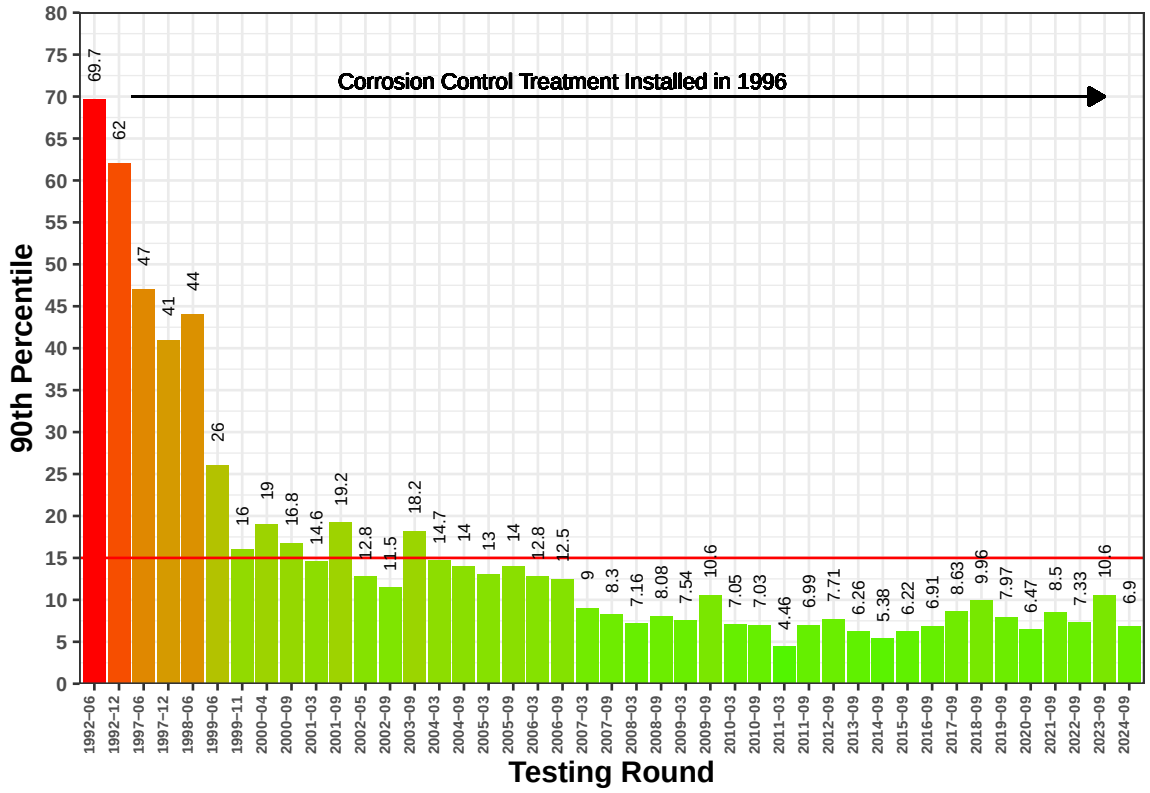
Analysis of Lead Levels From MWRA Communities 1992 to 2024

In this document, a statistical summary of the results of the Lead and Copper Rule (LCR) sampling is provided, spanning the time between 1992 when the EPA first required sampling under the Lead and Copper Rule to present. During that time, the Massachusetts Water Resources Authority (MWRA) designed, constructed and optimized corrosion control treatment to lower lead levels in consumer tap water. Now, while the regional results are routinely passing the 90th percentile Action Level (AL) of 15 parts per billion (ppb), MWRA and the member communities continue to work to further reduce lead levels and to identify and replace lead service lines. Divided into four sections, this document gives an overview of lead results for the service area with nearly 600 samples currently taken per sampling round. The first section presents a plot of the variation of the 90th percentile across sampling rounds. The second section lays out the empirical distribution of the sample concentrations for each sampling round since 1992 illustrated by histograms. Each histogram is further annotated with extra statistical measures that provide a more detailed understanding of the results, and context for the 90h percentile value. The third section shows boxplots for each sampling round. Finally, the fourth section displays a plot of stacked bars that illustrates the proportion of samples with various lead concentrations from December 1992 to September, 2024. More detail on lead results, including individual sampling results for various sampling programs is provided here.

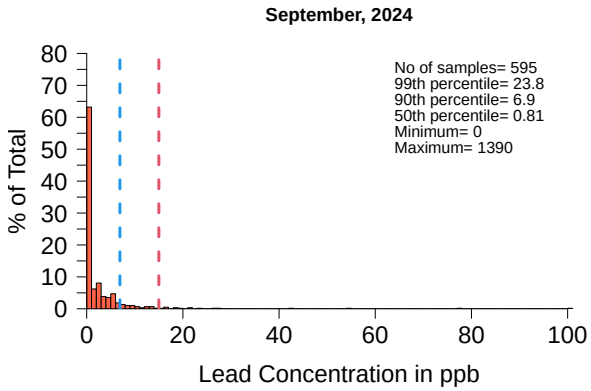
90th Percentile Concentration

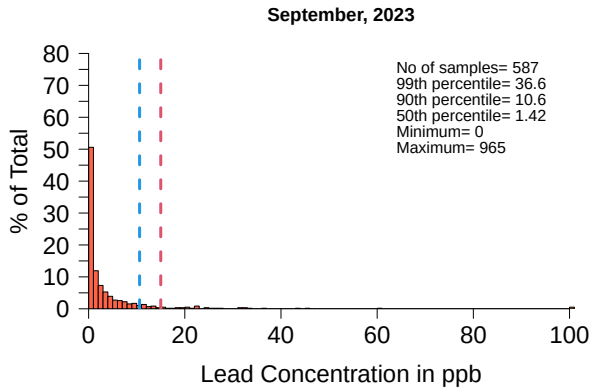
The bar graph below improvements in the 90th percentile results over time as MWRA began operating modern corrosion control treatment in 1996, and gradually optimized it over several years. The red horizontal line represents the lead Action Level of 15 parts per billion (ppb).

