Indiana Harbor and Canal Ambient Air Monitoring Program: Construction Phase Annual Report 2011

U.S. Army Corps of Engineers
Chicago District
September 2012

Executive Summary

Ambient air monitoring data, including polycyclic aromatic hydrocarbons (PAH), polychlorinated biphenyls (PCB), volatile organic compounds (VOC), metals, and Total Suspended Particulates (TSP) are currently being collected as part of the Indiana Harbor and Canal Confined Disposal Facility construction project. The construction project is located on the former Energy Cooperative, Inc. refinery site. Two monitoring locations are used: the south site (adjacent to the Indiana Harbor Canal just south of the ECI property), and the East Chicago High School.

This report presents a summary of the mean concentrations for both monitoring sites, for a number of compounds. Data are analyzed based on the location of the monitoring station, the season (corresponding to the average temperature), and whether construction activities are occurring on site.

Based on a statistical analysis of the data, there is no indication that construction activities at the ECI site are causing degradation of the ambient air at either the south monitoring site or at the high school. Construction activities are substantially complete as of the end of calendar year 2011. At this time, it is recommended that an adequate level of monitoring continue during the start of dredging activities at the ECI site, and that the data be re-evaluated on an annual basis to determine whether dredging activities are having an impact on the ambient air conditions near the CDF.

Table of Contents

Tables

Figures

Introduction

In November 2001, the U.S. Army Corps of Engineers (USACE) implemented an ambient air monitoring program at the property known as the Energy Cooperative, Inc. (ECI) site, located in East Chicago, Indiana. The ECI site is the location of a confined disposal facility (CDF), which is currently being constructed to hold sediment dredged from the Indiana Harbor and Canal. In May 2004, the construction phase of the ambient air monitoring program was implemented. The ambient air monitoring program results, including the background phase (reference 1 below) and construction phase monitoring through 2010 (references 1 through 8) are presented in the following reports:

1. Indiana Harbor and Canal Air Monitoring: Background Phase Ambient Summary & Construction Phase Ambient Air Monitoring Program, USACE Chicago District, November 2003.

2. Indiana Harbor and Canal Ambient Air Monitoring Program: Construction Phase Annual Report 2004, USACE Chicago District, June 2005.

3. Indiana Harbor and Canal Ambient Air Monitoring Program: Construction Phase Annual Report 2005, USACE Chicago District, June 2006.

4. Indiana Harbor and Canal Ambient Air Monitoring Program: Construction Phase Annual Report 2006, USACE Chicago District, July 2007.

5. Indiana Harbor and Canal Ambient Air Monitoring Program: Construction Phase Annual Report 2007, USACE Chicago District, July 2008.

6. Indiana Harbor and Canal Ambient Air Monitoring Program: Construction Phase Annual Report 2008, USACE Chicago District, September 2009.

7. Indiana Harbor and Canal Ambient Air Monitoring Program: Construction Phase Annual Report 2009, USACE Chicago District, June 2010.

8. Indiana Harbor and Canal Ambient Air Monitoring Program: Construction Phase Annual Report 2010, USACE Chicago District, July 2011.

These reports include detailed information on the selection of the monitoring sites, the handling of non-detectable data, an evaluation of meteorological data, and statistical analyses of the previous air monitoring data. Because the monitoring locations, physical conditions, and data handling have not changed, that information will not be repeated in this report. Interested readers are referred to the above referenced documents for details.

The purpose of this report is to present an updated statistical analysis of the ambient air monitoring data. Air monitoring data will be compared by location, season, and parameter. The entire ambient air monitoring dataset is used for this analysis, including data from 2001 through 2011.

Air Monitoring Data

Locations and Parameters

The air monitoring data used for the statistical analysis were collected at two locations, referred to as the “south” site and as the “high school” site. These two locations are shown in Figure 1. The south site is located adjacent to the Lake George Branch of the Indiana Harbor Canal. The high school (HS) site is located approximately 1700 feet south of the south sampler, on the East Chicago High School property. The rationale for these monitoring locations is discussed in previous reports.

The air sampling stations operate in tandem, on a 12-day rotational schedule. Each sample is a 24 hour sample. Parameters measured and used in the statistical analysis include the analytes listed in Table 1. The parameters fall into several chemical groups: polycyclic aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs), volatile organic compounds (VOCs), metals, and Total Suspended Particulates (TSP).

Figure 1: Location of Ambient Air Sampling Stations and the ECI site in East Chicago, Indiana.

