SAT Initiative: NW Harllee Elementary School (Dallas, Texas)

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

I. Executive Summary

- Air monitoring has been conducted at Norman Washington Harllee (NW Harllee) Elementary School 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.
- This school was selected for monitoring based on information indicating the potential for elevated ambient concentrations of acetaldehyde, acrolein, benzene, and 1,3-butadiene in air outside the school. That information included EPA's 2002 National-Scale Air Toxics Assessment (NATA) which indicated elevated levels of acetaldehyde from a nearby paper processing facility which emits acetaldehyde. Additionally, NATA indicated elevated levels of acetaldehyde (also a mobile source pollutant), acrolein, benzene, and 1,3-butadiene from mobile sources; this school is located in an urban area and is near an interstate highway and other roadways.
- Air monitoring was performed from September 16, 2009 through December 15, 2009 for acetaldehyde and other carbonyls, as well as benzene, 1,3-butadiene and other volatile organic compounds (VOCs).
- Measured levels of acetaldehyde, benzene, and 1,3-butadiene and associated longer-term concentration estimates at this school were not as high as suggested by the modeling information available prior to monitoring. Although these pollutants, and other mobile source air toxics monitored (e.g., formaldehyde) were below levels of significant concern that had been suggested by the modeling information, these results indicate the influence of mobile source pollutants of concern that are the focus of EPA actions nationwide. Results for other air toxics monitored do not indicate levels of concern
- Acetaldehyde, benzene and 1,3-butadiene are common in the outdoor air in urban areas where many sources are located near one another, particularly mobile sources such as cars and other motor vehicles and off-road machinery. Levels of acetaldehyde, benzene, and 1,3-butadiene in many such urban areas can be elevated. EPA remains concerned about mobile source emissions and continues to work to reduce those emissions across the country, through national rules and by providing information and suggestions to assist with reductions in local areas (http://www.epa.gov/schoolair/mobile.html).
- EPA will not use the 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). The Agency made this determination after results of a short-term laboratory study raised questions about the consistency and reliability of monitoring results of acrolein. (More information is available at http://www.epa.gov/schoolair/acrolein.html).

- Based on the analysis described here, EPA will not extend air toxics monitoring at this school. However, EPA's ongoing national air toxics monitoring program will continue to collect information on mobile source impacts on outdoor air nationally.
- The Texas Commission on Environmental Quality (TCEQ) will continue to oversee industrial facilities in the area through their air permits and other programs. Additionally, TCEQ will continue to implement reductions in mobile sources through implementation of national programs and its own programs. TCEQ has also developed specific air monitoring comparison values for these key pollutants which may be found at http://www.tceq.state.tx.us/implementation/tox/AirToxics.html#amcv.

II. Background on this Initiative

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

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

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

- consider what next steps might be appropriate to better understand and address air toxics at the school, and
- improve the information and methods we will use in the future (e.g., NATA) for estimating air toxics concentrations in communities across the U.S.

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

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

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

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

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

NW Harllee Elementary School was selected for monitoring because we were interested in evaluating the ambient concentrations of acetaldehyde in air outside of the school due to emissions of this pollutant in EPA's 2002 NATA analysis for a nearby paper processing facility. This school was also one of several schools selected to represent geographically distributed urban areas near heavily travelled roadways. As such, we were also interested in evaluating the ambient concentrations of acetaldehyde, acrolein, benzene and 1,3-butadiene, which are four key mobile source air toxics in air outside the school and were indicated in EPA's 2002 NATA for the potential for levels of concern due to estimated emissions from mobile sources. This school is located in an urban area and is near an interstate highway and other roadways (Figure 1). More information on mobile sources of air toxics can be found on EPA's website (http://www.epa.gov/schoolair/mobile.html).

Monitoring commenced at this school on September 16, 2009 and continued through December 15, 2009. During this period, ten carbonyl samples and ten VOC samples were collected and analyzed for the key pollutants (acetaldehyde, benzene, and 1,3-butadiene) and other air toxics that are routinely included in the analytical methods for the key pollutants. Due to an issue with VOC monitoring equipment, five initial VOC results were invalidated (see EPA's technical document, Investigation and Resolution of Contamination Problems in the Collection of Volatile Organic Compounds, at http://www.epa.gov/schoolair/pdfs/VocTechdocwithappendix1209.pdf).

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[2] For example, http://www.epa.gov/schoolair/pollutants.html, http://www.epa.gov/ttn/fera/risk_atoxic.html.
[3] For example, http://www.epa.gov/ttn/atw/3_90_022.html, http://www.epa.gov/ttn/atw/3_90_024.html.

Additional VOC samples were collected to ensure that ten 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). Sampling methodologies are described in EPA's schools air toxics monitoring plan (http://www.epa.gov/schoolair/techinfo.html).[4]

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

The primary objective of this initiative is to investigate - through monitoring air concentrations of key air toxics at each school over a 2-3 month period - whether levels measured and associated longer-term concentration estimates are of a magnitude, in light of health risk-based criteria, for which follow-up activities may need to be considered. To evaluate the monitoring results consistent with this objective, we developed health risk-based air concentrations (the long-term comparison levels summarized in Appendix A) for the monitored air toxics using established EPA methodology and practices for health risk assessment[6] and, in the case of cancer

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[4] TCEQ staff operated the monitors and sent the canisters and cartridges to the analytical laboratory under contract to EPA.

[5] 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.

[6] 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.

risk, consistent with the implied level of risk considered in identifying schools for monitoring. Consistent with the long-term or chronic focus of the modeling analyses, based on which these schools were selected for monitoring, we have analyzed the full record of concentrations of air toxics measured at this school, using routine statistical tools, to derive a 95 percent confidence interval[7] 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).[8] 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.[9] In general, where the monitoring results indicate estimates of longer-term average concentrations that are above the comparison levels - i.e., above the cancer-based comparison levels or notably above the noncancer-based comparison levels - we will consider the need for follow-up actions such as:

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

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[7] 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.

[8] 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.

[9] 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).

monitoring projects. The intent of this analysis is to make this 2-3 month monitoring dataset as useful as possible to state, local and national air toxics programs in their longer-term efforts to improve air quality nationally. To that end, this analysis:

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

B. Chemical Concentrations

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

In developing or identifying these comparison levels, we have given priority to use of relevant and appropriate air standards and EPA risk assessment guidance and precedents.[10] These levels are based upon health effects information, exposure concentrations and risk estimates developed and assessed by EPA, the U.S. Agency for Toxic Substances and Disease Registry, and the California EPA. These agencies recognize the need to account for potential differences in sensitivity or susceptibility of different groups (e.g., asthmatics) or lifestages/ages (e.g., young children or the elderly) to a particular pollutant's effects so that the resulting comparison levels are relevant for these potentially sensitive groups as well as the broader population.

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

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

Using the analysis approach described above, we analyzed the chemical concentration data (Table 1 and Figures 2a-2c) with regard to areas of interest identified below.

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

- Acetaldehyde measured over the 3-month sampling period and associated longer-term concentration estimates at this school were below the levels of significant concern and did not indicate the influence of a nearby source.
- Benzene and 1,3-butadiene levels measured over the 3-month sampling period and associated longer-term concentration estimates at this school were below the levels of significant concern; however, the results do indicate the influence of mobile source pollutants of concern that are the focus of EPA actions nationwide.
- Results for other air toxics monitored do not indicate levels of concern.

Acetaldehyde, key pollutant:

Acetaldehyde is one of several air toxics that EPA recognizes as a key pollutant nationally. A large number of people live in areas across the U.S. with elevated ambient concentrations of this pollutant due to mobile sources.[11]

- Do the monitoring data indicate influence from a nearby source?
  → The monitoring data do not indicate influence from a nearby source as there is only one acetaldehyde concentration that is slightly higher than concentrations commonly observed in other locations nationally.[12]
- Do the monitoring data indicate elevated levels that pose significant long-term health concerns?
  → Measured acetaldehyde levels and associated longer-term concentration estimates at this school were not as high as suggested by the modeling information available prior to monitoring. While emitted from a nearby stationary source, the acetaldehyde emissions may also indicate the ubiquitous nature and influence of mobile source pollutants of concern that are the focus of EPA actions nationwide.
    - The estimate of longer-term acetaldehyde concentration (i.e., the upper bound of the 95 percent confidence interval on the mean of the dataset) is well below both of the long-term comparison levels (Table 1).[13] These comparison levels

[11] Additional information on mobile sources of air toxics is available at http://www.epa.gov/schoolair/mobile.html
[12] For example, one of the concentrations at this site (Table 2a) was 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.
[13] The upper end of the interval is 1.3 times the mean of the monitoring data and less than 26% of the long-term noncancer-based comparison level.

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

- Further, the longer-term concentration estimate is more than tenfold lower than the cancer-based comparison level, indicating the longer-term estimate is below a continuous (24 hours a day, 7 days a week) lifetime exposure concentration associated with 1-in-100,000 additional cancer risk.

→ Additionally, we did not identify any concerns regarding short-term exposures as each individual measurement is below the individual sample screening level for acetaldehyde (which is based on consideration of exposure all day, every day over a period ranging up to a couple of weeks or longer for some pollutants).[10]

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

Benzene is one of several air toxics that EPA recognizes as a key pollutant nationally. A large number of people live in areas across the U.S. with elevated ambient concentrations of this pollutant due to mobile sources.[11]

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

→ Measured benzene levels and associated longer-term concentration estimates at this school were not as high as suggested by the modeling information available prior to monitoring. Although they were below the levels of significant concern that had been suggested by the modeling information, these results indicate the ubiquitous nature and influence of mobile source pollutants of concern that are the focus of EPA actions nationwide.

