**SAT Initiative: Enterprise High School (Enterprise, MS)**

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, School Air Toxics Monitoring Project. The document has been prepared for technical audiences (e.g., risk assessors, meteorologists) and their management. It is intended to describe the technical analysis of data collected for this school in clear, but generally technical, terms. A summary of this analysis is presented on the page focused on this school on EPA's website (www.epa.gov/schoolair).

## I. Executive Summary

- Air monitoring was initially conducted at Enterprise Elementary School from July 30, 2009 to October 10, 2009 to assess concentrations of acrolein and volatile organic compounds (VOCs) in the air. EPA was not able to use the acrolein data due to concerns about the consistency and reliability of monitoring results of acrolein. (More information is available at http://www.epa.gov/schoolair/acrolein.html). Additional monitoring for acrolein and VOCs was conducted at the same location from October 31, 2011 to December 13, 2011.
- Since the original monitoring, EPA identified several steps that we believe significantly improved the accuracy of acrolein sampling and that provided data that will allowed us to understand whether acrolein in the outdoor air may pose a health concern at a particular school. EPA decided to apply these improvements to the acrolein method at the two schools where there was a specific source of acrolein emissions (the other school is Temple Elementary School (Diboll, TX)).
- This school was selected for monitoring based on information indicating the potential for elevated ambient concentrations of acrolein in air outside the school. That information included emissions of acrolein in EPA's 2002 National-Scale Air Toxics Assessment (NATA) from a nearby natural gasoline transmission station. Emission estimates for 2011 indicate around 6.7 tons of acrolein were emitted from this source.
- Measured values of acrolein and other VOCs indicate no influence of the source at Enterprise High School. Concentrations of acrolein are lower than the average measurement for acrolein across the United States and within the range of estimates without appreciable risk of adverse effects.
- The Mississippi Department of Environmental Quality (MDEQ) 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 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 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 allowed us to:
  - assess specific air toxics levels occurring at these sites and associated estimates of longer-term concentrations in light of health risk-based criteria for long-term exposures,
  - better understand, in many cases, potential contributions from nearby sources to key air toxics concentrations at the schools,
  - consider what next steps might be appropriate to better understand and address air toxics at the school, and
  - improve the information and methods we will use in the future (e.g., NATA) for estimating air toxics concentrations in communities across the U.S.

Assessment of air quality under this initiative was specific to the air toxics identified for monitoring at each school. This initiative was implemented in addition to ongoing state, local

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

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

Enterprise High School was selected for monitoring in consultation with the State air agency, the Mississippi Department of Environmental Quality (MDEQ). We were interested in evaluating the ambient concentrations of acrolein in air outside the school because EPA's 2002 NATA analysis indicated the potential for levels of concern due to estimates of acrolein emissions in the 2002 National Emissions Inventory for a nearby natural gasoline transmission station (Figure 1).

Initial VOC data were collected from July 30, 2009 to October 10, 2009. All VOC results from this sampling with the exception of acrolein were evaluated for health concerns. Results of a short-term laboratory study conducted in 2010 raised questions about the consistency and reliability of monitoring results of acrolein. As a result, EPA did not use the acrolein data from this initial sampling event. The EPA worked on several different techniques to improve the quality of the current acrolein method (see next section). Once these improvements were made, additional monitoring for acrolein and VOCs was conducted at the same location from October 31, 2011 to December 13, 2011 because there is a stationary source of acrolein nearby. Concentrations of acrolein are lower than the average measurement for acrolein across the United States and within the range of estimates without appreciable risk of adverse effects. [4]

## IV. Acrolein Method Improvement

The current methodology for the sampling and analysis of acrolein is EPA Compendium Method TO-15. Improvements to the methodology to minimize bias, positive or negative, have been employed for the School Air Toxics re-monitoring plan. These improvements included several actions to ensure the data would be useable for SAT evaluation. EPA used a specific type of canister (fused silica lined) which was less likely to allow chemicals to react within the canister. Then each canister was tested for a period of 3 weeks after being cleaned and prior to being used in the field to ensure no positive bias of acrolein (pollutants reacting to create more acrolein). In

[2] For example, http://www.epa.gov/schoolair/pollutants.html, http://www.epa.gov/ttn/fera/risk_atoxic.html.
[3] For example, http://www.epa.gov/ttn/atw/3_90_022.html, http://www.epa.gov/ttn/atw/3_90_024.html.
[4] Ambient acrolein data reported to EPA from 2003-2011 for over 9,900 measurements had a mean of 0.894 $\mu g/m^3$.

addition, canisters were spiked with a known concentration of acrolein and tested for acrolein over a 3 week period to quantify determine how much of the acrolein might react and form another compound resulting in less measurable acrolein in the canister or a negative bias. Additional quality assurance steps were also employed to ensure the quality of data for the re-monitoring. The result of these improvements yielded high quality data and provided increased confidence in the acrolein measurements.

Sampling methodologies are described in EPA's schools air toxics monitoring plan (http://www.epa.gov/schoolair/techinfo.html).[5]

## V. Monitoring Results and Analysis

### A. Background for the SAT Analysis

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

The primary objective of this initiative was 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.

[5] A contractor was used to collect samples in the additional round of monitoring. Analysis was conducted by EPA's Office of Research and Development for the additional monitoring and by an analytical laboratory under contract to EPA for the initial monitoring.

[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. These pollutants are distinguished from the six pollutants for which criteria and national ambient air quality standards (NAAQS) are developed as described in section 108. One of the criteria pollutants, lead, is also represented, as lead compounds, on the HAP list.

[7] While this EPA initiative relied 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.

