SAT Initiative: Lapwai High School (Lapwai, Idaho)

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

I. Executive Summary

- Air monitoring has been conducted at Lapwai High School as part of the EPA initiative to monitor specific air toxics in the outdoor air around priority schools in 22 states and 2 tribal areas.
- This school was selected for monitoring based on information indicating the potential for elevated ambient concentrations of acetaldehyde, benzene, 1,3-butadiene, and acrolein in air outside the school. The Nez Perce Tribe recommended this school to assess potential air quality impacts from a nearby highway located to the east of the school.
- Air monitoring was performed from September 16, 2009 through December 9, 2009 for the following pollutants: acetaldehyde and other carbonyls; benzene, 1,3-butadiene, acrolein, and other volatile organic compounds (VOC); and metals in particulate matter less than 10 microns (PM_{10}).
- Measured levels of acetaldehyde, benzene, and 1,3-butadiene and associated longer-term concentration estimates are not as high as suggested by the information available prior to monitoring. Although they were below the levels of significant concern that had been suggested, these results indicate the influence of mobile source pollutants that are the focus of EPA actions nationwide.
- Even though this is a rural area, the school is located near US Highway 95. Acetaldehyde, benzene, and 1,3-butadiene are common in the outdoor air where mobile sources such as cars and other motor vehicles and off-road machinery may be found. Levels of acetaldehyde, benzene, and 1,3-butadiene in many such areas can be elevated. EPA remains concerned about mobile source emissions and continues to work to reduce those emissions across the country, through national rules and by providing information and suggestions to assist with reductions in local areas (http://www.epa.gov/schoolair/mobile.html).
- Sample set data from the School Air Toxics Monitoring project (SAT) may not be indicative of concentrations under all seasons. In a year-long EPA Community-Scale Air Toxics Monitoring study conducted by the Nez Perce Tribe during 2006-2007, the acetaldehyde and formaldehyde concentrations exhibited a seasonal pattern reflecting air temperature and were probably related to secondary formation during warm summer months. Since the SAT sampling occurred during the winter period, the SAT sampling may under-estimate the ambient concentrations of acetaldehyde and formaldehyde during other times of the year in Lapwai.

- EPA will not use the acrolein data in evaluating the potential for health concerns from exposure to air toxics in outdoor air as part of the School Air Toxics Monitoring project (SAT). The Agency made this determination after results of a short-term laboratory study raised questions about the consistency and reliability of monitoring results of acrolein. (More information is available at http://www.epa.gov/schoolair/acrolein.html).
- Based on the analysis described here, EPA will not extend air toxics monitoring at this school. However, EPA's ongoing research and national air toxics monitoring programs will continue to collect information on mobile source impacts on outdoor air nationally.
- The Nez Perce Tribe's ERWM Air Quality Program has identified two priority areas for further study. The first is to monitor during warm summer months using real time PTR-MS to quantify aldehyde precursors from biogenic and anthropogenic sources to identify contributions to elevated summer carbonyl concentrations. A second priority is to quantify concentrations during inversion events. Results will add to the understanding of atmospheric aldehyde chemistry.

II. Background on this Initiative

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

- The schools selected for monitoring included some schools that are near large industries that are sources of air toxics, and some schools that are in urban areas, where emissions of air toxics come from a mix of large and small industries, cars, trucks, buses and other sources.
- With assistance from two tribal air quality programs EPA also selected schools in two tribal areas where there was an interest in understanding the potential impact of air toxics at schools located within tribal areas.
- Monitors were placed at each school for approximately 60 days, and took air samples on at least 10 different days during that time. The samples were analyzed for specific air toxics identified for monitoring at the school (i.e., key pollutants).[1]
- These monitoring results and other information collected at each school during this initiative allow us to:
  - assess specific air toxics levels occurring at these sites and associated estimates of longer-term concentrations in light of health risk-based criteria for long-term exposures,
  - better understand, in many cases, potential contributions from nearby sources to key air toxics concentrations at the schools,
  - consider what next steps might be appropriate to better understand and address air toxics at the school, and

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

– improve the information and methods we will use in the future (e.g., NATA) for estimating air toxics concentrations in communities across the U.S.

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

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

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

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

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

This school was selected for monitoring in consultation with the Nez Perce Tribe. Lapwai High School was one of several schools selected to represent geographically distributed areas near heavily travelled roadways. We were interested in evaluating the ambient concentrations of acetaldehyde, benzene, 1,3-butadiene, and acrolein, four key mobile source air toxics, in air outside the Lapwai High School. The Tribe recommended this school as closest to the source of interest, which is US Highway 95 located to the east of the school (Figure 1).

Monitoring commenced at this school on September 16, 2009 and continued through December 9, 2009. During this period, thirteen volatile organic compound (VOC) samples, fourteen carbonyl samples, and thirteen metal samples of airborne pollutants were collected using a PM_{10} sampler.[4] These samples were analyzed for the key pollutants and other air toxics at this school.

All VOC results with the exception of acrolein were evaluated for health concerns. Results of a recent short-term laboratory study have raised questions about the consistency and reliability of monitoring results of acrolein. As a result, EPA will not use these acrolein data in evaluating the potential for health concerns from exposure to air toxics in outdoor air as part of the School Air Toxics Monitoring project (SAT) (http://www.epa.gov/schoolair/acrolein.html). Sampling

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[2] For example, http://www.epa.gov/schoolair/pollutants.html, http://www.epa.gov/ttn/fera/risk_atoxic.html.
[3] For example, http://www.epa.gov/ttn/atw/3_90_022.html, http://www.epa.gov/ttn/atw/3_90_024.html.
[4] In general, this sampler collects airborne particles with a diameter of 10 microns or smaller, more of which would be considered to be in the respirable range which is what the health-based comparison levels are based on.

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

IV. Monitoring Results and Analysis

A. Background for the SAT Analysis

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

The primary objective of this initiative is to investigate - through monitoring air concentrations of key air toxics at each school over a 2-3 month period - whether levels measured and associated longer-term concentration estimates are of a magnitude, in light of health risk-based criteria, for which follow-up activities may need to be considered. To evaluate the monitoring results consistent with this objective, we developed health risk-based air concentrations (the long-term comparison levels summarized in Appendix A) for the monitored air toxics using established EPA methodology and practices for health risk assessment[7] and, in the case of cancer risk, consistent with the implied level of risk considered in identifying schools for monitoring. Consistent with the long-term or chronic focus of the modeling analyses, based on which these schools were selected for monitoring, we have analyzed the full record of concentrations of air toxics measured at this school, using routine statistical tools, to derive a 95 percent confidence

[5] Tribal staff operated the monitors and sent the filters, cartridges, and canisters to the analytical laboratory under contract to EPA.

[6] The term hazardous air pollutants (commonly called HAPs or air toxics) refers to pollutants identified in section 112(b) of the Clean Air Act which are the focus of regulatory actions involving stationary sources described by CAA section 112 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.

[7] While this EPA initiative will rely on EPA methodology, practices, assessments and risk policy considerations, we recognize that individual agency methods, practices and policies may differ and subsequent analyses of the monitoring data by these agencies may draw additional or varying conclusions.

interval[8] for the estimate of the longer-term average concentration of each of these pollutants. In this project, we are reporting all actual numerical values for pollutant concentrations including any values below method detection limit (MDL).[9] Additionally, a value of 0.0 is used when a measured pollutant has no value detected (ND). The projected range for the longer-term concentration estimate for each chemical (most particularly the upper end of the range) is compared to the long-term comparison levels. These long-term comparison levels conservatively presume continuous (all-day, all-year) exposure over a lifetime. The analysis of the air concentrations also includes a consideration of the potential for cumulative multiple pollutant impacts.[10] In general, where the monitoring results indicate estimates of longer-term average concentrations that are above the comparison levels - i.e., above the cancer-based comparison levels or notably above the noncancer-based comparison levels - we will consider the need for follow-up actions such as:

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

We have further analyzed the dataset to describe what it indicates in light of some other criteria and information commonly used in prioritizing state, tribal, local and national air toxics program activities. State, tribal, local and national programs often develop long-term monitoring datasets in order to better characterize pollutants near particular sources. The 2-3 month dataset developed under this initiative will be helpful to those programs in setting priorities for longer-term monitoring projects. The intent of this analysis is to make this 2-3 month monitoring dataset as useful as possible to state, tribal, local and national air toxics programs in their longer-term efforts to improve air quality nationally. To that end, this analysis:

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[8] When data are available for only a portion of the period of interest (e.g., samples not collected on every day during this period), statisticians commonly calculate the 95% confidence interval around the dataset mean (or average) in order to have a conservative idea of how high or low the "true" mean may be. More specifically, this interval is the range in which the mean for the complete period of interest is expected to fall 95% of the time (95% probability is commonly used by statisticians). The interval includes an equal amount of quantities above and below the sample dataset mean. The interval that includes these quantities is calculated using a formula that takes into account the size of the dataset (i.e., the 'n') as well as the amount by which the individual data values vary from the dataset mean (i.e., the "standard deviation"). This calculation yields larger confidence intervals for smaller datasets as well as ones with more variable data points. For example, a dataset including {1.0, 3.0, and 5.0}, results in a mean of 3.0 and a 95% confidence interval of 3.0 +/- ~5 (or -2.0 to 8.0). For comparison purposes, a dataset including {2.5, 3 and 3.5} results in a mean of 3.0 and a 95% confidence interval of 3.0 +/- ~1.2 (or 1.8 to 4.2). The smaller variation within the data in the second set of values causes the second confidence interval to be smaller.

[9] Method detection limit (MDL) is the minimum concentration of a substance that can be measured and reported with 99% confidence that the pollutant concentration is greater than zero and is determined from the analysis of a sample in a given matrix containing the pollutant.

[10] As this analysis of a 2-3 month monitoring dataset is not intended to be a full risk assessment, consideration of potential multiple pollutant impacts may differ among sites. For example, in instances where no individual pollutant appears to be present above its comparison level, we will also check for the presence of multiple pollutants at levels just below their respective comparison levels (giving a higher priority to such instances).

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

B. Chemical Concentrations

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

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

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

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

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

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

- Acetaldehyde, benzene, and 1,3-butadiene levels measured over the 3-month sampling period and associated longer-term concentration estimates at this school were not as high as suggested information prior to monitoring. Although they were below the levels of significant concern that had been suggested, these results indicate the influence of mobile source pollutants of concern that are the focus of EPA actions nationwide.

Acetaldehyde, key pollutant:

Acetaldehyde is one of several air toxics that EPA recognizes as a key pollutant nationally. A large number of people live in areas across the U.S. with elevated ambient concentrations of this pollutant due to mobile sources.[12]

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

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

  - The estimate of longer-term acetaldehyde concentration (i.e., the upper bound of the 95 percent confidence interval on the mean of the dataset) is below both of the long-term comparison levels (Table 1).[13] These comparison levels are based on a consideration of continuous exposure concentrations (24 hours a day, all year, over a lifetime).
  - Further, the longer-term concentration estimate is more than tenfold lower than the cancer-based comparison level, indicating the longer-term estimate is below a continuous (24 hours a day, 7 days a week) lifetime exposure concentration associated with 1-in-100,000 additional cancer risk.

