Neville Island Area
Air Toxics Study

Monitoring and Health Outcomes

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Overview

Neville Township is one of the most industrialized municipalities in Allegheny County. The western part of the island is largely residential. However, the eastern region is home to many large industrial facilities including Neville Chemical Company, (former) Shenango Coke Works, and Calgon Carbon. Air pollution from these, and other local facilities has been a concern in Allegheny County for decades. This area also has heavy transportation volume relating to industry and population density on the nearby highways and the Ohio River, which contribute to air pollution in the region.

In an effort to understand and document regional air pollution and its possible effect on health, the Allegheny County Health Department (ACHD) conducted an extensive air toxics study in the municipalities surrounding Neville Island. The study consisted of two discrete parts: a temporary air monitoring network and investigations into health outcomes.
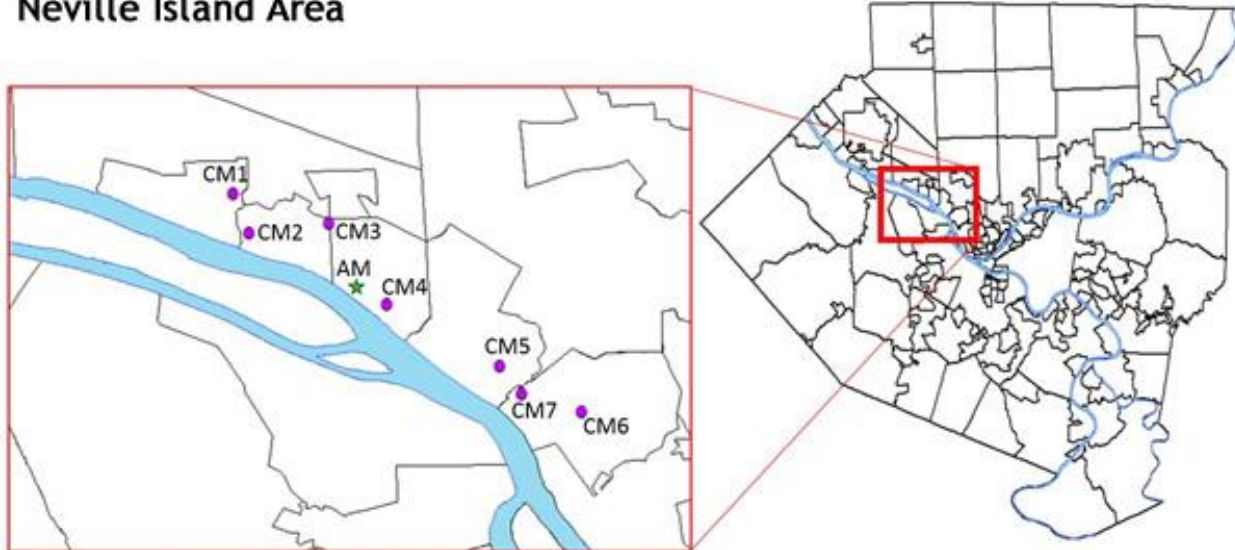

Neville Island Area
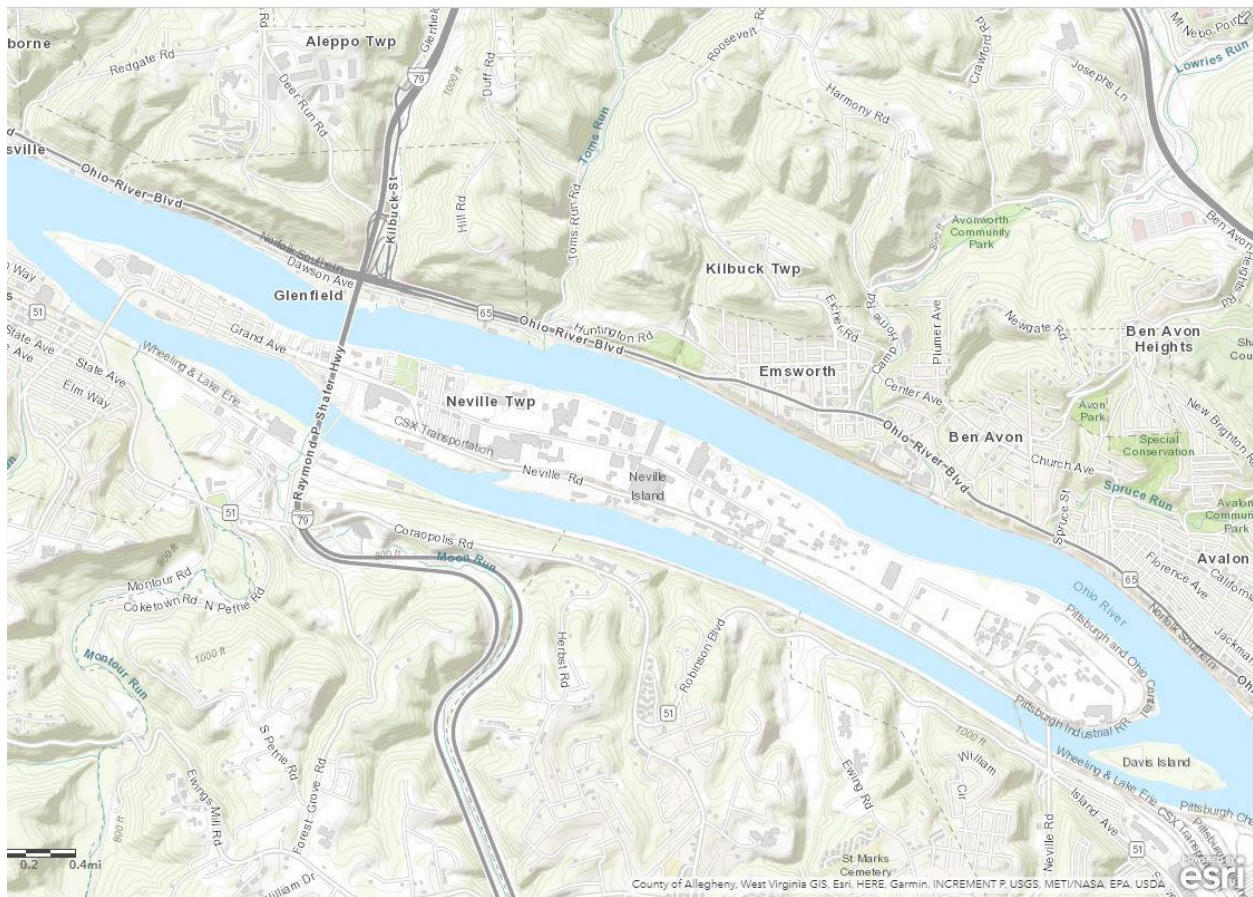
Monitoring Network

The health department located passive volatile organic compound (VOC) samplers on or near 7 properties in the study area and an 8th sampler at our permanent Avalon monitoring site. The samplers were located in municipalities that were typically downwind of the industries on Neville Island, including Emsworth, Ben Avon, Avalon, Brighton Heights, and Bellevue.

Radiello® passive samplers were used for this study. Briefly, such samplers include a stainless steel net cylinder cartridge packed with activated charcoal traps VOCs by adsorption. These compounds are then recovered by carbon disulfide displacement and analyzed by gas chromatography. More detail on their use and analysis can be found in the Radiello manual.

An ACHD employee collected the used cartridge for analysis every two weeks (subject to change with ongoing evaluation). Cartridge concentrations are determined by an accredited, contracted laboratory. Ambient concentrations are then calculated from this data by ACHD staff. VOC concentrations are averaged over each sample period. The laboratory is able to detect a level of less than 1 part per billion (ppb) of the seven pollutants tested in this study (benzene, ethylbenzene, toluene, xylenes, styrene, n-hexane, and naphthalene). Results were posted on the ACHD website as they were received from the laboratory. The monitoring was conducted for 6 months to one year.

Monitor Placement

Focus Pollutants

The Environmental Protection Agency (EPA) collects information on the types of pollutants industries emit in the Toxic Release Inventory (TRI). Based upon this EPA information, the air is being sampled for these seven pollutants; basic information as well as sources and possible health effects of each pollutant are listed below:

1. Benzene
2. Ethylbenzene
3. Toluene
4. Xylenes (o-Xylene and m,p-Xylenes)
5. Styrene
6. n-Hexane
7. Naphthalene

Benzene

Brief description
- A colorless or light yellow liquid at room temperature
- Highly flammable
- Evaporates into the air very quickly

Sources
- Formed from both natural processes and human activities
- A constituent of crude oil, gasoline, and cigarette smoke
- Outdoor air contains low levels of benzene, primarily from tobacco smoke, gas stations, motor vehicle exhaust, and industrial emissions
- Indoor air generally contains higher levels of benzene than outdoor air. The benzene in indoor air comes from products that contain benzene such as glues, paints, furniture wax, and detergents

Local industrial sources
- Shenango, Inc.
- Gulf Oil LP Neville Island Terminal

Potential health risks
- Benzene exposure has been linked to cancer, primarily leukemia

Ethylbenzene

Brief description
- Colorless liquid that smells like gasoline
- Evaporates at room temperature

Sources
- Found naturally in oil
- Most production in the US is used to make styrene
- Found in paints, inks, pesticides, carpet glue, tobacco products, and automobile products

Local industrial sources
- Neville Chemical
- Gulf Oil LP Neville Island Terminal

Potential health risks
- Ethylbenzene may cause kidney damage and cancer

Toluene

Brief description
- A clear, colorless liquid at room temperature
- Evaporates very quickly

Sources
- Occurs naturally in crude oil and is produced in the process of making gasoline and other fuels and making coke from coal
- Used in making paints, paint thinners, fingernail polish, and adhesives
- Found in automobile exhaust

Local industrial sources
- Neville Chemical Company
- Shenango, Inc.
- Gulf Oil LP Neville Island Terminal
- Engineered Polymer Solutions

Potential health risks
- Toluene may affect the nervous system and the kidneys

o-Xylenes (and m,p-Xylenes)

Brief description
- A colorless liquid at room temperature
- Highly flammable and evaporates quickly

Sources
- Primarily released from industrial sites and automobile exhaust
- Found in gasoline, paint, varnish, shellac, rust preventatives, and cigarette smoke
- Occurs naturally in petroleum and coal tar
- Used as a solvent in the printing, rubber, and leather industries

Local industrial sources
- Neville Chemical Company
- Shenango, Inc
- Gulf Oil LP Neville Island Terminal
- Watson Standard Company
- Engineered Polymer Solutions

Potential health risks
- Large amounts of xylenes may affect the kidneys, lungs, heart, and nervous system

Styrene

Brief description
- A colorless liquid that evaporates easily

Sources
- Widely used to make plastics and rubber
- Present in combustion products such as cigarette smoke and automobile exhaust
- In consumer products such as packaging materials, insulation, drinking cups, and carpet backing

Local industrial sources
- Neville Chemical Company
- Shenango, Inc.
- Ashland, Inc.

Potential health risks
- Styrene may affect the nervous system and is a possible carcinogen

n-Hexane

Brief description
- A colorless liquid that evaporates very easily
- Highly flammable

Sources
- Gasoline contains n-hexane, so exposure occurs at service stations and in vehicle exhaust
- Used in cleaning agents and specialty glues

Local industrial sources
- Gulf Oil LP Neville Island Terminal

Potential health risks
- n-hexane may affect the nervous system

Naphthalene

Brief description
- A white solid that evaporates easily

Sources
- A natural constituent of fossil fuels
- Produced by burning tobacco or wood

Local industrial sources
- Neville Chemical Company
- Shenango, Inc.

Potential health risks
- Naphthalene may damage or destroy red blood cells
- Naphthalene may also be a carcinogen

Data / Lab Analysis Tables

Below is a map indicating the various monitoring stations. Values for each of the focus pollutants are listed by table on the following pages for each of the monitoring locations.
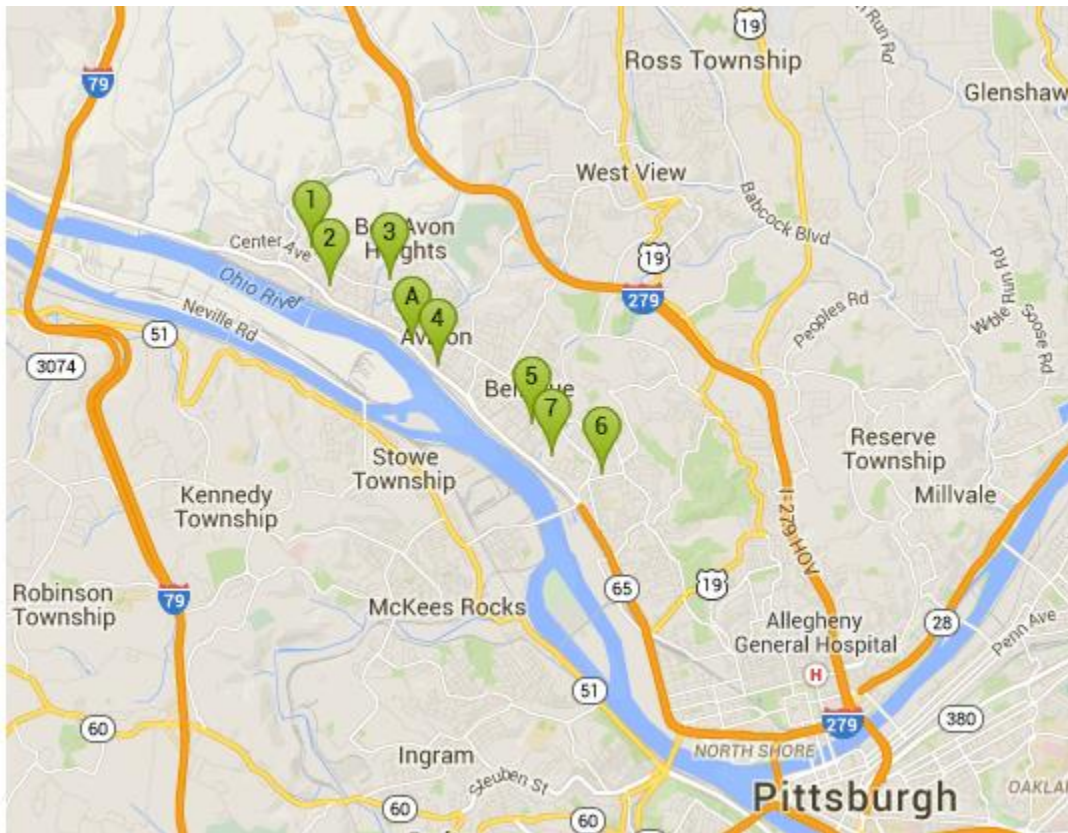
Exposure information was gathered from two sources:

