pennsylvania
DEPARTMENT OF HEALTH

EVALUATION OF ENVIRONMENTAL AND CANCER DATA AT THE NORWOOD LANDFILL SITE
Norwood Borough, Delaware County, PA

SUMMARY OF FINDINGS AND RECOMMENDATIONS

The Pennsylvania Department of Health (PADOH) evaluated the Environmental Protection Agency's (EPA) 2017-2018 soil, sediment and surface water sampling data of the lower Norwood landfill site to determine whether detected chemical concentrations at the selected sampling locations could harm human health. The chemicals detected at these locations are found throughout our environment, whether from natural or manmade sources. A review of the data revealed that, except for lead, for which there is no presumed safe level of exposure, **dermal and incidental ingestion exposures were unlikely to cause adverse non-cancer health effects.** As a health protective approach, PADOH considered each residential soil sample as independent from one another. Accordingly, the highest estimated lifetime excess cancer risk was **3 in 10,000** for children and **2 in 100,000** for adults, based on the **highest** benzo[a]pyrene-equivalent polycyclic aromatic hydrocarbon (BaP-PAH) sample. This single residential soil sample had a BaP-PAH concentration 3.5 times above the next highest residential sample, and this lifetime risk estimate assumes daily exposure to this concentration from birth up to age 21 for children, and for 33 consecutive years for adults.

An analysis of the latest available cancer incidence data from the Pennsylvania Cancer Registry revealed that **lung cancer** was higher at Norwood and surrounding boroughs between 1985-2019 when compared to Delaware County and Pennsylvania rates. However, the cancer registry does not account for the most common factor influencing lung cancer risk, which is smoking. Additionally, the registry does not collect data on family history/genetic predisposition, residential or occupational history, prior environmental exposures, or other factors that can contribute to cancer.

Lead can be found throughout our environment in air, water, and soil from fossil fuels, including past use of leaded gasoline and lead-based paint in homes, and from some types of industrial facilities. As a general precaution and to avoid possible exposures to lead in soil, residents should ensure that soil is not tracked inside the home and that children avoid playing on bare soil. Young children should be closely monitored if suspected of pica behavior, which is uncommon and involves eating soil; PADOH found that harmful health effects *might* occur if a child eats (whether regularly, or once) an amount of soil equivalent to 5 packets of artificial sweetener used in coffee or tea. Crop uptake of chemicals in soil is generally low, but as further precaution, residents can adhere to EPA's suggested best practices for gardening in more urban soil environments, such as using garden beds and pots with clean soil, mixing additional compost into in-ground gardens, and washing and peeling root crops and outer leaves of vegetables before eating.

QUESTIONS AND ANSWERS

1. How did PADOH evaluate EPA's sampling data?

PADOH followed methods established by the Agency for Toxic Substances and Disease Registry (ATSDR). First, PADOH screened more than 80 sampled chemicals across the sampling locations (residential surface soil, non-residential surface soil, and Darby and Muckinipattis Creek sediment and surface water) against screening levels set by the ATSDR, the EPA, or other environmental and health agencies. Screening levels are health protective estimates of a chemical level below which no harmful health effects are expected to occur. A chemical's exceedance of a screening level doesn't necessarily mean it will harm human health. Some screening levels are set very low (for instance, at or near background levels).

If a chemical exceeded a screening level, PADOH evaluated it further to determine its potential to harm health. PADOH also assessed chemicals of community concern, such as polychlorinated biphenyls (PCBs) and heavy metals.

PADOH assessed 13 chemicals that exceeded screening levels or were community concerns: polycyclic aromatic hydrocarbons (PAHs), di(2-ethylhexyl) phthalate (DEHP), PCBs, aldrin and dieldrin, copper, iron, manganese, arsenic, chromium, mercury, dimethyl phthalate (DMP), ethanol, and lead. PADOH assessed an additional 4 chemicals (aluminum, antimony, lindane and cadmium) that exceeded screening levels for soil pica behavior, only.

2. How did PADOH assess the chemicals?

PADOH calculated **dermal and incidental ingestion exposure doses** to these chemicals from surface soil, sediment, and surface water. Exposures can also occur from inhaling dust suspended from surface soil during recreation or other activities; however, no air emissions data were collected, and therefore PADOH did not evaluate an inhalation pathway. For all exposure dose calculations, PADOH used ATSDR's Public Health Assessment Site Tool (PHAST). Note: PADOH's calculations for surface water are based on exposures to inorganic metals, since other chemical types (e.g., PCBs, pesticides) were not sampled in surface water.

