SAT Initiative: San Jacinto Elementary School and Deer Park Junior High School (Deer Park, TX)

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 San Jacinto 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. For the purposes of this study, results from the air monitoring at San Jacinto Elementary School are considered to be indicative of conditions at the nearby Deer Park Junior High School (located within a half mile of Deer Park Junior High School).
- These schools were selected for monitoring based on information indicating the potential for elevated ambient concentrations of 1,3-butadiene, benzene, and benzo(a)pyrene in air outside the school. That information included EPA's 2002 National-Scale Air Toxics Assessment (NATA), which indicated elevated levels of these pollutants from a nearby petrochemical complex. The schools were also ranked in the top 25 on a USA Today list based on 2005 Toxics Release Inventory estimates of air toxics emissions from nearby industries. These schools are located in an urban area near several industrial facilities and a major highway.
- Air monitoring was performed from September 4, 2009 to January 11, 2010 for the following pollutants: 1,3-butadiene, benzene, and other volatile organic compounds (VOC); and benzo(a)pyrene and other polycyclic aromatic hydrocarbons (PAH).
- Measured levels of benzo(a)pyrene and the associated longer-term concentration estimate for the outdoor air at this school are below levels of concern and do not indicate influence of a nearby source.
- The levels of 1,3-butadiene and benzene measured in the outdoor air at this school indicate influence of a nearby source.
- Measured levels of 1,3-butadiene varied widely during the monitoring period. While all individual sample results are below levels of concern for short-term exposure, the longer-term concentration estimate indicates a potential concern for long-term, continuous exposure, due primarily to one elevated result. Measured levels of benzene and the associated longer-term concentration estimate are not as high as suggested by the information available prior to monitoring. The results for these two pollutants together, however, indicate a potential concern for long-term, continuous exposure to the mixture.
- Results for other air toxics monitored do not indicate levels of concern.

- EPA recommends additional air toxics monitoring for a longer duration to better characterize the potential for exposures of concern in the community.
- EPA remains concerned about emissions from sources of air toxics and continues to work to reduce these emissions across the country, through national rules and by providing information and suggestions to assist with reductions in local areas (http://www.epa.gov/ttn/atw/eparules.html).
- The Texas Commission on Environmental Quality (TCEQ) will continue to oversee industrial facilities in the area through air permits and other 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 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

We were interested in evaluating the ambient concentrations of 1,3-butadiene, benzene, and benzo(a)pyrene in air outside the San Jacinto Elementary School based on information from EPA's 2002 NATA for a nearby petrochemical complex. For the purposes of this study, results from the air monitoring at the San Jacinto Elementary School are considered to be indicative of conditions at the nearby Deer Park Junior High School (located within a half mile of San Jacinto Elementary School) (Figure 1). In addition, this school was ranked in the top 25 in a USA Today list based on 2005 TRI estimates of air toxics emissions from nearby industries.

Monitoring commenced at this school on September 4, 2009 and continued through January 11, 2010. During this period, ten VOC samples and eleven PAH samples were collected and analyzed for the key pollutants and other air toxics at this school. Due to an issue with VOC monitoring equipment, the first nine 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). Additional VOC samples were collected to ensure that 10 samples were available for analysis.

With the exception of acrolein, all VOC results 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

[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.

Toxics Monitoring project (SAT) (http://www.epa.gov/schoolair/acrolein.html). All sampling methodologies are described in EPA's schools air toxics monitoring plan (http://www.epa.gov/schoolair/techinfo.html).[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 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

[4] TCEQ staff operated the monitors and sent the canisters 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.

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

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[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).

- → 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.

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

[10] The development of long-term comparison levels, as well as of individual sample screening levels, is described in detail in *Schools Air Toxics Monitoring Activity (2009), Uses of Health Effects Information in Evaluating Sample Results.*

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

- The VOC air sampling data collected over the 3-month sampling period indicate influence from nearby source(s) of 1,3-butadiene and benzene emissions. Both of these pollutants can come from multiple sources including industrial and mobile sources (cars, trucks, etc.).
- Measured levels of 1,3-butadiene varied widely during the monitoring period. While all individual sample results are below levels of concern for short-term exposure, the longer-term concentration estimate indicates a potential concern for long-term, continuous exposure, due primarily to one elevated result.
- Measured levels of benzene and the associated longer-term concentration estimate are not as high as suggested by the information available prior to monitoring. In combination with the results for 1,3-butadiene, these results indicate a potential concern for long-term, continuous exposure to the pollutant mixture.
- Results for other air toxics monitored do not indicate levels of concern.

1,3-Butadiene, key pollutant:

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

  → Emissions of 1,3-butadiene may be associated with several different sources including stationary and mobile (cars, trucks, etc). The monitoring data include multiple 1,3-butadiene concentrations that are higher than concentrations commonly observed in other locations nationally.[11]

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

  → The monitoring data for 1,3-butadiene indicate levels of potential health concern for long-term, continuous exposures.

    - 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 above both the long-term noncancer-based and cancer-based comparison levels (Table 1).[12] These comparison levels are continuous exposure concentrations (24 hours a day, all year, over a lifetime).
    - The finding of the longer-term concentration estimate above the cancer-based comparison level indicates that the longer-term estimate is greater than a continuous (24 hours a day, 7 days a week) lifetime exposure concentration associated with a 1-in-10,000 additional cancer risk.

[11] For example, eight of the concentrations at this site (Table 2a) were higher than 75 percent of samples collected at the National Air Toxics Trends Stations (NATTS) from 2004-2008 (Appendix B). Because these NATTS sites are generally sited so as to not be influenced by specific nearby sources, EPA is using the 75th percentile point of concentrations at these sites as a benchmark of indicating potential influence from a source nearby to the school.
[12] The upper end of the interval is nearly 2.6 times the mean of the monitoring data and nearly 1.6 times the long-term cancer-based comparison level.

→ 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]

→ In summary, while none of the individual measurements indicate concentrations of concern for short-term exposures, the combined contributions of all individual measurements of butadiene in the estimate of longer-term concentration indicate a level of potential concern for long-term exposures.

Benzene, key pollutant:

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

  → Emissions of benzene may be associated with several different sources including industrial and mobile sources (cars, trucks, etc). The monitoring data include several benzene concentrations that are higher than concentrations commonly observed in other locations nationally.[13]

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

  → Benzene levels measured and associated longer-term concentration estimates at this school were not as high as was suggested by modeling information available prior to monitoring. In combination with the results for 1,3-butadiene, these results indicate a potential concern for long-term, continuous exposure to the pollutant mixture.

    - The estimate of longer-term benzene concentration (i.e., the upper bound of the 95 percent confidence interval on the mean of the dataset) is below the long-term comparison levels (Table 1).[14] These comparison levels are continuous exposure concentrations (24 hours a day, all year, over a lifetime).
    - The longer-term concentration estimate is approximately 40% of the cancer-based comparison level, indicating the longer-term estimate falls between continuous (24 hours a day, 7 days a week) lifetime exposure concentrations associated with 1-in-100,000 and 1-in-10,000 additional cancer risk.

  → 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 ranging from a couple of weeks to longer for some pollutants).[10]

[13] For example six of the concentrations at this site (Table 2a) were higher than 75 percent of samples collected at the National Air Toxics Trends Stations (NATTS) from 2004-2008 (Appendix B). Because these NATTS sites are generally sited so as to not be influenced by specific nearby sources, EPA is using the 75th percentile point of concentrations at these sites as a benchmark of indicating potential influence from a source nearby to the school.
[14] The upper end of the interval is nearly 1.8 times the mean of the monitoring data and less than 43% of the long-term cancer-based comparison level.

Benzo(a)pyrene, key pollutant:

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

  → The monitoring data do not include any benzo(a)pyrene concentrations that are higher than concentrations commonly observed in other locations nationally.[15]

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

  → The monitoring data for benzo(a)pyrene do not indicate levels of health concern.

    - Benzo(a)pyrene was detected in only one of the 11 samples collected. The level of analytical detection as well as the concentration in the single sample in which benzo(a)pyrene was detected were substantially below the long-term comparison level (Table 1). This comparison level is a continuous exposure concentration (24 hours a day, all year, over a lifetime).

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

  → In summary, none of the individual measurements indicate concentrations of concern for short-term exposures, and the combined contributions of all individual measurements in the estimate of longer-term concentration do not indicate a level of concern for long-term exposure.

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, in which the longer-term concentration estimates for these HAPs are below their long-term comparison levels (Appendix C). Additionally, each individual measurement for these pollutants is below the individual sample screening level for that pollutant (Appendix D).[10]

Multiple Pollutants:

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

  → Although the longer-term concentration estimate for benzene is below the cancer-based comparison level for benzene, in combination with the results for 1,3-

[15] For example, none of the concentrations at this site (Table 2b) were higher than 75 percent of samples collected at the National Air Toxics Trends Stations (NATTS) from 2004-2008 (Appendix B). Because these NATTS sites are generally sited so as to not be influenced by specific nearby sources, EPA is using the 75th percentile point of concentrations at these sites as a benchmark of indicating potential influence from a source nearby to the school.

butadiene, the magnitude of this benzene estimate, which is 40% of the cancer-based comparison level, indicates a potential concern for long-term, continuous exposure to the pollutant mixture (Appendix C).[16]

→ Aside from the key pollutants, 1,3-butadiene and benzene, no other HAPs monitored had a longer-term concentration estimate more than ten percent of its comparison levels.

