Parsons, Susan

From: Dee White <deewhite1@mindspring.com>
Sent: Monday, March 06, 2017 1:27 PM
To: Moore-Love, Karla
Subject: 3 Agenda item 215/235 for March 8 PWB contract with Confluence
Attachments: 1st Quarter - PWB WQ Corrosion Study.pdf; Treatment & Monitoring _ How the Water Bureau Reduces Lead Exposure _ The City of Portland, Oregon.pdf; City of Portland_ our drinking water is safe _ KGW.pdf; EPA urges states to locate lead water lines as required.pdf; Portland Water Bureau warns of high lead levels in sampling of homes _ OregonLive.pdf; 00657 Lead & Copper Details _ Data Online _ Oregon Drinking Water Services.pdf; The heroic professor who helped uncover the Flint lead water crisis_ has been asked to fix it - The Washington Post.pdf; Jeffrey Griffiths, AB, MD, MPH&TM _ Tufts University School of Medicine.pdf; High-risk homes _ OregonLive.pdf; Lead in the water_ Why Portland's on wrong end of national list _ OregonLive.pdf

Karla,

Please include these documents in the record for this agenda item. Please also send me a receipt that you have received. THANKS so much.

Dee White

QUARTERLY REPORT

WATER QUALITY CORROSION STUDY 1ST MONITORING PERIOD REPORT – DRAFT.REV1

PWB CONTRACT# 30003222

B&V PROJECT NO. 182435

PREPARED FOR

City of Portland, Portland Water Bureau

JULY 15, 2016

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City of Portland, Water Bureau

WATER QUALITY CORROSION STUDY

Quarterly Data Report – Q4 2015 and Q1 2016

Acknowledgements

Reviewed by: Melinda Friedman, P.E., Confluence Engineering Group, LLC

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Abbreviations and Acronyms

A list of abbreviations and acronyms used in this Technical Memorandum (TM) are summarized in the following list:

ATP	Adenosine Triphosphate
DOC	Dissolved Organic Carbon
Fe	Iron
GIS	Geographic Information System
HPC-R2A	Heterotrophic Plate Counts
IQR	Interquartile range
JMP	Joint Monitoring Plan
LCR	Lead and Copper Rule
mg/L	milligrams per Liter
Mn	Manganese
ND	Non-detect
NTU	Nephelometric Turbidity Units
ORP	Oxidation Reduction Potential
PRS	Process Research Solutions, LLC
PWB	City of Portland, Portland Water Bureau
Q1	First quarter
Q4	Fourth quarter
Study	Water Quality Corrosion Study
TCR	Total Coliform Rule
TM	Technical Memorandum
TM2	Technical Memorandum 2 – Distribution System Sampling Plan
ug/L	Micrograms per liter
UCL	Upper Control Limit
WQSS	water quality sampling stations
Zn	Zinc

1 Introduction

The Portland Water Bureau (PWB) is conducting a Water Quality Corrosion Study (Study) to document baseline water quality conditions and identify the causes of lead release in the PWB distribution system. At the end of the study the results will assist PWB in understanding the potential impact future operational or treatment changes could have on lead release in the distribution system. TM2 – Distribution System Sampling Plan (TM2) was developed earlier in this study to aid in the collection of the information necessary to answer specific questions and hypotheses regarding water quality in the PWB distribution system.

This quarterly report summarizes the data collected during this monitoring period. The monitoring quarters are defined in order to best align with seasonal temperatures. In this way, each quarter will be representative of a season with data influenced by a narrower temperature range than if the period was divided otherwise. For the purposes of the quarterly reports generated for this project the monitoring quarters are aligned as shown in Table 1.

Table 1 Monitoring Quarter Date Ranges

Quarter	Date Range	Notes
Q4 2015*	Sep 2015 - Nov 2015	Typical nitrification season
Q1 2016*	Dec 2015 - Feb 2016	Typical winter conditions
Q2 2016	Mar 2016 - May 2016	Typical spring conditions
Q3 2016	Jun 2016 - Aug 2016	Typical summer conditions
Q4 2016	Sep 2016 - Nov 2016	Typical nitrification season

* Indicates the quarters analyzed in this monitoring period.

The monitoring period described in this report is for data collected during fourth quarter (Q4) 2015 and first quarter (Q1) 2016.

It should be noted that the main intent of the quarterly reports is to analyze the data sufficiently to determine if any changes are warranted to the sampling plan moving forward. While the quarterly reports will identify preliminary trends in the data observed during the reporting period, it should be acknowledged that conclusions regarding any trends in the data should not be made until the remaining quarters' data have been collected. At the end of the study a final report will be assembled which interprets all of the data collected during the 5 quarters of monitoring. Any conclusions or extrapolation to what may be occurring in the actual distribution system will be reserved for the final report to allow for interpretation of all available data and should not be made from the data collected during this quarter alone.

2 Data Analysis

2.1 SUMMARY OF AVAILABLE DATA

This section summarizes the data that was collected during this sampling period. The data are organized according to the sampling pool for which the data are collected as described in TM2.

Data was collected during the current monitoring period from the following sample pools:

Operations data. The PWB maintains a log of operational changes that may have an impact on distribution system water quality.

Total Coliform Rule Monitoring Sites. The PWB collects water quality parameters at 78 sites, with approximately 250 samples collected per month.

Nitrification Route Sites. The PWB developed a Nitrification Monitoring and Action Plan in 2013 that identifies approximately 45 sites per week for nitrification parameter monitoring. While some of these sites are also Total Coliform Rule (TCR) sample sites, a few were established specifically for the nitrification monitoring. Nitrification data was only collected during Q4 2015 (not collected during Q1 2016), as nitrification is typically highest during the Fall.

Data collected from customer taps (compliance and voluntary). A lead and copper rule (LCR) compliance sample round occurred during Q4 2015. Other water quality data were taken from various flowing water sites in the distribution system to accompany the residential stagnating water samples for metals according to the LCR requirements. Approximately 300 voluntary customer samples were received during the 2 quarters analyzed in this quarterly report. No additional follow up residential customer sampling was performed during this period.

Monitoring Stations and Extended Water Quality Monitoring Sites. The PWB purchased and installed three Process Research Solutions (PRS) monitoring stations to better monitor for various flowing water and stagnation sample parameters. The monitoring stations and a description of the water quality parameters monitored are described in more detail in TM2.

The following sections summarize the data collected this monitoring period for each sampling pool.

2.2 DATA ANALYSIS TECHNIQUES

The data analysis techniques used in this study were defined previously in TM2. One additional data analysis tool used in this report but not described previously is box and whisker plots.

Box and whisker plots are used in some of the data to show the distribution of the data. The "interquartile range" or IQR (difference between the value of the third quartile and the value of the first quartile) is calculated for a box plot and used to determine the outliers (greater than 1.5 times IQR) and the "extreme outliers" (greater than 3 times the IQR). An outlier data point refers to a sample this is greatly higher or lower than the majority of data points in a dataset; it does not imply that the outlier data are to be disqualified for technical reasons.

Additional details of box and whisker plots can be found in Appendix A.

2.3 OPERATIONS DATA

The PWB maintains a log of operations data so that any observations from the data can be associated back with any operational changes made during the monitoring period. A summary of relevant operational events is provided below. The full Operations Log is included as Appendix B.

- Groundwater was used from approximately June 11 through November 4, 2015. Groundwater comprised between 40% and 75% of the total supply for much of September and October, and between 20% and 40% during June through August. This represented a higher than average usage of groundwater during a typical operating year for the PWB.
- The South Tower was used for water supply from approximately November 2 through November 18th, 2015. The South Tower only withdraws water from the lower elevation in the reservoir.
- On December 2, 2015 open reservoir #5 (Mt Tabor) was taken offline permanently.
- On December 16th 2015 the chloramine dosing target was reduced from 2.5 mg/L to to 2.2 mg/L.
- On February 4th, 2016 Powell Butte 1 (north and south cells) was taken out of service.

2.4 TCR DATA

Samples are collected from 78 TCR sites and analyzed for water temperature, pH, total chlorine residual, and turbidity. The TCR data presents a good opportunity to observe general water quality parameters in the distribution system as the TCR sites are spread throughout the system. This section summarizes the water quality data collected from the TCR sites during this monitoring period. Additional discussion and extrapolation of what this data may indicate related to overall water quality in the PWB water system will be reserved for the final report.

2.4.1 Turbidity

Turbidity values from Q4 2015 and Q1 2016 are shown in Figure 1 below. Observing the data from all the sampling sites on one graph is a valuable way to visualize system wide trends or trends that only occur at particular sites. As observed, the turbidity was consistently below 0.5 Nephelometric Turbidity Units (NTU) throughout the distribution system during September and October 2015 at all sites. At the beginning of November 2015 the turbidity in the distribution system began to rise at all sites. The turbidity continued increasing throughout November and into December, peaking around the middle of December with turbidity at most TCR sites between 1 and 2 NTU. The turbidity then began to decrease towards the levels seen earlier, with most sites between 0.5 and 1 NTU by the end of February.

It should be noted that the increase in turbidity appears shortly after the use of groundwater stopped (November 4) and switching the intake to partial use of the South Tower at Bull Run Reservoir (November 3 – 18). These turbidity values are not outside the range typically observed during this time of year in the Bull Run due to storms.

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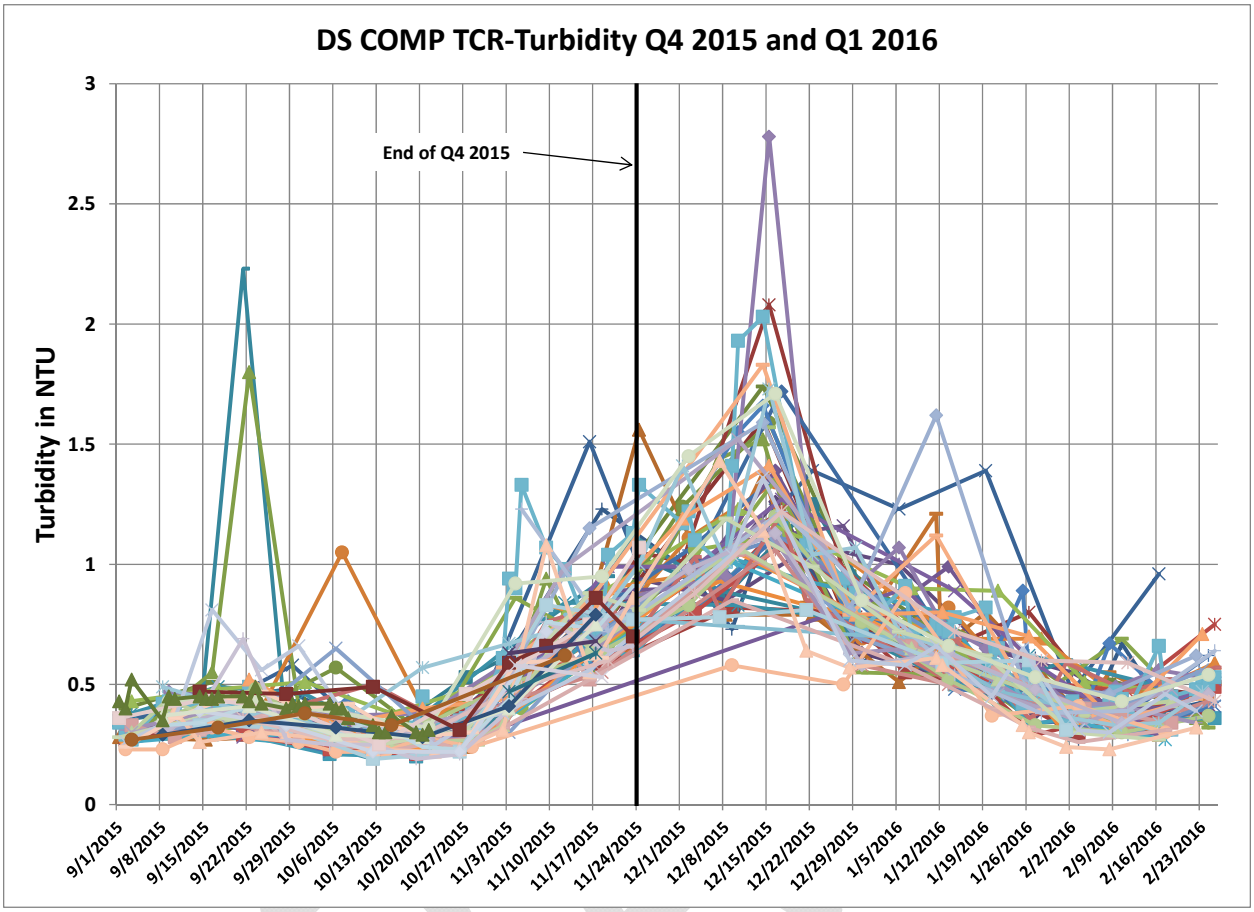

Figure 1 Turbidity values from Q4 2015 and Q1 2016 individual TCR sites.

Note that turbidity was elevated during November and December 2015. Note also that the increase in turbidity appears shortly after the use of groundwater stopped (November 4) and switching the intake to partial use of the South Tower at Bull Run Reservoir (November 3 – 18).

2.4.2 Chlorine residual

Total chlorine residuals from all TCR sites for Q4 2015 and Q1 2016 are shown in Figures 2 and 3 below. As observed there is considerable spread in the residual throughout the distribution system in Q4 2015. The residual was generally lower in Q4 2015 and the data spread between 0.5 mg/L and 2.5 mg/L. In Q1 2016 the chlorine residual is generally less spread and between the values of 1.5 mg/L and 2.2 mg/L. Decay in chlorine residual such as observed during Q4 is known to occur in the Portland system during the Fall nitrification season.

It should be noted that operational changes which may have impacted the chlorine residual include:

- Chlorine target was decreased from 2.5 mg/L to 2.2 mg/L on December 16.
- Open reservoir #5 was taken offline permanently on December 2.

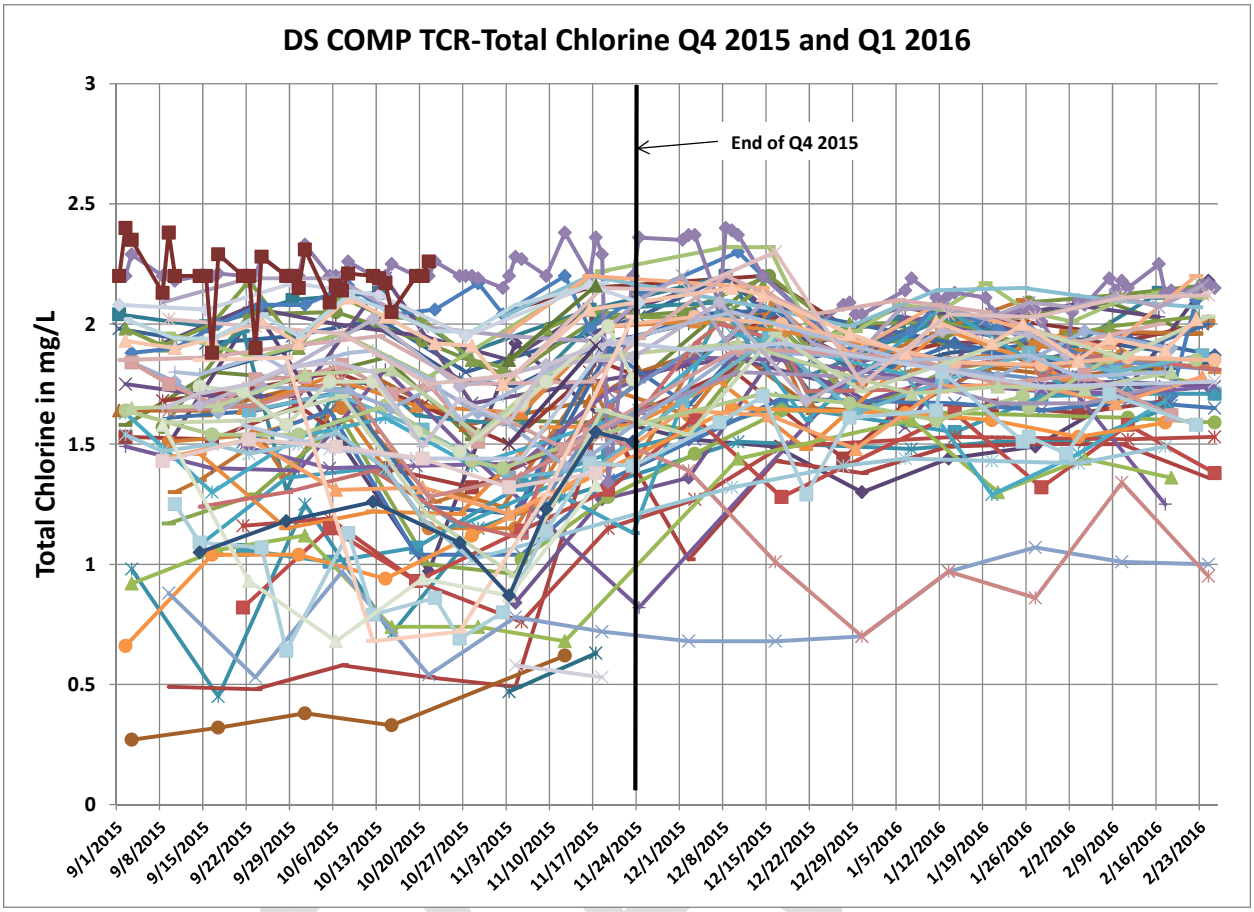

Figure 2 Total chlorine residual during Q4 2015 and Q1 2016.

Note that total chlorine residual was lower in many locations during September and October 2015. There was a system wide increase starting in November, and was maintained higher and less variable throughout the distribution system throughout Q1 2016.

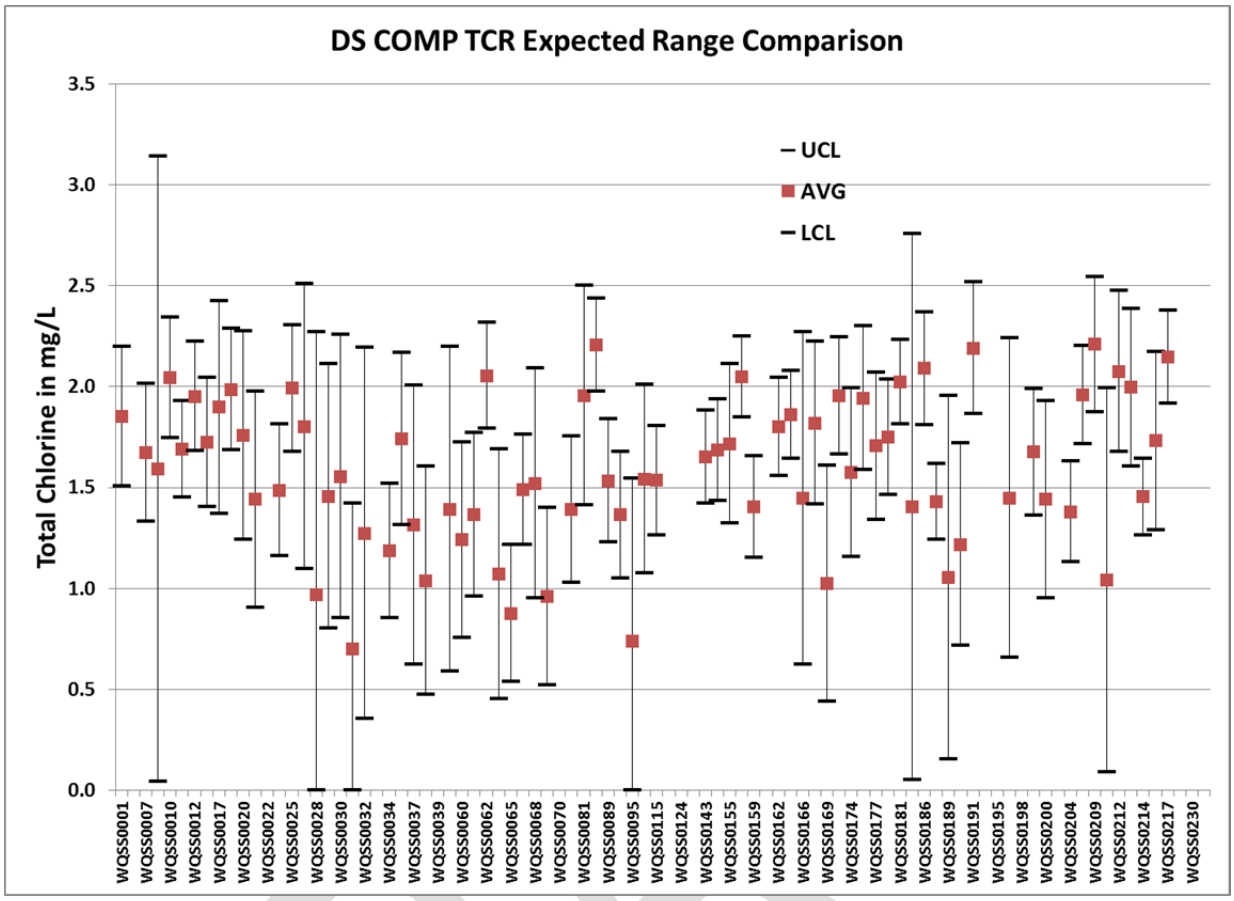

Figure 3 Expected range of total chlorine residual for each WQSS from data collected during Q4 2015.

Red squares indicate the average chlorine concentration from the 2015 Q4 datasets for each TCR sampling site. The "whiskers" emanating from the average indicate the expected range of the data at that site where 99% of the data will fall as calculated by the Shewhart Control Chart statistical concept of variation. Individual sites with low average or expected range of chlorine residual can be observed.

2.4.3 pH

TCR sites are monitored routinely for pH and give a good indication for how the pH changes throughout the distribution system. pH values at TCR sites are shown in Figure 4 below. As observed in the graph, the pH was generally higher and less variable during the Q4 2015 quarter. This is likely due to the higher alkalinity of the groundwater which was in use until November 4, 2015.

The pH at many TCR sites began to drop in the system in November, with the lowest pH values observed in December and January between 7.3 and 7.5. In general the pH was more variable and lower during Q1 2016.

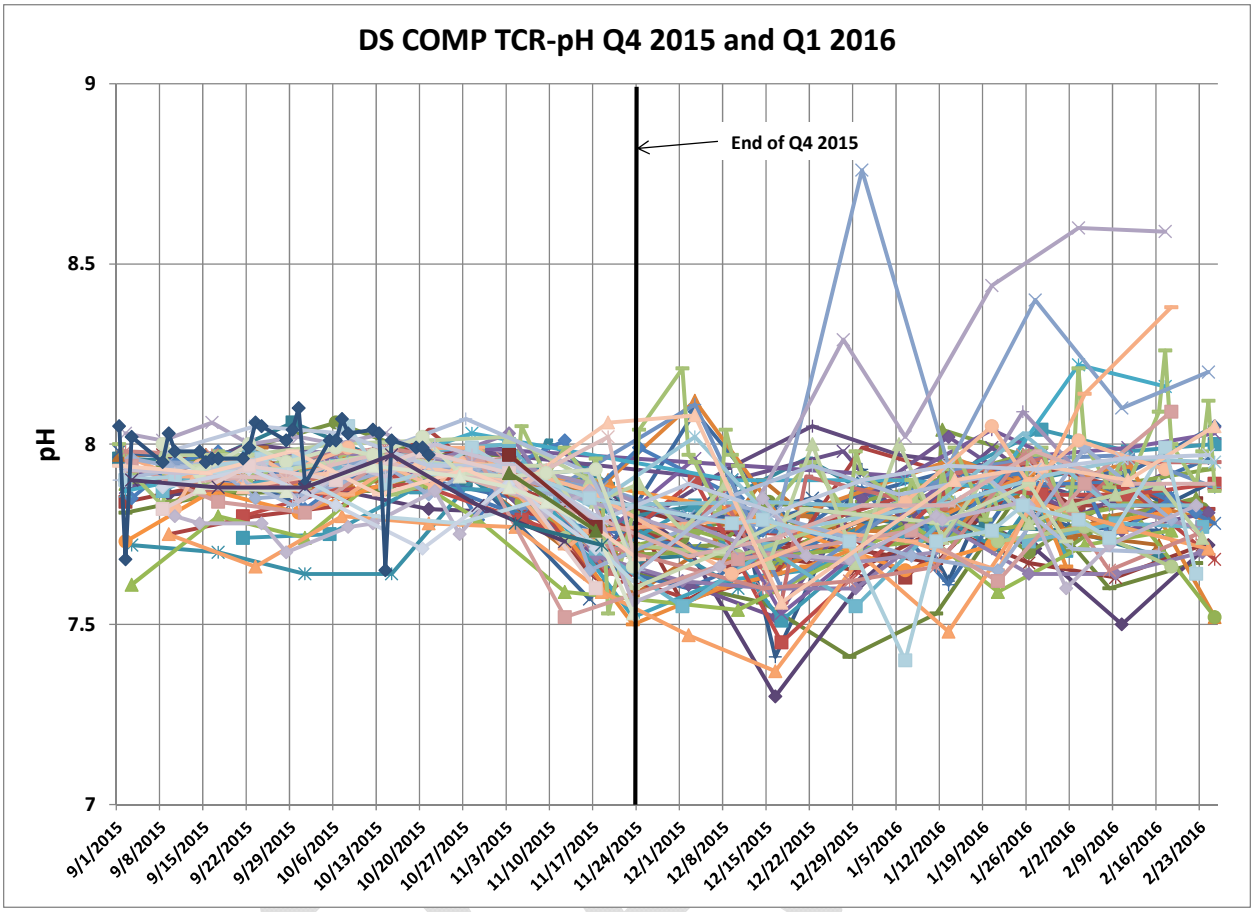

Figure 4 pH values for Q4 2015 and Q1 2016 for all TCR sites.
Note that groundwater was used until November 4.

2.4.4 Summary of TCR data

In summary, the following observations were made from a review of the TCR data:

- The turbidity was elevated throughout most of the distribution system between November 2015 and February 2016.
- The chlorine residual was generally lower and more variable during Q4 2015. This is known to occur in the Portland system in the fall.
- The pH was higher and less variable in most of the distribution system during Q4 2015. This is likely due to the use of groundwater during this period. Shortly after groundwater was turned off, the pH at many TCR sites began to decrease.
- It should be noted that a more complete set of water quality parameters was monitored at two of the TCR sites (extended WQSS). This data is presented in section 2.8 below.

2.5 NITRIFICATION DATA

The PWB monitors select sites to determine the extent to which nitrification is occurring within the Portland distribution system. Samples are collected and analyzed for total chlorine, oxidation reduction potential (ORP), Heterotrophic Plate Counts (HPC) using R2A agar (R2A), free ammonia, nitrite, nitrate, pH, temperature, and turbidity. This section summarizes the water quality data collected from the sites monitored for nitrification during this monitoring period. The pH and turbidity trends are the same as observed in the TCR data above and are not presented again in this section.

Nitrification data was only collected during Q4 2015 (not collected during Q1 2016), as nitrification is typically highest during the Fall. It should be noted that additional discussion and extrapolation of what this data may indicate related to overall water quality and lead release in the PWB water system will be reserved for the final report, after data are obtained from the Q4 2016 nitrification data.

Temperature was monitored at all nitrification sites and is shown in Figure 5 below.

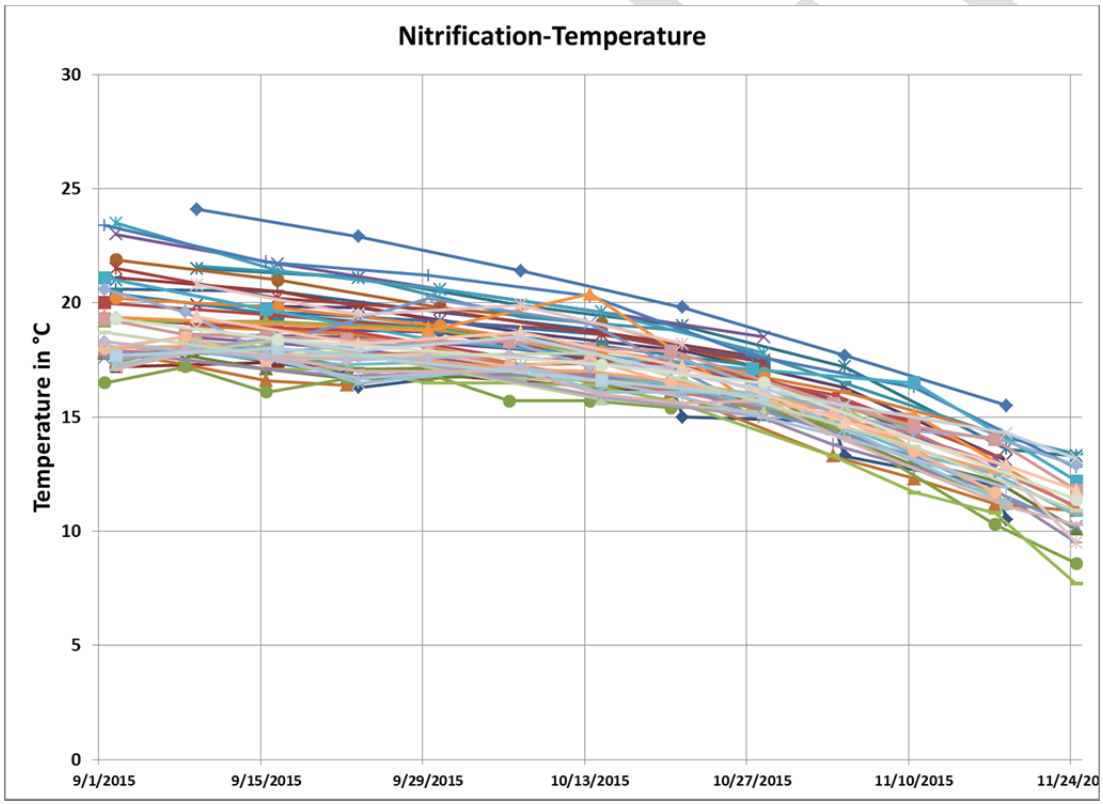

Figure 5 Temperature observed at nitrification sites during Q4 2015.
Note the drop in temperature throughout Q4.