  → Additionally, we did not identify any concerns regarding short-term exposures as each individual measurement is below the individual sample screening level for acetaldehyde (which is based on consideration of exposure all day, every day over a period ranging from a couple of weeks to longer for some pollutants).[11]

[12] Additional information on mobile sources of air toxics is available at http://www.epa.gov/schoolair/mobile.html.
[13] The upper end of the interval is nearly 1.3 times the mean of the monitoring data and less than 20% of the long-term noncancer-based comparison level.

Benzene, key pollutant:

Benzene is one of several air toxics that EPA recognizes as a key pollutant nationally. A large number of people live in areas across the U.S. with elevated ambient concentrations of this pollutant due to mobile sources.[12]

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

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

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

  → Additionally, we did not identify any concerns regarding short-term exposures as each individual measurement is below the individual sample screening level for benzene (which is based on consideration of exposure all day, every day over a period ranging from a couple of weeks to longer for some pollutants).[11]

1,3-Butadiene, key pollutant:

1,3-Butadiene is one of several air toxics that EPA recognizes as a key pollutant nationally. A large number of people live in areas across the U.S. with elevated ambient concentrations of this pollutant due to mobile sources.[12]

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

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

  - The estimate of longer-term 1,3-butadiene concentration (i.e., the upper bound of the 95 percent confidence interval on the mean of the dataset) is below both

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[14] The upper end of the interval is nearly 1.25 times the mean of the monitoring data and less than 6% of the long-term cancer-based comparison level.

of the long-term comparison levels (Table 1).[15] These comparison levels are based on a consideration of continuous exposure concentrations (24-hours a day, all year, over a lifetime).

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

→ Additionally, we did not identify any concerns regarding short-term exposures as each individual measurement is below the individual sample screening level for 1,3-butadiene (which is based on consideration of exposure all day, every day over a period ranging from a couple of weeks to longer for some pollutants).[11]

<u>Other Air Toxics:</u>

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

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

<u>Multiple Pollutants:</u>

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

  → Although the multiple air toxics monitored at this site were below the levels of significant concern for multi-pollutant cumulative risk, these results indicate the influence of multiple mobile source pollutants of concern that are the focus of EPA actions nationwide (Appendix C).[16]

C. Wind and Other Meteorological Data

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

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[15] The upper end of the interval is nearly 1.4 times the mean of the monitoring data and less than 2% of the long-term cancer-based comparison level.

[16] We note that this initiative is focused on investigation for a school-specific set of key pollutants indicated by previous analyses (and a small set of others for which measurements are obtained in the same analysis). Combined impacts of pollutants or stressors other than those monitored in this project are 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.

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

The meteorological station at Lapwai High School collected wind speed and wind direction measurements beginning on September 8, 2009, continuing through the sampling period (September 16, 2009-December 9, 2009), and ending on March 23, 2010. As a result, on-site data for these meteorological parameters are available for all dates of sample collection, and also for a period before and after the sampling period, producing a continuous record of approximately 7 months of on-site meteorological data. The meteorological data collected at the school site on sampling days are presented in Figures 3a-3c and Tables 2a-2b.

The nearest NWS station is at Lewiston-Nez Perce County Airport in Lewiston, ID. This station is approximately 9.5 miles west of the school. A closer meteorological station operated by the Nez Perce Tribe in Lapwai (AQS ID = 160690013), 0.3 mile south of the school, has been operating since 2003. Measurements taken at the closer station include wind, temperature, and precipitation. These are presented in Tables 2a-2b and Appendix E.

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

- Both the sampling results and the on-site wind data indicate that some of the air samples were collected on days when the nearby key source was contributing to conditions at the school location.
- The wind patterns at the monitoring site across sampling dates are somewhat similar to those observed across the record of on-site meteorological data during the sampling period.
- Our ability to provide a confident characterization of the wind flow patterns at the monitoring site over the long-term is somewhat limited; however, the meteorological station operated by the Nez Perce Tribe in Lapwai somewhat appears to represent the specific wind flow patterns at the school location for the same period of time.
- The wind pattern at the Lapwai meteorological station during the sampling period is similar to the historical long-term wind flow pattern at that same meteorological station.

- What is the direction of the key source of acetaldehyde, benzene, and 1,3-butadiene emissions in relation to the school location?

→ The key sources were identified as nearby roadway mobile sources east of the school.
→ Considering the boundaries of the sources of interest, we have determined the range of wind directions to use in considering potential influence of the mobile sources on air concentrations at the school.
→ Due to the location of the school in relation to potential impacts from mobile sources, the range of wind directions, from 10 to 170 degrees, is referred to as the expected zone of influence (ZOI).

- On days the air samples were collected, how often did wind come from direction of the key source?
  → For acetaldehyde, there were 14 out of 14 sampling days in which the on-site wind data had a portion of the winds from the expected ZOI. For benzene and 1,3-butadiene, there were 13 out of 13 sampling days in which the on-site wind data had a portion of the winds from the expected ZOI (Figures 3a-3c, Tables 2a-2b).

- How do wind patterns on the air monitoring days compare to those across the complete monitoring period and what might be expected over the longer-term at the school location?
  → Wind patterns across the air monitoring days appear somewhat similar to those observed over the record of on-site meteorological data during the sampling period.
  → We note that the wind patterns at the nearest meteorological station (in Lapwai) during the sampling period are similar to those recorded at that station over the long-term (2004-2006 period; Appendix E), supporting the idea that regional meteorological patterns in the area during the sampling period were consistent with long-term patterns. However, there is 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 Lapwai meteorological station.

- Are there other meteorological patterns that may influence the measured concentrations at the school monitoring site?
  → We did not observe other meteorological patterns that may influence the measured concentrations at the school monitoring site.

V. Other Air Monitoring in This Community

The Nez Perce Tribe monitored air toxics in Lapwai as part of their EPA Community-Scale Air Toxics Monitoring study during 2006-2007. The monitoring site was located at the Lapwai meteorological station 0.3 mile south of the SAT sampling location. Mean acetaldehyde concentration at the Lapwai site from the EPA Community-Scale Air Toxics Monitoring study was greater than upper end of the 95% confidence interval of the mean in the SAT sampling (2.85 $\mu g/m^3 \pm 0.95\ \mu g/m^3$). In the year-long Community-Scale Air Toxics Monitoring study, the acetaldehyde and formaldehyde concentrations exhibited a seasonal pattern reflecting air temperature and were probably related to secondary formation during warm summer months. In addition, the area is known to have inversions where air stagnates in the lower parts of the valley. Since the SAT sampling occurred during the winter period, the long-term concentration estimated from the SAT sampling likely under-represent the ambient concentration of acetaldehyde and formaldehyde in Lapwai. Average concentrations from the Community-Scale Air Toxics Monitoring study are presented in the table below.

Pollutant	Study Dates	Units	Mean of Measurements	95% Confidence Interval on the Mean
Acetaldehyde	2006-2007	µg/m^3	2.85	1.90 - 3.85
1,3-Butadiene			0.099	0.081 - 0.116
Formaldehyde			3.74	2.69 - 4.79

VI. Key Source Information

- Was mobile source activity typical during the monitoring period?
  → NATA 2005 data indicates that the most recently available county-level acetaldehyde, benzene, and 1,3-butadiene emissions from on-road mobile sources are lower than previous years (2002 NATA).
  - Sample set data from the School Air Toxics Monitoring project (SAT) may not be indicative of concentrations under all seasons. In a year-long EPA Community-Scale Air Toxics Monitoring study conducted by the Nez Perce Tribe during 2006-2007, the acetaldehyde and formaldehyde concentrations exhibited a seasonal pattern reflecting air temperature and were probably related to secondary formation during warm summer months. Since the SAT sampling occurred during the winter period, the SAT sampling may under-estimate the ambient concentrations of acetaldehyde and formaldehyde during other times of the year in Lapwai.

VII. Integrated Summary and Next Steps

A. Summary of Key Findings

1. What are the key HAPs for this school?
   → Acetaldehyde, benzene, 1,3-butadiene, and acrolein are the key HAPs for this school, identified based on emissions information considered in identifying the school for monitoring. Acrolein was not evaluated due to reasons discussed in Section III.

2. Do the data collected at this school indicate an elevated level of concern, as implied by information that led to identifying this school for monitoring?
   → Measured acetaldehyde, benzene, and 1,3-butadiene levels and associated longer-term concentration estimates at this school were not as high as suggested by information prior to monitoring. Although they were below the levels of significant concern, these results indicate the influence of mobile source pollutants of concern that are the focus of EPA actions nationwide.
   → EPA will not use the acrolein data in evaluating the potential for health concerns from exposure to air toxics in outdoor air as part of the SAT Monitoring project. The Agency made this determination after results of a short-term laboratory study raised questions about the consistency and

reliability of monitoring results of acrolein. (More information is available at http://www.epa.gov/schoolair/acrolein.html).

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 SAT data we have collected appear to reflect air concentrations during the entire SAT monitoring period, with no indications from the on-site meteorological data that the sampling day conditions were inconsistent with conditions overall during this period.
   - → The wind flow patterns at the nearest meteorological station in Lapwai during the SAT sampling period appears to be similar to the wind flow pattern at the school. However, this data may not reflect the long term meteorology of the Region.
   - → Sample set data from the SAT may not be indicative of concentrations under all seasons. In a year-long EPA Community-Scale Air Toxics Monitoring study conducted by the Nez Perce Tribe during 2006-2007, the acetaldehyde and formaldehyde concentrations exhibited a seasonal pattern reflecting air temperature and were probably related to secondary formation during warm summer months. Since the SAT sampling occurred during the winter period, the SAT sampling may under-estimate the ambient concentrations of acetaldehyde and formaldehyde during other times of the year in Lapwai.

B. Next Steps for Key Pollutants

1. Based on the analysis described here, EPA will not extend air toxics monitoring at this school.
2. EPA's ongoing research and national air toxics monitoring program will continue to collect information on mobile source impacts on outdoor air nationally. EPA will also continue to work toward reductions in mobile source emissions nationally and to facilitate reductions in local areas (http://www.epa.gov/schoolair/mobile.html).
3. The Nez Perce Tribe's ERWM Air Quality Program has identified two priority areas for further study. The first is to monitor during warm summer months using real time PTR-MS to quantify aldehyde precursors from biogenic and anthropogenic sources to identify contributions to elevated summer carbonyl concentrations. A second priority is to quantify concentrations during inversion events. Results will add to the understanding of atmospheric aldehyde chemistry.

VII. Figures and Tables

A. Tables

1. Lapwai High School – Key Pollutant Analysis.

2a. Lapwai High School Key Pollutant Concentrations (Acetaldehyde) and Meteorological Data.

2b. Lapwai High School Key Pollutant Concentrations (Benzene and 1,3-Butadiene) and Meteorological Data.

B. Figures

1. Lapwai High School Source of Interest.

2a. Lapwai High School – Key Pollutant (Acetaldehyde) Analysis.