Consistent with the long-term or chronic focus of the modeling analyses, based on which these schools were selected for monitoring, we have analyzed the full record of concentrations of air toxics measured at this school, using routine statistical tools, to derive a 95 percent confidence interval[8] for the estimate of the longer-term average concentration of each of these pollutants. In this project, we are reporting all actual numerical values for pollutant concentrations including any values below method detection limit (MDL).[9] Additionally, a value of 0.0 is used when a measured pollutant has no value detected (ND). The projected range for the longer-term concentration estimate for each chemical (most particularly the upper end of the range) is compared to the long-term comparison levels. These long-term comparison levels conservatively presume continuous (all-day, all-year) exposure over a lifetime. The analysis of the air concentrations also includes a consideration of the potential for cumulative multiple pollutant impacts.[10] In general, where the monitoring results indicated 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 considered 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 further analyzed the dataset to describe what it indicated 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

[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).

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

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

### B. Chemical Concentrations

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

In developing or identifying these comparison levels, we have given priority to use of relevant and appropriate air standards and EPA risk assessment guidance and precedents.[11] These levels are based upon health effects information, exposure concentrations and risk estimates developed and assessed by EPA, the U.S. Agency for Toxic Substances and Disease Registry, and the California EPA. These agencies recognize the need to account for potential differences in sensitivity or susceptibility of different groups (e.g., asthmatics) or lifestages/ages (e.g., young children or the elderly) to a particular pollutant's effects so that the resulting comparison levels are relevant for these potentially sensitive groups as well as the broader population.

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.

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

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

- Concentrations of acrolein are lower than the average measurement for acrolein across the United States and within the range of estimates without appreciable risk of adverse effects.[4]

- Concentrations of VOCs are similar to those typically measured in most locations throughout the United States and within the range of estimated levels without appreciable risk of adverse effects.

Acrolein, the key pollutant:

- The longer-term concentration estimate for acrolein is within the range of long-term concentrations estimated to be without appreciable risk of adverse health effects and all acrolein measurements are below the acrolein sample screening level (Figure 2).
  - → The longer-term concentration estimate for acrolein falls between the SAT noncancer-based comparison level (based on the EPA Reference Concentration or RfC) and a more recent comparable level derived by the California EPA (Cal-EPA).[12] The Cal-EPA Reference Exposure Level (REL) is based on more recent information than that on which the EPA RfC is based.[13]
    - The EPA RfC is defined as an estimated continuous (24 hours-per-day daily) exposure concentration considered likely to be without adverse effects over a lifetime. The EPA RfC is set well below a level associated with health effects.
    - Since the EPA RfC was derived, the California EPA has derived a chronic REL based on more recently available information on acrolein and its effects. The Cal-EPA REL, which is 0.35 $\mu g/m^3$, is also well below a level associated with effects in the more recently available study.

[12] As described in the background document for this project (*Uses of Health Effects Information in Evaluating Sample Results*), the more direct strength of the RfC (and comparable values) is in interpretations regarding exposures at or below it. As the RfC is not a direct estimator of risk but rather a reference point to gauge the potential for effects, any long-term exposure above the RfC does not necessarily indicate a risk of adverse health effect. The potential for risk increases with exposures increasingly above the RfC, with the risk potential associated with a particular increased exposure varying among pollutants and information specific to that pollutant. As a result, depending on the pollutant, longer-term average concentration estimates that are appreciably above the noncancer comparison level may be more relevant to gauging significance for health concerns than estimates above but falling much closer to this comparison level. Thus, in drawing conclusions about potential concerns associated with estimated longer-term average concentration estimates higher than the long-term comparison level, we consider a variety of factors, including those specific to the site or sources involved which might influence exposures (e.g., pending source actions), as well as factors particular to the health effects information, including whether or not the RfC represents current methods and current information for the chemical.

[13] As described in the background document for this project (*Uses of Health Effects Information in Evaluating Sample Results*), in the case of acrolein, there is more recent and relevant information available now than was the case when the EPA RfC was derived and the California REL is based on that information. Thus, we have considered the acrolein longer-term concentration estimate for Enterprise in light of both values.

Other Air Toxics:

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

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

Multiple Pollutants:

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

  → The data collected for the key and other air toxics and the associated longer-term concentration estimates do not pose significant concerns for cumulative health risk from these pollutants (Appendix B).[14]

### C. Wind and Other Meteorological Data

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

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

The meteorological station at Enterprise High School collected wind speed and wind direction measurements during the initial monitoring event from July 30, 2009 through October 10, 2009 and again during the second monitoring event beginning October 31, 2011 through December 13, 2011. As a result, on-site data for these meteorological parameters are available for all but one date of sample collection, and also for a period before and after the sampling period, producing a continuous record of over six months of on-site meteorological data. The meteorological data collected onsite on sampling days are presented in Table 1 and Figure 3. We

[14] 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

have also included composite wind data in Figure 4 which includes the met data over both periods of monitoring.

The nearest NWS station is at Key Field Airport in Meridian, MS. This station is approximately 11.7 miles north northeast of the school. Measurements taken at that station include wind, temperature, and precipitation. These are also presented in Table 1.

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

- The meteorological data at the school indicate that only a small percentage of the winds on a few days were from the Zone of Influence (ZOI).

- What is the direction of the key source of acrolein emissions in relation to the school location?
  - → The nearby industrial facility emitting the key pollutant into the air (described in section III above) lies approximately two miles southwest of the school (Figure 1).
  - → Using the property boundaries of the full facility (in lieu of information regarding the location of specific sources of acrolein emissions at the facility), we have identified an approximate range of wind directions to use in considering the potential influence of this facility on air concentrations at the school.
  - → This general range of wind directions, from approximately 215-260 degrees, is referred to here as the expected zone of source influence (ZOI).

- How often did wind come from direction of the key source?
  - → There were three sampling days in which some portion of the winds were from the expected ZOI (Table 1).

