

LEAD IN THE CITY: WHAT YOU CAN DO

Allison Harris



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2. Is lead really that bad? (probably)
3. Sources of lead
4. Exposure pathways
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1. WHAT IS LEAD?



Periodic Table of the Elements																	
<div> <div>Atomic Number</div> <div>Atomic Mass</div> <div>Symbol</div> <div>Name</div> <div>Electron Shells</div> <div>Electron Configuration</div> </div>																	
<div> <div>Element symbol represents state at room temperature.</div> <div>Solid, Liquid or Gas</div> </div>																	
<div> <div>3</div> <div>IIIB</div> <div>3B</div> </div> <div> <div>4</div> <div>IVB</div> <div>4B</div> </div> <div> <div>5</div> <div>VB</div> <div>5B</div> </div> <div> <div>6</div> <div>VIB</div> <div>6B</div> </div> <div> <div>7</div> <div>VII B</div> <div>7B</div> </div> <div> <div>8</div> <div>VIII</div> <div>8</div> </div> <div> <div>9</div> <div>VIII</div> <div>8</div> </div> <div> <div>10</div> <div>VIII</div> <div>8</div> </div> <div> <div>11</div> <div>IB</div> <div>1B</div> </div> <div> <div>12</div> <div>IIB</div> <div>2B</div> </div>																	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1 H Hydrogen 1 1s ¹	2 He Helium 2 1s ²	3 Li Lithium 2.1 [He]3s ¹	4 Be Beryllium 2.2 [He]2s ²	5 B Boron 2.3 [He]2s ² 2p ¹	6 C Carbon 2.4 [He]2s ² 2p ²	7 N Nitrogen 2.5 [He]2s ² 2p ³	8 O Oxygen 2.6 [He]2s ² 2p ⁴	9 F Fluorine 2.7 [He]2s ² 2p ⁵	10 Ne Neon 2.8 [He]2s ² 2p ⁶	11 Na Sodium 2.8.1 [Ne]3s ¹	12 Mg Magnesium 2.8.2 [Ne]3s ²	13 Al Aluminum 2.8.3 [Ne]3s ² 3p ¹	14 Si Silicon 2.8.4 [Ne]3s ² 3p ²	15 P Phosphorus 2.8.5 [Ne]3s ² 3p ³	16 S Sulfur 2.8.6 [Ne]3s ² 3p ⁴	17 Cl Chlorine 2.8.7 [Ne]3s ² 3p ⁵	18 Ar Argon 2.8.8 [Ne]3s ² 3p ⁶