- The estimate of longer-term benzene concentration (i.e., the upper bound of the 95 percent confidence interval on the mean of the dataset) is below both of the long-term comparison levels (Table 1).[14] 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 is more than tenfold lower than the cancer-based comparison level, indicating the longer-term estimate is below a continuous (24 hours a day, 7 days a week) lifetime exposure concentration associated with 1-in-100,000 additional cancer risk.

→ Additionally, we did not identify any concerns regarding short-term exposures as each individual measurement is below the individual sample screening level for benzene (which is based on consideration of exposure all day, every day over a period from a couple of weeks to longer for some pollutants).[10]

[14] The upper end of the interval is 1.5 times the mean of the monitoring data and less than 10% of the long-term cancer-based comparison level.

<u>1,3-Butadiene, key pollutant:</u>

1,3-Butadiene is one of several air toxics that EPA recognizes as a key pollutant nationally. A large number of people live in areas across the U.S. with elevated ambient concentrations of this pollutant due to mobile sources.[11]

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

  → Measured 1,3-butadiene levels and associated longer-term concentration estimates at this school were not as high as suggested by the modeling information available prior to monitoring. Although they were below the levels of significant concern that had been suggested by the modeling information, these results indicate the ubiquitous nature and influence of mobile source pollutants of concern that are the focus of EPA actions nationwide.

  - The estimate of longer-term 1,3-butadiene concentration (i.e., the upper bound of the 95 percent confidence interval on the mean of the dataset) is below both of the long-term comparison levels (Table 1).[15] 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 is more than tenfold lower than the cancer-based comparison level, indicating the longer-term estimate is below a continuous (24 hours a day, 7 days a week) lifetime exposure concentration associated with 1-in-100,000 additional cancer risk.

  → Additionally, we did not identify any concerns regarding short-term exposures as each individual measurement is below the individual sample screening level for 1,3-butadiene (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).[10]

<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 the other HAPs monitored including all other VOCs monitored, with longer-term concentration estimates for these HAPs below their long-term comparison levels (Appendix C). Additionally, each individual measurement for these pollutants is below the individual sample screening level[10] for that pollutant (Appendix D).

[15] The upper end of the interval is 1.5 times the mean of the monitoring data and less than 5% of the long-term cancer-based comparison level.

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 for the key and other air toxics and associated longer-term concentration estimates were below levels of significant concern for cumulative health risk for these pollutants (Appendix C).[16] However, these results do indicate the influence of multiple pollutants that may occur in the air at this school as a result of several different sources, including cars and trucks and the exhaust of other gasoline-powered engines. Because these types of sources are found almost everywhere where there are people, these pollutants are commonly elevated in urban areas across the country, and EPA has identified them as a national priority for reduction in the air in communities across the country.[17]

C. Wind and Other Meteorological Data

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

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

The meteorological station at NW Harllee Elementary School collected wind speed and wind direction measurements beginning on September 2, 2009, continuing through the sampling period (September 16, 2009-December 15, 2009), and ending on March 25, 2010. As a result, on-site data for these meteorological parameters are available for all dates of sample collection, and also for a period before and after the sampling period, producing a continuous record of nearly seven months of on-site meteorological data. The meteorological data collected at the school on sampling days are presented in Figures 3a-3c and Tables 2a-2b.

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[16] 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

[17] Additional information about these pollutants are available at: http://www.epa.gov/schoolair/mobile.htm, and information about activities to reduce emissions are available at: http://www.epa.gov/otaq/toxics.htm.

The nearest NWS station is at Dallas Executive Airport in Dallas, TX. This station is approximately 5.9 miles southwest of the school. Measurements taken at that station include wind, temperature, and precipitation. These data are presented in Tables 2a-2b and Appendix E.

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

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

- The wind patterns at the monitoring site across sampling days are somewhat similar to those observed across the record of on-site meteorological data during the sampling period.

- Our ability to provide a confident characterization of the wind flow patterns at the monitoring site over the long-term is limited, as the NWS station in Dallas Executive Airport shows some similarities to represent the specific wind flow patterns at the school location.

- Although we lack long-term wind data at the monitoring site, the wind pattern at the NWS station during the sampling period is similar to the historical long-term wind flow patterns at that location. This suggests that, on a regional scale, the 3-month sampling period may be representative of year-round wind patterns.

- What is the direction of the key sources of acetaldehyde, benzene, and 1,3-butadiene emissions in relation to the school location?
  - → The key sources were identified as an industrial source south of the school and a nearby roadway source to the southwest, west, and northwest of the school (described in section III above). Therefore winds from these directions may be considered as from the directions of key sources.
  - → Considering the boundaries of the sources of interest (in lieu of information regarding the location of specific sources of acetaldehyde, benzene, and 1,3-butadiene emissions), we have identified a range of wind directions to use in considering potential influence of the industrial and mobile sources on air concentrations at the school.
  - → This general range of wind directions, referred to here as the expected zone of source influence (ZOI), is from approximately 170 degrees through 215 degrees (identified as ZOI A) for the industrial source, and approximately 215 degrees through 350 degrees (identified as ZOI B) for the mobile sources.

- On days the air samples were collected, how often did wind come from direction of the key source?
  - → For ZOI A, there were five out of ten acetaldehyde sampling days in which a portion of the winds were from this zone.

→ For ZOI B, there were seven out of ten acetaldehyde, benzene, and 1,3-butadiene sampling days in which a portion of the winds were from this zone.

- How do wind patterns on the air monitoring days compare to those across the complete monitoring period and what might be expected over the longer-term at the school location?
  → Wind patterns across the acetaldehyde, benzene, and 1,3-butadiene air monitoring days appear to be somewhat similar to those observed over the record of on-site meteorological data during the sampling period, especially in particular to the ZOI.
  → We note that wind patterns at the nearest NWS station (at Dallas Executive Airport) during the sampling period are somewhat similar to those recorded at the NWS station over the long-term (2002-2007 period; Appendix E), supporting the idea that regional meteorological patterns in the area during the monitoring period were somewhat consistent with long-term patterns. There is some uncertainty as to whether the general wind patterns at the school location for longer periods would be similar to the general wind patterns at the Dallas Executive Airport (see below).

- How do wind patterns at the school compare to those at the Dallas Executive Airport station, particularly with regard to prevalent wind directions and the direction of the key source?
  → During the sampling period for which data are available both at the school site and at the reference NWS station (approximately 3 months), prevalent winds at the school site are predominantly from the southeast to south and northwest to northeast, while those at the NWS station are from the southeast to south and northwest to north. The windroses for the two sites during the sampling period (Figures 3a-3c and Appendix E) show some similarities in wind flow patterns.
- Are there other meteorological patterns that may influence the measured concentrations at the school monitoring site?
  → No, we did not observe other meteorological patterns that may influence the measured concentrations at the school monitoring site.

V. Key Source Information

- Was the source operating as usual during the monitoring period?
  – The nearby industrial source of acetaldehyde (described in section III above) has an operating permit issued by TCEQ that includes operating requirements.[18]
  – Information from the nearby source indicates that this facility was operating at a rate of 81% during the sampling period, in comparison to its usual conditions of 90% capacity.
  – The most recently available acetaldehyde emissions for the nearby paper processing facility (NATA 2005) are higher than those relied upon in previous modeling analysis for this area (e.g., 2002 NATA).

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

- Was mobile source activity typical during the monitoring period?
  → The most recently available county-level acetaldehyde, benzene and 1,3-butadiene emissions for on-road mobile sources (2005 NATA) are lower than those relied upon previous modeling analysis for this area (2002 NATA).

VI. Integrated Summary and Next Steps

A. Summary of Key Findings

1. What are the key HAPs for this school?
   → Acetaldehyde, acrolein, benzene, and 1,3-butadiene are the key HAPs for this school, identified based on emissions information considered in identifying the school for monitoring. The ambient air acetaldehyde, benzene, and 1,3-butadiene concentrations on multiple days during the sampling period indicate contributions from sources in the area.

2. Do the data collected at this school indicate an elevated level of concern, as implied by information that led to identifying this school for monitoring?
   → Measured acetaldehyde, benzene, and 1,3-butadiene levels and associated longer-term concentration estimates at this school were not as high as suggested by the modeling information prior to monitoring. Although these pollutants and other air toxics monitored were below levels of significant concern that had been suggested by the modeling information, these results indicate the influence of mobile source pollutants of concern that are the focus of EPA actions nationwide.
   → 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 SAT project (http://www.epa.gov/schoolair/acrolein.html).

3. Are there indications, e.g., from the meteorological or other data, that the sample set may not be indicative of longer-term air concentrations? Would we expect higher (or lower) concentrations at other times of year?
   → The data we have collected appear to reflect air concentrations during the entire sampling period, with no indications from the on-site meteorological data that the sampling day conditions were inconsistent with conditions overall during this period.
   → Among the data collected for this site, we have none that would indicate generally higher (or lower) concentrations during other times of year. The wind flow patterns at the nearest NWS station during the sampling period appear to be representative of long-term wind flow at that site. The lack of long-term meteorological data at the school location, along with our finding that the wind patterns from the nearest NWS station are only somewhat similar to those at the school, limit our ability to confidently predict longer-

term wind patterns at the school (which might provide further evidence relevant to concentrations during other times).