2b. Lapwai High School – Key Pollutant (Benzene) Analysis

2c. Lapwai High School – Key Pollutant (1,3-Butadiene) Analysis

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3b. Lapwai High School (Lapwai, ID) Benzene Concentration and Wind Information

3c. Lapwai High School (Lapwai, ID) 1,3-Butadiene Concentration and Wind Information

VIII. Appendices

A. Summary Description of Long-term Comparison Levels.

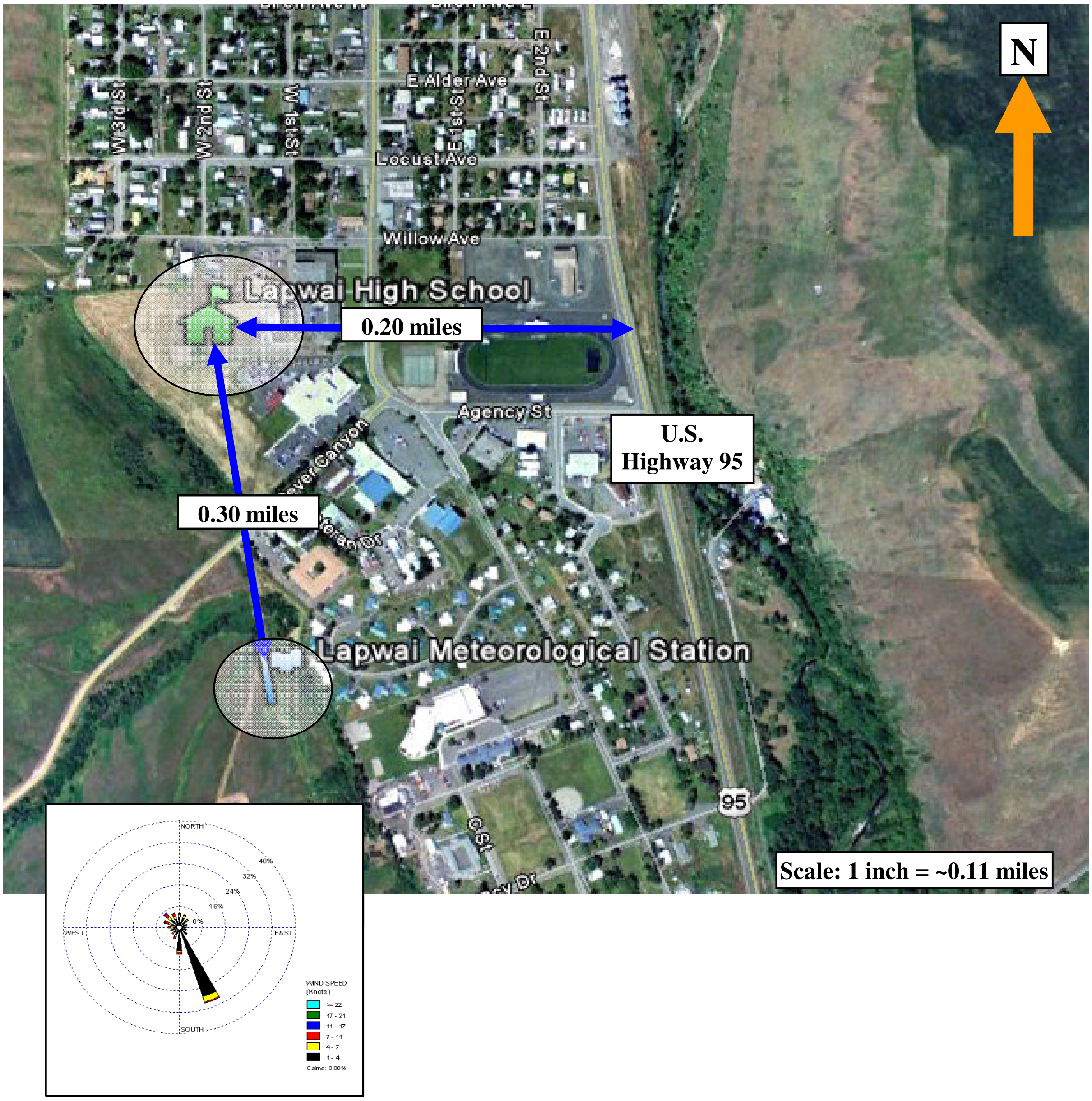
B. National Air Toxics Trends Stations Measurements (2004-2008).

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

D. Lapwai High School Pollutant Concentrations.

E. Windroses for Lapwai Meteorological Station (160690013).

Figure 1. Lapwai High School, Source of Interest, and Closest Meteorological Station.



2004-2006
Historical Windrose

Table 1. Lapwai High School - Key Pollutant Analysis.

Parameter	Units	Mean of Measurements	95% Confidence Interval on the Mean	Long-term Comparison Level[a]	
				Cancer-Based[b]	Noncancer-Based[c]
Acetaldehyde	$\mu g/m^3$	1.33 [d]	0.92 - 1.75	45	9
Benzene	$\mu g/m^3$	0.55 [e]	0.42 - 0.69	13	30
Butadiene, 1,3-	$\mu g/m^3$	0.043 [f]	0.027 - 0.060	3.3	2

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

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

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

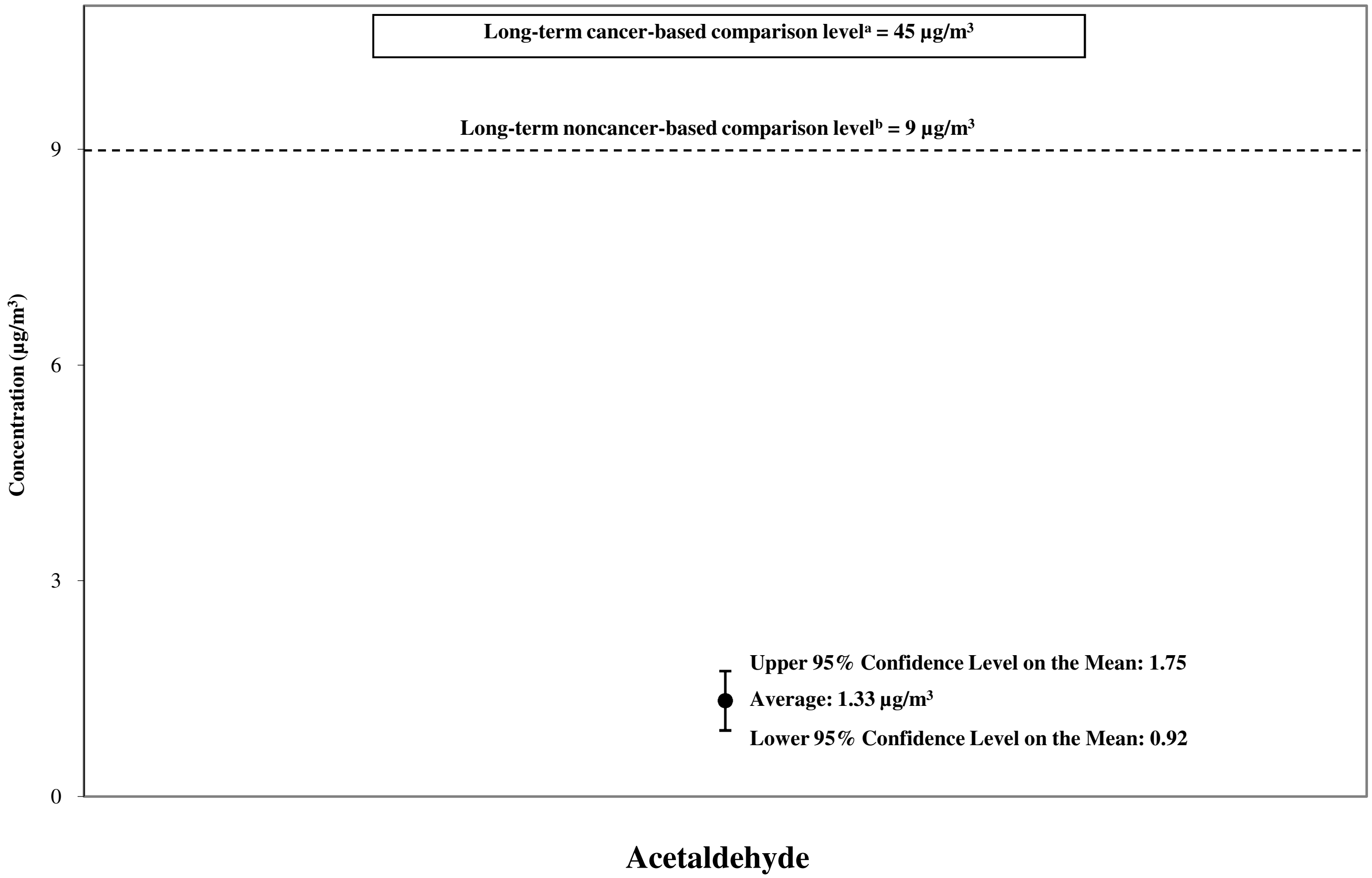
[c] Air toxics for which the upper 95% confidence limit on the mean concentration are near or below the noncancer-based comparison level are generally of low concern and will generally be considered a low priority for follow-up activity. Pollutants for which the 95% confidence limits extend appreciably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

[d] The mean of measurements for acetaldehyde is the average of all sample results, which include fourteen detections that ranged from 0.588 to 2.90 $\mu g/m^3$.

[e] The mean of measurements for benzene is the average of all sample results, which include thirteen detections that ranged from 0.25 to 1.04 $\mu g/m^3$.

[f] The mean of measurements for 1,3-butadiene is the average of all sample results, which include twelve detections that ranged from 0.02 to 0.104 $\mu g/m^3$, as well as one sample in which no chemical was registered by the laboratory analytical equipment. For this sample, a value of zero was used in calculating the mean.

