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SAT Initiative: Life Skills of Trumbull County and Academy of Arts and Humanities (Warren, Ohio)

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 this school in clear, but generally technical, terms. A summary of this analysis is presented on the page focused on this school on EPA's website (www.epa.gov/schoolair).

US EPA ARCHIVE DOCUMENT

I. Executive Summary

- Air monitoring has been conducted at Life Skills of Trumbull County as part of the EPA initiative to monitor specific air toxics in the outdoor air around priority schools in 22 states and 2 tribal areas. For the purposes of this study, results from the air monitoring at Life Skills of Trumbull County are considered to be indicative of conditions at the nearby Academy of Arts and Humanities (located within a half mile of Life Skills of Trumbull County).
- These schools were selected for monitoring based on information indicating the potential for elevated ambient concentrations of manganese, benzene, arsenic, lead, and benzo(a)pyrene in air outside the schools from several facilities. That information included significant emissions of the key pollutants from EPA's 2002 National-Scale Air Toxics Assessment (NATA) from a nearby coke oven. Additionally, the schools were ranked in the top 25 on the USA Today list due to 2005 Toxics Release Inventory estimates of manganese emissions for a nearby steel mill.
- Air monitoring was performed from August 17, 2009 through November 27, 2009 for: benzene and other volatile organic compounds (VOCs); arsenic, manganese, and other particulate matter less than 10 microns (PM_{10}); lead in total suspended particles (TSP); and benzo(a)pyrene and other polycyclic aromatic hydrocarbons (PAHs).
- EPA plans to extend air toxics monitoring at this school, because key sources near the school were not operating at typical levels during the monitoring period.
- The Ohio EPA will continue to oversee industrial facilities in the area through the facilities Title V air permits and other programs.

II. Background on this Initiative

As part of an EPA initiative to implement Administrator Lisa Jackson's commitment to assess potentially elevated air toxics levels at some of our nation's schools, EPA and state and local air pollution control agencies are monitoring specific (key) air toxics in the outdoor air around priority schools in 22 states and 2 tribal areas (http://www.epa.gov/schoolair/schools.html).

- The schools selected for monitoring include some schools that are near large industries that are sources of air toxics, and some schools that are in urban areas, where emissions

of air toxics come from a mix of large and small industries, cars, trucks, buses and other sources.

- EPA selected schools based on information available to us about air pollution in the vicinity of the school, including results of the 2002 National-Scale Air Toxics Assessment (NATA), results from a 2008 USA Today analysis on air toxics at schools, and information from state and local air agencies. The analysis by USA Today involved use of EPA's Risk Screening Environmental Indicators tool and Toxics Release Inventory (TRI) for 2005.
  - Available information had raised some questions about air quality near these schools that EPA concluded merited investigation. In many cases, the information indicated that estimated long-term average concentrations of one or more air toxics were above the upper end of the range that EPA generally considers as acceptable (e.g., above 1-in-10,000 cancer risk for carcinogens).
- Monitors are placed at each school for approximately 60 days, and take air samples on at least 10 different days during that time. The samples are analyzed for specific air toxics identified for monitoring at the school (i.e., key pollutants).[1]
- These monitoring results and other information collected at each school during this initiative allow us to:
  - assess specific air toxics levels occurring at these sites and associated estimates of longer-term concentrations in light of health risk-based criteria for long-term exposures,
  - better understand, in many cases, potential contributions from nearby sources to key air toxics concentrations at the schools,
  - consider what next steps might be appropriate to better understand and address air toxics at the school, and
  - improve the information and methods we will use in the future (e.g., NATA) for estimating air toxics concentrations in communities across the U.S.

Assessment of air quality under this initiative is specific to the air toxics identified for monitoring at each school. This initiative is being implemented in addition to ongoing state, local and national air quality monitoring and assessment activities, including those focused on criteria pollutants (e.g., ozone and particulate matter) or existing, more extensive, air toxics programs.