B. Next Steps for Key Pollutants

1. Based on the analysis described here, EPA will not extend air toxics monitoring at this school.
2. EPA's ongoing national air toxics monitoring program will continue to collect information on mobile source impacts on outdoor air nationally. EPA will also continue to work toward reductions in mobile source emissions nationally and to facilitate reductions in local areas (http://www.epa.gov/schoolair/mobile.html).
3. The TCEQ will continue to implement reductions in mobile sources through implementation of national programs and its own programs. Additionally, TCEQ will continue to implement reductions in mobile sources through implementation of national programs and its own programs. TCEQ has also developed specific air monitoring comparison values for these key pollutants which may be found at http://www.tceq.state.tx.us/implementation/tox/AirToxics.html#amcv.

VII. Figures and Tables

A. Tables

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VIII. Appendices

A. Summary Description of Long-term Comparison Levels.

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

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

D. NW Harllee Elementary School Pollutant Concentrations.

E. Windroses for Dallas Executive Airport NWS Station.

Figure 1. NW Harllee Elementary School and Sources of Interest.

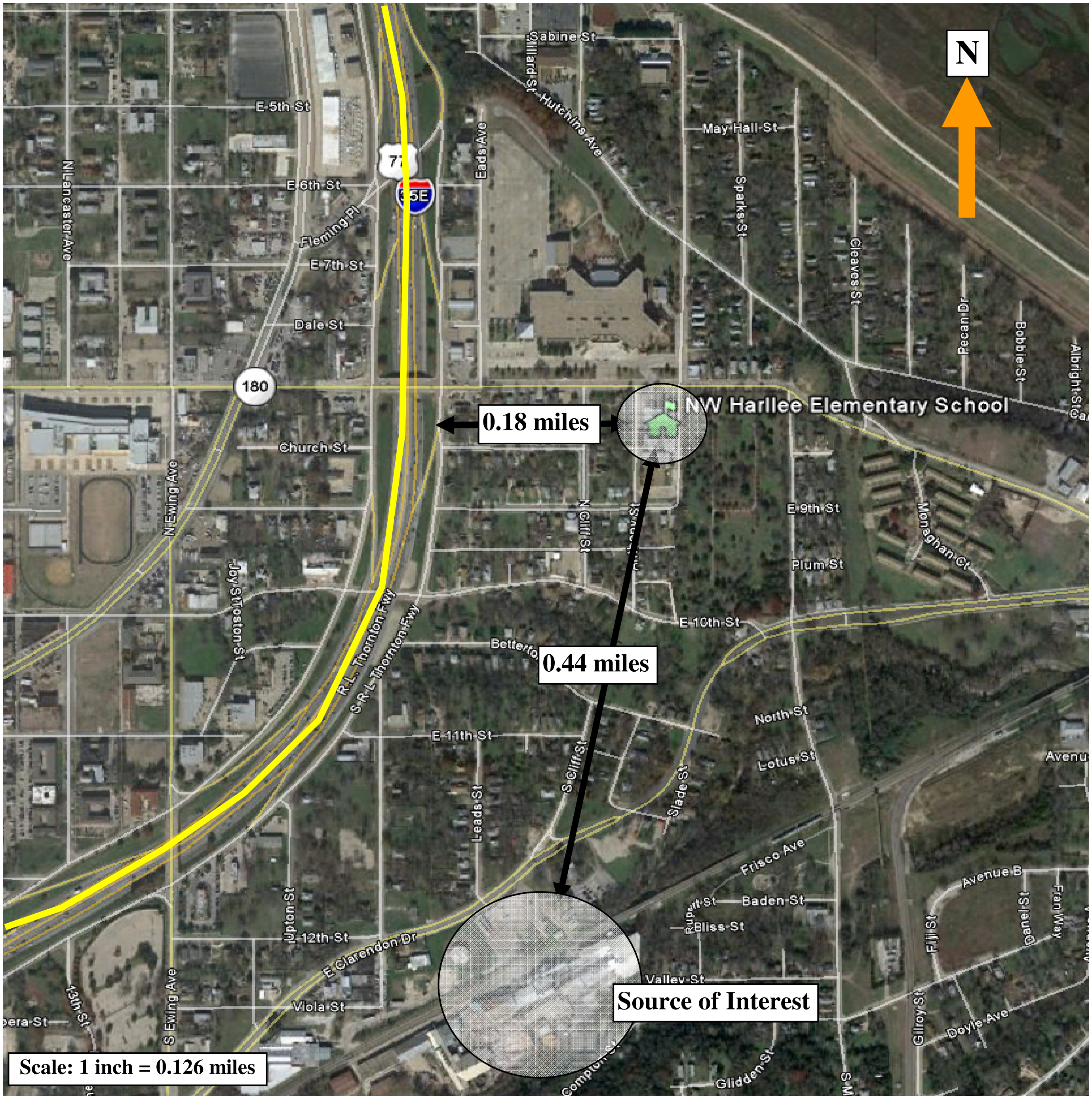


Table 1. NW Harllee Elementary School - Key Pollutant Analysis.

Parameter	Units	Mean of Measurements	95% Confidence Interval on the Mean	Long-term Comparison Level[a]	
				Cancer-Based[b]	Noncancer-Based[c]
Acetaldehyde	$\mu g/m^3$	1.75 [d]	1.22 - 2.29	45	9
Benzene	$\mu g/m^3$	0.79 [e]	0.39 - 1.20	13	30
Butadiene, 1,3-	$\mu g/m^3$	0.09 [f]	0.04 - 0.15	3.3	2

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

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

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

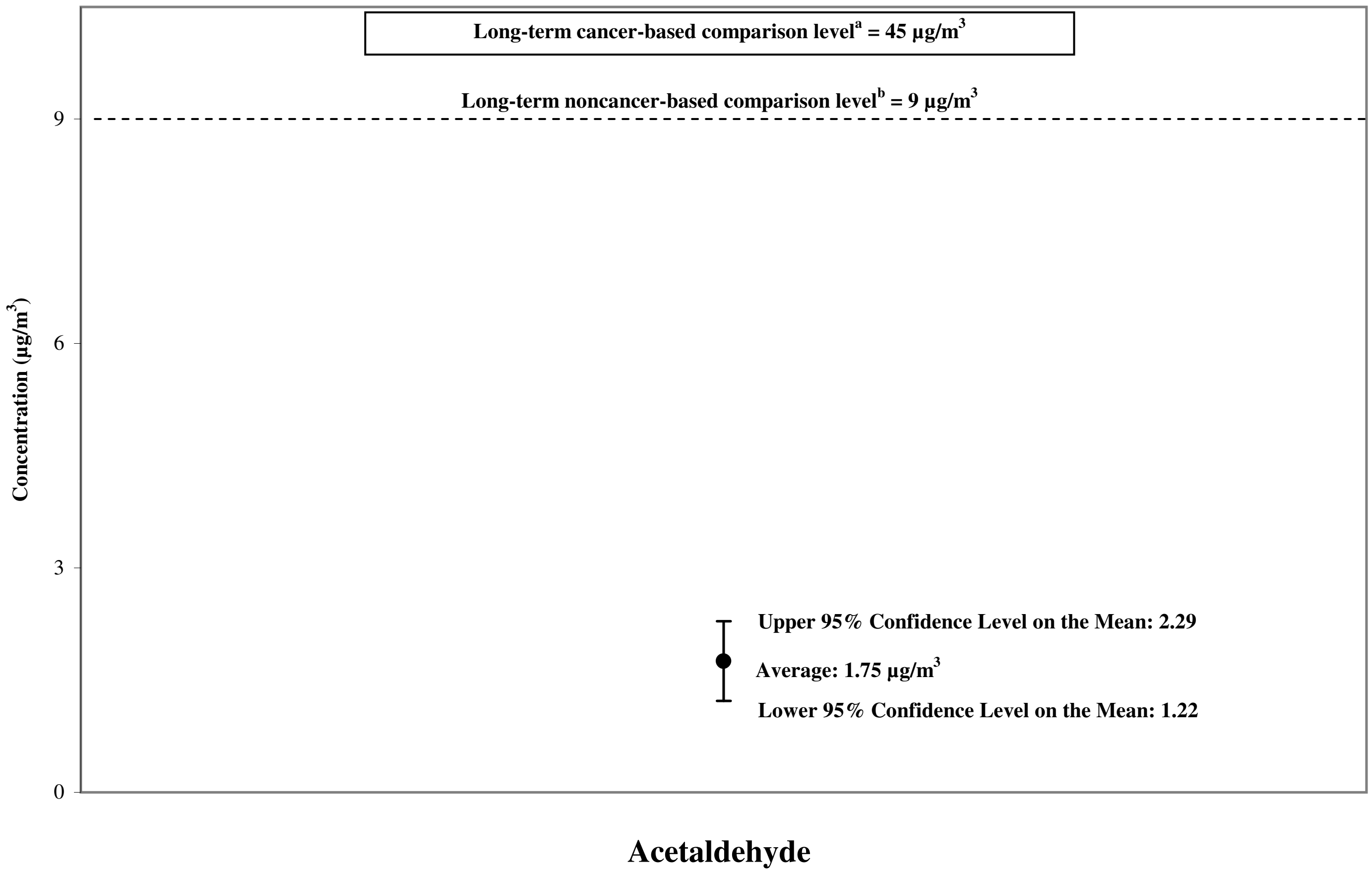
[c] Air toxics for which the upper 95% confidence limit on the mean concentration are near or below the noncancer-based comparison level are generally of low concern and will generally be considered a low priority for follow-up activity. Pollutants for which the 95% confidence limits extend appreciably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

[d] The mean of measurements for acetaldehyde is the average of all sample results, which include ten detections that ranged from 1.15 to 3.69 $\mu g/m^3$.

