SAT Initiative: Additional Monitoring South Allegheny Middle School/High School (McKeesport, Pennsylvania)

This document describes the analysis of air monitoring and other data collected under EPA's initiative to assess potentially elevated air toxics levels at some of our nation's schools. The document has been prepared for technical audiences (e.g., risk assessors, meteorologists) and their management. It is intended to describe the technical analysis of data collected for these schools in clear, but generally technical, terms. A summary of this analysis is presented on the page focused on these schools on EPA's website (www.epa.gov/schoolair).

I. Executive Summary

- Air monitoring was initially conducted for volatile organic compounds (VOCs); metals and polycyclic aromatic hydrocarbons (PAH) at South Allegheny Middle School/High School (S. Allegheny) and Clairton Educational Center (Clairton) during fall 2009. This monitoring effort was part of the EPA initiative to monitor specific air toxics in the outdoor air around priority schools in 22 states and 2 tribal areas.
- These schools were selected for monitoring in consultation with the local air agency, the Allegheny County Health Department (ACHD), based on information indicating the potential for elevated ambient concentrations of pollutants associated with coke oven operations, including benzene, arsenic, and benzo(a)pyrene, in air outside the schoo1. That information included EPA's completed 2002 National-Scale Air Toxics Assessment (NATA) from two sources: a nearby coke oven and a coke by-product facility, which converts the coke oven tars to other products.
- Based on the analysis of the 2009 monitoring data, EPA extended air toxics monitoring at S. Allegheny to better characterize exposure to that community from the nearby coke oven and the coke by-product facilities. At Clairton, levels of pollutants were below the levels of significant concern. This information from the 2009 monitoring is provided in the first report (http://www.epa.gov/schoolair/pdfs/ClairtonTechReport.pdf).
- Additional air monitoring was conducted at S. Allegheny from August 19, 2011 to April 3, 2012 for benzene and other VOCs; arsenic and other metals in particulate matter less than 10 microns (PM_{10}); and benzo(a)pyrene and other PAH. The levels of benzene, arsenic and other PM_{10} metals, and benzo(a)pyrene measured in the outdoor air over this nine month period continue to indicate the influence of nearby sources. The concentrations of these key pollutants plus others discussed in Appendix C, and the associated longer-term concentration estimates indicate the potential for the mixture of pollutants in the air to pose concerns for long-term continuous exposures.
- The area surrounding S. Allegheny (the Liberty-Clairton area of Allegheny County) is currently not meeting national ambient air quality standards (NAAQS) for fine particles (particulate matter less than 2.5 microns in size) which can contain some of the pollutants monitored. The ACHD has submitted a state implementation plan ($PM_{2.5}$ SIP) which details how the area will be brought back into attainment with the NAAQS.
- The nearby sources influencing the air quality at the school have recently taken actions to control air emissions. The facilities will continue control equipment upgrades to meet the

$PM_{2.5}$ SIP that requires compliance with $PM_{2.5}$ NAAQS within 5 years of approval. One facility has invested nearly $500 million to upgrade older polluting equipment with newer cleaner equipment. In addition, the same facility has applied for government grants to install new, updated quench towers to control particulate pollution. Another nearby contributing facility has installed a new thermal oxidizer that is expected to reduce naphthalene emissions by nearly 68%. These recent upgrades are expected to further reduce the air pollution from the contributing facilities. In addition, the contributing coal burning EGU upwind of the school has recently shut down and is no longer in operation. Emissions from the power plant are no longer impacting S. Allegheny and the surrounding area.

- EPA remains concerned about emissions from sources of air toxics and continues to work to reduce these emissions across the country, through national rules and by providing information and suggestions to assist with emissions reductions in local areas (http://www.epa.gov/ttn/atw/eparules.html).
- The Allegheny County Health Department (ACHD) will continue to oversee industrial facilities in the area through air permits and other programs. ACHD has been collecting monitoring data for a variety of pollutants at S. Allegheny since October 4, 1969. Additional air monitors that measure particulates in the same area are located at Glassport, Lincoln and Clairton air monitoring stations. These stations as well as the S. Allegheny station will continue to be operated as part of the ACHD's routine air monitoring network.

II. Basis for Selecting this School and the Air Monitoring Conducted

In 2009, this school was selected for monitoring in consultation with the local air agency, the Allegheny County Health Department (ACHD). EPA's 2002 NATA analysis indicated the potential for air levels of concern for pollutants associated with emissions from coke oven operations, including benzene, arsenic, and benzo(a)pyrene. This analysis was based on the 2002 National Emissions Inventory for a nearby coke oven and a coke by-product facility located next to each other (Figure 1). Additionally, ACHD has been conducting long-term air monitoring for volatile organic compounds (VOCs) including benzene, particulate matter in two forms (PM_{10} and $PM_{2.5}$), sulfur dioxide (SO_2), and hydrogen sulfide (H_2S) at S. Allegheny for several years. Initial monitoring conducted by EPA at S. Allegheny from August 5, 2009 through November 30, 2009 indicated the potential for benzene, arsenic and benzo(a)pyrene to be present in areas of this community at levels of concern for long-term continuous exposure to the mixture of pollutants.

Additional monitoring was conducted at this school from August 9, 2011 through April 3, 2012 collecting: 34 PM_{10} samples, which were analyzed for arsenic (PM_{10}) and a small standardized set of additional metals; 37 PAH samples, which were analyzed for benzo(a)pyrene and a small standardized set of additional PAHs; and 35 VOC samples, which were analyzed for benzene and other volatile organic compounds (VOC). All sampling methodologies are described in EPA's schools air toxics monitoring plan (http://www.epa.gov/schoolair/techinfo.html).[1]

III. Monitoring Results and Analysis

Key findings drawn from the information on chemical concentrations and the considerations discussed below include:

- The air sampling data collected over the nine-month sampling period indicate influence from the identified nearby sources of benzene, arsenic and benzo(a)pyrene.
- At South Allegheny, these data, and the associated longer-term concentration estimates. for the monitored pollutants commonly associated with coke oven emissions, including benzene, arsenic and benzo(a)pyrene, indicate the potential for the mixture of pollutants in the air in areas of this community to pose concerns for long-term continuous exposures.

A. Chemical Concentrations

Benzene, Arsenic and Benzo(a)pyrene, key pollutants:

- Do the monitoring data indicate influence from a nearby source?
  - → The monitoring data at both schools include several benzene, arsenic (PM_{10}), and benzo(a)pyrene concentrations that are higher than concentrations commonly observed in other locations nationally.[2]
- Do the monitoring data indicate elevated levels that pose significant long-term health concerns at either school?
  - → Although the concentrations of benzene, arsenic (PM_{10}), and benzo(a)pyrene are individually below their long-term comparison levels (as described below), the concentrations of these and some other pollutants associated with coke oven emissions contribute to the potential for levels of concern for long-term continuous exposure to the mixture of pollutants (see Appendix C).
    - ▪ The estimate of longer-term benzene, arsenic (PM_{10}), and benzo(a)pyrene concentrations (i.e., the upper bound of the 95 percent confidence interval on the mean of the dataset) is each below the comparison level (Table 1).[3] This

[1] EPA contractors operated the monitors and sent the canisters and filters to the analytical laboratory under contract to EPA.

[2] For example, 26 of 35 benzene concentrations, 28 of 34 arsenic (PM_{10}) concentrations, and 29 of 37 benzo(a)pyrene concentrations (Table 2) were higher than 75 percent of samples collected at the National Air Toxics Trends Stations (NATTS) from 2003-2010 (Appendix B). Because these NATTS sites are generally sited so as to not be influenced by specific nearby sources, EPA is using the 75th percentile point of concentrations at these sites as a benchmark of indicating potential influence from a source nearby to the school.

[3] The upper ends of the intervals at South Allegheny is between 1.32 and 1.42 times the mean of the monitoring data. Benzene, arsenic (PM_{10}), and benzo(a)pyrene are less than 47%, 30%, and 14% of their long-term cancer-based comparison levels, respectively.

comparison level is based on consideration of continuous exposure concentrations (24 hours a day, all year, over a lifetime).

- The longer-term concentration estimates for benzene, arsenic (PM_{10}), and benzo(a)pyrene are all less than one half their cancer-based comparison levels, indicating that the longer-term estimate at this location falls between continuous (24 hours a day, 7 days a week) lifetime exposure concentrations associated with 1-in-100,000 and 1-in-10,000 additional cancer risk.

- We did not identify concerns regarding short-term exposures as each individual measurement is below the individual sample screening level for benzene, arsenic (PM_{10}), and benzo(a)pyrene (which is based on consideration of exposure all day, every day over a period ranging from a couple of weeks to longer for some pollutants).[4]

Other Air Toxics:

- Do the monitoring data indicate elevated levels of any other air toxics (or HAPs) that pose significant long-term health concerns?

  → The monitoring data for other HAPs monitored indicate longer-term concentration estimates below their long-term comparison levels (Appendix C).

Multiple Pollutants:

- Do the data collected for the air toxics monitored indicate the potential for other monitored pollutants to be present at levels that in combination with the key pollutant levels indicate an increased potential for cumulative impacts of significant concern (e.g., that might warrant further investigation)?

  → The combined presence of several pollutants associated with coke oven operations (Appendix C) indicate the potential for levels of concern for long-term, continuous exposure to the mixture of pollutants particularly in areas of the South Allegheny community.[5]

[4] The development of long-term comparison levels, as well as of individual sample screening levels, is described in detail in *Schools Air Toxics Monitoring Activity (2009), Uses of Health Effects Information in Evaluating Sample Results.*.

[5] We note that this initiative is focused on investigation for a school-specific set of key pollutants indicated by previous analyses (and a small set of others for which measurements are obtained in the same analysis). Combined impacts of pollutants or stressors other than those monitored in this project is a broader area of consideration in other EPA activities. General information on additional air pollutants is available at http://www.epa.gov/air/airpollutants.html.

B. Wind and Other Meteorological Data

At each school monitored as part of this initiative, we collected meteorological data, minimally for wind speed and direction, during the sampling period. Additionally, we identified the nearest National Weather Service (NWS) station at which a longer record is available. Although the closest NWS station to these schools is at the Allegheny County Airport (4.5 miles from S. Allegheny), meteorological information has been collected at S. Allegheny since 2002. Wind speed and wind direction measurements from this school are being used to provide a context of historical wind patterns in this area.

In reviewing these data at each school in this initiative, we are considering if these data indicate that the general pattern of winds on our sampling dates are significantly different from those occurring across the full sampling period or from those expected over the longer-term. Additionally, we are noting, particularly for school sites where the measured chemical concentrations show little indication of influence from a nearby source, whether wind conditions on some portion of the sampling dates were indicative of a potential to capture contributions from the nearby "key" source in the air sample collected.

Data from the meteorological stations for wind speed and wind direction measurements is reported here for the time period January 1, 2002 continuing through April 3, 2012. This meteorological station continues to collect wind speed and wind direction measurements.

On-site data for these meteorological parameters are available for all dates of sample collection and also for intervening days, producing an approximately 9-month record for this sampling event. The meteorological data collected on sampling days are presented in Table 2 and Figures 3a-c. Sampling period and historical meteorological data at S. Allegheny from 2002 through 2012 are also presented in Appendix E.

As mentioned above, the nearest meteorological station is located at S. Allegheny High School in McKeesport, Pennsylvania. Only temperature and precipitation measurements were retrieved from the Allegheny County Airport NWS station, and this information is presented in Tables 2.

Key findings drawn from this information and the considerations discussed below include:

- Both the sampling results and the on-site wind data indicate that the majority of the air samples were collected on days when the nearby key source was contributing to conditions at the school locations.
- The wind patterns at the monitoring site at the school across sampling dates for the key pollutants are similar to those observed across the record of on-site meteorological data during the sampling period.
- For the meteorological station sited at S. Allegheny, the wind patterns during the sampling period are similar to the historical long-term wind flow patterns at that same site. This suggests that, on a regional scale, the 9-month sampling period may be representative of year-round wind patterns.

- What are the directions of the key sources of benzene, arsenic, and benzo(a)pyrene emissions in relation to the school location?
  - → The nearby industrial facilities emitting the key pollutants into the air (described in section III above) both lie less than 2 miles south to south-southwest of S. Allegheny.
  - → Using the property boundaries of the full facilities (in lieu of information regarding the location of specific sources of benzene, arsenic, and benzo(a)pyrene emissions at the facility), we have identified an approximate range of wind directions to use in considering the potential influence of these facilities on air concentrations at each school.
  - → This general range of wind directions is referred to here as the expected zone of source influence (ZOI). The expected ZOI for S. Allegheny is from approximately 170-235 degrees.

- On days the air samples were collected, how often did wind come from direction of the key source and is there any relationship in wind patterns between the two schools?
  - → For benzene, there were 28 out of 35 sampling days in which the on-site wind data had a portion of the winds from the ZOI (Table 2 and Figure 3a). For arsenic (PM_{10}), there were 27 out of 34 sampling days in which on-site wind data had a portion of the winds from the ZOI (Table 2 and Figure 3b). For benzo(a)pyrene, there were 30 out of 37 sampling days in which on-site wind data had a portion of the winds from the ZOI (Table 2 and Figure 3c).

- How do wind patterns on the air monitoring days compare to those across the complete monitoring period and what might be expected over the longer-term at the school location?
  - → Wind patterns across the air monitoring days appear similar to those observed over the record of on-site meteorological data during the sampling period.
  - → Wind data are available at the S. Allegheny site from 2005-2012. We note that wind patterns at the S. Allegheny during the sampling period are similar those recorded at that same school over the long-term (2002-2012 period; Appendix E), supporting the idea that regional meteorological patterns in the area during the sampling period were consistent with long-term patterns.

V. Other Monitoring in This Community

The ACHD has conducted air monitoring at S. Allegheny since October 4, 1969. Monitoring parameters at this site include the following;

- Daily $PM_{2.5}$ FRM
- Every six day $PM_{2.5}$ speciation
- Continuous $PM_{2.5}$ (non-equivalent)
- Every three day PM_{10}
- Continuous PM_{10} (equivalent)
- Continuous sulfur dioxide
- Continuous hydrogen sulfide

- Continuous benzene (auto GC)
- Meteorological tower with sonic wind speed/direction and ambient temperature.

Additional sites are operated nearby to better characterize the particulate concentration distribution in the community. These sites are Clairton Education Center ($PM_{2.5}$ FRM, PM_{10}, both every six days), Glassport High Street (PM_{10} continuous equivalent monitor) and Lincoln ($PM_{2.5}$ nonequivalent and PM_{10} equivalent continuous monitors).

The most recent assessment of the ACHD monitoring network describes the role of the nighttime inversions in the elevated levels of particulate matter concentrations documented at the S. Allegheny (referred to as the Liberty monitoring site).[6] The inversions have been demonstrated to contribute to localized elevated fine particulate levels that are unique to the Liberty-Clairton $PM_{2.5}$ nonattainment area.

S. Allegheny is within the Liberty-Clairton nonattainment area for the national ambient air quality standard (NAAQS) for $PM_{2.5}$. Among the monitors in this area, levels of $PM_{2.5}$ are routinely greatest at the S. Allegheny site. For the most recent 3-years for which $PM_{2.5}$ data are available (2009-2011), levels exceed the annual standard. Additionally, the 2011 $PM_{2.5}$ levels at the S. Allegheny site also exceed the 24-hour standard.[6]

The ACHD benzene monitoring method at the S. Allegheny site differs from that used in this project, contributing to some differences in the results. The ACHD uses an auto gas chromatograph (Auto GC) which samples and analyzes air over short (e.g., 2 minute) averaging periods with results available in close to real time. This instrumentation is used to screen for select compounds at higher concentrations to evaluate for acute health concerns. The VOC sample method used in the SAT project collects a 24 hour composite sample which is typically used to detect a greater variety of VOCs at lower concentrations to evaluate for chronic health concerns.

