SAT Initiative: Riggins School, North Birmingham Elementary School, and Lewis Elementary School in Birmingham, Alabama

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

I. Executive Summary

- Air monitoring has been conducted at Riggins School (Riggins), North Birmingham Elementary School (N. Birmingham), and Lewis Elementary School (Lewis) in Birmingham, Alabama, 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. These three schools have been combined into one report as they are located close to each other and are in the same school system (Figure 1). EPA also evaluated another school, Tarrant Elementary, in nearby Tarrant, Alabama, which was impacted more by a separate source and is discussed in a separate report.
- These schools were selected for monitoring based on information indicating the potential for elevated ambient concentrations of lead and pollutants associated with coke plant operations, including benzene, arsenic, and benzo(a)pyrene, in air outside the schools from the nearby presence of two coke plants, an electric arc furnace, and a chemical distribution facility. That information included EPA's 2002 National-Scale Air Toxics Assessment (NATA). Air monitoring was performed at Riggins, N. Birmingham, and Lewis from August 5, 2009, to December 3, 2009, for the following pollutants: lead in total suspended particulates (TSP); benzene and other volatile organic compounds (VOCs); arsenic and other metals in particulate matter less than 10 microns in diameter (PM_{10}); and benzo(a)pyrene and other polycyclic aromatic hydrocarbons (PAH).
- The 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 for all three schools.
- The air sampling data collected over the sampling period indicate influence from a nearby source of benzene, arsenic, and benzo(a)pyrene emissions. The concentrations of these key pollutants plus others discussed in Appendix C, and the associated longer-term concentration estimates indicate the potential for levels of concern for long-term, continuous exposure to the mixture of pollutants, particularly in areas closest to the source(s).
- Measured levels of an additional pollutant, manganese (PM_{10}), also indicate influence from a nearby source. The elevated level of manganese, while not indicating a level at which health effects might be expected at this location, indicates potential concern for areas closer to the source. There are several sources of manganese emissions and additional monitoring will better characterize potential impacts of this pollutant on the community.

- EPA recommends additional monitoring for metals in PM_{10}, PAHs and VOCs to better characterize the potential for exposures of concern in the community from the coke plants. Additional monitoring will also be conducted at Lewis to better define the potential impact of manganese concentrations on the community.
- 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 might be found at this website: http://www.epa.gov/ttn/atw/eparules.html.
- The Jefferson County Department of Health (JCDH) will continue to oversee industrial facilities in the area through 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 each 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 these School and the Air Monitoring Conducted

This document describes air monitoring data collected at Riggins, N. Birmingham, and Lewis. These schools were selected for monitoring in consultation with the Jefferson County Department of Health (JCDH). We were interested in evaluating the ambient concentrations of lead and pollutants associated with coke plant operations, including benzene, arsenic, and benzo(a)pyrene in air outside these three schools. EPA's 2002 NATA analysis indicated the potential for levels of concern due to estimates of benzene, arsenic, lead, and benzo(a)pyrene emissions in the 2002 National Emissions Inventory from two nearby coke plants, an electric arc furnace, and chemical distribution facility (Figure 1). It has been determined since the sources were identified that the chemical distribution center does not produce chemicals, only distributes them.

Monitoring commenced at these schools on August 5, 2009, and continued through December 3, 2009. During this period, 14 samples of VOCs from Lewis and 17 samples of VOCs from N. Birmingham were analyzed for benzene and a small standardized set of additional VOCs. Due to an issue with VOC monitoring equipment, VOC results from Riggins were invalidated (see EPA's technical document, *Investigation and Resolution of Contamination Problems in the Collection of Volatile Organic Compounds*, at

[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.

http://www.epa.gov/schoolair/pdfs/VocTechdocwithappendix1209.pdf). Additional VOC samples were collected at Riggins between November 30, 2009 and December 3, 2009 to ensure that 10 valid samples were available for analysis. All VOC results with the exception of acrolein were evaluated for health concerns. Results of a recent short-term laboratory study have raised questions about the consistency and reliability of monitoring results of acrolein. As a result, EPA will not use these acrolein data in evaluating the potential for health concerns from exposure to air toxics in outdoor air as part of the School Air Toxics Monitoring project (SAT) (http://www.epa.gov/schoolair/acrolein.html).

During this time period, 24 PM_{10} samples at Riggins, 20 PM_{10} samples at Lewis, and 18 PM_{10} samples at N. Birmingham[4] were collected and analyzed for arsenic and a small standardized set of additional metals. In addition, 24 lead samples were collected at Riggins, 20 lead samples were collected at Lewis, and 18 lead samples were collected at N. Birmingham. Finally, 24 polycyclic aromatic hydrocarbon (PAH) samples at Riggins, 19 PAH samples at Lewis, and 20 PAH samples at N. Birmingham were collected and analyzed for benzo(a)pyrene and a small standardized set of additional PAHs. 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 being monitored in this initiative were selected based on modeling analyses that indicated the potential for annual average air concentrations of some specific (key) hazardous air pollutants (HAPs or air toxics)[6] to be of particular concern based on approaches that are commonly used in the air toxics program for considering potential for long-term risk. For example, such analyses suggested annual average concentrations of some air toxics were greater than long-term risk-based concentrations associated with an additional cancer risk greater than 10-in-10,000 or a hazard index on the order of or above 10. To make projections of air concentrations, the modeling analyses combined estimates of air toxics emissions from industrial, motor vehicle and other sources, with past measurements of winds, and other meteorological factors that can influence air concentrations, from a weather station in the general area. In some cases, the weather station was very close (within a few miles), but in other cases, it was much further away (e.g., up to 60 miles), which may contribute to quite different conditions being modeled than actually exist at the school. The modeling analyses are intended to be used to prioritize locations for further investigation.

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[4] In general, this sampler collects airborne particles with a 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] EPA contractors operated the monitors and sent the 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.

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

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[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-2d) with regard to areas of interest identified below.

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

- At all three schools, measured levels of lead, a pollutant for which there are national standards for ambient air, while indicating potential influence from a nearby source, are below the national standard for protection of public health.
- The air sampling data collected over the 4-month sampling period indicate influence from a nearby source of benzene, arsenic, and benzo(a)pyrene emissions. The concentrations of these pollutants and the associated longer-term concentration estimates indicate the potential for levels of concern for long-term, continuous exposure to the mixture of pollutants, particularly in those areas closest to the source(s).
- The air sampling data for manganese at Lewis indicate influence from a nearby source, and the related longer-term concentration estimate is slightly above the long-term comparison level for continuous, long-term exposures. This comparison level is a continuous long-term exposure concentration appreciably below exposure levels at which effects have been observed. The slightly elevated concentrations at this location, however, indicate a potential concern for areas of the community closer to the source(s).

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

- Do the monitoring data indicate influence from a nearby source?
  - → The measurements at these schools included several lead (TSP) concentrations at each school which were somewhat higher than other measurements taken at the schools. This may indicate that those samples were collected on days when a nearby source was influencing concentrations at the schools.
- Do the monitoring data indicate elevated levels that pose long-term health concerns?
  - → The monitoring concentrations of lead (TSP) at all three schools are below the national ambient air quality standard for protection of public health.
    - ▪ 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 these three schools are

substantially below the long-term comparison level (Table 1).[12] The comparison level is the level of the national ambient air quality standard.

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

<u>Benzene, Arsenic, and Benzo(a)pyrene key pollutants:</u>

- Do the monitoring data indicate influence from a nearby source?
  - → The monitoring data include several benzene,[13] arsenic (PM_{10}),[14] and benzo(a)pyrene[15] 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?
  - → Although the concentrations of arsenic and benzo(a)pyrene are individually below their long-term comparison levels (as described below), benzene concentrations are near or above their long-term comparison levels, indicating a potential for levels of concern, and concentrations of these and some other pollutants associated with coke plant emissions contribute to the potential for levels of concern for long-term continuous exposure to the mixture of pollutants (see Appendix C). There are also other sources of benzene in the vicinity of at least one of the monitors.
    - The estimate of longer-term benzene concentration (i.e., the upper bound of the 95 percent confidence interval on the mean of the dataset) for Riggins is above the long-term cancer-based comparison level and this estimate for the other two schools is just below the comparison level (Table 1). This comparison level is based on consideration of continuous exposure concentrations (24 hours a day, all year, over a lifetime).

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[12] The upper end of the interval is approximately 1.6 times the mean of the monitoring data and less than 17% of the long-term noncancer-based comparison level for each school. 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.

[13] For example, seven of the concentrations at Riggins, nine of the concentrations at N. Birmingham, and seven of the concentrations at Lewis (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..

[14] For example, eighteen of the concentrations at Riggins, nine of the concentrations at N. Birmingham, and nine of the concentrations at Lewis (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.

[15] For example, seventeen of the concentrations at Riggins, twelve of the concentrations at N. Birmingham, and seven of the concentrations at Lewis (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.

- The estimates of longer-term arsenic (PM_{10}) concentrations (i.e., the upper bound of the 95 percent confidence interval on the mean of the dataset) are below the long-term comparison levels (Table 1).[16] These comparison levels are based on consideration of continuous exposure concentrations (24 hours a day, all year, over a lifetime).
  - Further, the longer-term concentration estimate at Riggins is somewhat below 20% of the cancer-based comparison level, indicating the longer-term estimate falls between continuous (24 hours a day, 7 days a week) lifetime exposure concentrations associated with 1-in-100,000 and 1-in-10,000 additional cancer risk, while the long-term estimates for the other schools are more than tenfold lower than this comparison level.
- The estimates of longer-term benzo(a)pyrene concentrations (i.e., the upper bound of the 95 percent confidence interval on the mean of the dataset) are below the long-term comparison levels (Table 1).[17] This comparison level is based on consideration of continuous exposure concentrations (24 hours a day, all year, over a lifetime).
  - Further, the longer-term concentration estimates at each school are 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.

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

  → We did identify one individual measurement at Riggins and one at N. Birmingham which were higher than the individual sample screening level for 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] An individual sample result above the screening level is a signal to EPA to evaluate that sample result as well as immediately prior and subsequent results. Consideration of all these results indicated no concerns regarding short-term exposure.

<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?

  → The monitoring data show low levels of other HAPs monitored, with longer-term concentration estimates for all of these HAPs, with the exception of manganese at Lewis, below their long-term comparison levels (Appendix C).

  → The longer-term concentration estimate for manganese is slightly above the long-term comparison level for continuous, long-term exposures (Appendix C).[11] 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 an exposure concentration appreciably

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[16] The upper end of the interval for each school is approximately 1.4 times the mean of the monitoring data and less than 25% of the long-term noncancer-based comparison level.

[17] The upper end of the interval for each school is approximately 1.8 times the mean of the monitoring data and less than 10% of the long-term cancer-based comparison level.

below levels at which effects have been observed.[18] The slightly elevated levels at this location, however, indicate a potential concern for areas of the community much closer to the source.

→ Additionally, each individual measurement for these pollutants is below the individual 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)?

  → The data collected and the associated long-term concentration estimates of several pollutants pose a concern when those pollutants are considered together as a mixture, (Appendix C).[19] In order to better define the long-term concentrations, the Jefferson County Department of Health and the EPA will conduct monitoring at a number of locations over the course of a year.

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 stations at Riggins, N. Birmingham, and Lewis collected wind speed and wind direction measurements for the following time periods:

→ Riggins: June 23, 2009 continuing through the sampling period (August 5, 2009-December 3, 2009), and ending on December 10, 2009;

[18] 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).

[19] 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.

→ N. Birmingham: June 19, 2009 continuing through the sampling period (August 5, 2009-November 24, 2009), and ending on December 10, 2009; and

→ Lewis: June 23, 2009 continuing through the sampling period (August 5, 2009-November 24, 2009), and ending on December 11, 2009.

As a result, on-site data for these meteorological parameters are available for all dates of sample collection at each school and also for a period before and after the sampling period, producing a continuous record of nearly six months at each school. The meteorological data collected during the sampling period are presented in Figures 3a-3c, and Tables 2a-2b.

The nearest NWS station is at Birmingham-Shuttlesworth International Airport in Birmingham, Alabama. This station is 2.7 miles east-southeast of Riggins, 3.6 miles east-northeast of N. Birmingham, and 4.1 miles east of Lewis. Measurements taken at that station include wind, temperature, and precipitation. These are presented in Tables 2a-2b, and Appendix E. Information for lead, arsenic and benzo(a)pyrene are presented in Table 2(a) while data for benzene is presented in Table 2(b). Due to an equipment timer issue, samples for benzene and other VOCs were collected manually at different times and for some dates than other key pollutants.

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

- Both the sampling results and the on-site wind data suggest that some of the air samples were collected on days when the nearby key sources were contributing to conditions at each school location.

- Wind directions at the three schools appear somewhat similar in that only small amounts of wind came from the southwest quadrant during sampling days. The most prevalent winds at each school appear to come generally from the southeast quadrant, the northwest quadrant, or the northeast quadrant.

- The wind patterns at two of the school monitoring sites (Riggins and North Birmingham) on the sampling dates share some similarities with those observed across the record of on-site meteorological data during each school sampling period. Note that the composite wind pattern over the whole sampling period differs from the composite for the sampling days at Lewis Elementary. Our ability to provide a confident characterization of the wind flow patterns at the monitoring sites over the long-term is limited. The wind patterns at the Birmingham-Shuttlesworth International Airport NWS station differ from the patterns at the schools.

- Although we lack long-term wind data at the monitoring sites, the wind pattern at the NWS station during the sampling period shares some similarities with the historical long-term wind flow pattern at that same NWS station.

- What are the directions of the key sources of lead, benzene, arsenic, and benzo(a)pyrene emissions in relation to the school locations.

→ The distances and direction from each of the key sources to each school are listed in the table below and illustrated in Figure 1. Several potential sources of lead emissions are listed although two of these facilities no longer emit lead. The monitoring data from airborne lead do not indicate concentrations above the national ambient air quality standard for protection of public health.

Key Source	Riggins	N. Birmingham	Lewis
Coke plant (Source A)	1.58 miles SW	2.77 miles SW	3.50 miles SW
Coke plant (Source B)	0.20 miles NNW	1.14 miles SW	1.87 miles SW
Electric Arc Furnace (Source C)	1.60 miles S	1.19 miles NW	1.06 miles W
Lead source (D)	2.50 miles SW	1.26 miles SW	0.78 miles E
Lead source (E) (no longer emits lead)	2.19 miles NNW	2.13 miles WNW	2.03 miles W
Lead source (F) (closed and demolished)	1.17 miles NNE	0.55 miles WNW	0.91 miles SW

→ The key source of manganese is not known, and further investigation will be done to determine the potential impact on the community. In addition, the chemical distribution center is not included in the evaluation as no chemicals are produced at the facility.

→ Using the property boundaries of each facility (in lieu of information regarding the location of specific sources of lead, benzene, arsenic, and benzo(a)pyrene emissions at each facility), we have identified an approximate range of wind directions to use in considering the potential influence of these facilities on air concentrations at each school.

→ This general range of wind directions is referred to here as the expected zone of source influence (ZOI). The expected ZOI which includes all identified sources for Riggins is from 35 to 260 degrees; N. Birmingham is from 35 to 255 degrees; and Lewis is from 270 to 120 degrees.

- On days the air samples were collected, how often did wind come from direction of the key sources and is there any relationship in wind patterns between the three schools?

→ For Riggins, there were twenty-one sampling days for lead (TSP), arsenic (PM_{10}), and benzo(a)pyrene, and nine sampling days for benzene in which a portion of the winds were from the expected ZOI (Figures 4a-4d, Tables 2a-2b).

→ For N. Birmingham, there were twenty sampling days for benzo(a)pyrene, eighteen sampling days for lead (TSP) and arsenic (PM_{10}), and seventeen days for benzene in which a portion of the winds were from the expected ZOI (Figures 4a-4d, Tables 2a-2b).

→ For Lewis, there were twenty sampling days for lead (TSP) and arsenic (PM_{10}), nineteen days for benzo(a)pyrene, and fourteen days for benzene in which a portion of the winds were from the expected ZOI (Figures 4a-4d, Tables 2a-2b).

→ Wind directions at the three schools appear somewhat similar in that only small amounts of wind came from the southwest quadrant during sampling days. The most prevalent winds at each school appear to come generally from either the southeast quadrant, the northwest quadrant, or the northeast quadrant.

- How do wind patterns on the air monitoring days at each school compare to those across the complete monitoring period and what might be expected over the longer-term at each school location?
  - → At Riggins, the composite wind pattern over the entire sampling period is similar to that for the sampling days with some exceptions. Wind patterns across the air monitoring days appear to be generally similar to those observed over the entire sampling period at N. Birmingham. For Lewis, the composite wind pattern over the entire sampling period shows less wind from the northwest quadrant than the composite wind pattern for sampling days.
  - → The wind patterns at the nearest NWS station (at Birmingham-Shuttlesworth International Airport) during the 4-month sampling period share some similarities with those recorded at the NWS station over the long-term (2002-2007 period; Appendix E).
- How do wind patterns at each school compare to those at the Birmingham-Shuttlesworth International Airport NWS station, particularly with regard to prevalent wind directions and the direction of the key sources?
  - → During the sampling period for which data are available both at the school sites and at the reference NWS station (approximately 4 months), prevalent winds at the three school sites were from the northwest, northeast, and southeast quadrants while those at the NWS station are more from the northwest and southeast quadrants and the cardinal (N,S,E,W) directions.
- Are there other meteorological patterns that may influence the measured concentrations at each school monitoring site?
  - → We did not observe other meteorological patterns that may influence the measured concentrations at the school monitoring sites.

V. Other Air Toxics Monitoring in This Community

Between July 2005 and June 2006, JCDH conducted an air monitoring study of a large number of air pollutants including VOCs, semi-volatile organic compounds (SVOCs), carbonyls, metals and hexavalent chromium at four locations in the Jefferson County, Alabama area. The four sites were East Thomas, North Birmingham, Providence, and Shuttlesworth (for more information go to http://www.epa.gov/ttn/amtic/files/20032004csatam/JeffersonCountyFR.pdf). The purpose of the study was to assess the potential health effects to the local population from exposure to chemicals in ambient air. A risk assessment of all monitoring data collected was completed in 2007 and final report provided to EPA in February 2009. Results of the risk characterization indicated all areas exceeded a cancer risk of $1x10^{-6}$ with the highest cumulative risk ($1.66x10^{-4}$) at the Shuttlesworth location. The JCDH concluded that most of the chemicals that were risk drivers are quite ubiquitous in nature, emanating from a variety of sources including industrial, small area sources (gas stations, dry cleaners) and mobile sources.

