SAT Initiative: Central Virginia Training Center and Solid Rock Christian Academy (Madison Heights, Virginia)

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 the Central Virginia Training Center (CVTC) as part of the EPA initiative to monitor specific air toxics in the outdoor air around priority schools in 22 states and 2 tribal areas. For the purposes of this study, results from the air monitoring at CVTC are considered to be indicative of conditions at the nearby Solid Rock Christian Academy (located within ¾ mile of CVTC).
- Originally, EPA selected Solid Rock Christian Academy for further investigation based on the USA Today ranking in their top 25 schools of concern. However, after the Virginia Department of Environmental Quality (VADEQ) performed a site evaluation, it was determined that there was not an acceptable location on the property to place the monitor due to certain siting requirements. Therefore, we relocated the monitor to CVTC, a school that due to proximity would have similar potential for toxics exposure as compared with Solid Rock Christian Academy. Both schools are equal distance from a foundry which produces cast iron pipe.
- The key pollutants which are being monitored are manganese and lead due to 2005 Toxics Release Inventory estimates of manganese and lead emissions for this nearby industrial facility.
- Air monitoring for manganese and other metals in particulate matter less than 10 microns (PM_{10}), as well as lead in total suspended particles (TSP), was performed from August 23, 2009 through October 16, 2009.
- Measured levels of manganese (PM_{10}) and the associated longer-term concentration estimates are below levels of concern. Additionally, levels of lead, a pollutant for which there are national standards for ambient air, are below the level of the national standard for protection of public health.
- The levels of manganese (PM_{10}) and lead (TSP) measured in the outdoor air at this school indicate the potential influence of a nearby source.
- Based on the analysis described here, EPA will not extend air toxics monitoring at this school.
- The VADEQ will continue to oversee the industrial facilities in the area through air permits and other programs. Nearby industrial facilities, including the one responsible for targeting this school, are regulated by air permits and by applicable federal regulations such as New Source Performance Standards (NSPS) and Maximum

Achievable Control Technology (MACT) standards. In addition, VADEQ will be conducting lead (TSP) monitoring at this location in the future as part of their National Ambient Air Quality Standards monitoring network for lead.

II. Background on this Initiative

As part of an EPA initiative to implement Administrator Lisa Jackson's commitment to assess potentially elevated air toxics levels at some of our nation's schools, EPA and state and local air pollution control agencies are monitoring 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 include some schools that are near large industries that are sources of air toxics, and some schools that are in urban areas, where emissions of air toxics come from a mix of large and small industries, cars, trucks, buses and other sources.
- EPA selected schools based on information available to us about air pollution in the vicinity of the school, including results of the 2002 National-Scale Air Toxics Assessment (NATA), results from a 2008 USA Today analysis on air toxics at schools, and information from state and local air agencies. The analysis by USA Today involved use of EPA's Risk Screening Environmental Indicators tool and Toxics Release Inventory (TRI) for 2005.
  - Available information had raised some questions about air quality near these schools that EPA concluded merited investigation. In many cases, the information indicated that estimated long-term average concentrations of one or more air toxics were above the upper end of the range that EPA generally considers as acceptable (e.g., above 1-in-10,000 cancer risk for carcinogens).
- Monitors are placed at each school for approximately 60 days, and take air samples on at least 10 different days during that time. The samples are 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
  - improve the information and methods we will use in the future (e.g., NATA) for estimating air toxics concentrations in communities across the U.S.

Assessment of air quality under this initiative is specific to the air toxics identified for monitoring at each school. This initiative is being implemented in addition to ongoing state, local and national air quality monitoring and assessment activities, including those focused on

[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.

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 State air agency, Virginia Department of Environmental Quality (VADEQ). Originally, EPA selected this area for further investigation based on USA Today's ranking of the Solid Rock Christian Academy in their top 25 schools of concern. However, after VADEQ performed a site evaluation, it was determined that there was not an acceptable location on the property to place the monitor due to certain siting requirements. Therefore, we relocated the monitor to CVTC, which is equal distance from the source and has similar potential for toxics exposure as compared with Solid Rock Christian Academy (located within ¾ mile of CVTC) (Figure 1). VADEQ expressed interest in evaluating the ambient concentrations of manganese (PM_{10}) and lead (TSP) outside the school after Solid Rock Christian Academy was listed by USA Today. The CVTC is a state-run residential facility supplying long-term care to individuals with mental disabilities. While CVTC is not the exact school on which the USA Today ranking was based due to estimates of manganese and lead emissions in the 2005 Toxics Release Inventory, it is nevertheless similarly influenced by the industrial emissions from a nearby foundry which produces cast iron pipe.

Monitoring commenced at this school on August 23, 2009 and continued through October 16. During this period, ten samples of airborne particles were collected using a PM_{10} sampler[4] and ten samples were collected using a TSP sampler. The samples were analyzed for manganese (PM_{10}) and lead (TSP) (the two key pollutants at this school) and for a small standardized set of additional metals that are routinely included in the analytical methods for the key pollutants. (http://www.epa.gov/schoolair/techinfo.html).[5]

---

[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 level for manganese is based on.
[5] VADEQ staff operated the monitors and sent the sample filters to the analytical laboratory under contract to EPA.

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

[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 state methods, practices and policies may differ and subsequent analyses of the monitoring data by state 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 actions taken to address the type of ubiquitous emissions that came from mobile sources.

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

---

[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-2b) with regard to areas of interest identified below.

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

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

- The air sampling data collected over the 2-month sampling period and the related longer-term concentration estimates for manganese and lead, while indicating potential influence from a nearby source are below levels of concern for manganese and below the national ambient air standard for protection of public health for lead.

<u>Manganese, key pollutant:</u>

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

  → The data collected include one manganese (PM_{10}) concentration that was appreciably higher than concentrations commonly observed in other locations nationally.[12] Additionally, as discussed in section IV.C below, on the day in which the highest concentration was measured, the wind information indicated a significant portion of that day's winds came from the direction of a nearby source.

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

  → The monitoring data for manganese do not indicate levels of health concern for long-term exposures.

