Louisville Metro Air Pollution Control District
Hot Spots Monitoring: Short Term Study
November 2006 – January 2007

Tua McDermott, Louisville Metro APCD

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EXECUTIVE SUMMARY

This report summarizes the results and the methodology for the Hot Spots monitoring project conducted by Louisville Metro Air Pollution Control District (APCD). Analysis included reviewing the data results from the samples provided by Air Toxics Ltd., the meteorological data collected by APCD, and preparing visual summaries and comparisons of the data results. The purpose of the study was to identify findings and observations that were most significant and to help shape and direct the future toxics monitoring plan for Louisville Metro.

Three area sources were selected for the short term monitoring plan (see Table 1). They were chosen because they are area sources in close proximity to a receptor and they are a type of facility representative of various sources in Louisville Metro. The three sources from Table 1 are in different parts of Jefferson County. Those sources, a dry cleaner, a busy road intersection, and a gas station provided diversity in the monitoring.

The receptor sites of interest in the study were chosen because they contain "at risk" population groups and were screened to be within 500 meters (0.311 miles) of the area source. "At risk" populations include any group that may be more sensitive to the health effects of toxic chemicals, such as children, the elderly, or those with pre-existing illnesses. The study's three receptors identified are all considered to be sensitive populations: a child care center, an elementary school and a high school.

The Preston Highway/Outer Loop source revealed no inconsistencies with what was expected for the sampling location being near a road and a gas station. The data results were consistent with the speciation for evaporative emissions of a gas station and/or vehicle car exhaust. Okolona Elementary, the corresponding receptor, did have one atypical positive hit. On December 19, tetrachloroethylene (perchloroethylene) was reported at 10.0 $\mu g/m^3$for the one hour sample.

Thorntons (source) and Ballard High School (receptor) sampling sites had data results consistent with the speciation for evaporative emissions of a gas station and/or vehicle car exhaust. Thorntons and Ballard High had reported tetrachloroethylene concentrations of 1.2 $\mu g/m^3$ and 1.5 $\mu g/m^3$ respectively on December 19. STAR lists the BAC for Cancer Risk for this compound at 0.17 $\mu g/m^3$ and it is a Category 1 TAC.

The Village Cleaner (source) and Southeast Christian Childcare Center (SCCC) (receptor) did not have a single positive hit for tetrachloroethylene. Before choosing this source/receptor set for this monitoring project, District staff called Village Cleaner to confirm that the dry cleaning equipment was in operation. Unfortunately, District staff was misinformed regarding the status of the dry cleaning operations. After receiving the monitoring data, District staff again contacted Village Cleaner, which then provided the correct information that dry cleaning no longer occurred at this location. Although the monitoring data did not identify concentrations of tetrachloroethylene, the data did reveal the impact that idling cars have on the air quality surrounding the daycare. The air samples taken at the daycare were similar in composition (compounds and concentrations) to the air samples from the intersection of Preston Highway and Outer Loop. Therefore, although not quatifying the impact of the intended source's emissions (tetrachloroethylene) on this sensitive population receptor, this portion of the monitoring project revealed a different concern for this receptor site.

Future study recommendations may include a longer study period and sampling time. A recommendation may be made to SCCC and other daycares to voluntarily enforce the local regulation that mentions "no idling" to improve the air quality for the children. The Louisville ordinance that mentions no idling 72.032 states "It shall be a parking violation for any person driving or in charge of a motor vehicle to permit it to stand unattended without stopping the engine, locking the ignition, and removing the key, or when standing on any perceptible grade without setting the brake thereon and turning the front wheels to the curb."

The high level of tetrachloroethylene at Okolona Elementary is a concern. Future samples should be collected to see if this was a chance occurrence or a result of a regular event. If the compound is detected again, an effort will be made to identify the source.

1.0 INTRODUCTION

The hot spot monitoring program was designed to assess emissions primarily from area sources or minor sources. The monitoring plan focused on both source and receptors as monitoring points. The sources chosen fall under Regulation 5.30 of the STAR Program. Louisville Metro APCD collected air samples for analysis of volatile organic compounds (VOCs) beginning on November 29, 2006 with the final sample collected on January 8, 2007. The study focused on many of the volatile organic compounds from the chemicals of concern for the Louisville Metro area identified by the 2003 West Louisville Air Toxics Study Risk Assessment. The goal of the short term monitoring program was to collect and analyze air toxics data so that recommendations for future monitoring, policy development, regulation, or enforcement could be developed and presented to the to the 5.30 Stakeholder group and the Air Pollution Control District's (APCD) Board for further consideration and possible action.

1.1 Sources and Receptors

Regulation 5.30 requires the District to assess and address the toxic air contaminant emissions from non-major point sources such as:

- Mobile sources: motorized vehicles that are registered for use on the public roads and highways.
- Non-road mobile sources: motorized vehicles that are not registered for use on public roads and highways, or any other equipment with a fossil fuel-fired engine that is not included as a point source.
- Minor stationary sources: a point source that is not a major or moderate point source.
- Area sources: a non-permitted commercial stationary source or other anthropogenic source of emissions that is not included in section 1.1.1, 1.1.3, or 1.1.4 of Regulation 5.30.

Three area sources were selected for the short term monitoring plan (see Pictures 1-3). They were chosen because they are area sources in close proximity to a receptor and they are a type of facility representative of various sources in Louisville Metro. A review of Map 1 illustrates that the three sources from Table 1 are in different parts of Jefferson County. Those sources, a dry cleaner, a busy road intersection, and a gas station provided diversity in the monitoring.

The receptor sites (Pictures 3-6) of interest in the study were considered because they contain "at risk" population groups and were initially screened to be within 500 meters (0.311 miles) of an area source (see Maps 2 – 4). "At risk" populations include any group that may be more sensitive to the health effects of toxic chemicals, such as children, the elderly, or those with pre-existing illnesses. The study's three receptors identified are all considered to be sensitive populations: a child care center, and elementary school and a high school. The source-receptor monitoring distance was chosen was to reflect the average sampling criteria for middle-scale and neighborhood-scale objectives defined in 40 CFR Part 58 appendices D and E.

Another consideration of the study was area source monitoring of businesses that operate during the times when sensitive populations occupy the receptor sites. The receptors in Table 1 were selected because of proximity to a source, hours of business, and type of business. Table 2 shows the hours of business for both the source and receptor sites. It was important that the receptors had similar business hours to the sources in order to collect air samples that would exhibit the most significant effect that the sources can have on the receptors.

1.2 Chemicals of Concern

The chemicals of concern consist of many of the volatile organic compounds listed in Regulation 5.23. The results of the monitoring study highlight any chemical found above the detection limit in the Hot Spot areas. A list of the compounds that were included in the lab analysis was provided by Air Toxics LTD and is included in Appendix A.

1.3 Monitoring Plan

Six-liter Summa canisters were used to collect one-hour samples at the selected source and/or receptor sites. The monitoring at each site was scheduled for once per week beginning November 29, 2006 and continuing until January 8, 2007. The whole air sample was collected on a different day of the week and at a different time each monitoring day. The Summa canister was placed at the site, the valve opened and subsequently closed after the one hour duration. The canisters were sent to Air Toxics Ltd. laboratory to be analyzed using FRM TO-15. The VOC's in the sample were analyzed and quantified by GC/MS. The lab cleaned and delivered canisters to APCD for each round of sampling. A field blank and a lab blank were incorporated for quality assurance.

1.4 Laboratory

Research was done to find labs that were capable of performing TO-15 analysis. Only two labs were found that were capable of chloroprene analysis and quantification. A quote package was submitted and Air Toxics Ltd. (ATL) in Folsom, CA was selected to provided the equipment and analysis. APCD received all the data back from ATL by the end of January 2007. The invoiced total from ATL for the equipment and analysis was $8,292.00.

2.0 PROJECT MANAGEMENT

2.1 Project and Task Organization

The following individuals and organizations were involved in collecting data and analyzing the air samples.

- Louisville Metro Air Pollution Control District: Tua McDermott, Marty Layman, Damon Harris and Mario Beeler
- Air Toxics Ltd.

2.2 Problem Definition

This short term study was conducted to collect air toxics data to provide the basis for long term studies, regulation, and policy development. The data was evaluated in an effort to provide a connection between source and receptor locations and to give an overview of the toxic chemical composition of the air at each site.

2.3 Project Description

This monitoring project consisted of a point-monitoring technique (Summa cans) to measure airborne concentrations of VOCs. The locations selected were area sources in close proximity to a receptor.

APCD personnel collected ambient air samples in six liter evacuated Summa canisters. A flow controller was attached to the canister which allowed the canister to slowly fill over one hour. A meteorological station was set up and operated by APCD at either the source or receptor sampling location during each sampling event.

2.4 Special Training Requirements

No special training requirements or certifications are required to operate the Summa canisters or the meteorological station. All four APCD staff that assisted with the project have years of monitoring background. ATL sent a document explaining the Summa canisters and equipment with explanations on the correct way to sample. The MetOne instruction book was used as a reference for the operation of the meteorological station.

2.5 Documentation and Records

APCD maintained standard field documentation for the VOC samples and electronic data storage in regard to saving the meteorological data. The data was downloaded at the office and saved as text file. Manual field logs were maintained including photos, daily notes, general field procedures, and monitoring notes.

3.0 SAMPLING METHODOLOGY

3.1 Sampling Design

The main objective of this sampling project was to monitor for VOCs at designated source and receptor sites for a specified period of time. A passivated canister was set up at each source and at the correspondent receptor site. The canisters were placed at the approximate breathing height of a child. The canister sampling equipment has been designated as Federal Reference Method TO-15. The meteorological station was set up at either the source or receptor site for each sampling period.

Four one-hour samples were collected at each of the source sites and receptor sites. Table 3 shows the date, weekday and time that the samples were collected.

3.2 Canisters and Associated Apparatus

3.2.1 Canister Description

An air sampling canister is a container for collecting whole air samples. The air sample is collected by opening the hand valve on the canister. Once the desired volume is collected or designated time has elapsed, the valve is closed.

A Summa canister is a stainless canister that has had the internal surfaces specially passivated using a “Summa” process. This process makes the

interior nearly chemically inert. The canisters used for this study were 6-liter spherical Summa canisters.

3.2.2 Critical Orifice Flow Restrictor

The air flow entering the canister is controlled by the critical orifice flow controller. The flow restrictor is pre-set at ATL for the designated sampling interval which was one hour for this sampling project. The flow is controlled by forcing the air sample through a minute capillary. The capillary is replaced by ATL after every sample to avoid contamination from previous use. A vacuum gauge is also part of the device which allows monitoring of the sample progress.

3.3 Quality Control

The canisters were evacuated by ATL to a vacuum of approximately 29.9 inches of Mercury (in. Hg). Each canister was individually 100% certified by ATL before being shipped to APCD. This ensured that the cans were cleaned properly and not contaminated before being shipped. With each sampling batch, a canister was set up in the field but not opened to serve the purpose of a field blank. The field blank was analyzed at ATL to check the canisters for leaks during times that the valve was not opened. All field blank results except one showed no contamination. The field blank from 12/15/2007 was received at the lab with a vacuum of 9.0 in. Hg. The vacuum was confirmed at -27 in. Hg before being shipped back to California. The can may have leaked during shipment or once unpacked at the lab.

A laboratory blank was also analyzed with each batch to further assure that no contamination was occurring in the lab. No lab blanks showed signs of contamination.

One canister from each sample batch was analyzed twice at ATL to show that the results were reproducible. All lab duplicates reproduced well.

4.0 Lab Results

4.1 Results from November 29 Sampling

There were no unexpected results from November 29, 2006 sampling date (see Table 4.). The Ballard High School and Thorntons samples were deleted inadvertently by ATL. APCD sampled on a future day at these two sites to make up for the lost samples.

Most of the Preston Highway/Outer Loop results reflect vehicle exhaust composition (see Appendix B of this report). 4-ethyltoluene, 2-butanone, acetone,

chloromethane, Freon 11, Freon 12, and heptane are not included in the vehicle exhaust profile.

