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

I. Executive Summary

- Air monitoring was initially conducted at Temple Elementary School from October 28, 2009 to March 8, 2010 to assess concentrations of acrolein and volatile organic compounds (VOCs) in the air. As provided in the first technical report (http://www.epa.gov/schoolair/pdfs/TempleTechReport.pdf), EPA was not able to use the acrolein data due to concerns about the consistency and reliability of monitoring results of acrolein. (More information is available at http://www.epa.gov/schoolair/acrolein.html). Additional monitoring for acrolein and VOCs was conducted at the same location from October 31, 2011 to December 13, 2011.
- Since the original monitoring, EPA identified several steps that we believe significantly improved the accuracy of acrolein sampling and that provided data that will allow us to understand whether acrolein in the outdoor air may pose a health concern at a particular school. EPA decided to apply these improvements to the acrolein method at the two schools where there was a specific source of acrolein emissions (the other school is Enterprise High School (Enterprise, MS)).
- This school was selected for monitoring based on information indicating the potential for elevated ambient concentrations of acrolein in air outside the school. That information included emissions of acrolein in EPA's 2002 National-Scale Air Toxics Assessment (NATA) for a nearby lumber, fiberboard and particleboard manufacturing complex. Acrolein emissions from this facility have decreased significantly since 2002. Due to reasons unrelated to this monitoring, the school was recently moved to another location in 2012 which is two miles northeast of the facility.
- Measured values of acrolein and other VOCs indicate no influence of the source at the original Temple Elementary School location. Concentrations of acrolein and VOCs are similar to those typically measured in most locations throughout the United States and within the range of estimates without appreciable risk of adverse effects.
- The Texas Commission on Environmental Quality (TCEQ) will continue to oversee industrial facilities in the area through clean air regulatory programs. TCEQ has developed air monitoring comparison values (AMCVs) for acrolein and many other air toxic pollutants which can be found at http://www.tceq.texas.gov/toxicology/AirToxics.html. In addition, see the TCEQ

acrolein development support document (DSD) at
http://www.tceq.texas.gov/toxicology/dsd/final.html.

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

This school was selected for monitoring because we were interested in evaluating the ambient concentrations of acrolein in air outside the school due to emissions of this pollutant in EPA's 2002 NATA analysis for a nearby lumber, fiberboard and particleboard manufacturing complex (Figure 1).

Initial VOC data were collected between October 28, 2009 and March 8, 2010. All VOC results from this sampling with the exception of acrolein were evaluated for health concerns. Measured values for all other VOC compounds and their associated concentrations were below levels of significant concern. Results of a short-term laboratory study conducted in 2010 raised questions about the consistency and reliability of monitoring results of acrolein. As a result, EPA did not use the acrolein data from this initial sampling event. The EPA worked on several different techniques to improve the quality of the current acrolein method. Once these improvements were made, EPA decided to conduct additional monitoring for acrolein and VOCs at this school because there is a stationary source which emits acrolein. Sampling was conducted at the same location from October 31, 2011 to December 13, 2011. Concentrations of acrolein and VOCs are similar to those typically measured in most locations throughout the United States and within the range of estimates without appreciable risk of adverse effects. [1] Due to reasons unrelated to this monitoring, the school was recently moved to another location in 2012 which is two miles northeast of the facility.

III. Acrolein Method Improvement

The current methodology for the sampling and analysis of acrolein is EPA Compendium method TO-15. Improvements to the methodology to minimize bias, positive or negative, have been employed for the School Air Toxics re-monitoring plan. These improvements included several actions to ensure the data would be useable for SAT evaluation. EPA used a specific type of canister (fused silica lined) which was less likely to allow chemicals to react within the canister. Then each canister was tested for a period of 3 weeks after being cleaned and prior to being used in the field to ensure no positive bias of acrolein (pollutants reacting to create more acrolein). In addition, canisters were spiked with a known concentration of acrolein and tested for acrolein over a 3 week period to quantify determine how much of the acrolein might react and form another compound resulting in less measurable acrolein in the canister or a negative bias. Additional quality assurance steps were also employed to ensure the quality of data for the re-monitoring. The result of these improvements yielded high quality data and provided increased confidence in the acrolein measurements.