Exposure doses are the estimated amounts of a chemical that enter a person's body over a specified period of time. They account for factors such as the amount of a chemical found in the environment, its ability to be absorbed into the body, skin surface areas, human intake levels, and differences in body weight and age. PADOH compared exposure doses to **reference health effect levels** established by ATSDR or EPA. These are the estimated amounts of a chemical that a person can eat, drink, or breathe each day without experiencing adverse non-cancer health effects. For chemicals known or suspected to cause cancer, **PADOH estimated a lifetime cancer risk using a cancer slope factor**. A cancer slope factor is a measure of a chemical's cancer potency.

4. Did PADOH determine that any chemicals may pose a threat to human health?

Except for lead for which there is no presumed safe level of exposure, harmful non-cancer health effects were unlikely to occur from exposures to the detected chemical levels. Chemical exposure doses were much lower than health effect levels from scientific studies. Based on EPA's 2017-2018 sampling, 3 of 21 residential and 5 of 17 non-residential soil samples exceeded a threshold that could result in a child 0-12 months having an elevated blood lead level. Lead is a naturally occurring element in the earth's crust and can be found throughout our environment in the air, water, and soil from sources such as fossil fuels, including past use of leaded gasoline, some types of industrial facilities and past use of lead-based paint in homes. Soil lead levels at sampling locations were higher than U.S. and Pennsylvania averages but lower than typically found in more urban areas, such as Philadelphia.

PADOH found that if a child 1-5 years old engages in **soil-pica** behavior (which is uncommon and involves eating a large amount of soil), the child *might* experience harmful gastrointestinal effects if consuming the highest copper or iron concentrations, or neurological or other health effects from the highest lead concentrations. This assumes a child consumes 5,000 mg worth of soil (whether for 3 days per week for up to a year, or on a single occasion), which is equivalent to 5 packets of artificial sweetener used in coffee or tea.

5. How did PADOH assess cancer at this site?

PADOH assessed A) the potential lifetime excess cancer risk from chemical exposure based on the sampling data, and B) historical cancer incidence data for the community. These are independent analyses, and cancer incidence results are discussed in question 8. Lifetime cancer risk based on EPA's 2017-2018 sampling data is discussed below.

Lifetime cancer risk estimates are expressed as the proportion of a population that *may* be affected by a carcinogen during a lifetime of exposure. For example, an estimated cancer risk of 2 in 100,000 represents *potentially* 2 additional cancer cases above expected cases in a population of 100,000 over a lifetime of continuous exposure. Lifetime cancer risk estimates are theoretical estimates and not predictions of actual cancer cases in a community.

The highest lifetime excess cancer risk estimate was 3 in 10,000 for children and 2 in 100,000 for adults based on the **maximum** residential soil concentration of benzo[a]pyrene-equivalent polycyclic aromatic hydrocarbons (BaP-PAHs). The risk of 3 in 10,000 for children assumes **daily** exposure to the **maximum** BaP-PAH residential soil concentration **from birth through age 20 years.** The adult estimate of 2 in 100,000 assumes daily exposure at this concentration for **33 consecutive years**. Risks would be lower for exposures of shorter duration. Lifetime excess cancer risk from the **next** highest BaP-PAH sample was 7 in 100,000 for children and 5 in 1,000,000 for adults. PADOH considered each residential soil sample as a separate unit and independent from one another.

6. What are benzo[a]pyrene-equivalent polycyclic aromatic hydrocarbons (BaP-PAHs)?

Polycyclic aromatic hydrocarbons (PAHs) are formed by incomplete combustion and are present throughout the environment. There are over 100 PAHs. The burning of wood in homes and vehicle exhaust are common sources of PAHs. Meat cooked under high temperatures can also release PAHs. Most people in the U.S. are exposed to PAHs from the ingestion of PAH-contaminated food or inhalation from PAHs in tobacco smoke, wood smoke, or contaminated air. Benzo[a]pyrene is among the most well-known PAHs and is a human carcinogen. Because of benzo[a]pyrene's toxicity, PADOH assessed the toxicity of other PAHs relative to benzo[a]pyrene (e.g., "BaP-PAHs").

7. Did PADOH assess the potential for multiple sclerosis (MS) from Norwood exposures?

Despite years of ongoing research, the exact cause for MS remains unknown. PADOH found that exposure doses to chemicals at sampling locations were often well below reported immune system and neurological effects found in scientific studies. However, due to the lack of definitive data on the chemical contributions to MS, PADOH cannot conclude whether a chemical present in lower Norwood caused or contributed to MS. There is currently no PA MS registry similar to a cancer registry to conduct an MS rate analysis.