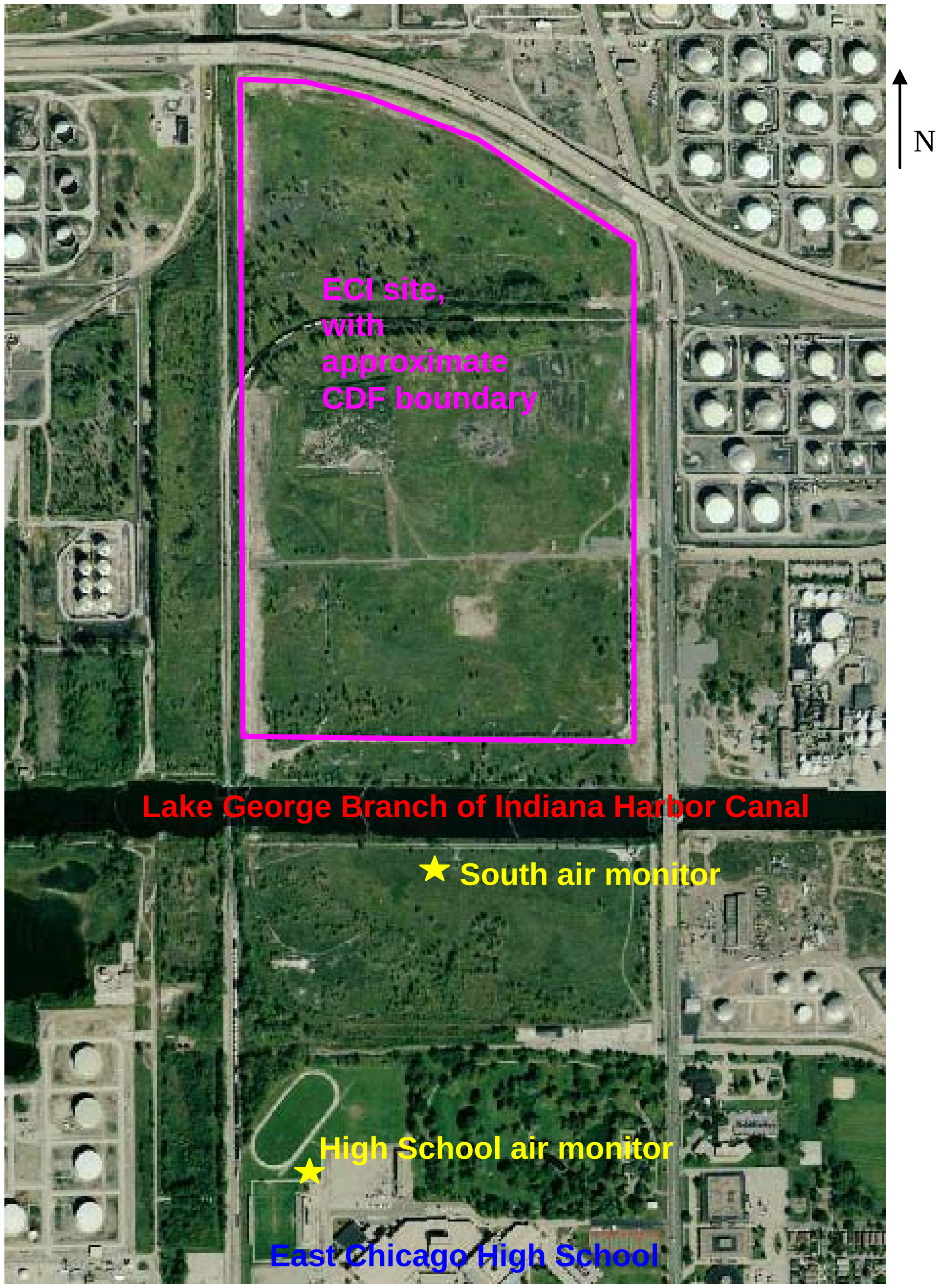

Table 1: Air Monitoring Analytes

PAHs	**Metals**
Acenaphthene	Aluminum
Acenaphthylene	Arsenic
Fluoranthene	Barium
Fluorene	Chromium
Naphthalene	Cobalt
Phenanthrene	Copper
Pyrene	Iron
PCBs	Lead
Congener 8	Manganese
Congener 15	Nickel
Congener 18	Selenium
Congener 28	Zinc
Congener 31	
VOCs	Total Suspended Particulates (TSP)
Benzene	
Toluene	

The PAH and PCB samples are obtained using a high-volume vacuum pump air sampler, with a glass fiber filter, a polyurethane foam (PUF) and adsorbent resin (XAD-2) media. Total suspended particulates and metals are collected using a separate high-volume vacuum pump air sampler, with a glass fiber filter medium. VOCs are collected using specially treated stainless steel canisters, which utilize a bellows-type pump to draw in air.

Data Organization

For analyzing the ambient air monitoring data, the data are subdivided into two main groups: Active and Idle. Active refers to data collected while construction activities were occurring on the ECI site. Various types of construction were occurring from 2004 through 2011, the same period during which the data in this report was being collected. Construction activities included excavations, obstruction removal, grading, embankment (dike) construction, cut-off wall construction, well installation, and construction of various other structures. This construction work occurred at various times of the year over the 2004 to 2011 time period. Idle refers to data collected while no construction activities are occurring. This includes the initial years of data collection, before construction started on the ECI site (2001-2003), as well as data from more recent years when construction activities were not occurring, such as during winter and shutdown periods.

Air data, particularly for volatile compounds, show temperature related trends. For this reason, the data were broken down by season: spring/fall (March, April, May, October, November), summer (June, July, August, September), and winter (December, January, February). These groups correspond to mean monthly temperatures of <40^{o}F (winter), 40 – 60^{o}F (spring/fall), and >60^{o}F (summer). Thus, based on seasonal subgroups and also the status of construction activities, there are a total of twelve data subsets for each parameter:

- South site, Active, spring/fall
- South site, Active, summer
- South site, Active, winter
- South site, Idle, spring/fall
- South site, Idle, summer
- South site, Idle, winter
- HS site, Active, spring/fall
- HS site, Active, summer
- HS site, Active, winter
- HS site, Idle, spring/fall
- HS site, Idle, summer
- HS site, Idle, winter

Statistical Analysis

The ambient air monitoring data were compared using a non-parametric comparison of means, the Mann-Whitney test. Non-parametric tests are used when a normal distribution of the data cannot be assumed or when there are small numbers of data points. The handling of non-detectable data and other details of the statistical analysis can be found in previous reports.

Results

Appendix A contains the results of comparisons of means. These tables give the updated means and the results of statistical comparisons of the data sets. The continued primary objective of this analysis is to evaluate the potential impacts of construction activities at the ECI site on the ambient air quality near the facility. To facilitate this evaluation, the data have been compared based on location and activity (or lack of activity). The data presentation follows the format used in previous Indiana Harbor and Canal ambient air monitoring reports. The results are discussed further, below.

South Site versus High School Site

The ambient concentrations of each analyte were compared between locations (south monitoring site versus the high school monitoring site) for both idle (no construction) and active (construction) periods. Data were broken down into seasonal groups for comparison, and the overall data group was also used for comparison. Tables A1 through A8 show the mean concentrations and also the statistical significance of each comparison.

For PAHs (shown in Tables A1 and A2), acenaphthene, acenaphthylene, and fluorene were significantly different between the south site and the high school for idle conditions, with the south site having a higher acenaphthene, acenaphthylene, and fluorene concentration than the high school in the spring/fall and overall; and the south site having higher acenaphthylene concentration than the high school in the summer, and the south site having higher acenaphthene and fluorene concentration than the high school in the winter. For the active period, spring/fall and overall acenaphthylene concentrations, and spring/fall fluorene concentrations were also higher at the south site than at the high school site. However, summer acenaphthene, floranthene, and naphthalene concentrations, as well as overall naphthalene concentrations were statistically higher at the high school site than the south site during the active period. The remaining data show no seasonal or overall differences. The overall naphthalene concentration had previously been higher at the high school site during active conditions, and while this trend was not confirmed with the 2010 data, it re-emerged in 2011. The higher concentrations of acenaphthene, acenaphthylene, and fluorene at the south site during idle conditions and higher fluorene and acenaphthylene concentrations at the south site during active conditions are attributed to the known concentrations of PAHs in the canal sediment and water column. It is not known why some PAHs are higher at the high school than at the south site during the active summer season. It is possible that there is a local source of PAH emissions nearer the high school than the south monitoring site.

For PCBs (shown in Tables A3 and A4), there were differences between the south site and the high school for all seasons and overall, for both idle and active periods. Congeners 15, 18, 28, 31, and the total PCB concentration were statistically different, with concentrations at the south site being higher than the concentrations at the high school site in the spring/fall, summer, and overall for both the idle and active periods. Congeners 18, 28, 31, and total PCBs were also statistically higher at the south site for the winter, idle conditions than at the high school. Congener 8 did not show any statistically significant differences between the two monitoring locations for any season for both idle and active periods. The higher concentrations of PCBs at the south site are attributed to the known concentrations of PCBs in the canal sediment and water column. All PCB trends are consistent with previously reported results; there were no new trends with inclusion of the latest data.

Except for the overall benzene concentration being higher at the high school site than the south site for the idle period, the concentrations of VOCs (benzene and toluene) were statistically similar for all seasons, for both idle and active conditions. Concentrations are very similar for all seasons, and do not appear to show strong seasonality. VOC data are summarized in Tables A5 and A6. Elevated toluene concentrations were detected at both sites, but especially at the High School site throughout June of 2011. This spike shifted the cumulative 2001-2011 summer toluene mean concentrations at the High School site from 3.3 $\mu g/m^3$ to 9.8 $\mu g/m^3$, while the cumulative mean concentrations at the South site also increased, but much less dramatically. This data suggests a temporary condition at or south of the high school site during the summer of June 2011. The East Chicago High School conducted construction activities at their campus during the summer of 2011. Artificial turf was installed on their football and soccer fields, which may explain this unusual episode of increased toluene concentrations. Despite the large shift in mean toluene concentrations over the 2004-2011 time period, the non-parametric Mann-Whitney test compares the two groups of data and finds no significant difference between the groups overall, suggesting that the June 2011 points are essentially outliers. All other VOC trends are consistent with previously reported results.