19 K Potassium 2.8.8.1 [Ar]4s ¹	20 Ca Calcium 2.8.8.2 [Ar]4s ²	21 Sc Scandium 2.8.9.2 [Ar]3d ¹ 4s ²	22 Ti Titanium 2.8.9.2 [Ar]3d ² 4s ²	23 V Vanadium 2.8.10.2 [Ar]3d ³ 4s ²	24 Cr Chromium 2.8.10.1 [Ar]3d ⁵ 4s ¹	25 Mn Manganese 2.8.10.2 [Ar]3d ⁵ 4s ²	26 Fe Iron 2.8.12.2 [Ar]3d ⁶ 4s ²	27 Co Cobalt 2.8.12.2 [Ar]3d ⁷ 4s ²	28 Ni Nickel 2.8.12.2 [Ar]3d ⁸ 4s ²	29 Cu Copper 2.8.12.1 [Ar]3d ¹⁰ 4s ¹	30 Zn Zinc 2.8.12.2 [Ar]3d ¹⁰ 4s ²	31 Ga Gallium 2.8.13.2 [Ar]3d ¹⁰ 4s ² 4p ¹	32 Ge Germanium 2.8.13.2 [Ar]3d ¹⁰ 4s ² 4p ²	33 As Arsenic 2.8.13.3 [Ar]3d ¹⁰ 4s ² 4p ³	34 Se Selenium 2.8.13.4 [Ar]3d ¹⁰ 4s ² 4p ⁴	35 Br Bromine 2.8.13.5 [Ar]3d ¹⁰ 4s ² 4p ⁵	36 Kr Krypton 2.8.13.6 [Ar]3d ¹⁰ 4s ² 4p ⁶
37 Rb Rubidium 2.8.18.1 [Kr]5s ¹	38 Sr Strontium 2.8.18.2 [Kr]5s ²	39 Y Yttrium 2.8.18.2 [Kr]4d ¹ 5s ²	40 Zr Zirconium 2.8.18.2 [Kr]4d ² 5s ²	41 Nb Niobium 2.8.18.1 [Kr]4d ⁴ 5s ¹	42 Mo Molybdenum 2.8.18.2 [Kr]4d ⁵ 5s ¹	43 Tc Technetium 2.8.18.2 [Kr]4d ⁵ 5s ²	44 Ru Ruthenium 2.8.18.1 [Kr]4d ⁷ 5s ¹	45 Rh Rhodium 2.8.18.1 [Kr]4d ⁸ 5s ¹	46 Pd Palladium 2.8.18.2 [Kr]4d ¹⁰	47 Ag Silver 2.8.18.1 [Kr]4d ¹⁰ 5s ¹	48 Cd Cadmium 2.8.18.2 [Kr]4d ¹⁰ 5s ²	49 In Indium 2.8.18.3 [Kr]4d ¹⁰ 5s ² 5p ¹	50 Sn Tin 2.8.18.3 [Kr]4d ¹⁰ 5s ² 5p ²	51 Sb Antimony 2.8.18.5 [Kr]4d ¹⁰ 5s ² 5p ³	52 Te Tellurium 2.8.18.6 [Kr]4d ¹⁰ 5s ² 5p ⁴	53 I Iodine 2.8.18.7 [Kr]4d ¹⁰ 5s ² 5p ⁵	54 Xe Xenon 2.8.18.8 [Kr]4d ¹⁰ 5s ² 5p ⁶
55 Cs Cesium 2.8.18.8.1 [Xe]6s ¹	56 Ba Barium 2.8.18.8.2 [Xe]6s ²	57-71 Lanthanides and Actinides	72 Hf Hafnium 2.8.18.3.2 [Xe]4f ¹⁴ 5d ² 6s ²	73 Ta Tantalum 2.8.18.3.2 [Xe]4f ¹⁴ 5d ³ 6s ²	74 W Tungsten 2.8.18.3.2 [Xe]4f ¹⁴ 5d ⁴ 6s ²	75 Re Rhenium 2.8.18.3.2 [Xe]4f ¹⁴ 5d ⁵ 6s ²	76 Os Osmium 2.8.18.3.2 [Xe]4f ¹⁴ 5d ⁶ 6s ²	77 Ir Iridium 2.8.18.3.2 [Xe]4f ¹⁴ 5d ⁷ 6s ²	78 Pt Platinum 2.8.18.3.2 [Xe]4f ¹⁴ 5d ⁹ 6s ¹	79 Au Gold 2.8.18.3.2 [Xe]4f ¹⁴ 5d ¹⁰ 6s ¹	80 Hg Mercury 2.8.18.3.2 [Xe]4f ¹⁴ 5d ¹⁰ 6s ²	81 Tl Thallium 2.8.18.3.3 [Xe]4f ¹⁴ 5d ¹⁰ 6s ² 6p ¹	82 Pb Lead 2.8.18.3.4 [Xe]4f ¹⁴ 5d ¹⁰ 6s ² 6p ²	83 Bi Bismuth 2.8.18.3.5 [Xe]4f ¹⁴ 5d ¹⁰ 6s ² 6p ³	84 Po Polonium 2.8.18.3.6 [Xe]4f ¹⁴ 5d ¹⁰ 6s ² 6p ⁴	85 At Astatine 2.8.18.3.7 [Xe]4f ¹⁴ 5d ¹⁰ 6s ² 6p ⁵	86 Rn Radon 2.8.18.3.8 [Xe]4f ¹⁴ 5d ¹⁰ 6s<