VI. Key Sources Information

- Were the sources operating as usual during the monitoring period?
  - → The nearby sources of lead, benzene, arsenic, and benzo(a)pyrene have operating permits issued by the JCDH that include operating requirements.[20]
  - → Based on the 2002 NATA model, one facility appeared to be the source of lead. Upon further evaluation of additional source emissions data, 3 other potential sources of lead have been identified and are within several miles of the 3 schools monitored in the study. Since monitoring was completed, one of those sources has ceased operations (Source E), and another source is closed and demolished (Source F). At one facility (Source C), production fell to about half of normal production levels. At another facility (Source D), production fell over 20% in 2009, but began to recover (about 5%) in 2010. The data collected from the monitors at all three schools did not show levels of concern for lead.
  - → The most recently available benzene (2008 TRI, 2005 NATA) emissions data for both coke plants (Sources A and B) are lower than those relied upon in previous modeling analysis for this area (2002 NATA). The most recently available arsenic emissions data (2005 NATA) for one coke plant (Source B) are higher than those relied upon in a previous modeling analysis for this area (2002 NATA). No arsenic emissions were reported for the coke plant identified as Source A.
    - – During the monitoring months (August - December 2009), the coke plants in the area operated at about 58-60% of the level at which they operated during the same months in the years before and after the monitoring, i.e. in 2008 and 2010. Although production fell in 2009, by 2010 production at each facility had approximately returned the 2008 levels.
    - – According to JCDH, although a lower production level might intuitively suggest a reduction in pollutant emissions, this is not necessarily the case with the coke plants in Jefferson County. Operating at lower capacity can lead to cracks and warping of the ovens, and leakage of pollutants. With decreased production there is less coke oven gas to fire boilers and generate power, possibly leading to greater HAP generation during a power outage. It is difficult to predict the HAP emissions from the coke plants in Jefferson County directly from the production levels, since about half of the HAPs emitted are from coke battery leaks (e.g., through doors and lids) which are controlled by work practices. Production levels at the Jefferson County coke plants are increasing and good work practices are in place. Results from recent inspections have shown the plants to be performing well in the management of HAP emissions.
  - → It has been determined that the chemical distribution center does not produce chemicals - only distributes them.
  - → No benzo(a)pyrene emissions were reported by the sources of interest.

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

VII. Integrated Summary and Next Steps

A. Summary of Key Findings

1. What are the key HAPs for each school?

   → Lead (TSP), benzene, arsenic, and benzo(a)pyrene are the key HAPs for all three schools, identified based on emissions information considered in identifying these schools for monitoring. The ambient air concentrations on multiple days during the monitoring period indicate contributions from sources in the area.

2. Do the data collected at each school indicate a level of concern, as implied by information that led to identifying the schools for monitoring?

   → The data collected for pollutants associated with coke plant emissions, including benzene, arsenic and benzo(a)pyrene, and other monitored pollutants such as naphthalene (indicate a potential for levels of concern for long-term continuous exposure to this mixture of pollutants in the air (Appendix C).

   → Additionally, the measured levels and associated longer-term concentration estimate for manganese, while not indicating a level at which health effects might be expected at this location, indicate potential concern for areas closer to the source. Additional data would assist in further characterizing potential exposures in the area.

   → The data collected over the 4-month sampling period and the related longer-term concentration estimates for lead, while indicating potential influence from a nearby source are below the national ambient air quality standard for protection of public health for lead at all three schools.

   → 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 might be found at this website: http://www.epa.gov/ttn/atw/eparules.html.

3. Are there indications, e.g., from the meteorological or other data, that the sample set may not be indicative of longer-term air concentrations? Would we expect higher (or lower) concentrations at other times of year?

   → The data we have collected appear to reflect air concentrations during the entire sampling period, among the data collected for this site, we have none that would indicate generally higher (or lower) concentrations during other times of year. The wind patterns at the nearest NWS station (at Birmingham-Shuttlesworth International Airport) during the 4-month sampling period share some similarities with those recorded at the NWS station over the long-term (2002-2007 period; Appendix E). The lack of long-term meteorological data at the school locations, along with our finding that the wind patterns from the nearest NWS station are only somewhat similar to those at the school, however, limit our ability to confidently predict longer-term wind patterns at the schools.

B. Next Steps for Key Pollutants

1. EPA recommends additional monitoring in several locations for metals in PM_{10}, PAHs and VOCs to better characterize the potential for exposures of concern in the community. EPA will also conduct additional monitoring at Lewis to better define manganese concentrations in the community.
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. These rules might be found at this website: http://www.epa.gov/ttn/atw/eparules.html.
3. The Jefferson County Department of Health (JCDH) will continue to oversee industrial facilities in the area through air permits and other programs.

VIII. Figures and Tables

A. Tables

B. Figures

4d. Birmingham, Alabama Area Schools – Benzo(a)pyrene Concentration and Wind Information.

IX. 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 Measured at Each School and Multiple-pollutant Considerations.

D-1. Riggins School Pollutant Concentrations.

D-2. North Birmingham Elementary School Pollutant Concentrations.

D-3. Lewis Elementary School Pollutant Concentrations.

E. Windroses for Birmingham-Shuttlesworth International Airport NWS Station.

Figure 1. Birmingham, AL Area Schools, Sources of Interest (A, B, C, D, E, F), and the Birmingham-Shuttlesworth International Airport NWS Station.

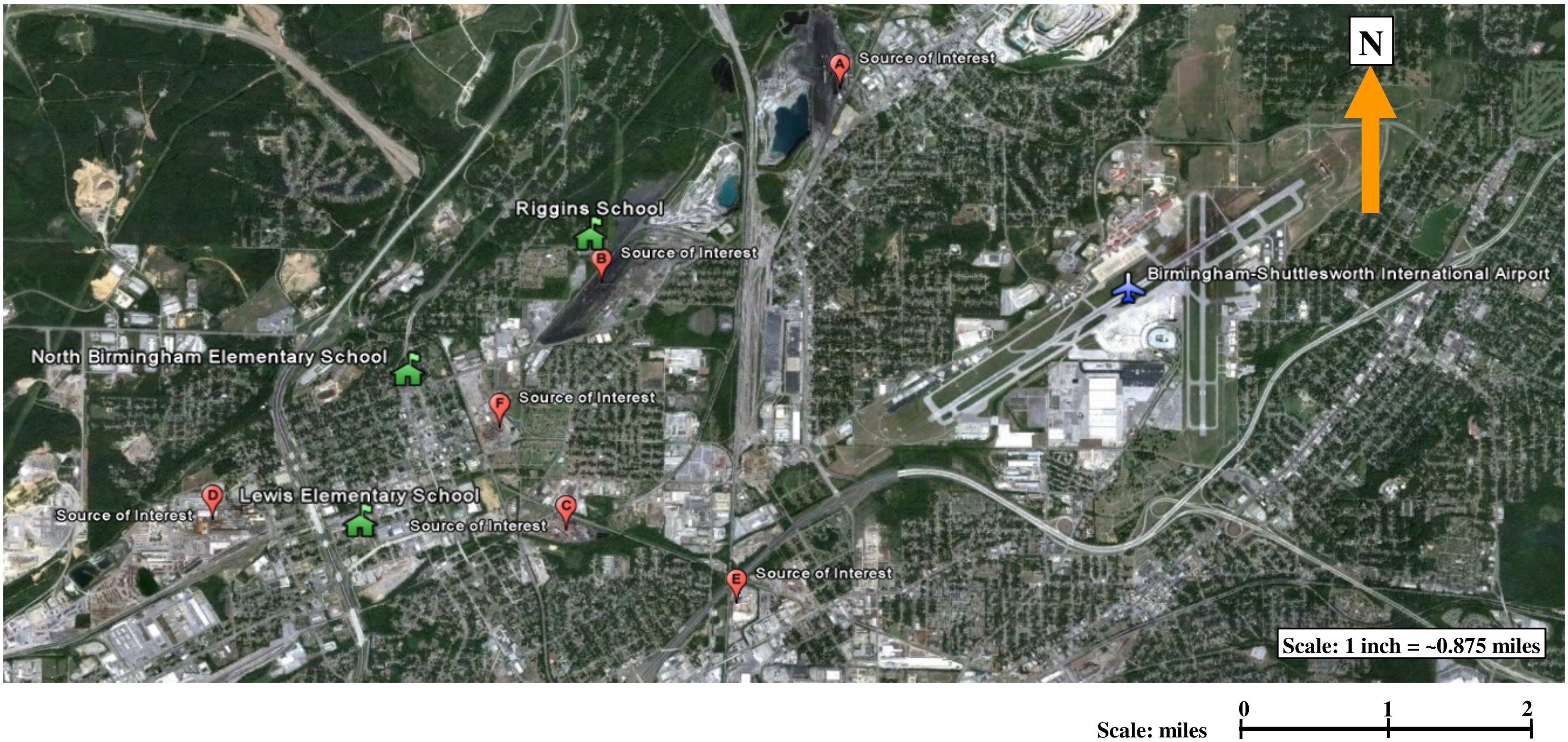


Table 1. Birmingham, Alabama Area Schools - Key Pollutant Analysis.

Parameter	School Name		Units	Mean of Measurements	95% Confidence Interval on the Mean	Long-term Comparison Level[a]	
						Cancer-Based[b]	Noncancer-Based[c]
Lead (TSP)	Riggins School	Aug.-Oct.	ng/m^3	9.84 [d]	5.31 - 14.4	NA	150
		Sept.-Nov.	ng/m^3	12.97 [e]	5.53 - 20.4		
	North Birmingham Elementary School	Aug.-Oct.	ng/m^3	8.99 [f]	4.54 - 13.4		
		Sept.-Nov.	ng/m^3	9.91 [g]	5.97 - 13.9		
	Lewis Elementary School	Aug.-Oct.	ng/m^3	15.65 [h]	3.92 - 27.4		
		Sept.-Nov.	ng/m^3	18.55 [i]	6.26 - 30.8		
Benzene	Riggins School		µg/m^3	10.9 [j]	2.04 - 19.8	13	30
	North Birmingham Elementary School		µg/m^3	5.49 [k]	1.10 - 9.88		
	Lewis Elementary School		µg/m^3	4.68 [l]	0.45 - 8.92		
Arsenic (PM_{10})	Riggins School		ng/m^3	2.72 [m]	1.73 - 3.72	23	15
	North Birmingham Elementary School		ng/m^3	1.56 [n]	0.97 - 2.15		
	Lewis Elementary School		ng/m^3	1.50 [o]	0.97 - 2.03		
Benzo(a)pyrene	Riggins School		ng/m^3	2.95 [p]	0.46 - 5.44	57	NA
	North Birmingham Elementary School		ng/m^3	0.35 [q]	0.14 - 0.55		
	Lewis Elementary School		ng/m^3	0.12 [r]	0.05 - 0.19		

µg/m^3 micrograms per cubic meter
ng/m^3 nanograms 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 lead (TSP) is the average of the August, September, and October monthly averages, which include 21 detections that ranged from 0.829 to 41.6 ng/m$^{3.}$

[e] The mean of measurements for lead (TSP) is the average of the September, October, and November monthly averages, which include 20 detections that ranged from 0.829 to 58.4 ng/m$^{3.}$

[f] The mean of measurements for lead (TSP) is the average of the August, September, and October monthly averages, which include 13 detections that ranged from 1.82 to 27.7 ng/m$^{3.}$

[g] The mean of measurements for lead (TSP) is the average of the September, October, and November monthly averages, which include 14 detections that ranged from 1.82 to 27.7 ng/m$^{3.}$

[h] The mean of measurements for lead (TSP) is the average of the August, September, and October monthly averages, which include 15 detections that ranged from 1.56 to 85.0 ng/m$^{3.}$

[i] The mean of measurements for lead (TSP) is the average of the September, October, and November monthly averages, which include 16 detections that ranged from 1.56 to 85.0 ng/m$^{3.}$

[j] The mean of measurements for benzene is the average of all sample results, which include 10 detections that ranged from 0.42 to 30.5 µg/m^3.

[k] The mean of measurements for benzene is the average of all sample results, which include 17 detections that ranged from 0.26 to 30.1 µg/m^3.

[l] The mean of measurements for benzene is the average of all sample results, which include 14 detections that ranged from 0.28 to 22.4 µg/m^3.

[m] The mean of measurements for arsenic (PM_{10}) is the average of all sample results, which include 24 detections that ranged from 0.21 to 8.97 ng/m^3.

[n] The mean of measurements for arsenic (PM_{10}) is the average of all sample results, which include 18 detections that ranged from 0.29 to 3.85 ng/m$^{3.}$

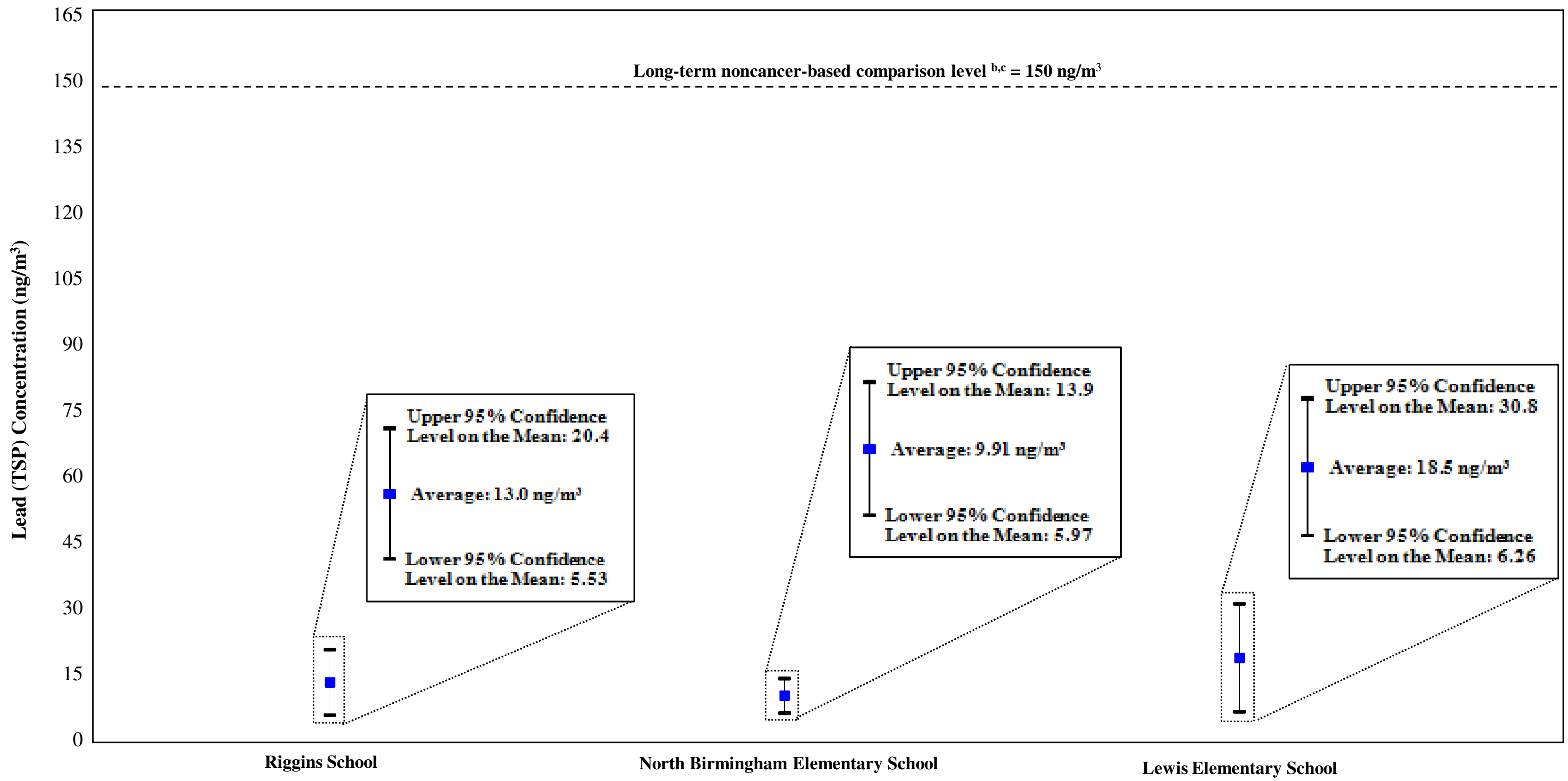
[o] The mean of measurements for arsenic (PM_{10}) is the average of all sample results, which include 19 detections that ranged from 0.17 to 4.03 ng/m^3, as well as one sample in which no chemical was registered by the laboratory analytical equipment. This value was assumed to be zero when calculating the mean.

[p] The mean of measurements for benzo(a)pyrene is the average of all sample results, which include 21 detections that ranged from 0.03 to 26.4 ng/m^3, as well as three samples in which no chemical was registered by the laboratory analytical equipment. These values were assumed to be zero when calculating the mean.

[q] The mean of measurements for benzo(a)pyrene is the average of all sample results, which include 17 detections that ranged from 0.04 to 1.44 ng/m^3, as well as three samples in which no chemical was registered by the laboratory analytical equipment. These values were assumed to be zero when calculating the mean.

[r] The mean of measurements for benzo(a)pyrene is the average of all sample results, which include 17 detections that ranged from 0.03 to 0.57 ng/m^3, as well as two samples in which no chemical was registered by the laboratory analytical equipment. These values were assumed to be zero when calculating the mean.

Figure 2a. Birmingham, Alabama Area Schools - Key Pollutant (Lead (TSP)) Analysis.[a]

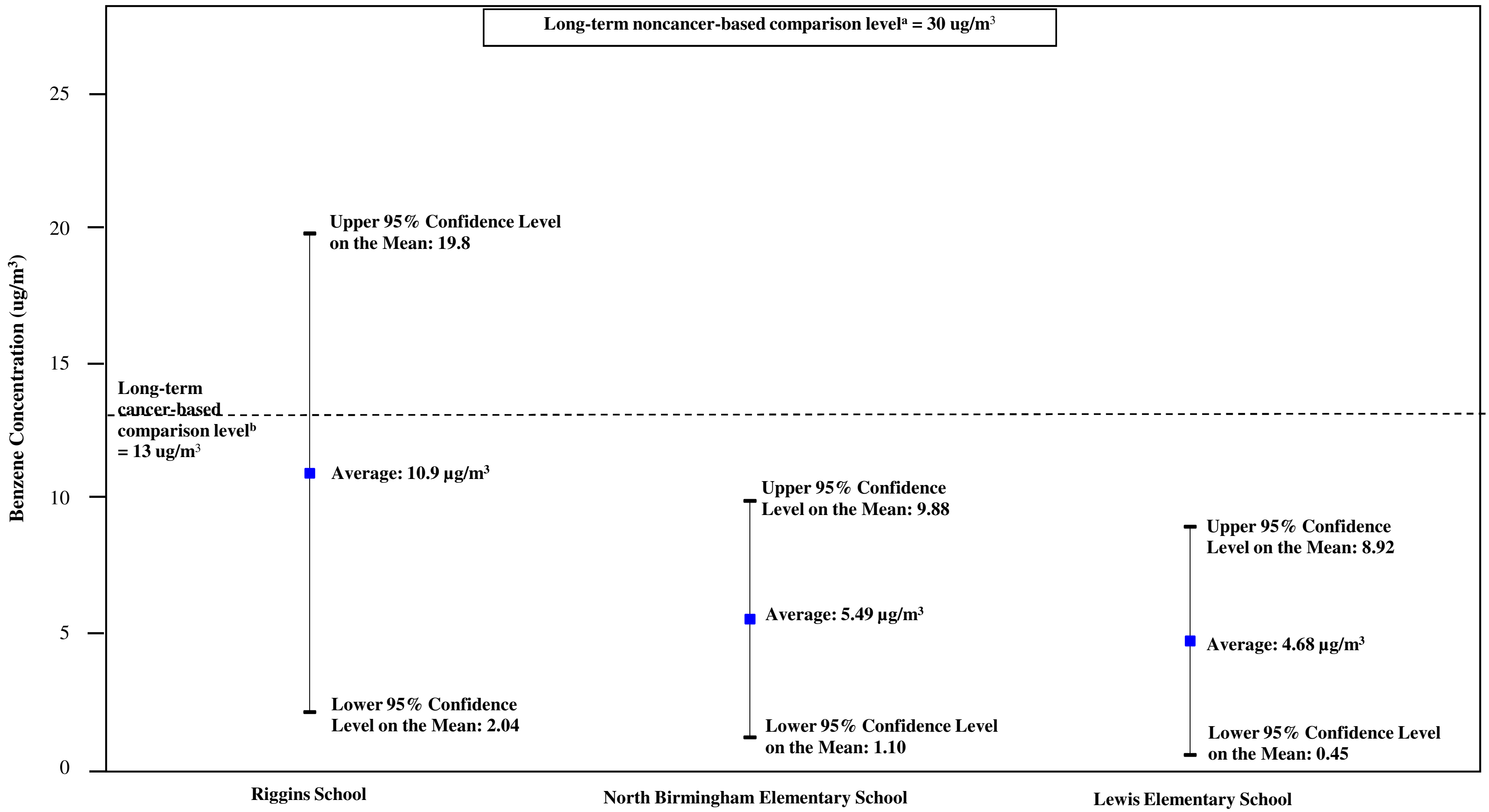


[a] Three-month rolling averages were calculated at each school for the August-October and September-November time periods. For presentation purposes, the higher of the two ranges is presented.