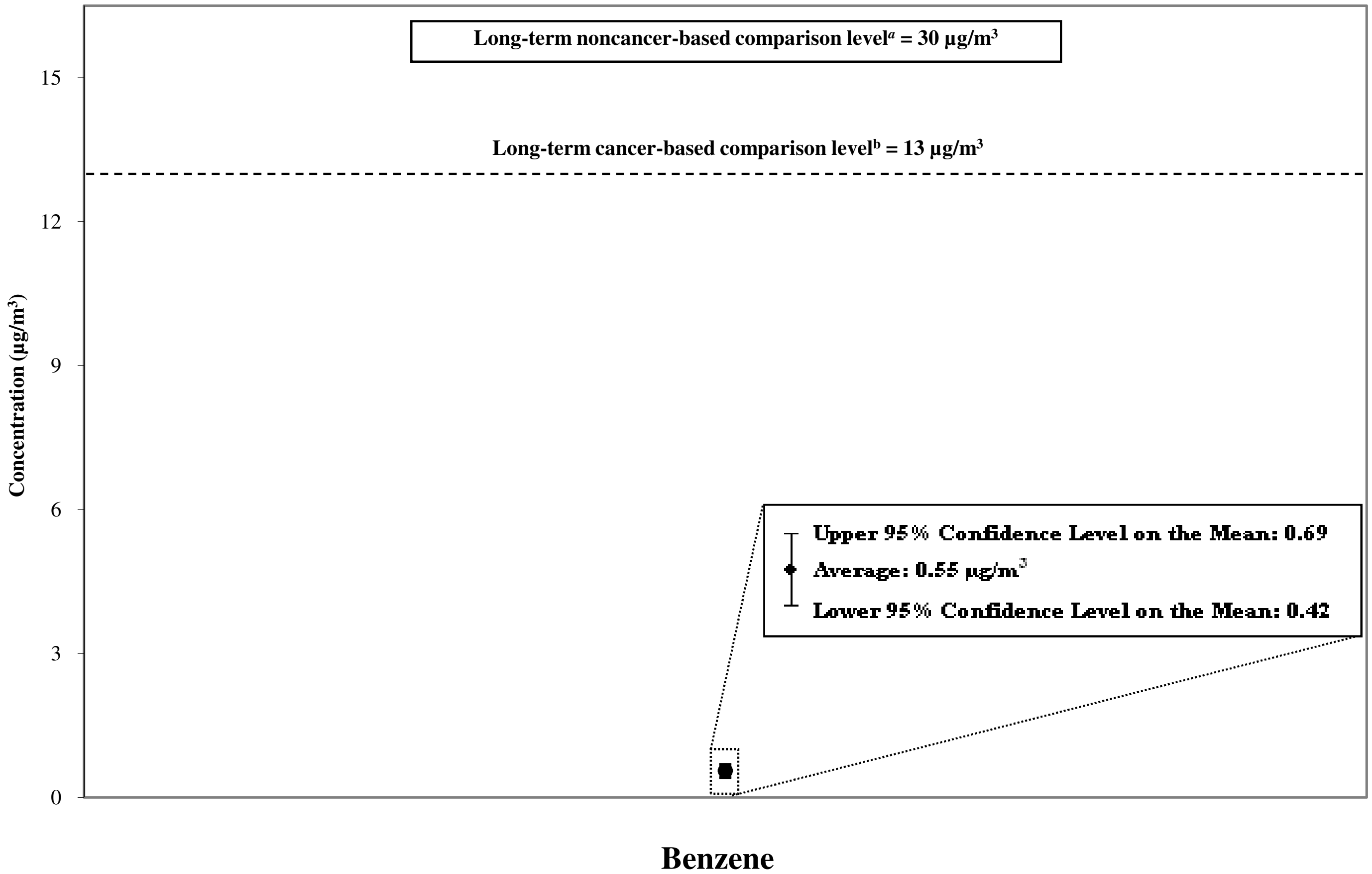
Figure 2a. Lapwai High School - Key Pollutant (Acetaldehyde) Analysis.



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

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

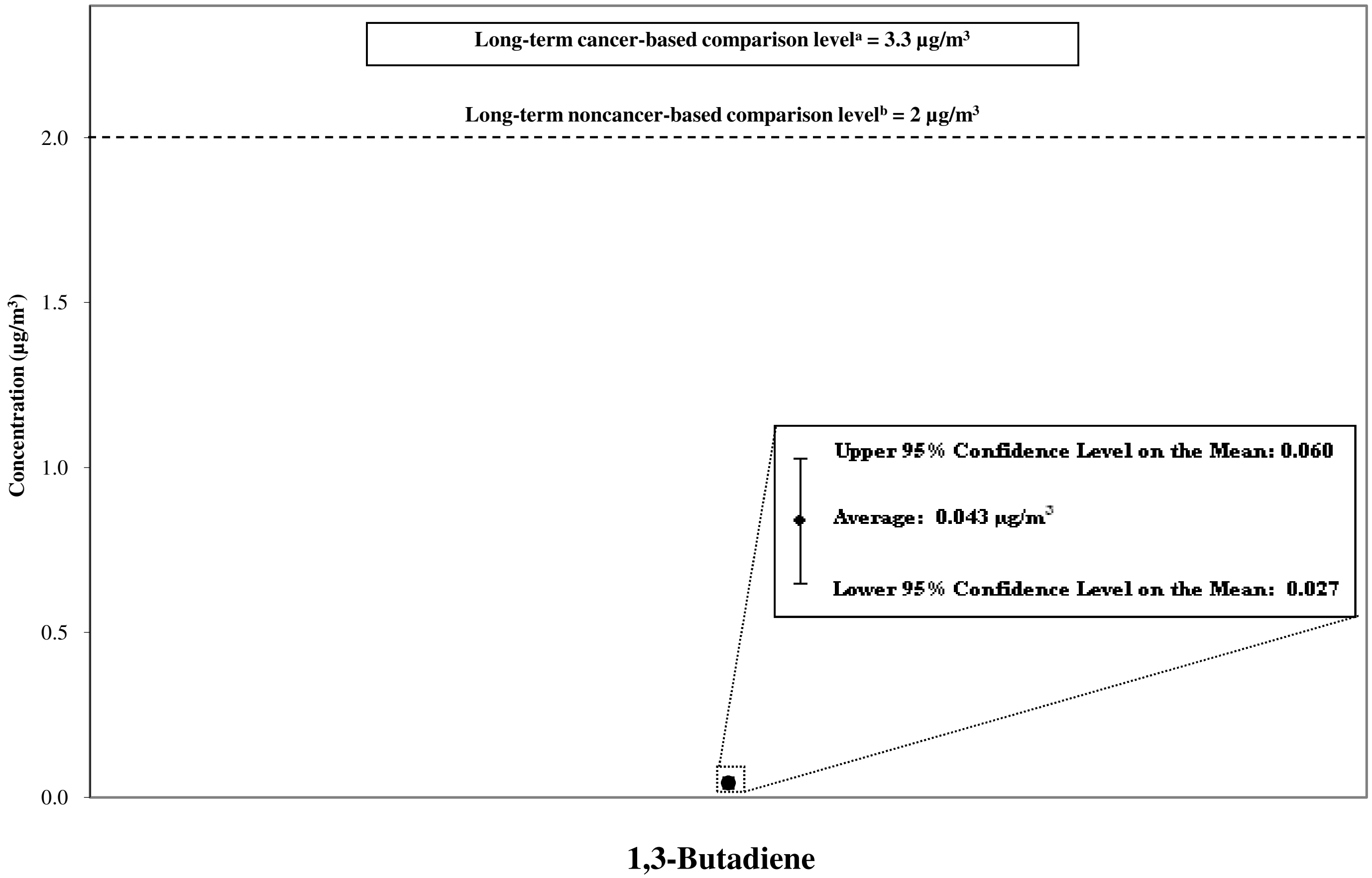
Figure 2b. Lapwai High School - Key Pollutant (Benzene) Analysis.



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

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

Figure 2c. Lapwai High School - Key Pollutant (1,3-Butadiene) Analysis.



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

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

Table 2a. Lapwai High School Key Pollutant Concentrations (Acetaldehyde) and Meteorological Data.

Parameter	Units	9/16/2009	9/22/2009	9/28/2009	10/4/2009	10/10/2009	10/16/2009	10/22/2009	11/3/2009	11/9/2009	11/12/2009	11/18/2009	11/24/2009	12/3/2009	12/9/2009
Acetaldehyde	$\mu g/m^3$	2.90	1.98	2.40	0.901	1.93	1.46	1.09	1.31	0.849	0.598	0.732	0.681	0.588	1.24
% Hours w/Wind Direction from Expected ZOI[a]	%	37.5	37.5	37.5	70.8	33.3	41.7	4.2	4.2	16.7	20.8	16.7	25.0	8.3	25.0
Wind Speed (avg. of hourly speeds)	mph	3.5	3.5	4.0	5.1	3.0	3.0	2.2	3.4	3.4	2.3	2.5	3.0	2.2	2.1
Wind Direction (avg. of unitized vector)[b]	deg.	160.4	172.1	175.3	98.4	179.7	169.2	254.2	214.7	200.9	232.8	241.8	226.8	191.7	3.0
% of Hours with Speed below 2 knots	%	16.7	16.7	8.3	29.2	25.0	25.0	58.3	16.7	29.2	58.3	58.3	25.0	66.7	66.7
Daily Average Temperature	° F	77.8	68.7	64.3	55.3	34.8	62.3	52.1	38.8	44.8	39.1	38.7	45.4	27.5	9.6
Daily Precipitation	inches	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.15	0.00	0.00	0.00	0.00

(Shaded) All precipitation and temperature data were from the Lapwai Meteorological Station (AQS ID = 160690013).

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

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

Table 2b. Lapwai High School Key Pollutant Concentrations (Benzene and 1,3-Butadiene) and Meteorological Data.

Parameter	Units	9/16/2009	9/22/2009	9/28/2009	10/4/2009	10/10/2009	10/16/2009	10/22/2009	11/3/2009[a]	11/9/2009[a]	11/12/2009[a]	11/18/2009[a]	11/24/2009[a]	12/9/2009[a]
Benzene	µg/m^3	0.27	0.428	0.579	0.438	0.435	0.25	0.722	1.04	0.885	0.473	0.658	0.486	0.518
Butadiene, 1,3-	µg/m^3	ND	0.024	0.029	0.033	0.035	0.02	0.077	0.069	0.10	0.031	0.055	0.055	0.035
% Hours w/Wind Direction from Expected ZOI[b]	%	37.5	37.5	37.5	70.8	33.3	41.7	4.2	8.3	12.5	20.8	8.3	16.7	33.3
Wind Speed (avg. of hourly speeds)	mph	3.5	3.5	4.0	5.1	3.0	3.0	2.2	4.1	2.4	2.3	3.0	3.3	2.9
Wind Direction (avg. of unitized vector)[c]	deg.	160.4	172.1	175.3	98.4	179.7	169.2	254.2	198.2	217.1	232.8	223.4	218.9	179.2
% of Hours with Speed below 2 knots	%	16.7	16.7	8.3	29.2	25.0	25.0	58.3	16.7	50.0	58.3	37.5	16.7	41.7
Daily Average Temperature	° F	77.8	68.7	64.3	55.3	34.8	62.3	52.1	41.0	47.7	39.1	39.5	44.6	10.0
Daily Precipitation	inches	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.06	0.00	0.00	0.00	0.00

(Highlighted) All precipitation and temperature data were from the Lapwai Meteorological Station (AQS ID = 160690013).

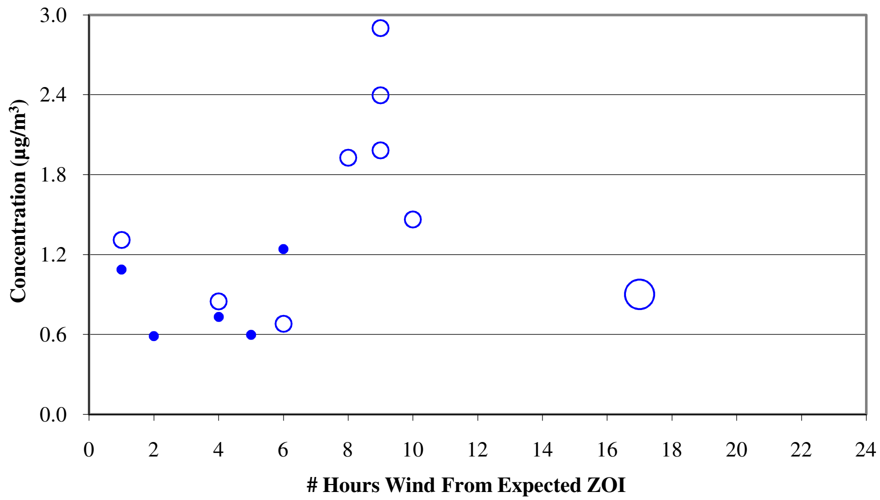
[a] Due to timer issues, manual samples were taken on these days, beginning after 8am and extending for 24 hours into the next day. As such, the hourly meteorological measurements correlating to the 24 hour sample were adjusted.