- What might be expected over the longer-term at the school location?
  - → We would expect that the wind is not often from the southeast which is the direction of the source.
  - → The NWS station at Key Field Airport is not representative of the specific wind flow patterns at the school location but is indicative of historical windflow in the region. During the period for which data are available both at the school site and at the reference NWS station (approximately 6 months), prevalent winds at the school site are predominantly from the northeast to southeast, while those at the NWS station are predominantly from the north and south with occasional winds from the southeast.

## V. Key Source Information

- Was the source operating as usual during the monitoring period?
  - The nearby source of acrolein (described in section III above) has an operating permit issued by the MDEQ that includes operating requirements.[15]

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

- Production levels at the nearby source have increased over the last few years with 6.7 tons of acrolein being emitted in 2011.
- The most recently available acrolein emissions for this source are higher than those relied upon in previous modeling analysis for this area (e.g., 2002 NATA).

## VI. Integrated Summary and Next Steps

### A. Summary of Key Findings

1. What is the key HAP for this school?
   → Acrolein is the key HAP for this school, identified based on emissions information considered in identifying the school for monitoring.

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

   → Concentrations of acrolein and VOCs are similar to those typically measured in most locations throughout the United States and within the range of estimated concentrations without appreciable risk of adverse effects.

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 monitoring period, with no indications from the on-site meteorological data that the sampling day conditions were inconsistent with conditions overall during this period.
   → The wind flow patterns during the sampling period are not normally from the expected zone of influence. We would not anticipate that concentrations would be higher during other times of the year as the general wind flow is not from the source towards the school. Among the data collected for this site, we have none that would indicate generally higher (or lower) concentrations during other times of year.

### 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 has identified several simple steps that we believe have significantly improved the accuracy of acrolein sampling. EPA plans to further improve the method for measuring acrolein.
3. The MDEQ will continue to oversee industrial facilities in the area through air permits and other programs.

## VII. Figures and Table

### A. Table

1. Enterprise High School – Key Pollutant Concentrations (Acrolein) and Meteorological Data

### B. Figures

1. Enterprise High School and Source of Interest
2. Enterprise High School – Key Pollutant (Acrolein) Analysis
3. Enterprise High School (Enterprise, MS) Acrolein Concentration and Wind Information
4. Enterprise High School: Composite Wind Data