[1] Ambient acrolein data reported to EPA from 2003-2011 for over 9,900 measurements had a mean of 0.894 $\mu g/m^3$.

Sampling methodologies for TO-15 without the improvements described above can be found in the monitoring plan (http://www.epa.gov/schoolair/techinfo.html).[2]

IV. Monitoring Results and Analysis

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

- Concentrations of acrolein and VOCs are similar to those typically measured in most locations throughout the United States and within the range of estimated levels without appreciable risk of adverse effects.[1]

Acrolein, the key pollutant:

- The longer-term concentration estimate for acrolein is within the range of long-term concentrations estimated to be without appreciable risk of adverse health effects and all acrolein measurements are below the acrolein sample screening level (Figure 2).
  - → The longer-term concentration estimate for acrolein falls between the SAT noncancer-based comparison level (based on the EPA Reference Concentration or RfC) and a more recent comparable level derived by the California EPA (Cal-EPA).[3] The Cal-EPA Reference Exposure Level (REL) is based on more recent information than that on which the EPA RfC is based.[4]
    - ▪ The EPA RfC is defined as an estimated continuous (24 hours-per-day daily) exposure concentration considered likely to be without adverse effects over a lifetime. The EPA RfC is set well below a level associated with health effects.

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

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

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

- Since the EPA RfC was derived, the California EPA has derived a chronic REL based on more recently available information on acrolein and its effects. The Cal-EPA REL, which is 0.35 µg/m^3, is also well below a level associated with effects in the more recently available study.

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 from both sampling events indicate low levels of other VOCs monitored, with longer-term concentration estimates for these HAPs below their long-term comparison levels (Appendix A). Additionally each individual measurement for these pollutants is below the individual sample screening level[5] for that pollutant (Appendix B).

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 other air toxics and the associated longer-term concentration estimates do not pose significant concerns for cumulative health risk from these pollutants (Appendix A).[6]

A. Wind and Other Meteorological Data

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

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

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

[6] 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

The meteorological station at Temple Elementary School collected wind speed and wind direction measurements during the initial monitoring event from August 18, 2009 through March 11, 2010, and was initiated during the second monitoring event on October 31, 2011. Unfortunately, the met station did not collect data after the October 31 sampling, so we have used data from the closest NWS instead which is at Angelina County Airport in Diboll, TX. This station is approximately 4.4 miles northeast of the school. Measurements taken at that station include wind, temperature, and precipitation. This data are presented in Table 1 and Figure 3. We have also included composite wind data in Figure 4 which includes the met data over both periods of monitoring.

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

- While sampling results for the key pollutant acrolein are not being evaluated, the sampling results for several of the other pollutants monitored 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 sampling days are similar to those observed during the entire sampling period.
- Our ability to provide a confident characterization of the wind flow patterns at the monitoring site over the long-term is limited as the wind flow patterns at the NWS site at the Angelina County Airport are only somewhat similar to those at the school location.
- We lack long-term wind data at the monitoring site, and the wind patterns at the NWS site during the sampling period are not similar to the historical long-term wind flow pattern at that location. This suggests that, on a regional scale, the 5-month sampling period may not be representative of year-round wind patterns.

- What is the direction of the key source of acrolein emissions in relation to the school location?
  - → The nearby industrial facility emitting the key pollutant into the air (described in section II above) lies less than one mile north of the school.
  - → Using the property boundaries of the full facility (in lieu of information regarding the location of specific sources of acrolein emissions at the facility), we have identified an approximate range of wind directions to use in considering the potential influence of this facility on air concentrations at the school.
  - → This general range of wind directions, from approximately 326-34 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?
  - → There were 9 days out of 10 sampling days in which a portion of the winds were from the expected ZOI (Figure 3).

- How do wind patterns on the air monitoring days compare to those across the complete monitoring period and what might be expected over the longer-term at the school location?

  → Wind patterns across the air monitoring days appear to be more frequently from the source than those observed over the nine year composite period of the nearest NWS.

  → We note that wind patterns at the nearest NWS station at Angelina County Airport during the initial sampling period were somewhat similar to on-site wind patterns at the school. Due to failure of the met station in the second round of monitoring the only data we have is from the NWS which in general shows winds primarily from the southeast over the long-term (2002-2010; Figure 4). Therefore, there is some uncertainty as to whether the general wind patterns at the school location for longer periods would be similar to the general wind patterns at the Angelina County Airport.