Freon 11, Freon 12, ethanol, chloromethane and acetone occur at all sights each sampling day with consistent variance in concentrations which may suggest that there is a persistent background in the atmosphere. These compounds, except for chloromethane, are generally innocuous to humans unless ingested in large amounts. Chloromethane is listed as a hazardous air pollutant (HAP) in the Clean Air Act (http://www.epa.gov/ttn/atw/188polls.html). Freon 11 and 12 have ozone depleting potential once they reach the upper atmosphere so should still remain a concern.

The Okolona Elementary School sample and the Southside Christian Child Care (SCCC) samples both contained carbon disulfide which was not found that day at the other two sites. Although carbon disulfide is not included on the STAR list, it is a health hazard and ranks in the worst 10% to ecosystems and human health (www.scorecard.org). The University of Louisville reports carbon disulfide detection in its 24 hour toxics samples and it was detected at different sites on the sample days closest to November 29.

The SCCC sample was similar to the Preston Highway/Outer Loop sample due to the number of cars idling outside the front door of the daycare. Most cars were left running as the guardian went in to pick up a child or to drop a child off at the daycare. Delivery trucks and school transportation (buses and vans) were also left idling outside of the daycare. Cyclohexane and 2-propanol were unique at this site of all the November 29 samples. Cyclohexane is included in the vehicle exhaust profile. 2-propanol (also known as isopropyl alcohol) is not one of the most toxic chemicals and it was not detected at a high level so raises no concerns.

4.2 Results from December 5 Sampling

There were no unusual results from December 5, 2006 sampling date (see Table 5). The Ballard High School and Thorntons samples were voided at the request of APCD. The flow controller at the Thorntons site malfunctioned and the sample was not collected. APCD sampled on a future day at these two sites to make up for the lost samples.

The Preston Highway/Outer Loop sample has the same composition as the sample from November 29 with one exception. Cyclohexane was detected in the sample which is part of the vehicle exhaust profile. Almost all the compounds were at higher concentrations in the December 5 sample compared to the November 29 sample.

Once again, the SCCC sample was similar to the Preston Highway/Outer Loop sample. Carbon disulfide and 2-propanol were not detected in this sample like on December 19. Four additional compounds were detected that were not detected

on November 29 at this site: 1, 3-butadiene, 4-ethyltoluene, o-xylene, and ethyl benzene. Except for 4-ethyltoluene, the additional four compounds are included in the vehicle exhaust profile.

The Okolona Elementary school sample did not contain carbon disulfide or 2-butanone in this sample. Hexane was detected which was not present in the first sample.

Village Cleaners had a similar sample to the November 29 sample. The concentration of ethanol increased from 3.7 to 17 $\mu g/m^3$. Hexane and m,p-xylene were detected in the December 5 sample. Both are part of the vehicle exhaust profile (see Appendix B of this report).

4.3 Results from December 8 Sampling

The sample on December 8, 2006 was a replacement for one of the samples that was voided (see Table 6). The two samples had similar composition that reflected vehicle exhaust and/or evaporative emissions from a gas station (Appendix B and Appendix C of this report). Ballard High School also had positive hits for 1,2, 4-trimethylbenzene, ethyl benzene, and o-xylene which are all included in the vehicle exhaust speciation. Benzene, ethyl benzene, and toluene are all included in the gas station evaporative emissions speciation.

It would be difficult to differentiate the source of the pollutants at Ballard because most of the compounds are not unique to gas stations and could have also come from vehicle exhaust.

4.4 Results from December 15 Sampling

December 15, 2006 was the first sampling day that had successful data collection at all 6 sites (see Table 7). 1, 3-butadiene was not detected in any of the samples. The samples did not have a positive hit for heptane and hexane which was a variance from the three other samples at this location. Methylene chloride was present in the Preston Hwy/Outer Loop intersection sample. This was the only date that this compound was detected. Methylene chloride is a Category 1 TAC that is a recognized human carcinogen.

4.5 Results from December 19 Sampling

December 19, 2006 also had successful data collection at all 6 sites. 1, 3-butadiene was not detected at any of the sites. The lab results for the Okolona sample showed four compounds that were not detected on any other sampling day at this location: 1, 2, 4-trimelthylbenzene, elthyl benzene, m, p-xylene and tetrachloroethene. A 0.76 $\mu g/m^3$ concentration for 1, 2, 4-trimelthylbenzene was reported. STAR Regulation 5.23 does not list a cancer risk BAC for this compound. It is included as part of the vehicle exhaust profile (Appendix B of

this report). Ethyl benzene was reported at 0.84. The cancer risk BAC is listed as 3 µg/m^3. M, p-xylene is not listed in STAR regulation 5.23 but it is listed as a HAP in the Clean Air Act. A concentration of 10 µg/m^3 of tetrachloroethene was reported. STAR Regulation 5.23 lists this is compound as a Category 1 TAC with a cancer BAC of 0.17 µg/m^3.

The only difference from other sampling dates in results from the Village Cleaners and the SCCC samples was a concentration of heptane. Heptane is not listed in Regulation 5.23 or as HAP in the Clean Air Act. It is part of the vehicle exhaust profile.

Thorntons data results had four compounds detected that were not detected on other dates at this location: 1, 2, 4-trimelthylbenzene, elthyl benzene, heptane and tetrachloroethene.

Tetrachoroethene was also detected at Ballard High School on this date and not on any other sampling dates.

4.6 Results from January 8 Sampling

The sample on January 08, 2007 was a replacement for one of the samples that was voided. The two samples had similar composition that reflected vehicle exhaust and/or evaporative emissions from a gas station (Appendix B and Appendix C of this report). There were no compounds detected that had not been detected on previous dates at these two sites.

5.0 Meteorological Station Results

A MetOne portable meteorological station was set up at either the source or receptor site for each sampling event. The meteorological station should be started about 10 minutes before sampling begins and be allowed to run for ten minutes after sampling ends to ensure that all data is captured. Wind speed, wind direction, temperature, barometric pressure and relative humidity were recorded (Tables 10-18). The wind direction and wind speed were modeled as wind roses using free software from Lakes Environmental called WRPLOT View (Appendix D of this report).

The wind roses indicate the frequency of speed and direction that the wind is blowing to and which direction was dominant. Wind roses can help identify the source of particular pollutants. The highest 5 minute average for wind speed was 4.8 m/s (10.75 mph). The wind was not notably strong on any sampling date. On December 5th at Okolona the wind did not have any wind speeds register on the Met Station.

6.0 Conclusions

The focus of this study was to identify and help define how minor sources affect high risk receptors. The results will be used to develop a long term monitoring plan and help develop and support new policy and enforcement with the goal of protecting public health and the environment.

There were three unexpected results that should be noted. The most significant was the positive identification of tetrachloroethylene (perchloroethylene) at Okolona Elementary, Thorntons and Ballard High School on December 19. The results from the daycare should also be noted because the results were similar in composition (compounds and concentrations) to the air samples from the intersection of Preston Highway and Outer Loop. These two results pose an increased risk to the receptors.

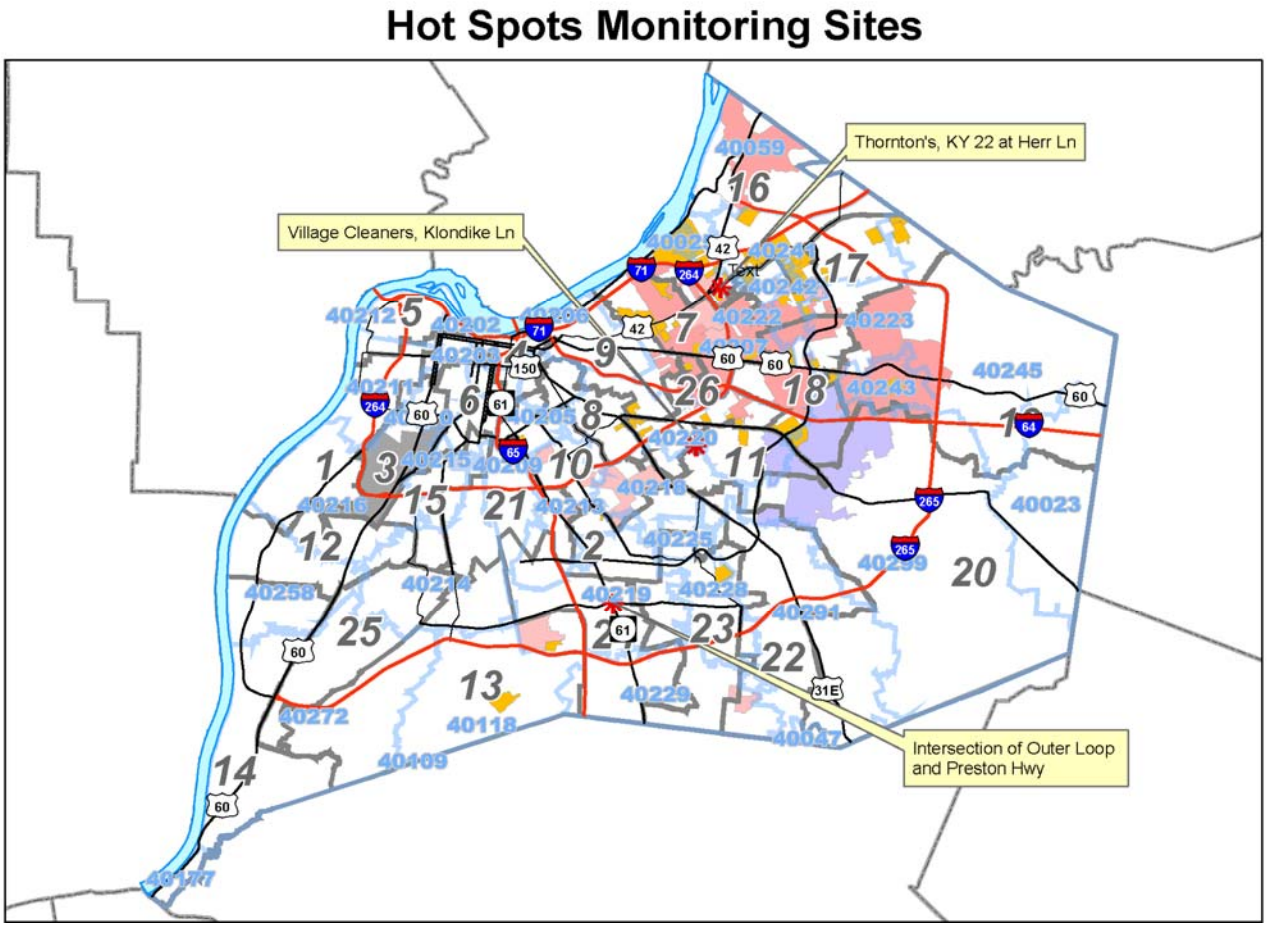
The third unexpected result was that the Village Cleaner (source) and Southside Christian Childcare (SCCC) (receptor) did not have a single positive hit for tetrachloroethlylene. Before choosing this source/receptor set for this monitoring project, District staff called Village Cleaner to confirm that the dry cleaning equipment was in operation. Unfortunately, District staff was misinformed regarding the status of the dry cleaning operations. After receiving the monitoring data, District staff again contacted Village Cleaner, which then provided the correct information that this location is only a drop-off/pick-up site and dry cleaning is no longer performed at this location. Although the monitoring data did not identify concentrations of tetrachloroethlylene, the data did reveal the impact that idling cars have on the air quality surrounding the daycare. The air samples taken at the daycare were similar in composition (compounds and concentrations) to the air samples from the intersection of Preston Highway and Outer Loop. Therefore, although not quantifying the impact of the intended source's emissions (tetrachloroethlylene) on this sensitive population receptor, this portion of the monitoring project revealed a different concern for this receptor site.

Future study recommendations may include a longer study period and sampling time. A recommendation may be made to SCCC and other daycares to voluntarily recommend and enforce a "no idling" rule to improve the air quality for the children. The Louisville ordinance 72.032 that mentions no idling states "It shall be a parking violation for any person driving or in charge of a motor vehicle to permit it to stand unattended without stopping the engine, locking the ignition, and removing the key, or when standing on any perceptible grade without setting the brake thereon and turning the front wheels to the curb." This ordinance is not very strong because it does not prohibit idling if the vehicle is occupied by the operator.

