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Appendix 1 - Relating to Section 2

CITY OF PORTLAND, OREGON
BUREAU OF WATER WORKS

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May 14, 1997 WQ 1.11.1

Mr. Dave Leland, P.E.
Oregon Health Division, Drinking Water Program
P.O. Box 14450
Portland OR 97214-0450

Subject: Lead and Copper Rule Compliance: Proposal to Implement a Joint Monitoring Plan for the City of Portland and its Wholesale Water Customers

Dear Dave:

Oregon drinking water regulations (OAR 333-061-0036(2)(e)(C)) require water systems that install corrosion control treatment to conduct follow-up monitoring after installation. The purpose of this letter is to present a proposal for and request your approval of a joint monitoring plan in which Portland and its wholesale water customers listed in Table 1 would be considered a single "large" system for the purpose of complying with Lead and Copper Rule (LCR) monitoring requirements. Table 1 also shows these systems have jointly conducted a corrosion control study and coordinate public education activities as required by the LCR. These systems have also recently submitted a joint proposal to implement a Lead Hazard Reduction Program as a substitute for optimal corrosion control treatment and public education requirements of the LCR.

The Code of Federal Regulations (Protection of the Environment, Chapter 40, Part 141.29) states that when a public water system supplies water to one or more other public water systems, the State may modify monitoring requirements to the extent the interconnection of the systems justifies treating them as a single system for monitoring purposes.

Portland and its wholesale water system customers use Bull Run water as their sole or major source of supply. Several systems make use of other sources on a supplemental or emergency basis as described in Table 2. Most of these water systems have jointly conducted a corrosion control study required by the LCR to determine the "optimal" treatment for Bull Run water, and have jointly conducted public education required by the LCR.

Under this joint monitoring plan:

- Monitoring would be conducted according to the schedule required for large systems (sampling will begin during the first six months of 1997).

- Monitoring would be conducted with consideration of LCR requirements for the total number of samples for required for large systems, sampling frequency, and sample site location.

  Portland and its wholesale water customers would collectively monitor at least 100 customer taps for lead and copper and 25 sites within the distribution system for water quality parameters. The number of sample sites selected from each water system would be a fraction of this total, proportional to the system's consumption of the total amount of water supplied by Portland in FY 95-96. Samples would be collected by 7 of the 18 Bull Run water systems, as described below. These 7 systems account for about 97% of the population, as well as 97% of the Portland-supplied water consumed, in the entire Bull Run water service area.

- The samples would be collected and analyzed in a consistent manner, in that all sampling water systems would use the same set of instructions for sample collection, samples would be collected during the same week and would be analyzed using the same methods and laboratory.

- Compliance with applicable corrosion control treatment requirements (such as meeting action levels and specified values of water quality parameters) and public education requirements for Portland and its wholesale customers would be based on the joint monitoring results.

Proposed specifics are presented below for monitoring 1) lead and copper in tap water; 2) water quality parameters at the entry point to the distribution system; 3) water quality parameters within the distribution system; and 4) lead and copper in source water.

1. Lead and Copper in Tap Water

Large systems are required to conduct follow-up monitoring at a minimum of 100 Tier 1, 2, or 3 sites from which samples had been collected during the initial monitoring period.

Under this proposal, at least 100 samples would be collected from the 7 largest systems, as shown in Table 3. We believe that this approach is appropriate, given that the 90th percentile values for lead and copper are essentially the same for pooled initial monitoring period data from all 18 systems and for pooled data from the 7 largest systems (lead: 0.041 mg/L; copper 1.6-1.7 mg/L). (For reference, a summary of 1992-93 “initial” monitoring period results is provided in Table 4.)

For the first follow-up monitoring period, each of the 7 sampling water systems would select its set of sample sites in a random manner from its set of sites sampled during the "initial" LCR monitoring period. This approach to site selection will be applied consistently by each water system to produce an aggregate sample pool that is free of site selection bias due to knowledge of previous monitoring results. Of course, actual sample collection from any Tier 1, 2, or 3 site requires customer cooperation. For each sample, the source water(s) (Bull Run and/or other sources) comprising each sample would be recorded.

For subsequent standard (i.e., not "reduced") follow-up monitoring periods, the same aggregate sampling pool will be used. If a water system is unable to obtain a sample from a site in this pool for any reason, it would 1) document the reason and 2) if necessary to meet minimum sample number requirements, select a additional site at random from its set of remaining sites sampled during the "initial" LCR monitoring period.

2. Water Quality Parameters at the Entry Point to the Distribution System

Large systems are required to conduct follow-up monitoring at entry points to the distribution system that are representative of each source, or combination (blend) of sources, after treatment. If a system draws water from more than one source, and the sources are combined before distribution, the system must sample at an entry point to the distribution system when water is representative of all sources being used. At each entry point, 1 sample every two weeks for pH only is required (alkalinity adjustment and corrosion inhibitors are not used as part of corrosion control treatment).

Under this proposal, Portland would be responsible for monitoring the pH of the Bull Run source, and of blends of Bull Run water and groundwater from the South Shore Columbia well field, entering the Bull Run distribution system.

The Tualatin Valley Water District, the Powell Valley Road Water District, and the City of Tigard make use of other sources on a supplemental or emergency basis as described in Table 2. These systems would monitor at entry points to their individual systems that are representative of these other sources (their wells or water purchased from systems other than Portland) only when they are in use.

Because the other Bull Run water systems use only water supplied by Portland, these systems would not monitor at the entry points to their individual systems.

3. Water Quality Parameters Within the Distribution System

Large systems are required to conduct follow-up monitoring a minimum of 25 sites within the distribution system. Tap samples should be representative of water quality throughout the distribution system taking into account the number of persons served, the different sources of water, and the different treatment methods used by the system.

Under this proposal, at least 25 samples would be collected from the 7 largest systems, as shown in Table 5. EES conducted a statistical analysis of pH data collected in 1993-94 by the 7 largest Bull Run water systems (attached). This analysis indicates that pH data are homogeneous enough throughout the Bull Run distribution system so that the 90% confidence interval around the median pH value is about 0.1 pH units with a sample size of 25; increasing sample size above 25 made little difference in estimating median value or the confidence interval.

For each sample, the source water(s) (Bull Run and/or other sources) comprising the sample will be recorded.

4. Lead and Copper in Source Water

Large systems exceeding the lead and/or copper levels and not required to install source water treatment are required to collect one annual sample of each source after treatment or at entry points to the distribution system after any application of treatment, and analyze that sample for lead and copper.

Under this proposal, Portland would be responsible for monitoring lead and copper in the Bull Run source, and water from the South Shore Columbia well field, entering the Bull Run distribution system.

The Tualatin Valley Water District, the Powell Valley Road Water District, and the City of Tigard make use of other sources on a supplemental or emergency basis as described in Table 2. These systems would monitor at entry points to their individual systems that are representative of other sources (their wells or water purchased from systems other than Portland) after treatment only when these other sources are in use.

We would like to thank Chris Hughes and Kurt Putnam for their assistance during the past few months in formulating this proposed monitoring plan. We would be happy to meet with you to discuss this proposal or other Lead and Copper Rule compliance activities.

Sincerely,

Rosemary Menard
Portland Water Bureau

Jesse Lowman
Tualatin Valley Water District

Duane Robinson
Rockwood Water PUD

Dale Anderson
City of Gresham

Tom Pokorny
Powell Valley Road Water District

Mike McKillip
City of Tualatin

Ed Wegner
City of Tigard

Roger Meyer
West Slope Water District

Von Walter
Raleigh Water District

Cindy Zinser
Pleasant Home Water District

Margaret Leonard
Valley View Water District

Julie Morrow
Burlington Water District

Ruth Pruitt
Lorna Water Company

cc:

Burlington WD, Julie Morrow
GNR Corporation, Harold Ayers
City of Gresham, Dale Anderson
Lake Grove WD, John Goodwin
Lorna Water Company, Ruth Pruitt
Lusted WD, Vance Hardy
Palatine Hill WD, Saidee McKay
Pleasant Home WD, Cindy Zinser
Powell Valley Road WD, Tom Pokorny
Raleigh WD, Von Walter
Rockwood Water PUD, Duane Robinson
Skyview Acres Water Co., Oran Denhart
Tigard Water Dept, Ed Wegner
City of Tualatin, Mike McKillip
Valley View WD, Margaret Leonard
West Slope WD, Roger Meyer
Tualatin Valley WD, Jesse Lowman

Wendy Marshall, EPA Region 10

Attachment

Table 1: City of Portland and Contract Holders (1)

Name	Participated in Joint Corrosion Control Study	Participated in Joint Public Education	Population (2)	% of total Pop'n	FY 95-96 consumption of water supplied by Portland (100 cu ft)	% of consumption	LCR System Size	Source(s) other than Bull Run (3)	Bull Run water supplied via
Burlington WD			390	0.1	27,232	0.1	Small		Transmission lines
GNR Corp		×	72	0.0	2,500	0.0	Small		Supply Conduits
Gresham, City of	×	×	35,000	4.4	2,588,116	5.1	Medium		Supply Conduits
Lake Grove WD	×	×	3,300	0.4	113,492	0.2	Medium		Transmission lines
Lorna WD			200	0.0	8,919	0.0	Small		Supply Conduits
Lusted WD	×		1,300	0.2	71,071	0.1	Small		Supply Conduits
Palatine Hill WD	×	×	1,500	0.2	124,700	0.3	Small		Transmission lines
Pleasant Home WD	×	×	1,200	0.2	85,024	0.2	Small		Supply Conduits
Portland, City of	×	×	460,000	57.9	30,030,000	59.1	Large	Yes	Supply Conduits
Powell Valley Road WD	×	×	32,000	4.0	1,486,075	2.9	Medium	Yes	Supply Conduits
Raleigh WD	×		4,000	0.5	306,879	0.6	Medium		Wa Co Sup Line
Rockwood WD	×	×	43,000	5.4	3,357,368	6.6	Medium		Supply Conduits
Skyview Acres WD	×	×	47	0.0	12,776	0.0	Small		Supply Conduits
Tigard, City of			37,350	4.7	1,463,904 (4)	2.9	Medium	Yes	Transmission lines
Tualatin, City of	×	×	17,450	2.2	1,433,066	2.8	Medium		Wa Co Sup Line
Tualatin Valley WD	×	×	144,980	18.2	8,993,577 (5)	17.7	Large	Yes	Wa Co Sup Line
Valley View WD	×		950	0.1	64,519	0.1	Small		Transmission lines
West Slope WD	×	×	12,000	1.5	627,661 (6)	1.2	Medium		Transmission lines
SUM			794,739	100.0	50,796,879	100.0			

(1) Excluding Green Valley Water Co. and Hideaway Hills Water Co. ("State Regulated" water systems)
(2) Source: OHD
(3) See Table 2 for additional information
(4) Adjusted from FY 95-96 acual 117,490 ccf to 1,463,904 ccf (3 MGD), more representatIve of projected use In FY 96-97
(5) Adjusted from FY 95-96 actual 9,293,577 ccf to 8,993,577 ccf, to account for water sold to West Slope WD
(6) Adjusted from FY 95-96 actual 327,661 ccf to 627,661 ccf, to account for water purchased from Tualatin Valley WD

Table 2: Water Sources Used in Addition to Bull Run Water by City of Portland and Contract Holders

Water System	**Additional Source**	**When Used**	**Typical Water Quality**	**Entry point(s) to distribution system**	**Blended with Bull Run water before entering dis sys?**	**% demand met with additional source**	**Area of water system's distribution system receiving additional source**	**Comments**
City of Portland	Columbia South Shore Well field	In some summer seasons to meet demand In supply emergencies	BLA wells: pH: 7.2 alk: 85 Blend of Bull Run water (75%) and BLA (25%): pH: 7.1 alk: 28	Inlet to Powell Butte Reservoir (blended with Bull Run water)	Yes	When in summer use, typically meets 25% of demand	Entire service area	All wholesale water customers downstream of Powell Butte Reservoir receive Bull Run/groundwater blend when Well field in use
Powell Valley Road WD	Well No. 3 and Well No. 4	Year-round	Well 3: pH: 6.7 alk: 40 Well 4: pH: 7.4 alk: 110 Blend of Bull Run water (50%) and Wells 3/4: pH: 7.1 alk: 55	Raymond Street Reservoir (blended with Bull Run water)	Winter: Yes Summer: Yes, except for former Gilbert WD service area, which receives 100% groundwtr	Winter: 50% Summer: 50%, except for former Gilbert WD service area, which receives 100% groundwater	Entire service area	
City of Tigard	Lake Oswego	Year-round	Lake Oswego: pH: 7.6 alk: 20 Blend of Bull Run water and Lake O water: pH: 7.1-8.0 alk: 6-13	Bonita pump station	Yes	5-25%	Entire service area	
Tualatin Valley WD	Joint Water Commission	Year-round	JWC: pH: 7.7 alk: 40	SW Johnson X SW Cornelius Pass	No	10% summer 20% winter	Service area west of 185th and north of Farmington Road	