[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.

[c] 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.

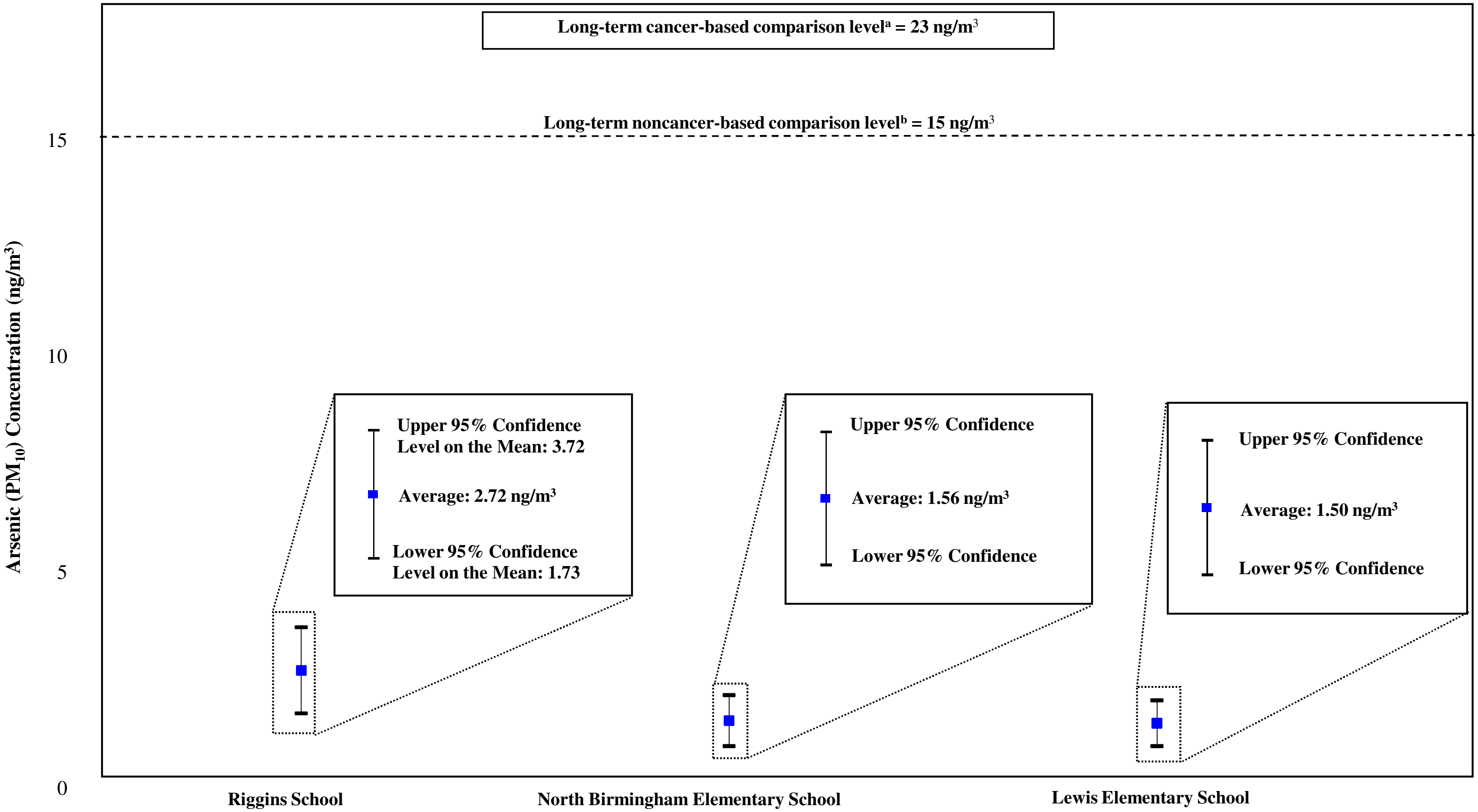
Figure 2b. Birmingham, Alabama Area Schools - Key Pollutant (Benzene) Analysis.



[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.

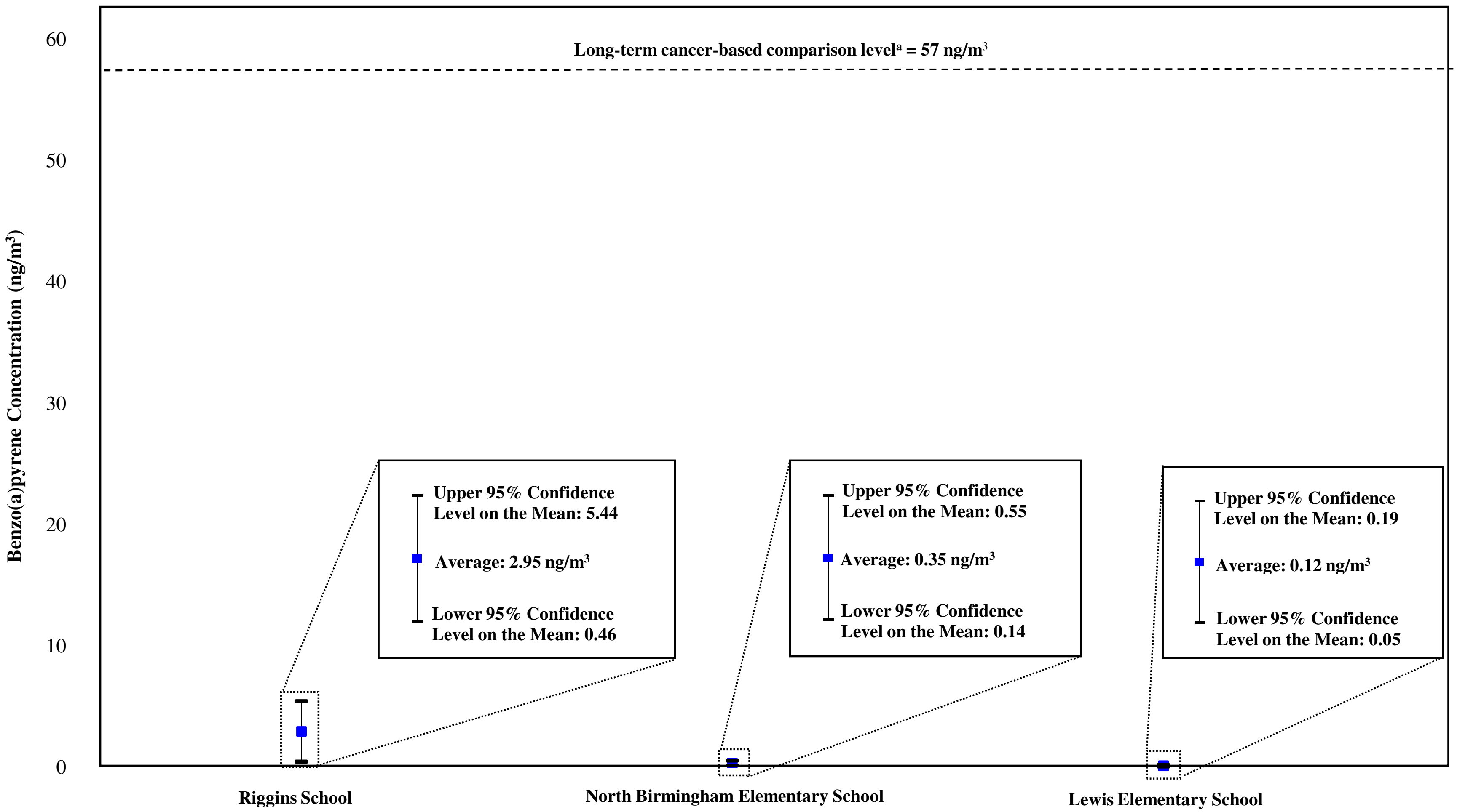
Figure 2c. Birmingham, Alabama Area Schools - Key Pollutant (Arsenic (PM_{10})) Analysis.



[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 2d. Birmingham, Alabama Area Schools - Key Pollutant (Benzo(a)pyrene) Analysis.[a]



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

Table 2a. Birmingham, Alabama Area Schools Key Pollutant Concentrations (Lead (TSP), Arsenic (PM_{10}), and Benzo(a)pyrene) and Meteorological Data.

Parameter	Units	8/5/2009	8/11/2009	8/17/2009	8/23/2009	8/25/2009	8/29/2009	9/4/2009	9/10/2009	9/14/2009	9/16/2009	9/22/2009	9/24/2009	9/25/2009	9/28/2009	10/4/2009	10/10/2009	10/16/2009	10/19/2009	10/22/2009	10/28/2009	10/30/2009	11/3/2009	11/9/2009	11/12/2009	11/18/2009	11/24/2009
Riggins School																											
Lead (TSP)	ng/m^3	4.93	9.87	14.8	1.77	9.32	4.52	3.96	8.37	7.26	8.79	15.4	--	4.34	5.56	7.62	3.42	0.829	--	23.9	8.52	41.6	58.4	4.86	1.64	5.03	14.7
Arsenic (PM_{10})	ng/m^3	1.19	1.22	3.83	0.65	4.67	3.24	1.64	2.08	2.45	4.05	5.85	--	2.24	0.68	2.63	0.69	0.21	--	8.13	2.24	8.97	2.23	1.05	0.39	0.42	4.57
Benzo(a)pyrene	ng/m^3	ND	0.0300	4.82	ND	0.870	0.110	0.150	2.00	0.340	5.24	5.88	--	0.420	0.0300	0.550	0.0300	ND	--	11.2	1.33	26.4	1.21	0.320	0.0400	0.110	9.73
% Hours w/Wind Direction from Expected ZOI[a]	%	4.2	4.2	95.8	0.0	45.8	8.3	37.5	83.3	95.8	100	83.3	--	29.2	25.0	58.3	4.2	0.0	--	100	20.8	95.8	16.7	91.7	8.3	0.0	83.3
Wind Speed (avg. of hourly speeds)	mph	2.9	2.6	4.2	3.2	3.1	2.5	2.3	3.4	3.7	3.8	3.2	--	2.2	3.8	4.9	2.9	4.3	--	4.3	2.4	4.8	3.3	5.5	3.7	2.8	2.4
Wind Direction (avg. of unitized vector)[b]	deg.	305.4	308.4	134.4	354.6	42.9	306.0	22.3	87.9	114.6	139.2	135.5	--	1.8	279.4	51.5	2.1	349.4	--	126.9	356.5	157.4	14.5	67.1	6.0	316.5	206.9
% of Hours with Speed below 2 knots	%	41.7	58.3	20.8	45.8	54.2	62.5	58.3	29.2	12.5	0.0	29.2	--	50.0	29.2	20.8	25.0	0.0	--	0.0	62.5	0.0	41.7	12.5	25.0	45.8	50.0
North Birmingham Elementary School																											
Lead (TSP)	ng/m^3	--	4.08	7.32	2.09	--	4.65	8.06	--	--	--	9.32	7.93	--	27.7	--	2.67	1.82	18.1	15.3	8.01	--	7.92	11.3	2.56	8.20	6.54
Arsenic (PM_{10})	ng/m^3	--	1.05	0.65	0.85	--	3.61	3.85	2.25	--	0.48	1.10	1.79	--	0.95	3.83	0.70	0.29	--	--	--	--	2.42	2.13	0.92	0.33	0.95
Benzo(a)pyrene	ng/m^3	--	0.147	0.0401	ND	--	0.0446	0.493	0.2210	--	ND	0.0444	0.426	--	0.0523	1.44	0.0545	ND	0.2130	0.381	1.16	--	1.04	0.905	--	0.123	0.125
% Hours w/Wind Direction from Expected ZOI[a]	%	--	16.7	100	16.7	--	25.0	37.5	87.5	--	100	87.5	66.7	--	37.5	50.0	54.2	87.5	58.3	100	75.0	--	79.2	100	79.2	100	100
Wind Speed (avg. of hourly speeds)	mph	--	2.4	5.0	2.8	--	2.1	2.3	3.6	--	4.3	3.4	2.4	--	3.7	3.9	2.6	4.2	2.3	5.7	2.0	--	2.3	4.1	2.8	3.0	4.1
Wind Direction (avg. of unitized vector)[b]	deg.	--	306.4	109.0	15.5	--	296.6	30.9	70.7	--	116.0	101.6	69.4	--	273.0	45.7	21.7	58.2	101.2	137.1	223.4	--	139.9	104.1	99.7	213.5	166.4
% of Hours with Speed below 2 knots	%	--	62.5	0.0	50.0	--	62.5	62.5	20.8	--	0.0	25.0	50.0	--	25.0	33.3	50.0	8.3	45.8	0.0	58.3	--	62.5	29.2	54.2	25.0	4.2
Lewis Elementary School																											
Lead (TSP)	ng/m^3	16.2	9.30	12.3	2.09	--	7.16	16.7	16.4	--	2.80	4.35	--	--	16.0	85.0	1.56	3.41	37.2	4.27	--	--	45.6	16.2	15.4	7.97	5.37
Arsenic (PM_{10})	ng/m^3	1.07	0.95	0.56	0.56	--	2.18	3.52	1.95	--	ND	0.69	--	--	0.96	4.03	0.58	0.17	--	0.63	2.05	--	3.36	1.98	0.99	1.75	0.6
Benzo(a)pyrene	ng/m^3	0.0500	0.140	0.0300	ND	--	0.130	0.290	0.0300	--	0.0400	0.0300	--	--	0.0300	0.570	0.0500	ND	0.1150	0.0700	--	--	--	0.410	0.0900	0.0400	0.110
% Hours w/Wind Direction from Expected ZOI[a]	%	83.3	70.8	37.5	100	--	62.5	83.3	83.3	--	41.7	37.5	--	--	66.7	100	95.8	100	87.5	25.0	70.8	--	95.8	100	87.5	75.0	8.3
Wind Speed (avg. of hourly speeds)	mph	3.6	3.2	5.7	3.7	--	2.7	2.3	3.9	--	4.4	3.8	--	--	4.8	4.6	2.9	4.9	1.9	4.5	1.8	--	3.0	5.1	2.9	3.3	2.8
Wind Direction (avg. of unitized vector)[b]	deg.	302.3	298.2	133.7	338.3	--	276.9	83.4	95.4	--	130.6	126.5	--	--	287.8	66.1	1.4	332.2	72.2	133.5	68.2	--	21.9	357.0	280.1	173.1	239.4
% of Hours with Speed below 2 knots	%	20.8	45.8	0.0	37.5	--	58.3	54.2	25.0	--	0.0	20.8	--	--	0.0	25.0	25.0	0.0	70.8	20.8	75.0	--	58.3	20.8	54.2	16.7	33.3
Birmingham International Airport NWS Station																											
Daily Average Temperature	° F	79.0	80.4	76.7	68.0	77.4	76.1	74.4	74.8	75.3	77.1	76.7	77.8	78.3	72.3	59.8	64.6	52.5	48.8	68.3	59.5	70.5	55.8	63.3	51.6	45.5	53.9
Daily Precipitation	inches	0.00	0.07	0.04	0.00	0.00	0.02	0.00	0.00	0.05	0.09	0.03	0.00	0.03	0.00	1.71	0.12	0.01	0.01	0.02	0.00	0.78	0.01	0.31	0.00	0.00	0.00

(highlighted) All precipitation and temperature data were from the Birmingham-Shuttlesworth International Airport NWS Station.

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

[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).

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

Table 2b. Birmingham, Alabama Area Schools Key Pollutant Concentrations (Benzene) and Meteorological Data.

Parameter	Units	8/5/2009	8/11/2009	8/17/2009	8/23/2009	8/29/2009	9/4/2009	9/10/2009	9/16/2009	9/22/2009	9/24/2009	9/28/2009	10/4/2009	10/10/2009	10/16/2009	10/19/2009	10/22/2009	10/28/2009	10/30/2009	11/3/2009	11/8/2009	11/9/2009	11/12/2009	11/18/2009	11/24/2009	11/30/2009	12/3/2009
Riggins School[e]																											
Benzene	µg/m^3	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	30.5	29.2	26.0	6.52	--	1.58	0.837	3.77	9.53	0.665	0.419
% Hours w/Wind Direction from Expected ZOI[b]	%	0.0	0.0	91.7	0.0	45.8	8.3	25.0	79.2	91.7	100	83.3	8.3	0.0	45.8	0.0	100	25.0	62.5	16.7	--	100	4.2	12.5	79.2	20.8	0.0
Wind Speed (avg. of hourly speeds)	mph	2.9	2.6	4.2	3.2	3.1	2.5	2.3	3.4	3.7	3.8	3.2	2.2	3.8	4.9	2.9	4.3	2.5	4.8	3.3	--	7.9	3.5	2.7	2.6	4.2	4.5
Wind Direction (avg. of unitized vector)[c]	deg.	305.4	308.4	134.4	354.6	42.9	306.0	22.3	87.9	114.6	139.2	135.5	1.8	279.4	51.5	2.1	126.9	16.3	196.8	12.1	--	69.1	3.3	330.0	225.3	355.5	348.5
% of Hours with Speed below 2 knots	%	41.7	58.3	20.8	45.8	54.2	62.5	58.3	29.2	12.5	0.0	29.2	50.0	29.2	20.8	25.0	0.0	50.0	0.0	37.5	--	0.0	45.8	50.0	33.3	12.5	0.0
North Birmingham Elementary School[a]																											
Benzene	µg/m^3	0.662	0.927	--	--	0.847	6.65	7.58	0.582	1.42	4.03	--	--	--	0.26	30.1	0.588	24.50	--	4.70	2.83	--	1.12	5.980	0.735	--	--
% Hours w/Wind Direction from Expected ZOI[b]	%	20.8	16.7	100	16.7	25.0	37.5	87.5	100	87.5	66.7	37.5	--	54.2	87.5	58.3	100	70.8	--	79.2	100	--	58.3	100	100	--	--
Wind Speed (avg. of hourly speeds)	mph	2.3	2.4	5.0	2.8	2.1	2.3	3.6	4.3	3.4	2.4	3.7	--	2.6	4.2	2.3	5.7	2.0	--	2.6	2.7	--	2.9	2.7	4.5	--	--
Wind Direction (avg. of unitized vector)[c]	deg.	294.8	306.4	109.0	15.5	296.6	30.9	70.7	116.0	101.6	69.4	273.0	--	21.7	58.2	101.2	137.1	205.4	--	140.1	124.4	--	64.4	199.2	180.2	--	--
% of Hours with Speed below 2 knots	%	58.3	62.5	0.0	50.0	62.5	62.5	20.8	0.0	25.0	50.0	25.0	--	50.0	8.3	45.8	0.0	66.7	--	41.7	58.3	--	41.7	50.0	4.2	--	--
Lewis Elementary School[d]																											
Benzene	µg/m^3	0.824	0.872	0.28	--	1.48	--	--	0.527	0.783	--	--	--	--	0.31	22.4	0.527	18.6	--	12.0	--	1.90	3.67	1.36	--	--	--
% Hours w/Wind Direction from Expected ZOI[b]	%	83.3	70.8	37.5	100.0	62.5	83.3	83.3	41.7	37.5	66.7	--	95.8	--	100.0	87.5	25.0	79.2	--	95.8	--	100.0	87.5	75.0	--	--	--
Wind Speed (avg. of hourly speeds)	mph	3.6	3.2	5.7	3.7	2.7	2.3	3.9	4.4	3.8	4.8	--	2.9	--	4.9	1.9	4.5	1.9	--	2.9	--	8.7	2.9	3.3	--	--	--
Wind Direction (avg. of unitized vector)[c]	deg.	302.3	298.2	133.7	338.3	276.9	83.4	95.4	130.6	126.5	287.8	--	1.4	--	332.2	72.2	133.5	67.9	--	15.1	--	68.0	357.0	280.1	--	--	--
% of Hours with Speed below 2 knots	%	20.8	45.8	0.0	37.5	58.3	54.2	25.0	0.0	20.8	0.0	--	25.0	--	0.0	70.8	20.8	70.8	--	62.5	--	0.0	54.2	16.7	--	--	--
Birmingham International Airport NWS Station																											
Daily Average Temperature	° F	79.0	80.4	76.7	68.0	76.1	74.4	74.8	77.1	76.7	77.8	72.3	0.0	64.6	52.5	48.8	68.3	60.7	64.0	55.7	64.5	63.1	50.9	45.0	54.2	42.0	41.3
Daily Precipitation	inches	0.00	0.07	0.04	0.00	0.02	0.00	0.00	0.09	0.03	0.00	0.00	0.00	0.12	0.01	0.01	0.02	0.03	1.17	0.00	0.00	2.02	0.01	0.00	0.00	0.16	0.00

(grey box) Due to instrument error, meteorological measurements were not collected for four hours at Lewis Elementary on November 9th. As such, hourly wind information was extracted from the Birmingham-Shuttlesworth International Airport NWS Station for these hours and used as a surrogate.