1. The EPA's Integrated Risk Information System (IRIS) using RfCs (inhalation reference concentrations), which are estimates (with uncertainty spanning perhaps an order of magnitude) of a continuous inhalation exposure of a chemical to the human population through inhalation (including sensitive subpopulations), that is likely to be without risk of deleterious noncancer effects during a lifetime. (See Chart 1)

Chart 1

Risk estimates from EPA's Integrated Risk Information System (IRIS)

Compound	Inhalation Reference Concentration (RfC) ppb	Critical Health Effect	Carcinogenic Classification	Lifetime continuous exposure for an added 1 in 100,000 risk of cancer ppb
Benzene	9.39	Decreased blood cell count	A - human carcinogen	0.41 - 1.41
Toluene	1326.8	Neurological effects	Inadequate data	NA
Ethylbenzene	230.3	Developmental toxicity	D - not classifiable	NA
m,p-Xylenes	23.0	Impaired motor coordination	Inadequate data	NA
o-Xylene	23.0	Impaired motor coordination	Inadequate data	NA
Naphthalene	0.57	Damage to the lining of the respiratory system	C - possible human carcinogen	NA
Styrene	234.8	Damage to the nervous system	NA	NA
n-Hexane	198.6	Damage to the nervous system	Inadequate data	NA

PLEASE NOTE: Compounds on this list do not have an an ambient level that is regulated by the EPA or ACHD

All estimates were converted from $\mu g/m^3$ to ppb

NA = not available

2. The CDC's Agency for Toxic Substances and Disease Registry (ATSDR) uses MRLs (minimal risk levels), which are estimates of the daily human exposure to a hazardous substance that is likely to be without appreciable risk of adverse noncancer health effects over a specified exposure duration (acute, intermediate, or chronic). (See Chart 2)

Chart 2

Risk estimates from CDC's Agency for Toxic Substances and Disease Registry (ATSDR)

Compound	Minimal Risk Levels (MRL), in ppb			Health Effects
	Acute duration (≤ 14 days)	Intermediate duration (15 – 364 days)	Chronic duration (≥ 1 year)	
Benzene	9	6	3	A known carcinogen. May be associated with reproductive and developmental effects based on animal studies.
Toluene	1,000	NA	80	Neurological effects.
Ethylbenzene	5,000	2,000	60	Neurological and renal effects.
m,p-Xylenes	2,000	600	50	Neurological effects.
o-Xylene	2,000	600	50	Neurological effects.
Naphthalene	NA	NA	0.7	Respiratory effects.
Styrene	5,000	NA	200	Neurological effects.
n-Hexane	NA	NA	600	Neurological effects.

PLEASE NOTE: Compounds on this list do not have an an ambient level that is regulated by the EPA or ACHD

NA = not available

All reference levels are for informational purposes only. It is not appropriate to compare long term reference levels to individual shorter term measures. It would be more acceptable to compare the 14-day samples with the acute MRLs, and averages over time (as they are gathered and calculated) with the intermediate and chronic MRLs, RfCs, and cancer risk levels.

[NOTE: All measurements are in parts per billion (ppb); ND = Not Detected; all pollutants measured can be detected at levels below 0.5 ppb]

Values for location A

Start	End	Benzene	Toluene	Ethylbenzene	m,p-Xylene	o-Xylene	Naphthalene	Styrene	n-Hexane
04-Feb-15	18-Feb-15	0.25	0.15	ND	ND	ND	ND	ND	ND
18-Feb-15	04-Mar-15	0.16	0.32	ND	ND	ND	ND	ND	ND
04-Mar-15	18-Mar-15	0.92	0.40	ND	0.18	ND	ND	ND	ND
18-Mar-15	01-Apr-15	0.37	0.22	ND	ND	ND	ND	ND	ND
01-Apr-15	15-Apr-15	0.41	0.36	ND	0.17	ND	ND	ND	ND
15-Apr-15	29-Apr-15	0.17	0.15	ND	ND	ND	ND	ND	ND
29-Apr-15	20-May-15	0.40	0.23	ND	ND	ND	ND	ND	ND
20-May-15	03-Jun-15	0.56	0.18	ND	ND	ND	ND	ND	ND
03-Jun-15	17-Jun-15	0.82	0.29	ND	ND	ND	ND	ND	ND
17-Jun-15	01-Jul-15	0.32	0.25	ND	ND	ND	ND	ND	ND
01-Jul-15	15-Jul-15	0.32	0.40	ND	0.19	ND	ND	ND	ND
15-Jul-15	29-Jul-15	0.51	0.39	ND	0.16	ND	ND	ND	0.21
29-Jul-15	12-Aug-15	0.39	0.31	ND	ND	ND	ND	ND	ND
12-Aug-15	26-Aug-15	0.43	0.34	ND	ND	ND	ND	ND	0.21
26-Aug-15	09-Sep-15	0.45	0.41	ND	0.16	ND	ND	ND	0.21
09-Sep-15	23-Sep-15	0.38	0.40	ND	0.17	ND	ND	ND	0.44
23-Sep-15	07-Oct-15	0.20	0.22	ND	ND	ND	ND	ND	0.22
07-Oct-15	21-Oct-15	0.58	0.32	ND	ND	ND	ND	ND	0.23
21-Oct-15	04-Nov-15	0.48	0.32	ND	ND	ND	ND	ND	0.23
04-Nov-15	18-Nov-15	0.60	0.46	ND	0.18	ND	ND	ND	0.46
18-Nov-15	02-Dec-15	0.43	0.31	ND	ND	ND	ND	ND	ND
02-Dec-15	16-Dec-15	1.44	0.80	0.11	0.36	0.13	ND	ND	0.47
16-Dec-15	30-Dec-15	0.51	0.37	ND	ND	ND	ND	ND	ND
30-Dec-15	14-Jan-16	0.87	0.48	ND	0.18	ND	ND	ND	0.23

14-Jan-16	27-Jan-16	0.44	0.38	ND	ND	ND	ND	ND	0.27
27-Jan-16	10-Feb-16	0.37	0.34	ND	ND	ND	ND	ND	ND
10-Feb-16	24-Feb-16	0.29	0.25	ND	ND	ND	ND	ND	ND
24-Feb-16	09-Mar-16	0.33	0.28	ND	ND	ND	ND	ND	ND
09-Mar-16	24-Mar-16	0.31	0.30	ND	0.16	ND	ND	ND	ND
24-Mar-16	06-Apr-16	0.20	0.21	ND	ND	ND	ND	ND	ND
06-Apr-16	20-Apr-16	0.25	0.27	ND	ND	ND	ND	ND	ND
20-Apr-16	05-May-16	0.21	0.28	ND	ND	ND	ND	ND	ND
05-May-16	18-May-16	0.18	0.26	ND	ND	ND	ND	ND	ND
18-May-16	02-Jun-16	0.24	0.39	ND	0.16	ND	ND	ND	ND
02-Jun-16	16-Jun-16	0.16	0.29	ND	ND	ND	ND	ND	ND
16-Jun-16	28-Jun-16	0.23	0.38	ND	ND	ND	ND	ND	ND
28-Jun-16	13-Jul-16	0.18	0.32	ND	0.15	ND	ND	ND	ND
13-Jul-16	27-Jul-16	0.19	0.26	ND	ND	ND	ND	ND	ND
27-Jul-16	11-Aug-16	0.20	0.35	ND	0.15	ND	ND	ND	ND
11-Aug-16	24-Aug-16	0.21	0.41	ND	0.18	ND	ND	ND	ND
24-Aug-16	07-Sep-16	0.26	0.43	ND	0.16	ND	ND	ND	ND
07-Sep-16	21-Sep-16	0.24	0.41	ND	0.17	ND	ND	ND	ND
21-Sep-16	05-Oct-16	0.26	0.46	ND	0.17	ND	ND	ND	ND
05-Oct-16	20-Oct-16	0.28	0.45	ND	0.16	ND	ND	ND	ND
20-Oct-16	02-Nov-16	0.25	0.33	ND	ND	ND	ND	ND	ND
02-Nov-16	15-Nov-16	0.44	0.61	0.10	0.37	0.10	ND	ND	ND
15-Nov-16	30-Nov-16	0.44	0.53	0.09	0.34	0.09	ND	ND	ND
30-Nov-16	14-Dec-16	0.18	0.16	ND	ND	ND	ND	ND	ND
14-Dec-16	29-Dec-16	0.43	0.47	ND	0.17	ND	ND	ND	0.45
29-Dec-16	12-Jan-17	0.22	0.22	ND	ND	ND	ND	ND	ND

12-Jan-17	26-Jan-17	0.30	0.39	ND	0.18	ND	ND	ND	0.24
26-Jan-17	08-Feb-17	0.26	0.22	ND	ND	ND	ND	ND	ND
08-Feb-17	23-Feb-17	0.32	0.42	ND	0.17	ND	ND	ND	0.22
23-Feb-17	08-Mar-17	0.23	0.27	ND	ND	ND	ND	ND	ND
08-Mar-17	22-Mar-17	0.24	0.20	ND	ND	ND	ND	ND	ND
22-Mar-17	04-Apr-17	0.25	0.27	ND	ND	ND	ND	ND	ND
04-Apr-17	19-Apr-17	0.19	0.42	ND	ND	ND	ND	ND	0.16
19-Apr-17	03-May-17	0.16	0.30	ND	ND	ND	ND	ND	ND
03-May-17	17-May-17	0.16	0.26	ND	ND	ND	ND	ND	ND
17-May-17	31-May-17	0.14	0.26	ND	ND	ND	ND	ND	ND
31-May-17	14-Jun-17	0.20	0.33	ND	0.33	ND	ND	ND	0.22
14-Jun-17	28-Jun-17	0.16	0.29	ND	ND	ND	ND	ND	ND
28-Jun-17	12-Jul-17	0.18	0.32	ND	ND	ND	ND	ND	0.22
12-Jul-17	26-Jul-17	0.20	0.32	ND	ND	ND	ND	ND	0.21
26-Jul-17	08-Aug-17	0.21	0.39	ND	ND	ND	ND	ND	0.23
08-Aug-17	23-Aug-17	0.26	0.40	ND	0.15	ND	ND	ND	0.2
23-Aug-17	06-Sep-17	0.24	0.28	ND	ND	ND	ND	ND	ND
06-Sep-17	20-Sep-17	0.28	0.44	ND	0.17	ND	ND	ND	0.22
20-Sep-17	04-Oct-17	0.32	0.53	ND	0.33	ND	ND	ND	0.44
04-Oct-17	18-Oct-17	0.34	0.46	ND	0.17	0.09	ND	ND	0.22
18-Oct-17	01-Nov-17	0.48	0.56	ND	0.35	0.11	ND	ND	0.23

Values for location 1

Start	End	Benzene	Toluene	Ethylbenzene	m,p-Xylene	o-Xylene	Naphthalene	Styrene	n-Hexane
04-Feb-15	18-Feb-15	0.14	ND	ND	ND	ND	ND	ND	ND
18-Feb-15	04-Mar-15	0.21	ND	ND	ND	ND	ND	ND	ND
04-Mar-15	18-Mar-15	0.57	0.28	ND	ND	ND	ND	ND	ND
18-Mar-15	01-Apr-15	0.22	0.14	ND	ND	ND	ND	ND	ND
01-Apr-15	15-Apr-15	0.27	0.25	ND	ND	ND	ND	ND	ND
15-Apr-15	29-Apr-15	0.13	0.13	ND	ND	ND	ND	ND	ND
29-Apr-15	20-May-15	0.24	0.18	ND	ND	ND	ND	ND	ND
20-May-15	03-Jun-15	0.40	0.15	ND	ND	ND	ND	ND	ND
03-Jun-15	17-Jun-15	0.33	0.22	ND	ND	ND	ND	ND	ND
17-Jun-15	01-Jul-15	0.18	0.22	ND	ND	ND	ND	ND	ND
01-Jul-15	15-Jul-15	0.24	0.31	ND	0.19	ND	ND	ND	ND
15-Jul-15	29-Jul-15	0.31	0.30	ND	ND	ND	ND	ND	ND
29-Jul-15	12-Aug-15	0.16	0.22	ND	ND	ND	ND	ND	ND
12-Aug-15	26-Aug-15	0.25	0.23	ND	ND	ND	ND	ND	ND
26-Aug-15	09-Sep-15	0.33	0.34	ND	ND	ND	ND	ND	0.21
09-Sep-15	23-Sep-15	0.28	0.28	ND	ND	ND	ND	ND	0.22
23-Sep-15	07-Oct-15	0.14	0.19	ND	ND	ND	ND	ND	0.22
07-Oct-15	21-Oct-15	0.48	0.23	ND	ND	ND	ND	ND	0.23
21-Oct-15	04-Nov-15	0.33	0.29	ND	0.17	ND	ND	ND	0.46
04-Nov-15	18-Nov-15	0.44	0.40	ND	0.18	ND	ND	ND	0.46
18-Nov-15	02-Dec-15	0.36	0.23	ND	ND	ND	ND	ND	ND
02-Dec-15	16-Dec-15	0.96	0.53	ND	0.18	ND	ND	ND	0.23
16-Dec-15	30-Dec-15	0.38	0.21	ND	ND	ND	ND	ND	ND
30-Dec-15	14-Jan-16	0.58	0.32	ND	ND	ND	ND	ND	ND

