SAT Initiative: Additional Monitoring at 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).

I. Executive Summary

- Air monitoring was 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.
- EPA extended air toxics monitoring at this school, because key sources near the school were not operating at typical levels during the previous monitoring period August 17, 2009 through November 27, 2009 (http://www.epa.gov/schoolair/LifeSkills.html). 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.
- It was determined that the coke oven was operating below normal levels during the original monitoring session conducted August 17, 2009 through November 27, 2009, and a decision was made to repeat monitoring when the coke oven was operating at normal conditions. Additional air monitoring was performed from November 16, 2010 through February 8, 2011 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).
- Measured levels of manganese (PM_{10}) and associated longer-term concentration estimates are below levels of concern.
- Measured levels of lead (TSP), a pollutant for which there are national standards for ambient air, are below the level of the national standard for protection of public health.
- Levels of pollutants associated with coke plant emissions, including benzene, arsenic (PM_{10}), and benzo(a)pyrene and associated longer-term concentration estimates were not as high as suggested by the information available prior to monitoring. Although the key pollutants were below the levels of significant concern that had been suggested by the

modeling information, the arsenic (PM_{10}) and benzo(a)pyrene concentrations indicate the influence of these pollutants emitted from a nearby source.

- Based on the analysis included here, EPA will not extend air toxics monitoring at this school as all pollutant levels were below levels of concern.
- 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. These rules may be found at this website, http://www.epa.gov/ttn/atw/eparules.html.
- 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 monitored 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 included 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 were placed at each school for approximately 60 days, and took air samples on at least 10 different days during that time. The samples were 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,

[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.

- 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*

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 Additional Monitoring Conducted

Life Skills of Trumbull County was selected for monitoring in consultation with the state air agency, Ohio EPA (OEPA). 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. OEPA determined that the coke oven was operating below normal levels during the original monitoring session conducted August 17, 2009 through November 27, 2009, and a decision was made to repeat monitoring when the coke oven was operating at normal conditions.

Additional monitoring was initiated on November 29, 2010, and continued through February 8, 2011, when the coke oven was monitoring at normal levels. During this period, ten PM_{10}

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[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.

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 volatile organic compound (VOC) samples and ten 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, ten 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 did 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]

IV. Monitoring Results and Analysis

A. Background for the SAT Analysis

The majority of schools 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

[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.

[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.

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 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

[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.

[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 2-3 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).

→ 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 the 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:

→ 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.

[11] 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.*

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 and Figures 2a-2e) with regard to areas of interest identified below.

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 for manganese (PM_{10}) and the related longer-term concentration estimates, while indicating influence from a nearby source of manganese, are below concentrations of concern.
- The air sampling data and related longer-term concentration estimates for lead (TSP), a pollutant for which there are national standards for ambient air, are below the national standard for protection of public health.
- Levels of the monitored pollutants commonly associated with coke plant emissions, including benzene, arsenic (PM_{10}), and benzo(a)pyrene, were not as high as suggested by the information available prior to monitoring. While the key pollutants were identified based on emission information from coke plants, additional sources of these pollutants exist, such as motor vehicles and gas stations which could be contributors to the measured concentrations of air toxics, depending on proximity of the sources monitored. Although the key pollutants were below the levels of concern that had been suggested by the modeling information, arsenic (PM_{10}) and benzo(a)pyrene results indicate the influence of these pollutants of concern emitted from nearby sources.

<u>Manganese, key pollutant:</u>

- Do the monitoring data indicate influence from a nearby source?
  - → The monitoring data include several manganese (PM_{10}) concentrations that are higher than concentrations commonly observed in other locations nationally.[12]
- Do the monitoring data indicate elevated levels that pose significant long-term health concerns?
  - → The monitoring data for manganese do not indicate levels of health concern for long-term exposures.

[12] For example, seven of the concentrations at this site (Table 2a) were higher than 75 percent of samples collected at the National Air Toxics Trends Stations (NATTS) from 2004-2008 (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.

- The estimate of longer-term manganese concentration (i.e., the upper bound of the 95 percent confidence interval on the mean of the dataset) is below the noncancer-based long-term comparison level (Table 1).[13] This comparison level is a continuous exposure concentration (24 hours a day, all year, over a lifetime) associated with little risk of adverse effect; it is not an exposure concentration at which effects have been observed or are predicted to occur.[14]
- As manganese has not been found to be carcinogenic, it has no cancer-based comparison level.[15]

→ Additionally, we did not identify any concerns regarding short-term exposures as each individual measurement is below the individual sample screening level for manganese (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).[11]

→ In summary, the individual measurements do not indicate concentrations of concern for short-term exposures and the combined contributions of all individual measurements in the estimate of longer-term concentration do not indicate a level of concern for long-term exposure.

Lead (TSP), key pollutant:

- Do the monitoring data indicate influence from a nearby source?

  → The measurements at these schools included a few lead (TSP) concentrations that were somewhat higher than the other valid sample measurements taken at the school, which may indicate that those samples were collected on days where nearby sources were influencing concentrations at this school.

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

  → The monitoring data for lead (TSP) are below the national ambient air quality standard for protection of public health for lead.

  - The estimates of longer-term lead (TSP) concentrations (i.e., the upper bound of the 95 percent confidence interval on the mean of the dataset) at this school are substantially below the long-term comparison level (Table 1).[16] The comparison level is the level of the national ambient air quality standard, which is for a 3-month averaging period.

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[13] The upper end of the interval is less than 1.6 times the mean of the monitoring data and less than 65 percent of the long-term noncancer-based comparison level.

[14] The comparison level for manganese is based on the RfC. Manganese concentrations at which health effects have been observed are higher than the RfC (http://www.atsdr.cdc.gov/tfacts151.html, http://www.epa.gov/ttn/atw/hlthef/manganes.html#conversion)

[15] www.epa.gov/iris

[16] The upper end of the interval is less than 1.4 times the mean of the monitoring data and less than 5% of the long-term noncancer-based comparison level. This comparison value for lead is the level of the National Ambient Air Quality Standard, which is in terms of a 3-month average level of lead in total suspended particles.

→ In summary, the monitoring data do not indicate concentrations above the national ambient air quality standard for protection of public health.

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

- Do the monitoring data indicate influence from a nearby source?

  → The monitoring data include no benzene[17] concentrations that are higher than concentrations commonly observed in other locations nationally, and some arsenic (PM_{10})[18] and benzo(a)pyrene[19] concentrations that are higher than concentrations commonly observed in other locations nationally.

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

  → Levels of pollutants associated with coke plant emissions, including benzene, arsenic (PM_{10}), and benzo(a)pyrene were not as high as suggested by the information available prior to monitoring. Although they were below the levels of concern that had been suggested by the modeling information, the arsenic (PM_{10}) and benzo(a)pyrene results indicate the influence of these pollutants of concern emitted from nearby sources.

  - The estimate of longer-term benzene concentration (i.e., the upper bound of the 95 percent confidence interval on the mean of the dataset) is below the long-term comparison levels (Table 1).[20] These comparison levels are based on consideration of continuous exposure concentrations (24 hours a day, all year, over a lifetime).

    - The longer-term concentration estimate is approximately 4% the cancer-based comparison level, indicating the longer-term estimate falls between continuous (24 hours a day, 7 days a week) lifetime exposure concentration associated with 1-in-100,000 additional cancer risk.

    - We did not identify any concerns regarding short-term exposures during the four-month sampling period, as each individual measurement is below the individual sample screening level for

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[17] For example, none of the concentrations at this site (Table 2b) were higher than 75 percent of samples collected at the National Air Toxics Trends Stations (NATTS) from 2004-2008 (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.

[18] For example three of the concentrations at this site (Table 2a) were higher than 75 percent of samples collected at the National Air Toxics Trends Stations (NATTS) from 2004-2008 (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.

[19] For example, six of the concentrations at this site (Table 2a) were higher than 75 percent of samples collected at the National Air Toxics Trends Stations (NATTS) from 2004-2008 (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.

[20] The upper end of the interval is less than 1.3 times the mean of the monitoring data and less than 4% of the long-term cancer-based comparison level.

benzene (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).[11]

- The estimate of longer-term arsenic (PM_{10}) concentration (i.e., the upper bound of the 95 percent confidence interval on the mean of the dataset) is below the long-term comparison levels (Table 1).[21] These comparison levels are based on consideration of continuous exposure concentrations (24 hours a day, all year, over a lifetime).
  - The longer-term concentration estimate is more than tenfold lower than the cancer-based comparison level, indicating the longer-term estimate is below a continuous (24 hours a day, 7 days a week) lifetime exposure concentration associated with 1-in-100,000 additional cancer risk.
  - We did not identify any concerns regarding short-term exposures during the four-month sampling period, as each individual measurement is below the individual sample screening level for arsenic (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).[11]
- The estimate of longer-term benzo(a)pyrene concentration (i.e., the upper bound of the 95 percent confidence interval on the mean of the dataset) is below the long-term comparison level (Table 1).[22] This comparison level is based on consideration of continuous exposure concentrations (24 hours a day, all year, over a lifetime).
  - The longer-term concentration estimate is more than tenfold lower than the cancer-based comparison level, indicating the longer-term estimate is below a continuous (24 hours a day, 7 days a week) lifetime exposure concentration associated with 1-in-100,000 additional cancer risk.
  - We did not identify any concerns regarding short-term exposures during the four-month sampling period, as each individual measurement is below the individual sample screening level for 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).[11]

<u>Other Air Toxics:</u>

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

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[21] The upper end of the interval is only 1.6 times the mean of the monitoring data and approximately 11% of the long-term noncancer-based comparison level.
[22] The upper end of the interval is 1.4 times the mean of the monitoring data and approximately 1% of the long-term cancer-based comparison level.

→ The monitoring data show low levels of the other HAPs monitored, with longer-term concentration estimates for these HAPs below their long-term comparison levels (Appendix C). Additionally, each individual measurement for these pollutants is below the individual short-term sample screening level[11] for that pollutant (Appendix D).

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)?

  → Although the multiple air toxics monitored at this location were below the levels of significant concern that had been suggested by the modeling information (Appendix C), 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.[23]

C. 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.

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.

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 (November 16, 2010-February 8, 2011), and ending on February 18, 2011. 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 eighteen months of on-site meteorological data. The meteorological data collected at the school site on sampling days are presented in Table 2.

[23] 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.

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 E.

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

- Both the sampling results and the on-site wind data indicate that some of the air samples were collected on days when the nearby key sources were contributing to conditions at the school location.
- The wind patterns at the monitoring site across sampling dates are similar to those observed across the record of on-site meteorological data during the sampling period.
- Our ability to provide a confident characterization of the wind flow patterns at the school station over the long-term is somewhat limited, although the NWS station at Youngstown Municipal Airport does appear to represent the specific wind flow patterns at the school location.
- Although we lack long-term wind data at the school monitoring site, the wind pattern at the NWS station across the sampling period is somewhat similar to the historical long-term wind flow pattern at that location. This suggests that, on a regional scale, the sampling period may be representative of year-round wind patterns.

- 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?
  - → For manganese, arsenic, and benzo(a)pyrene sampling, there were 6 out of 10 sampling days in which the on-site wind data had a portion of the winds from the ZOI (Figures 3a, 3d-3e, Table 2a). For lead sampling, there were 7 out of 10 sampling days in which on-site wind data had a portion of the winds from the ZOI (Figure 3b, Table 2a). For benzene sampling, there were 8 out of 10 days in which on-site wind data had a portion of the winds from the (Figure 3c, Table 2b).