  - The estimate of longer-term manganese (PM_{10}) concentration (i.e., the upper bound of the 95 percent confidence interval on the mean of the dataset) is substantially below the long-term comparison level (Table 1).[13] This comparison level represents a continuous exposure concentration (24 hours a day, all year, over a lifetime) associated with little risk of adverse effect; it is not an exposure concentration at which effects have been observed or are predicted to occur.[14]
  - As manganese has not been found to be carcinogenic, it has no cancer-based comparison level.[15]

  → Additionally, we did not identify any concerns regarding short-term exposures as each individual measurement is below the individual sample screening level for manganese (which is 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).[11]

---

[12] For example, one of the concentrations at this site (Table 2) was higher than 75 percent of samples collected at the National Air Toxics Trends Stations (NATTS) from 2004-2008 (Appendix B). Because these NATTS sites are generally sited so as not to be influenced by specific nearby sources, EPA is using the 75th percentile point of concentrations at these sites as a benchmark for indicating potential influence from a source nearby to this school.

[13] The upper end of the interval is nearly two times the mean of the monitoring data, but only 10% of the noncancer long-term comparison level.

[14] The comparison level for manganese is based on the RfC. Manganese concentrations at which health effects have been documented are higher than the RfC (http://www.atsdr.cdc.gov/tfacts151.html, http://www.epa.gov/ttn/atw/hlthef/manganes.html#conversion)

[15] <u>www.epa.gov/iris</u>

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

Lead (TSP), key pollutant:

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

  → The data collected include one lead (TSP) concentration that was several times higher than the other measurements. Additionally, as discussed in section IV.C below, on the day in which the highest concentration was measured, the wind information indicated a significant portion of that day's winds came from the direction of a nearby source.

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

  → The monitoring levels of lead (TSP) are below the national ambient air quality standard for protection of public health for lead.

    - The estimate of longer-term lead (TSP) concentration (i.e., the upper bound of the 95 percent confidence interval on the mean of the dataset) is substantially below the long-term comparison level (Table 1).[16] The comparison level is the level of the national ambient air quality standard.

  → In summary, the monitoring data do not indicate concentrations above the national ambient air quality standard for protection of public health.

Other Air Toxics

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

  → The monitoring data show low levels of the other HAPs monitored, all which have associated longer-term concentration estimates which are 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.

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)?

---

[16] The upper end of the interval is nearly two times the mean of the monitoring data and only 6% of the noncancer-based long-term comparison level. This comparison value for lead is the level of the national ambient air quality standard, which is in terms of a 3-month average level of lead in total suspended particles.

→ 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 (Appendix C).[17]

C. Wind and Other Meteorological Data

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

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

The meteorological station at the Central Virginia Training Center collected wind speed and wind direction measurements beginning on August 17, 2009, continuing through the sampling period (August 23, 2009-October 16, 2009), and ending on February 17, 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 six months of on-site meteorological data. The meteorological data collected at the school site on sampling days are presented in Figures 3a-3b and Table 2.

The nearest NWS station is at Lynchburg Regional/Preston Glenn Field Airport. This station is approximately 7 miles south-southwest of the school. Measurements taken at this station include wind, temperature and precipitation. These are presented in Table 2 and Appendix E.

[17] We note that this initiative is focused on investigation for a school-specific set of key pollutants indicated by previous analyses (and a small set of others for which measurements are obtained in the same analysis). Combined impacts of pollutants or stressors other than those monitored in this project is a broader area of consideration in other EPA activities. General information on additional air pollutants is available at http://www.epa.gov/air/airpollutants.html

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

- Both the sampling results and the on-site wind data indicate that two of the air samples (one for each pollutant) were collected on a day when the nearby key source appears to be contributing to conditions at the school location.
- The wind patterns at the monitoring site across sampling dates are very 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, as the NWS station in Lynchburg Regional/Preston Glenn Field Airport does not appear to represent the specific wind flow patterns at the school location probably due to differences in terrain.
- Although we lack long-term wind data at the monitoring station, the wind patterns at the NWS station during the sampling period are generally not similar to the historical long-term wind flow pattern at that location. This suggests that, on a regional scale, the 2-month sampling period is not representative of year-round wind patterns.

- What is the direction of the key source of manganese and lead emissions in relation to the school location?
  → The nearby industrial facility emitting manganese and lead into the air (described in section III above) lies less than one mile northwest of the school.
  → Using the property boundaries of the full facility (in lieu of information regarding the location of specific sources of manganese and lead 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 280 to 315 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?
  → On 9 of the 10 sampling days, the winds were originating from the expected ZOI (Figures 2a and 2b, Table 2).
  → We additionally note that the highest recorded concentrations for lead (TSP) and manganese (PM_{10}) were on a day in which a large proportion of the air was coming directly from the source of interest, with nearly 42% of the hourly winds within the expected ZOI. The highest manganese PM_{10} concentration was higher than 75 percent of samples collected at 28 NATTS National Air Toxics Trends Sites from 2004-2008 (the most recently compiled period, Appendix B), also indicating that this sample was collected on a day when there was a source contribution to air quality at the school site (Table 2).

- How do wind patterns on the air monitoring days compare to those across the complete monitoring period and what might be expected over the longer-term at the school location?
  - → Wind patterns across the air monitoring days appear to be very similar to those observed over the record of on-site meteorological data during the sampling period.
  - → We note that wind patterns at the nearest NWS station (at Lynchburg Regional/ Preston Glenn Field Airport) during the sampling period are somewhat similar to the on-site wind patterns, but not very similar to those recorded at the NWS station over the long-term (2002-2007 period; Appendix E). Because of this discrepancy, 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 Lynchburg Regional/Preston Glenn Field Airport (see below).

- How do wind patterns at the school compare to those at the Lynchburg Regional/Preston Glenn Field Airport station, particularly with regard to prevalent wind directions and the direction of the key source?
  - → During the sampling period for which data are available both at the school site and at the reference NWS station (approximately two months), prevalent winds at the school site are predominantly from the northwest and northeast, while those at the NWS station are more from the north-northeast to northeast. The windroses for the two sites during the sampling period (Figures 3a-3b and Appendix E) show differences in wind flow patterns, most likely resulting from differences in topographical influence between the two sites which are separated by more than 7 miles. Frequent hills and other changes in terrain run northeast to southwest near the airport, and may subsequently impact the wind directions coming primarily from the northeast. In addition, the source is located only approximately 1.5 miles from the school station in a river valley. The distance and complex terrain generally requires higher winds in order for the pollutants to reach the site. Lower wind speeds would most likely result in a potential "pollutant plume" following the valley and not reaching the school site which is outside the valley (charts in Figures 3a-3b).