Only one metal, copper, showed any statistical differences between the two monitoring sites. During idle conditions, the copper concentration is higher at the high school during the summer. The copper concentration had previously been higher at the south site during the winter, but this trend was not confirmed with the latest data. During active conditions, copper concentrations were higher at the south site for the spring/fall and overall, but higher at the school during the summer. These trends are similar to those observed in previous years. Metals data are summarized in Tables A7 and A8. The difference in trends between the two sites suggests that there may be different local sources of copper in the area.

Idle versus Active

Data for each monitoring site, the south site and the high school, were compared between idle (no construction) and active (construction) periods. The intent of this comparison is to evaluate differences in ambient air conditions that may be attributed to construction activities. The data were analyzed as seasonal groups and also as an overall data group. The data are presented in Appendix A, Tables A9 through A16.

Several PAHs (Table A9 and A10) showed seasonal and overall differences between active and idle conditions. At the south site, acenaphthylene and naphthalene were statistically higher in the summer and overall during idle conditions. Fluoranthene, fluorene, phenanthrene, and pyrene were higher overall during active conditions. All of these trends are consistent with previously reported results, except for acenaphthylene being higher overall during idle conditions, which is a new trend. In 2010, overall naphthalene concentrations were also statistically greater during idle conditions, but this trend was not repeated in 2011. Higher concentrations during idle conditions and summer months may indicate that these compounds are originating from other local sources, possibly seasonal sources such as warm weather maintenance or operations, rather than from the ECI site. Higher active overall concentrations of some PAHs (fluoranthene, fluorene, phenanthrene, and pyrene) are attributed to the prevalence of summer data (when most PAH concentrations are highest – see Tables A17 and A18 and the Seasonal Dependence discussion below) in the active period data set, rather than actual impact from construction activities. This is confirmed by the fact that the active vs. idle comparisons of these PAHs by season do not show statistical differences.

At the school, naphthalene was higher during the idle conditions during the summer and acenaphthylene was higher during active conditions in the winter. Acenaphthene, fluoranthene, fluorene, phenanthrene, and pyrene were higher overall during the active conditions. As discussed in the previous paragraph, the higher active overall concentrations of most of the PAHs are attributed to the prevalence of summer data (when most PAH concentrations are highest – see Tables A17 and A18 and the Seasonal Dependence discussion below) in the active period data set, rather than actual impact from construction activities. This is confirmed by the fact the active vs. idle comparisons of these PAHs by season do not show statistical differences.

For PCBs at the south site (Table A11), the overall concentrations of congeners 8, 15, 18, 28, 31, and total PCBs were all statistically higher during active periods. At the school (Table A12), the overall concentrations of congeners 8, 15, 18, 28, 31, and total PCBs were also all statistically higher during active periods. As discussed in the previous paragraphs about PAHs, the higher active overall concentrations of these PCBs are attributed to the prevalence of summer data (when the PCB concentrations are highest – see Tables A19 and A20 and the Seasonal Dependence discussion below) in the active period data set, rather than actual impact from construction activities. This is confirmed by the fact the active vs. idle comparisons of PCBs by season do not show any statistical differences. These trends are consistent with previous years' analyses.

Also, it should be noted that although the PCB concentrations were found to be higher during active periods at both the south site and the high school site, the mean total PCB concentrations are 0.000124 ug/m^3 and 0.000087 ug/m^3 (at the south site and high school site, respectively) during idle conditions and 0.000184 ug/m^3 (south site) and 0.000120 ug/m^3 (high school site) during active conditions. These concentrations are more than 10 times *less* than the USEPA Region 3 risk based concentration for total PCBs in ambient air. The risk based concentration for total PCBs in ambient air is 0.0031 ug/m^3, which corresponds to a lifetime cancer risk of 1 x 10^{-6}. The PCB concentrations measured at the south site and high school represent an even lower risk.

VOC data are summarized in Tables A13 and A14. At the south site, the overall toluene concentration is statistically higher for the active period. For the high school site, benzene is statistically higher during the idle than the active periods for the spring/fall and summer seasons and overall. Compounds with higher concentrations during idle conditions may be emitted from industry or other local sources. Toluene, on the other hand, is statistically higher during the active period overall at the high school. The higher active overall toluene concentration is attributed to the prevalence of summer data when toluene concentrations are highest. These are consistent with previous trends observed of the VOC data, except for benzene being higher during the idle period in the summer at the high school site.

Concentrations of some metals showed statistically significant differences between active and idle conditions (Tables A15 and A16). At the south site (Table A15), overall aluminum, overall arsenic, overall barium, overall chromium, overall iron, overall lead, overall manganese, and overall total suspended particulates (TSP) concentrations were statistically higher during active conditions than during idle conditions. The south site summer cobalt concentration was statistically higher during idle than active conditions. As with PAHs and PCBs, the higher active overall concentrations of some metals and TSP are attributed to the prevalence of summer data (when metal and TSP concentrations are higher – see Tables A23 and A24 and the Seasonal Dependence discussion below) in the active period data set, rather than actual impact from construction activities. This is generally confirmed by the fact that the active vs. idle comparisons of metals and TSP at the south site by season do not show any statistical differences.

At the high school site (Table A16), overall aluminum, overall chromium, overall iron, overall lead, overall manganese, overall TSP, and spring/fall cobalt concentrations were statistically greater during active conditions. The high school site spring/fall, summer, and overall copper concentrations and summer barium concentration were statistically higher during idle than active conditions. Again, as with PAHs, PCBs, and metals and TSP at the south site, the higher overall concentrations of some metals and TSP at the high school site during the active periods are attributed to the prevalence of summer data (when metal and TSP concentrations are higher – see Tables A23 and A24 and the Seasonal Dependence discussion below) in the active period data set, rather than actual impact from construction activities. This is generally confirmed by the fact that the active vs. idle comparisons of metals and TSP at the high school site by season do not show any statistical differences. Copper does not follow this trend (higher during idle periods at the high school for spring/fall, summer, and overall). The copper trends suggest that the sources of copper to the air may be different from that of other metals in this area.

<u>Seasonal Dependence of Concentration</u>

Many factors, including air temperature and wind velocity, can impact the concentration of compounds in the ambient air. For this reason, the average concentrations for each compound during each period, and at each location were compared between seasons. The data are presented in Appendix A, Tables A17 through A24.

In general, the PAHs had statistically greater concentrations during the summer period than during the spring/fall or winter (Tables A17 and A18). Most of the PAHs also show a significant difference between the spring/fall concentration and the winter concentration. Although the concentrations may be different between location and period, the tendency for seasonally higher concentrations holds true for all the data except for acenaphthylene and naphthalene at both sites during active and idle conditions. The spring/fall and winter acenaphthylene concentrations were higher than the summer concentration at the south site during active conditions, and the winter acenaphthylene concentration is higher than the spring/fall and summer acenaphthylene concentrations at the high school site during the active period. Winter naphthalene concentrations also exceeded summer naphthalene concentrations at the South site. This is not consistent with greater volatility of the compounds during warmer months and is difficult to explain. This trend was also observed in previous years' results for acenaphthylene, but not naphthalene. Naphthalene concentrations were not statistically different between the seasons at the South site during the idle period or the High School site during the active period.