V. Key Source Information

- Was the source operating as usual during the monitoring period?
  - The nearby source of acrolein is a manufacturing complex that consists of three facilities including lumber processing, fiberboard and particleboard manufacture. The complex has an air permit issued by the TCEQ that includes operating requirements.[7]
  - Acrolein emissions from the key source have decreased significantly from the estimate relied upon in previous modeling analyses for this area (2002 NATA). The 2002 NATA emissions estimate of approximately 13 tons per year is consistent with the TRI emissions from 1996 to 2006. Information from 2011 indicates that a little over 4 tons of acrolein were emitted from the manufacturing complex over the year.

VI. Integrated Summary and Next Steps

A. Summary of Key Findings

1. What is the key HAP for this school?

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

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

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

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

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

   - → Based on longer-term air conditions at the nearest NWS, we would expect that air concentrations in the vicinity of the school would not be higher than indicated by results here. The nearest NWS indicates predominant winds from the southeast which would be from the school towards the facility.

B. Next Steps for Key Pollutants

- Based on the analysis described here, EPA will not extend air toxics monitoring at this location.
- EPA has identified several simple steps that we believe have significantly improved the accuracy of acrolein sampling. EPA plans to further improve the method for measuring acrolein.
- The Texas Commission on Environmental Quality (TCEQ) will continue to oversee industrial facilities in the area through clean air regulatory programs.

VII. Figures and Table

A. Tables

1. Temple Elementary School Key Pollutant Concentrations (Acrolein) and Meteorological Data.

B. Figures

1. Temple Elementary School and Source of Interest
2. Temple Elementary School – Key Pollutant (Acrolein) Analysis
3. Temple Elementary School (Diboll, TX) Acrolein Concentration and Wind Information
4. Temple Elementary School: Composite Wind Data