- 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.

→ We note that wind patterns at the nearest NWS station (at Youngstown Municipal Airport) during the sampling period are similar to on-site wind patterns and are somewhat similar to those recorded at the NWS station over the long-term (2002-2007 period; Appendix E), supporting the idea that regional meteorological patterns in the area during the sampling period were consistent with long-term patterns. There is some uncertainty as to whether the general wind patterns at the school location for longer periods would be similar to the general wind patterns at the Youngstown Municipal Airport (see below).

- How do wind patterns at the school compare to those at the Youngstown Municipal Airport NWS station, particularly with regard to prevalent wind directions and the direction of the key source?

  → During the sampling period for which data are available both at the school site and at the reference NWS station (approximately 3 months), prevalent winds at the school site are predominantly from the south to southwest, while those at the NWS station are somewhat more from the west and southwest. The windroses for the two sites during the sampling period (Figures 3a-3e and Appendix E) show similarities in wind flow patterns.

- Are there other meteorological patterns that may influence the measured concentrations at the school monitoring site?

  → No, we did not observe other meteorological patterns that may influence the measured concentrations at the school monitoring site.

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.[24]
  - During the monitoring period, several of the emission units at the steel mill were not in operation including their coal-fired boiler. Facility emissions for 2010 were 3454 tons compared with 1172 tons for 2009.
  - The coke production facility operated at levels varying from 62-66% of normal production levels during the monitoring period.
  - The most recently available benzene, arsenic, and lead emissions data (2005 NATA, 2009 TRI) for the coke oven facility are lower than what was used for modeling (2002 NATA, 2005 TRI). There were no recently reported benzo(a)pyrene emissions.
  - The most recently available manganese emissions data (2008 TRI) from the steel manufacturing facility are lower than what was used for modeling (2005 TRI).

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

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 levels measured and associated longer-term concentration estimates for the key pollutants are not as high as that suggested by the information available prior to monitoring and are below levels of concern for long-term exposures.

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 somewhat reflect air concentrations during the entire sampling period, with indications from the on-site meteorological data that the sampling day conditions were similar with conditions overall during this period.

   → Among the data collected for this site, we have several that would indicate generally higher (or lower) concentrations during other times of year. The wind flow patterns at the nearest NWS station during the sampling period appear to be representative of long-term wind flow at that site. The lack of long-term meteorological data at the school location, along with our finding that the wind patterns from the nearest NWS station are somewhat similar to those at the school, however, limit somewhat our ability to confidently predict longer-term wind patterns at the school (which might provide further evidence relevant to concentrations during other times).

B. Next Steps for Key Pollutants

1. Based on the analysis described here, EPA does not plan to extend air toxics monitoring at this school in the near future.
2. 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. 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.

VII. Figures and Tables

A. Tables

1. Life Skills of Trumbull County – Key Pollutant Analysis.

2a. Life Skills of Trumbull County Key Pollutant Concentrations (Manganese (PM_{10}), Arsenic (PM_{10}), Lead (TSP), and Benzo(a)pyrene) and Meteorological Data.

2b. Life Skills of Trumbull County Key Pollutant Concentrations (Benzene) and Meteorological Data.

B. Figures

1. Life Skills of Trumbull County, Academy of Arts and Humanities, and the Sources of Interest.
2a. Life Skills of Trumbull County – Key Pollutant (Manganese (PM_{10}) Analysis.
2b. Life Skills of Trumbull County – Key Pollutant (Lead (TSP)) Analysis.
2c. Life Skills of Trumbull County – Key Pollutant (Benzene) Analysis.
2d. Life Skills of Trumbull County – Key Pollutant (Arsenic (PM_{10}) Analysis.
2e. Life Skills of Trumbull County – Key Pollutant (Benzo(a)pyrene) Analysis.
3a. Life Skills of Trumbull County (Warren, OH) Manganese (PM_{10}) Concentration and Wind Information.
3b. Life Skills of Trumbull County (Warren, OH) Lead (TSP) Concentration and Wind Information.
3c. Life Skills of Trumbull County (Warren, OH) Benzene Concentration and Wind Information.
3d. Life Skills of Trumbull County (Warren, OH) Arsenic (PM_{10}) Concentration and Wind Information.
3e. Life Skills of Trumbull County (Warren, OH) Benzo(a)pyrene Concentration and Wind Information.

VIII. Appendices

A. Summary Description of Long-term Comparison Levels.

B. National Air Toxics Trends Stations Measurements (2004-2008).

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

D. Life Skills of Trumbull County Pollutant Concentrations.

E. Windroses for Youngstown Municipal Airport NWS Station.

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

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	20.0 [d]	7.57 - 32.3	NA	50
Lead (TSP)	ng/m^3	8.85 [e]	5.59 - 12.1	NA	150
Benzene	µg/m^3	0.39 [g]	0.29 - 0.49	13	30
Arsenic (PM_{10})	ng/m^3	1.10 [h]	0.49 - 1.71	23	15
Benzo(a)pyrene	ng/m^3	0.455 [i]	0.279 - 0.632	57	NA

ng/m^3 nanograms per cubic meter
µg/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 10 detections that ranged from 3.09 to 50.3 ng/m^3.

[e] The mean of measurements for lead (TSP) is the average of all sample results, which include 10 detections that ranged from 2.82 to 14.6 ng/m^3.

[f] The mean of measurements for benzene is the average of all sample results, which include 8 detections that ranged from 0.23 to 0.66 µg/m^3.

[g] The mean of measurements for arsenic (PM_{10}) is the average of all sample results, which include 10 detections that ranged from 0.110 to 3.26 ng/m^3.

[h] The mean of measurements for benzo(a)pyrene is the average of all sample results, which include 10 detections that ranged from 0.179 to 0.900 ng/m^3.

Table 2a. Life Skills of Trumbull County Key Pollutant Concentrations (Manganese (PM_{10}), Arsenic (PM_{10}), Lead (TSP), and Benzo(a)pyrene) and Meteorological Data.

Parameter	Units	11/16/2010	11/22/2010	11/29/2010	12/6/2010	12/7/2010	12/9/2010	12/16/2010	12/22/2010	12/28/2010	1/3/2011	1/10/2011	1/12/2011
Manganese (PM_{10})	ng/m^3	16.9	50.3	32.8	3.09	--	12.3	12.3	4.82	7.78	48.6	10.7	--
Lead (TSP)	ng/m^3	10.3	14.6	--	--	2.93	6.44	12.8	5.67	5.85	14.4	12.7	2.8
Arsenic (PM_{10})	ng/m^3	1.73	1.02	3.26	0.11	--	0.93	1.20	0.62	0.66	0.73	0.74	--
Benzo(a)pyrene	ng/m^3	0.419	0.252	0.629	0.900	--	0.179	0.295	0.205	0.317	0.750	0.606	--
% Hours w/Wind Direction from Expected ZOI[a]	%	0.0	0.0	0.0	95.8	100	4.2	62.5	20.8	25.0	12.5	0.0	58.3
Wind Speed (avg. of hourly speeds)	mph	8.9	8.3	5.8	5.3	6.8	3.9	3.4	3.9	6.8	6.4	2.8	5.9
Wind Direction (avg. of unitized vector)[b]	degrees	195.6	158.4	268.0	173.4	3.1	345.3	223.0	215.1	61.2	98.7	195.6	158.4
% of Hours with Speed below 2 knots	%	37.5	0.0	8.3	8.3	0.0	16.7	20.8	16.7	0.0	16.7	50.0	4.2
Daily Average Temperature	˚F	44.7	60.2	23.5	20.2	14.9	25.5	21.1	25.1	16.6	0.0	0.0	0.0
Daily Precipitation	inches	0.70	0.06	0.00	0.46	0.33	0.04	0.06	0.07	0.00	0.00	0.06	0.20

ng/m^3 nanograms per cubic meter

[yellow box] 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.

Table 2b. Life Skills of Trumbull County Key Pollutant Concentrations (Benzene) and Meteorological Data.

Parameter	Units	11/29/2010	12/6/2010	12/9/2010	12/16/2010	12/28/2010	1/20/2011	1/24/2011	1/27/2011	1/31/2011	2/8/2011
Benzene	$\mu g/m^3$	0.32	0.23	0.49	0.44	0.66	0.33	0.54	0.31	0.35	0.24
% Hours w/Wind Direction from Expected ZOI[a]	%	0.0	95.8	4.2	79.2	4.2	58.3	12.5	37.5	0.0	25.0
Wind Speed (avg. of hourly speeds)	mph	9.6	6.9	5.6	3.9	5.5	6.0	4.4	5.0	5.8	6.9
Wind Direction (avg. of unitized vector)[b]	degrees	268.0	173.4	345.3	223.0	61.2	259.7	173.4	231.9	345.3	223.0
% of Hours with Speed below 2 knots	%	0.00	0.00	4.17	12.50	8.33	4.17	4.17	0.00	0.00	0.00
Daily Average Temperature	˚F	45.5	21.7	22.5	18.5	23.4	18.1	28.5	25.9	23.0	11.0
Daily Precipitation	inches	0.56	0.33	0.08	0.06	0.00	0.20	0.09	0.17	0.24	0.00

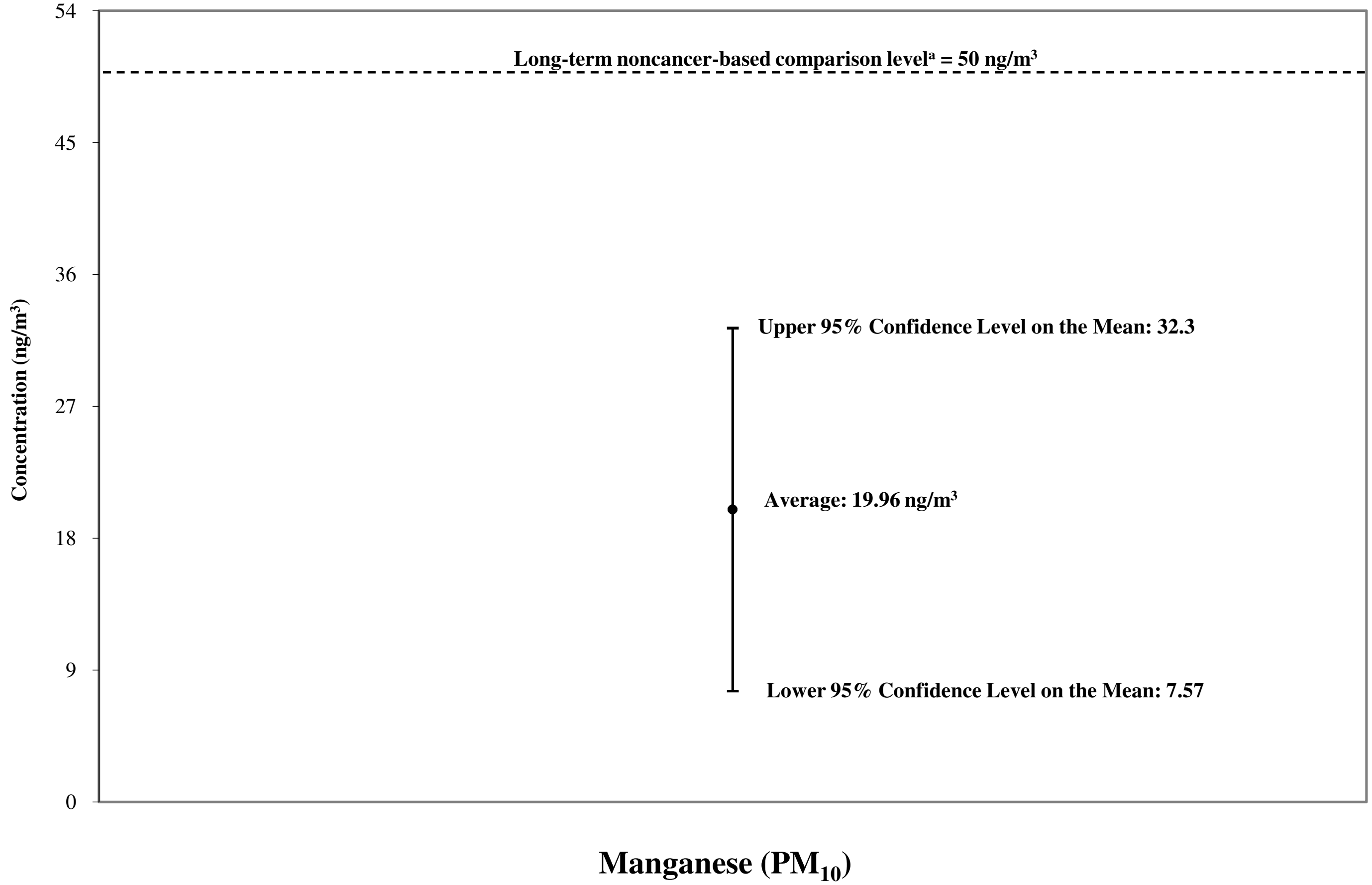
$\mu g/m^3$ micrograms per cubic meter

(yellow box) 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.