Lanthanide Series	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71
	138.905	140.116	140.908	144.243	144.913	150.36	151.964	157.25	158.925	162.500	164.930	167.259	168.934	173.055	174.967
	La	Ce	Pr	Nd	Pm	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu
	Lanthanum 28 18 19 2 [Xe]5d ¹ 6s ²	Cerium 28 18 20 2 [Xe]4f ¹ 5d ¹ 6s ²	Praseodymium 28 18 21 2 [Xe]4f ³ 6s ²	Neodymium 28 18 22 2 [Xe]4f ⁴ 6s ²	Promethium 28 18 23 2 [Xe]4f ⁵ 6s ²	Samarium 28 18 24 2 [Xe]4f ⁶ 6s ²	Europium 28 18 25 2 [Xe]4f ⁷ 6s ²	Gadolinium 28 18 25 2 [Xe]4f ⁷ 5d ¹ 6s ²	Terbium 28 18 27 2 [Xe]4f ⁹ 6s ²	Dysprosium 28 18 28 2 [Xe]4f ¹⁰ 6s ²	Holmium 28 18 28 2 [Xe]4f ¹¹ 6s ²	Erbium 28 18 28 2 [Xe]4f ¹² 6s ²	Thulium 28 18 28 2 [Xe]4f ¹³ 6s ²	Ytterbium 28 18 32 2 [Xe]4f ¹⁴ 6s ²	Lutetium 28 18 32 2 [Xe]4f ¹⁴ 5d ¹ 6s ²
Actinide Series	89	90	91	92	93	94	95	96	97	98	99	100	101	102	103
	227.028	232.038	231.036	238.029	237.048	244.064	243.061	247.070	247.070	251.080	[254]	257.095	258.101	259.101	[262]
	Ac	Th	Pa	U	Np	Pu	Am	Cm	Bk	Cf	Es	Fm	Md	No	Lr
	Actinium 28 18 32 18 9 2 [Rn]6d ¹ 7s ²	Thorium 28 18 32 18 10 2 [Rn]6d ² 7s ²	Protactinium 28 18 32 20 9 2 [Rn]5f ² 6d ¹ 7s ²	Uranium 28 18 32 21 9 2 [Rn]5f ³ 6d ¹ 7s ²	Neptunium 28 18 32 23 8 2 [Rn]5f ⁴ 6d ¹ 7s ²	Plutonium 28 18 32 24 8 2 [Rn]5f ⁶ 7s ²	Americium 28 18 32 25 8 2 [Rn]5f ⁷ 7s ²	Curium 28 18 32 25 9 2 [Rn]5f ⁷ 6d ¹ 7s ²	Berkelium 28 18 32 27 8 2 [Rn]5f ⁹ 7s ²	Californium 28 18 32 28 8 2 [Rn]5f ¹⁰ 7s ²	Einsteinium 28 18 32 29 8 2 [Rn]5f ¹² 7s ²	Fermium 28 18 32 30 8 2 [Rn]5f ¹³ 7s ²	Mendelevium 28 18 32 31 8 2 [Rn]5f ¹³ 7s ²	Nobelium 28 18 32 32 8 2 [Rn]5f ¹⁴ 7s ²	Lawrencium 28 18 32 32 9 2 [Rn]5f ¹⁴ 6d ¹ 7s ²