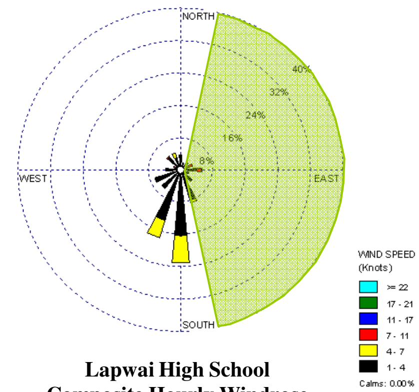
[b] Based on count of hours for which vector wind direction is from expected zone of influence.

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

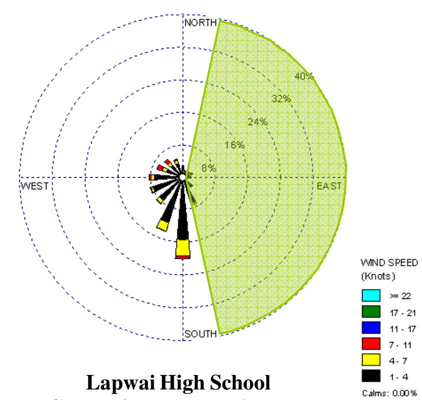
Figure 3a. Lapwai High School (Lapwai, ID) Acetaldehyde Concentration and Wind Information.

Acetaldehyde Concentrations vs. Number of Hours Wind Blows from Expected Zone of Influence





Lapwai High School
Composite Hourly Windrose
on Sample Days
(Sep. 16, 2009-Dec. 9, 2009)



Lapwai High School
Composite Hourly Windrose
Across Sampling Period
(Sep. 16, 2009-Dec. 9, 2009)

Expected Zone of Source Influence

KEY

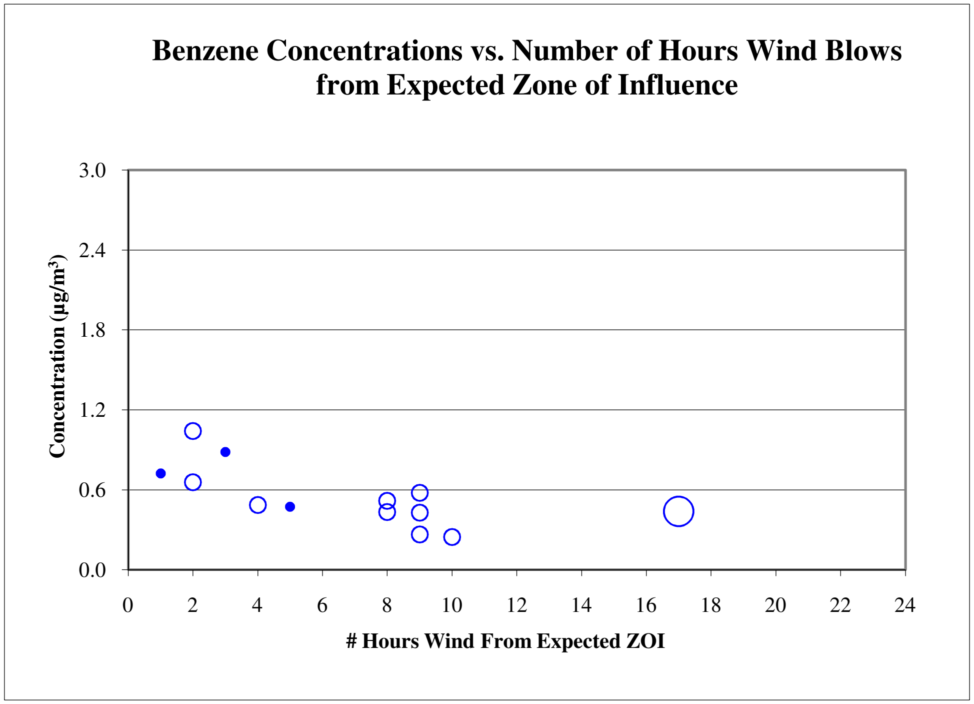
Pollutant: Acetaldehyde
Timeframe: September 16 - December 9, 2009

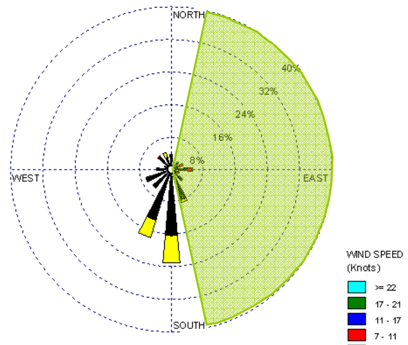
Wind Speed: 0.1-2.5 mph
Wind Speed: 2.5-5.0 mph
Wind Speed: > 5.0 mph

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 2a). The expected zone of source influence is a rough approximation of the range of directions from which winds carrying chemicals emitted by the key source may originate.

Figure 3b. Lapwai High School (Lapwai, ID) Benzene Concentration and Wind Information.





Lapwai High School
Composite Hourly Windrose
on Sample Days
(Sep. 16, 2009-Dec. 9, 2009)

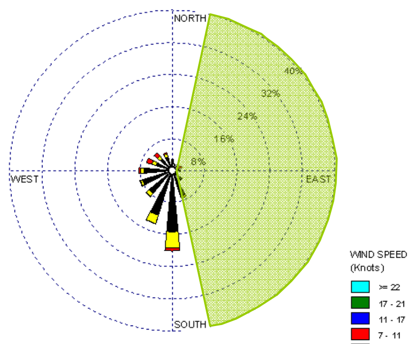
KEY

Pollutant: Benzene
Timeframe: September 16 - December 9, 2009

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 2b). The expected zone of source influence is a rough approximation of the range of directions from which winds carrying chemicals emitted by the key source may originate.

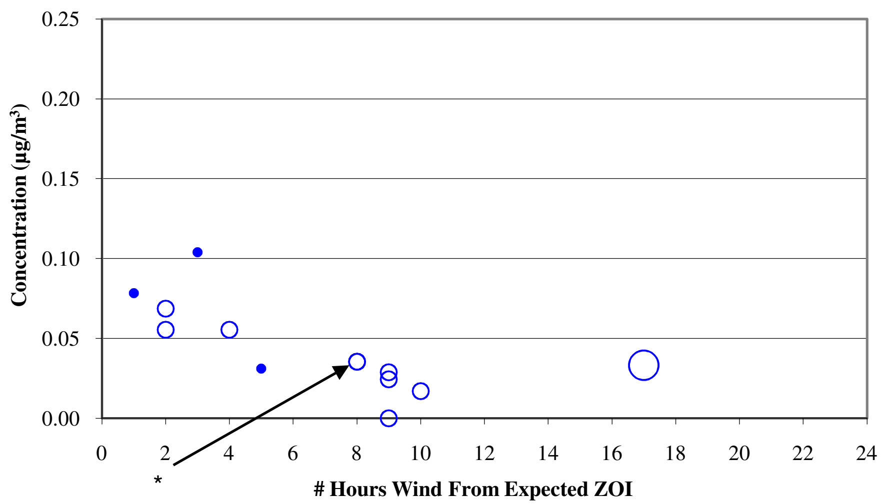


Lapwai High School
Composite Hourly Windrose
Across Sampling Period
(Sep. 16, 2009-Dec. 9, 2009)

Expected Zone of Source Influence

Figure 3c. Lapwai High School (Lapwai, ID) 1,3-Butadiene Concentration and Wind Information.

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



* = two "2.5-5.0 mph" observations

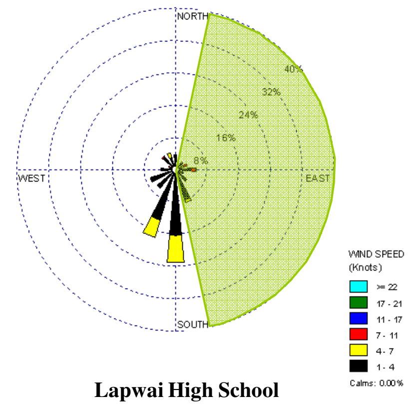
KEY

Pollutant: 1,3-Butadiene
Timeframe: September 16 - December 9, 2009

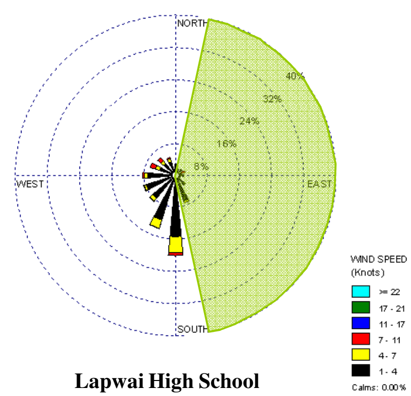
Wind Speed: 0.1-2.5 mph
Wind Speed: 2.5-5.0 mph
Wind Speed: > 5.0 mph

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 2b). The expected zone of source influence is a rough approximation of the range of directions from which winds carrying chemicals emitted by the key source may originate.



Lapwai High School
Composite Hourly Windrose
on Sample Days
(Sep. 16, 2009-Dec. 9, 2009)



Lapwai High School
Composite Hourly Windrose
Across Sampling Period
(Sep. 16, 2009-Dec. 9, 2009)

Expected Zone of Source Influence

Appendix A. Summary Description of Long-term Comparison Levels

In addressing the primary objective identified above, to investigate through the monitoring data collected for key pollutants at the school whether levels are of a magnitude, in light of health risk-based criteria, to indicate that follow-up activities be considered, we developed two types of long-term health risk-related comparison levels. These two types of levels are summarized below.[17]

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.[18] This general range is from 1 to 100 in a million.
- Air toxics with long-term mean concentrations below one one-hundredth of this comparison level would be below a comparably developed level for 1-in-a-million risk (which is the lower bound of EPA's traditional acceptable risk range). Such pollutants, with long-term mean concentrations below the Agency's traditional acceptable risk range, are generally considered to pose negligible risk.
- Air toxics with long-term mean concentrations above the acceptable risk range would generally be a priority for follow-up activities. In this evaluation, we compare the upper 95% confidence limit on the mean concentration to the comparison level. Pollutants for which this upper limit falls above the comparison level are fully discussed in the school monitoring report and may be considered a priority for potential follow-up activities in light of the full set of information available for that site.
- Situations where the summary statistics for a pollutant are below the cancer-based comparison level but above 1% of that level are fully discussed in Appendix C.

[17] These comparison levels are described in more detail *Schools Air Toxics Monitoring Activity (2009), Uses of Health Effects Information in Evaluating Sample Results*.
[18] While no one would be exposed at a school for 24 hours a day, every day for an entire lifetime, we chose this worst-case exposure period as a simplification for the basis of the comparison level in recognition of other uncertainties in the analysis. Use of continuous lifetime exposure yields a lower, more conservative, comparison level than would use of a characterization more specific to the school population (e.g., 5 days a week, 8-10 hours a day for a limited number of years).

