SAT Initiative: Additional Monitoring 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 was initially conducted at San Jacinto Elementary School from September 4, 2009 to January 11, 2010 to assess 1,3-butadiene, benzene, and other volatile organic compounds (VOC); and benzo(a)pyrene and other polycyclic aromatic hydrocarbons (PAH) in the air. 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.
- EPA extended air toxics monitoring at this school, because measurements of 1,3-butadiene including one elevated result indicated a potential concern for long-term, continuous exposure. EPA was also concerned about the mixture of benzene and 1,3-butadiene over the long-term as provided in the first technical report (http://www.epa.gov/schoolair/pdfs/SanJacintoTechReport.pdf),
- Additional air monitoring was conducted at this school from October 13, 2011 through May 28, 2012 for 1,3-butadiene, benzene, and other volatile organic compounds (VOC).
- The levels of 1,3-butadiene and benzene measured in the outdoor air over this eight month period indicate influence of a key source although measurements are well below levels of significant concern. Results of all air toxics monitored do not indicate levels of concern.
- Based on the analysis described here, EPA does not recommend further monitoring at this school. 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. Basis for Selecting this School and the Air Monitoring Conducted

In 2009 this school was selected for monitoring because 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. Results from the air monitoring at the San Jacinto Elementary School are also 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 conducted from September 4, 2009 through January 11, 2010 indicated potential issues with 1,3-butadiene and benzene from nearby sources, and additional monitoring for a longer period of time was recommended.

Additional monitoring was conducted at this school from October 13, 2011 through May 28, 2012 for 1,3-butadiene, benzene, and other volatile organic compounds (VOC). During this period, 34 VOC samples were collected and analyzed for the key pollutants and other air toxics at this school. All sampling methodologies are described in EPA's schools air toxics monitoring plan (http://www.epa.gov/schoolair/techinfo.html).[1]

III. Monitoring Results and Analysis

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

- The VOC air sampling data collected over the 8-month sampling period indicate the influence of 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 and benzene do not indicate levels of concern.
- Results for other air toxics monitored do not indicate levels of concern.

A. Chemical Concentrations

1,3-Butadiene, key pollutant:

- Do the monitoring data indicate influence from nearby sources?
  - → Emissions of 1,3-butadiene may be associated with several different sources including stationary and mobile (cars, trucks, etc). The monitoring data include

[1] EPA contractors operated the monitors and sent the canisters to the analytical laboratory under contract to EPA.

multiple 1,3-butadiene concentrations that are higher than concentrations commonly observed in other locations nationally.[2]

→ Concentrations of 1,3-butadiene monitored at a nearby National Air Toxics Trends Station (Figure 2) indicate slightly lower but similar measurements of this pollutant over a 8-year period from 2003-2010 (Appendix C).

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

→ The monitoring data for 1,3-butadiene do not indicate levels of significant 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 below the long-term comparison levels (Table 1 and Figure 3a).[3] These comparison levels are based on consideration of continuous exposure concentrations (24 hours a day, all year, over a lifetime).
- Further, the longer-term concentration estimate is approximately 12% 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 a 1-in-100,000 additional cancer risk 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 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).[4]

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

Benzene, key pollutant:

- Do the monitoring data indicate influence from nearby sources?

→ Emissions of benzene may be associated with several different sources including stationary and mobile (cars, trucks, etc). The monitoring data include multiple

---

[2] For example, 21 of the concentrations at this site (Table 2) were higher than 75 percent of samples collected at the National Air Toxics Trends Stations (NATTS) from 2003-2010 (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.
[3] The upper end of the interval is nearly 1.3 times the mean of the monitoring data and approximately 27% of the long-term noncancer-based comparison level.
[4] 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.*

benzene concentrations that are higher than concentrations commonly observed in other locations nationally.[5]

→ Concentrations of benzene monitored at a nearby National Air Toxics Trends Station (Figure 2) indicate slightly lower but similar measurements of this pollutant over a 8-year period from 2003-2010 (Appendix C).

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

→ The monitoring data for benzene do not indicate levels of significant health concern for long-term, continuous exposures.

- 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 and Figure 3b).[6] These comparison levels are based on consideration of continuous exposure concentrations (24 hours a day, all year, over a lifetime).
- Further, the longer-term concentration estimate is approximately 18% 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 a 1-in-100,000 additional cancer risk 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).[4]

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

Other Air Toxics:

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

---

[5] For example, twenty of the concentrations at this site (Table 2) were higher than 75 percent of samples collected at the National Air Toxics Trends Stations (NATTS) from 2003-2010 (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.

[6] The upper end of the interval is nearly 1.3 times the mean of the monitoring data and approximately 24% of the long-term cancer-based comparison level.

→ 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 D). Additionally, each individual measurement for these pollutants is below the individual sample screening level[4] for that pollutant (Appendix E).

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 concentrations estimates do not pose significant concerns for cumulative health risk from these pollutants (Appendix D).[7]

B. 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 evaluated whether these data indicate that the general pattern of winds on our sampling dates was 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 nearby sources, 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 November 6, 2011, continuing through the sampling period and ending on May 28, 2012. Data was not available from the first four sampling days (October 13, 2011 through part of October 31, 2011), and also on a few other days during sampling (see Table 2). Wind information from the NWS Station was used as a surrogate on all days when data was not available from the school location. The meteorological data collected at the school site on sampling days are presented in Figures 4a-4b and Table 2.

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 Table 2 and Appendix F.

---

[7] 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 on the 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.
- The NWS station at William P. Hobby Airport appears to represent the specific wind flow patterns at the school location. The historical data from the NWS station indicates that winds are predominantly from the south which was also the predominant wind direction during the eight month monitoring event.

- What is the direction of the key source of 1,3-butadiene and benzene 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 and benzene emissions within 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 19 out of 34 sampling days in which the on-site wind data had a portion of the winds from the ZOI. (Figures 4a-4b, Table 2).

- 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 appears very 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 similar to those recorded at the NWS station over the long-term (January 2002-May 2012 period; Appendix F). Winds in the area are usually predominantly from the southerly directions during the majority of the year.

- 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 eight months), prevalent winds at the school site are predominantly from the south-southeast, which is the same as the NWS station. The windroses for the two sites during the sampling period (Figures 4a-4b and Appendix F) show similarities in wind flow patterns.

IV. 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.[8] 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 refinery's process units that handle, produce or process high concentration benzene streams were all operating in normal production mode.
  - The 1,3-butadiene production unit was down for maintenance from 10/9/2011 to 11/10/2011. This unit processes high-concentration 1,3-butadiene containing streams from the site's olefins units.
  - The Benzene Extraction Unit was not in production mode from 10/6/2011 to 11/13/2011. This unit process high concentration benzene containing streams from the site's olefin units.
  - The most recently available 1,3-butadiene and benzene emissions data for this source (2011 TRI) are lower to those relied upon in the previous modeling analysis for this area (2002 NATA, 2005 TRI).

V. Integrated Summary and Next Steps

A. Summary of Key Findings

1. What are the key HAPs for this school?
   → 1,3-Butadiene and benzene are the key HAPs for this school, based on previous monitoring conducted September 2009 through January 2010. The ambient air concentrations of benzene and 1,3-butadiene on multiple days during this monitoring period (October 13, 2011 through May 28, 2012) indicate contributions from multiple 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 additional monitoring?

---

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

- → Measured levels of 1,3-butadiene and benzene and the associated longer-term concentration estimate for the outdoor air at this school are below levels of concern.
- → 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 site. The wind patterns seen over eight months of sampling at the school are similar to those seen at the nearest NWS station.

B. Next Steps for Key Pollutants

1. Based on the analysis described here, EPA does not plan to extend air toxics monitoring at this school in the near future.
2. EPA remains concerned about emissions from sources of air toxics and continues to work to reduce these emissions across the country, through national rules and by providing information and suggestions to assist with reductions in local areas (http://www.epa.gov/ttn/atw/eparules.html).
3. The Texas Commission on Environmental Quality (TCEQ) will continue to oversee industrial facilities in the area through air permits and other programs.

VI. Figures and Tables

A. Tables

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

B. Figures

1. San Jacinto Elementary School and Deer Park Junior High School and Source of Interest.
2. San Jacinto Elementary School, Deer Park Junior High School, the Houston NATTS Site, and the Source of Interest.

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

3b. San Jacinto Elementary School – Key Pollutant (Benzene) Analysis.

4a. San Jacinto Elementary School (Deer Park, TX) 1,3-Butadiene Concentration and Wind Information.

4b. San Jacinto Elementary School (Deer Park, TX) Benzene Concentration and Wind Information.