Table 3: Lead and Copper Tap Monitoring-City of Portland and Contract Holders Proposal for Follow-up Monitoring

Name	Population (1)	% of total Pop'n	LCR System Size	Pb 90th %tile (2)	Cu 90th %tile (2)	FY 95-96 consumption of water supplied by Portland (100 cu ft)	% of total consumption	Proposed minimum no. of samples
Burlington WD	390	0.1	Small	0.011	1.3	27,232	0.1	
GNR Corp	72	0.0	Small	0.008	0.18	2,500	0.0	
Gresham, City of	35,000	4.4	Medium	0.041	1.4	2,588,116	5.1	5
Lake Grove WD	3,300	0.4	Medium	0.062	1.1	113,492	0.2	
Lorna WD	200	0.0	Small	0.015	0.13	8,919	0.0	
Lusted	1,300	0.2	Small	0.007	0.9	71,071	0.1	
Palatine Hill WD	1,500	0.2	Small	0.075	1.9	124,700	0.3	
Pleasant Home WD	1,200	0.2	Small	0.030	1.9	85,024	0.2	
Portland, City of	460,000	57.9	Large	0.044	1.2	30,030,000	59.1	61
Powell Valley Road WD	32,000	4.0	Medium	0.035	1.3	1,486,075	2.9	3
Raleigh WD	4,000	0.5	Medium	0.034	1.3	306,879	0.6	
Rockwood WD	43,000	5.4	Medium	0.037	1.8	3,357,368	6.6	7
Skyview Acres WD	47	0.0	Small	0.022	1.3	12,776	0.0	
Tigard, City of	37,350	4.7	Medium	NA (3)	NA(3)	1,463,904 (4)	2.9	3
Tualatin, City of	17,450	2.2	Medium	0.043	0.85	1,433,066	2.8	3
Tualatin Valley WD	144,980	18.2	Large	0.028	1.4	8,993,577 (5)	17.7	18
Valley View WD	950	0.1	Small	0.039	1.1	64,519	0.1	
West Slope WD	12,000	1.5	Medium	0.039	1.2	627,661 (6)	1.2	
Total for ALL systems	794,739	100.0%		0.041 (7)	1.6 (7)	50,796,879	100.0%	100
Total for SHADED systems only	769,780	% of total = 96.9%		0.041	1.7	49,352,106	% of Total = 97.2%	100

(1) Source: OHD (2) 1st round of initial monitoring in 1992/93
(3) Tigard not using Bull Run water during initial monitoring period
(4) Adjusted from FY 95-96 actual 117,490 ccf to 1,463,904 ccf (3 MGD), more representative of projected use in FY 96-97
(5) Adjusted from FY 95-96 actual 9,293,577 ccf to 8,993,577 ccf, to account for water sold to West Slope WD
(6) Adjusted from FY 95-96 actual 327,661 ccf to 627,661 ccf, to account for water purchased from Tualatin Valley WD
(7) Not including GNR Corp (5 samples) and Skyview Acres (5 samples)

Table 4: Lead and Copper Tap Monitoring - City of Portland and Contract Holders Results of Initial Monitoring

Name	**Population (1)**	**LCR System Size**	**Req'd no. samples**	**1st round - Initial monitoring period**	**Actual no. of samples**	**Pb 90th %tile**	**Cu 90th %tile**	**2nd round initial monitoring period**	**Actual no. of samples**	**Pb 90th %tile**	**Cu 90th %tile**
Burlington WD	390	Small	10	Jul-Dec 93	10	0.011	1.3				
GNR Corp	72	Small	5	Jul-Dec 93	5	0.008	0.18				
Gresham, City of	35,000	Medium	60	Jul-Dec 92	60	0.041	1.4	(3)			
Lake Grove WD	3,300	Medium	20	Jul-Dec 93	20	0.062	1.1				
Lorna WD	200	Small	10	Jul-Dec 93	10	0.015	0.13				
Lusted	1,300	Small	20	Jul-Dec 93	20	0.007?	0.9?				
Palatine Hill WD	1,500	Small	20	Jul-Dec 93	21	0.075	1.9				
Pleasant Home WD	1,200	Small	20	Jul-Dec 93	20	0.030	1.9				
Portland, City of	460,000	Large	100	Jan-Jun 92	126	0.044	1.8	Jul-Dec 92	125	0.053	1 .3
Powell Valley Road WD	32,000	Medium	60	Jul-Dec 92	60	0.035	1.3	(3)			
Raleigh WD	4,000?	Medium	20	Jul-Dec 92	30	0.034	1.3				
Rockwood WD	43,000	Medium	60	Jul-Dec 92	61	0.037	1.8	(3)			
Skyview Acres WD	47	Small	5	Jul-Dec 93	5	0.022	1.3				
Tigard, City of	37,350	Medium	60	Jul-Dec 92	NA(2)	NA(2)	NA(2)	NA(2)	NA(2)	NA(2)	NA(2)
Tualatin, City of	17,450	Medium	60	Jul-Dec 92	60	0.043	0.85	(3)			
Tualatin Valley WD	144,980	Large	100	Jan-Jun92	102	0.028	1.4	Jul-Dec 92	102	0.029 (4)	0.099 (4)
Valley View WD	950	Small	10	Jul-Dec 93	9	0.039	1.1				
West Slope WD	12,000	Medium	60	Jul-Dec 92	75	0.039	1.2	(3)	79	0.037	1 .3

(1) Source: OHD
(2) Tigard not using Bull Run water during initial monitoring period
(3) OHD waived requirement for 2nd round of monitoring for medium systems that exceeded lead and/or copper action levels in first round of monitoring
(4) Sources of water other than Bull Run in use at the time of monitoring

Table 5: Water Quality Parameter Monitoring in the Distribution System- City of Portland and Contract Holders Proposal for Follow-up Monitoring

Name	Population (1)	% of total Pop'n	LCR System Size	FY 95-96 consumption of water supplied by Portland (100 cu ft)	% of total consumption	Proposed minimum no. of samples
Burlington WD	390	0.1	Small	27,232	0.1	
GNR Corp	72	0.0	Small	2,500	0.0	
Gresham, City of	35,000	4.4	Medium	2,588,116	5.1	1
Lake Grove WD	3,300	0.4	Medium	113,492	0.2	
Lorna WD	200	0.0	Small	8,919	0.0	
Lusted	1,300	0.2	Small	71,071	0.1	
Palatine Hill WD	1,500	0.2	Small	124,700	0.3	
Pleasant Home WD	1,200	0.2	Small	85,024	0.2	
Portland, City of	460,000	57.9	Large	30,030,000	59.1	15
Powell Valley Road WD	32,000	4.0	Medium	1,486,075	2.9	1
Raleigh WD	4,000	0.5	Medium	306,879	0.6	
Rockwood WD	43,000	5.4	Medium	3,357,368	6.6	2
Skyview Acres WD	47	0.0	Small	12,776	0.0	
Tigard, City of	37,350	4.7	Medium	1,463,904 (2)	2.9	1
Tualatin, City of	17,450	2.2	Medium	1,433,066	2.8	1
Tualatin Valley WD	144,980	18.2	Large	8,993,577 (3)	18.3	5
Valley View WD	950	0.1	Small	64,519	0.1	
West Slope WD	12,000	1.5	Medium	627,661 (4)	0.6	
Total for ALL systems	794,739	100.0%		50,796,879	100.0%	25
Total for SHADED systems only	769,780	% of total = 96.9%		49,352,106	% of Total = 97.2%	25

(1) Source: OHD
(2) Adjusted from FY 95-96 actual 117,490 ccf to 1,463,904 ccf (3 MGD), more representative of projected use in FY 96-97
(3) Adjusted from FY 95-96 actual 9,293,577 ccf to 8,993,577 ccf, to account for water sold to West Slope WD
(4) Adjusted from FY 95-96 actual 327,661 ccf to 627,661 ccf, to account for water purchased from Tualatin Valley WD

CITY OF PORTLAND, OREGON
BUREAU OF WATER WORKS

July 10, 1997

Oregon State Health Division
Drinking Water Program
P0 Box 14350
Portland, OR 97214

To Whom it May Concern:
In conformance with the requirements of OAR 333-061-0040, the results of our Lead and Copper Rule compliance monitoring for the first period of 1997 are attached. These results are presented as a technical memorandum, including and evaluation of the monitoring plan and comparison of 1997 results to 1992 data.

As required, monitoring was conducted within 6 months of initiating corrosion control treatment in January 1997. This monitoring was conducted as described in our joint monitoring proposal submitted May 14, 1997 and approved by Oregon Health Division June 23, 1997. As described in the plan, all water systems using Bull Run water as their sole or major source of supply are considered as a single large system for compliance with Lead and Copper Rule monitoring requirements. The following systems submitted the Joint Monitoring Plan:

- Burlington Water District
- The City of Gresham
- Lake Grove Water District
- Lorna Water Company
- Powell Valley Road Water District
- The City of Portland
- Rockwood PUD
- The City of Tigard
- The City of Tualatin
- Tualatin Valley Water District
- Valley View Water District
- West Slope Water District

In summary the monitoring included collection of 130 samples from Tier I homes distributed throughout We participating systems' service areas. Samples were collected between May 24 and June 5, 1997. As detailed in the attached report, the 90th percentile values for the Joint Plan data are as follows:

Lead	0.012 mg/L
Copper	0.65 mg/L

As described in our monitoring proposal, the homes sampled were randomly chosen from the set of homes sampled in 1992. The 1992 homes selected for the 1997 joint monitoring program gave similar lead results as compared to the homes which were not selected. The 1992 homes selected for the 1997 joint monitoring program gave higher copper results than the homes which were not selected, providing a conservative assessment of reduction in copper levels.

Also presented are results from the distribution system water quality parameters. In summary, the system pH ranged from 6.9 to 8.0.

We find these results very encouraging in demonstrating the effectiveness of our corrosion control treatment process. Distribution system water quality parameters will continue to be monitored twice per six month period. The next round of home sampling is scheduled for November 1997.

Please contact me at 823-7499 if you have any questions or concerns regarding this information.

Sincerely,
Mark Knudson, P.E.
Water Quality Manager

attachment

c: Rosemary Menard, Mort Anoushiravani, Participating Utilities, Alberta Seierstad, Babette Faris.

DATE: July 10, 1997

TO: Mark Knudson

FROM: Kathy Casson and Sisay Mengistu

SUBJECT: Lead and Copper Monitoring Results

Objectives

This technical memorandum summarizes the first round of follow-up monitoring required by the Lead and Copper Rule following startup of pH adjustment of the Bull Run supply in January 1997. The 1997 joint monitoring plan is reviewed and statistically evaluated. Results for the June 1997 lead and copper tap sampling and distribution water quality parameters are presented. Lastly, comparisons with 1992 monitoring data are presented to evaluate the effectiveness of current treatment.

Corrosion Control Treatment

The Portland Water Bureau began continuous corrosion treatment of the Bull Run source at the Bull Run Headworks in January 1997. Sodium hydroxide (caustic soda, NaOH) was added to increase the pH. The dose has been gradually increased as shown in the table below.

Date	Sodium hydroxide dose	Target pH (at Lusted Ammoniation Facility)
January 6, 1997	1.0 mg/L	6.8
January 10, 1997	1.6 mg/L	7.0
May 8, 1997	2.7 mg/L	7.3
May 14, 1997	3.7 mg/L	7.4

On June 24, the Lusted facility began adding sodium hydroxide. The dose rate was adjusted as needed to achieve a target pH of 7.5 at the entry point to the distribution system.

Monitoring Plan

The monitoring during the first six-month period of 1997 was conducted according to the proposed joint monitoring plan submitted May 14, 1997 and approved by Oregon Health Division June 23, 1997. As described in the plan, all water systems using Bull Run water as their sole or major source of supply would be considered as a single large system of complying with Lead and Copper Rule monitoring requirements. The following systems submitted the Joint Monitoring Plan:

- Burlington Water District
- The City of Gresham
- Lake Grove Water District
- Lorna Water Company
- Powell Valley Road Water District
- The City of Portland
- Rockwood PUD
- The City of Tigard
- The City of Tualatin
- Tualatin Valley Water District
- Valley View Water District
- West Slope Water District

Tap Monitoring for Lead and Copper

The table below presents the samples required by the Joint Monitoring Plan and the actua1 total number of samples collected in the first period of 1997. Extra samples were collected to provide a contingency in the event individual homeowners withdraw from the program over time.

System	**Number of Samples**		
	Specified in Joint Monitoring Plan	**Extra**	**Total Samples Collected**
The City of Gresham	5	0	5
Powell Valley Road Water District	3	0	3
The City of Portland	61	27	88
Rockwood PUD	7	0	7
The City of Tigard	3	0	3
The City of Tualatin	3	1	4
Tualatin Valley Water District	18	2	20
Joint Monitoring Plan Total	**100**	**30**	**130**

All samples were collected from Tier I homes randomly selected from those which had been previously sampled in 1992. All samples were collected by between May 2 and June 5, 1997. First draw one-liter samples were drawn from the cold water kitchen or bathroom tap by customers according to instructions shown in Appendix 1. Analyses were performed by the Portland Water Bureau Water Quality Laboratory. The 90th percentile lead and copper values were determined as described in 40 CFR 141.80.