The high level of tetrachloroethylene at Okolona Elementary, Thorntons and Ballard High School is a concern. Future samples should be collected to see if this was a chance occurrence or a regular event. If the compound is detected again, an effort will be made to identify the source.

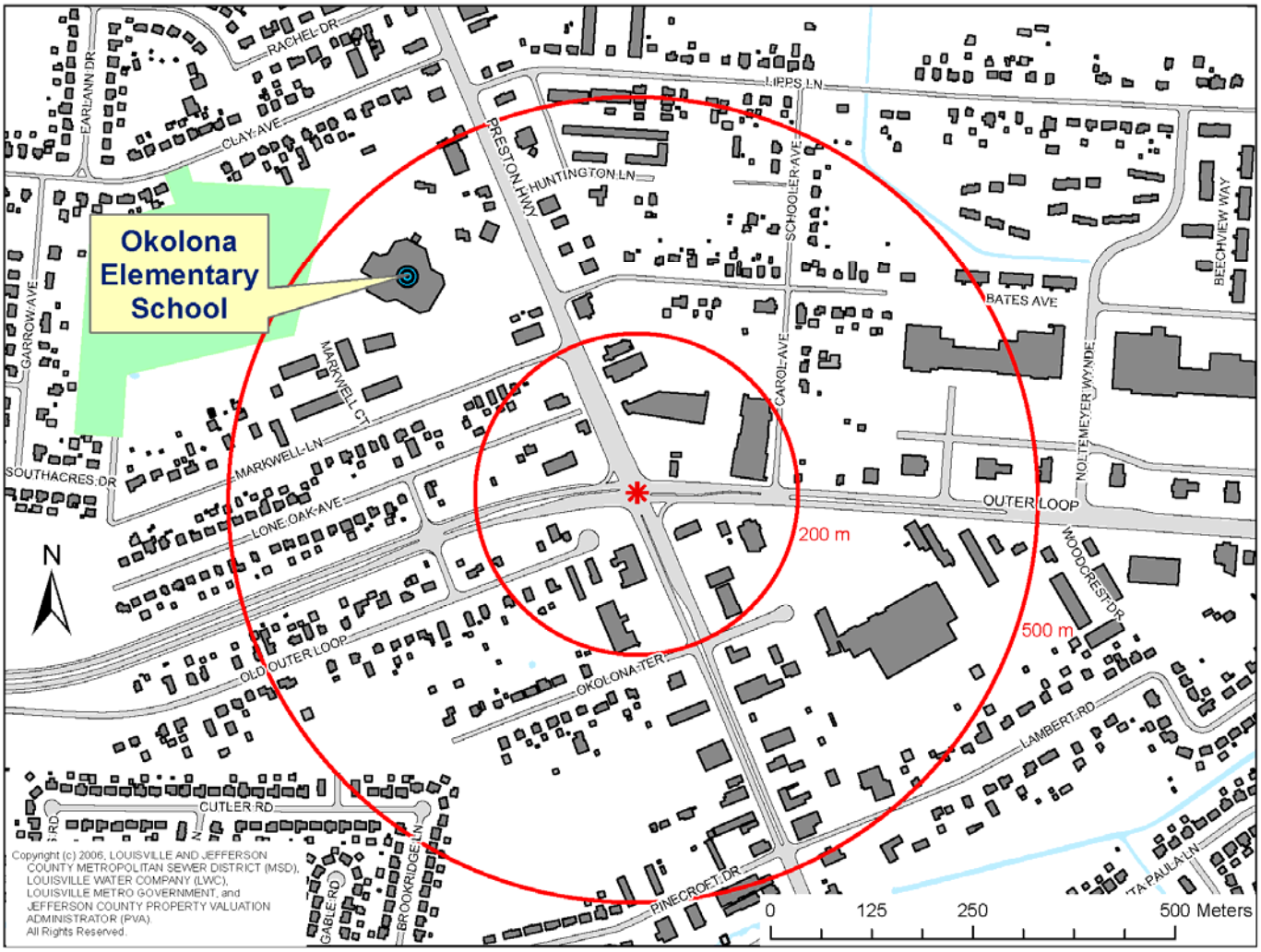
Maps

Map 1.


Hot Spots Monitoring Sites
Thornton's, KY 22 at Herr Ln
Village Cleaners, Klondike Ln
Intersection of Outer Loop and Preston Hwy

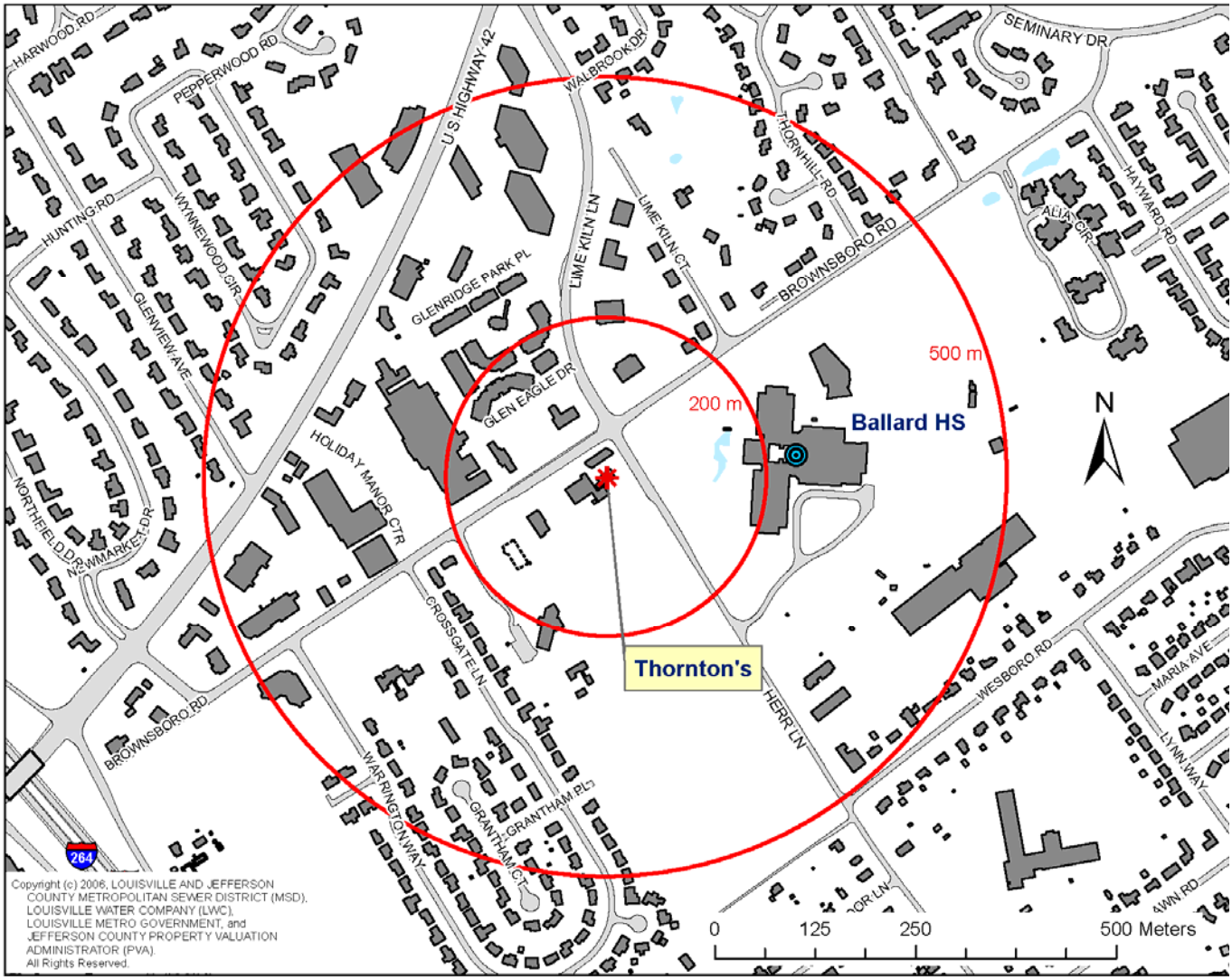
Map 2.

Outer Loop and Preston Highway



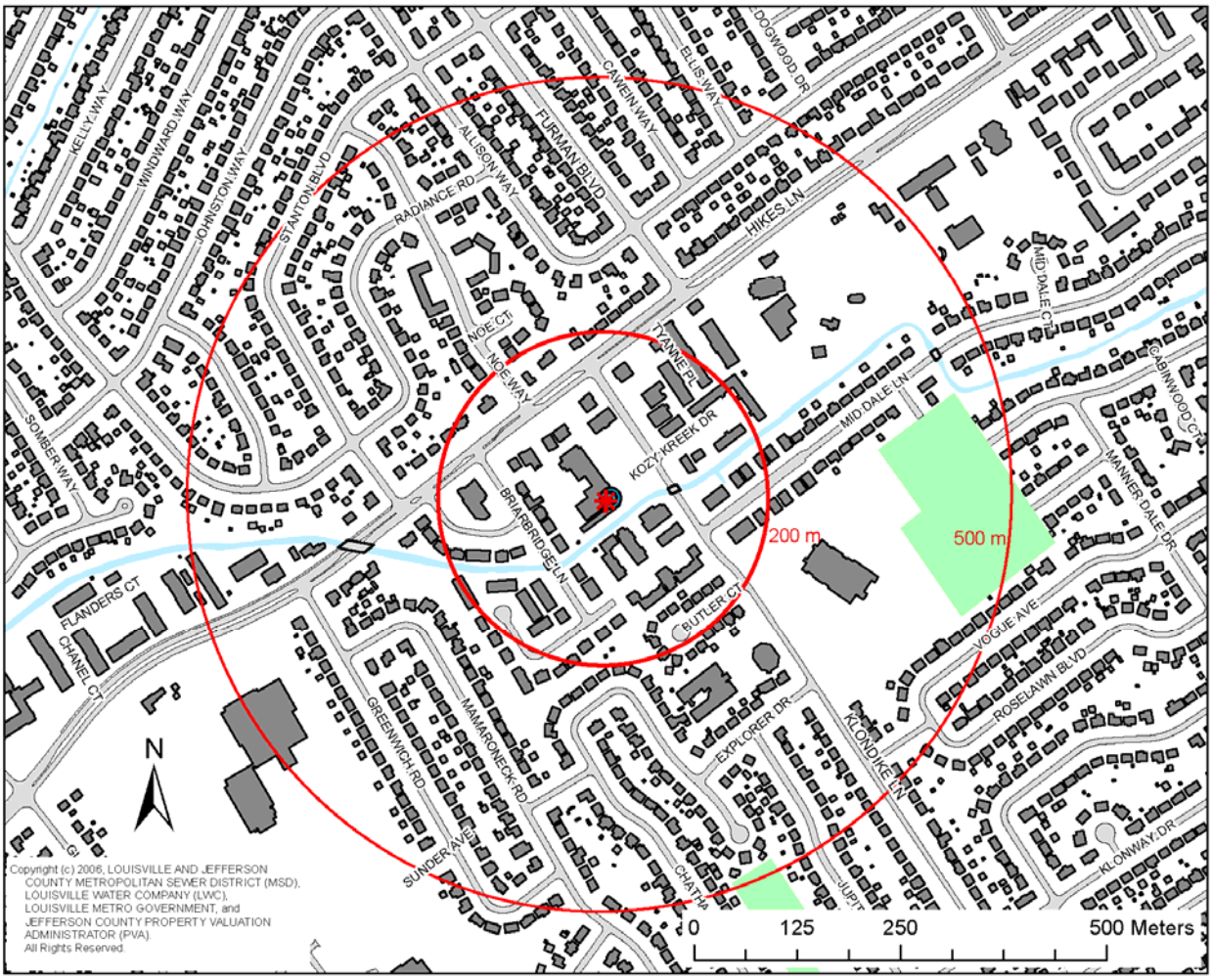
Map 3.