- Are there other meteorological patterns that may influence the measured concentrations at the school monitoring site?
  - → We did observe that the highest concentration recorded was on a day in which the wind speeds were somewhat higher, and only ~8% of the wind speeds were less than 2 knots, or calm.

V. Key Source Information

- Was the source operating as usual during the monitoring period?
  - – The nearby source of manganese and lead (described in section III above) has an operating permit issued by VADEQ that includes operating requirements.[18]

---

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

- Information from regional and state staff indicates that the nearby source is a metal processing facility. The facility manufactures ductile iron pipe by melting scrap iron in a cupola using coke as fuel and treats the molten iron with additives to make ductile iron. It incorporates some two hundred manufacturing operations which include: melting and re-melting of metals to produce alloy ingots, hot and cold rolling, forging, drawing, machining, grinding, shot blasting, pickling, annealing, and ancillary testing and byproduct recovery operations.
- Due to reduced market demand, this facility was operating at approximately 60% of its capacity during the monitoring period, which is generally lower than its usual condition of operating near 90% capacity.
- The most recently available manganese and lead emissions estimates for this source (2008 TRI) are lower than those relied upon in previous modeling analyses for this area (e.g., 2005 TRI and 2002 NATA).

VI. Integrated Summary and Next Steps

A. Summary of Key Findings

1. What are the key HAPs for this school?
   → Manganese and lead (TSP) are the key HAPs 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?
   → No; the levels measured and associated longer-term concentration estimates are not as high as that suggested by the information available prior to monitoring. Levels of manganese (PM_{10}) are below levels of concern for long-term exposures. Additionally, levels of lead, a pollutant for which there are national standards for ambient air, are below the level of the national standard for protection of public health.
   → The low measurements indicate that even should the facility begin operating at more typical production rates (90% vs. 60%), and emissions and air concentrations were to increase proportionally, the same conclusions would be reached.

3. Are there indications, e.g., from the meteorological or other data, that the sample set may not be indicative of longer-term air concentrations? Would we expect higher (or lower) concentrations at other times of year?
   → The data we have collected appear to reflect air concentrations during the entire monitoring period, with no indications from the on-site meteorological data that the sampling day conditions were inconsistent with conditions overall during this period.
   → Based on the data collected for this site, we have no available information to determine whether generally higher (or lower) concentrations occur during other times of year. The wind flow patterns at the nearest NWS station during the sampling period do not appear to be representative of long-term

wind flow at that site. The lack of long-term meteorological data at the school location, along with our finding that the wind patterns from the nearest NWS station differ from one season to the next, limits our ability to confidently predict longer-term wind patterns at the school (which might provide further evidence relevant to concentrations during other times of the year).

B. Next Steps for Key Pollutants

1. Based on the analysis described here, EPA will not extend air toxics monitoring at this school.
2. The VADEQ will continue to oversee the industrial facilities in the area through air permits and other programs. Nearby industrial facilities, including the one responsible for targeting this school, are regulated by air permits and by applicable federal regulations such as New Source Performance Standards (NSPS) and Maximum Achievable Control Technology (MACT) standards. In addition, VADEQ will be conducting lead (TSP) monitoring at this location in the future as part of the National Ambient Air Quality Standard for lead.

VII. Figures and Tables

A. Tables

1. Central Virginia Training Center – Key Pollutant Analysis.
2. Central Virginia Training Center Key Pollutant Concentrations and Meteorological Data.

B. Figures

1. Central Virginia Training Center, Solid Rock Christian Academy, and the Source of Interest.

2a. Central Virginia Training Center – Key Pollutant (Manganese (PM_{10})) Analysis.

2b. Central Virginia Training Center – Key Pollutant (Lead (TSP)) Analysis.

3a. Central Virginia Training Center (Madison Heights, VA) Manganese (PM_{10}) Concentration and Wind Information.

3b. Central Virginia Training Center (Madison Heights, VA) Lead (TSP) 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. Central Virginia Training Center Pollutant Concentrations.

E. Windroses for Lynchburg Regional/Preston Glenn Field Airport NWS Station.

Figure 1. Central Virginia Training Center, Solid Rock Christian Academy, and the Source of Interest.