Review of Home Selection for 1997 Joint Monitoring Plan

The homes sampled in 1997 were randomly selected from homes sampled in 1992. Thus, one would expect that 1992 lead and copper results from the homes which were selected for the Joint Monitoring Plan would be similar to the homes which were not selected. The null hypothesis that the selected and not-selected homes were from the same population was tested using the non-parametric Wilcoxon test at a 95% level of significance. Various 1992 summary statistics for these sets of homes are summarized below.

	1992 Median Value		**1992 90th percentile value**		**Significant Difference?**
	Selected	**Not-selected**	**Selected**	**Not-selected**	
Lead	0.009	0.009	0.040	0.043	No
Copper	1.2	0.885	1.7	1.6	Yes

The 1992 lead results in selected and non-selected homes showed remarkably similar results. Statistically one cannot disprove the null hypothesis that the resampled and non-resampled homes were from the same population.

However, copper in the selected homes was significantly higher than found in the non-selected homes in 1992 samples. This would indicate that using the homes selected for the Joint Monitoring Plan in would likely result in higher copper values than using the non-selected homes.

We believe the design of joint monitoring plan is sound and consistent with criteria identified in the Lead and Copper Rule. The distribution of homes in the Joint Monitoring Plan more closely reflects the actual distribution of population served by Bull Run water than was the case in 1992. The differences in copper levels of sampled and non-resampled homes would lead to a conservative assessment of the effectiveness of corrosion treatment for copper.

Entry Point Sampling

Samples were collected weekly at the Powell Butte outlet, representing the entry point of Bull Run Water into the distribution system. The City of Tigard, Powell Valley Water District and Tualatin Valley Water District utilized additional sources during this six-month period. pH and alkalinity were measured biweekly during their operation.

Water Quality Parameters in Distribution System

Tap samples were collected at twenty-eight sites throughout the area served by Bull Run water as shown in the table below.

System	**Number of Samples**		
	Specified in Joint Monitoring Plan	**Extra**	**Total Samples Collected**
The City of Gresham	1	0	1
Powell Valley Road Water District	1	0	1
The City of Portland	15	1	16
Rockwood PUD	2	0	2
The City of Tigard	1	1	2
The City of Tualatin	1	0	1
Tualatin Valley Water District	5	0	5
Joint Monitoring Plan Total	**26**	**2**	**28**

These sites were sampled twice during the first six months of 1997. Samples were collected during the week of April 16-19 and the week of June 3-9. These samples were analyzed for pH in the field using pH meters equipped with electrodes suitable for water flow ionic strength. The Portland Water Bureau provided a training session to participating water systems to ensure standardized sampling and measurement techniques. Although not required, alkalinity was also measured to better understand its effect on pH stability in the system. Alkalinity samples were analyzed by the Portland Water Bureau Water Quality Laboratory.

Results

Tap Monitoring for Lead and Copper

The lead and copper results from tap sampling at the 130 tier I homes sampled in 1997 according the the Joint Monitoring Plan are shown in Table la. and lb. and briefly summarized below. In Figure 1, the percentile distributions lead and copper data are shown graphically. Addresses for the 130 homes are shown in Appendix 2.

Table 1a. Portland Area Water Systems Lead and Copper Rule Home Sampling Data (Lead 1997)

Lead Data			
Lead Home No.	Lead	Hours	Percentile
8	< 0.001	7.50	0
22	< 0.001	6.50	1
28	< 0.001	9.00	2
29	< 0.001	6.00	2
61	< 0.001	8.00	3
62	< 0.001	7.50	4
128	< 0.001	9.50	5
137	< 0.001	7.50	5
139	< 0.001	8.50	6
146	< 0.001	8.25	7
149	< 0.001	6.25	8
152	< 0.001	8.00	9
157	< 0.001	8.50	9
1	0.001	10.50	10
10	0.001	7.00	11
12	0.001	6.50	12
14	0.001	9.50	12
38	0.001	6.00	13
42	0.001	9.00	14
117	0.001	7.00	15
121	0.001	7.50	16
145	0.001	13.50	16
6	0.002	7.00	17
15	0.002	7.00	18
17	0.002		19
20	0.002	7.00	19
21	0.002		20
33	0.002	7.00	21
37	0.002	7.00	22
40	0.002	13.00	22

Lead Data			
Lead Home No.	Lead	Hours	Percentile
168	0.003	10.50	50
2	0.004	9.00	51
19	0.004	9.00	52
24	0.004	8.50	53
59	0.004	7.00	53
63	0.004	8.00	54
76	0.004	6.50	55
85	0.004	17.00	56
88	0.004	12.00	57
89	0.004	9.00	57
91	0.004	6.00	58
93	0.004	7.50	59
103	0.004	8.00	60
119	0.004	8.00	60
120	0.004	10.00	61
132	0.004	8.00	62
140	0.004	8.50	63
154	0.004	8.00	64
164	0.004	7.50	64
171	0.004	8.00	65
67	0.005	7.00	66
96	0.005	8.50	67
100	0.005		67
156	0.005	8.50	68
159	0.005	7.00	69
160	0.005	6.50	70
16	0.006	6.50	71
65	0.006	8.00	71
78	0.006	10.00	72
110	0.006	8.00	73

Lead Data			
Lead Home No.	Lead	Hours	Percentile
47	0.002	9.50	23
52	0.002	6.50	24
55	0.002	9.00	25
68	0.002	7.00	26
70	0.002	7.00	26
81	0.002	6.00	27
82	0.002	7.00	28
99	0.002	8.50	29
101	0.002	7.00	29
107	0.002	7.00	30
122	0.002	9.00	31
124	0.002	8.50	32
129	0.002		33
135	0.002	12.00	33
138	0.002	9.00	34
141	0.002	26.00	35
142	0.002	9.50	36
148	0.002	8.00	36
170	0.002	7.00	37
9	0.003	6.50	38
25	0.003	7.50	39
26	0.003	12.00	40
45	0.003	8.00	40
56	0.003	9.00	41
71	0.003	7.50	42
92	0.003	6.50	43
111	0.003	6.00	43
143	0.003	8.00	44
150	0.003	6.00	45
151	0.003	6.50	46
155	0.003	7.00	47
161	0.003	7.00	47

Lead Data			
Lead Home No.	Lead	Hours	Percentile
147	0.006	7.75	74
153	0.006	6.50	74
158	0.006	7.00	75
166	0.006		76
3	0.007	9.00	77
23	0.007	6.00	78
80	0.007	9.00	78
123	0.007	6.00	79
136	0.007	8.50	80
79	0.008	7.50	81
86	0.008	8.00	81
87	0.008	10.50	82
134	0.008	8.50	83
173	0.008	9.00	84
58	0.009	8.50	84
64	0.009	8.00	85
169	0.009	9.00	86
131	0.010	6.50	87
162	0.010	6.25	88
172	0.010	7.00	88
35	0.012	8.00	89
102	0.012	10.00	90
5	0.015	14.00	91
32	0.015	7.00	91
116	0.015	7.50	92
90	0.018	7.00	93
66	0.019	7.00	94
133	0.022	7.00	95
98	0.026	7.00	95
109	0.029	7.50	96
126	0.048	8.50	97
83	0.066	7.00	98

Lead Data			
Lead Home No.	Lead	Hours	Percentile
163	0.003	7.25	48
165	0.003	8.00	49
167	0.003	8.00	50

Lead Data			
Lead Home No.	Lead	Hours	Percentile
30	0.080	11.00	98
144	0.087	7.00	99
108	0.120	8.50	100

Table 1b. Portland Area Water Systems Lead and Copper Rule Home Sampling Data (Copper 1997)

Copper Data			
Copper Home No.	Copper	Hours	Percentile
166	0.032		0
165	0.076	8.00	1
89	0.095	9.00	2
29	0.100	6.00	2
91	0.100	6.00	3
55	0.110	9.00	4
164	0.110	7.50	5
99	0.120	8.50	5
154	0.120	8.00	6
157	0.130	8.50	7
93	0.130	7.50	8
155	0.140	7.00	9
158	0.140	7.00	9
92	0.150	6.50	10
1	0.160	10.50	11
38	0.160	6.00	12
37	0.160	7.00	12
101	0.160	7.00	13
56	0.180	9.00	14
17	0.220		15
100	0.220		16
23	0.230	6.00	16
136	0.230	8.50	17
162	0.240	6.25	18

Copper Data			
Copper Home No.	Copper	Hours	Percentile
124	0.410	8.50	50
119	0.420	8.00	51
98	0.420	7.00	52
128	0.430	9.50	53
168	0.430	10.50	53
88	0.430	12.00	54
71	0.440	7.50	55
163	0.440	7.25	56
2	0.440	9.00	57
159	0.440	7.00	57
35	0.440	8.00	58
116	0.440	7.50	59
20	0.460	7.00	60
160	0.460	6.50	60
153	0.460	6.50	61
52	0.480	6.50	62
96	0.480	8.50	63
110	0.480	8.00	64
134	0.480	8.50	64
102	0.480	10.00	65
126	0.480	8.50	66
108	0.480	8.50	67
132	0.490	8.00	67
40	0.500	13.00	68

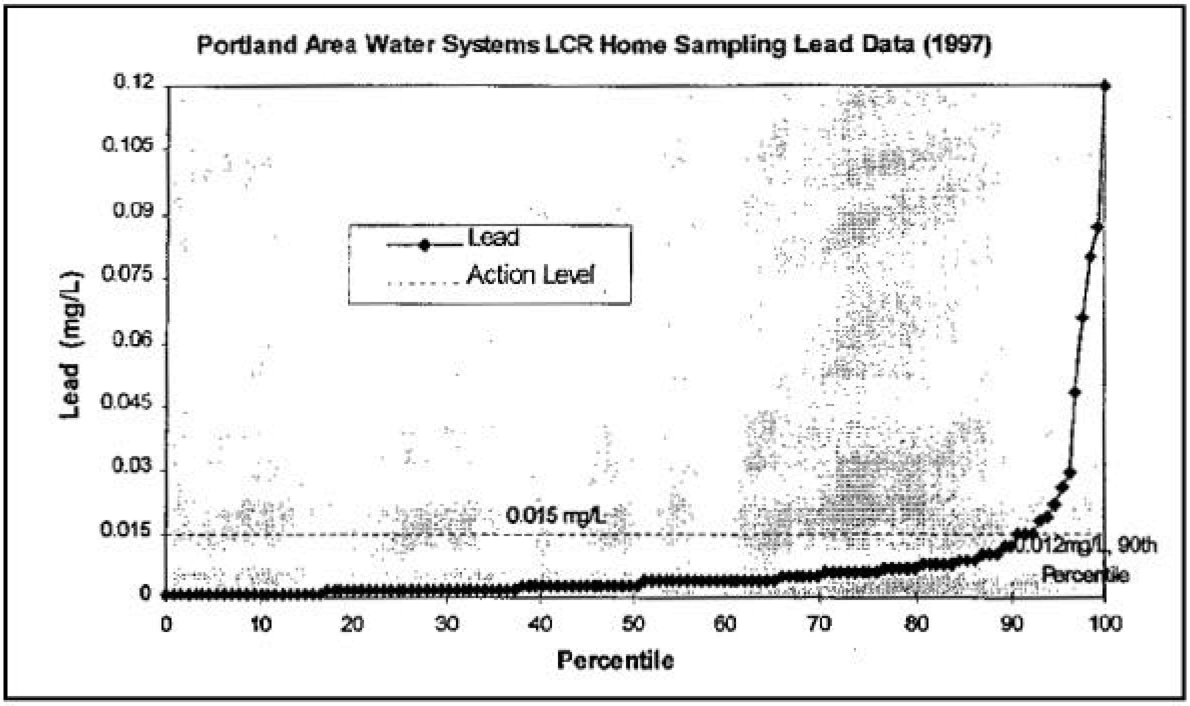
Copper Data			
Copper Home No.	Copper	Hours	Percentile
170	0.250	7.00	19
8	0.260	7.50	19
145	0.260	13.50	20
161	0.260	7.00	21
151	0.270	6.50	22
24	0.270	8.50	22
156	0.270	8.50	23
172	0.270	7.00	24
109	0270	7.50	25
107	0.280	7.00	26
9	0.280	6.50	26
26	0.280	12.00	27
3	0.280	9.00	28
123	0.280	6.00	29
10	0.290	7.00	29
142	0.290	9.50	30
143	0.290	8.00	31
137	0.300	7.50	32
33	0.300	7.00	33
122	0.300	9.00	33
138	0.300	9.00	34
173	0.300	9.00	35
59	0.310	7.00	36
121	0.320	7.50	36
70	0.330	7.00	37
45	0.330	8.00	38
12	0.340	6.50	39
103	0.340	8.00	40
65	0.340	8.00	40
28	0.350	9.00	41
135	0.350	12.00	42
171	0.350	8.00	43
131	0.370	6.50	43