HPCs were monitored at all nitrification sites and are shown in Figure 6 below. As indicated the HPCs were fairly stable throughout the nitrification season, despite the drop in temperature observed during the quarter. A few sites had consistently higher HPCs than the other sites. The five stations with the highest HPC values are listed below:

- WQSS0108
- WQSS5005
- WQSS5014
- WQSS5006
- WQSS5013

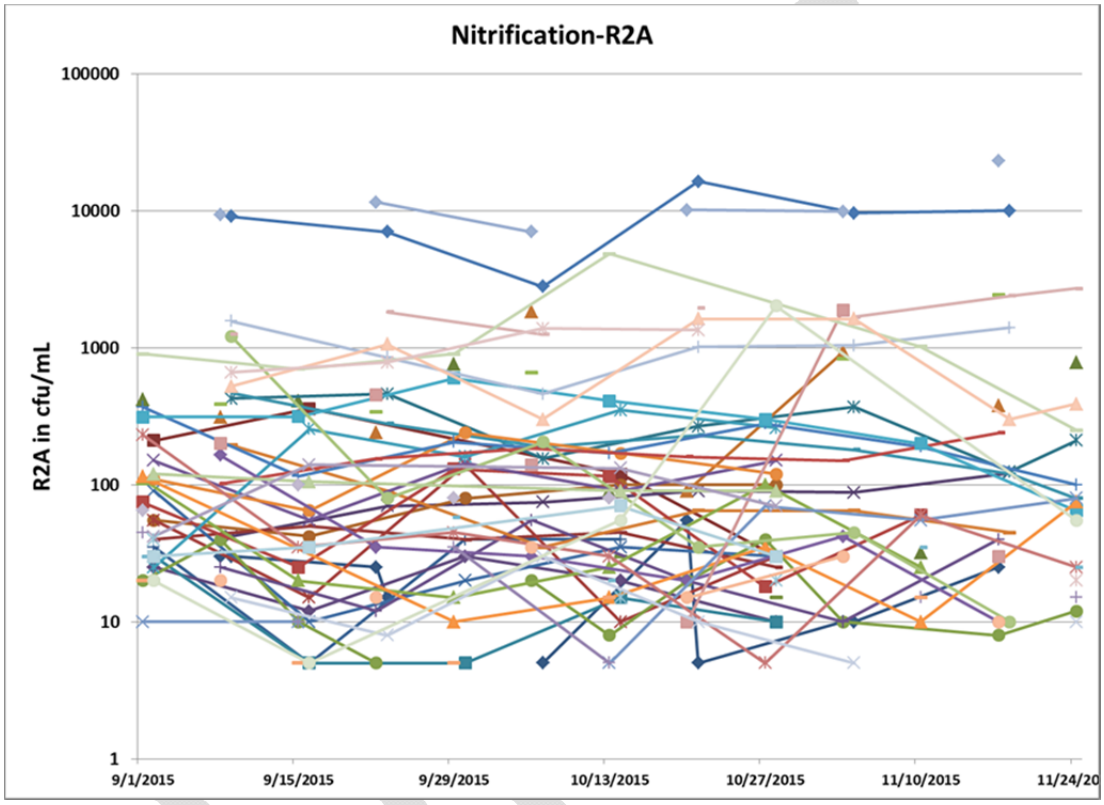

Figure 6 Heterotrophic plate counts using R2A agar from nitrification sites during Q4 2015.

Release of free ammonia was monitored at all nitrification sites and is shown in Figure 7 below. As observed there was an increase in free ammonia at most sites towards the end of November. The five stations with the highest free ammonia values are listed below:

- WQSS5019
- WQSS5005
- WQSS0069
- WQSS0064
- WQSS5017

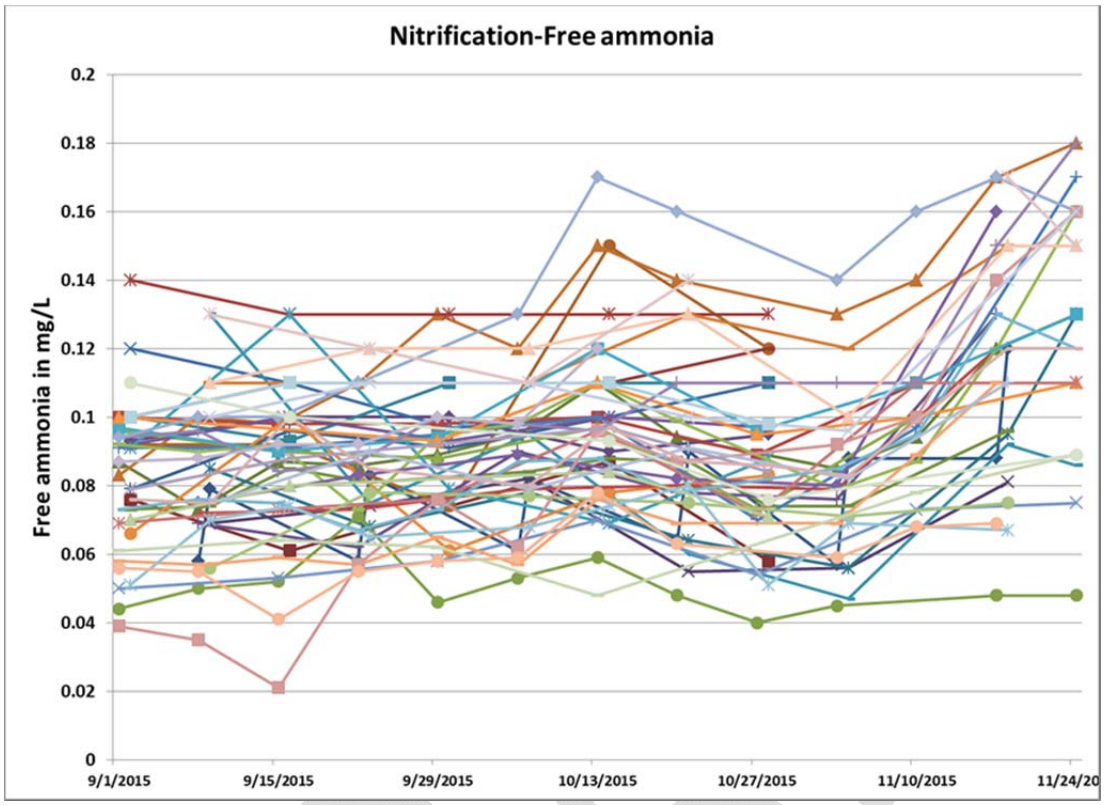

Figure 7 Free ammonia observed at nitrification sites during Q4 2015.

The presence of nitrite is a good indication that nitrification is actively occurring, as once generated nitrite concentrations tend to be quickly converted to nitrate. The nitrite concentrations observed at nitrification monitoring sites is shown in Figure 8 below. A few of the sites showed an increase in nitrite concentration towards the end of November, but the trend was not as pronounced as it was in the release of free ammonia. The five stations with the highest nitrite concentrations are listed below:

- WQSS0169
- WQSS0034
- WQSS0095
- WQSS0182
- WQSS0031

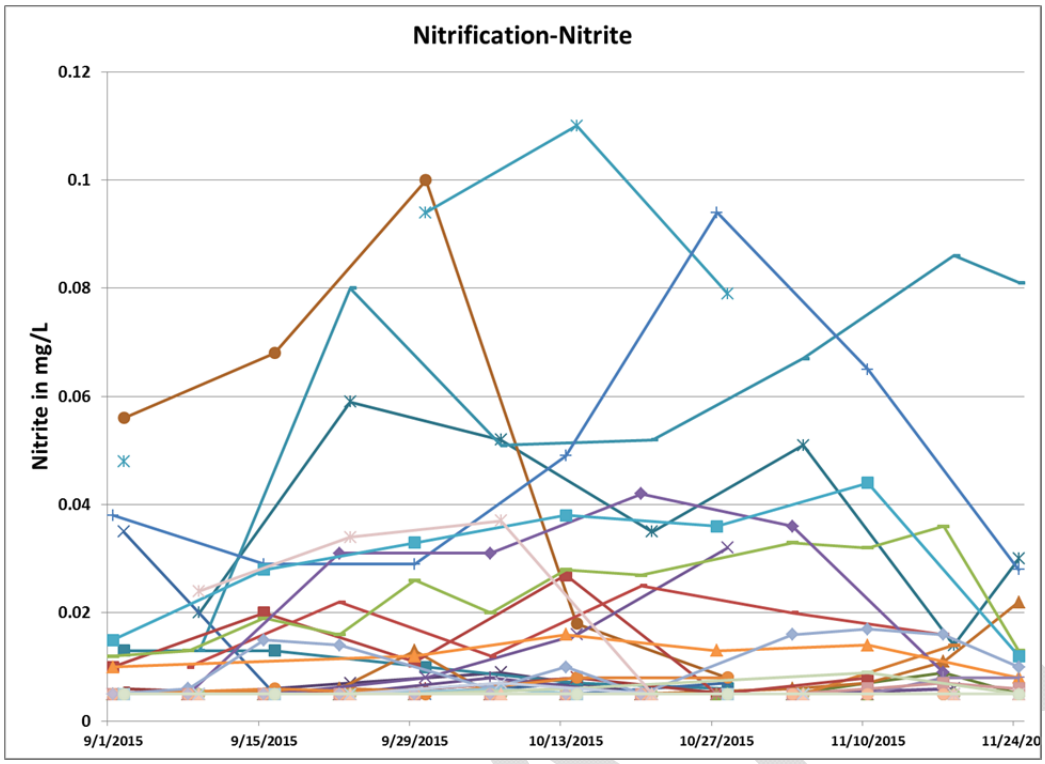

Figure 8 Nitrite concentrations observed at nitrification monitoring sites during Q4 2015.

Nitrate forms when nitrite is converted to nitrate. The nitrate concentrations observed at nitrification monitoring sites is shown in Figure 9 below. There was a pronounced increase in nitrate concentration towards the end of November. The five stations with the highest nitrite are listed below:

The five stations with the highest nitrate are listed below:

- WQSS0108
- WQSS5014
- WQSS0095
- WQSS5019
- WQSS0169

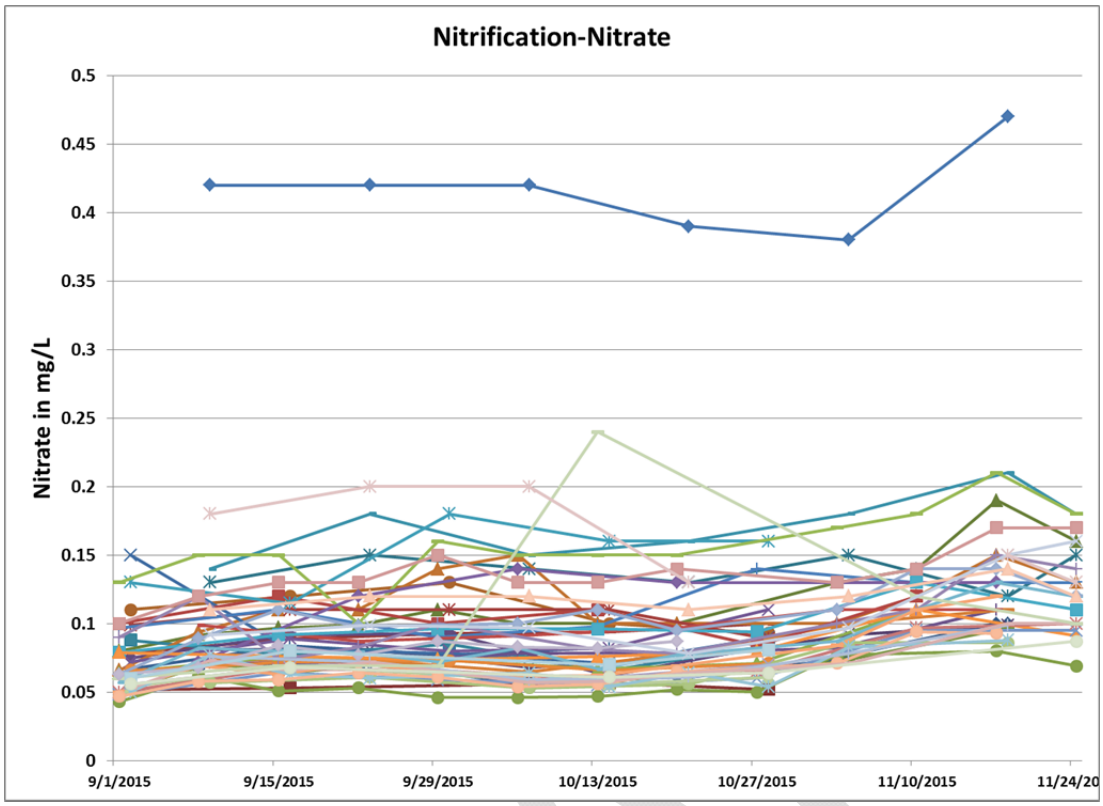

Figure 9 Nitrate concentrations observed at nitrification monitoring sites during Q4 2015.

2.5.1 Summary of nitrification data

In summary, the following observations were made from a review of the nitrification data:

- The HPCs were relatively constant throughout Q4, despite a decrease in temperature.
- An increase in free ammonia and nitrate was observed towards the end of November, with a less noticeable increase in nitrite observed as well.
- Individual stations with the most evidence of nitrification can be plotted in GIS to determine if spatial patterns exist.

Table 2 below indicates the water quality stations with the highest values of HPC, free ammonia, nitrite, and nitrate.

Table 2 Stations with the Most Evidence of Nitrification

Station	HPC	Free Ammonia	Nitrite	Nitrate
WQSS0031			X	
WQSS0034			X	
WQSS0064		X		

Station	HPC	Free Ammonia	Nitrite	Nitrate
WQSS0069		X		
WQSS0095			X	X
WQSS0108	X			X
WQSS0169			X	X
WQSS0182			X	
WQSS5005	X	X		
WQSS5006	X			
WQSS5013	X			
WQSS5014	X			X
WQSS5017		X		
WQSS5019		X		X

2.6 LEAD AND COPPER COMPLIANCE DATA

2.6.1 Lead and copper compliance data

The PWB collected a compliance round of LCR sampling during Q4 2015. Compliance samples were collected by the residential customers during the last week in October and first week in November, 2015. The samples were analyzed for total lead (Pb), copper (Cu), iron (Fe), manganese (Mn), and zinc (Zn).

A statistical distribution of both the lead and copper sample results is shown in Figure 10 below. The whiskers on the plot below define the expected range of the data (see Appendix A for more information). The outliers in the figure represent samples which had the greatest lead concentrations and fall outside of the expected range based on the distribution of data. That is to say that a few of the homes had much higher lead concentration than the rest of the samples.

The 90th percentile lead concentration of the compliance dataset was 14.1 micrograms per liter (ug/L). Eleven of the 114 homes had a lead concentration greater than the action level of 15 ug/L.

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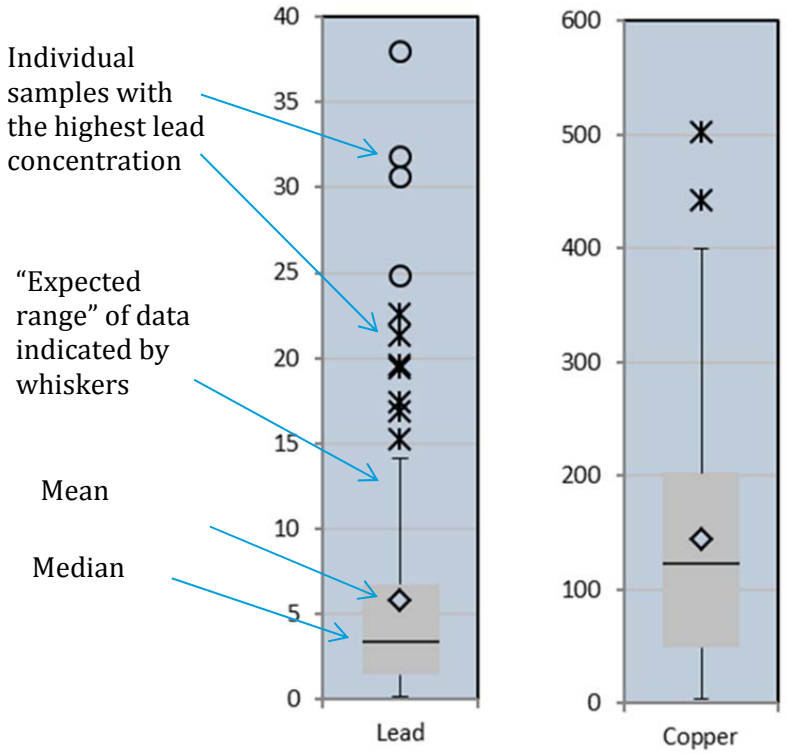

Figure 10 Results for lead and copper (ug/L) from Q4 2015 from 114 compliance samples. On the Box and Whisker Plots used below the whiskers indicate the IQR, an outlier is denoted by "x", and extreme outlier is denoted by "o". Sample outliers represent samples with the highest lead concentrations. See Appendix A for additional details on box and whiskers plots.

It should be noted that the data presented above was for the entire Joint Monitoring Plan (JMP) set of Tier 1 homes. Of the 114 samples from the JMP, 29 of the samples were from the PWB system, while the remaining homes are from wholesale customers. A review of the compliance samples from the PWB system only shows that 3 of the 29 homes were over the action level of 15 ug/L with a 90th percentile concentration of 16.9 ug/L.

An analysis of additional metals (Zn, Fe, Mn) concentrations was performed together with lead and copper analysis. The concentration data for iron, manganese, and zinc are shown in Figure 11 below. The higher concentrations are likely due to pipe wall scale release, though speciation between dissolved and particulate form was not conducted to verify. Levels were well below associated secondary MCLs for these metals.

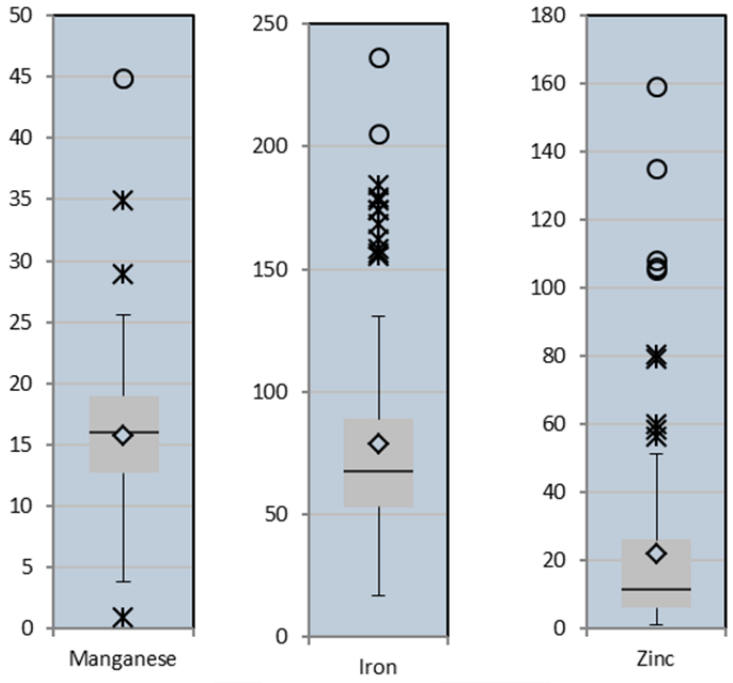

Figure 11 Metals concentration (ug/L) collected as part of LCR compliance sampling

A statistical analysis was performed to determine if there was a correlation between lead and any of the other metals. In this dataset, there is not a strong correlation between lead with iron, manganese, and zinc (data not shown). However, only the total concentrations of each metal are known. Collection of lead speciation data as suggested in the additional residential customer sample analysis protocol would help provide additional information relating to the lead speciation and relationship to other metals, as well as help relate PRS monitoring station data to conditions observed in customer homes.

2.6.2 Lead and copper compliance water quality parameter data

Additional samples were collected as part of the LCR sampling program and analyzed for additional water quality parameters. Note that these are not paired samples with the lead samples, as the samples discussed below were collected in the distribution system and not from customer taps. Therefore this data can only be interpreted as what the general conditions were during the time of compliance sampling, and should not be used to draw correlations between individual lead samples and water quality parameters such as pH. Samples were collected during Q4 2015 (Nov 3-6) and Q1 2016 (Feb 1-3) and analyzed for the following parameters:

- pH, conductivity, alkalinity
- Total chlorine
- Temperature

The pH, conductivity, and alkalinity data collected during Q4 2015 (during the same time period as the compliance samples were collected) are summarized in the box and whisker plots below. Note that the water quality parameter samples were collected from November 3 – 6, just before and after

switching off groundwater use on November 4. The spread of the alkalinity data suggests that some of the compliance samples may have been receiving surface water only, while others with the higher alkalinity were receiving the mix of groundwater and surface water.

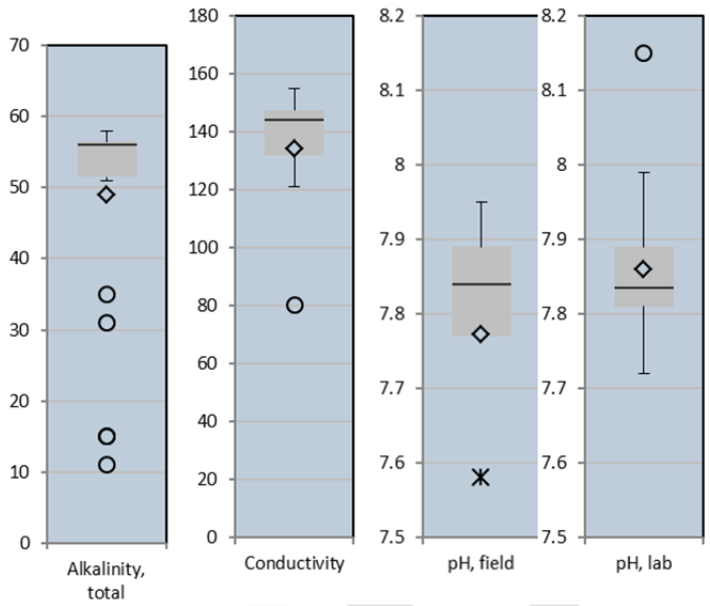

Figure 12 Alkalinity (mg/L as $CaCO_3$, 27 samples), Conductivity (uS/cm, 7 samples), pH (standard units, 9 samples) for compliance water quality monitoring conducted in Q4 2015. Spread of the alkalinity data indicate that some of the samples were likely from a surface water source (low alkalinity), while other samples were from the groundwater source (higher alkalinity).

A second round of water quality parameters was collected during Q1 2016. This data is useful to see the change in alkalinity and conductivity that occurred between Q4 2015 and Q1 2016 and is shown in Figure 13 below. As discussed previously, the higher alkalinity and conductivity observed during Q4 2015 is likely due to the presence of groundwater throughout the system.

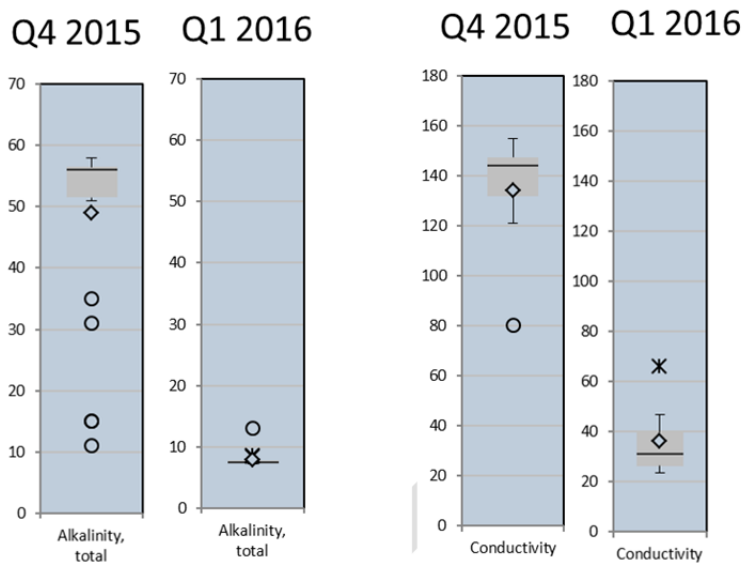

Figure 13 Alkalinity (mg/L as $CaCO_3$, 27 samples each Q4 and Q1) and conductivity (uS/cm, 7 samples each Q4 and Q1) measurements during Q4 2015 and Q1 2016.

Note the drop in alkalinity and conductivity observed when the groundwater supply was turned off.

2.6.3 Follow up residential customer stagnation testing

A more detailed testing protocol is described in TM2 for collecting additional water chemistry data at residential customer homes from a select group of LCR compliance homes. This data set is expected to generate water quality data paired with lead analysis to aid in identifying the specific mechanisms of lead release occurring in the Portland water system.

Follow up sampling in residential customer homes was not performed during this monitoring period.

2.6.4 Summary of LCR data

In summary, the following observations were made from a review of the LCR compliance data:

- A compliance round of lead and copper sampling took place during Q4 2015. The 90th percentile lead concentration was 14.1 ug/L overall from the set of homes in the JMP. The 90th percentile lead concentration from just the set of PWB Tier 1 homes was 16.9 ug/L.
- There were no apparent correlations between total lead and other metals. Speciation of the metal samples may provide more insight.
- The change from groundwater to surface water may have impacted compliance results due to water chemistry changes at the time of LCR sampling. However, more analysis is necessary to determine what impact, if any, this shift had on lead levels.
- The next round of LCR compliance sampling is scheduled to take place during Q2 2016.

2.7 VOLUNTEER CUSTOMER LEAD DATA

The PWB has a program in place that allows customers to request that a stagnation sample be collected from the home and be analyzed for lead by the PWB.

2.7.1 Metals analysis

The PWB received approximately 500 requests for lead testing during the monitoring period. Of the approximately 500 samples, the results for 436 homes were available by the time this quarterly report was prepared. Voluntary customer samples were analyzed for total lead (Pb), copper (Cu), iron (Fe), manganese (Mn), and zinc (Zn).

The 90th percentile lead concentration of the voluntary customer dataset was 3.4 ug/L in Q4 2015 and 4.3 ug/L in Q1 2016. A greater percentage of the homes were over the action level during Q4, with 6 of 165 homes over action level in Q4 2015 and 4 of 271 homes over the action level in Q1 2016. It should be noted that individual voluntary customer samples do not necessarily have a source of lead in the homes, explaining why the values are lower overall than the set of compliance Tier 1 homes reported above.

A statistical analysis was performed to determine if there was a correlation between lead and any of the other metals. In this dataset, there is not a strong correlation between lead with iron, manganese, and zinc (data not shown).

2.7.2 Follow up residential customer stagnation testing

A more detailed testing protocol is described in TM2 for collecting additional water chemistry data at residential customer homes from a select group of voluntary customer homes. This data set is expected to generate water quality data paired with the lead analysis to aid in identifying the specific mechanisms of lead release occurring in the Portland water system.

Follow up sampling in residential customer homes was not performed during this monitoring period.

2.7.3 Summary of voluntary customer lead data

In summary, the following observations were made from a review of the voluntary customer lead data:

- More homes were over the action level during Q4 2015 than during Q1 2016
- Results could be plotted in GIS maps to determine if spatial patterns exist to the lead data
- Lead concentration was not correlated with iron, manganese, or zinc

2.8 PRS MONITORING STATION AND EXTENDED WQ SAMPLE STATION DATA

Data from the three monitoring stations and the two extended water quality stations are presented below. The PRS Monitoring Stations were started up with flowing water in October 2015, during the middle of Q4 2015. Samples from the test chambers were not taken until a month after startup

to allow for the development of metal plate surface scales and biofilm. Therefore, the data collected from the stagnation chambers began in Q1 2016.

The monitoring stations are installed at the following sites:

- Powell Butte (defined as "Entry point" for the purposes of this study, EP)
- Willalatin Tank. (DS 1)
- Vernon Low Tank. (DS2)

Analysis was conducted on the flowing water entering the monitoring stations, as well as on the stagnant water that has been in contact with metal test chambers (23 hour per day stagnation period). The test chamber materials were selected to represent the sources of lead known to have been used historically by PWB water customers. It should be noted that there are no lead service lines in PWB's service area; lead was selected to show the exaggerated response of lead to other water quality conditions. The following test chambers are in use:

- Lead.
- Copper with Lead Solder Connection.
- Galvanized Iron.
- Brass.

