Indiana Harbor and Canal
Ambient Air Monitoring Program:
Construction Phase Annual Report 2005

U.S. Army Corps of Engineers
Chicago District
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Executive Summary

Ambient air monitoring data, including polycyclic aromatic hydrocarbons (PAH), polychlorinated biphenyls (PCB), volatile organic compounds (VOC), and metals, 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 as 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. It is recommended that monitoring continue during construction activities at the ECI site, and that the data be re-evaluated on an annual basis.

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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 construction phase monitoring through 2004 are presented in two 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.

These two 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 2005.

Air Monitoring Data

<u>Locations and Parameters</u>

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 rational for these monitoring locations is discussed in previous reports.

The air sampling stations operate in tandem, on a 6-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), and metals.

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

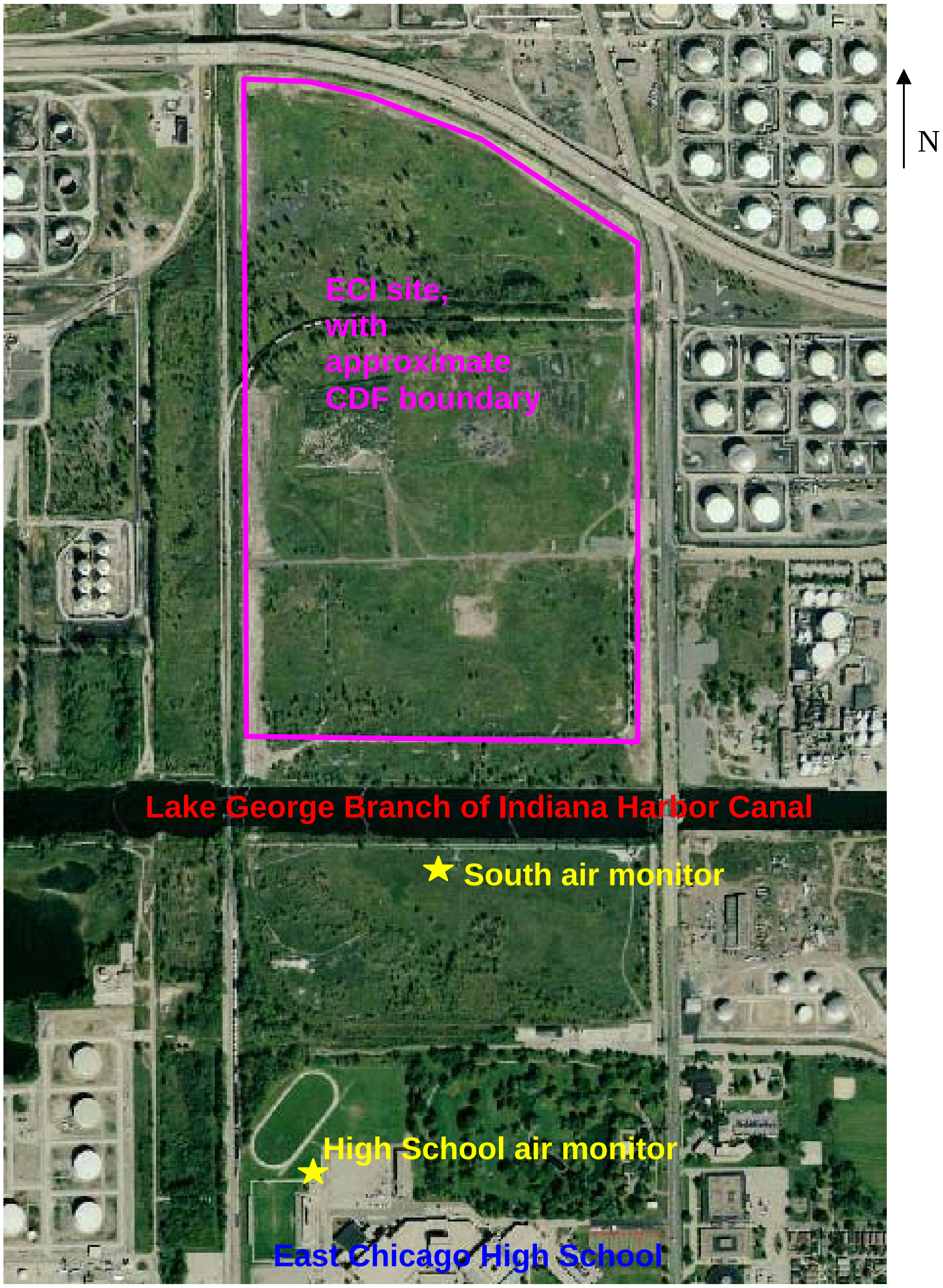

Table 1: Air Monitoring Analytes

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

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 have occurred and will continue during the next few years, including excavations, obstruction removal, grading, embankment (dike) construction, cut-off wall construction, and well installation. This construction work occurs at various times of the year. 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, as well as data from more recent years when construction activities were not occurring.