8. How did PADOH analyze Norwood cancer rates?

PADOH reviewed state cancer registry incidence rates from 1985-2019 across 4 time periods (1985-1994; 1995-2004; 2005-2014; 2015-2019) to compare rates at Norwood and surrounding boroughs to Delaware County and Pennsylvania. (Note: 2019 is the most recent year of Pennsylvania Cancer Registry data at the time of this report.) The registry analysis can provide an overall understanding of a community's cancer health status, but not information on the causation of cancers. This is because, other than age and sex, the registry lacks information on family history, behaviors (e.g., smoking), or other risk factors known to influence cancer rates. Cancer takes many years to develop before it's diagnosed and is influenced by a variety of risk factors, including family history, age, environmental and occupational exposures, and behaviors. Additionally, some people with known risk factors do not develop cancer, and others without risk factors still develop cancer. Due to the combination of these factors and many limitations, it is often difficult to understand why some people get cancer and some people don't. On average, U.S. lifetime cancer risk is about 1 in 2 men and 1 in 3 women.

9. What did the review of the Cancer Registry data reveal?

Lung cancer was statistically higher for most of the assessed time periods between 1985-2019, and it affected men and women similarly. Several other cancer types were statistically higher for a single time period or sex, and a few were statistically lower. Unlike lung cancer, the remaining cancer types showed no consistent pattern.

10. Is the Norwood site contributing to high lung cancer rates?

The lung cancer finding does not determine causality between observed rates and environmental exposures in lower Norwood. Because the registry does not account for cancer risk factors aside from age and sex, differences in other

risk factors at Norwood and surrounding boroughs compared to the comparison areas could be influencing rate differences for some cancer types. In Pennsylvania, lung cancer is the 3rd most common cancer and leading cause of cancer death. Chemical-based risk for lung cancer has typically been found from much higher exposure scenarios to certain chemicals (e.g., from certain occupations or contaminated drinking water) than the likely exposures for most Norwood residents, who are and have historically been served by a public water system. High radon and outdoor air pollution levels are additional environmental risk factors for lung cancer.

11. Did PADOH assess exposures from garden produce or creek fish?

Garden crops and creek fish were not sampled in EPA's Site Assessment. PADOH did not evaluate these exposures. Generally, vegetable uptake of chemicals from soil is low and unlikely to be of concern for human consumption. PADOH found that tending to one's garden was unlikely to harm health.

As of July 2022, a Pennsylvania Fish Consumption Advisory is in effect for the Darby Creek Basin for channel-caught catfish, which recommends 1 meal per month due to polychlorinated biphenyls (PCBs). There is also a Consumption Advisory for the tidal portions of all Pennsylvania water bodies that feed the Delaware River Estuary for several other species of fish. Updates to fish consumption advisories can be found on the Pennsylvania Department of Environmental Protection website.

12. Are there limitations to PADOH's analysis?

- This analysis accounts for EPA's 2017-2018 data at select sampling locations, which cannot be extrapolated to past concentrations. In 2017, EPA began collecting these data as part of a Site Assessment to determine whether the site qualified for the National Priorities List (NPL). In the NPL process, Site Assessments do not typically fully characterize a site area. They are designed to help determine whether there has been a release of hazardous substances that is threatening human health and the environment.
- In 2017-2018, EPA sampled residential soil at 0" to 12" inches soil depth. ATSDR notes that ideally, surface soil be sampled at 0-3 inches' depth for a human exposure assessment evaluation. In its expanded sampling at Norwood conducted in 2020, EPA sampled soil at shallower depths.
- EPA reported total chromium and did not conduct metal speciation analysis. Chromium(III) is much less toxic than chromium(VI). As a "worst case scenario" approach, PADOH assumed that all detected total chromium was in its more toxic, chromium(VI) form, although, in most soils, chromium is present in its less toxic form. EPA speciated surface soils for chromium(VI) at a few residential locations following its 2020 sampling at Norwood.
- PADOH's cancer analysis accounts for age and sex but not other potential risk factors known to influence cancer rates, such as genetic pre-disposition, occupational or environmental exposures, behavioral factors, residential history, diet, etc. Currently, there is no registry available to assess Norwood MS rates, and the causes and risk factors for MS are not well understood.

13. Where is PADOH's analysis of the results from EPA's 2020 expanded investigation of Norwood?

PADOH's assessment of EPA's 2020 expanded sampling data, which EPA released in 2021, will be added as an addendum to this Health Consultation at a later date.

FOR FURTHER INFORMATION

- PADOH site fact sheet (on website) and Health Consultation Document (on website)
- ATSDR Tox FAQs – Polycyclic Aromatic Hydrocarbons (PAHs)
- EPA Frequently Asked Questions about the Norwood Landfill Site

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