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Dear School Garden Coordinators,

I am sending you the results for your soil/compost samples- thank you for your patience! In this email, you will find background information about the project, the results for all the schools, and suggestions to reduce children's exposure to metals.

As you know, school gardens provide many benefits; however, garden soils may contain heavy metals, which can adversely impact children's health. Children may be exposed to metals through inhalation, dermal contact, or ingestion of soil. It is recommended that schools measure heavy metals in garden soil; however, few schools have the resources to conduct these analyses.

I have spent over 10 years studying heavy metals and their impacts on children's health. To help schools address this knowledge gap, my lab conducted a survey of school garden soils in Oregon. Eligible schools had student populations, of which 40% or more were eligible for free and reduced price lunch (i.e., Title 1 schools). A total of 43 schools responded to our request, and provided up to five soil or compost samples. Schools were located in 20 (out of 36) counties in Oregon, and approximately 2,500 children participated in the school gardening programs.

For 42 (of 43) schools, 10 metals were analyzed in soil/compost samples, including manganese, iron, cobalt, nickel, copper, zinc, arsenic, cadmium, lead, and mercury. For one school, only mercury was measured because the samples arrived after analyses for other metals were completed. Mercury was analyzed following U.S. Environmental Protection Agency (EPA) Method 7473, using atomic absorption spectrometry. The other metals were analyzed following EPA Method 3051a, using inductively coupled plasma mass spectrometry.

Metals concentrations were compared to soil screening levels from the EPA and the Agency for Toxic Substances and Diseases Registry (ATSDR) (Table 1). Different soil screening levels exist across federal agencies (and between states) because national standards for soil metals concentrations do not exist. By definition, soil screening levels are concentrations, which are derived from standardized equations utilizing exposure data (in this case, children's exposures) and toxicity data for each metal. Soil screening levels are used for guidance, to identify areas that may require further investigation. Note that soil screening levels protect human health; however, these concentrations may be considered too low for plant health.

**Table 1. Soil screening levels**

<b>Metal</b>	<b>EPA soil screening level<sup>1</sup> (mg/kg)</b>	<b>ATSDR soil screening level<sup>2</sup> (mg/kg)</b>
<b>Manganese</b>	1,800	2500
<b>Iron</b>	55,000	N/A
<b>Cobalt</b>	23	500
<b>Nickel</b>	N/A	1,000
<b>Copper</b>	3,100	N/A
<b>Zinc</b>	23,000	N/A
<b>Arsenic</b>	N/A	15
<b>Cadmium</b>	7.1	5
<b>Lead</b>	400	N/A
<b>Mercury</b>	N/A	15

<sup>1</sup> U.S. Environmental Protection Agency (EPA) (2023). Regional Screening Levels (RSLs)- Generic Tables for Resident Soil [Target Hazard Quotient (THQ)=1.0] <https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables>

<sup>2</sup> Oregon Health Authority (2017). Healthy Soils: Information About Testing Your Yard or Garden. Agency for Toxic Substances and Disease Registry (ATSDR) soil screening levels. <https://shredsystems.dhsosha.state.or.us/DHSForms/Served/le9745.pdf>

**Summary of results:**

The results for each school are included in tables at the end of this cover letter. Six schools (of 42, 14%) had soil or compost samples that exceeded at least one screening level. Four schools had elevated levels of cobalt, two schools had elevated levels of iron, and one school had elevated levels of arsenic. Metals concentrations in all samples were below the soil screening levels for manganese, nickel, copper, zinc, cadmium, lead, and mercury.

**Mitigation measures:**

- Add compost and keep garden soil near neutral pH
- Avoid using compost from landfills
- Promote good soil drainage
- Wear gloves when working with soil
- Wash hands after gardening
- Don't track soil into school
- Use raised beds to grow edible crops
- Wash and/or peel produce
- Cover or mulch bare soil to reduce dust
- Avoid using treated wood as mulch

Cornell University has published many resources for gardeners- see References. In the future, if you wish to analyze metals in your garden soil or compost, including arsenic, barium, cadmium, chromium, copper, nickel, lead, and zinc, you can send your samples to the Cornell University Soil Health Laboratory (the fee is \$30/sample):

<https://soilhealthlab.cals.cornell.edu/testing-services/individual-soil-analyses/#metals>

Lastly, I want to extend a huge thank you to all the school garden coordinators, who contributed soil/compost samples to this project. I have learned so much from all of you. I realize that Oregon schools include many dedicated gardeners, who are helping children develop a lifelong connection to nature and to their food. Many thanks for your good work.

Happy holidays!



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