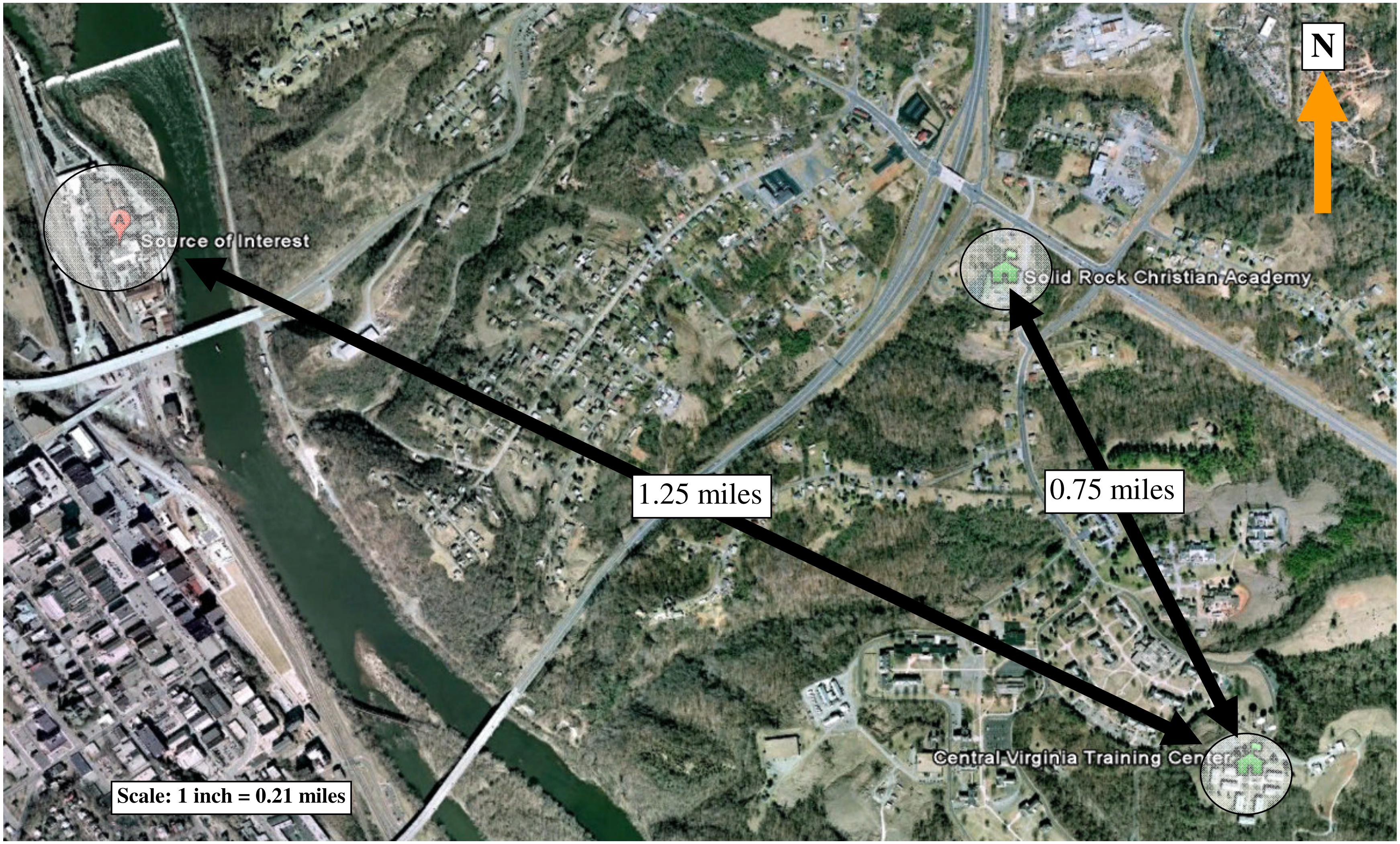


Table 1. Central Virginia Training Center - Key Pollutant Analysis.

Parameter	Units	Mean of Measurements	95% Confidence Interval on the Mean	Long-term Comparison Level[a]	
				Cancer-Based[b]	Noncancer-Based[c]
Manganese (PM_{10})	ng/m^3	5.28 [d]	0.87 - 9.68	NA	50
Lead (TSP)	ng/m^3	3.51 [e]	0.70 - 6.32	NA	150[f]

ng/m^3 nanograms per cubic meter
NA Not applicable

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

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

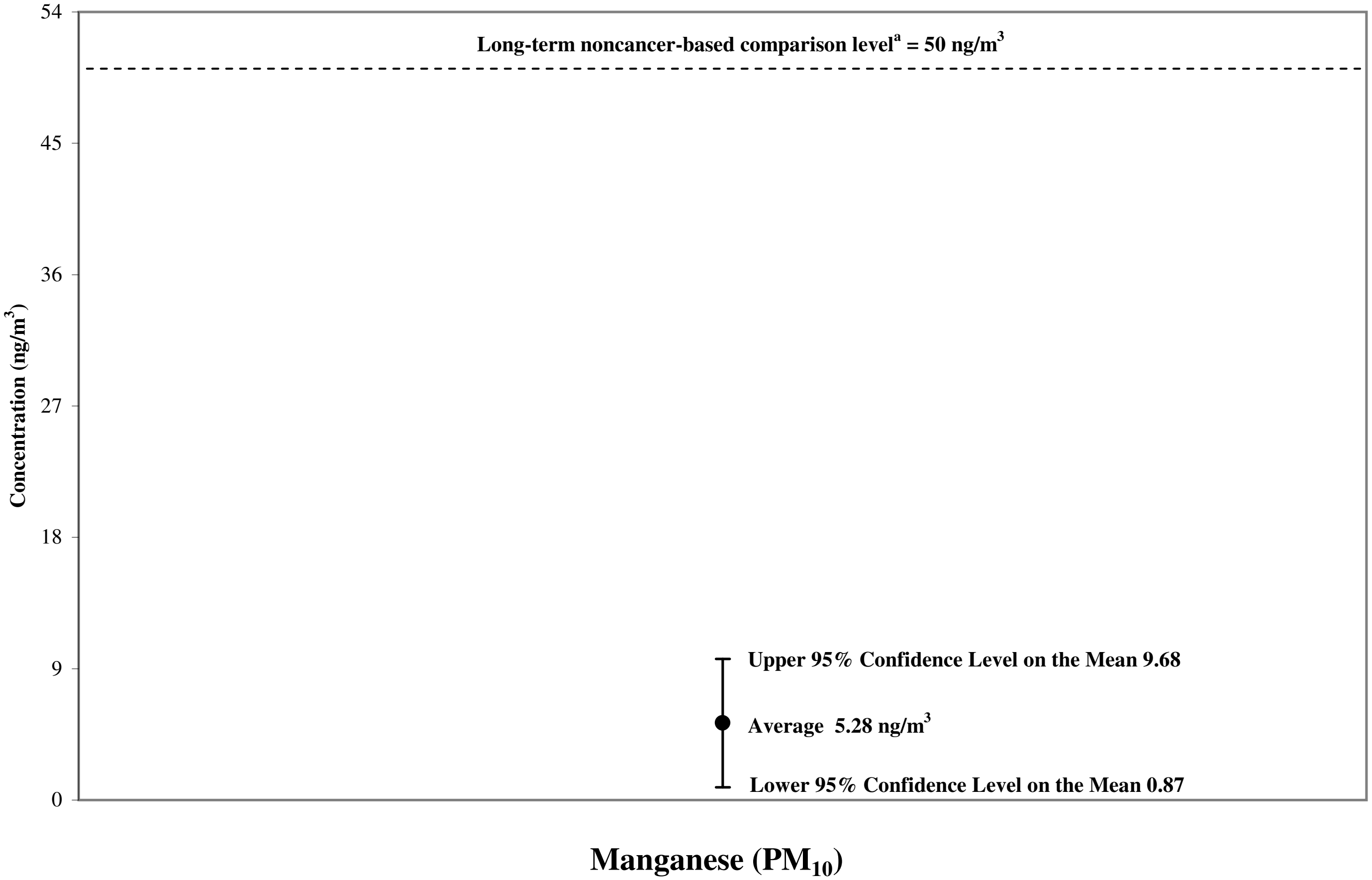
[c] Air toxics for which the upper 95% confidence limit on the mean concentration are near or below the noncancer-based comparison level are generally of low concern and will generally be considered a low priority for follow-up activity. Pollutants for which the 95% confidence limits extend appreciably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