14-Jan-16	27-Jan-16	0.37	0.27	ND	ND	ND	ND	ND	ND
27-Jan-16	10-Feb-16	0.28	0.20	ND	ND	ND	ND	ND	ND
10-Feb-16	24-Feb-16	0.25	0.18	ND	ND	ND	ND	ND	ND
24-Feb-16	09-Mar-16	0.24	0.18	ND	ND	ND	ND	ND	ND
09-Mar-16	24-Mar-16	0.22	0.22	ND	ND	ND	ND	ND	ND
24-Mar-16	06-Apr-16	0.16	0.17	ND	ND	ND	ND	ND	ND
06-Apr-16	20-Apr-16	0.21	0.23	ND	ND	ND	ND	ND	ND
20-Apr-16	05-May-16	0.17	0.25	ND	ND	ND	ND	ND	ND
05-May-16	18-May-16	0.15	0.28	ND	ND	ND	ND	ND	ND
18-May-16	02-Jun-16	0.20	0.34	ND	0.16	ND	ND	ND	ND
02-Jun-16	16-Jun-16	0.14	0.24	ND	ND	ND	ND	ND	ND
16-Jun-16	28-Jun-16	0.18	0.33	ND	ND	ND	ND	ND	ND
28-Jun-16	13-Jul-16	0.17	0.30	ND	ND	ND	ND	ND	ND
13-Jul-16	27-Jul-16	0.15	0.26	ND	ND	ND	ND	ND	ND
27-Jul-16	11-Aug-16	0.18	0.31	ND	ND	ND	ND	ND	ND
11-Aug-16	24-Aug-16	0.21	0.44	ND	0.18	ND	ND	ND	ND
24-Aug-16	07-Sep-16	0.20	0.43	ND	ND	ND	ND	ND	ND
07-Sep-16	21-Sep-16	0.18	0.36	ND	ND	ND	ND	ND	ND
21-Sep-16	05-Oct-16	0.20	0.35	ND	ND	ND	ND	ND	ND
05-Oct-16	20-Oct-16	0.23	0.38	ND	0.16	ND	ND	ND	ND
20-Oct-16	02-Nov-16	0.18	0.27	ND	ND	ND	ND	ND	ND
02-Nov-16	15-Nov-16	0.33	0.45	ND	0.19	ND	ND	ND	ND
15-Nov-16	30-Nov-16	0.34	0.39	ND	0.17	ND	ND	ND	ND
30-Nov-16	14-Dec-16	0.18	0.14	ND	ND	ND	ND	ND	ND
14-Dec-16	29-Dec-16	0.35	0.30	ND	ND	ND	ND	ND	0.23
29-Dec-16	12-Jan-17	0.20	0.16	ND	ND	ND	ND	ND	ND

12-Jan-17	26-Jan-17	0.26	0.28	ND	ND	ND	ND	ND	ND
26-Jan-17	08-Feb-17	0.17	0.15	ND	ND	ND	ND	ND	ND
08-Feb-17	23-Feb-17	0.22	0.22	ND	ND	ND	ND	ND	ND
23-Feb-17	08-Mar-17	0.16	0.15	ND	ND	ND	ND	ND	ND
08-Mar-17	22-Mar-17	0.18	0.12	ND	ND	ND	ND	ND	ND

Values for location 2

Start	End	Benzene	Toluene	Ethylbenzene	m,p-Xylene	o-Xylene	Naphthalene	Styrene	n-Hexane
04-Feb-15	18-Feb-15	0.18	0.17	ND	ND	ND	ND	ND	ND
18-Feb-15	04-Mar-15	0.12	0.13	ND	ND	ND	ND	ND	ND
04-Mar-15	18-Mar-15	0.63	0.36	ND	0.18	ND	ND	ND	0.24
18-Mar-15	01-Apr-15	0.24	0.22	ND	ND	ND	ND	ND	ND
01-Apr-15	15-Apr-15	0.31	0.30	ND	0.17	ND	ND	ND	ND
15-Apr-15	29-Apr-15	0.15	0.23	ND	ND	ND	ND	ND	ND
29-Apr-15	20-May-15	0.32	0.29	ND	0.11	ND	ND	ND	ND
20-May-15	03-Jun-15	0.54	0.22	ND	ND	ND	ND	ND	ND
03-Jun-15	17-Jun-15	0.43	0.27	ND	ND	ND	ND	ND	ND
17-Jun-15	01-Jul-15	0.20	0.33	ND	ND	ND	ND	ND	ND
01-Jul-15	15-Jul-15	0.36	0.51	ND	0.38	ND	ND	ND	ND
15-Jul-15	29-Jul-15	0.45	0.54	ND	0.33	0.09	ND	ND	0.21
29-Jul-15	12-Aug-15	0.33	0.39	ND	0.16	ND	ND	ND	0.22
12-Aug-15	26-Aug-15	0.43	0.47	ND	0.16	ND	ND	ND	0.22
26-Aug-15	09-Sep-15	0.49	0.50	ND	0.33	ND	ND	ND	0.21
09-Sep-15	23-Sep-15	0.46	0.48	ND	0.34	ND	ND	ND	0.44
23-Sep-15	07-Oct-15	0.24	0.31	ND	ND	ND	ND	ND	0.22
07-Oct-15	21-Oct-15	0.54	0.42	ND	0.17	ND	ND	ND	0.46
21-Oct-15	04-Nov-15	0.42	0.36	ND	0.17	ND	ND	ND	0.23
04-Nov-15	18-Nov-15	0.56	0.50	ND	0.35	0.09	ND	ND	0.46
18-Nov-15	02-Dec-15	0.49	0.41	ND	0.18	ND	ND	ND	0.23
02-Dec-15	16-Dec-15	1.19	0.80	0.11	0.36	0.13	ND	ND	0.47
16-Dec-15	30-Dec-15	0.51	0.33	ND	ND	ND	ND	ND	ND
30-Dec-15	14-Jan-16	0.85	0.48	ND	0.18	ND	ND	ND	0.23

14-Jan-16	27-Jan-16	0.46	0.40	ND	0.21	ND	ND	ND	0.27
27-Jan-16	10-Feb-16	0.37	0.34	ND	ND	ND	ND	ND	ND
10-Feb-16	24-Feb-16	0.31	0.29	ND	ND	ND	ND	ND	ND
24-Feb-16	09-Mar-16	0.31	0.30	ND	ND	ND	ND	ND	ND
09-Mar-16	24-Mar-16	0.35	0.41	ND	0.16	ND	ND	ND	ND
24-Mar-16	06-Apr-16	0.20	0.21	ND	ND	ND	ND	ND	ND
06-Apr-16	20-Apr-16	0.27	0.34	ND	ND	ND	ND	ND	ND
20-Apr-16	05-May-16	0.25	0.35	ND	0.16	ND	ND	ND	ND
05-May-16	18-May-16	0.26	0.38	ND	ND	ND	ND	ND	ND
18-May-16	02-Jun-16	0.32	0.49	ND	0.31	0.08	ND	ND	ND
02-Jun-16	16-Jun-16	0.24	0.40	ND	0.17	ND	ND	ND	ND
16-Jun-16	28-Jun-16	0.27	0.48	ND	0.19	ND	ND	ND	ND
28-Jun-16	13-Jul-16	0.26	0.44	ND	0.15	ND	ND	ND	ND
13-Jul-16	27-Jul-16	0.25	0.41	ND	0.16	ND	ND	ND	ND
27-Jul-16	11-Aug-16	0.32	0.55	0.08	0.30	0.08	ND	ND	0.20
11-Aug-16	24-Aug-16	0.27	0.50	ND	0.18	ND	ND	ND	ND
24-Aug-16	07-Sep-16	0.29	0.54	ND	0.16	ND	ND	ND	ND
07-Sep-16	21-Sep-16	0.28	0.50	ND	0.17	ND	ND	ND	ND
21-Sep-16	05-Oct-16	0.28	0.50	ND	0.17	ND	ND	ND	ND
05-Oct-16	20-Oct-16	0.30	0.47	ND	0.16	ND	ND	ND	ND
20-Oct-16	02-Nov-16	0.29	0.37	ND	ND	ND	ND	ND	ND
02-Nov-16	15-Nov-16	0.47	0.63	ND	0.37	0.10	ND	ND	ND
15-Nov-16	30-Nov-16	0.44	0.53	ND	0.34	ND	ND	ND	ND
30-Nov-16	14-Dec-16	0.18	0.18	ND	ND	ND	ND	ND	ND
14-Dec-16	29-Dec-16	0.35	0.36	ND	0.17	ND	ND	ND	0.23
29-Dec-16	12-Jan-17	0.20	0.20	ND	ND	ND	ND	ND	ND

12-Jan-17	26-Jan-17	0.30	0.39	ND	0.18	ND	ND	ND	0.24
26-Jan-17	08-Feb-17	0.24	0.22	ND	ND	ND	ND	ND	ND
08-Feb-17	23-Feb-17	0.30	0.35	ND	0.17	ND	ND	ND	0.22
23-Feb-17	08-Mar-17	0.23	0.23	ND	ND	ND	ND	ND	ND
08-Mar-17	22-Mar-17	0.22	0.18	ND	ND	ND	ND	ND	ND

Values for location 3

Start	End	Benzene	Toluene	Ethylbenzene	m,p-Xylene	o-Xylene	Naphthalene	Styrene	n-Hexane
04-Feb-18	18-Feb-15	0.18	0.13	ND	ND	ND	ND	ND	ND
18-Feb-15	04-Mar-15	0.32	0.32	ND	ND	ND	ND	ND	ND
04-Mar-15	18-Mar-15	0.57	0.28	ND	ND	ND	ND	ND	ND
18-Mar-15	01-Apr-15	0.35	0.18	ND	ND	ND	ND	ND	ND
01-Apr-15	15-Apr-15	0.29	0.23	ND	ND	ND	ND	ND	ND
15-Apr-15	29-Apr-15	0.10	0.11	ND	ND	ND	ND	ND	ND
29-Apr-15	20-May-15	0.37	0.21	ND	ND	ND	ND	ND	ND
20-May-15	03-Jun-15	0.54	0.18	ND	ND	ND	ND	ND	ND
03-Jun-15	17-Jun-15	0.75	0.23	ND	ND	ND	ND	ND	ND
17-Jun-15	01-Jul-15	0.18	0.22	ND	ND	ND	ND	ND	ND
01-Jul-15	15-Jul-15	0.30	0.34	ND	ND	ND	ND	ND	ND
15-Jul-15	29-Jul-15	0.39	0.29	ND	ND	ND	ND	ND	0.21
29-Jul-15	12-Aug-15	0.23	0.22	ND	ND	ND	ND	ND	ND
12-Aug-15	26-Aug-15	0.35	0.27	ND	ND	ND	ND	ND	ND
26-Aug-15	09-Sep-15	0.39	0.36	ND	0.16	ND	ND	ND	0.21
09-Sep-15	23-Sep-15	0.38	0.33	ND	ND	ND	ND	ND	0.22
23-Sep-15	07-Oct-15	0.18	0.18	ND	ND	ND	ND	ND	ND
07-Oct-15	21-Oct-15	0.54	0.25	ND	ND	ND	ND	ND	0.23
21-Oct-15	04-Nov-15	0.37	0.25	ND	ND	ND	ND	ND	0.23

Values for location 4

Start	End	Benzene	Toluene	Ethylbenzene	m,p-Xylene	o-Xylene	Naphthalene	Styrene	n-Hexane
04-Feb-15	18-Feb-15	0.28	0.17	ND	ND	ND	ND	ND	ND
18-Feb-15	04-Mar-15	0.32	0.13	ND	ND	ND	ND	ND	ND
04-Mar-15	18-Mar-15	1.05	0.44	ND	0.18	ND	ND	ND	ND
18-Mar-15	01-Apr-15	0.37	0.26	ND	ND	ND	ND	ND	ND
01-Apr-15	15-Apr-15	0.39	0.32	ND	0.17	ND	ND	ND	ND
15-Apr-15	29-Apr-15	0.19	0.17	ND	ND	ND	ND	ND	ND
29-Apr-15	20-May-15	0.43	0.26	ND	ND	ND	ND	ND	ND
20-May-15	03-Jun-15	0.44	0.17	ND	ND	ND	ND	ND	ND
03-Jun-15	17-Jun-15	0.80	0.31	ND	ND	ND	ND	ND	ND
17-Jun-15	01-Jul-15	0.24	0.23	ND	ND	ND	ND	ND	ND
01-Jul-15	15-Jul-15	0.30	0.38	ND	0.19	ND	ND	ND	ND
15-Jul-15	29-Jul-15	0.51	0.41	ND	0.16	ND	ND	ND	0.21
29-Jul-15	12-Aug-15	0.31	0.23	ND	ND	ND	ND	ND	ND
12-Aug-15	26-Aug-15	0.49	0.36	ND	0.16	ND	ND	ND	0.21
26-Aug-15	09-Sep-15	0.47	0.45	ND	0.16	ND	ND	ND	0.21
09-Sep-15	23-Sep-15	0.36	0.40	ND	0.17	ND	ND	ND	0.44
23-Sep-15	07-Oct-15	0.20	0.22	ND	ND	ND	ND	ND	0.22
07-Oct-15	21-Oct-15	0.43	0.30	ND	ND	ND	ND	ND	0.23
21-Oct-15	04-Nov-15	0.50	0.36	ND	0.17	ND	ND	ND	0.23
04-Nov-15	18-Nov-15	0.69	0.48	ND	0.18	ND	ND	ND	0.46
18-Nov-15	02-Dec-15	0.45	0.31	ND	ND	ND	ND	ND	ND
02-Dec-15	16-Dec-15	1.44	0.78	0.09	0.36	0.12	ND	ND	0.47
16-Dec-15	30-Dec-15	0.70	0.35	ND	ND	ND	ND	ND	ND
30-Dec-15	14-Jan-16	1.52	0.55	ND	0.35	ND	ND	ND	0.23

