Particulate Matter Sampling of Metals in Cully, NE Portland

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Introduction
In response to public concern about toxic metals air pollution in Portland neighborhoods, the Institute for Sustainable Solutions (ISS) at Portland State University (PSU), in partnership with the City of Portland and Multnomah County partnered with the Sustainable Atmospheres Research Lab (STAR Lab) at PSU to conduct sampling and analysis of metals on particulate matter in several Portland area neighborhoods.

The STAR lab collaborated with Neighbors for Clean Air (NCA) and Cully Clean Air neighborhood group to identify sites to host air sampling monitors for nearly 3 months (July – October, 2017). We are grateful for the hosts for providing electrical power and site access for this effort.

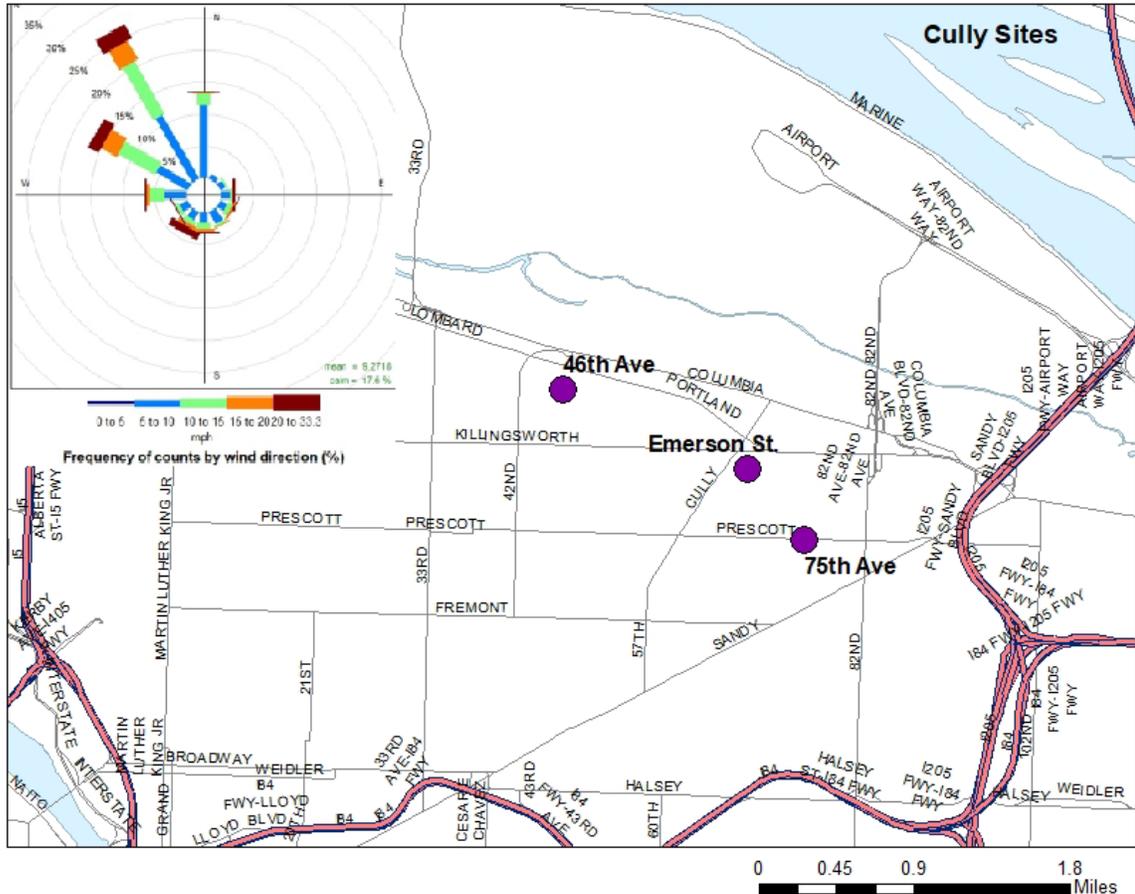Below are maps of the sampling locations that were identified.

