	0.008	0.939	89.3	25.5	42.4		04/20/95	149	3.440	0.006	0.016	0.3	0.1	175.1
	04/25/95	154	0.191	0.006	0.738	80.5	25.0	36.7		04/25/95	154	2.714	0.007	0.014	0.3	0.1	165.1
	04/27/95	156	0.190	0.005	0.897	83.8	24.4	43.7		04/27/95	156	3.214	0.008	0.014	0.3	0.1	173.7
	05/02/95	161	0.123	0.007	0.967	81.2	25.1	45.1		05/02/95	161	2.987	0.008	0.019	0.3	0.1	175.3
	05/09/95	168	0.208	0.006	0.844	81.8	24.2	40.0		05/09/95	168	2.936	0.007	0.012	0.3	0.1	166.9
	05/11/95	170	0.191	0.004	0.808	79.4	23.5	38.4		05/11/95	170	2.907	0.007	0.011	0.3	0.1	161.3
	05/16/95	175	0.169	0.004	0.234	76.8	23.0	43.4		05/16/95	175	3.345	0.008	0.013	0.2	0.1	159.5
	05/18/95	177	0.064	0.002	0.089	74.7	22.3	35.8		05/18/95	177	2.990	0.007	0.009	0.2	0.1	150.2
	05/23/95	182	0.225	0.008	0.760	79.7	22.9	41.4		05/23/95	182	3.816	0.008	0.007	0.1	0.0	168.7
	05/30/95	189	0.259	0.008	0.503	88.8	24.6	46.5		05/30/95	189	3.837	0.005	0.015	0.4	0.2	187.9
	06/01/95	191	0.281	0.007	0.956	88.8	24.6	45.5		06/01/95	191	4.395	0.005	0.015	0.4	0.3	193.6
	06/06/95	196	0.275	0.010	1.048	93.1	24.7	42.6		06/06/95	196	4.757	0.006	0.015	0.4	0.1	187.8
	06/08/95	198	0.252	0.009	1.012	88.7	23.0	42.9		06/08/95	198	4.302	0.006	0.016	0.3	0.1	176.7
	06/13/95	203	0.214	0.009	0.660	77.4	22.4	31.4		06/13/95	203	3.006	0.007	0.010	0.3	0.1	165.5
	06/15/95	205	0.297	0.007	1.062	87.8	24.1	37.5		06/15/95	205	4.558	0.005	0.035	0.4	0.2	176.3
	06/20/95	210	0.270	0.009	0.967	87.1	24.0	40.9		06/20/95	210	4.375	0.006	0.015	0.3	0.1	179.8
	06/22/95	212	0.280	0.008	0.764	86.4	24.3	33.9		06/22/95	212	4.155	0.005	0.012	0.3	0.1	166.4
	06/27/95	217	0.291	0.007	0.940	86.7	26.0	44.5		06/27/95	217	4.235	0.005	0.014	0.4	0.2	199.4
	06/29/95	219	0.200	0.007	0.662	80.9	23.7	37.2		06/29/95	219	2.809	0.006	0.011	0.3	0.1	169.4
	07/06/95	226	0.212	0.008	0.605	78.5	22.6	36.4		07/06/95	226	2.891	0.006	0.011	0.3	0.1	167.4
	07/11/95	231	0.203	0.008	0.701	79.0	21.5	35.9		07/11/95	231	3.479	0.007	0.014	0.4	0.3	167.2
	07/13/95	233	0.237	0.007	0.775	84.2	23.6	38.6		07/13/95	233	3.583	0.008	0.008	0.6	0.5	170.5
	07/18/95	238	0.162	0.006	0.533	72.9	21.2	32.7		07/18/95	238	2.570	0.005	0.012	0.3	0.1	165.9

* All units in mg/L.