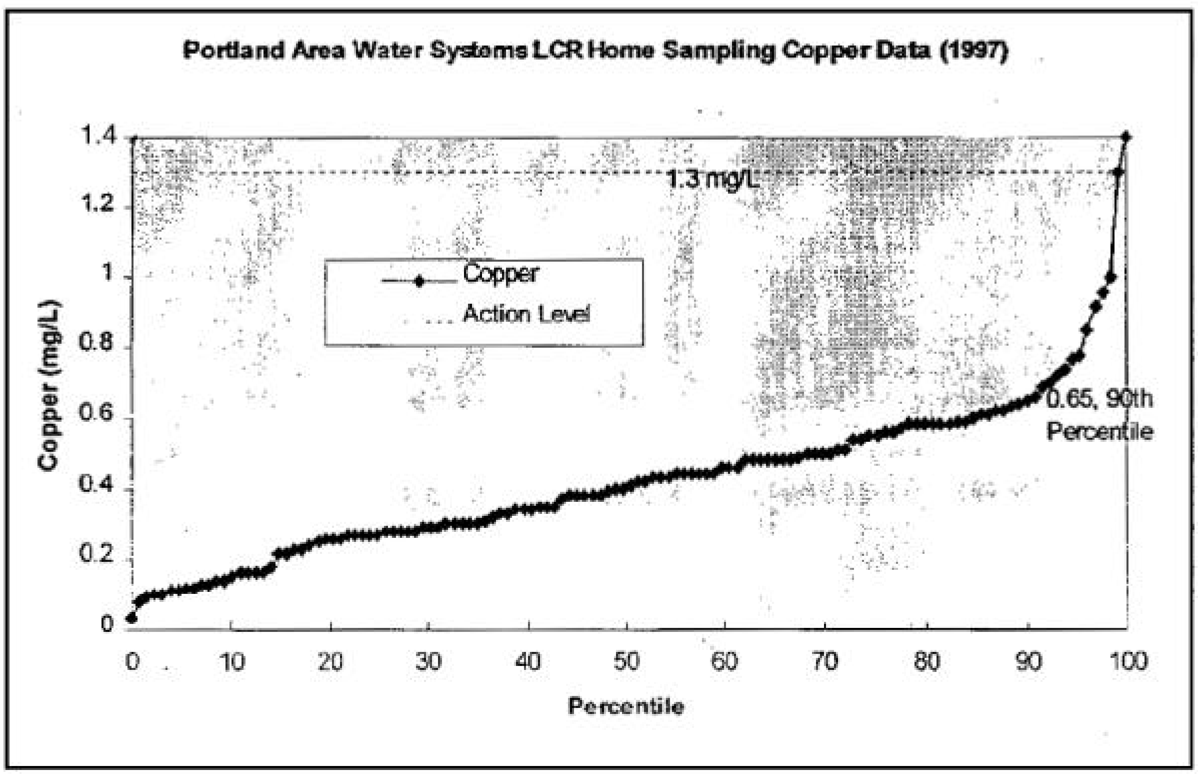
Copper Data			
Copper Home No.	Copper	Hours	Percentile
81	0.500	6.00	69
16	0.500	6.50	70
87	0.500	10.50	71
86	0.510	8.00	71
64	0.510	8.00	72
67	0.540	7.00	73
79	0.540	7.50	74
47	0.550	9.50	74
167	0.550	8.00	75
6	0.560	7.00	76
68	0.560	7.00	77
42	0.570	9.00	78
22	0.580	6.50	78
14	0.580	9.50	79
25	0.580	7.50	80
150	0.580	6.00	81
169	0.580	9.00	81
90	0.580	7.00	82
152	0.590	8.00	83
78	0.590	10.00	84
58	0.600	8.50	84
61	0.610	8.00	85
146	0.610	8.25	86
149	0.620	6.25	87
85	0.620	17.00	88
133	0.630	7.00	88
148	0.640	8.00	89
5	0.650	14.00	90
129	0.660		91
66	0.690	7.00	91
30	0.700	11.00	92
76	0.720	6.50	93
63	0.740	8.00	94

Copper Data			
Copper Home No.	Copper	Hours	Percentile
117	0.380	7.00	44
15	0.380	7.00	45
82	0.380	7.00	46
111	0.380	6.00	47
120	0.380	10.00	47
21	0.390		48
19	0.400	9.00	49
80	0.400	9.00	50

Copper Data			
Copper Home No.	Copper	Hours	Percentile
62	0.770	7.50	95
32	0.780	7.00	95
83	0.850	7.00	96
147	0.920	7.75	97
139	0.960	8.50	98
141	1.000	26.00	98
140	1.300	8.50	99
144	1.400	7.00	100

Figure 1. Portland Area Water Systems LCR Home Sampling Data Summary





1997 Joint Monitoring	90th Percentile		Median		Range of results	Action Level
	Value	% Redn. from 1992 Value	Value	% Redn. from 1992 Value		
Lead	0.012 mg/L	73%	0.003 mg/L	67%	ND @ 0.001 to 0.12 mg/L	0.015 mg/L
Copper	0.65 mg/L	62%	0.405 mg/L	66%	0.032 to 1.4 mg/L	1.3 mg/L

Both lead and copper 90th percentile results are below the action levels for this round of monitoring. In the following paragraphs, 1997 results are compared with 1992 results and the 1997 results compared among the monitoring systems.

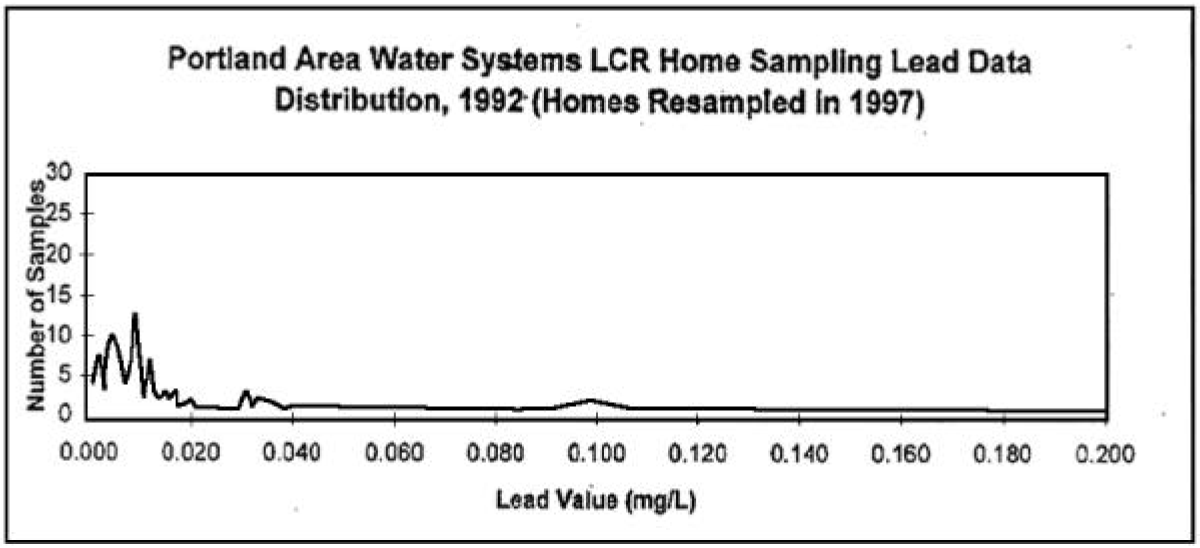
In 1992, Portland and its wholesalers conducted tap sampling for lead and copper for each system, rather than a joint monitoring strategy. The table below presents 1992 summary statistics for the same homes that were sampled as part of the joint monitoring plan in 1997. These were the round 1 samples and we believe these are the best available comparison group for the 1997 joint monitoring plan data presented above. All comparisons with 1992 data in this report will be using these selected round 1 homes.

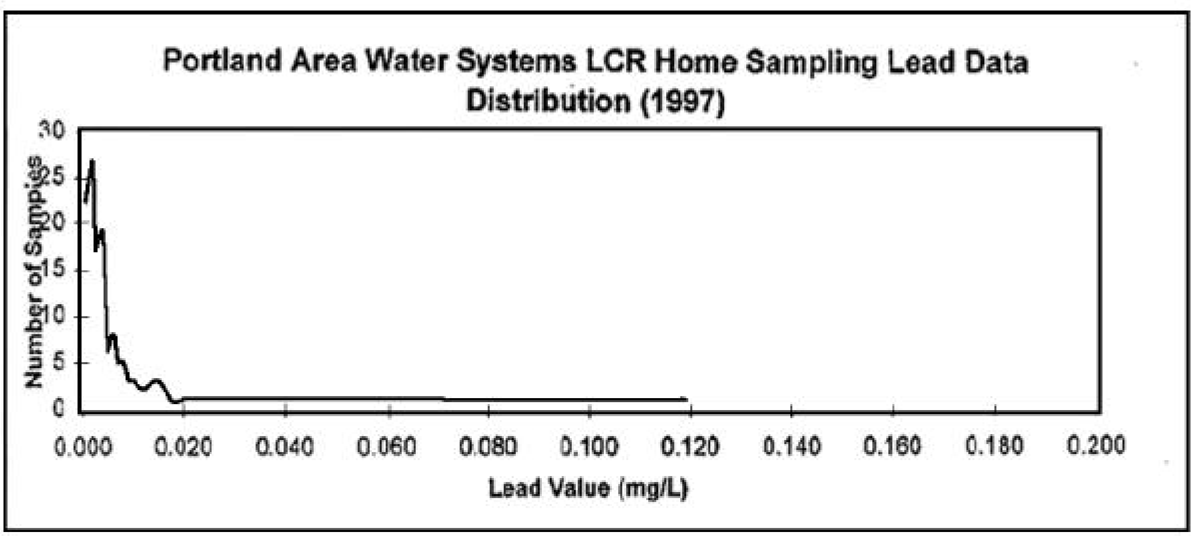
1992 Data from 1992 homes sampled in 1997	90th Percentile	Median	Range	Action Level
Lead	0.044 mg/L	0.009 mg/L	ND @ 0.001 to 0.20 mg/L	0.015 mg/L
Copper	1.7 mg/L	1,2 mg/L	0.14 to 3.0 mg/L	1.3 mg/L

1997 monitoring data reflect a dramatic reduction in both lead and copper in these homes since 1992. Median values for both lead and copper were approximately one-third of the levels measured in 1992. Figures 3 and 4 graphically compare the frequency distribution of the lead and copper results from 1992 and 1997, showing this shift. Statistical testing with a nonparametric Wilcoxon test confirmed that this difference was highly significant (less than a 0.01 percent probability this difference could have occurred by chance).

Figure 2

Portland Area Water Systems LCR Home Sampling Lead Values Distribution Cor





Reductions of median lead and copper values occurred in almost all participating systems. A summary of the monitoring results by water system are shown below. Although the number of homes sampled for the smaller systems are too few to be statistically reliable, all systems did see some reductions. Powell Valley Road Water District had very low lead levels in 1992, and in the three homes sampled in 1997 were very similar. Tigard, Powell Valley and Tualatin Valley have other water sources, which were operational during 1997, which could have and effect on lead and copper levels. Nonetheless, the levels seen were similar to those seen for the Portland system.

Lead 1997 by system mg/L	**90th Percentile Value**	**Median**		**Range**	**Number of Samples**
		Value	**% Reduction from 1992 median**		
City of Gresham	0.010	0.005	67%	0.003 to 0.010	5
City of Tigard	0.006	0.004	No Bull Run used in 1992	0.003 to 0.006	3
City of Tualatin	0.006	0.004	82%	ND@ 0.001 to 0.006	4
Portland Water Bureau	0.015	0.0035	84%	ND@ 0.001 to 0.12	88
Powell Valley Water District	0.006	0.004	0%	ND@ 0.001 to 0.006	3
Rockwood Water District	0.010	0.004	87%	0.002 to 0.10	7
Tualatin Valley Water District	0.015	0.0025	64%	ND@ 0.001 to 0.087	20

Copper 1997 by system mg/L	90th Percentile Value	Median		Range	Number of Samples
		Value	% Reduction from 1992 median		
City of Gresham	0.46	0.44	39%	0.24 to 0.46	5
City of Tigard	0.11	0.076	No Bull Run in 1992	0.032 to 0.110	3
City of Tualatin	0.27	0.14	80%	0.13 to 0.27	4
Portland Water Bureau	0.65	0.415	68%	0.095 to 0.85	88
Powell Valley Water District	0.59	0.46	65%	0.12 to 0.59	3
Rockwood Water District	0.58	0.35	75%	0.25 to 0.58	7
Tualatin Valley Water District	1.15	0.535	39%	0.23 to 1.4	20

Entry Point Monitoring

Bull Run. The Bull Run entry point pH has gradually increased to current values of approximately 7.5. The following table presents entry point pH and alkalinity results for the Bull Run source for the first 6 months of 1997. Source water pH before treatment is also shown in this table. Source water is first chlorinated at Headworks which results in a drop in pH. Before entry into the distribution system, ammonia is added which may raise pH slightly. Sodium hydroxide addition now brings treated water pH at Powell Butte approximately 0.5 to 1.0 units above average historical values.