More information may be found at the ACHD website: http://www.achd.net/air/index.html

VI. Key Source Information

- Was the source operating as usual during the monitoring period?

  - Two nearby sources have operating permits issued by ACHD that include operating requirements.[7] Information from one of the nearby coke oven sources indicates that the facility was operating at a rate of about 94% of normal capacity during the sampling period. These production rates have increased since the initial sampling was conducted in 2009. Information from another nearby coke by-product facility indicates that this facility was operating at 87% capacity during the sampling period.

[6] See Allegheny County Health Department 2009 Air Quality Annual Report available at: http://www.achd.net/air/annualreports/2009_final_AQ.pdf.
[7] Operating permits, which are issued to air pollution sources under the Clean Air Act, are described at: http://www.epa.gov/air/oaqps/permits.

These production rates have increased since the initial sampling was conducted in 2009.

- The nearby sources influencing the air quality at the school have recently taken actions to control air emissions. The facilities will continue control equipment upgrades to meet the PM2.5 SIP that requires compliance with PM2.5 NAAQS within 5 years of approval. One facility has invested nearly $500 million to upgrade older polluting equipment with newer cleaner equipment. In addition, the same facility has applied for government grants to install new, updated quench towers to control particulate pollution. Another nearby contributing facility has installed a new thermal oxidizer that is expected to reduce naphthalene emissions by nearly 68%. These recent upgrades are expected to further reduce the air pollution from the contributing facilities. In addition, the contributing coal burning EGU upwind of the school has recently shut down and is no longer in operation. Emissions from the power plant are no longer impacting S. Allegheny and the surrounding area.

– The most recently available benzene emissions data from Source A (2011 TRI) are lower to those relied upon in previous modeling analysis for this area (2002 NATA, 2005 TRI). The most recently available benzene emissions data from Source B (2011 TRI) are similar to those relied upon in previous modeling analysis for this area (2005 TRI). The most recently available emissions data from both sources benzo(a)pyrene (2005 NATA) are similar to those relied upon in previous modeling analysis for this area (2002 NATA). Neither source reported arsenic emissions.

VII. Integrated Summary and Next Steps

A. Summary of Key Findings

1. What are the key HAPs for these schools?
   → Benzene, arsenic, and benzo(a)pyrene are the key HAP(s) for these schools, identified based on coke oven emissions information considered in identifying the schools for monitoring. The ambient air concentrations of benzene, arsenic (PM_{10}), and benzo(a)pyrene on several days during the sampling period indicate contributions from sources in the area.

2. Do the data collected at these schools indicate an elevated level of concern, as implied by information that led to identifying this school for monitoring?
   → The data collected for pollutants associated with coke oven emissions, including benzene, arsenic (PM_{10}), and benzo(a)pyrene and other monitored pollutants indicate a potential for this mixture of pollutants in the air in areas of the S. Allegheny community to pose levels of concern for long-term continuous exposures.
   → EPA remains concerned about emissions from sources of air toxics and continues to work to reduce these emissions across the country, through national rules and by providing information and suggestions to assist with reductions in local areas (http://www.epa.gov/ttn/atw/eparules.html).

3. Are there indications, e.g., from the meteorological or other data, that the sample set may not be indicative of longer-term air concentrations? Would we expect higher (or lower) concentrations at other times of year?
   - → The data we have collected appear to reflect air concentrations during the entire sampling period, with no indications from the on-site meteorological data that the sampling day conditions were inconsistent with conditions overall during this period.
   - → Among the data collected for these sites, we have none that would indicate generally higher (or lower) concentrations during other times of year. The wind flow patterns during the sampling period appear to be representative of long-term wind flow at that site.

B. Next Steps for Key Pollutants

1. EPA remains concerned about emissions from sources of air toxics and continues to work to reduce these emissions across the country, through national rules and by providing information and suggestions to assist with reductions in local areas (http://www.epa.gov/ttn/atw/eparules.html).

2. The Allegheny County Health Department (ACHD) will continue to oversee industrial facilities in the area through air permits and other programs. The ACHD will continue also collecting monitoring data for a variety of pollutants at S. Allegheny, which has been carried out consistently since 1969.

3. The ACHD expects the air quality in this area to continue to improve due to the installation of air pollution controls at the influencing facilities. Additionally, the nearby coal fired power plant was shut down in June 2012 and the area is no longer influenced by that source.

VII. Figures and Tables

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2c. South Allegheny Middle/High School – Key Pollutant (Benzo(a)pyrene) Analysis.

3a. South Allegheny Middle/High School – Benzene Concentrations and Wind Information.

3b. South Allegheny Middle/High School – Arsenic (PM_{10}) Concentrations and Wind Information.

3c. South Allegheny Middle/High School – Benzo(a)pyrene Concentrations and Wind Information.

VIII. Appendices

A. Summary Description of Long-term Comparison Levels.
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Figure 1. South Allegheny Middle/High School and the Sources of Interest (A, B).

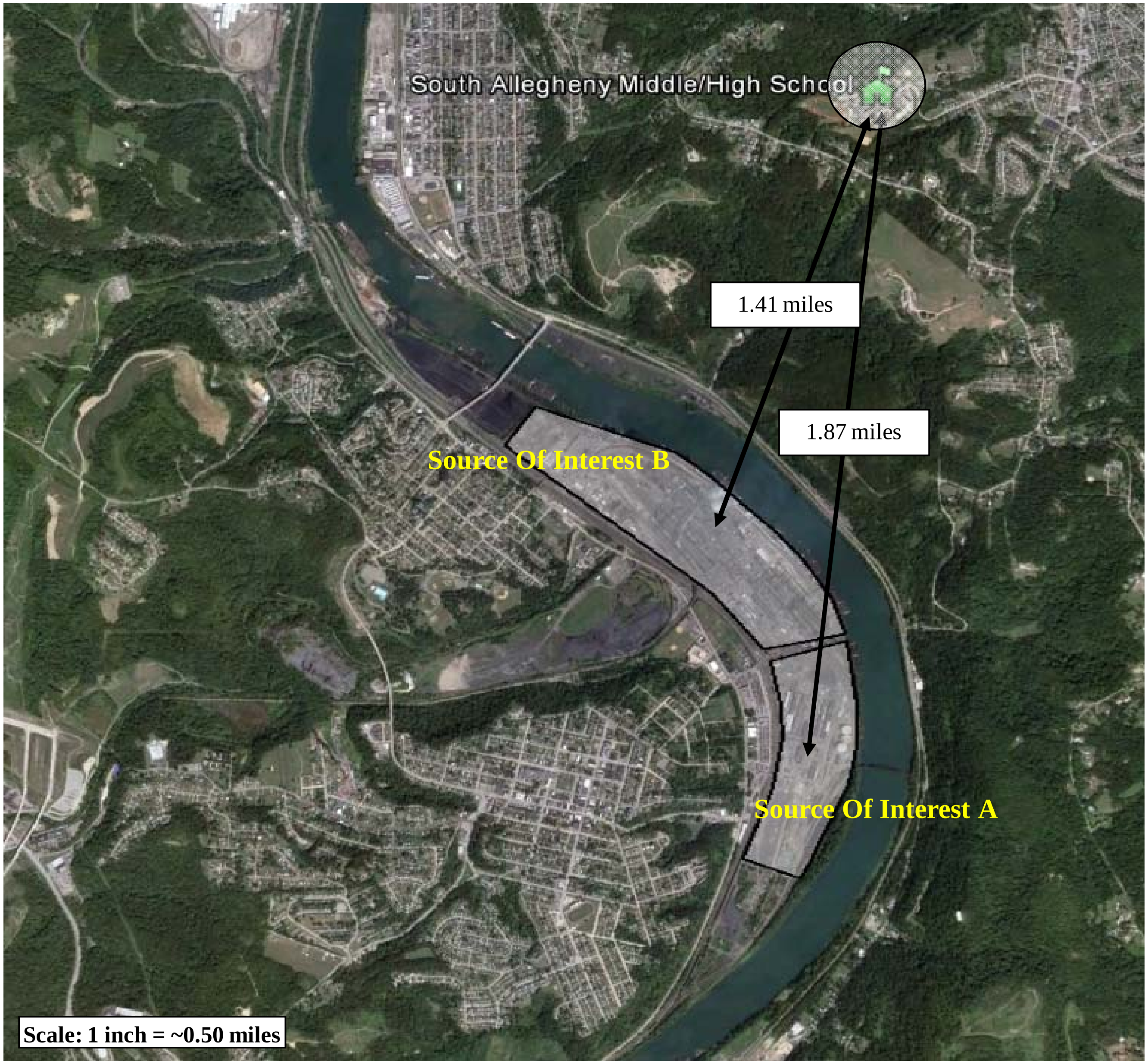


Table 1. South Allegheny Middle/High School - Key Pollutant Analysis.

Parameter	Units	Mean of Measurements	95% Confidence Interval on the Mean	Long-term Comparison Level[a]	
				Cancer-Based[b]	Noncancer-Based[c]
Benzene	$\mu g/m^3$	4.57 [d]	3.11 - 6.02	13	30
Arsenic (PM_{10})	ng/m^3	5.02 [e]	3.36 - 6.67	23	15
Benzo(a)pyrene	ng/m^3	5.34 [f]	3.09 - 7.58	57	NA

$\mu g/m^3$ micrograms per cubic meter

ng/m^3 nanograms per cubic meter

NA Not available

[a] Details regarding these values are in the technical report, Schools Air Toxics Monitoring Activity (2009) Uses of Health Effects Information.

[b] Air toxics for which the upper 95% confidence limit on the mean concentration is above this cancer-based comparison level will be fully discussed in the text and may be considered a priority for potential follow-up activities, if indicated in light of the full set of information available for the site. Findings of the upper 95% confidence limit below 1% of the comparison level (i.e., where the upper 95% confidence limit is below the corresponding 1-in-1-million cancer risk based concentration) are generally considered a low priority for follow-up activity. Situations where the summary statistics for a pollutant are below this comparison level but above 1% of this level are fully discussed in the text of the report.

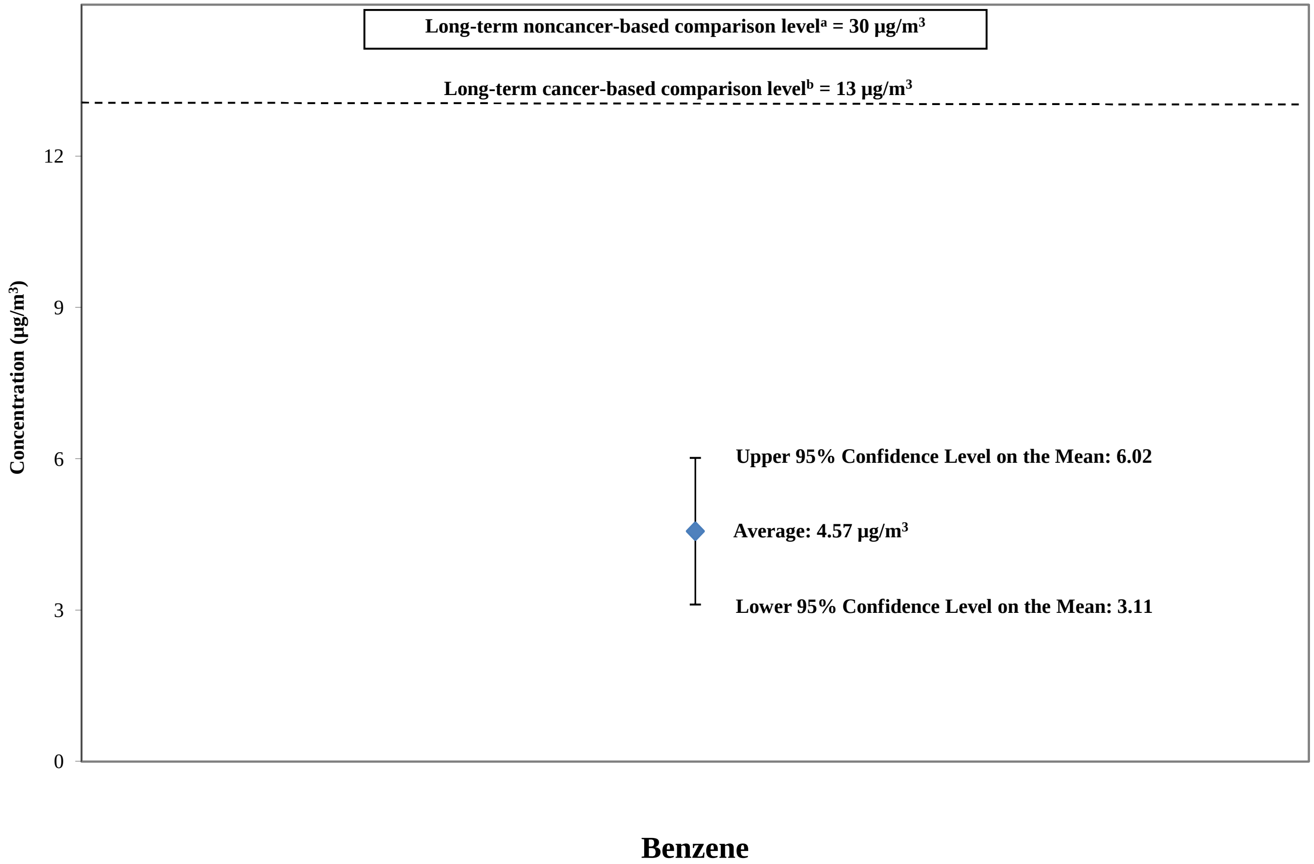
[c] Air toxics for which the upper 95% confidence limit on the mean concentration are near or below the noncancer-based comparison level are generally of low concern and will generally be considered a low priority for follow-up activity. Pollutants for which the 95% confidence limits extend appreciably above the noncancer-based comparison level are fully discussed in the school-specific report and may be considered a priority for follow-up activity, if indicated in light of the full set of information available for the site.

[d] The mean of measurements for benzene is the average of all sample results, which include 35 detections that ranged from 0.38 to 17.2 $\mu g/m^3$.

[e] The mean of measurements for arsenic (PM_{10}) is the average of all sample results, which include 34 detections that ranged from 0.32 to 19.9 ng/m^3.

[f] The mean of measurements for benzo(a)pyrene is the average of all sample results, which include 35 detections that ranged from 0.0174 to 31.9 ng/m^3, as well as two samples in which no chemical was registered by the laboratory analytical equipment. For these samples, a value of zero were used in calculating the mean.