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 $<40^oF$ (winter), 40

– 60^{o}F (spring/fall), and >60^{o}F. 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), only acenaphthylene was significantly different between the south site and the high school for idle conditions, with the south site having a higher overall acenaphthylene concentration than the high school. The remaining data show no seasonal or overall differences.

For PCBs (shown in Tables A3 and A4), there were seasonal differences between the south site and the high school for spring/fall data, summer data, 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. Congener 18 was 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. It is likely that the concentrations are significantly different during the warmer months because the PCBs are more volatile during the warmer weather. The higher concentrations of PCBs at the south site are attributed to the known concentrations of PCBs in the canal sediment and water column. The PCB trends are consistent with previously reported results.

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.

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 and overall. During active conditions, the copper concentration is higher at the high school overall. It is not known why the high school site has higher concentrations, however it is possible that there is a local source of copper emissions nearer the high school than the south monitoring site. The higher copper concentrations at the high school were also reported in previous studies. Metals data are summarized in Tables A7 and A8.

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 during idle conditions. Naphthalene was also higher overall during idle conditions. Phenanthrene was higher during summer active conditions and also over all during active conditions. Fluoranthene and pyrene were higher overall during active conditions. These compounds were not statistically different in earlier studies, but the addition of new information has lead to the identification of new trends in the data. 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.

At the school, acenaphthylene was higher during idle conditions in the summer, while phenanthrene was higher during active conditions in the summer. Compounds which have higher concentrations during idle conditions may be emitted from industry or other local sources. For example, acenaphthylene is a byproduct of diesel combustion, and locally elevated concentrations could be due to vehicle traffic.   The lack of consistently higher concentrations of compounds during active periods indicates that construction activities at the ECI site are not causing consistently higher local concentrations of PAHs.

For PCBs, at the south site (Table A11), the overall concentrations of congeners 15, 18, 28 and total PCBs were all statistically higher during active periods. Congener 18 was also statistically higher during summer active conditions (table A12). At the school, only the overall concentration of congener 18 was statistically higher during active conditions. During spring and summer 2005, obstruction removal activities were occurring within the canal. These activities resulted in the disturbance of sediment in the canal, and may have caused higher PCB emissions since the canal sediment and water column are known to contain PCBs. The higher active concentrations at the south site may indicate that construction activities are having a localized effect on PCB concentrations; any effect does not appear to extend to the high school. This trend is newly identified; future data collection will help confirm this finding. It should be noted that although the overall PCB concentrations were found to be higher during active concentrations, the mean total PCB concentrations are 0.000144 ug/m^3 during idle conditions and 0.000220 ug/m^3 during active conditions. These concentrations are more than 10 times *less* than the USEPA Region 3 risk base 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 1×10^{-6}. The PCB concentrations measured at the south site and high school represent an even lower risk.

Benzene was the only VOC that showed any statistically significant differences between active and idle conditions. Benzene was statistically higher at the school during the summer and also overall during idle conditions. The higher concentrations during idle conditions indicates that benzene concentrations at the school are more impacted by other local sources, such as vehicles, than by construction activities at the ECI site. Previous reports also identified the trend of statistically higher benzene at the school during summer idle conditions. VOC data are shown in Tables A13 and A14.

For metals, concentrations of some compounds showed statistically significant differences (Tables A15 and A16). At the south site, spring/fall barium, winter barium, the overall barium concentration, and the overall lead concentration were statistically higher during active conditions than during idle conditions. In addition, the south site summer arsenic, summer cobalt, and summer copper concentrations were statistically higher during idle conditions. At the high school site, the barium concentrations (summer, winter, and overall) and the lead concentrations (winter and overall) were statistically greater during active conditions, while the summer and overall copper concentrations were greater during idle conditions. The barium, copper, and lead trends were identified previously and were discussed in previous reports. The cobalt and arsenic trends are newly identified; since these compounds have higher concentrations during idle periods the data are not related to construction activities at the ECI site. As with the PAH data, the lack of consistent trends supports the conclusion that other emission sources may be impacting ambient air concentrations of metals.