Entry Point Data from Bull Run Source (Powell Butte)

Sample collection date	Raw water pH at Heaworkds	Entry Point pH at Powell Butte	Alkalinity as CACO3, mg/l
07-Jan-97	7.10	6.70	4.60
14-Jan-97	6.90	6.90	5.60
21-Jan-97	6.90	7.10	6.60
28-Jan-97	7.00	7.00	7.30
04-Feb-97	7.20	6.90	6.10
11-Feb-97	6.80	6.90	5.70
18-Feb-97	7.10	7.00	5.80
25-Feb-97	7.30	7.10	6.60
04-Mar-97	6.90	7.00	6.40
11-Mar-97	7.10	7.10	6.40
18-Mar-97	7.10	7.10	6.10
25-Mar-97	7.10	6.90	6.10
01-Apr-97	7.10	7.10	6.20
08-Apr-97	7.00	7.20	6.70
15-Apr-97	7.00	7.30	7.80
22-Apr-97	7.10	7.20	7.10
29-Apr-97	7.00	7.50	7.00
06-May-97	7.10	7.40	7.70
13-May-97	7.10	7.20	7.30
20-May-97	7.20	7.40	8.50
27-May-97	7.00	7.40	8.60
03-Jun-97	7.00	7.40	10.00
10-Jun-97	7.30	7.50	9.40
17-Jun-97	7.00	7.30	10.00
24-Jun-97	6.90	7.50	10.00

OTHER ENTRY POINTS

Tigard. Tigard has the most complex water supply among the participants in joint Lead and Copper Rule monitoring. Sources include purchased Lake Oswego water as well as Tigard Wells 1 and 2. pH and alkalinity results are shown below for each entry point. These points sample the listed source directly. These sources supplement Bull Run Supply.

	Bonita Pump Station 100% Lake Oswego		**Well 1 100% Well 1**		**Well 2 100% Well 2**	
Date (1997)	**pH**	**alkalinity**	**pH**	**alkalinity**	**pH**	**alkalinity**
April 18	7.4	8.0				
April 29		15				
May 15	7.3	17				
May 30	7.6	20				
June 10	7.2	20	7.0	72	6.5	100
June 27	7.2	22	6.85	112	6.5	105

Powell Valley Road Water District. Powell Valley Road Water District blends Bull Run water with their wells 3 & 4 in the Raymond St. Reservoir. The Powell Valley Road entry point occurs after the wells have blended with Bull Run water. The typical target blend percentage is 50%; however, this varies with conditions.

	Raymond St. Reservoir (blend)		**Blend Percentage**	
Date (1997)	**pH**	**alkalinity**	**Bull Run**	**Wells 3 & 4**
April 16	7.1	51	50%	50%
April 29	7.1	43	50%	50%
May 14	7.1	53	50%	50%
May 29	7.1	52	50%	50%
June 9	7.1	34	70%	30%
June 24	7.2	34	70%	30%

Tualatin Valley Water District: Tualatin Valley Water District uses both Joint Water Commission water and Bull Run water. Their entry point sample for Joint Water Commission Water is not blended.

Joint Water Commission Entry Point (100% JWC)		
Date (1997)	**pH**	**alkalinity**
April 16	7.7	40
April 29	7.9	40
May 14	7.0	28
May 28	7.0	29
June 3	7.1	24
June 11	6.9	34
June 24	7.8	44

Distribution System Water Quality

The table on the following page compares the pH and alkalinity results from April and June sampling.

DISTRIBUTION SYSTEM WATER QUALITY PARAMETERS

Sample collection location	April		June		Water Source
	Field pH	Alkalinity as CACO3, mg/l	Field pH	Akalinity as CAC03 mg/l	
Portland Water Bureau					
Res 3	7.2	7.30	7.5	8.20	Bull Run
Res 4	7.4	7.00	7.6	8.50	Bull Run
Res 5	7.1	7.10	7.3	8.70	Bull Run
Res 6	7.0	6.80	7.4	8.00	Bull Run
Vernon	7.0	6.90	7.6	8.50	Bull Run
Duniway School	7.0	6.90	7.4	7.30	Bull Run
Engine 48	7.3	7.60	7.9	9.60	Bull Run
North Precinct	7.2	7.20	7.5	8.00	Bull Run
Portland Airport	7.2	7.60	7.7	9.00	Bull Run
Capitol Hill School	7.1	6.80	7.4	8.70	Bull Run
Columbia School	7.2	7.10	7.6	8.50	Bull Run
Engine 11	7.2	7.00	7.1	8.50	Bull Run

Sample collection location	April		June		Water Source
	Field pH	**Alkalinity as CACO3, mg/l**	**Field pH**	**Akalinity as CAC03 mg/l**	
Engine 23	7.0	6.90	7.4	7.40	Bull Run
Mt Scott	7.3	7.30	7.3	9.60	Bull Run
Smith School	7.1	7.30	7.5	8.50	Bull Run
Washington Park Zoo	7.1	7.00		9.10	Bull Run
Tualatin Valley WD					
SS #17	7.2	6.70	7.4	7.30	Bull Run
SS #36	7.6	7.50	8.0	9.20	Bull Run
SS #30	7.1	7.20	7.4	7.30	Bull Run
SS #21	7.7	40.00	7.1	26.00	JWC
SS #3	7.9	7.70	8.0	8.50	Bull Run
City of Tigard					
Station #31	7.3	7.40	7.6	8.70	Blend BR/LO *
Station #16	7.3	8.00	7.3	9.00	Blend BR/LO *
Rockwood					
Station #10	7.4	7.20	7.4	8.20	Bull Run
Station #32	7.4	8.10	76	9.00	Bull Run
City of Gresham					
Station #9	7.4	7.40	7.4	7.90	Bull Run
City of Tualatin					
City Hall	7.8	8.10	6.9	11.00	Bull Run
Powell Valley Road					
Sample Station	7.1	56.00	7.2	35.00	Blend BR/W3+4**

Notes:

* Blend of 90% Bull Run and 10% Lake Oswego in April, 1997
Blend of 75% Bull Run and 25% Lake Oswego in June, 1997

** Blend of 50% Bull Run and 50% Wells 3 & 4 in April, 1997
Blend of 70% Bull Run and 30% Wells 3 & 4 in June, 1997

Conclusions

Based on the preceding analysis, the following conclusions are offered:

- The homes sampled in 1992 that were selected for the 1997 joint monitoring program gave similar lead results to the homes which were not selected.

- The homes sampled in 1992 that were selected for the 1997 joint monitoring program gave higher copper results than the homes which were not selected, providing a conservative assessment of reduction in copper levels.

- The reduced sample size of 130 provides sufficient data to allow statistical analysis to distinguish system-wide changes in lead and copper levels.

- Both lead and copper levels are now below the action levels of the Lead and Copper Rule.

- The lead 90th percentile level has decreased by 72% and the copper 90th percentile level has decreased by 62% from their 1992 levels.

- Although the reduced sample size limits the ability to statistically confirm changes in individual systems, the raw numbers show all systems experienced reductions.

- Although supplementary sources were used by three of the providers who monitored, the lead and copper levels seen in these systems were similar to those of Portland and other systems.

- pH adjustment of the Bull Run Supply is effective in maintaining a pH of 7.0 to 7.5 in the service area.

Appendix 2 - Relating to Section 3

Blood Lead Levels in the U.S. 1991-1994: Phase 2 NHANES III Data
(Centers for Disease Control, Morbidity and Mortality Weekly Report, February 21, 1997, Vol.46, No. 7)

Summary of Observations:

NHANES	Conducted during	Blood lead level, geometric mean, persons aged 1-74 years	Prevalence of elevated blood lead levels (≥ 10 µg/dL), persons aged 1-74 years
II	1976-1980	12.8 µg/dL	77.8%
III, Phase 1	10/88 - 9/91	2.9 µg/dL	4.4%
III, Phase 2	10/91- 9/94	2.3 µg/dL	2.2%

- Risk for lead exposure remains disproportionately high for some groups, including children who are poor, non-Hispanic black, living in large metropolitan areas, or living in older housing.

- The most common source of lead exposure for children is lead-based paint that has deteriorated into paint chips and dust; soil and dust contaminated with residual lead fallout from vehicle exhaust contribute to exposure.

- Because the distribution of risk for lead exposure varies widely within the United States, prevention activities must be conducted at the local level and must be appropriate to local conditions. In areas where the risk for elevated blood lead levels is low, screening efforts should be targeted to children who remain at elevated risk for lead exposure.

CDC Centers for Disease Control

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MMWR MORBIDITY AND MORTALITY WEEKLY REPORT™

Update: Blood Lead Levels – United States, 1991–1994

Lead is an environmental toxicant that may deleteriously affect the nervous, hematopoietic, endocrine, renal, and reproductive systems (1). Lead exposure in young children is a particular hazard because children absorb lead more readily than do adults and because the developing nervous systems of children are more susceptible to the effects of lead (2). Blood lead levels (BLLs) at least as low as 10 µg/dL can adversely affect the behavior and development of children (2). CDC's National Health and Nutrition Examination surveys (NHANES), an ongoing series of national examinations of the health and nutritional status of the civilian noninstitutionalized population, have been the primary source for monitoring BLLs in the U.S. population. From NHANES II (conducted during 1976–1980) to Phase 1 of NHANES III (conducted during October 1988–September 1991), the geometric mean (GM) BLL for persons aged 1–74 years declined from 12.8 µg/dL to 2.9 µg/dL, and the prevalence of elevated BLLs (BLLs ≥ 10 µg/dL) decreased from 77.8% to 4.4% (3).[*] This report updates national BLL estimates with data from Phase 2 of NHANES III (conducted during October 1991–September 1994), which indicate that BLLs in the U.S. population aged ≥1 year continued to decrease and that BLLs among children aged 14 years were more likely to be elevated among those who were poor, non-Hispanic black, living in large metropolitan areas, or living in older housing.

In NHANES III, blacks, Mexican Americans, children aged 2 months–6 years, and persons aged ≥60 years were oversampled to increase the reliability of estimates for these groups (4). A household interview and a physical examination were conducted for each survey participant. During the physical examination, 1 mL of whole blood was collected by venipuncture from examinees aged ≥1 year. Graphite furnace atomic absorption spectrophotometry was used to measure BLLs at a detection limit of 1 µg/dL (5); BLLs below the level of detection were assigned a value of 0.7 µg/dL.

[*]The BLL value assigned to persons with BLLs below the level of detection and the sample examination weights were revised slightly in the NHANES III data set after publication of BLLs from Phase 1. Therefore, some values for Phase 1 date reported here do not match previously published values.

In this analysis, income categories were defined using the poverty-income ratio (PIR; the ratio of total family income to the poverty threshold for the year of the interview); low income was defined as PIR ≤1,300; middle, as PIR 1.301–3,500; and high, as PIR ≥3,501. Urban status was based on U.S. Department of Agriculture codes that classify counties by total population and proximity to major metropolitan areas (6); the two categories used were metropolitan areas with a population ≥1 million and metropolitan and nonmetropolitan areas with a population <1 million. Data on the age-of-housing variable were collected by self-report using three categories (built before 1946, during 1946–1973, and after 1973); these cutpoints closely correspond to years in which the amount of lead contained in residential paint was altered (2).** The sample included 13,642 persons; 2392 were children aged 1–5 years. Data for racial/ethnic groups other than non-Hispanic black, non-Hispanic white, and Mexican American were too small for reliable estimates. Statistical analyses were performed using Software for Survey Data Analysis, which accounted for the complex sample design. Asymmetric 95% confidence intervals were calculated using the natural logarithmic transformation (7).

During 1991–1994, the overall GM BLL of the U.S. population aged ≥1 year was 2.3 µg/dL (Table 1). GM BLLs varied by age and were highest among children aged 1–2 years and persons aged ≥50 years. Among those aged ≥1 year, approximately 2.2% had BLLs ≥ 10 µg/dL (Table 1). Among those aged 1-5 years, approximately 4.4% had BLLS ≥10 µg/dL (Table 1), representing an estimated 930,000 children aged 1–5 years in the United States with BLLs ≥10 µg/dL. In addition, among children aged 1-5 years, approximately 1.3% had BLLs ≥15 µg/dL and 0.4% had BLLs ≥20 µg/dL.

For children aged 1-5 years, the prevalence of BLLs ≥10 µg/dL was higher among those who were non-Hispanic blacks or Mexican Americans, from lower-income families, living in metropolitan areas with a population ≥1 million, or living in older housing (Table 2). The differences in risk for an elevated BLL by race/ethnicity, income, and urban status generally persisted across age-of-housing categories. Similarly, the higher risk for an elevated BLL associated with older age of housing generally persisted across race/ethnicity, income, and urban status categories. Therefore, the risk for an elevated BLL was higher among non-Hispanic black children living in housing built before 1946 (21.9%) or built during 1946–1973 (13.7%), among children in low-income households who lived in housing built before 1946 (16.4%), and among children in areas with populations ≥1 million who live in housing built before 1946 (11.5%) when compared with children in other categories. Based on a multivariate logistic regression model, non-Hispanic black race/ethnicity, low income, and living in housing built before 1946 were independent predictors of elevated BLLs in children aged 1–5 years. Living in urban areas was not an independent predictor of elevated BLLs when controlling for race/ethnicity, income, and age of housing.