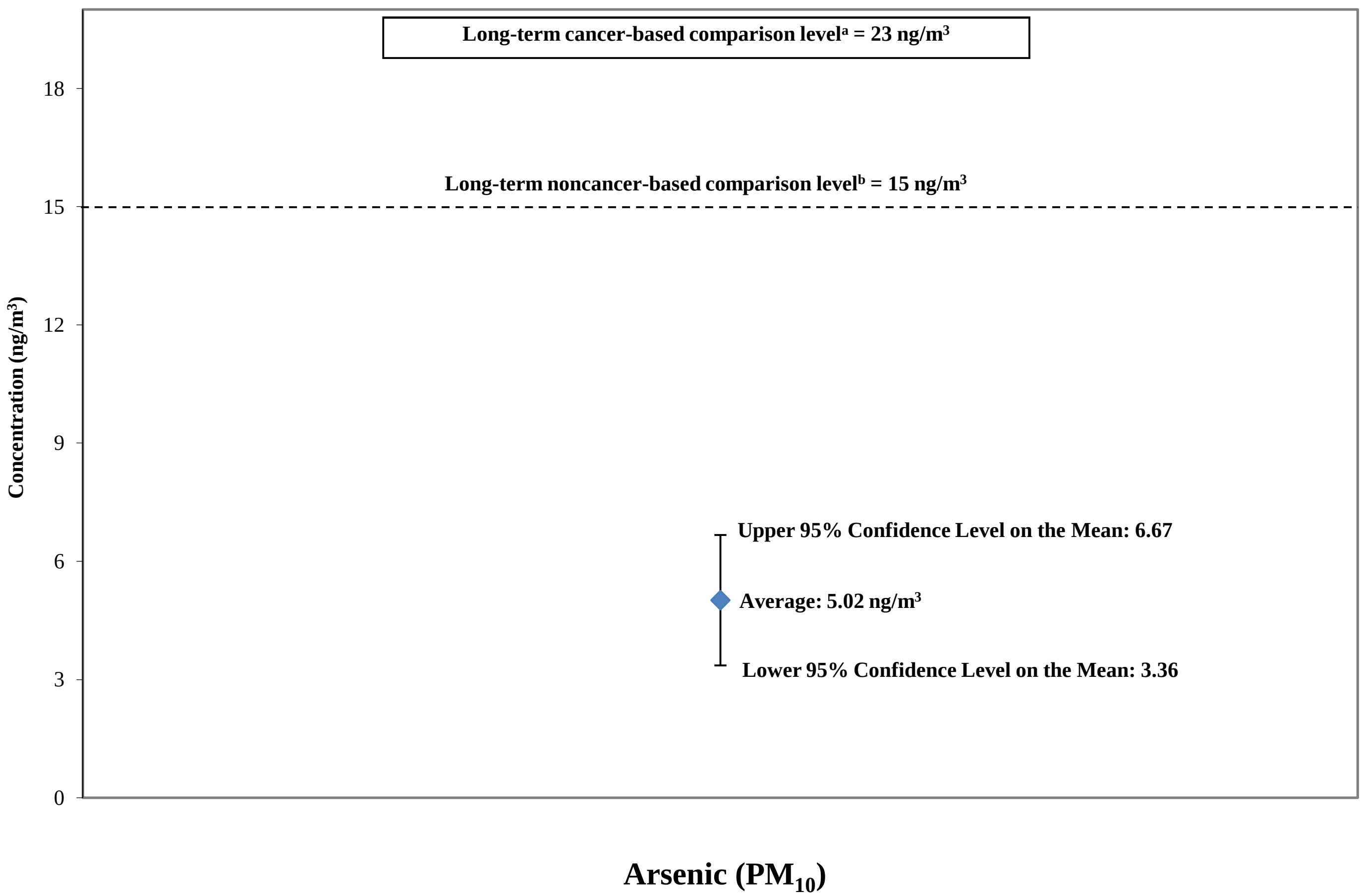
Figure 2a. South Allegheny Middle/High School - Key Pollutant (Benzene) Analysis.



[a] Air toxics for which the upper 95% confidence limit on the mean concentration are near or below the noncancer-based comparison level are generally of low concern and will generally be considered a low priority for follow-up activity. Pollutants for which the 95% confidence limits extend appreciably above the noncancer-based comparison level are fully discussed in the school-specific report and may be considered a priority for follow-up activity, if indicated in light of the full set of information available for the site.

[b] Air toxics for which the upper 95% confidence limit on the mean concentration is above this cancer-based comparison level will be fully discussed in the text and may be considered a priority for potential follow-up activities, if indicated in light of the full set of information available for the site. Findings of the upper 95% confidence limit below 1% of the comparison level (i.e., where the upper 95% confidence limit is below the corresponding 1-in-1-million cancer risk based concentration) are generally considered a low priority for follow-up activity. Situations where the summary statistics for a pollutant are below this comparison level but above 1% of this level are fully discussed in the text of the report.

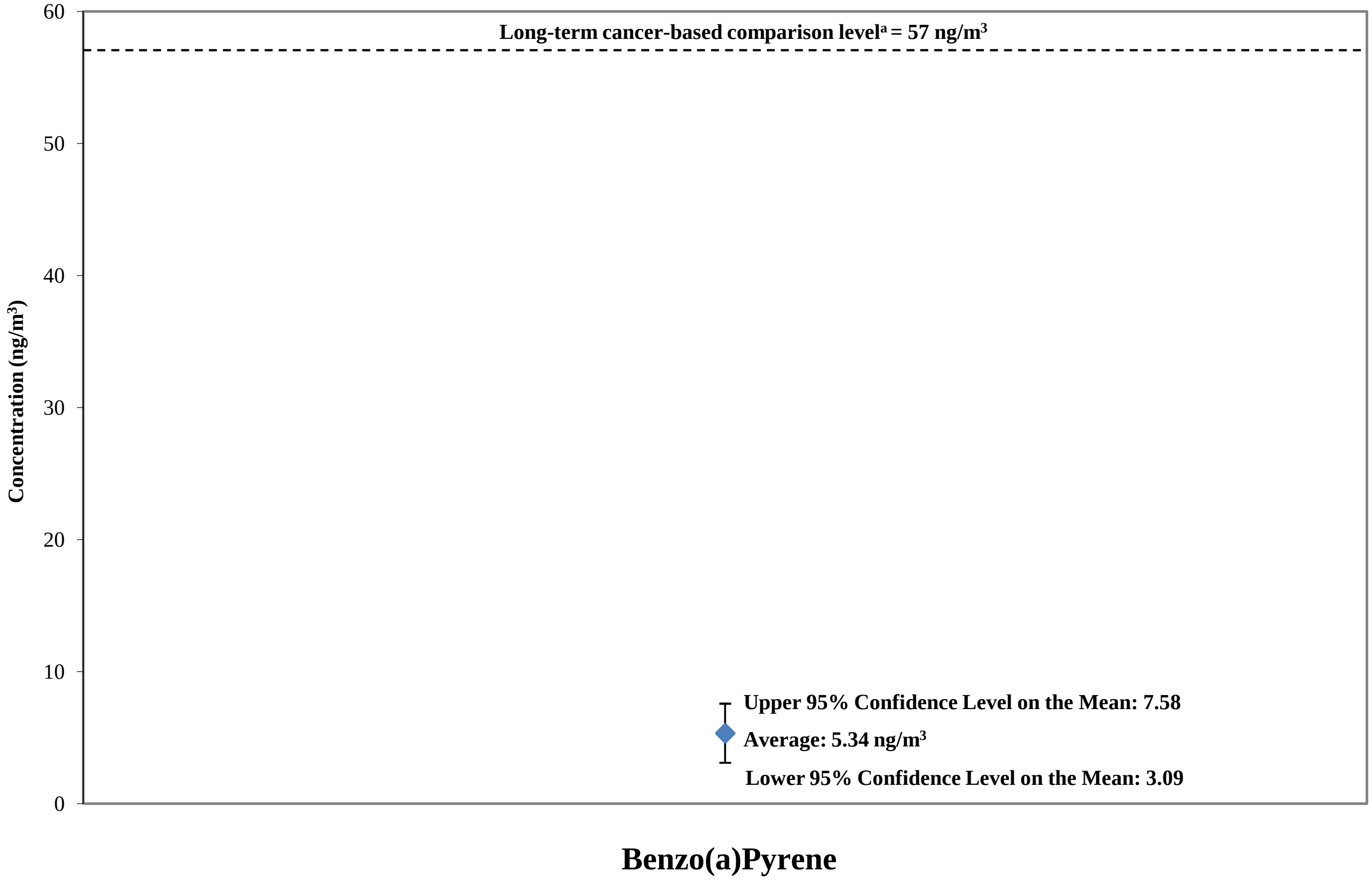
Figure 2b. South Allegheny Middle/High School - Key Pollutant (Arsenic (PM_{10})) Analysis.



[a] Air toxics for which the upper 95% confidence limit on the mean concentration is above this cancer-based comparison level will be fully discussed in the text and may be considered a priority for potential follow-up activities, if indicated in light of the full set of information available for the site. Findings of the upper 95% confidence limit below 1% of the comparison level (i.e., where the upper 95% confidence limit is below the corresponding 1-in-1-million cancer risk based concentration) are generally considered a low priority for follow-up activity. Situations where the summary statistics for a pollutant are below this comparison level but above 1% of this level are fully discussed in the text of the report.

[b] Air toxics for which the upper 95% confidence limit on the mean concentration are near or below the noncancer-based comparison level are generally of low concern and will generally be considered a low priority for follow-up activity. Pollutants for which the 95% confidence limits extend appreciably above the noncancer-based comparison level are fully discussed in the school-specific report and may be considered a priority for follow-up activity, if indicated in light of the full set of information available for the site.

Figure 2c. South Allegheny Middle/High School - Key Pollutant (Benzo(a)Pyrene) Analysis.



[a] Air toxics for which the upper 95% confidence limit on the mean concentration is above this cancer-based comparison level will be fully discussed in the text and may be considered a priority for potential follow-up activities, if indicated in light of the full set of information available for the site. Findings of the upper 95% confidence limit below 1% of the comparison level (i.e., where the upper 95% confidence limit is below the corresponding 1-in-1-million cancer risk based concentration) are generally considered a low priority for follow-up activity. Situations where the summary statistics for a pollutant are below this comparison level but above 1% of this level are fully discussed in the text of the report.

Table 2. South Allegheny Middle/High School Key Pollutant Concentrations and Meteorological Data.

Parameter	Units	8/19/2011	8/25/2011	8/31/2011	9/6/2011	9/12/2011	9/18/2011	9/24/2011	9/30/2011	10/6/2011	10/12/2011	10/18/2011	10/24/2011	10/30/2011	11/5/2011	11/11/2011	11/17/2011	11/23/2011	12/5/2011	12/11/2011
Benzene	µg/m^3	10.3	4.63	3.67	0.38	6.01	0.52	1.77	2.30	8.91	0.85	3.09	10.3	4.15	0.50	1.90	0.55	1.77	5.72	14.0
Arsenic (PM_{10})	ng/m^3	6.78	2.37	3.93	0.47	4.73	1.34	3.27	1.78	8.47	--	2.88	--	--	1.44	2.20	0.45	1.45	6.15	11.4
Benzo(a)pyrene	ng/m^3	8.65	2.41	5.67	ND	6.34	0.02	1.50	1.50	15.0	ND	1.15	9.10	3.58	0.09	3.32	0.09	1.14	6.67	10.1
% Hours w/Wind Direction from Expected ZOI[a]	%	33.3	41.7	37.5	0.0	95.8	0.0	8.3	66.7	8.3	0.0	41.7	91.7	12.5	0.0	20.8	0.0	16.7	50.0	41.7
Wind Speed (avg. of hourly speeds)	mph	4.1	6.9	2.7	7.5	4.8	3.9	2.5	9.0	2.0	4.0	4.1	5.5	2.2	4.6	8.5	8.3	9.4	3.6	2.3
Wind Direction (avg. of unitized vector)[b]	deg.	170.0	252.3	143.0	34.3	214.3	81.9	96.5	244.6	55.8	59.9	83.8	214.1	102.9	80.2	242.4	281.7	282.9	167.7	143.7
% of Hours with Speed below 2 knots	%	45.8	0.0	41.7	45.8	0.0	41.7	0.0	4.2	29.2	41.7	0.0	62.5	20.8	0.0	8.3	66.7	12.5	0.0	0.0
Daily Average Temperature	° F	69.7	73.5	72.8	57.8	67.2	57.0	62.7	52.9	61.0	58.6	57.3	51.4	35.2	42.6	36.2	35.0	45.1	54.1	28.5
Daily Precipitation	inches	0.49	0.65	0.00	0.73	0.01	0.00	0.00	0.15	0.01	0.60	0.11	0.07	0.01	0.00	0.00	0.01	0.18	0.15	0.00

Parameter	Units	12/17/2011	12/23/2011	12/29/2011	1/4/2012	1/10/2012	1/16/2012	1/22/2012	1/28/2012	2/3/2012	2/9/2012	2/15/2012	2/21/2012	2/27/2012	3/4/2012	3/10/2012	3/16/2012	3/22/2012	3/28/2012	4/3/2012
Benzene	µg/m^3	1.06	--	3.80	4.76	17.2	8.56	0.94	5.14	6.93	1.48	0.91	2.27	11.5	0.99	2.89	8.50	1.69	--	--
Arsenic (PM_{10})	ng/m^3	1.01	0.32	4.57	4.45	16.9	6.39	1.01	2.54	9.01	--	1.27	2.19	19.9	0.32	8.15	10.2	3.75	10.8	8.72
Benzo(a)pyrene	ng/m^3	0.06	--	3.98	3.18	31.9	7.11	0.12	2.86	10.4	0.06	0.16	0.89	21.2	0.04	7.27	9.72	0.24	12.2	9.71
% Hours w/Wind Direction from Expected ZOI[a]	deg.	12.5	0.0	91.7	100.0	54.2	58.3	0.0	54.2	25.0	45.8	16.7	41.7	45.8	16.7	45.8	50.0	0.0	41.7	16.7
Wind Speed (avg. of hourly speeds)	inches	5.8	5.3	5.1	7.1	6.0	6.0	4.5	9.8	2.3	6.8	4.7	6.0	8.7	7.6	4.5	5.6	2.6	10.3	2.9
Wind Direction (avg. of unitized vector)[b]	mph	259.5	318.5	189.0	210.8	230.5	171.7	84.5	223.5	134.4	240.3	217.7	183.9	238.3	253.5	245.3	224.6	33.4	247.8	18.0
% of Hours with Speed below 2 knots	deg.	0.0	25.0	62.5	0.0	0.0	16.7	0.0	12.5	20.8	4.2	0.0	58.3	0.0	8.3	8.3	12.5	0.0	8.3	8.3
Daily Average Temperature	inches	30.4	35.6	32.5	20.6	38.2	33.0	27.9	34.5	37.3	28.0	35.7	39.8	42.3	30.4	32.5	61.6	67.5	59.7	54.0
Daily Precipitation	mph	0.09	0.07	0.03	0.00	0.00	0.08	0.43	0.03	0.00	0.06	0.00	0.03	0.00	0.07	0.00	0.21	0.00	0.16	0.01

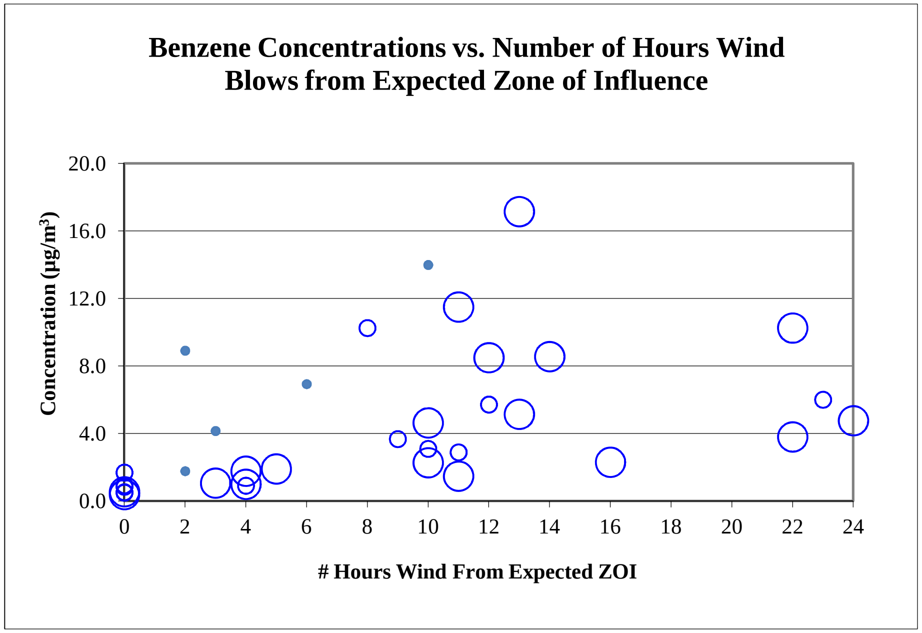
(yellow box) All precipitation and temperature data were from the Allegheny County Airport NWS Station.