[d] The mean of measurements for manganese (PM_{10}) is the average of all sample results, which include ten detections that ranged from 0.48 to 22.1 ng/m^3.

[e] The mean of measurements for lead (TSP) is the average of all sample results, which include ten detections that ranged from 0.64 to 14.4 ng/m^3.

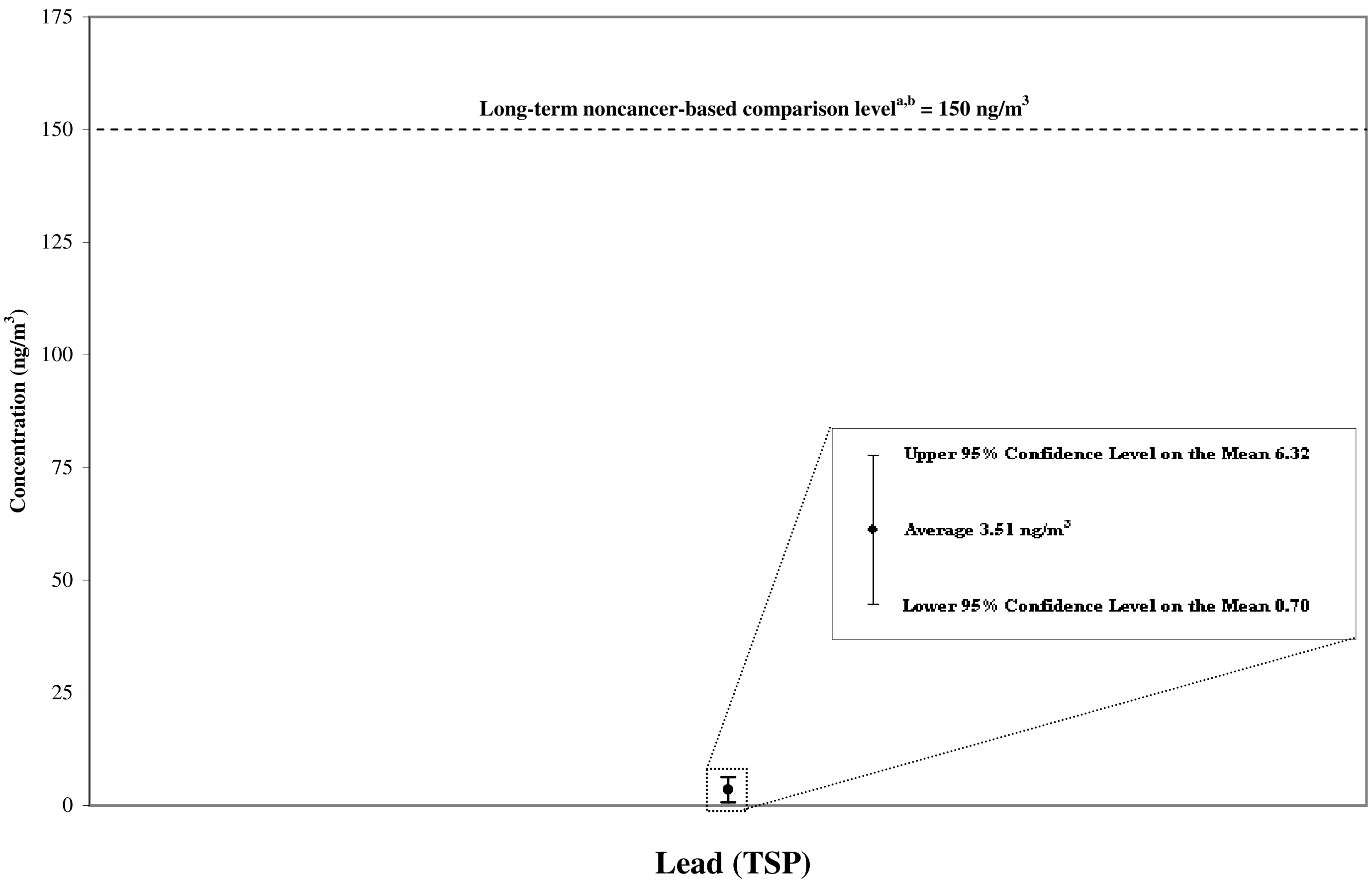
[f] This comparison value for lead is the level of the national ambient air quality standard, which is in terms of a rolling 3-month average level of lead in total suspended particles.

Figure 2a. Central Virginia Training Center - Key Pollutant (Manganese (PM_{10})) 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.

Figure 2b. Central Virginia Training Center - Key Pollutant (Lead (TSP)) 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] This comparison value for lead is the level of the national ambient air quality standard, which is in terms of a rolling 3-month average level of lead in total suspended particles.

Table 2. Central Virginia Training Center Key Pollutant Concentrations and Meteorological Data.