The PCB data during idle conditions (Table A19) showed a similar expected trend, with the summer concentrations being statistically greater than the spring/fall concentrations, which were in turn statistically greater than the winter concentrations for both the south and high school sites. This is the expected behavior of the compounds based on air temperature data. During active conditions (Table A20), the summer concentrations were also statistically greater than the spring/fall concentrations which were in turn statistically greater than the winter concentrations for the south and high school sites.

The VOC data showed fewer trends based on temperature. The idle toluene data (Table A21) for both the south site and the high school were statistically greater during the summer than during the spring/fall and during the winter. This is consistent with previous years' data trends. The benzene data during idle and active conditions showed no significant difference between the seasons for either the south or high school site. During active conditions (Table A22), summer toluene concentrations were statistically higher than spring/fall concentrations at both sites. Summer toluene concentrations were also statistically significantly higher than winter concentrations at the south site. It is likely that the benzene and toluene data do not show as much seasonal trend for two reasons: first these compounds are quite volatile, even at lower temperatures and so are already in the air regardless of the air temperature, and second, there are probably many local sources of these ubiquitous compounds and the multiple emissions may have a greater impact than temperature or other climactic factors.

The metals data (Tables A23 and A24) showed some seasonal trends, more for the idle datasets than the active datasets. It should be noted that metals are not expected to show as many temperature dependent trends as organic compounds, since the atmospheric transport of metals is driven by particulate concentration (except for mercury) rather than volatilization. There is some seasonal correlation to metal concentrations in the air, which may be attributed to other factors such as more anthropogenic activity during the warm seasons, or to seasonal wind patterns. In general, the summer concentrations were statistically higher than the spring/fall and winter concentrations for idle conditions for most but not all metals. Selenium concentrations at both the south site (idle conditions) and the high school site (idle and active conditions) were greater during the spring/fall than during the summer for idle conditions. This trend is not consistent with other metals' results and is difficult to explain.

Conclusions

The air monitoring data presented were statistically analyzed based on location, season, and whether construction activities were occurring on the ECI site. The data and statistical significance are presented in tables. Based on a statistical analysis of the data, there is no indication that construction activities at the ECI site are causing degradation of the ambient air at either the south monitoring site or at the high school. It is recommended that an adequate level of monitoring continue for the purpose of expanding the dataset, and that the data and statistical analysis be revisited on an annual basis.

Appendix A Data Summary

Table A 1: Comparison of Mean Concentrations between Locations (South site vs. High School site) of PAHs during IDLE conditions

Analyte & Location		Spring/Fall		Summer		Winter		Overall	
		ng/m^3	S/D*	ng/m^3	S/D*	ng/m^3	S/D*	ng/m^3	S/D*
Acenaphthene	South	8.879	yes	15.287		3.759	yes	8.662	yes
	HS	7.223		16.252		2.606		7.852	
Acenaphthylene	South	2.698	yes	2.864	yes	3.061		2.853	yes
	HS	2.219		2.156		2.704		2.352	
Fluoranthene	South	3.084		5.854		2.018		3.362	
	HS	2.952		6.620		2.078		3.508	
Fluorene	South	8.807	yes	14.633		4.920	yes	8.858	yes
	HS	6.888		15.008		3.694		7.774	
Naphthalene	South	83.360		96.984		73.146		83.116	
	HS	87.696		109.646		78.378		89.416	
Phenanthrene	South	14.375		27.603		8.769		15.536	
	HS	13.288		28.557		8.104		15.185	
Pyrene	South	2.078		3.330		1.853		2.287	
	HS	2.030		3.340		1.793		2.253	

*S/D indicates a statistically significant difference between the two values at a 95% confidence interval

Table A 2: Comparison of Mean Concentrations between Locations (South site vs. High School site) of PAHs during ACTIVE conditions

Analyte & Location		Spring/Fall		Summer		Winter		Overall	
		ng/m^3	S/D*	ng/m^3	S/D*	ng/m^3	S/D*	ng/m^3	S/D*
Acenaphthene	South	7.014		12.117		3.693		9.023	
	HS	6.922		16.322	yes	2.770		10.748	
Acenaphthylene	South	2.858	yes	1.797		3.684		2.454	yes
	HS	2.322		1.499		3.437		2.092	
Fluoranthene	South	3.093		5.408		2.243		4.080	
	HS	3.222		6.829	yes	2.313		4.756	
Fluorene	South	8.350	yes	13.620		5.054		10.435	
	HS	7.094		16.178		4.171		10.766	
Naphthalene	South	74.077		60.907		78.888		68.325	
	HS	79.677		75.939	yes	87.545		77.501	yes
Phenanthrene	South	15.691		29.277		8.810		21.265	
	HS	14.899		35.250		8.466		23.220	
Pyrene	South	2.367		3.239		1.993		2.732	
	HS	2.139		3.403		2.023		2.713	

*S/D indicates a statistically significant difference between the two values at a 95% confidence interval

Table A 3: Comparison of Mean Concentrations between Locations (South site vs. High School site) of PCBs during IDLE Conditions

Analyte & Location		Spring/Fall		Summer		Winter		Overall	
		pg/m^3	S/D*	pg/m^3	S/D*	pg/m^3	S/D*	pg/m^3	S/D*
Congener 8	South	34.231		75.926		16.562		37.754	
	HS	31.655		71.191		14.497		34.911	
Congener 15	South	6.214	yes	13.526	yes	2.493		6.637	yes
	HS	4.417		10.432		2.051		4.992	
Congener 18	South	32.267	yes	58.885	yes	11.366	yes	31.543	yes
	HS	18.295		39.873		7.235		19.509	
Congener 28	South	22.222	yes	45.874	yes	8.265	yes	22.779	yes
	HS	13.119		29.942		5.144		14.284	
Congener 31	South	23.878	yes	48.567	yes	8.474	yes	24.468	yes
	HS	13.535		30.236		5.229		14.564	
Sum PCBs	South	118.948	yes	243.651	yes	47.683	yes	123.601	yes
	HS	80.479		182.233		32.600		86.955	

*S/D indicates a statistically significant difference between the two values at a 95% confidence interval

Table A 4: Comparison of Mean Concentrations between Locations (South site vs. High School site) of PCBs during ACTIVE Conditions

Analyte & Location		Spring/Fall		Summer		Winter		Overall	
		pg/m^3	S/D*	pg/m^3	S/D*	pg/m^3	S/D*	pg/m^3	S/D*
Congener 8	South	35.653		68.811		16.127		48.930	
	HS	33.425		62.685		19.148		45.756	
Congener 15	South	6.327	yes	14.224	yes	2.921		9.635	yes
	HS	4.345		9.190		2.842		6.472	
Congener 18	South	30.162	yes	66.066	yes	13.916		45.114	yes
	HS	17.304		35.715		13.066		25.534	
Congener 28	South	21.880	yes	61.270	yes	9.527		39.090	yes
	HS	12.920		29.271		8.640		20.177	
Congener 31	South	23.398	yes	58.629	yes	9.561		38.295	yes
	HS	13.113		28.367		8.869		19.859	
Sum PCBs	South	118.229	yes	276.426	yes	49.902		184.492	yes
	HS	80.995		169.062		50.219		119.831	