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 considered if these data indicate that the general pattern of winds on our sampling dates were significantly different from those occurring across the full sampling period or from those expected over the longer term. Additionally, we noted, 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 San Jacinto Elementary School collected wind speed and wind direction measurements beginning August 26, 2009, continuing through the sampling period (September 4, 2009-January 11, 2010), and ending on May 10, 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 approximately nine months of on-site meteorological data. The meteorological data collected at the school site on sampling days are presented in Figures 3a-3c and Tables 2a-2b.

The nearest NWS station is at William P. Hobby Airport in Houston, Texas. This station is approximately 10.25 miles southwest of the school. Measurements taken at that station include wind, temperature, and precipitation. These are presented in Tables 2a-2b and Appendix E.

[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.

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 dates for benzo(a)pyrene are similar to those observed across the record of on-site meteorological data during the sampling period. The wind patterns at the monitoring site across sampling dates for 1,3-butadiene and benzene 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 somewhat limited. The NWS station at William P. Hobby Airport does not appear to represent the specific wind flow patterns at the school location.
- Although we lack long-term wind data at the monitoring site, the historical data from the NWS station indicates that winds are predominantly from the south. During monitoring, winds were predominantly from the north where the source is located.

- What is the direction of the key source of 1,3-butadiene, benzene, and benzo(a)pyrene emissions in relation to the school location?
  → The nearby industrial facility emitting the key pollutants into the air (described in section III above) lies less than 1 mile northwest to northeast of the school.
  → Using the property boundaries of the full facility (in lieu of information regarding the location of specific sources of 1,3-butadiene, benzene, and benzo(a)pyrene 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 281 to 56 degrees, is referred to here as the expected zone of source influence (ZOI).

- On days the air samples were collected, how often did wind come from the direction of the key source?
  → For 1,3-butadiene and benzene sampling, there were 8 out of 10 sampling days in which the on-site wind data had a portion of the winds from the ZOI. For benzo(a)pyrene sampling, all eleven sampling days in which on-site wind data had a portion of the winds from the ZOI (Figures 3a-3c, Tables 2a-2b).

- How do wind patterns on the air monitoring days compare to those across the complete monitoring period and what might be expected over the longer-term at the school location?
  → On the 1,3-butadiene and benzene sampling days, wind patterns appear somewhat similar to those observed over the record of on-site meteorological data during the sampling period, particularly with regard to the expected ZOI. On benzo(a)pyrene sampling days, wind patterns appear similar to those observed over the record of on-site meteorological data during the sampling period, particularly with regard to the expected ZOI.We note that wind patterns at the nearest NWS station (at William P. Hobby Airport) during the sampling period are somewhat similar to those recorded at

the NWS station over the long-term (2002-2007 period; Appendix E), However, winds in the area are usually predominantly from the southerly directions during the majority of the year. During this sampling event winds were predominantly from the north and the direction of the source.

- How do wind patterns at the school compare to those at the William P. Hobby Airport NWS station, particularly with regard to prevalent wind directions and the direction of the key source?
  → During the sampling period for which data are available both at the school site and at the reference NWS station (approximately months), prevalent winds at the school site are predominantly from the north to northeast and from the southeast, while those at the NWS station are somewhat more from the north, northeast, and southeast. The windroses for the two sites during the sampling period (Figures 3a-3c and Appendix E) show some similarities in wind flow patterns.

V. Key Source Information

- Was the source operating as usual during the monitoring period?
  – The nearby industrial source of 1,3-butadiene and benzene has permits issued by TCEQ that includes operating requirements.[17] This facility is a petrochemical complex that includes a butadiene-producing plant. This is a joint venture between Shell Chemical Company, BASF and Total Fina. The plant started up in 2002. A distribution system to pipe the butadiene directly to major regional customers was also built. The Deer Park refinery site is important in terms of supplying raw materials for this butadiene plant, although it does not belong entirely to Shell Chemical (http://www.chemicals-technology.com/projects/deerpark/)
  – The Deer Park Chemical Plant that produces 1,3-butadiene was shut down September 2009 and was restarted on December 14, 2009. The refinery part of the complex does not produce 1,3-butadiene.
  – The portions of the Deer Park Chemical Plant that either produce or process significant concentrations of benzene were shut down from September 24, 2009 to October 28, 2009. The benzene production units at the Deer Park Refinery were shut down for around 5 days starting September 27, 2009. Even though a certain production unit may not be producing a product, that does not necessarily mean that it will have no VOC emissions coming from it. In many cases while a unit is "down", it can still have portions in VOC service by definition, and emissions can still occur.
  – The most recently available 1,3-butadiene and benzene emissions data for this source (2008 TRI) are lower to those relied upon in the previous NATA modeling analysis for this area (2002 TRI). There were no TRI emissions for benzo(a)pyrene from the key source of interest.

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

VI. Integrated Summary and Next Steps

A. Summary of Key Findings

1. What are the key HAPs for this school?
   → 1,3-Butadiene, benzene, and benzo(a)pyrene are the key HAPs for this school, based on emissions information considered in identifying the school for monitoring. The ambient air concentrations of benzene and 1,3-butadiene on multiple days during the monitoring period indicate contributions from sources in the area, while concentrations of benzo(a)pyrene do not indicate 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 levels of benzo(a)pyrene and the associated longer-term concentration estimate for the outdoor air at this school are below levels of concern.
   → Measured levels of 1,3-butadiene varied widely during the monitoring period. While all individual sample results are below levels of concern for short-term exposure, the longer-term concentration estimate indicates a potential concern for long-term, continuous exposure, due primarily to one elevated result. .
   → Measured levels of benzene and the associated longer-term concentration estimate are not as high as suggested by the information available prior to monitoring. In combination with the results for 1,3-butadiene, these results indicate a potential concern for long-term, continuous exposure to the pollutant mixture.
   → Results for other air toxics monitored do not indicate levels of concern.

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.
   → 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 station. 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, however, limit somewhat our ability to confidently predict longer-term wind patterns at the school (which might provide further evidence relevant to concentrations during other times).

B. Next Steps for Key Pollutants

1. EPA recommends additional monitoring for a longer duration to better characterize the potential for exposures of concern in the community.
2. EPA remains concerned about emissions from sources of air toxics and continues to work to reduce these emissions across the country, through national rules and by providing information and suggestions to assist with reductions in local areas (http://www.epa.gov/ttn/atw/eparules.html).
3. The Texas Commission on Environmental Quality (TCEQ) will continue to oversee industrial facilities in the area through air permits and other programs.

VII. Figures and Tables

A. Tables

1. San Jacinto Elementary School – Key Pollutant Analysis.

2a. San Jacinto Elementary School Key Pollutant Concentrations (1,3-Butadiene and Benzene) and Meteorological Data.

2b. San Jacinto Elementary School Key Pollutant Concentrations (Benzo(a)pyrene) and Meteorological Data.

B. Figures

1. San Jacinto Elementary School and Deer Park Junior High School and Source of Interest

2a. San Jacinto Elementary School – Key Pollutant (1,3-Butadiene) Analysis.

2b. San Jacinto Elementary School – Key Pollutant (Benzene) Analysis.

3a. San Jacinto Elementary School (Deer Park, TX) 1,3-Butadiene Concentration and Wind Information.

3b. San Jacinto Elementary School (Deer Park, TX) Benzene Concentration and Wind Information.

3c. San Jacinto Elementary School (Deer Park, TX) Benzo(a)pyrene Concentration and Wind Information.

VIII. Appendices

A. Summary Description of Long-term Comparison Levels.

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

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

D. San Jacinto Elementary School Pollutant Concentrations.

E. Windroses for William P. Hobby Airport NWS Station.

Figure 1. San Jacinto Elementary School and Deer Park Junior High School and Source of Interest.