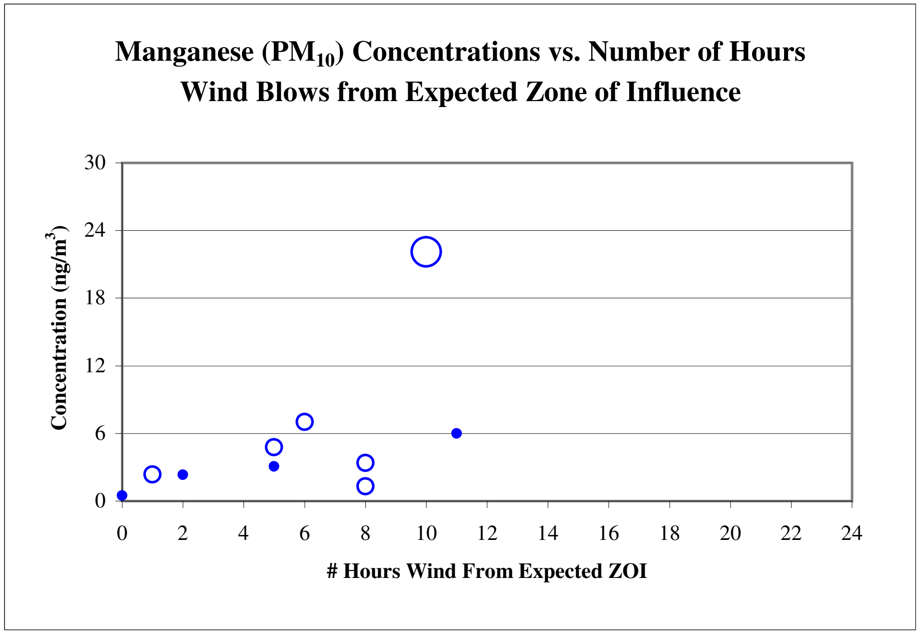
Parameter	Units	8/23/2009	8/29/2009	9/4/2009	9/10/2009	9/16/2009	9/22/2009	9/28/2009	10/4/2009	10/10/2009	10/16/2009
Manganese (PM_{10})	ng/m^3	3.08	7.02	5.99	2.35	4.76	2.32	22.1	3.37	1.30	0.48
Lead (TSP)	ng/m^3	1.70	1.47	3.65	3.28	4.00	1.82	14.4	3.03	1.10	0.64
% Hours w/Wind Direction from Expected ZOI[a]	%	20.8	25.0	45.8	4.2	20.8	8.3	41.7	33.3	33.3	0.0
Wind Speed (avg. of hourly speeds)	mph	2.0	2.7	2.0	3.2	3.3	1.6	5.6	3.3	2.8	2.3
Wind Direction (avg. of unitized vector)[b]	deg.	11.1	247.9	319.5	38.7	27.1	24.0	265.5	315.8	316.2	52.4
% of Hours with Speed below 2 knots	%	70.8	41.7	66.7	20.8	37.5	91.7	8.3	45.8	29.2	54.2
Daily Average Temperature	° F	74.4	73.8	67.6	64.5	70.5	67.5	63.5	57.8	66.5	46.4
Daily Precipitation	inches	0.02	0.45	0.00	0.01	0.01	0.15	0.00	0.00	0.01	0.00

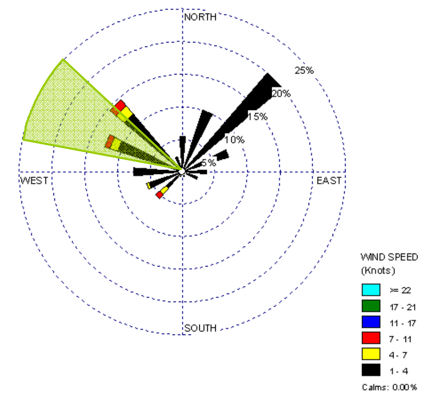
(yellow shading) All precipitation and temperature data were from the Lynchburg Regional/Preston Glenn Field Airport NWS Station.

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

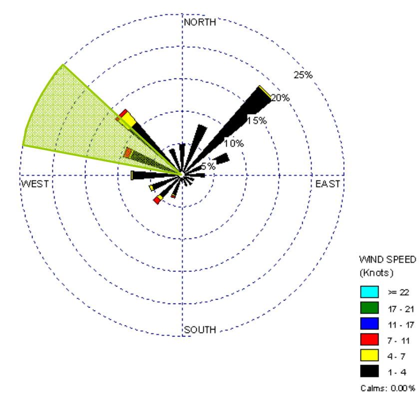
[b] Wind direction for each day is represented by values derived by scalar averaging of hourly estimates that were produced (by wind instrumentation's logger) as unitized vectors (specified as degrees from due north).

Figure 3a. Central Virginia Training Center (Madison Heights, VA) Manganese (PM_{10}) Concentration and Wind Information.





Central Virginia Training Center
Composite Hourly Windrose
on Sample Days
(Aug. 23, 2009-Oct. 16, 2009)



Central Virginia Training Center
Composite Hourly Windrose
Across Sampling Period
(Aug. 23, 2009-Oct. 16, 2009)

Expected Zone of Source Influence

KEY

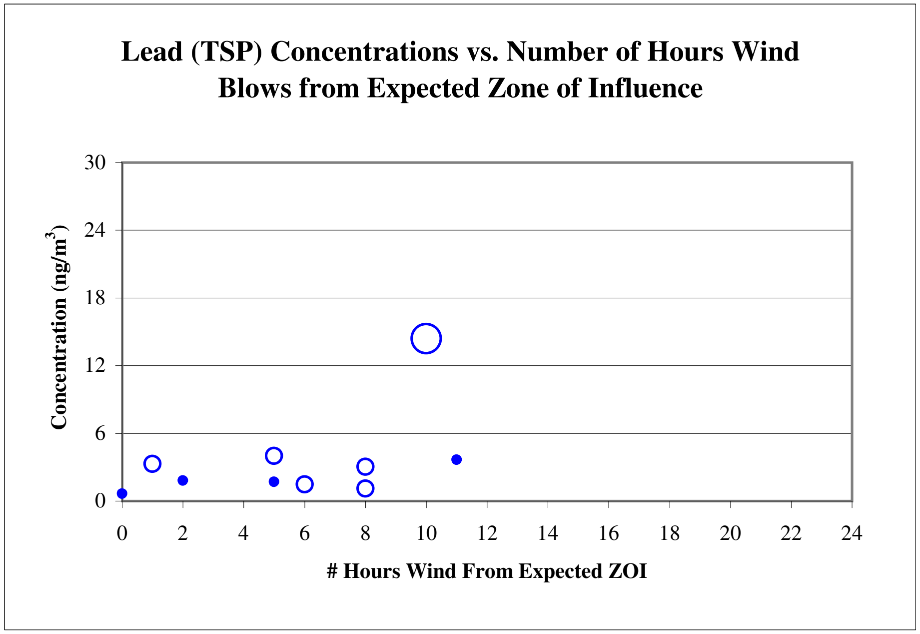
Pollutant: Manganese (PM_{10})
Timeframe: August 23, 2009 - October 16, 2009