Table C-4. Results of analyses of non-softened standing water samples of faucets, phase II study.*

Faucet 1	Date	Days	Cu	Pb	Zn	Ca	Mg	Na	Faucet 2	Date	Days	Cu	Pb	Zn	Ca	Mg	Na
	07/20/95	240	0.194	0.008	0.590	85.9	24.1	35.4		07/20/95	240	2.957	0.006	0.011	0.3	0.1	162.7
	07/25/95	245	0.204	0.008	0.578	89.0	26.1	40.4		07/25/95	245	3.524	0.006	0.015	0.3	0.1	184.2
	07/27/95	247	0.180	0.009	0.523	84.7	24.8	37.9		07/27/95	247	2.877	0.006	0.011	0.4	0.2	180.4
	08/01/95	252	0.152	0.007	0.465	74.3	22.1	35.7		08/01/95	252	2.898	0.006	0.011	0.3	0.1	171.1
	08/03/95	254	0.169	0.007	0.594	82.0	22.9	37.3		08/03/95	254	4.351	0.007	0.018	0.3	0.1	190.0
	08/08/95	259	0.197	0.011	0.626	91.3	24.2	40.1		08/08/95	259	3.593	0.006	0.015	0.3	0.1	174.9
	08/10/95	261	0.161	0.010	0.423	77.2	22.5	38.1		08/10/95	261	2.634	0.006	0.012	0.3	0.1	173.2
	08/15/95	266	0.198	0.008	0.504	82.8	23.8	39.4		08/15/95	266	2.890	0.006	0.011	0.3	0.1	174.8
	08/17/95	268	0.179	0.008	0.530	83.1	23.9	39.3		08/17/95	268	2.857	0.006	0.011	0.3	0.1	161.6
	08/22/95	273	0.160	0.007	0.520	82.8	22.9	33.0		08/22/95	273	2.206	0.005	0.013	0.3	0.1	155.6
	08/24/95	275	0.203	0.008	0.595	85.2	24.4	37.7		08/24/95	275	3.110	0.006	0.011	0.3	0.1	170.9
	08/29/95	280	0.182	0.010	0.546	81.1	23.2	38.1		08/29/95	280	3.270	0.107	0.010	0.2	0.0	172.0
	08/31/95	282	0.181	0.008	0.597	82.5	23.6	36.4		08/31/95	282	3.189	0.007	0.010	0.2	0.1	169.8
	09/05/95	287	0.189	0.006	0.572	82.2	23.5	38.1		09/05/95	287	3.234	0.005	0.011	0.4	0.2	176.6
	09/07/95	289	0.185	0.007	0.545	83.0	23.5	37.5		09/07/95	289	3.284	0.006	0.010	0.3	0.1	170.7
	09/12/95	293	0.226	0.007	0.743	88.1	24.0	42.1		09/12/95	293	4.042	0.007	0.014	0.3	0.0	188.8
	09/14/95	295	0.233	0.007	0.735	89.7	25.3	43.0		09/14/95	295	4.401	0.006	0.009	0.3	0.1	193.6
	09/19/95	300	0.210	0.008	0.665	90.2	25.4	44.5		09/19/95	300	4.368	0.007	0.009	0.4	0.1	197.1
	09/21/95	302	0.223	0.009	0.763	91.3	24.7	41.3		09/21/95	302	4.132	0.006	0.009	0.4	0.2	183.7
	09/26/95	307	0.222	0.008	0.709	87.5	24.8	45.4		09/26/95	307	4.074	0.005	0.013	0.3	0.1	188.5
	09/28/95	309	0.205	0.008	0.622	85.2	23.3	49.4		09/28/95	309	3.633	0.007	0.014	0.4	0.1	184.1
	10/03/95	315	0.191	0.007	0.562	84.3	25.2	49.4		10/03/95	315	2.609	0.006	0.009	0.3	0.1	197.2
	10/05/95	317	0.178	0.006	0.547	84.1	24.4	43.2		10/05/95	317	2.432	0.005	0.016	0.3	0.1	176.8