VII. Appendices

A. Summary Description of Long-term Comparison Levels.

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

C. Houston National Air Toxics Trends Station Measurements (2003-2010).

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

E. San Jacinto Elementary School Pollutant Concentrations.

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

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

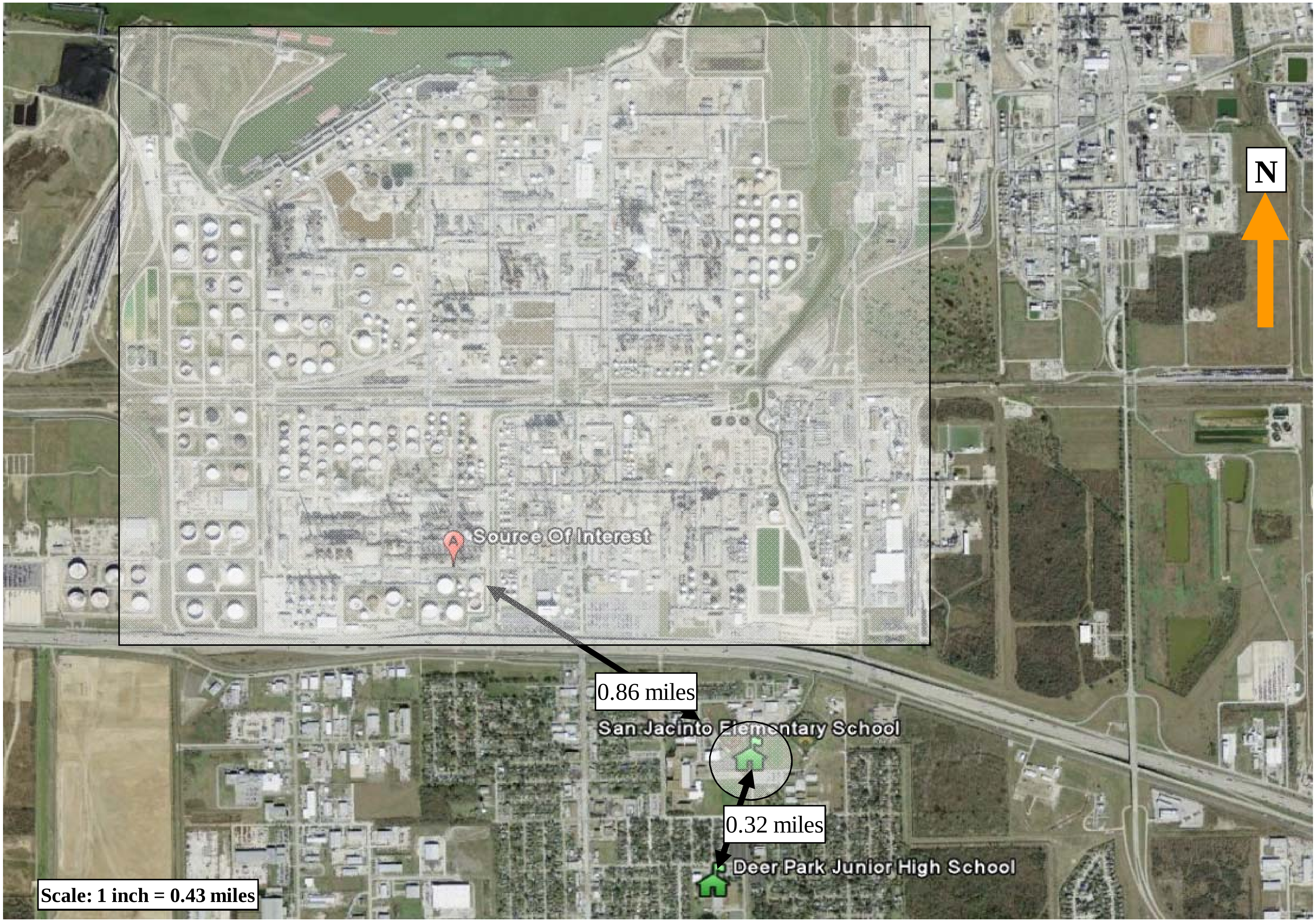


Table 1. San Jacinto Elementary School - Key Pollutant Analysis.

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	0.39 [d]	0.24 - 0.54	3.3	2
Benzene	µg/m^3	2.37 [e]	1.67 - 3.08	13	30

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 34 detections that ranged from 0.03 to 1.80 µg/m^3.

[e] The mean of measurements for benzene is the average of all sample results, which include 34 detections that ranged from 0.43 to 9.11 µg/m^3.

Figure 2. San Jacinto Elementary School, Deer Park Junior High School, the Houston, TX NATTS Site, and the Source of Interest.

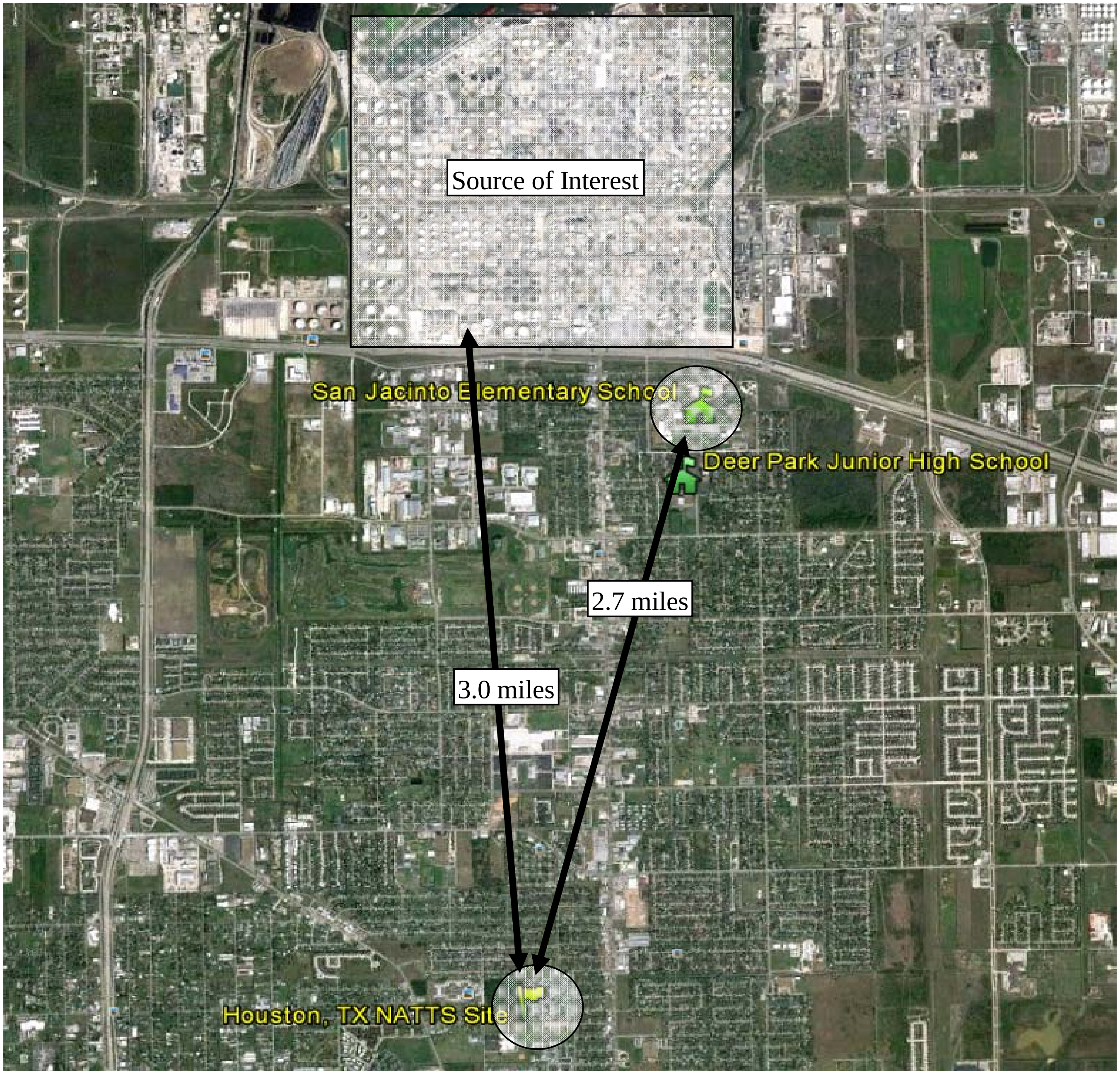
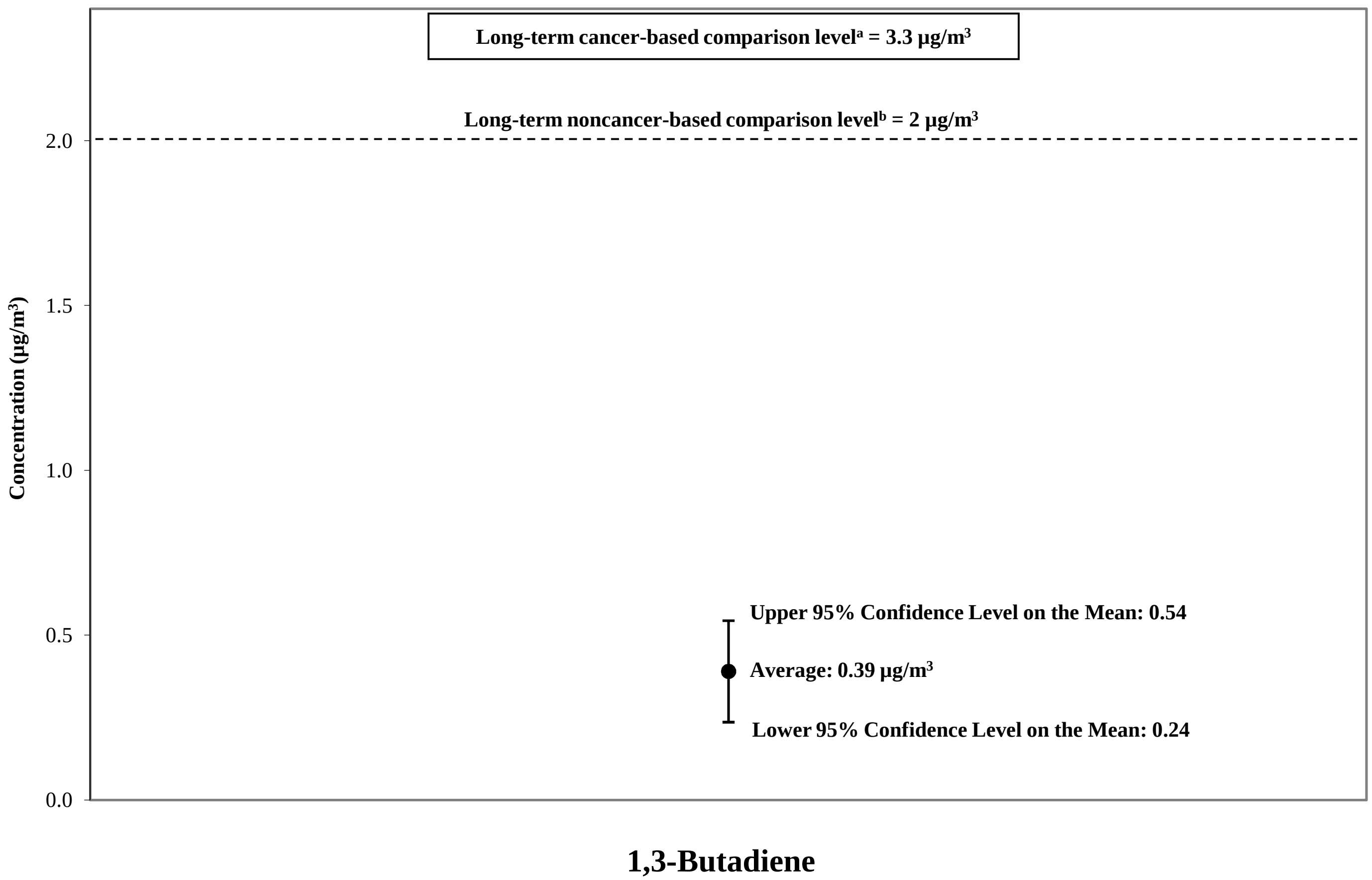