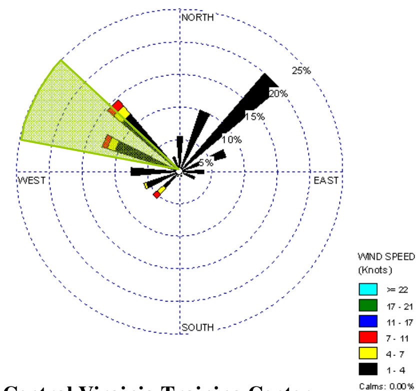
Wind Speed: 0.1-2.5 mph
Wind Speed: 2.5-5.0 mph
Wind Speed: > 5.0 mph

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

Figure 3b. Central Virginia Training Center (Madison Heights, VA) Lead (TSP) Concentration and Wind Information.





Central Virginia Training Center
Composite Hourly Windrose
on Sample Days
(Aug. 23, 2009-Oct. 16, 2009)

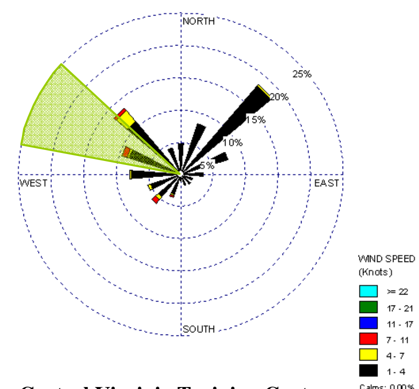
KEY

Pollutant: Lead (TSP)
Timeframe: August 23, 2009 - October 16, 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 2). The expected zone of source influence is a rough approximation of the range of directions from which winds carrying chemicals emitted by the key source may originate.



Central Virginia Training Center
Composite Hourly Windrose
Across Sampling Period
(Aug. 23, 2009-Oct. 16, 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.[19]

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.[20] 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.

[19] These comparison levels are described in more detail *Schools Air Toxics Monitoring Activity (2009), Uses of Health Effects Information in Evaluating Sample Results*.
[20] 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.[21] 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.

[21] 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
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

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).[22] 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).

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

- Do the monitoring data indicate elevated levels of any other air toxics or hazardous air pollutant (HAPs) that pose significant long-term health concerns?
  - → Longer-term concentration estimates for the other HAPs monitored are below their long-term comparison levels.
  - → Further, for pollutants with cancer-based comparison levels, longer-term concentration estimates for all but one of these is more than tenfold lower (chromium) and all but two (also arsenic) are more than 100-fold lower than these comparison levels.[23]
  - → Additionally each individual measurement for these pollutants is below the individual sample screening level developed for considering potential short-term exposures for that pollutant.[24]

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

- 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 well below even these very restrictive comparison values. The mean and 95 percent upper bound on the mean for chromium (PM_{10}) are approximately half of the cancer-based comparison level. Further, as Cr^{+6} is

[22] 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.

[23] 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.

[24] 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,[25] 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 is lower than the 95th percentile of samples collected from 2004 to 2008 (the most recently compiled period) at the NATTS (Appendix B).

- The second HAP mentioned above is arsenic. The mean and 95 percent upper bound on the mean of arsenic (PM_{10}) at the site are approximately 4-8 % of the cancer-based comparison level. The upper bound is nearly two times the mean due to a single measurement being much different from the others (although still well below the individual sample screening level). A review of information available at other sites nationally shows that the mean concentration of arsenic (PM_{10}) at this site falls between the 50th and 75th percentile of samples collected from 2004 to 2008 (the most recently compiled period) at the NATTS (Appendix B).

Multiple Pollutants

As described in the main body of the report and background materials, this initiative and the associated analyses are focused on investigation of key pollutants for each school that were identified by previous analyses. This focused design does not provide for the consideration of combined impacts of pollutants or stressors other than those monitored in this project. Broader analyses and those involving other pollutants may be the focus of other EPA activities.[26]

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.
    - In addition to the key pollutant manganese, the only other HAPs monitored whose longer-term concentration estimates are more than ten percent of their lowest comparison levels are chromium (PM_{10}) and arsenic (PM_{10}). The lowest comparison level for chromium is based on carcinogenic risk to the respiratory

[25] 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.
[26] General information on additional air pollutants is available at http://www.epa.gov/air/airpollutants.html.

system posed by the most toxic form of chromium, hexavalent chromium,[27] while the comparison level for manganese and the lowest comparison level for arsenic are based on non-carcinogenic effects to a different system. Additionally, as noted above, hexavalent chromium is commonly a small fraction of the total chromium (PM_{10}) reported. With regard to arsenic and manganese, it can be seen that in the aggregate, their longer-term concentration estimates comprise less than half the noncancer-based comparison levels. Taken together these considerations reduce concerns for cumulative health risk from these pollutants.

[27] 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. Central Virginia Training Center - Other Monitored Pollutant Analysis.

Parameter	Units	Mean of Measurements[a]	95% Confidence Interval on the Mean	Long-term Comparison Level[b] Cancer-Based[c]	Long-term Comparison Level[b] Noncancer-Based[d]
Non-Key HAPs with mean greater than 10% of the lowest comparison level					
Chromium (PM_{10})	ng/m^3	3.54	2.98 - 4.11	8.3 [e]	100 [e]
Non-Key HAPs with mean lower than 10% of the lowest comparison level					
Arsenic (PM_{10})	ng/m^3	0.97	0.05 - 1.88	23	15
Cadmium (PM_{10})	ng/m^3	0.09	0.05 - 0.14	56	10
Nickel (PM_{10})	ng/m^3	0.37	0.27 - 0.46	420	90
Antimony (PM_{10})	ng/m^3	0.55	0.36 - 0.74	NA	200
Cobalt (PM_{10})	ng/m^3	0.06	0.03 - 0.08	NA	100
Selenium (PM_{10})	ng/m^3	0.50	0.25 - 0.74	NA	20,000
Beryllium (PM_{10})	ng/m^3	0.01 [f]	0 - 0.02 [f]	42	20
Non-Key HAPs with more than 50% ND results.					
Mercury (PM_{10})	ng/m^3	60% of results were ND[g]		NA	300 [i]

ng/m^3 nanograms per cubic meter
NA Not applicable
ND No results of this chemical were 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

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

[f] Beryllium (PM_{10}) was detected in 6 of 10 samples, ranging from 0.001 to 0.05 ng/m^3. The MDL is 0.03 ng/m^3.