Noncancer-based Comparison Levels

- To consider concentrations of air toxics other than lead (for which we have a national ambient air quality standard) with regard to potential for health effects other than cancer, we derived noncancer-based comparison levels using EPA chronic reference concentrations (or similar values). A chronic reference concentration (RfC) is an estimate of a long-term continuous exposure concentration (24 hours a day, every day) without appreciable risk of adverse effect over a lifetime.[19] 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.

[19] EPA defines the RfC as "an estimate (with uncertainty spanning perhaps an order of magnitude) of a continuous inhalation exposure to the human population (including sensitive subgroups) that is likely to be without an appreciable risk of deleterious effects during a lifetime. It can be derived from a NOAEL, LOAEL, or benchmark concentration, with uncertainty factors generally applied to reflect limitations of the data used. Generally used in EPA's noncancer health assessments." http://www.epa.gov/ncea/iris/help_gloss.htm#r

Appendix B. National Air Toxics Trends Stations Measurements (2004-2008).[a]

Pollutant	Units	# Samples Analyzed	% Detections	Maximum	Arithmetic Mean[b]	Geometric Mean	5th Percentile	25th Percentile	50th Percentile	75th Percentile	95th Percentile
Acetaldehyde	µg/m^3	6,401	100%	92.78	1.87	1.40	0.41	0.86	1.42	2.34	4.48
Formaldehyde	µg/m^3	6,403	100%	91.50	3.09	2.22	0.51	1.35	2.32	3.92	7.65
Propionaldehyde	µg/m^3	4,330	93%	5.53	0.28	0.22	ND	0.13	0.21	0.35	0.77
Antimony (PM_{10})	ng/m^3	2,372	94%	43.30	1.71	1.21	ND	0.60	1.13	2.17	4.33
Arsenic (PM_{10})	ng/m^3	5,076	86%	47.70	0.93	0.70	ND	0.29	0.56	1.02	2.89
Beryllium (PM_{10})	ng/m^3	4,771	64%	1.97	0.05	0.02	ND	ND	<0.01	0.02	0.50
Cadmium (PM_{10})	ng/m^3	4,793	85%	15.30	0.27	0.17	ND	0.05	0.13	0.29	0.94
Chromium (PM_{10})	ng/m^3	5,094	92%	172.06	2.71	1.66	ND	0.93	1.98	2.85	7.10
Cobalt (PM_{10})	ng/m^3	2,614	91%	20.30	0.28	0.18	ND	0.08	0.15	0.27	1.00
Manganese (PM_{10})	ng/m^3	4,793	99%	734.00	10.39	5.20	<0.01	2.41	4.49	9.96	33.78
Mercury (PM_{10})	ng/m^3	1,167	81%	2.07	0.07	0.04	ND	0.01	0.02	0.06	0.32
Nickel (PM_{10})	ng/m^3	4,815	90%	110.10	2.05	1.49	ND	0.74	1.44	2.50	5.74
Selenium (PM_{10})	ng/m^3	2,382	96%	13.00	1.10	0.53	<0.01	0.24	0.53	1.07	5.50
Acetonitrile	µg/m^3	1,804	69%	542.30	3.55	0.72	ND	ND	0.27	0.76	8.60
Acrylonitrile	µg/m^3	3,673	31%	5.51	0.06	0.10	ND	ND	ND	0.03	0.33
Benzene	µg/m^3	6,313	94%	10.19	1.03	0.84	ND	0.48	0.80	1.31	2.81
Benzyl chloride	µg/m^3	3,046	9%	2.49	0.01	0.05	ND	ND	ND	ND	0.05
Bromoform	µg/m^3	2,946	4%	1.18	0.01	0.16	ND	ND	ND	ND	ND
Bromomethane	µg/m^3	5,376	61%	120.76	0.11	0.05	ND	ND	0.03	0.05	0.12
Butadiene, 1,3-	µg/m^3	6,427	67%	15.55	0.10	0.09	ND	ND	0.05	0.13	0.38
Carbon disulfide	µg/m^3	1,925	91%	46.71	2.32	0.25	ND	0.03	0.09	0.96	12.65
Carbon tetrachloride	µg/m^3	6,218	86%	1.76	0.52	0.58	ND	0.47	0.57	0.65	0.87
Chlorobenzene	µg/m^3	5,763	30%	1.10	0.02	0.04	ND	ND	ND	0.01	0.11
Chloroethane	µg/m^3	4,625	37%	0.58	0.02	0.04	ND	ND	ND	0.03	0.08
Chloroform	µg/m^3	6,432	73%	48.05	0.17	0.14	ND	ND	0.10	0.17	0.61
Chloromethane	µg/m^3	5,573	95%	19.70	1.17	1.20	ND	1.03	1.18	1.36	1.68
Chloroprene	µg/m^3	2,341	11%	0.17	<0.01	0.03	ND	ND	ND	ND	0.02
Dichlorobenzene, *p*-	µg/m^3	5,409	60%	13.65	0.19	0.16	ND	ND	ND	0.18	0.90
Dichloroethane, 1,1-	µg/m^3	5,670	16%	0.36	0.01	0.02	ND	ND	ND	ND	0.02
Dichloroethylene, 1,1-	µg/m^3	5,480	19%	0.44	0.01	0.02	ND	ND	ND	ND	0.04
Dichloromethane	µg/m^3	6,206	82%	214.67	0.59	0.34	ND	0.14	0.28	0.49	1.35

Appendix B. National Air Toxics Trends Stations Measurements (2004-2008).[a]

Pollutant	Units	# Samples Analyzed	% Detections	Maximum	Arithmetic Mean[b]	Geometric Mean	5th Percentile	25th Percentile	50th Percentile	75th Percentile	95th Percentile
Dichloropropane,1,2-	µg/m^3	6,225	17%	1.80	0.01	0.03	ND	ND	ND	ND	0.04
Dichloropropylene, *cis*-1,3-	µg/m^3	4,705	18%	0.80	0.01	0.05	ND	ND	ND	ND	0.11
Dichloropropylene, *trans*-1,3-	µg/m^3	4,678	18%	1.13	0.02	0.05	ND	ND	ND	ND	0.11
Ethyl acrylate	µg/m^3	1,917	1%	0.08	<0.01	0.04	ND	ND	ND	ND	ND
Ethylbenzene	µg/m^3	6,120	84%	8.84	0.42	0.32	ND	0.10	0.29	0.53	1.33
Ethylene dibromide	µg/m^3	5,646	19%	4.15	0.01	0.05	ND	ND	ND	ND	0.05
Ethylene dichloride	µg/m^3	6,143	38%	4.49	0.03	0.05	ND	ND	ND	0.04	0.09
Hexachlorobutadiene	µg/m^3	3,727	20%	0.97	0.03	0.10	ND	ND	ND	ND	0.18
Methyl chloroform	µg/m^3	5,944	73%	3.17	0.09	0.10	ND	ND	0.08	0.11	0.20
Methyl isobutyl ketone	µg/m^3	2,936	60%	2.95	0.11	0.09	ND	ND	0.02	0.12	0.49
Methyl methacrylate	µg/m^3	1,917	9%	14.05	0.13	0.49	ND	ND	ND	ND	0.53
Methyl *tert*- butyl ether	µg/m^3	4,370	41%	20.50	0.28	0.12	ND	ND	ND	0.04	1.53
Styrene	µg/m^3	6,080	70%	27.22	0.16	0.11	ND	ND	0.05	0.16	0.60
Tetrachloroethane, 1,1,2,2-	µg/m^3	5,952	20%	2.47	0.02	0.04	ND	ND	ND	ND	0.07
Tetrachloroethylene	µg/m^3	6,423	71%	42.12	0.28	0.20	ND	ND	0.13	0.27	0.88
Toluene	µg/m^3	5,947	95%	482.53	2.46	1.54	0.01	0.70	1.51	3.05	7.42
Trichlorobenzene, 1,2,4-	µg/m^3	4,301	21%	45.27	0.07	0.10	ND	ND	ND	ND	0.16
Trichloroethane,1,1,2-	µg/m^3	5,210	19%	5.89	0.01	0.04	ND	ND	ND	ND	0.05
Trichloroethylene	µg/m^3	6,410	46%	6.50	0.05	0.07	ND	ND	ND	0.05	0.22
Vinyl chloride	µg/m^3	6,284	18%	1.61	0.01	0.02	ND	ND	ND	ND	0.03
Xylene, *m/p*-	µg/m^3	4,260	90%	21.41	1.12	0.71	ND	0.26	0.69	1.43	3.65
Xylene, *o*-	µg/m^3	6,108	83%	9.21	0.41	0.30	ND	0.09	0.24	0.52	1.39

Key Pollutant

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

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

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

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

At each school, monitoring has been targeted to get information on a limited set of key hazardous air pollutants (HAPs).[20] These pollutants are the primary focus of the monitoring activities at a school and a priority for us based on our emissions, modeling and other information. In analyzing air samples for these key pollutants, we have also obtained results for some other pollutants that are routinely included with the same test method. Our consideration of the data collected for these additional HAPs is described in the first section below. In addition to evaluating monitoring results for individual pollutants, we also considered the potential for cumulative impacts from multiple pollutants as described in the second section below (See Table C-1).

Other Air Toxics (HAPs)

- Do the monitoring data indicate elevated levels of any other air toxics or hazardous air pollutant (HAPs) that pose significant long-term health concerns?
  - → Longer-term concentration estimates for each of the other HAPs monitored are below their long-term comparison levels.
    - Further, for pollutants with cancer-based comparison levels, longer-term concentration estimates for all but two of these (chromium and formaldehyde) are more than tenfold lower and all but five (also *p*-dichlorobenzene, carbon tetrachloride, and arsenic) are more than 100-fold lower.[21]
  - → Additionally, each individual measurement for these pollutants is below the individual sample screening level developed for considering potential short-term exposures for that pollutant.[22]

Additional Information on Five HAPs:

- The first HAP mentioned above is chromium. The comparison values for chromium are conservatively based on the most toxic form of chromium (hexavalent chromium, Cr^{+6}), which is only a fraction of the chromium in the ambient air. Nonetheless, the longer-term concentration estimate for chromium (PM_{10}) is below even these very restrictive comparison values. The mean and 95 percent upper bound on the mean for chromium (PM_{10}) are both less than half of the lowest comparison level. Further, as Cr^{+6} is

[20] 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.

[21] 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.

[22] 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.*

commonly only a small fraction of the total,[23] the levels of Cr^{+6} in these samples would be expected to be appreciably lower than this. A review of information available at other sites nationally shows that the mean concentration of chromium (PM_{10}) at this site falls between the 50th and the 75th percentile of samples collected from 2004 to 2008 (the most recently compiled period) at the NATTS (Appendix B).

- The second HAP mentioned above is formaldehyde. The mean and 95 percent upper bound on the mean for formaldehyde are approximately 25-30% of the cancer-based comparison level. A review of information available at other sites nationally shows that the mean concentration of formaldehyde at this site is between the 25th and 50th percentile of samples collected from 2004 to 2008 (the most recently compiled period) at the NATTS sites (Appendix B).