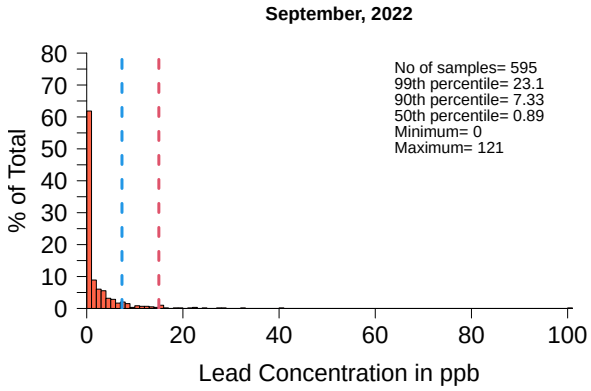


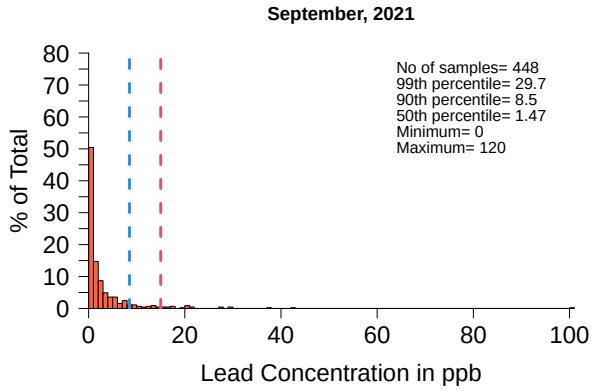
Distribution by Sampling Round – Most Recent Shown First

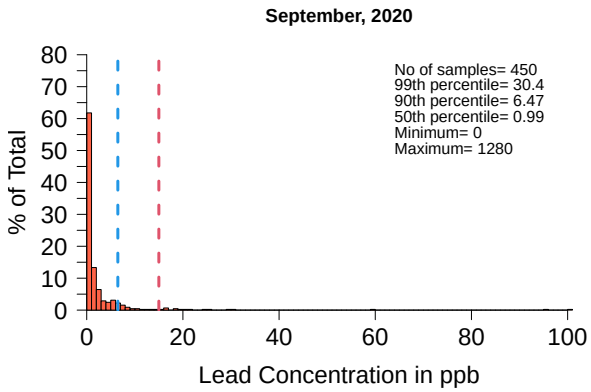
The following histograms illustrate the empirical distribution of the sample concentration for each sampling round, starting from the latest round, which was done in September, 2024.The vertical dashed red line on each histogram represents the action level of 15 ppb. The vertical dashed blue line represents the 90th percentile concentration for each sampling round. Each histogram is further annotated with extra statistical measures that may be of interest to management and other researchers. Until 2011, MWRA sampled twice annually. Since then only annual sampling has been required.

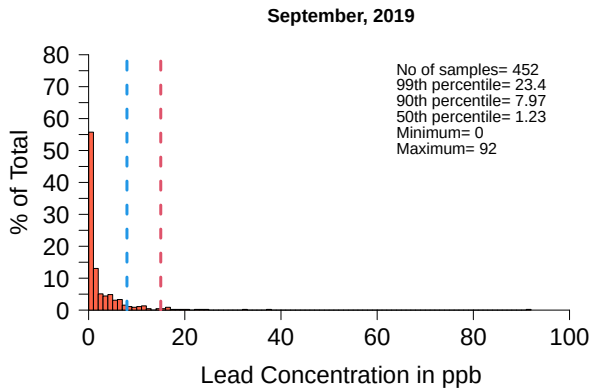




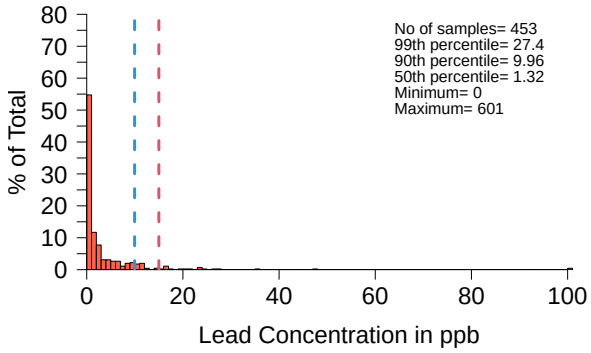








September, 2018



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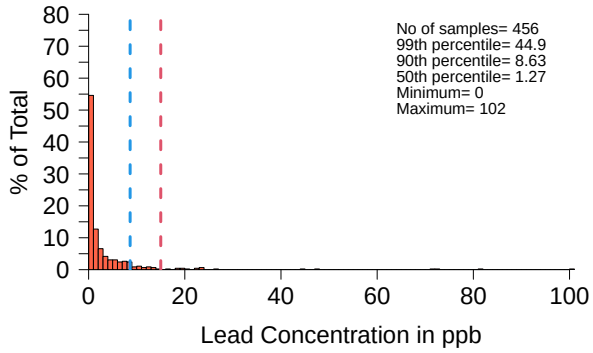