The Monitoring Stations are designed to exaggerate the release of lead and copper into the water. This exaggeration serves to magnify the factors that are at work in the distribution system that shape water quality and allow for better understanding of the relationships between parameters. It should be noted that for this reason the concentrations of metals detected in the monitoring stations are not necessarily reflective of the concentrations that are present in customer tap samples.

The same data collected at the influent of the monitoring stations are also collected from 2 additional extended water quality sampling stations (WQSS) selected from the TCR sites and are also reported in this section. These extended WQSS provide more detailed water quality information from the distribution system than is collected at all TCR sites. The extended sites for sampling are WQSS 0031(DS 3) and WQSS 0093 (DS 4).

All of the parameters describing uniform corrosion, biostability, and scale release were monitored in the monitoring stations and extended WQSS.

The monitoring stations are identified by codes which consist of two parts: PRS-XX-YY

XX and YY for each monitoring station vary depending on the station location and the test chamber material, as shown below. This code is applicable to the figures throughout this chapter.

XX (Station Location)	YY (Test Chamber Material)
Powell Butte (PB)	Brass (BR)
Willalatin Tank (WI)	Copper with Lead Solder Connection (CU)
Vernon Low Tank (VE)	Lead (PB)
	Influent Flowing (FL)
	Galvanized Iron (GA)

2.8.1 Lead release in the PRS monitoring station data

The total lead concentration found at monitoring stations is shown in Figure 14 below. The highest lead comes from the lead stagnation chambers, followed by the copper/lead solder chamber and brass chambers. There was not a significant difference in lead release between the monitoring station locations. The galvanized steel test chambers did not show significant lead at any test station. It should be noted that lead is monitored in the galvanized chambers because the zinc coating on the galvanized steel contains lead.

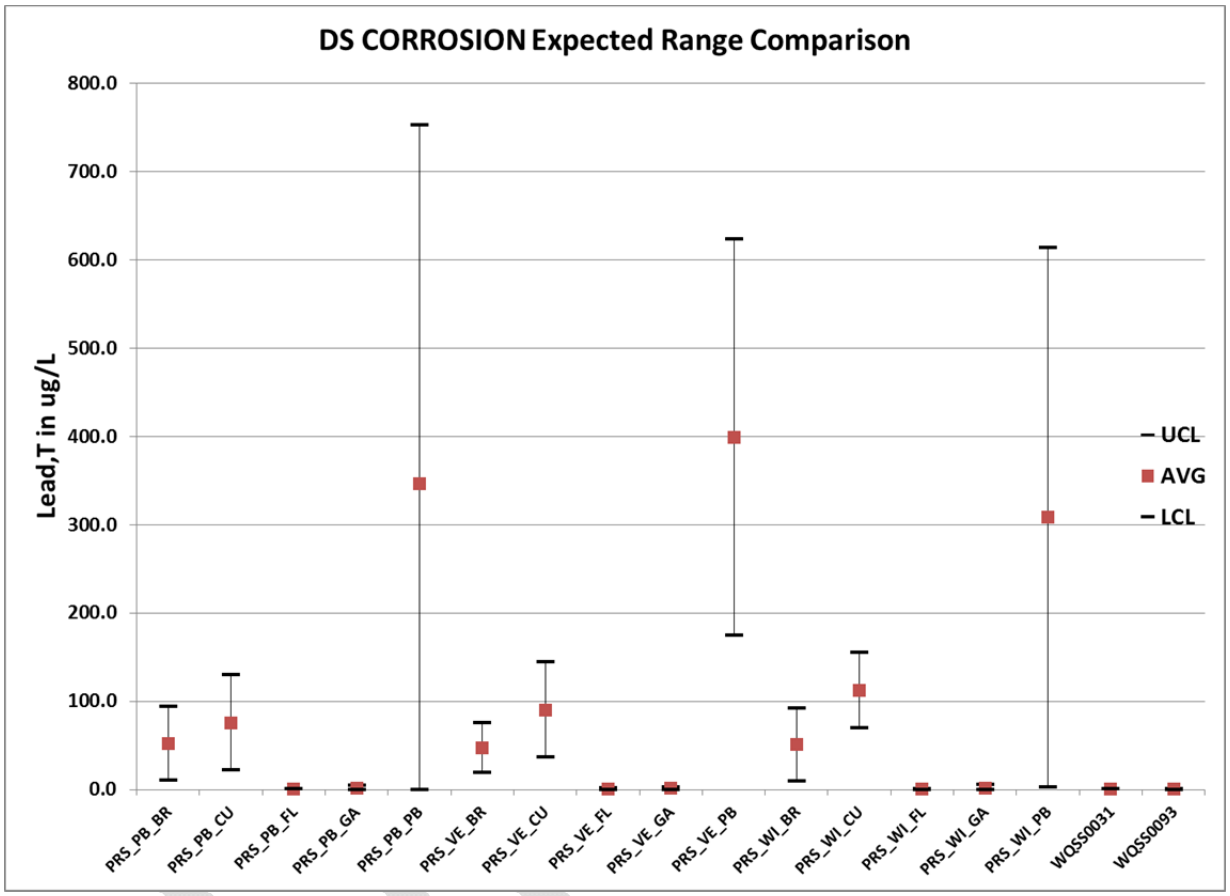

Figure 14 Lead concentrations from PRS monitoring station data for Q1 2016.

Red squares indicate the average lead concentration for each location and test chamber. The "whiskers" emanating from the average indicate the expected range of the data at that site where 99% of the data will fall as calculated by the Shewhart Control Chart statistical concept of variation.

An analysis of lead release at individual stations over time gives indications of the trends of lead release observed in the PRS stations. The lead release over time observed at the Powell Butte monitoring station is shown in Figure 15 below. The December spike in lead release from the lead test chamber seen in the figure below was observed at all test chambers. Speciation of the lead data between particulate and dissolved lead was performed. In all test chambers the total lead concentration is roughly 50% attributed to particulate lead and 50% to dissolved lead. In the case

of lead spikes such as the one observed in December in the graph below, the spike in total lead was predominantly in particulate form.

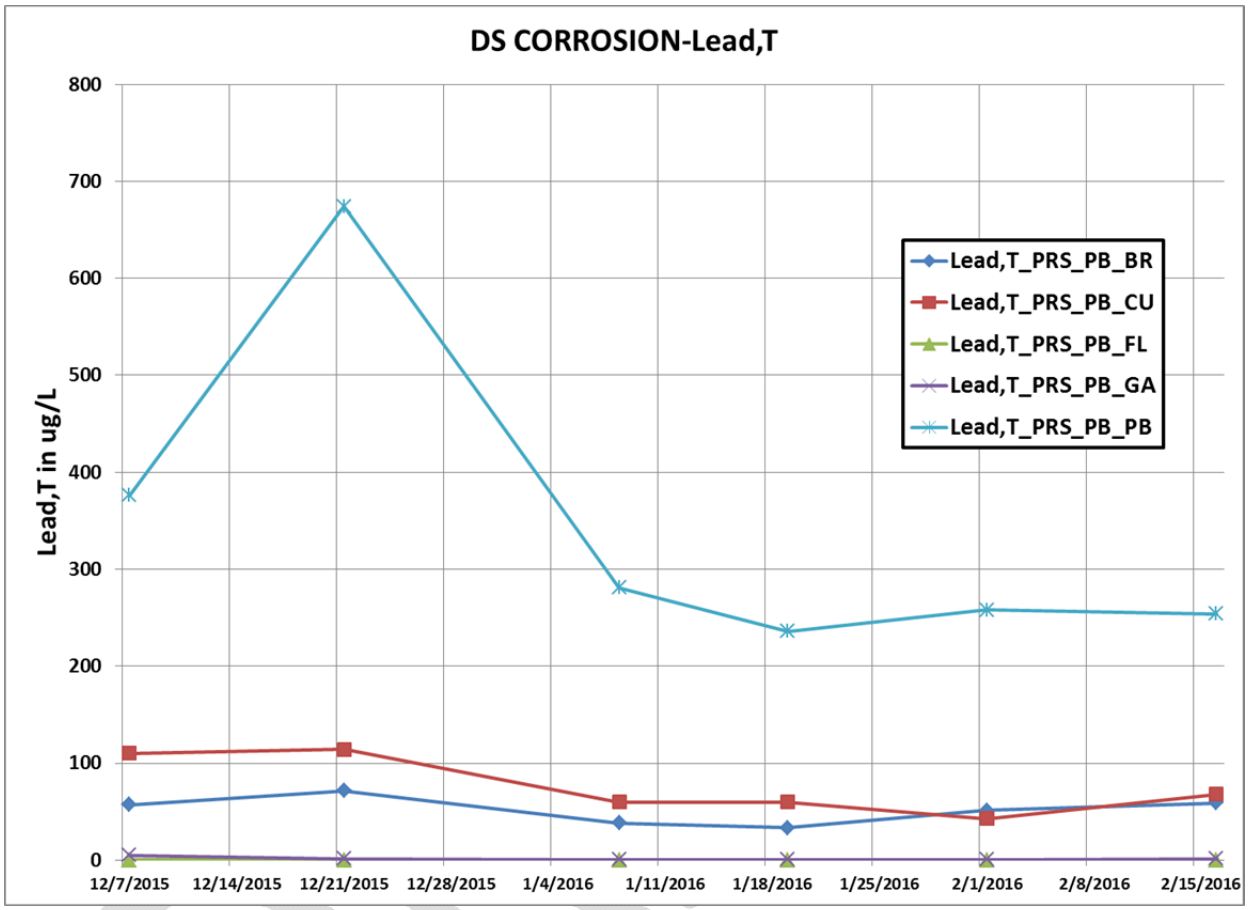

Figure 15 Total lead concentrations from Powell Butte monitoring station.

The spike in total lead observed in the lead chamber in December was predominantly in particulate form. Typical of other station data (not shown).

2.8.2 Categories of lead release

Water quality parameters are monitored at the PRS monitoring stations to allow for paired sample analysis between lead release and the various water quality parameters describing the potential mechanisms of lead release. These data are presented in the sections below according to the mechanism of lead release which the water quality parameters describe.

2.8.2.1 Uniform Corrosion

Roughly 50% of the lead measured in the PRS monitoring stations was in the dissolved form, indicating solubility processes such as in uniform corrosion were occurring in the test chambers. The parameters describing carbonate chemistry (pH, alkalinity, hardness, and temperature), chloride and sulfate chemistry, and ORP were monitored along with lead release in the test

chamber effluents to determine if relationships existed between the water quality parameters and lead release.

The pH in the test chambers can be observed in Figure 16 below. As observed, the pH dropped by about 0.2 pH units in all test chambers during the stagnation period.

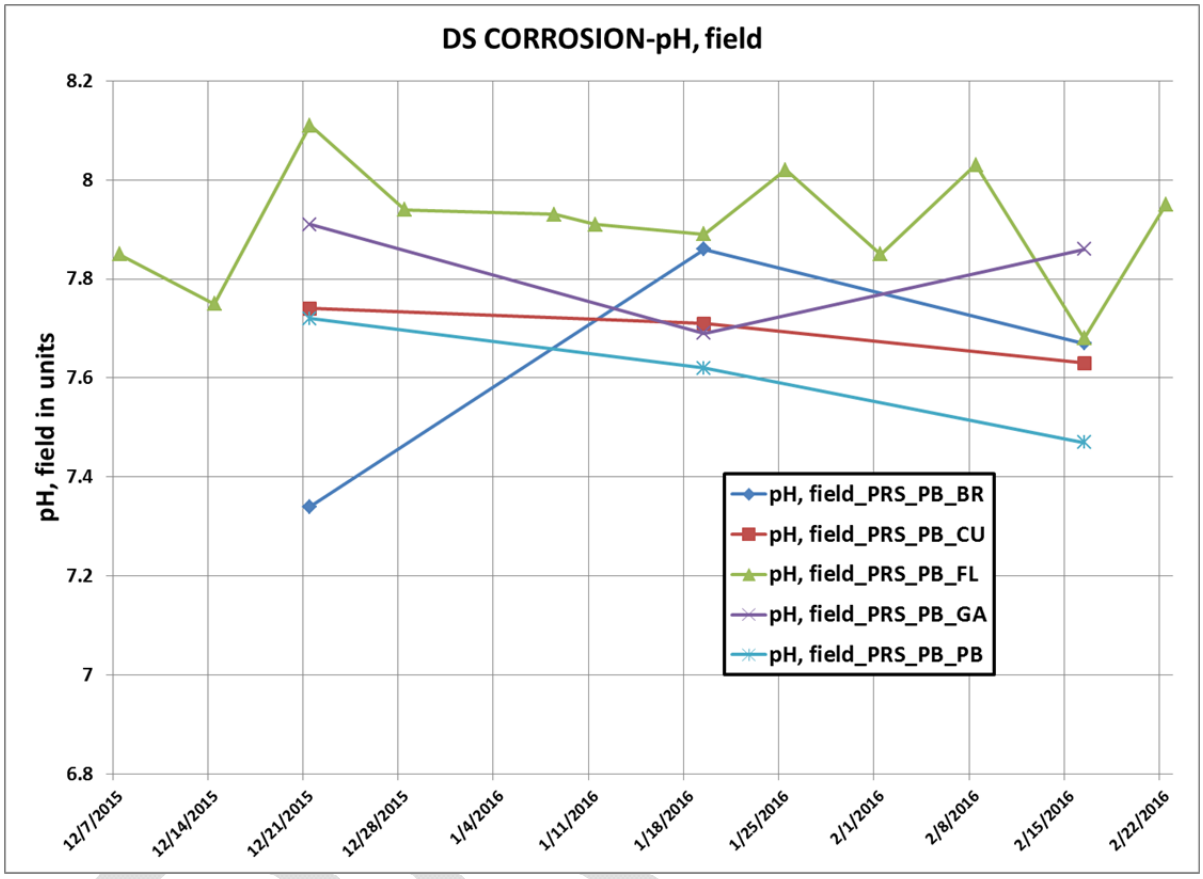

Figure 16 pH values in the flowing water entering the test chambers (FL) and the various test chambers after stagnation.

Note that the pH dropped between 0.2 and 0.5 pH units during stagnation.

A statistical analysis was performed to determine if there was a correlation between lead release and any of the water quality parameters describing uniform corrosion processes. In this dataset, there is not a strong correlation between lead with any of these water quality parameters (data not shown). This is consistent with the observation that the lead spike was predominantly particulate in nature. Relationships between the data will continue to be examined during the next monitoring quarter.

2.8.2.2 Biostability

The ATP at the Powell Butte monitoring station (typical of others) is shown in Figure 17 below. ATP is a measure of overall microbial activity and an increase in ATP indicates an increase in overall microbial activity. ATP was sometimes higher in the influent flowing water and sometimes

higher in the stagnating test chambers. It is unclear what caused the spike observed in ATP in February, but overall ATP levels are low and suggest good microbial control.

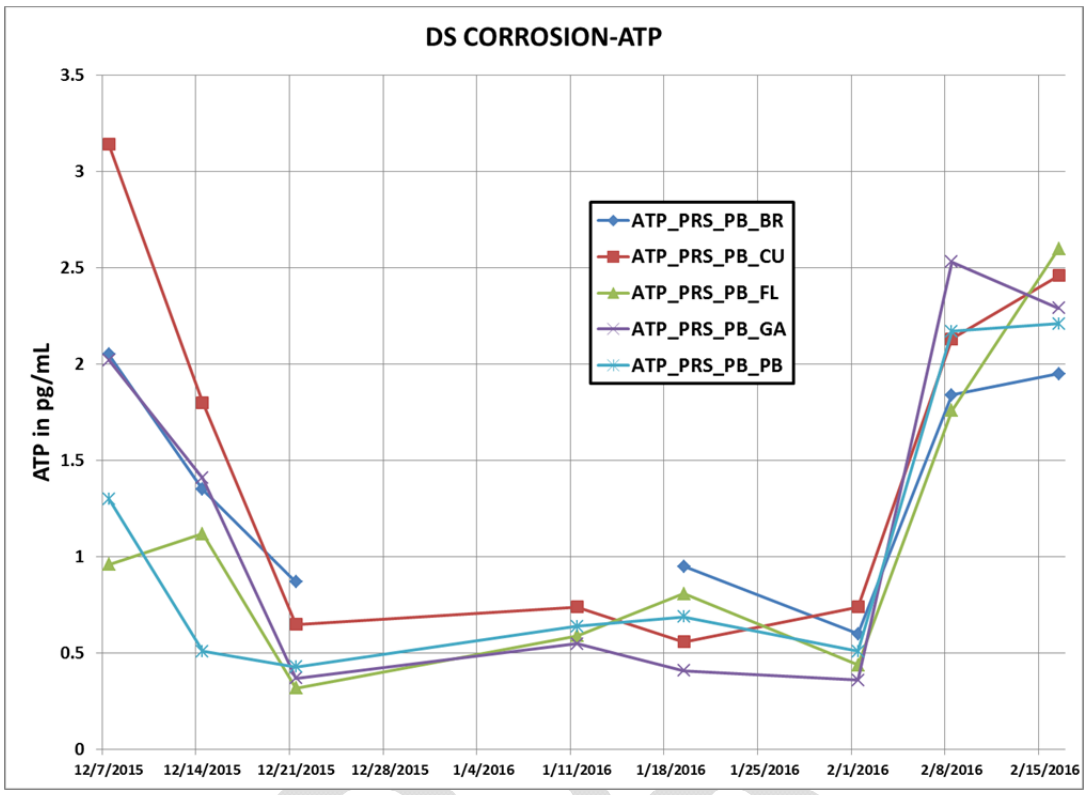

Figure 17 ATP at PRS monitoring station at Powell Butte (data typical of other stations)

A statistical analysis was performed to determine if there was a correlation between lead release and any of the water quality parameters describing biostability processes (data not shown). In this dataset, there is not a strong correlation between lead with ATP or ORP in the test chambers. Lead release appears positively correlated with DOC, ammonia release, and negatively correlated with disinfectant residual in the PRS monitoring station data. Relationships between the data will continue to be examined during the next monitoring quarter.

2.8.2.3 Scale release

Roughly 50% of the total lead detected at the PRS monitoring stations was in particulate form in most samples indicating that scale release is contributing towards total lead release in the monitoring stations. In the cases of lead spikes the elevated lead is predominantly in the particulate form, indicating that scale release is predominantly responsible for the observed spikes in lead.

The particulate aluminum concentration at Powell Butte for Q1 2016 is shown in Figure 18 below. Metals were higher both in the inlets to the PRS monitoring stations and the stagnation effluent samples. Note that iron and manganese follow same trends as aluminum and are not shown here. The December spike in particulate aluminum (and iron and manganese) in the test chamber effluent is of interest because it was associated with the spike in particulate lead, indicating that

release of metal scale containing iron, manganese, aluminum, and lead is likely responsible for the lead spike in the PRS test chamber effluent.

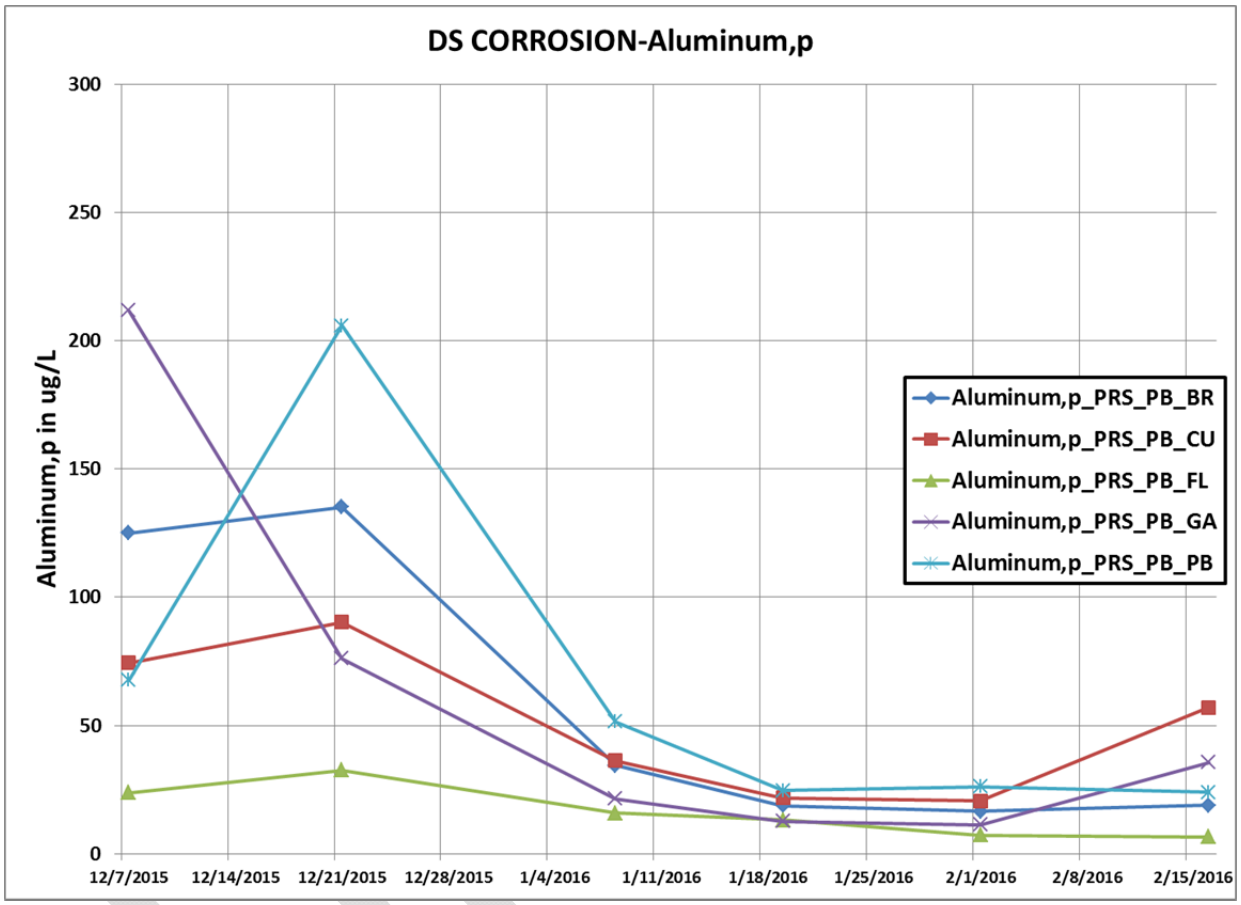

Figure 18 Particulate aluminum concentration from Q1 2016 Powell Butte monitoring station data.

Note that the spike in particulate aluminum observed in December was seen at all stations. Iron and manganese data follow same trends and are not shown here.

Lead release in the monitoring stations was strongly correlated with both turbidity and particulate metals such as iron, manganese, and aluminum. Relationships between the data will continue to be examined during the next monitoring quarter.

2.8.3 Extended WQSS data

Two TCR sites (WQSS 0031and WQSS 0093) were selected to monitor additional water quality parameters than are monitored at the remainder of the TCR sites. In this way the extended WQSS provide an excellent opportunity to gather additional details on water quality in the distribution system. These stations also provide information on the amount of lead being released from the

PWB distribution system itself, since the water has not been in contact with customer premise plumbing or service lines.

2.8.3.1 Lead release

The lead concentration in the flowing water samples collected at the extended WQSS give an indication of what portion of lead originates in the distribution system. As shown in Figure 19 below, the samples were mostly lower than 0.2 ug/L. This lead is mostly in dissolved form.

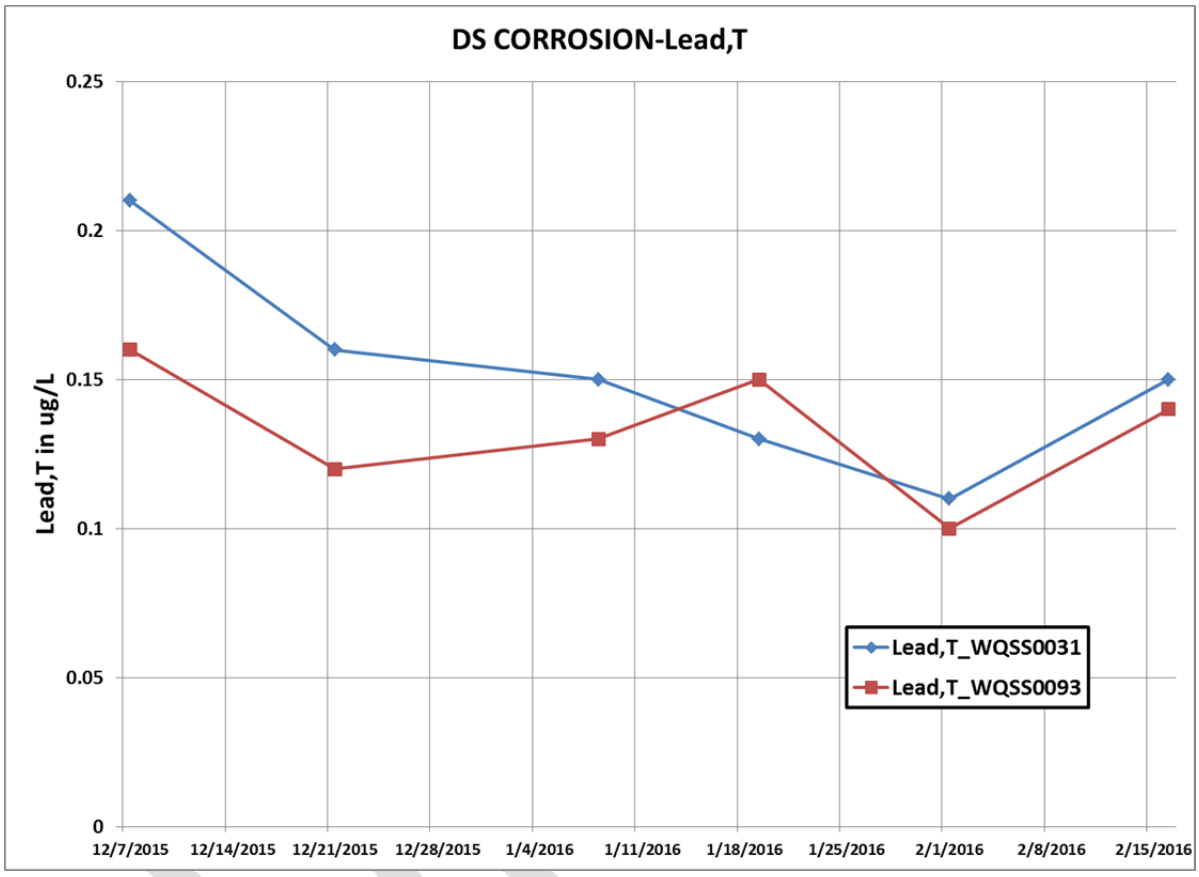

Figure 19 Lead concentration measured at the extended WQSS shows the level of lead originating from the distribution system itself.

2.8.3.2 Metals and turbidity

The TCR data presented earlier indicated that turbidity was elevated in the system during December 2015. The turbidity observed at the extended WQSS (2 of the TCR sites) is shown in Figure 20 below, and indicates that these two extended WQSS followed the same trend as observed in the remainder of the TCR sites.

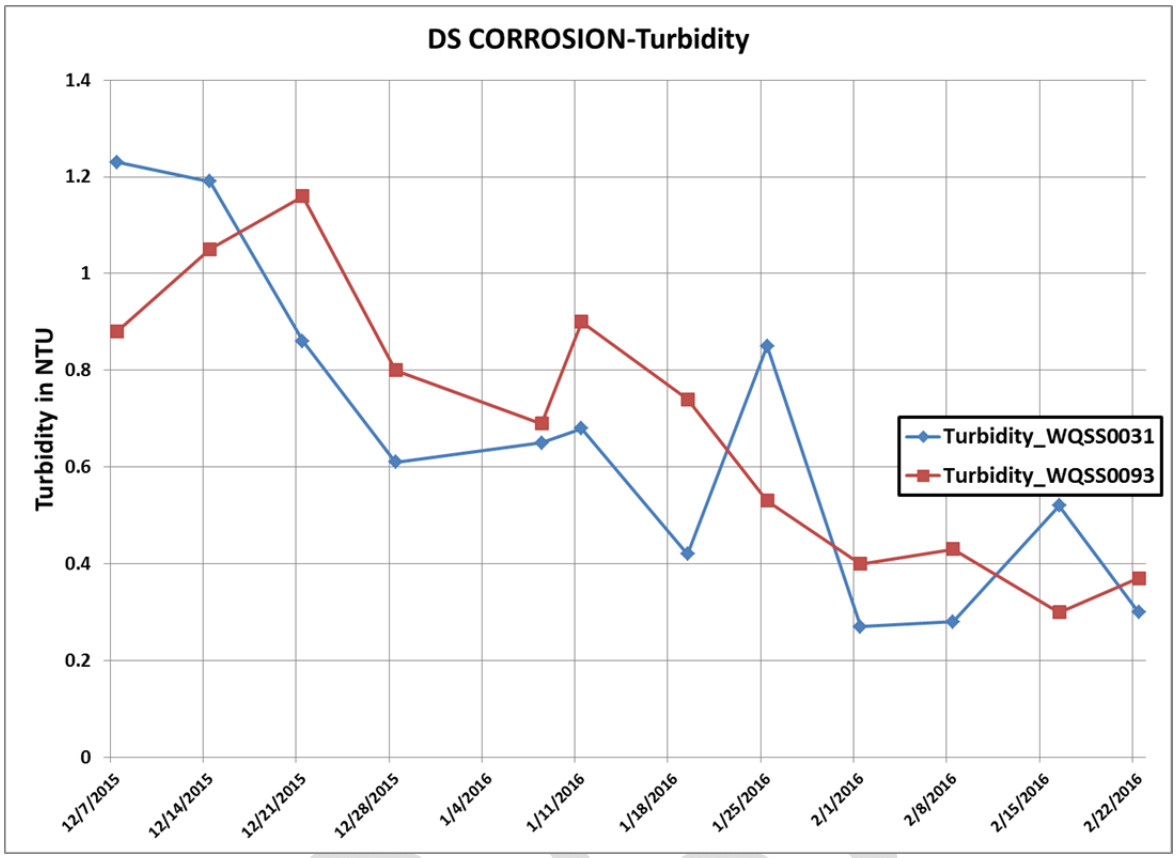

Figure 20 Turbidity observed at extended WQSS during Q1 2016.