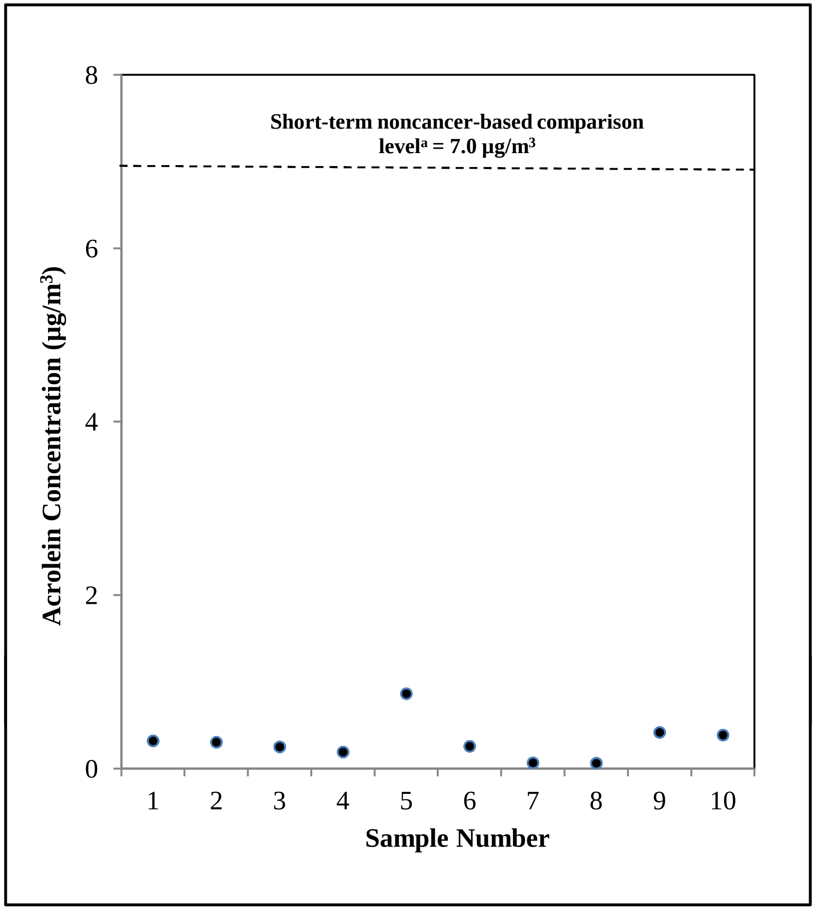
VIII. Appendix

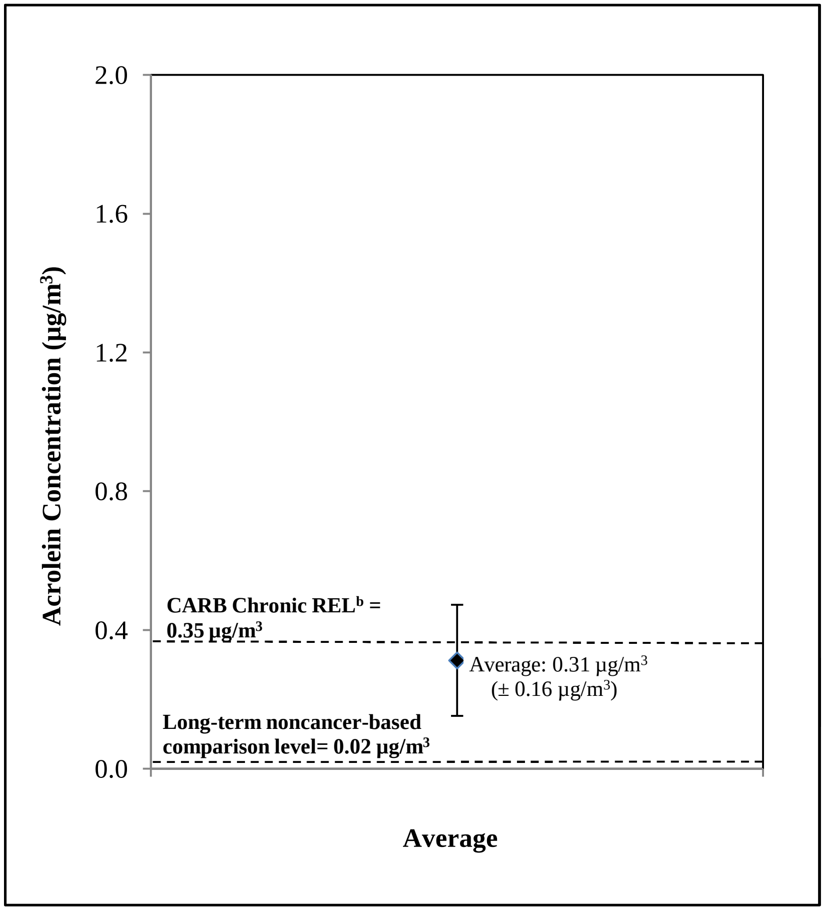
A. Analysis of Other (non-key) Air Toxics Monitored at the School and Multiple-pollutant Considerations.

B. Enterprise High School Pollutant Concentrations.

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

Figure 2. Temple Elementary School - Key Pollutant (Acrolein) Analysis.

