# Evaluating Cancer Risks for Eastwick: Analysis of Air Toxics and the Clearview Landfill

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## Abstract

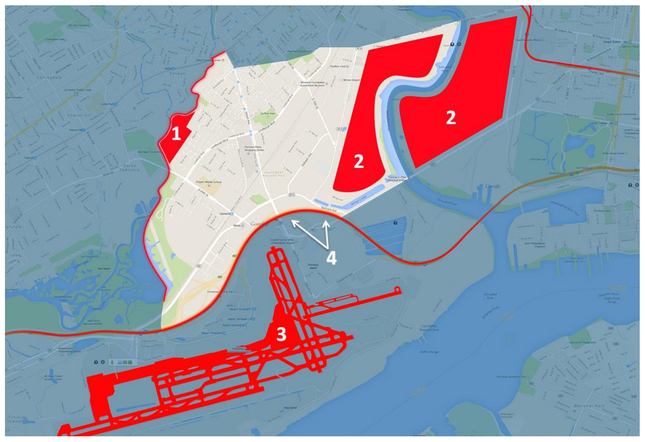
Eastwick, PA is a community in southwest Philadelphia in close proximity to the oil refineries, a Superfund site, major traffic routes I-95 and I-76, and the Philadelphia International airport. Residents are concerned about their cancer risk from these pollution sources. In 2011, the Pennsylvania Department of Health reported that Eastwick had 109% higher incidence of liver cancer than expected for Pennsylvania. In order to address community concerns, we performed a hypothesis-generating risk assessment to determine whether Eastwick had unique exposures that could account for high liver cancer incidence. We aimed to determine whether residents were exposed to known human carcinogens associated with liver cancer. The Agency for Toxic Substances and Disease Registry (ATSDR) and International Agency for Research on Cancer (IARC) monographs were used to determine whether local exposures were known human carcinogens implicated in liver cancer development. Exposures from proximity to the Superfund site and general air pollution in the region were considered. Web-based tools provided by the EPA {Toxic Release Inventory (TRI) Explorer; Risk Screening Environmental Indicators (RSEI) Model; Community-Focused Exposure and Risk Screening Tool (C-FERST); and Environmental Justice Screening and Mapping (EJScreen) tool} were used to identify and prioritize toxic releases in the area. Data from the 2005 National Air Toxics Assessment (NATA) were used to estimate exposure and cancer risks of air pollution for the region, and this model was supplemented by local data provided by the Philadelphia Air Monitoring Network. The Remedial Investigation for the Lower Darby Creek Area Superfund was reviewed to analyze hazardous substances detected in surface soils in the neighborhood. We determined that air pollution exposures had decreased in the region during the past 10 years and liver carcinogens were no longer being detected by local air monitors. However, liver carcinogens have been detected in soil samples in the community and warrant further study to estimate whether Eastwick residents are at risk of exposure. [Supported by T32019581 to JRM]

## Background

### Environmental Exposure Sources in Eastwick, PA.

Exposure sources include the following:

1. The Clearview Landfill. The Clearview Landfill accepted municipal, demolition, and hospital wastes during operation from 1956 to 1973. Waste disposal practices contaminated soil and groundwater.
2. Oil Refineries. Philadelphia Energy Solutions is one of the largest oil refining complexes on the U.S. Eastern seaboard.
3. Philadelphia International Airport. The airport contributes to local air pollution via air emissions from off-road transit and spent aviation fuel.
4. Major traffic routes I-95 and I-76.




### Cancer Incidence is Elevated in Eastwick and Philadelphia County Compared to Pennsylvania (PCR, 2011).

| *Eastwick vs. PA (1992-2008)* | |
|---|---|
| *Cancer Types* | *SIR* |
| All | 1.06 |
| Stomach | 1.73 |
| **Liver** | **2.09** |
| Lung | 1.23 |
| Prostate | 1.31 |

| *Philadelphia vs. PA (1992-2008)* | |
|---|---|
| *Cancer Types* | *SIR* |
| All | 1.10 |
| Stomach | 1.51 |
| Liver | 1.89 |
| Lung | 1.29 |
| Prostate | 1.20 |

SIR = Standardized Incidence Ratio

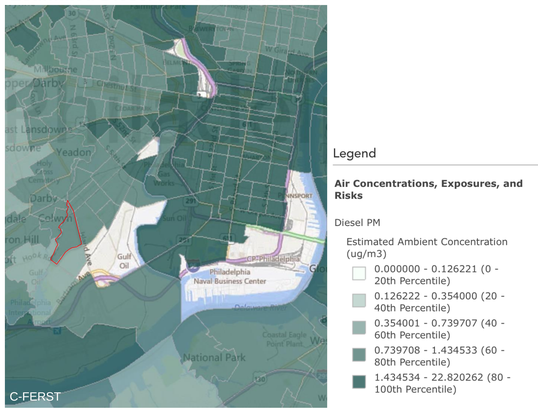
Eastwick has 6% higher incidence of all cancer types and 109% higher incidence of liver cancer than expected for Pennsylvania (PCR, 2011). For our study, we aimed to evaluate environmental exposures in Eastwick and determine whether residents were exposed to known liver carcinogens. Both air pollution and proximity to the Clearview Landfill were considered.

## Modeling National Air Toxics Assessment (NATA) Data

### Ambient Concentrations of Air Toxics in Eastwick Compared to Philadelphia

**Estimated Benzene Concentrations**


**Estimated Diesel PM Concentrations**




Methodology

C-FERST (beta test version 1.0) was used to visualize NATA estimations of ambient concentrations of benzene and diesel particulate matter (PM). Eastwick neighborhood in closest proximity to the Clearview landfill is outlined in red. The estimated ambient concentrations of both pollutants are lower in Eastwick than center and south Philadelphia. This may be due to prevailing wind patterns.