	10/10/95	322	0.196	0.007	0.584	83.0	24.2	44.2		10/10/95	322	2.925	0.007	0.016	0.3	0.1	184.8
	10/12/95	324	0.204	0.007	0.589	82.4	24.6	46.4		10/12/95	324	2.828	0.006	0.009	0.3	0.1	181.0
	10/17/95	329	0.197	0.006	0.571	81.9	23.7	43.6		10/17/95	329	2.895	0.006	0.013	0.3	0.1	180.1
	10/19/95	331	0.202	0.006	0.581	81.2	23.9	43.9		10/19/95	331	2.907	0.006	0.008	0.3	0.1	184.9
	10/24/95	336	0.186	0.006	0.542	81.8	23.4	42.2		10/24/95	336	2.791	0.006	0.009	0.3	0.1	176.5
	10/26/95	338	0.183	0.005	0.520	80.9	23.6	42.1		10/26/95	338	2.820	0.006	0.011	0.3	0.1	174.0
	10/31/95	343	0.183		0.497	79.8	23.7	43.0		10/31/95	343	2.779	0.004	0.008	0.4	0.2	173.7
	11/02/95	345	0.203	0.006	0.496	82.6	24.2	42.7		11/02/95	345	2.871	0.005	0.011	0.3	0.1	181.4
	11/07/95	350	0.281	0.006	0.929	91.2	25.4	36.4		11/07/95	350	3.719	0.004	0.008	0.3	0.1	182.9
	11/09/95	352	0.229	0.004	0.745	83.3	24.0	40.4		11/09/95	352	3.134	0.004	0.011	0.3	0.1	174.0
	11/21/95	364	0.223	0.007	0.606	79.6	23.2	37.6		11/21/95	364	3.433	0.006	0.006	0.2	0.1	171.7
	11/28/95	371	0.232	0.006	0.627	78.5	23.3	37.1		11/28/95	371	3.425	0.003	0.006	0.3	0.1	165.7
	11/30/95	373	0.232	0.005	0.638	79.1	23.7	38.0		11/30/95	373	3.452	0.004	0.006	0.2	0.1	169.6
	12/05/95	378	0.223	0.009	0.618	78.0	23.8	39.6		12/05/95	378	3.061	0.007	0.005	0.2	0.1	173.6
	12/07/95	380	0.224	0.006	0.696	77.8	22.9	35.6		12/07/95	380	3.458	0.005	0.002	0.2	0.1	167.1
	12/12/95	385	0.237	0.007	0.793	78.6	23.7	38.1		12/12/95	385	3.394	0.005	0.006	0.2	0.1	164.4
	12/19/95	392	0.268	0.006	0.656	78.7	25.3	42.4		12/19/95	392	3.517	0.004	0.007	0.2	0.1	181.2
	12/21/95	394	0.231	0.005	0.675	84.2	25.4	39.8		12/21/95	394	3.532	0.005	0.006	0.2	0.1	178.4
	12/29/95	401	0.249	0.005	0.816	84.2	25.4	39.7		12/29/95	401	3.816	0.005	0.005	0.3	0.1	179.1
	01/05/96	408	0.246	0.005	0.771	81.8	25.1	36.6		01/05/96	408	3.781	0.005	0.004	0.3	0.1	176.3
	01/09/96	413	0.219	0.005	0.693	73.6	21.5	33.5		01/09/96	413	3.618	0.005	0.003	0.3	0.2	158.5
	01/11/96	415	0.249	0.004	0.798	82.3	23.9	36.7		01/11/96	415	4.169	0.005	0.005	0.3	0.2	172.2
	01/16/96	420	0.223	0.006	0.730	75.1	22.9	35.8		01/16/96	420	3.643	0.008	0.005	0.2	0.1	161.5
	01/18/96	422	0.195	0.004	0.603	67.0	20.6	31.6		01/18/96	422	3.953	0.005	0.004	0.2	0.0	168.9
	01/23/96	427	0.271	0.005	0.952	84.7	24.9	37.2		01/23/96	427	4.568	0.006	0.007	0.3	0.2	177.2
	01/25/96	429	0.254	0.005	0.824	79.7	24.6	39.3		01/25/96	429	4.426	0.007	0.008	0.3	0.2	172.6