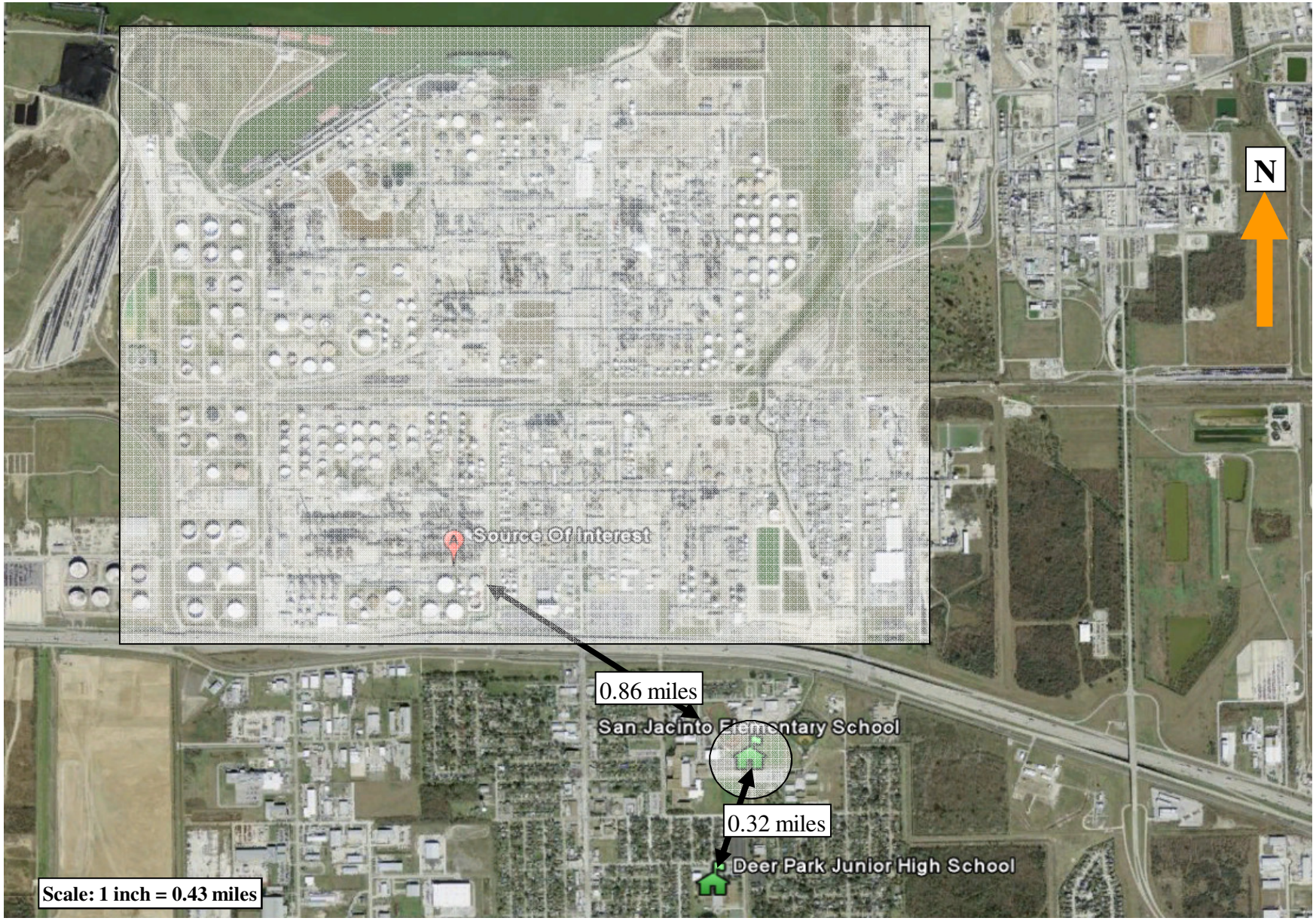


Table 1. San Jacinto Elementary School - Key Pollutant Analysis.

Parameter	Units	Mean of Measurements	95% Confidence Interval on the Mean	Long-term Comparison Level[a]	
				Cancer-Based[b]	Noncancer-Based[c]
Butadiene, 1,3-	µg/m^3	2.01 [d]	0 - 5.17	3.3	2
Benzene	µg/m^3	3.15 [e]	0.70 - 5.61	13	30
Benzo(a)pyrene	ng/m^3	91% of the results were ND[f]		57	NA

ng/m^3 nanograms per cubic meter

µg/m^3 micrograms per cubic meter

NA Not applicable

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

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

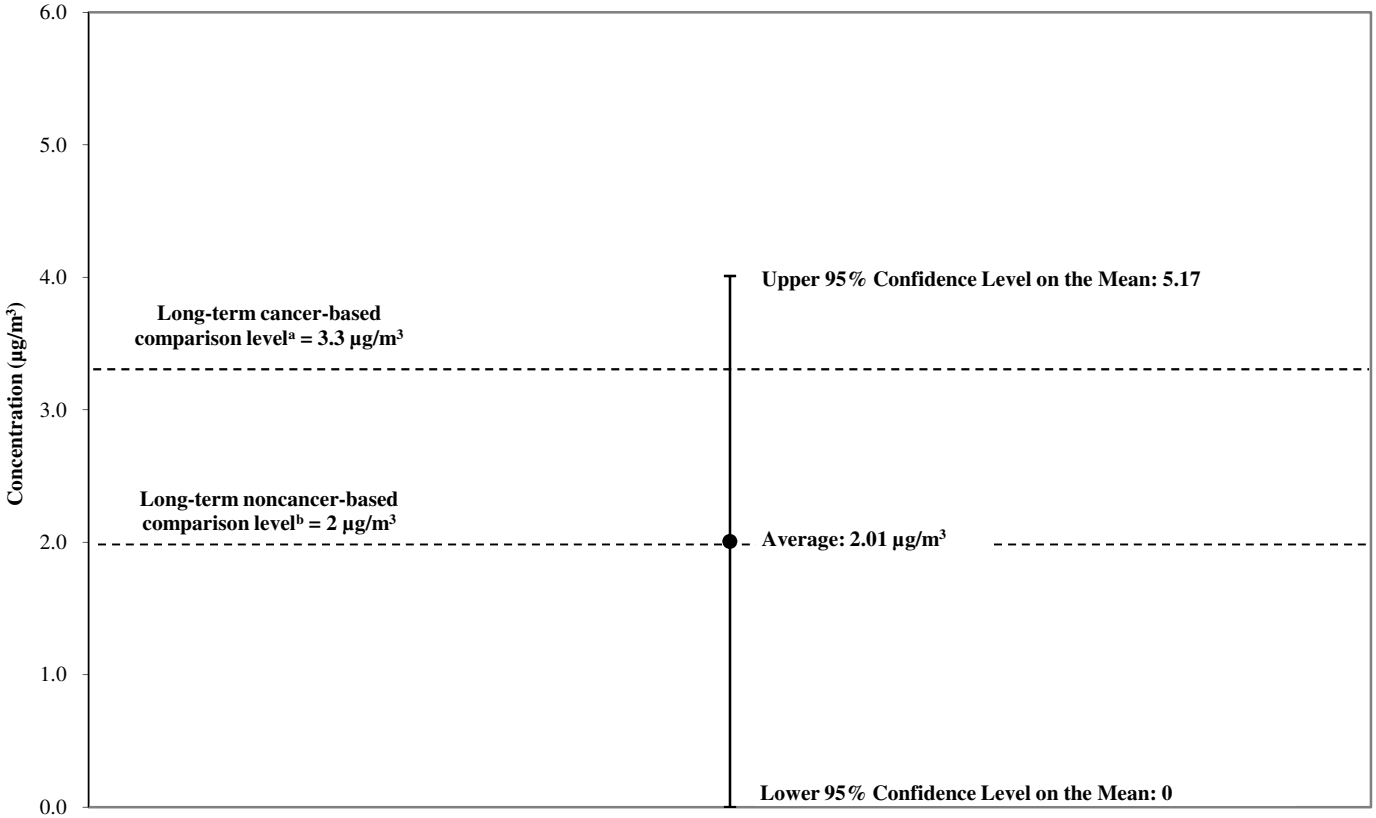
[c] Air toxics for which the upper 95% confidence limit on the mean concentration are near or below the noncancer-based comparison level are generally of low concern and will generally be considered a low priority for follow-up activity. Pollutants for which the 95% confidence limits extend appreciably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

[d] The mean of measurements for 1,3-butadiene is the average of all sample results, which include 10 detections that ranged from 0.058 to 14.5 µg/m^3.

[e] The mean of measurements for benzene is the average of all sample results, which include 10 detections that ranged from 0.556 to 12.1 µg/m^3.

[f] Benzo(a)pyrene was detected in only 1 of 11 samples, with a result of 0.0200 ng/m^3. The MDL range is 0.0435 to 0.0605 ng/m^3. The detected levels (as well as the method detection limit) are well below the long-term comparison level. Therefore, had we estimated a mean and confidence interval, they would be well below the long-term comparison level.