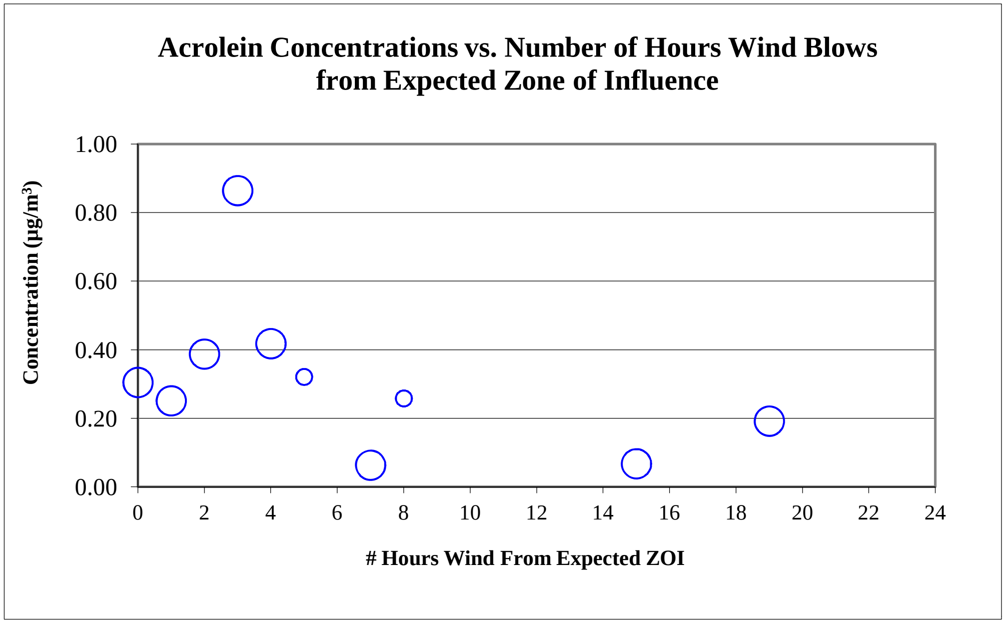


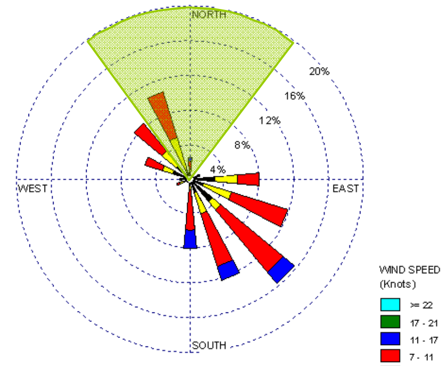


[a] The individual sample screening levels and their use is summarized on the web site and described in detail in Schools Air Toxics Monitoring Activity (2009), "Uses of Health Effects Information in Evaluating Sample Results", see http://www.epa.gov/schoolair/pdfs/UsesOfHealthEffectsInfoinEvalSampleResults.pdf.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

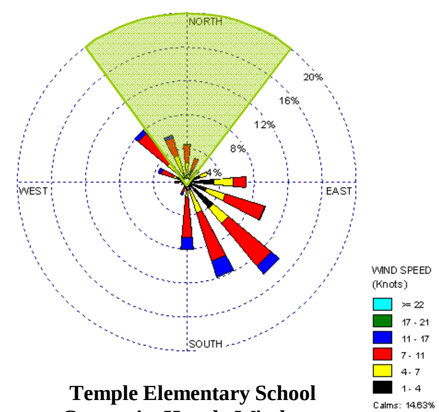
[b] California Air Resources Board Chronic Reference Exposure Level. See http://www.oehha.ca.gov/air/toxic_contaminants/pdf_zip/Acrolein_postSRP3.pdf

Figure 3. Temple Elementary School (Diboll, TX) Acrolein Concentration and Wind Information.





Temple Elementary School Composite Hourly Windrose on Sample Days (Oct. 31, 2011 - Dec. 13, 2011)



Temple Elementary School Composite Hourly Windrose Across Sampling Period (Oct. 31, 2011 - Dec. 13, 2011)

Expected Zone of Source Influence

KEY

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

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 1). The expected zone of source influence is a rough approximation of the range of directions from which winds carrying chemicals emitted by the key source may originate.

Table 1. Temple Elementary School Key Pollutant Concentrations (Acrolein) and Meteorological Data.

Parameter	Units	10/31/2011	11/1/2011	11/7/2011	11/8/2011	11/14/2011	11/15/2011	12/5/2011	12/6/2011	12/12/2011	12/13/2011
Acrolein	$\mu g/m^3$	0.321	0.305	0.251	0.192	0.865	0.258	0.067	0.063	0.418	0.387
% Hours w/Wind Direction from Expected ZOI[a]	%	20.8	0.0	4.2	79.2	12.5	33.3	63	29	16.7	8.3
Wind Speed (avg. of hourly speeds)	mph	3.9	8.5	12.0	7.1	7.4	3.8	7.2	6.0	6.3	7.9
Wind Direction (avg. of unitized vector)[b]	deg.	118.6	142.1	146.2	338.8	160.5	325.1	326.4	309.1	92.5	110.2
% of Hours with Speed below 2 knots	%	41.7	0.0	4.2	25.0	12.5	29.2	0.0	12.5	12.5	4.2
Daily Average Temperature	° F	58.5	65.1	73.4	57.0	72.3	66.8	39.9	35.4	56.0	63.6
Daily Precipitation	inches	0.00	0.02	0.08	1.39	0.06	0.80	0.04	0.00	0.00	0.00