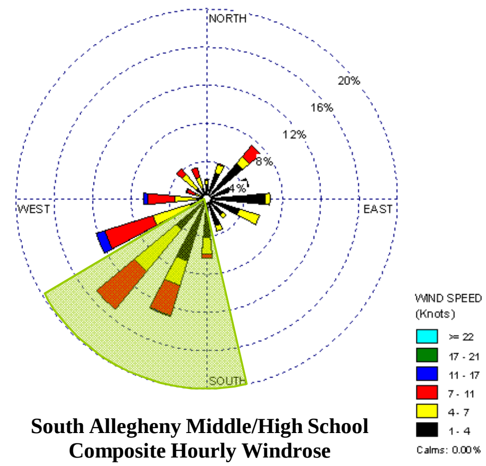
[a] Based on count of hours for which vector wind direction is from expected zone of influence.

[b] Wind direction for each day is represented by values derived by scalar averaging of hourly estimates that were produced (by wind instrumentation's logger) as unitized vectors (specified as degrees from due north).

-- No sample was conducted for this pollutant on this day or the result was invalidated.

Figure 3a. South Allegheny Middle/High School - Benzene Concentrations and Wind Information.





South Allegheny Middle/High School Composite Hourly Windrose on Sample Days (Aug. 19, 2011- Mar. 22, 2012)

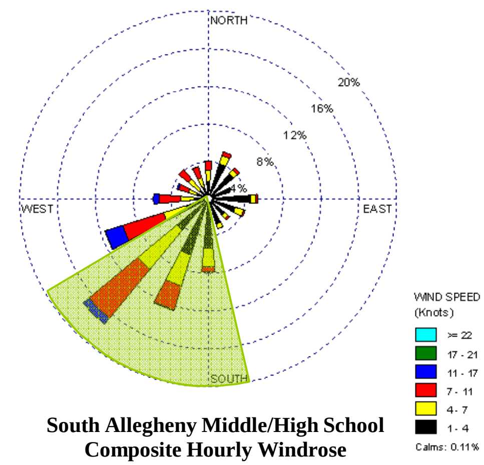
KEY

Pollutant: Benzene
Timeframe: August 19, 2011 - March 22, 2012

Wind Speed: 0.1-2.5 mph
Wind Speed: 2.5-5.0 mph
Wind Speed: > 5.0 mph

Note

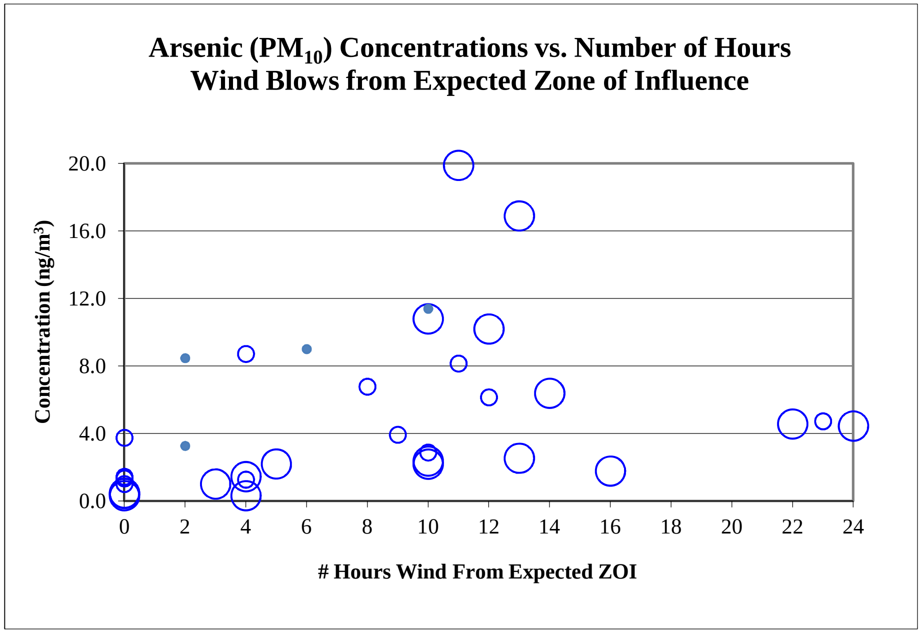
Each circle denotes a 24-hour collection of air for chemical analysis. The size of the circle indicates the magnitude of the wind speed for that day (wind data shown in Table 2). The expected zone of source influence is a rough approximation of the range of directions from which winds carrying chemicals emitted by the key source may originate.

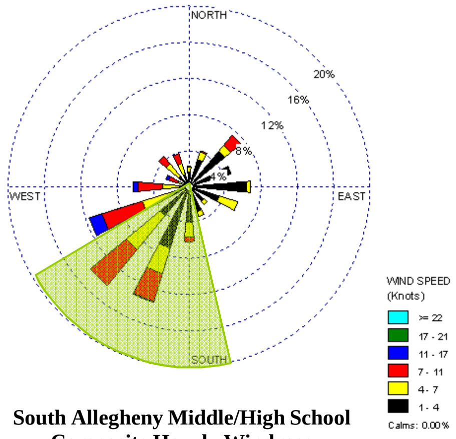


South Allegheny Middle/High School Composite Hourly Windrose Across Sampling Period (Aug. 19, 2011- Apr. 3, 2012)

Expected Zone of Source Influence

Figure 3b. South Allegheny Middle/High School - Arsenic (PM_{10}) Concentrations and Wind Information.





South Allegheny Middle/High School
Composite Hourly Windrose
on Sample Days
(Aug. 19, 2011- Apr. 3, 2012)

KEY

Pollutant: Arsenic (PM_{10})
Timeframe: August 19, 2011 - April 3, 2012

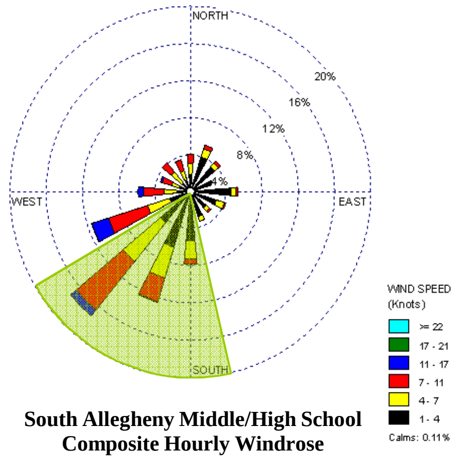
Wind Speed: 0.1-2.5 mph

Wind Speed: 2.5-5.0 mph

Wind Speed: > 5.0 mph

Note

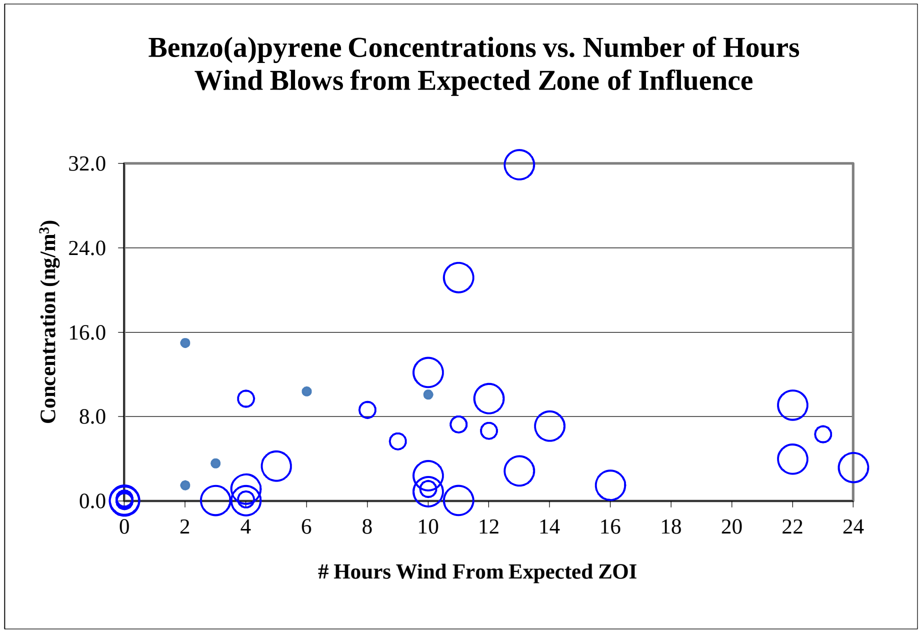
Each circle denotes a 24-hour collection of air for chemical analysis. The size of the circle indicates the magnitude of the wind speed for that day (wind data shown in Table 2). The expected zone of source influence is a rough approximation of the range of directions from which winds carrying chemicals emitted by the key source may originate.

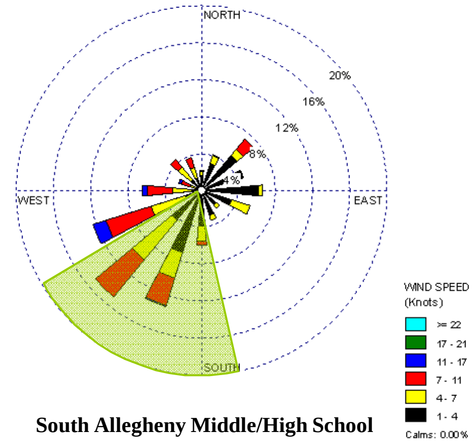


South Allegheny Middle/High School
Composite Hourly Windrose
Across Sampling Period
(Aug. 19, 2011- Apr. 3, 2012)

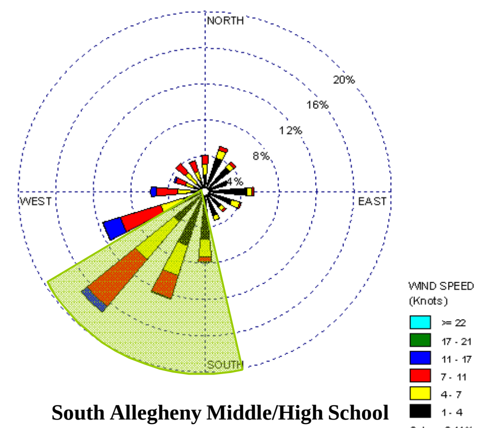
Expected Zone of Source Influence

Figure 3c. South Allegheny Middle/High School - Benzo(a)pyrene Concentrations and Wind Information.





South Allegheny Middle/High School
Composite Hourly Windrose
on Sample Days
(Aug. 19, 2011- Apr. 3, 2012)



South Allegheny Middle/High School
Composite Hourly Windrose
Across Sampling Period
(Aug. 19, 2011- Apr. 3, 2012)

Expected Zone of Source Influence

KEY

Pollutant: Benzo(a)pyrene
Timeframe: August 19, 2011 - April 3, 2012

Wind Speed: 0.1-2.5 mph
Wind Speed: 2.5-5.0 mph
Wind Speed: > 5.0 mph

Note

Each circle denotes a 24-hour collection of air for chemical analysis. The size of the circle indicates the magnitude of the wind speed for that day (wind data shown in Table 2). The expected zone of source influence is a rough approximation of the range of directions from which winds carrying chemicals emitted by the key source may originate.

Appendix A. Summary Description of Long-term Comparison Levels

In addressing the primary objective identified above, to investigate through the monitoring data collected for key pollutants at the school whether levels are of a magnitude, in light of health risk-based criteria, to indicate that follow-up activities be considered, we developed two types of long-term health risk-related comparison levels. These two types of levels are summarized below.[8]

Cancer-based Comparison Levels

- For air toxics where applicable, we developed cancer risk-based comparison levels to help us consider whether the monitoring data collected at the school indicate the potential for concentrations to pose incremental cancer risk above the range that EPA generally considers acceptable in regulatory decision-making to someone exposed to those concentrations continuously (24 hours a day, 7 days a week) over an entire lifetime.[9] This general range is from 1 to 100 in a million.
- Air toxics with long-term mean concentrations below one one-hundredth of this comparison level would be below a comparably developed level for 1-in-a-million risk (which is the lower bound of EPA's traditional acceptable risk range). Such pollutants, with long-term mean concentrations below the Agency's traditional acceptable risk range, are generally considered to pose negligible risk.
- Air toxics with long-term mean concentrations above the acceptable risk range would generally be a priority for follow-up activities. In this evaluation, we compare the upper 95% confidence limit on the mean concentration to the comparison level. Pollutants for which this upper limit falls above the comparison level are fully discussed in the school monitoring report and may be considered a priority for potential follow-up activities in light of the full set of information available for that site.
- Situations where the summary statistics for a pollutant are below the cancer-based comparison level but above 1% of that level are fully discussed in Appendix C.

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[8] These comparison levels are described in more detail *Schools Air Toxics Monitoring Activity (2009), Uses of Health Effects Information in Evaluating Sample Results.*

[9] While no one would be exposed at a school for 24 hours a day, every day for an entire lifetime, we chose this worst-case exposure period as a simplification for the basis of the comparison level in recognition of other uncertainties in the analysis. Use of continuous lifetime exposure yields a lower, more conservative, comparison level than would use of a characterization more specific to the school population (e.g., 5 days a week, 8-10 hours a day for a limited number of years).

Noncancer-based Comparison Levels

- To consider concentrations of air toxics other than lead (for which we have a national ambient air quality standard) with regard to potential for health effects other than cancer, we derived noncancer-based comparison levels using EPA chronic reference concentrations (or similar values). A chronic reference concentration (RfC) is an estimate of a long-term continuous exposure concentration (24 hours a day, every day) without appreciable risk of adverse effects over a lifetime.[10] This differs from the cancer risk-based comparison level in that it represents a concentration without appreciable risk *vs* a risk-based concentration.
- In using this comparison level in this initiative, the upper end of the 95% confidence limit on the mean is compared to the comparison level. Air toxics for which this upper confidence limit is near or below the noncancer-based comparison level (i.e., those for which longer-term average concentration estimates are below a long-term health-related reference concentration) are generally of low concern and will generally be considered a low priority for follow-up activity. Pollutants for which the 95% confidence limits extend appreciably above the noncancer-based comparison level are fully discussed below and may be considered a priority for follow-up activity if indicated in light of the full set of information available for the pollutant and the site.
- For lead, we set the noncancer-based comparison level equal to the level of the recently revised national ambient air quality standard (NAAQS). It is important to note that the NAAQS for lead is a 3-month rolling average of lead in total suspended particles. Mean levels for the monitoring data collected in this initiative that indicate the potential for a 3-month average above the level of the standard will be considered a priority for consideration of follow-up actions such as siting of a NAAQS monitor in the area.