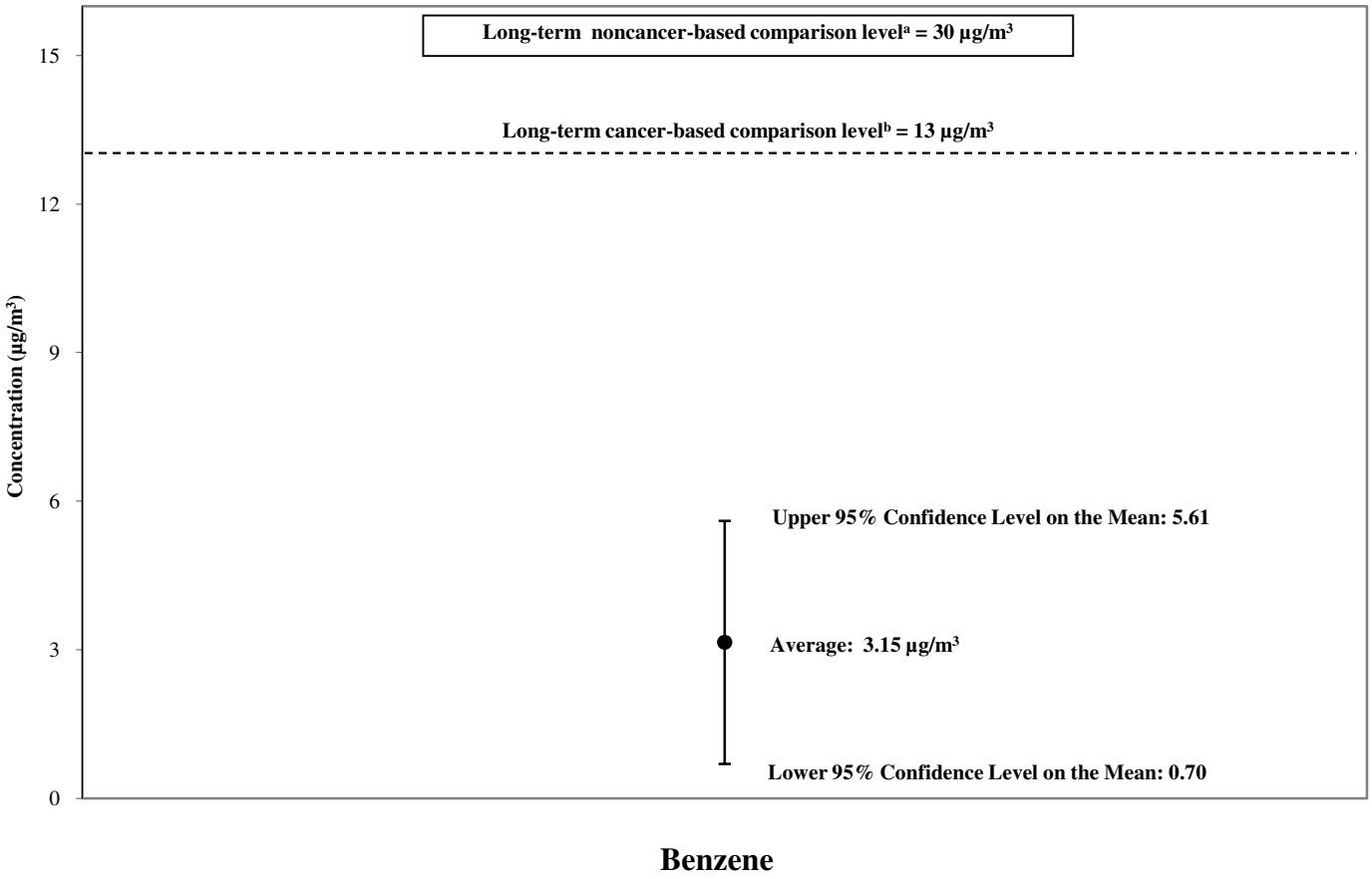
Figure 2a. San Jacinto Elementary School - Key Pollutant (1,3-Butadiene) Analysis.



[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.

Figure 2b. San Jacinto 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.

Table 2a. San Jacinto Elementary School Key Pollutant Concentrations (1,3-Butadiene and Benzene) and Meteorological Data.

Parameter	Units	10/28/2009	11/2/2009	11/23/2009	11/30/2009	12/3/2009	12/7/2009	12/14/2009	12/21/2009	12/22/2009	1/11/2010
Butadiene, 1,3-	µg/m^3	0.17	3.08	0.10	0.16	0.13	0.376	14.5	1.07	0.058	0.398
Benzene	µg/m^3	1.60	12.1	1.25	1.81	1.18	3.77	5.05	0.588	0.556	3.61
% Hours w/Wind Direction from Expected ZOI[a]	%	0.0	95.8	29.2	87.5	100	70.8	83.3	100	0.0	100
Wind Speed (avg. of hourly speeds)	mph	6.6	4.1	5.6	9.7	10.4	5.3	7.2	4.9	6.4	3.0
Wind Direction (avg. of unitized vector)[b]	deg.	129.9	27.3	77.8	32.7	12.4	47.2	28.2	125.9	139.1	2.3
% of Hours with Speed below 2 knots	%	25.0	4.2	0.0	0.0	0.0	0.0	8.3	8.3	4.2	0.0
Daily Average Temperature	° F	71.0	64.4	81.2	80.2	80.2	73.4	79.2	62.7	71.8	70.0
Daily Precipitation	inches	0.08	0.00	0.01	0.02	0.14	0.36	0.04	0.00	0.16	0.00

µg/m^3 micrograms per cubic meter

All precipitation and temperature data were from the William P. Hobby 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. San Jacinto Elementary School Key Pollutant Concentrations (Benzo(a)pyrene) and Meteorological Data.

Parameter	Units	9/4/2009	9/10/2009	9/16/2009	9/22/2009	9/28/2009	10/4/2009	10/10/2009	10/16/2009	10/22/2009	10/28/2009	11/3/2009
Benzo(a)pyrene	ng/m^3	ND	ND	0.0200	ND	ND	ND	ND	ND	ND	ND	ND
% Hours w/Wind Direction from Expected ZOI[a]	%	41.7	33.3	50.0	83.3	29.2	4.2	100	100	66.7	100	100
Wind Speed (avg. of hourly speeds)	mph	3.5	3.3	6.5	7.4	4.9	5.2	8.5	11.4	10.7	6.6	4.6
Wind Direction (avg. of unitized vector)[b]	deg.	67.3	87.7	282.1	19.1	217.0	174.4	10.5	16.6	299.5	129.9	67.3
% of Hours with Speed below 2 knots	%	25.0	25.0	4.2	8.3	8.3	25.0	0.0	0.0	8.3	25.0	0.0
Daily Average Temperature	° F	81.2	80.2	80.2	73.4	80.3	79.2	62.7	71.8	70.0	71.0	64.4
Daily Precipitation	inches	0.03	0.02	0.00	0.73	0.17	0.45	0.00	0.00	1.73	0.08	0.00

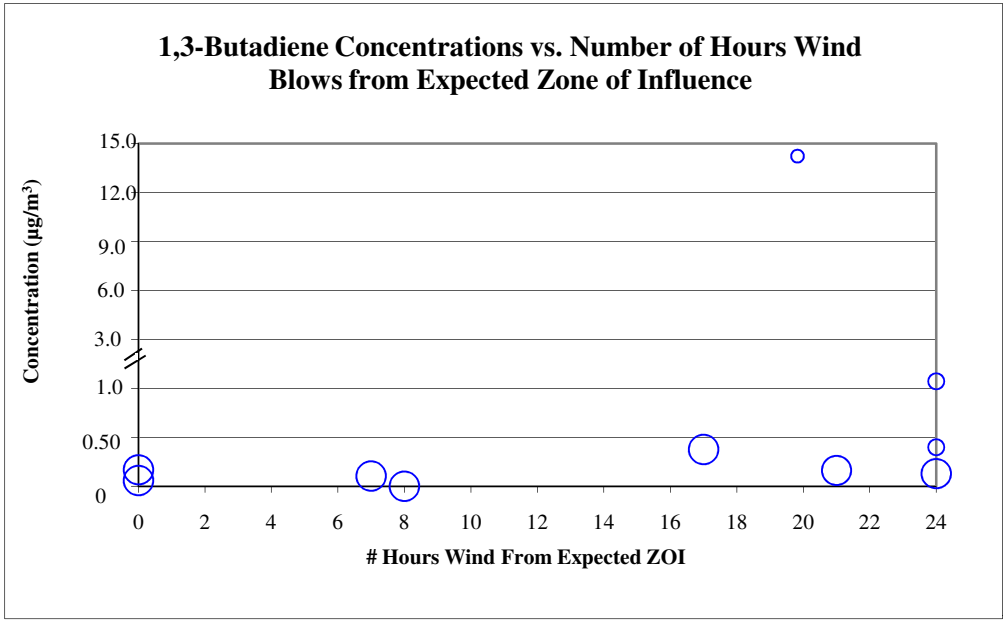
ng/m^3 micrograms per cubic meter

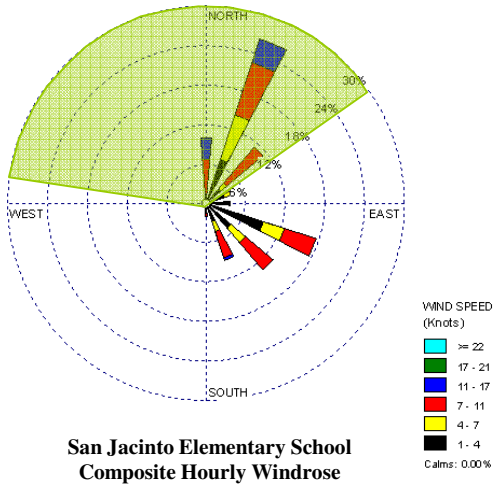
All precipitation and temperature data were from the William P. Hobby Airport NWS Station.