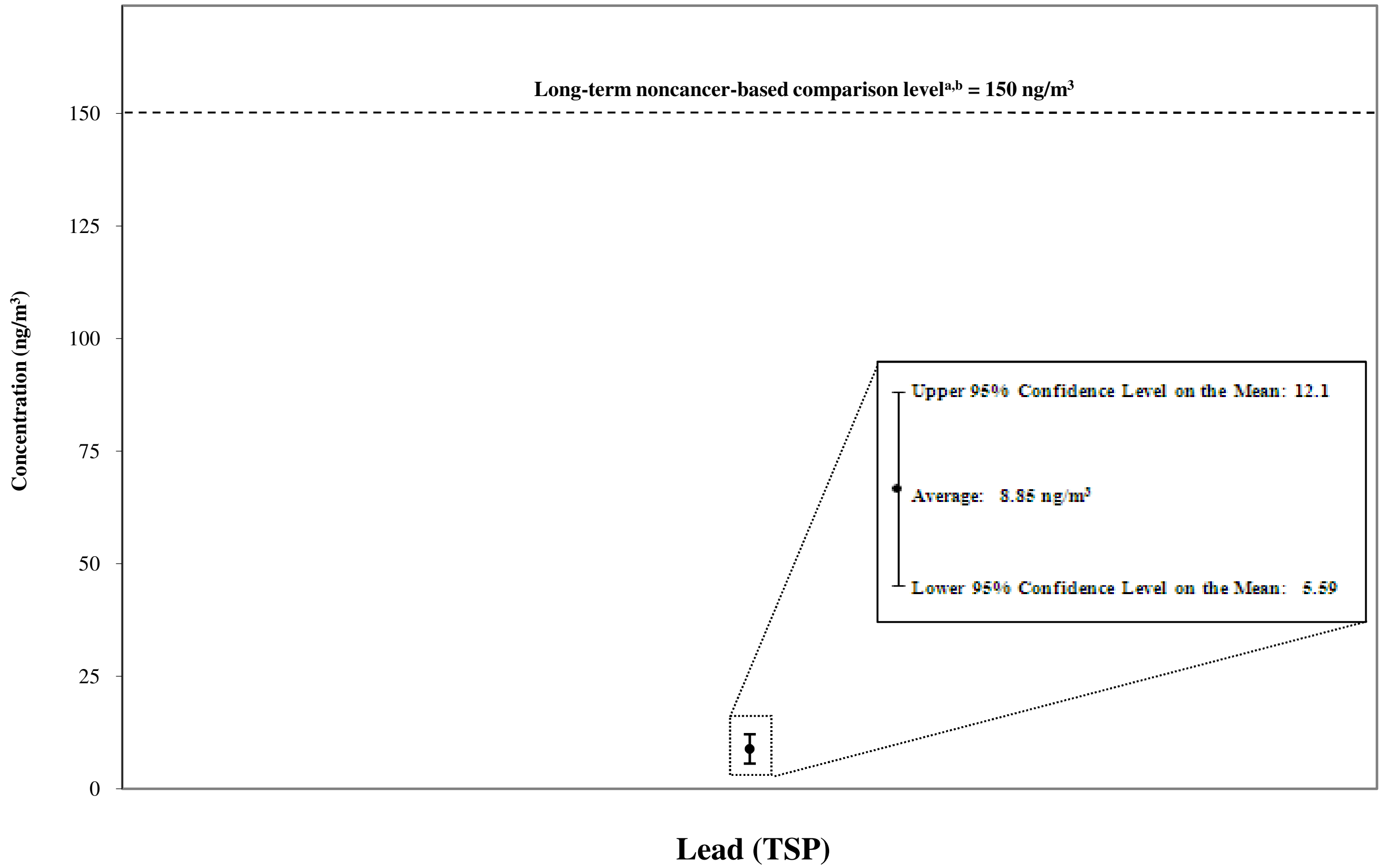
[b] Wind direction for each day is represented by values derived by scalar averaging of hourly estimates that were produced (by wind instrumentation's logger) as unitized vectors (specified as degrees from due north).

Figure 2a. Life Skills of Trumbull County - Key Pollutant (Manganese (PM_{10})) 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.

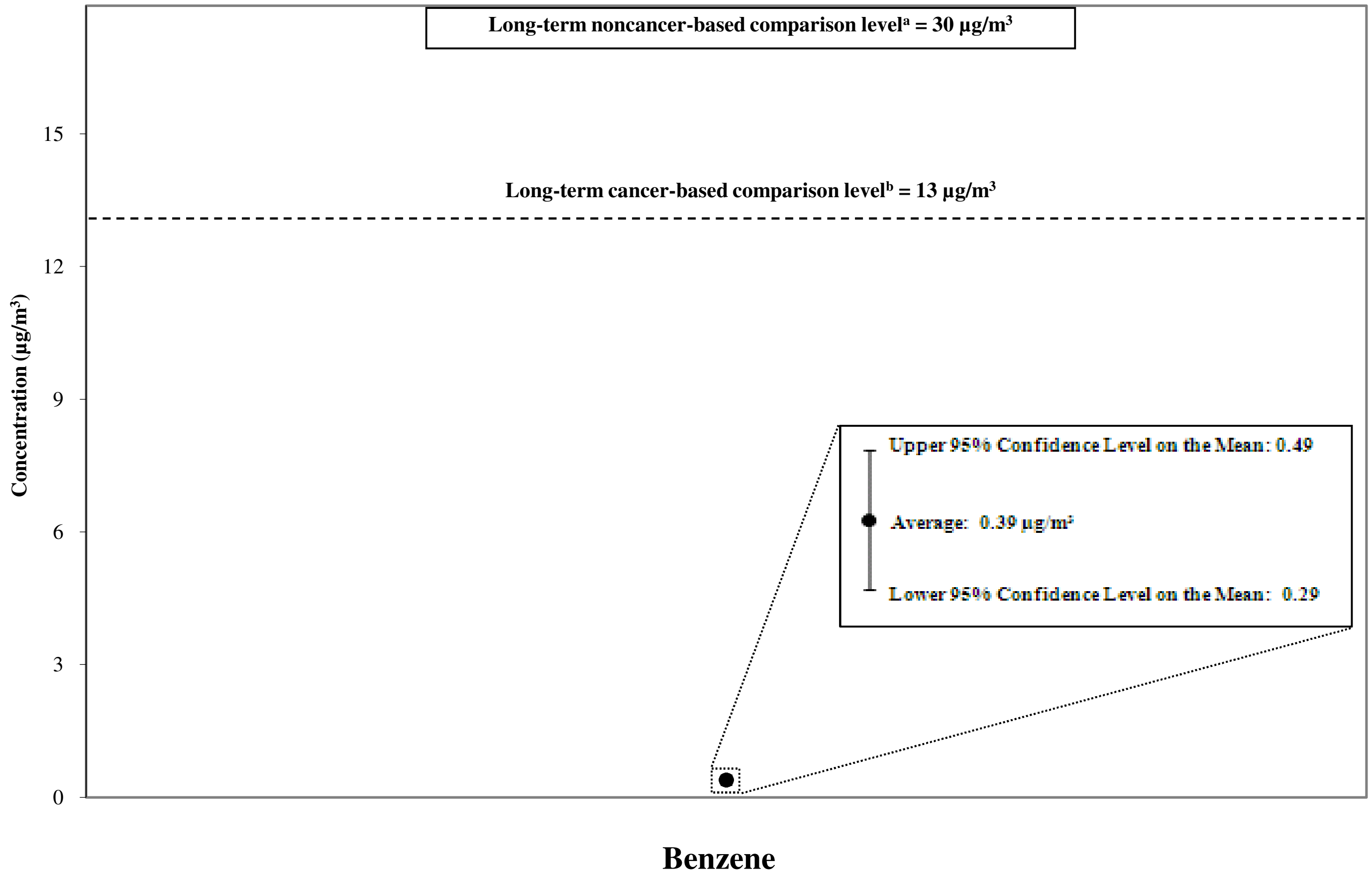
Figure 2b. Life Skills of Trumbull County - Key Pollutant (Lead (TSP)) Analysis.



[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] This comparison value for lead is the level of the national ambient air quality standard, which is in terms of a 3-month rolling average level of lead in total suspended particles.