[e] The mean of measurements for benzene is the average of all sample results, which include ten detections that ranged from 0.396 to 2.27 $\mu g/m^3$.

[f] The mean of measurements for 1,3-butadiene is the average of all sample results, which include ten detections that ranged from 0.033 to 0.301 $\mu g/m^3$.

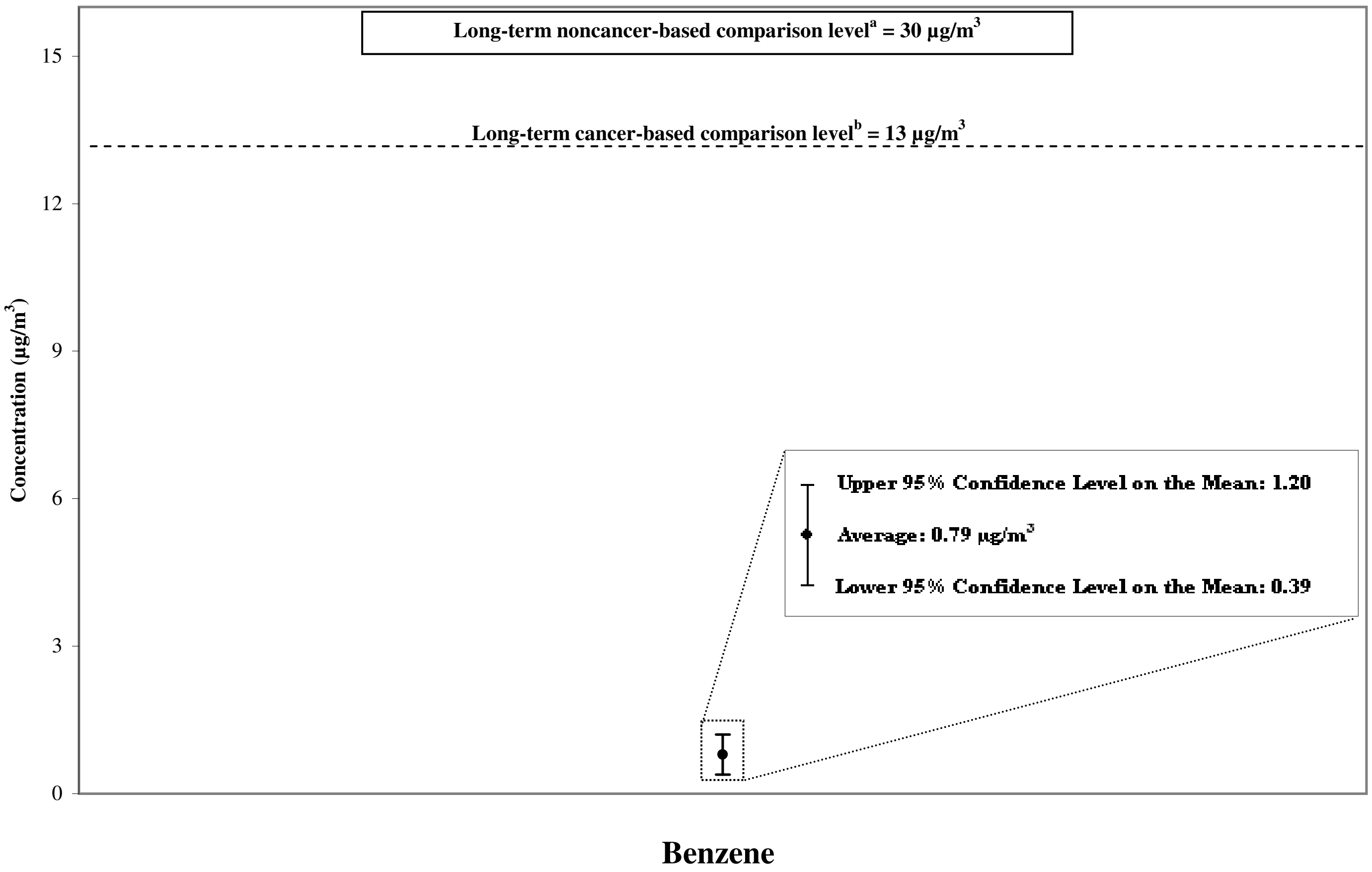
Figure 2a. NW Harllee Elementary School - Key Pollutant (Acetaldehyde) Analysis.



[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.

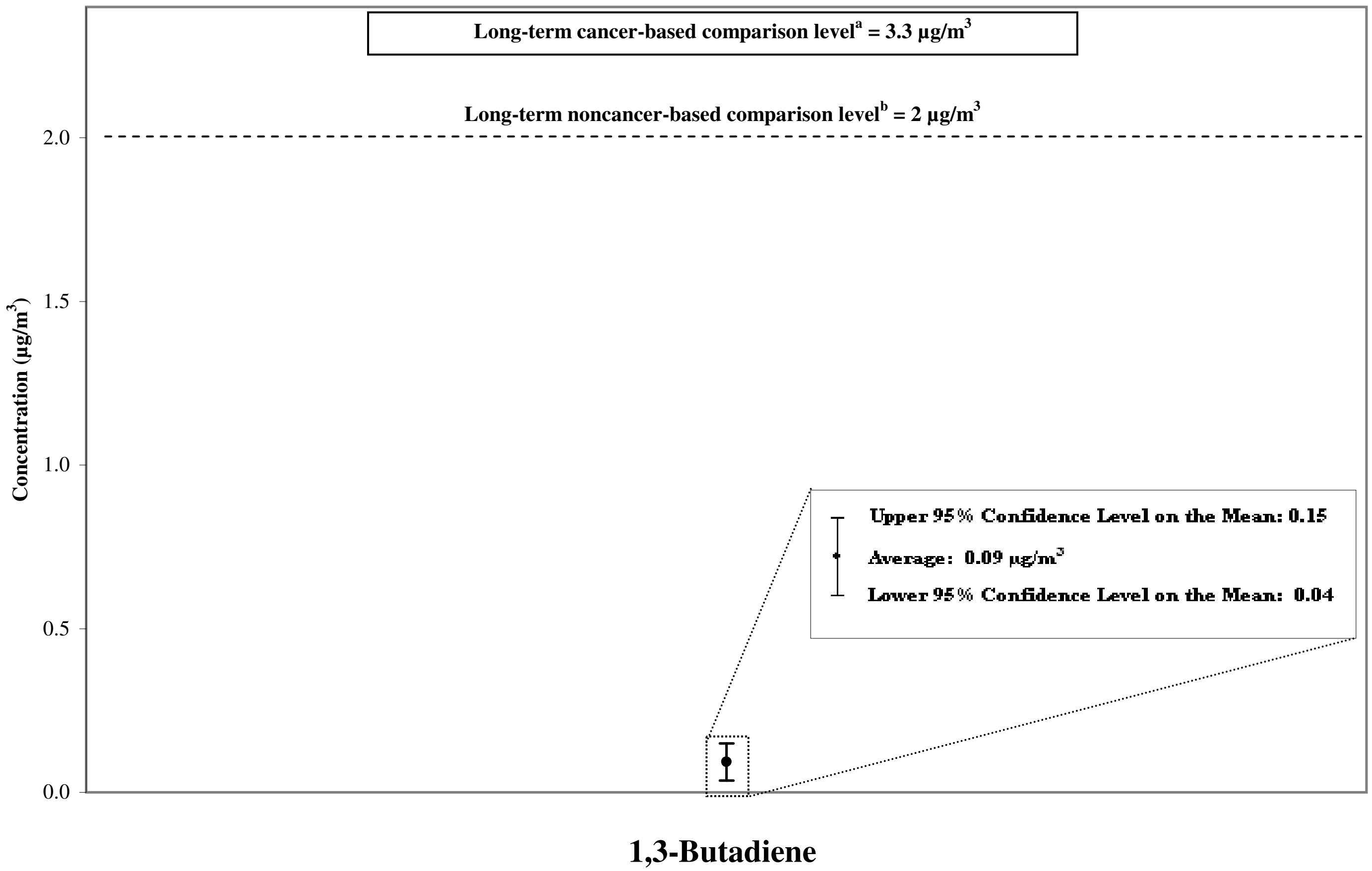
Figure 2b. NW Harllee Elementary School - Key Pollutant (Benzene) Analysis.



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

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

Figure 2c. NW Harllee Elementary School - Key Pollutant (1,3-Butadiene) 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.

Table 2a. NW Harllee Elementary School Key Pollutant Concentrations (Acetaldehyde) and Meteorological Data.

Parameter	Units	9/16/2009	9/22/2009	9/28/2009	10/10/2009	10/16/2009	10/28/2009	11/3/2009	11/9/2009	12/9/2009	12/15/2009
Acetaldehyde	$\mu g/m^3$	1.42	1.15	1.80	1.36	2.02	1.39	3.70	2.09	1.20	1.41
% Hours w/Wind Direction from Expected ZOI A (168.76°-213.75°)[a]	%	0.0	4.2	16.7	0.0	4.2	0.0	12.5	4.2	0.0	0.0
% Hours w/Wind Direction from Expected ZOI B (213.76°-347.25°)[a]	%	100	45.8	4.2	0.0	4.2	0.0	37.5	0.0	100	4.2
Wind Speed (avg. of hourly speeds)	mph	5.2	4.2	5.5	3.3	4.1	7.1	2.0	3.1	7.1	6.3
Wind Direction (avg. of unitized vector)[b]	deg.	327.0	337.0	41.6	53.8	36.6	212.6	87.1	326.6	36.6	5.7
% of Hours with Speed below 2 knots	%	0.0	20.8	0.0	4.2	20.8	0.0	75.0	37.5	0.0	0.0
Daily Average Temperature	° F	72.2	66.5	76.4	52.7	58.8	63.2	63.1	67.6	31.2	36.0
Daily Precipitation	inches	0.07	0.11	0.00	0.01	0.00	0.07	0.00	0.02	0.00	0.00

(Yellow shading) All precipitation and temperature data were from the Dallas Executive Airport NWS Station.