The iron concentration at the extended WQSS is shown in Figure 21 below. As indicated, an increase in total iron was observed at the extended WQSS during the same time as the increase in turbidity was observed at all TCR sites. The patterns of aluminum and manganese concentrations at the WQSS were similar to iron and are not shown here.

It should be noted that the metals concentrations observed were all well below any secondary MCL for these metals – the "elevated" levels are only of significance in that these metals are known to combine with lead and then transport together when the metal scales release from the pipe wall surface (as was observed in the PRS monitoring station data presented above).

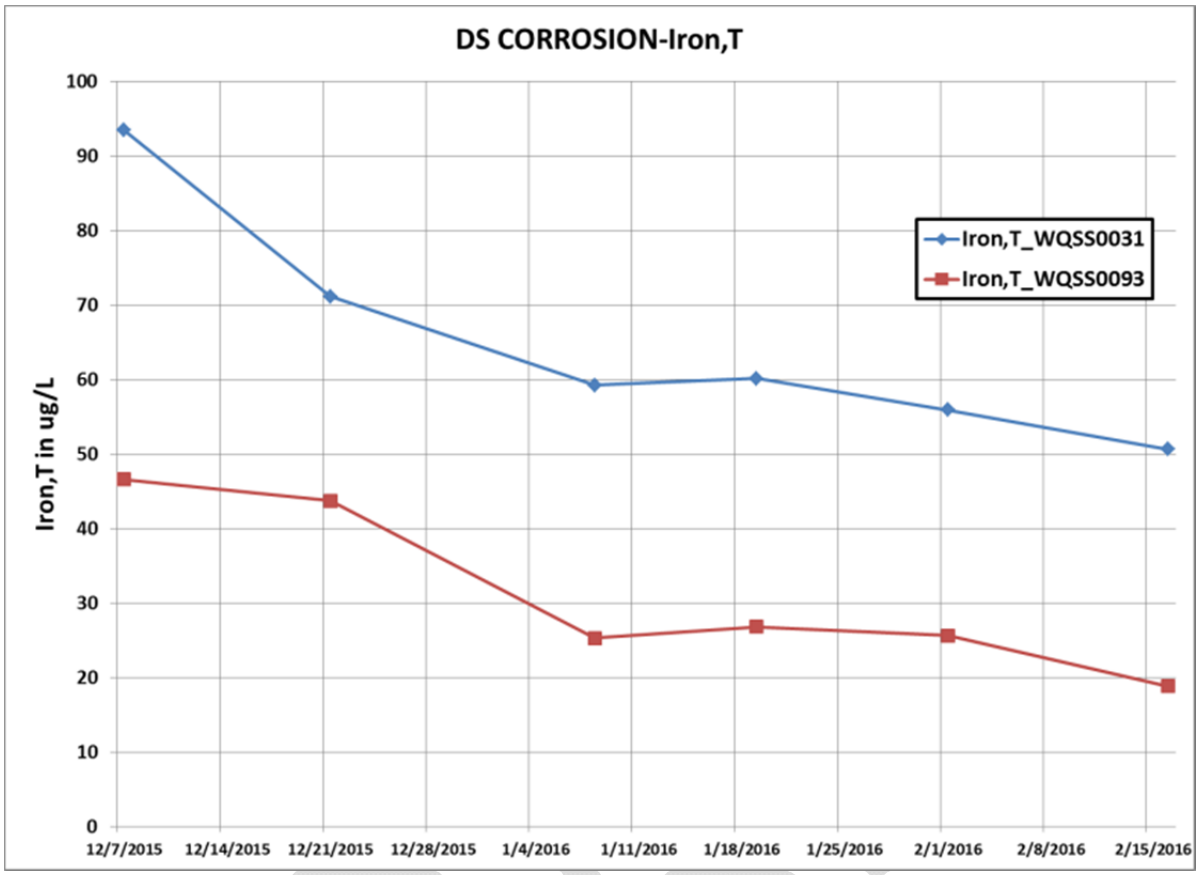

Figure 21 Total iron concentration for the extended WQSS during Q1 2016.

The metals concentration followed the same temporal trend as the turbidity. Note that aluminum and manganese data follow the same trends as iron and are not shown here.

2.8.4 Summary of PRS monitoring station and extended WQSS data

In summary, the following observations were made from a review of the PRS monitoring station and extended WQSS data:

- In most samples lead release was approximately evenly attributable to soluble and particulate lead.
- Spikes in lead observed were associated with particulate lead. The spikes in lead were associated with similar spikes in aluminum, iron, and manganese indicated release of these metal scales is responsible for the spikes in lead. Particulate lead release correlated strongly with iron, manganese, aluminum, and turbidity.
- Significant differences in lead release between different monitoring station locations were not observed.
- The extended WQSS data suggest that iron, manganese, and aluminum were elevated (compared to background levels) in the distribution system during November and December as were

associated with the elevated turbidity observed at the TCR sites. These metals were well below associated secondary MCLs.

- Lead at the extended WQSS provides an indication for the amount of lead originating from the distribution system itself. Total lead was generally less than 0.2 ug/L in these samples, and mostly in dissolved form.

2.9 QA/QC DATA

QA/QC data is collected regularly to ensure accuracy of the results. QA/QC data was still being evaluated at the time this report was prepared and will be evaluated in more detail in the next quarterly report.

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3 Preliminary Observations

This section identifies the major observations made during this quarter.

3.1 DEVIATIONS FROM SAMPLING PLAN

The following deviations to the sampling plan occurred during this monitoring period:

- Follow on sampling at residential customer homes was not performed this monitoring period.

3.2 FIELD SAMPLING NOTES AND OBSERVATIONS

Field sampling was conducted according to the monitoring plan.

3.3 LAB ANALYSIS NOTES AND OBSERVATIONS

Laboratory analysis was conducted according to the monitoring plan. There were no anomalies in laboratory data to be reported.

3.4 SUMMARY OF DATA TRENDS

Data trends which are indicative of specific mechanisms of lead release are identified below. The intention of this section of the report is to identify trends in the data from this monitoring period which should continue to be observed throughout the remaining monitoring quarters. Sufficient data may not yet be available to draw final conclusions about what mechanisms are or are not contributing to lead release throughout the Portland water system. Any conclusions or extrapolation of the current data will be reserved for the final report after one full year of data is evaluated.

3.4.1 Uniform corrosion

Approximately 50% of the total lead observed in the PRS monitoring station test chamber effluent was in the dissolved form, indicating solubility processes are occurring. However, no correlations were observed between lead release and the water quality parameters that describe uniform corrosion. Further data will need to be collected to determine if uniform corrosion parameters are influencing lead release in the Portland water system.

The sample analysis from residential customer homes anticipated to be conducted during the next quarter will help provide additional data related to the impact of uniform corrosion on lead release.

3.4.2 Biostability

Lead release appears positively correlated with dissolved organic carbon DOC, ammonia release, and negatively correlated with disinfectant residual in the PRS monitoring station data. Lead release did not appear to correlate with other parameters which describe biostability, such as ATP. More data will need to be collected to determine the extent to which microbial processes are contributing towards lead release.

The sample analysis from residential customer homes anticipated to be conducted during the next quarter will help provide additional data related to the impact of biostability on lead release.

3.4.3 Scale release

Particulate lead release accounted for approximately 50% of the total lead release observed in most of the test chambers. Occasional spikes in total lead observed in the test chamber effluents were

predominantly in the particulate form. These spikes in lead were strongly associated with similar spikes in particulate iron, manganese, and aluminum, indicating that release of these metal scales is contributing to the lead spikes observed in the PRS monitoring station test chambers. The spike in particulate metals coming off of the test chambers indicate that the metals are sorbing to the lead material in the chambers, and then releasing together with particulate lead. Lead appears to be positively correlated with turbidity and particulate metals from the data, though more data should be collected in future monitoring periods to validate this initial trend.

A review of TCR data indicates that the turbidity throughout the distribution system increased in November and December. The same pattern observed at distribution sites was observed at Powell Butte ("entry point" for the purposes of this study), indicating that the turbidity is originating from the source water as opposed to the distribution system itself. The elevated turbidity was associated with higher concentrations of aluminum, iron, and manganese in the distribution system, as measured at the PRS monitoring station inlets and the extended WQSS.

The sample analysis from residential customer homes anticipated to be conducted during the next quarter will help provide additional data related to the impact of metal scales on lead release.

3.4.4 Lead release in the distribution system

Lead concentrations were monitored at WQSS and PRS monitoring station inlets to determine if there are any significant sources of lead from the actual distribution system (as opposed to service line and customer premise plumbing). Lead was typically below 0.2 ug/L in these samples, and mostly in the dissolved form. Lead will continue to be monitored at the extended WQSS and monitoring station inlets during Q2 2016 and will provide additional information related to lead release in the distribution system.

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4 Next Quarter Look-Ahead

4.1 RECOMMENDED CHANGES FOR NEXT QUARTER

The following are recommended changes to the monitoring plan based upon the data analyzed this monitoring period.

- Prioritize residential customer water chemistry and lead sampling during the next quarter. This data set gives the most direct measure of actual lead release mechanisms in the Portland water system. Consider returning to LCR homes soon after compliance samples are collected to conduct additional testing. The PWB may wish to extend the protocol to include home profile testing (analyzing more than just the first draw sample).
- Discontinue the measurement of cadmium, chromium, cobalt, as they are found at concentrations below the detection levels.
- Continue monitoring for remaining parameters at the frequencies described in TM2.
- Consider using GIS analysis using the locations of the sampling stations to determine any spatial patterns of water quality changes described in this quarterly report.

4.2 ANTICIPATED PROJECT SCHEDULE

The following outlines the next steps in the PWB Water Quality and Corrosion Study.

- The Q2 2016 quarterly report will be prepared covering data collecting from March through June, 2016.
- PWB to collect its next round of LCR compliance in April 2016. Results will be presented in the Q2 2016 quarterly report
- Final report and workshop to be scheduled after Q4 2016 data are analyzed

DRAFT

Abigail Cantor
Process Research Solutions, LLC
April 18, 2016

Appendix A - Box and Whisker Plots

Every set of data has its own distribution of values. Two sets of data may have the same average value but one set may have a higher maximum. Or, one set may have more of its data in a certain smaller range. It is good to compare datasets by their distributions to get a complete picture of similarities or dissimilarities between the situations that produced the data.

A set of data can be described using five parameters:

1. Minimum value
2. Maximum value
3. Middle value (median)
4. A value that divides the data between the median and the minimum
5. A value that divides the data between the median and the maximum

There are several statistical methods by which to determine the dividing points. It is important to be consistent in which technique is used in a project so that all datasets are compared in the same way.

There is another option to add to the Box and Whisker Plots. That is, instead of just dividing the data between the median and the maximum and the median and the minimum, a "reasonable" value can be calculated as a maximum and also a minimum of the dataset. Then, any actual value outside of these "reasonable" boundaries can be viewed as "outliers".

To define this "reasonable" range, the "interquartile range" or IQR is calculated for a box plot. This is the difference between the value of the third quartile and the value of the first quartile. It has been defined that any outlier is a value that lies outside 1.5 times the IQR. (1.5 is an arbitrary value but has been used since John Tukey, a statistician, introduced the technique in 1977.) Values at over 3.0 times the IQR are "extreme outliers".

On the Box and Whisker Plots used in this project, an outlier is denoted by "x". An extreme outlier is denoted by "o".

Features of the Box and Whisker Plot are:

- X=extreme outlier
- O=outlier
- T or upside down T= maximum or minimum value that is not an outlier. It is either the actual maximum or minimum value of the dataset when no outliers are present or 1.5* IQR when outliers are present.
- Bottom line of the 'box'=First quartile value
- Middle line of the 'box'=Second quartile value (median)
- Top line of the 'box'=Third quartile value
- Third quartile value minus First quartile value = interquartile range (IQR)

Appendix B - Corrosion Study Operations Log

Start Date	End Date	Event	Questions/Comments
11/2/2009	present	Reservoir 6 South Cell off line PERMANENTLY	date is approximate
10/1/2010	present	Reservoir 6 North Cell off line PERMANENTLY	
7/20/2011	7/21/2011	Reservoir 3 out of service	
7/21/2011	11/8/2011	Reservoir 3 in service	
9/9/2011	present	Reservoir 4 off line PERMANENTLY	
11/8/2011	3/23/2012	Reservoir 3 out of service	
1/21/2012	1/31/2012	Turbidity event in watershed; Groundwater activated	Range of Daily GW Production: 18 - 83.6 MGD; Total Volume Pumped: 0.82 BG
2/23/2012	2/27/2012	Turbidity event in watershed; Groundwater activated	Range of Daily GW Production: 23.6 - 52.4 MGD; Total Volume Pumped: 0.22 BG
3/23/2012	7/20/2012	Reservoir 3 in service	
7/20/2012	8/3/2012	Reservoir 3 out of service	
8/3/2012	10/18/2012	Reservoir 3 in service	
8/6/2012	8/23/2012	Groundwater Maintenance Operation	Range of Daily GW Production: 0-5 MGD; Total Volume Pumped: 0.03 BG
10/18/2012	4/22/2013	Reservoir 3 out of service	
4/22/2013	6/12/2013	Reservoir 3 in service	
6/12/2013	7/3/2013	Reservoir 3 out of service	
7/3/2013	9/18/2013	Reservoir 3 in service	
7/30/2013	8/8/2013	Groundwater Maintenance Run for summer 2013	Range of Daily GW Production: 0-5 MGD; Total Volume Pumped: 0.03 BG
9/1/2013	present	Switched from a systematic flushing program to a targeted flushing program due to Berth TC event	
9/18/2013	present	Reservoir 3 out of service	
10/2/2013	12/3/2013	Increased target chlorine residual at Lusted Hill from 1.8 mg/L to 3.0 mg/L.	
12/4/2013	1/16/2014	Reduced target chlorine residual at Lusted Hill from 3.0 mg/L to 2.5 mg/L.	
1/16/2014	6/10/2014	Reduced target chlorine residual at Lusted Hill from 2.5 mg/L to 2.2 mg/L.	
5/19/2014	6/29/2015	Powell Butte floating on the inlet or outlet main to permit thrust harness replacement at 162nd Ave. conduit interties.	
3/10/2014	3/12/2014	Testing of Dam 2 North Tower gates	
4/1/2014	present	Began using Dam 2 North Tower gates	see "North Tower Gate Positions" for gates in use and percent open

6/6/2014	6/6/2014	Inadvertent opening of N. Tower lower gate	A few hours only and resulted in lower water temps and increased chlorine demand
6/10/2014	12/9/2014	Increased target chlorine residual at Lusted Hill from 2.2 mg/L to 2.5 mg/L.	
7/9/2014		Powell Butte II West Cell was placed into service.	
7/1/2014	7/9/2014	Groundwater Maintenance Operation + supplemental supply due to Conduit 3 break/repair.	Range of Daily GW Production: 0-27.8 MGD; Total Volume Pumped: 0.12 BG
7/28/2014	11/19/15	Powell Butte 1 South Cell out of service	
8/15/2014		Powell Butte II East Cell placed into service	
10/28/2014	11/19/15	Powell Butte 1 North Cell out of service	
10/29/2014	11/14/2014	Switched from N. Tower to S. Tower during this period	Sheen on Diversion Pool; related to Powerhouse 2 Operations
12/9/2014	6/8/2015	Reduced target chlorine residual at Lusted Hill from 2.5 mg/L to 2.2 mg/L.	
12/23/2014	12/29/2014	Increase in turbidity at Diversion Pool	Elevated turbidity also observed at upper elevations in Reservoir 2. Switched from N. Tower to S. Tower during this period to pull water from lower elevations.
2/26/2015	present	Westside connected directly to Conduit 2 and/or 3	
5/11/2015	present	New regulator was activated. It supplies WP229 and Palatine area from 30" Tabor 411 bridge crossing to 16" main in SW Macadam Ave. Regulator is called ***SW***	Keep for now; may not be relevant to corrosion study
6/1/2015	11/1/2015	Seasonal mitigation of nitrification by managing storage	Approximate dates
6/8/2015	12/16/2015	Increased target chlorine residual at Lusted Hill from 2.2 mg/L to 2.5 mg/L.	
6/11/2015	6/29/2015	Groundwater activated to meet system demands due to scheduled work on conduit #4; also used as annual GW maintenance run	See demand sheet for % supply from GW.
6/30/2015	7/15/2015	Groundwater off	
6/29/2015	present	Powell Butte returned to normal operation with separate inlet & outlet mains. (End of Powell Butte float for thrust harness project at 162nd Ave conduit interties)	
7/15/2015	present	Stopped booster chlorination at Washington Park	
7/16/2015	11/4/2015	Groundwater re-started for summer supply	See Demand spreadsheet for % supply from GW.
8/6/2015	present	Reservoir 1 taken out of service	
11/3/2015	11/18/2015	Partial use of S. Tower during this period	Sheen on Diversion Pool; related to operation of North Howell Bunger Valves
11/4/2015		Groundwater off, no longer needed for summer supply	
11/19/2015	2/4/2016	Powell Butte 1 (North & South cells) in service	
12/2/2015	present	Reservoir 5 off line PERMANENTLY	
12/16/2015	present	Reduced chlorine dosing target to achieve 2.2 mg/L at Lusted Hill	
2/4/2016	present	Powell Butte 1 (North & South cells) taken out of serivce	

Oregon Public Health
Drinking Water Data Online

Oregon Health Authority

Introduction :: Data Search Options :: WS Name Look Up :: WS ID Look Up :: DWS Home :: Quick Data Links

PWS ID: 00657 ---- PORTLAND WATER BUREAU

Action Levels: Lead = 0.015 mg/L; Copper = 1.3 mg/L
ND = Not detected at the minimum reporting level; -- = Not sampled

Return to summary results

Lead and Copper Sample Monitoring Details

Sample ID	Sample Date	Received Date	Sample Point	Lead (mg/L)	Copper (mg/L)	Notes
BB78619P10	10/26/16	11/18/16	DIST-A	0.0072100	0.1210000	
BB78620P1	10/26/16	11/18/16	DIST-A	0.0123000	0.2290000	
BB78622P8	10/26/16	11/18/16	DIST-A	0.0116000	0.1220000	
BB78623P9	10/26/16	11/18/16	DIST-A	0.0031600	0.1350000	
BB78624P10	10/26/16	11/18/16	DIST-A	0.0055300	0.2300000	
BB78625P11	10/26/16	11/18/16	DIST-A	0.0013500	0.0925000	
BB78626P1	10/26/16	11/18/16	DIST-A	0.0030300	0.0686000	
BB78627P2	10/26/16	11/18/16	DIST-A	**0.0303000**	0.3150000	
BB78621P2	10/25/16	11/18/16	DIST-A	0.0039900	0.4120000	
BB78600P4	10/25/16	11/18/16	DIST-A	0.0009000	0.0993000	
BB78618P7	10/25/16	11/18/16	DIST-A	0.0032700	0.1030000	
BB78592P6	10/24/16	11/18/16	DIST-A	0.0056100	0.1010000	
BB78587P6	10/22/16	11/18/16	DIST-A	0.0019600	0.0610000	
BB78461P6	10/20/16	11/18/16	DIST-A	0.0006700	0.0511000	
BB78598P1	10/19/16	11/18/16	DIST-A	0.0022500	0.2570000	
BB78423P4	10/19/16	11/18/16	DIST-A	0.0031800	0.1320000	
BB78424P5	10/19/16	11/18/16	DIST-A	**0.0252000**	0.1510000	
BB78425P6	10/19/16	11/18/16	DIST-A	**0.0164000**	0.5220000	
BB78426P7	10/19/16	11/18/16	DIST-A	0.0038400	0.6570000	
BB78427P8	10/19/16	11/18/16	DIST-A	0.0007800	0.1290000	
BB78429P10	10/19/16	11/18/16	DIST-A	0.0143000	0.5340000	
BB78430P1	10/19/16	11/18/16	DIST-A	0.0093700	0.1710000	
BB78431P2	10/19/16	11/18/16	DIST-A	**0.0320000**	0.1610000	
BB78460P5	10/19/16	11/18/16	DIST-A	0.0030800	0.0737000	
BB78464P9	10/19/16	11/18/16	DIST-A	0.0067500	0.2260000	
BB78465P10	10/19/16	11/18/16	DIST-A	0.0098400	0.2410000	
BB78475P6	10/19/16	11/18/16	DIST-A	0.0150000	0.2310000	
BB78476P7	10/19/16	11/18/16	DIST-A	0.0078100	0.2730000	
BB78477P8	10/19/16	11/18/16	DIST-A	0.0016100	0.0286000	
BB78478P9	10/19/16	11/18/16	DIST-A	0.0029400	0.1500000	
BB78479P10	10/19/16	11/18/16	DIST-A	0.0023500	0.0550000	
BB78633P8	10/19/16	11/18/16	DIST-A	0.0021800	0.1110000	
BB78574P9	10/19/16	11/18/16	DIST-A	0.0003600	0.0172000	
BB78578P3	10/19/16	11/18/16	DIST-A	0.0027400	0.1160000	
BB78609P2	10/19/16	11/18/16	DIST-A	0.0124000	0.1100000	
BB78480P7	10/19/16	11/18/16	DIST-A	0.0095900	0.3100000	
BB78581P8	10/19/16	11/18/16	DIST-A	0.0082200	0.1110000	
BB78602P9	10/19/16	11/18/16	DIST-A	0.0036400	0.0360000	
BB78588P7	10/19/16	11/18/16	DIST-A	0.0026700	0.0993000	
BB78483P3	10/19/16	11/18/16	DIST-A	0.0084800	0.5280000	
BB78486P5	10/19/16	11/18/16	DIST-A	0.0111000	0.2820000	
BB78594P8	10/19/16	11/18/16	DIST-A	0.0003700	0.2620000	
BB78596P10	10/19/16	11/18/16	DIST-A	0.0001400	0.0209000	
BB78421P2	10/18/16	11/18/16	DIST-A	0.0106000	0.4240000	

BB78433P4	10/18/16	11/18/16	DIST-A	0.0005300	0.4680000
BB78463P8	10/18/16	11/18/16	DIST-A	0.0047900	0.2460000
BB78466P1	10/18/16	11/18/16	DIST-A	0.0012300	0.0238000
BB78470P5	10/18/16	11/18/16	DIST-A	0.0060200	0.1470000
BB78471P6	10/18/16	11/18/16	DIST-A	0.0079700	0.0985000
BB78472P7	10/18/16	11/18/16	DIST-A	0.0069900	0.3230000
BB78473P8	10/18/16	11/18/16	DIST-A	**0.0244000**	0.1000000
BB78557P9	10/18/16	11/18/16	DIST-A	0.0040200	0.2040000
BB78558P10	10/18/16	11/18/16	DIST-A	**0.0194000**	0.4650000
BB78559P1	10/18/16	11/18/16	DIST-A	0.0047900	0.0429000
BB78560P2	10/18/16	11/18/16	DIST-A	0.0013700	0.0461000
BB78561P3	10/18/16	11/18/16	DIST-A	0.0002800	0.0069000
BB78562P4	10/18/16	11/18/16	DIST-A	0.0026600	0.0593000
BB78564P6	10/18/16	11/18/16	DIST-A	0.0032200	0.1220000
BB78565P7	10/18/16	11/18/16	DIST-A	0.0016300	0.1060000
BB78566P8	10/18/16	11/18/16	DIST-A	0.0006600	0.0922000
BB78474P9	10/18/16	11/18/16	DIST-A	0.0028800	0.0972000
BB78599P3	10/18/16	11/18/16	DIST-A	**0.0231000**	0.2750000
BB78601P5	10/18/16	11/18/16	DIST-A	**0.0176000**	0.2340000
BB78567P1	10/18/16	11/18/16	DIST-A	0.0022300	0.1500000
BB78568P2	10/18/16	11/18/16	DIST-A	0.0033100	0.1280000
BB78569P3	10/18/16	11/18/16	DIST-A	0.0040100	0.1730000
BB78570P4	10/18/16	11/18/16	DIST-A	0.0018700	0.1060000
BB78571P5	10/18/16	11/18/16	DIST-A	0.0118000	0.1020000
BB78572P6	10/18/16	11/18/16	DIST-A	0.0013100	0.0268000
BB78573P7	10/18/16	11/18/16	DIST-A	0.0001000	0.0106000
BB78575P10	10/18/16	11/18/16	DIST-A	0.0015400	0.0462000
BB78576P1	10/18/16	11/18/16	DIST-A	0.0046600	0.1270000
BB78577P2	10/18/16	11/18/16	DIST-A	0.0052900	0.2010000
BB78579P4	10/18/16	11/18/16	DIST-A	0.0012700	0.0178000
BB78580P5	10/18/16	11/18/16	DIST-A	0.0007000	0.1570000
BB78603P6	10/18/16	11/18/16	DIST-A	0.0029000	0.0608000
BB78604P7	10/18/16	11/18/16	DIST-A	0.0017900	0.1440000
BB78605P8	10/18/16	11/18/16	DIST-A	0.0020700	0.1780000
BB78606P9	10/18/16	11/18/16	DIST-A	0.0028900	0.2690000
BB78607P10	10/18/16	11/18/16	DIST-A	0.0031300	0.2020000
BB78608P1	10/18/16	11/18/16	DIST-A	0.0060500	0.1450000
BB78610P3	10/18/16	11/18/16	DIST-A	0.0045000	0.1110000
BB78611P4	10/18/16	11/18/16	DIST-A	0.0090000	0.2090000
BB78612P5	10/18/16	11/18/16	DIST-A	0.0009800	0.0146000
BB78613P6	10/18/16	11/18/16	DIST-A	0.0119000	0.1300000
BB78481P10	10/18/16	11/18/16	DIST-A	0.0021100	0.0837000
BB78582P1	10/18/16	11/18/16	DIST-A	0.0114000	0.2040000
BB78583P2	10/18/16	11/18/16	DIST-A	0.0018500	0.0848000
BB78584P3	10/18/16	11/18/16	DIST-A	0.0038500	0.1190000
BB78585P4	10/18/16	11/18/16	DIST-A	0.0003100	0.0545000
BB78586P5	10/18/16	11/18/16	DIST-A	0.0017700	0.1340000
BB78589P8	10/18/16	11/18/16	DIST-A	0.0030700	0.1060000
BB78590P9	10/18/16	11/18/16	DIST-A	0.0088700	0.0433000
BB78482P10	10/18/16	11/18/16	DIST-A	0.0036900	0.0969000
BB78614P1	10/18/16	11/18/16	DIST-A	**0.0321000**	0.1850000
BB78616P4	10/18/16	11/18/16	DIST-A	**0.0210000**	0.1990000
BB78591P5	10/18/16	11/18/16	DIST-A	0.0033100	0.1680000
BB78617P6	10/18/16	11/18/16	DIST-A	**0.0194000**	0.3190000
BB78484P3	10/18/16	11/18/16	DIST-A	0.0046000	0.1240000