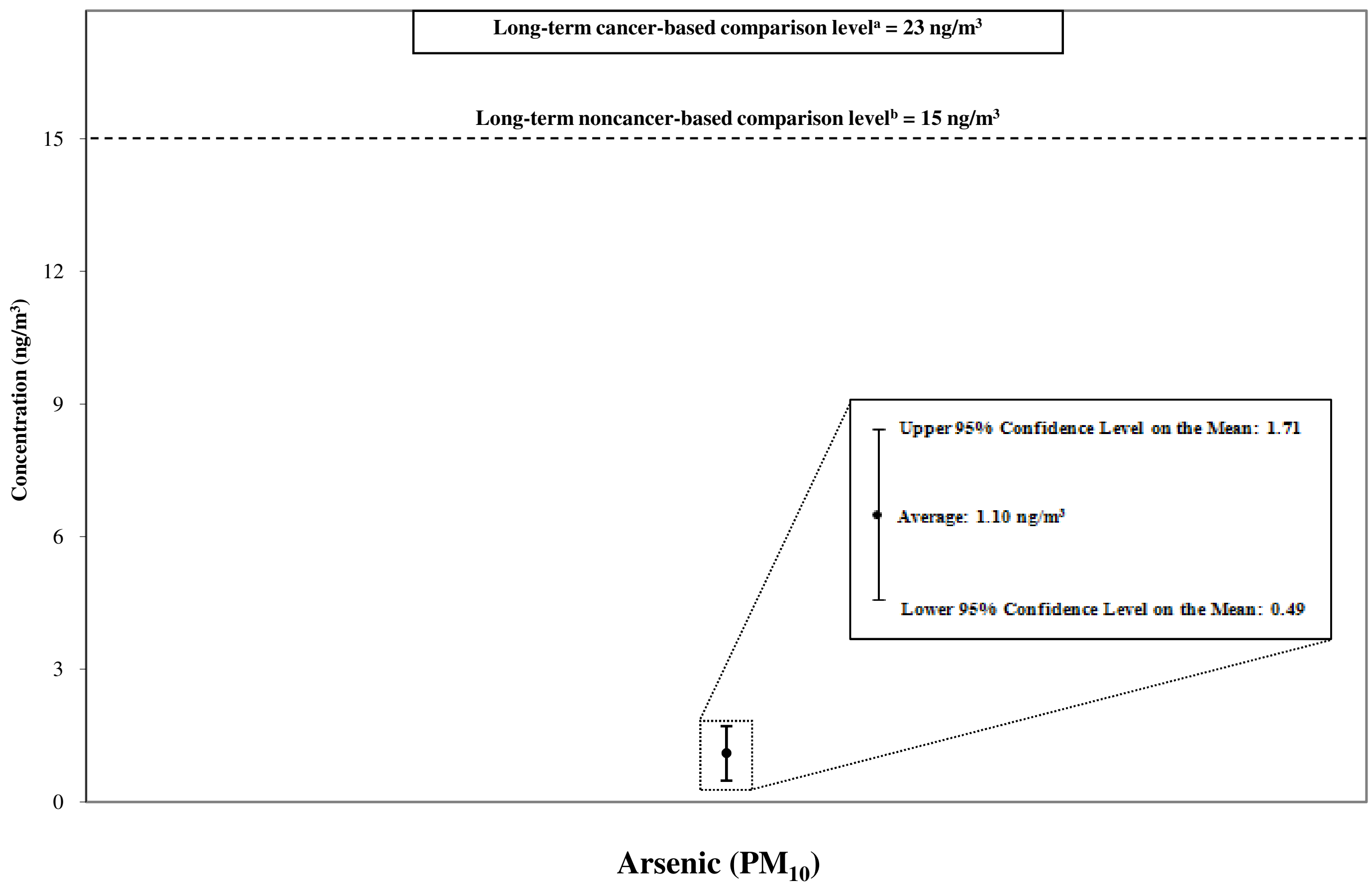
Figure 2c. Life Skills of Trumbull County - Key Pollutant (Benzene) Analysis.



[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.

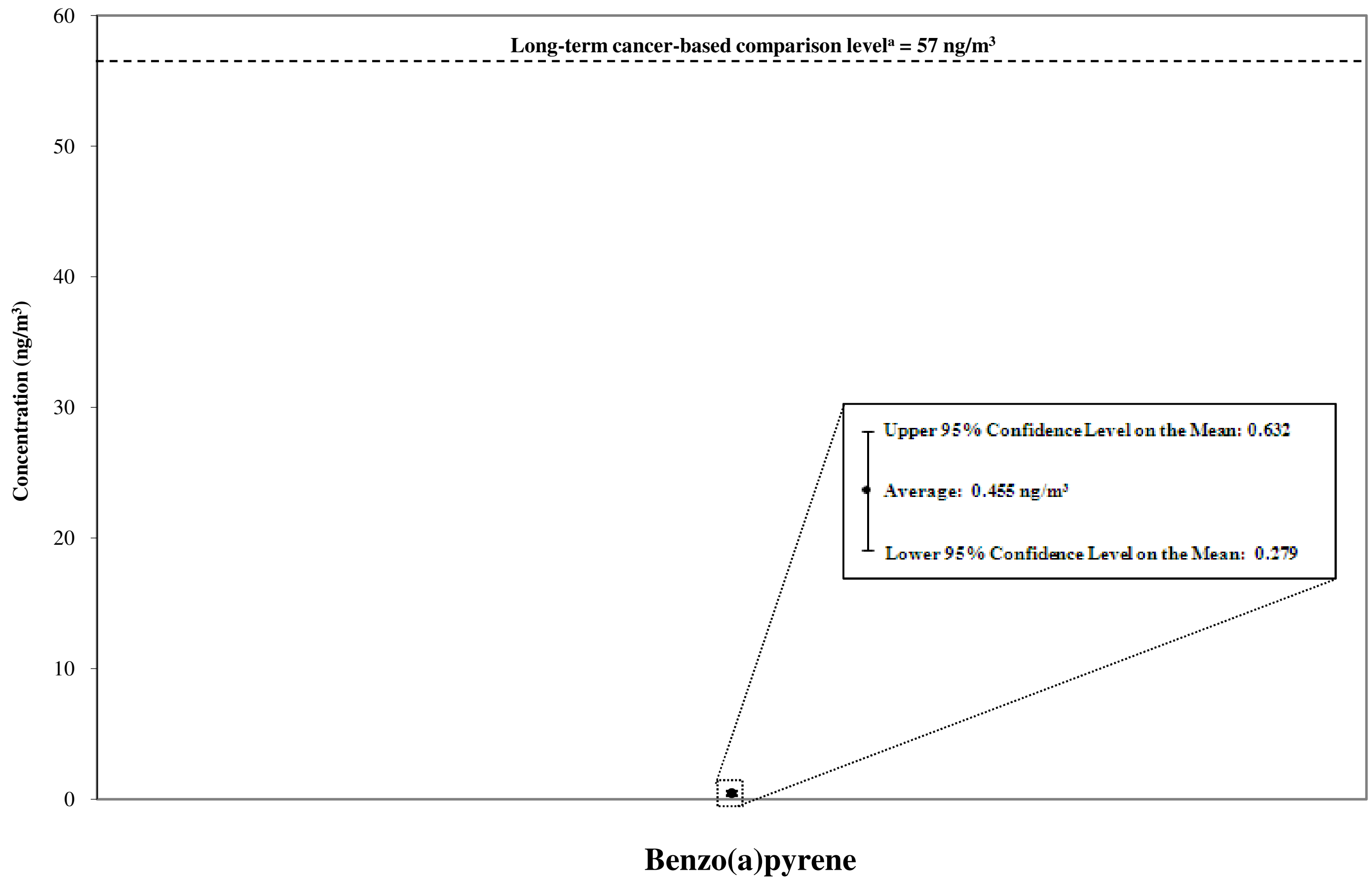
Figure 2d. Life Skills of Trumbull County - Key Pollutant (Arsenic (PM_{10})) Analysis.



[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.

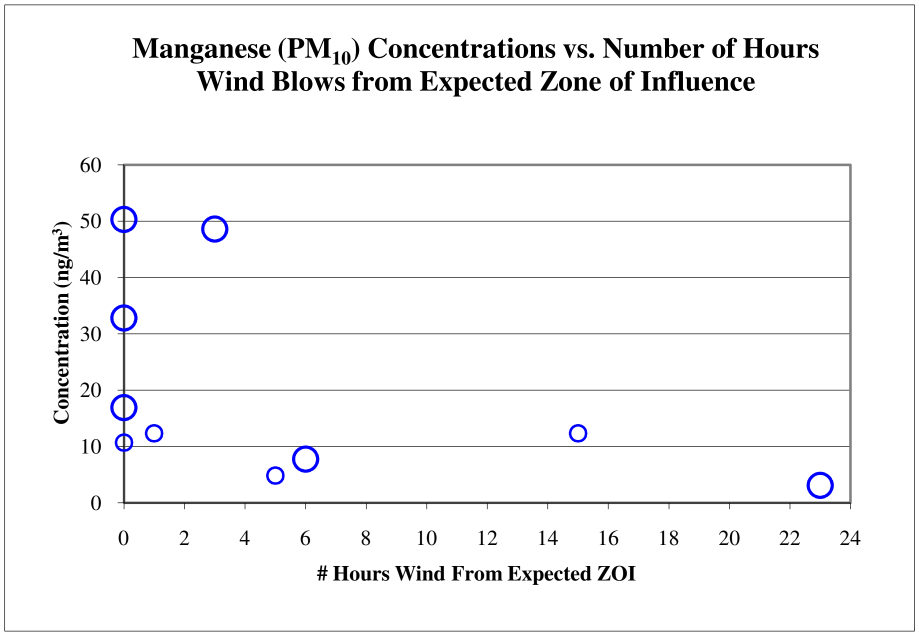
[b] Air toxics for which the upper 95% confidence limit on the mean concentration are near or below the noncancer-based comparison level are generally of low concern and will generally be considered a low priority for follow-up activity. Pollutants for which the 95% confidence limits extend appreciably 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.

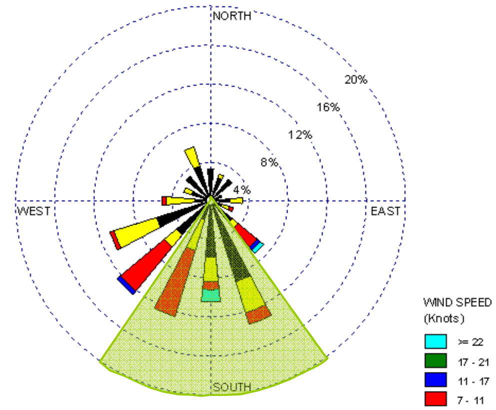
Figure 2e. Life Skills of Trumbull County - Key Pollutant (Benzo(a)pyrene) Analysis.



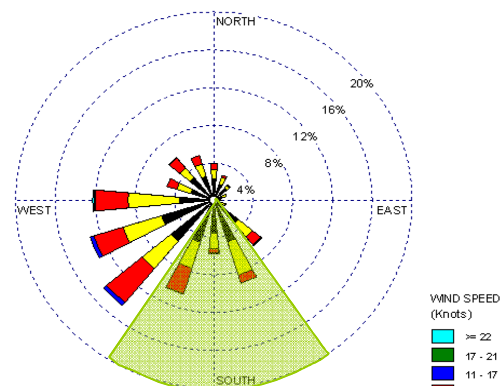
[a] Air toxics for which the upper 95% confidence limit on the mean concentration is above this cancer-based comparison level will be fully discussed in the text and may be considered a priority for potential follow-up activities, if indicated in light of the full set of information available for the 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.

Figure 3a. Life Skills of Trumbull County (Warren, OH) Manganese (PM_{10}) Concentration and Wind Information.





Life Skills of Trumbull County Composite Hourly Windrose on Sample Days (Nov. 16, 2010 - Jan. 10, 2011)



Life Skills of Trumbull County Composite Hourly Windrose Across Sampling Period (Nov. 16, 2010 -Feb. 8, 2011)

Expected Zone of Source Influence

KEY

Pollutant: Manganese (PM_{10})
Timeframe: November 16, 2010 - February 8, 2011

Wind Speed: 0.1-2.5 mph

Wind Speed: 2.5-5.0 mph

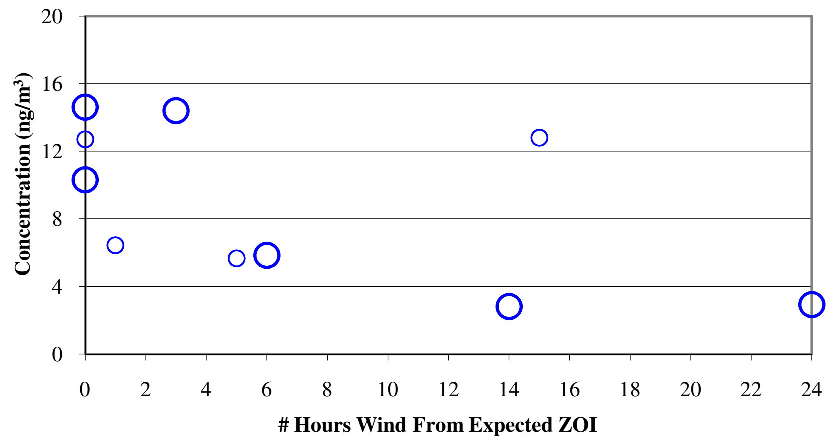
Wind Speed: > 5.0 mph

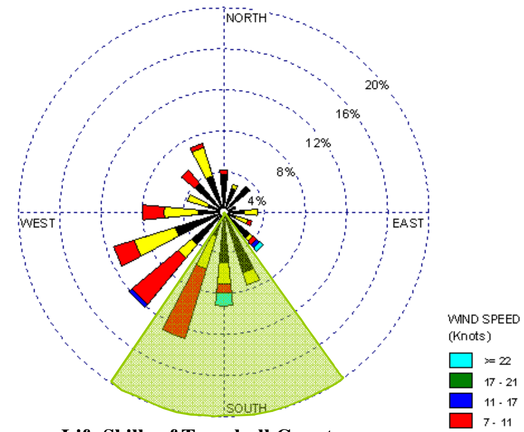
<u>Note</u>

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 2a). 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.