Several technical documents prepared for this project provide further details on aspects of monitoring and data interpretation and are available on the EPA website (e.g., www.epa.gov/schoolair/techinfo.html). The full titles of these documents are provided here:

- *School Air Toxics Ambient Monitoring Plan*
- *Quality Assurance Project Plan For the EPA School Air Toxics Monitoring Program*
- *Schools Air Toxics Monitoring Activity (2009), Uses of Health Effects Information in Evaluating Sample Results*

[1] In analyzing air samples for these key pollutants, samples are also being analyzed for some additional pollutants that are routinely included in the analytical methods for the key pollutants.

US EPA ARCHIVE DOCUMENT

Information on health effects of air toxics being monitored[2] and educational materials describing risk concepts[3] are also available from EPA's website.

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

Life Skills of Trumbull County was selected for monitoring in consultation with the state air agency, Ohio EPA. For the purposes of this study, results from the air monitoring at Life Skills of Trumbull County are considered to be indicative of conditions at the nearby Academy of Arts and Humanities (located within a half mile of Life Skills of Trumbull County) (Figure 1). We were interested in evaluating the ambient concentrations of benzene, arsenic, lead, and benzo(a)pyrene in air outside the schools based on information indicating the potential for elevated levels of these pollutants. That information included EPA's 2002 National-Scale Air Toxics Assessment for a nearby coke oven. Additionally, the schools were ranked in the top 25 on the USA Today list due to 2005 Toxics Release Inventory estimates of manganese emissions for a nearby steel mill. Information provided by the Ohio EPA indicates that the key sources of emissions of these pollutants were not operating during the monitoring period, but are now currently operating at typical levels.

Monitoring commenced at Life Skills of Trumbull County on August 17, 2009, and continued through November 27, 2009. During this period, sixteen PM_{10} samples of airborne particles were collected using a PM_{10} sampler[4] and analyzed for arsenic and manganese (two of the key pollutants at this school) and for a small standardized set of additional metals that are routinely included in the analytical method for the key pollutants. Additionally, ten VOC samples and seventeen polycyclic aromatic hydrocarbon (PAH) samples were collected and analyzed for the key pollutants (benzene and benzo(a)pyrene, respectively) and other air toxics at this school. Also, fourteen samples of total suspended particulate (TSP) were collected and analyzed for lead.

All VOCs results with the exception of acrolein were evaluated for health concerns. Results of a recent short-term laboratory study have raised questions about the consistency and reliability of monitoring results of acrolein. As a result, EPA will not use these acrolein data in evaluating the potential for health concerns from exposure to air toxics in outdoor air as part of the School Air Toxics Monitoring project (SAT) (http://www.epa.gov/schoolair/acrolein.html). All sampling methodologies are described in EPA's schools air toxics monitoring plan (http://www.epa.gov/schoolair/techinfo.html).[5]

[2] For example, http://www.epa.gov/schoolair/pollutants.html, http://www.epa.gov/ttn/fera/risk_atoxic.html.
[3] For example, http://www.epa.gov/ttn/atw/3_90_022.html, http://www.epa.gov/ttn/atw/3_90_024.html.
[4] In general, this sampler collects particles with an aerodynamic diameter of 10 microns or smaller more of which would be considered to be in the respirable range which is what the health-based comparison levels for arsenic and manganese are based on.
[5] Ohio EPA staff operated the monitors and sent the sample canisters and filters to the analytical laboratory under contract to EPA.

US EPA ARCHIVE DOCUMENT

IV. Monitoring Results and Analysis

A. Background for the SAT Analysis

The majority of schools being monitored in this initiative were selected based on modeling analyses that indicated the potential for annual average air concentrations of some specific (key) hazardous air pollutants (HAPs or air toxics)[6] to be of particular concern based on approaches that are commonly used in the air toxics program for considering potential for long-term risk. For example, such analyses suggested annual average concentrations of some air toxics were greater than long-term risk-based concentrations associated with an additional cancer risk greater than 10-in-10,000 or a hazard index on the order of or above 10. To make projections of air concentrations, the modeling analyses combined estimates of air toxics emissions from industrial, motor vehicle and other sources, with past measurements of winds, and other meteorological factors that can influence air concentrations, from a weather station in the general area. In some cases, the weather station was very close (within a few miles), but in other cases, it was much further away (e.g., up to 60 miles), which may contribute to quite different conditions being modeled than actually exist at the school. The modeling analyses are intended to be used to prioritize locations for further investigation.