14-Jan-16	27-Jan-16	0.46	0.40	ND	ND	ND	ND	ND	0.27
27-Jan-16	10-Feb-16	0.37	0.32	ND	ND	ND	ND	ND	ND
10-Feb-16	24-Feb-16	0.31	0.27	ND	ND	ND	ND	ND	ND
24-Feb-16	09-Mar-16	0.33	0.28	ND	ND	ND	ND	ND	ND
09-Mar-16	24-Mar-16	0.31	0.34	ND	0.16	ND	ND	ND	ND
24-Mar-16	06-Apr-16	0.23	0.23	ND	ND	ND	ND	ND	ND
06-Apr-16	20-Apr-16	0.27	0.30	ND	ND	ND	ND	ND	ND
20-Apr-16	05-May-16	0.21	0.28	ND	ND	ND	ND	ND	ND
05-May-16	18-May-16	0.20	0.30	ND	ND	ND	ND	ND	ND
18-May-16	02-Jun-16	0.28	0.43	ND	0.16	ND	ND	ND	ND
02-Jun-16	16-Jun-16	0.16	0.31	ND	ND	ND	ND	ND	ND
16-Jun-16	28-Jun-16	0.23	0.42	ND	ND	ND	ND	ND	ND
28-Jun-16	13-Jul-16	0.20	0.40	ND	0.15	ND	ND	ND	ND
13-Jul-16	27-Jul-16	0.17	0.30	ND	ND	ND	ND	ND	ND
27-Jul-16	11-Aug-16	0.22	0.38	ND	0.15	ND	ND	ND	ND
11-Aug-16	24-Aug-16	0.23	0.44	ND	0.18	ND	ND	ND	ND
24-Aug-16	07-Sep-16	0.25	0.49	ND	0.16	ND	ND	ND	ND
07-Sep-16	21-Sep-16	0.24	0.43	ND	0.16	ND	ND	ND	ND
21-Sep-16	05-Oct-16	0.24	0.46	ND	0.17	ND	ND	ND	ND
05-Oct-16	20-Oct-16	0.28	0.43	ND	0.16	ND	ND	ND	ND
20-Oct-16	02-Nov-16	0.25	0.35	ND	ND	ND	ND	ND	ND
02-Nov-16	15-Nov-16	0.40	0.63	ND	0.37	ND	ND	ND	ND
15-Nov-16	30-Nov-16	0.36	0.49	ND	0.34	ND	ND	ND	ND
30-Nov-16	14-Dec-16	0.18	0.16	ND	ND	ND	ND	ND	ND
14-Dec-16	29-Dec-16	0.35	0.38	ND	ND	ND	ND	ND	0.23
29-Dec-16	12-Jan-17	0.22	0.22	ND	ND	ND	ND	ND	ND

12-Jan-17	26-Jan-17	0.26	0.37	ND	0.18	ND	ND	ND	ND
26-Jan-17	08-Feb-17	0.24	0.20	ND	ND	ND	ND	ND	ND
08-Feb-17	23-Feb-17	0.30	0.39	ND	0.17	ND	ND	ND	0.22
23-Feb-17	08-Mar-17	0.23	0.21	ND	ND	ND	ND	ND	ND
08-Mar-17	22-Mar-17	0.22	0.20	ND	ND	ND	ND	ND	ND

Values for location 5

Start	End	Benzene	Toluene	Ethylbenzene	m,p-Xylene	o-Xylene	Naphthalene	Styrene	n-Hexane
04-Feb-15	18-Feb-15	0.16	0.17	ND	ND	ND	ND	ND	ND
18-Feb-15	04-Mar-15	0.23	0.51	ND	0.19	ND	ND	ND	ND
04-Mar-15	18-Mar-15	1.00	0.44	0.13	0.18	ND	ND	ND	ND
18-Mar-15	01-Apr-15	0.54	0.42	ND	0.18	ND	ND	ND	ND
01-Apr-15	15-Apr-15	0.21	0.25	ND	ND	ND	ND	ND	ND
15-Apr-15	29-Apr-15	0.15	0.15	ND	ND	ND	ND	ND	ND
29-Apr-15	20-May-15	0.21	0.23	ND	0.11	ND	ND	ND	ND
20-May-15	03-Jun-15	0.30	0.15	ND	ND	ND	ND	ND	ND
03-Jun-15	17-Jun-15	0.26	0.25	ND	ND	ND	ND	ND	ND
17-Jun-15	01-Jul-15	0.24	0.23	ND	ND	ND	ND	ND	ND
01-Jul-15	15-Jul-15	0.30	0.38	ND	0.19	ND	ND	ND	ND
15-Jul-15	29-Jul-15	0.35	0.39	ND	0.16	ND	ND	ND	0.21
29-Jul-15	12-Aug-15	0.18	0.18	ND	ND	ND	ND	ND	ND
12-Aug-15	26-Aug-15	0.35	0.34	ND	ND	ND	ND	ND	0.21
26-Aug-15	09-Sep-15	0.43	0.45	ND	0.16	ND	ND	ND	0.21
09-Sep-15	23-Sep-15	0.40	0.44	ND	0.17	ND	ND	ND	0.44
23-Sep-15	07-Oct-15	0.20	0.33	ND	ND	ND	ND	ND	0.22
07-Oct-15	21-Oct-15	0.56	0.57	ND	0.17	ND	ND	ND	0.46
21-Oct-15	04-Nov-15	0.33	0.40	ND	0.17	ND	ND	ND	0.46
04-Nov-15	18-Nov-15	0.69	0.74	0.09	0.35	0.09	ND	ND	1.14
18-Nov-15	02-Dec-15	0.43	0.45	ND	0.18	ND	ND	ND	0.23
02-Dec-15	16-Dec-15	0.83	0.70	0.09	0.36	0.13	ND	ND	0.47
16-Dec-15	30-Dec-15	0.38	0.33	ND	ND	ND	ND	ND	ND
30-Dec-15	14-Jan-16	0.79	0.69	0.11	0.35	0.11	ND	ND	0.69

14-Jan-16	27-Jan-16	0.81	0.85	0.15	0.41	0.16	ND	ND	1.07
27-Jan-16	10-Feb-16	0.37	0.34	ND	ND	ND	ND	ND	ND
10-Feb-16	24-Feb-16	0.29	0.25	ND	ND	ND	ND	ND	ND
24-Feb-16	09-Mar-16	0.28	0.26	ND	ND	ND	ND	ND	ND
09-Mar-16	24-Mar-16	0.29	0.32	ND	0.16	ND	ND	ND	ND
24-Mar-16	06-Apr-16	0.25	0.29	ND	ND	ND	ND	ND	ND
06-Apr-16	20-Apr-16	0.27	0.34	ND	0.17	ND	ND	ND	ND
20-Apr-16	05-May-16	0.21	0.33	ND	ND	ND	ND	ND	ND
05-May-16	18-May-16	0.29	0.46	ND	0.19	ND	ND	ND	ND
18-May-16	02-Jun-16	0.32	0.56	ND	0.31	0.08	ND	ND	0.20
02-Jun-16	16-Jun-16	0.18	0.36	ND	ND	ND	ND	ND	ND
16-Jun-16	28-Jun-16	0.27	0.56	ND	0.19	ND	ND	ND	ND
28-Jun-16	13-Jul-16	0.22	0.42	ND	0.15	ND	ND	ND	ND
13-Jul-16	27-Jul-16	0.37	0.83	0.13	0.49	0.16	ND	ND	0.42
27-Jul-16	11-Aug-16	0.54	1.24	0.12	0.45	0.15	ND	ND	0.59
11-Aug-16	24-Aug-16	0.27	0.79	ND	0.35	0.10	ND	ND	ND
24-Aug-16	07-Sep-16	0.29	0.74	ND	0.16	ND	ND	ND	ND
07-Sep-16	21-Sep-16	0.47	1.20	0.15	0.49	0.16	ND	ND	0.43
21-Sep-16	05-Oct-16	0.26	0.57	ND	0.17	ND	ND	ND	ND
05-Oct-16	20-Oct-16	0.34	0.64	0.08	0.32	0.10	ND	ND	ND
20-Oct-16	02-Nov-16	0.27	0.49	ND	0.19	ND	ND	ND	ND
02-Nov-16	15-Nov-16	0.44	0.73	0.10	0.37	0.12	ND	ND	ND
15-Nov-16	30-Nov-16	0.36	0.49	ND	0.17	ND	ND	ND	ND
30-Nov-16	14-Dec-16	0.20	0.18	ND	ND	ND	ND	ND	ND
14-Dec-16	29-Dec-16	0.35	0.36	ND	ND	ND	ND	ND	0.23
29-Dec-16	12-Jan-17	0.22	0.20	ND	ND	ND	ND	ND	ND

12-Jan-17	26-Jan-17	0.26	0.41	ND	0.18	ND	ND	ND	0.24
26-Jan-17	08-Feb-17	0.21	0.22	ND	ND	ND	ND	ND	ND
08-Feb-17	23-Feb-17	0.30	0.35	ND	0.17	ND	ND	ND	0.22
23-Feb-17	08-Mar-17	0.21	0.21	ND	ND	ND	ND	ND	ND
08-Mar-17	22-Mar-17	0.22	0.20	ND	ND	ND	ND	ND	ND

Values for location 6

Start	End	Benzene	Toluene	Ethylbenzene	m,p-Xylene	o-Xylene	Naphthalene	Styrene	n-Hexane
04-Feb-15	18-Feb-15	0.18	0.17	ND	ND	ND	ND	ND	ND
18-Feb-15	04-Mar-15	ND	ND	ND	ND	ND	ND	ND	ND
04-Mar-15	18-Mar-15	0.76	0.42	ND	0.18	ND	ND	ND	ND
18-Mar-15	01-Apr-15	0.35	0.26	ND	ND	ND	ND	ND	ND
01-Apr-15	15-Apr-15	0.21	0.28	ND	ND	ND	ND	ND	ND
15-Apr-15	29-Apr-15	0.15	0.15	ND	ND	ND	ND	ND	ND
29-Apr-15	20-May-15	0.19	0.22	ND	0.11	ND	ND	ND	ND
20-May-15	03-Jun-15	0.22	0.17	ND	ND	ND	ND	ND	ND
03-Jun-15	17-Jun-15	0.22	0.31	ND	ND	ND	ND	ND	ND
17-Jun-15	01-Jul-15	0.10	0.14	ND	ND	ND	ND	ND	ND
01-Jul-15	15-Jul-15	0.32	0.40	ND	0.19	ND	ND	ND	ND
15-Jul-15	29-Jul-15	0.33	0.39	ND	0.16	ND	ND	ND	0.21
29-Jul-15	12-Aug-15	0.16	0.20	ND	ND	ND	ND	ND	ND
12-Aug-15	26-Aug-15	0.33	0.39	ND	0.16	ND	ND	ND	0.21
26-Aug-15	09-Sep-15	0.45	0.54	ND	0.33	ND	ND	ND	0.21
09-Sep-15	23-Sep-15	0.36	0.44	ND	0.17	ND	ND	ND	0.44
23-Sep-15	07-Oct-15	0.20	0.26	ND	ND	ND	ND	ND	0.22
07-Oct-15	21-Oct-15	0.46	0.36	ND	0.17	ND	ND	ND	0.23
21-Oct-15	04-Nov-15	0.25	0.30	ND	ND	ND	ND	ND	0.23
04-Nov-15	18-Nov-15	0.44	0.50	ND	0.18	ND	ND	ND	0.46
18-Nov-15	02-Dec-15	0.34	0.33	ND	ND	ND	ND	ND	ND
02-Dec-15	16-Dec-15	0.72	0.60	ND	0.36	0.12	ND	ND	0.47
16-Dec-15	30-Dec-15	0.41	0.39	ND	0.18	ND	ND	ND	ND
30-Dec-15	14-Jan-16	0.58	0.50	ND	0.17	ND	ND	ND	0.23

14-Jan-16	27-Jan-16	0.39	0.34	ND	ND	ND	ND	ND	0.27
27-Jan-16	10-Feb-16	0.35	0.32	ND	ND	ND	ND	ND	ND
10-Feb-16	24-Feb-16	0.27	0.20	ND	ND	ND	ND	ND	ND
24-Feb-16	09-Mar-16	0.26	0.24	ND	ND	ND	ND	ND	ND
09-Mar-16	24-Mar-16	0.25	0.29	ND	ND	ND	ND	ND	ND
24-Mar-16	06-Apr-16	0.20	0.19	ND	ND	ND	ND	ND	ND
06-Apr-16	20-Apr-16	0.25	0.30	ND	ND	ND	ND	ND	ND
20-Apr-16	05-May-16	0.21	0.32	ND	ND	ND	ND	ND	ND
05-May-16	18-May-16	0.18	0.30	ND	ND	ND	ND	ND	ND
18-May-16	02-Jun-16	0.26	0.44	ND	0.16	ND	ND	ND	ND
02-Jun-16	16-Jun-16	0.18	0.33	ND	ND	ND	ND	ND	ND
16-Jun-16	28-Jun-16	0.25	0.44	ND	ND	ND	ND	ND	ND
28-Jun-16	13-Jul-16	0.22	0.46	ND	0.15	ND	ND	ND	ND
13-Jul-16	27-Jul-16	0.19	0.37	ND	ND	ND	ND	ND	ND
27-Jul-16	11-Aug-16	0.23	0.41	ND	0.15	ND	ND	ND	ND
11-Aug-16	24-Aug-16	0.21	0.48	ND	0.18	ND	ND	ND	ND
24-Aug-16	07-Sep-16	0.29	0.59	ND	0.16	ND	ND	ND	ND
07-Sep-16	21-Sep-16	0.27	0.56	ND	0.16	ND	ND	ND	ND
21-Sep-16	05-Oct-16	0.28	0.52	ND	0.17	ND	ND	ND	ND
05-Oct-16	20-Oct-16	0.28	0.45	ND	0.16	ND	ND	ND	ND
20-Oct-16	02-Nov-16	0.22	0.35	ND	ND	ND	ND	ND	ND
02-Nov-16	15-Nov-16	0.53	0.69	0.12	0.37	0.12	ND	ND	0.24
15-Nov-16	30-Nov-16	0.46	0.59	0.09	0.34	0.11	ND	ND	ND
30-Nov-16	14-Dec-16	0.20	0.16	ND	ND	ND	ND	ND	ND
14-Dec-16	29-Dec-16	0.35	0.34	ND	ND	ND	ND	ND	0.23
29-Dec-16	12-Jan-17	0.20	0.18	ND	ND	ND	ND	ND	ND

12-Jan-17	26-Jan-17	0.26	0.35	ND	ND	ND	ND	ND	0.24
26-Jan-17	08-Feb-17	0.21	0.22	ND	ND	ND	ND	ND	ND
08-Feb-17	23-Feb-17	0.32	0.35	ND	0.17	ND	ND	ND	0.22
23-Feb-17	08-Mar-17	0.23	0.21	ND	ND	ND	ND	ND	ND
08-Mar-17	22-Mar-17	0.22	0.18	ND	ND	ND	ND	ND	ND

