

Particulate Matter Sampling of Metals in South Portland

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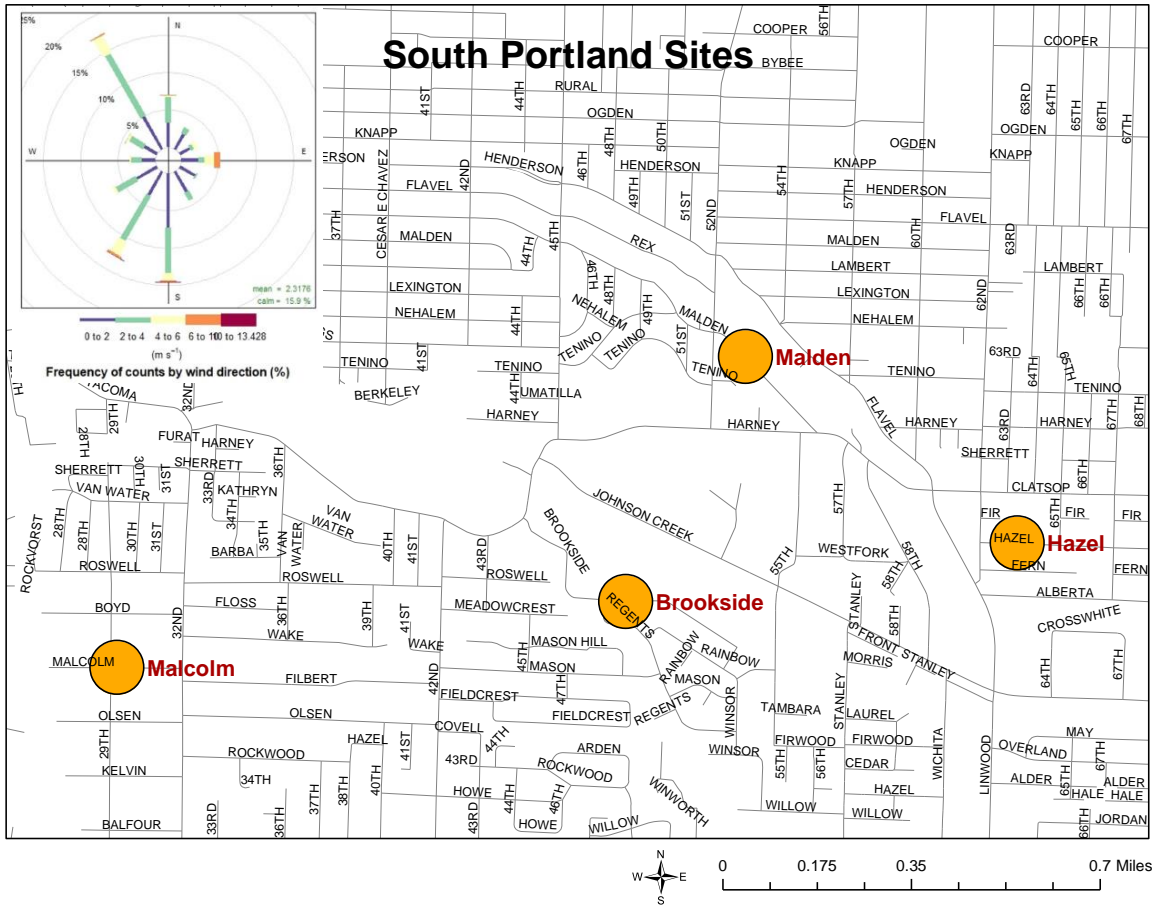
Undergraduate volunteers: Cayla Sigrav, Kirsten Sarle, Kat Maloney, Mike Holloway, Summer Dean, Derek Espinoza