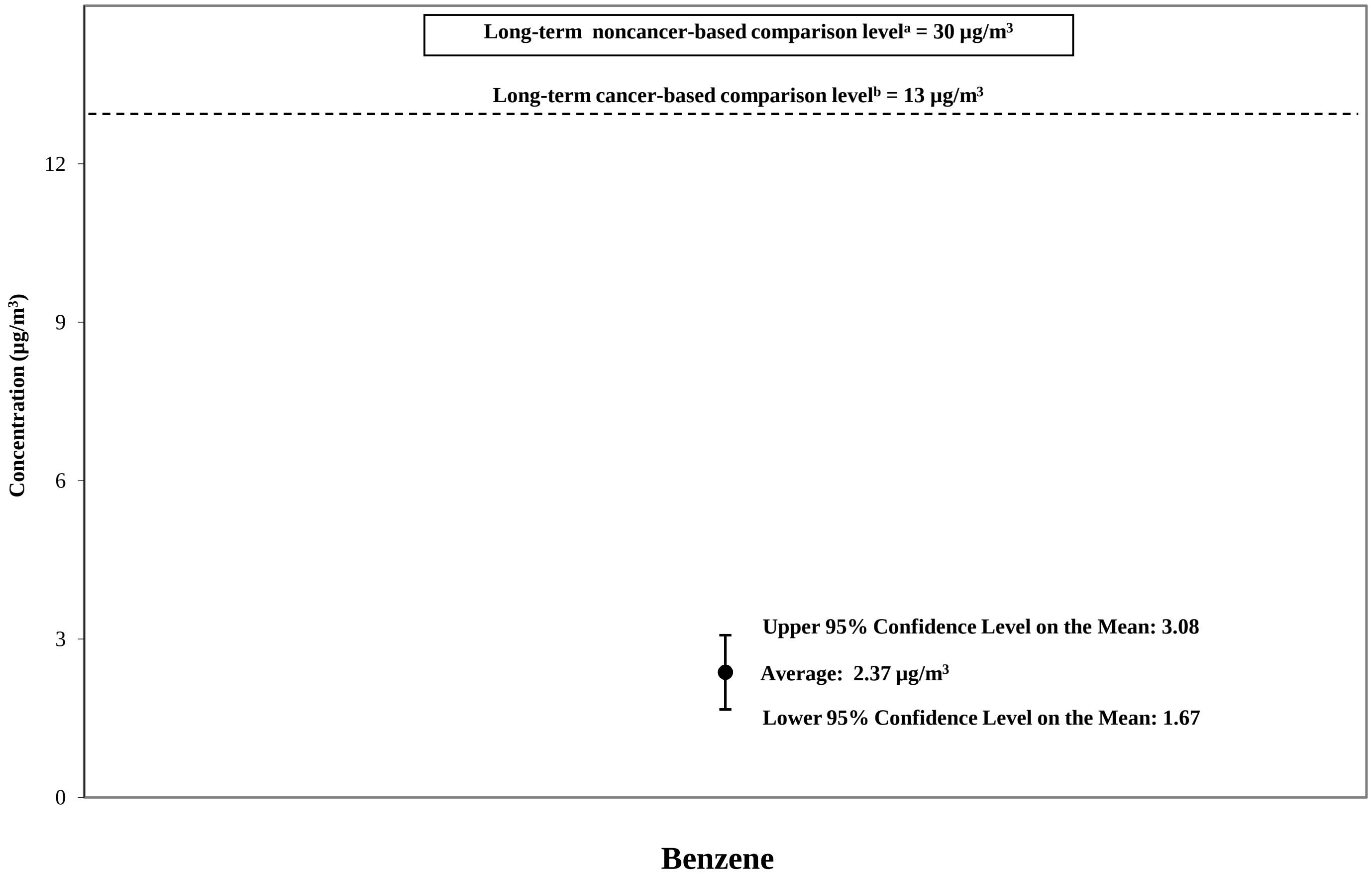
Figure 3a. San Jacinto Elementary School - Key Pollutant (1,3-Butadiene) Analysis.