The primary objective of this initiative is to investigate - through monitoring air concentrations of key air toxics at each school over a 2-3 month period - whether levels measured and associated longer-term concentration estimates are of a magnitude, in light of health risk-based criteria, for which follow-up activities may need to be considered. To evaluate the monitoring results consistent with this objective, we developed health risk-based air concentrations (the long-term comparison levels summarized in Appendix A) for the monitored air toxics using established EPA methodology and practices for health risk assessment[7] and, in the case of cancer risk, consistent with the implied level of risk considered in identifying schools for monitoring. Consistent with the long-term or chronic focus of the modeling analyses, based on which these schools were selected for monitoring, we have analyzed the full record of concentrations of air toxics measured at this school, using routine statistical tools, to derive a 95 percent confidence

[6] The term hazardous air pollutants (commonly called HAPs or air toxics) refers to pollutants identified in section 112(b) of the Clean Air Act which 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.

[7] While this EPA initiative will rely on EPA methodology, practices, assessments and risk policy considerations, we recognize that individual state methods, practices and policies may differ and subsequent analyses of the monitoring data by state agencies may draw additional or varying conclusions.

US EPA ARCHIVE DOCUMENT

interval[8] for the estimate of the longer-term average concentration of each of these pollutants. In this project, we are reporting all actual numerical values for pollutant concentrations including any values below method detection limit (MDL).[9] Additionally, a value of 0.0 is used when a measured pollutant has no value detected (ND). The projected range for the longer-term concentration estimate for each chemical (most particularly the upper end of the range) is compared to the long-term comparison levels. These long-term comparison levels conservatively presume continuous (all-day, all-year) exposure over a lifetime. The analysis of the air concentrations also includes a consideration of the potential for cumulative multiple pollutant impacts.[10] In general, where the monitoring results indicate estimates of longer-term average concentrations that are above the comparison levels - i.e., above the cancer-based comparison levels or notably above the noncancer-based comparison levels - we will consider the need for follow-up actions such as:

- → Additional monitoring of air concentrations and/or meteorology in the area,
- → Evaluation of potentially contributing sources to help us confirm their emissions and identify what options (regulatory and otherwise) may be available to us to achieve emissions reductions, and
- → Evaluation of actions being taken or planned nationally, regionally or locally that may achieve emission and/or exposure reductions. An example of this would be actions taken to address the type of ubiquitous emissions that come from mobile sources.

We have further analyzed the dataset to describe what it indicates in light of some other criteria and information commonly used in prioritizing state, local and national air toxics program activities. State, local and national programs often develop long-term monitoring datasets in order to better characterize pollutants near particular sources. The 2-3 month dataset developed under this initiative will be helpful to those programs in setting priorities for longer-term monitoring projects. The intent of this analysis is to make this 2-3 month monitoring dataset as useful as possible to state, local and national air toxics programs in their longer-term efforts to improve air quality nationally. To that end, this analysis:

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[8] When data are available for only a portion of the period of interest (e.g., samples not collected on every day during this period), statisticians commonly calculate the 95% confidence interval around the dataset mean (or average) in order to have a conservative idea of how high or low the "true" mean may be. More specifically, this interval is the range in which the mean for the complete period of interest is expected to fall 95% of the time (95% probability is commonly used by statisticians). The interval includes an equal amount of quantities above and below the sample dataset mean. The interval that includes these quantities is calculated using a formula that takes into account the size of the dataset (i.e., the 'n') as well as the amount by which the individual data values vary from the dataset mean (i.e., the "standard deviation"). This calculation yields larger confidence intervals for smaller datasets as well as ones with more variable data points. For example, a dataset including {1.0, 3.0, and 5.0}, results in a mean of 3.0 and a 95% confidence interval of 3.0 +/- ~5 (or -2.0 to 8.0). For comparison purposes, a dataset including {2.5, 3 and 3.5} results in a mean of 3.0 and a 95% confidence interval of 3.0 +/- ~1.2 (or 1.8 to 4.2). The smaller variation within the data in the second set of values causes the second confidence interval to be smaller.