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

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

Table 2b. NW Harllee Elementary School Key Pollutant Concentrations (Benzene and 1,3-Butadiene) and Meteorological Data.

Parameter	Units	10/22/2009	10/28/2009	11/3/2009[a]	11/9/2009[b]	11/23/2009	11/30/2009	12/3/2009	12/7/2009	12/9/2009	12/15/2009
Benzene	µg/m^3	0.467	0.598	2.27	1.28	0.435	0.643	0.396	0.745	0.438	0.678
Butadiene, 1,3-	µg/m^3	0.071	0.046	0.301	0.15	0.033	0.091	0.044	0.064	0.060	0.062
% Hours w/Wind Direction from Expected ZOI B (213.76º-347.25º)[c]	%	95.8	0.0	8.3	37.5	0.0	4.2	41.7	0.0	100	4.2
Wind Speed (avg. of hourly speeds)	mph	4.7	7.1	2.1	2.3	5.0	4.5	4.0	5.5	7.1	6.3
Wind Direction (avg. of unitized vector)[d]	deg.	307.6	138.5	146.6	50.2	147.4	21.5	345.9	25.2	326.6	0.5
% of Hours with Speed below 2 knots	%	4.2	0.0	66.7	66.7	20.8	29.2	4.2	0.0	0.0	0.0
Daily Average Temperature	° F	57.4	63.2	65.4	65.3	58.0	48.4	38.5	42.6	31.2	36.0
Daily Precipitation	inches	0.93	0.07	0.00	0.00	0.01	0.00	0.00	0.06	0.00	0.00

(yellow box) Based on count of hours for which vector wind direction is from expected zone of influence.

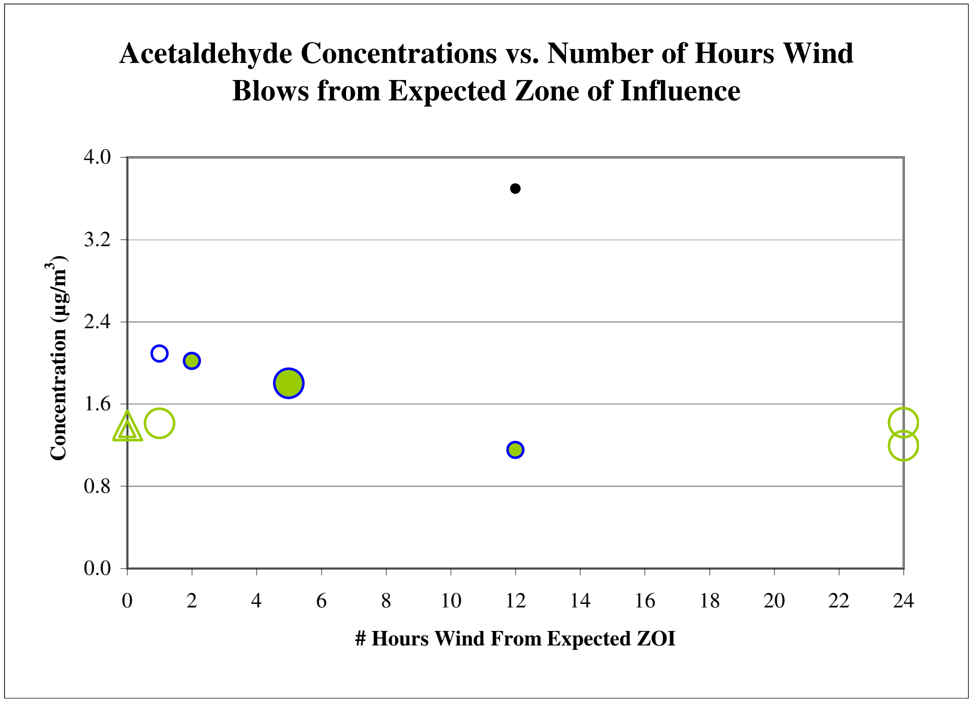
[a] Sampling began at 11:45am on this day, and continued for 24 hours until the next day. As such, the hourly meteorological observations used to correlate with this sample were from 12:00pm on 11/3/2009 to 11:00am on 11/4/2009.

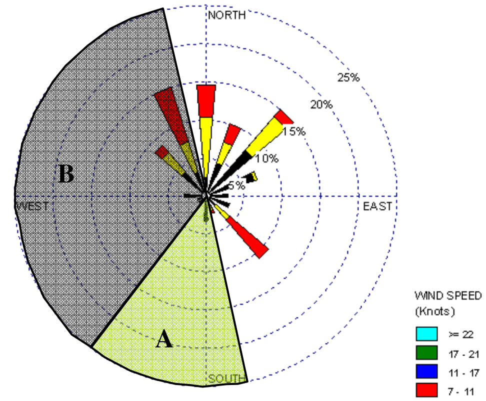
[b] Sampling began at 11:00am on this day, and continued for 24 hours until the next day. As such, the hourly meteorological observations used to correlate with this sample were from 11:00am on 11/9/2009 to 10:00am on 11/10/2009.

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

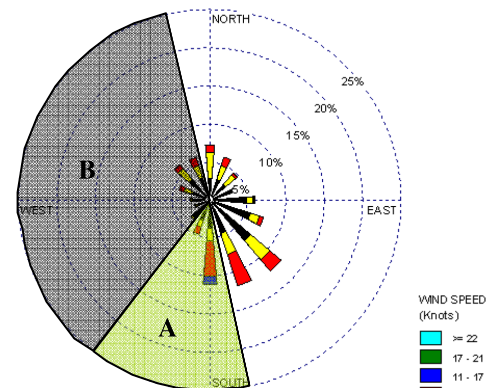
[d] Wind direction for each day is represented by values derived by scalar averaging of hourly estimates that were produced (by wind instrumentation's logger) as unitized vectors (specified as degrees from due north).

Figure 3a. NW Harllee Elementary School (Dallas, TX) Acetaldehyde Concentration and Wind Information.





NW Harllee Elementary School Composite Hourly Windrose on Sample Days (Sep. 16, 2009-Dec. 15, 2009)



NW Harllee Elementary School Composite Hourly Windrose Across Sampling Period (Sep. 16, 2009-Dec. 15, 2009)

Expected Zone of Source Influence A
Expected Zone of Source Influence B

KEY

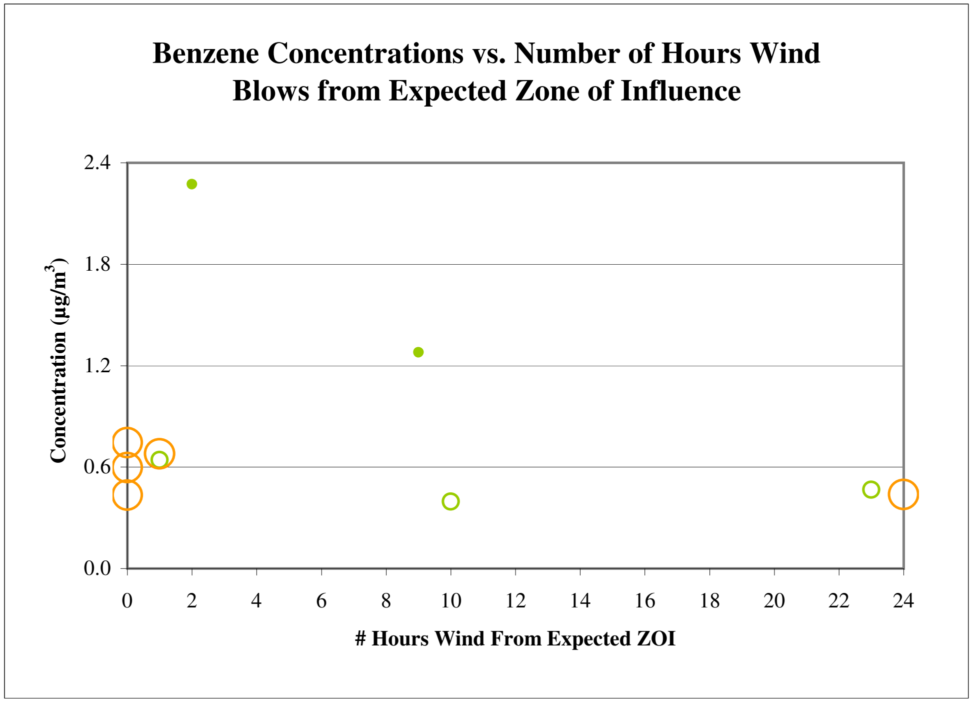
Pollutant: Acetaldehyde
Timeframe: September 16, 2009 - December 15, 2009

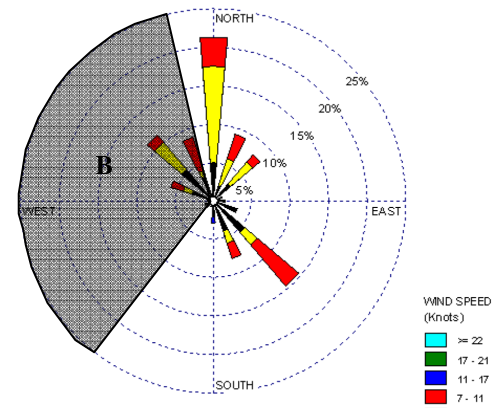
Note

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.