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

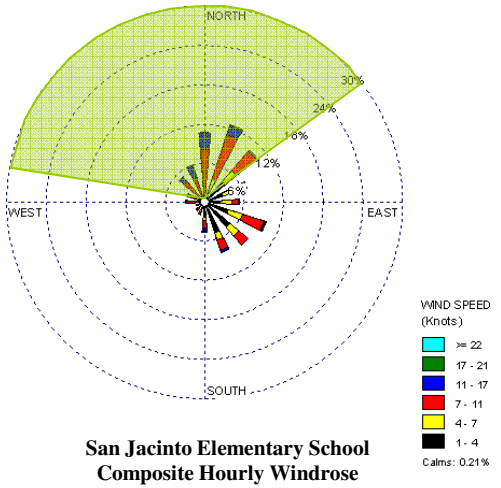
[b] Wind direction for each day is represented by values derived by scalar averaging of hourly estimates that were produced (by wind instrumentation's logger) as unitized vectors (specified as degrees from due north).

Figure 3a. San Jacinto Elementary School (Deer Park, TX) 1,3-Butadiene Concentration and Wind Information.





San Jacinto Elementary School Composite Hourly Windrose on Sample Days (Oct. 28, 2009 - Jan. 11, 2010)



San Jacinto Elementary School Composite Hourly Windrose Across Sampling Period (Sept. 4, 2009 - Jan. 11, 2010)

KEY

Pollutant: 1,3-Butadiene
Timeframe: October 28, 2009 - January 11, 2010

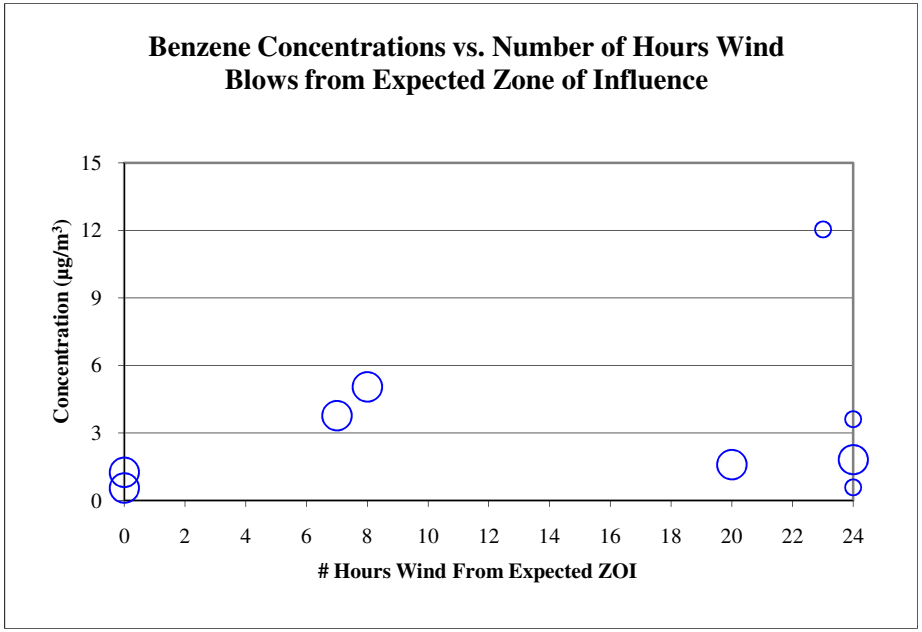
Note

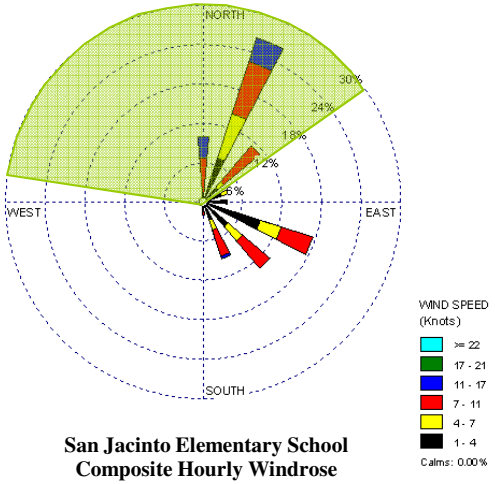
Each circle denotes a 24-hour collection of air for chemical analysis. The size of the circle indicates the magnitude of the wind speed for that day (wind data shown in Table 2a). The expected zone of source influence is a rough approximation of the range of directions from which winds carrying chemicals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

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

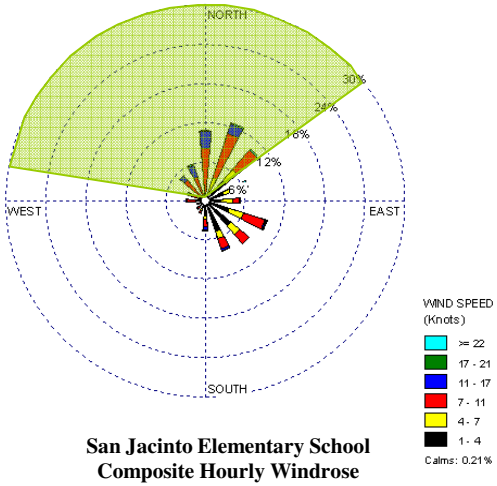
Expected Zone of Source Influence

Figure 3b. San Jacinto Elementary School (Deer Park, TX) Benzene Concentration and Wind Information.





San Jacinto Elementary School Composite Hourly Windrose on Sample Days (Oct. 28, 2009 - Jan. 11, 2010)



San Jacinto Elementary School Composite Hourly Windrose Across Sampling Period (Sept. 4, 2009 - Jan. 11, 2010)

Expected Zone of Source Influence

KEY

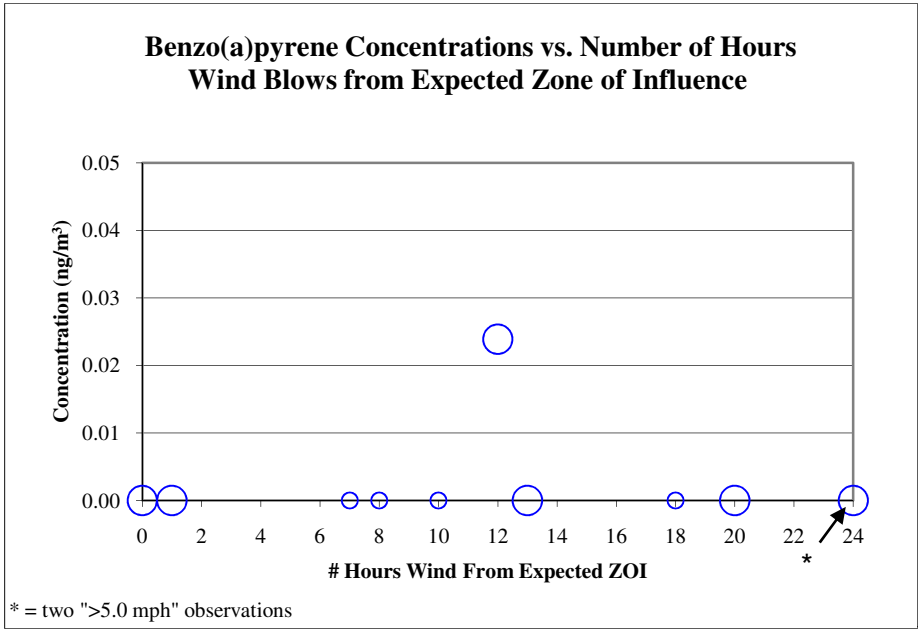
Pollutant: Benzene
Timeframe: October 28, 2009 - January 11, 2010

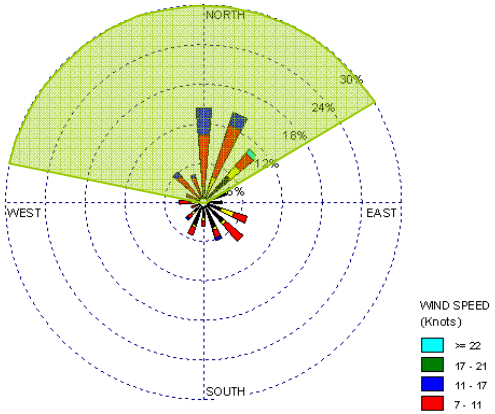
Note

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

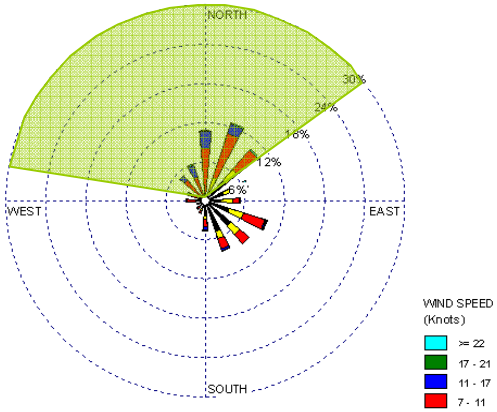
- Wind Speed: 0.1-2.5 mph
- Wind Speed: 2.5-5.0 mph
- Wind Speed: > 5.0 mph

Figure 3c. San Jacinto Elementary School (Deer Park, TX) Benzo(a)pyrene Concentration and Wind Information.