**Residential paint containing up to 50% lead was in widespread use through the 1940s; lead usage in residential paint declined thereafter and was banned in 1978.

TABLE 1. Weighted geometric mean (GM) blood lead levels BLLs) and percentage of population aged ≥1 year with BLLs ≥10 µg/dL, by age group–United States, Third National Health and Nutrition Examination Survey–Phase 2, 1991–1994

Age group (yrs)	Sample size	GM BLL (µg/dL)		% with BLLs ≥ 10 µg/dL	
		BLL	(95% CI*)	%	(95% CI)
1–5	2,392	2.7	(2.5–3.0)	4.4%	(2.9%-6.6%)
1–2	987	3.1	(2.8-3.5)	5.9%	(3.7%–9.2%)
3-6	1,405	2.5	(2.3–2.7)	3.5%	(2.2%–5.4%)
6–11	1,345	1.9	(1.8–2.1)	2.0%	(1.2%–3.3%)
12–19	1,615	1.5	(1.4-1.7)	0.8%	(0.3%–1.9%)
20–49	4,716	2.1	(2.0–2.2)	1.5%	(1.0%–2.2%)
50–69	2,026	3.1	(2.9–3.2)	2.9%	(2.1%–3.8%)
≥70	1,548	3.4	(3.3–3.6)	4.6%	(3.4%-6.0%)
Total	13,642	2.3	(2.1–2.4)	2.2%	(1.6%–2.8%)

* Confidence interval.

TABLE 2. Percentage of children aged 1-5 years with blood lead levels (BLLs) ≥10 µg/dL, by year housing built and selected characteristics, and weighted geometric mean (GM) BLLs, by selected characteristics - United States, Third National Health and Nutrition Examination Survey–Phase 2, 1991-1994*

Characteristic	Year housing built+						Total			
	Before 1946		During 1946–1973		After 1973				GM BLL (µ/dL)	
	%	(95% CI)	%	(95% CI)	%	(95% CI)	%	(95% CI)	BLL	(95% CI)
Race/Ethnicity¶										
Black, non-Hispanic	21.9%	(9.4%–51.1%)	13.7%	(9.1%–20.6%)	3.4%	(1.4%–7.9%)	11.2%	(6.7%–18.7%)	4.3	(3.7–5.0)
Mexican American	13.0%	(5.7%–29.8%)	2.3%	(1.1%–5.1%)	1.6%	(0.5%–5.2%)	4.0%	(2.2%–7.2%)	3.1	(2.7–3.5)
White, non-Hispanic	5.6%	(2.2%–14.4%)	1.4%	(0.3%–6.0%)	1.5%	(0.3%–7.0%)	2.3%	(1.0%–5.0%)	2.3	(2.1–2.5)
Income**										
Low	16.4%	(9.9%-27.2%)	7.3%	(4.6%-11.4%)	4.3%	(2.1%–9.1%)	8.0%	(5.4%-11.7%)	3.8	(3.3-4.2)
Middle	4.1%	(1.3%-12.8%)	2.0%	(1.0%-4.1%)	0.4%	(0.1%–1.3%)	1.9%	(1.1%–3.2%)	2.3	(2.1–2.5)
High	0.9%	(0.1%–6.5%)	2.7%	(0.6%–11.3%)	0++		1.0%	(0.3%–3.4%)	1.9	(1.7–2.1)
Urban status§§										
Population ≥1 million	11.5%	(6.5%–20.2%)	5.8%	(3.2%–10.4%)	0.8%	(0.3%–2.1%)	5.4%	(3.0%-9.8%)	2.8	(2.4–3.2)
Population <1 million	5.8%	(2.0%–16.8%)	3.1%	(0.9%–10.1%)	2.5%	(0.7%–9.6%)	3.3%	(1.5%–7.0%)	2.7	(2.3–3.0)
Total	8.6%	(5.2%–14.2%)	4.6%	(2.9%–7.5%)	1.6%	(0.6%-4.4%)	4.4%	(2.9%-6.6%)	2.7	(2.6–3.0)

*Sample size = 2392, and includes racial/ethnic groups in addition to those listed separately.
+Age of housing was unknown by the household respondent for 11.7% of children aged 1–5 years; approximately 5.6% of these children had BLLs ≥10 µg/dL.
§Confidence interval.
¶Data for other racial/ethnic groups were too small for reliable estimates.
**Income categories ware defined using the poverty-income ratio (PIR; the ratio of total family income to the poverty threshold for the year of the interview); low income was defined as PIR ≤1,300; middle, as PIR 1,301–3,500; and high, as PIR ≥3,501 Persons with data missing for income were not included in the analysis of income.
++No children in the sample had these characteristics; however, the true estimate for this population group is probably larger than zero.
§§Urban status was based on U.S. Department of Agriculture codes that classify counties by total population and proximity to major metropolitan areas (6) and divided into two categories: metropolitan areas with a population ≥1 million and metropolitan and nonmetropolitan areas with a population <1 million.

For the total population, GM BLLs decreased by 21.7% from Phase 1 to Phase 2 with minimal variation within age, sex, race/ethnicity, income, age-of-housing, and urban status groups (range: 17.4%–26.4%): Among children aged 1–5 years, the overall absolute decrease in the prevalence of elevated BLLS from Phase 1 to Phase 2 was 4.1 percentage points. The percentage point decrease was generally greater among those groups with higher prevalences of elevated BLLs during Phase 1: children aged 1–2 years (5.2), non-Hispanic black children (7.4), children from low-income families (6.9), children living in areas with a population <1 million (5.3), and children living in housing built before 1946 (9.6). Conversely, the percentage decrease of elevated BLLs from Phase 1 to Phase 2 was 48.4% among all children aged 1–5 years and generally was smaller among those groups at highest risk for elevated BLLs.
Reported by: Div of Health Examination Statistics, National Center for Health Statistics; Lead Poisoning Prevention Br, Div of Environmental Hazards and Health Effects, and Div of Environmental Health Laboratory Sciences, National Center for Environmental Health, CDC.

Editorial Note: The findings in this analysis of NHANES III data indicate that the GM BLL for the U.S. population aged ≥1 year decreased by 22% from Phase 1 to Phase 2, and the prevalence of BLLs ≥10 µg/dL decreased by 51% over the same period. However, constraints of the survey design of NHANES III precluded statistical testing for the differences in GM BLLs and the prevalences of elevated BLLs from Phase 1 to Phase 2. The decrease in BLLs observed from Phase 1 to Phase 2 follow even larger decreases from NHANES II (1976–1980) to Phase 1 of NHANES III. Among persons aged 1–74 years, the GM BLL declined 77% from NHANES II to Phase 1 of NHANES III, and the prevalence of BLLs ≥10 µg/dL decreased by 94% (3).

The dramatic decline in BLLs in the U.S. population since the late 1970s is probably a direct consequence of the regulatory and voluntary bans enacted during this period on the use of lead in gasoline, household paint, food and drink cans, and plumbing systems (2). The effects of these changes benefited all U.S. population groups studied. In addition, BLLs may have been reduced in some groups as the result of childhood lead poisoning-prevention efforts undertaken by public health agencies, lead paint-abatement programs, and the promulgation of a standard for lead exposure in industry.

Despite the recent and large declines in BLLs, the risk for lead exposure remains disproportionately high for some groups, including children who are poor, non-Hispanic black, Mexican American, living in large metropolitan areas, or living in older housing. Although confidence intervals for elevated BLL prevalence estimates overlapped across age-of-housing and urban status categories for all children aged 1–5 years, the overall direction of the risk differentials is consistent with results from previous years (8). In addition, with the exception of urban status–which was too broadly defined in this study to reflect gradations of risk associated with residence in a central city versus residence in outlying metropolitan or suburban areas–each of these factors was an independent contributor to the risk for elevated BLLs among children.

The risk for lead exposure in children is primarily determined by environmental conditions of the child's residence. The mast common source for lead exposure for children is lead-based paint that has deteriorated into paint chips and lead dust (2). In the United States, approximately 83% of privately owned housing units and 86% of public housing units built before 1980 contain some lead-based paint

(9). In addition, soil and dust contaminated with residual lead fallout from vehicle exhaust contribute to exposure; concentrations of lead in soil and dust are highest in central urban areas (10). For adults, the most common high-dose exposure sources are occupational (1). Other exposure sources for adults and children can include lead dust brought into the home on clothing from workplaces, lead used for some hobbies, lead contained in some "folk" medicines and cosmetics, and lead in plumbing and in crystal and ceramic containers that leaches into water or food (2).

Despite the substantial progress in eliminating sources of lead in the United States, the NHANES data indicate that nearly 1 million children aged 1-5 years had elevated BLLs during 1991–1994. In addition to efforts to reduce or eliminate sources of lead and exposure to lead, screening efforts are necessary for early identification of children with elevated BLLs to enable prompt and appropriate environmental, educational, and medical interventions.

Because the distribution of risk for childhood lead exposure varies widely within the United States, prevention activities must be conducted at the local level and must be appropriate to local conditions. In areas where the risk for elevated BLLs is low, screening efforts should be targeted to children who remain at elevated risk for lead exposure. CDC is developing guidelines to assist state and local health departments in designing screening recommendations appropriate to their jurisdictions. A draft of these guidelines is available for public review and comment through April 7, 1997; copies can be obtained by calling (888) 232-6789 or accessing the World Wide Web at http://www.cdc.gov/nceh.

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Trends in Ischemic Heart Disease Deaths–United States, 1990-1994

In 1994, a total of 481,458 persons died as a result of ischemic heart disease (IHD), which comprises two thirds of all heart disease–the leading cause of death in the United States. This report presents trends in IHD mortality in the United States for 1990–1994 (the latest year for which data are available) and compares these trends by race, sex, and state. These findings indicate IHD death rates decreased from 1990 through 1994; however, the rate of decline was slower than rates of previously observed declines.

Age-adjusted IHD death rates for persons aged ≥35 years were calculated using mortality data tapes compiled by CDC and population estimates from the Bureau of the Census. IHD death rates were directly age-adjusted to the 1980 U.S. standard population aged ≥35 years. IHD deaths were defined as those with the underlying cause of death listed on the death certificate as *International Classification of Diseases, Ninth Revision* [ICD-9], codes 410–414.9. The average annual percentage change in IHD mortality from 1990 through 1994 was calculated as the 1994 rate minus the 1990 rate divided by the 1990 rate divided by 4 multiplied by 100. Data are presented only for blacks and whites because numbers for other racial/ethnic groups were too small for meaningful analysis.

From 1990 through 1994, age-adjusted IHD death rates for the US population aged ≥35 years decreased 10.3%, from 416.3 deaths per 100,000 to 373.6 deaths per 100,000. However, the rate of decrease varied by race and sex; rates of decline were faster for whites then for blacks and for men than for women (Figure 1). The largest average annual percentage decrease occurred among white men (2.9% per year), followed by white women (2.5%), black men (2.3%), and black women (1.6%).

IHD death rates varied substantially among the states (Table 1). In 1994, the rates for both women and men residing in the states with the highest IHD death rates were approximately two times higher than for persons residing in the states with the lowest IHD death rates. For women, IHD death rates in 1994 ranged from 156.7 per 100,000 (Montana) to 406.3 per 100,000 (New York) and, for men, ranged from 289.4 per 100,000 (New Mexico) to 638.8 per 100,000 (New York).

From 1990 through 1994, IHD death rates declined in nearly all 50 states and the District of Columbia (Table 1). However, the magnitude of change over time varied widely; some states had small declines (e.g., Nevada, 0.1% per year and Hawaii, 0.9% per year) while other states experienced larger declines (e.g., Alaska, 5.5% per year and Montana, 5.6% per year). Sex-specific IHD death rates for both men and women declined for each state except Idaho and Nevada (small increase for women only) and the District of Columbia (small increase for men only).

Reported by: Cardiovascular Health Br, Div of Adult and Community Health, National Center for Chronic Disease Prevention and Health Promotion, CDC.

The Oregon Childhood Lead Poisoning Prevention Program: A Program Coordinator's Perspective

A summary of the challenges facing the Program Coordinator of a State Childhood Lead Poisoning Prevention Program, as well as the strategies he intends to employ to overcome them

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Oregon Childhood Lead Poisoning Prevention Program

The last recorded death of a child from lead poisoning in Oregon occurred in November of 1982. State-mandated reporting of elevated blood lead levels began in 1990. In 1991 the reportable level dropped from 25 micrograms per deciliter (µg/dl) to 10 µg/dl after the publication of the Centers of Disease Control and Prevention's (CDC's) *Protecting Young Children From Lead Poisoning*. In 1992 the Oregon Health Division (OHD) received a CDC grant to fund the Oregon Childhood Lead Poisoning Program (OCLPPP), whose mission is to:

(1) screen Oregon children ages six months to six years;

(2) ensure that children with elevated blood lead levels receive appropriate medical and environmental follow-up;

(3) educate the general and professional public about lead risks and exposures;

(4) maintain a statewide childhood blood lead surveillance program; and

(5) prevent future childhood lead poisoning.