Seasonal Dependence of Concentration

Many factors, including air temperature and wind direction, 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 the statistically greater concentrations during the summer period than during the spring/fall or winter (Tables A17 and A18). Most compounds do not 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. This is consistent with greater volatility of the compounds during warmer months.

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. 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 and winter concentrations. However, unlike the idle conditions, during the active conditions there was not a statistical difference between the spring/fall and winter data. This is likely an artifact of the datasets; there are very few winter active data (most construction activities do not occur during the winter) so it is difficult to demonstrate the statistical significance of the numbers. It is expected that the data will follow the pattern shown by the idle data when more measurements are available.

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, however the winter data were not statistically different from the other seasons. The benzene concentration at the school during idle conditions was greater during the winter than during the spring/fall, which is the opposite result one would anticipate based on temperature alone. The higher VOC concentrations at the school in the winter may be related to increased traffic at the school while classes are in session. During active conditions (Table A22) only the benzene concentration at the high school showed any statistically significant trend; the winter concentration was greater than the summer concentration. 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 column 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, mostly for the idle datasets. In general, the summer concentrations were statistically higher than the winter concentrations for idle conditions. There was a statistical difference between the spring/fall and winter concentrations for a few metals, but not for all. One interesting finding was that the selenium concentration at the high school was greater during the spring/fall than during the summer. This is the only statistically significant selenium finding, and it is interesting that the highest concentration did not occur during the warmest season. The high school selenium concentration is probably attributable to a local emission source.

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 the data, it does not appear that the construction conditions occurring on the ECI site are causing degradation of the ambient air quality, either at the south monitoring site or at the high school. It is recommended that 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	9.588		15.381		4.158		10.073	
	HS	7.468		15.811		2.962		9.087	
Acenaphthylene	South	2.713		3.002		4.028		3.143	yes
	HS	2.419		2.239		3.788		2.699	
Fluoranthene	South	3.589		5.915		2.373		4.030	
	HS	3.258		6.593		2.512		4.167	
Fluorene	South	9.265		14.717		5.978		10.188	
	HS	7.484		14.597		4.821		9.157	
Naphthalene	South	91.345		97.432		87.600		92.356	
	HS	95.291		103.111		98.670		98.694	
Phenanthrene	South	14.300		27.523		10.391		17.576	
	HS	13.741		27.881		10.067		17.468	
Pyrene	South	2.231		3.391		2.301		2.624	
	HS	2.279		3.395		2.307		2.652	

*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	6.288		11.468		4.721		8.059	
	HS	5.728		12.962		3.048		8.133	
Acenaphthylene	South	3.206		1.624		4.917		2.839	
	HS	2.723		1.349		4.276		2.408	
Fluoranthene	South	3.612		5.970		2.740		4.396	
	HS	3.217		6.586		2.621		4.425	
Fluorene	South	8.686		13.931		6.234		10.358	
	HS	7.239		14.406		4.864		9.659	
Naphthalene	South	71.976		63.232		86.478		70.658	
	HS	78.794		75.555		86.273		78.570	
Phenanthrene	South	17.010		32.668		11.019		22.188	
	HS	14.556		33.453		9.663		21.124	
Pyrene	South	2.951		3.618		2.622		3.161	
	HS	2.345		3.476		2.429		2.789	

*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** pg/m^3	S/D*	**Summer** pg/m^3	S/D*	**Winter** pg/m^3	S/D*	**Overall** pg/m^3	S/D*
Congener 8	South	38.128		77.568		22.301		46.833	
	HS	36.604		73.056		20.330		44.394	
Congener 15	South	6.688	yes	13.805	yes	2.891		8.057	yes
	HS	5.032		10.815		2.443		6.266	
Congener 18	South	33.432	yes	59.434	yes	12.157	yes	36.400	yes
	HS	21.120		42.006		9.152		24.907	
Congener 28	South	22.106	yes	45.066	yes	7.975		25.917	yes
	HS	14.094		30.519		6.290		17.484	
Congener 31	South	23.846	yes	47.379	yes	8.835		27.617	yes
	HS	14.744		30.770		6.487		17.887	
∑PCBs	South	123.935	yes	243.220	yes	53.121		144.398	yes
	HS	90.018		187.066		43.620		110.343	