## VIII. Appendices

A. Summary Description of Long-term Comparison Levels.

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

C. Enterprise High School Pollutant Concentrations.

D. National Air Toxics Trends Stations Measurements (2003-2010).

**Figure 1. Enterprise High School and Source of Interest.**

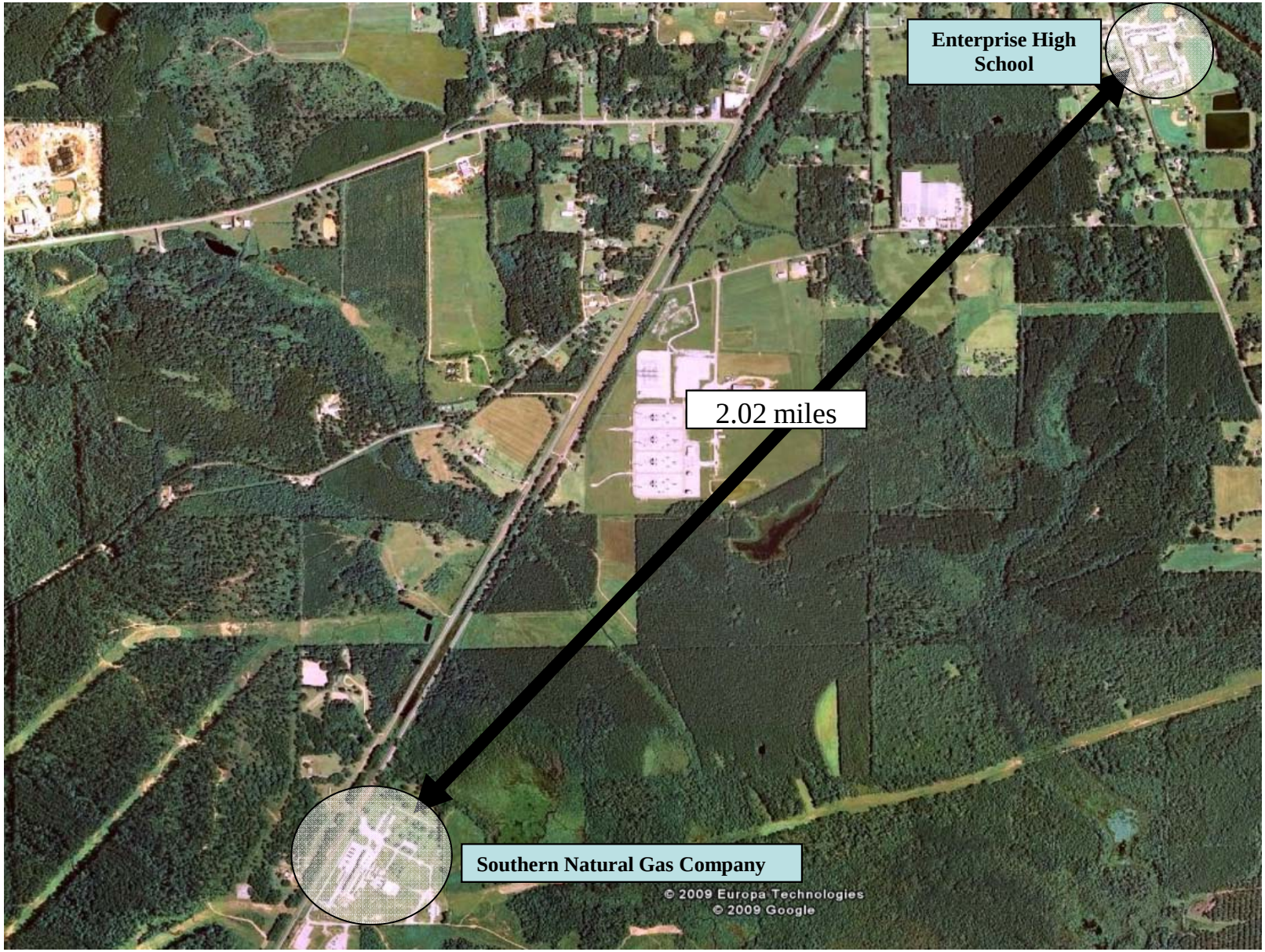
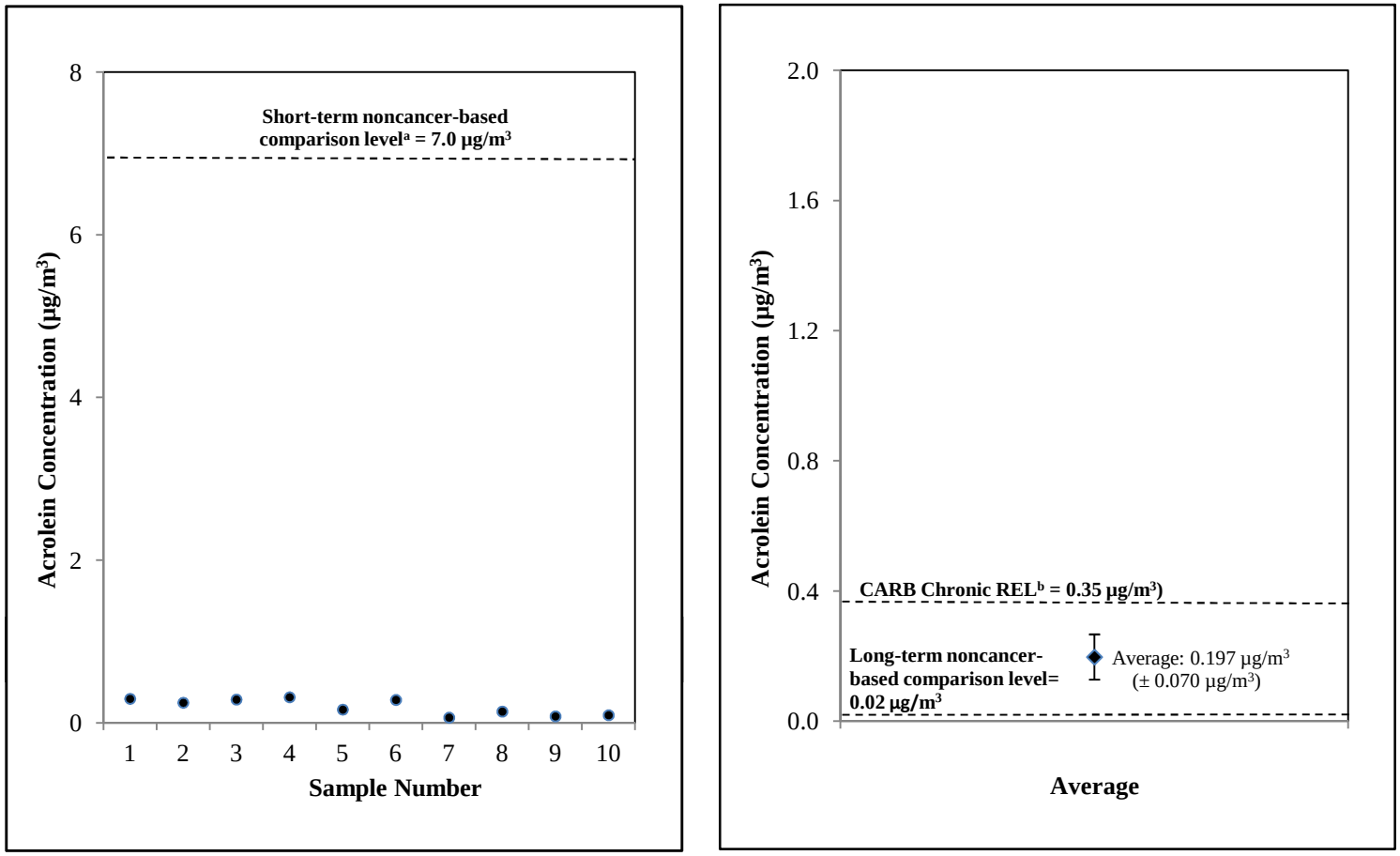


**Figure 2. Enterprise High School - Key Pollutant (Acrolein) Analysis.**




[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. 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] California Air Resources Board Chronic Reference Exposure Level. See http://www.oehha.ca.gov/air/toxic_contaminants/pdf_zip/Acrolein_postSRP3.pdf

## Table 1. Enterprise High School Key Pollutant Concentrations (Acrolein) and Meteorological Data.

| Parameter | Units | 10/31/2011 | 11/1/2011 | 11/7/2011 | 11/8/2011 | 11/14/2011 | 11/15/2011 | 12/6/2011 | 12/7/2011 | 12/12/2011 | 12/13/2011 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Acrolein | µg/m$^3$ | 0.296 | 0.248 | 0.287 | 0.315 | 0.163 | 0.282 | 0.065 | 0.139 | 0.081 | 0.094 |
| % Hours w/Wind Direction from Expected ZOI[a] | % | 0.0 | 0.0 | 0.0 | 4.2 | 0.0 | 16.7 | 0.0 | 0.0 | 4.2 | 0.0 |
| Wind Speed (avg. of hourly speeds) | mph | 2.1 | 1.8 | 1.9 | 2.9 | 3.8 | 4.2 | 5.3 | 3.4 | 2.0 | 3.5 |
| Wind Direction (avg. of unitized vector)[b] | deg. | 62.8 | 125.9 | 129.4 | 189.7 | 193.9 | 203.4 | 298.5 | 343.2 | 60.7 | 80.5 |
| % of Hours with Speed below 2 knots | % | 66.7 | 70.8 | 66.7 | 45.8 | 25.0 | 12.5 | 4.2 | 25.0 | 62.5 | 66.7 |
| Daily Average Temperature | ° F | 50.7 | 51.3 | 59.3 | 69.2 | 71.5 | 69.5 | 40.3 | 36.0 | 50.5 | 56.1 |
| Daily Precipitation | inches | 0.00 | 0.00 | 0.00 | 0.01 | 0.07 | 1.32 | 0.44 | 0.00 | 0.00 | 0.00 |