Actinide

SOME STUFF YOU SHOULD KNOW

- Lead is a naturally occurring element found in soils
- Human activity tends to elevate these levels
- The body has no need for lead
- Lead's periodic table symbol is Pb from the Latin Plumbum – which is where the name plumbing comes from.
- It is a heavy metal



WHAT IS A SAFE LEVEL OF LEAD IN THE BODY?



WHAT IS A SAFE LEVEL OF LEAD IN THE BODY?



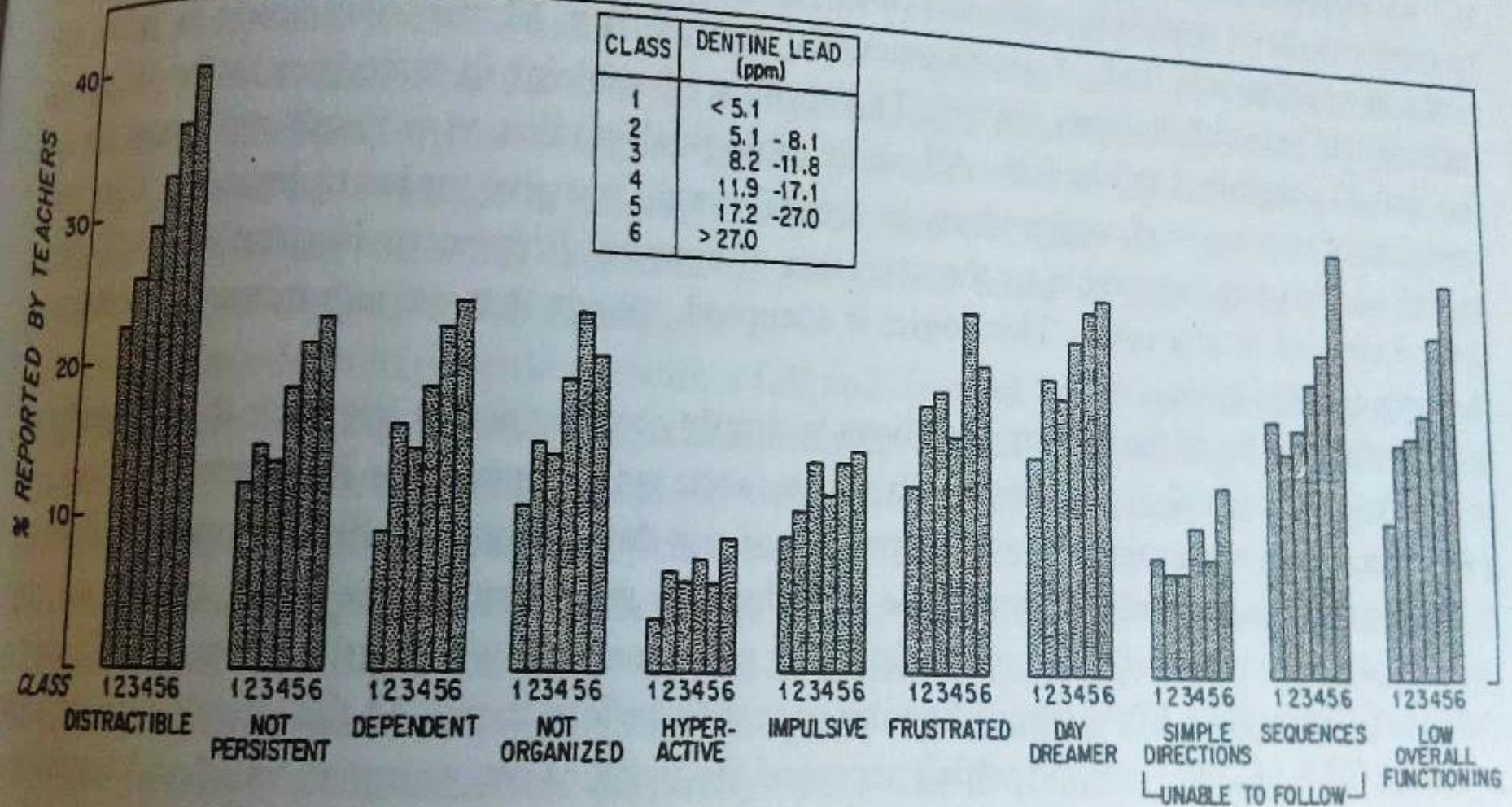
2. IS LEAD REALLY THAT BAD? (probably)



ELEVATED LEVELS OF LEAD IS SOMETIMES CALLED LEAD POISONING

- There is no safe level of lead in the body
- Children under age 6 are most at risk
- Lead accumulates in bone
- Exposure to lead can cause damage to brain and nervous system
- That damage is permanent






Needleman et al., 1974. Lead to the decision to remove lead from gasoline

3. SOURCES OF LEAD



WHERE DOES LEAD IN OUR ENVIRONMENT COME FROM?

- Naturally occurring
 - Paint
 - Leaded gas
 - Industrial air emissions
 - Mine tailings
 - Lead in water distribution systems
 - Ammunition and fishing weights
 - Various other sources – pottery, toys, makeup, chalk, etc.
- 

4. EXPOSURE PATHWAYS



Exposure Routes

- House dust is the primary source of lead poisoning
 - What are the sources of lead in house dust?
- Water is not the biggest risk except in extreme situations (read: Flint)
- Detroit ranks 4th in the country in childhood lead poisoning



5. WHAT CAN YOU DO?

DON'T PANIC!