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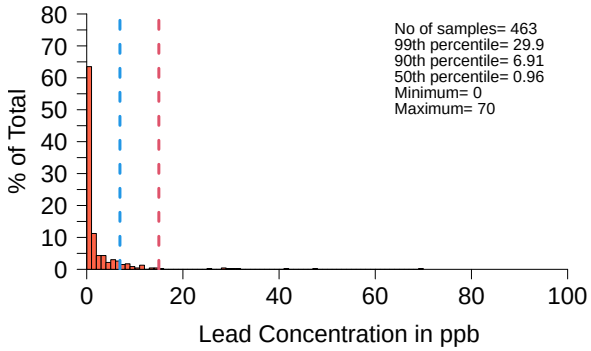

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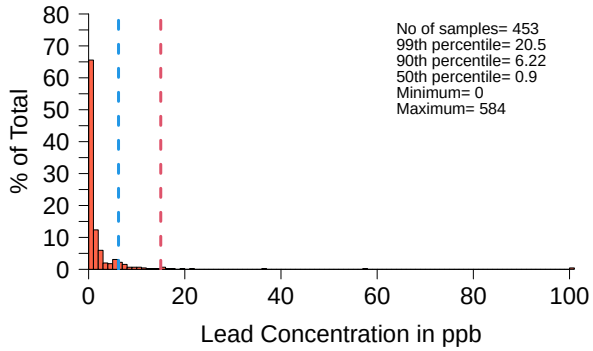

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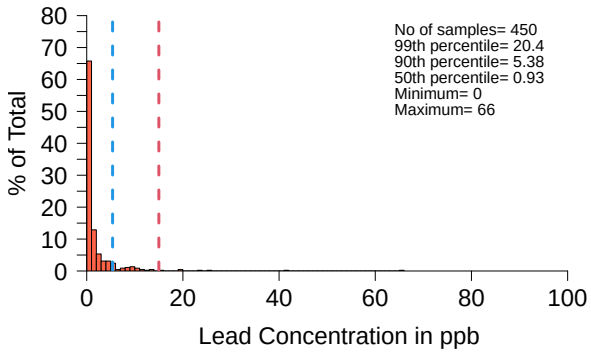

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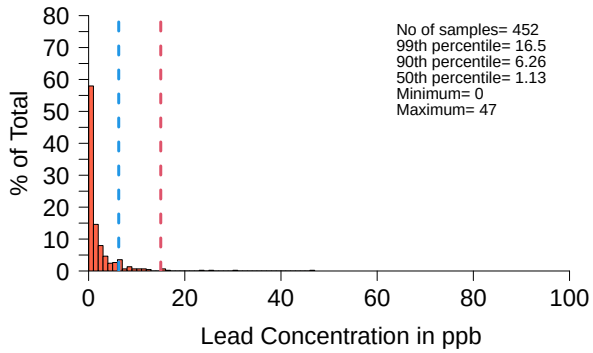

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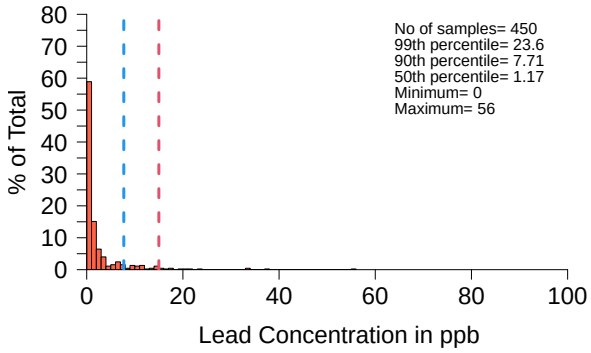

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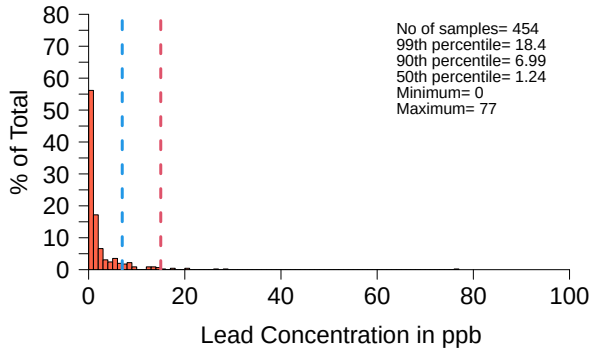

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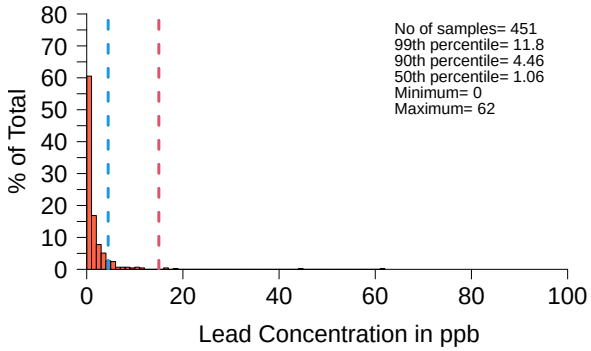

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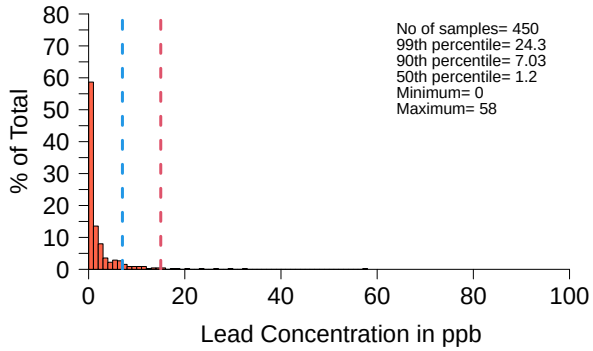