- Wind Speed: 0.1-2.5 mph, ZOI A and B
- Wind Speed: 2.5-5.0 mph, ZOI A and B
- Wind Speed: > 5.0 mph, ZOI A and B
- Wind Speed: 2.5-5.0 mph, ZOI A
- Wind Speed: > 5.0 mph, ZOI B
- Wind Speed: 2.5-5.0 mph, no ZOIs
- Wind Speed: > 5.0 mph, no ZOIs

Figure 3b. NW Harllee Elementary School (Dallas, TX) Benzene Concentration and Wind Information.





NW Harllee Elementary School Composite Hourly Windrose on Sample Days (Oct. 22, 2009-Dec. 15, 2009)

KEY

Pollutant: Benzene
Timeframe: October 22, 2009 - December 15, 2009

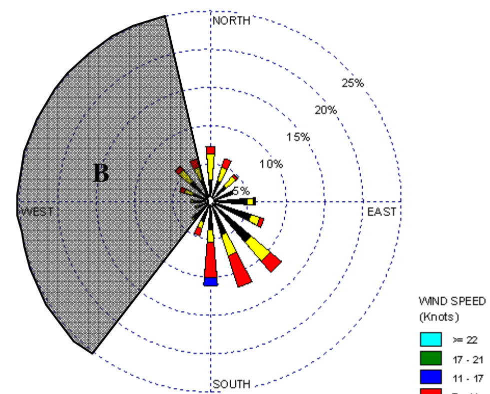
Wind Speed: 0.1-2.5 mph, ZOI B

Wind Speed: 2.5-5.0 mph, ZOI B

Wind Speed: > 5.0 mph, ZOI B

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.

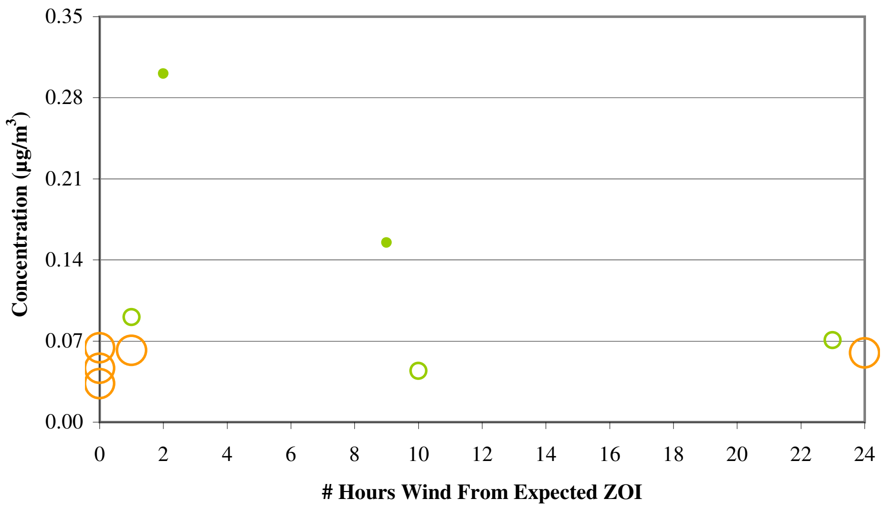


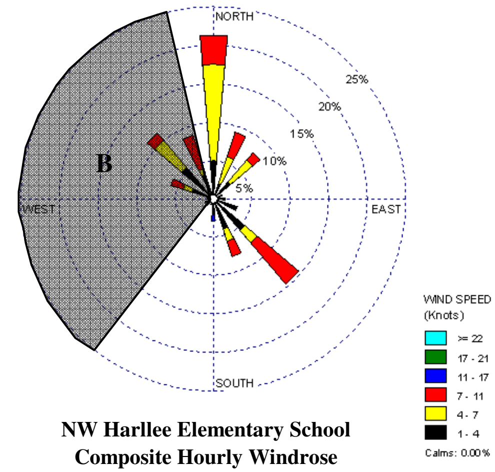
NW Harllee Elementary School Composite Hourly Windrose Across Sampling Period (Sep. 16, 2009-Dec. 15, 2009)

Expected Zone of Source Influence B

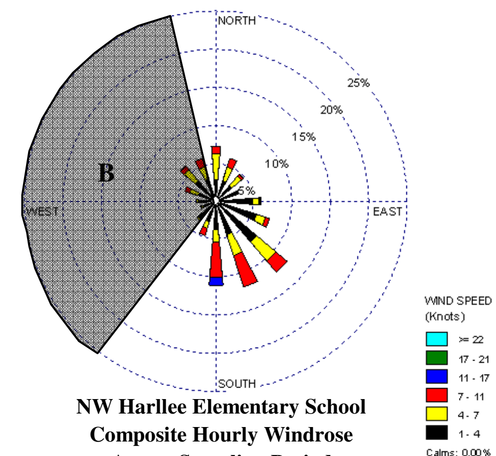
Figure 3c. NW Harllee Elementary School (Dallas, TX) 1,3-Butadiene Concentration and Wind Information.

1,3-Butadiene Concentrations vs. Number of Hours Wind Blows from Expected Zone of Influence





NW Harllee Elementary School
Composite Hourly Windrose
on Sample Days
(Oct. 22, 2009-Dec. 15, 2009)



NW Harllee Elementary School
Composite Hourly Windrose
Across Sampling Period
(Sep. 16, 2009-Dec. 15, 2009)

Expected Zone of Source Influence B

KEY

Pollutant: 1,3-Butadiene
Timeframe: October 22, 2009 - December 15, 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.

- Wind Speed: 0.1-2.5 mph, ZOI B
- Wind Speed: 2.5-5.0 mph, ZOI B
- Wind Speed: > 5.0 mph, ZOI B

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.[19]

<u>Cancer-based Comparison Levels</u>

- 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.[20] 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.

[19] These comparison levels are described in more detail *Schools Air Toxics Monitoring Activity (2009), Uses of Health Effects Information in Evaluating Sample Results.*
[20] 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 effect over a lifetime.[21] 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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[21] 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
Acetaldehyde	µg/m³	6,401	100%	92.78	1.87	1.40	0.41	0.86	1.42	2.34	4.48
Formaldehyde	µg/m³	6,403	100%	91.50	3.09	2.22	0.51	1.35	2.32	3.92	7.65
Propionaldehyde	µg/m³	4,330	93%	5.53	0.28	0.22	ND	0.13	0.21	0.35	0.77
Acetonitrile	µg/m³	1,804	69%	542.30	3.55	0.72	ND	ND	0.27	0.76	8.60
Acrylonitrile	µg/m³	3,673	31%	5.51	0.06	0.10	ND	ND	ND	0.03	0.33
Benzene	µg/m³	6,313	94%	10.19	1.03	0.84	ND	0.48	0.80	1.31	2.81
Benzyl chloride	µg/m³	3,046	9%	2.49	0.01	0.05	ND	ND	ND	ND	0.05
Bromoform	µg/m³	2,946	4%	1.18	0.01	0.16	ND	ND	ND	ND	ND
Bromomethane	µg/m³	5,376	61%	120.76	0.11	0.05	ND	ND	0.03	0.05	0.12
Butadiene, 1,3-	µg/m³	6,427	67%	15.55	0.10	0.09	ND	ND	0.05	0.13	0.38
Carbon disulfide	µg/m³	1,925	91%	46.71	2.32	0.25	ND	0.03	0.09	0.96	12.65
Carbon tetrachloride	µg/m³	6,218	86%	1.76	0.52	0.58	ND	0.47	0.57	0.65	0.87
Chlorobenzene	µg/m³	5,763	30%	1.10	0.02	0.04	ND	ND	ND	0.01	0.11
Chloroethane	µg/m³	4,625	37%	0.58	0.02	0.04	ND	ND	ND	0.03	0.08
Chloroform	µg/m³	6,432	73%	48.05	0.17	0.14	ND	ND	0.10	0.17	0.61
Chloromethane	µg/m³	5,573	95%	19.70	1.17	1.20	ND	1.03	1.18	1.36	1.68
Chloroprene	µg/m³	2,341	11%	0.17	<0.01	0.03	ND	ND	ND	ND	0.02
Dichlorobenzene, *p-*	µg/m³	5,409	60%	13.65	0.19	0.16	ND	ND	ND	0.18	0.90
Dichloroethane, 1,1-	µg/m³	5,670	16%	0.36	0.01	0.02	ND	ND	ND	ND	0.02
Dichloroethylene, 1,1-	µg/m³	5,480	19%	0.44	0.01	0.02	ND	ND	ND	ND	0.04
Dichloromethane	µg/m³	6,206	82%	214.67	0.59	0.34	ND	0.14	0.28	0.49	1.35
Dichloropropane,1,2-	µg/m³	6,225	17%	1.80	0.01	0.03	ND	ND	ND	ND	0.04
Dichloropropylene, *cis* -1,3-	µg/m³	4,705	18%	0.80	0.01	0.05	ND	ND	ND	ND	0.11
Dichloropropylene, *trans* -1,3-	µg/m³	4,678	18%	1.13	0.02	0.05	ND	ND	ND	ND	0.11
Ethyl acrylate	µg/m³	1,917	1%	0.08	<0.01	0.04	ND	ND	ND	ND	ND
Ethylbenzene	µg/m³	6,120	84%	8.84	0.42	0.32	ND	0.10	0.29	0.53	1.33
Ethylene dibromide	µg/m³	5,646	19%	4.15	0.01	0.05	ND	ND	ND	ND	0.05
Ethylene dichloride	µg/m³	6,143	38%	4.49	0.03	0.05	ND	ND	ND	0.04	0.09
Hexachlorobutadiene	µg/m³	3,727	20%	0.97	0.03	0.10	ND	ND	ND	ND	0.18
Methyl chloroform	µg/m³	5,944	73%	3.17	0.09	0.10	ND	ND	0.08	0.11	0.20
Methyl isobutyl ketone	µg/m³	2,936	60%	2.95	0.11	0.09	ND	ND	0.02	0.12	0.49
Methyl methacrylate	µg/m³	1,917	9%	14.05	0.13	0.49	ND	ND	ND	ND	0.53