Figure 1. Map of collection sites for filter samples and windrose(inset) for the sampling period from PDX airport station.
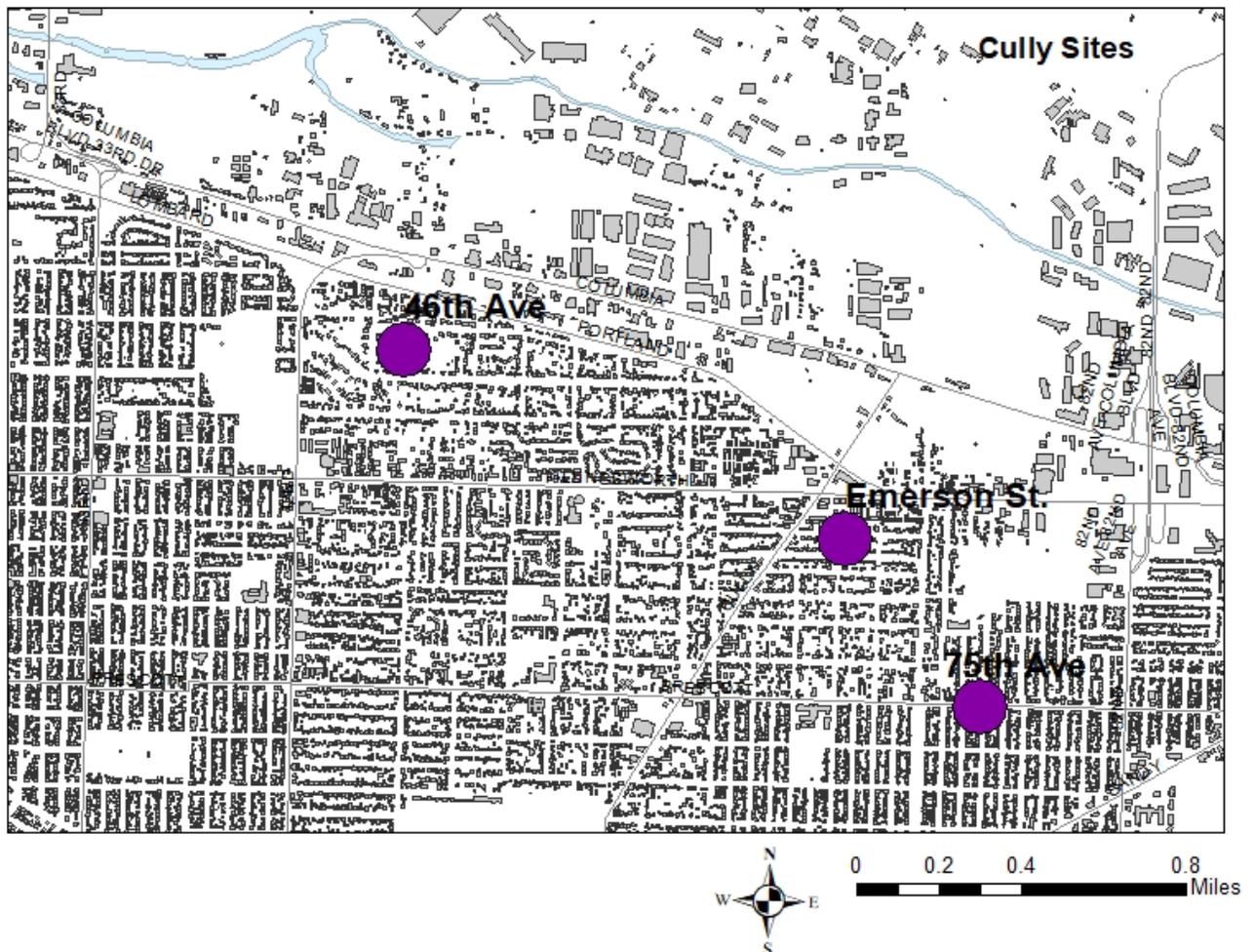
Figure 2. Map of collection sites with building footprints. Shows industrial facilities around Columbia Blvd.