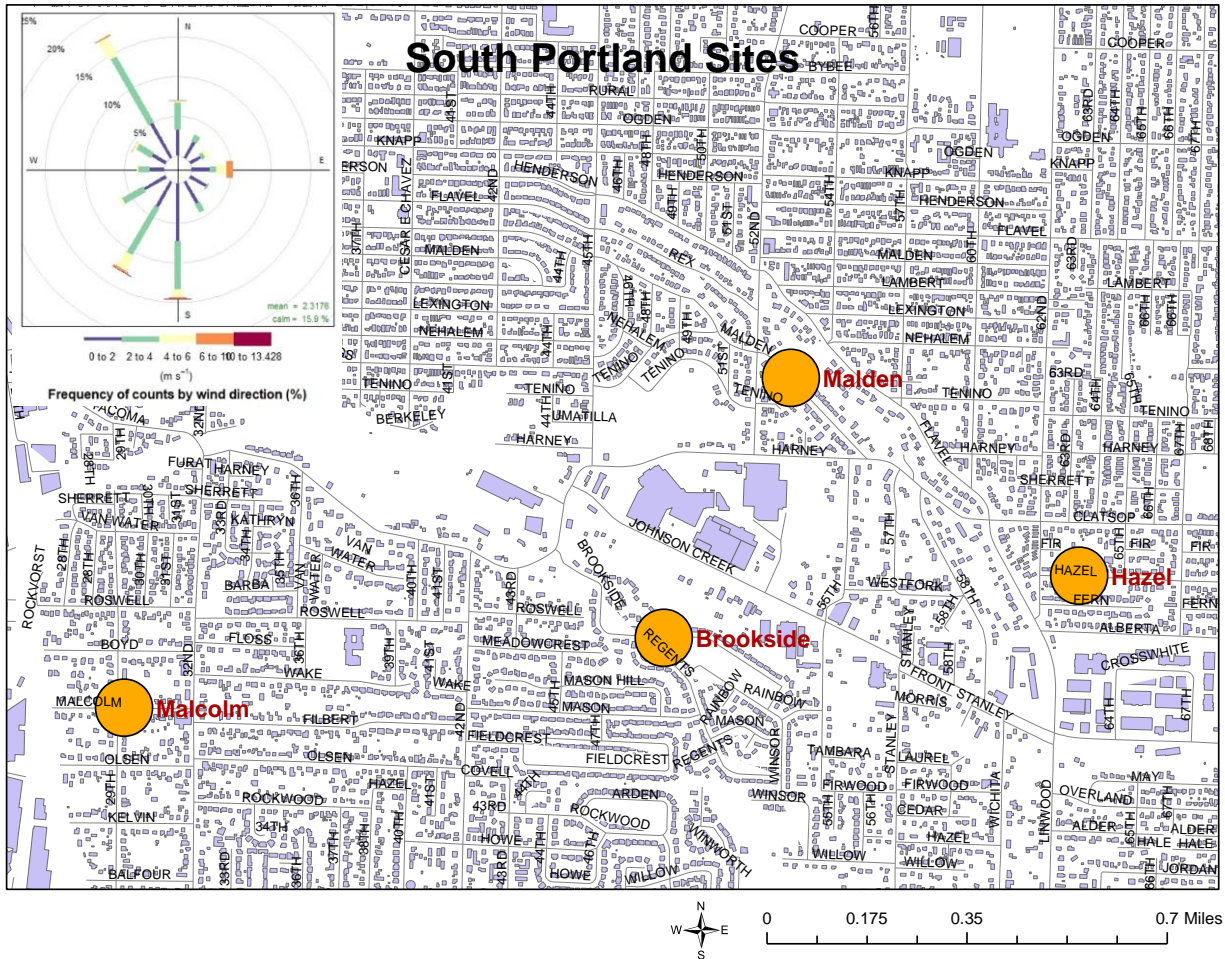
Introduction

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 South Portland Air Quality (SPAQ) to identify sites to host air sampling monitors for nearly 3 months (April-June 2017). We are grateful to the hosts for providing electrical power and site access for this effort.

Below are maps of the sampling sites that SPAQ identified. The first map shows street name details. The second map shows building outlines. Inset on both maps are the wind roses for the period as measured by ODEQ at the SE Lafayette station. The wind rose shows the frequency (length of line) of wind coming from a particular direction; the color is the windspeed.





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 South Portland area from April 2017 until the end of June 2017. We collected over 100 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.

