Indiana Harbor and Canal Ambient Air Monitoring Program: Construction Phase Annual Report 2009

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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 an adequate level of 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 background phase (reference 1 below) and construction phase monitoring through 2008 (references 1 through 5) 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.

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 2009.

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 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 Acenaphthene Acenaphthylene Fluoranthene Fluorene Naphthalene Phenanthrene Pyrene	**Metals** 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, well installation, and construction of various other structures. 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 $<40^{o}$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, winter, and overall; and the south site having higher acenaphthylene concentration than the high school in the summer. For the active period, overall acenaphthylene concentrations, and spring/fall fluorene concentrations were also higher at the south site than at the high school site. Additionally, summer Acenaphthene and Floranthene concentrations, and summer and overall Naphthalene concentrations were statistically higher at the High School site. The remaining data show no seasonal or overall differences. The summer Acenaphthyene concentration had previously been higher at the south site during active conditions, but this trend was not confirmed with the latest data. These high concentrations during active conditions at the high school site were new trends; the addition of new information has led to the identification of new trends in the data. 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 and spring/fall 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. It is not known why the high school site has higher benzene concentration in the spring/fall idle period and the overall idle period, however it is possible that there is a local source of benzene emissions nearer the high school than the south monitoring site. VOC data are summarized in Tables A5 and A6. All VOC trends are consistent with previously reported results; there were no new trends with inclusion of the latest data.

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. It is not known why the high school site has higher concentration in the summer idle period, 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. 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 for the active conditions are new, based on additional data collected. 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. Fluoranthene, fluorene, phenanthrene, and pyrene were higher overall during active conditions. All of these trends are consistent with previously reported results. 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, acenaphthylene and naphthalene were 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.

Also, it should be noted that although the PCB concentrations were found to be higher during active concentrations at both the south site and the high school site, the mean total PCB concentrations are 0.000129 ug/m^3 and 0.000093 ug/m^3 (at the south site and high school site, respectively) during idle conditions and 0.000192 ug/m^3 (south site) and 0.000123 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 1×10^{-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. This is a new trend observed with the inclusion of the latest data. For the high school site, benzene is statistically higher during the idle than the active periods for the spring/fall season 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. 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 from 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), aluminum (winter and overall), overall barium, overall cobalt, 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 and summer barium concentrations were statistically higher during idle than active conditions. The summer barium concentration was the only new trend observed. Overall Chromium and spring/fall barium concentrations were previously observed to be higher during active conditions, but this trend was not observed for the past 2 years. Additionally, the summer copper concentration was previously observed to be higher during active conditions, but this trend was not verified with the current data. 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), aluminum (winter and overall), 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. Overall barium concentration and overall chromium concentration were previously identified as statistically higher during the active than idle periods, but these trends were not confirmed with the latest data. The higher spring/fall cobalt concentration during active conditions and higher summer barium concentration during idle conditions were new trends with the latest data. Again, as with PAHs, PCBs, and metals and TSP at the south site, the higher active overall concentrations of some metals and TSP at the high school site 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.

Seasonal Dependence of Concentration

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 at both sites during active and idle conditions, and naphthalene at both the south and high school sites during active conditions. The winter acenaphthylene concentration is higher than the spring/fall and summer acenaphthylene concentrations at both the south site and the high school site during the active period. 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.

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. The summer concentration being higher than spring/fall concentration was a new trend for the high school site based on the latest data. 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. More seasonal trends were identified with the inclusion of the latest data than with previous years' data, in particular for active conditions. 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	9.023	yes	15.287		3.840	yes	8.982	yes
	HS	7.071		16.252		2.517		7.976	
Acenaphthylene	South	2.816	yes	2.864	yes	3.104	yes	2.918	yes
	HS	2.312		2.156		2.671		2.384	
Fluoranthene	South	3.220		5.854		2.001		3.503	
	HS	3.025		6.620		2.047		3.629	
Fluorene	South	9.071	yes	14.633		5.114	yes	9.237	yes
	HS	6.987		15.008		3.723		8.000	
Naphthalene	South	88.962		96.984		73.579		86.171	
	HS	92.795		109.646		78.735		92.686	
Phenanthrene	South	14.831		27.603		8.952		16.216	
	HS	13.615		28.557		8.147		15.692	
Pyrene	South	2.137		3.330		1.868		2.354	
	HS	2.101		3.340		1.794		2.319	