*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** pg/m^3	S/D*	**Summer** pg/m^3	S/D*	**Winter** pg/m^3	S/D*	**Overall** pg/m^3	S/D*
Congener 8	South	46.938		97.969		24.303		63.373	
	HS	42.626		79.601		27.807		54.765	
Congener 15	South	7.411	yes	20.028	yes	4.747		11.888	yes
	HS	5.240		11.837		4.469		7.660	
Congener 18	South	41.423	yes	86.400	yes	24.498		56.335	yes
	HS	24.250		46.547		22.446		32.539	
Congener 28	South	23.539	yes	87.771	yes	16.093		47.194	yes
	HS	14.927		34.851		14.358		22.475	
Congener 31	South	24.357	yes	72.445	yes	16.080		41.685	yes
	HS	15.427		34.283		14.918		22.575	
∑PCBs	South	143.302	yes	364.568	yes	84.004		220.042	yes
	HS	101.917		207.077		82.161		139.480	

*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	1.194		1.379		1.918		1.436	
	HS	1.459		1.589		1.898		1.610	
Toluene	South	1.887		3.036		3.055		2.588	
	HS	2.158		3.304		2.932		2.725	

*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	1.307		1.498		1.440		1.403	
	HS	1.295		1.443		1.983		1.437	
Toluene	South	2.486		2.527		2.059		2.492	
	HS	2.699		3.146		2.463		2.876	

*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	0.342		0.376		0.196		0.321	
	HS	0.339		0.386		0.190		0.322	
Arsenic	South	0.00169		0.00177		0.00135		0.00164	
	HS	0.00166		0.00177		0.00134		0.00162	
Barium	South	0.0189		0.0253		0.0191		0.0212	
	HS	0.0195		0.0271		0.0199		0.0221	
Chromium	South	0.00562		0.00555		0.00356		0.00514	
	HS	0.00533		0.00530		0.00341		0.00490	
Cobalt	South	0.00079		0.00094		0.00075		0.00083	
	HS	0.00078		0.00096		0.00067		0.00081	
Copper	South	0.0766		0.115	yes	0.0890		0.0925	yes
	HS	0.0998		0.168		0.0875		0.120	
Iron	South	1.013		1.116		0.652		0.968	
	HS	0.954		1.057		0.634		0.918	
Lead	South	0.0222		0.0216		0.0150		0.0204	
	HS	0.0180		0.0189		0.0138		0.0174	
Manganese	South	0.0970		0.107		0.0610		0.0924	
	HS	0.0894		0.101		0.0583		0.0865	
Nickel	South	0.00198		0.00196		0.00159		0.00188	
	HS	0.00196		0.00185		0.00157		0.00184	
Selenium	South	0.00263		0.00178		0.00186		0.00216	
	HS	0.00285		0.00169		0.00183		0.00224	
Zinc	South	0.120		0.105		0.0918		0.109	
	HS	0.107		0.101		0.0787		0.0987	
TSP	South	5.024E-05		5.542E-05		4.162E-05		5.009E-05	
	HS	4.876E-05		5.552E-05		4.186E-05		4.952E-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	0.317		0.357		0.239		0.326	
	HS	0.303		0.375		0.240		0.330	
Arsenic	South	0.00335		0.00147		0.00125		0.00228	
	HS	0.00291		0.00150		0.00199		0.00216	
Barium	South	0.0255		0.0238		0.0291		0.0251	
	HS	0.0253		0.0319		0.0308		0.0290	
Chromium	South	0.00643		0.00476		0.00514		0.00555	
	HS	0.00571		0.00481		0.00504		0.00522	
Cobalt	South	0.00236		0.00070		0.00061		0.00143	
	HS	0.00192		0.00070		0.00062		0.00121	
Copper	South	0.0729		0.0873		0.0703		0.0790	yes
	HS	0.0742		0.165		0.0839		0.118	
Iron	South	0.955		1.026		0.743		0.964	
	HS	0.878		1.038		0.793		0.943	
Lead	South	0.0297		0.0238		0.0250		0.0265	
	HS	0.0220		0.0227		0.0273		0.0229	
Manganese	South	0.0886		0.107		0.0762		0.0953	
	HS	0.0806		0.101		0.0698		0.0890	
Nickel	South	0.00372		0.00202		0.00152		0.00272	
	HS	0.00320		0.00193		0.00179		0.00246	
Selenium	South	0.00321		0.00191		0.00134		0.00243	
	HS	0.00272		0.00201		0.00136		0.00224	
Zinc	South	0.0858		0.0917		0.0798		0.0878	
	HS	0.0768		0.0923		0.0850		0.0849	
TSP	South	4.872E-05		5.927E-05		3.847E-05		5.232E-05	
	HS	4.651E-05		5.880E-05		3.751E-05		5.128E-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/m^3	S/D*	ng/m^3	S/D*	ng/m^3	S/D*	ng/m^3	S/D*
Acenaphthene	Idle	9.588		15.381		4.158		10.073	
	Active	6.288		11.468		4.721		8.059	
Acenaphthylene	Idle	2.713		3.002	yes	4.028		3.143	
	Active	3.206		1.624		4.917		2.839	
Fluoranthene	Idle	3.589		5.915		2.373		4.030	yes
	Active	3.612		5.970		2.740		4.396	
Fluorene	Idle	9.265		14.717		5.978		10.188	
	Active	8.686		13.931		6.234		10.358	
Naphthalene	Idle	91.345		97.432	yes	87.600		92.356	yes
	Active	71.976		63.232		86.478		70.658	
Phenanthrene	Idle	14.300		27.523	yes	10.391		17.576	yes
	Active	17.010		32.668		11.019		22.188	
Pyrene	Idle	2.231		3.391		2.301		2.624	yes
	Active	2.951		3.618		2.622		3.161	