San Jacinto Elementary School Composite Hourly Windrose on Sample Days (Sept. 4, 2009 - Nov. 3, 2009)



San Jacinto Elementary School Composite Hourly Windrose Across Sampling Period (Sept. 4, 2009 - Jan. 11, 2010)

Expected Zone of Source Influence

KEY

Pollutant: Benzo(a)pyrene
Timeframe: September 4, 2009 - November 3, 2009

Note

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

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

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.[18]

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.[19] 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.

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

[19] 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.[20] 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.

[20] 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
Acetonitrile	µg/m^3	1,804	69%	542.30	3.55	0.72	ND	ND	0.27	0.76	8.60
Acrylonitrile	µg/m^3	3,673	31%	5.51	0.06	0.10	ND	ND	ND	0.03	0.33
Benzene	µg/m^3	6,313	94%	10.19	1.03	0.84	ND	0.48	0.80	1.31	2.81
Benzyl chloride	µg/m^3	3,046	9%	2.49	0.01	0.05	ND	ND	ND	ND	0.05
Bromoform	µg/m^3	2,946	4%	1.18	0.01	0.16	ND	ND	ND	ND	ND
Bromomethane	µg/m^3	5,376	61%	120.76	0.11	0.05	ND	ND	0.03	0.05	0.12
Butadiene, 1,3-	µg/m^3	6,427	67%	15.55	0.10	0.09	ND	ND	0.05	0.13	0.38
Carbon disulfide	µg/m^3	1,925	91%	46.71	2.32	0.25	ND	0.03	0.09	0.96	12.65
Carbon tetrachloride	µg/m^3	6,218	86%	1.76	0.52	0.58	ND	0.47	0.57	0.65	0.87
Chlorobenzene	µg/m^3	5,763	30%	1.10	0.02	0.04	ND	ND	ND	0.01	0.11
Chloroethane	µg/m^3	4,625	37%	0.58	0.02	0.04	ND	ND	ND	0.03	0.08
Chloroform	µg/m^3	6,432	73%	48.05	0.17	0.14	ND	ND	0.10	0.17	0.61
Chloromethane	µg/m^3	5,573	95%	19.70	1.17	1.20	ND	1.03	1.18	1.36	1.68
Chloroprene	µg/m^3	2,341	11%	0.17	<0.01	0.03	ND	ND	ND	ND	0.02
Dichlorobenzene, *p*-	µg/m^3	5,409	60%	13.65	0.19	0.16	ND	ND	ND	0.18	0.90
Dichloroethane, 1,1-	µg/m^3	5,670	16%	0.36	0.01	0.02	ND	ND	ND	ND	0.02
Dichloroethylene, 1,1-	µg/m^3	5,480	19%	0.44	0.01	0.02	ND	ND	ND	ND	0.04
Dichloromethane	µg/m^3	6,206	82%	214.67	0.59	0.34	ND	0.14	0.28	0.49	1.35
Dichloropropane,1,2-	µg/m^3	6,225	17%	1.80	0.01	0.03	ND	ND	ND	ND	0.04
Dichloropropylene, c*is* -1,3-	µg/m^3	4,705	18%	0.80	0.01	0.05	ND	ND	ND	ND	0.11
Dichloropropylene, *trans* -1,3-	µg/m^3	4,678	18%	1.13	0.02	0.05	ND	ND	ND	ND	0.11
Ethyl acrylate	µg/m^3	1,917	1%	0.08	<0.01	0.04	ND	ND	ND	ND	ND
Ethylbenzene	µg/m^3	6,120	84%	8.84	0.42	0.32	ND	0.10	0.29	0.53	1.33
Ethylene dibromide	µg/m^3	5,646	19%	4.15	0.01	0.05	ND	ND	ND	ND	0.05
Ethylene dichloride	µg/m^3	6,143	38%	4.49	0.03	0.05	ND	ND	ND	0.04	0.09
Hexachlorobutadiene	µg/m^3	3,727	20%	0.97	0.03	0.10	ND	ND	ND	ND	0.18
Methyl chloroform	µg/m^3	5,944	73%	3.17	0.09	0.10	ND	ND	0.08	0.11	0.20
Methyl isobutyl ketone	µg/m^3	2,936	60%	2.95	0.11	0.09	ND	ND	0.02	0.12	0.49
Methyl methacrylate	µg/m^3	1,917	9%	14.05	0.13	0.49	ND	ND	ND	ND	0.53
Methyl *tert*- butyl ether	µg/m^3	4,370	41%	20.50	0.28	0.12	ND	ND	ND	0.04	1.53
Styrene	µg/m^3	6,080	70%	27.22	0.16	0.11	ND	ND	0.05	0.16	0.60

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
Tetrachloroethane, 1,1,2,2-	µg/m^3	5,952	20%	2.47	0.02	0.04	ND	ND	ND	ND	0.07
Tetrachloroethylene	µg/m^3	6,423	71%	42.12	0.28	0.20	ND	ND	0.13	0.27	0.88
Toluene	µg/m^3	5,947	95%	482.53	2.46	1.54	0.01	0.70	1.51	3.05	7.42
Trichlorobenzene, 1,2,4-	µg/m^3	4,301	21%	45.27	0.07	0.10	ND	ND	ND	ND	0.16
Trichloroethane,1,1,2-	µg/m^3	5,210	19%	5.89	0.01	0.04	ND	ND	ND	ND	0.05
Trichloroethylene	µg/m^3	6,410	46%	6.50	0.05	0.07	ND	ND	ND	0.05	0.22
Vinyl chloride	µg/m^3	6,284	18%	1.61	0.01	0.02	ND	ND	ND	ND	0.03
Xylene, *m/p-*	µg/m^3	4,260	90%	21.41	1.12	0.71	ND	0.26	0.69	1.43	3.65
Xylene, *o-*	µg/m^3	6,108	83%	9.21	0.41	0.30	ND	0.09	0.24	0.52	1.39
Benzo(a)anthracene (total tsp & vapor)	ng/m^3	1,122	73%	2.56	0.10	0.07	ND	ND	0.04	0.10	0.35
Benzo(a)pyrene (total tsp & vapor)	ng/m^3	1,111	58%	2.64	0.09	0.09	ND	ND	0.03	0.10	0.34
Benzo(b)fluoranthene	ng/m^3	1,110	86%	4.63	0.19	0.13	ND	0.04	0.10	0.21	0.67
Benzo(k)fluoranthene	ng/m^3	1,122	67%	1.28	0.05	0.05	ND	ND	0.02	0.06	0.20
Chrysene (total tsp & vapor)	ng/m^3	1,117	92%	3.85	0.22	0.15	ND	0.07	0.13	0.25	0.70
Dibenz(a,h)anthracene	ng/m^3	69	4%	0.08	<0.01	0.08	ND	ND	ND	ND	ND
Indeno(1,2,3-cd)pyrene	ng/m^3	69	51%	0.55	0.06	0.08	ND	ND	0.02	0.07	0.30
Naphthalene (total tsp & vapor)	µg/m^3	1,099	100%	0.54	0.08	0.05	<0.01	0.03	0.06	0.10	0.20

Key Pollutant

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

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

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

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

At each school, monitoring has been targeted to get information on a limited set of key hazardous air pollutants (HAPs).[21] 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, the longer-term concentration estimates for all are more than 10-fold lower and all but six of these (carbon tetrachloride, naphthalene, vinyl chloride, ethylbenzene, tetrachloroethylene, and methyl *tert*-butyl ether) are more than 100-fold lower.[22]

  → 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.[23]

Additional Information on Six HAPs:

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

[21] 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.

[22] 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.

[23] 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 naphthalene. The mean and 95 percent upper bound on the mean for naphthalene are approximately 2-3% of the cancer-based comparison level. A review of information available at other sites nationally shows that the mean concentration of naphthalene at this site is between the 50th and 75th 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 vinyl chloride. The mean and 95 percent upper bound on the mean for vinyl chloride are approximately 2-4% of the cancer-based comparison level. A review of information available at other sites nationally shows that the mean concentration of vinyl chloride 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 fourth HAP mentioned above is ethylbenzene. The mean and 95 percent upper bound on the mean for ethylbenzene are approximately 1-2% 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 between the 50th and 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 1-2% 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 between the 50th and 75th percentile of samples collected from 2004 to 2008 (the most recently compiled period) at the NATTS sites (Appendix B).