	01/30/96	434	0.291	0.007	1.203	79.7	23.3	33.3		01/30/96	434	4.452	0.008	0.008	0.2	0.1	158.0
	02/01/96	436	0.268	0.005	0.963	78.8	23.2	33.3		02/01/96	436	4.728	0.006	0.009	0.2	0.1	167.5
	02/06/96	441	0.251	0.006	1.029	86.1	24.3	36.5		02/06/96	441	4.161	0.006	0.004	0.3	0.1	174.7
	02/08/96	443	0.289	0.006	1.038	92.8	26.5	39.9		02/08/96	443	4.752	0.005	0.006	0.7	0.8	177.4
	02/13/96	448	0.279	0.007	1.194	93.9	25.8	44.5		02/13/96	448	5.081	0.006	0.010	0.4	0.1	192.9
	02/15/96	450	0.281	0.007	1.021	93.0	25.8	45.8		02/15/96	450	5.279	0.007	0.009	0.4	0.1	197.0
	02/20/96	455	0.227	0.006	0.742	76.9	22.0	42.0		02/20/96	455	5.212	0.005	0.009	0.6	0.5	197.8
	02/22/96	457	0.235	0.006	0.835	81.2	22.7	41.4		02/22/96	457	4.511	0.004	0.007	0.6	0.5	171.2
	02/27/96	462	0.218	0.006	0.714	83.5	25.0	40.6		02/27/96	462	2.674	0.004	0.008	0.2	0.1	163.7
	03/05/96	469	0.250	0.012	0.932	95.9	25.5	49.8		03/05/96	469	6.078	0.004	0.013	0.1	0.0	204.1
	03/07/96	471	0.273	0.012	1.047	96.2	26.1	45.2		03/07/96	471	5.342	0.005	0.008	19.4	31.3	112.1
	03/12/96	476	0.294	0.010	1.152	94.0	24.4	42.1		03/12/96	476	4.401	0.003	0.012	0.3	0.1	171.0

* All units in mg/L.

Table C-4a. Results of analyses of softened standing water samples of faucets, phase II study.*

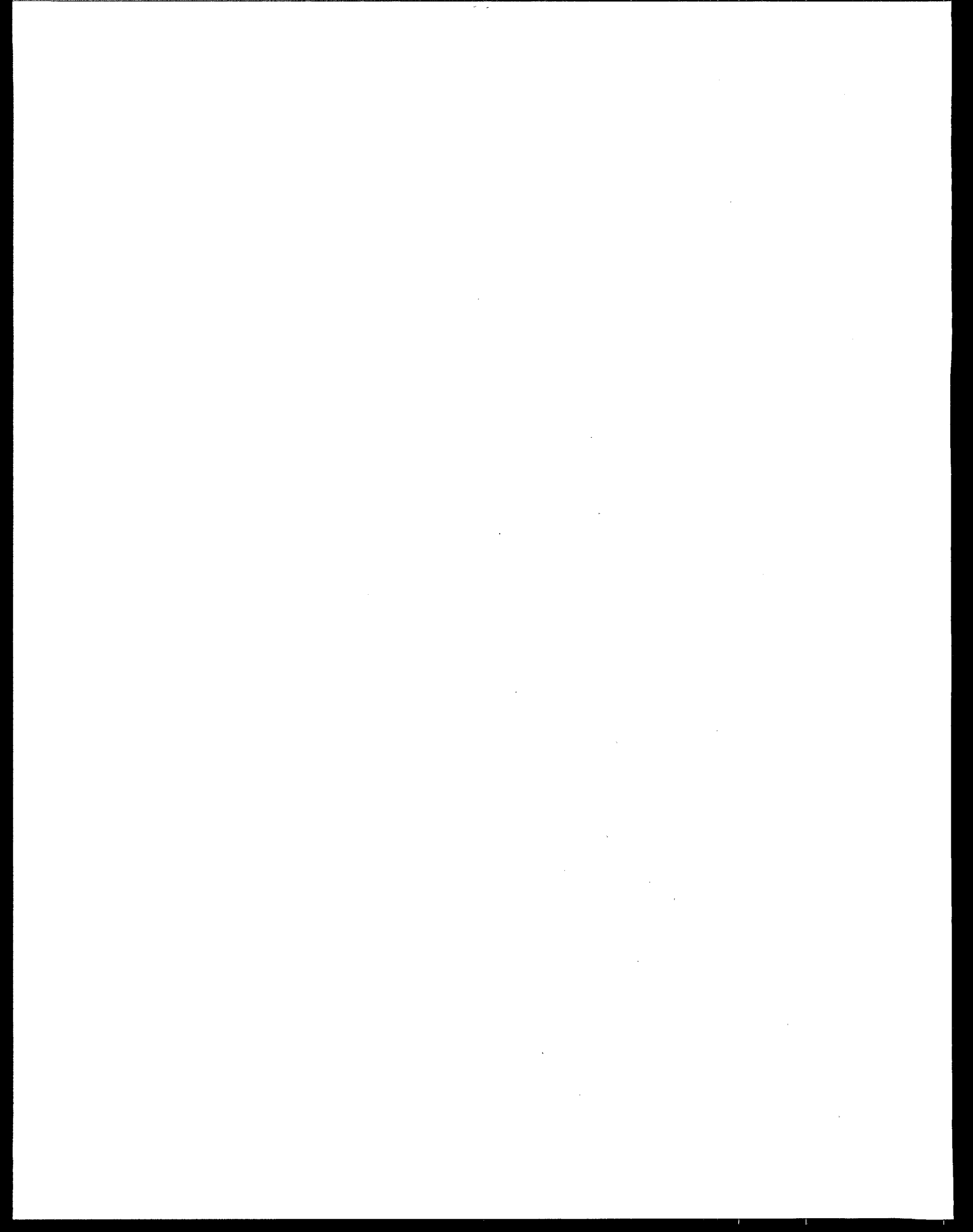
Faucet 1	Date	Days	Cu	Pb	Zn	Ca	Mg	Na	Faucet 2	Date	Days	Cu	Pb	Zn	Ca	Mg	Na
	11/23/94	1	0.150	0.109	0.305	3.0	0.8	218.1		11/23/94	1	0.277	0.080	0.281	2.4	0.7	208.9
	11/29/94	7	0.150	0.103	0.479	50.4	25.6	75.0		11/29/94	7	0.180	0.051	0.339	48.9	24.6	73.8
	12/02/94	10	0.129	0.091	0.627	56.4	20.1	151.2		12/02/94	10	0.203	0.065	0.530	58.4	21.1	137.2
	12/06/94	14	0.119	0.062	0.667	0.4	0.1	170.7		12/06/94	14	0.151	0.040	0.583	0.4	0.1	177.8
	12/08/94	16	0.142	0.077	0.808	0.4	0.1	169.7		12/08/94	16	0.152	0.041	0.655	0.3	0.1	169.7
	12/13/94	21	0.036		0.660	0.3	0.0	175.3		12/13/94	21	0.064	0.033	0.573	0.2	0.1	172.2
	12/16/94	24	0.030	0.037	0.378	1.7	0.5	201.1		12/16/94	24	0.077	0.030	0.579	1.4	0.4	195.7
	12/20/94	28	0.051	0.036	0.649	0.5	0.2	167.4		12/20/94	28	0.109	0.025	0.601	0.5	0.2	162.6
	12/22/94	30	0.036	0.033	0.600	35.8	24.2	66.9		12/22/94	30	0.096	0.026	0.635	39.4	26.8	74.4
	12/28/94	36	0.034	0.027	0.652	65.7	23.6	45.2		12/28/94	36	0.077	0.017	0.588	70.4	25.0	47.7
	12/30/94	38	0.045	0.026	0.869	73.9	24.4	43.7		12/30/94	38	0.115	0.015	0.726	72.8	24.9	46.2