*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/m^3	S/D*	ng/m^3	S/D*	ng/m^3	S/D*	ng/m^3	S/D*
Acenaphthene	Idle	7.468		15.811		2.962		9.087	
	Active	5.728		12.962		3.048		8.133	
Acenaphthylene	Idle	2.419		2.239	yes	3.788		2.699	
	Active	2.723		1.349		4.276		2.408	
Fluoranthene	Idle	3.258		6.593		2.512		4.167	
	Active	3.217		6.586		2.621		4.425	
Fluorene	Idle	7.484		14.597		4.821		9.157	
	Active	7.239		14.406		4.864		9.659	
Naphthalene	Idle	95.291		103.111		98.670		98.694	
	Active	78.794		75.555		86.273		78.570	
Phenanthrene	Idle	13.741		27.881	yes	10.067		17.468	
	Active	14.556		33.453		9.663		21.124	
Pyrene	Idle	2.279		3.395		2.307		2.652	
	Active	2.345		3.476		2.429		2.789	

*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 pg/m³	S/D*	Summer pg/m³	S/D*	Winter pg/m³	S/D*	Overall pg/m³	S/D*
Congener 8	Idle	38.128		77.568		22.301		46.833	
	Active	46.938		97.969		24.303		63.373	
Congener 15	Idle	6.688		13.805		2.891		8.057	yes
	Active	7.411		20.028		4.747		11.888	
Congener 18	Idle	33.432		59.434	yes	12.157		36.400	yes
	Active	41.423		86.400		24.498		56.335	
Congener 28	Idle	22.106		45.066		7.975		25.917	yes
	Active	23.539		87.771		16.093		47.194	
Congener 31	Idle	23.846		47.379		8.835		27.617	
	Active	24.357		72.445		16.080		41.685	
∑PCBs	Idle	123.935		243.220		53.121		144.398	yes
	Active	143.302		364.568		84.004		220.042	

*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 pg/m³	S/D*	Summer pg/m³	S/D*	Winter pg/m³	S/D*	Overall pg/m³	S/D*
Congener 8	Idle	36.604		73.056		20.330		44.394	
	Active	42.626		79.601		27.807		54.765	
Congener 15	Idle	5.032		10.815		2.443		6.266	
	Active	5.240		11.837		4.469		7.660	
Congener 18	Idle	21.120		42.006		9.152		24.907	yes
	Active	24.250		46.547		22.446		32.539	
Congener 28	Idle	14.094		30.519		6.290		17.484	
	Active	14.927		34.851		14.358		22.475	
Congener 31	Idle	14.744		30.770		6.487		17.887	
	Active	15.427		34.283		14.918		22.575	
∑PCBs	Idle	90.018		187.066		43.620		110.343	
	Active	101.917		207.077		82.161		139.480	