In developing or identifying these comparison levels, we have given priority to use of relevant and appropriate air standards and EPA risk assessment guidance and precedents. These levels are based upon health effects information, exposure concentrations and risk estimates developed and assessed by EPA, the U.S. Agency for Toxic Substances and Disease Registry, and the California EPA. These agencies recognize the need to account for potential differences in sensitivity or susceptibility of different groups (e.g., asthmatics) or lifestages/ages (e.g., young children or the elderly) to a particular pollutant's effects so that the resulting comparison levels are relevant for these potentially sensitive groups as well as the broader population.

[10] EPA defines the RfC as "an estimate (with uncertainty spanning perhaps an order of magnitude) of a continuous inhalation exposure to the human population (including sensitive subgroups) that is likely to be without an appreciable risk of deleterious effects during a lifetime. It can be derived from a NOAEL, LOAEL, or benchmark concentration, with uncertainty factors generally applied to reflect limitations of the data used. Generally used in EPA's noncancer health assessments." http://www.epa.gov/ncea/iris/help_gloss.htm#r

Appendix B. National Air Toxics Trends Stations Measurements (2003-2010).[a]

Pollutant	Units	# Samples Analyzed	% Detections	Maximum	Arithmetic Meanb	Geometric Mean	5th Percentile	25th Percentile	50th Percentile	75th Percentile	95th Percentile
Acetonitrile	µg/m^3	3,419	72%	554.05	8.24	0.90	ND	ND	0.35	0.94	26.11
Acrylonitrile	µg/m^3	5,848	28%	5.51	0.04	0.07	ND	ND	ND	0.02	0.22
Benzene	µg/m^3	13,170	96%	43.14	1.08	0.82	0.10	0.46	0.77	1.28	3.00
Benzyl Chloride	µg/m^3	5,081	10%	2.49	<0.01	0.04	ND	ND	ND	ND	0.05
Bromoform	µg/m^3	4,699	4%	1.45	0.01	0.15	ND	ND	ND	ND	ND
Bromomethane	µg/m^3	8,793	58%	120.76	0.08	0.05	ND	ND	0.03	0.05	0.12
Butadiene, 1,3-	µg/m^3	12,030	71%	18.81	0.14	0.10	ND	ND	0.06	0.14	0.48
Carbon disulfide	µg/m^3	3,350	91%	46.71	1.97	0.22	ND	0.03	0.09	0.46	12.38
Carbon tetrachloride	µg/m^3	10,861	90%	9.00	0.54	0.57	ND	0.48	0.57	0.65	0.85
Chlorobenzene	µg/m^3	9,475	28%	1.68	0.02	0.03	ND	ND	ND	<0.01	0.09
Chloroethane	µg/m^3	7,450	35%	0.58	0.02	0.04	ND	ND	ND	0.03	0.08
Chloroform	µg/m^3	11,146	77%	145.50	0.20	0.15	ND	0.02	0.10	0.20	0.63
Chloromethane	µg/m^3	9,233	95%	19.70	1.18	1.21	0.49	1.04	1.20	1.36	1.67
Chloroprene	µg/m^3	3,749	8%	0.33	<0.01	0.03	ND	ND	ND	ND	0.02
Dichlorobenzene, *p*-	µg/m^3	8,924	59%	17.50	0.16	0.14	ND	ND	0.05	0.14	0.85
Dichloroethane, 1,1-	µg/m^3	9,296	16%	0.81	<0.01	0.02	ND	ND	ND	ND	0.03
Dichloroethylene, 1,1-	µg/m^3	9,047	18%	0.56	<0.01	0.03	ND	ND	ND	ND	0.04
Dichloromethane	µg/m^3	10,727	84%	5245.19	2.06	0.43	ND	0.17	0.33	0.61	2.08
Dichloropropane, 1,2-	µg/m^3	10,467	17%	2.99	0.02	0.04	ND	ND	ND	ND	0.05
Dichloropropylene, *cis* -1,3-	µg/m^3	9,754	15%	11.03	0.02	0.04	ND	ND	ND	ND	0.04
Dichloropropylene, *trans* -1,3-	µg/m^3	9,728	16%	8.78	0.02	0.04	ND	ND	ND	ND	0.04
Ethyl acrylate	µg/m^3	3,159	1%	0.20	<0.01	0.04	ND	ND	ND	ND	ND
Ethylbenzene	µg/m^3	12,641	84%	10.43	0.41	0.31	ND	0.10	0.25	0.52	1.31
Ethylene dibromide	µg/m^3	9,769	17%	4.97	0.02	0.05	ND	ND	ND	ND	0.05
Ethylene dichloride	µg/m^3	10,247	39%	4.49	0.04	0.06	ND	ND	ND	0.04	0.12
Hexachloro-1,3-butadiene	µg/m^3	6,263	19%	2.13	0.02	0.10	ND	ND	ND	ND	0.15
Methyl chloroform	µg/m^3	9,942	67%	6.44	0.08	0.09	ND	ND	0.06	0.11	0.21
Methyl isobutyl ketone	µg/m^3	4,968	60%	5.28	0.10	0.09	ND	ND	0.02	0.12	0.43
Methyl methacrylate	µg/m^3	3,243	7%	14.05	0.08	0.34	ND	ND	ND	ND	0.11

Appendix B. National Air Toxics Trends Stations Measurements (2003-2010).[a]

Pollutant	Units	# Samples Analyzed	% Detections	Maximum	Arithmetic Meanb	Geometric Mean	5th Percentile	25th Percentile	50th Percentile	75th Percentile	95th Percentile
Methyl *tert* -butyl ether	µg/m^3	7,249	37%	37.50	0.30	0.13	ND	ND	ND	0.03	1.80
Styrene	µg/m^3	12,381	64%	40.72	0.15	0.11	ND	ND	0.04	0.14	0.55
Tetrachloroethane, 1,1,2,2-	µg/m^3	9,538	19%	4.44	0.02	0.05	ND	ND	ND	ND	0.07
Tetrachloroethylene	µg/m^3	11,083	73%	518.86	0.38	0.20	ND	ND	0.14	0.27	0.90
Toluene	µg/m^3	12,418	96%	482.53	2.47	1.58	0.11	0.75	1.51	3.01	7.67
Trichlorobenzene, 1,2,4-	µg/m^3	7,018	21%	45.27	0.05	0.08	ND	ND	ND	ND	0.15
Trichloroethane, 1,1,2-	µg/m^3	8,544	17%	5.89	<0.01	0.04	ND	ND	ND	ND	0.04
Trichloroethylene	µg/m^3	11,085	47%	89.74	0.08	0.08	ND	ND	ND	0.05	0.27
Vinyl chloride	µg/m^3	10,722	20%	1.65	0.01	0.02	ND	ND	ND	ND	0.04
Xylene, *m/p-*	µg/m^3	12,128	91%	24.46	1.09	0.71	ND	0.29	0.65	1.35	3.62
Xylene, *o-*	µg/m^3	12,628	85%	9.21	0.42	0.30	ND	0.09	0.24	0.52	1.42
Antimony (PM_{10})	ng/m^3	5,381	94%	43.30	1.55	1.07	ND	0.52	0.95	2.00	4.38
Arsenic (PM_{10})	ng/m^3	8,874	87%	44.10	0.96	0.68	ND	0.28	0.56	1.03	2.94
Beryllium (PM_{10})	ng/m^3	8,459	63%	1.97	0.05	0.01	ND	ND	<0.01	0.02	0.50
Cadmium (PM_{10})	ng/m^3	8,537	84%	30.58	0.26	0.15	ND	0.05	0.11	0.25	0.93
Chromium (PM_{10})	ng/m^3	8,189	92%	172.06	2.46	1.46	ND	0.80	1.79	2.57	6.61
Cobalt (PM_{10})	ng/m^3	5,508	91%	20.30	0.32	0.18	ND	0.07	0.14	0.32	1.00
Manganese (PM_{10})	ng/m^3	8,475	99%	734.00	9.57	4.65	0.96	2.19	4.05	8.66	30.22
Mercury (PM_{10})	ng/m^3	1,941	84%	2.07	0.05	0.02	ND	<0.01	0.02	0.04	0.24
Nickel (PM_{10})	ng/m^3	8,555	91%	135.88	1.93	1.36	ND	0.67	1.26	2.39	5.39
Selenium (PM_{10})	ng/m^3	4,968	95%	44.00	1.10	0.54	0.01	0.24	0.53	0.89	5.00
Acenaphthene	ng/m^3	4,427	97%	175.00	4.19	2.29	0.24	1.02	2.22	4.85	13.97
Acenaphthylene	ng/m^3	4,403	59%	175.00	0.88	0.60	ND	ND	0.17	0.74	3.92
Anthracene	ng/m^3	4,412	61%	69.10	0.44	0.32	ND	ND	0.12	0.41	1.42
Benzo(a)anthracene	ng/m^3	4,429	67%	35.80	0.11	0.07	ND	ND	0.03	0.10	0.39
Benzo(a)pyrene	ng/m^3	4,653	60%	42.70	0.12	0.09	ND	ND	0.03	0.11	0.43
Benzo(b)fluoranthene	ng/m^3	4,420	89%	38.70	0.24	0.13	ND	0.05	0.10	0.24	0.80
Benzo(e)pyrene	ng/m^3	3,886	78%	22.20	0.13	0.10	ND	0.02	0.06	0.15	0.42

Appendix B. National Air Toxics Trends Stations Measurements (2003-2010).[a]

Pollutant	Units	# Samples Analyzed	% Detections	Maximum	Arithmetic Meanb	Geometric Mean	5th Percentile	25th Percentile	50th Percentile	75th Percentile	95th Percentile
Benzo(g,h,i)perylene	ng/m^3	4,427	84%	29.20	0.15	0.10	ND	0.03	0.07	0.15	0.51
Benzo(k)fluoranthene	ng/m^3	4,433	68%	13.50	0.07	0.06	ND	ND	0.03	0.07	0.24
Chrysene	ng/m^3	4,426	95%	28.80	0.23	0.15	ND	0.07	0.13	0.25	0.71
Dibenz(a,h)anthracene	ng/m^3	4,482	16%	3.52	0.01	0.04	ND	ND	ND	ND	0.06
Fluoranthene	ng/m^3	4,402	100%	111.00	2.17	1.33	0.26	0.72	1.33	2.47	6.55
Fluorene, 9H-	ng/m^3	4,421	99%	152.00	4.52	3.09	0.78	1.75	2.97	5.32	12.40
Indeno(1,2,3-cd)pyrene	ng/m^3	4,426	65%	30.70	0.12	0.11	ND	ND	0.05	0.13	0.44
Naphthalene	µg/m^3	4,634	100%	1.24	0.08	0.05	<0.01	0.03	0.06	0.10	0.21
Perylene	ng/m^3	3,902	32%	6.88	0.03	0.06	ND	ND	ND	0.03	0.17
Phenanthrene	ng/m^3	4,422	100%	239.00	9.67	6.02	1.23	3.17	6.02	11.60	28.10
Pyrene	ng/m^3	4,411	100%	154.00	1.34	0.80	0.14	0.45	0.83	1.50	4.03

Key Pollutant

µg/m^3 micrograms per cubic meter

ng/m^3 nanograms per cubic meter

ND No results of this chemical were registered by the laboratory analytical equipment.

[a] The summary statistics in this table represent the range of actual daily HAP measurement values taken at NATTS sites from 2003 through 2010. These data were extracted from AQS in December 2011. During the time period of interest, there were 30 sites measuring VOCs, carbonyls, metals, PAHs, and hexavalent chromium. We note that some sites did not sample for particular pollutant types during the initial year of the NATTS Program, which was 2003. Most of the monitoring stations in the NATTS network are located such that they are not expected to be impacted by single industrial sources. The concentrations typically measured at NATTS sites can thus provide a comparison point useful to considering whether concentrations measured at a school are likely to have been influenced by a significant nearby industrial source, or are more likely to be attributable to emissions from many small sources or to transported pollution from another area. For example, concentrations at a school above the 75th percentile may suggest that a nearby industrial source is affecting air quality at the school.

[b] In calculations involving non-detects (ND), a value of zero is used.

Appendix C. Analysis of Other (non-key) Air Toxics Monitored at the Schools and Multiple-pollutant Considerations.

At each school, monitoring has been targeted to get information on a limited set of key hazardous air pollutants (HAPs).[11] These pollutants are the primary focus of the monitoring activities at a school and a priority for us based on our emissions, modeling and other information. In analyzing air samples for these key pollutants, we have also obtained results for some other pollutants that are routinely included with the same test method. Our consideration of the data collected for these additional HAPs is described in the first section below. In addition to evaluating monitoring results for individual pollutants, we also considered the potential for cumulative impacts from multiple pollutants as described in the second section below (See Table C-1).

<u>Other Air Toxics (HAPs)</u>

- Do the monitoring data indicate elevated levels of any other air toxics or hazardous air pollutant (HAPs) that pose significant long-term health concerns?

  → With the exception of chromium (PM_{10}), the longer-term concentration estimates for the other HAPs monitored at each school are below their long-term comparison levels. The comparison values for chromium, however, are conservatively based on the most toxic form of chromium (hexavalent chromium, Cr^{+6}), which is only a fraction of the chromium in the ambient air. Nonetheless, the longer-term concentration estimate for chromium (PM_{10}) is above these very restrictive comparison values. The mean and 95 percent upper bound on the mean for chromium (PM_{10}) are just below and above, respectively, the cancer-based comparison level for hexavalent chromium. A review of information available at other sites nationally shows that the mean concentration of chromium (PM_{10}) at this schools is greater than the 95th percentile of samples collected from 2003 to 2010 (the most recently compiled period) at the NATTS sites (Appendix B).

    - Further, for pollutants with cancer-based comparison levels, the longer-term concentration estimates for all but two of these pollutants (chromium (PM_{10}) and naphthalene) are more than 10-fold lower and all but eleven (chromium (PM_{10}), naphthalene, 1,3-butadiene, carbon tetrachloride, cadmium (PM_{10}), dibenz(a,h)anthracene, benzo(b)fluoranthene, benzo(a)anthracene, ethylbenzene, indeno(1,2,3-cd)pyrene, and benzo(k)fluoranthene) are more than 100-fold lower than the cancer-based comparison levels.[12]

[11] Section 112(b) of the Clean Air Act identifies 189 hazardous air pollutants, three of which have subsequently been removed from this list. These pollutants are the focus of regulatory actions involving stationary sources described by CAA section 112 and are distinguished from the six pollutants for which criteria and national ambient air quality standards (NAAQS) are developed as described in section 108. One of the criteria pollutants, lead, is also represented as lead compounds on the HAP list.

[12] For pollutants with cancer-based comparison levels, this would indicate longer-term estimates below continuous (24 hours a day, 7 days a week) lifetime exposure concentrations associated with 10^{-5} and 10^{-6} excess cancer risk, respectively.

→ Additionally each individual measurement for these pollutants is below the individual sample (short-term) screening level developed for considering potential short-term exposures for that pollutant.[13]

Additional Information on Ten HAPs:

- The first HAP mentioned above is naphthalene. The mean and 95 percent upper bound on the mean for naphthalene are approximately one half the cancer-based comparison level at this school. A review of information available at other sites nationally shows that the mean concentrations of naphthalene at this school is greater than the 95th percentile of samples collected from 2003 to 2010 (the most recently compiled period) at the NATTS sites (Appendix B).

- The second HAP mentioned above is 1,3-butadiene. The mean and 95 percent upper bound on the mean for 1,3-butadiene are approximately 3-4% of the cancer-based comparison level at this school. A review of information available at other sites nationally shows that the mean concentration of 1,3-butadiene at this school is between the 50th and 75th percentile of samples collected from 2003 to 2010 (the most recently compiled period) at the NATTS sites (Appendix B).