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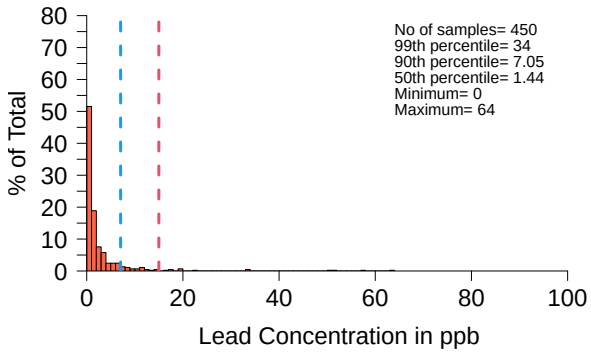

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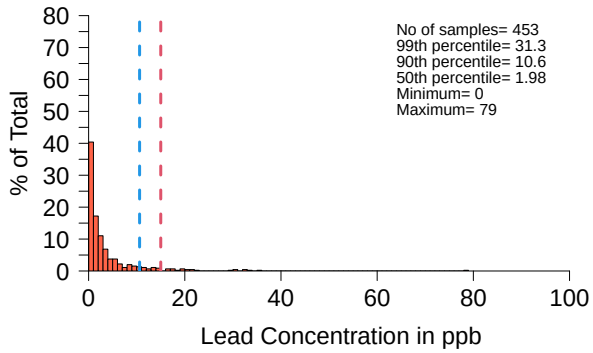

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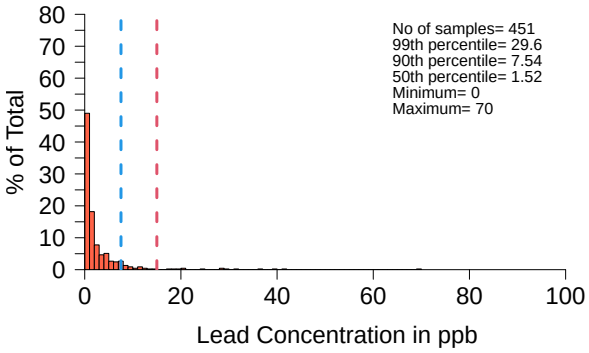

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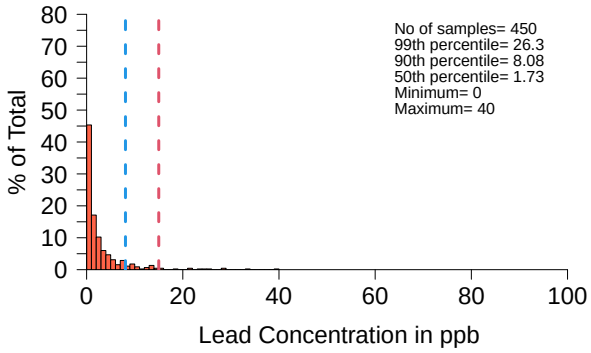

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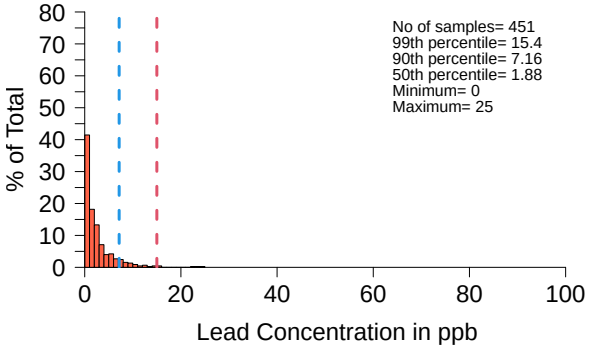

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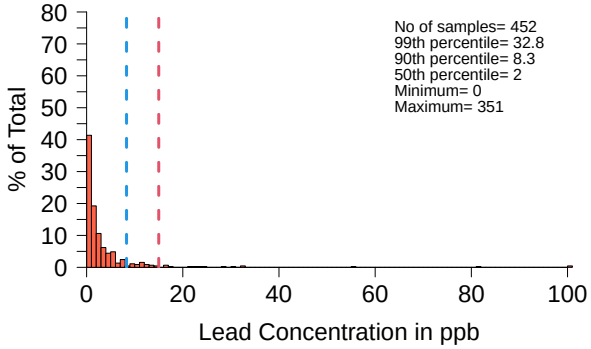

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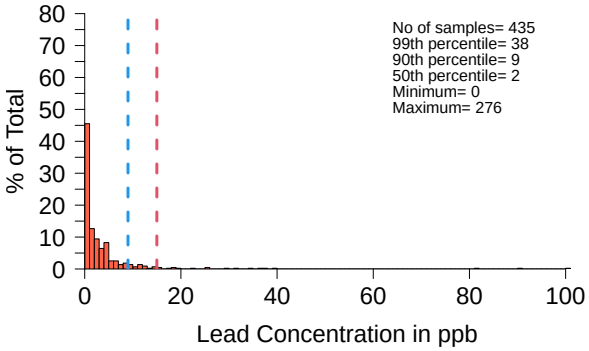

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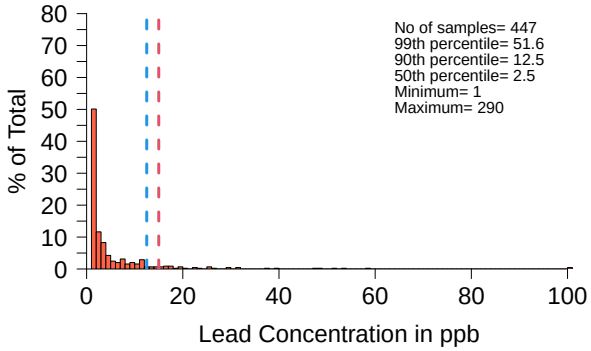