*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	1.194		1.379		1.918		1.436	
	Active	1.307		1.498		1.440		1.403	
Toluene	Idle	1.887		3.036		3.055		2.588	
	Active	2.486		2.593		2.059		2.492	

*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	1.459		1.589	yes	1.898		1.610	yes
	Active	1.295		1.443		1.983		1.437	
Toluene	Idle	2.158		3.304		2.932		2.725	
	Active	2.699		3.146		2.463		2.876	

*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** ug/m^3	S/D*	**Summer** ug/m^3	S/D*	**Winter** ug/m^3	S/D*	**Overall** ug/m^3	S/D*
Aluminum	Idle	0.342		0.376		0.196		0.321	
	Active	0.317		0.357		0.239		0.326	
Arsenic	Idle	0.00169		0.00177	yes	0.00135		0.00164	
	Active	0.00335		0.00147		0.00125		0.00228	
Barium	Idle	0.0189	yes	0.0253		0.0191	yes	0.0212	yes
	Active	0.0255		0.0238		0.0291		0.0251	
Chromium	Idle	0.00562		0.00555		0.00356		0.00514	
	Active	0.00643		0.00476		0.00514		0.00555	
Cobalt	Idle	0.00079		0.00094	yes	0.00075		0.00083	
	Active	0.00236		0.00070		0.00061		0.00143	
Copper	Idle	0.0766		0.115	yes	0.0890		0.0925	
	Active	0.0729		0.0873		0.0703		0.0790	
Iron	Idle	1.013		1.116		0.652		0.968	
	Active	0.955		1.027		0.743		0.964	
Lead	Idle	0.0222		0.0216		0.0150		0.0204	yes
	Active	0.0297		0.0238		0.0250		0.0265	
Manganese	Idle	0.0970		0.107		0.0610		0.0924	
	Active	0.0886		0.107		0.0762		0.0953	
Nickel	Idle	0.00198		0.00196		0.00159		0.00188	
	Active	0.00372		0.00202		0.00152		0.00272	
Selenium	Idle	0.00263		0.00178		0.00186		0.00216	
	Active	0.00321		0.00191		0.00134		0.00243	
Zinc	Idle	0.120		0.105		0.0918		0.109	
	Active	0.0858		0.0917		0.0798		0.0878	
TSP	Idle	5.024E-05		5.542E-05		4.162E-05		5.009E-05	
	Active	4.872E-05		5.927E-05		3.847E-05		5.232E-05	

*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** ug/m³	S/D*	**Summer** ug/m³	S/D*	**Winter** ug/m³	S/D*	**Overall** ug/m³	S/D*
Aluminum	Idle	0.339		0.386		0.190		0.322	
	Active	0.303		0.375		0.240		0.330	
Arsenic	Idle	0.00166		0.00177		0.00134		0.00162	
	Active	0.00291		0.00150		0.00199		0.00216	
Barium	Idle	0.0195	yes	0.0271		0.0199	yes	0.0221	yes
	Active	0.0253		0.0319		0.0308		0.0290	
Chromium	Idle	0.00533		0.00530		0.00341		0.00490	
	Active	0.00571		0.00481		0.00504		0.00522	
Cobalt	Idle	0.00078		0.00096		0.00067		0.00081	
	Active	0.00192		0.00070		0.00062		0.00121	
Copper	Idle	0.0998		0.168	yes	0.0875		0.120	yes
	Active	0.0742		0.165		0.0839		0.118	
Iron	Idle	0.954		1.057		0.634		0.918	
	Active	0.878		1.038		0.793		0.943	
Lead	Idle	0.0180		0.0189		0.0138	yes	0.0174	yes
	Active	0.0220		0.0227		0.0273		0.0229	
Manganese	Idle	0.0894		0.101		0.0583		0.0865	
	Active	0.0806		0.101		0.0698		0.0890	
Nickel	Idle	0.00196		0.00185		0.00157		0.00184	
	Active	0.00320		0.00193		0.00179		0.00246	
Selenium	Idle	0.00285		0.00169		0.00183		0.00224	
	Active	0.00272		0.00201		0.00136		0.00224	
Zinc	Idle	0.107		0.101		0.0787		0.0987	
	Active	0.0768		0.0923		0.0850		0.0849	
TSP	Idle	4.876E-05		5.552E-05		4.186E-05		4.952E-05	
	Active	4.651E-05		5.880E-05		3.751E-05		5.128E-05	