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

Parameter	Units	10/13/2011	10/19/2011	10/25/2011	10/31/2011	11/6/2011	11/12/2011	11/18/2011	11/24/2011	11/30/2011	12/6/2011	12/12/2011	12/18/2011	12/30/2011	1/5/2012	1/11/2012	1/17/2012	1/23/2012
Butadiene, 1,3-	µg/m³	1.80	0.69	0.05	0.29	0.03	0.06	0.04	0.44	0.22	0.99	0.07	0.04	0.23	0.15	1.60	0.56	0.69
Benzene	µg/m³	5.11	9.11	0.58	3.83	0.43	0.44	0.56	3.39	2.30	2.29	1.14	0.65	2.63	1.31	1.48	2.48	3.29
% Hours w/Wind Direction from Expected ZOI[a]	%	83.3	66.7	0.0	4.2	0.0	0.0	0.0	12.5	4.2	91.7	4.2	0.0	0.0	0.0	54.2	75.0	25.0
Wind Speed (avg. of hourly speeds)	mph	6.0	5.9	8.0	4.0	8.0	7.6	5.6	4.1	3.9	10.0	4.8	5.1	3.7	4.4	11.4	8.7	4.5
Wind Direction (avg. of unitized vector)[b]	deg.	12.5	348.4	159.6	197.6	114.1	177.2	140.6	175.7	143.4	303.3	110.9	139.5	198.1	184.8	278.9	14.8	71.6
% of Hours with Speed below 2 knots	%	20.8	29.2	0.0	8.3	0.0	0.0	4.2	33.3	33.3	0.0	8.3	0.0	37.5	4.2	0.0	0.0	4.2
Daily Average Temperature	° F	73.4	61.8	74.8	64.1	72.1	70.9	66.7	61.1	55.7	38.3	59.9	61.8	63.9	65.4	54.5	55.4	62.7
Daily Precipitation	inches	0.00	0.00	0.00	0.00	0.00	0.12	0.00	0.01	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.01	0.10

Parameter	Units	1/29/2012	2/4/2012	2/10/2012	2/16/2012	3/5/2012	3/11/2012	3/17/2012	3/23/2012	3/28/2012	3/29/2012	4/4/2012	4/22/2012	4/28/2012	5/4/2012	5/16/2012	5/22/2012	5/28/2012
Butadiene, 1,3-	µg/m³	0.71	1.19	0.41	0.29	0.37	0.36	0.03	0.36	0.07	0.09	0.32	0.59	0.03	0.07	0.35	0.03	0.05
Benzene	µg/m³	6.52	2.66	1.42	3.90	0.81	2.87	0.69	5.40	0.85	1.02	4.35	3.58	0.57	0.63	3.05	0.51	0.79
% Hours w/Wind Direction from Expected ZOI[a]	%	0.0	100.0	95.8	75.0	0.0	12.5	0.0	12.5	0.0	20.8	8.3	95.8	0.0	0.0	8.3	0.0	0.0
Wind Speed (avg. of hourly speeds)	mph	4.59	9.25	9.34	4.72	6.69	2.42	7.75	3.64	5.26	4.61	4.18	6.70	7.54	5.08	3.50	7.43	6.05
Wind Direction (avg. of unitized vector)[b]	deg.	149.3	351.1	346.5	38.9	147.9	199.7	155.6	181.8	160.3	137.4	201.4	2.1	142.7	168.3	136.7	190.6	199.4
% of Hours with Speed below 2 knots	%	12.5	0.0	0.0	0.0	0.0	62.5	0.0	8.3	4.2	20.8	20.8	0.0	0.0	20.8	12.5	0.0	8.3
Daily Average Temperature	° F	54.0	53.9	49.5	61.9	63.7	63.3	74.3	68.2	72.6	71.9	72.4	73.2	77.5	79.4	76.3	80.1	81.6
Daily Precipitation	inches	0.00	0.11	0.01	0.04	0.00	0.15	0.00	0.00	0.05	0.01	0.00	0.00	0.00	0.01	0.01	0.00	0.00

µg/m³ micrograms per cubic meter

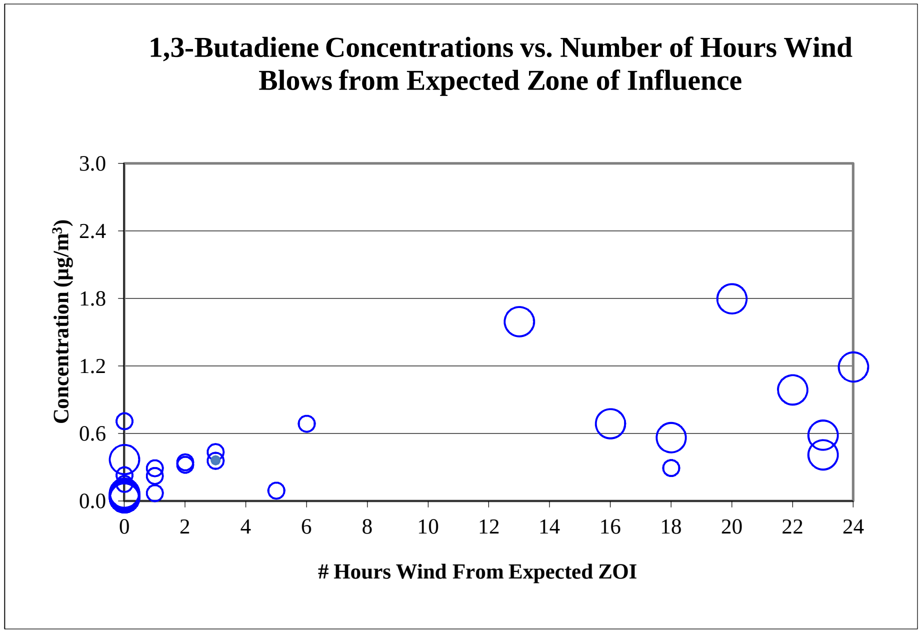
(yellow) All precipitation and temperature data were from the William P. Hobby Airport NWS Station.

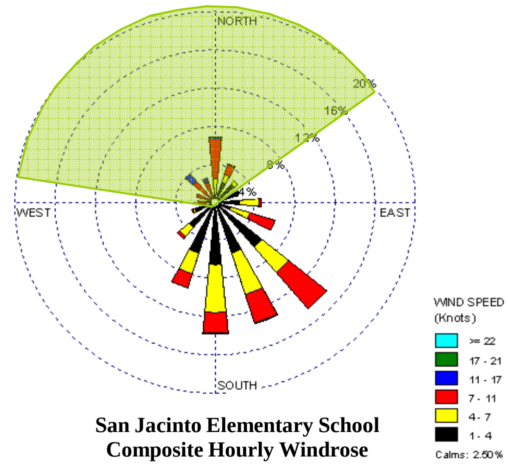
(gray) Wind information was not taken at the site on from 10/13/11 to 10/30/11, and the NWS Station data was used as a surrogate. Additionally, wind information was not collected during the first 14 hours on 10/31/11. Instrument error occurred during the first 4 hours of sampling on 3/11/12, the first 10 hours of sampling on 3/29/12, and the last two hours of sampling on 5/28/12.

[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 4a. 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. 13, 2011- May 28, 2012)

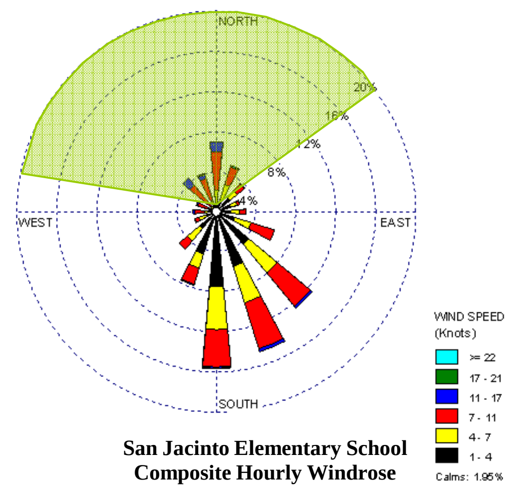
KEY

Pollutant: 1,3-Butadiene
Timeframe: October 13, 2011 - May 28, 2012

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

Note

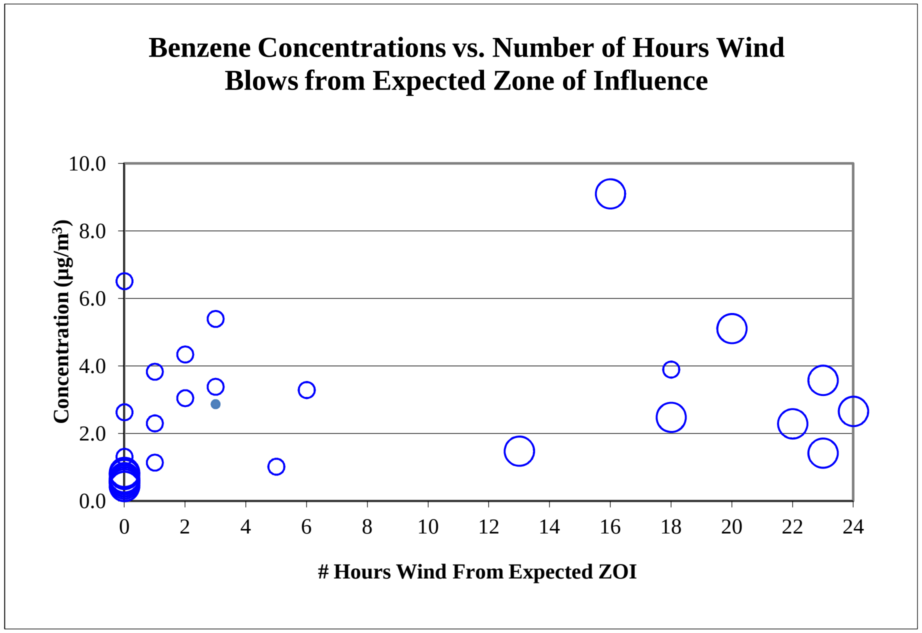
Each circle denotes a 24-hour collection of air for chemical analysis. The size of the circle indicates the magnitude of the wind speed for that day (wind data shown in Table 2). The expected zone of source influence is a rough approximation of the range of directions from which winds carrying chemicals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

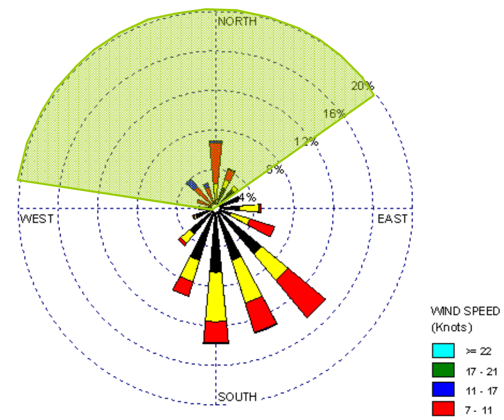


San Jacinto Elementary School Composite Hourly Windrose Across Sampling Period (Oct. 13, 2011- May 28, 2012)

Expected Zone of Source Influence

Figure 4b. San Jacinto Elementary School (Deer Park, TX) Benzene Concentration and Wind Information.