- The third HAP mentioned above is carbon tetrachloride. The mean and 95 percent upper bound on the mean for carbon tetrachloride are approximately 4% of the cancer-based comparison level. A review of information available at other sites nationally shows that the mean concentration of carbon tetrachloride at this site is between the 75th and 95th percentile of samples collected from 2003 to 2010 (the most recently compiled period) at the NATTS sites (Appendix B). Carbon tetrachloride is found globally as a result of its significant past uses in refrigerants and propellants for aerosol cans and its chemical persistence. Virtually all uses have been discontinued. However, it is still measured throughout the world as a result of its slow rate of degradation in the environment and global distribution in the atmosphere.

- The fourth HAP mentioned above is cadmium. The mean and 95 percent upper bound on the mean for cadmium (PM_{10}) at this school are approximately 1% of the cancer-based comparison level. A review of information available at other sites nationally shows that the mean concentration of cadmium (PM_{10}) at this school is between the 75th and 95th percentile of samples collected from 2003 to 2010 (the most recently compiled period) at the NATTS sites (Appendix B).

- The fifth HAP mentioned above is dibenz(a,h)anthracene. The mean and 95 percent upper bound on the mean for dibenz(a,h)anthracene at this site are approximately 2% of the cancer-based comparison level. A review of information available at other sites nationally shows that the mean concentration of dibenz(a,h)anthracene at this site is

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[13] The individual sample screening levels and their use is summarized on the website and described in detail in *Schools Air Toxics Monitoring Activity (2009), Uses of Health Effects Information in Evaluating Sample Results.*

greater than the 95th percentile of samples collected from 2003 to 2010 (the most recently compiled period) at the NATTS sites (Appendix B).

- The sixth HAP mentioned above is benzo(b)fluoranthene. The mean and 95 percent upper bound on the mean for benzo(b)fluoranthene at this school are approximately 2% of the cancer-based comparison level. A review of information available at other sites nationally shows that the mean concentration of benzo(b)fluoranthene at this school is greater than the 95th percentile of samples collected from 2003 to 2010 (the most recently compiled period) at the NATTS sites (Appendix B).

- The seventh HAP mentioned above is benzo(a)anthracene. The mean and 95 percent upper bound on the mean for benzo(a)anthracene at this school are approximately 1-2% of the cancer-based comparison level. A review of information available at other sites nationally shows that the mean concentration of benzo(a)anthracene at this school is greater than the 95th percentile of samples collected from 2003 to 2010 (the most recently compiled period) at the NATTS sites (Appendix B).

- The eighth HAP mentioned above is ethylbenzene. The mean and 95 percent upper bound on the mean for ethylbenzene at this school are approximately 1% of the cancer-based comparison level. A review of information available at other sites nationally shows that the mean concentration of ethylbenzene at this site is between the 50th and 75th percentile of samples collected from 2003 to 2010 (the most recently compiled period) at the NATTS sites (Appendix B).

- The ninth HAP mentioned above is indeno(1,2,3-cd)pyrene. The mean and 95 percent upper bound on the mean for indeno(1,2,3-cd)pyrene at this site are approximately 1% of the cancer-based comparison level. A review of information available at other sites nationally shows that the mean concentration of indeno(1,2,3-cd)pyrene at this site is greater than the 95th percentile of samples collected from 2003 to 2010 (the most recently compiled period) at the NATTS sites (Appendix B).

- The tenth HAP mentioned above is benzo(k)fluoranthene. The mean and 95 percent upper bound on the mean for benzo(k)fluoranthene at this site are approximately 1% of the cancer-based comparison level. A review of information available at other sites nationally shows that the mean concentration of benzo(k)fluoranthene at this site is greater than the 95th percentile of samples collected from 2003 to 2010 (the most recently compiled period) at the NATTS sites (Appendix B).

Multiple Pollutants

As described in the main body of the report and background materials, this initiative and the associated analyses are focused on investigation of key pollutants for each school that were identified by previous analyses. This focused design does not provide for the consideration of combined impacts of pollutants or stressors other than those monitored in this project. Broader analyses and those involving other pollutants may be the focus of other EPA activities.[14]

In our consideration of the potential for impacts from key pollutants at the monitored schools, we have also considered the potential for other monitored pollutants to be present at levels that in combination with the key pollutant levels contribute to an increased potential for cumulative impacts. This was done in cases where estimates of longer-term concentrations for any non-key HAPs are within an order of magnitude of their comparison levels even if these pollutant levels fall below the comparison levels. This analysis is summarized below.

- Do the data collected for the air toxics monitored indicate the potential for other monitored pollutants to be present at levels that in combination with the key pollutant levels indicate an increased potential for cumulative impacts of significant concern (e.g., that might warrant further investigation)?
  - → The data collected for naphthalene, and the key pollutants, benzene, arsenic (PM_{10}), and benzo(a)pyrene and the associated longer-term concentration estimates considered together indicate the potential for levels of concerns for cumulative health risk with long-term continuous exposure to these pollutants. The longer-term concentration estimates for benzene and naphthalene are approximately one half their lowest comparison levels. The lowest comparison levels for these pollutants are based on carcinogenic risk. Arsenic and benzo(a)pyrene also have long-term comparison levels based on carcinogenic risk. When aggregated as a group, the fractions of the cancer-based comparison levels comprised by the longer-term concentration estimates are greater than 100%. This indicates the potential for levels of concern for long-term continuous exposure to the mixture of these pollutants, particularly at areas near the South Allegheny community.
    - ▪ The long-term concentration estimate for chromium (PM_{10}) is also more than ten percent of its lowest comparison level. As described in the Other Air Toxics section above, however, this comparison level is based on the most toxic form of chromium, hexavalent chromium, which is generally only a small fraction of the total chromium in the ambient air.[15]
    - ▪ The long-term concentration estimates for manganese (PM_{10}) are also more than ten percent of its lowest comparison level at South Allegheny. However, this pollutant poses a different type of risk and acts on a different target in the body (nervous system), reducing potential for contribution to cumulative health risk from this pollutant.

[14] General information on additional air pollutants is available at http://www.epa.gov/air/airpollutants.html.
[15] Hexavalent chromium is commonly a small fraction of the total chromium reported. The long-term comparison level for noncancer-based chromium is much higher than the cancer-based level and is based on risk of other effects posed to the respiratory system by hexavalent chromium in particulate form.

Table C-1. South Allegheny Middle/High School - Other Monitored Pollutant Analysis.

Parameter	Units	Mean of Measurements[a]	95% Confidence Interval on the Mean	Long-term Comparison Level[b]	
				Cancer-Based[c]	Noncancer-Based[d]
Non-Key HAPs with mean greater than 10% of the lowest comparison level					
Chromium (PM_{10})	ng/m^3	7.72	6.39 - 9.06	8.3 [e]	100 [e]
Naphthalene	$\mu g/m^3$	1.45	0.95 - 1.96	2.9	3
Manganese (PM_{10})	ng/m^3	8.75	6.55 - 11.0	NA	50
Non-Key HAPs with mean lower than 10% of the lowest comparison level					
Butadiene, 1,3-	$\mu g/m^3$	0.09	0.07 - 0.12	3.3	2
Carbon Tetrachloride	$\mu g/m^3$	0.66	0.62 - 0.70	17	100
Cadmium (PM_{10})	ng/m^3	0.30	0.24 - 0.36	56	10
Dibenz (a,h) anthracene	ng/m^3	0.86	0.51 - 1.22	52	NA
Benzo (b) fluoranthene	ng/m^3	9.40	5.79 - 13.0	570	NA
Nickel (PM_{10})	ng/m^3	1.25	0.87 - 1.63	420	90
Benzo (a) anthracene	ng/m^3	7.86	4.69 - 11.0	570	NA
Chloromethane	$\mu g/m^3$	1.10	1.06 - 1.14	NA	90
Antimony (PM_{10})	ng/m^3	1.77	1.37 - 2.17	NA	200
Xylene, *m/p-*	$\mu g/m^3$	0.82	0.63 - 1.01	NA	100
Ethylbenzene	$\mu g/m^3$	0.30	0.24 - 0.35	40	1000
Indeno(1,2,3-cd)pyrene	ng/m^3	3.76	2.35 - 5.18	570	NA
Benzo (k) fluoranthene	ng/m^3	2.97	1.79 - 4.15	570	NA
Tetrachloroethylene	$\mu g/m^3$	0.16	0.12 - 0.19	380	40
Acetonitrile	$\mu g/m^3$	0.21	0.17 - 0.25	NA	60
Dichloromethane	$\mu g/m^3$	2.03	0 - 5.39	5900	600
Xylene, *o-*	$\mu g/m^3$	0.31	0.24 - 0.37	NA	100
Cobalt (PM_{10})	ng/m^3	0.18	0.14 - 0.23	NA	100
Chrysene	ng/m^3	8.95	5.66 - 12.2	5700	NA
Beryllium (PM_{10})	ng/m^3	0.02	0.02 - 0.03	42	20
Chloroform	$\mu g/m^3$	0.09	0.07 - 0.11	NA	98
Toluene	$\mu g/m^3$	2.20	1.59 - 2.81	NA	5000
Styrene	$\mu g/m^3$	0.31	0.24 - 0.39	NA	1000
Selenium (PM_{10})	ng/m^3	5.70	2.82 - 8.57	NA	20000
Carbon Disulfide	$\mu g/m^3$	0.15	0.12 - 0.17	NA	700
Mercury (PM_{10})	ng/m^3	0.04	0.03 - 0.05	NA	300 [f]
Methyl isobutyl ketone	$\mu g/m^3$	0.10	0.05 - 0.15	NA	3000
Methyl Chloroform	$\mu g/m^3$	0.06	0.05 - 0.07	NA	5000
Ethylene dichloride	$\mu g/m^3$	0.06	0.04 - 0.07	3.8 [g]	2400
Bromomethane	$\mu g/m^3$	0.04	0.02 - 0.05	NA [h]	5
Dichlorobenzene, *p-*	$\mu g/m^3$	0.03	0.02 - 0.04	9.1 [i]	800
Non-Key HAPs with more than 50% ND Results.					
Ethylene dibromide	$\mu g/m^3$	89% of the results were ND[j]		0.17	9
Trichloroethylene	$\mu g/m^3$	74% of the results were ND[k]		21	2
Tetrachloroethane, 1,1,2,2-	$\mu g/m^3$	86% of the results were ND[l]		1.7	NA
Hexachloro-1,3-butadiene	$\mu g/m^3$	77% of the results were ND[m]		4.5	90
Acrylonitrile	$\mu g/m^3$	94% of the results were ND[n]		1.5	2
Trichloroethane, 1,1,2-	$\mu g/m^3$	97% of the results were ND[o]		6.3	400
Bromoform	$\mu g/m^3$	86% of the results were ND[p]		91	NA
Vinyl chloride	$\mu g/m^3$	91% of the results were ND[q]		11	100

Table C-1. South Allegheny Middle/High School - Other Monitored Pollutant Analysis.

Parameter	Units	Mean of Measurements[a]	95% Confidence Interval on the Mean	Long-term Comparison Level[b] Cancer-Based[c]	Long-term Comparison Level[b] Noncancer-Based[d]
Trichlorobenzene, 1,2,4-	$\mu g/m^3$	80% of the results were ND[r]		NA	200
Dichloroethylene, 1,1-	$\mu g/m^3$	91% of the results were ND[s]		NA	200
Chlorobenzene	$\mu g/m^3$	94% of the results were ND[t]		NA	1000
Methyl Methacrylate	$\mu g/m^3$	97% of the results were ND[u]		NA	700
Chloroethane	$\mu g/m^3$	97% of the results were ND[v]		NA	10000
No other HAPs were detected in any other samples.					

ng/m^3 nanograms per cubic meter
$\mu g/m^3$ micrograms per cubic meter
NA Not applicable
ND No detection of this chemical was registered by the laboratory analytical equipment.

[a] Mean of measurements is the average of all sample results which include actual measured values. If no chemical was registered, then a value of zero is used when calculating the mean.

[b] Details regarding these values are in the technical report, Schools Air Toxics Monitoring Activity (2009) Uses of Health Effects Information.

[c] Air toxics for which the upper 95% confidence limit on the mean concentration is above this cancer-based comparison level will be fully discussed in the text and may be considered a priority for potential follow-up activities, if indicated in light of the full set of information available for the site. Findings of the upper 95% confidence limit below 1% of the comparison level (i.e., where the upper 95% confidence limit is below the corresponding 1-in-1-million cancer risk based concentration) are generally considered a low priority for follow-up activity. Situations where the summary statistics for a pollutant are below this comparison level but above 1% of this level are fully discussed in the text of the report.

[d] Air toxics for which the upper 95% confidence limit on the mean concentration are near or below the noncancer-based comparison level are generally of low concern and will generally be considered a low priority for follow-up activity. Pollutants for which the 95% confidence limits extend appreciably above the noncancer-based comparison level are fully discussed in the school-specific report and may be considered a priority for follow-up activity, if indicated in light of the full set of information available for the site.

[e] The comparison levels are specific to hexavalent chromium (recognized as the most toxic form) which is a fraction of the total chromium reported.

[f] This comparison value is based on the EPA IRIS cancer assessment. It is noted that the EPA is currently updating this assessment with regard to the mode of action. If the update were to conclude that this chemical is carcinogenic by a mutagenic mode of action, this comparison level would be revised to a slightly lower value of 5.2 ng/m^3, consistent with EPA's Supplemental Guidance for Assessing Susceptibility from Early-Life exposure.

[g] Dibenz(a,h)anthracene was detected in 9 out of 13 samples, ranging from 0.0312 to 0.978 ng/m^3. The MDL range is from 0.036 to 0.0485 ng/m^3.

[h] Mercury (PM_{10}) was detected in 5 out of 10 samples, ranging from 0.006 to 0.09 ng/m^3. The MDL range is from 1.12 to 1.35 ng/m^3.

[i] The comparison level is specific to elemental mercury, which is more readily and completely absorbed into the body than mercury conveyed on particles (e.g., divalent species).

[j] Beryllium (PM_{10}) was detected in 6 out of 10 samples, ranging from 0.004 to 0.04 ng/m^3. The MDL range is from 0.03 to 0.04 ng/m^3.

[k] Chloroethane was detected in 6 out of 10 samples, ranging from 0.02 to 0.040 $\mu g/m^3$. The MDL range is from 0.005 to 0.0053 $\mu g/m^3$.

[l] Acrylonitrile was detected in only 1 out of 10 samples, with a value equal to 0.14 $\mu g/m^3$. The MDL range is from 0.033 to 0.0326 $\mu g/m^3$.

[m] Vinyl chloride was detected in only 2 out of 10 samples, both with a value equal to 0.02 $\mu g/m^3$. The MDL is 0.005 $\mu g/m^3$.

[n] Ethylene dichloride was detected in only 1 out of 10 samples with a value equal to 0.13 $\mu g/m^3$. The MDL is 0.008 $\mu g/m^3$.

[o] Hexachloro-1,3-butadiene was detected in only 1 out of 10 samples, with a value equal to 0.04 $\mu g/m^3$. The MDL is 0.128 $\mu g/m^3$.

[p] Trichloroethylene was detected in only 4 out of 10 samples, ranging from 0.054 to 0.086 $\mu g/m^3$. The MDL is 0.011 $\mu g/m^3$.

[q] Methyl *tert* -Butyl Ether was detected in only 2 out of 10 samples, ranging from 0.02 to 0.03 $\mu g/m^3$. The MDL is 0.05 $\mu g/m^3$.