- The third HAP mentioned above is *p*-dichlorobenzene. The mean and 95 percent upper bound on the mean for *p*-dichlorobenzene are approximately 4-6% 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 75th and 95th percentile of samples collected from 2004 to 2008 (the most recently compiled period) at the NATTS sites (Appendix B).

- The fourth HAP mentioned above is 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 2004 to 2008 (the most recently compiled period) at the NATTS sites (Appendix B). Carbon tetrachloride is found globally as a result of its significant past uses in refrigerants and propellants for aerosol cans and its chemical persistence. Virtually all uses have been discontinued. However, it is still measured throughout the world as a result of its slow rate of degradation in the environment and global distribution in the atmosphere.

- The fifth HAP mentioned above is arsenic. The mean and 95 percent upper bound on the mean for arsenic (PM_{10}) are approximately 1-2% of the cancer-based comparison level. A review of information available at other sites nationally shows that the mean concentration of arsenic (PM_{10}) at this site is between the 25th and 50th percentile of samples collected from 2004 to 2008 (the most recently compiled period) at the NATTS sites (Appendix B).

Multiple Pollutants

As described in the main body of the report and background materials, this initiative and the associated analyses are focused on investigation of key pollutants for each school that were identified by previous analyses. This focused design does not provide for the consideration of

[23] Data in EPA's Air Quality System for locations that are not near a facility emitting hexavalent chromium indicate hexavalent chromium concentrations to comprise less than approximately 10% of total chromium concentrations.

combined impacts of pollutants or stressors other than those monitored in this project. Broader analyses and those involving other pollutants may be the focus of other EPA activities.[24]

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

- Do the data collected for the air toxics monitored indicate the potential for other monitored pollutants to be present at levels that in combination with the key pollutant levels indicate an increased potential for cumulative impacts of significant concern (e.g., that might warrant further investigation)?
  - → Although the multiple air toxics monitored at this site were below the levels of significant concern for multi-pollutant cumulative risk that had been suggested by the modeling information, these results do indicate the influence of multiple mobile source pollutants of concern that are the focus of EPA actions nationwide.
    - In addition to the key pollutant acetaldehyde, the only other HAPs monitored whose longer-term concentration estimates are more than ten percent of their lowest comparison levels are chromium, manganese, and formaldehyde. The lowest comparison levels for chromium (posed by hexavalent chromium)[25], and formaldehyde are based on carcinogenic risk. When aggregated as a group, they comprise less than 72% of their cancer-based comparison levels. Additionally, the lowest comparison levels for manganese and acetaldehyde are based on non-carcinogenic effects to different systems (central nervous system and respiratory, respectively). Finally, as noted above, hexavalent chromium is commonly a small fraction of the total chromium reported. Taken together these considerations reduce concerns for cumulative health risk from these pollutants.

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

[25] The noncancer-based comparison level for chromium is much higher than the cancer-based level and is based on risk of other effects posed to the respiratory system by hexavalent chromium in particulate form.

Table C-1. Lapwai High School - Other Monitored Pollutant Analysis.

Parameter	Units	Mean of Measurements[a]	95% Confidence Interval on the Mean	Long-term Comparison Level[b]	
				Cancer-Based[c]	Noncancer-Based[d]
Non-Key HAPs with mean greater than 10% of the lowest comparison level					
Chromium (PM_{10})	ng/m^3	2.71	2.25 - 3.16	8.3 [e]	100 [e]
Manganese (PM_{10})	ng/m^3	13.6	1.29 - 25.9	NA	50
Formaldehyde	µg/m^3	2.11	1.54 - 2.68	8	9.8
Non-Key HAPs with mean lower than 10% of the lowest comparison level					
Dichlorobenzene, *p* -	µg/m^3	0.41	0.25 - 0.56	9.1	100
Carbon Tetrachloride	µg/m^3	0.68	0.62 - 0.74	17	800
Propionaldehyde	µg/m^3	0.21	0.15 - 0.28	NA	8
Arsenic (PM_{10})	ng/m^3	0.35	0.17 - 0.53	23	15
Chloromethane	µg/m^3	1.02	0.89 - 1.15	NA	90
Bromomethane	µg/m^3	0.04	0.03 - 0.05	NA	5
Cadmium (PM_{10})	ng/m^3	0.05	0.03 - 0.07	56	10
Acetonitrile	µg/m^3	0.16	0.10 - 0.23	NA	60
Cobalt (PM_{10})	ng/m^3	0.23	0.03 - 0.42	NA	100
Ethylbenzene	µg/m^3	0.08	0.06 - 0.10	40	1000
Xylene, *m/p* -	µg/m^3	0.16	0.11 - 0.20	NA	100
Dichloromethane	µg/m^3	0.23	0.20 - 0.26	210	1000
Antimony (PM_{10})	ng/m^3	0.19	0.08 - 0.30	NA	200
Chloroform	µg/m^3	0.09	0.07 - 0.10	NA	98
Xylene, *o* -	µg/m^3	0.07	0.05 - 0.09	NA	100
Methyl isobutyl ketone	µg/m^3	0.33	0.15 - 0.51	NA	3000
Toluene	µg/m^3	0.49	0.40 - 0.58	NA	5000
Carbon Disulfide	µg/m^3	0.07	0.04 - 0.10	NA	700
Styrene	µg/m^3	0.04	0.03 - 0.06	NA	1000
Methyl chloroform	µg/m^3	0.07	0.06 - 0.08	NA	5000
Chloroethane	µg/m^3	0.03	0.01 - 0.05	NA	10000
Nickel (PM_{10})	ng/m^3	0.30 [f]	0.04 - 0.57 [f]	420	90
Tetrachloroethylene	µg/m^3	0.05 [g]	0.03 - 0.08 [g]	17	270
Mercury (PM_{10})	ng/m^3	0.006 [h]	0.001 - 0.011 [h]	NA	300 [i]
Non-Key HAPs with more than 50% ND results					
Ethylene dichloride	µg/m^3	85% of results were ND[j]		3.8	2400
Beryllium (PM_{10})	ng/m^3	62% of results were ND[k]		42	20
Vinyl chloride	µg/m^3	77% of results were ND[l]		11	100
Trichloroethylene	µg/m^3	92% of results were ND[m]		50	600
Selenium (PM_{10})	ng/m^3	54% of results were ND[n]		NA	20000
No other HAPs were detected in any samples					

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

Table C-1. Lapwai High School - Other Monitored Pollutant Analysis.

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

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

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

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

[e] The comparison levels are specific to hexavalent chromium (recognized as the most toxic form) which is a fraction of the total chromium reported.

[f] Nickel (PM_{10}) was detected in 9 of 13 samples, ranging from 0.04 to 1.35 ng/m^3. The MDL is 0.96 to 0.98 ng/m^3.

[g] Tetrachloroethylene was detected in 9 of 13 samples, ranging from 0.05 to 0.17 µg/m^3. The MDL is 0.20 µg/m^3.

[h] Mercury (PM_{10}) was detected in 8 of 13 samples, ranging from 0.005 to 0.03 ng/m^3. The MDL is 1.12 to 1.14 ng/m^3.

[i] The comparison level is specific to elemental mercury, which is more readily and completely absorbed into the body than mercury conveyed on particles (e.g., divalent species).

[j] Ethylene dichloride was detected in only 2 of 13 samples, ranging from 0.081 to 0.089 µg/m^3. The MDL is 0.008 µg/m^3.

[k] Beryllium (PM_{10}) was detected in only 5 of 13 samples, ranging from 0.001 to 0.06 ng/m^3. The MDL is 0.03 ng/m^3.

[l] Vinyl chloride was detected in only 3 of 13 samples, all with result 0.02 µg/m^3. The MDL is 0.005 µg/m^3.

[m] Trichloroethylene was detected in only 1 of 13 samples, with a result of 0.065 µg/m^3. The MDL is 0.011 µg/m^3.

[n] Selenium (PM_{10}) was detected in only 6 of 13 samples, ranging from 0.08 to 0.50 ng/m^3. The MDL is 0.37 to 0.38 ng/m^3.

Appendix D. Lapwai High School Pollutant Concentrations.

Parameter	Units	9/16/2009	9/22/2009	9/28/2009	10/4/2009	10/10/2009	10/16/2009	10/22/2009	10/28/2009	11/3/2009	11/9/2009	11/12/2009	11/18/2009	11/24/2009	12/3/2009	12/9/2009	Sample Screening Level[a]
Acetaldehyde	µg/m³	2.90	1.98	2.40	0.901	1.93	1.46	1.09	--	1.31	0.849	0.598	0.732	0.681	0.588	1.24	90
Benzene	µg/m³	0.27	0.428	0.579	0.438	0.435	0.25	0.722	--	1.04	0.885	0.473	0.658	0.486	--	0.518	30
Butadiene, 1,3-	µg/m³	ND	0.024	0.029	0.033	0.035	0.02	0.077	--	0.07	0.104	0.031	0.055	0.055	--	0.035	20
Chromium (PM_{10})	ng/m³	--	2.720	3.240	3.830	4.060	--	2.760	1.91	3.18	2.520	1.770	1.800	1.780	2.710	2.930	580 [b]
Manganese (PM_{10})	ng/m³	--	19.8	50.7	64.3	15.7	--	3.77	1.86	4.02	3.30	1.21	0.98	1.86	1.43	7.70	500
Formaldehyde	µg/m³	3.87	2.830	4.508	2.002	2.149	1.73	1.621	--	2.06	1.326	1.241	1.621	1.363	1.194	1.990	50
Dichlorobenzene, *p* -	µg/m³	0.72	0.818	0.590	0.705	0.642	0.66	0.724	--	0.71	0.919	0.617	0.604	0.522	--	0.610	200
Carbon Tetrachloride	µg/m³	0.94	0.451	0.469	0.228	0.132	0.45	0.234	--	0.28	0.595	0.355	0.848	0.210	--	0.066	10,000
Propionaldehyde	µg/m³	0.52	0.278	0.323	0.176	0.209	0.24	0.230	--	0.22	0.147	0.100	0.121	0.116	0.107	0.185	80
Arsenic (PM_{10})	ng/m³	--	0.080	0.400	0.320	0.190	--	0.260	1.09	0.58	0.380	0.590	ND	0.480	0.050	0.100	150
Chloromethane	µg/m³	1.28	1.298	1.177	1.070	1.237	0.64	0.992	--	0.91	1.292	0.876	0.818	0.785	--	0.880	1,000
Bromomethane	µg/m³	0.05	0.054	0.047	0.039	0.039	0.03	0.030	--	0.03	0.047	0.039	0.047	0.023	--	0.023	200
Cadmium (PM_{10})	ng/m³	--	0.020	0.060	0.070	0.020	--	0.090	0.04	0.10	0.130	0.040	ND	0.030	0.040	0.050	30
Acetonitrile	µg/m³	0.36	0.267	0.365	0.171	0.087	0.15	0.161	--	0.03	0.173	0.126	0.099	0.077	--	0.071	600
Cobalt (PM_{10})	µg/m³	--	0.380	0.870	0.950	0.270	--	0.050	0.03	0.08	0.070	0.007	ND	0.020	0.050	0.170	100
Ethylbenzene	ng/m³	0.07	0.065	0.070	0.052	0.065	0.06	0.130	--	0.11	0.120	0.078	0.120	0.083	--	0.030	40,000
Xylene, *m/p* -	µg/m³	0.17	0.148	0.130	0.104	0.083	0.11	0.313	--	0.17	0.278	0.109	0.221	0.156	--	0.039	9,000
Dichloromethane	µg/m³	0.34	0.247	0.226	0.268	0.195	0.25	0.219	--	0.25	0.233	0.212	0.201	0.160	--	0.188	2,000
Antimony (PM_{10})	µg/m³	--	0.080	0.150	0.080	0.110	--	0.180	0.12	0.26	0.750	0.110	0.090	0.150	0.130	0.240	2,000
Chloroform	µg/m³	0.08	ND	0.098	0.112	0.098	0.08	0.117	--	0.11	0.110	0.093	0.078	0.073	--	0.073	500
Xylene, *o* -	µg/m³	0.07	0.078	0.078	0.052	0.048	0.06	0.135	--	0.08	0.130	0.043	0.087	0.061	--	0.017	9,000
Methyl isobutyl ketone	µg/m³	0.80	0.418	0.750	0.484	ND	0.16	0.791	--	0.20	0.156	ND	0.250	0.300	--	ND	30,000
Toluene	µg/m³	0.55	0.411	0.415	0.283	0.339	0.37	0.732	--	0.71	0.630	0.411	0.633	0.547	--	0.385	4,000
Carbon Disulfide	ng/m³	0.06	0.144	0.087	0.078	0.037	0.06	0.050	--	0.02	0.184	0.041	0.078	0.037	--	0.022	7,000
Styrene	µg/m³	0.05	0.051	0.038	0.051	0.047	ND	0.077	--	0.04	0.068	0.034	0.068	0.051	--	ND	9,000
Methyl chloroform	µg/m³	0.08	0.071	0.066	0.093	0.066	0.07	0.082	--	0.08	0.087	0.066	0.055	0.044	--	0.071	10,000

