CDC IN YOUR NEIGHBORHOOD:
Final Summary Results of the Childhood Blood Lead Study in Philadelphia, PA

November 2017

In July 2014, several agencies conducted a health study to evaluate the association between lead in the environment and blood lead levels in children living in some neighborhoods in Philadelphia near the former John T. Lewis facility. We shared preliminary results in 2015.

Learn what we found in our final analyses and how you can get more information.

We did this study to

- evaluate the relationship between blood lead levels and potential lead contamination in tap water, soil, and dust in children's homes and yards;
- determine if young children in the community were exposed to elevated levels of lead; and
- help scientists develop better ways of identifying lead exposure in young children where they live.

Protecting children from exposure to lead is important to lifelong good health. No safe blood lead level in children has been identified. Even low levels of lead in blood have been shown to affect IQ, ability to pay attention, and academic achievement. And the effects of lead exposure cannot be corrected.

What We Found

There were four main findings in the study.

Children living in the investigation area are more likely to have blood lead levels equal or above most children's levels.

We compared the blood lead data from this investigation to a national survey that CDC conducts called the National Health and Nutrition Examination survey, or NHANES.

- 12.5% of children living in the investigation area have blood lead levels equal or above 5 µg/dL, the reference level experts use to identify children with blood lead levels that are higher than most children's levels. At the national level, only 2.5% of children have a level of 5 µg/dL or above.
- Portions of five ZIP codes were part of our 2014 study. Based on the City of Philadelphia's child blood lead surveillance data, the percent of children with BLLs ≥5 µg/dL was lower (range 5.3–12.8%) in all but one of the five study ZIP codes compared to children tested in our study (12.5%).
- The average blood lead level among children who participated in the study was 2.0 µg/dL. At the national level, the average blood lead level of children younger than six years old is 1.3 µg/dL.

NOTE: The study and the City of Philadelphia use different methods to identify, collect, and, report childhood blood lead data. These data are not directly comparable and caution should be exercised in drawing conclusions. Further, a limitation of our study is that it is based on a small number of participants.

Children in households with two or more elevated environmental lead samples (such as front door dust and soil) were more likely to have elevated blood lead compared to children in households with one or no elevated environmental lead samples. Children with an elevated blood lead level were more likely to stay in households with an elevated level of lead in dust by the front door.

We evaluated the relationship between elevated blood lead levels and elevated environmental sample results.

- If a household had two or more elevated environmental results (soil, dust or water), the children were more likely to have an elevated blood lead level.
- Previous research has established that interior dust lead is known to be associated with elevated blood lead levels. Entryway dust is an integrated measure of dust contributed from both interior and exterior lead sources. It was not possible for us to identify whether the lead found in the dust in our study households was from interior or exterior sources.

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We considered lead levels in soil, dust and water to be high if they were above EPA's guidance levels. Lead from all environmental sources (for example, soil, water, etc.) contribute to a child's total lead exposure. Elevated levels of lead in soil and dust often happen at the same time. Because of this, it is difficult to know if a child's elevated blood lead is due to lead in the soil or the dust.

- Overall, soil lead and household dust lead were higher in the households in our study than expected. This may be due to multiple lead contributing factors such as old housing stock and household renovation activities.

The majority of households in our study had elevated levels of lead in their soil. Elevated soil lead by itself was not found to be a risk factor for elevated blood lead.

- We evaluated the levels of lead found in the soil. We also evaluated if children living in households with elevated lead in soil were more likely to have elevated blood lead levels. 71% of households had soil lead levels exceeding EPA's guidance level of 400 parts per million (ppm) used for exposed soils in children's play area.
- Soil and street dust can be transported inside the home and contribute to interior house dust. Almost a third of our study soil samples were collected from yards that were at least partially covered with concrete. This may have reduced the potential for tracking contaminated dust/soil from outside into the household.

Living close to a former lead emitting facility did not increase the chance of a child having an elevated blood lead level or a household having an elevated environmental sample (e.g., dust, soil sample result).

We evaluated if children living close to a former lead emitting industry were more likely to have elevated blood lead results compared to children living farther away from a former industry. The study area included at least twelve suspect historic lead-emitting point sources of interest (see Figures 1 and 2).

- Household proximity to any former lead emitting facility did not result in higher blood lead levels.
- Environmental samples collected from households near former lead emitting industries were not higher than samples collected from households farther away.

RECOMMENDATION:

All children who live in and around the study area in Philadelphia should be tested for blood lead.

The Philadelphia Department of Public Health recommends all children should be screened for lead at ages 12 and 24 months or at 36–72 months if there is no proof of prior of screening.

How We Conducted the Study

We recruited participants for the study during a two-week period in July 2014. We selected households at random from various neighborhoods near the site, including Port Richmond, Kensington, and Northern Liberties. If the head of the household agreed to participate in the study, we offered to do 4 things:

1. Collect tap water, soil, and indoor dust samples and analyze them for lead.
2. Collect and analyze a blood sample from children 9 months through 8 years of age who lived in the participating households.
3. Ask the heads of households/guardians of children enrolled in the study to answer questions on factors potentially associated with lead exposure and other environmental hazards.
4. Conduct a Healthy Homes survey at each household.