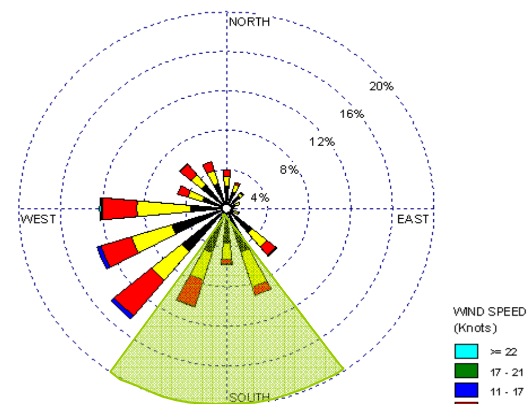
Figure 3b. Life Skills of Trumbull County (Warren, OH) Lead (TSP) Concentration and Wind Information.

Lead (TSP) Concentrations vs. Number of Hours Wind Blows from Expected Zone of Influence





Life Skills of Trumbull County Composite Hourly Windrose on Sample Days (Nov. 16, 2010 - Jan. 10, 2011)



Life Skills of Trumbull County Composite Hourly Windrose Across Sampling Period (Nov. 16, 2010 -Feb. 8, 2011)

Expected Zone of Source Influence

KEY

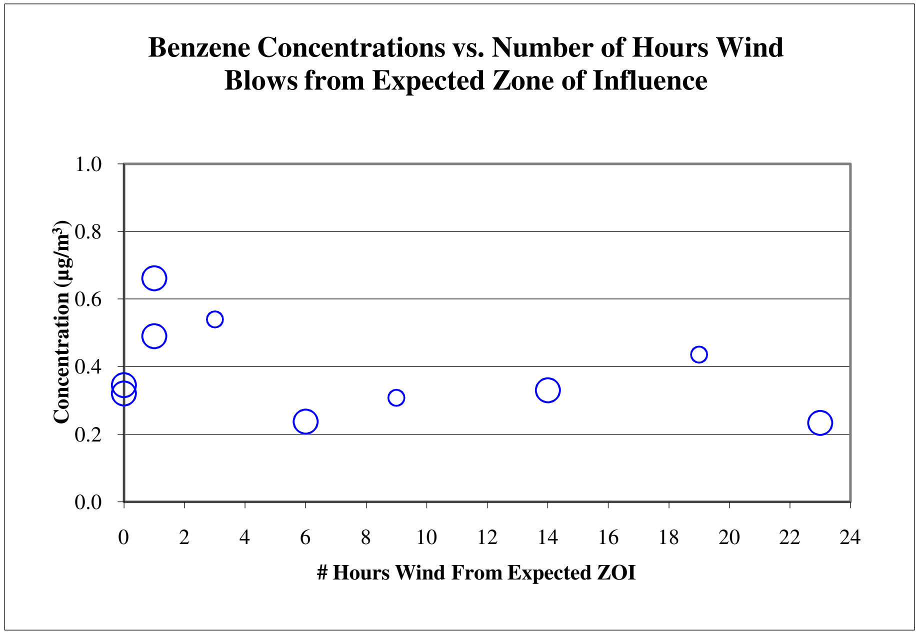
Pollutant: **Lead (TSP)**
Timeframe: November 16, 2010 - February 8, 2011

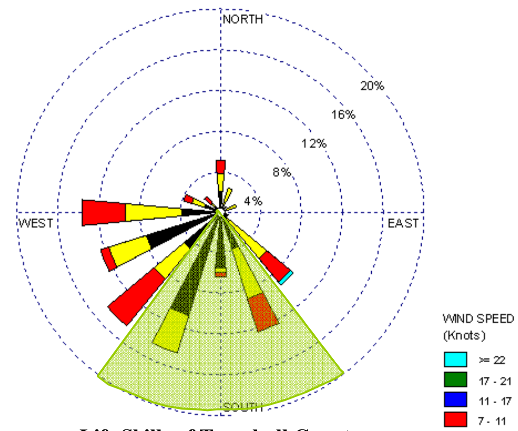
Wind Speed: 0.1-2.5 mph
Wind Speed: 2.5-5.0 mph
Wind Speed: > 5.0 mph

Note

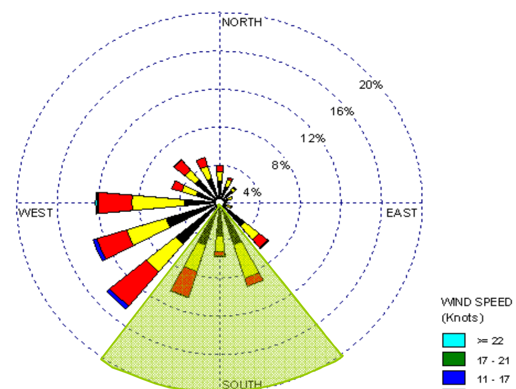
Each circle denotes a 24-hour collection of air for chemical analysis. The size of the circle indicates the magnitude of the wind speed for that day (wind data shown in Table 2a). The expected zone of source influence is a rough approximation of the range of directions from which winds carrying chemicals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

Figure 3c. Life Skills of Trumbull County (Warren, OH) Benzene Concentration and Wind Information.





Life Skills of Trumbull County Composite Hourly Windrose on Sample Days (Nov. 29, 2010 - Feb. 8, 2011)



Life Skills of Trumbull County Composite Hourly Windrose Across Sampling Period (Nov. 16, 2010 -Feb. 8, 2011)

Expected Zone of Source Influence

KEY

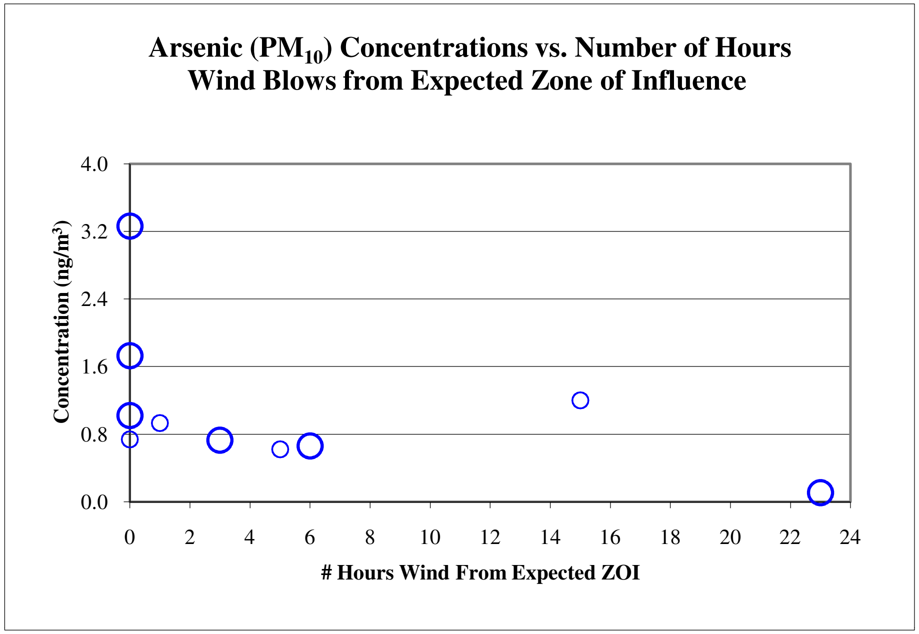
Pollutant: Benzene
Timeframe: November 16, 2010 - February 8, 2011

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 2b). 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.

Figure 3d. Life Skills of Trumbull County (Warren, OH) Arsenic (PM_{10}) Concentration and Wind Information.



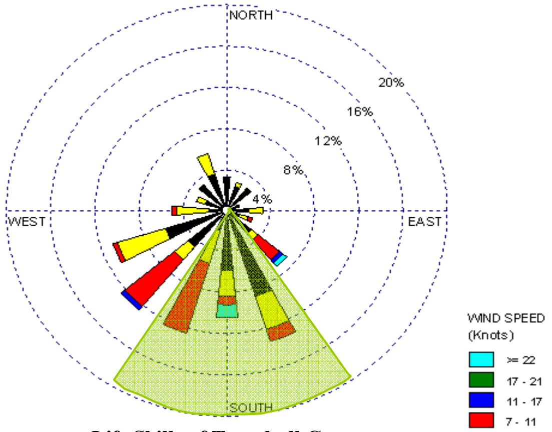
KEY

Pollutant: Arsenic (PM_{10})
Timeframe: November 16, 2010 - February 8, 2011

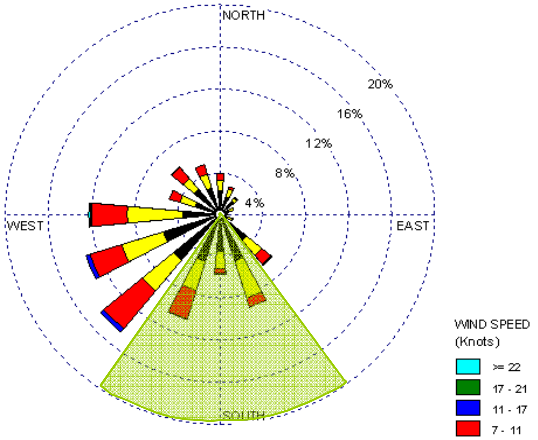
Wind Speed: 0.1-2.5 mph
Wind Speed: 2.5-5.0 mph
Wind Speed: > 5.0 mph

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 2a). 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.