San Jacinto Elementary School
Composite Hourly Windrose
on Sample Days
(Oct. 13, 2011- May 28, 2012)

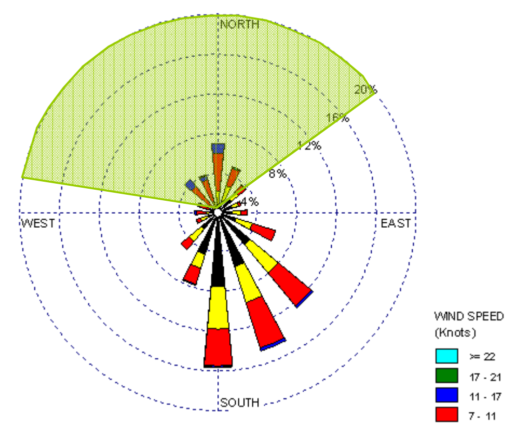
KEY

Pollutant: Benzene
Timeframe: October 13, 2011 - May 28, 2012

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 2). 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



San Jacinto Elementary School
Composite Hourly Windrose
Across Sampling Period
(Oct. 13, 2011- May 28, 2012)

Expected Zone of Source Influence

Appendix A. Summary Description of Long-term Comparison Levels

In addressing the primary objective identified above, we developed two types of long-term health risk-related comparison levels. These two types of levels are summarized below.[9]

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.[10] 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 D.

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

[10] 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.[11] 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.

---

[11] 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 (2003-2010).[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	3,419	72%	554.05	8.24	0.90	ND	ND	0.35	0.94	26.11
Acrylonitrile	µg/m^3	5,848	28%	5.51	0.04	0.07	ND	ND	ND	0.02	0.22
Benzene	µg/m^3	13,170	96%	43.14	1.08	0.82	0.10	0.46	0.77	1.28	3.00
Benzyl Chloride	µg/m^3	5,081	10%	2.49	<0.01	0.04	ND	ND	ND	ND	0.05
Bromoform	µg/m^3	4,699	4%	1.45	0.01	0.15	ND	ND	ND	ND	ND
Bromomethane	µg/m^3	8,793	58%	120.76	0.08	0.05	ND	ND	0.03	0.05	0.12
Butadiene, 1,3-	µg/m^3	12,030	71%	18.81	0.14	0.10	ND	ND	0.06	0.14	0.48
Carbon disulfide	µg/m^3	3,350	91%	46.71	1.97	0.22	ND	0.03	0.09	0.46	12.38
Carbon tetrachloride	µg/m^3	10,861	90%	9.00	0.54	0.57	ND	0.48	0.57	0.65	0.85
Chlorobenzene	µg/m^3	9,475	28%	1.68	0.02	0.03	ND	ND	ND	<0.01	0.09
Chloroethane	µg/m^3	7,450	35%	0.58	0.02	0.04	ND	ND	ND	0.03	0.08
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
Chloroprene	µg/m^3	3,749	8%	0.33	<0.01	0.03	ND	ND	ND	ND	0.02
Dichlorobenzene, *p-*	µg/m^3	8,924	59%	17.50	0.16	0.14	ND	ND	0.05	0.14	0.85
Dichloroethane, 1,1-	µg/m^3	9,296	16%	0.81	<0.01	0.02	ND	ND	ND	ND	0.03
Dichloroethylene, 1,1-	µg/m^3	9,047	18%	0.56	<0.01	0.03	ND	ND	ND	ND	0.04
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
Dichloropropylene, *cis* -1,3-	µg/m^3	9,754	15%	11.03	0.02	0.04	ND	ND	ND	ND	0.04
Dichloropropylene, *trans* -1,3-	µg/m^3	9,728	16%	8.78	0.02	0.04	ND	ND	ND	ND	0.04
Ethyl acrylate	µg/m^3	3,159	1%	0.20	<0.01	0.04	ND	ND	ND	ND	ND
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
Hexachloro-1,3-butadiene	µg/m^3	6,263	19%	2.13	0.02	0.10	ND	ND	ND	ND	0.15
Methyl chloroform	µg/m^3	9,942	67%	6.44	0.08	0.09	ND	ND	0.06	0.11	0.21
Methyl isobutyl ketone	µg/m^3	4,968	60%	5.28	0.10	0.09	ND	ND	0.02	0.12	0.43
Methyl methacrylate	µg/m^3	3,243	7%	14.05	0.08	0.34	ND	ND	ND	ND	0.11
Methyl *tert* -butyl ether	µg/m^3	7,249	37%	37.50	0.30	0.13	ND	ND	ND	0.03	1.80

Appendix B. 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
Styrene	µg/m³	12,381	64%	40.72	0.15	0.11	ND	ND	0.04	0.14	0.55
Tetrachloroethane, 1,1,2,2-	µg/m³	9,538	19%	4.44	0.02	0.05	ND	ND	ND	ND	0.07
Tetrachloroethylene	µg/m³	11,083	73%	518.86	0.38	0.20	ND	ND	0.14	0.27	0.90
Toluene	µg/m³	12,418	96%	482.53	2.47	1.58	0.11	0.75	1.51	3.01	7.67
Trichlorobenzene, 1,2,4-	µg/m³	7,018	21%	45.27	0.05	0.08	ND	ND	ND	ND	0.15
Trichloroethane, 1,1,2-	µg/m³	8,544	17%	5.89	<0.01	0.04	ND	ND	ND	ND	0.04
Trichloroethylene	µg/m³	11,085	47%	89.74	0.08	0.08	ND	ND	ND	0.05	0.27
Vinyl chloride	µg/m³	10,722	20%	1.65	0.01	0.02	ND	ND	ND	ND	0.04
Xylene, *m/p*-	µg/m³	12,128	91%	24.46	1.09	0.71	ND	0.29	0.65	1.35	3.62
Xylene, *o*-	µg/m³	12,628	85%	9.21	0.42	0.30	ND	0.09	0.24	0.52	1.42

Key Pollutant

µg/m³ 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.

Appendix C. Houston National Air Toxics Trends Station Measurements (2003-2010).

Analyte	Units	# AQS Records	% Detection	Average Concentration	Standard Deviation	Maximum Concentration	Percentile Value						
							5th	10th	25th	50th	75th	90th	95th
Acetaldehyde	$\mu g/m^3$	457	100%	1.84	1.34	9.26	0.40	0.57	0.92	1.46	2.41	3.74	4.31
Arsenic (PM_{10})	ng/m^3	451	100%	3.12	4.02	14.49	0.50	0.51	0.55	1.09	3.05	11.41	11.73
Benzene	$\mu g/m^3$	455	100%	1.77	1.43	10.19	0.50	0.61	0.85	1.31	2.14	3.58	4.47
Benzo(a)pyrene	ng/m^3	220	92%	0.04	0.06	0.72	ND	<0.01	0.01	0.02	0.05	0.07	0.10
Beryllium (PM_{10})	ng/m^3	451	99%	0.44	0.16	0.56	0.07	0.07	0.49	0.50	0.52	0.53	0.53
Butadiene, 1,3-	$\mu g/m^3$	455	84%	0.32	0.88	15.55	ND	ND	0.01	0.13	0.40	0.72	1.08
Cadmium (PM_{10})	ng/m^3	451	0%	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Carbon Tetrachloride	$\mu g/m^3$	455	100%	0.63	0.12	1.20	0.44	0.50	0.57	0.63	0.69	0.75	0.82
Chloroform	$\mu g/m^3$	455	99%	0.16	0.17	2.25	0.02	0.02	0.05	0.12	0.20	0.32	0.39
Formaldehyde	$\mu g/m^3$	457	100%	3.37	2.96	25.27	1.09	1.33	1.76	2.52	3.99	6.30	7.78
Hexavalent Chromium	ng/m^3	244	84%	0.10	0.09	0.60	ND	ND	0.03	0.08	0.14	0.21	0.27
Lead (PM_{10})	ng/m^3	451	100%	3.62	3.53	33.92	0.98	0.99	1.02	2.17	4.17	10.02	10.31
Manganese (PM_{10})	ng/m^3	451	100%	5.39	5.00	49.10	1.97	1.99	2.03	4.09	6.22	10.64	14.54
Naphthalene	ng/m^3	220	100%	64.18	49.21	502.96	18.69	23.35	34.26	52.57	79.42	110.79	138.30
Nickel (PM_{10})	ng/m^3	451	100%	2.64	1.25	9.52	1.72	1.97	1.99	2.06	3.26	4.19	4.72
Tetrachloroethylene	$\mu g/m^3$	455	95%	0.15	0.21	2.17	ND	0.03	0.03	0.07	0.20	0.38	0.54
Trichloroethylene	$\mu g/m^3$	455	81%	0.04	0.05	0.75	ND	ND	0.03	0.03	0.03	0.11	0.13
Vinyl Chloride	$\mu g/m^3$	455	82%	0.04	0.08	0.54	ND	ND	0.01	0.01	0.03	0.10	0.18