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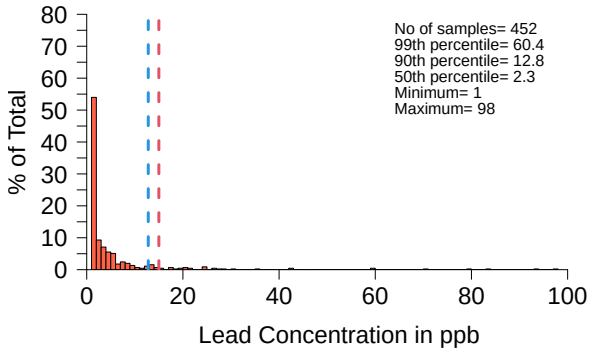

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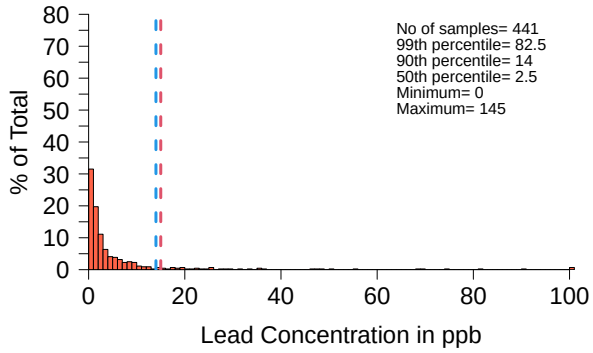

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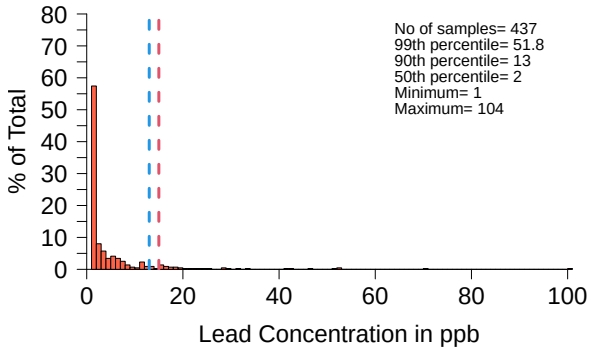

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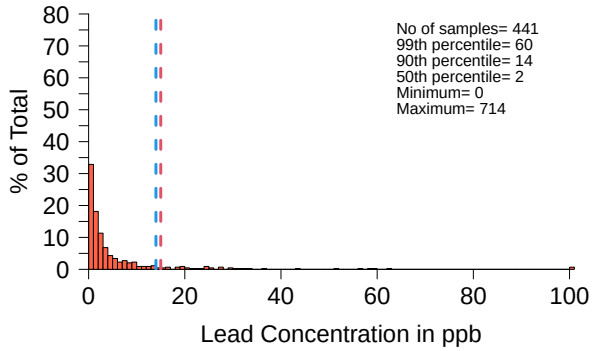

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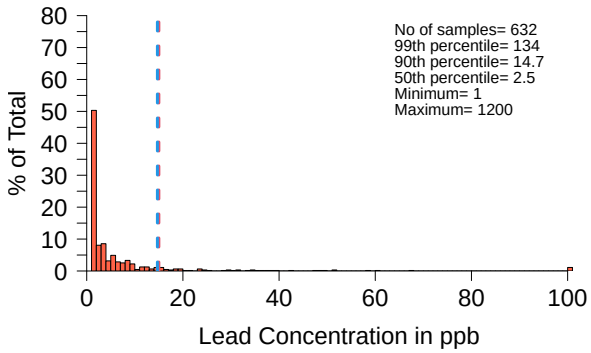

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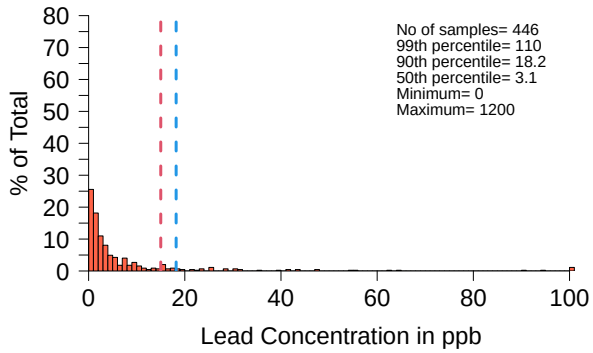

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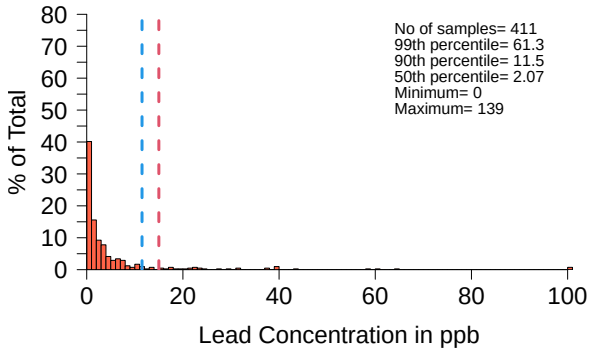
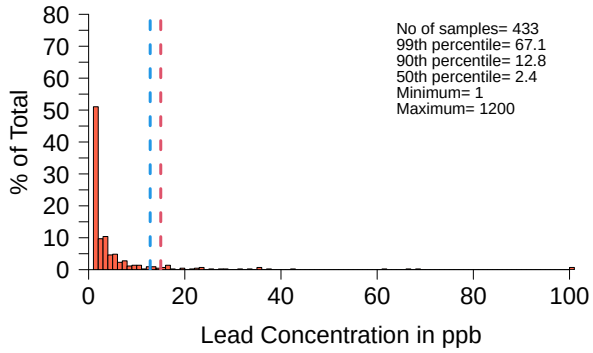