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

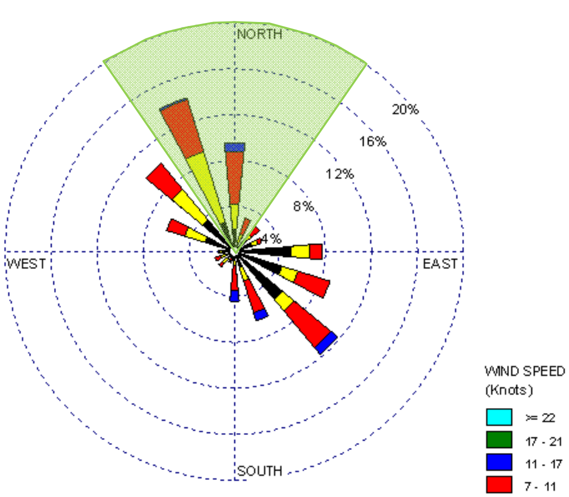
(yellow) All precipitation and temperature data were from the Angelina County Airport NWS Station.

(gray) Wind Information was also taken from this NWS Station from 11/1/12 through 12/13/11 due to instrument failure at the school.

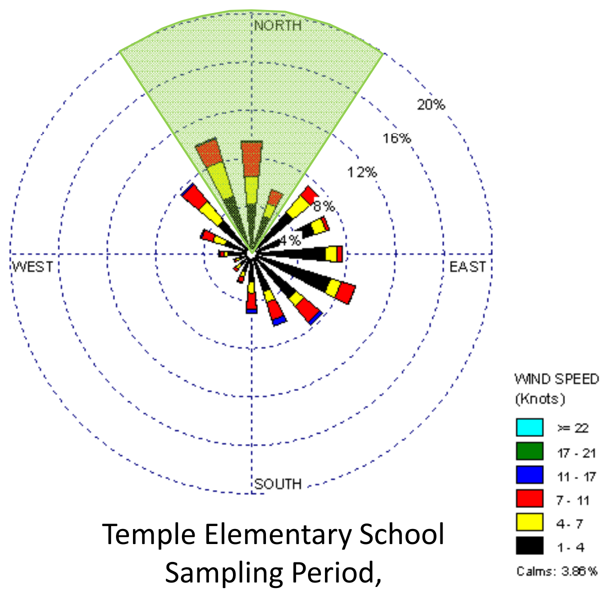
[a] Based on count of hours for which vector wind direction is from expected zone of influence.

[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).

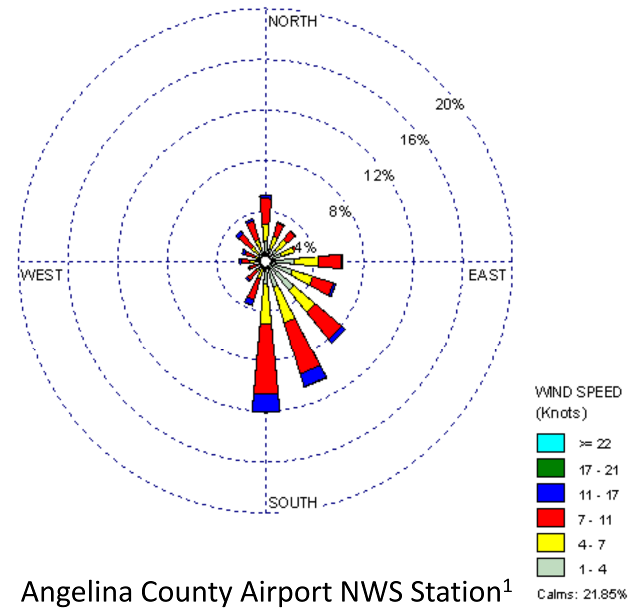
Figure 4. Temple Elementary School: Composite Wind Data



Temple Elementary School
Sample Days,
Oct. 28, 2009-Mar. 8, 2010
Oct. 31, 2011-Dec. 13, 2011



Temple Elementary School
Sampling Period,
Oct. 28, 2009-Mar. 8, 2010
Oct. 31, 2011-Dec. 13, 2011



