

## Introduction:

### Background

The historic use of the insecticide lead arsenate throughout the US has left the biologically harmful metal, lead (Pb), to persist in soils today. The upper/surface horizons, or layers, of a soil profile contain more of the organic and sandy soils. These horizons also tend to contain higher lead (Pb) concentrations<sup>1</sup>. Children are at the greatest risk of Pb toxicity, as many play outside frequently and don't wash their hands before putting them in their mouth<sup>2</sup>. This early childhood Pb exposure has been linked to neuro-cognitive deficits and social problems in adulthood<sup>2</sup>.

### Study Area

Rice Creek Field Station was established in 1965–66 by SUNY Oswego<sup>3</sup>. Prior to this, much of the surrounding area was pasture- and farmland, including an abandoned orchard<sup>3</sup>. The shared area of Figure 1 locates this abandoned orchard area<sup>3</sup>.

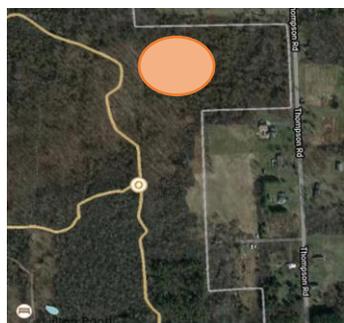


Figure 1: Modified Rice Creek Field Station Map<sup>3</sup>. Shaded orange area represents the abandoned orchard location.

**References:** <sup>1</sup> Durkee, J.; Bartrem, C.; Moller, G.; Legacy lead arsenate soil contamination at childcare centers in Yakima Valley, Central Washington, USA. *Chemosphere*. **2017**, 168, 1126–1135

<sup>2</sup> ToxGuide for Lead. U.S. Department of Health and Human Services Agency for Toxic Substances and Disease Registry. **2020**, <https://www.cdc.gov/TSP/ToxProfiles/ToxProfiles.aspx?id=96&tid=22>

<sup>3</sup> About | Rice Creek Field Station <https://www.oswego.edu/rice-creek/about> (accessed Apr 6, 2021).

## Methods:

### Sample Preparation and Digestion

Soil samples were collected using a Forestry Suppliers Tubular Soil Sampler. Segments were separated into 2 cm increments with respect to depth below the soil surface. Segments were collected in labeled plastic sandwich bags. Once back in the lab, segments were left in paper bags to air dry over multiple days. Now dried soil segments were ground using a mortar and pestle, with visible rock fragments that were unable to be broken removed<sup>4,5</sup>. 2-gram portions of each segment were then divided into fused silica quartz crucibles<sup>4,5</sup>. These portions were heated at 475 °C overnight to ash the organic components of the soil<sup>4,5</sup>.

Ashed segment samples were digested in 10 mL of 7.5 M HNO<sub>3</sub> solution<sup>4,5</sup>. Each digestion was performed for 1 hour directly in the fused silica quartz crucibles, on a hot plate at 95 °C<sup>4,5</sup>. Digested samples were gravity filtered using Fischerbrand P5 filter paper in 50 mL volumetric flasks and diluted to the mark using deionized water<sup>5</sup>. These sample solutions were then transferred to low density polyethylene (LDPE) bottles for storage.

### Standard Solution Preparation

Standard solutions were prepared using CertiPur 1000 ppm Lead AA standard, diluted to form a 200 ppm Pb concentrated standard solution. A blank solution of 0.075 M HNO<sub>3</sub> was made at a large volume. 10 ppm, 25 ppm, 50 ppm, and 100 ppm Pb standard solutions were made by portioning the 200 ppm Pb standard solution. Each Pb standard solution was diluted using the 0.075 M HNO<sub>3</sub> blank solution.

<sup>4</sup> Kučak, A.; Blanuša, M.; Comparison of Two Extractions for Determination of Trace Metals in Soil by Atomic Absorption Spectrometry. *Arh. Hig. Rada Toksikol*. **1998**, 49, 327–334

<sup>5</sup> Schneider, J. A. The Spectrophotometric Determination of Lead with 5/10,15,20 - Tetra(4-N-Sulfoethylpyridinium)porphine Using Merging Zones Flow Injection Analysis. Ph.D. Thesis, Dartmouth College, June 1992

<sup>6</sup> Ander, E. L.; Johnson, C. C.; Cave, M. R.; Palumbo-Roe, B.; Nathanail, C. P.; Lark, R. M.; Methodology for the determination of normal background concentrations of contaminants in English soil. *Sci. Total Environ*. **2013**, 454–455, 604–618

<sup>7</sup> Anderson, P.; Soil and Soil Dynamics – Bozeman Science. [https://www.youtube.com/watch?v=mg7XSjcnZQM&feature=emb\\_logo](https://www.youtube.com/watch?v=mg7XSjcnZQM&feature=emb_logo), (accessed Sept. 25, 2020), educational Youtube video

## Results:

### Conclusion and Discussion

An Agilent Technologies 200 Series AA instrument was used to determine absorbance values of all Pb solutions. Figure 3 illustrates the calibration curve of the Pb standards, which was used to determine the Pb concentration of each sample solution for Locations A and B. Figure 4 illustrates the determined Pb concentrations of each 2 g segment before dilution with deionized water for Locations A and B. More exemplified by Location B, Pb concentrations can be seen to decrease at deeper depths of soil. This is likely due to a transition between soil horizons, to deeper horizons containing lower Pb concentrations. If cores of a deeper depth could be taken, this decrease in Pb concentration and deeper horizons would likely be more profound. Due to lower absorbance readings of sample solutions, determined Pb concentrations in the original soil segment samples are rounded.

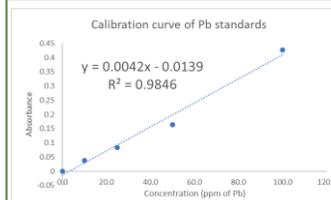


Figure 3: Calibration curve of Pb standard solutions.

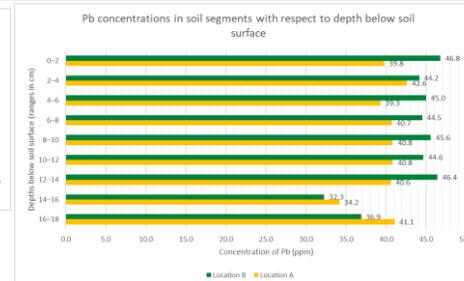


Figure 4: Pb concentrations in soil segments with respect to depth below soil surface.

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<sup>8</sup> Rashid, M. H.; Fardous, Z.; Chowdhury, M.A.Z.; Alam, M. K.; Bari, M. L.; Moniruzzaman, M.; Gan, S.H.; Determination of heavy metals in the soils of tea plantations and in fresh and processed tea leaves: an evaluation of six digestion methods. *Chem Cent J*. **2016**, 10, 7

<sup>9</sup> Pocięcha, M.; Lestan, D.; Recycling of EDTA solution after soil washing of Pb, Zn, Cd and As contaminated soil. *Chemosphere*. **2012**, 86, 843–846