Thornton's, Brownsboro Road at Herr Lane



Map 4.

Village Cleaners



Pictures

Picture 1. Outer Loop and Preston Highway (Source)

Picture 2. Thorntons (Source)

Picture 3. Village Cleaners (Source) and Southside Christian Child Care (Receptor)

Picture 4. Okolona Elementary School (Receptor)

Picture 5. Ballard High School (Receptor)

Picture 6. Summa Can at Southside Christian Child Care (Receptor)

Picture 7. Summa and Meteorological Station at Village Cleaners (Source)

Tables

Table 1. Monitoring Plan Sources and Receptors

Source	Receptor	Distance
Intersection of Preston Highway and Outer Loop Louisville, KY	Okolona Elementary School 7606 Preston Highway Louisville, KY 40219	~ 330 meters
Thorntons Oil Company 4950 Brownsboro Rd Louisville, KY 40222	Ballard High School 6000 Brownsboro Rd Louisville, KY 40222	~225 meters
Village Cleaners 3618 Klondike Lane Louisville, KY 40218	Southside Christian Child Care 3620 Klondike Lane Louisville, KY 40218	Separated by narrow alley in a strip mall

Table 2. Source and Receptor Hours of Operation

	Source A	**Receptor A**	**Source B**	**Receptor B**	**Source C**	**Receptor C**
	Preston Hwy and Outer Loop Intersection	**Okolona Elementary School**	**Thorntons**	**Ballard High School**	**Village Cleaners**	**Southside Christian Child Care**
Days of Operation	Monday – Sunday	Monday - Friday	Monday - Friday	Monday-Friday August-May	Monday – Friday, Saturday	Monday - Friday
Hours of Operation	24 hours	7 am – 4 pm	24 hours	7 am – 4 pm	7:30 am - 6 pm, 8 am - 3 pm	6 am – 6 pm

Table 3. Summary of Sampling Days and Time

	11/29/06 Wednesday	12/05/06 Tuesday	12/08/06 Friday	12/15/06 Friday	12/19/06 Tuesday	01/08/07 Monday
Thorntons/Ballard High School	Lab Error: Inadvertently voided sample	Flow controller malfunctioned: Sample voided	12:31 pm	Thornton's- 1:59 pm Ballard HS- 1:11 pm	9:40 am	11:00 am
Village Cleaners/ SCCC	3:31 pm	9:05 am		11:32 am	11:42 am	
Outer Loop & Preston Intersection/Okolona Elementary	11:15 am	2:05 pm		9:40 am	1:45 pm	

Table 4. November 29 Results

Compound Name	TAC Category #	Preston Hwy/Outer Loop µg/m^3	Okolona Elementary µg/m^3	Village Cleaners µg/m^3	Southside Christian Child Care µg/m^3
1,2,4-Trimethylbenzene	2	1.4			
1,3-Butadiene	1	0.56			
2-Butanone (Methyl Ethyl Ketone)	4	0.86	0.91	0.91	1.7
2-Propanol					2.4
4-Ethyltoluene		1.0			
Acetone		6.7	13	7.6	8.9
Benzene	1	2.7		0.76	1.3
Carbon Disulfide			3.5		5.0
Chloromethane		1.2	0.86	1.1	1.2
Cyclohexane					0.65
Ethanol		11	2.9	3.7	29
Ethyl Benzene	4	0.84			
Freon 11		1.5	1.9	1.6	1.4
Freon 12		2.5	2.5	2.0	2.6
Heptane		1.2			1.3
Hexane	4	2.4			1.2
m,p-Xylene		2.8			1.4
o-Xylene	2	1.1			
Toluene	2	4.7	0.70	1.1	6.3

Table 5. **December 5 Results**

Compound Name	TAC Category #	Preston Hwy/Outer Loop µg/m^3	Okolona Elementary µg/m^3	Village Cleaners µg/m^3	Southside Christian Child Care µg/m^3
1,2,4-Trimethylbenzene	2	2.6			1.2
1,3-Butadiene	1	1.0			0.71
2-Butanone (Methyl Ethyl Ketone)	4	0.56		0.72	0.95
4-Ethyltoluene		2.0			1.0
Acetone		4.4	3.2	4.3	5.8
Benzene	1	4.3	1.0	1.4	3.2
Chloromethane		1.0	1.2	0.98	0.99
Cyclohexane		1.1			0.56
Ethanol		13	4.0	17	22
Ethyl Benzene	4	1.5			1.0
Freon 11		1.5	1.5	1.6	1.6
Freon 12		2.6	2.8	2.6	2.7
Heptane		1.8			1.1
Hexane	4	4.1	0.72	1.1	2.2
m,p-Xylene		5.0		1.5	3.2
o-Xylene	2	2.1			1.2
Toluene	2	8.0	2.3	4.3	7.3

Table 6. **December 8 Results**

Compound Name	TAC Category #	Thorntons µg/m^3	Ballard High School µg/m^3
1,2,4-Trimethylbenzene	2		1.2
Acetone		5.6	3.6
Benzene	1	1.5	2.4
Chloromethane		1.0	1.0
Ethanol		11	17
Ethyl Benzene	4		0.93
Freon 11		2.3	2.2
Freon 12		3.0	3.0
m,p-Xylene		1.3	3.0
o-Xylene	2		1.2
Toluene	2	7.1	9.5

Table 7. December 15 Results

Compound Name	TAC Cat egory #	Preston Hwy/ Outer Loop µg/m³	Okolona µg/m³	Village Cleaner µg/m³	Southside Christian Child Care µg/m³	Thorntons µg/m³	Ballard High School µg/m³
1,2,4-Trimethylbenzene	2	1.3					
2-Butanone (Methyl Ethyl Ketone)	4						0.94
Acetone		6.4	6.0	6.9	22	17	6.0
Benzene	1	2.8	0.91	0.94	1.4	2.2	1.5
Chloromethane		1.2	1.1	1.2	1.2	0.99	1.3
Ethanol		7.4	2.5	6.0	13	12	8.7
Ethyl Benzene	4	0.78					
Freon 11		1.5	1.2	1.3	1.4	1.4	1.6
Freon 12		2.5	2.4	2.6	2.6	2.5	2.8
Heptane							0.77
Hexane	4					4.4	1.3
m,p-Xylene		2.7			1.0	1.7	1.3
Methylene Chloride	1	1.6					
o-Xylene	2	1.1					3.2
Toluene	2	4.5	0.89	1.3	2.0	4.5	

Table 8. December 19 Results

Compound Name	TAC Category #	Preston Hwy/Outer Loop µg/m^3	Okolona Elementary µg/m^3	Village Cleaners µg/m^3	Southside Christian Child Care µg/m^3	Thorntons µg/m^3	Ballard High School µg/m^3
1,2,4-Trimethylbenzene	2	0.85	0.76			0.82	
2-Butanone (Methyl Ethyl Ketone)	4	1.6	0.63	0.58	0.68	1.8	2.0
2-Propanol		2.0					
Acetone		12	5.2	4.9	5.4	11	17
Benzene	1	1.5	1.0	1.0	1.4	1.9	1.0
Chloromethane		1.3	1.2	1.1	1.1	1.0	1.2
Cyclohexane		0.56					
Ethanol		14	3.3	5.8	6.7	8.6	6.5
Ethyl Benzene	4	1.1	0.84			0.88	
Freon 11		1.8	1.8	1.9	1.7	1.5	1.5
Freon 12		3.2	3.0	2.7	2.9	2.9	2.4
Heptane		1.2		0.89	0.87	0.99	
Hexane	4	1.9	0.74	0.66	0.63	1.2	
m,p-Xylene		2.8	2.3	0.88	0.99	1.8	0.74
o-Xylene	2	0.93					
Tetrachloroethene	1		10			1.2	1.5
Tetrahydrofuran		2.8					
Toluene	2	9.9	1.6	3.0	3.9	6.2	1.6

Table 9. January 8 Results

Compound Name	TAC Category #	Thorntons µg/m^3	Ballard High School µg/m^3
2-Butanone (Methyl Ethyl Ketone)	4	0.90	0.69
Acetone		6.4	2.6
Benzene	1	1.5	1.5
Chloromethane		1.2	1.0
Ethanol		7.3	2.8
Freon 11		1.3	1.2
Freon 12		2.7	2.4
Hexane	4	1.1	0.83
m,p-Xylene		1.2	1.2
Toluene	2	2.1	1.7

Table 10. **Meteorological Data**

Okolona Elementary 11/29/2006

Time	WS (mps)	WD (Deg)	AT (Deg C)	AT (Deg F)	RH (%)	BP (mmHg)
10:50	2.3	221.1	23.2	73.76	68.2	701.78
10:55	2.2	229	22.5	72.5	68	701.59
11:00	2.7	209.9	22.4	72.32	68.1	701.78
11:05	2.5	188.1	22.2	71.96	68.4	701.87
11:10	2.6	175.9	22.3	72.14	68.2	701.87
11:15	2.4	127.5	22.3	72.14	68	701.97
11:20	2.1	113.9	22.3	72.14	67.7	701.97
11:25	1.9	110.2	22.3	72.14	67.7	701.87
11:30	2.4	87.8	22.4	72.32	67.1	701.78
11:35	2.8	71.3	22.5	72.5	66.5	701.69
11:40	2.5	49.2	22.7	72.86	66	701.69
11:45	3.1	49.2	22.6	72.68	65.9	701.69
11:50	3.1	66.3	22.5	72.5	65.9	701.59
11:55	2.6	43.2	22.8	73.04	64.9	701.59
12:00	2.2	14.1	22.9	73.22	64.6	701.59
12:05	2.4	32.6	22.8	73.04	64.8	701.5
12:10	2.5	4.4	22.5	72.5	65.2	701.41
12:15	2.6	349.7	22.4	72.32	65.1	701.22
12:20	2.6	29.8	22.4	72.32	65.1	701.22
12:25	2	26	-14.9	5.18	46.9	701.13

Table 11. **Meteorological Data**

Village Cleaners 11/29/2006

	WS (mps)	WD (Deg)	AT (Deg C)	AT (Deg F)	RH (%)	BP (mmHg)
14:50	4.2	8.5	24.3	75.74	56.3	698.9
14:55	3.3	298.9	23.4	74.12	57.6	699.55
15:00	2.5	254.7	23.1	73.58	58.5	697.59
15:05	2.6	220.8	23.1	73.58	58.7	698.99
15:10	3	175.6	23	73.4	58.9	699.64
15:15	2.7	131.3	23	73.4	58.8	699.64
15:20	3.3	95.6	23	73.4	58.7	699.55
15:25	3.1	58.8	22.9	73.22	58.9	697.13
15:30	2.5	25	22.9	73.22	59	695.36
15:35	2.5	12.7	22.9	73.22	59.1	693.87
15:40	2.6	7.7	22.8	73.04	59.2	691.27
15:45	2.7	356.5	22.8	73.04	59.2	688.57
15:50	3.6	244.1	22.7	72.86	59.1	682.8
15:55	2.5	175	22.7	72.86	59.6	678.43

Table 12. **Meteorological Data**

Okolona Elementary 12/05/2006

	WS (mps)	WD (Deg)	AT (Deg C)	AT (Deg F)	RH (%)	BP (mmHg)
14:00	0.3	325.2	7.8	46.04	27.8	705.5
14:05	0.3	325.5	7.7	45.86	27.5	705.59
14:10	0.3	325.6	7.6	45.68	29.5	705.59
14:15	0.3	325.4	7.5	45.5	30.5	705.59
14:20	0.3	325.3	7.6	45.68	30.3	705.69
14:25	0.3	325.2	7.7	45.86	28.9	705.69
14:30	0.3	325.1	7.6	45.68	29.4	705.78
14:35	0.3	325.1	7.6	45.68	28.6	705.69
14:40	0.3	325.1	7.6	45.68	28.5	705.5
14:45	0.3	325.1	7.6	45.68	28.6	705.41
14:50	0.3	325.1	7.8	46.04	28.7	705.32
14:55	0.3	325.1	7.9	46.22	27.8	705.32
15:00	0.3	324.9	7.9	46.22	27.2	705.32
15:05	0.3	324.7	7.9	46.22	26.7	705.22