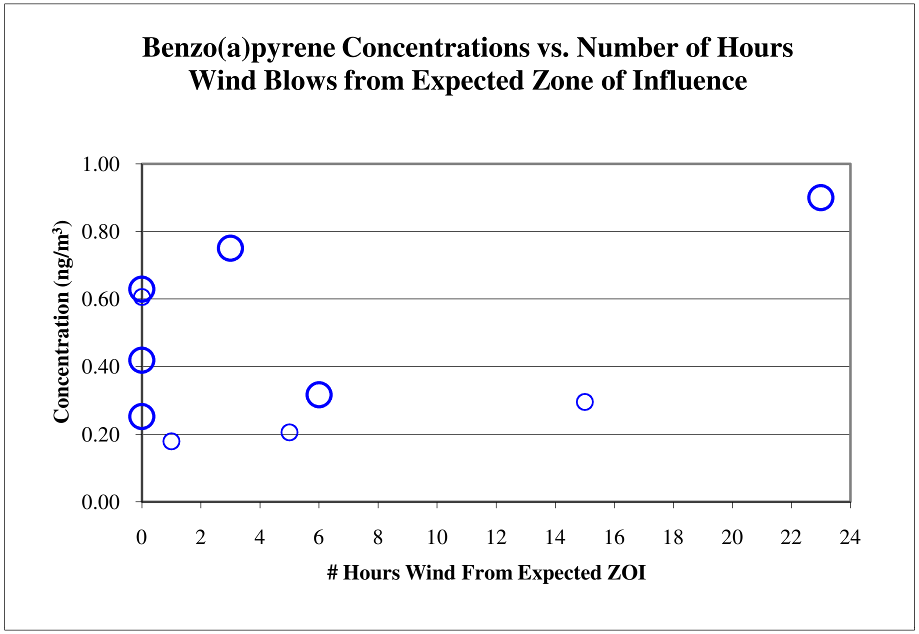
Life Skills of Trumbull County Composite Hourly Windrose on Sample Days (Nov. 16, 2010 - Jan. 10, 2011)

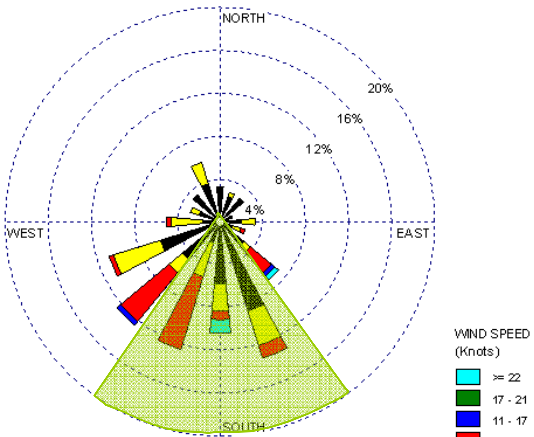


Life Skills of Trumbull County Composite Hourly Windrose Across Sampling Period (Nov. 16, 2010 -Feb. 8, 2011)

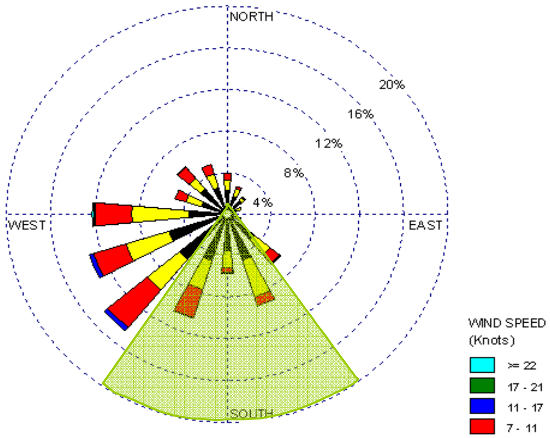
Expected Zone of Source Influence

Figure 3e. Life Skills of Trumbull County (Warren, OH) Benzo(a)pyrene Concentration and Wind Information.





Life Skills of Trumbll County Composite Hourly Windrose on Sample Days (Nov. 16, 2010 -Jan. 10, 2011)



Life Skills of Trumbull County Composite Hourly Windrose Across Sampling Period (Nov. 16, 2010 -Feb. 8, 2011)

Expected Zone of Source Influence

KEY

Pollutant: Benzo(a)pyrene
Timeframe: November 16, 2010 - February 8, 2011

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 2a). 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.[25]

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.[26] 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.

[25] These comparison levels are described in more detail *Schools Air Toxics Monitoring Activity (2009), Uses of Health Effects Information in Evaluating Sample Results*.
[26] 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.[27] 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.

[27] 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 (2004-2008).[a]

Pollutant	Units	# Samples Analyzed	% Detections	Maximum	Arithmetic Mean[b]	Geometric Mean	5th Percentile	25th Percentile	50th Percentile	75th Percentile	95th Percentile
Antimony (PM_{10})	ng/m^3	2,372	94%	43.30	1.71	1.21	ND	0.60	1.13	2.17	4.33
Arsenic (PM_{10})	ng/m^3	5,076	86%	47.70	0.93	0.70	ND	0.29	0.56	1.02	2.89
Beryllium (PM_{10})	ng/m^3	4,771	64%	1.97	0.05	0.02	ND	ND	<0.01	0.02	0.50
Cadmium (PM_{10})	ng/m^3	4,793	85%	15.30	0.27	0.17	ND	0.05	0.13	0.29	0.94
Chromium (PM_{10})	ng/m^3	5,094	92%	172.06	2.71	1.66	ND	0.93	1.98	2.85	7.10
Cobalt (PM_{10})	ng/m^3	2,614	91%	20.30	0.28	0.18	ND	0.08	0.15	0.27	1.00
Manganese (PM_{10})	ng/m^3	4,793	99%	734.00	10.39	5.20	<0.01	2.41	4.49	9.96	33.78
Mercury (PM_{10})	ng/m^3	1,167	81%	2.07	0.07	0.04	ND	0.01	0.02	0.06	0.32
Nickel (PM_{10})	ng/m^3	4,815	90%	110.10	2.05	1.49	ND	0.74	1.44	2.50	5.74
Selenium (PM_{10})	ng/m^3	2,382	96%	13.00	1.10	0.53	<0.01	0.24	0.53	1.07	5.50
Acetonitrile	µg/m^3	1,804	69%	542.30	3.55	0.72	ND	ND	0.27	0.76	8.60
Acrylonitrile	µg/m^3	3,673	31%	5.51	0.06	0.10	ND	ND	ND	0.03	0.33
Benzene	µg/m^3	6,313	94%	10.19	1.03	0.84	ND	0.48	0.80	1.31	2.81
Benzyl chloride	µg/m^3	3,046	9%	2.49	0.01	0.05	ND	ND	ND	ND	0.05
Bromoform	µg/m^3	2,946	4%	1.18	0.01	0.16	ND	ND	ND	ND	ND
Bromomethane	µg/m^3	5,376	61%	120.76	0.11	0.05	ND	ND	0.03	0.05	0.12
Butadiene, 1,3-	µg/m^3	6,427	67%	15.55	0.10	0.09	ND	ND	0.05	0.13	0.38
Carbon disulfide	µg/m^3	1,925	91%	46.71	2.32	0.25	ND	0.03	0.09	0.96	12.65
Carbon tetrachloride	µg/m^3	6,218	86%	1.76	0.52	0.58	ND	0.47	0.57	0.65	0.87
Chlorobenzene	µg/m^3	5,763	30%	1.10	0.02	0.04	ND	ND	ND	0.01	0.11
Chloroethane	µg/m^3	4,625	37%	0.58	0.02	0.04	ND	ND	ND	0.03	0.08
Chloroform	µg/m^3	6,432	73%	48.05	0.17	0.14	ND	ND	0.10	0.17	0.61
Chloromethane	µg/m^3	5,573	95%	19.70	1.17	1.20	ND	1.03	1.18	1.36	1.68
Chloroprene	µg/m^3	2,341	11%	0.17	<0.01	0.03	ND	ND	ND	ND	0.02
Dichlorobenzene, *p*-	µg/m^3	5,409	60%	13.65	0.19	0.16	ND	ND	ND	0.18	0.90
Dichloroethane, 1,1-	µg/m^3	5,670	16%	0.36	0.01	0.02	ND	ND	ND	ND	0.02
Dichloroethylene, 1,1-	µg/m^3	5,480	19%	0.44	0.01	0.02	ND	ND	ND	ND	0.04
Dichloromethane	µg/m^3	6,206	82%	214.67	0.59	0.34	ND	0.14	0.28	0.49	1.35

Appendix B. National Air Toxics Trends Stations Measurements (2004-2008).[a]

Pollutant	Units	# Samples Analyzed	% Detections	Maximum	Arithmetic Mean[b]	Geometric Mean	5th Percentile	25th Percentile	50th Percentile	75th Percentile	95th Percentile
Dichloropropane,1,2-	µg/m^3	6,225	17%	1.80	0.01	0.03	ND	ND	ND	ND	0.04
Dichloropropylene, *cis* -1,3-	µg/m^3	4,705	18%	0.80	0.01	0.05	ND	ND	ND	ND	0.11
Dichloropropylene, *trans* -1,3-	µg/m^3	4,678	18%	1.13	0.02	0.05	ND	ND	ND	ND	0.11
Ethyl acrylate	µg/m^3	1,917	1%	0.08	<0.01	0.04	ND	ND	ND	ND	ND
Ethylbenzene	µg/m^3	6,120	84%	8.84	0.42	0.32	ND	0.10	0.29	0.53	1.33
Ethylene dibromide	µg/m^3	5,646	19%	4.15	0.01	0.05	ND	ND	ND	ND	0.05
Ethylene dichloride	µg/m^3	6,143	38%	4.49	0.03	0.05	ND	ND	ND	0.04	0.09
Hexachlorobutadiene	µg/m^3	3,727	20%	0.97	0.03	0.10	ND	ND	ND	ND	0.18
Methyl chloroform	µg/m^3	5,944	73%	3.17	0.09	0.10	ND	ND	0.08	0.11	0.20
Methyl isobutyl ketone	µg/m^3	2,936	60%	2.95	0.11	0.09	ND	ND	0.02	0.12	0.49
Methyl methacrylate	µg/m^3	1,917	9%	14.05	0.13	0.49	ND	ND	ND	ND	0.53
Methyl *tert-* butyl ether	µg/m^3	4,370	41%	20.50	0.28	0.12	ND	ND	ND	0.04	1.53
Styrene	µg/m^3	6,080	70%	27.22	0.16	0.11	ND	ND	0.05	0.16	0.60
Tetrachloroethane, 1,1,2,2-	µg/m^3	5,952	20%	2.47	0.02	0.04	ND	ND	ND	ND	0.07
Tetrachloroethylene	µg/m^3	6,423	71%	42.12	0.28	0.20	ND	ND	0.13	0.27	0.88
Toluene	µg/m^3	5,947	95%	482.53	2.46	1.54	0.01	0.70	1.51	3.05	7.42
Trichlorobenzene, 1,2,4-	µg/m^3	4,301	21%	45.27	0.07	0.10	ND	ND	ND	ND	0.16
Trichloroethane,1,1,2-	µg/m^3	5,210	19%	5.89	0.01	0.04	ND	ND	ND	ND	0.05
Trichloroethylene	µg/m^3	6,410	46%	6.50	0.05	0.07	ND	ND	ND	0.05	0.22
Vinyl chloride	µg/m^3	6,284	18%	1.61	0.01	0.02	ND	ND	ND	ND	0.03
Xylene, *m/p-*	µg/m^3	4,260	90%	21.41	1.12	0.71	ND	0.26	0.69	1.43	3.65
Xylene, *o-*	µg/m^3	6,108	83%	9.21	0.41	0.30	ND	0.09	0.24	0.52	1.39
Benzo(a)anthracene (total tsp & vapor)	ng/m^3	1,122	73%	2.56	0.10	0.07	ND	ND	0.04	0.10	0.35
Benzo(a)pyrene (total tsp & vapor)	ng/m^3	1,111	58%	2.64	0.09	0.09	ND	ND	0.03	0.10	0.34
Benzo(b)fluoranthene	ng/m^3	1,110	86%	4.63	0.19	0.13	ND	0.04	0.10	0.21	0.67
Benzo(k)fluoranthene	ng/m^3	1,122	67%	1.28	0.05	0.05	ND	ND	0.02	0.06	0.20
Chrysene (total tsp & vapor)	ng/m^3	1,117	92%	3.85	0.22	0.15	ND	0.07	0.13	0.25	0.70
Dibenz(a,h)anthracene	ng/m^3	69	4%	0.08	<0.01	0.08	ND	ND	ND	ND	ND
Indeno(1,2,3-cd)pyrene	ng/m^3	69	51%	0.55	0.06	0.08	ND	ND	0.02	0.07	0.30

Appendix B. National Air Toxics Trends Stations Measurements (2004-2008).[a]

Pollutant	Units	# Samples Analyzed	% Detections	Maximum	Arithmetic Mean[b]	Geometric Mean	5th Percentile	25th Percentile	50th Percentile	75th Percentile	95th Percentile
Naphthalene (total tsp & vapor)	µg/m^3	1,099	100%	0.54	0.08	0.05	<0.01	0.03	0.06	0.10	0.20

Key Pollutant

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 2004 through 2008. These data were extracted from AQS in summer 2008 and 2009. During the time period of interest, there were 28 sites measuring VOCs, carbonyls, metals, 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 2004. 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 School and Multiple-pollutant Considerations.