*S/D indicates a statistically significant difference between the two values at a 95% confidence interval

Table A 5: Comparison of Mean Concentrations between Locations (South site vs. High School site) of VOCs during IDLE Conditions

Analyte & Location		Spring/Fall		Summer		Winter		Overall	
		ug/m^3	S/D*	ug/m^3	S/D*	ug/m^3	S/D*	ug/m^3	S/D*
Benzene	South	1.3143		1.3129		1.2560		1.2950	
	HS	1.2789		1.5192		1.4331		1.3807	yes
Toluene	South	1.8128		2.8654		1.8524		2.0661	
	HS	1.8627		3.1095		2.1920		2.2442	

*S/D indicates a statistically significant difference between the two values at a 95% confidence interval

Table A 6: Comparison of Mean Concentrations between Locations (South site vs. High School site) of VOCs during ACTIVE Conditions

Analyte & Location		Spring/Fall		Summer		Winter		Overall	
		ug/m^3	S/D*	ug/m^3	S/D*	ug/m^3	S/D*	ug/m^3	S/D*
Benzene	South	1.0521		1.3147		1.0445		1.1824	
	HS	1.1438		1.4083		1.4523		1.3066	
Toluene	South	1.9568		3.5518		1.5546		2.7382	
	HS	2.4771		9.8452		2.2057		5.9891	

*S/D indicates a statistically significant difference between the two values at a 95% confidence interval

Table A 7: Comparison of Mean Concentrations between Locations (South site vs. High School site) of Metals during IDLE Conditions

Analyte & Location		**Spring/Fall**		**Summer**		**Winter**		**Overall**	
		ug/m^3	S/D*	ug/m^3	S/D*	ug/m^3	S/D*	ug/m^3	S/D*
Aluminum	South	0.3253		0.3676		0.1862		0.2922	
	HS	0.3273		0.3747		0.1755		0.2920	
Arsenic	South	0.0018		0.0018		0.0013		0.0016	
	HS	0.0016		0.0017		0.0013		0.0015	
Barium	South	0.0176		0.0242		0.0150		0.0180	
	HS	0.0180		0.0257		0.0151		0.0189	
Chromium	South	0.0051		0.0056		0.0034		0.0047	
	HS	0.0049		0.0053		0.0032		0.0045	
Cobalt	South	0.0007		0.0009		0.0007		0.0008	
	HS	0.0007		0.0009		0.0006		0.0007	
Copper	South	0.0791		0.1175		0.1029		0.0944	
	HS	0.0946		0.1565	yes	0.0800		0.1043	
Iron	South	0.9660		1.1242		0.6400		0.9025	
	HS	0.9393		1.0685		0.6129		0.8698	
Lead	South	0.0271		0.0221		0.0136		0.0219	
	HS	0.0185		0.0183		0.0125		0.0166	
Manganese	South	0.0911		0.1066		0.0560		0.0839	
	HS	0.0859		0.0991		0.0520		0.0787	
Nickel	South	0.0018		0.0019		0.0015		0.0018	
	HS	0.0018		0.0019		0.0016		0.0017	
Selenium	South	0.0021		0.0018		0.0017		0.0019	
	HS	0.0023		0.0017		0.0016		0.0019	
Zinc	South	0.1083		0.1108		0.0860		0.1020	
	HS	0.1028		0.0979		0.0769		0.0938	
TSP (g/m^3)	South	4.73E-05		5.49E-05		3.68E-05		4.57E-05	
	HS	4.69E-05		5.53E-05		3.56E-05		4.54E-05	

*S/D indicates a statistically significant difference between the two values at a 95% confidence interval

Table A 8: Comparison of Mean Concentrations between Locations (South site vs. High School) of Metals during ACTIVE Conditions

Analyte & Location		**Spring/Fall**		**Summer**		**Winter**		**Overall**	
		ug/m^3	S/D*	ug/m^3	S/D*	ug/m^3	S/D*	ug/m^3	S/D*
Aluminum	South	0.3334		0.4313		0.1907		0.3665	
	HS	0.3192		0.3823		0.1924		0.3415	
Arsenic	South	0.0022		0.0017		0.0012		0.0019	
	HS	0.0020		0.0016		0.0015		0.0018	
Barium	South	0.0199		0.0209		0.0177		0.0202	
	HS	0.0198		0.0233		0.0189		0.0214	
Chromium	South	0.0054		0.0059		0.0037		0.0055	
	HS	0.0049		0.0054		0.0037		0.0051	
Cobalt	South	0.0012		0.0007		0.0006		0.0009	
	HS	0.0011		0.0007		0.0006		0.0008	
Copper	South	0.0888	yes	0.1122		0.0763		0.0988	yes
	HS	0.0706		0.1152	yes	0.1013		0.0962	
Iron	South	0.9423		1.3386		0.6361		1.1062	
	HS	0.8545		1.2190		0.6218		1.0227	
Lead	South	0.0261		0.0256		0.0143		0.0247	
	HS	0.0205		0.0227		0.0147		0.0227	
Manganese	South	0.0884		0.1186		0.0490		0.0991	
	HS	0.0790		0.1053		0.0465		0.0902	
Nickel	South	0.0026		0.0020		0.0015		0.0021	
	HS	0.0022		0.0020		0.0016		0.0021	
Selenium	South	0.0022		0.0018		0.0016		0.0019	
	HS	0.0020		0.0018		0.0016		0.0019	
Zinc	South	0.0926		0.0998		0.0665		0.0941	
	HS	0.0800		0.0965		0.0626		0.0862	
TSP (g/m^3)	South	4.93E-05		6.17E-05		3.51E-05		5.39E-05	
	HS	4.67E-05		5.63E-05		3.48E-05		5.06E-05	

*S/D indicates a statistically significant difference between the two values at a 95% confidence interval

Table A 9: Comparison of Mean Concentrations between Periods (Idle vs. Active) of PAHs at the South Site

Analyte & Location		Spring/Fall		Summer		Winter		Overall	
		ng/m³	S/D*	ng/m³	S/D*	ng/m³	S/D*	ng/m³	S/D*
Acenaphthene	Idle	8.879		15.287		3.759		8.662	
	Active	7.014		12.117		3.693		9.023	
Acenaphthylene	Idle	2.698		2.864	yes	3.061		2.853	yes
	Active	2.858		1.797		3.684		2.454	
Fluoranthene	Idle	3.084		5.854		2.018		3.362	
	Active	3.093		5.408		2.243		4.080	yes
Fluorene	Idle	8.807		14.633		4.920		8.858	
	Active	8.350		13.620		5.054		10.435	yes
Naphthalene	Idle	83.360		96.984	yes	73.146		83.116	yes
	Active	74.077		60.907		78.888		68.325	
Phenanthrene	Idle	14.375		27.603		8.769		15.536	
	Active	15.691		29.277		8.810		21.265	yes
Pyrene	Idle	2.078		3.330		1.853		2.287	
	Active	2.367		3.239		1.993		2.732	yes