- The sixth HAP mentioned above is methyl *tert*-butyl ether. The mean and 95 percent upper bound on the mean for methyl *tert*-butyl ether are approximately 1-2% of the cancer-based comparison level. A review of information available at other sites nationally shows that the mean concentration of methyl *tert*-butyl ether 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).

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.[24]

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 1,3-butadiene and benzene and the associated longer-term concentration estimates indicate a potential cumulative health risk concern for long-term, continuous exposure to these pollutants.
  - → Aside from the key pollutants, 1,3-butadiene and benzene, no other HAPs monitored had a longer-term concentration estimate more than ten percent of its comparison levels.
    - o The cancer-based comparison levels for these two pollutants are both based on risk of cancer in the lymphohematopoietic system. Although the longer-term concentration estimate for benzene is below the cancer-based comparison level for benzene, in combination with the results for 1,3-butadiene, the magnitude of this benzene estimate, which is 40% of the cancer-based comparison level, indicates a potential concern for long-term, continuous exposure to the pollutant mixture.

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

Table C-1. San Jacinto 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 - all means are lower than 10% of the lowest comparison level					
Carbon Tetrachloride	µg/m^3	0.70	0.58 - 0.82	17	100
Naphthalene	µg/m^3	0.07	0.04 - 0.10	2.9	3
Acetonitrile	µg/m^3	1.39	0 - 3.55	NA	60
Vinyl chloride	µg/m^3	0.20	0 - 0.48	11	100
Chloromethane	µg/m^3	1.11	0.94 - 1.29	NA	90
Ethylbenzene	µg/m^3	0.47	0.15 - 0.78	40	1,000
Tetrachloroethylene	µg/m^3	0.19	0.07 - 0.31	17	270
Bromomethane	µg/m^3	0.05	0.04 - 0.07	NA	5
Xylene, *m/p-*	µg/m^3	1.00	0.29 - 1.70	NA	100
Methyl *tert*-Butyl Ether	µg/m^3	2.83	0.00 - 6.05	380	3,000
Xylene, *o-*	µg/m^3	0.40	0.10 - 0.71	NA	100
Dichloromethane	µg/m^3	0.81	0.41 - 1.21	210	1,000
Chloroform	µg/m^3	0.20	0.14 - 0.25	NA	98
Toluene	µg/m^3	3.12	1.05 - 5.18	NA	5,000
Carbon Disulfide	µg/m^3	0.26	0.00 - 0.66	NA	700
Styrene	µg/m^3	0.15	0.08 - 0.21	NA	1,000
Methyl isobutyl ketone	µg/m^3	0.38	0.25 - 0.51	NA	3,000
Benzo(b)fluoranthene	ng/m^3	0.04	0.02 - 0.05	570	NA
Methyl chloroform	µg/m^3	0.08	0.07 - 0.10	NA	5,000
Chrysene	ng/m^3	0.06	0.05 - 0.08	5700	NA
Methyl Methacrylate	µg/m^3	0.56 [e]	0 - 1.22 [e]	NA	700
Benzo (a) anthracene	ng/m^3	0.015 [f]	0.006 - 0.02 [f]	570	NA
Chloroethane	µg/m^3	0.04 [g]	0.01 - 0.07 [g]	NA	10,000
Non-Key HAPs with more than 50% ND Results.					
Chloroprene	ng/m^3	90% of the results were ND[h]		NA	7
Dichlorobenzene, *p-*	µg/m^3	60% of the results were ND[i]		9.1	800
Trichloroethylene	µg/m^3	60% of the results were ND[j]		50	600
Ethyl Acrylate	µg/m^3	90% of the results were ND[k]		NA	700
Chlorobenzene	µg/m^3	70% of the results were ND[l]		NA	1000
Indeno(1,2,3-cd)pyrene	ng/m^3	91% of the results were ND[m]		570	NA
Benzo(k)fluoranthene	ng/m^3	82% of the results were ND[n]		570	NA
Acrylonitrile	µg/m^3	60% of the results were ND[o]		1.5	2
Ethylene dichloride	µg/m^3	60% of the results were ND[p]		3.8	2400
No other HAPs were detected in any other samples.					

µg/m^3 micrograms per cubic meter

ng/m^3 nanograms per cubic meter

NA Not applicable

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

Table C-1. San Jacinto Elementary School - Other Monitored Pollutant Analysis.

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] Methyl Methacrylate was detected in 5 of 10 samples, ranging from 0.29 to 2.70 $\mu g/m^3$. The MDL is 0.115 $\mu g/m^3$.

[f] Benzo(a)anthracene was detected in 7 of 11 samples, ranging from 0.0200 to 0.0400 ng/m^3 . The MDL is 0.045 ng/m^3.

[g] Chloroethane was detected in 6 of 10 samples, ranging from 0.029 to 0.14 $\mu g/m^3$. The MDL is 0.005 $\mu g/m^3$.

[h] Chloroprene was detected in only 1 of 10 samples, with a value of 0.435 $\mu g/m^3$. The MDL is 0.011 $\mu g/m^3$.

[i] Dichlorobenzene, *p-* was detected in only 4 of 10 samples, ranging from 0.05 to 0.18 $\mu g/m^3$. The MDL is 0.024 $\mu g/m^3$.

[j] Trichloroethylene was detected in only 4 of 10 samples, ranging from 0.11 to 0.893 $\mu g/m^3$. The MDL is 0.011 $\mu g/m^3$.

[k] Ethyl Acrylate was detected in only 1 out of 10 samples, with a value of 0.778 $\mu g/m^3$. The MDL is 0.025 $\mu g/m^3$.

[l] Chlorobenzene was detected in only 3 of 10 samples, ranging from 0.083 to 0.23 $\mu g/m^3$. The MDL is 0.009 $\mu g/m^3$.

[m] Indeno(1,2,3-cd)pyrene was detected in only 1 out of 11 samples, with a value of 0.03 ng/m^3 . The MDL is 0.029 ng/m^3.

[n] Benzo(k)fluoranthene was detected in only 2 of 11 samples, ranging from 0.0100 to 0.0200 ng/m^3 . The MDL is 0.042 ng/m^3.

[o] Acrylonitrile was detected in only 4 of 10 samples, ranging from 0.18 to 0.673 $\mu g/m^3$. The MDL is 0.033 $\mu g/m^3$.

[p] Ethylene dichloride was detected in only 4 of 10 samples, ranging from 0.36 to 0.753 $\mu g/m^3$. The MDL is 0.067 $\mu g/m^3$.

Appendix D. San Jacinto Elementary School Pollutant Concentrations.