We tested for metal content in suspended particulate matter in air using a sampler (ARA Inc. Sampler) that pulled air through a Teflon filter at a flow rate of 16.7 liter/min. Particles that were less than 10 microns in diameter (PM10) were collected on the filter over a 48 hours period of continuous sampling. After the 48 hour period the exposed filter was collected and a new one put in its place for the next sampling period. Samples were transported to the STAR lab for elemental analysis (including metals) using X-Ray Fluorescence (XRF). We monitored in the Cully neighborhood area from mid July 2017 until the mid of October 2017. We collected approximately 80 filter samples. Filters were deployed, collected and analyzed by trained volunteer PSU Environmental Science and Management students. Field blanks and laboratory blanks were collected and showed no process contamination. The XRF was calibrated with a suite of standards supplied by MicroMatter Inc. Calibration data is available upon request.

Figure 1. Modi Raduma checking on ARA Sampler

Results and Discussion

The graphs below show the concentration of toxic metals of potential concern over the sampling period at each of the sampling sites in the Cully neighborhood. To provide context, we also show the "1 in a million excess cancer level" based on DEQ's ambient benchmark concentrations (ABC) for annual average concentrations (orange line), the "10 in a million excess cancer level" (red line), and the "25 in a million excess cancer level" (brown line) on the graphs. The Ambient Benchmark Concentrations in Oregon's existing risk based air toxics