BB78485P4	10/18/16	11/18/16	DIST-A	**0.0830000**	0.1870000	
BB78593P7	10/18/16	11/18/16	DIST-A	0.0090800	0.1250000	
BB78595P9	10/18/16	11/18/16	DIST-A	**0.0283000**	0.1390000	
BB78597P11	10/18/16	11/18/16	DIST-A	0.0007000	0.0473000	
BB78422P3	10/17/16	11/18/16	DIST-A	0.0025300	0.1390000	
BB78428P9	10/17/16	11/18/16	DIST-A	0.0154000	0.2430000	
BB78468P3	10/17/16	11/18/16	DIST-A	0.0029900	0.1670000	
BB78469P4	10/17/16	11/18/16	DIST-A	0.0022900	0.1060000	
BB78563P5	10/17/16	11/18/16	DIST-A	0.0012400	0.0285000	
BB78615P2	10/17/16	11/18/16	DIST-A	0.0015200	0.1990000	
BB78432P3	10/16/16	11/18/16	DIST-A	0.0005900	0.2040000	
BB78462P7	10/15/16	11/18/16	DIST-A	0.0051000	0.4450000	
BB78467P2	10/15/16	11/18/16	DIST-A	0.0011500	0.0177000	
BB62516	04/27/16	06/10/16	DIST-A	0.0050600	0.0974000	
BB62368	04/26/16	06/10/16	DIST-A	0.0116000	0.0910000	
BB62370	04/26/16	06/10/16	DIST-A	**0.0195000**	0.3700000	
BB62322	04/21/16	06/10/16	DIST-A	0.0004500	0.0772000	
BB62343	04/21/16	06/10/16	DIST-A	0.0010900	0.0321000	
BB62488	04/21/16	06/10/16	DIST-A	0.0022700	0.2090000	
BB62376	04/21/16	06/10/16	DIST-A	0.0108000	0.1400000	
BB62524	04/21/16	06/10/16	DIST-A	0.0014500	0.0907000	
BB62526	04/21/16	06/10/16	DIST-A	0.0028100	0.0965000	
BB62312	04/21/16	06/10/16	DIST-A	0.0011100	0.1730000	
BB62314	04/21/16	06/10/16	DIST-A	**0.0206000**	0.1170000	
BB62321	04/20/16	06/10/16	DIST-A	**0.0426000**	0.2090000	
BB62326	04/20/16	06/10/16	DIST-A	0.0003300	0.3950000	
BB62344	04/20/16	06/10/16	DIST-A	0.0028900	0.1580000	
BB62324	04/20/16	06/10/16	DIST-A	0.0012400	0.0494000	
BB62491	04/20/16	06/10/16	DIST-A	0.0008600	0.0367000	
BB62492	04/20/16	06/10/16	DIST-A	0.0000700	0.0026000	
BB62494	04/20/16	06/10/16	DIST-A	0.0015000	0.0378000	
BB62496	04/20/16	06/10/16	DIST-A	0.0071700	0.2040000	
BB62514	04/20/16	06/10/16	DIST-A	0.0010700	0.1410000	
BB62517	04/20/16	06/10/16	DIST-A	0.0022400	0.2690000	
BB62381	04/20/16	06/10/16	DIST-A	0.0118000	0.1850000	
BB62521	04/20/16	06/10/16	DIST-A	0.0002100	0.0043000	
BB62528	04/20/16	06/10/16	DIST-A	0.0038500	0.0782000	
BB62311	04/20/16	06/10/16	DIST-A	0.0023300	0.2380000	
BB62315	04/20/16	06/10/16	DIST-A	0.0114000	0.4020000	
BB62316	04/20/16	06/10/16	DIST-A	0.0031600	0.5890000	
BB62317	04/20/16	06/10/16	DIST-A	0.0042000	0.4360000	
BB62318	04/20/16	06/10/16	DIST-A	0.0086700	0.2490000	
BB62319	04/20/16	06/10/16	DIST-A	**0.0177000**	0.2880000	
BB62320	04/20/16	06/10/16	DIST-A	0.0079100	0.1560000	
BB62328	04/19/16	06/10/16	DIST-A	0.0002900	0.0197000	
BB62329	04/19/16	06/10/16	DIST-A	0.0037400	0.2660000	
BB62331	04/19/16	06/10/16	DIST-A	0.0131000	0.1920000	
BB62323	04/19/16	06/10/16	DIST-A	0.0038500	0.0117000	
BB62333	04/19/16	06/10/16	DIST-A	0.0021100	0.1660000	
BB62336	04/19/16	06/10/16	DIST-A	0.0024300	0.1620000	
BB62337	04/19/16	06/10/16	DIST-A	0.0008900	0.1630000	
BB62339	04/19/16	06/10/16	DIST-A	0.0018000	0.0972000	
BB62473	04/19/16	06/10/16	DIST-A	0.0039600	0.1800000	

BB62474	04/19/16	06/10/16	DIST-A	0.0038600	0.0867000
BB62475	04/19/16	06/10/16	DIST-A	0.0012300	0.0342000
BB62476	04/19/16	06/10/16	DIST-A	0.0003400	0.0020000
BB62477	04/19/16	06/10/16	DIST-A	0.0017300	0.0163000
BB62479	04/19/16	06/10/16	DIST-A	0.0006000	0.0534000
BB62480	04/19/16	06/10/16	DIST-A	0.0000800	0.1460000
BB62481	04/19/16	06/10/16	DIST-A	0.0022900	0.1370000
BB62482	04/19/16	06/10/16	DIST-A	0.0011800	0.0752000
BB62483	04/19/16	06/10/16	DIST-A	0.0003200	0.0516000
BB62367	04/19/16	06/10/16	DIST-A	**0.0279000**	0.4770000
BB62369	04/19/16	06/10/16	DIST-A	0.0006200	0.0983000
BB62341	04/19/16	06/10/16	DIST-A	0.0069300	0.2430000
BB62342	04/19/16	06/10/16	DIST-A	0.0119000	0.2220000
BB62484	04/19/16	06/10/16	DIST-A	0.0021800	0.0504000
BB62485	04/19/16	06/10/16	DIST-A	0.0021900	0.1750000
BB62486	04/19/16	06/10/16	DIST-A	0.0021100	0.1050000
BB62487	04/19/16	06/10/16	DIST-A	0.0138000	0.1380000
BB62489	04/19/16	06/10/16	DIST-A	0.0010500	0.1170000
BB62490	04/19/16	06/10/16	DIST-A	**0.1130000**	0.9410000
BB62493	04/19/16	06/10/16	DIST-A	0.0014400	0.0710000
BB62495	04/19/16	06/10/16	DIST-A	0.0029700	0.0247000
BB62513	04/19/16	06/10/16	DIST-A	0.0049700	0.1910000
BB62515	04/19/16	06/10/16	DIST-A	0.0007300	0.0106000
BB62371	04/19/16	06/10/16	DIST-A	0.0010200	0.0653000
BB62372	04/19/16	06/10/16	DIST-A	0.0014000	0.1180000
BB62373	04/19/16	06/10/16	DIST-A	0.0014700	0.0869000
BB62374	04/19/16	06/10/16	DIST-A	0.0019600	0.2870000
BB62375	04/19/16	06/10/16	DIST-A	0.0040700	0.1270000
BB62377	04/19/16	06/10/16	DIST-A	0.0054900	0.1570000
BB62378	04/19/16	06/10/16	DIST-A	0.0009300	0.1350000
BB62379	04/19/16	06/10/16	DIST-A	0.0007000	0.0101000
BB62380	04/19/16	06/10/16	DIST-A	0.0150000	0.1190000
BB62071	04/19/16	06/10/16	DIST-A	0.0052500	0.2560000
BB62518	04/19/16	06/10/16	DIST-A	0.0099200	0.0972000
BB62073	04/19/16	06/10/16	DIST-A	0.0027800	0.1620000
BB62382	04/19/16	06/10/16	DIST-A	0.0057500	0.1160000
BB62383	04/19/16	06/10/16	DIST-A	0.0009600	0.1730000
BB62519	04/19/16	06/10/16	DIST-A	0.0064300	0.2010000
BB62520	04/19/16	06/10/16	DIST-A	0.0027100	0.0300000
BB62522	04/19/16	06/10/16	DIST-A	0.0021300	0.1310000
BB62523	04/19/16	06/10/16	DIST-A	0.0001600	0.0344000
BB62525	04/19/16	06/10/16	DIST-A	0.0027300	0.1540000
BB62527	04/19/16	06/10/16	DIST-A	0.0030200	0.1230000
BB62345	04/19/16	06/10/16	DIST-A	0.0050300	0.1710000
BB62384	04/19/16	06/10/16	DIST-A	**0.0388000**	0.0989000
BB62074	04/19/16	06/10/16	DIST-A	0.0071600	0.5220000
BB62385	04/19/16	06/10/16	DIST-A	0.0074900	0.1220000
BB62529	04/19/16	06/10/16	DIST-A	0.0028800	0.0899000
BB62313	04/19/16	06/10/16	DIST-A	0.0049400	0.1280000
BB62325	04/18/16	06/10/16	DIST-A	0.0001200	0.1430000
BB62338	04/18/16	06/10/16	DIST-A	0.0036400	0.3850000
BB62512	04/18/16	06/10/16	DIST-A	0.0130000	0.2460000
BB62478	04/18/16	06/10/16	DIST-A	0.0007000	0.0425000
BB62340	04/18/16	06/10/16	DIST-A	0.0013800	0.0942000

BB62330	04/17/16	06/10/16	DIST-A	0.0018800	0.1020000	
BB62332	04/16/16	06/10/16	DIST-A	0.0011200	0.0174000	
BB62327	04/15/16	06/10/16	DIST-A	0.0030000	0.2880000	
BB62334	04/15/16	06/10/16	DIST-A	0.0012000	0.1090000	
BB62067	04/14/16	06/10/16	DIST-A	0.0117000	0.0866000	
BB62066	04/14/16	06/10/16	DIST-A	0.0105000	0.1930000	
BB62068	04/14/16	06/10/16	DIST-A	0.0019100	0.0991000	
BB62069	04/14/16	06/10/16	DIST-A	0.0020600	0.3500000	
BB62070	04/14/16	06/10/16	DIST-A	0.0026400	0.0348000	
BB62072	04/13/16	06/10/16	DIST-A	0.0027700	0.0307000	
BB62052	03/17/16	06/10/16	DIST-A	**0.6480000**	0.1220000	
BB62048	03/16/16	06/10/16	DIST-A	0.0009600	0.0470000	
BB62049	03/16/16	06/10/16	DIST-A	0.0015800	0.0419000	
BB62050	03/16/16	06/10/16	DIST-A	0.0035500	0.0158000	
BB62051	03/16/16	06/10/16	DIST-A	**0.0384000**	0.0481000	
BB62053	03/16/16	06/10/16	DIST-A	0.0004300	0.1340000	
BB62054	03/16/16	06/10/16	DIST-A	0.0087200	0.0625000	
BB62057	03/16/16	06/10/16	DIST-A	0.0007200	0.0153000	
BB62055	03/15/16	06/10/16	DIST-A	0.0007500	0.0238000	
BB62056	03/15/16	06/10/16	DIST-A	0.0013200	0.1380000	
BB57545	11/12/15	01/08/16	DIST-A	**0.0306000**	0.1850000	
BB57579	11/12/15	01/08/16	DIST-A	0.0084000	0.3460000	
BB57573	11/09/15	01/08/16	DIST-A	0.0052000	0.1510000	
BB57543	11/08/15	01/08/16	DIST-A	0.0039900	0.3400000	
BB57540	11/06/15	01/08/16	DIST-A	0.0008700	0.0174000	
BB57541	11/06/15	01/08/16	DIST-A	0.0129000	0.2350000	
BB57542	11/06/15	01/08/16	DIST-A	0.0030100	0.1660000	
BB57549	11/05/15	01/08/16	DIST-A	0.0004000	0.0193000	
BB57552	11/05/15	01/08/16	DIST-A	0.0006100	0.0099000	
BB57553	11/05/15	01/08/16	DIST-A	0.0049500	0.0366000	
BB57548	11/05/15	01/08/16	DIST-A	0.0037300	0.0784000	
BB57294	11/05/15	01/08/16	DIST-A	0.0055500	0.3290000	
BB57296	11/05/15	01/08/16	DIST-A	0.0131000	0.1330000	
BB57307	11/05/15	01/08/16	DIST-A	0.0023300	0.2520000	
BB57560	11/05/15	01/08/16	DIST-A	0.0067500	0.1140000	
BB57565	11/05/15	01/08/16	DIST-A	0.0040200	0.0509000	
BB57566	11/05/15	01/08/16	DIST-A	0.0109000	0.1280000	
BB57571	11/05/15	01/08/16	DIST-A	0.0123000	0.3950000	
BB57580	11/05/15	01/08/16	DIST-A	0.0040100	0.0474000	
BB57233	11/04/15	01/08/16	DIST-A	0.0030900	0.2540000	
BB57235	11/04/15	01/08/16	DIST-A	0.0034600	0.1200000	
BB57237	11/04/15	01/08/16	DIST-A	**0.0196000**	0.5020000	
BB57238	11/04/15	01/08/16	DIST-A	0.0014600	0.0874000	
BB57537	11/04/15	01/08/16	DIST-A	0.0041200	0.3640000	
BB57241	11/04/15	01/08/16	DIST-A	0.0141000	0.1600000	
BB57243	11/04/15	01/08/16	DIST-A	**0.0174000**	0.1350000	
BB57244	11/04/15	01/08/16	DIST-A	0.0002900	0.0216000	
BB57245	11/04/15	01/08/16	DIST-A	0.0016900	0.1610000	
BB57248	11/04/15	01/08/16	DIST-A	0.0047600	0.2680000	
BB57258	11/04/15	01/08/16	DIST-A	0.0044900	0.3140000	
BB57284	11/04/15	01/08/16	DIST-A	0.0001500	0.1620000	
BB57289	11/04/15	01/08/16	DIST-A	0.0015300	0.0320000	

BB57290	11/04/15	01/08/16	DIST-A	0.0042300	0.2060000
BB57291	11/04/15	01/08/16	DIST-A	0.0028800	0.0681000
BB57293	11/04/15	01/08/16	DIST-A	0.0033700	0.1560000
BB57298	11/04/15	01/08/16	DIST-A	0.0001400	0.0093000
BB57299	11/04/15	01/08/16	DIST-A	0.0037000	0.1130000
BB57304	11/04/15	01/08/16	DIST-A	0.0006200	0.0111000
BB57556	11/04/15	01/08/16	DIST-A	0.0019400	0.1340000
BB57562	11/04/15	01/08/16	DIST-A	0.0010100	0.1020000
BB57569	11/04/15	01/08/16	DIST-A	0.0013100	0.0378000
BB57570	11/04/15	01/08/16	DIST-A	0.0033100	0.1500000
BB57311	11/04/15	01/08/16	DIST-A	0.0004200	0.0184000
BB57312	11/04/15	01/08/16	DIST-A	0.0031400	0.1480000
BB57316	11/04/15	01/08/16	DIST-A	0.0030500	0.1790000
BB57578	11/04/15	01/08/16	DIST-A	0.0018100	0.3370000
BB57234	11/03/15	01/08/16	DIST-A	0.0028800	0.1840000
BB57236	11/03/15	01/08/16	DIST-A	0.0123000	0.1300000
BB57240	11/03/15	01/08/16	DIST-A	**0.0194000**	0.0988000
BB57250	11/03/15	01/08/16	DIST-A	0.0141000	0.3350000
BB57251	11/03/15	01/08/16	DIST-A	0.0011900	0.0289000
BB57539	11/03/15	01/08/16	DIST-A	0.0077100	0.1590000
BB57255	11/03/15	01/08/16	DIST-A	0.0018200	0.1590000
BB57257	11/03/15	01/08/16	DIST-A	0.0036900	0.0876000
BB57259	11/03/15	01/08/16	DIST-A	**0.0226000**	0.3380000
BB57260	11/03/15	01/08/16	DIST-A	0.0033100	0.0201000
BB57261	11/03/15	01/08/16	DIST-A	0.0022700	0.0479000
BB57262	11/03/15	01/08/16	DIST-A	0.0001400	0.0035000
BB57281	11/03/15	01/08/16	DIST-A	0.0002600	0.0161000
BB57283	11/03/15	01/08/16	DIST-A	0.0007400	0.0432000
BB57285	11/03/15	01/08/16	DIST-A	0.0040600	0.1230000
BB57286	11/03/15	01/08/16	DIST-A	0.0035800	0.1340000
BB57287	11/03/15	01/08/16	DIST-A	0.0005800	0.1230000
BB57550	11/03/15	01/08/16	DIST-A	0.0152000	0.1480000
BB57551	11/03/15	01/08/16	DIST-A	0.0057500	0.2030000
BB57292	11/03/15	01/08/16	DIST-A	0.0006300	0.0671000
BB57544	11/03/15	01/08/16	DIST-A	**0.0248000**	0.3650000
BB57546	11/03/15	01/08/16	DIST-A	0.0015000	0.0834000
BB57547	11/03/15	01/08/16	DIST-A	**0.0380000**	0.3260000
BB57295	11/03/15	01/08/16	DIST-A	0.0021800	0.1080000
BB57300	11/03/15	01/08/16	DIST-A	0.0002700	0.0096000
BB57301	11/03/15	01/08/16	DIST-A	0.0033700	0.0487000
BB57302	11/03/15	01/08/16	DIST-A	0.0049900	0.2440000
BB57303	11/03/15	01/08/16	DIST-A	0.0056400	0.2160000
BB57305	11/03/15	01/08/16	DIST-A	0.0013100	0.0238000
BB57306	11/03/15	01/08/16	DIST-A	0.0118000	0.0747000
BB57554	11/03/15	01/08/16	DIST-A	0.0023400	0.0628000
BB57555	11/03/15	01/08/16	DIST-A	0.0031600	0.1860000
BB57557	11/03/15	01/08/16	DIST-A	0.0047500	0.3490000
BB57558	11/03/15	01/08/16	DIST-A	0.0071500	0.1580000
BB57559	11/03/15	01/08/16	DIST-A	**0.0213000**	0.1170000
BB57561	11/03/15	01/08/16	DIST-A	0.0046100	0.1230000
BB57563	11/03/15	01/08/16	DIST-A	0.0014700	0.0172000
BB57564	11/03/15	01/08/16	DIST-A	0.0050800	0.0611000
BB57308	11/03/15	01/08/16	DIST-A	0.0023600	0.0832000
BB57574	11/03/15	01/08/16	DIST-A	0.0126000	0.1560000
BB57575	11/03/15	01/08/16	DIST-A	0.0008400	0.0945000

BB57309	11/03/15	01/08/16	DIST-A	0.0138000	0.2640000
BB57310	11/03/15	01/08/16	DIST-A	0.0054100	0.1220000
BB57313	11/03/15	01/08/16	DIST-A	0.0001300	0.0207000
BB57314	11/03/15	01/08/16	DIST-A	0.0026800	0.1000000
BB57315	11/03/15	01/08/16	DIST-A	0.0007400	0.0251000
BB57317	11/03/15	01/08/16	DIST-A	0.0034600	0.1060000
BB57318	11/03/15	01/08/16	DIST-A	0.0002900	0.0070000
BB57576	11/03/15	01/08/16	DIST-A	0.0079700	0.1250000
BB57577	11/03/15	01/08/16	DIST-A	**0.0318000**	0.2110000
BB57581	11/03/15	01/08/16	DIST-A	0.0029000	0.0491000
BB57319	11/03/15	01/08/16	DIST-A	0.0039700	0.2360000
BB57239	11/02/15	01/08/16	DIST-A	**0.0168000**	0.2860000
BB57242	11/02/15	01/08/16	DIST-A	0.0010700	0.1180000
BB57247	11/02/15	01/08/16	DIST-A	0.0020200	0.2100000
BB57254	11/02/15	01/08/16	DIST-A	0.0029300	0.1170000
BB57256	11/02/15	01/08/16	DIST-A	0.0087700	0.3990000
BB57282	11/02/15	01/08/16	DIST-A	0.0021900	0.1070000
BB57288	11/02/15	01/08/16	DIST-A	0.0007700	0.0443000
BB57297	11/02/15	01/08/16	DIST-A	0.0007600	0.0209000
BB57568	11/02/15	01/08/16	DIST-A	0.0062200	0.0495000
BB57538	11/01/15	01/08/16	DIST-A	0.0001600	0.0374000
BB57252	11/01/15	01/08/16	DIST-A	0.0012200	0.0179000
BB57253	11/01/15	01/08/16	DIST-A	0.0038300	0.2000000
BB57249	10/31/15	01/08/16	DIST-A	0.0067600	0.3440000
BB57572	10/30/15	01/08/16	DIST-A	0.0066600	0.0478000
BB57246	10/29/15	01/08/16	DIST-A	0.0071300	0.4420000
BB57567	10/26/15	01/08/16	DIST-A	0.0008600	0.1200000
BB51481	05/12/15	07/10/15	DIST-A	**0.0314000**	0.1130000
BB51519	05/11/15	07/10/15	DIST-A	0.0057300	0.0435000
BB51513	05/08/15	07/10/15	DIST-A	0.0149000	0.2880000
BB51529	05/08/15	07/10/15	DIST-A	0.0012300	0.1190000
BB51263	05/07/15	07/10/15	DIST-A	0.0038900	0.1830000
BB51274	05/07/15	07/10/15	DIST-A	0.0063700	0.2910000
BB51484	05/07/15	07/10/15	DIST-A	0.0010900	0.0370000
BB51485	05/07/15	07/10/15	DIST-A	0.0003600	0.0156000
BB51486	05/07/15	07/10/15	DIST-A	0.0048900	0.0279000
BB51488	05/07/15	07/10/15	DIST-A	0.0018900	0.0153000
BB51490	05/07/15	07/10/15	DIST-A	0.0029900	0.1950000
BB51491	05/07/15	07/10/15	DIST-A	0.0009600	0.0367000
BB51512	05/07/15	07/10/15	DIST-A	**0.0169000**	0.0364000
BB51514	05/07/15	07/10/15	DIST-A	0.0005000	0.1780000
BB51515	05/07/15	07/10/15	DIST-A	0.0154000	0.0470000
BB51517	05/07/15	07/10/15	DIST-A	0.0010000	0.1200000
BB51535	05/07/15	07/10/15	DIST-A	0.0036300	0.0603000
BB51538	05/07/15	07/10/15	DIST-A	0.0144000	0.3520000
BB51246	05/06/15	07/10/15	DIST-A	0.0020700	0.3270000
BB51270	05/06/15	07/10/15	DIST-A	0.0117000	0.2410000
BB51271	05/06/15	07/10/15	DIST-A	0.0061300	0.2270000
BB51275	05/06/15	07/10/15	DIST-A	0.0073500	0.2470000
BB51463	05/06/15	07/10/15	DIST-A	0.0033700	0.2390000
BB51472	05/06/15	07/10/15	DIST-A	0.0023500	0.1360000
BB51473	05/06/15	07/10/15	DIST-A	0.0017900	0.1350000
BB51474	05/06/15	07/10/15	DIST-A	0.0003500	0.1620000

BB51475	05/06/15	07/10/15	DIST-A	0.0030300	0.0860000
BB51476	05/06/15	07/10/15	DIST-A	0.0064800	0.1920000
BB51477	05/06/15	07/10/15	DIST-A	0.0018600	0.1070000
BB51478	05/06/15	07/10/15	DIST-A	0.0023600	0.3890000
BB51493	05/06/15	07/10/15	DIST-A	0.0006900	0.0495000
BB51495	05/06/15	07/10/15	DIST-A	0.0010100	0.0186000
BB51496	05/06/15	07/10/15	DIST-A	0.0001800	0.0091000
BB51497	05/06/15	07/10/15	DIST-A	0.0003100	0.0215000
BB51501	05/06/15	07/10/15	DIST-A	0.0046400	0.0737000
BB51516	05/06/15	07/10/15	DIST-A	0.0008500	0.0309000
BB51523	05/06/15	07/10/15	DIST-A	0.0039300	0.1190000
BB51524	05/06/15	07/10/15	DIST-A	0.0002300	0.0150000
BB51525	05/06/15	07/10/15	DIST-A	0.0024000	0.1240000
BB51532	05/06/15	07/10/15	DIST-A	0.0028100	0.1320000
BB51241	05/05/15	07/10/15	DIST-A	0.0022500	0.3050000
BB51242	05/05/15	07/10/15	DIST-A	0.0033000	0.1800000
BB51243	05/05/15	07/10/15	DIST-A	**0.0240000**	0.1390000
BB51244	05/05/15	07/10/15	DIST-A	0.0107000	0.4820000
BB51245	05/05/15	07/10/15	DIST-A	0.0034300	0.6540000
BB51247	05/05/15	07/10/15	DIST-A	0.0127000	0.3090000
BB51248	05/05/15	07/10/15	DIST-A	**0.0302000**	0.0884000
BB51249	05/05/15	07/10/15	DIST-A	0.0077700	0.1350000
BB51250	05/05/15	07/10/15	DIST-A	0.0023500	0.1490000
BB51252	05/05/15	07/10/15	DIST-A	0.0076700	0.0263000
BB51254	05/05/15	07/10/15	DIST-A	0.0005500	0.5330000
BB51255	05/05/15	07/10/15	DIST-A	0.0011600	0.1480000
BB51260	05/05/15	07/10/15	DIST-A	0.0070900	0.3170000
BB51269	05/05/15	07/10/15	DIST-A	0.0016500	0.0780000
BB51273	05/05/15	07/10/15	DIST-A	0.0024000	0.0652000
BB51462	05/05/15	07/10/15	DIST-A	0.0037400	0.2140000
BB51464	05/05/15	07/10/15	DIST-A	**0.0454000**	0.2900000
BB51466	05/05/15	07/10/15	DIST-A	0.0010500	0.0249000
BB51467	05/05/15	07/10/15	DIST-A	0.0001100	0.0054000
BB51468	05/05/15	07/10/15	DIST-A	0.0005300	0.0400000
BB51469	05/05/15	07/10/15	DIST-A	0.0007500	0.0094000
BB51470	05/05/15	07/10/15	DIST-A	0.0006800	0.0405000
BB51471	05/05/15	07/10/15	DIST-A	0.0001300	0.1610000
BB51479	05/05/15	07/10/15	DIST-A	0.0026300	0.1920000
BB51480	05/05/15	07/10/15	DIST-A	**0.0357000**	0.5180000
BB51482	05/05/15	07/10/15	DIST-A	0.0005000	0.0711000
BB51487	05/05/15	07/10/15	DIST-A	0.0026300	0.0524000
BB51489	05/05/15	07/10/15	DIST-A	0.0030200	0.2850000
BB51492	05/05/15	07/10/15	DIST-A	0.0017700	0.0579000
BB51498	05/05/15	07/10/15	DIST-A	0.0016700	0.0543000
BB51499	05/05/15	07/10/15	DIST-A	0.0025300	0.2420000
BB51500	05/05/15	07/10/15	DIST-A	0.0077300	0.2450000
BB51502	05/05/15	07/10/15	DIST-A	0.0078400	0.0168000
BB51503	05/05/15	07/10/15	DIST-A	0.0036700	0.0970000
BB51504	05/05/15	07/10/15	DIST-A	0.0049200	0.1560000
BB51505	05/05/15	07/10/15	DIST-A	0.0007400	0.0664000
BB51506	05/05/15	07/10/15	DIST-A	0.0028200	0.3770000
BB51507	05/05/15	07/10/15	DIST-A	0.0005600	0.0223000
BB51508	05/05/15	07/10/15	DIST-A	0.0068000	0.1580000
BB51509	05/05/15	07/10/15	DIST-A	0.0006600	0.0737000
BB51510	05/05/15	07/10/15	DIST-A	0.0007900	0.0137000

BB51511	05/05/15	07/10/15	DIST-A	0.0115000	0.1050000
BB51518	05/05/15	07/10/15	DIST-A	0.0014800	0.0585000
BB51520	05/05/15	07/10/15	DIST-A	0.0062500	0.1460000
BB51521	05/05/15	07/10/15	DIST-A	**0.0537000**	0.3900000
BB51522	05/05/15	07/10/15	DIST-A	0.0062500	0.1960000
BB51526	05/05/15	07/10/15	DIST-A	0.0000600	0.0141000
BB51527	05/05/15	07/10/15	DIST-A	0.0012400	0.1140000
BB51528	05/05/15	07/10/15	DIST-A	0.0033800	0.1480000
BB51530	05/05/15	07/10/15	DIST-A	0.0050000	0.1820000
BB51531	05/05/15	07/10/15	DIST-A	0.0007100	0.0353000
BB51533	05/05/15	07/10/15	DIST-A	0.0005000	0.0118000
BB51534	05/05/15	07/10/15	DIST-A	**0.0227000**	0.1380000
BB51536	05/05/15	07/10/15	DIST-A	0.0014200	0.0455000
BB51537	05/05/15	07/10/15	DIST-A	0.0023600	0.2140000
BB51253	05/04/15	07/10/15	DIST-A	0.0001300	0.0549000
BB51257	05/04/15	07/10/15	DIST-A	0.0006600	0.1320000
BB51258	05/04/15	07/10/15	DIST-A	0.0047900	0.2680000
BB51261	05/04/15	07/10/15	DIST-A	0.0008000	0.0241000
BB51265	05/04/15	07/10/15	DIST-A	0.0049600	0.1630000
BB51266	05/04/15	07/10/15	DIST-A	0.0003900	0.0757000
BB51267	05/04/15	07/10/15	DIST-A	0.0056800	0.4140000
BB51268	05/04/15	07/10/15	DIST-A	0.0030500	0.1120000
BB51465	05/04/15	07/10/15	DIST-A	0.0039000	0.0565000
BB51483	05/04/15	07/10/15	DIST-A	**0.0321000**	0.4610000
BB51494	05/03/15	07/10/15	DIST-A	0.0019000	0.0189000
BB51256	05/02/15	07/10/15	DIST-A	0.0037000	0.6160000
BB51259	05/01/15	07/10/15	DIST-A	0.0064600	0.3230000
BB51264	04/30/15	07/10/15	DIST-A	0.0016700	0.1320000
BB51272	04/30/15	07/10/15	DIST-A	0.0032400	0.2190000
BB51262	04/29/15	07/10/15	DIST-A	0.0013300	0.0170000
BB51251	04/28/15	07/10/15	DIST-A	0.0011000	0.1430000
BB45695	10/15/14	12/10/14	DIST-A	**0.0227000**	0.1990000
BB45706	10/14/14	12/10/14	DIST-A	0.0055200	0.4760000
BB45709	10/14/14	12/10/14	DIST-A	0.0099600	0.0682000
BB45722	10/14/14	12/10/14	DIST-A	0.0025100	0.2730000
BB45701	10/10/14	12/10/14	DIST-A	0.0028200	0.0437000
BB45574	10/09/14	12/10/14	DIST-A	0.0035300	0.0842000
BB45723	10/09/14	12/10/14	DIST-A	0.0005000	0.0110000
BB45458	10/08/14	12/10/14	DIST-A	0.0033400	0.1720000
BB45533	10/08/14	12/10/14	DIST-A	0.0005800	0.0067000
BB45535	10/08/14	12/10/14	DIST-A	0.0049300	0.0935000
BB45536	10/08/14	12/10/14	DIST-A	0.0048300	0.4290000
BB45704	10/08/14	12/10/14	DIST-A	0.0025000	0.1840000
BB45710	10/08/14	12/10/14	DIST-A	0.0072900	0.1570000
BB45719	10/08/14	12/10/14	DIST-A	0.0085100	0.0236000
BB45720	10/08/14	12/10/14	DIST-A	0.0063200	0.1460000
BB45449	10/07/14	12/10/14	DIST-A	0.0007600	0.3370000
BB45450	10/07/14	12/10/14	DIST-A	0.0062500	0.1170000
BB45451	10/07/14	12/10/14	DIST-A	0.0065500	0.5580000
BB45693	10/07/14	12/10/14	DIST-A	0.0024400	0.1160000
BB45694	10/07/14	12/10/14	DIST-A	**0.0265000**	0.4370000
BB45696	10/07/14	12/10/14	DIST-A	0.0010800	0.0499000