(yellow box) All precipitation and temperature data were from the Birmingham-Shuttlesworth International Airport NWS Station.

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

[a] Due to timer issues, manual samples taken from 10/28/09 through 11/24/09 began after 7am and extending for 24 hours into the next day. As such, the hourly meteorological measurements correlating to the 24-hour sample were adjusted.

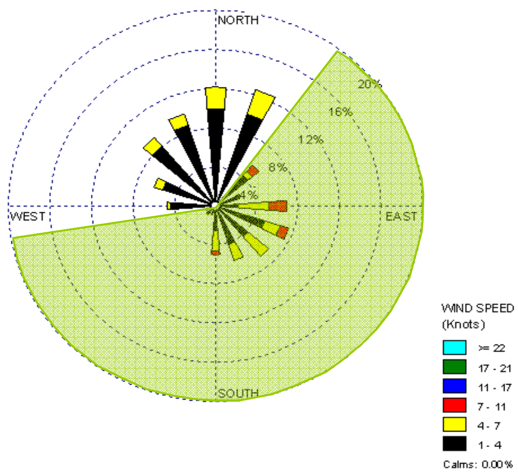
[b] Based on count of hours for which vector wind direction is from expected zone of influence.

[c] 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).

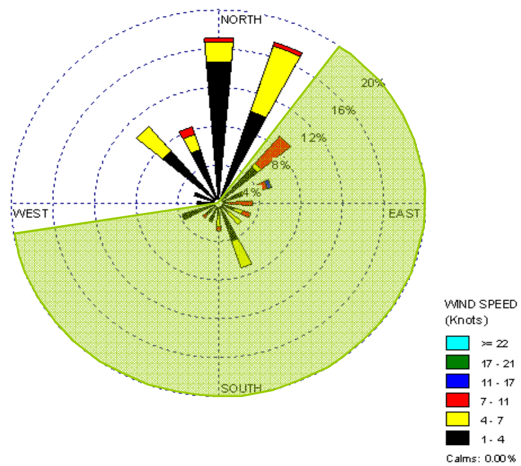
[d] Due to timer issues, manual samples taken from 10/28/09 through 11/9/09 began after 8am and extending for 24 hours into the next day. As such, the hourly meteorological measurements correlating to the 24-hour sample were adjusted.

[e] Due to timer issues, manual samples taken from 10/28/09 through 12/3/09 began after 7am and extending for 24 hours into the next day. As such, the hourly meteorological measurements correlating to the 24-hour sample

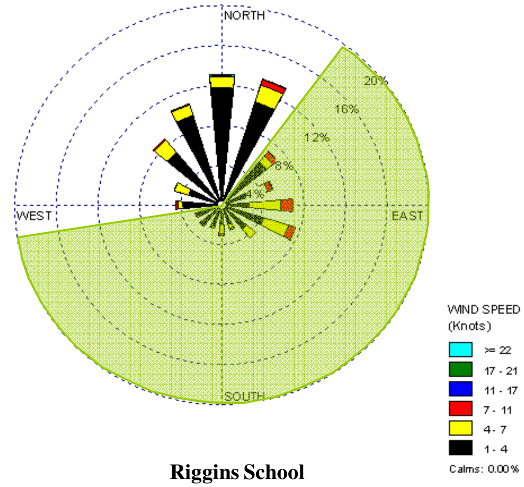
Figure 3a. Riggins School - Wind Information.



Riggins School
Composite Hourly Windrose
on Lead (TSP), Arsenic (PM_{10}). and Benzo(a)pyrene
Sample Days
(Aug. 5, 2009 - Nov. 24, 2009)



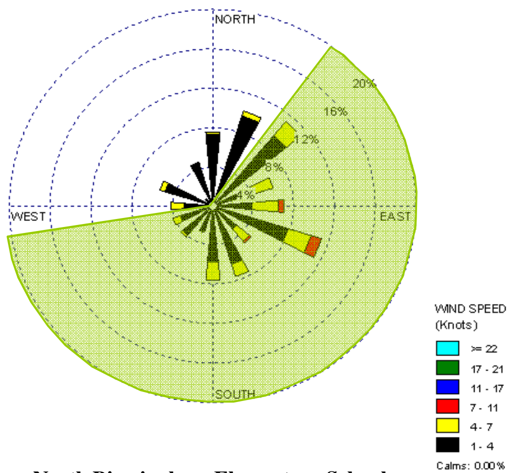
Riggins School
Composite Hourly Windrose
on Benzene Sample Days
(Oct. 22, 2009 - Dec. 3, 2009)



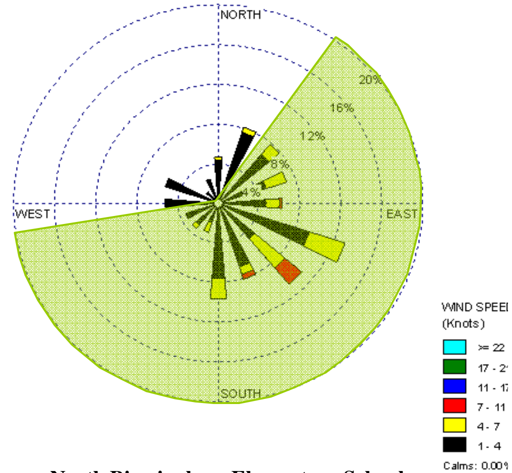
Riggins School
Composite Hourly Windrose
Across Sampling Period
(Aug. 5, 2009 - Dec. 3, 2009)

Expected Zone of Source Influence

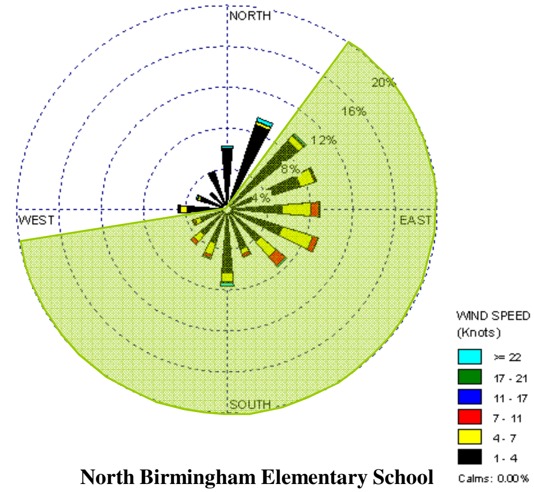
Figure 3b. North Birmingham Elementary School - Wind Information.



North Birmingham Elementary School
Composite Hourly Windrose
on Lead (TSP), Arsenic (PM_{10}), and
Benzo(a)Pyrene Sample Days
(Aug. 5, 2009-Nov. 24, 2009)



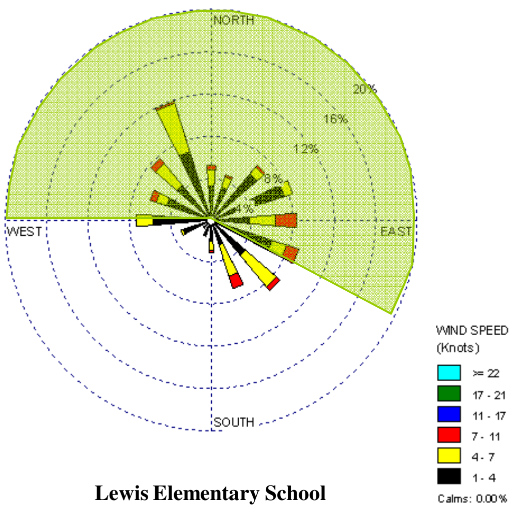
North Birmingham Elementary School
Composite Hourly Windrose
on Benzene Sample Days
(Aug. 5, 2009-Nov. 24, 2009)



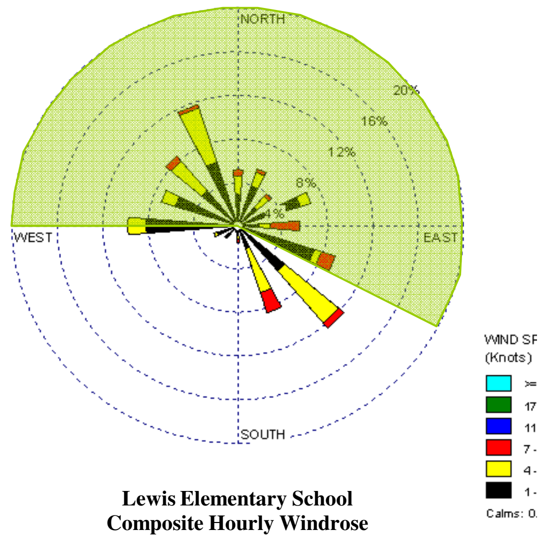
North Birmingham Elementary School
Composite Hourly Windrose
Across Sampling Period
(Aug. 5, 2009-Nov. 24, 2009)

Expected Zone of Source Influence

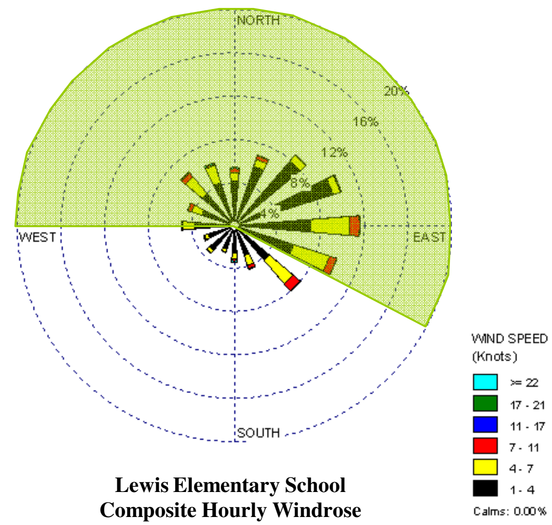
Figure 3c. Lewis Elementary School - Wind Information.



Lewis Elementary School
Composite Hourly Windrose
on Lead (TSP), Arsenic (PM_{10}), and
Benzo(a)Pyrene Sample Days
(Aug. 5, 2009-Nov. 24, 2009)



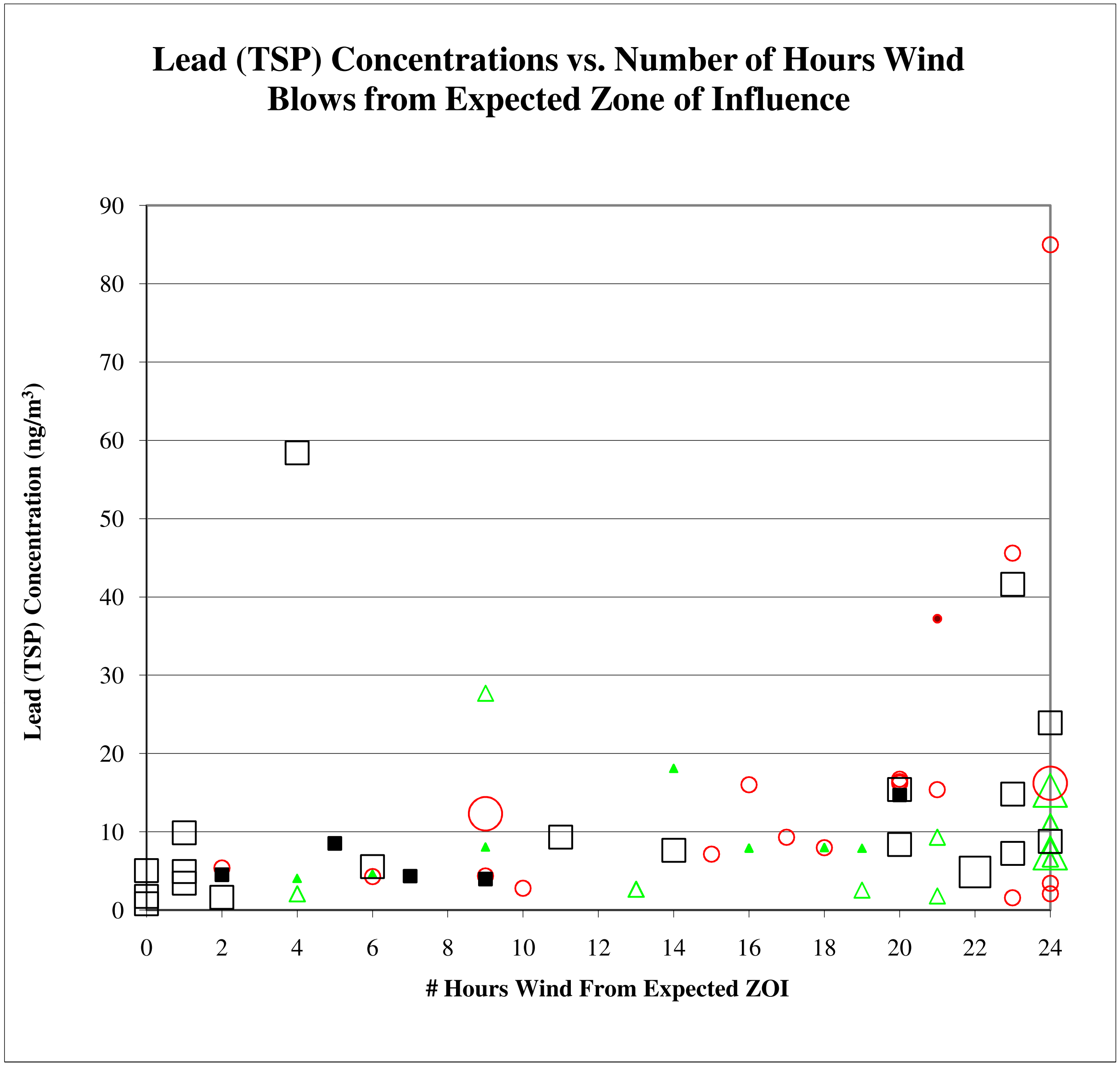
Lewis Elementary School
Composite Hourly Windrose
on Benzene Sample Days
(Aug. 5, 2009-Nov. 18, 2009)



Lewis Elementary School
Composite Hourly Windrose
Across Sampling Period
(Aug. 5, 2009-Nov. 24, 2009)

Expected Zone of Source Influence

Figure 4a. Birmingham, Alabama Area Schools - Lead (TSP) Concentration and Wind Information.



KEY

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

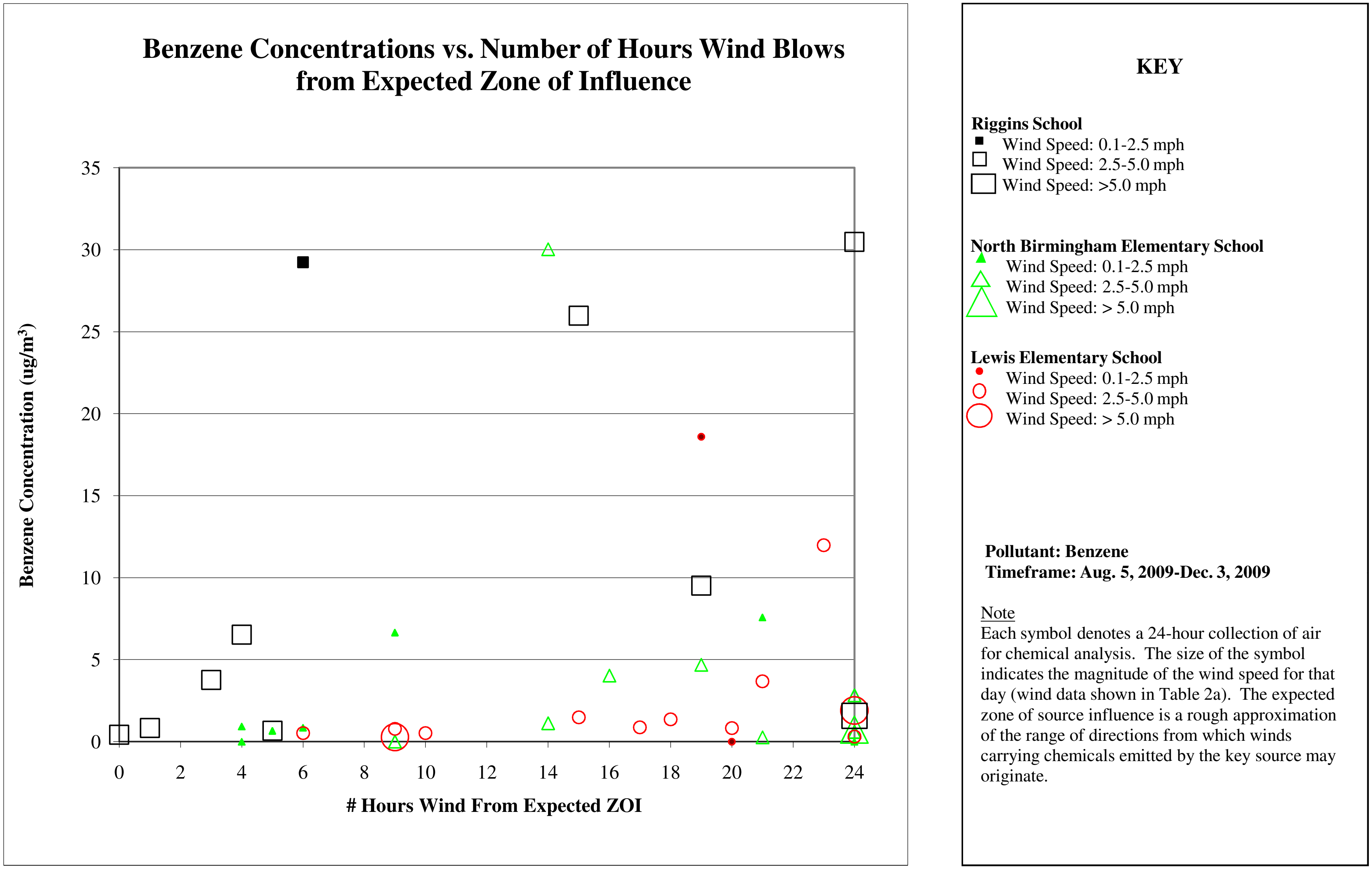
North Birmingham Elementary School
Wind Speed: 0.1-2.5 mph
Wind Speed: 2.5-5.0 mph
Wind Speed: > 5.0 mph

Lewis Elementary School
Wind Speed: 0.1-2.5 mph
Wind Speed: 2.5-5.0 mph
Wind Speed: > 5.0 mph

Pollutant: Lead (TSP)
Timeframe: Aug. 5, 2009-Nov. 24, 2009

Note
Each symbol denotes a 24-hour collection of air for chemical analysis. The size of the symbol 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.