	01/04/95	43	0.041	0.032	0.681	76.6	22.9	38.5		01/04/95	43	0.080	0.016	0.465	74.8	23.0	40.2
	01/05/95	44	0.044	0.036	1.275	79.5	23.1	41.8		01/05/95	44	0.116	0.020	1.182	79.4	22.9	41.4
	01/13/95	52	0.170	0.044	1.250	0.3	0.1	169.0		01/13/95	52	0.283	0.021	1.170	0.4	0.1	168.0
	01/18/95	57	0.115	0.036	0.974	1.4	0.5	201.2		01/18/95	57	0.187	0.042	1.106	1.3	0.4	193.1
	01/20/95	59	0.156	0.036	1.140	1.4	0.5	201.1		01/20/95	59	0.006	0.610	0.012	0.8	0.3	180.8
	01/24/95	63	0.086	0.032	0.689	1.2	0.4	187.9		01/24/95	63	0.115	0.017	0.613	1.0	0.4	175.7
	01/26/95	65	0.163	0.035	1.130	1.4	0.5	182.1		01/26/95	65	0.280	0.022	1.035	1.2	0.5	177.9
	01/31/95	70	0.190		1.207	0.4	0.1	168.9		01/31/95	70	0.330	0.020	1.186	0.4	0.1	169.8
	02/02/95	72	0.169	0.023	1.202	0.4	0.1	174.8		02/02/95	72	0.303	0.013	1.117	0.4	0.1	169.2
	02/07/95	77	0.153	0.024	1.137	1.2	0.4	188.0		02/07/95	77	0.344	0.012	1.207	1.2	0.4	204.2
	02/09/95	79	0.158	0.022	1.152	1.3	0.4	202.4		02/09/95	79	0.325	0.012	1.158	1.2	0.4	202.2
	02/14/95	84	0.120	0.023	0.999	0.3	0.1	176.7		02/14/95	84	0.252	0.013	0.977	0.3	0.1	176.0
	02/24/95	94	0.186	0.023	1.339	0.4	0.1	189.9		02/24/95	94	0.351	0.012	1.269	0.4	0.1	186.4
	02/28/95	98	0.201	0.019	1.278	0.4	0.1	184.1		02/28/95	98	0.358	0.010	1.323	0.4	0.1	191.4
	03/03/95	101	0.230	0.024	1.561	1.9	0.9	228.7		03/03/95	101	0.494	0.017	1.570	1.7	0.9	226.3
	03/07/95	105	0.247	0.022	1.446	2.0	1.0	214.9		03/07/95	105	0.420	0.013	1.429	1.9	1.0	216.4
	03/08/95	107	0.190	0.018	1.429	1.8	0.7	207.1		03/08/95	107	0.415	0.013	1.415	1.6	0.7	214.0
	03/14/95	112	0.265	0.017	1.369	0.4	0.1	185.5		03/14/95	112	0.367	0.011	1.289	0.3	0.1	176.0
	03/16/95	114	0.272	0.020	1.388	0.4	0.1	173.9		03/16/95	114	0.408	0.014	1.428	0.4	0.1	178.8
	03/21/95	119	0.266	0.015	1.337	1.4	0.4	199.9		03/21/95	119	0.379	0.011	1.375	1.2	0.4	192.6
	03/23/95	121	0.189	0.014	1.031	1.4	0.4	186.1		03/23/95	121	0.267	0.010	0.958	1.1	0.3	172.2
	03/28/95	126	0.249	0.018	1.381	0.4	0.1	194.0		03/28/95	126	0.422	0.013	1.435	0.4	0.1	195.7
	03/30/95	128	0.240	0.016	1.278	0.3	0.1	179.8		03/30/95	128	0.383	0.011	1.315	0.3	0.1	177.7
	04/04/95	133	0.282	0.020	1.659	1.8	0.6	222.0		04/04/95	133	0.488	0.014	1.532	1.7	0.5	222.3
	04/06/95	135	0.285	0.019	1.524	2.1	1.0	220.0		04/06/95	135	0.504	0.015	1.594	1.8	1.0	214.9
	04/11/95	140	0.219	0.012	0.999	0.3	0.1	174.3		04/11/95	140	0.347	0.010	1.056	0.3	0.1	176.4