*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	7.167		12.613	yes	3.825		9.201	
	HS	6.425		16.562		2.764		10.557	
Acenaphthylene	South	2.942		1.885		3.883		2.581	yes
	HS	2.370		1.539		3.409		2.143	
Fluoranthene	South	3.111		5.569	yes	2.303		4.118	
	HS	3.078		6.888		2.330		4.700	
Fluorene	South	8.394	yes	14.213		5.245		10.615	
	HS	6.721		16.329		4.219		10.745	
Naphthalene	South	77.295		67.106	yes	82.225		73.145	yes
	HS	82.284		81.489		85.251		82.475	
Phenanthrene	South	15.741		30.841		9.123		21.718	
	HS	14.298		35.981		8.576		23.299	
Pyrene	South	2.438		3.395		2.072		2.823	
	HS	2.171		3.425		2.025		2.706	

*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	36.239		75.926		17.738		40.468	
	HS	34.322		71.191		15.654		37.741	
Congener 15	South	6.471	yes	13.526	yes	2.454		6.995	yes
	HS	4.681		10.432		1.984		5.282	
Congener 18	South	33.625	yes	58.885	yes	11.838	yes	33.181	yes
	HS	19.196		39.873		7.427		20.693	
Congener 28	South	23.183	yes	45.874	yes	7.984	yes	24.154	yes
	HS	13.716		29.942		5.277		15.150	
Congener 31	South	24.692	yes	48.567	yes	8.584	yes	25.677	yes
	HS	14.191		30.236		5.348		15.452	
Sum PCBs	South	124.141	yes	243.651	yes	45.701	yes	129.169	yes
	HS	84.715		173.471		32.458		93.314	

*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	37.192		77.673		17.454		52.769	
	HS	35.464		69.486		20.304		49.256	
Congener 15	South	6.350	yes	15.575	yes	3.118		10.092	yes
	HS	4.421		9.662		2.984		6.643	
Congener 18	South	30.515	yes	69.593	yes	15.281		46.412	yes
	HS	17.872		35.359		14.097		25.396	
Congener 28	South	21.655	yes	65.475	yes	10.378		39.953	yes
	HS	12.805		29.104		9.236		19.812	
Congener 31	South	22.336	yes	63.106	yes	10.588		39.277	yes
	HS	13.047		28.775		9.585		19.807	
Sum PCBs	South	122.430	yes	261.408	yes	50.873		191.537	yes
	HS	80.032		162.013		48.794		122.608	

*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	1.1617	yes	1.3129		1.3259		1.2528	yes
	HS	1.3455		1.5192		1.4509		1.4206	
Toluene	South	1.7337		2.8654		1.9586		2.1004	
	HS	1.9481		3.1095		2.2221		2.3178	

*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	1.0836		1.3864		1.0847		1.2296	
	HS	1.0890		1.4947		1.5197		1.3302	
Toluene	South	2.0660		2.9122		1.6323		2.4311	
	HS	2.3170		3.4103		2.2660		2.8501	

*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	0.317		0.368		0.177		0.289	
	HS	0.321		0.375		0.174		0.292	
Arsenic	South	0.00188		0.00177		0.00132		0.00157	
	HS	0.00161		0.00174		0.00131		0.00156	
Barium	South	0.0174		0.0242		0.0143		0.0180	
	HS	0.0177		0.0257		0.0148		0.0189	
Chromium	South	0.00508		0.00558		0.00331		0.00469	
	HS	0.00490		0.00531		0.00322		0.00453	
Cobalt	South	0.00073		0.00090		0.00073		0.00077	
	HS	0.00072		0.00091		0.00064		0.00075	
Copper	South	0.0768		0.1175	yes	0.0910		0.0917	
	HS	0.0964		0.1565		0.0708		0.1044	
Iron	South	0.952		1.124		0.621		0.900	
	HS	0.936		1.069		0.609		0.877	
Lead	South	0.0187		0.0221		0.0140		0.0182	
	HS	0.0163		0.0183		0.0126		0.0158	
Manganese	South	0.0889		0.1066		0.0543		0.0833	
	HS	0.0848		0.0991		0.0514		0.0790	
Nickel	South	0.00186		0.00194		0.00154		0.00179	
	HS	0.00185		0.00186		0.00157		0.00178	
Selenium	South	0.00219		0.00180		0.00168		0.00194	
	HS	0.00238		0.00173		0.00159		0.00200	
Zinc	South	0.107		0.111		0.085		0.102	
	HS	0.999		0.098		0.077		0.093	
TSP (g/m^3)	South	4.60E-05		5.49E-05		3.52E-05		4.51E-05	
	HS	4.60E-05		5.53E-05		3.52E-05		4.52E-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		0.406		0.198		0.345	
	HS	0.316		0.363		0.199		0.326	
Arsenic	South	0.00234		0.00169		0.00124		0.00191	
	HS	0.00211		0.00163		0.00153		0.00181	
Barium	South	0.0194		0.0209		0.0184		0.0200	
	HS	0.0197		0.0237		0.0197		0.0216	
Chromium	South	0.00534		0.00583		0.00385		0.0054	
	HS	0.00497		0.00543		0.00385		0.0051	
Cobalt	South	0.00134		0.00067		0.00061		0.00094	
	HS	0.00115		0.00068		0.00064		0.00087	
Copper	South	0.0852	yes	0.1122	yes	0.0787		0.0971	yes
	HS	0.0698		0.1217		0.0876		0.965	
Iron	South	0.892		1.327		0.668		1.073	
	HS	0.840		1.213		0.652		0.999	
Lead	South	0.0222		0.0241		0.0152		0.0223	
	HS	0.0193		0.0220		0.0156		0.0202	
Manganese	South	0.0838		0.1143		0.0515		0.0944	
	HS	0.0783		0.1033		0.0487		0.0870	
Nickel	South	0.00275		0.00209		0.00151		0.00221	
	HS	0.00235		0.00206		0.00166		0.00214	
Selenium	South	0.00227		0.00181		0.00161		0.00198	
	HS	0.00203		0.00185		0.00164		0.00190	
Zinc	South	0.088		0.104		0.069		0.094	
	HS	0.075		0.099		0.064		0.085	
TSP (g/m^3)	South	4.76E-05		5.98E-05		3.48E-05		5.19E-05	
	HS	4.62E-05		5.39E-05		3.41E-05		4.86E-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	9.023		15.287		3.840		8.982	
	Active	7.167		12.613		3.825		9.201	
Acenaphthylene	Idle	2.816		2.864	yes	3.104		2.918	
	Active	2.942		1.885		3.883		2.581	
Fluoranthene	Idle	3.220		5.854		2.001		3.503	yes
	Active	3.111		5.569		2.303		4.118	
Fluorene	Idle	9.071		14.633		5.114		9.237	yes
	Active	8.394		14.213		5.245		10.615	
Naphthalene	Idle	88.962		96.984	yes	73.579		86.171	
	Active	77.295		67.106		82.225		73.145	
Phenanthrene	Idle	14.831		27.603		8.952		16.216	yes
	Active	15.741		30.841		9.123		21.718	
Pyrene	Idle	2.137		3.330		1.868		2.354	yes
	Active	2.438		3.395		2.072		2.823	