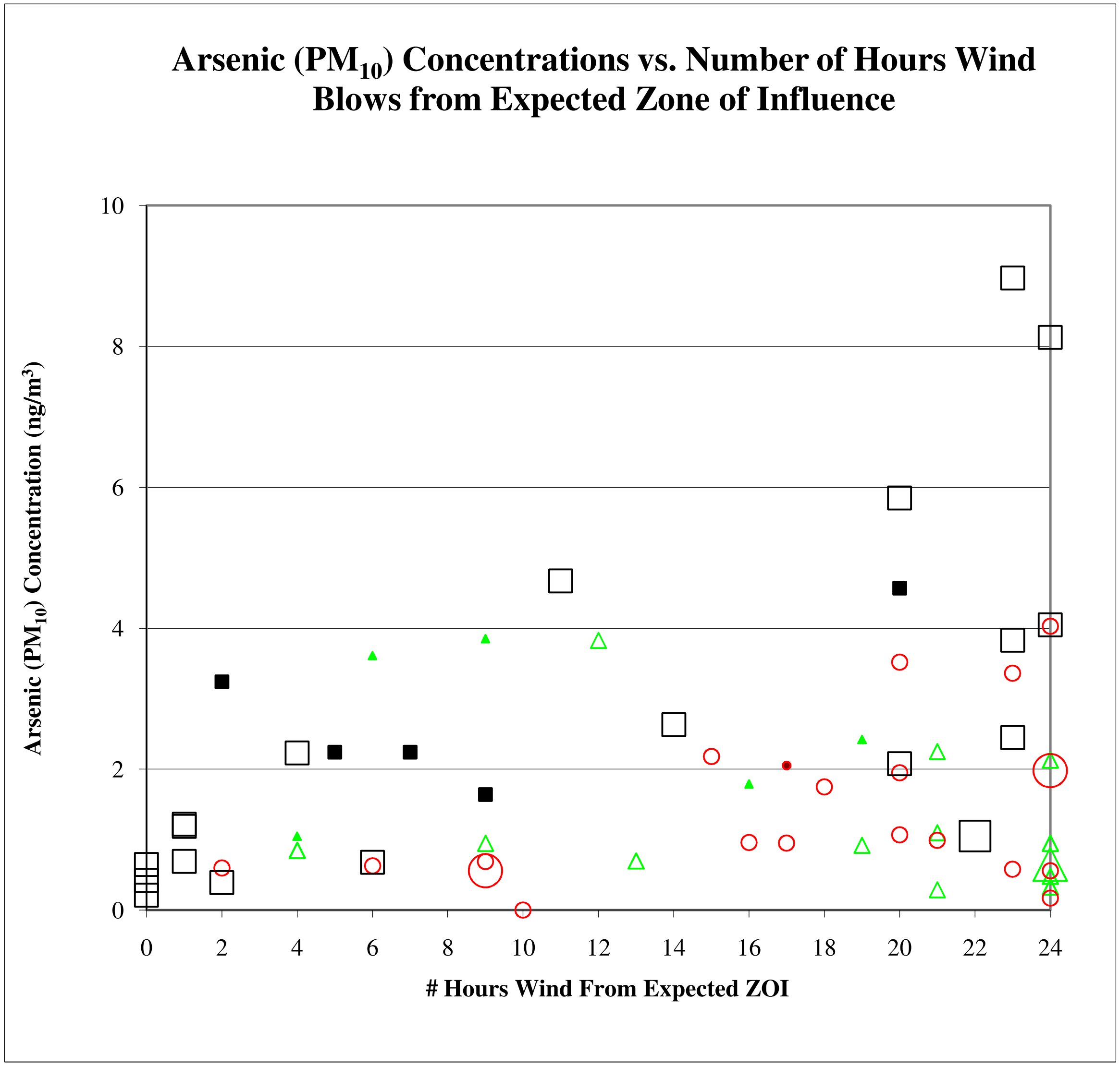
Figure 4b. Birmingham, Alabama Area Schools - Benzene Concentration and Wind Information.

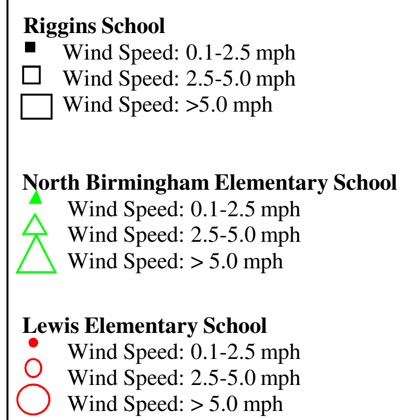


Pollutant: Benzene
Timeframe: Aug. 5, 2009-Dec. 3, 2009

Note
Each symbol denotes a 24-hour collection of air for chemical analysis. The size of the symbol 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 4c. Birmingham, Alabama Area Schools - Arsenic (PM_{10}) Concentration and Wind Information.

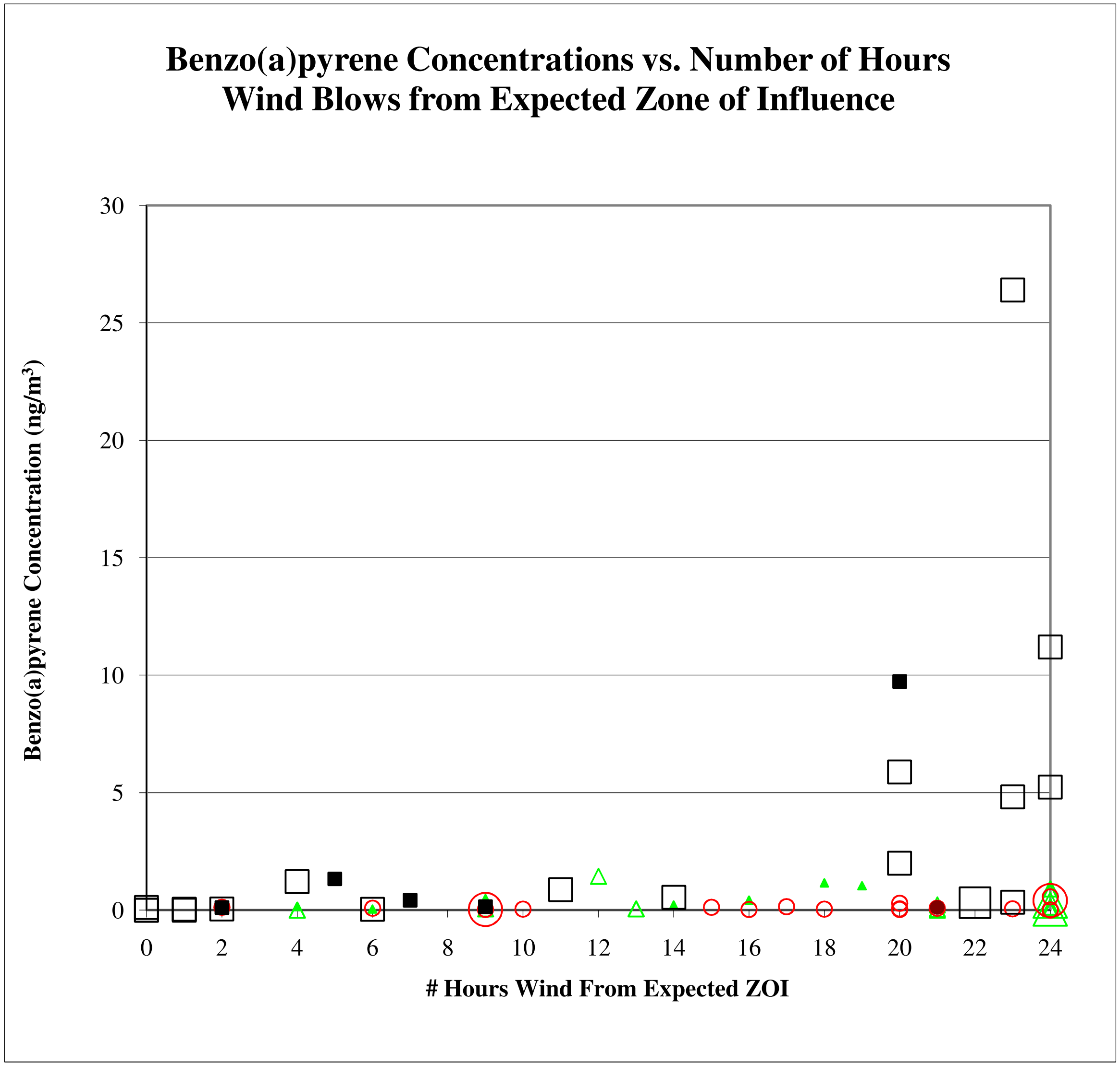




Pollutant: Arsenic (PM_{10})
Timeframe: Aug. 5, 2009-Nov. 24, 2009

Note
Each symbol denotes a 24-hour collection of air for chemical analysis. The size of the symbol 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 4d. Birmingham, Alabama Area Schools - Benzo(a)pyrene Concentration and Wind Information.



KEY

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

North Birmingham Elementary School
- Wind Speed: 0.1-2.5 mph
- Wind Speed: 2.5-5.0 mph
- Wind Speed: > 5.0 mph

Lewis Elementary School
- Wind Speed: 0.1-2.5 mph
- Wind Speed: 2.5-5.0 mph
- Wind Speed: > 5.0 mph

Pollutant: Benzo(a)pyrene
Timeframe: Aug. 5,2009-Nov. 24, 2009

Note
Each symbol denotes a 24-hour collection of air for chemical analysis. The size of the symbol 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.

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.[21]

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.[22] 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.

[21] These comparison levels are described in more detail *Schools Air Toxics Monitoring Activity (2009), Uses of Health Effects Information in Evaluating Sample Results*.
[22] 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.[23] 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.

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[23] 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 at a magnitude to indicate the potential influence by a significant nearby industrial source, or a lower magnitude reflecting less significant sources. 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 Each 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).[24] These pollutants are the primary focus of the monitoring activities at each 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 Tables C-1 through C-3).

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?
  - → For Lewis, the longer-term concentration estimate for manganese is above its long-term noncancer-based comparison level. The longer-term concentration estimates for manganese are below its long-term noncancer-based comparison level at Riggins and N. Birmingham. The longer-term concentration estimates for the other HAPs monitored at each school are also below their long-term comparison levels.
    - ▪ Further, for pollutants with cancer-based comparison levels, the longer-term concentration estimates for all but two of these (chromium and naphthalene) are more than 10-fold lower and all but twelve (chromium, naphthalene, 1,3-butadiene, carbon tetrachloride, tetrachloroethylene, and p-dichlorobenzene at all three schools; ethylbenzene at N. Birmingham and Lewis; cadmium at Lewis; and benzo(b)fluoranthene, benzo(a)anthracene, indeno(1,2,3-cd)pyrene, and dibenz(a,h)anthracene at Riggins) are more than 100-fold lower.[25]
  - → However, as described in the Multiple Pollutants section below, levels of naphthalene considered in combination with levels of the key pollutants, benzene, arsenic and benzo(a)pyrene indicate a potential for levels of concern for long-term continuous exposure to this mixture of pollutants in the air.

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[24] 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.

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

→ Additionally each individual measurement for these pollutants is below the individual sample (short-term) screening level developed for considering potential short-term exposures for that pollutant.[26]

Additional Information on Twelve 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. For all three schools, the mean and 95 percent upper bound on the mean for chromium (PM_{10}) are approximately 41–68% of the cancer-based comparison level. As Cr^{+6} is commonly only a small fraction of chromium (PM_{10}),[27] 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 each school is between the 75^{th} and 95^{th} 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. For all three schools, the mean and 95 percent upper bound on the mean for naphthalene are approximately 10-67% of the cancer-based comparison level. A review of information available at other sites nationally shows that the mean concentration of naphthalene at each school is above the 95^{th} 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 1,3-butadiene. For all three schools, the mean and 95 percent upper bound on the mean for 1,3-butadiene are approximately 3-8% 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 Riggins is between the 75^{th} and 95^{th} percentile of samples collected from 2004 to 2008 (the most recently compiled period) at the NATTS sites (Appendix B). The mean concentration of 1,3-butadiene at both N. Birmingham and Lewis is between the 50^{th} and 75^{th} percentile of samples collected from 2004 to 2008 at the NATTS sites.

- The fourth HAP mentioned above is carbon tetrachloride. For all three schools, the mean and 95 percent upper bound on the mean for carbon tetrachloride are approximately 4-5% of the cancer-based comparison level. A review of information available at other sites nationally shows that the mean concentration of carbon tetrachloride at each school is between the 75^{th} and 95^{th} percentile of samples collected from 2004 to 2008 (the most recently compiled period) at the NATTS sites (Appendix B). Carbon tetrachloride is found globally as a result of its significant past uses in refrigerants and propellants for

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[26] 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.*
[27] Data in EPA's Air Quality System for locations that are not near a facility emitting hexavalent chromium indicate that hexavalent chromium concentrations comprise less than approximately 10% of total chromium concentrations.

aerosol cans and its chemical persistence. Virtually all uses have been discontinued. However, it is still measured throughout the world as a result of its slow rate of degradation in the environment and global distribution in the atmosphere.

- The fifth HAP mentioned above is tetrachloroethylene. For all three schools, the mean and 95 percent upper bound on the mean for tetrachloroethylene are approximately 1-9% of the cancer-based comparison level. A review of information available at other sites nationally shows that the mean concentration of tetrachloroethylene at both Riggins and Lewis is between the 75^{th} and 95^{th} percentile of samples collected from 2004 to 2008 (the most recently compiled period) at the NATTS sites (Appendix B). The mean concentration of tetrachloroethylene at N. Birmingham is between the 50^{th} and 75^{th} percentile of samples collected from 2004 to 2008 at the NATTS sites.

- The sixth HAP mentioned above is *p*-dichlorobenzene. For all three schools, the mean and 95 percent upper bound on the mean for *p*-dichlorobenzene are approximately 1-3% of the cancer-based comparison level. A review of information available at other sites nationally shows that the mean concentration of *p*-dichlorobenzene at each school is below the 75^{th} percentile of samples collected from 2004 to 2008 (the most recently compiled period) at the NATTS sites (Appendix B).

- The seventh HAP mentioned above is ethylbenzene. For N. Birmingham and Lewis, the mean and 95 percent upper bound on the mean for ethylbenzene are approximately 1-3% of the cancer-based comparison level. A review of information available at other sites nationally shows that the mean concentration of ethylbenzene at N. Birmingham is between the 50^{th} and 75^{th} percentile of samples collected from 2004 to 2008 (the most recently compiled period) at the NATTS sites (Appendix B). The mean concentration of ethylbenzene at Lewis is between the 75^{th} and 95^{th} percentile of samples collected from 2004 to 2008 at the NATTS sites.

- The eighth HAP mentioned above is cadmium. For Lewis, 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}) at this site is between the 75^{th} and 95^{th} percentile of samples collected from 2004 to 2008 (the most recently compiled period) at the NATTS sites (Appendix B).

- The last four HAPs mentioned above are benzo(b)fluoranthene, benzo(a)anthracene, indeno(1,2,3-cd)pyrene, and dibenz(a,h)anthracene. For Riggins, the mean and 95 percent upper bound on the mean for each of these pollutants is approximately 1-3% of the cancer-based comparison level. A review of information available at other sites nationally shows that the mean concentrations of these pollutants at this site are greater than the 95^{th} percentile of samples collected from 2004 to 2008 (the most recently compiled period) for these pollutants 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.[28]

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

- Do the data collected for the air toxics monitored indicate the potential for other monitored pollutants to be present at levels that in combination with the key pollutant levels indicate an increased potential for cumulative impacts of significant concern (e.g., that might warrant further investigation)?
  - → The data collected for naphthalene, and the key pollutants, benzene, arsenic and benzo(a) pyrene and the associated longer-term concentration estimates considered together suggest the potential for levels of concern for cumulative health risk from these pollutants. The longer-term concentration estimates for benzene and naphthalene are more than ten percent of their lowest comparison levels. The lowest comparison levels for these pollutants are based on carcinogenic risk. Arsenic and benzo(a)pyrene also have long-term comparison levels based on carcinogenic risk. When aggregated as a group, the fractions of the cancer-based comparison levels comprised by the longer-term concentration estimates for these pollutants are greater than 100%. This indicates the potential for levels of concern for long-term continuous exposure to the mixture of these pollutants.
  - → The long-term concentration estimate for chromium (PM_{10}) is also more than ten percent of its lowest comparison level. As described in the Other Air Toxics section above (Additional Information on Twelve HAPs), this comparison level is based on the most toxic form of chromium, hexavalent chromium,[29] which is generally only a fraction of the total chromium in the ambient air.

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[28] General information on additional air pollutants is available at http://www.epa.gov/air/airpollutants.html.
[29] 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. Riggins School - Other Monitored Pollutant Analysis.