	04/13/95	142	0.228	0.013	1.095	0.4	0.1	175.6		04/13/95	142	0.354	0.009	1.102	0.4	0.1	180.7
	04/18/95	147	0.202	0.016	0.969	1.3	0.4	198.8		04/18/95	147	0.294	0.012	0.910	1.1	0.4	185.9
	04/20/95	149	0.280	0.016	1.356	1.4	0.4	208.6		04/20/95	149	0.470	0.014	1.324	1.2	0.4	210.8
	04/25/95	154	0.202	0.014	0.985	0.3	0.1	164.6		04/25/95	154	0.312	0.013	1.010	0.3	0.1	167.1
	04/27/95	156	0.232	0.014	1.138	0.4	0.1	174.0		04/27/95	156	0.382	0.013	1.185	0.4	0.1	179.1
	05/02/95	161	0.227	0.015	1.107	1.3	0.4	208.0		05/02/95	161	0.323	0.014	1.096	1.1	0.4	207.5
	05/09/95	168	0.218	0.014	1.028	0.3	0.1	171.9		05/09/95	168	0.271	0.013	0.978	0.3	0.1	169.1
	05/11/95	170	0.037	0.001	0.034	0.3	0.1	159.7		05/11/95	170	0.038	0.001	0.039	0.3	0.1	157.9
	05/16/95	175	0.250	0.013	1.162	1.2	0.3	186.1		05/16/95	175	0.332	0.012	1.156	1.0	0.3	191.7
	05/18/95	177	0.217	0.012	0.829	1.2	0.4	197.5		05/18/95	177	0.271	0.010	0.831	1.1	0.3	191.2
	05/23/95	182	0.212	0.026	1.044	0.1	0.0	171.8		05/23/95	182	0.223	0.029	1.154	0.1	0.0	168.3
	05/30/95	189	0.240	0.021	1.156	2.2	0.7	172.9		05/30/95	189	0.281	0.020	1.105	1.6	0.6	176.2
	06/01/95	191	0.280	0.021	1.315	1.7	0.6	218.0		06/01/95	191	0.341	0.020	1.286	1.5	0.5	218.1
	06/06/95	196	0.287	0.021	1.398	0.4	0.1	186.9		06/06/95	196	0.409	0.021	1.456	0.4	0.1	187.6
	06/08/95	198	0.278	0.017	1.358	0.4	0.1	184.5		06/08/95	198	0.384	0.013	1.279	0.4	0.1	191.4
	06/13/95	203	0.198	0.012	0.908	1.4	0.4	192.6		06/13/95	203	0.238	0.011	0.890	1.3	0.4	194.2
	06/15/95	205	0.324	0.014	1.133	1.6	0.5	215.8		06/15/95	205	0.445	0.012	0.934	1.5	0.4	205.5
	06/20/95	210	0.315	0.018	1.345	0.4	0.1	176.7		06/20/95	210	0.393	0.013	1.304	0.4	0.1	177.4
	06/22/95	212	0.267	0.016	1.087	0.3	0.1	150.3		06/22/95	212	0.438	0.013	1.404	0.4	0.1	172.9
	06/27/95	217	0.318	0.014	1.277	1.8	0.6	236.8		06/27/95	217	0.427	0.011	1.296	1.6	0.5	229.3
	06/29/95	219	0.154	0.012	0.853	1.6	0.5	208.7		06/29/95	219	0.194	0.009	0.869	1.4	0.4	213.1
	07/06/95	226	0.152	0.012	0.774	0.3	0.1	170.1		07/06/95	226	0.192	0.009	0.851	0.3	0.1	174.3
	07/11/95	231	0.186	0.013	0.923	1.5	0.5	187.2		07/11/95	231	0.266	0.012	0.933	1.4	0.5	185.6
	07/13/95	233	0.212	0.017	1.016	1.8	0.7	190.4		07/13/95	233	0.266	0.014	1.130	1.6	0.8	191.7
	07/18/95	238	0.114	0.013	0.629	0.3	0.1	149.7		07/18/95	238	0.128	0.008	0.732	0.3	0.1	159.1

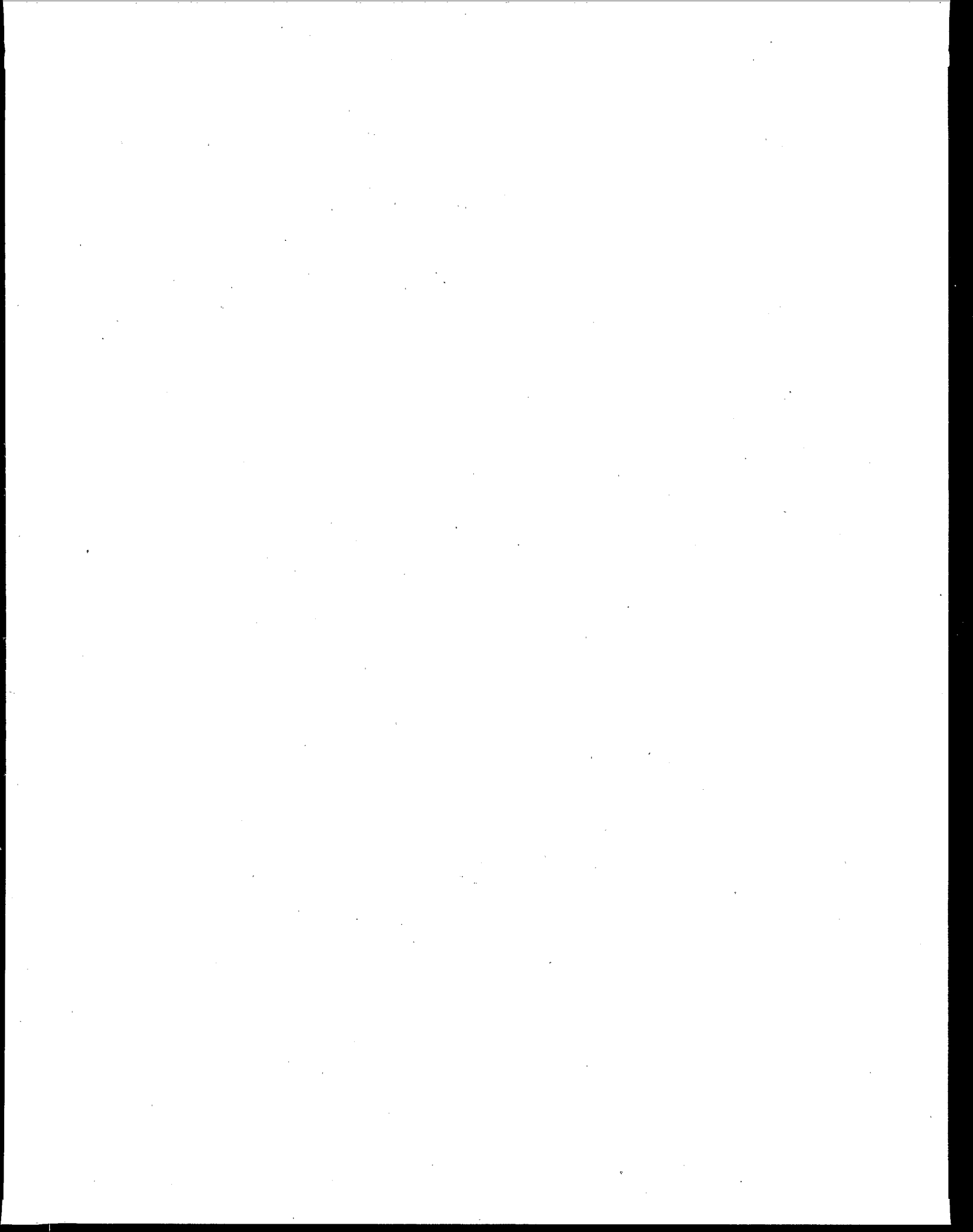
* All units in mg/L.