program set at one in a million excess cancer risk serve as risk reduction goals. They are set at a very health protective risk level because people are exposed to multiple pollutants daily and over a lifetime. The 10 in a million and 25 in a million levels have been used in community air toxics analysis projects to evaluate when individual pollutants could be causing health risk at levels of higher concern and should be prioritized for reduction efforts. A complete evaluation of air toxics causing cancer risk must be conducted by evaluating a year of monitoring, so the risk levels shown on the graph when applied to less than a year of data are for screening purposes. They can indicate which pollutants warrant more study or follow up monitoring.

Overall, the data shows that the levels of toxic metals were not elevated during the sampling period, as measured at the sampling sites available to us, except for arsenic and, potentially, nickel. Arsenic is generally elevated in the Portland area. We have found this level of arsenic consistently throughout the Portland area. It has been proposed that arsenic in Portland's air comes from soil dust that is naturally elevated in arsenic in this area.
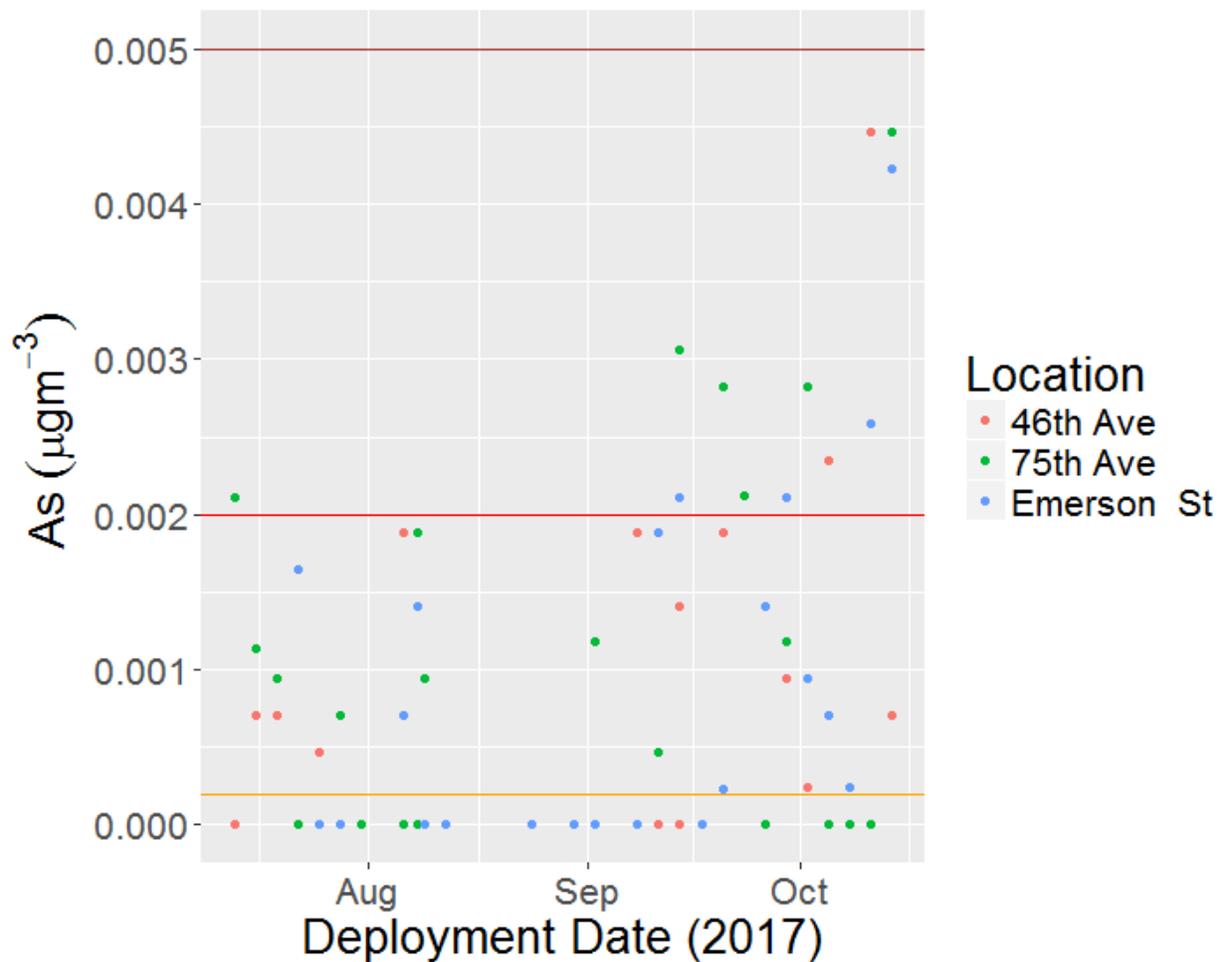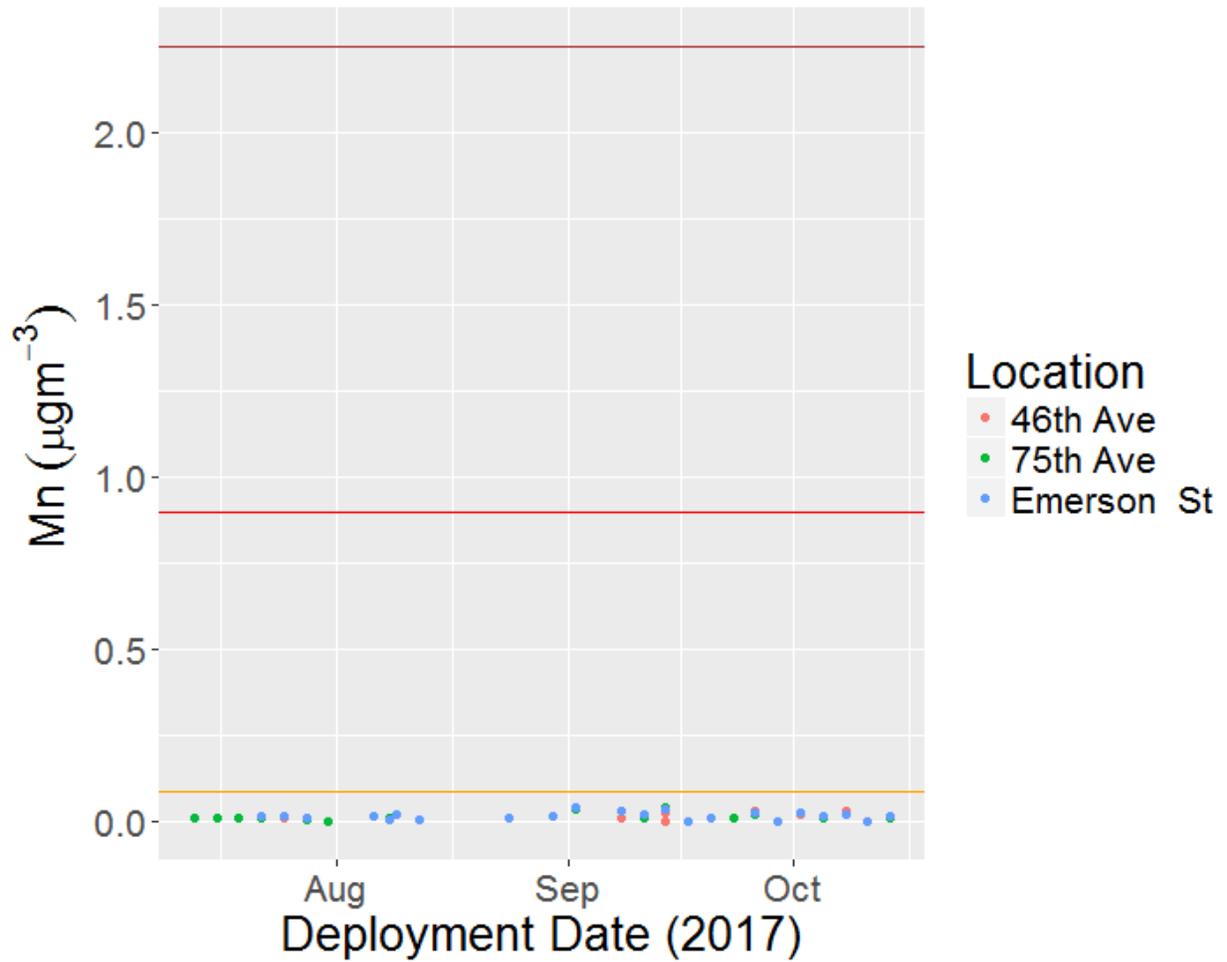

The orange horizontal line represents the current Ambient Benchmark Concentration of **arsenic** (ABC = 0.0002 ugm^{-3}). The red and brown horizontal lines are 10x ABC = 0.002 ugm^{-3} and 50x ABC = 0.01 ugm^{-3} respectively. **65.7% of the analyzed samples were below the detection limit (LOD = 0.001 ugm^{-3}).**
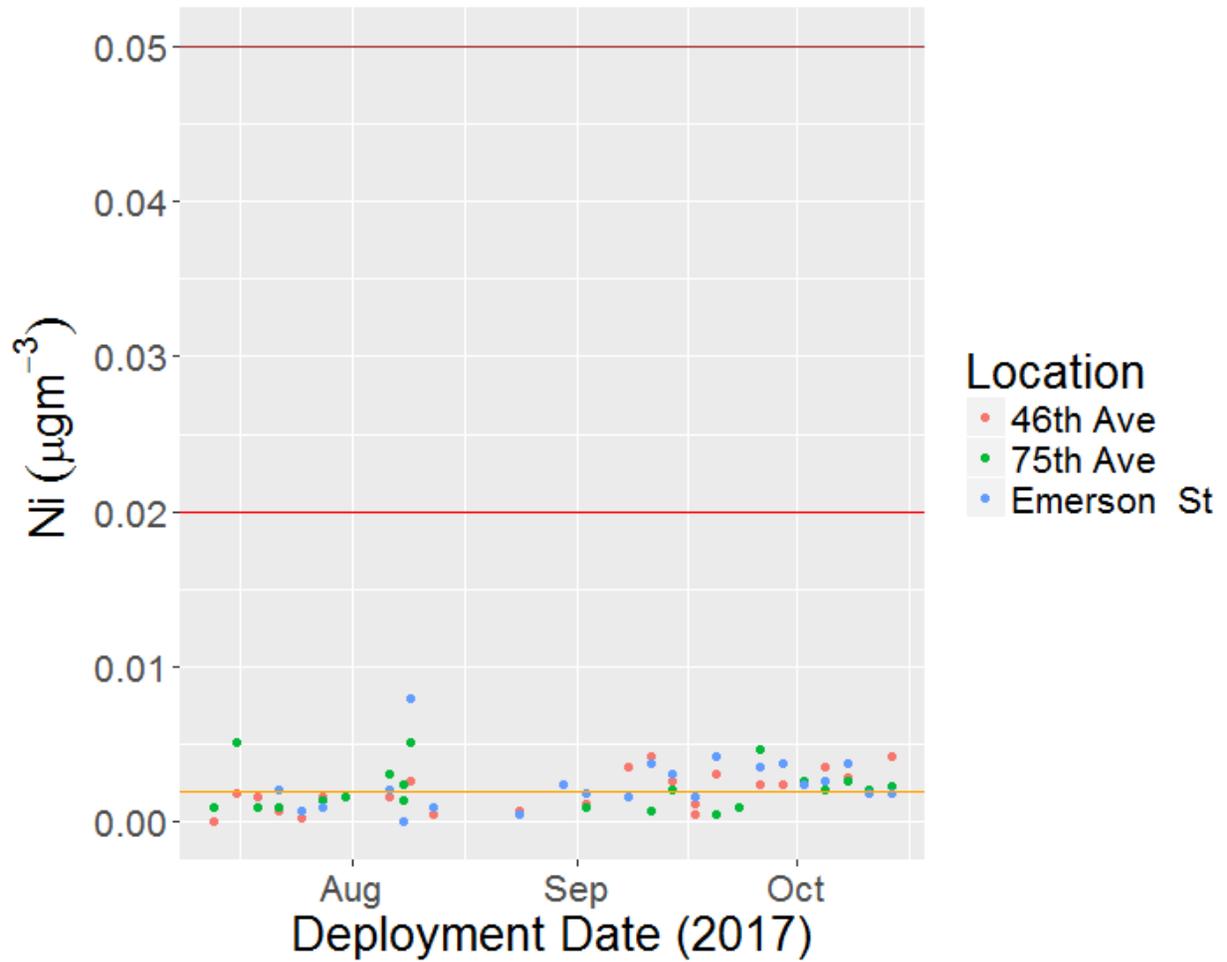