At each school, monitoring has been targeted to get information on a limited set of key hazardous air pollutants (HAPs).[28] 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).

Other Air Toxics (HAPs)

- Do the monitoring data indicate elevated levels of any other air toxics or hazardous air pollutant (HAPs) that pose significant long-term health concerns?
  - → The longer-term concentration estimates for the other HAPs monitored are below their long-term comparison levels.
    - ▪ Further, for pollutants with cancer-based comparison levels, the longer-term concentration estimates for all but one of these (chromium) are more than 10-fold lower and all but four (also naphthalene, cadmium, and 1,3-butadiene) are more than 100-fold lower.[29]
  - → 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.[30]

Additional Information on Four HAPs:

- ▪ The first HAP mentioned above is chromium. The comparison values for chromium 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 below even these very restrictive comparison values. The mean and 95 percent upper bound on the mean for chromium (PM_{10}) are approximately 55-63% of the cancer-based comparison level. As Cr^{+6} is

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[28] 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.

[29] 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.

[30] 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.*

commonly only a small fraction of chromium (PM_{10}),[31] the levels of Cr^{+6} in these samples would be expected to be appreciably lower than this. A review of information available at other sites nationally shows that the mean concentration of chromium (PM_{10}) at this site is between the 75th and 95th percentile of samples collected from 2004 to 2008 (the most recently compiled period) at the NATTS sites (Appendix B).

- The second HAP mentioned above is naphthalene. The mean and 95 percent upper bound on the mean for naphthalene are approximately 5-6% of the cancer-based comparison level. A review of information available at other sites nationally shows that the mean concentration of naphthalene at this site is between the 75th and 95th percentile of samples collected from 2004 to 2008 (the most recently compiled period) at the NATTS sites (Appendix B).

- The third HAP mentioned above is cadmium. The mean and 95 percent upper bound on the mean for cadmium (PM_{10}) 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}) is between the 75th and 95th percentile of samples collected from 2004 to 2008 (the most recently compiled period) at the NATTS sites (Appendix B).

- The fourth HAP mentioned above is 1,3-butadiene. The mean and 95 percent upper bound on the mean for 1,3-butadiene are approximately 2% of the cancer-based comparison level. A review of information available at other sites nationally shows that the mean concentration of 1,3-butadiene at this site is between the 50th and 75th percentile of samples collected from 2004 to 2008 (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.[32]

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.

[31] Data in EPA's Air Quality System for locations that are not near a facility emitting hexavalent chromium indicate hexavalent chromium concentrations to comprise less than approximately 10% of total chromium concentrations.
[32] General information on additional air pollutants is available at http://www.epa.gov/air/airpollutants.html.

- 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)?

  → Although the multiple air toxics monitored at this site were below the levels of significant concern for multipollutant cumulative risk that had been suggested by the modeling information, these results do indicate the influence of multiple pollutants of concern that are the focus of EPA actions nationwide. Although the multiple air toxics monitored at this site were below the levels of significant concern that had been suggested by the modeling information (Appendix C), 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.

  - In addition to the key pollutants manganese and arsenic, the only other HAP monitored whose longer-term concentration estimates is more than ten percent of its lowest comparison level is chromium. These various HAPs pose risk to differing targets in the body, reducing the potential for cumulative impact.

    - The lowest comparison level for manganese is based on non-carcinogenic effects to the central nervous system, while the lowest comparison level for arsenic is based on effects considering several endpoints including development.

    - The long-term concentration estimate for chromium (PM_{10}) is also more than ten percent of its lowest comparison level. The lowest comparison level for chromium is based on carcinogenic risk to the respiratory system posed by hexavalent chromium,[33] and, as noted in the Other Air Toxics section above, hexavalent chromium is commonly a small fraction of the total chromium reported in the ambient air.

[33] The noncancer-based comparison level for 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. Life Skills of Trumbull County - 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	4.63	0.28 - 5.28	8.3	100 [e]
Non-Key HAPs with mean less than 10% of the lowest comparison level					
Naphthalene	$\mu g/m^3$	0.13	0.09 - 0.17	2.9	3
Cadmium (PM_{10})	ng/m^3	0.37	0.16 - 0.58	56	10
Butadiene, 1,3-	$\mu g/m^3$	0.06	0.045 - 0.069	3.3	2
Nickel (PM_{10})	ng/m^3	1.03	0.40 - 1.66	420	90
Antimony (PM_{10})	ng/m^3	1.53	0.75 - 2.32	NA	200
Chloromethane	$\mu g/m^3$	0.55	0.52 - 0.58	NA	90
Carbon Tetrachloride	$\mu g/m^3$	0.096	0.084 - 0.108	17	100
Xylene, *m/p-*	$\mu g/m^3$	0.20	0.15 - 0.26	NA	100
Tetrachloroethylene	$\mu g/m^3$	0.03	0.02 - 0.04	17	270
Benzo (b) fluoranthene	ng/m^3	1.07	0.76 - 1.39	570	NA
Ethylbenzene	$\mu g/m^3$	0.073	0.056 - 0.09	40	1,000
Bromomethane	$\mu g/m^3$	0.009	0.006 - 0.012	NA	5
Acetonitrile	$\mu g/m^3$	0.098	0.071 - 0.124	NA	60
Dichlorobenzene, *p-*	$\mu g/m^3$	0.01	0.004 - 0.014	9.1	800
Indeno(1,2,3-cd)pyrene	ng/m^3	0.51	0.34 - 0.69	570	NA
Xylene, *o-*	$\mu g/m^3$	0.08	0.06 - 0.10	NA	100
Benzo (a) anthracene	ng/m^3	0.43	0.26 - 0.60	570	NA
Cobalt (PM_{10})	ng/m^3	0.07	0.04 - 0.10	NA	100
Dichloromethane	$\mu g/m^3$	0.13	0.10 - 0.16	210	1,000
Benzo (k) fluoranthene	ng/m^3	0.31	0.20 - 0.42	570	NA
Beryllium (PM_{10})	ng/m^3	0.009	0.002 - 0.017	42	20
Chloroform	$\mu g/m^3$	0.017	0.015 - 0.020	NA	98
Chrysene	ng/m^3	0.89	0.64 - 1.14	5700	NA
Mercury (PM_{10})	ng/m^3	0.03	0.01 - 0.05	NA	300 [f]
Toluene	$\mu g/m^3$	0.47	0.36 - 0.58	NA	5,000
Selenium (PM_{10})	ng/m^3	1.34	0.32 - 2.35	NA	20,000
Carbon Disulfide	$\mu g/m^3$	0.017	0.013 - 0.022	NA	700
Styrene	$\mu g/m^3$	0.02	0.01 - 0.03	NA	1,000
Methyl isobutyl ketone	$\mu g/m^3$	0.03	0.01 - 0.06	NA	3,000
Methyl Chloroform	$\mu g/m^3$	0.008	0.006 - 0.01	NA	5,000
Dibenz (a,h) anthracene	ng/m^3	0.05 [g]	0.01 - 0.09	52	NA
Non-Key HAPs with more than 50% ND Results					
Ethylene dichloride	$\mu g/m^3$	89% of the results were ND[h]		3.8	2,400
Trichloroethylene	$\mu g/m^3$	89% of the results were ND[i]		50	600
Chloroethane	$\mu g/m^3$	89% of the results were ND[j]		NA	10,000
No other HAPs were detected in any other samples.					

ng/m^3 nanograms per cubic meter

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

Table C-1. Life Skills of Trumbull County - Other Monitored Pollutant Analysis.

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 in Evaluating Sample Results.

[c] 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.

[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] 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).

[g] Dibenz(a,h)anthracene was detected in 4 out of 8 samples, ranging from 0.04 to 0.14 µg/m^3. The MDL is 0.035 ng/m^3

[h] Ethylene dichloride was detected in only 1 of 9 samples, with a result of 0.01 µg/m^3. The MDL is 0.012 µg/m^3.

[i] Trichloroethylene was detected in only 1 of 9 samples, with a result of 0.01 µg/m^3. The MDL is 0.015 µg/m^3.

[j] Chloroethane was detected in only 1 of 9 samples, with a result of 0.01 µg/m^3. The MDL is 0.011 µg/m^3.

Appendix D. Life Skills of Trumbull County Pollutant Concentrations.