Since July 1, 1992, the surveillance program has accumulated data on 19,360 children as of December 31, 1996. Of these, approximately 9,000 were tested through OCLPPP and approximately 10,000 were tested through private medical providers. A quick review of the data show that:

(1) five children have received chelation therapy for elevated lead levels. Traditional or folk medication was the source in two of these cases;

(2) the highest reported lead level in a child during this period was 61 µg/dl, later confirmed at 57 µg/dl;

(3) 5.4% of children tested through OCLPPP had elevated blood lead levels of ≥10 µg/dl, while approximately 3% of children tested through private providers had blood lead levels of ≥10 µg/dl.

(4) one- and two-year-olds had higher rates than older children, as did African-American and Hispanic children;

We ... have something that eastern and midwestern states may not have: the opportunity to create a truly lead-safe environment for all Oregon children within the next ten years.

(5) children living in older homes, especially homes built before 1930, were at higher risk than children living in post-1950 housing; and

(6) traditional or folk remedies, especially Azarcon and Greta, have been the probable source of exposure in some cases.

As the manager of OCLPPP, these facts lead me to pose the following question: does Oregon have a lead problem? Depending on how one defines the term, I believe the answer can be either "yes" or "no." Before explaining this response, allow me to set the stage.

First, a bit of background about Oregon is needed. Located in the Pacific Northwest and home to more than three million people, Oregon is one of the most beautiful and livable areas of the country (at least according to the local newspaper, *The Oregonian*). Oregon is not an industrial state. Until recently, timber has been one of the main industries in the state. Today, Oregon's economy is strong and diverse with no one dominant business or industry. The majority of Oregonians live in the western part of the state in the I-5 corridor, a three hundred plus mile stretch of interstate highway from the state line of Washington in the north to California in the south. Portland, the state's most populous city, sits in the northernmost part of the state where the Columbia and Willamette Rivers meet. The city is primarily located in Multnomah County (also the state's most populous), but parts of the city are also located in Washington and Clackamas Counties. Together, the three counties comprise the Tri-Region. Vancouver, Washington State's southern-most city, is also considered as part of the Portland metropolitan area. Statewide, 26.5% of all homes were built before 1950. For Multnomah County, this figure is 45%. In 14 out of 36 Oregon counties, more than 30% of the housing stock is pre-1950. However, unlike many eastern and midwestern cities, Portland does not have major public housing projects. Much of the most-at-risk housing in the state is found in single family units, duplexes, or small apartment complexes.

There are approximately 270,000 individuals comprising the OCLPPP target population (children aged six months to six years). Of these, approximately 30% are either on Medicaid or Medicaid-eligible. Within the Medicaid population, 87% are on managed care through the Oregon Health Plan (OHP), and 13% are fee-for-service patients. Another 8% are uninsured. The OHP went into effect in February, 1994, extending medical coverage to all Oregonians living below the Federal Poverty Level (FPL) and to children under six and pregnant women living below 133% of the FPL. Blood lead testing of Medicaid children at 12 and 24 months has been mandated since July 1, 1993.

Reporting of elevated blood levels is required in Oregon. Universal reporting of all blood lead testing is not. The Childhood Lead Surveillance Program has been collecting blood lead testing data since 1992. Two laboratories, the Oregon Public Health Laboratory (OPHL) and the Oregon Medical Laboratory (OML) have voluntarily been doing universal reporting since 1992. By the end of 1996, all major laboratories in the area had agreed to provide voluntary universal reporting of blood lead samples. Thus, we are now in a position to compile statewide prevalence data.

Maps with high risk areas readily and easily identified will be distributed to physicians and other child care providers.

Referring back to my original question: does Oregon have a lead problem? If you compare our data with that of Washington, D.C., Baltimore, Chicago, Pittsburgh, Philadelphia, or St. Louis, and base the answer only on reports of elevated blood lead levels (EBLLs), then by comparison, we do not have a lead problem. EBLLs, however, are only part of the equation. We also need to take a look at the potential problem based on factors such as age of housing, percentage of children living in poverty, and rental versus owner-occupied housing. Based on these risk factors, a different picture emerges which leads to the conclusion that Oregon does have a problem, or more specifically three problems, at least in certain areas of the state.

PROBLEM 1

The surveillance data shows that approximately 2.5% (non-OCLPPP) and 5.2% (OCLPPP) of tested children under six have EBLLs. If these are representative numbers, then somewhere between 6,750 and 13,500 children may have EBLLs. Yet, this data represents only 7% of the total number of children in our target population. We currently do not have good prevalence data for the state.

PROBLEM 2

Physicians are reluctant to test children because they often believe that “we do not have a lead problem.” Parents do not have their children tested because they have either heard “we do not have a lead problem” or, even worse, they have not heard anything about lead. There is a distinct lack of knowledge among both the general and professional population concerning the health hazards of lead.

PROBLEM 3

With money and cooperation from Multnomah County's Office of Action and Development, we created a pilot project to conduct risk assessments and perform remediation on houses with lead-based paint risks. Two houses were selected for assessment: one vacant and one occupied. Both were located in high risk neighborhoods. One house was a rental unit (owned by a community development corporation), and one was owner-occupied. Both houses tested extremely “hot” for lead and, in both cases, the assessor's recommendation was for total abatement. While assessing the vacant house, the assessor noted a neighboring house whose deteriorating paint was finding its way onto the assessed property. Analyses of chips obtained from the house showed the paint contained 19.5% lead. Both of these houses are typical of the neighborhoods in which they are located. We may not have large numbers of children with EBLLs, but we do have houses which contain lead-based paint.

While Oregon's lead problems may not compare in magnitude to the problems shared by the midwestern and eastern states, our situation is similar to that of many if not most of the western states. We have a certain number of children with EBLLs, areas with a substantial percentage of pre-1950 housing stock, and a population of people sorely in need of lead education. We also have something that eastern and midwestern states may not have: the opportunity to create a truly lead safe environment for all Oregon children within the next ten years. Of course, this will depend on the availability of resources and the will of government leaders at the national, local, and state level. But it is possible. To achieve this goal, there are three challenges facing us which must be overcome:

CHALLENGE 1

To establish a targeted screening program, we need to acquire good prevalence data for all areas of the state. To date, the majority of blood lead testing has been done in the Portland/Multnomah County area. It is time to move statewide with screening efforts. We agree that universal screening of all children in Oregon is not necessary, and to this end we are grateful for the proposed revisions in the 1991 CDC guidelines to shift responsibility for developing screening strategies from Atlanta to state health officials.

The problem is not that information is not available, but how to present it so that the receiver of the information retains it.

A targeted screening program depends on good data. In order to gather this data we need to help physicians identify "at risk" children, and then convince them to test these children. To do this, we have been making good use of GIS (Geographic Information System) software to map the state county by county. We are creating maps that delineate areas we consider to be high risk for lead poisoning. Until better data is available, risk is now based on age of housing, percentage of children under six living in poverty, and percentage of children in rental-occupied housing. Maps with high risk areas readily and easily identified will be distributed to physicians and other child care providers. The message accompanying these maps will be that children living in these high risk areas need to be tested. If successful, and with voluntary reporting from all major laboratories processing these samples, we believe that we will finally obtain the necessary prevalence data.

Once this data is gathered, we will go back to physicians, child care providers, local health department directors, and concerned parents and ask them to work with us to devise a blood lead screening strategy that will take Oregon into the 21st Century.

CHALLENGE 2

A random sample survey to determine the knowledge level about lead of Oregonians has never been conducted. My guess is that if you were to do one, or even a person-on-the-street survey, the majority would have no or very little knowledge of lead health risks. Educating both the professional and the general public presents a huge challenge. It is not that we have not tried in the past. We have. We have distributed literally tens of thousands of pieces of educational materials. We have made use of both the print and electronic media. We have held a "Childhood Lead Poisoning Prevention Week." We have hosted a national conference and are hosting a second one in June of 1997. The problem is not that information is not available, but how to present it so that the receiver of the information retains it. The Title X, Section 1018 real estate disclosure rule is a good beginning. Buying a home or renting an apartment is close and personal to most people, and lead information presented at this time may have an impact. The message needs to be reinforced.

Portland has been chosen to become one of six CLEAR Corps (Community Lead Education and Reduction) sites around the country.

Oregon passed Title X, Sections 402/404, enabling legislation in 1995. We now have a licensing and certification program for lead inspectors, risk assessors, workers, supervisors, and program planners. Market forces being what they are, it is very possible that many of these contractors will actively engage in marketing their newly acquired skills and provide much needed reinforcing lead information to the consumer.

Thanks to a grant from the Environmental Protection Agency (EPA) OHD's Lead Paint Program, where the licensing/certification program is housed, we recently hired a full time health educator. His target audience is contractors, painters, and remodelers, and his target message is "work safely" and "protect the children while working."

The Tri-Regional area will be home to what promises to be a one-of-a-kind program in the country. The Lead Hazard Reduction Program (LHRP) is the result of an ongoing partnership between OCLPPP, The Oregon Health Division, the Multnomah County Health Department, the Washington County Health Department, the Clackamas County Health Department, the Portland Water Bureau, and community and neighborhood organizations.

There are three essential components to this program: education, remediation, and evaluation. The educational and evaluation components will be housed at the Health Division. A second health educator will be hired whose target audience will be the residents of the three participating countries, most especially customers within the Water Bureau's service area. The LHRP is the Water Bureau's answer to EPA to bring itself into compliance with EPA's lead and copper water standards. Believing that lead-based paint and not water are the real sources of lead exposure for children, and believing that education and remediation will result in a much greater health return for the dollars spent, the Water Bureau has submitted the LHRP to the EPA's XL Communities Program for recognition as an outstanding example of community cooperation to address an environmental hazard. The Bureau has agreed to underwrite the costs of the LHRP for three years with an option for additional years should the evaluation show the program to be successful.

CHALLENGE 3

An educated populace will help create a lead-safe Oregon, but we also need to make existing housing stock lead safe. A ride through many of the designated high risk neighborhoods in north/northeast Portland, for example, shows that many houses at least have exterior paint problems. The lead risk assessment pilot project confirmed that in at least two cases, what appeared to be a lead-based paint problem turned out to be, in fact, just that.

The remediation component of the LHRP will be housed at the Multnomah County Health Department's Environmental Health Section. Portland has been chosen to become one of six CLEARCorps (Community Lead Education and Reduction) sites around the country. A team of eight men and women will be recruited from the local area. Teams will be diverse and will reflect the makeup of the neighborhoods in which they will be working. Team members will receive training as workers through the Western Regional Lead Training Center and become licensed lead-based paint abatement workers. Team members will receive a stipend to cover living costs, a $4,500 educational award at the end of their service, and a marketable skill. In addition, they will also gain the knowledge that they worked to make their community and their country a safer place for children to live. CLEARCorps is funded through the AmeriCorps National Service Network.

During the first year of the program, our goal is to create 75 lead safe and affordable houses. While we will be cleaning up homes where children have been reported with EBLLs, the program will also be doing primary prevention work to prevent children from being affected in the future.

Oregon is working at becoming a model for low-incidence states in creating targeted screening strategies and dealing with lead-based paint.

Oregon is working at becoming a model for low-incidence states in creating targeted screening strategies and dealing with lead- based paint. From the passage of our Title X-related enabling legislation in 1995, to the advent of the LHRP, to the formation of a CLEARCorps cleanup team and beyond, we seek practical, workable, and creative solutions to our lead problems. There is still much work to be done and much help that is needed. For instance, the LHRP will help create lead-safe housing in the Portland area, but the challenge lies in finding ways to clean up housing in other parts of the state. We are forming coalitions and networks of concerned individuals with the goal of being one of the first states in the nation to create a truly lead-safe environment for its children and all of its citizens.

For more information about: OCLPPP2 call (503) 248-5240 or contact the author via e-mail at chris.johnson@state.or us; Oregon's Childhood Lead Surveillance Program, call (503) 731-4025 or contact Rick Leiker via e-mail at richard.d.leiker@state.or.us; The Lead Paint Program or for information about certification, accreditation, or licensing, call (503) 731-4500 or contact Bill Anderman via e-mail at william.h.anderman@state.or.us.

CITY OF PORTLAND **BUREAU OF WATER WORKS**

INTEROFFICE CORRESPONDENCE

DATE: March 12, 1997
TO: B. Faris, C. Ireland CC: B. Hyde
FROM: Mike Sheets
SUBJECT: Lead Testing for Multnomah County Health

Here is the updated list of homes we have sampled for the Multnomah County Health Department. This list includes those that were on the previous list. As noted before, these are homes of children identified as having lead poisoning. Samples collected by the customer.