Values for location 7

Start	End	Benzene	Toluene	Ethylbenzene	m,p-Xylene	o-Xylene	Naphthalene	Styrene	n-Hexane
18-Feb-15	04-Mar-15	ND	ND	ND	ND	ND	ND	ND	ND
04-Mar-15	18-Mar-15	0.96	0.36	ND	ND	ND	ND	ND	ND
18-Mar-15	01-Apr-15	0.33	0.14	ND	ND	ND	ND	ND	ND
01-Apr-15	15-Apr-15	0.23	0.25	ND	ND	ND	ND	ND	ND
15-Apr-15	29-Apr-15	0.13	0.10	ND	ND	ND	ND	ND	ND
29-Apr-15	20-May-15	0.19	0.18	ND	ND	ND	ND	ND	ND
20-May-15	03-Jun-15	0.28	0.18	ND	ND	ND	ND	ND	ND
03-Jun-15	17-Jun-15	0.22	0.20	ND	ND	ND	ND	ND	ND
17-Jun-15	01-Jul-15	0.12	0.16	ND	ND	ND	ND	ND	ND
01-Jul-15	15-Jul-15	0.26	0.27	ND	ND	ND	ND	ND	ND
15-Jul-15	29-Jul-15	0.29	0.29	ND	ND	ND	ND	ND	ND
29-Jul-15	12-Aug-15	0.14	0.14	ND	ND	ND	ND	ND	ND
12-Aug-15	26-Aug-15	0.33	0.30	ND	ND	ND	ND	ND	ND
26-Aug-15	09-Sep-15	0.35	0.34	ND	0.16	ND	ND	ND	0.21
09-Sep-15	23-Sep-15	0.28	0.33	ND	ND	ND	ND	ND	0.22
23-Sep-15	07-Oct-15	0.16	0.19	ND	ND	ND	ND	ND	0.22
07-Oct-15	21-Oct-15	0.41	0.27	ND	ND	ND	ND	ND	0.23
21-Oct-15	04-Nov-15	0.21	0.23	ND	ND	ND	ND	ND	0.23
04-Nov-15	18-Nov-15	0.44	0.46	ND	0.18	ND	ND	ND	0.46
18-Nov-15	02-Dec-15	0.32	0.25	ND	ND	ND	ND	ND	ND
02-Dec-15	16-Dec-15	0.76	0.55	ND	0.18	ND	ND	ND	0.47
16-Dec-15	30-Dec-15	0.36	0.31	ND	ND	ND	ND	ND	ND
30-Dec-15	14-Jan-16	0.56	0.42	ND	0.17	ND	ND	ND	0.23
14-Jan-16	27-Jan-16	0.37	0.31	ND	ND	ND	ND	ND	0.27

27-Jan-16	10-Feb-16	0.35	0.28	ND	ND	ND	ND	ND	ND
10-Feb-16	24-Feb-16	0.22	0.16	ND	ND	ND	ND	ND	ND
24-Feb-16	09-Mar-16	0.24	0.22	ND	ND	ND	ND	ND	ND
09-Mar-16	24-Mar-16	0.23	0.29	ND	0.16	ND	ND	ND	ND
24-Mar-16	06-Apr-16	0.18	0.17	ND	ND	ND	ND	ND	ND
06-Apr-16	20-Apr-16	0.21	0.23	ND	ND	ND	ND	ND	ND
20-Apr-16	05-May-16	0.17	0.23	ND	ND	ND	ND	ND	ND
05-May-16	18-May-16	0.13	0.20	ND	ND	ND	ND	ND	ND
18-May-16	02-Jun-16	0.20	0.34	ND	ND	ND	ND	ND	ND
02-Jun-16	16-Jun-16	0.12	0.20	ND	ND	ND	ND	ND	ND
16-Jun-16	28-Jun-16	0.18	0.36	ND	ND	ND	ND	ND	ND
28-Jun-16	13-Jul-16	0.18	0.34	ND	ND	ND	ND	ND	ND
13-Jul-16	27-Jul-16	0.13	0.26	ND	ND	ND	ND	ND	ND
27-Jul-16	11-Aug-16	0.16	0.28	ND	ND	ND	ND	ND	ND
11-Aug-16	24-Aug-16	0.17	0.35	ND	ND	ND	ND	ND	ND
24-Aug-16	07-Sep-16	0.20	0.40	ND	ND	ND	ND	ND	ND
07-Sep-16	21-Sep-16	0.18	0.34	ND	ND	ND	ND	ND	ND
21-Sep-16	05-Oct-16	0.22	0.39	ND	0.17	ND	ND	ND	ND
05-Oct-16	20-Oct-16	0.26	0.38	ND	0.16	ND	ND	ND	ND
20-Oct-16	02-Nov-16	0.18	0.27	ND	ND	ND	ND	ND	ND
02-Nov-16	15-Nov-16	0.40	0.51	ND	0.37	ND	ND	ND	ND
15-Nov-16	30-Nov-16	0.36	0.46	ND	0.17	ND	ND	ND	ND
30-Nov-16	14-Dec-16	0.18	0.12	ND	ND	ND	ND	ND	ND
14-Dec-16	29-Dec-16	0.33	0.28	ND	ND	ND	ND	ND	ND
29-Dec-16	12-Jan-17	0.20	0.16	ND	ND	ND	ND	ND	ND
12-Jan-17	26-Jan-17	0.21	0.31	ND	ND	ND	ND	ND	ND

26-Jan-17	08-Feb-17	0.19	0.15	ND	ND	ND	ND	ND	ND
08-Feb-17	23-Feb-17	0.28	0.29	ND	ND	ND	ND	ND	ND
23-Feb-17	08-Mar-17	0.18	0.17	ND	ND	ND	ND	ND	ND
08-Mar-17	22-Mar-17	0.18	0.12	ND	ND	ND	ND	ND	ND

Health Outcomes Investigations

As part of the Neville Island Area Air Toxics study, the health department is continuing to collect data on health outcomes that have been associated with air pollution in the research literature.

The health outcomes currently included here are cancer incidence, low birth weight, and preterm birth. We are calculating annual (or sometimes 5-year) rates of these outcomes for the entire county, as well as for sections of the Neville Island area. More health outcome information will be added as it is collected and analyzed.

Two areas of interest in the Neville Island area were created by aggregating surrounding municipalities. Municipalities must be aggregated for most health outcomes due to small population size and the rarity of the health events. These groupings (referred to as "Tier 1" and "Tier 2") were formed by:
1. Input from the concerned residents of the area
2. Creating air toxics dispersion models for the industrial sites in the Neville Island area
3. Examining the National Air Toxics Assessment models of concentration of air pollutants in Allegheny County (created by the US EPA)

Tier 1

Tier 2

★ ACHD Avalon monitor
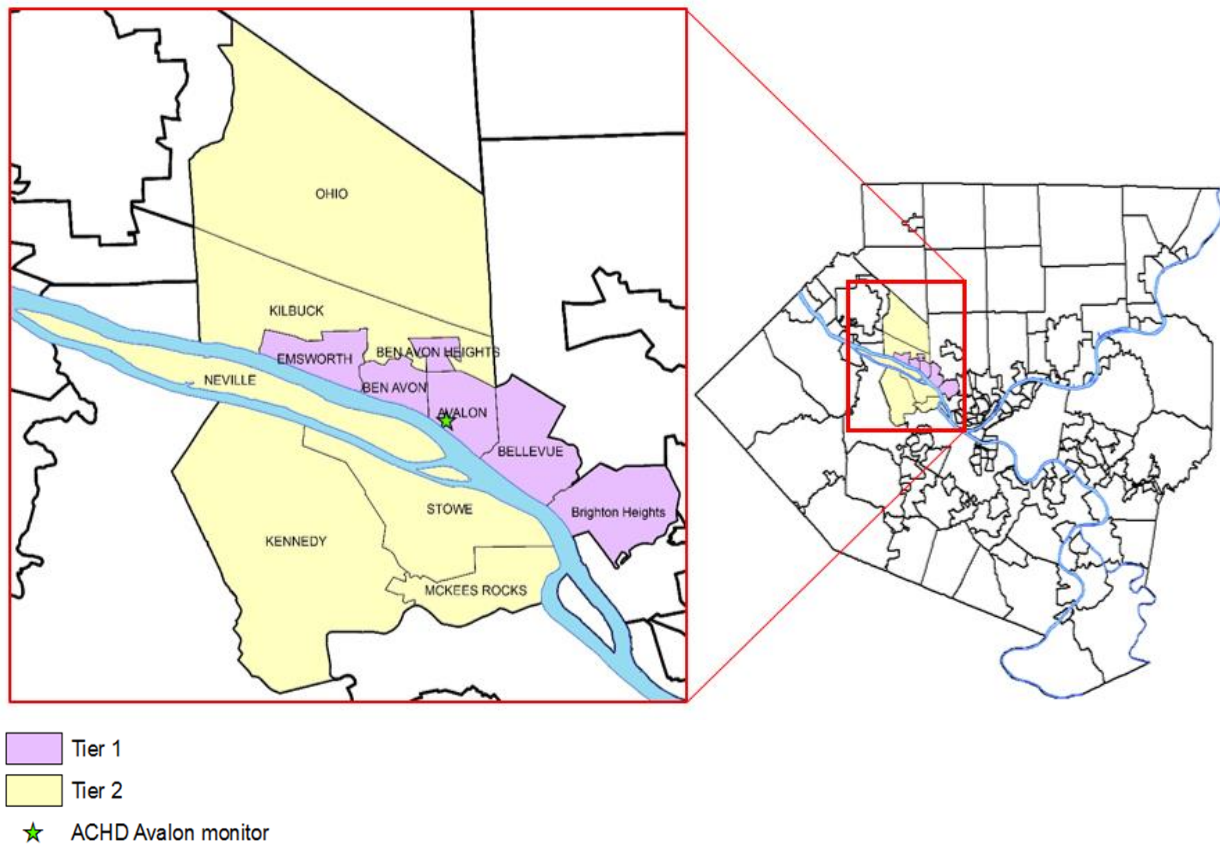
It is important to remember that air pollution is just one of many contributors to these health outcomes. Any elevation over the county (or state of Pennsylvania, where available) should not be interpreted as proof of substandard air quality, just as any lower rate should not be interpreted as proof of superior air quality. Other important contributors for these health outcomes are smoking status and history, obesity, diet, physical activity, socio-economic indicators, and genetic factors.

Cancer Incidence

Summary:
1. We are reasonably confident that Allegheny County rates are not statistically different from Pennsylvania.
2. We are reasonably confident that the Tier 1 rates are not statistically different from either the Allegheny County or the Pennsylvania rates during this time interval (2001 – 2012).
3. However, in 2006, we are reasonably confident that the Tier 2 rates are statistically higher than Pennsylvania, but not Allegheny County, rates.

Cancer was the second leading cause of death in the US in 2011. The National Cancer Institute (NCI) lists tobacco use, infections, radiation, and immunosuppressive medicines as factors that are known to increase cancer risk. The NCI lists diet, alcohol use, physical activity, obesity, and environmental risk factors (including air pollution) as factors that may increase cancer risk.

However, the International Agency for Research on Cancer (IARC) recently classified outdoor air pollution as carcinogenic to humans based on a review of scientific evidence. Currently, smoking is the leading cause of lung cancer and radon exposure is the second leading cause of lung cancer.

Proportion of cancers estimated to be due to non-heritable factors

Pie chart values: Tobacco 30%, Infection 10%, Parity 4%, Occupation 4%, Natural radiation/sunlight 3%, Alcohol 3%, Sexual activity 3%, Pollution 2%, Medication 1%, Industrial and consumer products 1%, Other 4%, Diet 35%
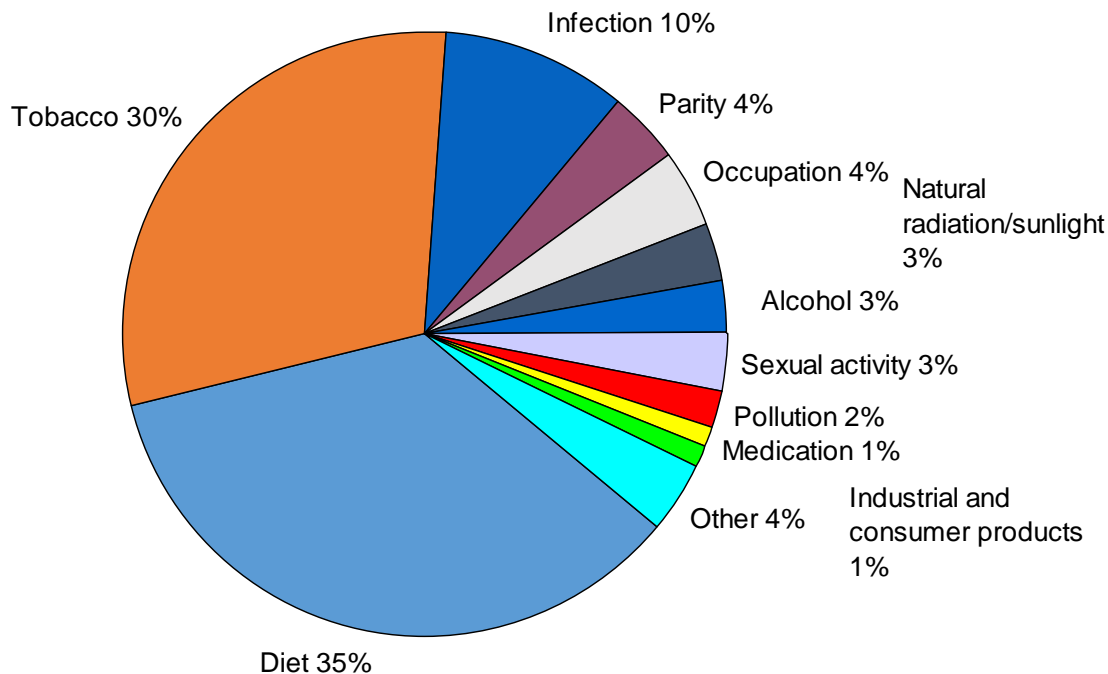
Source: Doll, R. and R. Peto; *The Causes of Cancer*; 1981; from *Chronic Disease Epidemiology and Control*, APHA, 1993.