Parameter	Units	9/4/2009	9/10/2009	9/16/2009	9/22/2009	9/28/2009	10/4/2009	10/10/2009	10/16/2009	10/22/2009	10/28/2009	11/2/2009	11/3/2009	11/23/2009	11/30/2009	12/3/2009	12/7/2009	12/14/2009	12/21/2009	12/22/2009	1/11/2010	Sample Screening Level[a]
Butadiene, 1,3-	µg/m^3	--	--	--	--	--	--	--	--	--	0.17	3.08	--	0.10	0.16	0.13	0.376	14.5	1.07	0.058	0.398	20
Benzene	µg/m^3	--	--	--	--	--	--	--	--	--	1.60	12.1	--	1.25	1.81	1.18	3.77	5.05	0.588	0.556	3.61	30
Benzo(a)pyrene	ng/m^3	ND	ND	0.0200	ND	ND	ND	ND	ND	ND	ND	--	ND	--	--	--	--	--	--	--	--	6,400
Carbon Tetrachloride	µg/m^3	--	--	--	--	--	--	--	--	--	0.793	0.61	--	0.54	0.59	0.699	0.692	0.680	0.636	0.604	1.13	200
Naphthalene	µg/m^3	0.131	0.0979	0.0663	0.0522	0.0584	0.0237	0.0325	0.0621	0.0166	0.0419	--	0.154	--	--	--	--	--	--	--	--	30
Acetonitrile	µg/m^3	--	--	--	--	--	--	--	--	--	0.480	0.435	--	0.215	0.215	0.354	0.242	1.71	0.12	0.13	10.0	600
Vinyl chloride	µg/m^3	--	--	--	--	--	--	--	--	--	0.061	0.079	--	0.036	0.12	0.077	0.049	0.25	ND	ND	1.33	1,000
Chloromethane	µg/m^3	--	--	--	--	--	--	--	--	--	1.75	1.08	--	1.10	0.831	0.998	1.17	1.12	1.07	0.87	1.16	1,000
Ethylbenzene	µg/m^3	--	--	--	--	--	--	--	--	--	0.41	1.64	--	0.19	0.24	0.39	0.32	0.504	0.14	0.12	0.713	40,000
Tetrachloroethylene	µg/m^3	--	--	--	--	--	--	--	--	--	0.34	0.14	--	0.15	ND	0.10	0.075	0.37	0.13	0.068	0.54	1,400
Bromomethane	µg/m^3	--	--	--	--	--	--	--	--	--	0.066	0.097	--	0.078	0.062	0.058	0.051	0.054	0.047	0.035	ND	200
Xylene, *m/p-*	µg/m^3	--	--	--	--	--	--	--	--	--	0.87	3.54	--	0.39	0.42	0.88	0.69	1.18	0.20	0.20	1.61	3,000
Methyl *tert-* Butyl Ether	µg/m^3	--	--	--	--	--	--	--	--	--	0.047	11.4	--	0.570	0.830	0.23	4.04	11.0	0.02	ND	0.18	7,000
Xylene, *o-*	µg/m^3	--	--	--	--	--	--	--	--	--	0.439	1.12	--	0.13	0.13	0.27	0.22	0.31	0.078	0.09	1.26	9,000
Dichloromethane	µg/m^3	--	--	--	--	--	--	--	--	--	1.97	1.62	--	0.525	0.34	0.26	0.539	0.928	0.525	0.455	0.973	2,000
Chloroform	µg/m^3	--	--	--	--	--	--	--	--	--	0.25	0.33	--	0.17	0.13	0.14	0.20	0.30	0.13	0.10	0.24	500
Toluene	µg/m^3	--	--	--	--	--	--	--	--	--	2.83	10.2	--	1.38	1.74	1.21	3.17	4.11	0.460	0.72	5.39	4,000
Carbon Disulfide	µg/m^3	--	--	--	--	--	--	--	--	--	0.087	0.065	--	0.056	0.18	0.044	0.087	0.078	0.02	0.04	1.90	7,000
Styrene	µg/m^3	--	--	--	--	--	--	--	--	--	0.11	0.26	--	0.11	0.12	0.081	0.31	0.24	0.047	0.03	0.17	9,000
Methyl isobutyl ketone	µg/m^3	--	--	--	--	--	--	--	--	--	0.730	0.553	--	0.34	0.29	0.11	0.549	0.25	0.22	0.42	0.33	30,000
Benzo(b)fluoranthene	ng/m^3	0.0300	0.0300	0.0500	ND	0.0400	0.0200	0.0300	0.0400	0.0500	0.0200	--	0.0800	--	--	--	--	--	--	--	--	64,000
Methyl chloroform	µg/m^3	--	--	--	--	--	--	--	--	--	0.087	0.13	--	0.076	0.076	0.082	0.093	0.071	0.055	0.055	0.11	10,000
Chrysene	ng/m^3	0.0900	0.0600	0.100	0.0200	0.0700	0.0300	0.0500	0.0700	0.0600	0.0500	--	0.0800	--	--	--	--	--	--	--	--	640,000
Benzo (a) anthracene	ng/m^3	ND	ND	0.0200	0.0200	0.0200	ND	0.0200	0.0200	0.0400	ND	--	0.0200	--	--	--	--	--	--	--	--	64,000
Chloroethane	µg/m^3	--	--	--	--	--	--	--	--	--	0.034	0.029	--	0.048	0.037	ND	0.095	0.14	ND	ND	ND	40,000
Chloroprene	ng/m^3	--	--	--	--	--	--	--	--	--	ND	ND	--	ND	ND	ND	ND	ND	ND	ND	0.435	70
Dichlorobenzene, *p-*	µg/m^3	--	--	--	--	--	--	--	--	--	0.090	0.10	--	ND	ND	ND	ND	0.05	ND	ND	0.18	10,000
Trichloroethylene	µg/m^3	--	--	--	--	--	--	--	--	--	ND	0.11	--	ND	0.893	ND	0.21	0.13	ND	ND	ND	10,000
Methyl Methacrylate	µg/m^3	--	--	--	--	--	--	--	--	--	ND	0.500	--	ND	ND	0.35	0.29	1.78	ND	ND	2.70	7,000
Ethyl Acrylate	µg/m^3	--	--	--	--	--	--	--	--	--	ND	ND	--	ND	ND	ND	ND	ND	ND	ND	0.778	20,000

Appendix D. San Jacinto Elementary School Pollutant Concentrations.

Parameter	Units	9/4/2009	9/10/2009	9/16/2009	9/22/2009	9/28/2009	10/4/2009	10/10/2009	10/16/2009	10/22/2009	10/28/2009	11/2/2009	11/3/2009	11/23/2009	11/30/2009	12/3/2009	12/7/2009	12/14/2009	12/21/2009	12/22/2009	1/11/2010	Sample Screening Level[a]
Chlorobenzene	µg/m^3	--	--	--	--	--	--	--	--	--	ND	ND	--	ND	0.083	ND	0.23	0.19	ND	ND	ND	10,000
Indeno(1,2,3-cd)pyrene	ng/m^3	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	--	0.03	--	--	--	--	--	--	--	--	640,000
Benzo(k)fluoranthene	ng/m^3	ND	ND	ND	ND	ND	ND	0.0200	0.0100	ND	ND	--	ND	--	--	--	--	--	--	--	--	64,000
Acrylonitrile	µg/m^3	--	--	--	--	--	--	--	--	--	0.18	ND	--	ND	ND	ND	ND	ND	0.358	0.55	0.673	200
Ethylene dichloride	µg/m^3	--	--	--	--	--	--	--	--	--	ND	0.640	--	ND	ND	ND	0.603	0.753	ND	ND	0.36	270
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
Dibenz(a,h)anthracene	ng/m^3	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	--	ND	--	--	--	--	--	--	--	--	5,800
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	ND	14
Dichloropropylene, *trans* -1,3-	µg/m^3	--	--	--	--	--	--	--	--	--	ND	ND	--	ND	ND	ND	ND	ND	ND	ND	ND	14
Hexachloro-1,3-butadiene	µg/m^3	--	--	--	--	--	--	--	--	--	ND	ND	--	ND	ND	ND	ND	ND	ND	ND	ND	320
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

Key Pollutant

ng/m^3 nanograms per cubic meter

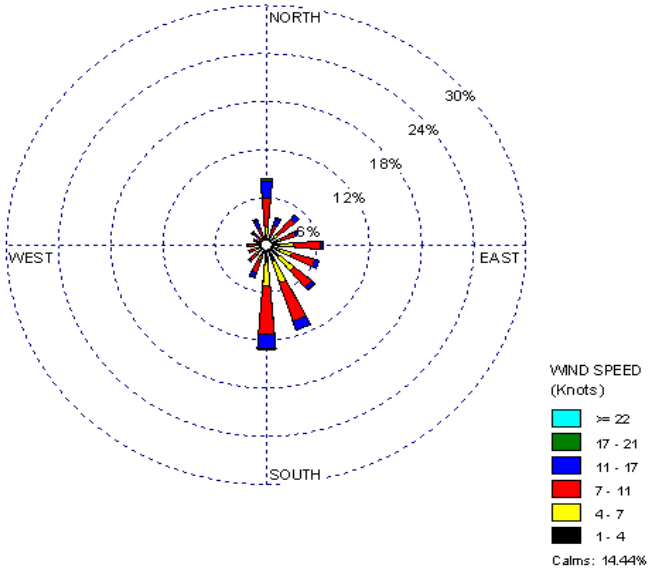
µg/m^3 micrograms per cubic meter

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

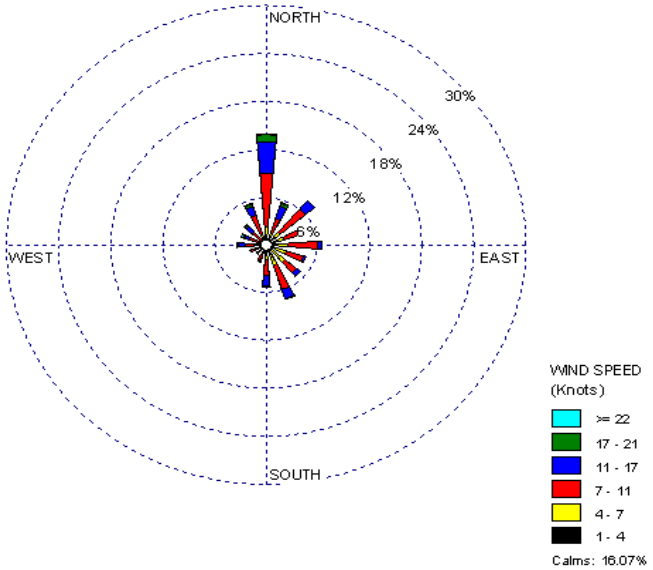
ND No results of this chemical were registered by the laboratory analytical equipment.

[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.

Appendix E. Windroses for William P. Hobby Airport NWS Station.



William P. Hobby Airport NWS Station
Composite Hourly Windrose,
2002-2007[1]



William P. Hobby Airport NWS Station
Across Sampling Period
(Sep. 4, 2009-Jan. 11, 2010)[1]

[1] William P. Hobby Airport NWS Station (WBAN 12918) is 10.25 miles from San Jacinto Elementary School.