BB45697	10/07/14	12/10/14	DIST-A	**0.0286000**	0.4570000
BB45698	10/07/14	12/10/14	DIST-A	0.0031200	0.0662000
BB45699	10/07/14	12/10/14	DIST-A	0.0031000	0.0508000
BB45700	10/07/14	12/10/14	DIST-A	0.0043400	0.0189000
BB45702	10/07/14	12/10/14	DIST-A	0.0049700	0.0238000
BB45570	10/07/14	12/10/14	DIST-A	0.0020800	0.1160000
BB45703	10/07/14	12/10/14	DIST-A	0.0015400	0.0335000
BB45705	10/07/14	12/10/14	DIST-A	0.0026800	0.2070000
BB45707	10/07/14	12/10/14	DIST-A	0.0013300	0.0629000
BB45708	10/07/14	12/10/14	DIST-A	0.0121000	0.1440000
BB45711	10/07/14	12/10/14	DIST-A	0.0008700	0.0518000
BB45712	10/07/14	12/10/14	DIST-A	0.0013200	0.0087000
BB45713	10/07/14	12/10/14	DIST-A	0.0095200	0.0612000
BB45715	10/07/14	12/10/14	DIST-A	**0.0191000**	0.2480000
BB45716	10/07/14	12/10/14	DIST-A	0.0009500	0.0994000
BB45721	10/07/14	12/10/14	DIST-A	0.0138000	0.1830000
BB45724	10/07/14	12/10/14	DIST-A	0.0097500	0.1870000
BB45725	10/07/14	12/10/14	DIST-A	0.0008100	0.0126000
BB45726	10/07/14	12/10/14	DIST-A	0.0038300	0.2660000
BB45437	10/06/14	12/10/14	DIST-A	0.0029800	0.2510000
BB45438	10/06/14	12/10/14	DIST-A	0.0023200	0.1330000
BB45439	10/06/14	12/10/14	DIST-A	0.0012100	0.0929000
BB45440	10/06/14	12/10/14	DIST-A	**0.0167000**	0.1290000
BB45441	10/06/14	12/10/14	DIST-A	0.0144000	0.4240000
BB45442	10/06/14	12/10/14	DIST-A	0.0019300	0.3920000
BB45443	10/06/14	12/10/14	DIST-A	0.0033400	0.3100000
BB45444	10/06/14	12/10/14	DIST-A	0.0116000	0.2520000
BB45445	10/06/14	12/10/14	DIST-A	**0.0248000**	0.0663000
BB45446	10/06/14	12/10/14	DIST-A	0.0151000	0.1090000
BB45447	10/06/14	12/10/14	DIST-A	**0.0209000**	0.0802000
BB45452	10/06/14	12/10/14	DIST-A	0.0016800	0.1990000
BB45453	10/06/14	12/10/14	DIST-A	0.0050700	0.2470000
BB45455	10/06/14	12/10/14	DIST-A	0.0128000	0.2580000
BB45456	10/06/14	12/10/14	DIST-A	0.0010200	0.0297000
BB45459	10/06/14	12/10/14	DIST-A	0.0032400	0.0703000
BB45460	10/06/14	12/10/14	DIST-A	0.0109000	0.1620000
BB45461	10/06/14	12/10/14	DIST-A	0.0049400	0.3320000
BB45462	10/06/14	12/10/14	DIST-A	0.0074200	0.3930000
BB45463	10/06/14	12/10/14	DIST-A	0.0035200	0.0753000
BB45464	10/06/14	12/10/14	DIST-A	0.0044200	0.2410000
BB45465	10/06/14	12/10/14	DIST-A	**0.0230000**	0.3590000
BB45467	10/06/14	12/10/14	DIST-A	0.0020800	0.0480000
BB45473	10/06/14	12/10/14	DIST-A	0.0030800	0.1310000
BB45476	10/06/14	12/10/14	DIST-A	0.0006900	0.0543000
BB45537	10/06/14	12/10/14	DIST-A	0.0132000	0.1680000
BB45538	10/06/14	12/10/14	DIST-A	**0.0156000**	0.1730000
BB45539	10/06/14	12/10/14	DIST-A	0.0021000	0.0257000
BB45571	10/06/14	12/10/14	DIST-A	0.0029500	0.4620000
BB45579	10/06/14	12/10/14	DIST-A	0.0024400	0.0575000
BB45581	10/06/14	12/10/14	DIST-A	0.0099800	0.1160000
BB45582	10/06/14	12/10/14	DIST-A	0.0010900	0.2390000
BB45718	10/06/14	12/10/14	DIST-A	0.0005800	0.0078000
BB45583	10/06/14	12/10/14	DIST-A	0.0067400	0.2720000
BB45590	10/06/14	12/10/14	DIST-A	0.0023400	0.0889000
BB45593	10/06/14	12/10/14	DIST-A	0.0029700	0.1250000

BB45594	10/06/14	12/10/14	DIST-A	0.0023500	0.0231000	
BB45595	10/06/14	12/10/14	DIST-A	0.0069100	0.1180000	
BB45454	10/05/14	12/10/14	DIST-A	0.0071000	0.3680000	
BB45457	10/05/14	12/10/14	DIST-A	0.0010100	0.0170000	
BB45466	10/05/14	12/10/14	DIST-A	0.0046100	0.0473000	
BB45468	10/05/14	12/10/14	DIST-A	0.0006500	0.0073000	
BB45448	10/04/14	12/10/14	DIST-A	0.0002000	0.1100000	
BB45597	10/04/14	12/10/14	DIST-A	0.0014400	0.0371000	
BB45469	10/03/14	12/10/14	DIST-A	0.0001200	0.0040000	
BB45471	10/03/14	12/10/14	DIST-A	0.0011400	0.0666000	
BB45472	10/03/14	12/10/14	DIST-A	0.0001900	0.1600000	
BB45474	10/03/14	12/10/14	DIST-A	0.0022800	0.1110000	
BB45475	10/03/14	12/10/14	DIST-A	0.0008100	0.0727000	
BB45540	10/03/14	12/10/14	DIST-A	0.0032300	0.0417000	
BB45541	10/03/14	12/10/14	DIST-A	0.0024500	0.1550000	
BB45542	10/03/14	12/10/14	DIST-A	0.0031400	0.1400000	
BB45543	10/03/14	12/10/14	DIST-A	0.0041900	0.2040000	
BB45544	10/03/14	12/10/14	DIST-A	0.0081000	0.1840000	
BB45572	10/03/14	12/10/14	DIST-A	0.0012100	0.0153000	
BB45573	10/03/14	12/10/14	DIST-A	0.0001800	0.0047000	
BB45575	10/03/14	12/10/14	DIST-A	0.0003200	0.0038000	
BB45576	10/03/14	12/10/14	DIST-A	0.0017300	0.0178000	
BB45577	10/03/14	12/10/14	DIST-A	0.0028900	0.1520000	
BB45578	10/03/14	12/10/14	DIST-A	0.0018000	0.2030000	
BB45580	10/03/14	12/10/14	DIST-A	0.0014600	0.0162000	
BB45584	10/03/14	12/10/14	DIST-A	0.0028500	0.0658000	
BB45585	10/03/14	12/10/14	DIST-A	0.0099500	0.1760000	
BB45586	10/03/14	12/10/14	DIST-A	0.0054000	0.0920000	
BB45587	10/03/14	12/10/14	DIST-A	0.0007900	0.0241000	
BB45588	10/03/14	12/10/14	DIST-A	0.0022300	0.1280000	
BB45589	10/03/14	12/10/14	DIST-A	ND	0.0044000	
BB45591	10/03/14	12/10/14	DIST-A	0.0029900	0.1520000	
BB45592	10/03/14	12/10/14	DIST-A	0.0012100	0.0723000	
BB45596	10/03/14	12/10/14	DIST-A	0.0069700	0.1640000	
BB45470	10/02/14	12/10/14	DIST-A	0.0005400	0.0083000	
BB45534	10/01/14	12/10/14	DIST-A	0.0080600	0.2140000	
BB45714	09/30/14	12/10/14	DIST-A	0.0026300	0.0391000	
BB45717	09/30/14	12/10/14	DIST-A	**0.0254000**	0.0322000	
BB40396	05/27/14	07/10/14	DIST-A	0.0010100	0.1420000	
BB40395	05/23/14	07/10/14	DIST-A	0.0070000	0.6750000	
BB40243	05/22/14	07/10/14	DIST-A	0.0001800	0.0029300	
BB40244	05/22/14	07/10/14	DIST-A	0.0011300	0.0574000	
BB40257	05/22/14	07/10/14	DIST-A	0.0069400	0.2200000	
BB40264	05/22/14	07/10/14	DIST-A	0.0021600	0.0833000	
BB40270	05/22/14	07/10/14	DIST-A	0.0009900	0.0681000	
BB40389	05/22/14	07/10/14	DIST-A	0.0007000	0.0341000	
BB40391	05/22/14	07/10/14	DIST-A	**0.0283000**	0.1490000	
BB40287	05/22/14	07/10/14	DIST-A	0.0069900	0.3890000	
BB40290	05/22/14	07/10/14	DIST-A	0.0009000	0.0587000	
BB40300	05/22/14	07/10/14	DIST-A	0.0007500	0.0136000	
BB40305	05/22/14	07/10/14	DIST-A	0.0004900	0.0162000	
BB40223	05/21/14	07/10/14	DIST-A	0.0019000	0.0801000	
BB40234	05/21/14	07/10/14	DIST-A	0.0029500	0.1700000	

BB40241	05/21/14	07/10/14	DIST-A	0.0010300	0.0742000
BB40245	05/21/14	07/10/14	DIST-A	0.0000550	0.0612000
BB40246	05/21/14	07/10/14	DIST-A	0.0005100	0.0158000
BB40386	05/21/14	07/10/14	DIST-A	0.0008600	0.0826000
BB40249	05/21/14	07/10/14	DIST-A	0.0076000	0.0927000
BB40250	05/21/14	07/10/14	DIST-A	0.0122000	0.2470000
BB40251	05/21/14	07/10/14	DIST-A	0.0074200	0.1340000
BB40252	05/21/14	07/10/14	DIST-A	0.0025600	0.4140000
BB40387	05/21/14	07/10/14	DIST-A	0.0080000	0.1820000
BB40263	05/21/14	07/10/14	DIST-A	0.0014300	0.1160000
BB40265	05/21/14	07/10/14	DIST-A	0.0051200	0.0895000
BB40266	05/21/14	07/10/14	DIST-A	0.0077000	0.2320000
BB40267	05/21/14	07/10/14	DIST-A	0.0013100	0.0663000
BB40268	05/21/14	07/10/14	DIST-A	0.0006000	0.0100000
BB40269	05/21/14	07/10/14	DIST-A	0.0001400	0.0030700
BB40271	05/21/14	07/10/14	DIST-A	0.0021200	0.0332000
BB40272	05/21/14	07/10/14	DIST-A	0.0000980	0.0028000
BB40276	05/21/14	07/10/14	DIST-A	0.0032700	0.1190000
BB40280	05/21/14	07/10/14	DIST-A	0.0004900	0.0441000
BB40288	05/21/14	07/10/14	DIST-A	0.0023700	0.1190000
BB40299	05/21/14	07/10/14	DIST-A	0.0072100	0.2180000
BB40301	05/21/14	07/10/14	DIST-A	0.0002700	0.0078200
BB40302	05/21/14	07/10/14	DIST-A	0.0019300	0.0705000
BB40303	05/21/14	07/10/14	DIST-A	0.0001500	0.0376000
BB40304	05/21/14	07/10/14	DIST-A	0.0022200	0.1180000
BB40306	05/21/14	07/10/14	DIST-A	0.0024100	0.1450000
BB40307	05/21/14	07/10/14	DIST-A	0.0014600	0.1810000
BB40308	05/21/14	07/10/14	DIST-A	0.0003300	0.0025100
BB40309	05/21/14	07/10/14	DIST-A	0.0059600	0.1460000
BB40310	05/21/14	07/10/14	DIST-A	0.0042600	0.0049900
BB40213	05/20/14	07/10/14	DIST-A	0.0015000	0.1530000
BB40214	05/20/14	07/10/14	DIST-A	0.0013700	0.1600000
BB40215	05/20/14	07/10/14	DIST-A	**0.0174000**	0.1310000
BB40216	05/20/14	07/10/14	DIST-A	0.0104000	0.4630000
BB40218	05/20/14	07/10/14	DIST-A	0.0012800	0.4260000
BB40222	05/20/14	07/10/14	DIST-A	0.0025100	0.1550000
BB40226	05/20/14	07/10/14	DIST-A	0.0005200	0.5390000
BB40228	05/20/14	07/10/14	DIST-A	0.0005600	0.0515000
BB40229	05/20/14	07/10/14	DIST-A	0.0050600	0.3170000
BB40231	05/20/14	07/10/14	DIST-A	0.0109000	0.2870000
BB40236	05/20/14	07/10/14	DIST-A	0.0068800	0.1910000
BB40237	05/20/14	07/10/14	DIST-A	0.0010000	0.1830000
BB40239	05/20/14	07/10/14	DIST-A	0.0068800	0.1240000
BB40240	05/20/14	07/10/14	DIST-A	0.0022500	0.0435000
BB40242	05/20/14	07/10/14	DIST-A	0.0009100	0.0021000
BB40385	05/20/14	07/10/14	DIST-A	0.0011100	0.0491000
BB40247	05/20/14	07/10/14	DIST-A	0.0010800	0.0955000
BB40253	05/20/14	07/10/14	DIST-A	0.0129000	0.4270000
BB40254	05/20/14	07/10/14	DIST-A	**0.0300000**	0.1040000
BB40255	05/20/14	07/10/14	DIST-A	0.0008500	0.0818000
BB40256	05/20/14	07/10/14	DIST-A	**0.0195000**	0.4620000
BB40393	05/20/14	07/10/14	DIST-A	0.0009900	0.0359000
BB40404	05/20/14	07/10/14	DIST-A	0.0015500	0.0389000
BB40258	05/20/14	07/10/14	DIST-A	0.0042400	0.0093900
BB40260	05/20/14	07/10/14	DIST-A	0.0028200	0.0473000

BB40388	05/20/14	07/10/14	DIST-A	0.0024100	0.0377000
BB40390	05/20/14	07/10/14	DIST-A	0.0032400	0.1880000
BB40273	05/20/14	07/10/14	DIST-A	**0.0192000**	0.0977000
BB40274	05/20/14	07/10/14	DIST-A	0.0010800	0.1280000
BB40275	05/20/14	07/10/14	DIST-A	0.0035400	0.3620000
BB40277	05/20/14	07/10/14	DIST-A	0.0061100	0.1120000
BB40278	05/20/14	07/10/14	DIST-A	0.0095800	0.1400000
BB40281	05/20/14	07/10/14	DIST-A	**0.0492000**	0.0712000
BB40392	05/20/14	07/10/14	DIST-A	0.0137000	0.1290000
BB40282	05/20/14	07/10/14	DIST-A	0.0020100	0.0528000
BB40283	05/20/14	07/10/14	DIST-A	0.0087800	0.1250000
BB40394	05/20/14	07/10/14	DIST-A	0.0005100	0.1830000
BB40284	05/20/14	07/10/14	DIST-A	**0.0261000**	0.0521000
BB40289	05/20/14	07/10/14	DIST-A	0.0040000	0.0252000
BB40291	05/20/14	07/10/14	DIST-A	0.0007900	0.0108000
BB40298	05/20/14	07/10/14	DIST-A	0.0014700	0.1320000
BB40311	05/20/14	07/10/14	DIST-A	0.0016600	0.0623000
BB40312	05/20/14	07/10/14	DIST-A	0.0064400	0.0746000
BB40313	05/20/14	07/10/14	DIST-A	0.0027800	0.1840000
BB40314	05/20/14	07/10/14	DIST-A	0.0039200	0.1380000
BB40217	05/19/14	07/10/14	DIST-A	0.0014900	0.2630000
BB40221	05/19/14	07/10/14	DIST-A	0.0117000	0.1240000
BB40224	05/19/14	07/10/14	DIST-A	**0.0324000**	0.1050000
BB40230	05/19/14	07/10/14	DIST-A	0.0056300	0.2690000
BB40232	05/19/14	07/10/14	DIST-A	0.0002300	0.0056100
BB40238	05/19/14	07/10/14	DIST-A	0.0042500	0.3920000
BB40259	05/19/14	07/10/14	DIST-A	0.0029700	0.0564000
BB40261	05/19/14	07/10/14	DIST-A	0.0023600	0.1790000
BB40262	05/19/14	07/10/14	DIST-A	0.0016300	0.0422000
BB40285	05/19/14	07/10/14	DIST-A	0.0014300	0.0347000
BB40286	05/19/14	07/10/14	DIST-A	0.0014600	0.1300000
BB40219	05/18/14	07/10/14	DIST-A	0.0146000	0.2930000
BB40220	05/18/14	07/10/14	DIST-A	**0.0287000**	0.1840000
BB40225	05/18/14	07/10/14	DIST-A	0.0001900	0.1410000
BB40212	05/17/14	07/10/14	DIST-A	0.0032700	0.2930000
BB40233	05/16/14	07/10/14	DIST-A	0.0013000	0.0149000
BB40248	05/16/14	07/10/14	DIST-A	0.0028100	0.0642000
BB40279	05/16/14	07/10/14	DIST-A	0.0032100	0.1250000
BB40227	05/15/14	07/10/14	DIST-A	0.0065600	0.2140000
BB40235	05/15/14	07/10/14	DIST-A	0.0023200	0.1160000
BB34548	11/18/13	01/10/14	DIST-A	0.0050100	0.1400000
BB34294	11/15/13	01/10/14	DIST-A	0.0021000	0.1550000
BB34303	11/15/13	01/10/14	DIST-A	0.0017300	0.2860000
BB34318	11/15/13	01/10/14	DIST-A	**0.0176000**	0.4730000
BB34324	11/15/13	01/10/14	DIST-A	0.0005360	0.0295000
BB34326	11/15/13	01/10/14	DIST-A	0.0008980	0.0627000
BB34259	11/14/13	01/10/14	DIST-A	0.0123000	0.5600000
BB34261	11/14/13	01/10/14	DIST-A	0.0006060	0.0374000
BB34263	11/14/13	01/10/14	DIST-A	0.0002800	0.0157000
BB34265	11/14/13	01/10/14	DIST-A	0.0010400	0.1230000
BB34267	11/14/13	01/10/14	DIST-A	0.0022700	0.1720000
BB34268	11/14/13	01/10/14	DIST-A	0.0019700	0.1550000
BB34269	11/14/13	01/10/14	DIST-A	0.0001090	0.1060000

BB34276	11/14/13	01/10/14	DIST-A	0.0006220	0.1080000
BB34287	11/14/13	01/10/14	DIST-A	0.0022700	0.2630000
BB34288	11/14/13	01/10/14	DIST-A	0.0026200	0.1680000
BB34290	11/14/13	01/10/14	DIST-A	0.0004330	0.0635000
BB34291	11/14/13	01/10/14	DIST-A	0.0012400	0.0650000
BB34292	11/14/13	01/10/14	DIST-A	0.0015300	0.0268000
BB34293	11/14/13	01/10/14	DIST-A	0.0001900	0.0150000
BB34295	11/14/13	01/10/14	DIST-A	0.0002090	0.0070700
BB34297	11/14/13	01/10/14	DIST-A	0.0013700	0.1830000
BB34299	11/14/13	01/10/14	DIST-A	0.0108000	0.2720000
BB34302	11/14/13	01/10/14	DIST-A	0.0018100	0.2000000
BB34319	11/14/13	01/10/14	DIST-A	0.0026300	0.1520000
BB34323	11/14/13	01/10/14	DIST-A	0.0006280	0.0499000
BB34325	11/14/13	01/10/14	DIST-A	0.0015900	0.1430000
BB34336	11/14/13	01/10/14	DIST-A	0.0032600	0.2260000
BB34242	11/13/13	01/10/14	DIST-A	0.0047300	0.3620000
BB34243	11/13/13	01/10/14	DIST-A	0.0068900	0.1820000
BB34251	11/13/13	01/10/14	DIST-A	0.0128000	0.4530000
BB34254	11/13/13	01/10/14	DIST-A	0.0035600	0.2690000
BB34260	11/13/13	01/10/14	DIST-A	0.0020300	0.0395000
BB34262	11/13/13	01/10/14	DIST-A	0.0001090	0.0046700
BB34264	11/13/13	01/10/14	DIST-A	0.0005180	0.0194000
BB34266	11/13/13	01/10/14	DIST-A	0.0001260	0.1870000
BB34271	11/13/13	01/10/14	DIST-A	0.0016200	0.0288000
BB34272	11/13/13	01/10/14	DIST-A	0.0113000	0.4330000
BB34273	11/13/13	01/10/14	DIST-A	0.0035400	0.5080000
BB34274	11/13/13	01/10/14	DIST-A	0.0051600	0.6690000
BB34275	11/13/13	01/10/14	DIST-A	**0.0438000**	0.1780000
BB34277	11/13/13	01/10/14	DIST-A	0.0106000	0.6010000
BB34278	11/13/13	01/10/14	DIST-A	0.0018900	0.1410000
BB34279	11/13/13	01/10/14	DIST-A	0.0029700	0.0663000
BB34281	11/13/13	01/10/14	DIST-A	0.0051400	0.2790000
BB34282	11/13/13	01/10/14	DIST-A	0.0125000	0.0348000
BB34285	11/13/13	01/10/14	DIST-A	0.0031800	0.2740000
BB34289	11/13/13	01/10/14	DIST-A	0.0021100	0.0882000
BB34296	11/13/13	01/10/14	DIST-A	0.0015300	0.0371000
BB34298	11/13/13	01/10/14	DIST-A	0.0016200	0.1630000
BB34300	11/13/13	01/10/14	DIST-A	0.0022000	0.2400000
BB34301	11/13/13	01/10/14	DIST-A	0.0142000	0.1320000
BB34304	11/13/13	01/10/14	DIST-A	0.0113000	0.5970000
BB34305	11/13/13	01/10/14	DIST-A	0.0007620	0.1160000
BB34306	11/13/13	01/10/14	DIST-A	0.0014400	0.0523000
BB34307	11/13/13	01/10/14	DIST-A	0.0092000	0.1880000
BB34308	11/13/13	01/10/14	DIST-A	0.0051000	0.2010000
BB34309	11/13/13	01/10/14	DIST-A	0.0015600	0.0580000
BB34310	11/13/13	01/10/14	DIST-A	**0.0626000**	0.1640000
BB34311	11/13/13	01/10/14	DIST-A	**0.0173000**	0.1610000
BB34312	11/13/13	01/10/14	DIST-A	0.0027100	0.0728000
BB34313	11/13/13	01/10/14	DIST-A	0.0077300	0.2550000
BB34314	11/13/13	01/10/14	DIST-A	0.0016200	0.1910000
BB34315	11/13/13	01/10/14	DIST-A	**0.0427000**	0.0697000
BB34317	11/13/13	01/10/14	DIST-A	0.0021900	0.1760000
BB34320	11/13/13	01/10/14	DIST-A	0.0043400	0.0390000
BB34321	11/13/13	01/10/14	DIST-A	0.0025200	0.4190000
BB34322	11/13/13	01/10/14	DIST-A	0.0145000	0.3110000

BB34327	11/13/13	01/10/14	DIST-A	0.0011800	0.1380000
BB34328	11/13/13	01/10/14	DIST-A	0.0018700	0.2480000
BB34329	11/13/13	01/10/14	DIST-A	0.0011500	0.0337000
BB34330	11/13/13	01/10/14	DIST-A	0.0022400	0.1060000
BB34331	11/13/13	01/10/14	DIST-A	0.0039600	0.0223000
BB34332	11/13/13	01/10/14	DIST-A	0.0082400	0.2160000
BB34333	11/13/13	01/10/14	DIST-A	**0.0507000**	0.0811000
BB34334	11/13/13	01/10/14	DIST-A	0.0046000	0.4610000
BB34335	11/13/13	01/10/14	DIST-A	0.0004560	0.0150000
BB34547	11/13/13	01/10/14	DIST-A	0.0057500	0.6020000
BB34549	11/13/13	01/10/14	DIST-A	0.0071500	0.4020000
BB34232	11/12/13	01/10/14	DIST-A	0.0093600	0.3090000
BB34233	11/12/13	01/10/14	DIST-A	0.0025000	0.2360000
BB34234	11/12/13	01/10/14	DIST-A	0.0016600	0.2540000
BB34235	11/12/13	01/10/14	DIST-A	**0.0190000**	0.1730000
BB34236	11/12/13	01/10/14	DIST-A	**0.0171000**	0.5970000
BB34237	11/12/13	01/10/14	DIST-A	0.0012900	0.5800000
BB34238	11/12/13	01/10/14	DIST-A	0.0035500	0.5820000
BB34240	11/12/13	01/10/14	DIST-A	**0.0366000**	0.5000000
BB34241	11/12/13	01/10/14	DIST-A	0.0138000	0.1410000
BB34244	11/12/13	01/10/14	DIST-A	0.0067900	0.1490000
BB34246	11/12/13	01/10/14	DIST-A	0.0005890	0.1270000
BB34247	11/12/13	01/10/14	DIST-A	0.0019300	0.2670000
BB34249	11/12/13	01/10/14	DIST-A	0.0083000	0.3460000
BB34252	11/12/13	01/10/14	DIST-A	0.0002830	0.0138000
BB34253	11/12/13	01/10/14	DIST-A	0.0019400	0.0349000
BB34256	11/12/13	01/10/14	DIST-A	0.0087100	0.2610000
BB34257	11/12/13	01/10/14	DIST-A	0.0013700	0.2560000
BB34258	11/12/13	01/10/14	DIST-A	0.0086600	0.2530000
BB34283	11/12/13	01/10/14	DIST-A	0.0016800	0.0469000
BB34284	11/12/13	01/10/14	DIST-A	0.0063600	0.0959000
BB34286	11/12/13	01/10/14	DIST-A	0.0019600	0.0731000
BB34316	11/12/13	01/10/14	DIST-A	**0.0178000**	0.1270000
BB34245	11/11/13	01/10/14	DIST-A	0.0001610	0.0542000
BB34250	11/11/13	01/10/14	DIST-A	**0.0233000**	0.1940000
BB34270	11/11/13	01/10/14	DIST-A	0.0039300	0.0911000
BB34280	11/11/13	01/10/14	DIST-A	0.0152000	0.2690000
BB34248	11/10/13	01/10/14	DIST-A	0.0030200	0.9000000
BB34255	11/10/13	01/10/14	DIST-A	0.0023700	0.1990000
BB34239	11/09/13	01/10/14	DIST-A	**0.0156000**	0.3540000
BB28369	05/21/13	07/10/13	DIST-A	**0.0473000**	0.2280000
BB28356	05/20/13	07/10/13	DIST-A	0.0024900	0.0991000
BB28364	05/20/13	07/10/13	DIST-A	0.0002320	0.0199000
BB28104	05/17/13	07/10/13	DIST-A	0.0068400	0.5830000
BB28340	05/17/13	07/10/13	DIST-A	0.0008180	0.1280000
BB28357	05/17/13	07/10/13	DIST-A	0.0047300	0.1350000
BB28367	05/17/13	07/10/13	DIST-A	0.0021600	0.0983000
BB28052	05/16/13	07/10/13	DIST-A	0.0012200	0.1080000
BB28081	05/16/13	07/10/13	DIST-A	0.0016100	0.2370000
BB28088	05/16/13	07/10/13	DIST-A	0.0053500	0.1320000
BB28096	05/16/13	07/10/13	DIST-A	0.0094700	0.3550000
BB28098	05/16/13	07/10/13	DIST-A	0.0102000	0.2700000
BB28101	05/16/13	07/10/13	DIST-A	0.0054200	0.1900000