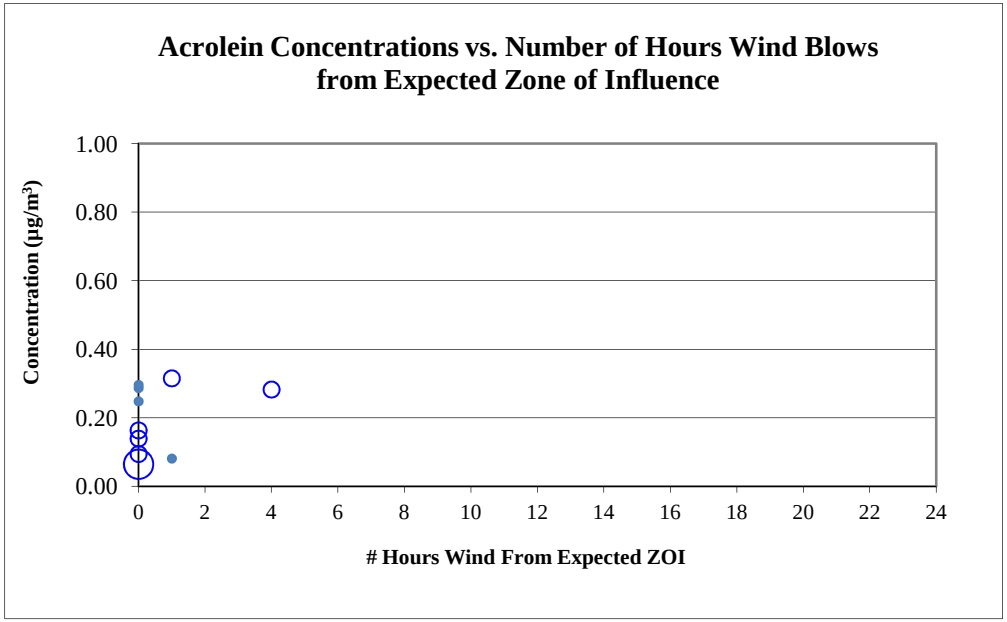
µg/m$^3$ micrograms per cubic meter

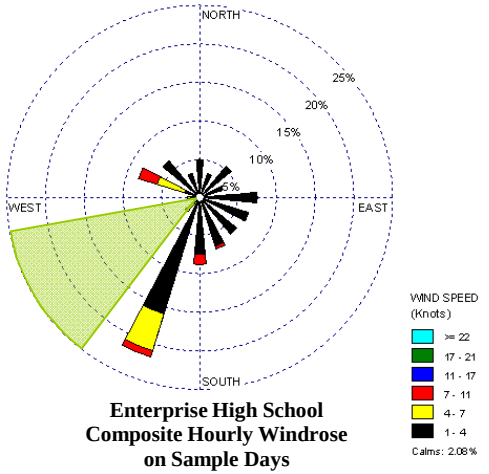
All precipitation and temperature data were from the Key Field Airport NWS Station.

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

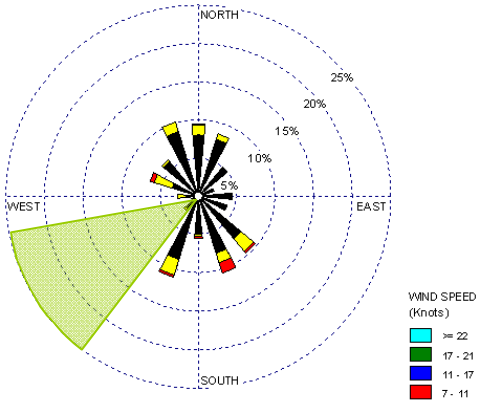
[b] Wind direction for each day is represented by values derived by scalar averaging of hourly estimates that were produced (by wind instrumentation's logger) as unitized vectors (specified as degrees from due north).

**Figure 3. Enterprise High School (Enterprise, MS) Acrolein Concentration and Wind Information.**




**Enterprise High School Composite Hourly Windrose on Sample Days (Oct. 31, 2011 - Dec. 13, 2011)**




**Enterprise High School Composite Hourly Windrose Across Sampling Period (Oct. 31, 2011 - Dec. 13, 2011)**

Expected Zone of Source Influence

## KEY

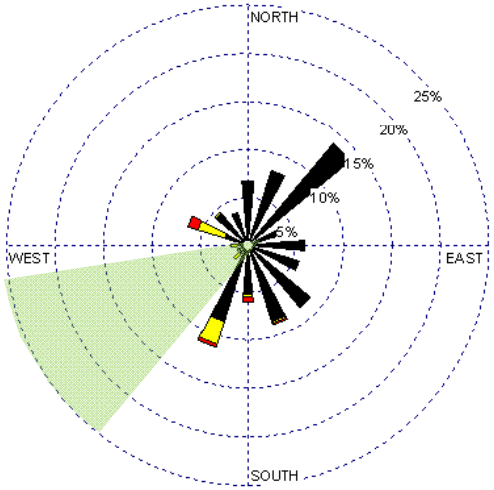
**Pollutant: Acrolein**
**Timeframe: October 31, 2011 - December 13, 2011**