Estimated Attributable Portion of Lung Cancer Cases by Cause
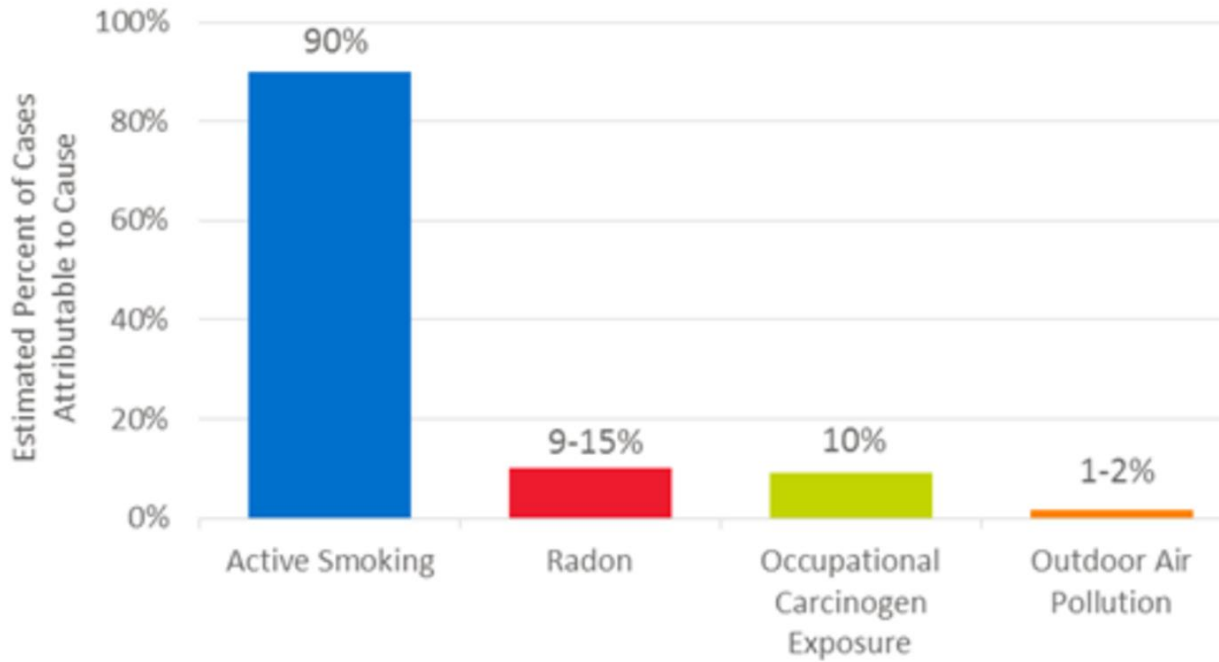
Source: Alberg AJ, Samet JM. Epidemiology of Lung Cancer. Chest. 2003; 123:21-49.

Radon in Allegheny County (ACHD Map)

Average Basement Measurement (pCi/L)
- 2.1 - 3.9
- 4.0 - 5.5
- 5.6 - 7.5
- 7.6 - 9.5
- 9.6 - 12.2
- Insufficient Data
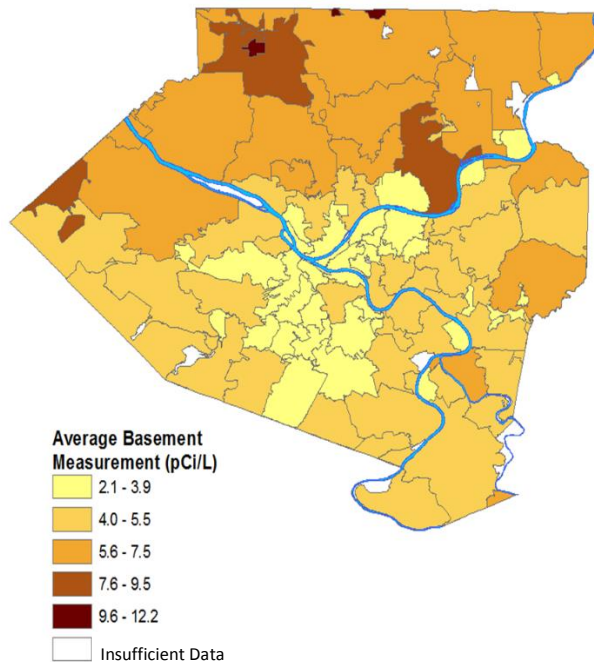
ACHD created this radon map showing average basement measures of radon in homes by zip code. Radon test data was downloaded from the Pennsylvania Department of Environmental Protection: depreportingservices.state.pa.us/ReportServer/Pages/ReportViewer.aspx?/Radon/RadonZip

The US EPA recommends homes be remediated if the radon level is 4 pCi/L (picocuries per liter) or more.

Radon in Allegheny County (EPA Map)
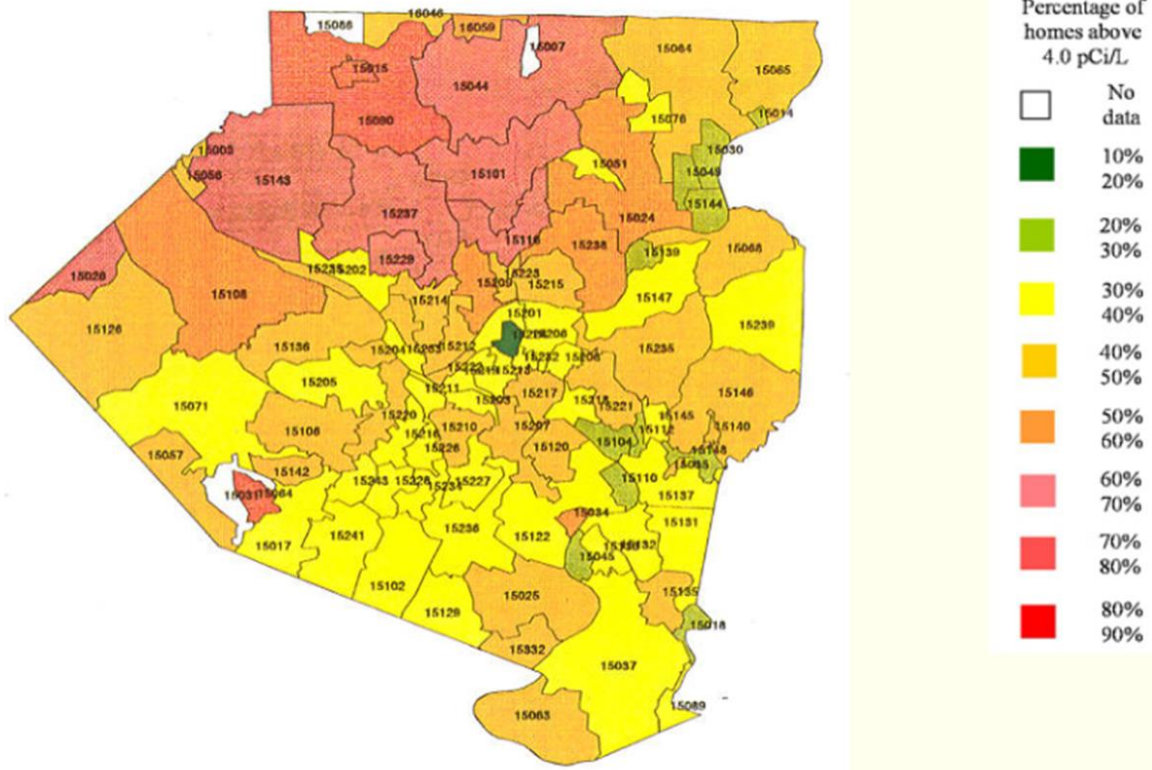
The EPA created this map showing percentage of homes with radon levels above 4.0 pCi/L in each zip code, and was downloaded from: http://www.wpb-radon.com/PA_radon_map.html

Although not all homes have been tested for radon, both maps suggest that the northwestern region of Allegheny County tends to have the highest concentrations of radon in the county.

Cancer Incidence (all-site and lung)

The following graphs show the age-adjusted cancer incidence for Allegheny County and the two study Tiers for the years 2001 – 2012. As older individuals are more likely to develop cancer, age adjustment is a way to allow for comparison between communities that have different age compositions. The vertical lines are called "confidence intervals." They show whether the levels of the outcome for each geographical area are statistically different from each other.

Notice how the confidence intervals are much bigger (longer) for the Tier 1 and Tier 2 areas (compared to Allegheny County and Pennsylvania). This is because they are inversely related to both how many 'events' there are and the population of the geographical area. As Allegheny County and Pennsylvania have a much larger population than the study areas (and therefore, has more low birth weight and preterm 'events'), the confidence intervals are much smaller.

Age adjusted cancer incidence rates (all-site) for Pennsylvania, Allegheny County, & study areas (2001 – 2012)
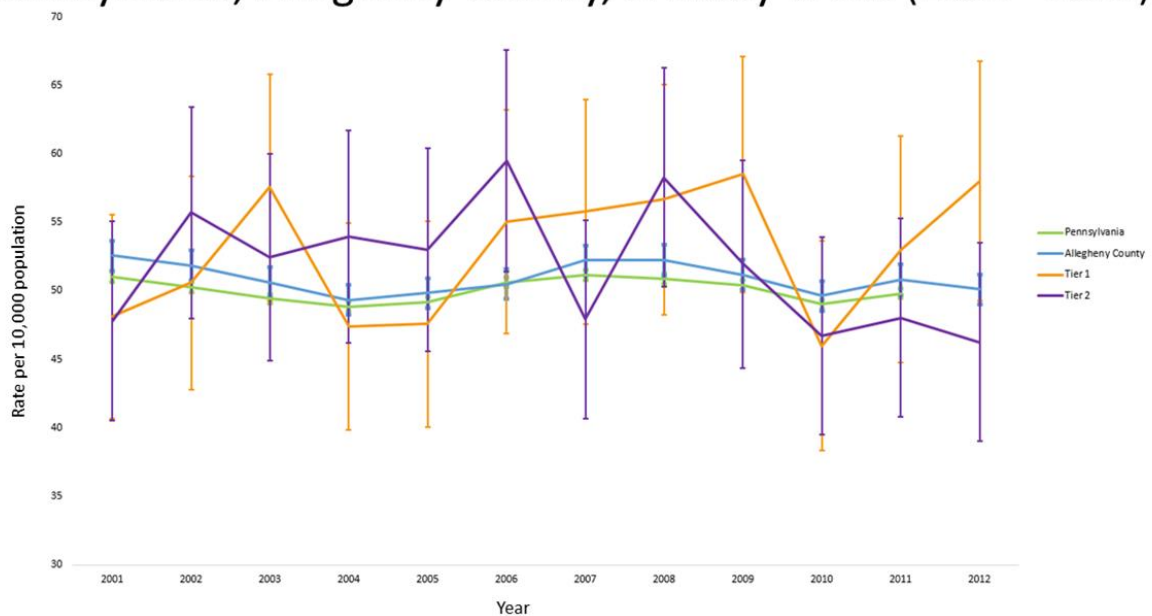
This chart includes Pennsylvania, Allegheny County, and both study Tiers. It is difficult to read because there is a lot going on visually, so let's look at smaller pieces to make sense of things.

Age adjusted cancer incidence rates (all-site) for Pennsylvania and Allegheny County (2001 – 2012)
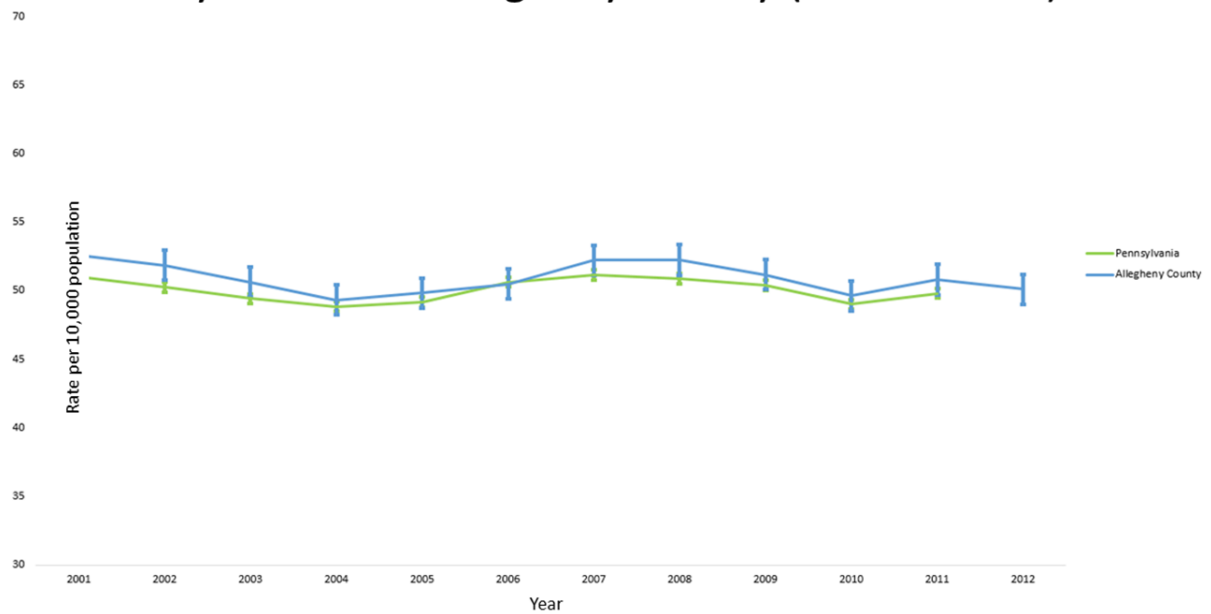
This chart just shows Pennsylvania (2001 – 2011) and Allegheny County (2001 – 2012) all site cancer incidence. (The Pennsylvania Department of Health website data was only updated to 2011 as of 3/25/15.) These trend lines are relatively flat compared to the other two lines (for Tier 1 and Tier 2 communities). Their rates are more stable because they are based on larger populations. Additionally, their 95% confidence interval bars are shorter (for precisely the same reason). Although the blue line of Allegheny County is more often above Pennsylvania's green line, we are never reasonably confident that the cancer incidence rate is higher in Allegheny County than in Pennsylvania. This is illustrated by their overlapping 95% confidence interval bars.