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
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

Key Pollutant

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

[a] The summary statistics in this table represent the range of actual daily HAP measurement values taken at NATTS sites from 2004 through 2008. These data were extracted from AQS in summer 2008 and 2009. During the time period of interest, there were 28 sites measuring VOCs, carbonyls, metals, and hexavalent chromium. We note that some sites did not sample for particular pollutant types during the initial year of the NATTS Program, which was 2004. Most of the monitoring stations in the NATTS network are located such that they are not expected to be impacted by single industrial sources. The concentrations typically measured at NATTS sites can thus provide a comparison point useful to considering whether concentrations measured at a school are likely to have been influenced by a significant nearby industrial source, or are more likely to be attributable to emissions from many small sources or to transported pollution from another area. For example, concentrations at a school above the 75th percentile may suggest that a nearby industrial source is affecting air quality at the school.

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

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

At each school, monitoring has been targeted to get information on a limited set of key hazardous air pollutants (HAPs).[22] These pollutants are the primary focus of the monitoring activities at a school and a priority for us based on our emissions, modeling and other information. In analyzing air samples for these key pollutants, we have also obtained results for some other pollutants that are routinely included with the same test method. Our consideration of the data collected for these additional HAPs is described in the first section below. In addition to evaluating monitoring results for individual pollutants, we also considered the potential for cumulative impacts from multiple pollutants as described in the second section below (see Table C-1).

Other Air Toxics (HAPs)

- Do the monitoring data indicate elevated levels of any other air toxics or hazardous air pollutant (HAPs) that pose significant long-term health concerns?
  - → Longer-term concentration estimates for the other HAPs monitored are below their long-term comparison levels.
  - → Further, for pollutants with cancer-based comparison levels, longer-term concentration estimates for all but two of these (formaldehyde and ethylbenzene) are more than tenfold lower and all but five (formaldehyde, ethylbenzene, carbon tetrachloride, *p*-dichlorobenzene, and tetrachloroethylene) are more than 100-fold lower.[23]
  - → Additionally, each individual measurement for these five pollutants is below the individual sample (short-term) screening level developed for considering potential short-term exposures for that pollutant.[24]

Additional Information on Five HAPs:

- The first HAP mentioned above is formaldehyde. The mean and 95 percent upper bound on the mean for formaldehyde are approximately 32-41% of the cancer-based comparison level. A review of information available at other sites nationally shows that the mean concentration of formaldehyde at this site is between the 50th and 75th percentile of samples collected from 2004 to 2008 (the most recently compiled period) at the NATTS

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[22] 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.

[23] 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.

[24] 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.*

sites (Appendix B). This pollutant may occur in the air at this school as a result of several different industrial sources, as well as cars and trucks and the exhaust of other gasoline-powered engines.

- The second HAP mentioned above is ethylbenzene. The mean and 95 percent upper bound on the mean for ethylbenzene are approximately 7-21% of the cancer-based comparison level. A review of information available at other sites nationally shows that the mean concentration of ethylbenzene at this site is greater than the 95th percentile of samples collected from 2004 to 2008 (the most recently compiled period) at the NATTS sites (Appendix B).

- The third HAP mentioned above is carbon tetrachloride. The mean and 95 percent upper bound on the mean for carbon tetrachloride are approximately 4% of the cancer-based comparison level. A review of information available at other sites nationally shows that the mean concentration of carbon tetrachloride at this site is at the 75th 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 aerosol cans and its chemical persistence. Virtually all uses have been discontinued. However, it is still measured throughout the world as a result of its slow rate of degradation in the environment and global distribution in the atmosphere.

- The fourth HAP mentioned above is *p*-dichlorobenzene. 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 this site is less than the 75th percentile of samples collected from 2004 to 2008 (the most recently compiled period) at the NATTS sites (Appendix B).

- The fifth HAP mentioned above is tetrachloroethylene. The mean and 95 percent upper bound on the mean for tetrachloroethylene are approximately 1% of the cancer-based comparison level. A review of information available at other sites nationally shows that the mean concentration of tetrachloroethylene at this site is at the 50th percentile of samples collected from 2004 to 2008 (the most recently compiled period) at the NATTS sites (Appendix B).

Multiple Pollutants

As described in the main body of the report and background materials, this initiative and the associated analyses are focused on investigation of key pollutants for each school that were identified by previous analyses. This focused design does not provide for the consideration of combined impacts of pollutants or stressors other than those monitored in this project. Broader analyses and those involving other pollutants may be the focus of other EPA activities.[25]

[25] General information on additional air pollutants is available at http://www.epa.gov/air/airpollutants.html.

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)?
  - → Although the multiple air toxics monitored at this site were below the levels of significant concern for multi-pollutant cumulative risk that had been suggested by the modeling information, these results do indicate the influence of multiple mobile source pollutants of concern that are the focus of EPA actions nationwide.
  - → These results indicate the influence of multiple pollutants (such as acetaldehyde, formaldehyde, benzene, and 1,3-butadiene) that may occur in the air at this school as a result of several different sources, including cars and trucks and the exhaust of other gasoline-powered engines. Because these types of sources are found almost everywhere there are people, these pollutants are commonly elevated in urban areas across the country, and EPA has identified them as a national priority for reductions the air in communities across the country. [26]
    - In addition to the key pollutant acetaldehyde, the only other HAPs monitored whose longer-term concentration estimates are more than ten percent of their lowest comparison levels are formaldehyde, *m/p*-xylene, and ethylbenzene. The lowest comparison levels for formaldehyde and ethylbenzene are based on carcinogenic risk. When aggregated as a group, the upper bounds of their longer-term concentration estimates comprise less than 65 percent of their cancer-based comparison levels. Additionally, the lowest comparison levels for acetaldehyde and *m/p*-xylene are based on non-carcinogenic effects to different systems (respiratory and nervous systems, respectively). Taken together, these considerations reduce concerns for cumulative health risk from these pollutants.

[26] Additional information is available at http://www.epa.gov/schoolair/mobile.html and http://www.epa.gov/otaq/toxics.htm.

Table C-1. NW Harllee 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					
Formaldehyde	µg/m³	2.57	1.88 - 3.26	8	9.8
Xylene, *m/p-*	µg/m³	10.9	0 - 34.5	NA	100
Ethylbenzene	µg/m³	2.77	0 - 8.57	40	1000
Non-Key HAPs with mean lower than 10% of the lowest comparison level					
Carbon Tetrachloride	µg/m³	0.65	0.60 - 0.70	17	100
Propionaldehyde	µg/m³	0.27	0.18 - 0.35	NA	8
Xylene, *o-*	µg/m³	2.55	0.00 - 7.88	NA	100
Chloromethane	µg/m³	1.07	0.92 - 1.22	NA	90
Tetrachloroethylene	µg/m³	0.13	0.04 - 0.22	17	270
Bromomethane	µg/m³	0.04	0.02 - 0.05	NA	5
Acetonitrile	µg/m³	0.18	0.13 - 0.23	NA	60
Dichloromethane	µg/m³	0.43	0.29 - 0.57	210	1000
Chloroform	µg/m³	0.14	0.08 - 0.20	NA	98
Toluene	µg/m³	1.71	0.34 - 3.08	NA	5000
Carbon Disulfide	µg/m³	0.06	0.04 - 0.08	NA	700
Methyl isobutyl ketone	µg/m³	0.25	0.08 - 0.43	NA	3000
Styrene	µg/m³	0.06	0.01 - 0.11	NA	1000
Methyl chloroform	µg/m³	0.07	0.06 - 0.08	NA	5000
Chloroethane	µg/m³	0.03	0.01 - 0.06	NA	10000
Dichlorobenzene, *p-*	µg/m³	0.11 [e]	0 - 0.23 [e]	9.1	800
Non-Key HAPs with more than 50% ND results					
Trichloroethylene	µg/m³	80% of the results were ND[f]		50	600
Vinyl chloride	µg/m³	70% of the results were ND[g]		11	100
Hexachloro-1,3-butadiene	µg/m³	90% of the results were ND[h]		4.5	90
No other HAPs were detected in any samples					

µg/m³ micrograms per cubic meter
NA Not applicable
ND No results of this chemical were registered by the laboratory analytical equipment.

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

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

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

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

[e] *p*-Dichlorobenzene was detected in 6 of 10 samples, ranging from 0.060 to 0.55 µg/m³. The MDL is 0.24 µg/m³.

[f] Trichloroethylene was detected in only 2 of 10 samples, ranging from 0.13 to 0.27 µg/m³. The MDL is 0.011 µg/m³.

[g] Vinyl chloride was detected in only 3 of 10 samples, ranging from 0.02 to 0.036 µg/m³. The MDL is 0.005 µg/m³.

[h] Hexachloro-1,3-butadiene was detected in only 1 sample, with a value of 0.03 µg/m³. The MDL is 0.128 µg/m³.