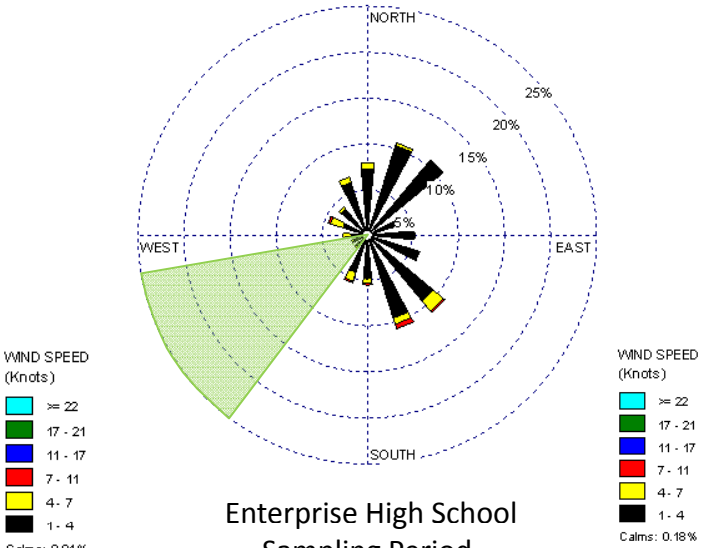
Note

Each circle denotes a 24-hour collection of air for chemical analysis. The size of the circle indicates the magnitude of the wind speed for that day (wind data shown in Table 1). 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
- Wind Speed: 2.5-5.0 mph
- Wind Speed: > 5.0 mph

# Figure 4. Enterprise High School: Composite Wind Data



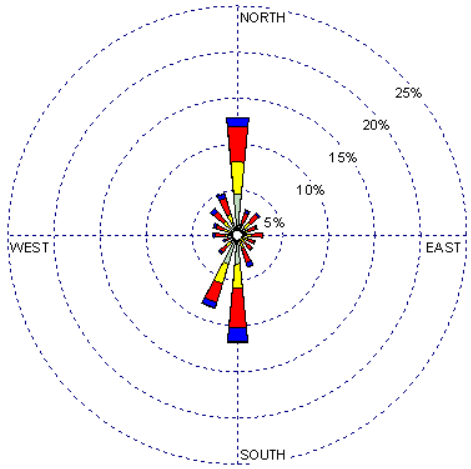

Enterprise High School
Sample Days,
July 30, 2009-Oct. 10, 2009
Oct. 31, 2011-Dec. 13, 2011







Enterprise High School
Sampling Period,
July 30, 2009-Oct. 10, 2009
Oct. 31, 2011-Dec. 13, 2011





Key Field Airport NWS Station[1]
Composite Hourly Windroses,
1/1/2002-12/13/2011

[1] Key Field Airport NWS Station (WBAN 13865) is 11.77 miles from Enterprise High School.
Light green shading indicates the Zone of Source Influence (ZOI)

## Phase 1 Sampling Results

| Parameter | Units | 7/30/2009 | 8/5/2009 | 8/6/2009 | 8/11/2009 | 8/17/2009 | 8/25/2009 | 9/4/2009 | 9/10/2009 | 9/16/2009 | 9/22/2009 | 9/28/2009 | 10/4/2009 | 10/10/2009 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| % Hours w/Wind Direction from Expected ZOI[a] | % | 0.0 | 12.5 | 4.2 | 4.2 | 0.0 | 16.7 | 0.0 | 0.0 | 0.0 | 0.0 | 8.3 | 4.2 | 0.0 |
| Wind Speed (avg. of hourly speeds) | mph | 3.2 | 3.0 | 2.5 | 3.0 | 2.7 | 1.9 | 2.2 | 2.1 | 3.5 | 3.0 | 3.7 | 2.4 | 2.5 |
| Wind Direction (avg. of unitized vector)[b] | deg. | 156.7 | 350.5 | 28.8 | 202.7 | 52.3 | 28.8 | 42.8 | 49.0 | 151.1 | 127.1 | 281.1 | 54.5 | 0.1 |
| % of Hours with Speed below 2 knots | % | 54.2 | 50.0 | 62.5 | 45.8 | 33.3 | 66.7 | 66.7 | 62.5 | 8.3 | 37.5 | 45.8 | 54.2 | 50.0 |

## Phase 2 Sampling Results

| Parameter | Units | 10/31/2011 | 11/1/2011 | 11/7/2011 | 11/8/2011 | 11/14/2011 | 11/15/2011 | 12/6/2011 | 12/7/2011 | 12/12/2011 | 12/13/2011 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Acrolein | $\mu g/m^3$ | 0.296 | 0.248 | 0.287 | 0.315 | 0.163 | 0.282 | 0.065 | 0.139 | 0.081 | 0.094 |
| % Hours w/Wind Direction from Expected ZOI[a] | % | 0.0 | 0.0 | 0.0 | 4.2 | 0.0 | 16.7 | 0.0 | 0.0 | 4.2 | 0.0 |
| Wind Speed (avg. of hourly speeds) | mph | 2.1 | 1.8 | 1.9 | 2.9 | 3.8 | 4.2 | 5.3 | 3.4 | 2.0 | 3.5 |
| Wind Direction (avg. of unitized vector)[b] | deg. | 62.8 | 125.9 | 129.4 | 189.7 | 193.9 | 203.4 | 298.5 | 343.2 | 60.7 | 80.5 |
| % of Hours with Speed below 2 knots | % | 66.7 | 70.8 | 66.7 | 45.8 | 25.0 | 12.5 | 4.2 | 25.0 | 62.5 | 66.7 |

Gray shading indicates surrogate wind information was taken from the nearby NWS Station due to instrument failure of the meteorological station at the school site.

## 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.[16]

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.[17] 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 B.

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

[17] 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.[18] 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.