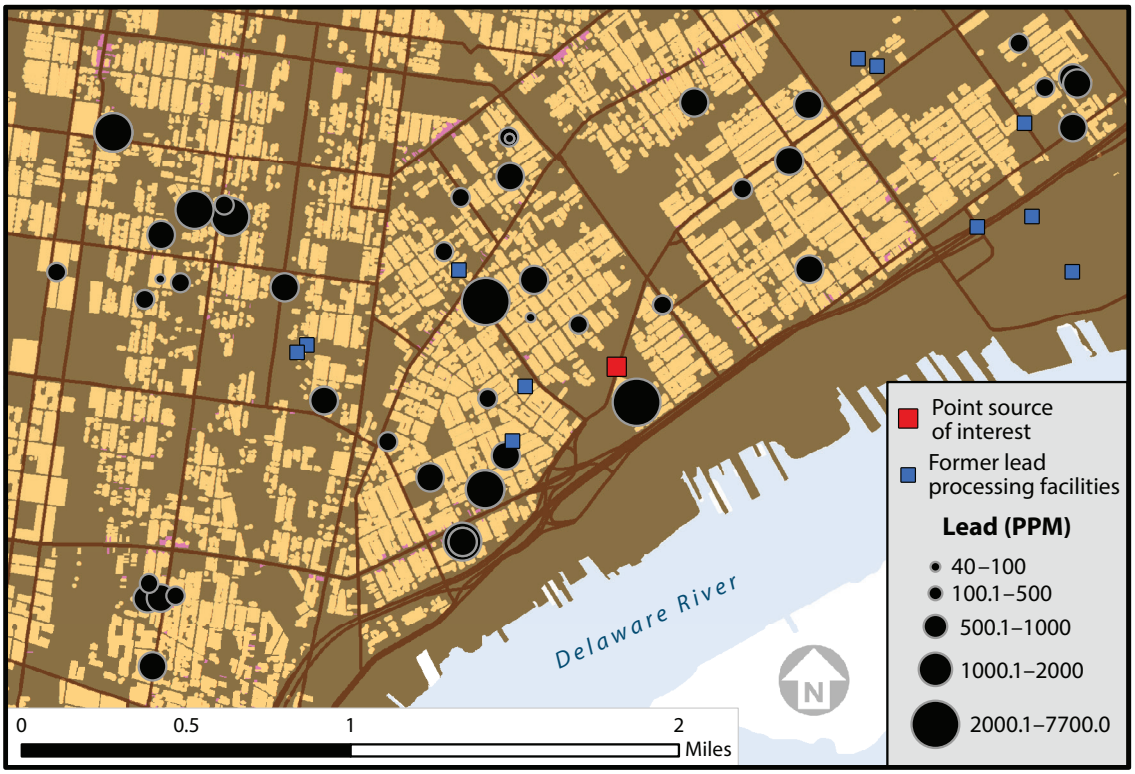
Detailed Study Findings

Blood Lead Results

The study's dataset for the blood lead analysis included blood lead samples from 104 children. The blood tests showed

- The geometric mean (a special type of average) was 2.0 micrograms per deciliter (µg/dL).
- About 12.5% of the children from the study had a blood lead level of 5 µg/dL or above.
- Children with elevated blood leads were more likely to
  - » Live in or regularly visit a household built before 1900.
  - » Live in or regularly visit a household with a high dust lead result in the entryway.
  - » Be enrolled in a government medical insurance program (Medicaid).

Figure 1: Soil lead sampling results from the 2014 study area, Philadelphia, PA[1]



[1] Households surveyed are not shown in their true locations. We created this figure by offsetting each surveyed home in a random direction and a random distance up to 800 feet. This method retains the general pattern of the actual distribution and preserves the confidentiality of study participants.