[r] Dichlorobenzene, *p-* was detected in 7 out of 12 samples, ranging from 0.04 to 0.11 $\mu g/m^3$. The MDL range is from 0.024 to 0.096 $\mu g/m^3$.

[s] Beryllium (PM_{10}) was detected in 10 out of 16 samples, ranging from 0.0008 to 0.09 ng/m^3. The MDL range is from 0.03 to 0.04 ng/m^3.

[t] Acrylonitrile was detected in only 1 out of 12 samples, with a value equal to 0.14 $\mu g/m^3$. The MDL range is from 0.033 to 0.13 $\mu g/m^3$.

[u] Vinyl chloride was detected in only 2 out of 12 samples, ranging from 0.01 to 0.02 $\mu g/m^3$. The MDL range is from 0.005 to 0.020 $\mu g/m^3$.

[v] Trichloroethylene was detected in only 1 out of 12 samples, with a value equal to 0.070 $\mu g/m^3$. The MDL range is from 0.011 to 0.043 $\mu g/m^3$.

Appendix D. South Allegheny Middle/High School - Pollutant Concentrations (8/9/2011-12/11/2011).

Parameter	Units	8/19/2011	8/25/2011	8/31/2011	9/6/2011	9/12/2011	9/18/2011	9/24/2011	9/30/2011	10/6/2011	10/12/2011	10/18/2011	10/24/2011	10/30/2011	11/5/2011	11/11/2011	11/17/2011	11/23/2011	12/5/2011	12/11/2011	Sample Screening Level[a]
Benzene	$\mu g/m^3$	10.3	4.63	3.67	0.38	6.01	0.52	1.77	2.30	8.91	0.85	3.09	10.3	4.15	0.50	1.90	0.55	1.77	5.72	14.0	30
Arsenic (PM_{10})	ng/m^3	6.78	2.37	3.93	0.47	4.73	1.34	3.27	1.78	8.47	--	2.88	--	--	1.44	2.20	0.45	1.45	6.15	11.4	150
Benzo(a)pyrene	ng/m^3	8.65	2.41	5.67	ND	6.34	0.02	1.50	1.50	15.0	ND	1.15	9.10	3.58	0.09	3.32	0.09	1.14	6.67	10.1	6400
Chromium (PM_{10})	ng/m^3	8.95	12.8	10.6	15.6	10.7	7.54	9.21	10.5	9.49	--	5.77	--	--	5.56	5.99	3.23	4.49	5.86	4.85	580[b]
Naphthalene	$\mu g/m^3$	2.32	0.87	1.23	0.03	1.58	0.12	0.51	0.57	1.88	0.04	0.75	2.99	1.28	0.08	1.76	0.10	0.28	1.06	3.72	30
Manganese (PM_{10})	ng/m^3	8.59	6.96	14.8	4.52	9.43	2.94	3.95	6.08	18.2	--	20.4	--	--	6.89	5.81	8.78	3.63	10.3	8.89	500
Butadiene, 1,3-	$\mu g/m^3$	0.15	0.06	0.10	ND	ND	0.05	0.06	0.04	0.19	0.05	0.06	0.15	0.16	0.04	0.06	0.03	0.06	0.12	0.31	20
Carbon Tetrachloride	$\mu g/m^3$	0.67	0.67	0.57	0.65	0.66	0.68	0.60	0.59	0.69	0.70	0.66	0.73	0.60	0.67	0.78	0.59	0.86	0.77	0.83	200
Cadmium (PM_{10})	ng/m^3	0.36	0.18	0.30	0.15	0.33	0.13	0.29	0.13	0.37	--	0.23	--	--	0.10	0.16	0.25	0.20	0.30	0.47	30
Dibenz (a,h) anthracene	ng/m^3	1.59	0.43	0.90	ND	1.09	ND	0.20	0.22	2.79	ND	0.22	1.49	0.58	0.02	0.54	0.02	0.24	1.03	1.60	5800
Benzo (b) fluoranthene	ng/m^3	15.4	5.73	9.13	0.09	12.5	0.10	2.96	3.36	24.8	0.08	2.59	17.4	7.05	0.22	5.62	0.21	2.79	12.1	17.2	64000
Nickel (PM_{10})	ng/m^3	0.91	0.74	1.28	5.92	1.90	0.67	0.61	0.71	1.89	--	3.88	--	--	0.50	0.57	0.89	1.00	0.92	0.65	200
Benzo (a) anthracene	ng/m^3	11.6	5.43	5.10	0.06	11.3	0.06	3.00	4.11	20.4	0.06	1.57	18.8	5.75	0.12	4.35	0.08	2.08	8.76	14.8	64000
Chloromethane	$\mu g/m^3$	1.26	1.29	1.02	1.04	1.17	1.05	1.08	1.03	1.00	1.05	1.02	1.07	1.00	1.11	0.97	0.95	1.11	1.12	1.17	1000
Antimony (PM_{10})	ng/m^3	2.33	0.82	2.53	1.02	2.45	1.03	1.48	0.56	4.90	--	1.76	--	--	1.12	2.87	0.56	0.61	1.99	3.25	2000
Xylene, *m/p-*	$\mu g/m^3$	1.94	0.83	1.23	0.41	0.98	0.43	0.57	0.38	2.28	0.68	0.79	2.01	0.93	0.47	0.86	0.28	0.50	1.80	1.71	9000
Ethylbenzene	$\mu g/m^3$	0.60	0.34	0.44	0.20	0.38	0.24	0.28	0.20	0.72	0.31	0.33	0.72	0.43	0.23	0.26	0.15	0.24	0.66	0.46	40000
Indeno(1,2,3-cd)pyrene	ng/m^3	7.07	2.06	5.23	0.03	4.95	0.03	1.12	1.12	9.55	0.02	1.02	6.67	2.76	0.09	2.20	0.09	1.14	5.43	7.79	64000
Benzo (k) fluoranthene	ng/m^3	4.97	1.76	2.82	ND	3.29	0.02	0.95	1.00	8.60	0.02	0.78	6.06	2.22	0.07	1.82	0.06	0.79	3.74	5.14	64000
Tetrachloroethylene	$\mu g/m^3$	0.17	0.16	0.26	ND	ND	0.15	0.17	0.09	0.40	0.18	0.20	0.41	0.16	0.07	0.21	0.18	0.14	0.29	0.11	1400
Acetonitrile	$\mu g/m^3$	0.56	0.39	0.24	0.16	0.34	0.18	0.16	0.14	0.31	0.19	0.23	0.27	0.20	0.14	0.13	0.09	0.15	0.27	0.32	600
Dichloromethane	$\mu g/m^3$	58.4	0.42	0.61	0.24	0.46	0.28	0.54	0.25	0.69	0.42	0.25	0.23	0.27	0.24	0.20	0.32	0.28	0.39	0.33	2000
Xylene, *o-*	$\mu g/m^3$	0.76	0.36	0.46	0.19	0.36	0.20	0.24	0.16	0.92	0.31	0.30	0.60	0.38	0.23	0.27	0.11	0.22	0.63	0.60	9000
Cobalt (PM_{10})	ng/m^3	0.30	0.11	0.21	0.07	0.27	0.03	0.06	0.07	0.23	--	0.28	--	--	0.06	0.11	0.10	0.04	0.15	0.21	100
Chrysene	ng/m^3	14.3	7.04	6.48	0.22	13.0	0.24	3.78	4.80	23.3	0.28	2.74	21.1	6.78	0.29	5.01	0.22	2.59	10.8	17.5	640000
Beryllium (PM_{10})	ng/m^3	0.03	0.01	0.03	0.01	0.03	0.01	0.01	0.01	0.03	--	0.03	--	--	0.00	0.02	0.00	0.01	0.03	0.04	20

Appendix D. South Allegheny Middle/High School - Pollutant Concentrations (8/9/2011-12/11/2011).

Parameter	Units	8/19/2011	8/25/2011	8/31/2011	9/6/2011	9/12/2011	9/18/2011	9/24/2011	9/30/2011	10/6/2011	10/12/2011	10/18/2011	10/24/2011	10/30/2011	11/5/2011	11/11/2011	11/17/2011	11/23/2011	12/5/2011	12/11/2011	Sample Screening Level[a]
Chloroform	$\mu g/m^3$	ND	0.12	0.20	ND	ND	0.20	0.13	0.11	ND	0.12	0.13	0.11	0.13	ND	0.10	0.09	0.12	ND	0.11	500
Toluene	$\mu g/m^3$	7.31	2.00	2.20	0.62	2.90	0.77	1.39	0.76	3.92	1.36	2.10	5.24	2.26	0.46	1.29	0.60	0.96	3.73	5.31	4000
Styrene	$\mu g/m^3$	0.71	0.43	0.24	ND	0.43	0.18	0.17	0.21	0.53	0.18	0.27	0.68	0.38	0.12	0.48	0.13	0.26	0.49	0.74	9000
Selenium (PM_{10})	ng/m^3	10.6	3.24	3.20	0.70	12.4	0.24	1.88	3.36	5.17	--	5.11	--	--	0.13	1.57	0.44	1.07	4.26	45.7	20000
Carbon Disulfide	$\mu g/m^3$	0.29	0.28	0.25	0.14	0.30	0.12	0.12	0.12	0.20	0.07	0.12	0.25	0.11	0.04	0.11	0.05	0.07	0.15	0.25	7000
Mercury (PM_{10})	ng/m^3	0.11	0.03	0.05	0.02	0.09	0.004	0.02	0.02	0.04	--	0.06	--	--	0.02	0.02	0.01	0.04	0.10	0.07	3000[c]
Methyl isobutyl ketone	$\mu g/m^3$	0.25	0.22	0.23	ND	ND	0.11	0.10	0.07	0.84	0.15	0.11	0.09	0.07	0.06	0.05	0.05	0.05	0.09	0.05	30000
Methyl Chloroform	$\mu g/m^3$	0.07	0.07	0.10	ND	ND	0.11	0.07	0.07	0.05	0.07	0.09	0.05	0.05	0.07	0.04	0.05	0.07	0.07	0.06	10000
Ethylene dichloride	$\mu g/m^3$	ND	ND	0.09	ND	ND	ND	0.08	0.07	ND	ND	ND	0.08	ND	0.08	0.07	0.07	0.08	ND	ND	270
Bromomethane	$\mu g/m^3$	0.05	0.05	0.07	ND	ND	0.07	0.05	0.05	ND	ND	0.06	0.04	0.04	ND	ND	0.05	0.05	0.04	ND	200
Dichlorobenzene, *p*-	$\mu g/m^3$	0.08	ND	0.10	ND	ND	0.10	0.06	0.05	0.05	0.04	0.06	0.04	0.04	ND	ND	0.04	0.04	0.04	ND	10000
Ethylene dibromide	$\mu g/m^3$	ND	ND	ND	ND	ND	0.10	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	12
Trichloroethylene	$\mu g/m^3$	ND	ND	0.08	ND	ND	0.09	ND	ND	0.06	ND	0.05	ND	ND	ND	ND	ND	ND	ND	ND	10000
Tetrachloroethane, 1,1,2,2-	$\mu g/m^3$	ND	ND	0.06	ND	ND	0.08	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	120
Hexachloro-1,3-butadiene	$\mu g/m^3$	ND	ND	0.10	ND	ND	0.14	ND	ND	ND	ND	0.07	ND	ND	ND	ND	ND	ND	ND	ND	320
Acrylonitrile	$\mu g/m^3$	ND	ND	0.04	ND	ND	0.03	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	200
Trichloroethane, 1,1,2-	$\mu g/m^3$	ND	ND	ND	ND	ND	0.09	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	440
Bromoform	$\mu g/m^3$	ND	ND	ND	ND	ND	0.14	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	6400
Vinyl chloride	$\mu g/m^3$	ND	ND	0.02	ND	ND	0.03	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1000
Trichlorobenzene, 1,2,4-	$\mu g/m^3$	ND	ND	0.06	ND	ND	0.07	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	2000
Dichloroethylene, 1,1-	$\mu g/m^3$	ND	ND	0.04	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	80
Chlorobenzene	$\mu g/m^3$	ND	ND	0.09	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	10000
Methyl Methacrylate	$\mu g/m^3$	ND	ND	ND	ND	ND	0.06	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	7000
Chloroethane	$\mu g/m^3$	ND	0.13	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	40000
Benzyl Chloride	$\mu g/m^3$	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	140
Chloroprene	$\mu g/m^3$	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	200
Dichloroethane, 1,1-	$\mu g/m^3$	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	4400

Appendix D. South Allegheny Middle/High School - Pollutant Concentrations (8/9/2011-12/11/2011).

Parameter	Units	8/19/2011	8/25/2011	8/31/2011	9/6/2011	9/12/2011	9/18/2011	9/24/2011	9/30/2011	10/6/2011	10/12/2011	10/18/2011	10/24/2011	10/30/2011	11/5/2011	11/11/2011	11/17/2011	11/23/2011	12/5/2011	12/11/2011	Sample Screening Level[a]
Dichloropropane, 1,2-	µg/m^3	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	200
Dichloropropylene, *cis* -1,3-	µg/m^3	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	40
Dichloropropylene, *trans* -1,3-	µg/m^3	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	40
Ethyl Acrylate	µg/m^3	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	7000
Methyl *tert* -Butyl Ether	µg/m^3	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	7000

Key Pollutant

ng/m^3 nanograms per cubic meter

µg/m^3 micrograms per cubic meter

ND No detection of this chemical was registered by the laboratory analytical equipment.

-- No sample was conducted for this pollutant on this day or the result was invalidated

[a] The individual sample screening levels and their use is summarized on the web site and described in detail in Schools Air Toxics Monitoring Activity (2009), "Uses of Health Effects Information in Evaluating Sample Results", see http://www.epa.gov/schoolair/pdfs/UsesOfHealthEffectsInfoinEvalSampleResults.pdf. These screening levels are based on consideration of exposure all day, every day over a period ranging up to a couple of weeks,and longer for some pollutants.

[b] The sample screening levels are specific to hexavalent chromium (recognized as the most toxic form) which is a fraction of the total chromium reported.

[c] The sample screening level is specific to elemental mercury, which is more readily and completely absorbed into the body than mercury conveyed on particles (e.g., divalent species).

Appendix D (continued). South Allegheny Middle/High School - Pollutant Concentrations (12/17/2011-4/3/2012).