[18] 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. 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).[19] 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 B-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 three (carbon tetrachloride, benzene, and 1,3-butadiene) are more than 100-fold lower.[20]

  → 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.[21]

Additional Information on Three HAPs:

- The first HAP mentioned above is carbon tetrachloride. The mean and 95 percent upper bound on the mean for carbon tetrachloride are approximately 3% of the cancer-based comparison level. A review of information available at other sites nationally shows that the mean concentration of carbon tetrachloride at this site is between the $25^{th}$ to $50^{th}$ percentile of samples collected from 2003 to 2010 (the most recently compiled period) at the NATTS sites (Appendix D). Carbon tetrachloride is found globally as a result of its

[19] 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.

[20] 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 $10^{-6}$ excess cancer risk, respectively.

[21] 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.*

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 second HAP mentioned above is benzene. The mean and 95 percent upper bound on the mean for benzene are approximately 3% of the cancer-based comparison level. A review of information available at other sites nationally shows that the mean concentration of benzene at this site is below the 25$^{th}$ percentile of samples collected from 2003 to 2010 (the most recently compiled period) at the NATTS sites (Appendix D).

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

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.[22]

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 the key and other air toxics and the associated longer-term concentration estimates do not together pose significant concerns for cumulative health risk from these pollutants.

    - There were not multiple HAPs monitored for which the longer-term concentration estimate was within an order of magnitude for their comparison levels.

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

## Table B-1. Enterprise High School - Other Monitored Pollutant Analysis.

| Parameter | Units | Mean of Measurements[a] | 95% Confidence Interval on the Mean | Long-term Comparison Level[b] | |
|---|---|---|---|---|---|
| | | | | Cancer-Based[c] | Noncancer-Based[d] |
| ***Non-Key HAPs - all means are lower than 10% of the lowest comparison level*** | | | | | |
| Carbon Tetrachloride | µg/m$^3$ | 0.508 | 0.495 - 0.520 | 17 | 100 |
| Benzene | µg/m$^3$ | 0.374 | 0.295 - 0.453 | 13 | 30 |
| Butadiene, 1,3- | µg/m$^3$ | 0.025 | 0 - 0.043 | 3.3 | 2 |
| Chloromethane | µg/m$^3$ | 0.730 | 0.652 - 0.807 | NA | 90 |
| Ethylbenzene | µg/m$^3$ | 0.214 | 0.175 - 0.253 | 40 | 1000 |
| Xylene, *m/p*- | µg/m$^3$ | 0.380 | 0.306 - 0.454 | NA | 100 |
| Xylene, *o*- | µg/m$^3$ | 0.221 | 0.181 - 0.261 | NA | 100 |
| Tetrachloroethylene | µg/m$^3$ | 0.082 | 0.071 - 0.094 | 380 | 40 |
| Dichloromethane | µg/m$^3$ | 0.153 | 0.121 - 0.185 | 5900 | 600 |
| Chloroform | µg/m$^3$ | 0.019 | 0.008 - 0.030 | NA | 98 |
| Toluene | µg/m$^3$ | 0.645 | 0.495 - 0.795 | NA | 5000 |
| Methyl isobutyl ketone | µg/m$^3$ | 0.132 | 0.112 - 0.153 | NA | 3000 |
| ***Non-Key HAPs with more than 50% ND Results.*** | | | | | |
| Trichloroethylene | µg/m$^3$ | 70% of the results were ND[e] | | NA | 20 |
| ***No other HAPs were detected in any other samples.*** | | | | | |

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

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

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

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

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

[e] Trichloroethylene was detected in only 3 of 10 samples, ranging from 0.0032 to 0.0044 µg/m$^3$. The MDL is 0.0645 µg/m$^3$.

## Appendix C. Enterprise High School Pollutant Concentrations.

| Parameter | Units | 10/31/2011 | 11/1/2011 | 11/7/2011 | 11/8/2011 | 11/14/2011 | 11/15/2011 | 12/6/2011 | 12/7/2011 | 12/12/2011 | 12/13/2011 | Sample Screening Level[a] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Acrolein | µg/m$^3$ | 0.296 | 0.248 | 0.287 | 0.315 | 0.163 | 0.282 | 0.065 | 0.139 | 0.081 | 0.094 | 7 |
| Ethylene dibromide[b] | µg/m$^3$ | 0.120 | 0.209 | 0.119 | 0.120 | 0.108 | 0.104 | 0.116 | 0.118 | 0.103 | 0.104 | 12 |
| Tetrachloroethane, 1,1,2,2-[b] | µg/m$^3$ | 0.105 | 0.182 | 0.106 | 0.105 | 0.091 | 0.090 | 0.105 | 0.106 | ND | 0.094 | 120 |
| Dichloropropane, 1,2-[b] | µg/m$^3$ | 1.254 | 0.010 | 0.025 | 0.016 | 0.014 | 0.003 | 0.018 | 0.051 | ND | 0.009 | 200 |
| Carbon Tetrachloride | µg/m$^3$ | 0.503 | 0.551 | 0.495 | 0.501 | 0.506 | 0.500 | 0.523 | 0.513 | 0.487 | 0.499 | 200 |
| Benzene | µg/m$^3$ | 0.456 | 0.416 | 0.487 | 0.293 | 0.172 | 0.225 | 0.503 | 0.424 | 0.422 | 0.340 | 30 |
| Ethylene dichloride[b] | µg/m$^3$ | 0.054 | 0.047 | 0.058 | 0.056 | 0.047 | 0.044 | 0.069 | 0.071 | 0.054 | 0.052 | 270 |
| Butadiene, 1,3- | µg/m$^3$ | 0.052 | 0.031 | 0.070 | ND | ND | 0.022 | 0.037 | 0.004 | ND | 0.037 | 20 |
| Chloromethane | µg/m$^3$ | 0.644 | 0.553 | 0.682 | 0.770 | 0.847 | 0.949 | 0.742 | 0.717 | 0.669 | 0.723 | 1,000 |
| Ethylbenzene | µg/m$^3$ | 0.210 | 0.357 | 0.250 | 0.188 | 0.170 | 0.172 | 0.198 | 0.195 | 0.209 | 0.192 | 40,000 |
| Xylene, *m/p-* | µg/m$^3$ | 0.394 | 0.591 | 0.546 | 0.317 | 0.296 | 0.288 | 0.332 | 0.322 | 0.369 | 0.344 | 9,000 |
| Xylene, *o-* | µg/m$^3$ | 0.231 | 0.364 | 0.269 | 0.191 | 0.177 | 0.180 | 0.198 | 0.194 | 0.209 | 0.198 | 9,000 |
| Tetrachloroethylene | µg/m$^3$ | 0.093 | 0.118 | 0.079 | 0.069 | 0.061 | 0.067 | 0.081 | 0.081 | 0.091 | 0.081 | 1,400 |
| Dichloromethane | µg/m$^3$ | 0.129 | 0.112 | 0.135 | 0.140 | 0.110 | 0.121 | 0.163 | 0.237 | 0.227 | 0.154 | 2,000 |
| Chloroform | µg/m$^3$ | 0.050 | 0.054 | 0.056 | 0.041 | 0.017 | 0.015 | 0.031 | 0.033 | 0.027 | 0.019 | 500 |
| Toluene | µg/m$^3$ | 0.638 | 0.665 | 0.916 | 0.446 | 0.407 | 0.380 | 0.531 | 0.838 | 0.987 | 0.641 | 4,000 |
| Methyl isobutyl ketone | µg/m$^3$ | 0.136 | 0.199 | 0.139 | 0.156 | 0.129 | 0.129 | 0.102 | 0.120 | 0.111 | 0.100 | 30,000 |
| Trichloroethylene | µg/m$^3$ | 0.004 | ND | ND | ND | ND | ND | 0.003 | 0.004 | ND | ND | 10,000 |
| Vinyl chloride | µg/m$^3$ | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | 1,000 |