Parameter	Units	Mean of Measurements[a]	95% Confidence Interval on the Mean	Long-term Comparison Level[b] Cancer-Based[c]	Long-term Comparison Level[b] Noncancer-Based[d]
Non-Key HAPs with mean greater than 10% of the lowest comparison level					
Naphthalene	µg/m^3	1.29	0.61 - 1.96	2.9	3
Chromium (PM_{10})	ng/m^3	3.43	2.85 - 4.01	8.3 [e]	100 [e]
Manganese (PM_{10})	ng/m^3	11.9	9.01 - 14.8	NA	50
Non-Key HAPs with mean lower than 10% of the lowest comparison level					
Butadiene, 1,3-	µg/m^3	0.16	0.05 - 0.28	3.3	2
Carbon Tetrachloride	µg/m^3	0.67	0.57 - 0.77	17	100
Tetrachloroethylene	µg/m^3	0.56	0.00 - 1.50	17	270
Cadmium (PM_{10})	ng/m^3	0.30	0.15 - 0.45	56	10
Benzo(b)fluoranthene	ng/m^3	8.37	2.18 - 14.6	570	NA
Chloromethane	µg/m^3	1.15	0.95 - 1.35	NA	90
Benzo(a)anthracene	ng/m^3	7.09	1.77 - 12.4	570	NA
Nickel (PM_{10})	ng/m^3	0.84	0.56 - 1.12	420	90
Antimony (PM_{10})	ng/m^3	1.83	0.91 - 2.74	NA	200
Bromomethane	µg/m^3	0.04	0.03 - 0.06	NA	5
Ethylbenzene	µg/m^3	0.25	0.15 - 0.35	40	1,000
Xylene, *m/p*-	µg/m^3	0.60	0.33 - 0.87	NA	100
Indeno(1,2,3-cd)pyrene	ng/m^3	3.17	0.60 - 5.73	570	NA
Benzo(k)fluoranthene	ng/m^3	2.61	0.59 - 4.62	570	NA
Acetonitrile	ng/m^3	0.19	0.12 - 0.27	NA	60
Dichloromethane	µg/m^3	0.45	0.28 - 0.63	210	1,000
Xylene, *o*-	µg/m^3	0.18	0.11 - 0.26	NA	100
Chrysene	ng/m^3	8.94	2.66 - 15.2	5700	NA
Cobalt (PM_{10})	ng/m^3	0.12	0.08 - 0.16	NA	100
Beryllium (PM_{10})	ng/m^3	0.02	0.01 - 0.04	42	20
Chloroform	µg/m^3	0.10	0.07 - 0.13	NA	98
Toluene	µg/m^3	2.32	1.21 - 3.44	NA	5,000
Styrene	µg/m^3	0.19	0.09 - 0.28	NA	1,000
Carbon Disulfide	µg/m^3	0.13	0.06 - 0.20	NA	700
Mercury (PM_{10})	ng/m^3	0.04	0.02 - 0.06	NA	300 [f]
Methyl isobutyl ketone	µg/m^3	0.25	0.14 - 0.37	NA	3,000
Selenium (PM_{10})	ng/m^3	1.32	0.92 - 1.72	NA	20,000
Trichloroethane, 1,1,1-	µg/m^3	0.06	0.04 - 0.08	NA	5,000
Chloroethane	µg/m^3	0.03	0.01 - 0.05	NA	10,000
Dibenz(a,h)anthracene	ng/m^3	0.76 [g]	0.16 - 1.36 [g]	52	NA
Dichlorobenzene, *p*-	µg/m^3	0.07 [h]	0.01 - 0.13 [h]	9.1	800
Vinyl chloride	µg/m^3	0.008 [i]	0.002 0.014 [i]	11	100
Non-Key HAPs with more than 50% ND Results					
Hexachloro-1,3-butadiene	ng/m^3	70% of the results were ND[j]		4.5	90
Ethylene dichloride	µg/m^3	90% of the results were ND[k]		3.8	2,400
Tetrachloroethane, 1,1,2,2-	µg/m^3	90% of the results were ND[l]		1.7	NA
Chloroprene	µg/m^3	90% of the results were ND[m]		NA	20
Trichloroethylene	µg/m^3	70% of the results were ND[n]		50	600
Dichloroethane, 1,1-	µg/m^3	90% of the results were ND[o]		63	500
Trichlorobenzene, 1,2,4-	µg/m^3	90% of the results were ND[p]		NA	200
Chlorobenzene	µg/m^3	80% of the results were ND[q]		NA	1,000
No other HAPs were detected in any other samples.					

µg/m^3 micrograms per cubic meter

ng/m^3 nanograms per cubic meter

NA Not applicable

Table C-1. Riggins School - Other Monitored Pollutant Analysis.

[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 is 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 14 of 24 samples, ranging from 0.03 to 5.82 ng/m^3. The MDL range is 0.049 to 0.517 ng/m^3.

[h] Dichlorobenzene, p- was detected in 7 of 10 samples, ranging from 0.03 to 0.26 ug/m^3. The MDL range is 0.024 to 0.096 ug/m^3.

[i] Vinyl chloride was detected in 5 of 10 samples, ranging from 0.01 to 0.02 µg/m^3. The MDL range is 0.005 to 0.020 µg/m^3.

[j] Hexachloro-1,3-butadiene was detected in only 3 of 10 samples, ranging from 0.02 to 0.05 ng/m^3. The MDL range is 0.128 to 0.512 ng/m^3.

[k] Ethylene dichloride was detected in only 1 of 10 samples, with a result of 0.069 µg/m^3. The MDL range is 0.008 to 0.032 µg/m^3.

[l] Tetrachloroethane, 1,1,2,2- was detected in only 1 of 10 samples, with a result of 0.03 µg/m^3. The MDL range is 0.021 to 0.082 µg/m^3.

[m] Chloroprene was detected in only 1 of 10 samples, with a result of 0.036 µg/m^3. The MDL range is 0.011 to 0.043 µg/m^3.

[n] Trichloroethylene was detected in only 3 of 10 samples, ranging from 0.04 to 0.054 µg/m^3. The MDL range is 0.011 to 0.043 µg/m^3.

[o] Dichloroethane, 1,1- was detected in only 1 of 10 samples, with a result of 0.03 µg/m^3. The MDL range is 0.008 to 0.032 µg/m^3.

[p] Trichlorobenzene, 1,2,4- was detected in only 1 of 10 samples, with a result of 0.02 µg/m^3. The MDL range is 0.052 to 0.208 µg/m^3.

[q] Chlorobenzene was detected in only 2 of 10 samples, ranging from 0.01 to 0.03 µg/m^3. The MDL range is 0.009 to 0.037 µg/m^3.

Table C-2. North Birmingham Elementary School - Other Monitored Pollutant Analysis.

Parameter	Units	Mean of Measurements[a]	95% Confidence Interval on the Mean	Long-term Comparison Level[b]	
				Cancer-Based[c]	Noncancer-Based[d]
Non-Key HAPs with mean greater than 10% of the lowest comparison level					
Chromium (PM_{10})	ng/m³	3.93	2.73 - 5.13	8.3 [e]	100 [e]
Manganese (PM_{10})	ng/m³	19.8	5.66 - 34.0	NA	50
Naphthalene	µg/m³	0.71	0.32 - 1.10	2.9	3
Non-Key HAPs with mean lower than 10% of the lowest comparison level					
Butadiene, 1,3-	µg/m³	0.11	0.06 - 0.15	3.3	2
Carbon Tetrachloride	µg/m³	0.73	0.66 - 0.80	17	100
Cadmium (PM_{10})	ng/m³	0.20	0.14 - 0.26	56	10
Chloromethane	µg/m³	1.36	1.21 - 1.51	NA	90
Dichlorobenzene, *p-*	µg/m³	0.13	0.09 - 0.18	9.1	800
Tetrachloroethylene	µg/m³	0.23	0.17 - 0.29	17	270
Nickel (PM_{10})	ng/m³	1.14	0.33 - 1.95	420	90
Bromomethane	µg/m³	0.05	0.04 - 0.06	NA	5
Ethylbenzene	µg/m³	0.33	0.25 - 0.42	40	1,000
Antimony (PM_{10})	ng/m³	1.65	1.18 - 2.11	NA	200
Xylene, *m/p-*	µg/m³	0.80	0.57 - 1.04	NA	100
Acetonitrile	µg/m³	0.37	0.26 - 0.47	NA	60
Xylene, *o-*	µg/m³	0.28	0.20 - 0.35	NA	100
Benzo(b)fluoranthene	ng/m³	1.31	0.49 - 2.13	570	NA
Dichloromethane	µg/m³	0.47	0.29 - 0.65	210	1,000
Benzo(a)anthracene	ng/m³	0.85	0.31 - 1.38	570	NA
Chloroform	µg/m³	0.13	0.12 - 0.15	NA	98
Cobalt (PM_{10})	ng/m³	0.09	0.06 - 0.12	NA	100
Indeno(1,2,3-cd)pyrene	ng/m³	0.44	0.14 - 0.73	570	NA
Benzo(k)fluoranthene	ng/m³	0.37	0.14 - 0.60	570	NA
Toluene	µg/m³	2.01	1.34 - 2.68	NA	5,000
Methyl isobutyl ketone	µg/m³	0.74	0.36 - 1.12	NA	3,000
Chrysene	µg/m³	1.38	0.55 - 2.22	5700	NA
Carbon Disulfide	µg/m³	0.17	0.06 - 0.28	NA	700
Styrene	µg/m³	0.16	0.10 - 0.22	NA	1,000
Mercury (PM_{10})	ng/m³	0.03	0.01 - 0.04	NA	300 [f]
Selenium (PM_{10})	ng/m³	1.29	0.71 - 1.87	NA	20,000
Trichloroethane, 1,1,1-	µg/m³	0.07	0.07 - 0.08	NA	5,000
Chloroethane	µg/m³	0.03	0.01 - 0.05	NA	10,000
Non-Key HAPs with more than 50% ND Results					
Acrylonitrile	µg/m³	88% of the results were ND[g]		1.5	2
Dibenz(a,h)anthracene	ng/m³	58% of the results were ND[h]		52	NA
Trichloroethylene	µg/m³	63% of the results were ND[i]		50	600
Beryllium (PM_{10})	ng/m³	56% of the results were ND[j]		42	20
Vinyl chloride	µg/m³	75% of the results were ND[k]		11	100
Trichloroethane, 1,1,2-	µg/m³	94% of the results were ND[l]		6.3	400
No other HAPs were detected in any other samples.					

µg/m³ micrograms per cubic meter

ng/m³ nanograms per cubic meter

NA Not applicable

Table C-2. North Birmingham Elementary School - Other Monitored Pollutant Analysis.

[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 is 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] Acrylonitrile was detected in only 2 of 17 samples, ranging from 0.041 to 0.13 µg/m^3. The MDL is 0.033 µg/m^3.

[h] Dibenz(a,h)anthracene was detected in only 9 of 20 samples, ranging from 0.02 to 0.42 ng/m^3. The MDL range is 0.039 to 0.075 ng/m^3.

[i] Trichloroethylene was detected in only 6 of 17 samples, ranging from 0.03 to 0.17 µg/m^3. The MDL is 0.011 µg/m^3.

[j] Beryllium (PM_{10}) was detected in only 8 of 18 samples, ranging from 0.002 to 0.08 ng/m^3. The MDL range is 0.002 to 0.03 ng/m^3.

[k] Vinyl chloride was detected in only 4 of 17 samples, ranging from 0.008 to 0.043 µg/m^3. The MDL is 0.005 µg/m^3.

[l] Trichloroethane, 1,1,2- was detected in only 1 of 17 samples, with a result of 0.02 µg/m^3. The MDL is 0.016 µg/m^3.

Table C-3. Lewis Elementary School -Other Monitored Pollutant Analysis.

Parameter	Units	Mean of Measurements[a]	95% Confidence Interval on the Mean	Long-term Comparison Level[b] Cancer-Based[c]	Long-term Comparison Level[b] Noncancer-Based[d]
Non-Key HAPs with mean greater than 10% of the lowest comparison level					
Manganese (PM_{10})	ng/m^3	41.6	22.3 - 60.9	NA	50
Chromium (PM_{10})	ng/m^3	4.16	2.64 - 5.68	8.3 [e]	100 [e]
Naphthalene	$\mu g/m^3$	0.30	0.07 - 0.52	2.9	3
Non-Key HAPs with mean lower than 10% of the lowest comparison level					
Butadiene, 1,3-	$\mu g/m^3$	0.11	0.06 - 0.17	3.3	2
Carbon Tetrachloride	$\mu g/m^3$	0.75	0.65 - 0.85	17	100
Cadmium (PM_{10})	ng/m^3	0.53	0.23 - 0.82	56	10
Tetrachloroethylene	$\mu g/m^3$	0.32	0.20 - 0.43	17	270
Dichlorobenzene, *p-*	$\mu g/m^3$	0.16	0.10 - 0.22	9.1	800
Ethylbenzene	$\mu g/m^3$	0.61	0.18 - 1.04	40	1,000
Chloromethane	$\mu g/m^3$	1.31	1.13 - 1.49	NA	90
Xylene, *m/p-*	$\mu g/m^3$	1.42	0.41 - 2.44	NA	100
Nickel (PM_{10})	ng/m^3	1.21	0.57 - 1.84	420	90
Antimony (PM_{10})	ng/m^3	2.44	1.34 - 3.54	NA	200
Bromomethane	$\mu g/m^3$	0.05	0.05 - 0.06	NA	5
Acetonitrile	$\mu g/m^3$	0.30	0.23 - 0.37	NA	60
Xylene, *o-*	$\mu g/m^3$	0.39	0.18 - 0.61	NA	100
Dichloromethane	$\mu g/m^3$	0.37	0.29 - 0.45	210	1,000
Cobalt (PM_{10})	ng/m^3	0.15	0.09 - 0.20	NA	100
Chloroform	$\mu g/m^3$	0.13	0.10 - 0.16	NA	98
Benzo(b)fluoranthene	ng/m^3	0.48	0.15 - 0.82	570	NA
Benzo(a)anthracene	ng/m^3	0.31	0.05 - 0.56	570	NA
Toluene	$\mu g/m^3$	2.26	0.95 - 3.58	NA	5,000
Indeno(1,2,3-cd)pyrene	ng/m^3	0.16	0.05 - 0.28	570	NA
Carbon Disulfide	$\mu g/m^3$	0.16	0.07 - 0.26	NA	700
Methyl isobutyl ketone	$\mu g/m^3$	0.68	0.43 - 0.94	NA	3,000
Benzo(k)fluoranthene	ng/m^3	0.13	0.04 - 0.22	570	NA
Mercury (PM_{10})	ng/m^3	0.04	0.02 - 0.07	NA	300 [f]
Styrene	$\mu g/m^3$	0.13	0.06 - 0.19	NA	1,000
Chrysene	ng/m^3	0.58	0.19 - 0.97	5,700	NA
Selenium (PM_{10})	ng/m^3	1.11	0.85 - 1.38	NA	20,000
Trichloroethane, 1,1,1-	$\mu g/m^3$	0.08	0.07 - 0.09	NA	5,000
Chloroethane	$\mu g/m^3$	0.03	0.02 - 0.05	NA	10,000
Beryllium (PM_{10})	ng/m^3	0.025 [g]	0.01 - 0.04 [g]	42	20
Non-Key HAPs with more than 50% ND Results					
Hexachloro-1,3-butadiene	$\mu g/m^3$	92% of the results were ND[h]		4.5	90
Trichloroethylene	$\mu g/m^3$	62% of the results were ND[i]		50	600
Vinyl chloride	$\mu g/m^3$	62% of the results were ND[j]		11	100
Dibenz(a,h)anthracene	ng/m^3	78% of the results were ND[k]		52	NA
No other HAPs were detected in any other samples.					

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

ng/m^3 nanograms per cubic meter

NA Not applicable

Table C-3. Lewis Elementary School -Other Monitored Pollutant Analysis.

[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 is 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] Beryllium (PM_{10}) was detected in 10 of 20 samples, ranging from 0.0007 to 0.14 ng/m^3. The MDL range is 0.03 to 0.15 ng/m^3.

[h] Hexachloro-1,3-butadiene was detected in only 1 of 14 samples, with a result of 0.07 µg/m^3. The MDL is 0.128 µg/m^3.

[i] Trichloroethylene was detected in only 6 of 14 samples, ranging from 0.065 to 0.13 µg/m^3. The MDL is 0.011 µg/m^3.

[j] Vinyl chloride was detected in only 6 of 14 samples, ranging from 0.01 to 0.026 µg/m^3. The MDL is 0.005 µg/m^3.

[k] Dibenz(a,h)anthracene was detected in only 5 of 19 samples, ranging from 0.03 to 0.20 ng/m^3. The MDL range is 0.042 to 0.062 ng/m^3.

Appendix D-1. Riggins School Pollutant Concentrations.