*S/D indicates a statistically significant difference between the two values at a 95% confidence interval

Table A 10: Comparison of Mean Concentrations between Periods (Idle vs. Active) of PAHs at the High School Site

Analyte & Location		Spring/Fall		Summer		Winter		Overall	
		ng/m³	S/D*	ng/m³	S/D*	ng/m³	S/D*	ng/m³	S/D*
Acenaphthene	Idle	7.223		16.252		2.606		7.852	
	Active	6.922		16.322		2.770		10.748	yes
Acenaphthylene	Idle	2.219		2.156		2.704		2.352	
	Active	2.322		1.499		3.437	yes	2.092	
Fluoranthene	Idle	2.952		6.620		2.078		3.508	
	Active	3.222		6.829		2.313		4.756	yes
Fluorene	Idle	6.888		15.008		3.694		7.774	
	Active	7.094		16.178		4.171		10.766	yes
Naphthalene	Idle	87.696		109.646	yes	78.378		89.416	
	Active	79.677		75.939		87.545		77.501	
Phenanthrene	Idle	13.288		28.557		8.104		15.185	
	Active	14.899		35.250		8.466		23.220	yes
Pyrene	Idle	2.030		3.340		1.793		2.253	
	Active	2.139		3.403		2.023		2.713	yes

*S/D indicates a statistically significant difference between the two values at a 95% confidence interval

Table A 11: Comparison of Mean Concentrations between Periods (Idle vs. Active) of PCBs at the South Site

Analyte & Location		Spring/Fall		Summer		Winter		Overall	
		pg/m^3	S/D*	pg/m^3	S/D*	pg/m^3	S/D*	pg/m^3	S/D*
Congener 8	Idle	34.231		75.926		16.562		37.754	
	Active	35.653		68.811		16.127		48.930	yes
Congener 15	Idle	6.214		13.526		2.493		6.637	
	Active	6.327		14.224		2.921		9.635	yes
Congener 18	Idle	32.267		58.885		11.366		31.543	
	Active	30.162		66.066		13.916		45.114	yes
Congener 28	Idle	22.222		45.874		8.265		22.779	
	Active	21.880		61.270		9.527		39.090	yes
Congener 31	Idle	23.878		48.567		8.474		24.468	
	Active	23.398		58.629		9.561		38.295	yes
Sum PCBs	Idle	118.948		243.651		47.683		123.601	
	Active	118.229		276.426		49.902		184.492	yes

*S/D indicates a statistically significant difference between the two values at a 95% confidence interval

Table A 12: Comparison of Mean Concentrations between Periods (Idle vs. Active) of PCBs at the High School Site

Analyte & Location		Spring/Fall		Summer		Winter		Overall	
		pg/m^3	S/D*	pg/m^3	S/D*	pg/m^3	S/D*	pg/m^3	S/D*
Congener 8	Idle	31.655		71.191		14.497		34.911	
	Active	33.425		62.685		19.148		45.756	yes
Congener 15	Idle	4.417		10.432		2.051		4.992	
	Active	4.345		9.190		2.842		6.472	yes
Congener 18	Idle	18.295		39.873		7.235		19.509	
	Active	17.304		35.715		13.066		25.534	yes
Congener 28	Idle	13.119		29.942		5.144		14.284	
	Active	12.920		29.271		8.640		20.177	yes
Congener 31	Idle	13.535		30.236		5.229		14.564	
	Active	13.113		28.367		8.869		19.859	yes
Sum PCBs	Idle	80.479		182.233		32.600		86.955	
	Active	80.995		169.062		50.219		119.831	yes

*S/D indicates a statistically significant difference between the two values at a 95% confidence interval

Table A 13: Comparison of Mean Concentrations between Periods (Idle vs. Active) of VOCs at the South Site

Analyte & Location		**Spring/Fall**		**Summer**		**Winter**		**Overall**	
		ug/m^3	S/D*	ug/m^3	S/D*	ug/m^3	S/D*	ug/m^3	S/D*
Benzene	Idle	1.3143		1.3129		1.2560		1.2950	
	Active	1.0521		1.3147		1.0445		1.1824	
Toluene	Idle	1.8128		2.8654		1.8524		2.0661	
	Active	1.9568		3.5518		1.5546		2.7382	yes

*S/D indicates a statistically significant difference between the two values at a 95% confidence interval

Table A 14: Comparison of Mean Concentrations between Periods (Idle vs. Active) of VOCs at the High School Site

Analyte & Location		**Spring/Fall**		**Summer**		**Winter**		**Overall**	
		ug/m^3	S/D*	ug/m^3	S/D*	ug/m^3	S/D*	ug/m^3	S/D*
Benzene	Idle	1.2789	yes	1.5192	yes	1.4331		1.3807	yes
	Active	1.1438		1.4083		1.4523		1.3066	
Toluene	Idle	1.8627		3.1095		2.1920		2.2442	
	Active	2.4771		9.8452		2.2057		5.9891	yes

*S/D indicates a statistically significant difference between the two values at a 95% confidence interval

Table A 15: Comparison of Mean Concentrations between Periods (Idle vs. Active) of Metals at the South Site

Analyte & Location		**Spring/Fall**		**Summer**		**Winter**		**Overall**	
		ug/m^3	S/D*	ug/m^3	S/D*	ug/m^3	S/D*	ug/m^3	S/D*
Aluminum	Idle	0.3253		0.3676		0.1862		0.2922	
	Active	0.3334		0.4313		0.1907		0.3665	yes
Arsenic	Idle	0.0018		0.0018		0.0013		0.0016	
	Active	0.0022		0.0017		0.0012		0.0019	yes
Barium	Idle	0.0176		0.0242	yes	0.0150		0.0180	
	Active	0.0199		0.0209		0.0177		0.0202	yes
Chromium	Idle	0.0051		0.0056		0.0034		0.0047	
	Active	0.0054		0.0059		0.0037		0.0055	yes
Cobalt	Idle	0.0007		0.0009	yes	0.0007		0.0008	
	Active	0.0012		0.0007		0.0006		0.0009	
Copper	Idle	0.0791		0.1175		0.1029		0.0944	
	Active	0.0888		0.1122		0.0763		0.0988	
Iron	Idle	0.9660		1.1242		0.6400		0.9025	
	Active	0.9423		1.3386		0.6361		1.1062	yes
Lead	Idle	0.0271		0.0221		0.0136		0.0219	
	Active	0.0261		0.0256		0.0143		0.0247	yes
Manganese	Idle	0.0911		0.1066		0.0560		0.0839	
	Active	0.0884		0.1186		0.0490		0.0991	yes
Nickel	Idle	0.0018		0.0019		0.0015		0.0018	
	Active	0.0026		0.0020		0.0015		0.0021	
Selenium	Idle	0.0021		0.0018		0.0017		0.0019	
	Active	0.0022		0.0018		0.0016		0.0019	
Zinc	Idle	0.1083		0.1108		0.0860		0.1020	
	Active	0.0926		0.0998		0.0665		0.0941	
TSP (g/m^3)	Idle	4.73E-05		5.49E-05		3.68E-05		4.57E-05	
	Active	4.93E-05		6.17E-05		3.51E-05		5.39E-05	yes