- Benzene was identified as the primary hazard released by oil refineries by the RSEI tool
- Diesel PM was mapped due to Eastwick's proximity to traffic
- NATA estimations were compared to local air monitor data and were comparable

### Estimated Cancer Risk from Inhaled Air Toxics


Methodology:

C-FERST (beta test version 1.0) was used to visualize NATA estimations of cancer risk due to inhalation of air toxics. Eastwick neighborhood in closest proximity to the Clearview landfill is outlined in red. The cancer risk in Eastwick is 49 per million.

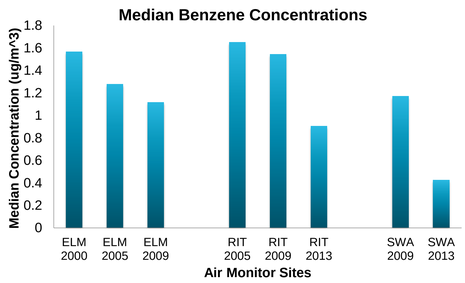
Note: NATA is intended as a tool to prioritize specific air toxics and sources for further study or regulation (EPA, 2005). Overall quality and uncertainties of the assessment will vary between locations and pollutants of interest.

## Philadelphia Air Monitoring Network Data

### Pollutants Detected in Local Air Monitors

| Hazardous Air Pollutant | IARC Cancer Classification | Primary Cancer Site |
|---|---|---|
| Benzene | 1 | Leukemia |
| **Vinyl chloride** | **1** | **Liver** |
| 1,3-Butadiene | 1 | Leukemia, Lymphoma |
| **Trichloroethylene** | **1** | Kidney, Lymphoma, **Liver** |
| Ethylene dibromide | 1 | Lung |
| Tetrachloroethylene | 2A | Liver & Kidney |
| Ethylene dichloride | 2B | Liver |
| trans-1,3-Dichloropropene | 2B | Liver |
| Dichloromethane | 2B | Liver & Lung |
| Carbon tetrachloride | 2B | Liver |
| Chloroform | 2B | Liver & Kidney |
| 1,2-Dichloropropane | 3 | None |

### Hazardous Air Pollution Trends

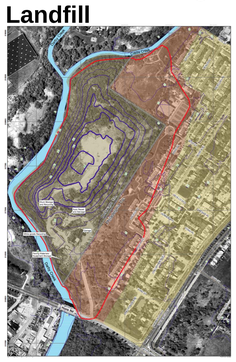



Methodology

The Philadelphia Air Monitoring Network has 11 stations positioned across Philadelphia. Three monitors in south and southwest Philadelphia (ELM, RIT, SWA) were used to estimate exposures in Eastwick. Air toxics detected by these monitors at any point between 2000 – 2013 are listed above with their corresponding IARC classification. Known liver carcinogens (IARC Class 1) are listed in bold, but have not been detected by air monitors since 2005. Ambient concentrations of most air toxics have decreased over time, including benzene. Data from the Philadelphia Air Monitoring Network is not available prior to 2000.

## Soil Sampling Data from Eastwick, PA

### Remedial Investigation of the Clearview Landfill



The Clearview Landfill is demarcated in green, the City Park in red, and the residential neighborhood in yellow. The historical landfill footprint is outlined in red.

The Remedial Investigation (EPA, 2011) analyzed surface soil samples from the Clearview Landfill, City Park, and the residential neighborhood. The primary contaminants of concern were polycyclic aromatic hydrocarbons (PAHs), heavy metals, and polychlorinated biphenyls (PCBs).

### Soil Contaminants in Eastwick City Park and Neighborhood

| Soil Contaminants | IARC Cancer Classification | Primary Cancer Site |
|---|---|---|
| **Arsenic** | **1** | Lung**, Liver**, Skin |
| **PCB - 1260** | **1** | **Liver** |
| **Vinyl chloride** | **1** | **Liver** |
| Benzo(*a*)pyrene | 1 | Lymphoma, Lung, Kidney |
| Lead | 2A | Lung, Kidney, Brain, Prostate |
| PAHs (several) | 2A-2B | Lung, Liver, Skin |
| DDD,DDE,DDT | 2B | Liver, Lung |
| Aldrin/dieldrin | 3 | Liver damage |

Contaminants detected in the surface soils in the City Park and residential neighborhood are listed above with their corresponding IARC classification.

## Conclusions

- **National Air Toxicity Assessment (EPA)**
  - NATA estimates that Eastwick has lower ambient concentrations of air toxics than other areas in Philadelphia
  - The cancer risk due to inhaled air toxics is average for the region
- **Philadelphia Air Monitors**
  - Data is consistent with NATA estimates
  - Air monitors show that most hazardous air pollutants are decreasing over time
  - Known carcinogens associated with liver cancer are no longer detected near Eastwick
- **Eastwick City Park and Neighborhood Soil**
  - Known liver carcinogens are detected in surface soil of the City Park and Eastwick residential areas
  - The estimated cancer risks due to soil exposures reported in the remedial investigation are much higher than air pollution exposures estimated by NATA (EPA, 2011)

| Source of Risk | Lifetime Cancer Risks |
|---|---|
| Eastwick City Park Surface Soil | 280 per million |
| Eastwick Neighborhood Surface Soil | 190 per million |
| Air Pollution (NATA, 2005) | 49 per million |

## Message to the Community

- **Raise awareness about dangers of accessing the landfill**
  - Ensure community members understand risks of trespassing on the landfill
  - Instruct children to avoid the landfill
- **Minimize current soil exposures**
  - Use raised beds with fresh soil when gardening
  - Wash hands after soil exposures
  - Take shoes off before entering the house
- **Ensure that soil exposures do not increase during remediation of landfill**