Parameter	Units	8/5/2009	8/11/2009	8/17/2009	8/23/2009	8/25/2009	8/29/2009	9/4/2009	9/10/2009	9/14/2009	9/16/2009	9/22/2009	9/25/2009	9/28/2009	10/4/2009	10/10/2009	10/16/2009	10/22/2009	10/28/2009	10/30/2009	11/3/2009	11/9/2009	11/12/2009	11/18/2009	11/24/2009	11/30/2009	12/3/2009	Sample Screening Level[a]
Benzene	μg/m^3	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	30.5	29.2	26.0	6.52	1.58	0.837	3.77	9.53	0.665	0.419	30
Arsenic (PM_{10})	ng/m^3	1.19	1.22	3.83	0.65	4.67	3.24	1.64	2.08	2.45	4.05	5.85	2.24	0.68	2.63	0.69	0.21	8.13	2.24	8.97	2.23	1.05	0.39	0.42	4.57	--	--	150
Lead (TSP)	ng/m^3	4.93	9.87	14.8	1.77	9.32	4.52	3.96	8.37	7.26	8.79	15.4	4.34	5.56	7.62	3.42	0.829	23.9	8.52	41.6	58.4	4.86	1.64	5.03	14.7	--	--	150
Benzo(a)pyrene	ng/m^3	ND	0.0300	4.82	ND	0.870	0.110	0.150	2.00	0.340	5.24	5.88	0.420	0.0300	0.550	0.0300	ND	11.2	1.33	26.4	1.21	0.320	0.0400	0.110	9.73	--	--	6,400
Naphthalene	μg/m^3	0.177	0.254	2.780	0.0619	1.150	0.338	0.568	0.728	0.702	1.990	4.060	0.986	0.0743	1.070	0.0768	0.0376	4.060	0.958	5.780	0.772	0.378	0.0737	0.130	3.650	--	--	30
Chromium (PM_{10})	ng/m^3	2.87	3.09	3.03	1.32	2.52	1.84	4.62	3.13	4.61	5.81	4.92	2.40	4.30	2.62	1.83	1.14	5.11	3.56	4.48	6.55	2.79	3.02	3.37	3.37	--	--	580[b]
Manganese (PM_{10})	ng/m^3	18.2	16.3	22.5	2.58	15.8	9.56	8.68	5.97	14.0	13.3	18.4	11.0	16.7	15.3	1.92	0.91	17.7	9.31	14.5	7.82	9.81	3.83	3.63	27.6	--	--	500
Butadiene, 1,3-	μg/m^3	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.458	0.21	0.421	0.17	0.040	0.042	0.071	0.17	ND	0.03	20
Carbon Tetrachloride	μg/m^3	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.699	0.812	0.686	0.674	0.951	0.52	0.51	0.58	0.692	0.59	200
Tetrachloroethylene	μg/m^3	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.16	0.40	0.081	0.17	0.081	0.12	0.14	0.18	ND	4.32	1,400
Cadmium (PM_{10})	ng/m^3	0.11	0.22	0.48	0.08	0.16	0.14	0.09	0.16	0.64	0.19	0.25	0.13	0.15	0.23	0.12	0.03	0.72	0.13	1.70	0.31	0.10	0.08	0.56	0.49	--	--	30
Benzo(b)fluoranthene	ng/m^3	0.150	0.220	13.4	0.170	3.74	0.42	0.580	5.79	2.13	16.2	23.1	1.87	0.180	2.14	0.190	0.0800	34.0	4.22	61.0	2.94	1.21	0.180	0.410	26.6	--	--	64,000
Chloromethane	μg/m^3	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1.13	1.30	1.43	1.27	1.73	0.864	0.888	1.11	0.955	0.841	1,000
Benzo(a)anthracene	ng/m^3	0.0800	0.130	10.2	0.110	2.420	0.270	0.400	5.590	2.57	16.7	22.1	1.63	0.0700	1.48	0.150	0.0300	26.8	2.68	52.5	1.61	0.600	0.0800	0.190	21.8	--	--	64,000
Nickel (PM_{10})	ng/m^3	2.44	0.57	1.2	0.28	1.08	0.61	0.65	2.21	0.77	0.86	2.28	0.63	0.53	0.66	0.007	ND	0.98	0.46	1.48	0.38	0.91	0.13	0.70	0.43	--	--	200
Antimony (PM_{10})	ng/m^3	1.37	1.41	0.86	0.81	3.98	2.6	1.60	1.35	1.11	0.72	1.14	1.38	0.75	1.39	1.21	0.19	1.38	2.34	2.71	11.3	1.14	1.01	0.77	1.28	--	--	2,000
Bromomethane	μg/m^3	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.051	0.074	0.051	0.03	0.051	0.03	0.058	0.039	ND	0.03	200
Ethylbenzene	μg/m^3	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.20	0.482	0.12	0.35	0.091	0.16	0.35	0.20	0.11	0.19	40,000
Xylene, *m/p*-	μg/m^3	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.94	1.36	0.71	0.84	0.18	0.25	0.67	0.56	0.20	0.27	9,000
Indeno(1,2,3-cd)pyrene	ng/m^3	0.05	0.08	5.52	ND	1.37	0.18	ND	2.20	0.51	4.78	6.97	0.46	0.04	0.79	ND	ND	14.10	1.61	26.40	1.17	0.31	0.07	0.17	9.24	--	--	64,000
Benzo(k)fluoranthene	ng/m^3	0.0300	0.0500	3.48	0.050	1.02	0.120	0.260	2.03	0.580	4.86	6.24	0.640	0.0500	0.620	0.0600	0.0300	10.5	1.28	20.3	0.650	0.380	0.0400	0.130	9.14	--	--	64,000
Acetonitrile	μg/m^3	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.391	0.178	0.262	0.12	0.299	0.16	0.15	0.252	ND	0.13	600
Dichloromethane	μg/m^3	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.487	0.563	0.30	0.361	0.34	0.23	0.24	0.688	0.28	1.01	2,000
Xylene, *o*-	μg/m^3	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.27	0.43	0.20	0.25	0.074	0.096	0.18	0.17	0.078	0.087	9,000
Chrysene	ng/m^3	0.330	0.480	12.3	0.280	3.93	0.680	0.770	7.29	3.75	20.9	27.0	3.12	0.260	2.41	0.440	0.110	34.7	4.57	61.3	2.68	1.75	0.240	0.470	24.7	--	--	640,000
Cobalt (PM_{10})	ng/m^3	0.27	0.13	0.29	0.02	0.34	0.08	0.10	0.06	0.13	0.15	0.22	0.09	0.10	0.12	0.02	ND	0.16	0.06	0.15	0.12	0.03	0.09	0.01	0.09	--	--	100
Beryllium (PM_{10})	ng/m^3	ND	0.03	0.04	0.006	0.08	0.01	0.06	ND	0.04	0.11	0.006	0.002	0.005	0.03	ND	ND	0.07	0.01	0.03	0.008	ND	0.003	ND	ND	--	--	20
Chloroform	μg/m^3	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.11	0.17	0.093	0.13	0.13	0.093	0.11	0.098	ND	0.10	500
Toluene	μg/m^3	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	4.45	5.01	3.57	2.06	0.505	0.943	1.18	2.54	0.709	2.26	4,000
Styrene	μg/m^3	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.29	0.42	0.26	0.24	0.077	0.14	0.32	0.13	ND	ND	9,000
Carbon Disulfide	μg/m^3	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.26	0.13	0.327	0.062	0.097	0.037	0.15	0.087	0.062	0.069	7,000
Mercury (PM_{10})	ng/m^3	0.02	0.06	0.03	0.002	0.01	0.006	0.01	ND	0.14	0.09	0.002	0.04	0.05	0.07	0.02	0.01	0.12	0.07	0.17	0.02	0.02	0.05	0.005	0.03	--	--	3000[c]
Methyl isobutyl ketone	μg/m^3	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.32	0.570	0.414	0.11	0.27	0.066	0.15	0.36	0.07	0.18	30,000
Selenium (PM_{10})	ng/m^3	0.68	0.77	1.64	0.36	1.46	1	1.59	1.30	2.77	1.85	2.98	0.73	1.54	0.75	0.29	0.27	2.74	1.20	3.86	0.83	0.61	0.56	0.38	1.50	--	--	20,000
Methyl chloroform	μg/m^3	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.07	0.08	0.07	0.06	0.08	0.05	0.05	0.07	ND	0.07	10,000
Chloroethane	μg/m^3	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.01	0.02	0.02	0.029	0.095	0.063	0.032	ND	ND	0.04	40,000
Dibenz(a,h)anthracene	ng/m^3	ND	ND	1.17	ND	0.28	ND	ND	0.47	0.14	1.38	2.07	ND	ND	0.15	ND	ND	3.40	0.37	5.82	0.24	0.08	ND	0.03	2.65	--	--	5,800

Appendix D-1. Riggins School Pollutant Concentrations.

Parameter	Units	8/5/2009	8/11/2009	8/17/2009	8/23/2009	8/25/2009	8/29/2009	9/4/2009	9/10/2009	9/14/2009	9/16/2009	9/22/2009	9/25/2009	9/28/2009	10/4/2009	10/10/2009	10/16/2009	10/22/2009	10/28/2009	10/30/2009	11/3/2009	11/9/2009	11/12/2009	11/18/2009	11/24/2009	11/30/2009	12/3/2009	Sample Screening Level[a]
Dichlorobenzene, *p*-	µg/m^3	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.060	0.16	0.04	0.10	0.03	0.26	0.066	ND	ND	ND	10,000
Vinyl chloride	µg/m^3	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.02	0.01	0.02	0.02	ND	ND	0.02	ND	ND	ND	1,000
Hexachloro-1,3-butadiene	µg/m^3	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	ND	0.04	0.05	0.02	ND	ND	ND	ND	ND	ND	320
Ethylene dichloride	µg/m^3	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	ND	0.069	ND	ND	ND	ND	ND	ND	ND	ND	270
Tetrachloroethane, 1,1,2,2-	µg/m^3	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	ND	ND	ND	ND	ND	ND	ND	0.03	ND	ND	120
Chloroprene	µg/m^3	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	ND	ND	ND	ND	ND	ND	0.036	ND	ND	ND	200
Trichloroethylene	µg/m^3	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	ND	0.04	ND	0.054	0.04	ND	ND	ND	ND	ND	10,000
Dichloroethane, 1,1-	µg/m^3	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	ND	ND	ND	ND	0.03	ND	ND	ND	ND	ND	4,400
Trichlorobenzene, 1,2,4-	µg/m^3	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	ND	0.02	ND	ND	ND	ND	ND	ND	ND	ND	2,000
Chlorobenzene	µg/m^3	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	ND	0.01	0.03	ND	ND	ND	ND	ND	ND	ND	10,000
Acrylonitrile	µg/m^3	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	200
Benzyl Chloride	µg/m^3	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	140
Bromoform	µg/m^3	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	6,400
Ethylene Dibromide	µg/m^3	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	12
Dichloroethylene, 1,1-	µg/m^3	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	80
Dichloropropane, 1,2-	µg/m^3	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	200
Dichloropropylene, *cis*- 1,3-	µg/m^3	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	40
Dichloropropylene, *trans*- 1,3-	µg/m^3	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	40
Ethyl Acrylate	µg/m^3	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	7,000
Methyl Methacrylate	µg/m^3	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	7,000
Methyl *tert*- Butyl Ether	µg/m^3	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	7,000
Trichloroethane, 1,1,2-	µg/m^3	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	440

Key Pollutant

ng/m^3 nanograms per cubic meter

µg/m^3 micrograms per cubic meter

-- No sample was conducted 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 comparison 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." These short-term 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 D-2. North Birmingham Elementary School Pollutant Concentrations.

Parameter	Units	8/5/2009	8/11/2009	8/17/2009	8/23/2009	8/29/2009	9/4/2009	9/10/2009	9/16/2009	9/22/2009	9/24/2009	9/28/2009	10/4/2009	10/10/2009	10/16/2009	10/19/2009	10/22/2009	10/28/2009	11/3/2009	11/8/2009	11/9/2009	11/12/2009	11/18/2009	11/24/2009	Sample Screening Level[a]
Benzene	$\mu g/m^3$	0.662	0.927	--	--	0.847	6.65	7.58	0.582	1.42	4.03	--	--	--	0.26	30.1	0.588	24.50	4.70	2.83	--	1.12	5.98	0.735	30
Arsenic (PM_{10})	ng/m^3	--	1.05	0.65	0.85	3.61	3.85	2.25	0.48	1.10	1.79	0.95	3.83	0.70	0.29	--	--	--	2.42	--	2.13	0.92	0.33	0.95	150
Lead (TSP)	ng/m^3	--	4.08	7.32	2.09	4.65	8.06	--	--	9.32	7.93	27.7	--	2.67	1.82	18.1	15.3	8.01	7.92	--	11.3	2.56	8.20	6.54	150
Benzo(a)pyrene	ng/m^3	--	0.150	0.0400	ND	0.0400	0.490	0.2200	ND	0.0400	0.430	0.0500	1.44	0.0500	ND	0.2130	0.380	1.16	1.04	--	0.910	--	0.120	0.130	6,400
Chromium (PM_{10})	ng/m^3	--	3.47	4.01	2.01	2.35	3.64	7.47	4.55	3.25	2.92	8.70	2.48	1.88	1.12	--	--	--	3.72	--	8.19	3.10	3.03	3.51	580
Manganese (PM_{10})	ng/m^3	--	16.8	23.1	2.05	7.45	18.0	16.1	115	25.3	11.8	26.6	17.5	1.79	1.17	--	--	--	17.4	--	13.2	3.70	5.97	17.9	500
Naphthalene	$\mu g/m^3$	--	0.258	0.261	0.0433	0.217	1.350	0.380	0.0665	0.159	1.520	0.455	2.260	0.0724	0.0390	0.42	0.387	0.943	2.220	--	1.390	--	0.0643	0.122	30
Butadiene, 1,3-	$\mu g/m^3$	0.058	0.10	--	--	0.075	0.12	0.13	0.038	0.075	0.15	--	--	--	0.02	0.48	0.058	0.321	0.17	0.077	--	0.100	0.11	0.080	20
Carbon Tetrachloride	$\mu g/m^3$	0.705	0.799	--	--	0.736	0.62	0.736	0.705	0.755	0.705	--	--	--	0.692	0.59	0.59	0.787	0.837	1.05	--	0.56	0.52	0.59	200
Cadmium (PM_{10})	ng/m^3	--	0.25	0.38	0.11	0.14	0.17	0.19	0.11	0.21	0.36	0.27	0.41	0.08	0.03	--	--	--	0.25	--	0.18	0.09	0.63	0.10	30
Chloromethane	$\mu g/m^3$	1.35	1.43	--	--	1.38	1.35	1.58	1.61	1.45	1.36	--	--	--	0.731	1.35	1.34	1.63	1.24	1.65	--	0.928	0.932	1.01	1,000
Dichlorobenzene, *p*-	$\mu g/m^3$	0.19	0.24	--	--	0.16	0.16	0.26	0.096	0.11	0.22	--	--	--	ND	0.16	0.05	0.14	0.13	0.04	--	0.10	0.090	ND	10,000
Tetrachloroethylene	$\mu g/m^3$	0.43	0.29	--	--	0.20	0.31	0.39	0.26	0.20	0.29	--	--	--	0.068	0.22	0.12	0.28	0.18	0.095	--	0.10	0.14	0.28	1,400
Nickel (PM_{10})	ng/m^3	--	0.64	1.37	ND	0.47	1.15	0.61	0.64	0.59	0.74	3.80	0.57	5.82	ND	--	--	--	1.08	--	0.57	0.14	0.43	ND	200
Bromomethane	$\mu g/m^3$	0.051	0.043	--	--	0.043	0.070	0.051	0.062	0.058	0.047	--	--	--	0.039	0.039	0.04	0.085	0.047	0.062	--	0.043	0.051	0.039	200
Ethylbenzene	$\mu g/m^3$	0.30	0.31	--	--	0.26	0.36	0.487	0.18	0.41	0.43	--	--	--	0.048	0.74	0.21	0.43	0.46	0.13	--	0.24	0.33	0.26	40,000
Antimony (PM_{10})	ng/m^3	--	1.49	0.70	1.04	3.08	2.56	1.53	0.71	1.22	2.94	1.31	1.88	1.80	0.35	--	--	--	3.14	--	1.44	1.13	0.83	1.31	2,000
Xylene, *m/p*-	$\mu g/m^3$	0.55	0.87	--	--	0.69	0.89	1.35	0.44	1.17	1.41	--	--	--	0.08	1.75	0.56	1.27	1.09	0.35	--	0.55	0.73	0.53	9,000
Acetonitrile	$\mu g/m^3$	0.344	0.546	--	--	0.306	0.391	0.911	0.338	0.386	0.356	--	--	--	0.16	0.302	0.30	0.370	0.328	0.225	--	0.193	0.176	0.15	600
Xylene, *o*-	$\mu g/m^3$	0.22	0.29	--	--	0.26	0.30	0.474	0.16	0.40	0.443	--	--	--	0.04	0.55	0.20	0.43	0.36	0.13	--	0.20	0.23	0.18	9,000
Benzo(b)fluoranthene	ng/m^3	--	0.690	0.160	0.0600	0.170	2.24	1.36	0.0900	0.120	1.53	0.120	5.39	0.180	0.0800	1.090	0.420	2.68	3.43	--	3.54	--	0.340	0.585	64,000
Dichloromethane	$\mu g/m^3$	0.348	0.386	--	--	1.51	0.431	0.452	0.34	0.452	0.31	--	--	--	0.601	0.51	0.27	0.577	0.33	0.32	--	0.24	0.28	0.660	2,000
Benzo(a)anthracene	ng/m^3	--	0.310	0.110	0.0300	0.090	1.85	1.18	0.0600	ND	1.01	0.0700	3.55	0.130	0.0400	0.457	0.320	1.49	2.31	--	1.86	--	0.220	0.257	64,000
Chloroform	$\mu g/m^3$	0.11	0.11	--	--	0.13	0.14	0.17	0.12	0.14	0.14	--	--	--	0.10	0.17	0.088	0.15	0.18	0.12	--	0.15	0.11	0.098	500
Cobalt (PM_{10})	ng/m^3	--	0.13	0.18	ND	0.07	0.17	0.07	0.09	0.04	0.09	0.12	0.12	0.16	ND	--	--	--	0.13	--	0.04	0.06	0.02	0.01	100
Indeno(1,2,3-cd)pyrene	ng/m^3	--	0.29	0.06	ND	0.08	0.67	0.26	ND	ND	0.56	0.07	2.00	ND	ND	0.39	0.20	0.97	1.19	--	1.07	--	0.09	0.22	64,000
Benzo(k)fluoranthene	ng/m^3	--	0.210	0.0400	0.0200	0.0400	0.750	0.410	0.0300	ND	0.450	0.0400	1.26	0.0500	ND	0.332	ND	0.840	1.19	--	0.990	--	0.330	0.142	64,000
Toluene	$\mu g/m^3$	1.43	1.99	--	--	2.12	2.54	3.57	0.905	1.87	2.93	--	--	--	0.26	5.88	1.15	4.56	2.62	0.762	--	1.38	1.83	1.30	4,000
Methyl isobutyl ketone	$\mu g/m^3$	0.971	2.36	--	--	0.664	0.23	0.25	0.627	1.65	1.34	--	--	--	0.02	0.11	0.959	0.25	0.574	0.098	--	0.39	0.25	0.22	30,000
Chrysene	ng/m^3	--	0.610	0.210	0.0800	0.260	2.76	1.62	0.180	0.180	1.51	0.150	5.28	0.120	0.0900	0.850	0.630	2.40	3.18	--	4.25	--	0.370	0.571	640,000
Carbon Disulfide	$\mu g/m^3$	0.18	0.21	--	--	0.093	0.826	0.12	0.12	0.16	0.11	--	--	--	0.047	0.16	0.087	0.18	0.11	0.081	--	0.041	0.065	0.02	7,000
Styrene	$\mu g/m^3$	0.29	0.17	--	--	0.081	0.33	0.24	0.051	0.12	0.20	--	--	--	ND	0.55	0.072	0.29	0.18	0.081	--	0.16	0.32	ND	9,000
Mercury (PM_{10})	ng/m^3	--	0.04	0.03	ND	ND	0.04	ND	0.08	0.03	0.04	0.07	0.04	ND	0.01	--	--	--	0.003	--	0.02	0.01	0.02	0.009	3,000
Selenium (PM_{10})	ng/m^3	--	0.97	0.84	0.44	0.67	1.84	1.35	1.49	2.39	4.79	1.71	0.92	0.30	0.26	--	--	--	0.84	--	0.86	0.98	0.35	1.20	20,000
Methyl chloroform	$\mu g/m^3$	0.066	0.076	--	--	0.087	0.071	0.082	0.076	0.071	0.071	--	--	--	0.082	0.065	0.060	0.066	0.076	0.082	--	0.066	0.055	0.066	10,000
Chloroethane	$\mu g/m^3$	0.029	ND	--	--	ND	0.13	0.032	0.026	0.037	0.029	--	--	--	0.02	0.03	0.02	0.037	0.032	0.026	--	0.02	0.026	ND	40,000
Acrylonitrile	$\mu g/m^3$	ND	0.13	--	--	ND	ND	ND	ND	ND	ND	--	--	--	0.041	ND	ND	ND	ND	ND	--	ND	ND	ND	200
Dibenz(a,h)anthracene	ng/m^3	--	ND	ND	ND	ND	0.18	0.04	ND	ND	ND	ND	0.42	ND	ND	0.10	ND	0.24	0.30	--	0.27	--	0.02	0.05	5,800

Appendix D-2. North Birmingham Elementary School Pollutant Concentrations.