Age adjusted cancer incidence rates (all-site) for Pennsylvania, Allegheny County, and Tier 1 (2001 – 2012)

We have now added the Tier 1 cancer incidence rate trend line with its 95% confidence interval bars. The bars are longer, and the trend line is more erratic because the rates and confidence intervals are based on a smaller population. At no point during this time interval (2001 – 2012) are we reasonably confident that the Tier 1 rates are statistically different from either the Allegheny County or the Pennsylvania rates.

Age adjusted cancer incidence rates (all-site) for Pennsylvania, Allegheny County, and Tier 2 (2001 – 2012)
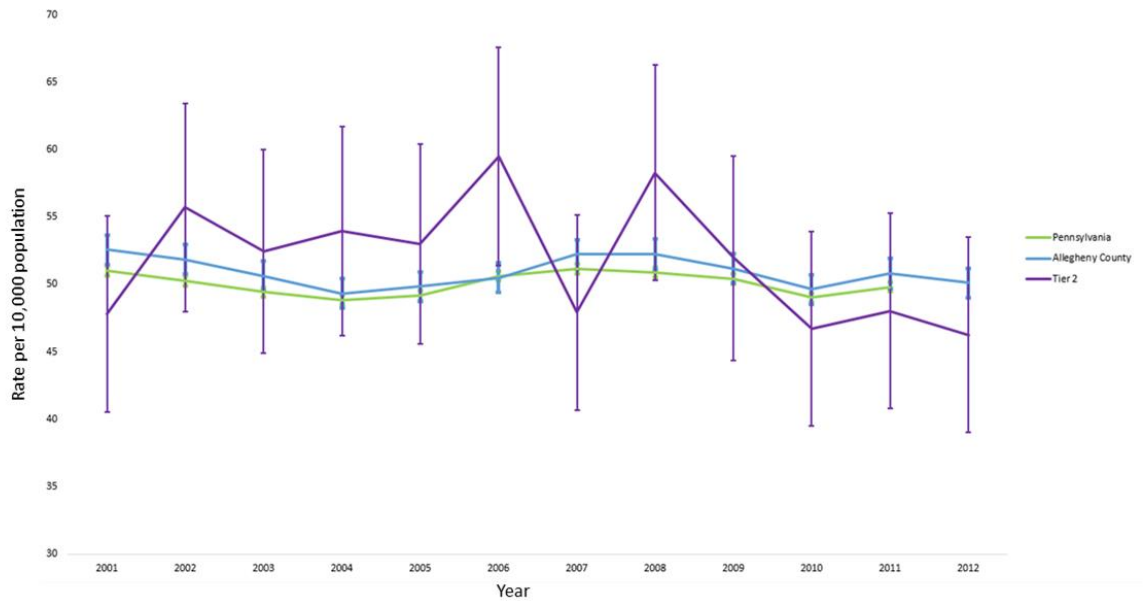
We have now added the Tier 2 cancer incidence rate trend line with its 95% confidence interval bars. Similar to Tier 1, the bars are longer, and the trend line is more erratic because the rates and confidence intervals are based on a smaller population. However, in 2006, we are reasonably confident that the Tier 2 rates are statistically higher than Pennsylvania, but not Allegheny County rates.

Lung Cancer

Summary:
1. Allegheny County has a higher incidence of lung cancer than Pennsylvania for all study years (2001 – 2012). Additionally, we are reasonably confident that this elevation is statistically significant for most years (2001, 2003, 2004, and 2007-2011).
2. Neither Tier 1 nor Tier 2 has any statistically significant elevations over Allegheny County rates during the study years.
3. The Tier 1 rates are statistically higher than Pennsylvania rates for 2008 and 2009.

Age adjusted lung cancer incidence rates for Pennsylvania, Allegheny County, and study areas (2001 – 2012)
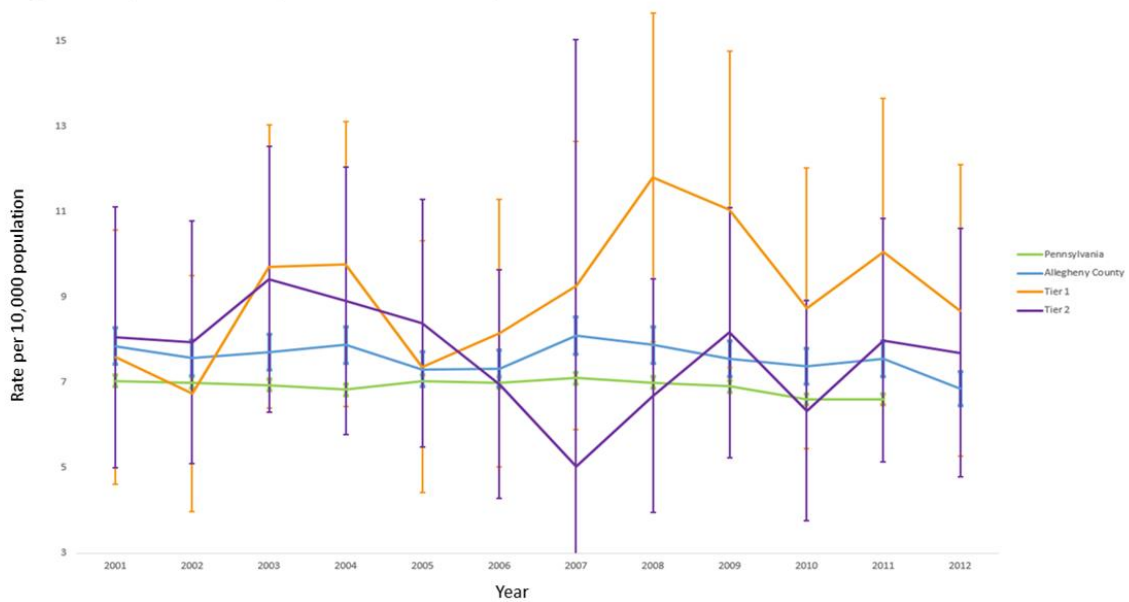
This chart includes Pennsylvania, Allegheny County, and both study Tiers. It is difficult to read because there is a lot going on visually, so let's look at smaller pieces to make sense of things.

Age adjusted lung cancer incidence rates for Pennsylvania and Allegheny County (2001 – 2012)
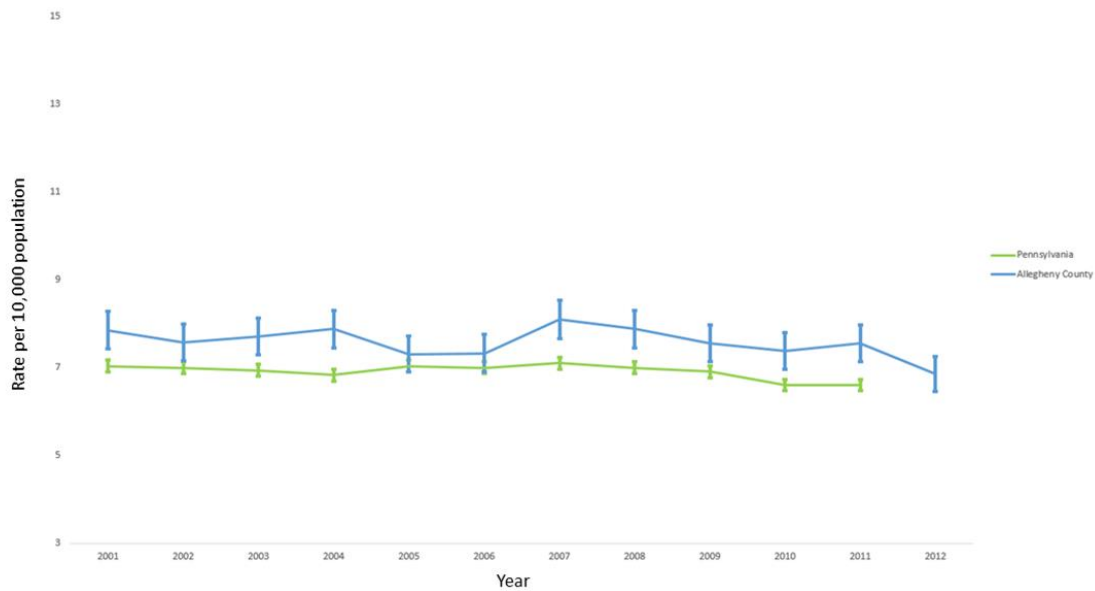
This chart just shows Pennsylvania (2001 – 2011) and Allegheny County (2001 – 2012) lung and bronchus cancer incidence. (The Pennsylvania Department of Health website data was only updated to 2011 as of 3/25/15) These trend lines are relatively flat compared to the other two lines (for Tier 1 and Tier 2 communities). Their rates are more stable because they are based on larger populations. Additionally, their 95% confidence interval bars are shorter (for precisely the same reason). The blue line of Allegheny County is always above Pennsylvania's green line, and in most years (2001, 2003, 2004, 2007-2011) we are reasonably confident that the lung cancer incidence rate is higher in Allegheny County than in Pennsylvania. This is illustrated by space between the 95% confidence interval bars for these years.

Age adjusted lung cancer incidence rates for Pennsylvania, Allegheny County, and Tier 1 (2001 – 2012)
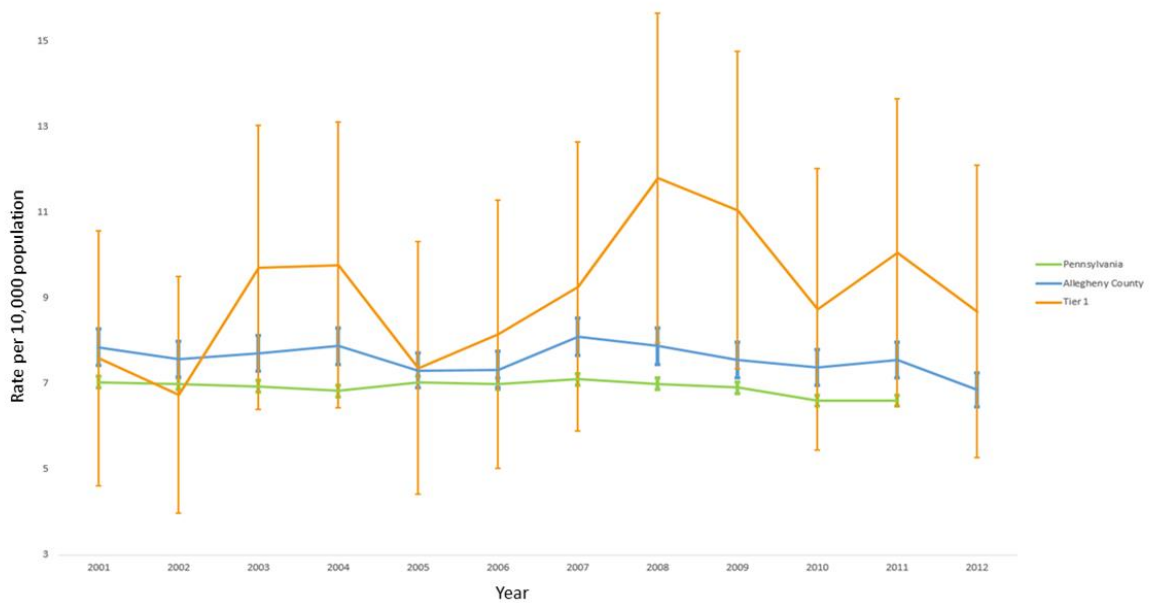
We have now added the Tier 1 cancer incidence rate trend line with its 95% confidence interval bars. The bars are longer, and the trend line is more erratic because the rates and confidence intervals are based on a smaller population. At no point during this time interval (2001 – 2012) are we reasonably confident that the Tier 1 rates are statistically different from Allegheny County rates, however in 2008 and 2009, we are reasonably confident that the Tier 1 rates are higher than Pennsylvania rates.

Age adjusted lung cancer incidence rates for Pennsylvania, Allegheny County, and Tier 2 (2001 – 2012)
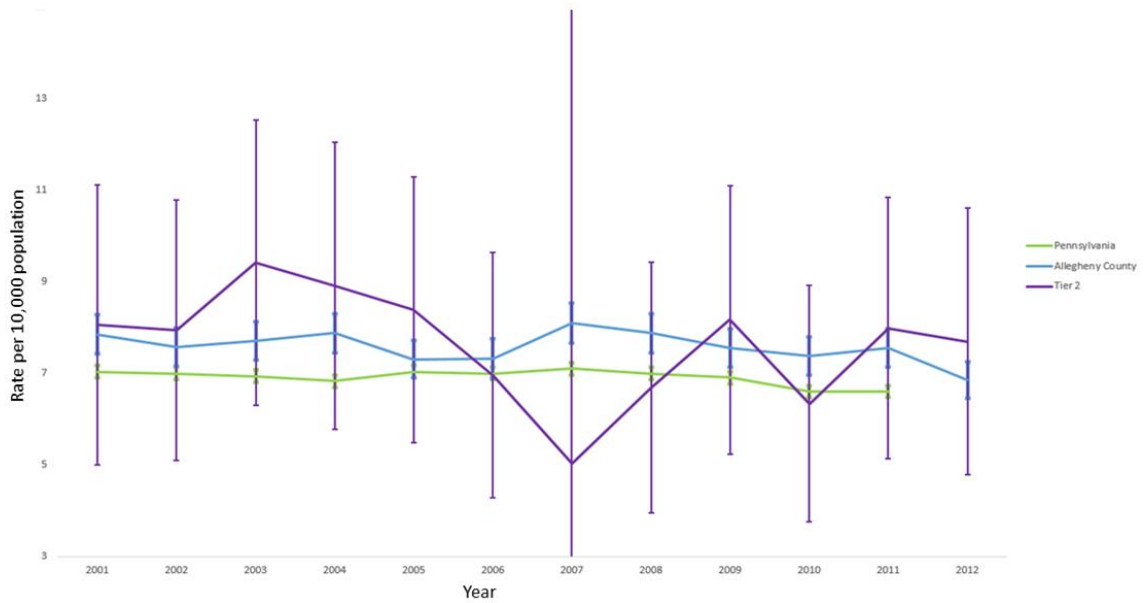
We have now added the Tier 2 cancer incidence rate trend line with its 95% confidence interval bars. Similar to Tier 1, the bars are longer, and the trend line is more erratic because the rates and confidence intervals are based on a smaller population. However, at no point during this time interval are we reasonably confident that the Tier 2 rates are statistically higher than either the Allegheny County or the Pennsylvania rates.