Key Pollutant

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

ng/m^3 micrograms per cubic meter

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

Appendix D. 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).[12] 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 D-1).

<u>Other Air Toxics (HAPs)</u>

- 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 but one of these (ethylene dichloride) are more than 10-fold lower and all but five of these (ethylene dichloride, carbon tetrachloride, ethylbenzene, *p*-dichlorobenzene, and vinyl chloride) are more than 100-fold lower.[13]
  - → 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.[14]

<u>Additional Information on Five HAPs:</u>

- The first HAP mentioned above is ethylene dichloride. The mean and 95 percent upper bound on the mean for ethylene dichloride are approximately 15-22% of the cancer-based comparison level. A review of information available at other sites nationally shows that the mean concentration of ethylene dichloride at this site is greater than the 95th

[12] 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.

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

[14] 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.*

percentile of samples collected from 2003 to 2010 (the most recently compiled period) at the NATTS sites (Appendix B).

- The second HAP mentioned above is carbon tetrachloride. The mean and 95 percent upper bound on the mean for carbon tetrachloride are approximately 4% of the cancer-based comparison level. A review of information available at other sites nationally shows that the mean concentration of carbon tetrachloride at this site is between the 75th and 95th percentile of samples collected from 2003 to 2010 (the most recently compiled period) at the NATTS sites (Appendix B). Carbon tetrachloride is found globally as a result of its significant past uses in refrigerants and propellants for aerosol cans and its chemical persistence. Virtually all uses have been discontinued. However, it is still measured throughout the world as a result of its slow rate of degradation in the environment and global distribution in the atmosphere.

- The third HAP mentioned above is ethylbenzene. The mean and 95 percent upper bound on the mean for ethylbenzene are approximately 1% 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 95th percentile of samples collected from 2003 to 2010 (the most recently compiled period) at the NATTS sites (Appendix B).

- The fourth HAP mentioned above is *p*-dichlorobenzene. The mean and 95 percent upper bound on the mean for *p*-dichlorobenzene are approximately 1% of the cancer-based comparison level. A review of information available at other sites nationally shows that the mean concentration of *p*-dichlorobenzene at this site is between the 50th and 75th percentile of samples collected from 2003 to 2010 (the most recently compiled period) at the NATTS sites (Appendix B).

- The fifth HAP mentioned above is vinyl chloride. The mean and 95 percent upper bound on the mean for vinyl chloride 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 vinyl chloride at this site is greater than the 95th percentile of samples collected from 2003 to 2010 (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.[15]

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

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

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

  → Although the multiple air toxics monitored at this location were below the levels of significant concern that had been suggested by the modeling information, EPA remains concerned about emissions from sources of air toxics and continues to work to reduce these emissions across the country, through national rules and by providing information and suggestions to assist with reductions in local areas.

    - In addition to the key pollutants, 1,3-butadiene and benzene, the only other HAP monitored whose longer-term concentration estimates is more than ten percent of its lowest comparison level is ethylene dichloride.
        - The lowest comparison levels for benzene and ethylene dichloride are based on carcinogenic risk. 1,3-Butadiene also has a long-term comparison level based on carcinogenic risk. When aggregated as a group, they comprise approximately 62% of their cancer-based comparison levels.
        - The lowest comparison level for 1,3-butadiene is based on reproductive effects.

Table D-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 greater than 10% of the lowest comparison level					
Ethylene dichloride	µg/m^3	0.57	0.31 - 0.82	3.8	2400
Non-Key HAPs - all means are lower than 10% of the lowest comparison level					
Carbon Tetrachloride	µg/m3	0.72	0.68 - 0.75	17	100
Chloromethane	µg/m3	1.35	1.18 - 1.52	NA	90
Xylene, *m/p*-	µg/m3	1.24	0.87 - 1.61	NA	100
Ethylbenzene	µg/m3	0.45	0.33 - 0.56	40	1000
Bromomethane	µg/m3	0.04	0.03 - 0.05	NA	5
Dichlorobenzene, *p*-	µg/m3	0.08	0.05 - 0.10	9.1	800
Acetonitrile	µg/m3	0.34	0.25 - 0.43	NA	60
Tetrachloroethylene	µg/m3	0.19	0.13 - 0.25	380	40
Xylene, *o*-	µg/m3	0.44	0.32 - 0.56	NA	100
Chloroform	µg/m3	0.20	0.13 - 0.28	NA	98
Dichloromethane	µg/m3	0.51	0.41 - 0.61	5900	600
Toluene	µg/m3	3.87	2.40 - 5.35	NA	5000
Styrene	µg/m3	0.27	0.18 - 0.36	NA	1000
Methyl isobutyl ketone	µg/m3	0.31	0.24 - 0.37	NA	3000
Carbon Disulfide	µg/m3	0.05	0.04 - 0.05	NA	700
Methyl Chloroform	µg/m3	0.06	0.05 - 0.06	NA	5000
Vinyl chloride	µg/m3	0.20 [e]	0.05 - 0.35 [e]	11	100
Methyl tert-Butyl Ether	µg/m3	0.66 [f]	0.27 - 1.04 [f]	380	3000
Non-Key HAPs with more than 50% ND Results.					
Acrylonitrile	µg/m^3	85% of the results were ND[g]		1.5	2
Trichloroethylene	µg/m^3	56% of the results were ND[h]		21	2
Trichloroethane, 1,1,2-	µg/m^3	85% of the results were ND[i]		6.3	400
Hexachloro-1,3-butadiene	µg/m^3	82% of the results were ND[j]		4.5	90
Tetrachloroethane, 1,1,2,2-	µg/m^3	88% of the results were ND[k]		1.7	NA
Dichloropropane, 1,2-	µg/m^3	97% of the results were ND[l]		5.3	4
Methyl Methacrylate	µg/m^3	56% of the results were ND[m]		NA	700
Trichlorobenzene, 1,2,4-	µg/m^3	85% of the results were ND[n]		NA	200
Bromoform	µg/m^3	76% of the results were ND[o]		91	NA
Chlorobenzene	µg/m^3	59% of the results were ND[p]		NA	1000
Dichloroethane, 1,1-	µg/m^3	97% of the results were ND[q]		63	500
Ethyl Acrylate	µg/m^3	97% of the results were ND[r]		NA	700
Chloroethane	µg/m^3	74% of the results were ND[s]		NA	10000
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] Vinyl chloride was detected in 22 of 34 samples, ranging from 0.01 to 2.07 µg/m^3. The MDL range is between 0.0205 and 0.0281 µg/m^3.

[f] Methyl *tert* -butyl ether was detected in 17 of 34 samples, ranging from 0.07 to 3.86 µg/m^3. The MDL range is between 0.0288 and 0.0397 µg/m^3.

[g] Acrylonitrile was detected in only 5 of 34 samples, ranging from 0.18 to 1.47 µg/m^3. The MDL range is between 0.0260 and 0.0434 µg/m^3.

[h] Trichloroethylene was detected in only 15 of 34 samples, ranging from 0.04 to 0.39 µg/m^3. The MDL range is between 0.1182 and 0.1343 µg/m^3.

[i] 1,1,2-Trichloroethane was detected in only 5 of 34 samples, ranging from 0.07 to 0.21 µg/m^3. The MDL range is 0.1146 and 0.136 µg/m^3.