The orange horizontal line represents the Ambient Benchmark Concentration of **cadmium** (ABC = 0.0006 ugm^{-3}). The red and brown horizontal lines represent 10x ABC = 0.006 ugm^{-3} and 50x ABC = 0.03 ugm^{-3} respectively. **91.4% of the analyzed samples were below the detection limit (LOD = 0.0006 ugm-3).**
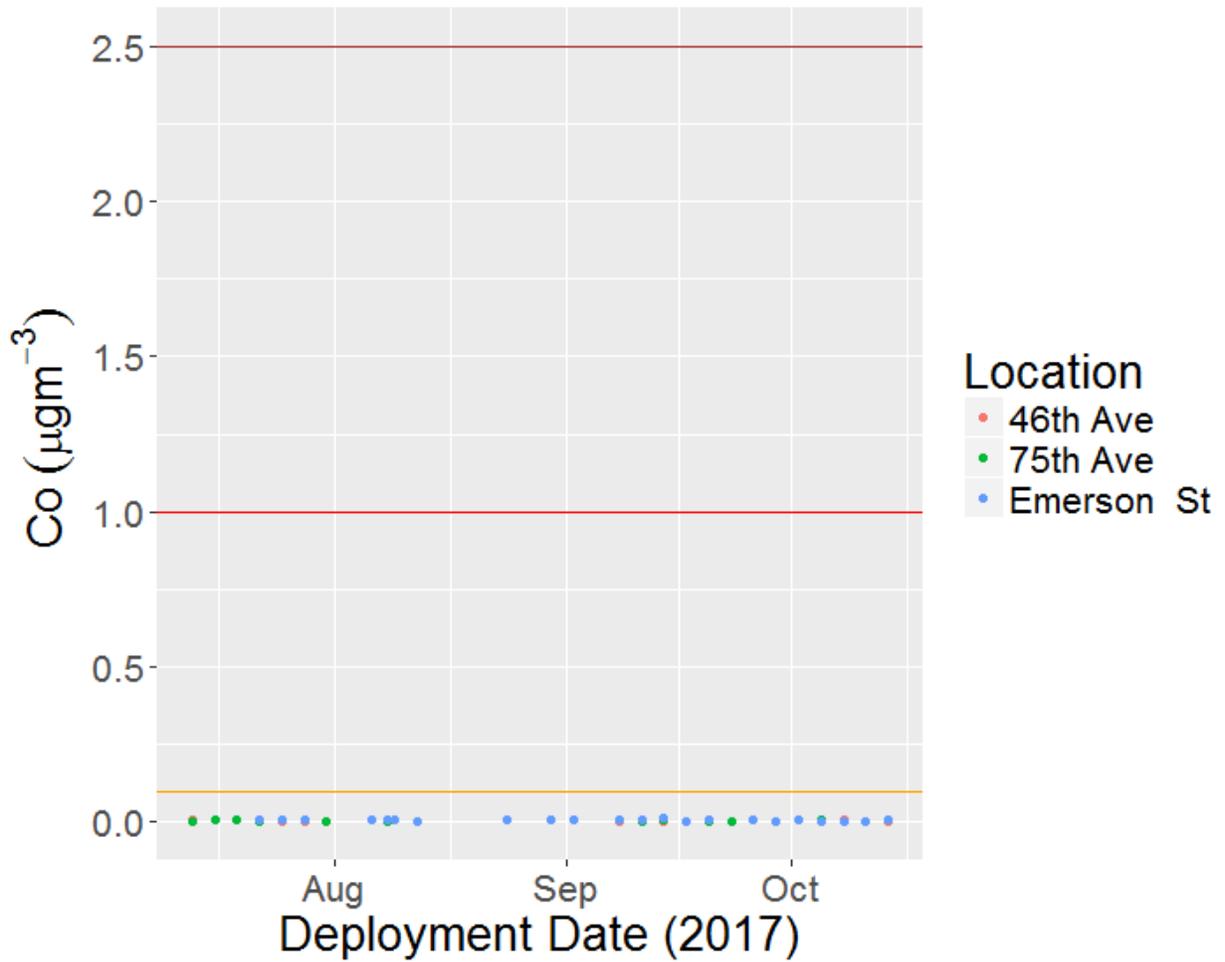
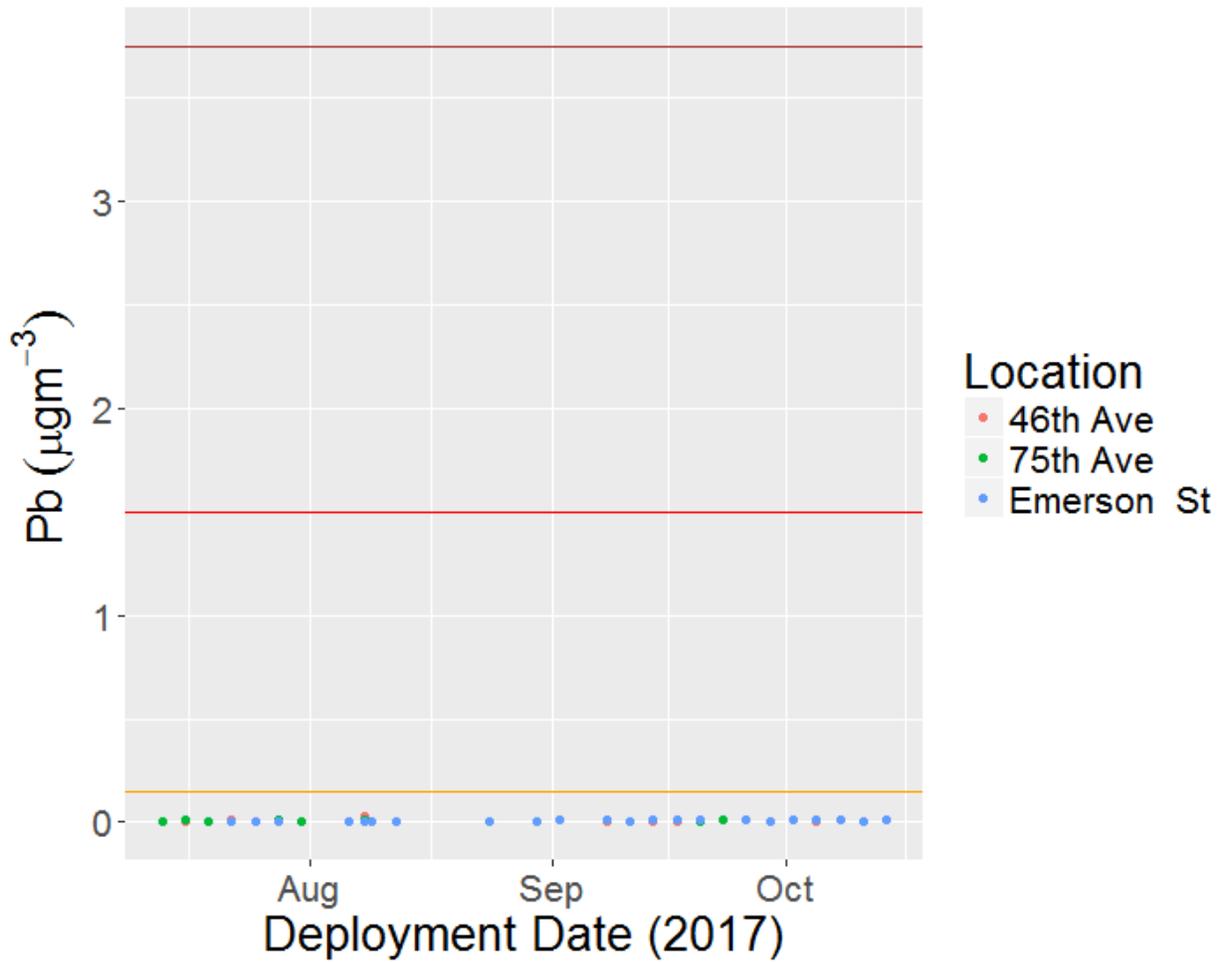The orange horizontal line represents the Ambient Benchmark Concentration of **cobalt** (ABC = 0.1 ugm^{-3}). The red and brown horizontal lines represent 10x ABC = 1.0 ugm-3 and 50x ABC = 5.0 ugm-3 respectively. **12.9% of the analyzed samples were below the detection limit (LOD = 0.0008 ugm-3).**

The orange horizontal line represents the Ambient Benchmark Concentration of **manganese** (ABC = 0.09 ugm^{-3}). The red and brown horizontal lines represent 10x ABC = 0.9 ugm-3 and 50x ABC = 4.5 ugm-3 respectively. **0% of the analyzed samples were below the detection limit (LOD = 0.0003 ugm-3).**

The orange horizontal line represents the Ambient Benchmark Concentration of **nickel** (ABC = 0.002 ugm^{-3}). The red and brown horizontal lines represent 10x ABC = 0.02 ugm-3 and 50x ABC = 0.1 ugm-3 respectively. **25.7% of the analyzed samples were below the detection limit (LOD = 0.001 ugm-3).**

The orange horizontal line represents the Ambient Benchmark Concentration of **lead** (ABC = 0.15 ugm^{-3}). The red and brown horizontal lines represent 10x ABC = 1.5 ugm-3 and 50x ABC = 7.5 ugm-3 respectively. **1.4% of the analyzed samples were below the detection limit (LOD = 0.003 ugm-3).**

End of report