*S/D indicates a statistically significant difference between the two values at a 95% confidence interval

Table A 16: Comparison of Mean Concentrations between Periods (Idle vs. Active) of Metals at the High School Site

Analyte & Location		Spring/Fall		Summer		Winter		Overall	
		ug/m^3	S/D*	ug/m^3	S/D*	ug/m^3	S/D*	ug/m^3	S/D*
Aluminum	Idle	0.327		0.375		0.176		0.2920	
	Active	0.319		0.382		0.192		0.3415	yes
Arsenic	Idle	0.002		0.002		0.001		0.0015	
	Active	0.002		0.002		0.002		0.0018	
Barium	Idle	0.018		0.026	yes	0.015		0.0189	
	Active	0.020		0.023		0.019		0.0214	
Chromium	Idle	0.005		0.005		0.003		0.0045	
	Active	0.005		0.005		0.004		0.0051	**yes**
Cobalt	Idle	7.32E-04		0.001		0.001		0.0007	
	Active	1.08E-03	yes	0.001		0.001		0.0008	
Copper	Idle	0.095	yes	0.157	yes	0.080		0.1043	yes
	Active	0.071		0.115		0.101		0.0962	
Iron	Idle	0.939		1.069		0.613		0.8698	
	Active	0.855		1.219		0.622		1.0227	yes
Lead	Idle	0.018		0.018		0.012		0.0166	
	Active	0.020		0.023		0.015		0.0227	yes
Manganese	Idle	0.086		0.099		0.052		0.0787	
	Active	0.079		0.105		0.047		0.0902	yes
Nickel	Idle	0.002		0.002		0.002		0.0017	
	Active	0.002		0.002		0.002		0.0021	
Selenium	Idle	0.002		0.002		0.002		0.0019	
	Active	0.002		0.002		0.002		0.0019	
Zinc	Idle	0.103		0.098		0.077		0.0938	
	Active	0.080		0.097		0.063		0.0862	
TSP (g/m^3)	Idle	4.69E-05		5.53E-05		3.56E-05		4.54E-05	
	Active	4.67E-05		5.63E-05		3.48E-05		5.06E-05	yes

*S/D indicates a statistically significant difference between the two values at a 95% confidence interval

Table A 17: Comparison of Mean Seasonal Concentrations between Locations (South site vs. High School) of PAHs during IDLE Conditions

Analyte & Location		**Concentration (ng/m^3)**			**Statistical Significance***
		Spring/Fall	Summer	Winter	
Acenaphthene	South	8.879	15.287	3.759	Summer > Spring/Fall > Winter
	HS	7.223	16.252	2.606	Summer > Spring/Fall > Winter
Acenaphthylene	South	2.698	2.864	3.061	
	HS	2.219	2.156	2.704	
Fluoranthene	South	3.084	5.854	2.018	Summer > Spring/Fall > Winter
	HS	2.952	6.620	2.078	Summer > Spring/Fall > Winter
Fluorene	South	8.807	14.633	4.920	Summer > Spring/Fall > Winter
	HS	6.888	15.008	3.694	Summer > Spring/Fall > Winter
Naphthalene	South	83.360	96.984	73.146	
	HS	87.696	109.646	78.378	Summer > Spring/Fall
Phenanthrene	South	14.375	27.603	8.769	Summer > Spring/Fall > Winter
	HS	13.288	28.557	8.104	Summer > Spring/Fall > Winter
Pyrene	South	2.078	3.330	1.853	Summer > Spring/Fall > Winter
	HS	2.030	3.340	1.793	Summer > Spring/Fall, Summer > Winter

*S/D indicates a statistically significant difference between the two values at a 95% confidence interval

Table A 18: Comparison of Mean Seasonal Concentrations between Locations (South site vs. High School) of PAHs during ACTIVE Conditions

Analyte & Location		**Concentration (ng/m^3)**			**Statistical Significance***
		Spring/Fall	Summer	Winter	
Acenaphthene	South	7.014	12.117	3.693	Summer > Spring/Fall > Winter
	HS	6.922	16.322	2.770	Summer > Spring/Fall > Winter
Acenaphthylene	South	2.858	1.797	3.684	Spring/Fall > Summer, Winter > Summer
	HS	2.322	1.499	3.437	Winter > Spring/Fall > Summer
Fluoranthene	South	3.093	5.408	2.243	Summer > Spring/Fall, Summer > Winter
	HS	3.222	6.829	2.313	Summer > Spring/Fall, Summer > Winter
Fluorene	South	8.350	13.620	5.054	Summer > Spring/Fall > Winter
	HS	7.094	16.178	4.171	Summer > Spring/Fall > Winter
Naphthalene	South	74.077	60.907	78.888	Winter > Summer
	HS	79.677	75.939	87.545	
Phenanthrene	South	15.691	29.277	8.810	Summer > Spring/Fall > Winter
	HS	14.899	35.250	8.466	Summer > Spring/Fall > Winter
Pyrene	South	2.367	3.239	1.993	Summer > Spring/Fall, Summer > Winter
	HS	2.139	3.403	2.023	Summer > Spring/Fall, Summer > Winter

*S/D indicates a statistically significant difference between the two values at a 95% confidence interval

Table A 19: Comparison of Mean Seasonal Concentrations between Locations (South site vs. High School) of PCBs during IDLE Conditions

Analyte & Location		Concentration (pg/m^3)			Statistical Significance*
		Spring/Fall	Summer	Winter	
Congener 8	South	34.231	75.926	16.562	Summer > Spring/Fall > Winter
	HS	31.655	71.191	14.497	Summer > Spring/Fall > Winter
Congener 15	South	6.214	13.526	2.493	Summer > Spring/Fall > Winter
	HS	4.417	10.432	2.051	Summer > Spring/Fall > Winter
Congener 18	South	32.267	58.885	11.366	Summer > Spring/Fall > Winter
	HS	18.295	39.873	7.235	Summer > Spring/Fall > Winter
Congener 28	South	22.222	45.874	8.265	Summer > Spring/Fall > Winter
	HS	13.119	29.942	5.144	Summer > Spring/Fall > Winter
Congener 31	South	23.878	48.567	8.474	Summer > Spring/Fall > Winter
	HS	13.535	30.236	5.229	Summer > Spring/Fall > Winter
Sum PCBs	South	118.948	243.651	47.683	Summer > Spring/Fall > Winter
	HS	80.479	182.233	32.600	Summer > Spring/Fall > Winter

*S/D indicates a statistically significant difference between the two values at a 95% confidence interval

Table A 20: Comparison of Mean Seasonal Concentrations between Locations (South site vs. High School) of PCBs during ACTIVE Conditions