Birth Outcomes

Summary:
1. Pennsylvania rates were only available for low birth weight babies born to all mothers.
2. Comparing rates of all births to rates of births to non-smoking mothers who gave birth to one infant only, a notable portion of both of these outcomes can be explained by at least one of these factors (maternal smoking and multiple births).
3. Although Tier 1, and especially Tier 2, levels of low birth weight and preterm birth are usually higher than Allegheny County, we are reasonably confident that they are not statistically different than the county levels.
    - There is one exception to point 3: During the 2006-2010 time period, Tier 2 municipalities had a statistically higher rate of low birth weight (all births) compared to both Pennsylvania and Allegheny County.

Low birth weight (less than 2500 grams, or about 5 ½ pounds, at birth) and preterm birth (less than 37 weeks of gestation) are two adverse birth outcomes that affect the life of an infant. Additionally, these conditions can lead to health problems later in life. According to the March of Dimes, babies born with low birth weight are more likely to develop diabetes, heart disease, and high blood pressure than babies born at a normal weight.

The bar charts show low birth weight and preterm birth for the 5-year periods of 2001-2005, 2006-2010, 2007-2011, and 2008-2012 for Allegheny County, Tier 1 municipalities, and Tier 2 municipalities. Additionally, Pennsylvania is included in the chart depicting low birth weight for all births, which is the only state data available at this time. Both of these birth outcomes are shown for all births during this time period, and for births to non-smoking women who gave birth to singleton babies (no twins, triplets, etc.). Smoking and multiple births are the primary risk factors for these (and other) adverse birth outcomes.

The solid colored bars on top of each patterned bar are called "confidence intervals." They show whether the levels of the outcome for each geographical area are statistically different from each other. Notice how the confidence intervals are much bigger (longer) for the Tier 1 and Tier 2 areas (compared to Allegheny County). This is because they are inversely related to both how many 'events' there are and the population of the geographical area. As Allegheny County has a much larger population than the study areas (and therefore, has more low birth weight and preterm 'events'), the confidence intervals are much smaller.

So although Tier 1, and especially Tier 2, levels of low birth weight and preterm birth are usually higher than Allegheny County, because they are based on smaller numbers, we are usually relatively confident that they are not statistically different than the county levels. The only exception is for low birth weight (all births). During the 2006-2010 time period, Tier 2 municipalities had a statistically higher rate of low birth weight compared to both Pennsylvania and Allegheny County.
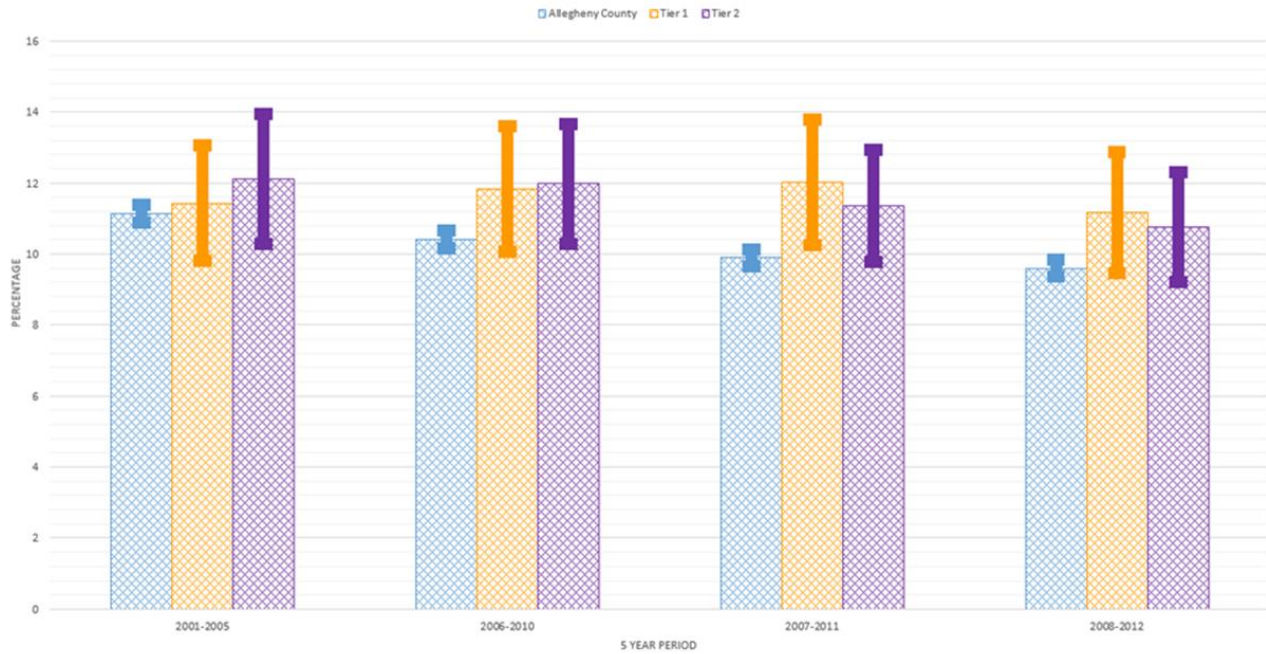
Percent of births in Pennsylvania and Allegheny County that were low birth weight from 2001-2012 (all births)
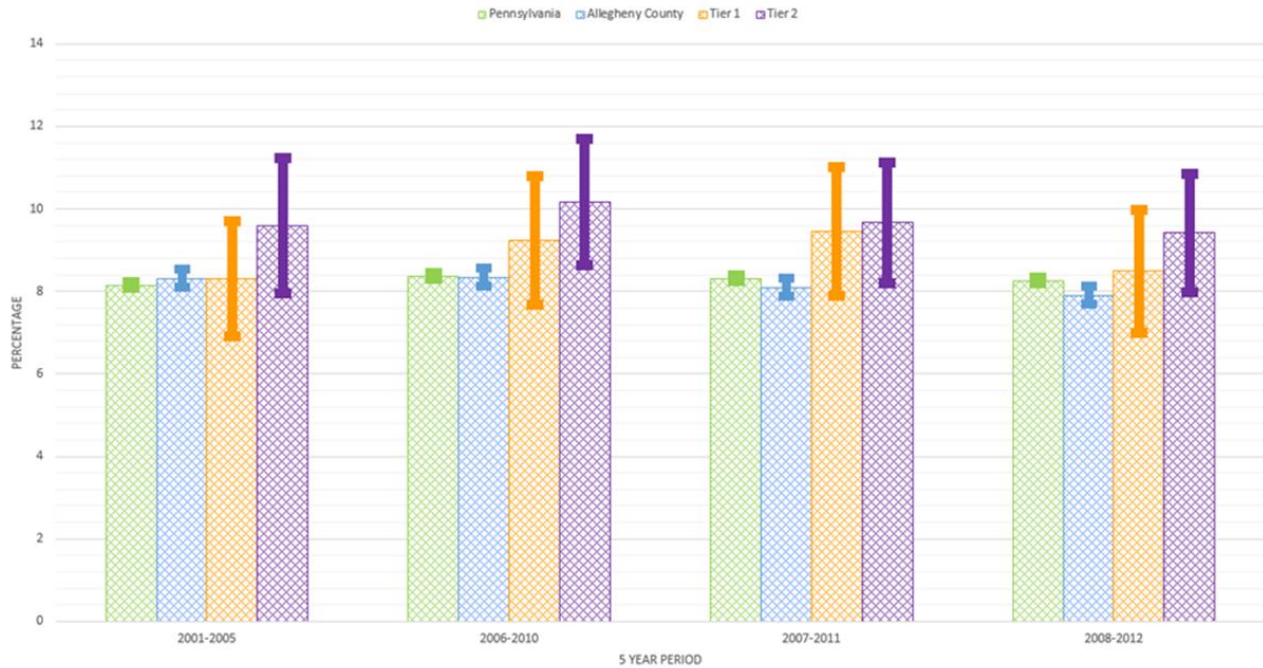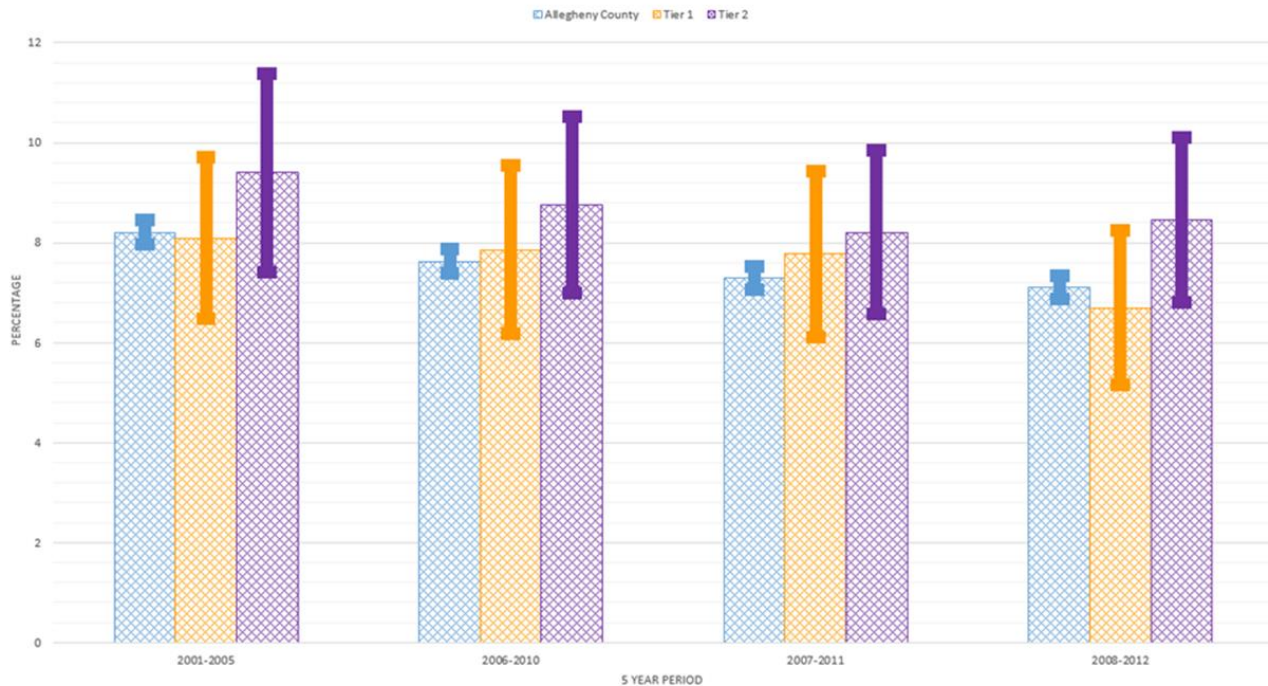
Percent of births in Allegheny County that were low birth weight from 2001-2012 (singleton births to non-smoking mothers)
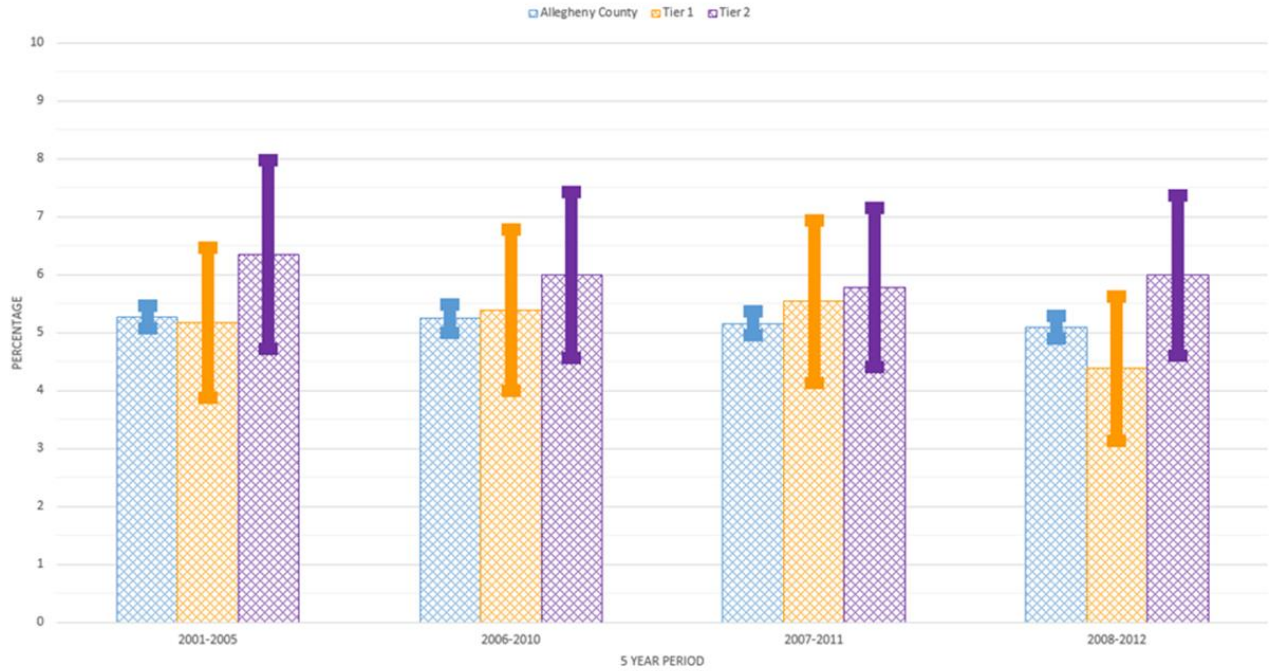
Percent of births in Allegheny County that were preterm from 2001-2012
(all births)

Percent of births in Allegheny County that were preterm from 2001-2012 (singleton births to non-smoking mothers)

Notes on data sources and rate calculations

- Reports generated in May 2015.

- The Pennsylvania specific rates were calculated by ACHD using state level data found on the PA Department of Health website.

- All Allegheny County, Tier 1, and Tier 2 specific rate data was calculated by ACHD with individual level data provided by the Pennsylvania Department of Health.

- The Bureau of Health Statistics and Research, Pennsylvania Department of Health specifically disclaims responsibility for any analyses, interpretations or conclusions.

- Cancer incidence rates were calculated to include any unknowns. With the exception of urinary bladder cancers, all in situ cancer cases were excluded.