May, 2002



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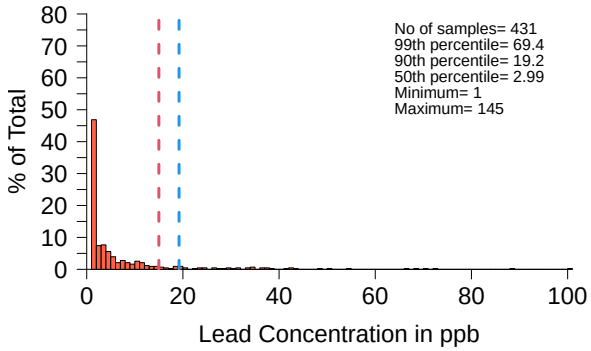

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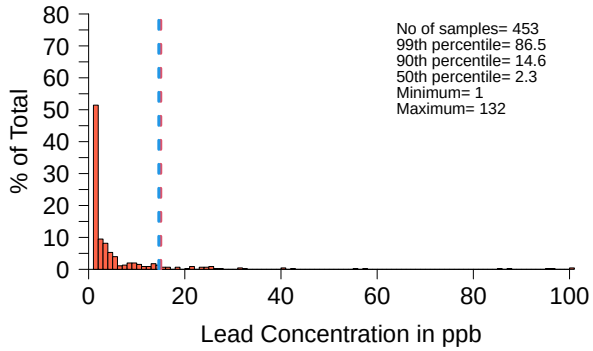

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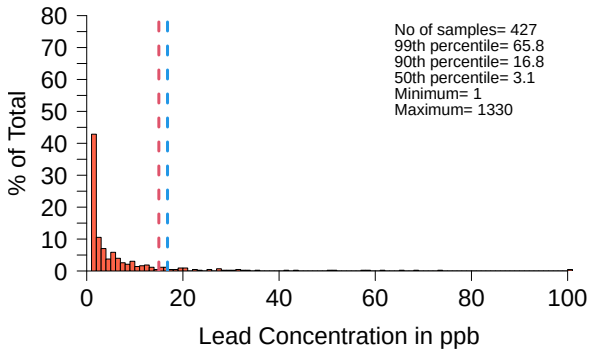
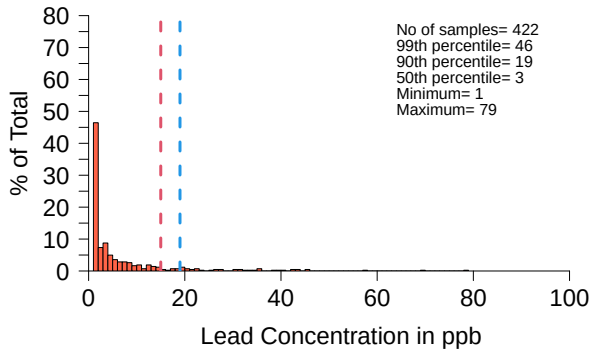
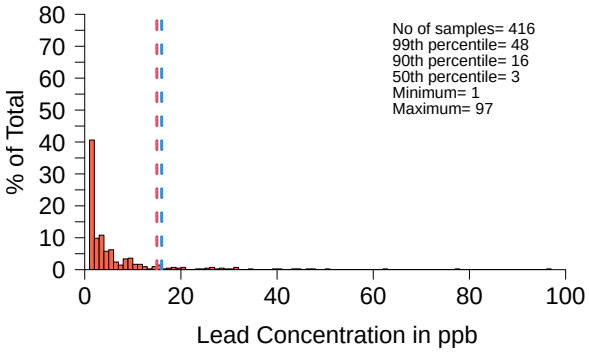


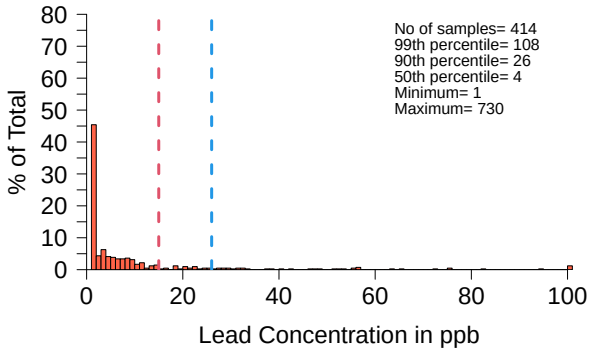
April, 2000



November, 1999



June, 1999



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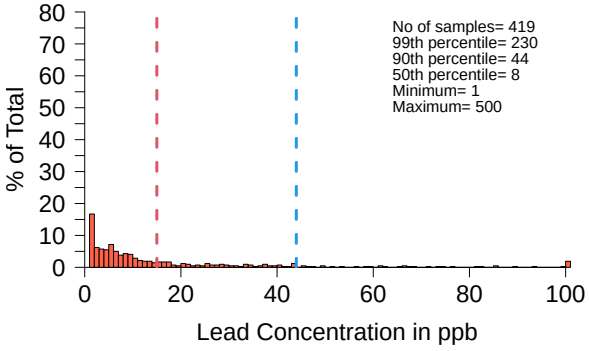
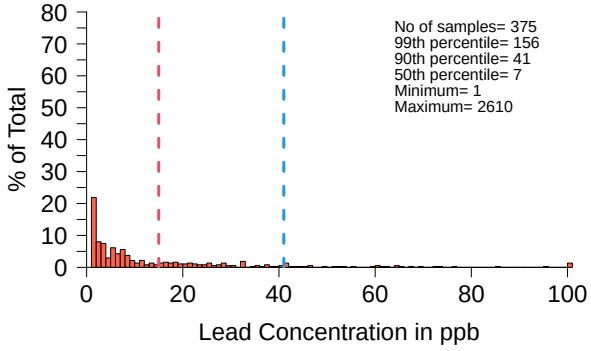