[j] Hexachlorobutadiene was detected in only 6 of 34 samples, ranging from 0.04 to 0.12 µg/m^3. The MDL range is between 0.2346 and 0.3946 µg/m^3.

[k] 1,1,2,2-Tetrachloroethane was detected in only 4 of 34 samples, ranging from 0.03 to 0.08 µg/m^3. The MDL range is between 0.1236 and 0.1648 µg/m^3.

[l] 1,2-Dichloropropane was detected in only 1 of 34 samples, with a value of 0.06 µg/m^3. The MDL range is between 0.0878 and 0.1063 µg/m^3.

[m] Methyl methacrylate was detected in only 15 of 34 samples, ranging from 0.05 to 0.88 µg/m^3. The MDL range is between 0.0901 and 0.1024 µg/m^3.

[n] 1,2,4-Trichlorobenzene was detected in only 5 of 34 samples, ranging from 0.02 to 0.67 µg/m^3. The MDL range is between 0.1633 and 0.2672 µg/m^3.

[o] Bromoform was detected in only 8 of 34 samples, ranging from 0.05 to 0.14 µg/m^3. The MDL range is between 0.2067 and 0.2584 µg/m^3.

[p] Chlorobenzene was detected in only 14 of 34 samples, ranging from 0.04 to 1.25 µg/m^3. The MDL range is between 0.0967 and 0.1151 µg/m^3.

[q] 1,1-Dichloroethane was detected in only 1 of 34 samples, with a value of 0.06 µg/m^3. The MDL range is between 0.0324 and 0.0607 µg/m^3.

[r] Ethyl acrylate was detected in only 1 of 34 samples, with a value of 0.33 µg/m^3. The MDL range is between 0.0573 and 0.0819 µg/m^3.

[s] Chloroethane was detected in only 9 of 34 samples, ranging from 0.05 to 0.29 µg/m^3. The MDL range is between 0.0237 and 0.0449 µg/m^3.

Appendix E. San Jacinto Elementary School Pollutant Concentrations.

Parameter	Units	10/13/2011	10/19/2011	10/25/2011	10/31/2011	11/6/2011	11/12/2011	11/18/2011	11/24/2011	11/30/2011	12/6/2011	12/12/2011	12/18/2011	12/30/2011	1/5/2012	1/11/2012	1/17/2012	1/23/2012	1/29/2012	2/4/2012	2/10/2012	2/16/2012	3/5/2012	3/11/2012	3/17/2012	3/23/2012	3/28/2012	3/29/2012	4/4/2012	4/22/2012	4/28/2012	5/4/2012	5/16/2012	5/22/2012	5/28/2012	Sample Screening Level[a]
Butadiene, 1,3-	µg/m^3	1.80	0.69	0.05	0.29	0.03	0.06	0.04	0.44	0.22	0.99	0.07	0.04	0.23	0.15	1.60	0.56	0.69	0.71	1.19	0.41	0.29	0.37	0.36	0.03	0.36	0.07	0.09	0.32	0.59	0.03	0.07	0.35	0.03	0.05	20
Benzene	µg/m^3	5.11	9.11	0.58	3.83	0.43	0.44	0.56	3.39	2.30	2.29	1.14	0.65	2.63	1.31	1.48	2.48	3.29	6.52	2.66	1.42	3.90	0.81	2.87	0.69	5.40	0.85	1.02	4.35	3.58	0.57	0.63	3.05	0.51	0.79	30
Ethylene dichloride	µg/m^3	1.35	3.40	0.11	0.47	ND	0.08	0.07	0.52	0.36	1.79	0.20	0.14	0.22	0.11	1.03	0.24	0.47	2.13	0.32	1.66	1.04	0.09	0.32	0.08	0.44	0.18	0.08	0.38	1.04	0.09	0.07	0.38	0.20	0.16	270
Carbon Tetrachloride	µg/m^3	0.49	0.67	0.77	0.71	0.80	0.79	0.70	0.87	0.72	0.69	0.99	0.67	0.66	0.69	0.76	0.63	0.70	0.84	0.57	0.56	0.74	0.67	0.63	0.62	0.88	0.52	0.75	0.83	0.82	0.82	0.73	0.82	0.67	0.62	200
Chloromethane	µg/m^3	0.97	1.09	1.29	1.36	1.20	1.10	1.10	1.35	1.20	1.11	1.35	1.11	1.24	1.12	1.04	1.12	1.42	1.29	1.19	1.12	1.53	1.20	1.34	1.38	1.36	1.07	1.49	3.94	1.33	1.71	1.57	1.46	1.44	1.23	1,000
Xylene, *m/p-*	µg/m^3	2.21	5.17	0.38	1.99	0.37	0.27	0.26	2.05	2.24	0.62	0.54	0.31	1.27	0.87	0.52	1.45	0.84	3.00	1.65	0.75	1.29	0.46	1.78	0.14	1.97	0.54	0.67	1.85	2.23	0.34	0.58	2.79	0.38	0.42	9,000
Ethylbenzene	µg/m^3	1.01	1.36	0.19	0.73	0.17	0.13	0.20	0.57	0.82	0.30	0.21	0.16	0.52	0.39	0.21	0.48	0.33	1.03	0.50	0.28	0.31	0.20	0.73	0.07	0.76	0.24	0.28	0.69	0.54	0.16	0.26	1.05	0.17	0.16	40,000
Bromomethane	µg/m^3	ND	ND	ND	0.09	0.05	0.05	ND	0.04	0.07	ND	ND	0.05	0.05	0.03	ND	0.03	0.08	0.05	0.05	ND	0.04	0.03	0.05	0.07	0.07	0.04	0.06	0.07	0.05	0.06	0.05	0.07	0.05	0.07	200
Dichlorobenzene, *p-*	µg/m^3	0.04	0.10	0.06	0.12	ND	0.04	ND	0.11	0.12	ND	ND	0.04	0.08	0.07	ND	0.03	0.07	0.11	0.05	0.04	0.03	0.04	0.14	ND	0.31	0.12	0.04	0.29	0.06	0.04	0.05	0.25	0.05	0.11	10,000
Acetonitrile	µg/m^3	0.34	0.25	0.26	0.26	0.26	0.20	0.19	0.25	0.27	0.42	0.22	0.19	0.32	0.22	0.35	0.15	0.25	0.23	0.53	0.25	0.18	0.21	0.35	0.30	0.28	0.25	0.37	1.76	0.34	0.53	0.49	0.49	0.31	0.28	600
Tetrachloroethylene	µg/m^3	0.18	0.22	0.11	0.34	0.07	0.06	0.09	0.15	0.27	0.07	0.28	0.11	0.23	0.18	0.09	0.09	0.15	0.20	0.13	0.14	0.13	0.09	0.37	0.07	0.58	0.16	0.12	0.90	0.11	0.05	0.09	0.37	0.09	0.13	1,400
Xylene, *o-*	µg/m^3	0.73	1.30	0.16	0.71	0.16	0.10	0.11	0.56	0.85	0.29	0.23	0.15	0.51	0.38	0.21	0.42	0.35	0.99	0.38	0.24	0.33	0.21	0.71	0.05	0.74	0.22	0.32	0.83	0.50	0.15	0.28	1.37	0.19	0.18	9,000
Chloroform	µg/m^3	0.29	ND	0.20	0.41	ND	0.11	0.11	0.35	ND	0.13	0.16	0.12	0.28	ND	0.13	0.18	0.31	1.10	0.19	0.20	0.46	ND	0.33	0.13	0.43	0.30	ND	0.48	0.26	ND	ND	ND	0.13	0.18	500
Dichloromethane	µg/m^3	0.38	0.40	0.27	0.77	0.29	0.22	1.21	0.79	0.70	0.28	0.65	0.94	0.60	0.63	0.28	0.31	0.92	1.21	0.27	0.29	0.80	0.28	0.40	0.22	0.68	0.30	0.33	0.62	0.32	0.25	0.32	0.86	0.34	0.24	2,000
Toluene	µg/m^3	16.0	17.6	0.81	6.59	0.53	0.56	0.73	5.77	7.54	1.79	1.17	0.59	3.73	2.20	1.58	3.17	2.78	9.87	2.04	1.75	10.2	1.13	5.73	0.47	5.09	1.55	1.85	4.86	3.45	0.86	1.65	6.44	0.75	0.85	4,000
Styrene	µg/m^3	0.69	0.63	0.14	1.02	0.07	0.04	0.06	0.19	1.08	0.16	0.10	0.14	0.17	0.20	0.10	0.20	0.20	0.31	0.36	0.11	0.21	0.56	0.39	ND	0.20	0.06	0.24	0.32	0.28	0.18	0.20	0.38	0.16	0.07	9,000
Methyl isobutyl ketone	µg/m^3	0.40	0.37	0.17	0.38	0.11	0.08	0.31	0.20	0.57	0.06	0.16	0.16	1.12	0.48	0.15	0.20	0.23	0.28	0.36	0.20	0.29	0.19	0.46	0.25	0.51	0.23	0.29	0.30	0.39	0.42	0.32	0.43	0.18	0.21	30,000
Carbon Disulfide	µg/m^3	0.03	0.03	0.02	0.05	0.03	0.04	0.02	0.04	0.10	0.07	0.04	0.07	0.04	0.03	0.04	0.07	0.05	0.04	0.09	0.02	0.02	0.03	0.04	0.06	0.07	0.02	0.02	0.10	0.06	0.03	0.04	0.05	0.02	0.05	7,000
Methyl Chloroform	µg/m^3	0.05	0.07	0.05	0.08	0.05	0.04	ND	0.05	0.07	0.04	0.06	0.07	0.08	0.05	0.04	0.04	0.07	0.07	0.07	0.03	0.05	0.04	0.07	0.04	0.09	0.03	0.06	0.04	0.07	0.07	0.05	0.09	0.05	0.08	10,000
Vinyl chloride	µg/m^3	0.25	2.07	ND	0.29	ND	ND	ND	0.04	0.03	1.40	ND	0.01	0.03	ND	0.18	0.05	0.08	0.20	0.18	1.01	0.18	ND	0.12	ND	0.11	0.02	ND	0.05	0.29	ND	ND	0.13	0.03	ND	1,000
Methyl tert-Butyl Ether	µg/m^3	3.08	3.86	ND	1.35	ND	ND	ND	0.35	0.35	ND	ND	ND	0.43	ND	0.07	0.50	1.17	3.55	0.12	0.11	1.58	ND	0.88	ND	ND	ND	ND	0.21	2.36	ND	ND	2.34	ND	ND	7,000
Acrylonitrile	µg/m^3	ND	ND	ND	ND	ND	ND	ND	ND	1.47	ND	ND	ND	0.84	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.40	ND	ND	0.18	ND	ND	ND	0.48	200
Trichloroethylene	µg/m^3	0.06	ND	ND	0.13	ND	ND	ND	ND	0.12	ND	ND	0.04	ND	0.07	ND	0.04	0.07	0.06	0.05	ND	0.06	ND	0.07	ND	0.14	ND	ND	0.39	0.05	ND	ND	0.13	ND	ND	10,000
Trichloroethane, 1,1,2-	µg/m^3	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.08	ND	ND	ND	ND	0.07	0.21	ND	ND	ND	ND	ND	ND	ND	0.13	ND	ND	0.08	ND	ND	440
Hexachloro-1,3-butadiene	µg/m^3	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.04	ND	ND	ND	ND	ND	ND	0.05	ND	ND	ND	ND	ND	0.12	ND	ND	ND	0.05	ND	ND	0.05	ND	0.11	320
Tetrachloroethane, 1,1,2,2-	µg/m^3	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.06	0.03	ND	0.05	ND	0.08	120
Dichloropropane, 1,2-	µg/m^3	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.06	ND	ND	ND	ND	200
Methyl Methacrylate	µg/m^3	0.72	0.30	ND	0.50	ND	ND	0.05	ND	ND	ND	ND	ND	0.12	ND	ND	0.88	0.14	ND	0.12	0.23	0.08	ND	0.53	ND	0.39	ND	ND	ND	0.66	0.07	ND	0.43	ND	ND	7,000
Trichlorobenzene, 1,2,4-	µg/m^3	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.02	ND	0.03	ND	0.03	ND	ND	0.04	ND	ND	ND	ND	ND	ND	ND	ND	0.67	ND	ND	ND	ND	ND	ND	2,000
Bromoform	µg/m^3	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.06	ND	ND	ND	ND	ND	0.06	0.05	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.06	0.09	0.06	0.07	ND	0.14	6,400
Chlorobenzene	µg/m^3	ND	0.06	ND	0.11	ND	ND	ND	0.17	0.12	ND	ND	ND	ND	ND	ND	ND	0.14	0.43	0.04	ND	0.08	ND	ND	ND	0.09	ND	ND	1.25	0.08	0.04	ND	0.06	ND	0.06	10,000
Dichloroethane, 1,1-	µg/m^3	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.06	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	4,400
Ethyl Acrylate	µg/m^3	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.33	ND	ND	ND	ND	ND	7,000
Chloroethane	µg/m^3	0.05	ND	ND	ND	ND	ND	ND	0.06	ND	0.09	ND	ND	ND	ND	ND	ND	0.20	0.17	ND	0.29	0.06	ND	ND	ND	ND	ND	ND	0.08	0.08	ND	ND	ND	ND	ND	40,000
Benzyl Chloride	µg/m^3	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	140
Chloroprene	µg/m^3	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	200
Dichloroethylene, 1,1-	µg/m^3	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	80