[9] Method detection limit (MDL) is the minimum concentration of a substance that can be measured and reported with 99% confidence that the pollutant concentration is greater than zero and is determined from the analysis of a sample in a given matrix containing the pollutant.

[10] As this analysis of a 3-4 month monitoring dataset is not intended to be a full risk assessment, consideration of potential multiple pollutant impacts may differ among sites. For example, in instances where no individual pollutant appears to be present above its comparison level, we will also check for the presence of multiple pollutants at levels just below their respective comparison levels (giving a higher priority to such instances).

US EPA ARCHIVE DOCUMENT

- → Describes the air toxics measurements in terms of potential longer-term concentrations, and, as available, compares the measurements at this school to monitoring data from national monitoring programs.
- → Describes the meteorological data by considering conditions on sampling days as compared to those over all the days within the 2-3 month monitoring period and what conditions might be expected over the longer-term (as indicated, for example, by information from a nearby weather station).
- → Describes available information regarding activities and emissions at the nearby source(s) of interest, such as that obtained from public databases such as TRI and/or consultation with the local air pollution authority.

B. Chemical Concentrations

We developed two types of long-term health risk-related comparison levels (summarized in Appendix A below) to address our primary objective. The primary objective is to investigate through the monitoring data collected for key pollutants at the school, whether pollutant levels measured and associated longer-term concentration estimates are elevated enough in comparison with health risk-based criteria to indicate that follow-up activities be considered. These comparison levels conservatively presume continuous (all-day, all-year) exposure over a lifetime.

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.[11] 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.

In addition to evaluating individual pollutants with regard to their corresponding comparison levels, we also considered the potential for cumulative impacts from multiple pollutants in cases where individual pollutant levels fall below the comparison levels but where multiple pollutant mean concentrations are within an order of magnitude of their comparison levels.

Using the analysis approach described above, we analyzed the chemical concentration data (Table 1) with regard to areas of interest identified below.

[11] This is described in detail in *Schools Air Toxics Monitoring Activity (2009), Uses of Health Effects Information in Evaluating Sample Results.*

US EPA ARCHIVE DOCUMENT

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

- The air sampling data collected over the 3-month sampling period do not indicate levels of health concern. However, as the sources were not operating during the monitoring period, additional monitoring will need to occur before a longer-term determination can be made.

US EPA ARCHIVE DOCUMENT

Manganese, Benzene, Arsenic, Lead, and Benzo(a)pyrene, the key pollutants

- Do the monitoring data indicate elevated levels that pose significant long-term health concerns?

  → The data collected do not indicate levels of health concern over the 3-month sampling period. However, as the sources were not operating during the monitoring period, additional monitoring will need to occur before a longer-term determination can be made.

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 do not indicate levels of health concern over the 3-month sampling period for the other HAPs monitored. However, as the sources were not operating during the monitoring period, additional monitoring will need to occur before a longer-term determination can be made.

C. Wind and Other Meteorological Data

At each school monitored as part of this initiative, we are collecting meteorological data, minimally for wind speed and direction, during the sampling period. Additionally, we have identified the nearest National Weather Service (NWS) station at which a longer record is available.

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.

As discussed above, for this school, the nearby key sources of emissions were not operating during the monitoring period, but are now currently operating at typical levels. Therefore, this review of meteorological data serves mainly to provide information on wind patterns near the

school during the sampling period and expected longer-term patterns that may be used to characterize meteorology when more sampling is completed.

The meteorological station at Life Skills of Trumbull County collected wind speed and wind direction measurements beginning on August 14, 2009, continuing through the sampling period (August 17, 2009-November 27, 2009), and ending on March 2, 2010. As a result, on-site data for these meteorological parameters are available for all dates of sample collection, and also for a period before and after the sampling period, producing a continuous record of over six months of on-site meteorological data. The meteorological data collected at the school site on sampling days are presented in Table 2.