Table C-4a. Results of analyses of softened standing water samples of faucets, phase II study.*

Faucet 1	Date	Days	Cu	Pb	Zn	Ca	Mg	Na	Faucet 2	Date	Days	Cu	Pb	Zn	Ca	Mg	Na
	07/20/95	240	0.155	0.014	0.800	0.4	0.1	178.0		07/20/95	240	0.183	0.010	0.850	0.3	0.1	177.2
	07/25/95	245	0.187	0.018	0.847	1.6	0.5	228.8		07/25/95	245	0.219	0.014	0.794	1.3	0.4	199.3
	07/27/95	247	0.123	0.014	0.628	1.5	0.5	195.8		07/27/95	247	0.149	0.009	0.685	1.3	0.4	193.8
	08/01/95	252	0.120	0.011	0.710	0.3	0.1	166.5		08/01/95	252	0.120	0.007	0.731	0.3	0.1	180.8
	08/03/95	254	0.191	0.019	0.998	0.4	0.1	203.6		08/03/95	254	0.238	0.014	0.905	0.4	0.1	190.7
	08/08/95	259	0.143	0.018	0.796	1.5	0.4	195.0		08/08/95	259	0.183	0.013	0.818	1.3	0.4	187.3
	08/10/95	261	0.101	0.015	0.597	1.6	0.4	199.2		08/10/95	261	0.118	0.011	0.675	1.4	0.4	200.0
	08/15/95	266	0.124	0.014	0.772	0.3	0.1	177.6		08/15/95	266	0.130	0.008	0.716	0.3	0.1	172.7
	08/17/95	268	0.128	0.013	0.767	0.3	0.1	181.5		08/17/95	268	0.128	0.008	0.678	0.3	0.1	179.3
	08/22/95	273	0.084	0.013	0.526	1.4	0.4	175.5		08/22/95	273	0.095	0.009	0.613	1.1	0.3	177.8
	08/24/95	275	0.133	0.013	0.787	1.3	0.4	194.6		08/24/95	275	0.147	0.009	0.787	1.1	0.3	195.7
	08/29/95	280	0.131	0.015	0.775	0.3	0.1	160.5		08/29/95	280	0.141	0.009	0.736	0.3	0.1	166.0
	08/31/95	282	0.133	0.012	0.793	0.3	0.1	170.9		08/31/95	282	0.158	0.015	0.786	0.3	0.1	168.8
	09/05/95	287	0.140	0.013	0.766	1.3	0.4	199.6		09/05/95	287	0.152	0.007	0.738	1.1	0.4	192.1
	09/07/95	289	0.134	0.013	0.744	1.4	0.4	188.1		09/07/95	289	0.153	0.009	0.763	1.1	0.3	180.5
	09/12/95	293	0.180	0.016	0.997	0.3	0.1	175.8		09/12/95	293	0.215	0.010	0.906	0.3	0.1	183.3
	09/14/95	295	0.199	0.019	1.046	0.3	0.1	196.6		09/14/95	295	0.231	0.012	0.926	0.3	0.1	195.7
	09/19/95	300	0.200	0.015	1.012	1.8	0.5	218.3		09/19/95	300	0.232	0.011	0.952	1.5	0.5	208.2
	09/21/95	302	0.194	0.015	0.956	1.6	0.5	211.5		09/21/95	302	0.223	0.010	0.901	1.4	0.4	207.1
	09/26/95	307	0.184	0.011	0.979	0.4	0.1	192.6		09/26/95	307	0.220	0.007	0.970	0.4	0.1	188.6
	09/28/95	309	0.148	0.011	0.927	0.4	0.1	181.1		09/28/95	309	0.168	0.009	0.857	0.4	0.1	182.1
	10/03/95	315	0.113	0.011	0.704	1.4	0.4	218.0		10/03/95	315	0.111	0.009	0.745	1.2	0.4	216.9
	10/05/95	317	0.095	0.013	0.662	1.4	0.4	204.1		10/05/95	317	0.099	0.009	0.693	1.2	0.4	210.7
	10/10/95	322	0.134	0.013	0.665	0.4	0.1	192.0		10/10/95	322	0.105	0.009	0.712	0.4	0.1	188.2
	10/12/95	324	0.119	0.013	0.719	0.4	0.1	188.1		10/12/95	324	0.111	0.009	0.791	0.3	0.1	188.1
	10/17/95	329	0.117	0.011	0.706	1.4	0.4	208.4		10/17/95	329	0.111	0.008	0.672	1.3	0.4	206.0
	10/19/95	331	0.113	0.011	0.683	1.4	0.4	207.0		10/19/95	331	0.119	0.007	0.728	1.1	0.3	202.8
	10/24/95	336	0.112	0.010	0.683	0.3	0.1	179.7		10/24/95	336	0.114	0.007	0.734	0.3	0.1	180.0
	10/26/95	338	0.118	0.011	0.670	0.3	0.1	181.1		10/26/95	338	0.114	0.006	0.639	0.3	0.1	177.5
	10/31/95	343	0.104	0.010	0.630	1.5	0.5	200.7		10/31/95	343	0.175	0.010	0.675	1.2	0.4	192.0