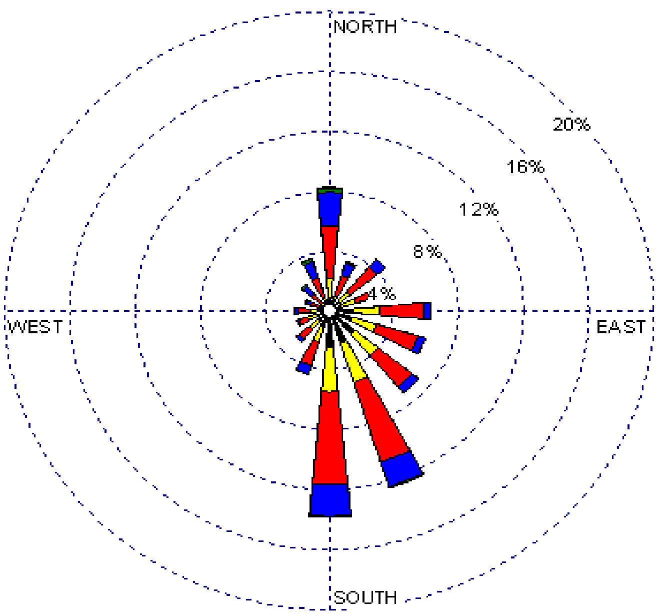
Appendix E. San Jacinto Elementary School Pollutant Concentrations.

Parameter	Units	10/13/2011	10/19/2011	10/25/2011	10/31/2011	11/6/2011	11/12/2011	11/18/2011	11/24/2011	11/30/2011	12/6/2011	12/12/2011	12/18/2011	12/30/2011	1/5/2012	1/11/2012	1/17/2012	1/23/2012	1/29/2012	2/4/2012	2/10/2012	2/16/2012	3/5/2012	3/11/2012	3/17/2012	3/23/2012	3/28/2012	3/29/2012	4/4/2012	4/22/2012	4/28/2012	5/4/2012	5/16/2012	5/22/2012	5/28/2012	Sample Screening Level[a]
Dichloropropylene, *cis* -1,3-	µg/m^3	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	40
Dichloropropylene, trans-1,3-	µg/m^3	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	40
Ethylene dibromide	µg/m^3	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.05	ND	ND	12

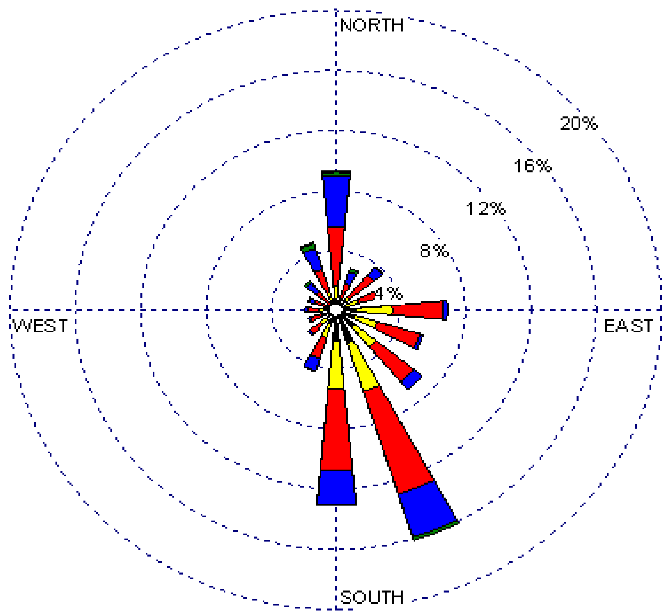
(yellow box)	Key Pollutant
µg/m^3	micrograms per cubic meter
--	No sample was collected for this pollutant on this day or the result was invalidated.
ND	No results of this chemical were registered by the laboratory analytical equipment.

[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.

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



William P. Hobby Airport NWS Station
Composite Hourly Windrose,
1/1/2002-5/31/2012[1]



William P. Hobby Airport NWS Station
Across Sampling Period
(Oct. 13, 2011-May 28 2012)[1]

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