Pro Tips: Testing

- Blood lead levels
 - City of Detroit Health dept
- Home lead inspection
 - ClearCorp Detroit
- Soil testing
 - Keep Growing Detroit
- Water testing
 - Hardware store kits



Pro Tips: In Your Yard

- Wash hands after outdoor play or gardening
 - Especially before eating
- Wash fruits and vegetables with soap
- Plant perennials
- Cover bare soil with mulch
- Sign up for the study



Pro Tips: In Your Home



- Home renovation/remediation:
Wayne County Lead Safe
- If you see chipping paint, paint over it
- Vacuum (with a HEPA filter)
- Wipe surfaces with a wet cloth
- Mop with a two bucket system
- Take off your shoes indoors



Pro Tips: Drinking water

- Run taps first thing in the morning
- Use only cold water
- Use on-the-tap filters
- Replace lead-containing pipes



Pro Tips: Gardening

- Learn about the history of your site
- Choose garden areas carefully
- Get a soil test
- Consider raised beds
- Plant perennials
- Use mulch
- Wash produce to reduce exposure
- Wear gloves/wash hands



Pro Tips: Limiting Absorption

- Have good nutrition
- Supplement with calcium and iron
 - especially after age 65





Soil Lead Project

Overview


This study looks at strategies to reduce the transfer of lead in soil to garden crops, gardeners, farmers, and children. Children are at the highest risk of lead exposure because of their small bodies and rapid brain development. Children and adults can be exposed to lead by accidentally swallowing (ingestion) or breathing in (inhalation) soil particles that contain lead. This study is being conducted in Detroit, Hamtramck, and Highland Park.

The goals of this study are:

1. To identify methods to reduce the risk of exposure to lead in residential soils.

Contact Us

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Study Leader

 soilleadtest@gmail.com

 (313) 894-1030

Participants Needed!

We're looking for up to 45 participants that are interested in whole-lot treatments for soil lead. You will receive free soil aeration and organic fertilization. Email us if you're interested or have questions.



CURRENT SOLUTIONS FOR LEAD IN SOIL

1.



2.



3. Live with it; practice safe, healthy habits

**Lead cannot break down but
it can take many forms**



VS.



GETTING TO:

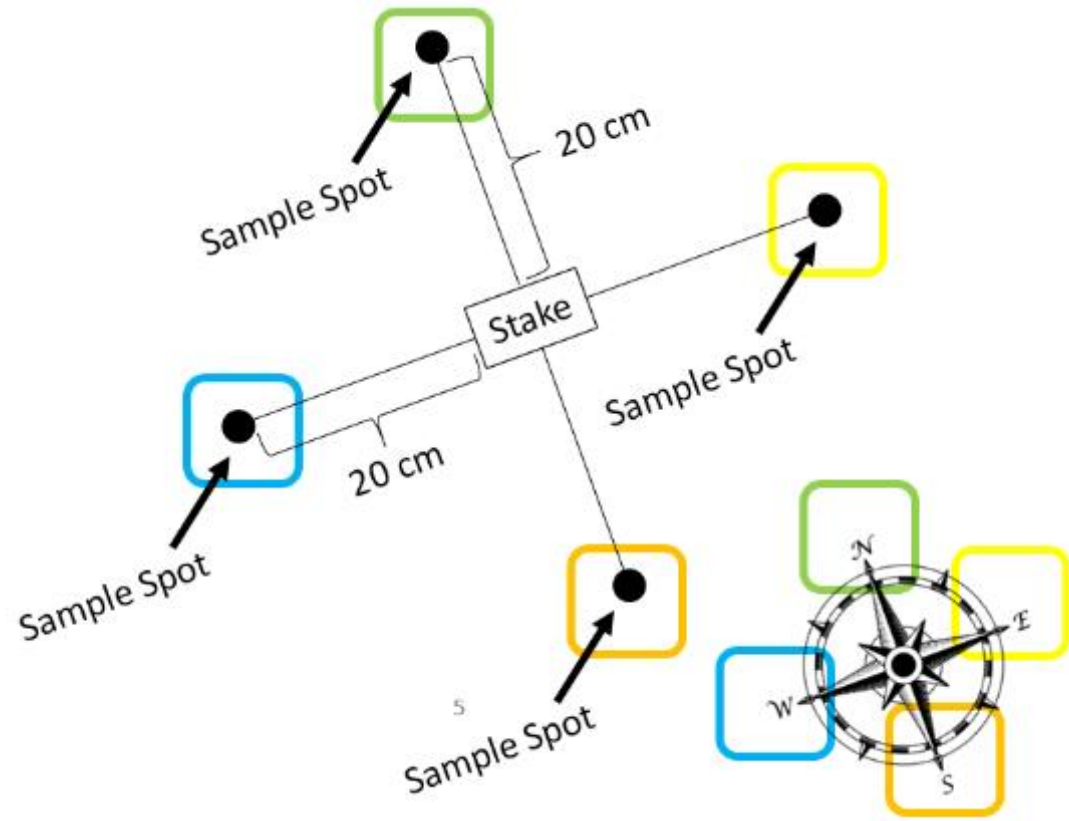


DETROIT SOILS

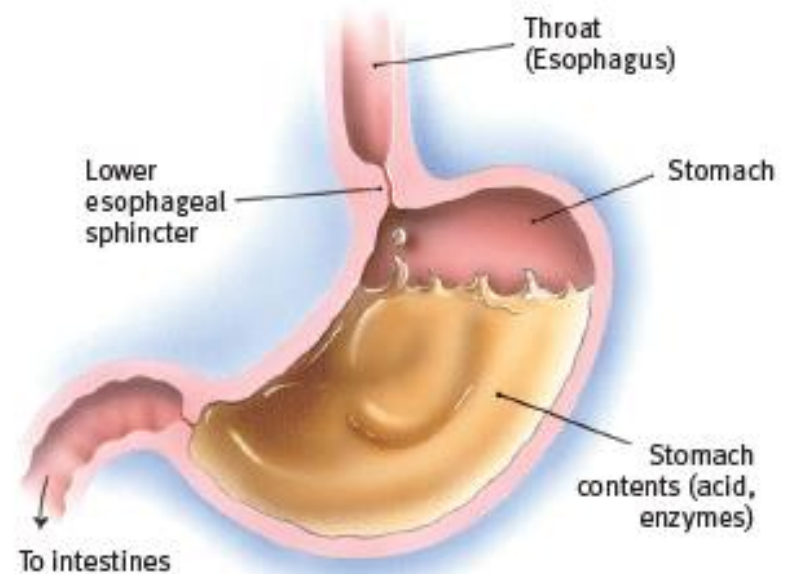
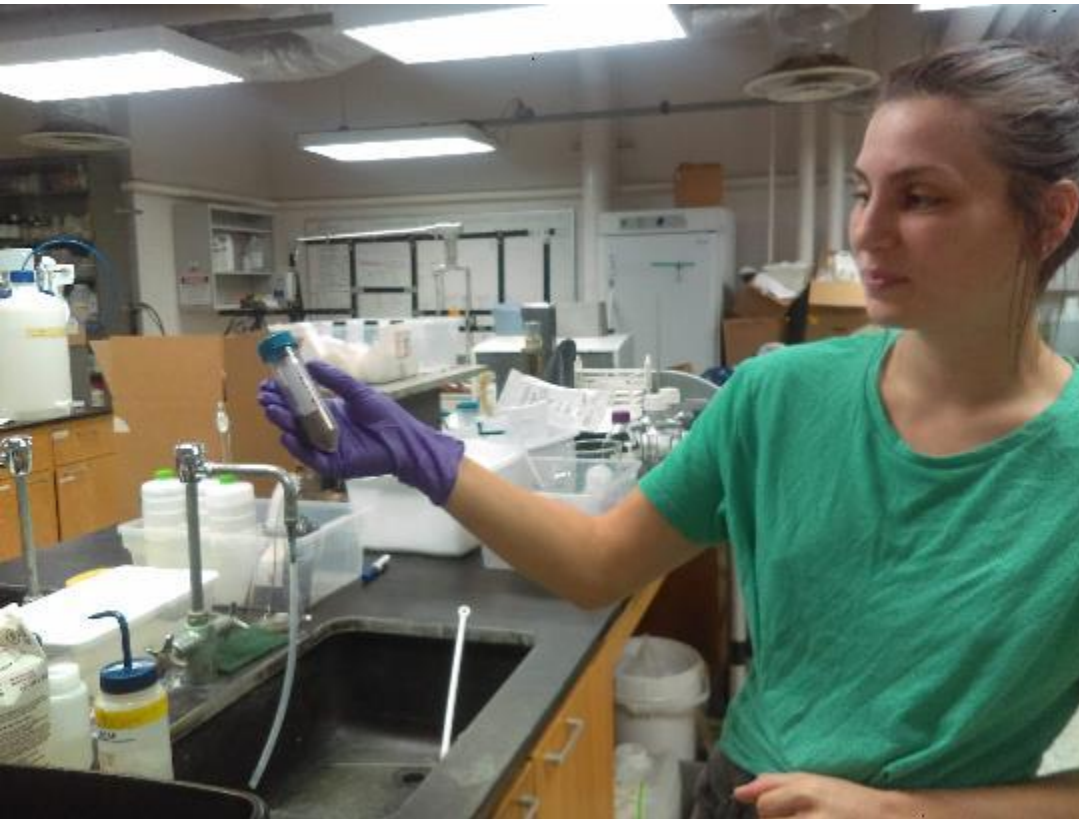
Soil Test Results	lbs/A N Credit	lbs/A P ₁ Bray	lbs/A K	lbs/A Mg	lbs/A Ca	lbs/A S	ppm B	ppm Zn	ppm Mn	ppm Fe	ppm Cu	ppm Mo	ppm Cl	ppm Na	ppm H	Soil pH
Available Nutrients	0	10	373	535	5695	31								0.0	0.0	7.9
% Base Saturation			2.8%	13.1%	84.0%									0.0%	0.0%	
Optimum Level	0	90	235	610	5083	40	2	8	50	50	3	0.4	50	< 15	5	6.5
% Base Saturation			1.8%	15.0%	75.0%									0.4%	3.0%	
No Crop Specified	lbs/A N	lbs/A P ₂ O ₅	lbs/A K ₂ O	lbs/A Mg	lbs/A Ca	lbs/A S	lbs/A B	lbs/A Zn	lbs/A Mn	lbs/A Fe	lbs/A Cu	lbs/A Mo	lbs/A Cl	Organic Matter %	CEC meq/100g	TI Salts mmhos/cm
Crop Uptake	0	0	0	0	0	0	0.0	0.0	0.0	0.0	0.0	0.00	0.0	7.0%	16.9	
Crop Removal	0	0	0	0	0	0	0.0	0.0	0.0	0.0	0.0	0.00	0.0	lbs/A Gypsum	lbs/A Lime	Buffer pH
Recommendations	0	0	0	0	0	0									0	



COLLECTING SAMPLES



TESTING BIOACCESSIBILITY



INTERVENTION

FALL/WINTER 2018



SUMMER 2019



PRELIMINARY RESULTS

- 202 parcels tested for lead
- 3 citizen scientists trained
- ~250 residents trained on safe handling of soils
- 142 sites received soil quality improvements



PRELIMINARY RESULTS

When we:

- Increase the organic matter content 1%, an 8.6% decrease in *in vitro* bioaccessible lead, on average can be expected.