*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	7.071		16.252		2.517		7.976	yes
	Active	6.425		16.562		2.764		10.557	
Acenaphthylene	Idle	2.312		2.156		2.671	yes	2.384	
	Active	2.370		1.539		3.409		2.143	
Fluoranthene	Idle	3.025		6.620		2.047		3.629	yes
	Active	3.078		6.888		2.330		4.700	
Fluorene	Idle	6.987		15.008		3.723		8.000	yes
	Active	6.721		16.329		4.219		10.745	
Naphthalene	Idle	92.795		109.646		78.735	yes	92.686	
	Active	82.284		81.489		85.251		82.475	
Phenanthrene	Idle	13.615		28.557		8.147		15.692	yes
	Active	14.298		35.981		8.576		23.299	
Pyrene	Idle	2.101		3.340		1.794		2.319	yes
	Active	2.171		3.425		2.025		2.706	

*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	36.239		75.926		17.738		40.468	yes
	Active	37.192		77.673		17.454		52.769	
Congener 15	Idle	6.471		13.526		2.454		6.995	yes
	Active	6.350		15.575		3.118		10.092	
Congener 18	Idle	33.625		58.885		11.838		33.181	yes
	Active	30.515		69.593		15.281		46.412	
Congener 28	Idle	23.183		45.874		7.984		24.154	yes
	Active	21.655		65.475		10.378		39.953	
Congener 31	Idle	24.692		48.567		8.584		25.677	yes
	Active	22.336		63.106		10.588		39.277	
Sum PCBs	Idle	124.141		243.651		45.701		129.169	yes
	Active	122.430		261.408		50.873		191.537	

*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	34.322		71.191		15.645		37.741	yes
	Active	35.464		69.486		20.304		49.256	
Congener 15	Idle	4.681		10.432		1.984		5.282	yes
	Active	4.421		9.662		2.984		6.643	
Congener 18	Idle	19.196		39.873		7.427		20.693	yes
	Active	17.872		35.359		14.097		25.396	
Congener 28	Idle	13.716		29.942		5.277		15.150	yes
	Active	12.805		29.104		9.236		19.812	
Congener 31	Idle	14.191		30.236		5.348		15.452	yes
	Active	13.047		28.775		9.585		19.807	
Sum PCBs	Idle	84.715		173.471		32.458		93.314	yes
	Active	80.032		162.013		48.794		122.608	

*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	1.1617		1.3129		1.3259		1.2528	
	Active	1.0836		1.3864		1.0847		1.2296	
Toluene	Idle	1.7337		2.8654		1.9586		2.1004	yes
	Active	2.0660		2.9122		1.6323		2.4311	