The nearest NWS station is at Youngstown Municipal Airport in Youngstown, OH. This station is approximately 7 miles east-northeast of the school. Measurements taken at that station include wind, temperature, and precipitation. Wind speed and direction data collected at the Youngstown Municipal Airport NWS station have been summarized in Appendix B.

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

- The meteorological data at the school indicate that approximately 30 percent of winds were from the ZOI.

- The NWS station at Youngstown Municipal Airport generally appears to represent the specific wind flow patterns at the school location. Also, the wind pattern at the NWS station during the sampling period is generally similar to the historical long-term wind flow pattern at that same NWS station. Therefore, the 3-month sampling period may be representative of year-round wind patterns. We will resume meteorological data collection when monitoring resumes at this school, and we will analyze all the meteorological data together when all monitoring is complete.

- What is the direction of the key sources of emissions in relation to the school location?
  → The nearby industrial facilities (described in section III above) lie approximately 1 mile south, and 2 miles south-southeast of the school.
  → Using the property boundaries of the full facilities (in lieu of information regarding the location of specific sources of emissions at the facilities), we have identified an approximate range of wind directions to use in considering the potential influence of these facilities on air concentrations at the school.
  → This general range of wind directions, from approximately 146 to 214 degrees, is referred to here as the expected zone of source influence (ZOI).

- How often did wind come from direction of the key sources?
  → The meteorological data at the school indicate that approximately 30 percent of winds were from the ZOI.

US EPA ARCHIVE DOCUMENT

- What might be expected over the longer-term at the school location?
  → The NWS station at Youngstown Municipal Airport generally appears to represent the specific wind flow patterns at the school location. Also, the wind pattern at the NWS station during the sampling period is generally similar to the historical long-term wind flow pattern at that same NWS station. Therefore, the 3-month sampling period may be representative of year-round wind patterns (2002-2007 period, Appendix B). We will resume meteorological data collection when monitoring resumes at this school, and we will analyze all the meteorological data together when all monitoring is complete.

V. Key Source Information

- Were the sources operating as usual during the monitoring period?
  - The nearby sources (described in section III above) have Title V operating air permits issued by Ohio EPA that includes operating requirements.[12]
  - The sources were not operating during the monitoring period, but are now currently operating at typical levels.

VI. Integrated Summary and Next Steps

A. Summary of Key Findings

1. What are the key HAPs for this school?
   → Benzene, arsenic, manganese, lead, and benzo(a)pyrene are the key HAPs for this school, identified based on emissions information considered in identifying the school for monitoring.

2. Do the data collected at this school indicate an elevated level of concern, as implied by information that led to identifying this school for monitoring?
   → The sources of the key pollutants were not operating at typical levels during monitoring period; therefore additional monitoring will need to occur before a longer-term determination can be made.

B. Next Steps for Key Pollutants

1. Based on the analysis described here, EPA plans to extend air toxics monitoring at this school in the near future.
2. The Ohio Environmental Protection Agency (Ohio EPA) will continue to oversee industrial facilities in the area through the facilities' Title V air permit and other programs.

[12] Operating permits, which are issued to air pollution sources under the Clean Air Act, are described at: http://www.epa.gov/air/oaqps/permits/

US EPA ARCHIVE DOCUMENT

VII. Figures and Tables

A. Tables

1. Life Skills of Trumbull County – Key Pollutant Analysis.
2. Life Skills of Trumbull County Key Pollutant Concentrations and Meteorological Data.

B. Figures

1. Life Skills of Trumbull County, Academy of Arts and Humanities, and Sources of Interest.

VIII. Appendices

A. Summary Description of Long-term Comparison Levels.

B. Windroses for Youngstown Municipal Airport NWS Station.

US EPA ARCHIVE DOCUMENT

Figure 1. Life Skills of Trumbull County, Academy of Arts and Humanities, and the Sources of Interest.