BB28343	05/16/13	07/10/13	DIST-A	0.0058700	0.2910000
BB28345	05/16/13	07/10/13	DIST-A	0.0053700	0.0116000
BB28347	05/16/13	07/10/13	DIST-A	0.0007700	0.0242000
BB28351	05/16/13	07/10/13	DIST-A	0.0025900	0.1120000
BB28353	05/16/13	07/10/13	DIST-A	0.0001810	0.0355000
BB28359	05/16/13	07/10/13	DIST-A	0.0004080	0.0300000
BB28362	05/16/13	07/10/13	DIST-A	0.0000960	0.0054300
BB28368	05/16/13	07/10/13	DIST-A	0.0016500	0.0230000
BB28372	05/16/13	07/10/13	DIST-A	0.0012000	0.1160000
BB28374	05/16/13	07/10/13	DIST-A	0.0006910	0.0547000
BB28377	05/16/13	07/10/13	DIST-A	0.0014200	0.0762000
BB28379	05/16/13	07/10/13	DIST-A	0.0010800	0.1380000
BB28381	05/16/13	07/10/13	DIST-A	0.0009010	0.0222000
BB28063	05/15/13	07/10/13	DIST-A	0.0101000	0.1000000
BB28064	05/15/13	07/10/13	DIST-A	0.0069200	0.2000000
BB28065	05/15/13	07/10/13	DIST-A	0.0024700	0.1350000
BB28067	05/15/13	07/10/13	DIST-A	0.0106000	0.5260000
BB28068	05/15/13	07/10/13	DIST-A	**0.0238000**	0.1210000
BB28069	05/15/13	07/10/13	DIST-A	0.0005600	0.1010000
BB28070	05/15/13	07/10/13	DIST-A	0.0049200	0.4430000
BB28073	05/15/13	07/10/13	DIST-A	0.0077500	0.1880000
BB28074	05/15/13	07/10/13	DIST-A	0.0045200	0.1990000
BB28080	05/15/13	07/10/13	DIST-A	0.0009000	0.1020000
BB28082	05/15/13	07/10/13	DIST-A	0.0011600	0.1710000
BB28083	05/15/13	07/10/13	DIST-A	0.0006030	0.0297000
BB28084	05/15/13	07/10/13	DIST-A	0.0045900	0.1270000
BB28085	05/15/13	07/10/13	DIST-A	0.0110000	0.1630000
BB28086	05/15/13	07/10/13	DIST-A	0.0036900	0.1830000
BB28087	05/15/13	07/10/13	DIST-A	0.0012300	0.1460000
BB28089	05/15/13	07/10/13	DIST-A	**0.0242000**	0.1110000
BB28091	05/15/13	07/10/13	DIST-A	0.0151000	0.1880000
BB28099	05/15/13	07/10/13	DIST-A	0.0118000	0.1430000
BB28100	05/15/13	07/10/13	DIST-A	0.0017000	0.1830000
BB28102	05/15/13	07/10/13	DIST-A	0.0024900	0.0105000
BB28103	05/15/13	07/10/13	DIST-A	0.0044900	0.1400000
BB28105	05/15/13	07/10/13	DIST-A	0.0051700	0.0674000
BB28106	05/15/13	07/10/13	DIST-A	0.0012300	0.0851000
BB28107	05/15/13	07/10/13	DIST-A	0.0012400	0.0237000
BB28342	05/15/13	07/10/13	DIST-A	0.0012300	0.1120000
BB28352	05/15/13	07/10/13	DIST-A	0.0014200	0.0433000
BB28355	05/15/13	07/10/13	DIST-A	0.0022000	0.1980000
BB28360	05/15/13	07/10/13	DIST-A	0.0011000	0.0988000
BB28361	05/15/13	07/10/13	DIST-A	0.0001160	0.0179000
BB28363	05/15/13	07/10/13	DIST-A	0.0015300	0.1060000
BB28365	05/15/13	07/10/13	DIST-A	0.0009360	0.0293000
BB28371	05/15/13	07/10/13	DIST-A	0.0029100	0.4020000
BB28376	05/15/13	07/10/13	DIST-A	0.0001260	0.0259000
BB28378	05/15/13	07/10/13	DIST-A	0.0021700	0.1410000
BB28380	05/15/13	07/10/13	DIST-A	0.0005940	0.0248000
BB28382	05/15/13	07/10/13	DIST-A	0.0032700	0.1540000
BB28046	05/14/13	07/10/13	DIST-A	0.0011900	0.2240000
BB28047	05/14/13	07/10/13	DIST-A	0.0016300	0.1300000
BB28048	05/14/13	07/10/13	DIST-A	0.0086300	0.1070000
BB28051	05/14/13	07/10/13	DIST-A	0.0024400	0.4920000

BB28057	05/14/13	07/10/13	DIST-A	0.0039200	0.1650000
BB28066	05/14/13	07/10/13	DIST-A	0.0008950	0.0614000
BB28071	05/14/13	07/10/13	DIST-A	0.0013100	0.0510000
BB28072	05/14/13	07/10/13	DIST-A	0.0017100	0.0530000
BB28075	05/14/13	07/10/13	DIST-A	0.0007730	0.0074500
BB28079	05/14/13	07/10/13	DIST-A	0.0008250	0.0094500
BB28090	05/14/13	07/10/13	DIST-A	0.0017000	0.0420000
BB28092	05/14/13	07/10/13	DIST-A	0.0004350	0.1720000
BB28093	05/14/13	07/10/13	DIST-A	**0.0284000**	0.0607000
BB28097	05/14/13	07/10/13	DIST-A	0.0131000	0.0361000
BB28339	05/14/13	07/10/13	DIST-A	0.0027000	0.0362000
BB28346	05/14/13	07/10/13	DIST-A	0.0000980	0.0028800
BB28350	05/14/13	07/10/13	DIST-A	0.0000540	0.0754000
BB28354	05/14/13	07/10/13	DIST-A	0.0043400	0.0669000
BB28358	05/14/13	07/10/13	DIST-A	0.0045800	0.2550000
BB28366	05/14/13	07/10/13	DIST-A	0.0024200	0.1620000
BB28370	05/14/13	07/10/13	DIST-A	0.0030800	0.2740000
BB28373	05/14/13	07/10/13	DIST-A	0.0089100	0.2290000
BB28375	05/14/13	07/10/13	DIST-A	0.0020700	0.1390000
BB28041	05/13/13	07/10/13	DIST-A	0.0013700	0.2550000
BB28042	05/13/13	07/10/13	DIST-A	0.0024700	0.2140000
BB28043	05/13/13	07/10/13	DIST-A	0.0082800	0.4150000
BB28044	05/13/13	07/10/13	DIST-A	0.0005210	0.0717000
BB28045	05/13/13	07/10/13	DIST-A	**0.0225000**	0.2800000
BB28049	05/13/13	07/10/13	DIST-A	0.0001170	0.0603000
BB28050	05/13/13	07/10/13	DIST-A	0.0004660	0.4850000
BB28053	05/13/13	07/10/13	DIST-A	0.0042200	0.2180000
BB28055	05/13/13	07/10/13	DIST-A	0.0004030	0.0196000
BB28056	05/13/13	07/10/13	DIST-A	0.0009620	0.0231000
BB28059	05/13/13	07/10/13	DIST-A	0.0066800	0.2000000
BB28061	05/13/13	07/10/13	DIST-A	0.0067000	0.1400000
BB28062	05/13/13	07/10/13	DIST-A	0.0024100	0.0558000
BB28077	05/13/13	07/10/13	DIST-A	0.0016500	0.1050000
BB28078	05/13/13	07/10/13	DIST-A	0.0020500	0.0666000
BB28094	05/13/13	07/10/13	DIST-A	0.0025600	0.0528000
BB28095	05/13/13	07/10/13	DIST-A	0.0018000	0.1670000
BB28341	05/13/13	07/10/13	DIST-A	0.0001090	0.0213000
BB28344	05/13/13	07/10/13	DIST-A	0.0025500	0.0316000
BB28348	05/13/13	07/10/13	DIST-A	0.0007080	0.0424000
BB28054	05/12/13	07/10/13	DIST-A	0.0027600	0.1660000
BB28058	05/12/13	07/10/13	DIST-A	0.0017800	0.1400000
BB28076	05/12/13	07/10/13	DIST-A	0.0032400	0.0541000
BB28060	05/11/13	07/10/13	DIST-A	0.0047700	0.4120000
BB28349	05/08/13	07/10/13	DIST-A	0.0009920	0.0832000
BB22985	10/23/12	01/09/13	DIST-A	ND	0.0400000
BB22996	10/23/12	01/09/13	DIST-A	0.0070000	0.3100000
BB22908	10/23/12	01/09/13	DIST-A	0.0010000	0.0700000
BB22913	10/23/12	01/09/13	DIST-A	ND	ND
BB22990	10/22/12	01/09/13	DIST-A	0.0030000	0.2000000
BB22886	10/19/12	01/09/13	DIST-A	0.0080000	0.6800000
BB22972	10/18/12	01/09/13	DIST-A	0.0050000	0.0800000
BB22979	10/18/12	01/09/13	DIST-A	0.0040000	0.1000000
BB22981	10/18/12	01/09/13	DIST-A	0.0060000	0.1600000

BB22986	10/18/12	01/09/13	DIST-A	0.0010000	0.2700000
BB22987	10/18/12	01/09/13	DIST-A	ND	0.0700000
BB22988	10/18/12	01/09/13	DIST-A	0.0010000	0.0900000
BB22989	10/18/12	01/09/13	DIST-A	ND	0.1700000
BB22991	10/18/12	01/09/13	DIST-A	0.0020000	0.1400000
BB22992	10/18/12	01/09/13	DIST-A	ND	0.1000000
BB22889	10/18/12	01/09/13	DIST-A	0.0010000	0.0500000
BB22891	10/18/12	01/09/13	DIST-A	ND	ND
BB22892	10/18/12	01/09/13	DIST-A	ND	0.0400000
BB22894	10/18/12	01/09/13	DIST-A	ND	0.2600000
BB22895	10/18/12	01/09/13	DIST-A	0.0020000	0.2000000
BB22896	10/18/12	01/09/13	DIST-A	0.0030000	0.1200000
BB22897	10/18/12	01/09/13	DIST-A	ND	ND
BB22903	10/18/12	01/09/13	DIST-A	0.0060000	0.0700000
BB22905	10/18/12	01/09/13	DIST-A	ND	0.0900000
BB22906	10/18/12	01/09/13	DIST-A	0.0020000	0.2400000
BB22907	10/18/12	01/09/13	DIST-A	0.0030000	0.1400000
BB22909	10/18/12	01/09/13	DIST-A	ND	0.1800000
BB22910	10/18/12	01/09/13	DIST-A	ND	0.0500000
BB22911	10/18/12	01/09/13	DIST-A	ND	ND
BB22912	10/18/12	01/09/13	DIST-A	0.0050000	0.0900000
BB22914	10/18/12	01/09/13	DIST-A	ND	0.0400000
BB22916	10/18/12	01/09/13	DIST-A	ND	0.1200000
BB22917	10/18/12	01/09/13	DIST-A	0.0020000	ND
BB22965	10/18/12	01/09/13	DIST-A	0.0060000	0.3200000
BB22967	10/17/12	01/09/13	DIST-A	0.0020000	0.1900000
BB22968	10/17/12	01/09/13	DIST-A	0.0120000	0.3900000
BB22969	10/17/12	01/09/13	DIST-A	0.0060000	0.1600000
BB22970	10/17/12	01/09/13	DIST-A	ND	ND
BB22971	10/17/12	01/09/13	DIST-A	0.0140000	0.1200000
BB22973	10/17/12	01/09/13	DIST-A	0.0040000	0.1700000
BB22974	10/17/12	01/09/13	DIST-A	0.0020000	0.1600000
BB22975	10/17/12	01/09/13	DIST-A	0.0120000	0.1400000
BB22976	10/17/12	01/09/13	DIST-A	0.0050000	0.0700000
BB22977	10/17/12	01/09/13	DIST-A	**0.0230000**	0.1200000
BB22978	10/17/12	01/09/13	DIST-A	0.0120000	0.3600000
BB22982	10/17/12	01/09/13	DIST-A	0.0100000	0.1600000
BB22983	10/17/12	01/09/13	DIST-A	0.0020000	0.2200000
BB22984	10/17/12	01/09/13	DIST-A	0.0120000	0.2000000
BB22993	10/17/12	01/09/13	DIST-A	0.0050000	0.1100000
BB22994	10/17/12	01/09/13	DIST-A	0.0060000	ND
BB22995	10/17/12	01/09/13	DIST-A	0.0030000	0.1200000
BB22998	10/17/12	01/09/13	DIST-A	0.0030000	0.2200000
BB22999	10/17/12	01/09/13	DIST-A	0.0020000	ND
BB22887	10/17/12	01/09/13	DIST-A	0.0100000	0.3000000
BB22890	10/17/12	01/09/13	DIST-A	ND	ND
BB22893	10/17/12	01/09/13	DIST-A	ND	0.0700000
BB22900	10/17/12	01/09/13	DIST-A	0.0050000	0.0500000
BB22901	10/17/12	01/09/13	DIST-A	0.0040000	0.1500000
BB22915	10/17/12	01/09/13	DIST-A	ND	0.0400000
BB22918	10/17/12	01/09/13	DIST-A	**0.0520000**	0.1500000
BB22919	10/17/12	01/09/13	DIST-A	0.0010000	0.4100000
BB22959	10/17/12	01/09/13	DIST-A	0.0010000	ND
BB22960	10/17/12	01/09/13	DIST-A	0.0120000	0.2100000
BB22961	10/17/12	01/09/13	DIST-A	0.0070000	0.1400000

BB22963	10/17/12	01/09/13	DIST-A	0.0100000	0.3800000	
BB22964	10/17/12	01/09/13	DIST-A	0.0010000	0.0600000	
BB22966	10/17/12	01/09/13	DIST-A	ND	ND	
BB22849	10/16/12	01/09/13	DIST-A	0.0020000	0.1400000	
BB22859	10/16/12	01/09/13	DIST-A	ND	0.3500000	
BB22860	10/16/12	01/09/13	DIST-A	0.0020000	0.1700000	
BB22862	10/16/12	01/09/13	DIST-A	ND	0.0400000	
BB22997	10/16/12	01/09/13	DIST-A	0.0070000	0.0700000	
BB22888	10/16/12	01/09/13	DIST-A	0.0050000	0.0600000	
BB22898	10/16/12	01/09/13	DIST-A	0.0030000	0.0600000	
BB22899	10/16/12	01/09/13	DIST-A	0.0040000	0.0700000	
BB22902	10/16/12	01/09/13	DIST-A	0.0020000	ND	
BB22904	10/16/12	01/09/13	DIST-A	0.0060000	0.0400000	
BB22920	10/16/12	01/09/13	DIST-A	0.0040000	0.0500000	
BB22921	10/16/12	01/09/13	DIST-A	0.0140000	0.1100000	
BB22922	10/16/12	01/09/13	DIST-A	0.0010000	0.0400000	
BB22923	10/16/12	01/09/13	DIST-A	**0.0230000**	0.0500000	
BB22925	10/16/12	01/09/13	DIST-A	0.0030000	0.1400000	
BB22847	10/15/12	01/09/13	DIST-A	0.0020000	0.2100000	
BB22848	10/15/12	01/09/13	DIST-A	ND	0.0900000	
BB22850	10/15/12	01/09/13	DIST-A	0.0070000	0.1200000	
BB22851	10/15/12	01/09/13	DIST-A	**0.0170000**	0.3800000	
BB22853	10/15/12	01/09/13	DIST-A	0.0050000	0.3300000	
BB22854	10/15/12	01/09/13	DIST-A	0.0020000	ND	
BB22855	10/15/12	01/09/13	DIST-A	**0.0180000**	0.2700000	
BB22856	10/15/12	01/09/13	DIST-A	0.0070000	0.1300000	
BB22857	10/15/12	01/09/13	DIST-A	0.0010000	ND	
BB22863	10/15/12	01/09/13	DIST-A	0.0080000	0.3600000	
BB22866	10/15/12	01/09/13	DIST-A	ND	ND	
BB22870	10/15/12	01/09/13	DIST-A	0.0060000	0.1900000	
BB22871	10/15/12	01/09/13	DIST-A	ND	0.0400000	
BB22873	10/15/12	01/09/13	DIST-A	0.0020000	0.0700000	
BB22874	10/15/12	01/09/13	DIST-A	0.0030000	0.0500000	
BB22875	10/15/12	01/09/13	DIST-A	0.0040000	ND	
BB22876	10/15/12	01/09/13	DIST-A	0.0020000	0.1300000	
BB22877	10/15/12	01/09/13	DIST-A	0.0050000	0.0400000	
BB22924	10/15/12	01/09/13	DIST-A	0.0040000	0.0600000	
BB22962	10/15/12	01/09/13	DIST-A	0.0040000	0.2600000	
BB22852	10/14/12	01/09/13	DIST-A	0.0040000	0.4600000	
BB22858	10/14/12	01/09/13	DIST-A	ND	0.1100000	
BB22864	10/14/12	01/09/13	DIST-A	0.0080000	0.2500000	
BB22861	10/13/12	01/09/13	DIST-A	0.0040000	0.4800000	
BB22867	10/13/12	01/09/13	DIST-A	0.0010000	ND	
BB22869	10/12/12	01/09/13	DIST-A	0.0030000	0.1200000	
BB22872	10/12/12	01/09/13	DIST-A	0.0090000	0.3700000	
BB22868	10/11/12	01/09/13	DIST-A	0.0040000	0.1800000	
BB22980	10/11/12	01/09/13	DIST-A	0.0040000	ND	
BB22865	10/10/12	01/09/13	DIST-A	0.0110000	0.3400000	
BB17606	05/23/12	07/10/12	DIST-A	0.0120000	0.2600000	
BB17592	05/22/12	07/10/12	DIST-A	0.0020000	0.1200000	
BB17531	05/21/12	07/10/12	DIST-A	ND	ND	
BB17579	05/21/12	07/10/12	DIST-A	ND	0.0500000	
BB17587	05/21/12	07/10/12	DIST-A	ND	0.1300000	

BB17601	05/21/12	07/10/12	DIST-A	ND	0.0500000	
BB17604	05/21/12	07/10/12	DIST-A	0.0020000	0.2600000	
BB17607	05/20/12	07/10/12	DIST-A	0.0010000	0.0700000	
BB17611	05/20/12	07/10/12	DIST-A	ND	0.0500000	
BB17536	05/18/12	07/10/12	DIST-A	0.0040000	0.1100000	
BB17577	05/18/12	07/10/12	DIST-A	0.0040000	0.3700000	
BB17578	05/18/12	07/10/12	DIST-A	0.0050000	0.2500000	
BB17581	05/18/12	07/10/12	DIST-A	ND	ND	
BB17616	05/18/12	07/10/12	DIST-A	ND	0.1100000	
BB17330	05/17/12	07/10/12	DIST-A	0.0020000	0.0300000	
BB17331	05/17/12	07/10/12	DIST-A	0.0050000	0.2300000	
BB17441	05/17/12	07/10/12	DIST-A	0.0060000	0.1600000	
BB17540	05/17/12	07/10/12	DIST-A	0.0120000	0.0800000	
BB17580	05/17/12	07/10/12	DIST-A	ND	ND	
BB17584	05/17/12	07/10/12	DIST-A	0.0010000	ND	
BB17585	05/17/12	07/10/12	DIST-A	ND	0.1500000	
BB17586	05/17/12	07/10/12	DIST-A	0.0020000	0.1100000	
BB17589	05/17/12	07/10/12	DIST-A	0.0020000	0.2400000	
BB17590	05/17/12	07/10/12	DIST-A	ND	0.0300000	
BB17591	05/17/12	07/10/12	DIST-A	0.0020000	0.2200000	
BB17593	05/17/12	07/10/12	DIST-A	0.0040000	0.1000000	
BB17594	05/17/12	07/10/12	DIST-A	ND	ND	
BB17595	05/17/12	07/10/12	DIST-A	ND	ND	
BB17596	05/17/12	07/10/12	DIST-A	0.0010000	0.0800000	
BB17597	05/17/12	07/10/12	DIST-A	ND	ND	
BB17602	05/17/12	07/10/12	DIST-A	ND	ND	
BB17612	05/17/12	07/10/12	DIST-A	ND	0.0400000	
BB17615	05/17/12	07/10/12	DIST-A	ND	0.1100000	
BB17320	05/16/12	07/10/12	DIST-A	**0.0180000**	0.2000000	
BB17321	05/16/12	07/10/12	DIST-A	0.0040000	0.2500000	
BB17332	05/16/12	07/10/12	DIST-A	0.0140000	0.1000000	
BB17333	05/16/12	07/10/12	DIST-A	0.0020000	0.0600000	
BB17445	05/16/12	07/10/12	DIST-A	0.0010000	0.2700000	
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BB17613	05/16/12	07/10/12	DIST-A	0.0010000	0.1300000	

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BB17618	05/16/12	07/10/12	DIST-A	ND	0.1700000
BB17619	05/16/12	07/10/12	DIST-A	ND	ND
BB17620	05/16/12	07/10/12	DIST-A	ND	ND
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BB17450	05/09/12	07/10/12	DIST-A	0.0090000	0.3500000

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BA55335	12/05/06	02/09/07	DIST-A	ND	--	

City of Portland: Our drinking water is safe

Rachael Rafanelli, KGW *1:57 PM. PST February 23, 2016*

PORTLAND, Ore. -- The events in Flint, Michigan have people in Portland concerned about lead in the water.

City Commissioner Nick Fish says the city's water is safe to drink, that the water comes from two high-quality sources: the water of the Bull Run Watershed, and Columbia South Shore Well Field.

Unlike Flint, Portland does not have lead pipes, and the distribution system has never used lead service lines.

Fish says any source of lead that might be found would be from your home's plumbing, usually homes built between 1970 and 1985. That's why the city encourages people living in those homes to get their water tested.

“In the last 20 years we had about 18,000 homes tested, and 300 tested positive for lead. It gives you a sense it's not a big problem, but for those 300 homeowners it was important to know they had higher levels of lead, and take precautions: flushing their water or getting a water filter or calling a plumber,” said Fish.

Fish even tested his water to make sure it was free of lead.

Those free kits come in 1-2 weeks, and it will take 4-6 weeks to receive results, once you mail in your sample. If you live in Portland, you'll see information about this in your March water bill.

You can also contact LeadLine (https://multco.us/health/lead-poisoning-prevention)to request a test. Call 503-988-4000 to request a free kit.

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Watch: National attention on Forest Grove noise (http://www.kgw.com/news/national-attention-on-forest-grove-noise/51675630)

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EPA urges states to locate lead water lines as required

USA TODAY NETWORK **Todd Spangler, Detroit Free Press** Published 5:54 p.m. ET Feb. 29, 2016 | **Updated 7:54 p.m. ET Feb. 29, 2016**

(Photo: John Wisely Detroit Free Press)

WASHINGTON — The U.S. Environmental Protection Agency on Monday sent letters to governors and water regulators across the U.S. promising greater enforcement of rules to protect citizens from lead in drinking water in the wake of the crisis in Flint, Mich., and urging every state to locate lead water lines as required.

As the *Detroit Free Press* reported Sunday, millions of lead service lines remain buried in cities across the nation but in many cases water utilities are uncertain where those lines are, making it difficult if not impossible for them to be sure those utilities are testing for lead at sites considered the most likely to have contamination as required by the EPA.

The agency, which has been criticized by some for not moving more quickly in Flint after learning of high levels of lead in at least one home last February and, two months later, that the water system was not practicing corrosion control as was required, also said it is is "increasing oversight of state programs to identify and address any deficiencies."

Flint water crisis: Most troubling quotes
(http://www.usatoday.com/story/news/nation-now/2016/02/29/flint-water-crisis-10-most-troubling-quotes/81129950/)

The EPA outlined its plans in two letters sent Monday: One, from agency Administrator Gina McCarthy to governors in 49 states, and a second, with more detail, from Deputy Assistant Administrator Joel Beauvais in the EPA Office of Water to state regulators. The state of Wyoming did not get letters because it has not taken primary responsibility for drinking water, so it remains with EPA.

Filmmakers' #JusticeForFlint benefit raises $145K on Oscars night
(http://www.usatoday.com/story/life/movies/2016/02/29/filmmakers-justiceforflint-benefit-raises-145k-oscars-night/81106450/)

In January, McCarthy issued an emergency order taking over testing and putting other requirements on Michigan and the city of Flint, saying they were delaying implementation of recommendations made by the federal agency. That came, however, some 20 months after Flint switched water sources and the state Department of Environmental Quality, with primary responsibility, failed to require corrosion control, which apparently allowed lead to leach from aging lines into residents' taps.

While the state DEQ has borne most of the blame, EPA has been criticized for not moving more decisively to restore corrosion control and react to fears of widespread lead contamination after the state acknowledged in April of last year that it did not believe it had to require corrosion control under the 25-year-old Lead and Copper Rule at that point. It has since acknowledged the mistake.

McCarthy said in her letter that her staff "will be meeting with every state drinking water program across the country to ensure that states are taking appropriate action to identify and address" issued of lead levels being above acceptable levels. She also called for states to do more to ensure that the public receives "better and quicker" information on lead risks.

Location of lead water lines often a city's mystery
(http://www.usatoday.com/story/news/nation-now/2016/02/28/location-lead-pipes-water-systems/81081736/)

In a letter drawing more specifics, Beauvais called on states to confirm that their drinking water programs are meeting the protocols and procedures set out in the Lead and Copper Rule, a complex regulation that requires water systems to test a number of sites for lead, but only requires actions if more than 10% of the homes show levels over 15 parts per billion.

The letters seemed indicative of more stringent oversight on the way, as state regulators were urged to ensure that strict sampling protocols were used and guidance for identifying so-called "Tier 1" sites — those where the worst potential problems with lead could lurk — were made public.

They also said state regulators should review more carefully the results of lead samples taken at homes, as well as justifications for systems deeming some results invalid. Michigan DEQ in November raised questions with Flint, saying it could only confirm that six of the sites it used for sampling, out of more than 200 over the years, were definitely from homes served with lead services lines.

It also made mention of a requirement that systems conduct a "materials evaluation" and attempt to locate all their lead service lines. Federal rules require each water system to attempt to identify its lead lines but EPA has acknowledged in the past that those evaluations didn't result in utilities

assessing their lead pipes system-wide, potentially making it more difficult to know where the worst sites may be.

"These actions are essential to restoring public confidence in our shared work to ensure safe drinking water," wrote Beauvais, who asked state regulators across the country to respond to "activities in these areas" in the next month.

Given that EPA has often been criticized for overreach, it was unclear how governors and state regulators would react. Even in Michigan, after the DEQ acknowledged it had misapplied the law, officials questioned EPA's authority to issue the emergency order, even though it's clear by the Safe Drinking Water Act that it has such authority.