Appendix D. NW Harllee Elementary School Pollutant Concentrations.

Parameter	Units	9/16/2009	9/22/2009	9/28/2009	10/10/2009	10/16/2009	10/22/2009	10/28/2009	11/3/2009	11/9/2009	11/23/2009	11/30/2009	12/3/2009	12/7/2009	12/9/2009	12/15/2009	Sample Screening Level[a]
Acetaldehyde	$\mu g/m^3$	1.42	1.15	1.80	1.36	2.02	--	1.39	3.70	2.09	--	--	--	--	1.20	1.41	90
Benzene	$\mu g/m^3$	--	--	--	--	--	0.467	0.598	2.27	1.28	0.435	0.643	0.396	0.745	0.438	0.678	30
Butadiene, 1,3-	$\mu g/m^3$	--	--	--	--	--	0.071	0.046	0.301	0.15	0.033	0.091	0.044	0.064	0.060	0.062	20
Formaldehyde	$\mu g/m^3$	2.59	2.18	4.33	1.66	2.42	--	2.33	4.23	2.73	--	--	--	--	1.67	1.61	50
Xylene, *m/p-*	$\mu g/m^3$	--	--	--	--	--	0.408	0.217	106	1.268	0.148	0.369	0.156	0.282	0.226	0.295	9,000
Ethylbenzene	$\mu g/m^3$	--	--	--	--	--	0.16	0.100	26.2	0.530	0.078	0.17	0.087	0.14	0.096	0.15	40,000
Carbon Tetrachloride	$\mu g/m^3$	--	--	--	--	--	0.60	0.724	0.699	0.655	0.62	0.60	0.57	0.730	0.54	0.736	200
Propionaldehyde	$\mu g/m^3$	0.245	0.20	0.299	0.17	0.247	--	0.22	0.587	0.295	--	--	--	--	0.17	0.23	80
Xylene, *o-*	$\mu g/m^3$	--	--	--	--	--	0.16	0.096	24.1	0.508	0.056	0.14	0.078	0.11	0.087	0.12	9,000
Chloromethane	$\mu g/m^3$	--	--	--	--	--	1.13	1.54	1.10	1.22	1.13	0.831	0.922	0.926	0.926	0.971	1,000
Tetrachloroethylene	$\mu g/m^3$	--	--	--	--	--	0.095	0.06	0.38	0.33	ND	0.12	ND	0.12	0.088	0.12	1,400
Bromomethane	$\mu g/m^3$	--	--	--	--	--	0.03	0.054	0.043	0.074	0.047	ND	ND	0.051	0.03	0.043	200
Acetonitrile	$\mu g/m^3$	--	--	--	--	--	0.16	0.198	0.336	0.267	0.215	0.12	0.16	0.099	0.099	0.15	600
Dichloromethane	$\mu g/m^3$	--	--	--	--	--	0.26	0.26	0.744	0.813	0.31	0.514	0.27	0.410	0.393	0.358	2,000
Chloroform	$\mu g/m^3$	--	--	--	--	--	0.083	0.098	0.35	0.20	0.10	0.13	0.093	0.12	0.078	0.12	500
Toluene	$\mu g/m^3$	--	--	--	--	--	1.13	0.513	6.30	4.18	0.615	1.27	0.532	0.879	0.716	0.962	4,000
Carbon Disulfide	$\mu g/m^3$	--	--	--	--	--	0.031	0.059	0.053	0.044	0.078	0.034	0.14	0.075	0.02	0.072	7,000
Methyl isobutyl ketone	$\mu g/m^3$	--	--	--	--	--	0.23	0.816	0.455	0.426	0.086	0.15	ND	0.16	0.15	0.049	30,000
Styrene	$\mu g/m^3$	--	--	--	--	--	0.04	0.047	0.22	0.12	ND	0.043	ND	0.12	0.043	ND	9,000
Methyl chloroform	$\mu g/m^3$	--	--	--	--	--	0.060	0.087	0.076	0.076	0.060	0.05	0.05	0.10	0.05	0.076	10,000
Chloroethane	$\mu g/m^3$	--	--	--	--	--	0.026	0.02	0.02	0.055	0.11	ND	0.069	ND	ND	0.042	40,000
Dichlorobenzene, *p-*	$\mu g/m^3$	--	--	--	--	--	0.060	0.072	0.55	0.25	0.072	0.078	ND	ND	ND	ND	10,000
Trichloroethylene	$\mu g/m^3$	--	--	--	--	--	ND	ND	0.13	0.27	ND	ND	ND	ND	ND	ND	10,000
Vinyl chloride	$\mu g/m^3$	--	--	--	--	--	ND	ND	0.02	0.036	0.031	ND	ND	ND	ND	ND	1,000
Hexachloro-1,3-butadiene	$\mu g/m^3$	--	--	--	--	--	ND	0.03	ND	ND	ND	ND	ND	ND	ND	ND	320
Acrylonitrile	$\mu g/m^3$	--	--	--	--	--	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	200

Appendix D. NW Harllee Elementary School Pollutant Concentrations.

Parameter	Units	9/16/2009	9/22/2009	9/28/2009	10/10/2009	10/16/2009	10/22/2009	10/28/2009	11/3/2009	11/9/2009	11/23/2009	11/30/2009	12/3/2009	12/7/2009	12/9/2009	12/15/2009	Sample Screening Level[a]
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
Chlorobenzene	µg/m^3	--	--	--	--	--	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	10,000
Chloroprene	µg/m^3	--	--	--	--	--	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	200
Ethylene dibromide	µg/m^3	--	--	--	--	--	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	12
Dichloroethane, 1,1-	µg/m^3	--	--	--	--	--	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	4,400
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	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
Ethylene dichloride	µg/m^3	--	--	--	--	--	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	270
Methyl Methacrylate	µg/m^3	--	--	--	--	--	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	7,000
Methy *tert-* Butyl Ether	µg/m^3	--	--	--	--	--	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	7,000
Tetrachloroethane, 1,1,2,2-	µg/m^3	--	--	--	--	--	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	120
Trichlorobenzene, 1,2,4-	µg/m^3	--	--	--	--	--	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	2,000
Trichloroethane, 1,1,2-	µg/m^3	--	--	--	--	--	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	440

Key Pollutant

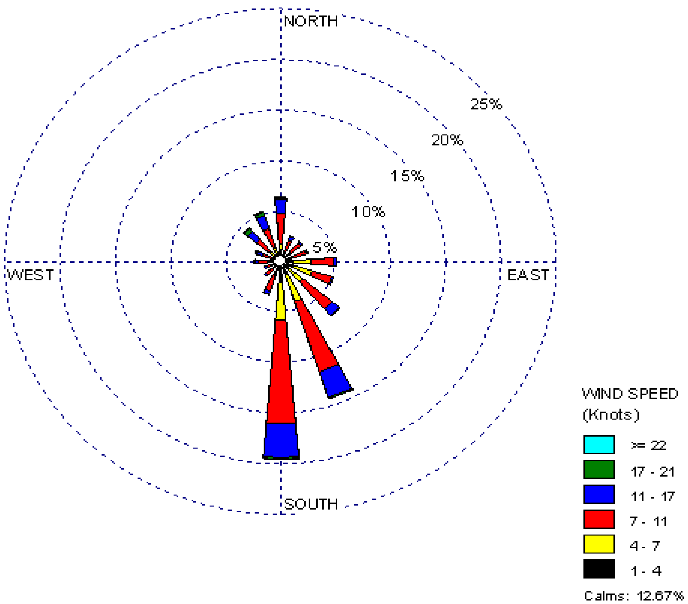
µg/m^3 micrograms per cubic meter

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

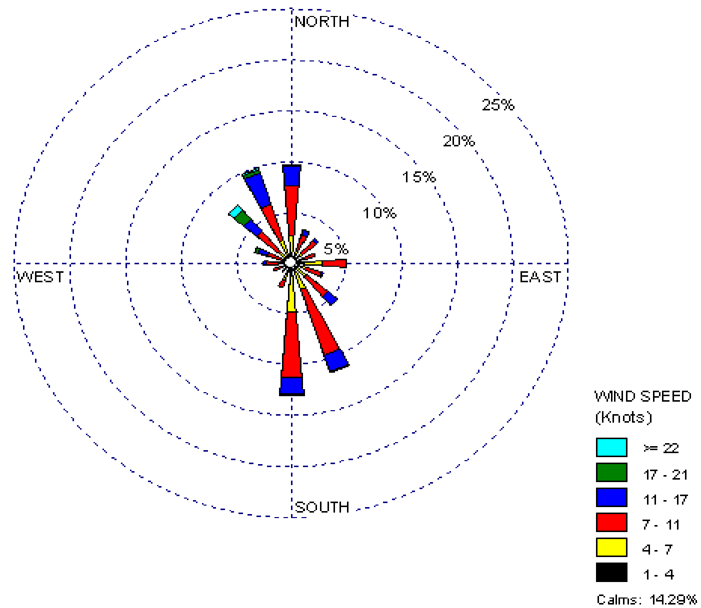
ND No results of this chemical were registered by the laboratory analytical equipment. The value is assumed to be zero.

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

Appendix E. Windroses for Dallas Executive Airport NWS Station.



Dallas Executive Airport
NWS Station
Composite Hourly Windrose,
2002-2007[1]



Dallas Executive Airport
NWS Station
Across Sampling Period
(Sep. 16, 2009-Dec. 15, 2009)[1]

[1] **Dallas Executive Airport NWS Station (WBAN 03971) is 5.90 miles from NW Harllee Elementary School.**