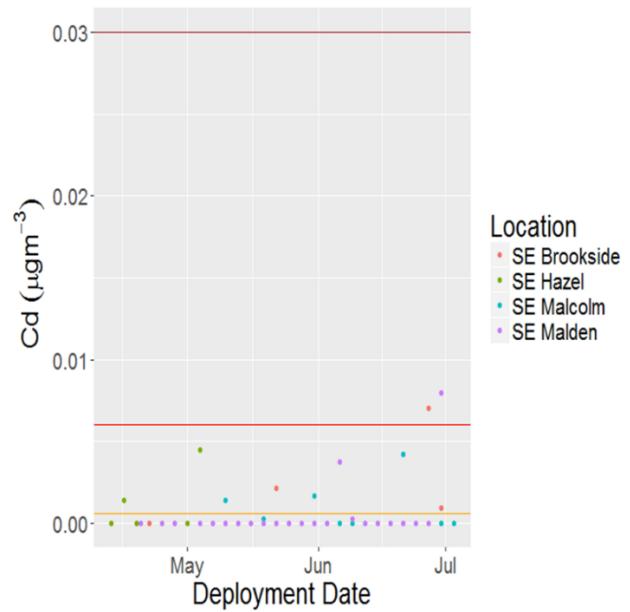
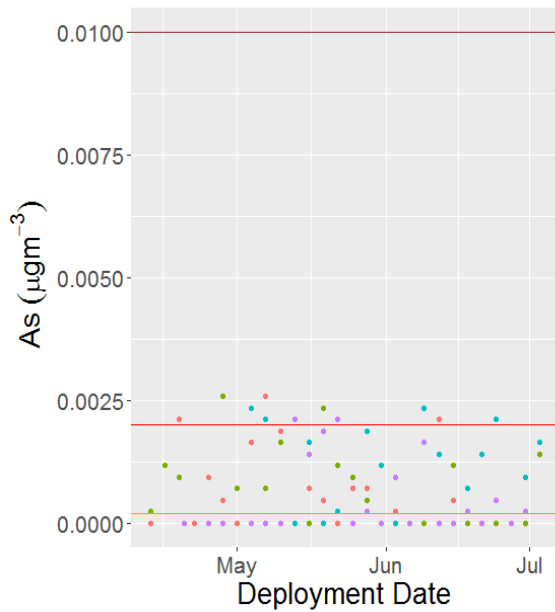


Figure 1. Modi Raduma checking on ARA Sampler

Results

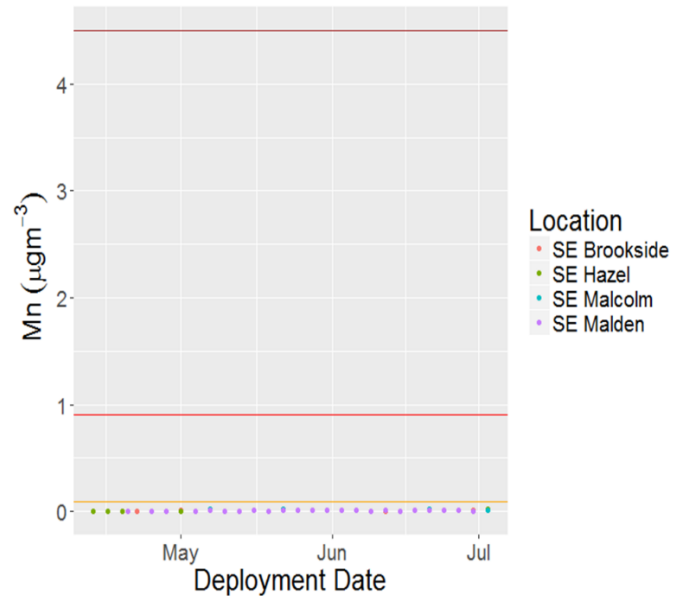
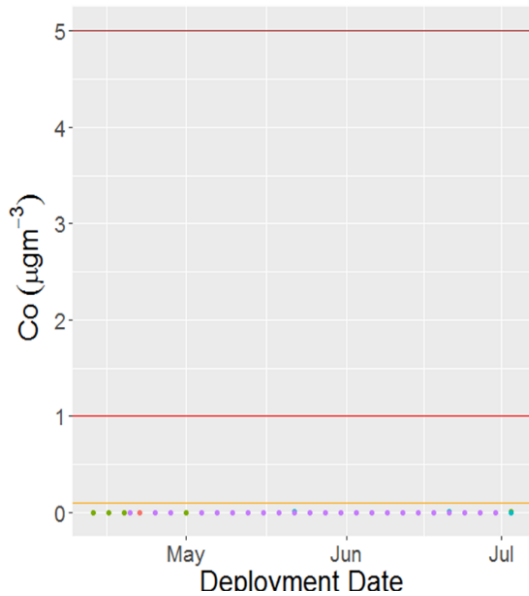
The graphs below show the concentration of toxic metals of potential concern over the sampling period at each of the sampling sites in the South Portland neighborhood. To provide context, we also show the “1 in a million excess cancer level” (orange line), the “10 in a million excess cancer level” (red line), and the “50 in a million excess cancer level” (brown line) on the graphs. The latter levels are the proposed levels of concern for new and existing sources for Cleaner Air Oregon (CAO), the pending rulemaking to address industrial sources in Oregon.