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Crisis Wednesday Lead Flint Crisis

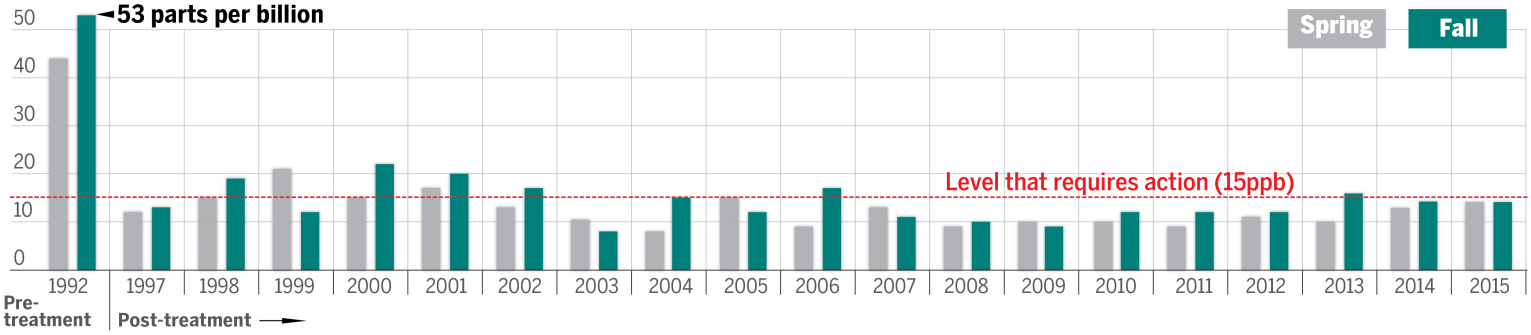
Read or Share this story: http://usat.ly/1oKipkF

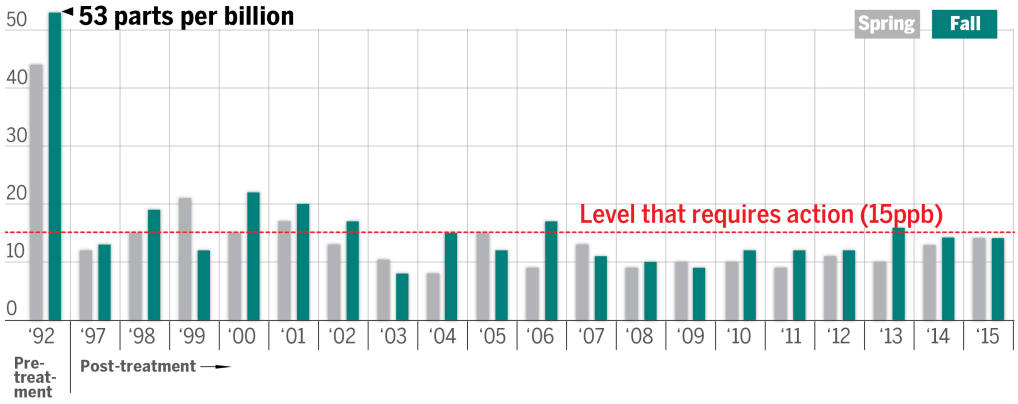
High-risk homes

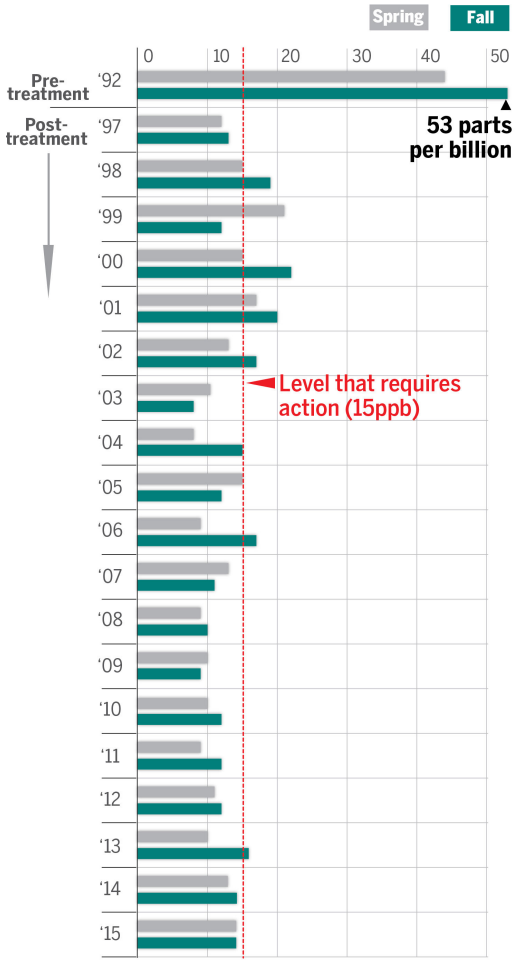
The map shows the percentage of homes in each census tract built from 1970 to 1985. Multnomah County officials consider this vintage of housing likely to contain lead solder, which homebuilders used to join copper plumbing components until the material was banned. The tracts shown use water supplied by Portland's water bureau.

Portland's lead levels

The chart shows the minimum lead levels for the top 10 percent of highest-risk homes, built between 1983 and 1985, whose water was tested for lead each year. Levels dropped after Portland began adding anti-corrosive agents to the water in 1997 but often hover close to the federal action threshold.







Graphics by Mark Graves

Sources: Oregon Health Authority

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Tufts UNIVERSITY | School of Medicine

PUBLIC HEALTH AND COMMUNITY MEDICINE
Home

Jeffrey Griffiths, AB, MD, MPH&TM

Positions:
Professor of Public Health and Community Medicine
Adjunct Professor, Friedman School of Nutrition
Adjunct Professor, School of Engineering

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Education:

Degrees: AB, MD, MPH&TM
Institutions: Harvard College, Albert Einstein College of Medicine, Tulane University School of Tropical Medicine and Hygiene

Research Focus:

The human, animal, and environmental epidemiology of the emerging pathogen Cryptosporidium;
Development of an ultrastable measles vaccine for use where there are is no refrigeration or during emergencies;
the influence of malnutrition and environmental factors, such as air pollution and heavy metals, on common infectious diseases such as diarrhea and pneumonia.
Dr. Griffiths has a long interest in waterborne diseases, ranging from research on the biology of the pathogens to their epidemiology and to public policy and regulation.

Select Publications:

Senate testimony on the Oversight Hearing on Federal Drinking Water Programs, December 2009

Senate testimony on the provision of clean water to US Troops in Iraq, April 2006

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Lead in the water: Why Portland's on wrong end of national list

By **Brad Schmidt | The Oregonian/OregonLive**
Email the author | **Follow on Twitter**
on April 09, 2016 at 5:01 AM, updated April 10, 2016 at 9:34 AM

Among America's 75 biggest water providers, only one has **recently exceeded federal standards for elevated lead levels** in the drinking water of high-risk homes.

Portland.

And when Portland isn't surpassing that benchmark, it **hovers just below** - with current testing showing the greatest lead levels among all large cities.

The Rose City's poor position nationally is coming into sharp focus in the fallout over toxic lead levels exposed in Flint, Michigan. A newly released database, compiled by The Associated Press and analyzed by The Oregonian/OregonLive, reveals publicly that Portland's water system is an outlier, with lead levels in high-risk homes four times above those from similar cities.

Testing of high-risk houses is limited locally to those built between 1983 and 1985, although the threat **encompasses homes constructed between 1970 and 1985**. Because Portland sells water to several suburban communities, at-risk homes spread east, west and south of Portland proper.

Portland officials have long known that Bull Run water is corrosive and prone to releasing lead in such homes. But state regulators approved a unique deal in the 1990s that allowed Portland to get away with minimal chemical treatment.

Over the decades, Portland's reported lead levels have plummeted by two thirds but remain stubbornly high compared to other jurisdictions. It **wasn't until 2003 that tests consistently began ducking under federal standards** -- but only after officials changed their testing pool to include more suburban homes with fewer problems.

Today, city officials maintain Portland's water is perfectly safe, though a consultant is actively studying whether distribution pipes might also carry lead-tainted particles. And they say they're not troubled by comparisons to other cities.

"Comparing us to other systems isn't really what we're concerned about," said Scott Bradway, Portland's lead hazard reduction manager. "What we're concerned about is how our system is, and what the risk is for our population."

No amount of lead is considered safe. But, to be sure, Portland is not Flint.

Lead levels in Portland are exponentially below the toxic water found in Flint last year, and the risk here is far less widespread.

That's because Portland doesn't have the same kind of lead service lines that allowed corrosive water to suck metals indiscriminately into the homes of Flint residents. Here, the risk is greatest from in-home plumbing that features copper pipes connected with lead solder.

Portland provides water to nearly 1 million people, a quarter of Oregon's population, including residents served by Gresham, Tualatin and the Tualatin Valley Water District. The city's prestigious Bull Run water flows into about 271,000 single-family homes throughout the region.

Of those, nearly one in six - an estimated **43,000 homes built between 1970 and 1985** - are at the greatest risk for high-lead exposure, The Oregonian/OregonLive found. But Portland officials say they've conducted voluntary testing for only a tiny fraction.

Jeffrey Griffiths, a Tufts University professor who chaired a U.S. Environmental Protection Agency drinking water committee, said Portland's results are concerning. He wouldn't recommend drinking water from high-risk homes at Portland's reported levels.

"Give me a break," he said. "And I certainly wouldn't be using that water to be making baby formula and giving it to my infant with a developing brain."

Lead is a toxic metal that builds up in blood when ingested. It's especially dangerous for children younger than 6 and pregnant women. Lead poisoning can lead to miscarriage or developmental problems in children.

Federal regulators require water providers to keep **lead levels at or below 15 parts per billion**, as measured through samples collected at specific homes throughout the system. If samples from at least 10 percent of those high-risk homes exceed that level, water systems must notify the public or take steps to reduce corrosion.

Portland has **exceeded that standard 10 times**, most recently in fall 2013 with results of **15.9 parts per billion**. In the past four testing cycles, it's held just below, including the latest results from **fall 2015 of 14.1**.

Seattle last tested at 3.5 parts per billion. Oakland reported 3.

"Oregon touts itself as some environmental mecca. Well congratulations, you're pretty near the top of the list for lead in water, and you've been there for more than a decade now," said **Marc Edwards**, a Virginia Tech professor who **helped spotlight problems in Flint.**

"And your water company seems perfectly content, and not the least bit embarrassed," he added. "And to be there with no lead pipes. That's not setting the bar very high."

A novel approach

Portland's water, from the **Bull Run watershed** 26 miles east of downtown, is "pure" and "clear," according to the city.

And it's injected with very few additives, a philosophy embodied by voters' long-standing rejection of fluoride treatments.

The water is also considered "soft," making it corrosive.

Back in 1991, federal authorities realized they needed to **lower lead and copper in drinking water across America**. In the following two years, Portland's samples from high-risk homes came back with plainly high results: **44 and 53 parts per billion.**

The EPA wanted Portland to add an assortment of chemicals to Portland's water. The most obvious solution was to add sodium hydroxide, carbon dioxide and soda ash, chemicals that would help reduce pipe corrosion that releases lead.

But city leaders pushed back, saying such steps would "exceed the benefit to the community" because only some homes had lead plumbing components.

Tips to reduce lead exposure

* Get a free lead-testing kit by calling 503-988-4000 or **filling out an online request form**

* Run water for 30 seconds to 2 minutes

* Don't use water from the hot-water tap for drinking or cooking

* Buy a water filter that reduces lead

In August 1995, officials pitched "minimal corrosion control" combined with education and testing programs to reach at-risk homes, with a special focus not on water but lead-based paint. They proposed adding only sodium hydroxide to water, estimated at the time to save about $10 million over 10 years compared to more treatment.

* Clean the faucet aerator

* Replace the faucet

SOURCE: Portland Water Bureau

State officials, with oversight responsibility for federal lead regulations, signed off.

Dave Leland, Oregon's drinking water manager, said he's not aware of a similar agreement in any other jurisdiction.

"It's a little bit novel, but we thought it met the intent," Leland said. "To be fair, EPA has been uneasy about that. They've been periodically uneasy."

Portland began adding sodium hydroxide in 1997. For 11/2 years, things looked good as results came back below federal action levels. But success was short-lived.

Diluting the numbers

Starting in fall 1998, results from six of nine testing cycles came back too high. The EPA again began pressing for action.

Portland added more sodium hydroxide to reduce corrosion. But city officials also made another change: They dramatically altered the sample of homes tested.

Officials cut more than half of the worst-performing homes, according to **a 2004 Washington Post investigation**, and replaced them with suburban locations with much lower lead levels.

In the years since, Portland has exceeded the federal action level just twice.

"It does look like we have a tendency to drive down or dilute the results" - Mark Knudson, Tualatin Valley water

Bradway, Portland's water lead hazard reduction manager, said altering the pool of test homes was not an effort to game the system. Homes selected for removal were picked at random, he said, and officials added suburban homes to better represent the distribution of at-risk properties rather than total customers served.

But the location of homes can make a huge difference, records obtained by The Oregonian/OregonLive show.

Some of Portland's suburban wholesale customers mix Bull Run water with other sources or add chemicals of their own. As a result, the prevalence of lead varies by jurisdiction.

Portland is required to collect at least 100 samples from area homes. At least 36 of those are collected from customers of the Tualatin Valley Water District, which serves unincorporated Washington County.

Just 28 samples must come from Portland, 18 from Gresham, and the rest from the remaining suburban water providers.

Tualatin Valley helps the whole system look better.

Between 2003 and 2013, records show, officials collected 879 samples from homes in the water district. Of those, just 2 percent came back above 15 parts per billion.

But for Portland, which had the second-most samples, the exceedance rate was three times higher. And for Gresham, it was six times higher.

In any testing cycle, system-wide results could tip past the federal threshold with high numbers from just a couple of additional homes.

Mark Knudson, Tualatin Valley's chief executive, recently suggested that the district - which also uses water from Hagg Lake - consider separate testing and treatment requirements for lead because of the differing results.

"It does look like we have a tendency to drive down or dilute the results" for everyone else, he said.

Reducing lead

Changes are on the horizon.

In the wake of Flint - where Edwards, the Virginia Tech professor, found one water sample with lead at **13,000 parts per billion** - federal authorities are now promising heightened scrutiny.

As a result, Portland recently met with **federal and state regulators to discuss its efforts**. Portland is in the process of disconnecting its open-air reservoirs, and officials are studying what those changes may mean for corrosion control.

Already, outside consultants are taking a hard look. While officials have regularly blamed in-home plumbing as the sole source of lead, consultants want to rule out that no lead is coming from the distribution system, according to records.

They've also questioned whether lead from decades-old city pipes has been absorbed into the coating of service lines, and whether disruptions in the flow of water may dislodge lead-laced particles - an issue that could affect more than just high-risk homes.

"Transport of lead by possibly iron or manganese is suspected to be significant in the water system because of the random patters of high lead" found in mapping, an October 2015 report reads.

City officials are downplaying that hypothesis.

"The report outlines theories about potential lead exposure that are being investigated by the study, not findings about our water system," Jaymee Cuti, a Water Bureau spokeswoman, said in a statement.

Full results won't be ready until later this year. Portland Commissioner Nick Fish, who oversees the Water Bureau, said it's premature to consider changing treatment options until it's complete.

"As always, important decisions about our drinking water will be driven by science and by Portland values," Fish said in a statement.

The EPA, meanwhile, praised Portland's long-term approach as "thoughtful." But the agency said it looks forward to Portland decommissioning its open-air reservoirs at Washington Park, which should improve its ability to minimize the corrosiveness of water.

"EPA now expects" that Portland can "maximize health protections by reducing lead at consumers' taps to levels as low as feasible, which is a priority for EPA," the agency said in a statement.

Leland, the state water official, said he's always suspected Portland would have the highest reported lead levels among big cities.

But Leland said it was the right decision to launch a broader lead-reduction program. Confirmed cases of children with high blood levels have dropped in Multnomah County, statistics show, although so have numbers statewide.

"We have not changed our minds," Leland said.

But in the nearly two decades since Portland resisted more expansive treatment, thousands of residents in high-risk homes have been exposed to potentially high lead levels.

Take Jerry Woodcock's house in Portland's Pleasant Valley neighborhood.

Results from Woodcock's home, built in 1984, are included in regional compliance numbers. Woodcock said he remembers receiving results from the Water Bureau but didn't pay them much mind.

Lead levels in Woodcock's home have exceeded 15 parts per billion in half of his tests since 2010, records show. Two of those topped 32 parts per billion.

He's tried to follow the city's advice and let his water run each morning, although he admits he's not always so diligent.

"You see a few of these things and they're below, or they're a hair above, and you're not particularly alarmed," he said of the city's notices. "But when you're giving me these high numbers, it's definitely more cause for concern. Kind of a wake-up call."

Correction: An earlier version of this story stated that reported lead levels had dropped by one third. They've dropped by about two thirds.

-- Brad Schmidt

Reporter Fedor Zarkhin contributed to this report

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Portland Water Bureau warns of high lead levels in sampling of homes

By **Lynne Terry | The Oregonian/OregonLive**
Email the author | **Follow on Twitter**
on February 25, 2014 at 3:03 PM, updated February 25, 2014 at 7:58 PM

Lead levels in water in a cluster of Portland area homes have spiked to dangerous levels.

The **Portland Water Bureau issued a warning** on Tuesday, saying that a recent round of tests of drinking water in a sampling of homes had more than 15 parts per billion of lead.

This is the highest level since 2006, said Scott Bradway, the bureau's water quality program manager.

The agency, which is investigating, does not know what caused the spike.

The tests were conducted last November as part of federally regulations that require the Water Bureau to test high-risk homes in the Bull Run service area twice a year. Any house built between 1970 and 1985, when plumbers used lead-based solder on copper pipes, are classed as high risk. A minimum of 100 homes must be tested each time.

In November, the bureau checked the water in 108 homes in a pool of 120 residences used for testing. There are thousands of high-risk homes are in the Bull Run service area, which includes Gresham, Portland, Tigard and Tualatin, along with the Burlington, Lake Grove, Lorna, Palatine Hill, Pleasant Home, Raleigh, Rockwood, Skyview, Tualatin Valley, Valley View and West Slope water districts.

To conduct the tests, water was drawn from kitchen faucets after sitting for at least six hours, allowing plenty of time for lead to leach into the water in a worst-case scenario.

Bradway said water in 13 homes exceeded 15 parts of lead per billion.

The bureau sent warning letters to residents who took part in the November tests, informing them of the results. City officials also notified other high-risk residences where children younger than 6 or pregnant women live.

Too much lead can cause serious health problems for children, damaging the brain and kidneys, interfering with the production of red blood cells and lowering IQs.

The Water Bureau is trying to figure out why the levels spiked.

"It's hard to pinpoint one cause," Bradway said. "We don't monitor every single parameter so it's hard to say what's changing.

"The Portland Water Bureau has been adding sodium hydroxide to the pipes of the treatment facility at Lusted near Sandy since 1997 to increase the pH of the water and make it less corrosive. The last time the bureau added the compound was in 2005.

Bradway said health officials are not worried about the results. There has never been a substantiated case of lead poisoning

traced to Bull Run water, he said. The biggest risk is lead paint, common in older homes.

The EPA estimates that 10 to 20 percent of the potential exposure to lead could come from drinking water.

The Water Bureau does not plan to change the chemistry of the water. The next tests are planned for April.

In the meantime, the bureau offers free lead testing kits and **has a list of tips** but essentially homeowners are on their own.

"We try to make the water less corrosive and monitor how the system is doing but we can't go in and replace their plumbing for them," Bradway said.

-- Lynne Terry

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The Washington Post

Inspired Life

The heroic professor who helped uncover the Flint lead water crisis has been asked to fix it

By Colby Itkowitz January 27, 2016

In Flint, Mich., there is a famous block of concrete that for decades has served as a community message board. Like an old-school Facebook feed, residents use it to post personal news, images, upcoming events and commentary in sprawling graffiti.

This week, several residents went to "The Block" (or "The Rock," depending on whom you ask) with a message. In big, black capital letters they painted: "YOU WANT OUR TRUST?? WE WANT VA Tech!!!" Underneath they wrote "PSI" and circled it in red with a line through it. It stands for Professional Service Industries Inc., the independent business the city had wanted to hire to test its water for contamination, and which the residents don't trust.

They want Marc Edwards.

And now, they're getting him.

On Wednesday, Michigan Gov. Rick Snyder announced that he was appointing Edwards to the newly created "Flint Water Interagency Coordinating Committee," tasked with finding a long-term strategy to address the water crisis. The 17-person team of experts will have three years to report their recommendations.

Edwards is the environmental engineering professor from Virginia Tech who once led, almost entirely on his own, a crusade against the federal government's failure to protect residents of Washington from lead in the city's water. And he won.

It was Edwards, 51, who more than a decade earlier proved, along with an investigation by The Washington Post, that corrosion in the nation's capital's pipes had caused lead to seep into the water supply and pass through kitchen faucets and shower heads. After helping to expose that water crisis in 2004, he spent six years challenging the Centers for Disease Control and Prevention to admit they weren't being honest about the extent of the damage the lead had on children.

He burned through thousands of dollars of his own money, as well as $500,000 from a MacArthur Foundation genius grant he won in 2008, to take on the federal government. He was harassed, lampooned, and threatened. He lost friends.

Then, in 2010, he was vindicated when it was proven that the CDC had lied to the public in a misleading report, which falsely claimed lead levels in the water had not posed a health risk to D.C. residents.

"I'm obsessed with what happened in Washington, D.C.," Edwards said in an interview last week. "Since 2005 through the present day, I've been trying to make sure another D.C. wouldn't happen."

[*Flint's water crisis reveals government failures at every level*]

And then his phone rang in April 2015. It was a woman named Leeanne Walters, a Flint, Mich., stay-at-home mother who was getting nowhere convincing state and local officials that there was something seriously wrong with the orange-tinted water coming out of her tap. Her family's hair was thinning. Her son's skin was red and irritated. They told her the water was perfectly safe. And even months later, when it had been determined there were high traces of lead in her water, the officials shrugged it off as an isolated problem.

Desperately, she called Edwards, whom she had read about online. Over the phone, he walked her through how to take her own water samples. The next day she sent them FedEx to Edwards to test. It was the worst lead levels he had ever seen.

"When we saw that my heart skipped a couple of beats," he said. "The last thing I needed in my life was another confrontation with government agencies. But it was us or nobody."

He shared his findings with the Environmental Protection Agency. He hoped the system would work this time. But in July, a high level EPA official ignored it and told the mayor of Flint everything was fine. The mayor famously went on television and drank a glass of the city's water to prove that all was well.

Edwards was furious. It felt like history repeating itself. So he formed a team of researchers at Virginia Tech, to, as he puts it, "go all in for Flint."

[*How you too can help the people in Flint*]

He collected hundreds more water samples, providing his expertise and funding. He set up a website to update the public on his findings and hold the government accountable. As he did in D.C., he became investigative reporter, activist and scientist.

He filed Freedom of Information Act requests for documents and emails of state and city officials to find out how much they knew and what they could be covering up. Turns out they knew a lot and did nothing.

"We just enabled them to really get to the truth," he said. "We couldn't sit by and let another D.C. unfold before our eyes."

He is again largely funding this effort out of his own pocket. He received a small $33,000 emergency grant from the National Science Foundation, but he has estimated that he's spent another almost $150,000. There is a GoFundMe page set up to raise money to offset some costs. The other night during a Notre Dame vs. Virginia Tech basketball game, the Fighting Irish presented their opponents with a $2,000 check for its Flint water work.

Since Edwards and his team intervened, the world has taken notice. They published all the documents from the FOIA requests, which showed just how badly the government had betrayed the people of Flint.

It's caused "a crisis in confidence in government," he said.

Walters, who leads a group of residents who call themselves the "Water Warriors," said the mistrust is so deep that they won't let the city's chosen company come test their water. They only want Edward's team.

"He was critical, he showed this problem was all throughout the city and not at one person's house," Walters said. "I don't think this fight would be where it was if it wasn't for Marc."

Edwards is a father of two teenagers. When he first started exposing the perils of lead water, his kids were two and four. He teaches a course on ethics and heroism at Virginia Tech. He tells his students that everyone has it in them to be heroic.

"I feel like I'm doing the job I was born to do," he said. "I get up every day with such a sense of purpose I wish everyone could experience something like that once in their life."

His colleagues in the field describe his passion and commitment. David Dzombak, a Carnegie Mellon University professor, met Edwards when he was a graduate student in 1988. He recalled Edwards speaking at a conference in 2002 warning other scientists to take seriously the threat of decaying water infrastructure. Even if it wasn't the hottest research topic of the moment, he told them it was their obligation as civil engineers to protect the public.

"I remember it vividly," Dzombak said. "He challenged his colleagues to talk about their priorities."

Bruce Lanphear, a professor at Simon Fraser University and also an expert in lead toxicity, said Edwards not only studies the impact of lead in water, but he makes his testing available to communities in need, like he did in Flint.

"What I think he does so beautifully is he fills a void that has been neglected," Lanphear said. "He's got passion and persistence. He's a bulldog. He's taken this problem on and he's going to help fix it. There's an arrogance in the best sense of the word. There's no question he will help force us to deal with it."

The work is far from over. Edwards sees his role as continuing to hold the government accountable to the residents of Flint. He'll share his scientific knowledge and continue to advocate for better civil servants.

"I didn't get in this field to stand by and let science be used to poison little kids," Edwards said. "I can't live in a world where

that happens. I won't live in that world."

This post, originally published Jan. 26, has been updated.

Inspired Life newsletter

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The lawyer who made friends with a 'murderer' — and proved his innocence

Meet the man who accidentally solved chronic homelessness

Colby Itkowitz is the lead anchor of the Inspired Life blog. She previously covered the quirks of national politics and the federal government. Follow @colbyitkowitz

Portland Water Bureau

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More Contact Info (http://www.portlandoregon.gov//water/article/398208)

Treatment & Monitoring

Corrosion Control Treatment

Lead and copper enter drinking water primarily through corrosion of home and building plumbing materials. In the Portland area, lead-containing plumbing materials are most commonly found in buildings built or plumbed between 1970 and 1985 with copper pipes and lead solder. Fixtures, such as faucets, installed prior to 1985 can also contribute to elevated lead in water. Faucets and fixtures installed before 2014 can also contain up to 8% lead.

Untreated water from the Bull Run Watershed is naturally corrosive, which can increase the amount of lead and copper that dissolves from home plumbing into drinking water. Since 1997, the Portland Water Bureau's corrosion control treatment has reduced corrosion in plumbing by adding sodium hydroxide, which increases the pH of the water to 8.1. This treatment has been shown to reduce the presence of lead in tap water up to 70%. This treatment is applied to water from both of Portland's water sources, the Bull Run Watershed and the Columbia South Shore Wellfield.

Future Changes

In 2014, in anticipation of changes to the water system, the Portland Water Bureau embarked on a water quality corrosion study. This study will inform potential changes in the future. We expect results from the study in early 2017. Preliminary results (http://www.portlandoregon.gov//water/article/550359#WQCCTStudy)indicate that treatment improvements can be effective at reducing the levels of lead in water. As a result, the Portland Water Bureau is working with state and federal health officials to develop a schedule for implementing additional corrosion control. These changes are anticipated to be implemented in the next 3 to 4 years.

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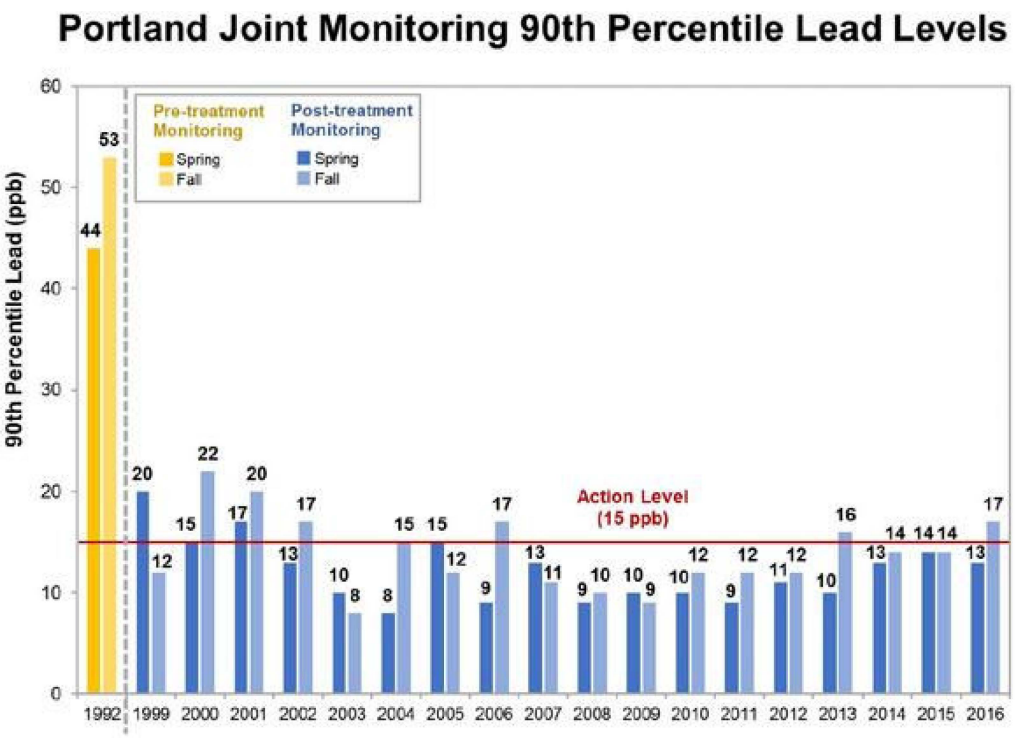
High-Risk Home Monitoring

Twice each year the Portland Water Bureau and regional water providers in the Bull Run service area test more than 100 high-risk homes to monitor the effectiveness of corrosion control for lead and copper in tap water. These high-risk homes are known to contain copper pipes and lead solder, which is more likely to contribute to elevated lead levels. These homes represent a worst-case scenario for lead in water.

Sample collection instructions (http://www.portlandoregon.gov//water/article/568690) for the homeowners follow Environmental Protection Agency (EPA) recommended procedures. Samples are collected by the homeowners after the water has been standing in the household plumbing for more than 6 hours. When samples are returned to the Water Bureau, they are put through a screening process to ensure they meet the regulatory requirements before being sent to the lab. This ensures that the results from all the samples analyzed by the lab will be used to determine compliance with the Lead and Copper Rule and will not be invalidated due to sampling issues. If lead levels are over 15 parts per billion*, the action level established by the Environmental Protection Agency to monitor the effectiveness of corrosion treatment, in more than 10% of these homes, the Portland Water Bureau notifies its customers and performs outreach and education to those most at-risk for lead exposure. In the most recent round of monitoring, more than 10% of homes were above the action level for lead in water.

*One part per billion corresponds to one penny in $10,000,000 or approximately one minute in 2,000 years.

High-Risk Home Monitoring Results



(http://www.portlandoregon.gov//water/article/578471)