Table 13. **Meteorological Data**

Ballard High School 12/08/2006

	WS (mps)	WD (Deg)	AT (Deg C)	AT (Deg F)	RH (%)	BP (mmHg)
12:30	1.6	25.8	-2.9	26.78	41.7	709.41
12:35	1.4	11.1	-2.6	27.32	39.9	709.41
12:40	1.3	70.2	-2.4	27.68	40.2	709.41
12:45	1.6	39.9	-2	28.4	39.6	709.31
12:50	2.1	351.8	-2.2	28.04	39.6	709.31
12:55	2.6	13.2	-2.5	27.5	39.6	709.22
13:00	2.2	59.7	-2.3	27.86	40.3	709.13
13:05	1.1	50.7	-2.2	28.04	40.1	709.13
13:10	1.4	73.4	-1.8	28.76	39.1	708.94
13:15	2.5	54.1	-1.8	28.76	38.1	708.94
13:20	1.1	102.6	-2	28.4	38.8	708.85
13:25	1.2	109.2	-1.4	29.48	37.3	708.85

Table 14. **Meteorological Data**

Ballard HS 12/15/2006

Time	WS (mps)	WD (Deg)	AT (Deg C)	AT (Deg F)	RH (%)	BP (mmHg)
13:10	1.9	27.8	3.3	37.94	39.5	691.18
13:15	3.1	47.7	16.7	62.06	39.4	691.18
13:20	2.9	28.1	16.8	62.24	38.8	691.27
13:25	3	39.1	16.9	62.42	38.5	691.36
13:30	2.9	48.3	17	62.6	38.1	691.36
13:35	3.9	53.7	16.9	62.42	37.4	691.46
13:40	3.9	57.9	16.7	62.06	37.3	691.36
13:45	3.8	42.4	16.7	62.06	36.7	691.46
13:50	4	54.5	16.8	62.24	35.8	691.46
13:55	3.7	48.3	16.7	62.06	35.8	691.46
14:00	4.8	53.1	16.7	62.06	35.3	691.46
14:05	3.6	64.2	16.6	61.88	35	691.46
14:10	2.7	55.4	17	62.6	34.8	691.46
14:15	4.2	65.1	17	62.6	34.7	691.55
14:20	3.5	46.8	16.9	62.42	34.9	691.55
14:25	3.7	58.8	17	62.6	34.7	691.55
14:30	3.6	57.9	17	62.6	33.7	691.64
14:35	4.2	57.7	16.9	62.42	33.8	691.64
14:40	4.5	52.1	16.8	62.24	33	691.73
14:45	4.1	61.3	16.8	62.24	32.8	691.73
14:50	4	65.7	16.7	62.06	32.8	691.83
14:55	2.7	47.1	16.8	62.24	32.5	691.92
15:00	3.4	50.2	17.1	62.78	31.3	691.92

Table 15. **Meteorological Data**

Ballard High School 12/19/2006

Time	WS (mps)	WD (Deg)	AT (Deg C)	AT (Deg F)	RH (%)	BP (mmHg)
9:40	1.2	140.6	12.6	54.68	48.2	705.59
9:45	1.3	132.1	8.8	47.84	57.4	705.97
9:50	1.3	142.5	7.1	44.78	63.4	706.15
9:55	1.5	151.3	6.5	43.7	64.8	706.25
10:00	1.4	138	6.4	43.52	64.5	706.34
10:05	1.5	147.2	6.5	43.7	64.1	706.34
10:10	1.4	133.7	6.5	43.7	63.8	706.25
10:15	1.5	138	6.5	43.7	63.3	706.15
10:20	1.5	118.7	6.6	43.88	62.9	706.25
10:25	1.4	111.9	6.7	44.06	62.7	706.25
10:30	1.1	130.2	7.2	44.96	61.6	706.25
10:35	1.3	100.5	7.5	45.5	60.1	706.25
10:40	1.2	132.3	7.8	46.04	59.6	706.25

Table 16. **Meteorological Data**

Village Cleaners 12/19/2006

Time	WS (mps)	WD (Deg)	AT (Deg C)	AT (Deg F)	RH (%)	BP (mmHg)
11:45	1.4	93	9.6	49.28	50.9	708.29
11:50	1.2	82.9	9.6	49.28	51.1	708.29
11:55	1.6	82.2	9.8	49.64	50.3	708.38
12:00	1.6	81.6	9.5	49.1	50.4	708.48
12:05	1.2	104.3	9.8	49.64	50	708.48
12:10	2.1	111.3	9.7	49.46	49.5	708.48
12:15	1.7	94	9.5	49.1	50	708.48
12:20	2.3	64	9.8	49.64	48.5	708.48
12:25	2.3	73.4	9.8	49.64	49.1	708.48
12:30	2	115.3	9.7	49.46	49.3	708.29
12:35	2.5	68.4	9.7	49.46	48.8	708.2
12:40	2.3	80.6	9.6	49.28	48.7	708.11
12:45	2.5	79.1	9.7	49.46	48.6	708.2

Table 17. **Meteorological Data**

Okolona Elementary 12/19/2006

Time	WS (mps)	WD (Deg)	AT (Deg C)	AT (Deg F)	RH (%)	BP (mmHg)
13:35	2.1	4.2	-65.2	-85.36	147.7	709.87
13:40	1.8	314.3	-10.6	12.92	46.8	708.01
13:45	1.7	305.5	10.8	51.44	41.2	708.11
13:50	2.2	310.7	10.5	50.9	42.1	708.2
13:55	1.7	293	10.3	50.54	43.4	708.29
14:00	2	279	10.3	50.54	42.6	708.29
14:05	2	301.5	10.3	50.54	42.7	708.2
14:10	2.1	295	10.3	50.54	41.7	708.29
14:15	2.5	262.3	10.2	50.36	41.4	708.2
14:20	2.2	268.2	10.2	50.36	41.7	708.11
14:25	2.8	249.3	10.1	50.18	41.3	708.01
14:30	2.1	247.2	10	50	41.6	708.11
14:35	1.6	255.5	10	50	41	708.11
14:40	1.9	235.3	10.1	50.18	41.2	708.11
14:45	2.1	232.7	10.2	50.36	41.2	708.11
14:50	1.7	254.3	10.1	50.18	41.4	708.2

Table 18. **Meteorological Data**

Ballard High School 01/08/2007

Time	WS (mps)	WD (Deg)	AT (Deg C)	AT (Deg F)	RH (%)	BP (mmHg)
10:50	1.6	288.5	8.6	47.48	42.4	691.08
10:55	3	161.8	5.6	42.08	48.9	696.01
11:00	2.6	148	4.6	40.28	52.5	696.39
11:05	3.4	79.9	4.3	39.74	51.5	696.29
11:10	3.6	46.1	4.2	39.56	51.4	696.29
11:15	2.8	11.3	4.4	39.92	52.1	696.39
11:20	3.8	318.4	4.6	40.28	50.2	696.29
11:25	3.5	233	4.4	39.92	49.9	696.29
11:30	3.2	177.1	4.5	40.1	49.7	696.2
11:35	2.5	129.7	4.8	40.64	48.3	696.2
11:40	2.9	100	5.1	41.18	47.6	696.11
11:45	2.8	57.7	5.1	41.18	48.1	696.11
11:50	2.2	56	5.3	41.54	48.2	696.01
11:55	2.7	37.5	5.5	41.9	46.4	696.01

Appendix A

Compounds Included in Lab Analysis

Compound Name	CAS Number	Reporting Limit µg/m3
Freon 12	75-71-8	0.84
Freon 114	76-14-2	1.2
Chloromethane	74-87-3	0.35
Vinyl Chloride	75-01-4	0.44
1,3-Butadiene	106-99-0	0.38
Bromomethane	74-83-9	0.66
Chloroethane	75-00-3	0.45
Freon 11	75-69-4	0.96
Ethanol	64-17-5	1.6
Freon 113	76-13-1	1.3
1,1-Dichloroethene	75-35-4	0.68
Acetone	67-64-1	2
2-Propanol	67-63-0	2.1
Carbon Disulfide	75-15-0	2.7
Methylene Chloride	75-09-2	1.2
Methyl tert-butyl ether	1634-04-4	0.62
trans-1,2-Dichloroethene	156-60-5	0.68
Hexane	110-54-3	0.6
1,1-Dichloroethane	75-34-3	0.69
2-Butanone (Methyl Ethyl Ketone)	78-93-3	0.5
cis-1,2-Dichloroethene	156-59-2	0.68
Tetrahydrofuran	109-99-9	2.5
Chloroform	67-66-3	0.83
1,1,1-Trichloroethane	71-55-6	0.93
Cyclohexane	110-82-7	0.59
Carbon Tetrachloride	56-23-5	1.1
Benzene	71-43-2	0.55
1,2-Dichloroethane	107-06-2	0.69
Heptane	142-82-5	0.7
Trichloroethene	79-01-6	0.92
1,2-Dichloropropane	78-87-5	0.79
1,4-Dioxane	123-91-1	0.62
Bromodichloromethane	75-27-4	1.1
cis-1,3-Dichloropropene	10061-01-5	0.78
4-Methyl-2-pentanone	108-10-1	0.7
Toluene	108-88-3	0.64
trans-1,3-Dichloropropene	10061-02-6	0.78
1,1,2-Trichloroethane	79-00-5	0.93
Tetrachloroethene	127-18-4	1.2
2-Hexanone	591-78-6	3.5
Dibromochloromethane	124-48-1	1.4

Compound Name	CAS Number	Reporting Limit µg/m3
1,2-Dibromoethane (EDB)	106-93-4	1.3
Chlorobenzene	108-90-7	0.79
Ethyl Benzene	100-41-4	0.74
m,p-Xylene	108-38-3/106-42-3	0.74
o-Xylene	95-47-6	0.74
Styrene	100-42-5	0.73
Bromoform	75-25-2	1.8
Cumene	98-82-8	0.84
1,1,2,2-Tetrachloroethane	79-34-5	1.2
Propylbenzene	103-65-1	0.84
4-Ethyltoluene	622-96-8	0.84
1,3,5-Trimethylbenzene	108-67-8	0.84
1,2,4-Trimethylbenzene	95-63-6	0.84
1,3-Dichlorobenzene	541-73-1	1
1,4-Dichlorobenzene	106-46-7	1
alpha-Chlorotoluene	100-44-7	0.88
1,2-Dichlorobenzene	95-50-1	1
1,2,4-Trichlorobenzene	120-82-1	6.3
Hexachlorobutadiene	87-68-3	9.1
Chloroprene	126-99-8	3.1

Appendix B

Vehicle Emissions Profile

1101.txt
US EPA - SPECIATE 3.2
Report Date: 4/2/07

Profile Number	1101
Profile Name	Light Duty Gasoline Vehicles - 46 Car Study
Controls	Catalyst
Original Quality	B
Date Profile Added	1/5/89