December, 1997



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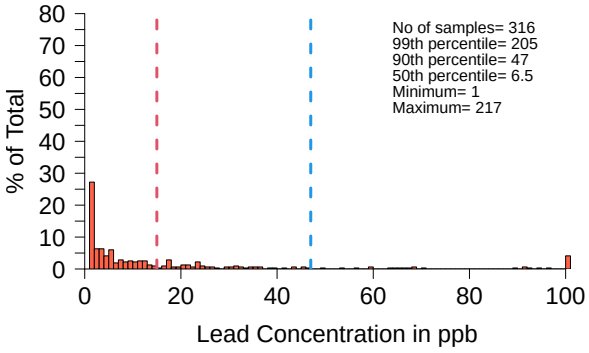
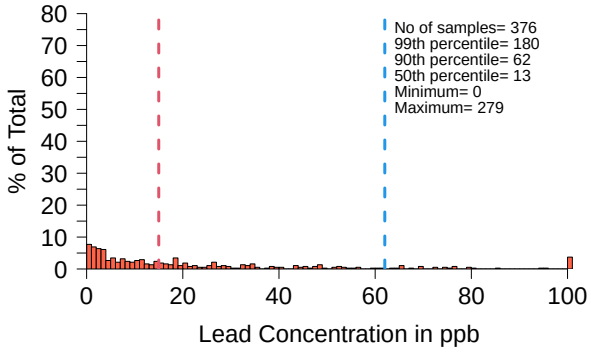
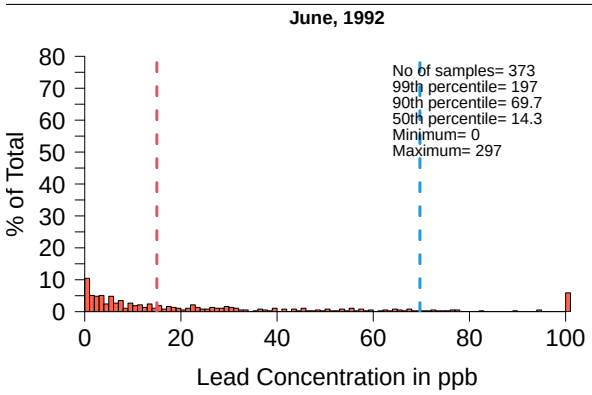