[g] Mercury (PM_{10}) was detected in only 4 of 10 samples, ranging from 0.01 to 0.04 ng/m^3. The MDL is 1.12 ng/m^3.

[h] 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).

Appendix D. Central Virginia Training Center Pollutant Concentrations.

Parameter	Units	8/23/2009	8/29/2009	9/4/2009	9/10/2009	9/16/2009	9/22/2009	9/28/2009	10/4/2009	10/10/2009	10/16/2009	Sample Screening Level[a]
Manganese (PM_{10})	ng/m^3	3.08	7.02	5.99	2.35	4.76	2.32	22.1	3.37	1.30	0.48	500
Lead (TSP)	ng/m^3	1.70	1.47	3.65	3.28	4.00	1.82	14.4	3.03	1.10	0.64	150
Chromium (PM_{10})	ng/m^3	3.96	4.21	4.78	4.63	3.26	3.31	2.95	2.95	2.47	2.92	580 [b]
Arsenic (PM_{10})	ng/m^3	0.92	0.92	0.63	0.36	0.70	0.51	0.53	4.61	0.27	0.22	150
Cadmium (PM_{10})	ng/m^3	0.15	0.04	0.10	0.06	0.13	0.06	0.22	0.12	0.03	0.02	30
Nickel (PM_{10})	ng/m^3	0.28	0.52	0.55	0.39	0.48	0.34	0.19	0.16	0.48	0.26	200
Antimony (PM_{10})	ng/m^3	0.75	0.33	0.92	0.40	0.93	0.52	0.60	0.66	0.26	0.12	2,000
Cobalt (PM_{10})	ng/m^3	0.04	0.14	0.09	0.04	0.09	0.03	0.07	0.04	0.01	0.008	100
Selenium (PM_{10})	ng/m^3	0.88	0.39	0.66	0.59	1.17	0.23	0.52	0.20	0.22	0.09	20,000
Beryllium (PM_{10})	ng/m^3	ND	0.02	0.05	ND	ND	ND	0.005	0.005	0.001	0.009	20
Mercury (PM_{10})	ng/m^3	ND	ND	0.01	ND	ND	ND	0.02	ND	0.02	0.04	3,000 [c]

Key Pollutant (yellow highlight)

ng/m^3 nanograms per cubic meter

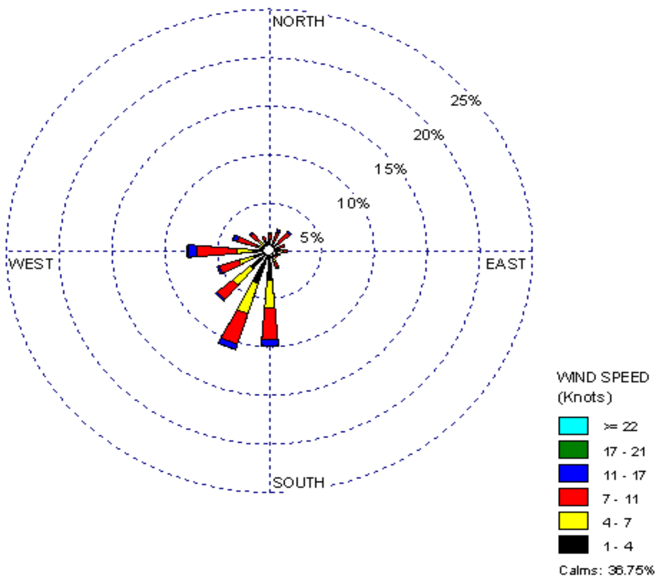
ND No results of this chemical were registered by the laboratory analytical equipment.

[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.

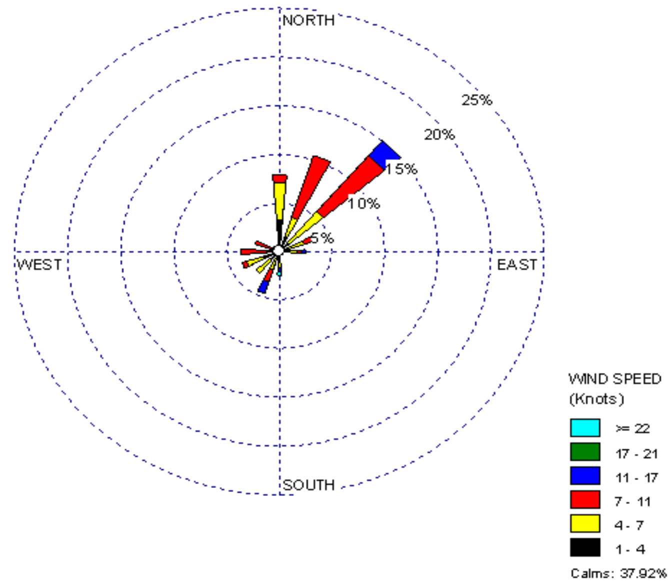
[b] The sample screening levels are specific to hexavalent chromium (recognized as the most toxic form) which is a fraction of the total chromium reported.

[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 Lynchburg Regional/Preston Glenn Field Airport NWS Station.



Lynchburg Regional/Preston Glenn Field Airport NWS Station Composite Hourly Windrose, 2002-2007[1]



Lynchburg Regional/Preston Glenn Field Airport NWS Station Across Sampling Period (Aug. 23, 2009-Oct. 16, 2009)[1]

[1] Lynchburg Regional/Preston Glenn Field Airport (WBAN 13733) is 6.93 miles from Central Virginia Training Center.