Appendix D. Lapwai High School Pollutant Concentrations.

Parameter	Units	9/16/2009	9/22/2009	9/28/2009	10/4/2009	10/10/2009	10/16/2009	10/22/2009	10/28/2009	11/3/2009	11/9/2009	11/12/2009	11/18/2009	11/24/2009	12/3/2009	12/9/2009	Sample Screening Level[a]
Chloroethane	ng/m^3	0.03	0.013	0.034	ND	0.142	0.03	ND	--	ND	0.016	0.042	0.024	0.037	--	0.042	40,000
Nickel (PM_{10})	ng/m^3	--	0.440	1.170	1.350	0.270	--	0.040	ND	ND	ND	0.220	0.160	ND	0.120	0.190	200
Tetrachloroethylene	$\mu g/m^3$	0.11	0.054	0.061	ND	0.068	0.05	0.075	--	0.06	0.068	ND	0.170	ND	--	ND	1,400
Mercury (PM_{10})	ng/m^3	--	ND	0.005	ND	0.007	--	0.030	0.01	ND	ND	0.008	ND	0.006	0.008	0.010	3,000 [c]
Ethylene dichloride	$\mu g/m^3$	ND	ND	ND	ND	ND	ND	ND	--	ND	0.089	ND	0.081	ND	--	ND	270
Beryllium (PM_{10})	$\mu g/m^3$	--	0.001	0.040	0.060	ND	--	0.020	ND	0.01	ND	ND	ND	ND	ND	ND	20
Vinyl chloride	$\mu g/m^3$	ND	0.015	ND	ND	0.015	ND	ND	--	ND	0.018	ND	ND	ND	--	ND	1,000
Trichloroethylene	ng/m^3	ND	ND	ND	ND	ND	ND	ND	--	ND	ND	ND	ND	0.065	--	ND	10,000
Selenium (PM_{10})	$\mu g/m^3$	--	0.110	0.500	ND	ND	--	ND	ND	0.16	0.080	0.490	ND	0.100	ND	ND	20,000
Acrylonitrile	$\mu g/m^3$	ND	ND	ND	ND	ND	ND	ND	--	ND	ND	ND	ND	ND	--	ND	200
Benzyl Chloride	$\mu g/m^3$	ND	ND	ND	ND	ND	ND	ND	--	ND	ND	ND	ND	ND	--	ND	140
Bromoform	$\mu g/m^3$	ND	ND	ND	ND	ND	ND	ND	--	ND	ND	ND	ND	ND	--	ND	6,400
Chlorobenzene	$\mu g/m^3$	ND	ND	ND	ND	ND	ND	ND	--	ND	ND	ND	ND	ND	--	ND	10,000
Chloroprene	$\mu g/m^3$	ND	ND	ND	ND	ND	ND	ND	--	ND	ND	ND	ND	ND	--	ND	200
Ethylene dibromide	$\mu g/m^3$	ND	ND	ND	ND	ND	ND	ND	--	ND	ND	ND	ND	ND	--	ND	12
Dichloroethane, 1,1-	$\mu g/m^3$	ND	ND	ND	ND	ND	ND	ND	--	ND	ND	ND	ND	ND	--	ND	4,400
Dichloroethylene, 1,1-	$\mu g/m^3$	ND	ND	ND	ND	ND	ND	ND	--	ND	ND	ND	ND	ND	--	ND	80
Dichloropropane, 1,2-	$\mu g/m^3$	ND	ND	ND	ND	ND	ND	ND	--	ND	ND	ND	ND	ND	--	ND	200
Dichloropropylene, *cis* -1,3-	$\mu g/m^3$	ND	ND	ND	ND	ND	ND	ND	--	ND	ND	ND	ND	ND	--	ND	40
Dichloropropylene, *trans* -1,3-	$\mu g/m^3$	ND	ND	ND	ND	ND	ND	ND	--	ND	ND	ND	ND	ND	--	ND	40
Ethyl Acrylate	$\mu g/m^3$	ND	ND	ND	ND	ND	ND	ND	--	ND	ND	ND	ND	ND	--	ND	7,000
Hexachloro-1,3-butadiene	$\mu g/m^3$	ND	ND	ND	ND	ND	ND	ND	--	ND	ND	ND	ND	ND	--	ND	320
Methyl Methacrylate	$\mu g/m^3$	ND	ND	ND	ND	ND	ND	ND	--	ND	ND	ND	ND	ND	--	ND	7,000
Methyl *tert* -Butyl Ether	$\mu g/m^3$	ND	ND	ND	ND	ND	ND	ND	--	ND	ND	ND	ND	ND	--	ND	7,000
Tetrachloroethane, 1,1,2,2-	$\mu g/m^3$	ND	ND	ND	ND	ND	ND	ND	--	ND	ND	ND	ND	ND	--	ND	120
Trichlorobenzene, 1,2,4-	$\mu g/m^3$	ND	ND	ND	ND	ND	ND	ND	--	ND	ND	ND	ND	ND	--	ND	2,000

Appendix D. Lapwai High School Pollutant Concentrations.

Parameter	Units	9/16/2009	9/22/2009	9/28/2009	10/4/2009	10/10/2009	10/16/2009	10/22/2009	10/28/2009	11/3/2009	11/9/2009	11/12/2009	11/18/2009	11/24/2009	12/3/2009	12/9/2009	Sample Screening Level[a]
Trichloroethane, 1,1,2-	$\mu g/m^3$	ND	ND	ND	ND	ND	ND	ND	--	ND	ND	ND	ND	ND	--	ND	440

Key Pollutant

ng/m^3 nanograms per cubic meter

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

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

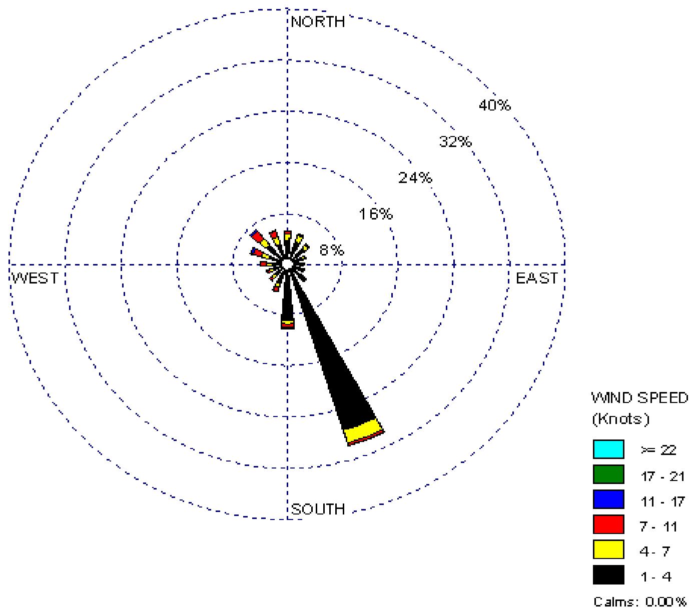
ND No results of this chemical were registered by the laboratory analytical equipment.

[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.

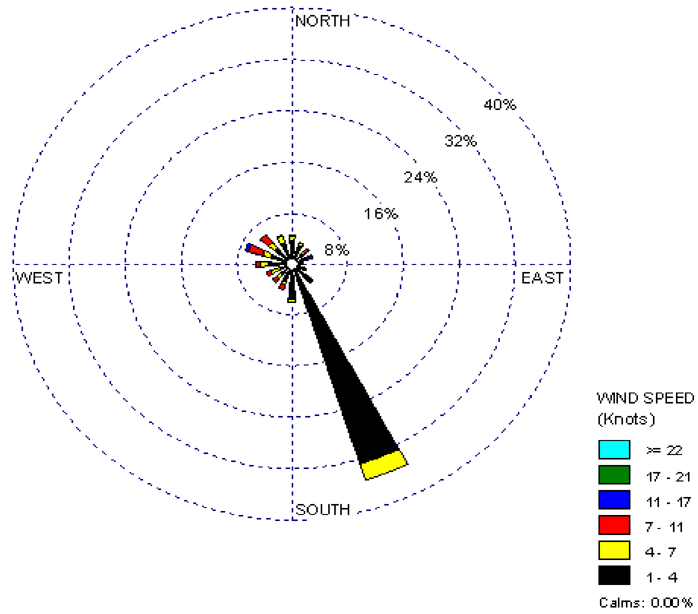
[b] The sample screening levels are specific to hexavalent chromium (recognized as the most toxic form) which is a fraction of the total chromium reported.

[c] The sample screening level is specific to elemental mercury, which is more readily and completely absorbed into the body than mercury conveyed on particles (e.g., divalent species).

Appendix E. Windroses for Lapwai Meteorological Station (AQS ID = 160690013).



Lapwai Meteorological Station
(AQS ID = 160690013)
2004-2006[1]



Lapwai Meteorological Station
(AQS ID = 160690013)
Across Sampling Period
(Sep. 16, 2009-Dec. 9, 2009)[1]

[1] **Lapwai Meterological Station (AQS ID =160690013) is less than 0.5 mile from Lapwai High School.**