CAS No.	Pollutant	Percent
75070	ACETALDEHYDE	0.28
74862	ACETYLENE	0.75
107028	ACROLEIN	0.06
100527	BENZALDEHYDE	0.08
71432	BENZENE	1.39
106990	1,3-BUTADIENE	1.68
106978	N-BUTANE	9.48
106989	1-BUTENE	0.85
590181	CIS-2-BUTENE	0.5
624646	TRANS-2-BUTENE	0.55
135988	S-BUTYLBENZENE	0.11
	C10 AROMATIC	2.02
	C10 PARAFFINS	0.16
627203	CIS-2-PENTENE	0.38
123739	CROTONALDEHYDE	0.02
110827	CYCLOHEXANE	1.4
287923	CYCLOPENTANE	0.35
142290	CYCLOPENTENE	0.37
124185	N-DECANE	0.16
135013	1,2 DIETHYLBENZENE	0.59
141935	M-DIETHYLBENZENE	0.59
75832	2,2-DIMETHYLBUTANE	0.21
79298	2,3-DIMETHYLBUTANE	0.69
2213232	2,4 DIMETHYLHEPTANE	0.11
2216300	2,5 DIMETHYLHEPTANE	0.73
590738	2,2 DIMETHYLHEXANE	0.05
589435	2,4-DIMETHYLHEXANE	0.63
	DIMETHYLHEXENE	0.12
4032944	2,4 DIMETHYLOCTANE	0.07
	3,4 DIMETHYLOCTANE	0.74
565593	2,3-DIMETHYLPENTANE	1.4
108087	2,4-DIMETHYLPENTANE	0.58
74840	ETHANE	1.41
100414	ETHYLBENZENE	0.77
74851	ETHYLENE	3.92
620144	M-ETHYLTOLUENE	1.06
611143	O-ETHYLTOLUENE	0.21
50000	FORMALDEHYDE	0.74
142825	N-HEPTANE	0.65
110543	N-HEXANE	0.87
592416	1-HEXENE	0.31
592438	2-HEXENE	0.16
496117	INDANE	0.52
75285	ISOBUTANE	1.7
538932	ISOBUTYLBENZENE	0.55
78784	ISOPENTANE	6.54
78795	ISOPRENE	0.07
74828	METHANE	10.07
563451	3-METHYL-1-BUTENE	0.15

513359	2-METHYL-2-BUTENE	0.98
625274	2-METHYL-2-PENTENE	0.42
535773	1-METHYL-3-ISOPROPYLBENZENE	0.38
1074437	1-METHYL-3-PROPYLBENZENE	0.17
74997	METHYLACETYLENE (PROPYNE)	0.06
108872	METHYLCYCLOHEXANE	0.5
96377	METHYLCYCLOPENTANE	0.78
693890	METHYLCYCLOPENTENE	0.01
6975980	2-METHYLDECANE	1.08
592278	2-METHYLHEPTANE	0.19
589811	3-METHYLHEPTANE	0.36
589537	4-METHYLHEPTANE	0.45
589344	3-METHYLHEXANE	1.06
3221612	2-METHYLOCTANE	0.01
107835	2-METHYLPENTANE	1.76
96140	3-METHYLPENTANE	1.09
111842	N-NONANE	0.19
111659	N-OCTANE	0.31
109660	N-PENTANE	2.88
109671	1-PENTENE	0.32
463490	PROPADIENE	0.08
74986	PROPANE	0.56
123386	PROPIONALDEHYDE	0.02
103651	N-PROPYLBENZENE	0.48
115071	PROPYLENE	1.06
13269528	T-3-HEXENE	0.29
108883	TOLUENE	5.14
646048	TRANS-2-PENTENE	0.68
526738	1,2,3-TRIMETHYLBENZENE	0.66
95636	1,2,4-TRIMETHYLBENZENE	2.3
108678	1,3,5-TRIMETHYLBENZENE	1.87
	2,4,5-TRIMETHYLHEPTANE	0.26
3522949	2,2,5-TRIMETHYLHEXANE	0.46
1069530	2,3,5-TRIMETHYLHEXANE	0.09
540841	2,2,4-TRIMETHYLPENTANE	1.97
560214	2,3,3 TRIMETHYLPENTANE	1.09
565753	2,3,4-TRIMETHYLPENTANE	0.12
1120214	N-UNDECANE	0.53
	UNIDENTIFIED	8.42
95476	O-XYLENE	1.56
106423	P-XYLENE	2.56

Notes:
Composition data collected using GC/FID and DNPH methods for exhaust and evaporative (hot soak) emissions from 45 cars were composited. Based on AP-42 (4th edition), data were weighted according to travel fractions.

References:
Sigsby, J. E., Jr., et al., Volatile Organic Compound Emissions from 46 In-Use Passenger Cars, Environmental Science and Technology, Volume 21, No. 5, 1987, pp. 466-475.

Profile Keywords:
GASOLINE COMBUSTION
VEHICLES

Appendix C

Gas Station- Evaporative Emissions

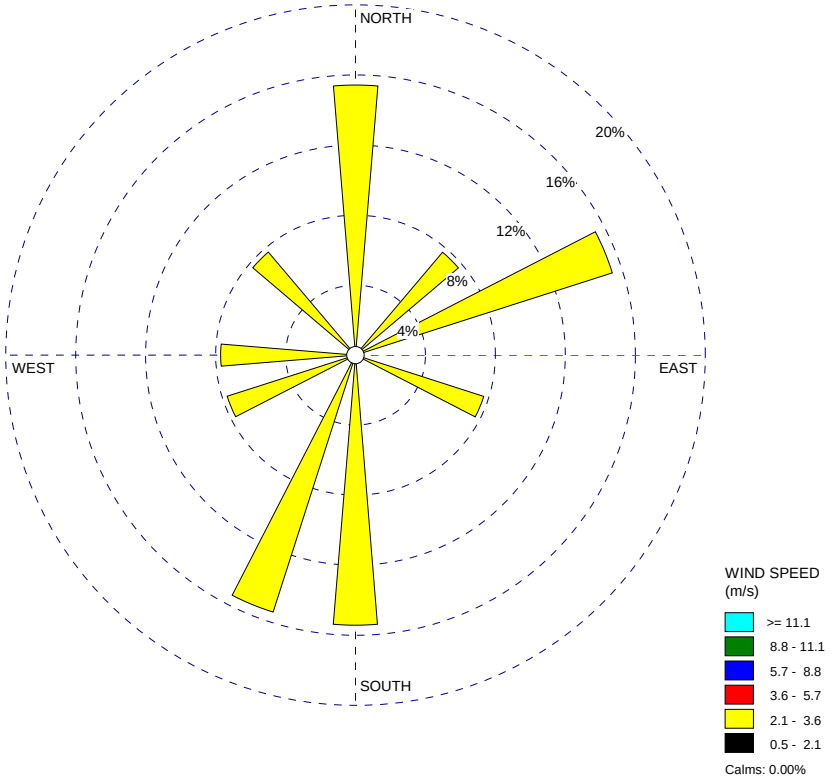
CAS#	Pollutant	Percent	TAC Category
108-08-7	2,4-Dimethylpentane	0.34	
563-46-2	2-Methyl-1-Butene	0.1	
513-35-9	2-Methyl-2-Butene	2.84	
107-83-5	2-Methylpentane	2.87	
589-34-4	3-Methylhexane	0.57	
96-14-0	3-Methylpentane	1.77	
71-43-2	Benzene	1.01	1
590-18-1	Cis-2-Butene	2.91	
100-41-4	Ethylbenzene	0.09	4
75-28-5	Isobutane	15.21	
78-78-4	Isopentane	19.17	
96-37-7	Methylcyclopentane	1.09	
106-97-8	N-butane	30.85	
110-54-3	N-Hexane	1.68	4
109-66-0	N-Pentane	7.75	
25377-72-4	N-Pentene	1.38	
	Other	7.11	
74-98-6	Propane	1.59	
108-88-3	Toluene	1.05	2
624-64-6	Tarans-2-Butene	0.05	
95-47-6	Xylene	0.6	2

Appendix D

Wind Rose Data

WIND ROSE PLOT:
Village Cleaners 11/29/2006

DISPLAY:
Wind Speed
Flow Vector (blowing to)



COMMENTS:	DATA PERIOD:	COMPANY NAME:	
5 Minute Averages	**2006** **Jan 1 - Dec 31** **00:00 - 13:00**	**APCD**	
		MODELER: **TUA MCDERMOTT**	
	CALM WINDS: **0.00%**	TOTAL COUNT: **13 hrs.**	
	AVG. WIND SPEED: **2.84 m/s**	DATE: **9/18/2007**	PROJECT NO.: **Hot Spots**

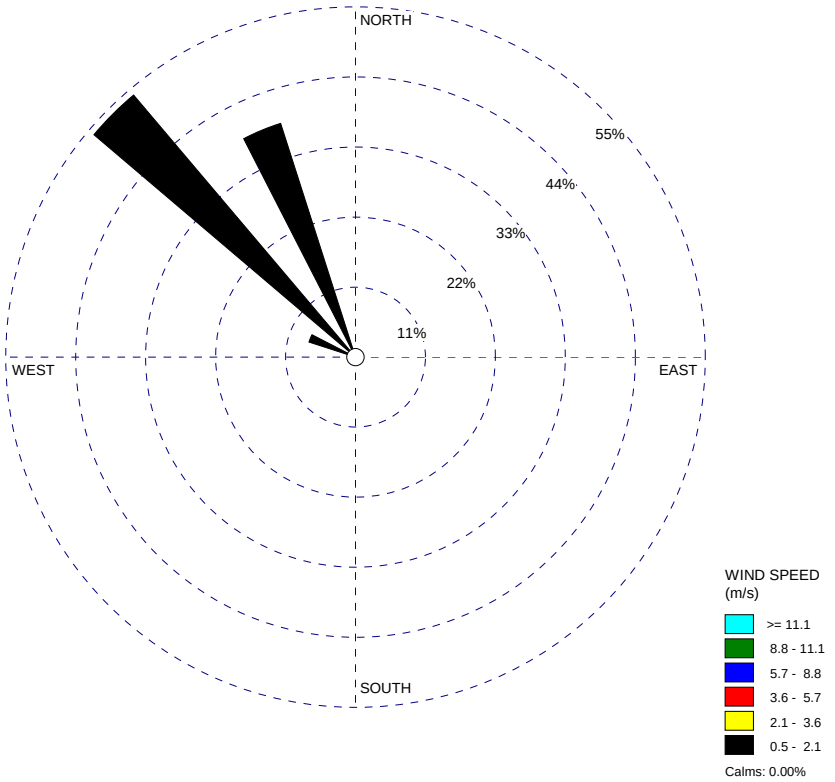
WRPLOT View - Lakes Environmental Software

WIND ROSE PLOT:

Village Cleaners 12/05/2006

DISPLAY:

Wind Speed
Flow Vector (blowing to)



COMMENTS:	DATA PERIOD:	COMPANY NAME:	
5 Minute Averages	**2006** **Jan 1 - Dec 31** **00:00 - 13:00**	**APCD**	
		MODELER: **TUA MCDERMOTT**	
	CALM WINDS: **0.00%**	TOTAL COUNT: **13 hrs.**	
	AVG. WIND SPEED: **1.42 m/s**	DATE: **9/18/2007**	PROJECT NO.: **Hot Spots**

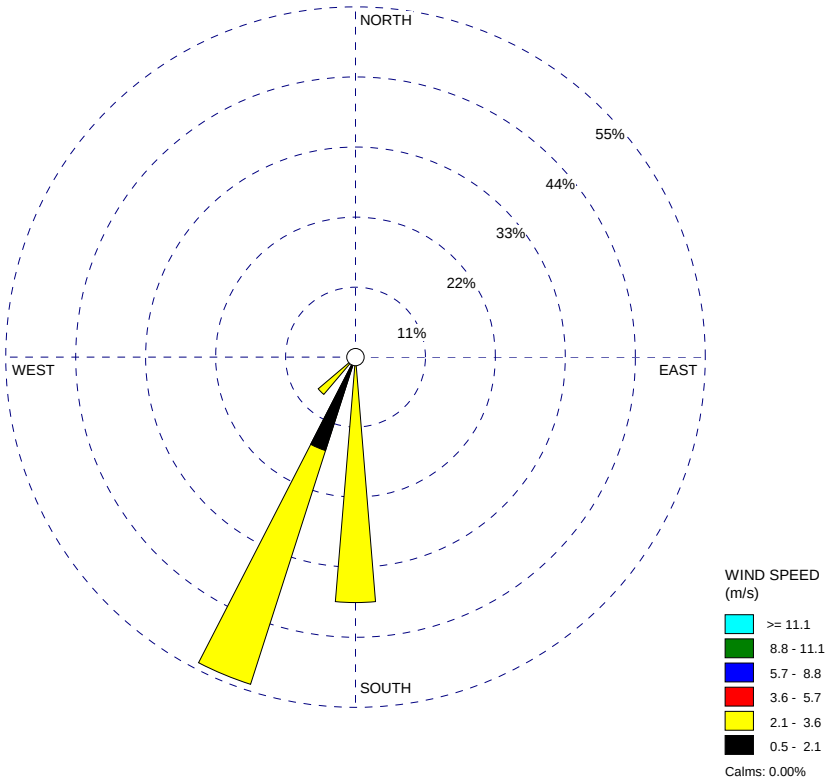
WRPLOT View - Lakes Environmental Software