Parameter	Units	11/16/2010	11/22/2010	11/29/2010	12/6/2010	12/7/2010	12/9/2010	12/16/2010	12/22/2010	12/28/2010	1/3/2011	1/10/2011	1/12/2011	1/20/2011	1/24/2011	1/27/2011	1/31/2011	2/8/2011	Sample Screening Level[a]
Manganese (PM_{10})	$\mu g/m^3$	16.9	50.3	32.8	3.09	--	12.3	12.3	4.82	7.78	48.6	10.7	--	--	--	--	--	--	500
Lead (TSP)	ng/m^3	10.3	14.6	--	--	2.93	6.44	12.8	5.67	5.85	14.4	12.7	2.82	--	--	--	--	--	150
Benzene	ng/m^3	--	--	0.32	0.23	--	0.49	0.44	--	0.66	--	--	--	0.33	0.54	0.31	0.35	0.24	30
Arsenic (PM_{10})	ng/m^3	1.73	1.02	3.26	0.11	--	0.93	1.20	0.62	0.66	0.73	0.74	--	--	--	--	--	--	150
Benzo(a)pyrene	ng/m^3	0.419	0.252	0.629	0.900	--	0.179	0.295	0.205	0.317	0.750	0.606	--	--	--	--	--	--	6,400
Chromium (PM_{10})	ng/m^3	5.38	5.06	6.03	3.20	--	4.02	4.57	4.22	4.65	5.68	3.50	--	--	--	--	--	--	580[b]
Naphthalene	$\mu g/m^3$	0.25	0.09	0.17	0.05	--	0.13	0.15	0.08	0.07	0.11	0.20	--	--	--	--	--	--	30
Cadmium (PM_{10})	ng/m^3	0.41	0.97	0.55	0.05	--	0.27	0.75	0.14	0.20	0.13	0.23	--	--	--	--	--	--	30
Butadiene, 1,3-	$\mu g/m^3$	--	--	0.04	0.04	--	0.07	0.08	--	0.06	--	--	--	0.06	0.08	0.05	0.05	0.03	20
Nickel (PM_{10})	ng/m^3	1.03	0.71	3.26	0.41	--	1.78	1.14	0.41	0.37	0.69	0.49	--	--	--	--	--	--	200
Antimony (PM_{10})	ng/m^3	4.23	1.63	2.28	0.24	--	1.15	1.67	0.48	1.19	1.08	1.38	--	--	--	--	--	--	2,000
Chloromethane	$\mu g/m^3$	--	--	0.60	0.47	--	0.54	0.58	--	0.58	--	--	--	0.60	0.58	0.53	0.56	0.49	1,000
Carbon Tetrachloride	$\mu g/m^3$	--	--	0.11	0.09	--	0.10	0.09	--	0.13	--	--	--	0.10	0.11	0.07	0.10	0.07	200
Xylene, *m/p-*	$\mu g/m^3$	--	--	0.16	0.15	--	0.23	0.30	--	0.22	--	--	--	0.23	0.34	0.11	0.17	0.14	9,000
Tetrachloroethylene	$\mu g/m^3$	--	--	0.05	0.02	--	0.04	0.05	--	0.03	--	--	--	0.03	0.04	0.02	0.04	0.02	1,400
Benzo (b) fluoranthene	ng/m^3	1.12	0.64	1.69	1.45	--	0.47	0.78	0.66	0.86	1.67	1.38	--	--	--	--	--	--	64,000
Ethylbenzene	$\mu g/m^3$	--	--	0.06	0.05	--	0.09	0.11	--	0.08	--	--	--	0.08	0.11	0.05	0.07	0.05	40,000
Bromomethane	$\mu g/m^3$	--	--	ND	0.01	--	0.010	0.009	--	0.010	--	--	--	0.009	0.012	0.010	0.008	0.008	200
Acetonitrile	$\mu g/m^3$	--	--	0.08	0.07	--	0.14	0.10	--	0.11	--	--	--	0.07	0.10	0.18	0.07	0.06	600
Dichlorobenzene, *p-*	$\mu g/m^3$	--	--	ND	0.01	--	0.01	0.02	--	0.02	--	--	--	ND	0.01	0.01	ND	0.01	10,000
Indeno(1,2,3-cd)pyrene	ng/m^3	0.53	0.30	0.81	0.63	--	0.21	0.37	0.29	0.37	0.97	0.64	--	--	--	--	--	--	64,000
Xylene, *o-*	$\mu g/m^3$	--	--	0.06	0.06	--	0.09	0.12	--	0.08	--	--	--	0.09	0.13	0.04	0.07	0.06	9,000
Benzo (a) anthracene	ng/m^3	0.34	0.25	0.56	0.92	--	0.21	0.37	0.16	0.23	0.58	0.68	--	--	--	--	--	--	64,000
Cobalt (PM_{10})	ng/m^3	0.08	0.06	0.15	0.03	--	0.06	0.09	0.02	0.04	0.10	0.06	--	--	--	--	--	--	100
Dichloromethane	$\mu g/m^3$	--	--	0.07	0.14	--	0.15	0.17	--	0.22	--	--	--	0.09	0.09	0.08	0.11	0.18	2,000
Benzo (k) fluoranthene	ng/m^3	0.33	0.18	0.48	0.52	--	0.11	0.23	0.15	0.23	0.54	0.36	--	--	--	--	--	--	64,000
Beryllium (PM_{10})	ng/m^3	0.01	0.02	0.02	0.003	--	0.002	0.0001	ND	ND	0.03	0.01	--	--	--	--	--	--	20
Chloroform	$\mu g/m^3$	--	--	0.02	0.02	--	0.02	0.02	--	0.02	--	--	--	0.014	0.02	0.02	0.02	0.01	500
Chrysene	ng/m^3	0.84	0.70	1.43	0.99	--	0.46	0.71	0.50	0.63	1.35	1.30	--	--	--	--	--	--	640,000

Appendix D. Life Skills of Trumbull County Pollutant Concentrations.

Parameter	Units	11/16/2010	11/22/2010	11/29/2010	12/6/2010	12/7/2010	12/9/2010	12/16/2010	12/22/2010	12/28/2010	1/3/2011	1/10/2011	1/12/2011	1/20/2011	1/24/2011	1/27/2011	1/31/2011	2/8/2011	Sample Screening Level[a]
Mercury (PM_{10})	ng/m^3	0.02	0.005	0.06	ND	--	0.07	0.03	0.003	0.01	0.05	0.08	--	--	--	--	--	--	3000[c]
Toluene	$\mu g/m^3$	--	--	0.35	0.35	--	0.58	0.73	--	0.58	--	--	--	0.49	0.67	0.30	0.36	0.31	4,000
Selenium (PM_{10})	ng/m^3	1.43	1.33	5.29	0.13	--	0.87	0.74	0.78	0.78	0.87	1.13	--	--	--	--	--	--	20,000
Carbon Disulfide	$\mu g/m^3$	--	--	0.011	0.019	--	0.022	0.03	--	0.018	--	--	--	0.012	0.025	0.016	0.012	0.009	7,000
Styrene	$\mu g/m^3$	--	--	0.014	0.020	--	0.014	0.04	--	0.015	--	--	--	0.030	0.045	0.012	0.041	0.010	9,000
Methyl isobutyl ketone	$\mu g/m^3$	--	--	0.016	0.041	--	0.03	0.05	--	0.02	--	--	--	0.02	0.04	0.013	0.12	ND	30,000
Methyl Chloroform	$\mu g/m^3$	--	--	ND	0.01	--	0.009	0.008	--	0.012	--	--	--	0.008	0.011	0.007	0.008	0.007	10,000
Dibenz (a,h) anthracene	ng/m^3	0.09	ND	0.11	0.12	--	ND	0.04	ND	ND	0.14	ND	--	--	--	--	--	--	5,800
Ethylene dichloride	$\mu g/m^3$	--	--	ND	ND	--	ND	ND	--	ND	--	--	--	ND	ND	ND	ND	0.01	270
Trichloroethylene	$\mu g/m^3$	--	--	ND	0.01	--	ND	0.01	--	ND	--	--	--	ND	ND	ND	ND	ND	10,000
Chloroethane	$\mu g/m^3$	--	--	ND	0.01	--	ND	ND	--	ND	--	--	--	ND	ND	ND	ND	0.01	40,000
Ethylene dibromide	$\mu g/m^3$	--	--	ND	0.01	--	ND	ND	--	ND	--	--	--	ND	ND	ND	ND	ND	12
Vinyl chloride	$\mu g/m^3$	--	--	ND	0.01	--	ND	ND	--	ND	--	--	--	ND	ND	ND	ND	ND	1,000
Trichlorobenzene, 1,2,4-	$\mu g/m^3$	--	--	ND	0.01	--	ND	ND	--	ND	--	--	--	ND	ND	ND	ND	ND	2,000
Dichloroethylene, 1,1-	$\mu g/m^3$	--	--	ND	0.01	--	ND	ND	--	ND	--	--	--	ND	ND	ND	ND	ND	80
Acrylonitrile	$\mu g/m^3$	--	--	ND	ND	--	ND	ND	--	ND	--	--	--	ND	ND	ND	ND	ND	200
Benzyl Chloride	$\mu g/m^3$	--	--	ND	ND	--	ND	ND	--	ND	--	--	--	ND	ND	ND	ND	ND	140
Bromoform	$\mu g/m^3$	--	--	ND	ND	--	ND	ND	--	ND	--	--	--	ND	ND	ND	ND	ND	6,400
Chlorobenzene	$\mu g/m^3$	--	--	ND	ND	--	ND	ND	--	ND	--	--	--	ND	ND	ND	ND	ND	10,000
Chloroprene	$\mu g/m^3$	--	--	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	4,400
Dichloropropane, 1,2-	$\mu g/m^3$	--	--	ND	ND	--	ND	ND	--	ND	--	--	--	ND	ND	ND	ND	ND	200
Dichloropropylene, *cis*- 1,3-	$\mu g/m^3$	--	--	ND	ND	--	ND	ND	--	ND	--	--	--	ND	ND	ND	ND	ND	40
Dichloropropylene, *trans*- 1,3-	$\mu g/m^3$	--	--	ND	ND	--	ND	ND	--	ND	--	--	--	ND	ND	ND	ND	ND	40
Ethyl Acrylate	$\mu g/m^3$	--	--	ND	ND	--	ND	ND	--	ND	--	--	--	ND	ND	ND	ND	ND	7,000
Hexachloro-1,3-butadiene	$\mu g/m^3$	--	--	ND	ND	--	ND	ND	--	ND	--	--	--	ND	ND	ND	ND	ND	320
Methyl Methacrylate	$\mu g/m^3$	--	--	ND	ND	--	ND	ND	--	ND	--	--	--	ND	ND	ND	ND	ND	7,000
Methyl *tert*- Butyl Ether	$\mu g/m^3$	--	--	ND	ND	--	ND	ND	--	ND	--	--	--	ND	ND	ND	ND	ND	7,000
Tetrachloroethane, 1,1,2,2-	$\mu g/m^3$	--	--	ND	ND	--	ND	ND	--	ND	--	--	--	ND	ND	ND	ND	ND	120

Appendix D. Life Skills of Trumbull County Pollutant Concentrations.

Parameter	Units	11/16/2010	11/22/2010	11/29/2010	12/6/2010	12/7/2010	12/9/2010	12/16/2010	12/22/2010	12/28/2010	1/3/2011	1/10/2011	1/12/2011	1/20/2011	1/24/2011	1/27/2011	1/31/2011	2/8/2011	Sample Screening Level[a]
Trichloroethane, 1,1,2-	µg/m^3	--	--	ND	ND	--	ND	ND	--	ND	--	--	--	ND	ND	ND	ND	ND	440

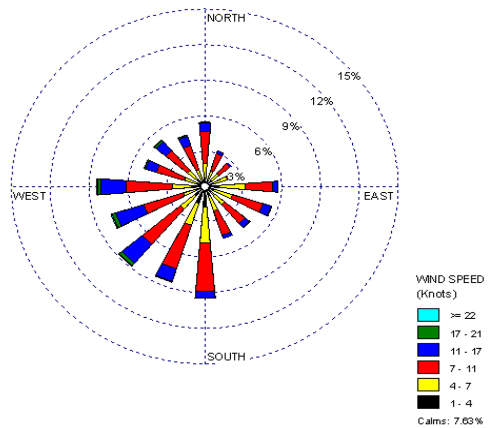
(yellow box) Key Pollutant
µg/m^3 micrograms per cubic meter
ng/m^3 nanograms per cubic meter
-- No sample was collected for this pollutant on this day or the result was invalidated.
ND No results of this chemical were registered by the laboratory analytical equipment.

[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 at least a couple of weeks, and longer for some pollutants.

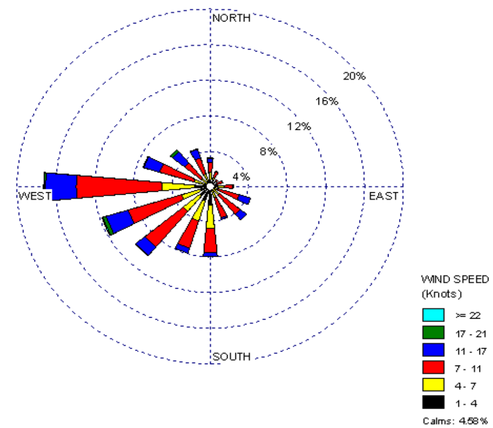
[b] The sample screening levels are specific to hexavalent chromium (recognized as the most toxic form) which is a fraction of the total chromium reported.

[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 Youngstown Municipal Airport NWS Station.



Youngstown Municipal Airport NWS Station 2002-2007[1]



Youngstown Municipal Airport NWS Station Across Sampling Period (Nov. 16, 2010-Feb. 9, 2011)[1]

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