Analyte & Location		Concentration (pg/m^3)			Statistical Significance*
		Spring/Fall	Summer	Winter	
Congener 8	South	35.653	68.811	16.127	Summer > Spring/Fall > Winter
	HS	33.425	62.685	19.148	Summer > Spring/Fall > Winter
Congener 15	South	6.327	14.224	2.921	Summer > Spring/Fall > Winter
	HS	4.345	9.190	2.842	Summer > Spring/Fall > Winter
Congener 18	South	30.162	66.066	13.916	Summer > Spring/Fall > Winter
	HS	17.304	35.715	13.066	Summer > Spring/Fall > Winter
Congener 28	South	21.880	61.270	9.527	Summer > Spring/Fall > Winter
	HS	12.920	29.271	8.640	Summer > Spring/Fall > Winter
Congener 31	South	23.398	58.629	9.561	Summer > Spring/Fall > Winter
	HS	13.113	28.367	8.869	Summer > Spring/Fall > Winter
Sum PCBs	South	118.229	276.426	49.902	Summer > Spring/Fall > Winter
	HS	80.995	169.062	50.219	Summer > Spring/Fall > Winter

*S/D indicates a statistically significant difference between the two values at a 95% confidence interval

Table A 21: Comparison of Mean Seasonal Concentrations between Locations (South site vs. High School) of VOCs during IDLE Conditions

Analyte & Location		**Concentration (ug/m^3)**			**Statistical Significance***
		Spring/Fall	Summer	Winter	
Benzene	South	1.3143	1.3129	1.2560	
	HS	1.2789	1.5192	1.4331	
Toluene	South	1.8128	2.8654	1.8524	Summer > Spring/Fall, Summer > Winter
	HS	1.8627	3.1095	2.1920	Summer > Spring/Fall, Summer > Winter

*S/D indicates a statistically significant difference between the two values at a 95% confidence interval

Table A 22: Comparison of Mean Seasonal Concentrations between Locations (South site vs. High School) of VOCs during ACTIVE Conditions

Analyte & Location		**Concentration (ug/m^3)**			**Statistical Significance***
		Spring/Fall	Summer	Winter	
Benzene	South	1.0521	1.3147	1.0445	
	HS	1.1438	1.4083	1.4523	
Toluene	South	1.9568	3.5518	1.5546	Summer > Spring/Fall, Summer > Winter
	HS	2.4771	9.8452	2.2057	Summer > Spring/Fall

*S/D indicates a statistically significant difference between the two values at a 95% confidence interval

Table A 23: Comparison of Mean Seasonal Concentrations between Locations (South site vs. High School) of Metals during IDLE Conditions

Analyte & Location		**Concentration (ug/m^3)**			**Statistical Significance***
		Spring/Fall	Summer	Winter	
Aluminum	South	0.3253	0.3676	0.1862	Spring/Fall > Winter, Summer > Winter
	HS	0.3273	0.3747	0.1755	Spring/Fall > Winter, Summer > Winter
Arsenic	South	0.0018	0.0018	0.0013	Summer > Spring/Fall > Winter
	HS	0.0016	0.0017	0.0013	Summer > Spring/Fall > Winter
Barium	South	0.0176	0.0242	0.0150	Summer > Spring/Fall > Winter
	HS	0.0180	0.0257	0.0151	Summer > Spring/Fall > Winter
Chromium	South	0.0051	0.0056	0.0034	Spring/Fall > Winter, Summer > Winter
	HS	0.0049	0.0053	0.0032	Spring/Fall > Winter, Summer > Winter
Cobalt	South	0.0007	0.0009	0.0007	Summer > Spring/Fall, Summer > Winter
	HS	0.0007	0.0009	0.0006	Spring/Fall > Winter, Summer > Winter
Copper	South	0.0791	0.1175	0.1029	Summer > Spring/Fall, Summer > Winter
	HS	0.0946	0.1565	0.0800	Summer > Spring/Fall, Summer > Winter
Iron	South	0.9660	1.1242	0.6400	Spring/Fall > Winter, Summer > Winter
	HS	0.9393	1.0685	0.6129	Spring/Fall > Winter, Summer > Winter
Lead	South	0.0271	0.0221	0.0136	Spring/Fall > Winter, Summer > Winter
	HS	0.0185	0.0183	0.0125	Spring/Fall > Winter, Summer > Winter
Manganese	South	0.0911	0.1066	0.0560	Spring/Fall > Winter, Summer > Winter
	HS	0.0859	0.0991	0.0520	Spring/Fall > Winter, Summer > Winter
Nickel	South	0.0018	0.0019	0.0015	Spring/Fall > Winter, Summer > Winter
	HS	0.0018	0.0019	0.0016	Spring/Fall > Winter, Summer > Winter
Selenium	South	0.0021	0.0018	0.0017	Spring/Fall > Summer
	HS	0.0023	0.0017	0.0016	Spring/Fall > Summer
Zinc	South	0.1083	0.1108	0.0860	Summer > Winter
	HS	0.1028	0.0979	0.0769	Summer > Winter
TSP (g/m^3)	South	4.73E-05	5.49E-05	3.68E-05	Summer > Spring/Fall > Winter
	HS	4.69E-05	5.53E-05	3.56E-05	Summer > Spring/Fall > Winter

*S/D indicates a statistically significant difference between the two values at a 95% confidence interval

Table A 24: Comparison of Mean Seasonal Concentrations between Locations (South site vs. High School) of Metals during ACTIVE Conditions

Analyte & Location		**Concentration (ug/m^3)**			**Statistical Significance***
		Spring/Fall	Summer	Winter	
Aluminum	South	0.3334	0.4313	0.1907	Summer > Spring/Fall > Winter
	HS	0.3192	0.3823	0.1924	Summer > Spring/Fall > Winter
Arsenic	South	0.0022	0.0017	0.0012	Spring/Fall > Winter, Summer > Winter
	HS	0.0020	0.0016	0.0015	Summer > Winter
Barium	South	0.0199	0.0209	0.0177	
	HS	0.0198	0.0233	0.0189	
Chromium	South	0.0054	0.0059	0.0037	Summer > Winter
	HS	0.0049	0.0054	0.0037	Summer > Winter
Cobalt	South	0.0012	0.0007	0.0006	
	HS	0.0011	0.0007	0.0006	
Copper	South	0.0888	0.1122	0.0763	Summer > Spring/Fall, Summer> Winter
	HS	0.0706	0.1152	0.1013	
Iron	South	0.9423	1.3386	0.6361	Summer > Spring/Fall > Winter
	HS	0.8545	1.2190	0.6218	Summer > Spring/Fall > Winter
Lead	South	0.0261	0.0256	0.0143	Spring/Fall > Summer, Summer > Winter
	HS	0.0205	0.0227	0.0147	Summer > Spring/Fall, Summer > Winter
Manganese	South	0.0884	0.1186	0.0490	Summer > Spring/Fall > Winter
	HS	0.0790	0.1053	0.0465	Summer > Spring/Fall > Winter
Nickel	South	0.0026	0.0020	0.0015	Summer > Winter
	HS	0.0022	0.0020	0.0016	
Selenium	South	0.0022	0.0018	0.0016	
	HS	0.0020	0.0018	0.0016	Spring/Fall > Summer
Zinc	South	0.0926	0.0998	0.0665	Summer > Winter
	HS	0.0800	0.0965	0.0626	Summer > Spring/Fall, Summer> Winter
TSP (g/m^3)	South	4.93E-05	6.17E-05	3.51E-05	Summer > Spring/Fall > Winter
	HS	4.67E-05	5.63E-05	3.48E-05	Summer > Spring/Fall, Summer > Winter

*S/D indicates a statistically significant difference between the two values at a 95% confidence interval