*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)** Spring/Fall	Summer	Winter	**Statistical Significance***
Acenaphthene	South	9.588	15.381	4.158	Summer > Spring/Fall > Winter
	HS	7.468	15.811	2.962	Summer > Spring/Fall > Winter
Acenaphthylene	South	2.713	3.002	4.028	
	HS	2.419	2.239	3.788	
Fluoranthene	South	3.589	5.915	2.373	Summer > Spring/Fall; Summer > Winter
	HS	3.258	6.593	2.512	Summer > Spring/Fall; Summer > Winter
Fluorene	South	9.265	14.717	5.978	Summer > Spring/Fall > Winter
	HS	7.484	14.597	4.821	Summer > Spring/Fall; Summer > Winter
Naphthalene	South	91.345	97.432	87.600	
	HS	95.291	103.111	98.670	
Phenanthrene	South	14.300	27.523	10.391	Summer > Spring/Fall; Summer > Winter
	HS	13.741	27.881	10.067	Summer > Spring/Fall; Summer > Winter
Pyrene	South	2.231	3.391	2.301	Summer > Spring/Fall; Summer > Winter
	HS	2.279	3.395	2.307	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)** Spring/Fall	Summer	Winter	**Statistical Significance***
Acenaphthene	South	6.288	11.468	4.721	Summer > Spring/Fall; Summer > Winter
	HS	5.728	12.962	3.048	Summer > Spring/Fall; Summer > Winter
Acenaphthylene	South	3.206	1.624	4.917	Spring/Fall > Summer; Winter > Summer
	HS	2.723	1.349	4.276	Summer > Spring/Fall; Summer > Winter
Fluoranthene	South	3.612	5.970	2.740	Summer > Spring/Fall; Summer > Winter
	HS	3.217	6.586	2.621	Summer > Spring/Fall; Summer > Winter
Fluorene	South	8.686	13.931	6.234	Summer > Spring/Fall; Summer > Winter
	HS	7.239	14.406	4.864	Summer > Spring/Fall; Summer > Winter
Naphthalene	South	71.976	63.232	86.478	
	HS	78.794	75.555	86.273	
Phenanthrene	South	17.010	32.668	11.019	Summer > Spring/Fall; Summer > Winter
	HS	14.556	33.453	9.663	Summer > Spring/Fall; Summer > Winter
Pyrene	South	2.951	3.618	2.622	Summer > Spring/Fall
	HS	2.345	3.476	2.429	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)** Spring/Fall	Summer	Winter	**Statistical Significance***
PCB 8	South	38.128	77.568	22.301	Summer > Spring/Fall > Winter
	HS	36.604	73.056	20.330	Summer > Spring/Fall; Summer > Winter
PCB 15	South	6.688	13.805	2.891	Summer > Spring/Fall > Winter
	HS	5.032	10.815	2.443	Summer > Spring/Fall > Winter
PCB 18	South	33.432	59.434	12.157	Summer > Spring/Fall > Winter
	HS	21.120	42.006	9.152	Summer > Spring/Fall > Winter
PCB 28	South	22.106	45.066	7.975	Summer > Spring/Fall > Winter
	HS	14.094	30.519	6.290	Summer > Spring/Fall > Winter
PCB 31	South	23.846	47.379	8.835	Summer > Spring/Fall > Winter
	HS	14.744	30.770	6.487	Summer > Spring/Fall > Winter
∑PCBs	South	123.935	243.220	53.121	Summer > Spring/Fall > Winter
	HS	90.018	187.066	43.620	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)** Spring/Fall	Summer	Winter	**Statistical Significance***
PCB 8	South	46.938	97.969	24.303	Summer > Spring/Fall; Summer > Winter
	HS	42.626	79.601	27.807	Summer > Spring/Fall; Summer > Winter
PCB 15	South	7.411	20.028	4.747	Summer > Spring/Fall; Summer > Winter
	HS	5.240	11.837	4.469	Summer > Spring/Fall; Summer > Winter
PCB 18	South	41.423	86.400	24.498	Summer > Spring/Fall; Summer > Winter
	HS	24.250	46.547	22.446	Summer > Spring/Fall; Summer > Winter
PCB 28	South	23.539	87.771	16.093	Summer > Spring/Fall; Summer > Winter
	HS	14.927	34.851	14.358	Summer > Spring/Fall; Summer > Winter
PCB 31	South	24.357	72.445	16.080	Summer > Spring/Fall; Summer > Winter
	HS	15.427	34.283	14.918	Summer > Spring/Fall; Summer > Winter
∑PCBs	South	143.302	364.568	84.004	Summer > Spring/Fall; Summer > Winter
	HS	101.917	207.077	82.161	Summer > Spring/Fall; Summer > 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	1.194	1.379	1.918	Winter > Spring/Fall
	HS	1.459	1.589	1.898	
Toluene	South	1.887	3.036	3.055	Summer > Spring/Fall
	HS	2.158	3.304	2.932	Summer > Spring/Fall