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

[1] Angelina County Airport NWS Station (WBAN 93987) is 4.37 miles from Temple Elementary School.
Light green shading indicates the Zone of Source Influence (ZOI)

Phase 1 Sampling Results

Parameter	Units	10/28/2009	12/2/2009	12/8/2009	1/7/2010	1/14/2010	1/25/2010	2/1/2010	2/11/2010	2/16/2010	2/22/2010	3/1/2010	3/8/2010
% Hours w/Wind Direction from Expected ZOI[a]	%	0.0	50.0	41.7	79.2	0.0	25.0	8.3	50.0	50.0	79.2	83.3	0.0
Wind Speed (avg. of hourly speeds)	mph	4.0	5.0	6.3	9.5	3.0	3.0	2.1	6.0	4.0	7.7	7.5	8.2
Wind Direction (avg. of unitized vector)[b]	deg.	120.4	324.9	284.0	353.3	100.4	315.4	87.5	24.8	328.9	10.2	347.8	179.1
% of Hours with Speed below 2 knots	%	16.7	8.3	12.5	4.2	16.7	62.5	62.5	0.0	50.0	0.0	4.2	0.0

Phase 2 Sampling Results

Parameter	Units	10/31/2011	11/1/2011	11/7/2011	11/8/2011	11/14/2011	11/15/2011	12/5/2011	12/6/2011	12/12/2011	12/13/2011
Acrolein	µg/m^3	0.321	0.305	0.251	0.192	0.865	0.258	0.067	0.063	0.418	0.387
% Hours w/Wind Direction from Expected ZOI[a]	%	20.8	0.0	4.2	79.2	12.5	33.3	63	29	16.7	8.3
Wind Speed (avg. of hourly speeds)	mph	3.9	8.5	12.0	7.1	7.4	3.8	7.2	6.0	6.3	7.9
Wind Direction (avg. of unitized vector)[b]	deg.	118.6	142.1	146.2	338.8	160.5	325.1	326.4	309.1	92.5	110.2
% of Hours with Speed below 2 knots	%	41.7	0.0	4.2	25.0	12.5	29.2	0.0	12.5	12.5	4.2

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

Appendix A. 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).[8] 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 A-1).

Other Air Toxics (HAPs):

- Do the monitoring data indicate elevated levels of any other air toxics or hazardous air pollutant (HAPs) that pose significant long-term health concerns?
  - → Longer-term concentration estimates for the other HAPs monitored are below their long-term comparison levels.
    - Further, for pollutants with cancer-based comparison levels, longer-term concentration estimates for all but three (benzene, carbon tetrachloride, and 1,3-butadiene) are more than 100-fold lower.[9]
  - → 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.[10]

Additional Information on Three HAPs:

- The first HAP mentioned above is benzene. The mean and 95 percent upper bound on the mean for benzene are approximately 5-6% of the cancer-based comparison level. A review of information available at other sites nationally shows that the mean concentration of benzene at this site is between the 25th to 50th percentile of samples collected from 2003 to 2010 (the most recently compiled period) at the NATTS sites (Appendix C).

[8] 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.

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

[10] 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.*

- The second HAP mentioned above is carbon tetrachloride. The mean and 95 percent upper bound on the mean for carbon tetrachloride are approximately 3% of the cancer-based comparison level. A review of information available at other sites nationally shows that the mean concentration of carbon tetrachloride at this site is between the 25^{th} to 50^{th} percentile of samples collected from 2003 to 2010 (the most recently compiled period) at the NATTS sites (Appendix C). 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 1,3-butadiene. The mean and 95 percent upper bound on the mean for 1,3-butadiene 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 1,3-butadiene at this site is below the 50^{th} percentile of samples collected from 2003 to 2010 (the most recently compiled period) at the NATTS sites (Appendix C).