Parameter	Units	8/5/2009	8/11/2009	8/17/2009	8/23/2009	8/29/2009	9/4/2009	9/10/2009	9/16/2009	9/22/2009	9/24/2009	9/28/2009	10/4/2009	10/10/2009	10/16/2009	10/19/2009	10/22/2009	10/28/2009	11/3/2009	11/8/2009	11/9/2009	11/12/2009	11/18/2009	11/24/2009	Sample Screening Level[a]
Trichloroethylene	μg/m³	0.059	ND	--	--	ND	0.070	0.17	ND	0.075	0.11	--	--	--	ND	ND	ND	ND	ND	0.03	--	ND	ND	ND	10,000
Beryllium (PM_{10})	ng/m³	--	0.02	0.008	ND	0.002	0.08	0.003	0.08	0.02	ND	ND	0.02	ND	ND	ND	--	--	ND	--	ND	ND	ND	ND	20
Vinyl chloride	μg/m³	ND	ND	--	--	ND	0.043	0.01	ND	0.01	ND	--	--	--	ND	ND	0.008	ND	ND	ND	--	ND	ND	ND	1,000
Trichloroethane, 1,1,2-	μg/m³	ND	0.02	--	--	ND	ND	ND	ND	ND	ND	--	--	--	ND	ND	ND	ND	ND	ND	--	ND	ND	ND	440
Benzyl Chloride	μg/m³	ND	ND	--	--	ND	ND	ND	ND	ND	ND	--	--	--	ND	ND	ND	ND	ND	ND	--	ND	ND	ND	140
Bromoform	μg/m³	ND	ND	--	--	ND	ND	ND	ND	ND	ND	--	--	--	ND	ND	ND	ND	ND	ND	--	ND	ND	ND	6,400
Chlorobenzene	μg/m³	ND	ND	--	--	ND	ND	ND	ND	ND	ND	--	--	--	ND	ND	ND	ND	ND	ND	--	ND	ND	ND	10,000
Chloroprene	μg/m³	ND	ND	--	--	ND	ND	ND	ND	ND	ND	--	--	--	ND	ND	ND	ND	ND	ND	--	ND	ND	ND	200
Ethylene Dibromide	μg/m³	ND	ND	--	--	ND	ND	ND	ND	ND	ND	--	--	--	ND	ND	ND	ND	ND	ND	--	ND	ND	ND	12
Dichloroethane, 1,1-	μg/m³	ND	ND	--	--	ND	ND	ND	ND	ND	ND	--	--	--	ND	ND	ND	ND	ND	ND	--	ND	ND	ND	4,400
Dichloroethylene, 1,1-	μg/m³	ND	ND	--	--	ND	ND	ND	ND	ND	ND	--	--	--	ND	ND	ND	ND	ND	ND	--	ND	ND	ND	80
Dichloropropane, 1,2-	μg/m³	ND	ND	--	--	ND	ND	ND	ND	ND	ND	--	--	--	ND	ND	ND	ND	ND	ND	--	ND	ND	ND	200
Dichloropropylene, *cis*- 1,3-	μg/m³	ND	ND	--	--	ND	ND	ND	ND	ND	ND	--	--	--	ND	ND	ND	ND	ND	ND	--	ND	ND	ND	40
Dichloropropylene, *trans*- 1,3-	μg/m³	ND	ND	--	--	ND	ND	ND	ND	ND	ND	--	--	--	ND	ND	ND	ND	ND	ND	--	ND	ND	ND	40
Ethyl Acrylate	μg/m³	ND	ND	--	--	ND	ND	ND	ND	ND	ND	--	--	--	ND	ND	ND	ND	ND	ND	--	ND	ND	ND	7,000
Ethylene dichloride	μg/m³	ND	ND	--	--	ND	ND	ND	ND	ND	ND	--	--	--	ND	ND	ND	ND	ND	ND	--	ND	ND	ND	270
Hexachloro-1,3-butadiene	μg/m³	ND	ND	--	--	ND	ND	ND	ND	ND	ND	--	--	--	ND	ND	ND	ND	ND	ND	--	ND	ND	ND	320
Methyl Methacrylate	μg/m³	ND	ND	--	--	ND	ND	ND	ND	ND	ND	--	--	--	ND	ND	ND	ND	ND	ND	--	ND	ND	ND	7,000
Methyl *tert*- Butyl Ether	μg/m³	ND	ND	--	--	ND	ND	ND	ND	ND	ND	--	--	--	ND	ND	ND	ND	ND	ND	--	ND	ND	ND	7,000
Tetrachloroethane, 1,1,2,2-	μg/m³	ND	ND	--	--	ND	ND	ND	ND	ND	ND	--	--	--	ND	ND	ND	ND	ND	ND	--	ND	ND	ND	120
Trichlorobenzene, 1,2,4-	μg/m³	ND	ND	--	--	ND	ND	ND	ND	ND	ND	--	--	--	ND	ND	ND	ND	ND	ND	--	ND	ND	ND	2,000

Key Pollutant

ng/m³ nanograms per cubic meter

μg/m³ micrograms per cubic meter

-- No sample was conducted 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 comparison 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." These short-term 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 D-3. Lewis Elementary School Pollutant Concentrations.

Parameter	Units	8/5/2009	8/11/2009	8/17/2009	8/23/2009	8/29/2009	9/4/2009	9/10/2009	9/16/2009	9/22/2009	9/28/2009	10/4/2009	10/10/2009	10/16/2009	10/19/2009	10/22/2009	10/28/2009	11/3/2009	11/9/2009	11/12/2009	11/18/2009	11/24/2009	Sample Screening Level[a]
Benzene	$\mu g/m^3$	0.825	0.873	0.28	--	1.48	--	--	0.527	0.783	--	--	--	0.31	22.4	0.527	18.6	12.0	1.90	3.68	1.36	--	30
Lead (TSP)	ng/m^3	16.2	9.30	12.3	2.09	7.16	16.7	16.4	2.80	4.35	16.0	85.0	1.56	3.41	37.2	4.27	--	45.6	16.2	15.4	7.97	5.37	150
Arsenic (PM_{10})	ng/m^3	1.07	0.95	0.56	0.56	2.18	3.52	1.95	ND	0.69	0.96	4.03	0.58	0.17	--	0.63	2.05	3.36	1.98	0.99	1.75	0.60	150
Benzo(a)pyrene	ng/m^3	0.0500	0.140	0.0300	ND	0.130	0.290	0.0300	0.0400	0.0300	0.0300	0.570	0.0500	ND	0.1150	0.0700	--	--	0.410	0.0900	0.0400	0.110	6,400
Manganese (PM_{10})	ng/m^3	25.1	25.1	27	2.37	10.9	49.4	43.1	31.5	36.1	24.4	42.1	2.14	1.54	--	80.3	30.2	105	31.1	13.9	75.9	175	500
Chromium (PM_{10})	ng/m^3	3.12	3.73	3.05	2.48	2.49	5.12	7.04	2.83	1.92	2.39	3.84	1.63	1.06	--	3.61	4.72	5.74	7.21	2.68	16.00	2.53	580[b]
Naphthalene	$\mu g/m^3$	0.161	0.344	0.0382	0.0486	0.289	1.050	0.127	0.0488	0.107	0.0915	1.740	0.0818	0.0428	0.267	0.214	--	--	0.800	0.102	0.0157	0.0830	30
Butadiene, 1,3-	$\mu g/m^3$	0.080	0.084	0.033	--	0.16	--	--	0.029	0.066	--	--	--	0.024	0.049	0.05	0.297	0.270	0.075	0.19	0.13	--	20
Carbon Tetrachloride	$\mu g/m^3$	0.818	0.705	0.825	--	0.736	--	--	0.718	1.10	--	--	--	0.768	0.63	0.57	0.711	0.655	1.06	0.54	0.55	--	200
Cadmium (PM_{10})	ng/m^3	0.28	0.29	0.79	0.12	0.18	0.47	0.67	0.07	0.10	0.39	1.55	0.08	0.03	--	0.34	0.31	1.66	0.37	0.33	2.42	0.13	30
Tetrachloroethylene	$\mu g/m^3$	0.53	0.692	0.14	--	0.33	--	--	0.15	0.24	--	--	--	0.12	0.34	0.10	0.45	0.45	0.16	0.48	0.28	--	1,400
Dichlorobenzene, *p*-	$\mu g/m^3$	0.20	0.20	0.090	--	0.25	--	--	0.060	0.072	--	--	--	0.096	0.32	0.060	0.20	0.37	0.05	0.29	0.12	--	10,000
Ethylbenzene	$\mu g/m^3$	0.30	0.452	0.100	--	0.43	--	--	0.11	0.20	--	--	--	0.056	2.07	0.15	1.38	2.26	0.26	1.15	0.36	--	40,000
Chloromethane	$\mu g/m^3$	1.63	1.25	1.43	--	1.46	--	--	1.53	1.67	--	--	--	0.934	1.41	1.26	1.42	0.984	1.67	0.851	0.915	--	1,000
Xylene, *m/p*-	$\mu g/m^3$	0.80	1.26	0.23	--	1.30	--	--	0.26	0.48	--	--	--	0.11	4.65	0.36	4.00	5.73	0.62	2.52	0.83	--	9,000
Nickel (PM_{10})	ng/m^3	0.90	1.41	1.06	ND	0.67	1.55	0.90	0.44	1.68	0.77	1.15	0.14	0.05	--	0.34	4.21	1.38	1.51	0.40	5.47	0.09	200
Antimony (PM_{10})	ng/m^3	1.40	1.38	0.75	0.79	4.66	3.81	2.21	0.83	1.24	1.21	2.68	2.02	0.23	--	1.07	10.3	3.81	1.95	1.24	5.86	1.41	2,000
Bromomethane	$\mu g/m^3$	0.058	0.047	0.054	--	0.066	--	--	0.047	0.062	--	--	--	0.043	0.04	0.039	0.078	0.043	0.054	0.039	0.058	--	200
Acetonitrile	$\mu g/m^3$	0.418	0.501	0.388	--	0.457	--	--	0.302	0.202	--	--	--	0.265	0.29	0.267	0.361	0.235	0.193	0.192	0.14	--	600
Xylene, *o*-	$\mu g/m^3$	0.30	0.40	0.100	--	0.456	--	--	0.11	0.20	--	--	--	0.052	1.29	0.14	1.06	1.16	0.22	0.626	0.29	--	9,000
Dichloromethane	$\mu g/m^3$	0.34	0.33	0.32	--	0.431	--	--	0.25	0.29	--	--	--	0.629	0.68	0.23	0.643	0.29	0.389	0.25	0.400	--	2,000
Cobalt (PM_{10})	ng/m^3	0.28	0.20	0.18	ND	0.1	0.34	0.10	0.06	0.05	0.12	0.24	0.02	ND	--	0.06	0.14	0.29	0.14	0.16	0.38	0.06	100
Chloroform	$\mu g/m^3$	0.10	0.13	0.11	--	0.18	--	--	0.12	0.17	--	--	--	0.13	0.23	0.08	0.18	0.19	0.13	0.14	ND	--	500
Benzo(b)fluoranthene	ng/m^3	0.200	0.650	0.0900	0.0600	0.390	1.30	0.160	0.130	0.0900	0.0700	2.61	0.180	0.0700	0.439	0.340	--	--	1.54	0.270	0.120	0.390	64,000
Benzo(a)anthracene	ng/m^3	0.120	0.420	0.0500	0.0300	0.18	0.100	0.0100	0.0400	0.0500	0.0500	2.02	0.100	0.0300	0.190	0.170	--	--	0.830	0.100	0.0600	0.160	64,000
Toluene	$\mu g/m^3$	1.56	2.00	0.694	--	3.12	--	--	0.664	1.12	--	--	--	0.35	7.91	0.814	7.05	6.52	0.958	3.11	1.47	--	4,000
Indeno(1,2,3-cd)pyrene	ng/m^3	0.09	0.25	0.04	ND	0.19	0.35	0.06	ND	ND	ND	0.95	0.06	ND	0.19	0.13	--	--	0.48	0.14	0.04	0.16	64,000
Carbon Disulfide	$\mu g/m^3$	0.411	0.583	0.17	--	0.14	--	--	0.11	0.084	--	--	--	0.12	0.16	0.062	0.17	0.100	0.081	0.062	0.041	--	7,000
Methyl isobutyl ketone	$\mu g/m^3$	1.47	1.41	0.480	--	1.14	--	--	0.685	0.475	--	--	--	0.17	0.28	0.832	0.603	0.619	0.40	0.414	0.21	--	30,000
Benzo(k)fluoranthene	ng/m^3	0.0500	0.170	ND	0.020	0.110	0.370	0.0300	0.0400	0.0200	ND	0.660	0.0500	ND	0.135	0.0800	--	--	0.450	0.0600	0.0400	0.130	64,000
Mercury (PM_{10})	ng/m^3	0.02	0.04	0.04	ND	ND	0.08	ND	0.08	0.04	0.009	0.23	ND	0.01	--	0.03	0.06	0.06	0.04	0.02	0.07	0.01	3,000[c]
Styrene	$\mu g/m^3$	0.13	0.13	0.047	--	0.094	--	--	0.04	0.068	--	--	--	ND	0.34	0.077	0.40	0.27	0.081	0.20	0.11	--	9,000
Chrysene	ng/m^3	0.320	0.920	0.120	0.150	0.380	1.46	0.290	0.130	0.130	0.120	3.11	0.270	0.0700	0.342	0.390	--	--	1.74	0.270	0.120	0.390	640,000
Selenium (PM_{10})	ng/m^3	0.86	1.14	0.8	0.48	0.81	2.41	1.13	1.13	2.18	1.92	1.04	0.38	0.19	--	0.86	1.43	1.32	0.88	1.02	1.49	0.79	20,000
Methyl chloroform	$\mu g/m^3$	0.076	0.087	0.076	--	0.10	--	--	0.071	0.10	--	--	--	0.093	0.076	0.060	0.076	0.071	0.098	0.076	0.066	--	10,000
Chloroethane	$\mu g/m^3$	0.037	0.029	0.032	--	0.029	--	--	0.02	0.01	--	--	--	0.12	0.09	0.042	0.032	0.02	0.02	0.032	0.02	--	40,000

Appendix D-3. Lewis Elementary School Pollutant Concentrations.

Parameter	Units	8/5/2009	8/11/2009	8/17/2009	8/23/2009	8/29/2009	9/4/2009	9/10/2009	9/16/2009	9/22/2009	9/28/2009	10/4/2009	10/10/2009	10/16/2009	10/19/2009	10/22/2009	10/28/2009	11/3/2009	11/9/2009	11/12/2009	11/18/2009	11/24/2009	Sample Screening Level[a]
Beryllium (PM_{10})	ng/m^3	ND	0.03	0.0008	ND	ND	0.14	ND	0.08	0.01	ND	0.08	ND	ND	--	0.03	0.06	0.06	ND	0.0007	ND	ND	20
Hexachloro-1,3-butadiene	$\mu g/m^3$	ND	ND	ND	--	ND	--	--	ND	ND	--	--	--	ND	ND	ND	ND	ND	ND	ND	0.07	--	320
Trichloroethylene	$\mu g/m^3$	ND	0.065	0.13	--	ND	--	--	ND	ND	--	--	--	ND	0.09	ND	ND	0.086	0.075	ND	0.12	--	10,000
Vinyl chloride	$\mu g/m^3$	0.026	0.01	ND	--	ND	--	--	ND	ND	--	--	--	0.01	0.02	ND	0.01	ND	ND	0.02	ND	--	1,000
Dibenz(a,h)anthracene	ng/m^3	ND	ND	ND	ND	ND	0.09	ND	ND	ND	ND	0.20	ND	ND	0.04	ND	--	--	0.11	ND	ND	0.03	5,800
Acrylonitrile	$\mu g/m^3$	ND	ND	ND	--	ND	--	--	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	ND	ND	ND	ND	--	140
Bromoform	$\mu g/m^3$	ND	ND	ND	--	ND	--	--	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	ND	ND	ND	ND	--	10,000
Chloroprene	$\mu g/m^3$	ND	ND	ND	--	ND	--	--	ND	ND	--	--	--	ND	ND	ND	ND	ND	ND	ND	ND	--	200
Ethylene Dibromide	$\mu g/m^3$	ND	ND	ND	--	ND	--	--	ND	ND	--	--	--	ND	ND	ND	ND	ND	ND	ND	ND	--	12
Dichloroethane, 1,1-	$\mu g/m^3$	ND	ND	ND	--	ND	--	--	ND	ND	--	--	--	ND	ND	ND	ND	ND	ND	ND	ND	--	4,400
Dichloroethylene, 1,1-	$\mu g/m^3$	ND	ND	ND	--	ND	--	--	ND	ND	--	--	--	ND	ND	ND	ND	ND	ND	ND	ND	--	80
Dichloropropane, 1,2-	$\mu g/m^3$	ND	ND	ND	--	ND	--	--	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	ND	ND	ND	ND	--	40
Dichloropropylene, *trans-* 1,3-	$\mu g/m^3$	ND	ND	ND	--	ND	--	--	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	ND	ND	ND	ND	--	7,000
Ethylene dichloride	$\mu g/m^3$	ND	ND	ND	--	ND	--	--	ND	ND	--	--	--	ND	ND	ND	ND	ND	ND	ND	ND	--	270
Methyl Methacrylate	$\mu g/m^3$	ND	ND	ND	--	ND	--	--	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	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	ND	ND	ND	ND	--	120
Trichlorobenzene, 1,2,4-	$\mu g/m^3$	ND	ND	ND	--	ND	--	--	ND	ND	--	--	--	ND	ND	ND	ND	ND	ND	ND	ND	--	2,000
Trichloroethane, 1,1,2-	$\mu g/m^3$	ND	ND	ND	--	ND	--	--	ND	ND	--	--	--	ND	ND	ND	ND	ND	ND	ND	ND	--	440

Key Pollutant

ng/m^3 nanograms per cubic meter

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

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

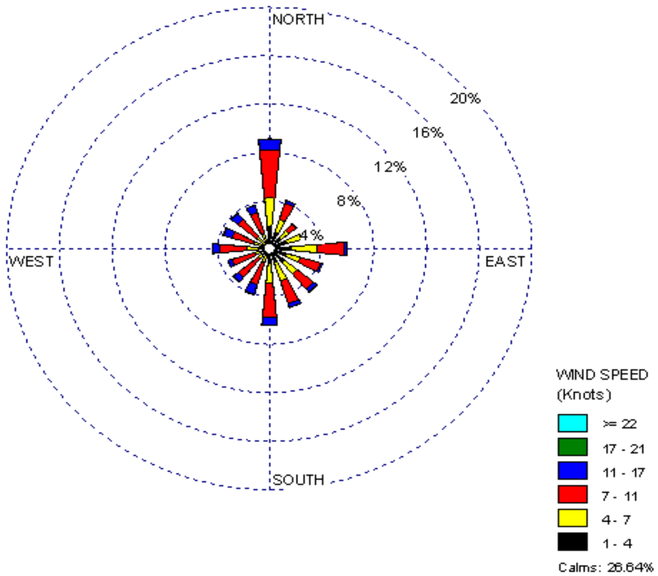
ND No results of this chemical were registered by the laboratory analytical equipment.

[a] The comparison 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." These short-term 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.

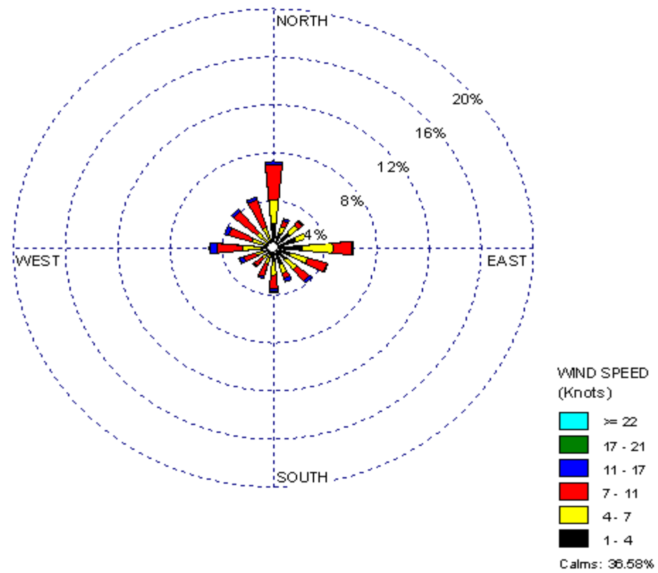
[b] The sample screening levels are specific to hexavalent chromium (recognized as the most toxic form) which is a fraction of the total chromium reported.

[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 Birmingham-Shuttlesworth International Airport NWS Station.



Birmingham International Airport
NWS Station
2002-2007



Birmingham International Airport NWS
Station
Across Sampling Period
(August 5, 2009-December 3, 2009)[a, b, c]

[a] **Birmingham-Shuttlesworth International Airport NWS Station (WBAN 13876) is 2.7miles from Riggins School.**

[b] **Birmingham-Shuttlesworth International Airport NWS Station (WBAN 13876) is 3.6 miles from North Birmingham Elementary School.**

[c] **Birmingham-Shuttlesworth International Airport NWS Station (WBAN 13876) is 4.1 miles from Lewis Elementary School.**