*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	1.307	1.498	1.440	Winter > Summer
	HS	1.295	1.443	1.983	
Toluene	South	2.486	2.527	2.059	
	HS	2.699	3.146	2.463	

*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/m³)** Spring/Fall	Summer	Winter	**Statistical Significance***
Aluminum	South	0.342	0.376	0.196	Summer > Winter; Spring/Fall > Winter
	HS	0.339	0.386	0.190	Summer > Winter; Spring/Fall > Winter
Arsenic	South	0.00169	0.00177	0.00135	Summer > Winter
	HS	0.00166	0.00177	0.00134	Summer > Winter
Barium	South	0.0189	0.0253	0.0191	Summer > Spring/Fall; Summer > Winter
	HS	0.0195	0.0271	0.0199	Summer > Spring/Fall; Summer > Winter
Chromium	South	0.00562	0.00555	0.00356	Summer > Winter; Spring/Fall > Winter
	HS	0.00533	0.00530	0.00341	Summer > Winter; Spring/Fall > Winter
Cobalt	South	0.00079	0.00094	0.00075	
	HS	0.00078	0.00096	0.00067	
Copper	South	0.0766	0.115	0.0890	Summer > Spring/Fall; Summer > Winter
	HS	0.0998	0.168	0.0875	Summer > Spring/Fall; Summer > Winter
Iron	South	1.013	1.116	0.652	Summer > Winter; Spring/Fall > Winter
	HS	0.954	1.057	0.634	Summer > Winter; Spring/Fall > Winter
Lead	South	0.0222	0.0216	0.0150	Summer > Winter
	HS	0.0180	0.0189	0.0138	Summer > Winter
Manganese	South	0.0970	0.107	0.0610	Summer > Winter
	HS	0.0894	0.101	0.0583	Summer > Winter
Nickel	South	0.00198	0.00196	0.00159	
	HS	0.00196	0.00185	0.00157	
Selenium	South	0.00263	0.00178	0.00186	
	HS	0.00285	0.00169	0.00183	
Zinc	South	0.120	0.105	0.0918	
	HS	0.107	0.101	0.0787	
TSP	South	5.024E-05	5.542E-05	4.162E-05	Summer > Winter
	HS	4.876E-05	5.552E-05	4.186E-05	Summer > 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 PAHs during ACTIVE Conditions.

Analyte & Location		**Concentration (ug/m^3)**			**Statistical Significance***
		Spring/Fall	Summer	Winter	
Aluminum	South	0.317	0.357	0.239	
	HS	0.303	0.375	0.240	
Arsenic	South	0.00335	0.00147	0.00125	
	HS	0.00291	0.00150	0.00199	
Barium	South	0.0255	0.0238	0.0291	
	HS	0.0253	0.0319	0.0308	
Chromium	South	0.00643	0.00476	0.00514	
	HS	0.00571	0.00481	0.00504	
Cobalt	South	0.00236	0.00070	0.00061	
	HS	0.00192	0.00070	0.00062	
Copper	South	0.0729	0.0873	0.0703	
	HS	0.0742	0.165	0.0839	
Iron	South	0.955	1.026	0.743	
	HS	0.878	1.038	0.793	
Lead	South	0.0297	0.0238	0.0250	
	HS	0.0220	0.0227	0.0273	
Manganese	South	0.0886	0.107	0.0762	
	HS	0.0806	0.101	0.0698	
Nickel	South	0.00372	0.00202	0.00152	
	HS	0.00320	0.00193	0.00179	
Selenium	South	0.00321	0.00191	0.00134	
	HS	0.00272	0.00201	0.00136	Spring/Fall > Summer
Zinc	South	0.0858	0.0917	0.0798	
	HS	0.0768	0.0923	0.0850	
TSP	South	4.872E-05	5.927E-05	3.847E-05	
	HS	4.651E-05	5.880E-05	3.751E-05	

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