Sample	location	running	standing	pb level	address
6967A	ks		8 hrs.	<.001	5729 SE 52ND
6967B	ks	1 min.		.002	
6968A	ks		8 hrs.	.004	1400 SE 30TH
6968B	ks	1 min.		<.001	
6816A	ks	1 min.		<.001	2021 SE SALMON
6816B	ks		8 hrs.	.002	
5899A	ks	1 min.		.001	903 NE PRESCOTT
5899B	ks		8 hrs.	.002	
6250A	ks		8 hrs.	.002	339 N SHAVER
6250B	ks	1 min.		.001	
6143A	ks	1 min.		<.001	6635 N ALBINA
61438	ks		8 hrs.	.003	
4513A	ks		8 hrs.	.005	4635 NE GARFIELD
4513B	ks	2 min.		.006	
874A	ks	1 min.		<.001	15035 NE OREGON
874B	ks		8 hrs.	.002	
8111A	ks		8 hrs.	.002	6901 N. Astor
8111B	bs		8 hrs.	.003	
8109A	ks		8 hrs.	.002	616 NE Beech
8109B	bs		8 hrs.	.008	
4513A	ks		8 hrs.	.005	4635 NE Garfield
4513B	ks	2 min.		.006	
2954	ks		8 hrs.	.030	5629 SE Holgate
(no running collected)					
2620A	ks	1 min.		.002	8627 SE Stephens
2620B	ks		8 hrs.	.002	
4681A	ks		7 hrs.	.002	3316 NE Tillamook
4681B	ks	1 min.		.003	
1712A	ks		10 hrs.	.013	5106 N Williams

Sample	location	running	standing	pb level	address
1712B	ks	3 min.		.003	
1510A	ks		9 hrs.	.003	3804 NE 6th
1510B	ks	1 min.		.002	
1513A	ks		10 hrs.	.005	2915 NE l8th
1513B	ks	1 min.		.035	***reversed???***
1513C	bs		10 hrs.	.008	
2177A	ks		6 hrs.	.002	2201 NE 23rd
2177B	ks	5 min.		<.001	
9760A	ks	1 min.		.001	3038 NE 56th
9760B	ks		8 hrs.	.001	
518	ks		8 hrs.	.012	3424 NE 58th
943A	ks	1 min.		<.001	1423 NE 63rd
943B	ks		8 hrs.	.007	
2176A	ks		8 hrs.	.002	3124 NE 76th
2176B	ks	5 min.		<.001	
1711A	ks		9.5 hrs.	<.001	5023 SE 77th
1711B	ks	3 min.		.001	
No # field test	ks		8 hrs.	.005	6730 SE 86th

Appendix 3 - Relating to Section 5

Relating to Section 5

- Summary of Population-based Modeling Results - Estimated Distribution of Blood Lead Levels before and after Implementation of Various Levels of Corrosion Control Treatment

Assumption: **Consistent consumption of 100% running water**

Treatment 1: pH adjustment to 7.5
Treatment 2: pH adjustment to 8.5
Treatment 3: pH adjustment to 9.5
Before CCT: no corrosion control treatment

Running Water Lead Distribution										
	10	20	30	40	50	60	70	80	90	100
Treatment 1	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006	0.0012	0.0012	0.0018	0.0324
Treatment 2	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0008	0.0008	0.0012	0.0216
Treatment 3	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0006	0.0006	0.0009	0.0162
Before CCT	0.001	0.001	0.001	0.001	0.001	0.001	0.002	0.002	0.003	0.054
Blood Lead Distribution (Total population)										
	10	20	30	40	50	60	70	80	90	100
Treatment 1	1.051119	1.531119	2.023505	2.509119	3.026134	3.730519	4.461919	5.647505	7.376382	21.24923
Treatment 2	1.033595	1.513595	2.005981	2.491595	3.00861	3.712995	4.444395	5.629981	7.358858	21.2317
Treatment 3	1.024833	1.504833	1.997219	2.482833	2.999848	3.704233	4.435633	5.621219	7.350096	21.22294
Before CCT	1.086167	1.566167	2.058553	2.544167	3.061182	3.765567	4.496967	5.682553	7.41143	21.28428
Blood Lead Distribution Infants (0-6 months of age)										
	10	20	30	40	50	60	70	80	90	100
Treatment 1	1.8648	1.8648	2.228657	2.7648	3.614943	4.1788	5.0128	6.128657	8.417429	23.84589
Treatment 2	1.7972	1.7972	2.161057	2.6972	3.547343	4.1112	4.9452	6.061057	8.349829	23.77829
Treatment 3	1.7634	1.7634	2.127257	2.6634	3.513543	4.0774	4.9114	6.027257	8.316029	23.74449
Before CCT	2	2	2.363857	2.9	3.750143	4.314	5.148	6.263857	8.552629	23.98109
Blood Lead Distribution (Children (>6 months to 6 years of age)										
	10	20	30	40	50	60	70	80	90	100
Treatment 1	1.783904	1.783904	2.147761	2.683904	3.534047	4.097904	4.931904	6.047761	8.336533	23.76499
Treatment 2	1.752704	1.752704	2.116561	2.652704	3.502847	4.066704	4.900704	6.016561	8.305333	23.73379
Treatment 3	1.737104	1.737104	2.100961	2.637104	3.487247	4.051104	4.885104	6.000961	8.289733	23.71819
Before OCT	1.846304	1.846304	2.210161	2.746304	3.596447	4.160304	4.994304	6.110161	8.398933	23.82739
Blood Lead Distribution (Adults (>6 years of age)										
	10	20	30	40	50	60	70	80	90	100
Treatment 1	0.9688	1.502133	2.0088	2.4888	2.9688	3.6888	4.4088	5.602133	7.2688	20.9688
Treatment 2	0.9532	1.486533	1.9932	2.4732	2.9532	3.6732	4.3932	5.586533	7.2532	20.9532
Treatment 3	0.9454	1.478733	1.9854	2.4654	2.9454	3.6654	4.3854	5.578733	7.2454	20.9454
Before CCT	1	1.533333	2.04	2.52	3	3.72	4.44	5.633333	7.3	21

Assumption: **Consistent consumption of 25% standing/75% running water**

Treatment 1: pH adjustment to 7.5
Treatment 2: pH adjustment to 8.5
Treatment 3: pH adjustment to 9.5
Before CCT: no corrosion control treatment

25% Standing Water Lead Distribution										
	10	20	30	40	50	60	70	80	90	100
Treatment 1	0.0006	0.0006	0.0006	0.0012	0.0012	0.0012	0.0018	0.0024	0.0036	0.1746
Treatment 2	0.0004	0.0004	0.0004	0.0008	0.0008	0.0008	0.0012	0.0016	0.0024	0.1164
Treatment 3	0.0003	0.0003	0.0003	0.0006	0.0006	0.0006	0.0009	0.0012	0.0018	0.0873
Before CCT	0.001	0.001	0.001	0.002	0.002	0.002	0.003	0.004	0.006	0.291
Blood Lead Distribution (Total population)										
	10	20	30	40	50	60	70	80	90	100
Treatment 1	1.026855	1.506855	1.999241	2.484855	3.00187	3.706255	4.437655	5.623241	7.352118	21.22496
Treatment 2	0.997199	1.477199	1.969585	2.455199	2.972214	3.676599	4.407999	5.593585	7.322462	21.19531
Treatment 3	0.982371	1.462371	1.954757	2.440371	2.957386	3.661771	4.393171	5.578757	7.307634	21.18048
Before CCT	1.086167	1.566167	2.058553	2.544167	3.061182	3.765567	4.496967	5.682553	7.41143	21.28428
Blood Lead Distribution (Infants (0-6 months of age)										
	10	20	30	40	50	60	70	80	90	100
Treatment 1	1.7712	1.7712	2.135057	2.6712	3.521343	4.0852	4.9192	6.035057	8.323829	23.75229
Treatment 2	1.6568	1.6568	2.020657	2.5568	3.406943	3.9708	4.8048	5.920657	8.209429	23.63789
Treatment 3	1.5996	1.5996	1.963457	2.4996	3.349743	3.9136	4.7476	5.863457	8.152229	23.58069
Before CCT	2	2	2.363857	2.9	3.750143	4.314	5.148	6.263857	8.552629	23.98109
Blood Lead Distribution (Chiidren (>6 months to 6 years of age)										
	10	20	30	40	50	60	70	80	90	100
Treatment 1	1.740704	1.740704	2.104561	2.640704	3.490847	4.054704	4.888704	6.004561	8.293333	23.72179
Treatment 2	1.687904	1.687904	2.051761	2.587904	3.438047	4.001904	4.835904	5.951761	8.240533	23.66899
Treatment 3	1.661504	1.661504	2.025361	2.561504	3.411647	3.975504	4.809504	5.925361	8.214133	23.64259
Before CCT	1.846304	1.846304	2.210161	2.746304	3.596447	4.160304	4.994304	6.110161	8.398933	23.82739
Blood Lead Distribution (Adults (>6 years of age)										
	10	20	30	40	50	60	70	80	90	100
Treatment 1	0.9472	1.480533	1.9872	2.4672	2.9472	3.6672	4.3872	5.580533	7.2472	20.9472
Treatment 2	0.9208	1.454133	1.9608	2.4408	2.9208	3.6408	4.3608	5.554133	7.2208	20.9208
Treatment 3	0.9076	1.440933	1.9476	2.4276	2.9076	3.6276	4.3476	5.540933	7.2076	20.9076
Before CCT	1	1.533333	2.04	2.52	3	3.72	4.44	5.633333	7.3	21

Assumption: **Consistent consumption of 100% standing**

Treatment 1: pH adjustment to 7.5
Treatment 2: pH adjustment to 8.5
Treatment 3: pH adjustment to 9.5
Before CCT: no corrosion control treatment

Standing Water Lead Distribution										
	10	20	30	40	50	60	70	80	90	100
Treatment 1	0.0006	0.0012	0.0012	0.0018	0.0024	0.003	0.0036	0.0054	0.0084	0.6
Treatment 2	0.0004	0.0008	0.0008	0.0012	0.0016	0.002	0.0024	0.0036	0.0056	0.4
Treatment 3	0.0003	0.0006	0.0006	0.0009	0.0012	0.0015	0.0018	0.0027	0.0042	0.3
Before CCT	0.001	0.002	0.002	0.003	0.004	0.005	0.006	0.009	0.014	1
Blood Lead Distribution (Total population)										
	10	20	30	40	50	60	70	80	90	100
Treatment 1	0.962151	1.442151	1.934537	2.420151	2.937166	3.641551	4.372951	5.558537	7.287414	21.08574
Treatment 2	0.900143	1.380143	1.872529	2.358143	2.875158	3.579543	4.310943	5.496529	7.225406	21.09825
Treatment 3	0.864729	1.344729	1.837115	2.322729	2.839744	3.544129	4.275529	5.461115	7.189992	21.06284
Before CCT	1.086167	1.566167	2.058553	2.544167	3.061182	3.765567	4.496967	5.682553	7.41143	21.28428
Blood Lead Distribution (Infants (0-6 months of age)										
	10	20	30	40	50	60	70	80	90	100
Treatment 1	1.5216	1.5216	1.885457	2.4216	3.271743	3.8356	4.6696	5.785457	8.074229	23.50269
Treatment 2	1.2824	1.2824	1.646257	2.1824	3.032543	3.5964	4.4304	5.546257	7.835029	23.26349
Treatment 3	1.1628	1.1628	1.526657	2.0628	2.912943	3.4768	4.3108	5.426657	7.715429	23.14389
Before CCT	2	2	2.363857	2.9	3.750143	4.314	5.148	6.263857	8.552629	23.98109
Blood Lead Distribution (Children (>6 months to 6 years of age)										
	10	20	30	40	50	60	70	80	90	100
Treatment 1	1.625504	1.625504	1.989361	2.525504	3.375647	3.939504	4.773504	5.889361	8.178133	23.60659
Treatment 2	1.515104	1.515104	1.878961	2.415104	3.265247	3.829104	4.663104	5.778961	8.067733	23.49619
Treatment 3	1.410904	1.410904	1.774761	2.310904	3.161047	3.724904	4.558904	5.674761	7.963533	23.39199
Before CCT	1.846304	1.846304	2.210161	2.746304	3.596447	4.160304	4.994304	6.110161	8.398933	23.82739
Blood Lead Distribution (Adults (>6 years of age)										
	10	20	30	40	50	60	70	80	90	100
Treatment 1	0.8896	1.422933	1.9296	2.4096	2.8896	3.6096	4.3296	5.522933	7.1896	20.8068
Treatment 2	0.8344	1.367733	1.8744	2.3544	2.8344	3.5544	4.2744	5.467733	7.1344	20.8344
Treatment 3	0.8068	1.340133	1.8468	2.3268	2.8068	3.5268	4.2468	5.440133	7.1068	20.8068
Before CCT	1	1.533333	2.04	2.52	3	3.72	4.44	5.633333	7.3	21