Parameter	Units	12/17/2011	12/23/2011	12/29/2011	1/4/2012	1/10/2012	1/16/2012	1/22/2012	1/28/2012	2/3/2012	2/9/2012	2/15/2012	2/21/2012	2/27/2012	3/4/2012	3/10/2012	3/16/2012	3/22/2012	3/28/2012	4/3/2012	Sample Screening Level[a]
Benzene	$\mu g/m^3$	1.06	--	3.80	4.76	17.2	8.56	0.94	5.14	6.93	1.48	0.91	2.27	11.5	0.99	2.89	8.50	1.69	--	--	30
Arsenic (PM_{10})	ng/m^3	1.01	0.32	4.57	4.45	16.9	6.39	1.01	2.54	9.01	--	1.27	2.19	19.9	0.32	8.15	10.2	3.75	10.8	8.72	150
Benzo(a)pyrene	ng/m^3	0.06	--	3.98	3.18	31.9	7.11	0.12	2.86	10.4	0.06	0.16	0.89	21.2	0.04	7.27	9.72	0.24	12.2	9.71	6400
Chromium (PM_{10})	ng/m^3	4.45	4.40	3.79	3.81	4.74	4.80	3.68	3.63	6.81	--	3.08	4.19	6.63	13.1	11.6	11.3	12.9	13.0	15.5	580[b]
Naphthalene	$\mu g/m^3$	0.07	--	1.40	2.51	4.70	2.12	0.06	1.09	1.32	0.07	0.14	1.35	4.65	0.06	0.87	2.93	0.88	6.48	1.83	30
Manganese (PM_{10})	ng/m^3	2.96	3.78	6.20	5.97	15.4	5.62	1.52	3.15	11.2	--	4.51	10.1	15.0	1.83	5.75	8.21	13.7	9.91	32.6	500
Butadiene, 1,3-	$\mu g/m^3$	0.04	--	0.10	0.08	0.27	0.16	0.09	0.08	0.15	0.04	0.05	0.07	0.22	0.02	0.07	0.12	0.06	--	--	20
Carbon Tetrachloride	$\mu g/m^3$	0.64	--	0.56	0.67	0.67	0.68	0.69	0.74	0.10	0.63	0.72	0.62	0.58	0.64	0.63	0.75	0.76	--	--	200
Cadmium (PM_{10})	ng/m^3	0.11	0.37	0.25	0.24	0.63	0.33	0.15	0.17	0.58	--	0.16	0.23	0.87	0.06	0.39	0.35	0.25	0.48	0.48	30
Dibenz (a,h) anthracene	ng/m^3	0.02	--	0.67	0.54	4.82	1.33	0.03	0.56	1.57	ND	ND	0.13	3.48	ND	0.87	1.46	0.05	2.06	1.38	5800
Benzo (b) fluoranthene	ng/m^3	0.19	--	7.27	6.62	45.9	13.0	0.42	6.15	16.0	0.16	0.43	2.02	38.7	0.13	11.5	17.0	0.64	23.4	18.8	64000
Nickel (PM_{10})	ng/m^3	0.77	0.79	0.89	1.62	1.18	0.85	0.54	0.54	1.39	--	0.45	1.10	1.55	0.54	0.61	0.78	2.08	1.12	2.59	200
Benzo (a) anthracene	ng/m^3	0.08	--	6.34	5.19	43.5	12.0	0.15	4.41	12.9	0.08	0.22	1.73	30.7	0.06	9.34	13.9	0.36	20.0	12.4	64000
Chloromethane	$\mu g/m^3$	1.08	--	0.93	0.97	0.96	1.10	1.09	1.11	1.18	1.26	1.18	1.05	1.06	1.11	1.21	1.45	1.36	--	--	1000
Antimony (PM_{10})	ng/m^3	0.78	0.59	1.17	0.96	2.96	1.06	0.67	0.57	1.60	--	2.32	2.07	4.74	0.37	1.50	1.54	2.51	2.77	2.81	2000
Xylene, *m/p-*	$\mu g/m^3$	0.33	--	0.51	0.42	1.39	0.89	0.30	0.77	0.99	0.20	0.26	0.41	1.00	0.24	0.31	0.97	0.57	--	--	9000
Ethylbenzene	$\mu g/m^3$	0.15	--	0.15	0.14	0.33	0.27	0.14	0.30	0.33	0.08	0.11	0.16	0.27	0.13	0.13	0.29	0.22	--	--	40000
Indeno(1,2,3-cd)pyrene	ng/m^3	0.09	--	3.05	2.59	18.1	5.13	0.15	2.41	7.97	0.06	0.14	0.58	14.8	0.06	4.68	6.36	0.24	8.27	6.25	64000
Benzo (k) fluoranthene	ng/m^3	0.06	--	2.32	2.03	14.4	4.25	0.11	1.78	5.36	0.05	0.12	0.67	13.5	0.03	3.18	5.04	0.17	7.50	5.32	64000
Tetrachloroethylene	$\mu g/m^3$	0.08	--	0.12	0.07	0.20	0.11	0.11	0.12	0.15	0.14	0.22	0.12	0.08	0.07	0.09	0.14	0.34	--	--	1400
Acetonitrile	$\mu g/m^3$	0.13	--	0.15	0.11	0.30	0.25	0.10	0.17	0.19	0.06	0.10	0.11	0.32	0.09	0.11	0.38	0.33	--	--	600
Dichloromethane	$\mu g/m^3$	0.30	--	0.42	0.39	0.36	1.38	0.26	0.27	0.40	0.27	0.30	0.28	0.29	0.25	0.24	0.42	0.47	--	--	2000
Xylene, *o-*	$\mu g/m^3$	0.15	--	0.18	0.14	0.43	0.32	0.13	0.29	0.40	0.07	0.10	0.14	0.30	0.12	0.10	0.32	0.23	--	--	9000
Cobalt (PM_{10})	ng/m^3	0.04	0.04	0.16	0.13	0.28	0.18	0.13	0.16	0.19	--	0.09	0.26	0.42	0.14	0.24	0.24	0.22	0.56	0.44	100
Chrysene	ng/m^3	0.24	--	7.09	7.22	41.1	12.3	0.40	5.29	15.0	0.21	0.48	2.58	34.9	0.18	10.3	14.5	1.03	22.5	15.5	640000
Beryllium (PM_{10})	ng/m^3	0.01	0.0004	0.02	0.02	0.06	0.04	0.01	0.02	0.04	--	ND	0.01	0.09	ND	0.02	0.03	0.03	0.04	0.04	20

Appendix D (continued). South Allegheny Middle/High School - Pollutant Concentrations (12/17/2011-4/3/2012).

Parameter	Units	12/17/2011	12/23/2011	12/29/2011	1/4/2012	1/10/2012	1/16/2012	1/22/2012	1/28/2012	2/3/2012	2/9/2012	2/15/2012	2/21/2012	2/27/2012	3/4/2012	3/10/2012	3/16/2012	3/22/2012	3/28/2012	4/3/2012	Sample Screening Level[a]
Chloroform	$\mu g/m^3$	ND	--	0.08	0.08	0.12	0.12	0.10	0.10	ND	0.07	0.09	0.09	0.07	0.09	0.11	0.12	0.13	--	--	500
Toluene	$\mu g/m^3$	0.65	--	1.36	1.19	5.16	2.88	0.75	2.02	2.76	0.58	0.64	1.07	4.56	0.41	1.49	5.09	1.22	--	--	4000
Styrene	$\mu g/m^3$	0.17	--	0.20	0.16	0.65	0.48	0.07	0.38	0.64	0.06	0.06	0.14	0.53	0.16	0.09	0.43	0.11	--	--	9000
Selenium (PM_{10})	ng/m^3	0.83	0.33	4.66	5.77	6.92	9.51	0.51	4.35	3.88	--	1.91	2.29	17.0	0.44	3.77	11.0	2.61	13.9	4.93	20000
Carbon Disulfide	$\mu g/m^3$	0.04	--	0.11	0.18	0.33	0.17	0.05	0.17	0.15	0.03	0.06	0.09	0.28	0.03	0.08	0.17	0.11	--	--	7000
Mercury (PM_{10})	ng/m^3	0.01	0.003	0.03	0.05	0.06	0.13	0.01	0.03	0.04	--	0.00	0.02	0.08	0.01	0.03	0.03	0.02	0.05	0.02	3000[c]
Methyl isobutyl ketone	$\mu g/m^3$	0.06	--	ND	ND	ND	0.05	0.07	0.11	0.13	ND	0.07	0.06	0.05	0.05	ND	0.14	0.17	--	--	30000
Methyl Chloroform	$\mu g/m^3$	0.07	--	0.04	0.05	0.08	0.08	0.08	0.08	0.05	0.04	0.07	0.05	0.03	0.04	0.06	0.07	0.10	--	--	10000
Ethylene dichloride	$\mu g/m^3$	0.08	--	0.07	0.07	0.10	0.10	0.09	0.10	0.08	0.07	0.08	0.08	0.06	0.07	0.08	0.09	0.11	--	--	270
Bromomethane	$\mu g/m^3$	0.04	--	ND	ND	0.06	0.06	ND	0.05	0.03	ND	0.05	0.04	0.03	0.03	ND	0.07	0.16	--	--	200
Dichlorobenzene, *p*-	$\mu g/m^3$	0.03	--	ND	ND	0.06	0.05	0.06	0.05	0.02	ND	ND	ND	ND	ND	ND	ND	0.11	--	--	10000
Ethylene dibromide	$\mu g/m^3$	ND	--	ND	ND	0.06	0.06	ND	0.05	ND	ND	ND	ND	ND	ND	ND	ND	ND	--	--	12
Trichloroethylene	$\mu g/m^3$	ND	--	ND	ND	0.06	0.09	ND	0.05	0.02	ND	ND	ND	ND	ND	ND	ND	0.07	--	--	10000
Tetrachloroethane, 1,1,2,2-	$\mu g/m^3$	ND	--	ND	ND	0.07	0.07	ND	0.05	ND	ND	ND	ND	ND	ND	ND	ND	ND	--	--	120
Hexachloro-1,3-butadiene	$\mu g/m^3$	0.03	--	ND	ND	0.11	0.06	ND	0.06	ND	ND	ND	ND	ND	ND	ND	ND	0.12	--	--	320
Acrylonitrile	$\mu g/m^3$	ND	--	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	--	--	200
Trichloroethane, 1,1,2-	$\mu g/m^3$	ND	--	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	--	--	440
Bromoform	$\mu g/m^3$	ND	--	ND	ND	0.10	0.10	ND	0.08	ND	ND	ND	ND	ND	ND	ND	ND	0.11	--	--	6400
Vinyl chloride	$\mu g/m^3$	ND	--	ND	ND	ND	0.02	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	--	--	1000
Trichlorobenzene, 1,2,4-	$\mu g/m^3$	0.04	--	ND	ND	0.05	0.04	ND	0.03	ND	ND	ND	ND	ND	ND	ND	ND	0.08	--	--	2000
Dichloroethylene, 1,1-	$\mu g/m^3$	ND	--	ND	ND	0.02	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.04	--	--	80
Chlorobenzene	$\mu g/m^3$	ND	--	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.07	--	--	10000
Methyl Methacrylate	$\mu g/m^3$	ND	--	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	--	--	7000
Chloroethane	$\mu g/m^3$	ND	--	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	--	--	40000
Benzyl Chloride	$\mu g/m^3$	ND	--	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	140
Chloroprene	$\mu g/m^3$	ND	--	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	--	--	200
Dichloroethane, 1,1-	$\mu g/m^3$	ND	--	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	--	--	4400

Appendix D (continued). South Allegheny Middle/High School - Pollutant Concentrations (12/17/2011-4/3/2012).

Parameter	Units	12/17/2011	12/23/2011	12/29/2011	1/4/2012	1/10/2012	1/16/2012	1/22/2012	1/28/2012	2/3/2012	2/9/2012	2/15/2012	2/21/2012	2/27/2012	3/4/2012	3/10/2012	3/16/2012	3/22/2012	3/28/2012	4/3/2012	Sample Screening Level[a]
Dichloropropane, 1,2-	µg/m^3	ND	--	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	--	--	200
Dichloropropylene, *cis* -1,3-	µg/m^3	ND	--	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	--	--	40
Dichloropropylene, *trans* -1,3-	µg/m^3	ND	--	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	--	--	40
Ethyl Acrylate	µg/m^3	ND	--	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	--	--	7000
Methyl *tert* -Butyl Ether	µg/m^3	ND	--	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	--	--	7000

Key Pollutant

ng/m^3 nanograms per cubic meter

µg/m^3 micrograms per cubic meter

ND No detection of this chemical was registered by the laboratory analytical equipment.

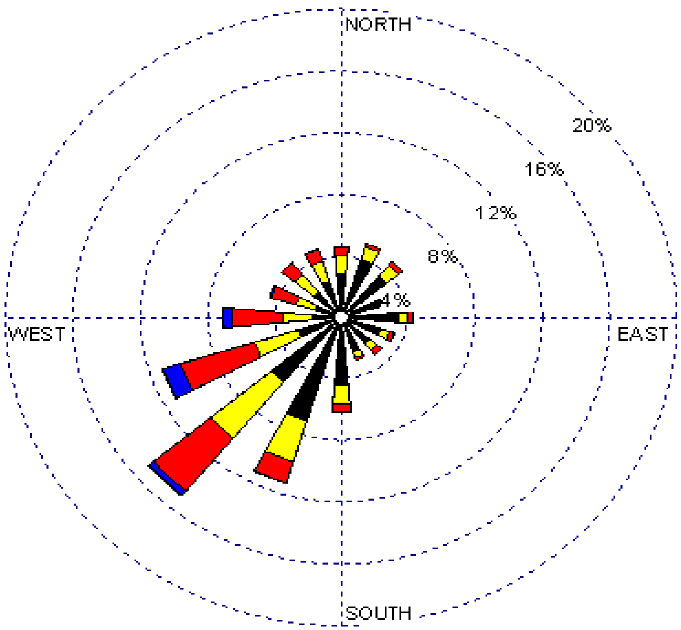
-- No sample was conducted for this pollutant on this day or the result was invalidated

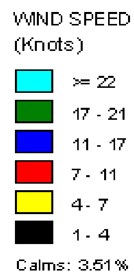
[a] The individual sample screening levels and their use is summarized on the web site and described in detail in Schools Air Toxics Monitoring Activity (2009), "Uses of Health Effects Information in Evaluating Sample Results", see http://www.epa.gov/schoolair/pdfs/UsesOfHealthEffectsInfoinEvalSampleResults.pdf. These screening levels are based on consideration of exposure all day, every day over a period ranging up to a couple of weeks,and longer for some pollutants.

[b] The sample screening levels are specific to hexavalent chromium (recognized as the most toxic form) which is a fraction of the total chromium reported.

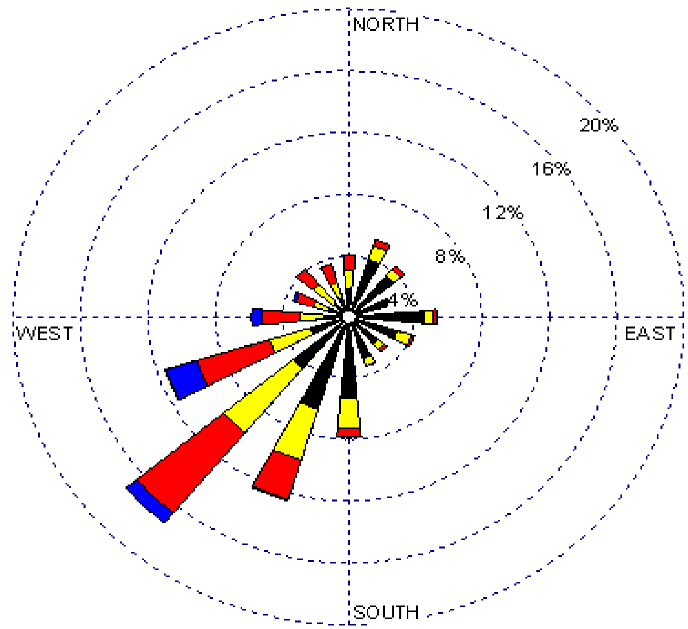
[c] The sample screening level is specific to elemental mercury, which is more readily and completely absorbed into the body than mercury conveyed on particles (e.g., divalent species).

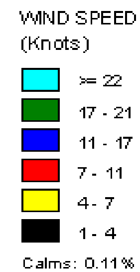
Appendix E. Windroses for South Allegheny Middle School/High School Meteorological Station.





South Allegheny Middle School/High School Meteorological Station (1/1/2002-4/3/2012)





South Allegheny Middle School/High School Meteorological Station Across Sampling Period Aug. 19, 2011-Apr. 3, 2012