	11/02/95	345	0.117	0.010	0.717	1.3	0.4	195.3		11/02/95	345	0.121	0.007	0.714	1.1	0.3	198.0
	11/07/95	350	0.220	0.011	0.981	0.4	0.1	186.1		11/07/95	350	0.225	0.007	0.834	0.4	0.1	190.6
	11/09/95	352	0.150	0.009	0.770	0.4	0.1	173.9		11/09/95	352	0.159	0.006	0.831	0.3	0.1	182.0
	11/21/95	364	0.155	0.011	0.838	0.3	0.1	170.4		11/21/95	364	0.168	0.008	0.818	0.3	0.1	168.8
	11/28/95	371	0.150	0.008	0.796	1.3	0.4	201.1		11/28/95	371	0.165	0.005	0.780	1.0	0.3	193.9
	11/30/95	373	0.156	0.009	0.891	1.1	0.4	196.3		11/30/95	373	0.164	0.005	0.765	1.0	0.3	190.7
	12/05/95	378	0.118	0.010	0.363	0.3	0.1	170.0		12/05/95	378	0.042	0.004	0.092	0.3	0.1	171.3
	12/07/95	380	0.164	0.009	0.859	0.3	0.1	166.5		12/07/95	380	0.174	0.006	0.809	0.3	0.1	162.5
	12/12/95	385	0.162	0.009	0.920	1.3	0.4	194.4		12/12/95	385	0.185	0.005	0.865	1.1	0.3	187.4
	12/19/95	392	0.182	0.009	1.027	0.3	0.1	176.8		12/19/95	392	0.184	0.005	0.827	0.3	0.1	181.9
	12/21/95	394	0.179	0.009	0.973	0.3	0.1	188.4		12/21/95	394	0.188	0.006	0.879	0.3	0.1	181.0
	12/29/95	401	0.218	0.009	1.138	0.3	0.1	183.1		12/29/95	401	0.221	0.005	1.050	0.3	0.1	180.1
	01/05/96	408	0.212	0.008	1.046	1.5	0.5	213.5		01/05/96	408	0.225	0.005	1.014	1.3	0.4	215.3
	01/09/96	413	0.233	0.010	1.146	1.5	0.5	218.3		01/09/96	413	0.226	0.006	1.034	1.3	0.5	204.0
	01/11/96	415	0.223	0.008	1.109	1.5	0.5	215.3		01/11/96	415	0.247	0.006	1.122	1.3	0.4	210.0
	01/16/96	420	0.203	0.009	1.055	0.3	0.1	170.1		01/16/96	420	0.224	0.007	1.041	0.3	0.1	168.5
	01/18/96	422	0.206	0.009	1.076	0.3	0.1	162.2		01/18/96	422	0.226	0.006	1.025	0.3	0.1	167.6
	01/23/96	427	0.274	0.011	1.379	1.5	0.5	205.3		01/23/96	427	0.296	0.007	1.346	1.3	0.4	203.1
	01/25/96	429	0.265	0.009	1.232	1.6	0.6	216.7		01/25/96	429	0.247	0.006	1.073	1.3	0.5	191.9
	01/30/96	434	0.303	0.012	1.306	0.3	0.1	168.0		01/30/96	434	0.338	0.010	1.332	0.3	0.1	167.2
	02/01/96	436	0.283	0.009	1.292	0.3	0.1	163.3		02/01/96	436	0.303	0.007	1.206	0.3	0.1	158.8
	02/06/96	441	0.253	0.009	1.265	1.6	0.5	207.0		02/06/96	441	0.276	0.007	1.145	1.4	0.4	202.1
	02/08/96	443	0.315	0.013	1.393	2.1	1.0	228.2		02/08/96	443	0.350	0.010	1.270	1.8	1.0	225.6
	02/13/96	448	0.301	0.012	1.528	0.5	0.1	199.8		02/13/96	448	0.311	0.010	1.345	0.5	0.1	199.0
	02/15/96	450	0.305	0.012	1.378	0.4	0.1	202.5		02/15/96	450	0.306	0.010	1.326	0.4	0.1	209.7
	02/20/96	455	0.300	0.013	1.457	2.0	0.8	242.1		02/20/96	455	0.288	0.010	1.326	1.9	0.8	232.1
	02/22/96	457	0.306	0.013	1.497	1.5	0.7	220.4		02/22/96	457	0.288	0.011	1.216	1.4	0.7	210.6
	02/27/96	462	0.170		0.891	0.3	0.1	167.8		02/27/96	462	0.168		0.875	0.3	0.1	171.8
	03/05/96	469	0.330	0.022	1.533	0.1	0.0	199.5		03/05/96	469	0.362	0.024	1.455	0.1	0.0	201.6
	03/07/96	471	0.050	0.003	0.028	7.5	7.7	282.6		03/07/96	471	0.048	0.003	0.028	7.2	7.3	269.7
	03/12/96	476	0.325	0.013	1.252	0.4	0.1	186.8		03/12/96	476	0.273	0.012	1.403	0.4	0.1	192.3

* All units in mg/L.





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