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Table 1. Life Skills of Trumbull County - 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]
Manganese (PM_{10})	ng/m^3	11.8 [d]	6.16 - 17.4	NA	50
Benzene	$\mu g/m^3$	1.39 [e]	0.86 - 1.92	13	30
Arsenic (PM_{10})	ng/m^3	1.11 [f]	0.66 - 1.57	23	15
Lead (TSP)	ng/m^3	8.20 [g]	5.33 - 11.1	NA	150
Benzo(a)pyrene	ng/m^3	0.180 [h]	0.121 - 0.240	57	NA

ng/m^3 nanograms per cubic meter
$\mu g/m^3$ micrograms per cubic meter
NA Not applicable

[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 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 manganese (PM_{10}) is the average of all sample results, which include 16 detections that ranged from 1.62 to 39.5 ng/m^3.

[e] The mean of measurements for benzene is the average of all sample results, which include 10 detections that ranged from 0.505 to 2.93 $\mu g/m^3$.

[f] The mean of measurements for arsenic (PM_{10}) is the average of all sample results, which include 16 detections that ranged from 0.07 to 3.70 ng/m^3.

[g] The mean of measurements for lead (TSP) is the average of all sample results, which include 14 detections that ranged from 1.64 to 19.5 ng/m^3.

[h] The mean of measurements for benzo(a)pyrene is the average of all sample results, which include 17 detections that ranged from 0.060 to 0.450 ng/m^3.

US EPA ARCHIVE DOCUMENT

Table 2. Life Skills of Trumbull County Key Pollutant Concentrations and Meteorological Data.

Parameter	Units	8/17/2009	8/23/2009	8/29/2009	9/4/2009	9/10/2009	9/16/2009	9/22/2009	9/28/2009	10/4/2009	10/10/2009	10/16/2009	10/22/2009	10/28/2009	11/3/2009	11/9/2009	11/15/2009	11/21/2009	11/27/2009
Manganese (PM_{10})	ng/m^3	25.8	--	4.16	--	14.3	12.5	11.5	11.3	3.78	3.05	3.42	26.7	2.97	9.66	39.5	12.7	5.52	1.62
Benzene	$\mu g/m^3$	1.44	--	--	--	--	0.505	1.35	--	1.11	1.02	--	1.54	0.831	--	2.93	2.36	--	0.815
Arsenic (PM_{10})	ng/m^3	1.39	--	0.90	--	1.27	0.56	1.20	0.07	1.62	0.89	0.39	0.93	0.72	0.46	2.03	3.70	1.29	0.39
Lead (TSP)	ng/m^3	--	--	--	8.45	9.02	4.88	4.31	--	4.17	6.86	1.64	9.09	4.42	7.55	19.5	13.6	15.9	5.43
Benzo(a)pyrene	ng/m^3	0.317	0.120	0.060	0.102	0.135	0.081	0.097	0.084	0.174	0.136	0.143	0.334	0.117	0.354	--	0.450	0.255	0.108
% Hours w/Wind Direction from Expected ZOI[a]	%	83.3	8.3	29.2	4.2	25.0	0.0	100.0	33.3	8.3	0.0	0.0	33.3	0.0	4.2	66.7	50.0	0.0	0.0
Wind Speed (avg. of hourly speeds)	mph	3.9	3.2	5.1	2.9	4.0	5.1	3.5	10.8	4.9	4.3	4.8	4.3	3.7	4.5	2.6	3.3	3.0	6.9
Wind Direction (avg. of unitized vector)[b]	deg.	202.8	291.7	241.2	345.6	138.4	16.9	179.2	226.4	240.9	309.2	23.7	231.3	348.5	273.3	205.1	182.1	272.4	261.9
% of Hours with Speed below 2 knots	%	37.5	29.2	4.2	41.7	25.0	0.0	25.0	0.0	20.8	16.7	0.0	29.2	20.8	16.7	62.5	45.8	8.3	0.0
Daily Average Temperature	° F	79.0	64.8	68.1	65.4	65.8	60.2	69.6	57.9	51.8	49.5	37.3	58.5	51.8	44.0	58.1	55.0	48.3	35.9
Daily Precipitation	inches	0.00	0.00	0.71	0.00	0.00	0.00	0.01	0.31	0.03	0.04	0.13	0.00	0.70	0.00	0.00	0.00	0.00	0.12

All precipitation and temperature data were from the Youngstown Municipal 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 taken for this pollutant on this day or the result was invalidated.