PRELIMINARY RESULTS

When we:

- Decrease the soil pH 0.1 units, a **10.7% decrease** in *in vitro* bioaccessible lead, on average can be expected



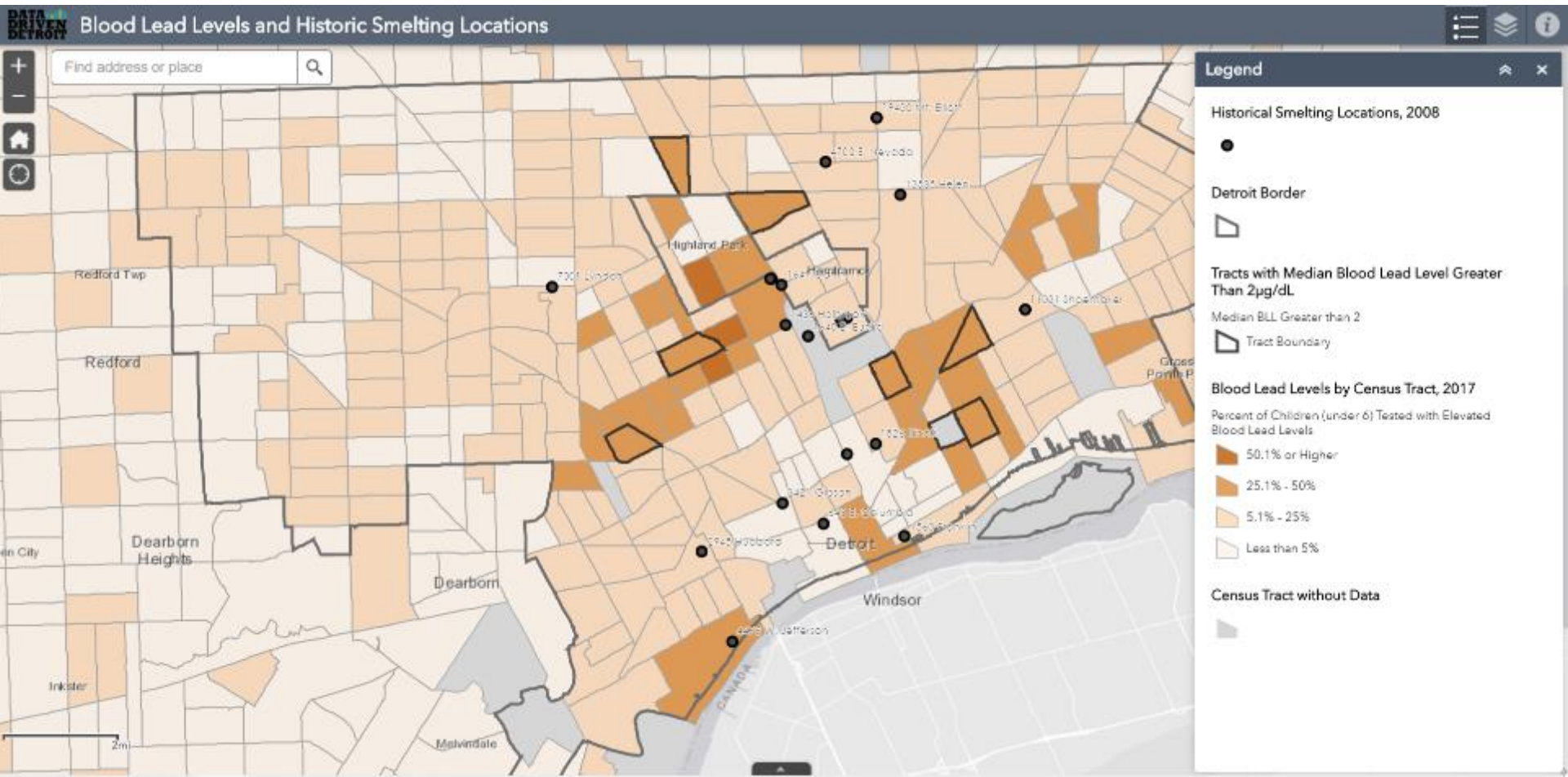
PRELIMINARY RESULTS

The treatment resulted in a **9.8% decrease** in *in vitro* bioaccessible lead.

Translates to an expected reduction in BLLs of ~1ug/DL



SMELTER LEAD < AUTOMOTIVE LEAD



STUDY GOALS – ROUND 2

- Leaching study
- Lot treatments on 45 lots
- Community education
- Treatment protocol and business plan
- Dissemination to policy makers and scientific community



QUESTIONS

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Learn more about our soil
lead study:

ecoworksdetroit.org/soilleadproject