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, based on Cleaner Air Oregon action levels. 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.



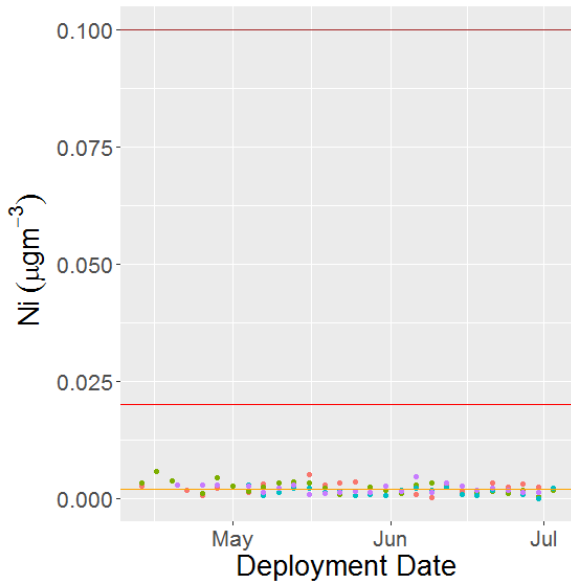
The orange horizontal line represents the current Ambient Benchmark Concentration of **arsenic** ($ABC = 0.0002 \text{ } \mu\text{gm}^{-3}$). The red and brown horizontal lines represent the proposed new CAO action levels for arsenic ($10x \text{ ABC} = 0.002 \text{ } \mu\text{gm}^{-3}$ and $50x \text{ ABC} = 0.01 \text{ } \mu\text{gm}^{-3}$ respectively). **71.4% of the analyzed samples were below the detection limit ($LOD = 0.001 \text{ } \mu\text{gm}^{-3}$).**

The orange horizontal line represents the Ambient Benchmark Concentration of **cadmium** ($ABC = 0.0006 \text{ } \mu\text{gm}^{-3}$). The red and brown horizontal lines represent the proposed new CAO action levels for cadmium ($10x \text{ ABC} = 0.006 \text{ } \mu\text{gm}^{-3}$ and $50x \text{ ABC} = 0.03 \text{ } \mu\text{gm}^{-3}$ respectively). **89.8% of the analyzed samples were below the detection limit ($LOD = 0.0006 \text{ } \mu\text{gm}^{-3}$).**



The orange horizontal line represents the Ambient Benchmark Concentration of **cobalt** ($\text{ABC} = 0.1 \mu\text{g m}^{-3}$). The red and brown horizontal lines represent the proposed new CAO action levels for cobalt ($10\times \text{ABC} = 1.0 \mu\text{g m}^{-3}$ and $50\times \text{ABC} = 5.0 \mu\text{g m}^{-3}$ respectively). **88.9% of the analyzed samples were below the detection limit ($\text{LOD} = 0.0008 \mu\text{g m}^{-3}$).**

The orange horizontal line represents the Ambient Benchmark Concentration of **manganese** ($\text{ABC} = 0.09 \mu\text{g m}^{-3}$). The red and brown horizontal lines represent the proposed new CAO action levels for manganese ($10\times \text{ABC} = 0.9 \mu\text{g m}^{-3}$ and $50\times \text{ABC} = 4.5 \mu\text{g m}^{-3}$ respectively). **0% of the analyzed samples were below the detection limit ($\text{LOD} = 0.0003 \mu\text{g m}^{-3}$).**



The orange horizontal line represents the Ambient Benchmark Concentration of **nickel** (ABC = 0.002 ugm^{-3}). The red and brown horizontal lines represent the proposed new CAO action levels for nickel (10x ABC = 0.02 ugm^{-3} and 50x ABC = 0.1 ugm^{-3} respectively). **17.3% 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 the proposed new CAO action levels for lead (10x ABC = 1.5 ugm^{-3} and 50x ABC = 7.5 ugm^{-3} respectively). **3.1% of the analyzed samples were below the detection limit (LOD = 0.003 ugm^{-3}).**

Calibration data available upon request.