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.[13]

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.[14] 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.

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

[14] 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).

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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 effect over a lifetime.[15] 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 sitting 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 life stages/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.

[15] 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

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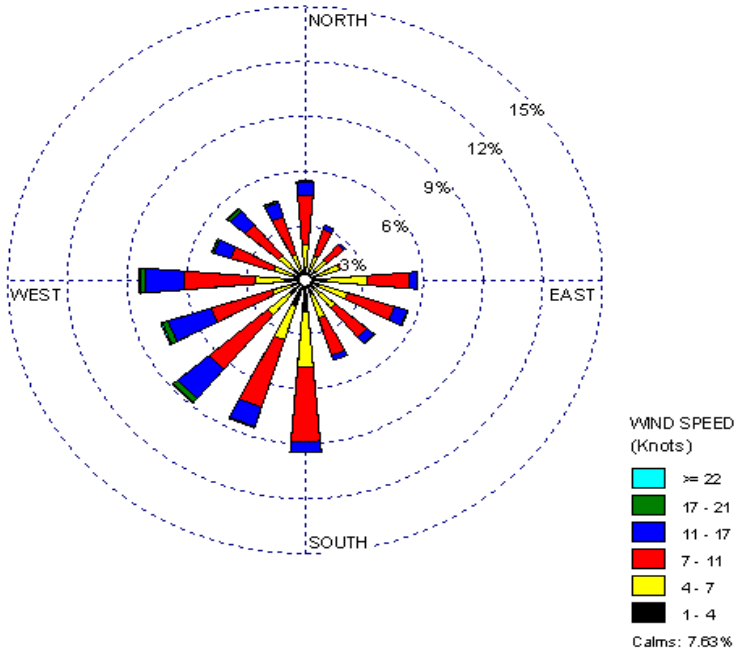
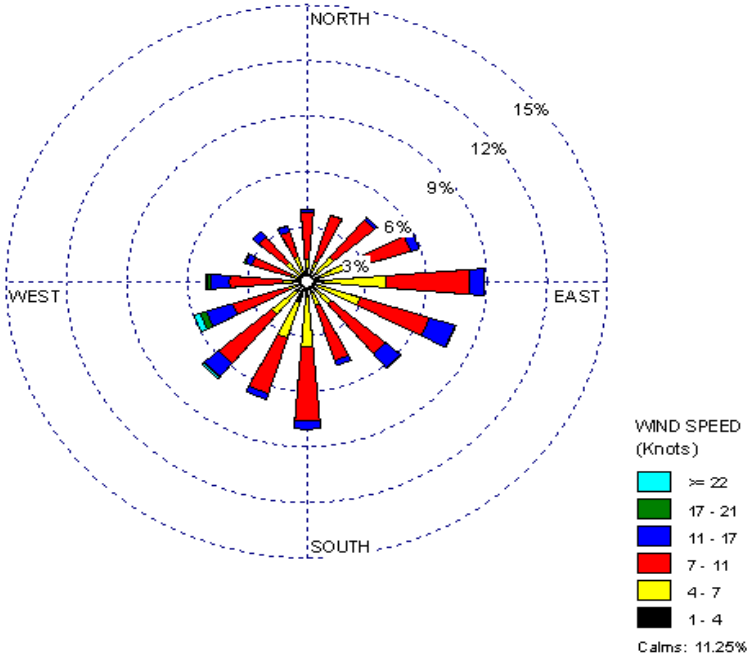
Appendix B. Windroses for Youngstown Municipal Airport NWS Station.



Youngstown Municipal Airport NWS Station
2002-2007[1]



Youngstown Municipal Airport NWS Station
Across Sampling Period
(Aug. 17, 2009-Nov. 27, 2009)[1]

[a] Youngstown Municipal Airport NWS Station (WBAN 14852) is 6.91 miles from Life Skills of Trumbull County.