Environmental Sample Results

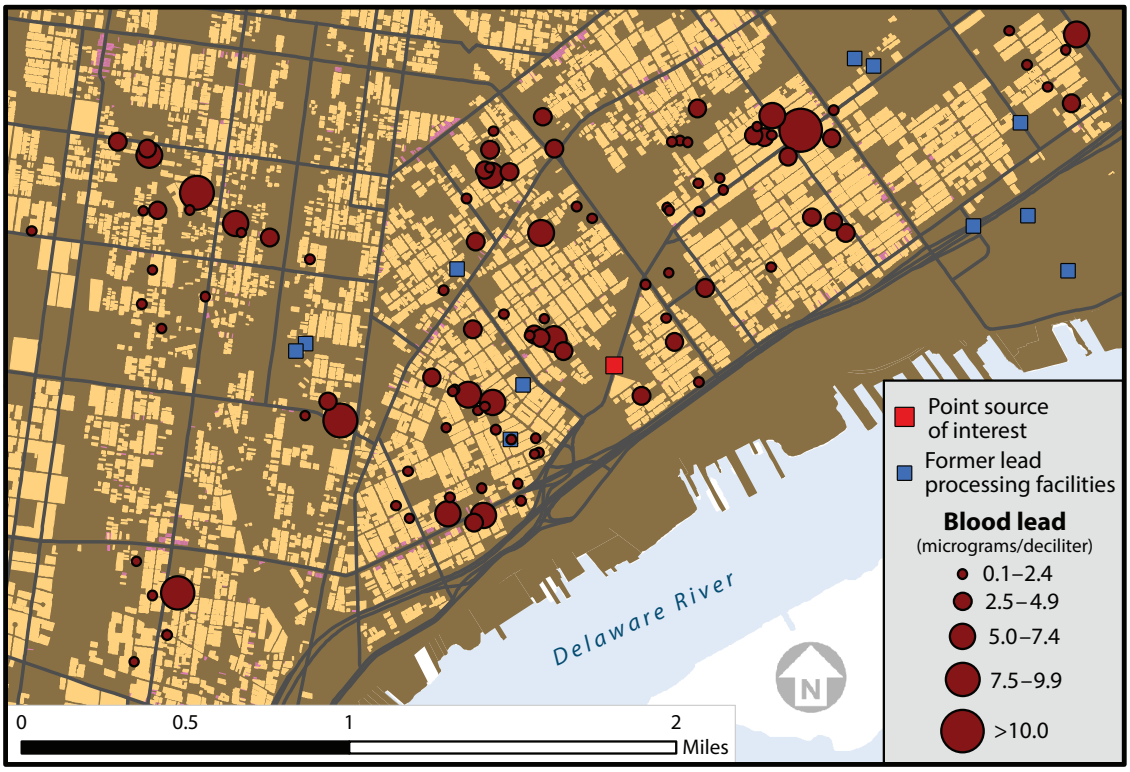
The table below describes

- the environmental samples we collected for this study,
- what is considered an elevated level for each type of sample,
- how many of the samples in this study exceeded the elevated level,
- the range of lead that we detected in the samples, and
- the average (or "mean") level of lead we found in the samples.

Type of Sample	Number of Samples	Definition of Elevated Lead Level	Number of Samples with Elevated Levels	Minimum and Maximum Concentrations in Samples	Mean Concentration in Samples
Soil	70	*400 ppm (in bare or exposed soil)	50 (71%)	40–7,700 ppm	760 ppm
Water	116	**15 µ/L	0	Non-detect–3.9 µg/L	N/A
Dust Floor (Front Door)	98	*40 µg/ft^2	24 (25%)	5.2–2,323 µg/ft^2	66 µg/ft^2
Dust Floor (Child Play Area)	71	*40 µg/ft^2	20 (28%)	Non-detect–632 µg/ft^2	50 µg/ft^2
Dust Interior Window (Child Room)	94	*250 µg/ft^2	13 (14%)	Non-detect–18,000 µg/ft^2	396 µg/ft^2

*EPA standards under the Lead Renovation, Repair, and Painting rule.
**EPA's action level for lead under the Lead and Copper rule.
A microgram (µg) = one millionth of a gram
A deciliter = one tenth of a liter

Figure 2: Blood lead sampling results from the 2014 study area, Philadelphia, PA[1]



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Next Steps

CDC/ATSDR will continue to

- Work with pediatricians and other health care providers to make sure young children living near the site routinely have blood lead tests.
- Help area residents understand the health risks associated with lead and the steps they can take to protect themselves.
- Provide scientific assistance to EPA and the local and state health departments to further assess the association between environmental lead and blood lead levels.

EPA is conducting experiments to identify how much of the lead found in soil has the potential to be absorbed by the body. This will allow scientists to better assess the potential impact of people's exposure to lead in soil.

Where Can I Learn More?

Ask agency representatives questions about the study:

- **Ana Pomales** (ATSDR) at 215-814-5716 or APomales@cdc.gov
- **Jack Kelly** (EPA) at 215-514-6792 or Kelly.Jack@epa.gov

Visit the study website:

- www.atsdr.cdc.gov/sites/jtlewis/index.html

Visit PDPH's Lead and Healthy Homes program website:

- http://www.phila.gov/health//ChildhoodLead/index.html

Read the final report and recommendations of the Philadelphia Childhood Lead Poisoning Advisory Group on reducing lead poisoning in Philadelphia:

- http://www.phila.gov/health/pdfs/Lead%20Advisory%20Group%20Report.pdf

Agencies involved in the study:

Centers for Disease Control (CDC)/Agency for Toxic Substances and Disease Registry (ATSDR),

U.S. Environmental Protection Agency (EPA),

Pennsylvania Department of Health (PADOH), and

Philadelphia Department of Public Health (PDPH).