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.

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

[b] Although these pollutants were detected in every sample, similar values were seen in field blanks and these pollutants were not detected in any samples collected previously at the school.

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

| Pollutant | Units | # Samples Analyzed | % Detections | Maximum | Arithmetic Mean[b] | Geometric Mean | 5th Percentile | 25th Percentile | 50th Percentile | 75th Percentile | 95th Percentile |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Benzene | µg/m$^3$ | 13,170 | 96% | 43.14 | 1.08 | 0.82 | 0.10 | 0.46 | 0.77 | 1.28 | 3.00 |
| Butadiene, 1,3- | µg/m$^3$ | 12,030 | 71% | 18.81 | 0.14 | 0.10 | ND | ND | 0.06 | 0.14 | 0.48 |
| Carbon tetrachloride | µg/m$^3$ | 10,861 | 90% | 9.00 | 0.54 | 0.57 | ND | 0.48 | 0.57 | 0.65 | 0.85 |
| Chloroform | µg/m$^3$ | 11,146 | 77% | 145.50 | 0.20 | 0.15 | ND | 0.02 | 0.10 | 0.20 | 0.63 |
| Chloromethane | µg/m$^3$ | 9,233 | 95% | 19.70 | 1.18 | 1.21 | 0.49 | 1.04 | 1.20 | 1.36 | 1.67 |
| Dichloromethane | µg/m$^3$ | 10,727 | 84% | 5245.19 | 2.06 | 0.43 | ND | 0.17 | 0.33 | 0.61 | 2.08 |
| Dichloropropane, 1,2- | µg/m$^3$ | 10,467 | 17% | 2.99 | 0.02 | 0.04 | ND | ND | ND | ND | 0.05 |
| Ethylbenzene | µg/m$^3$ | 12,641 | 84% | 10.43 | 0.41 | 0.31 | ND | 0.10 | 0.25 | 0.52 | 1.31 |
| Ethylene dibromide | µg/m$^3$ | 9,769 | 17% | 4.97 | 0.02 | 0.05 | ND | ND | ND | ND | 0.05 |
| Ethylene dichloride | µg/m$^3$ | 10,247 | 39% | 4.49 | 0.04 | 0.06 | ND | ND | ND | 0.04 | 0.12 |
| Methyl isobutyl ketone | µg/m$^3$ | 4,968 | 60% | 5.28 | 0.10 | 0.09 | ND | ND | 0.02 | 0.12 | 0.43 |
| Tetrachloroethane, 1,1,2,2- | µg/m$^3$ | 9,538 | 19% | 4.44 | 0.02 | 0.05 | ND | ND | ND | ND | 0.07 |
| Tetrachloroethylene | µg/m$^3$ | 11,083 | 73% | 518.86 | 0.38 | 0.20 | ND | ND | 0.14 | 0.27 | 0.90 |
| Toluene | µg/m$^3$ | 12,418 | 96% | 482.53 | 2.47 | 1.58 | 0.11 | 0.75 | 1.51 | 3.01 | 7.67 |
| Trichloroethylene | µg/m$^3$ | 11,085 | 47% | 89.74 | 0.08 | 0.08 | ND | ND | ND | 0.05 | 0.27 |
| Vinyl chloride | µg/m$^3$ | 10,722 | 20% | 1.65 | 0.01 | 0.02 | ND | ND | ND | ND | 0.04 |
| Xylene, *m/p*- | µg/m$^3$ | 12,128 | 91% | 24.46 | 1.09 | 0.71 | ND | 0.29 | 0.65 | 1.35 | 3.62 |
| Xylene, *o*- | µg/m$^3$ | 12,628 | 85% | 9.21 | 0.42 | 0.30 | ND | 0.09 | 0.24 | 0.52 | 1.42 |

Key Pollutant

µg/m$^3$ micrograms per cubic meter

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

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

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