WIND ROSE PLOT:

Village Cleaner 12/15/2006

DISPLAY:

Wind Speed
Flow Vector (blowing to)



COMMENTS: 5 Minute Averages		COMPANY NAME: **APCD**	
		MODELER: **TUA MCDERMOTT**	
	CALM WINDS: **0.00%**		
	AVG. WIND SPEED: **2.59 m/s**	DATE: **9/18/2007**	PROJECT NO.: **Hot Spots**

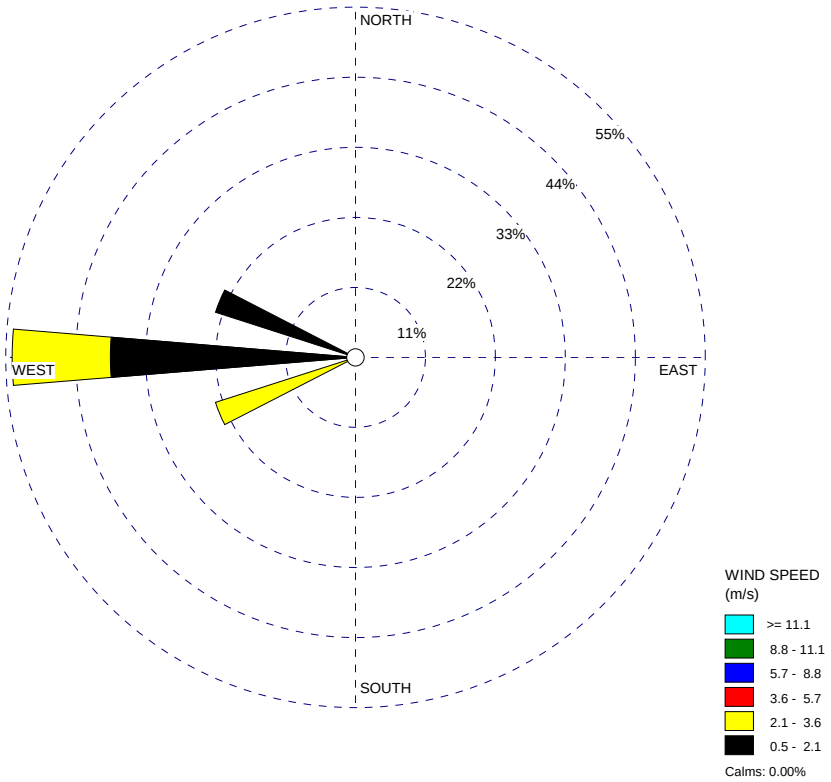
WRPLOT View - Lakes Environmental Software

WIND ROSE PLOT:

Village Cleaner 12/19/2006

DISPLAY:

Wind Speed
Flow Vector (blowing to)



COMMENTS:		COMPANY NAME:	
5 Minute Averages		**APCD**	
		MODELER: **TUA MCDERMOTT**	
	CALM WINDS: **0.00%**		
	AVG. WIND SPEED: **1.90 m/s**	DATE: **9/18/2007**	PROJECT NO.: **Hot Spots**

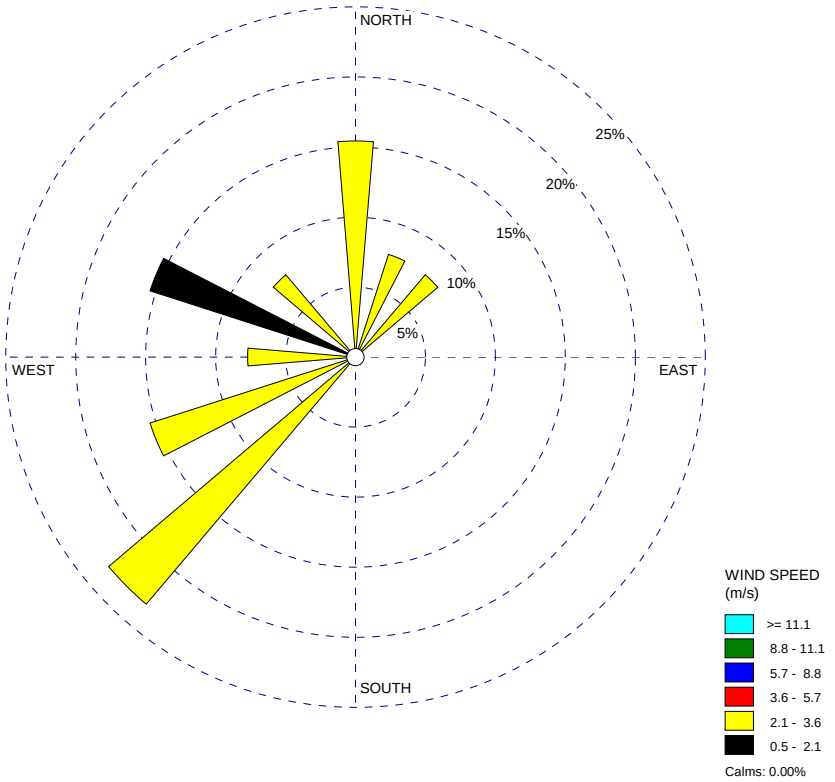
WRPLOT View - Lakes Environmental Software

WIND ROSE PLOT:

Okolona 11/29/2006

DISPLAY:

Wind Speed
Flow Vector (blowing to)



COMMENTS:		COMPANY NAME:	
5 Minute Averages		**APCD**	
		MODELER: **TUA MCDERMOTT**	
	CALM WINDS: **0.00%**		
	AVG. WIND SPEED: **2.53 m/s**	DATE: **9/18/2007**	PROJECT NO.: **Hot Spots**

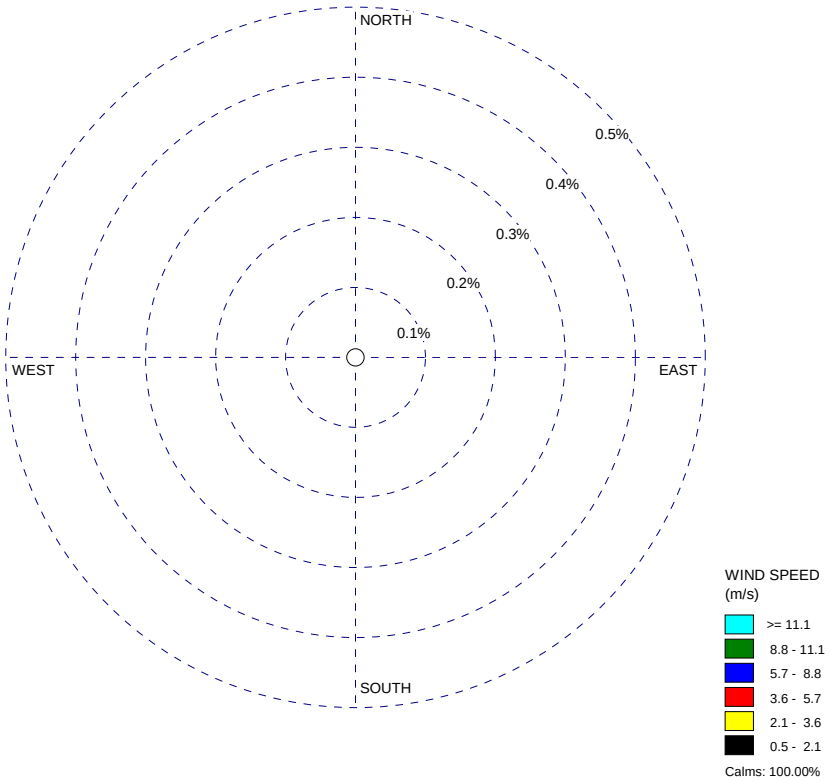
WRPLOT View - Lakes Environmental Software

WIND ROSE PLOT:

Okolona Elementary 12/05/2006

DISPLAY:

Wind Speed
Flow Vector (blowing to)



COMMENTS:		COMPANY NAME:	
5 Minute Averages		**APCD**	
		MODELER: **TUA MCDERMOTT**	
	CALM WINDS: **100.00%**		
	AVG. WIND SPEED: **0.00 m/s**	DATE: **9/18/2007**	PROJECT NO.: **Hot Spots**

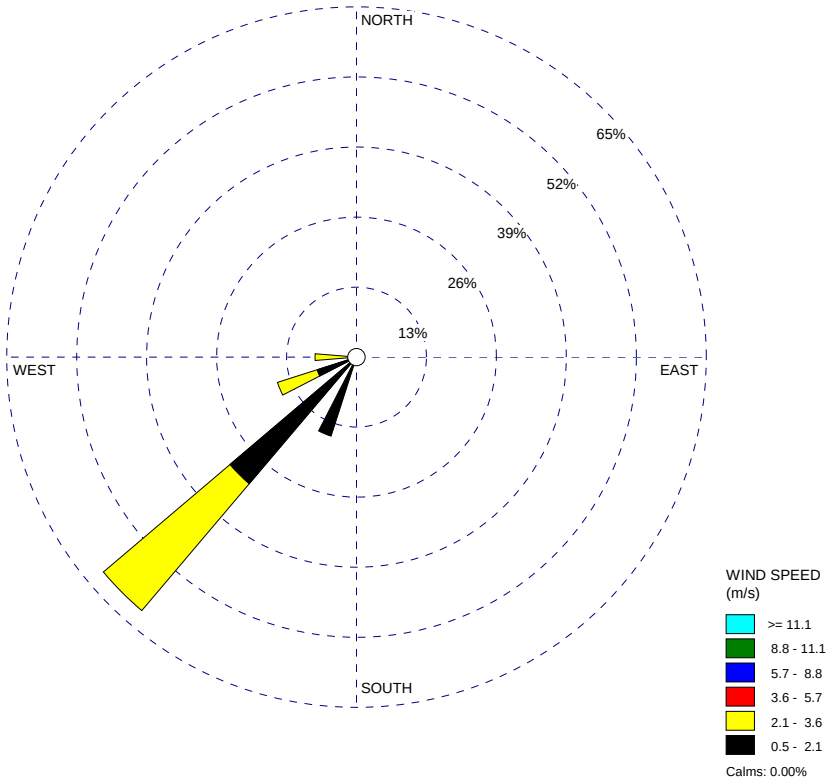
WRPLOT View - Lakes Environmental Software

WIND ROSE PLOT:

Okolona Elementary 12/15/2006

DISPLAY:

Wind Speed
Flow Vector (blowing to)



COMMENTS: 5 Minute Averages		COMPANY NAME: **APCD**	
		MODELER: **TUA MCDERMOTT**	
	CALM WINDS: **0.00%**		
	AVG. WIND SPEED: **1.94 m/s**	DATE: **9/18/2007**	PROJECT NO.: **Hot Spots**