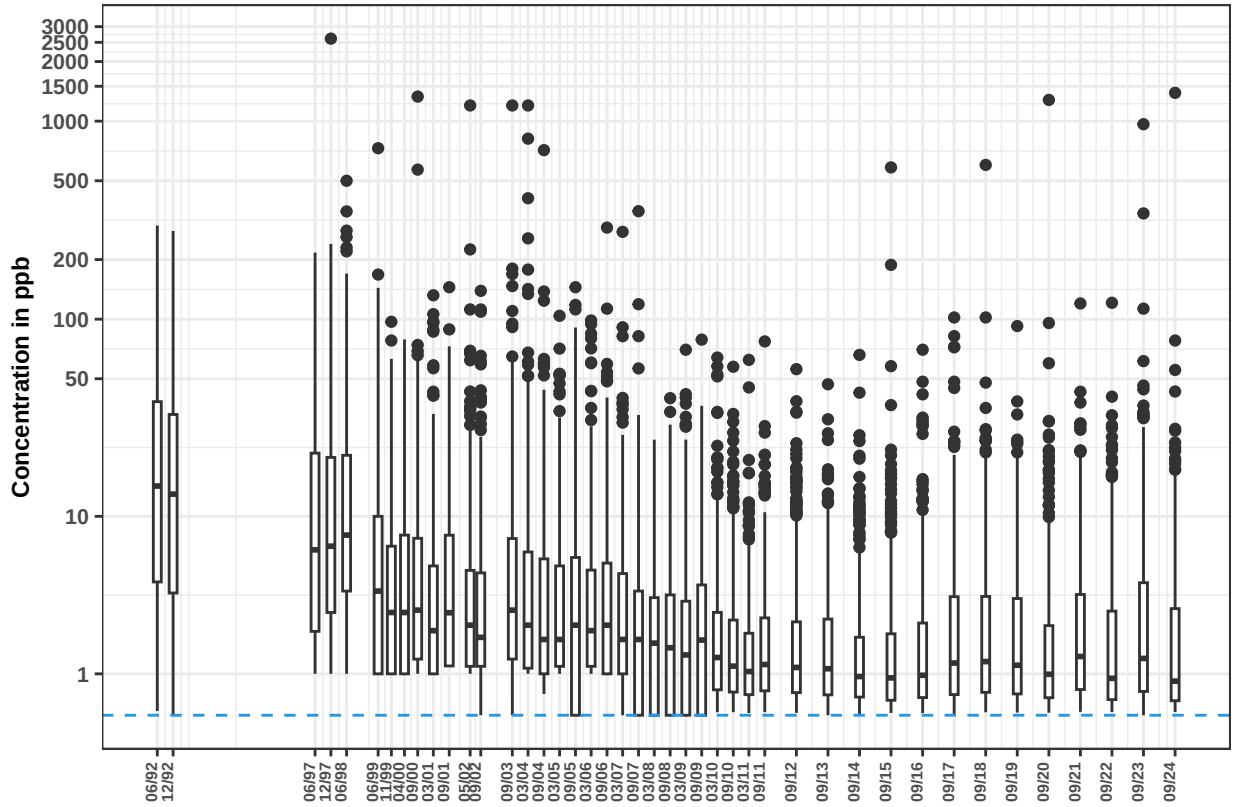
December, 1992



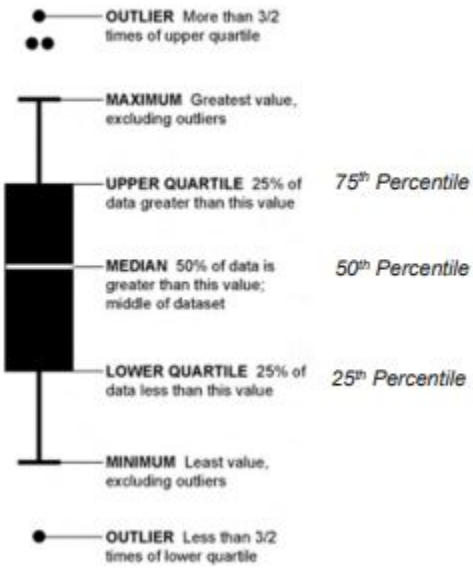

June, 1992
No of samples= 373
99th percentile= 197
90th percentile= 69.7
50th percentile= 14.3
Minimum= 0
Maximum= 297
% of Total
0
10
20
30
40
50
60
70
80
0
20
40
60
80
100
Lead Concentration in ppb

Sampling Round Comparative Boxplots

These boxplots illustrate the lead concentrations distribution for each sampling round starting from 1992 to 2024 . The concentrations are plotted on a logarithmic scale to emphasize the distribution of the low values.



Key To Box Whisker Plot



Explanation of Terms

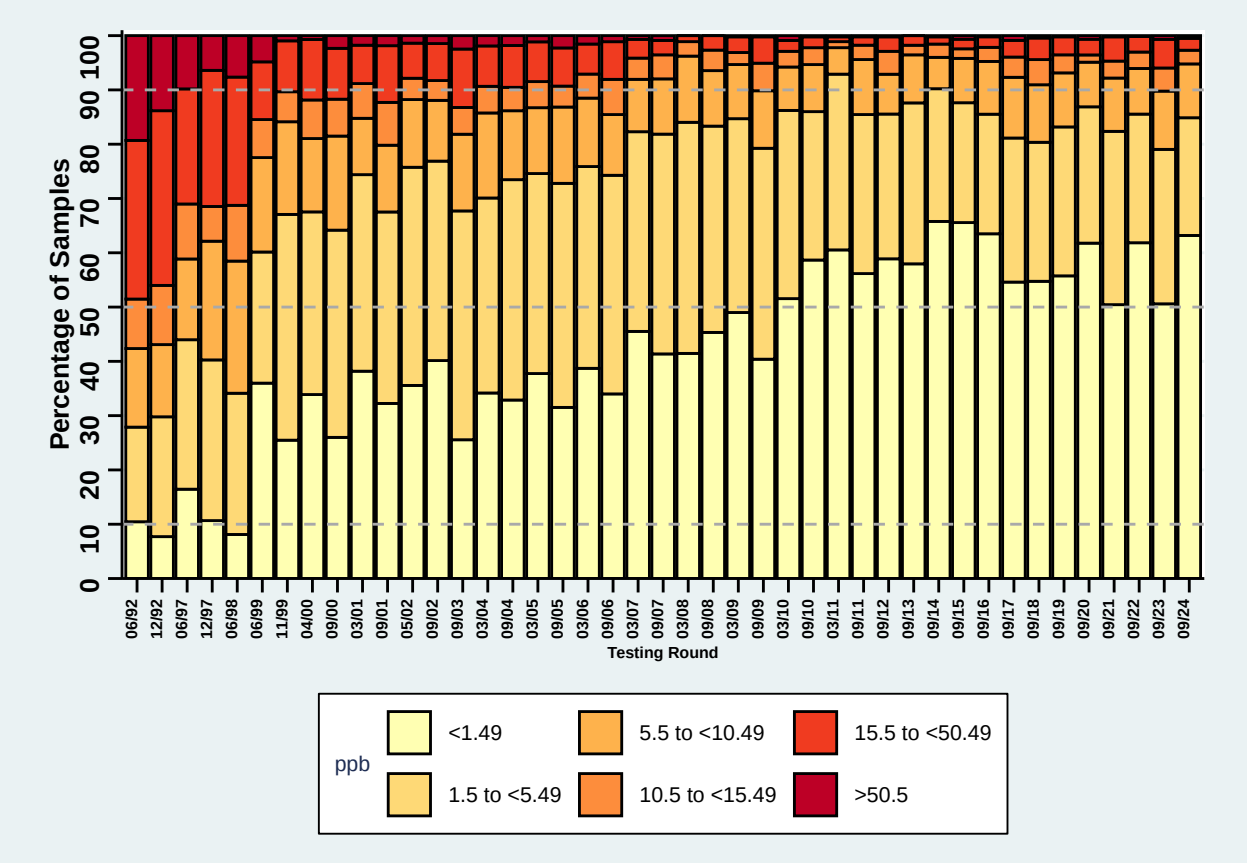
Median: Half the values are lower than this value, while the other half is higher. It is also the 50% Percentile.

99th Percentile: 1% of the values are higher than this value.

90th Percentile: 10% of the values are higher than this value.

50th Percentile: Same meaning as Median.

Range: As shown here, is the minimum and maximum value.

Stacked Bar Comparison 1992 to present year

The plot below shows the variation of the percentage of samples that fall into the following categories: (a) below 1.49 ppb (b) 1.5 to less than 5.49 ppb (c) 5.5 to less than 10.49 ppb (d) 10.5 to less than 15.49 ppb (e) 15.5 to less than 50.49 ppb (f) greater than 50.5 ppb. The plot particularly shows that the percentage of samples below 1 part per billion has been increasing over time.