<u>Multiple Pollutants:</u>

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.[11]

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

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

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

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

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

Table A-1. Temple 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					
Benzene	µg/m^3	0.601	0.424 - 0.778	13	30
Carbon Tetrachloride	µg/m^3	0.491	0.478 - 0.503	17	100
Butadiene, 1,3-	µg/m^3	0.033	0 - 0.069	3.3	2
Chloromethane	µg/m^3	0.829	0.744 - 0.914	NA	90
Ethylbenzene	µg/m^3	0.232	0.186 - 0.279	40	1000
Xylene, *m/p*-	µg/m^3	0.467	0.294 - 0.641	NA	100
Xylene, *o*-	µg/m^3	0.240	0.182 - 0.299	NA	100
Tetrachloroethylene	µg/m^3	0.094	0.077 - 0.111	380	40
Chloroform	µg/m^3	0.038	0.026 - 0.050	NA	98
Dichloromethane	µg/m^3	0.152	0.140 - 0.163	5900	600
Toluene	µg/m^3	0.696	0.494 - 0.899	NA	5000
Methyl isobutyl ketone	µg/m^3	0.152	0.073 - 0.231	NA	3000
Non-Key HAPs with more than 50% ND Results.					
Trichloroethylene	µg/m^3	80% of the results were ND[e]		NA	20
No other HAPs were detected in any other samples.					

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

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

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

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

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

[e] Trichloroethylene was detected in only 2 of 10 samples, ranging from 0.0027 to 0.0046 µg/m^3. The MDL is 0.0645 µg/m^3.

Appendix B. Temple Elementary School Pollutant Concentrations.

Parameter	Units	10/31/2011	11/1/2011	11/7/2011	11/8/2011	11/14/2011	11/15/2011	12/5/2011	12/6/2011	12/12/2011	12/13/2011	Sample Screening Level[a]
Acrolein	µg/m^3	0.321	0.305	0.251	0.192	0.865	0.258	0.067	0.063	0.418	0.387	7
Ethylene dibromide[b]	µg/m^3	0.122	0.119	0.122	0.122	0.120	0.121	0.118	0.118	0.105	0.108	12
Tetrachloroethane, 1,1,2,2-[b]	µg/m^3	0.107	0.106	0.106	0.108	0.107	0.104	0.105	0.105	0.091	0.095	120
Benzene	µg/m^3	0.825	0.814	0.387	0.357	0.638	0.372	0.499	0.401	1.115	0.605	30
Carbon Tetrachloride	µg/m^3	0.511	0.522	0.520	0.481	0.492	0.501	0.527	0.537	0.504	0.491	200
Ethylene dichloride[b]	µg/m^3	0.075	0.084	0.059	0.055	0.062	0.056	0.070	0.070	0.118	0.111	270
Butadiene, 1,3-	µg/m^3	0.119	0.032	ND	ND	ND	0.008	0.013	0.003	0.139	0.016	20
Dichloropropane, 1,2-[b]	µg/m^3	0.010	0.023	0.025	0.029	0.019	0.027	0.015	0.412	ND	0.055	200
Chloromethane	µg/m^3	0.758	0.728	0.805	0.855	0.931	1.113	0.720	0.727	0.805	0.850	1,000
Ethylbenzene	µg/m^3	0.328	0.190	0.209	0.187	0.348	0.193	0.181	0.186	0.302	0.199	40,000
Xylene, *m/p*-	µg/m^3	0.813	0.338	0.301	0.331	0.949	0.371	0.282	0.294	0.664	0.330	9,000
Xylene, *o*-	µg/m^3	0.367	0.194	0.189	0.194	0.390	0.204	0.178	0.180	0.313	0.195	9,000
Tetrachloroethylene	µg/m^3	0.115	0.085	0.066	0.086	0.074	0.136	0.071	0.130	0.092	0.083	1,400
Chloroform	µg/m^3	0.081	0.041	0.031	0.031	0.024	0.025	0.028	0.032	0.050	0.034	500
Dichloromethane	µg/m^3	0.137	0.141	0.157	0.123	0.148	0.142	0.176	0.176	0.159	0.157	2,000
Toluene	µg/m^3	1.015	0.994	0.629	0.405	0.990	0.493	0.393	0.470	1.084	0.491	4,000
Methyl isobutyl ketone	µg/m^3	0.113	0.106	0.118	0.117	0.148	0.136	0.097	0.098	0.119	0.467	30,000
Trichloroethylene	µg/m^3	ND	0.0027	ND	ND	ND	ND	ND	ND	ND	0.0046	10,000
Vinyl chloride	µg/m^3	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1,000

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

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

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

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

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

Key Pollutant

/m^3 micrograms per cubic meter

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

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

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