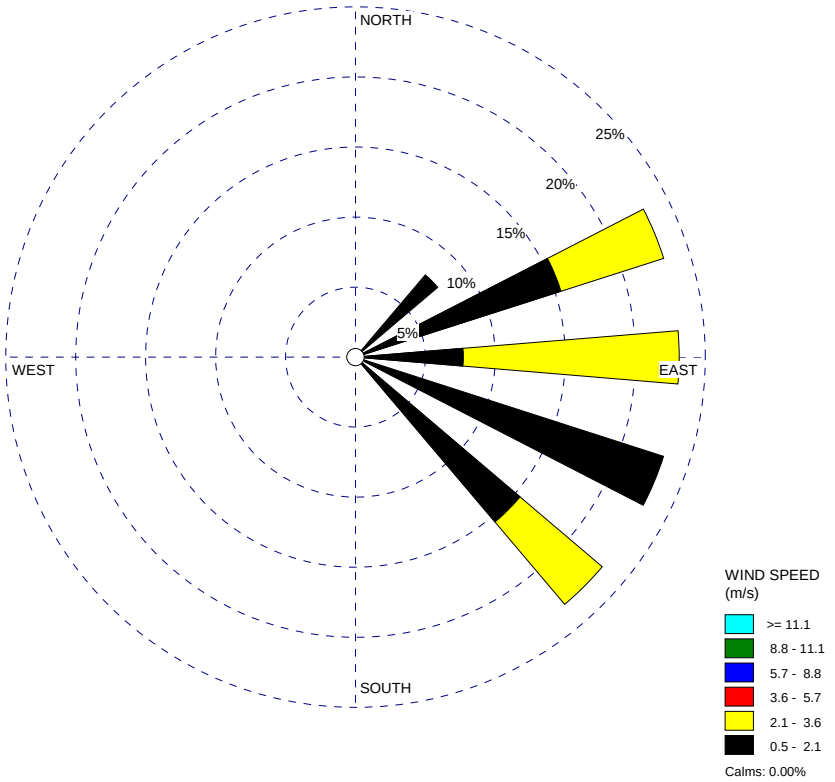
WRPLOT View - Lakes Environmental Software

WIND ROSE PLOT:

Okolona Elementary 12/19/2006

DISPLAY:

Wind Speed
Flow Vector (blowing to)



COMMENTS: 5 Minute Averages		COMPANY NAME: **APCD**	
		MODELER: **TUA MCDERMOTT**	
	CALM WINDS: **0.00%**		
	AVG. WIND SPEED: **2.05 m/s**	DATE: **9/18/2007**	PROJECT NO.: **Hot Spots**

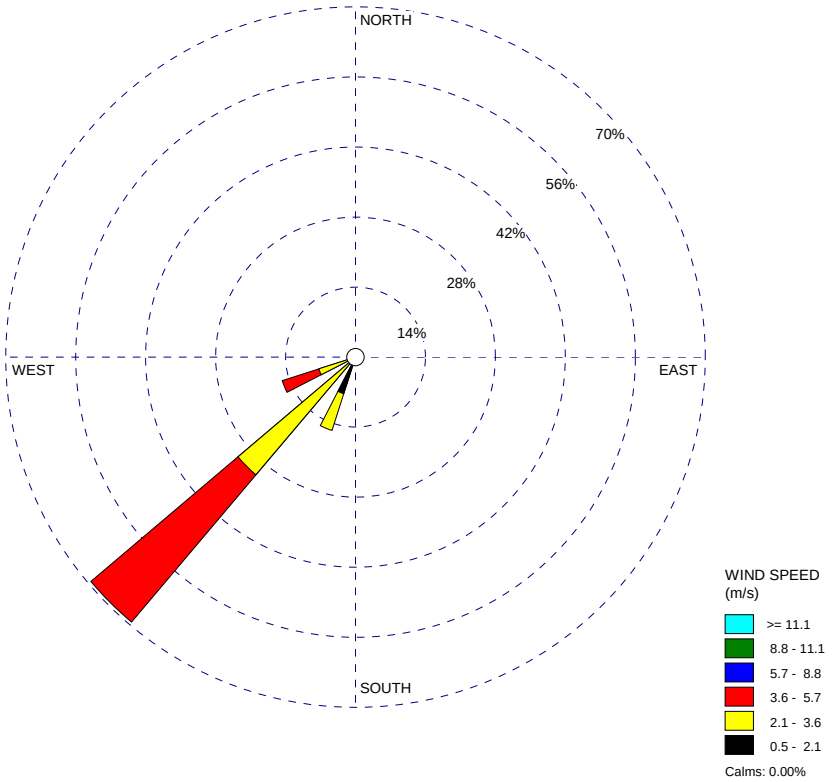
WRPLOT View - Lakes Environmental Software

WIND ROSE PLOT:

Ballard HS 12/08/2006

DISPLAY:

Wind Speed
Flow Vector (blowing to)



COMMENTS: 5 Minute Averages		COMPANY NAME: **APCD**	
		MODELER: **TUA MCDERMOTT**	
	CALM WINDS: **0.00%**		
	AVG. WIND SPEED: **3.40 m/s**	DATE: **9/18/2007**	PROJECT NO.: **Hot Spots**

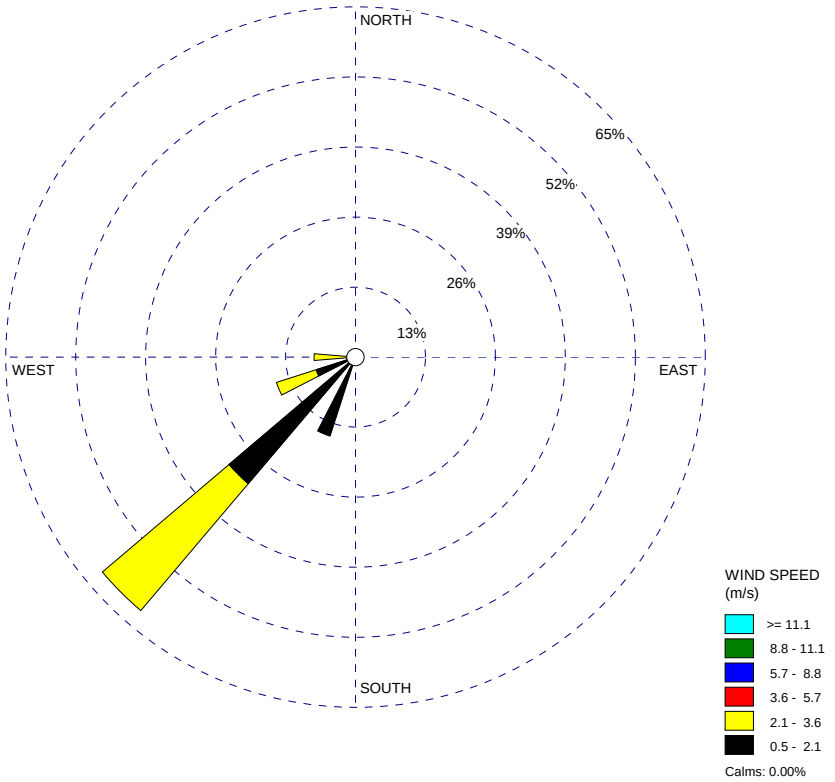
WRPLOT View - Lakes Environmental Software

WIND ROSE PLOT:

Okolona Elementary 12/15/2006

DISPLAY:

Wind Speed
Flow Vector (blowing to)



COMMENTS: 5 Minute Averages		COMPANY NAME: **APCD**	
		MODELER: **TUA MCDERMOTT**	
	CALM WINDS: **0.00%**		
	AVG. WIND SPEED: **1.94 m/s**	DATE: **9/18/2007**	PROJECT NO.: **Hot Spots**

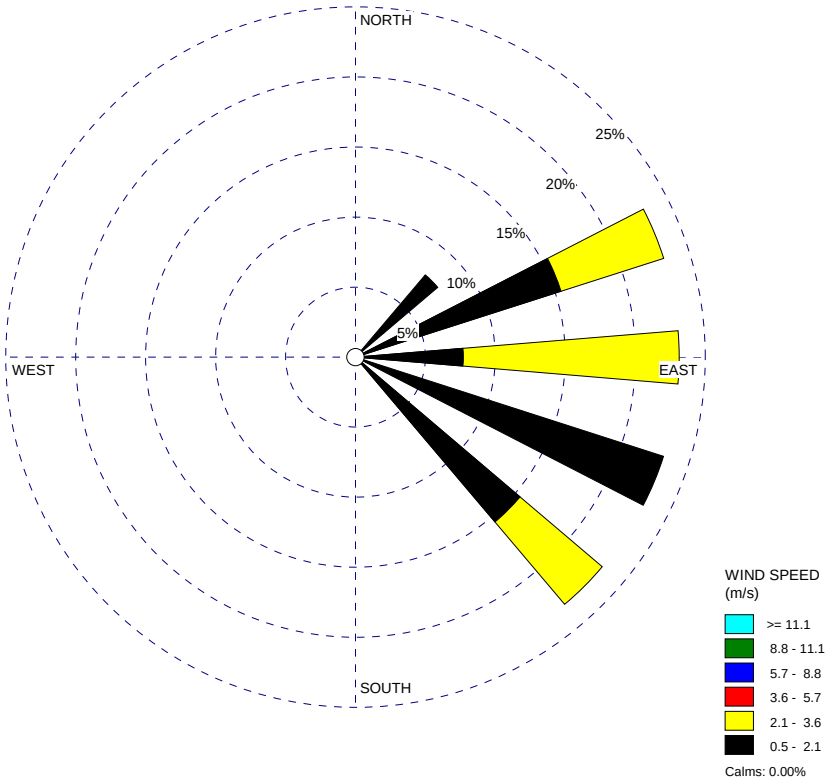
WRPLOT View - Lakes Environmental Software

WIND ROSE PLOT:

Okolona Elementary 12/19/2006

DISPLAY:

Wind Speed
Flow Vector (blowing to)



COMMENTS: 5 Minute Averages		COMPANY NAME: **APCD**	
		MODELER: **TUA MCDERMOTT**	
	CALM WINDS: **0.00%**		
	AVG. WIND SPEED: **2.05 m/s**	DATE: **9/18/2007**	PROJECT NO.: **Hot Spots**

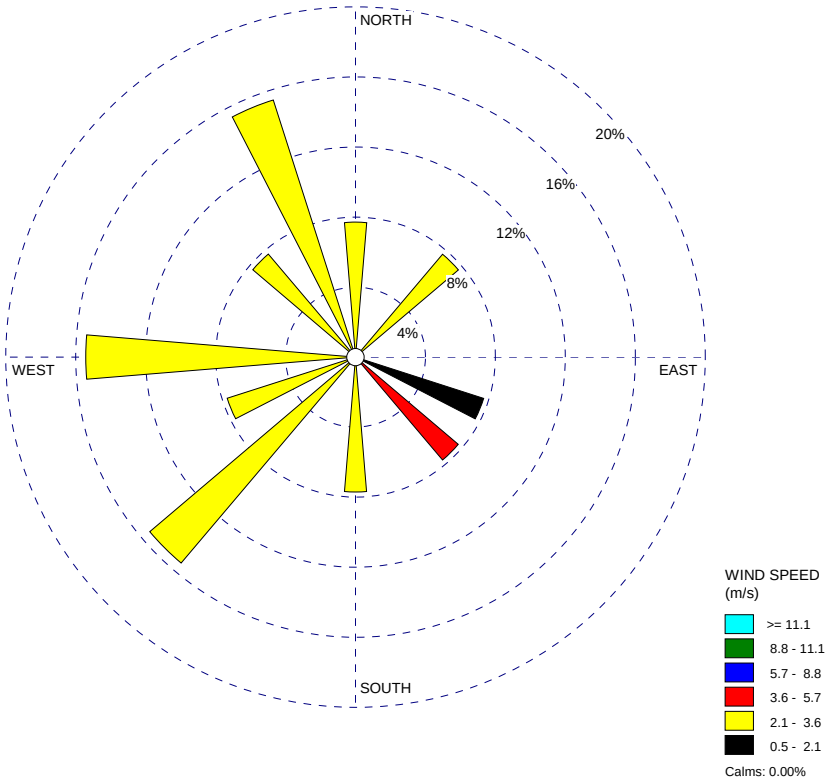
WRPLOT View - Lakes Environmental Software

WIND ROSE PLOT:

Ballard HS 01/08/2007

DISPLAY:

Wind Speed
Flow Vector (blowing to)



COMMENTS:		COMPANY NAME:	
5 Minute Averages		**APCD**	
		MODELER: **TUA MCDERMOTT**	
	CALM WINDS: **0.00%**		
	AVG. WIND SPEED: **2.92 m/s**	DATE: **9/18/2007**	PROJECT NO.: **Hot Spots**

WRPLOT View - Lakes Environmental Software