*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	1.3455	yes	1.5192		1.4509		1.4206	yes
	Active	1.0890		1.4947		1.5197		1.3302	
Toluene	Idle	1.9481		3.1095		2.2221		2.3178	yes
	Active	2.3170		3.4103		2.2660		2.8501	

*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	0.317		0.368		0.177	yes	0.289	yes
	Active	0.317		0.406		0.198		0.345	
Arsenic	Idle	0.00188		0.00177		0.00132		0.00157	
	Active	0.00234		0.00169		0.00124		0.00191	
Barium	Idle	0.0174		0.0242	yes	0.0143		0.0180	yes
	Active	0.0194		0.0209		0.0184		0.0200	
Chromium	Idle	0.00508		0.00558		0.00331		0.00469	
	Active	0.00534		0.00583		0.00385		0.00540	
Cobalt	Idle	0.00073		0.00090	yes	0.00073		0.00077	yes
	Active	0.00134		0.00067		0.00061		0.00094	
Copper	Idle	0.0768		0.1175		0.0910		0.0917	
	Active	0.0852		0.1122		0.0787		0.0971	
Iron	Idle	0.952		1.124		0.621		0.900	yes
	Active	0.892		1.327		0.668		1.073	
Lead	Idle	0.0187		0.0221		0.0140		0.0182	yes
	Active	0.0222		0.0241		0.0152		0.0223	
Manganese	Idle	0.0889		0.1066		0.0543		0.0833	yes
	Active	0.0838		0.1144		0.0515		0.0944	
Nickel	Idle	0.00186		0.00194		0.00154		0.00179	
	Active	0.00275		0.00209		0.00151		0.00221	
Selenium	Idle	0.00219		0.00180		0.00168		0.00194	
	Active	0.00227		0.00181		0.00161		0.00198	
Zinc	Idle	0.107		0.111		0.085		0.102	
	Active	0.088		0.104		0.069		0.094	
TSP (g/m^3)	Idle	4.60E-05		5.49E-05		3.52E-05		4.51E-05	yes
	Active	4.76E-05		5.98E-05		3.48E-05		5.19E-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**		**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	0.321		0.375		0.174	yes	0.292	yes
	Active	0.316		0.363		0.199		0.326	
Arsenic	Idle	0.00161		0.00174		0.00131		0.00156	
	Active	0.00211		0.00163		0.00153		0.00181	
Barium	Idle	0.0177		0.0257	yes	0.0148		0.0189	
	Active	0.0197		0.0237		0.0197		0.0216	
Chromium	Idle	0.00490		0.00531		0.00322		0.00453	
	Active	0.00497		0.00543		0.00385		0.00507	
Cobalt	Idle	0.00072	yes	0.00091		0.00064		0.00075	
	Active	0.00115		0.00068		0.00064		0.00087	
Copper	Idle	0.0964	yes	0.1565	yes	0.0708		0.1044	yes
	Active	0.0698		0.1217		0.0876		0.0965	
Iron	Idle	0.936		1.069		0.609		0.877	yes
	Active	0.840		1.213		0.652		0.999	
Lead	Idle	0.0163		0.0183		0.0126		0.0158	yes
	Active	0.0193		0.0220		0.0156		0.0202	
Manganese	Idle	0.0847		0.0991		0.0514		0.0790	yes
	Active	0.0783		0.1033		0.0487		0.0870	
Nickel	Idle	0.00185		0.00186		0.00157		0.00178	
	Active	0.00235		0.00206		0.00166		0.00214	
Selenium	Idle	0.00238		0.00173		0.00159		0.00199	
	Active	0.00203		0.00185		0.00164		0.00190	
Zinc	Idle	0.100		0.098		0.077		0.093	
	Active	0.075		0.985		0.064		0.085	
TSP (g/m^3)	Idle	4.60E-05		5.53E-05		3.52E-05		4.52E-05	yes
	Active	4.62E-05		5.39E-05		3.41E-05		4.86E-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)**			**Statistical Significance***
		Spring/Fall	Summer	Winter	
Acenaphthene	South	9.023	15.287	3.840	Summer > Spring/Fall > Winter
	HS	7.071	16.252	2.517	Summer > Spring/Fall > Winter
Acenaphthylene	South	2.816	2.864	3.104	
	HS	2.312	2.156	2.671	
Fluoranthene	South	3.220	5.854	2.001	Summer > Spring/Fall > Winter
	HS	3.025	6.620	2.047	Summer > Spring/Fall > Winter
Fluorene	South	9.071	14.633	5.114	Summer > Spring/Fall > Winter
	HS	6.987	15.008	3.723	Summer > Spring/Fall > Winter
Naphthalene	South	88.962	96.984	73.579	
	HS	92.795	109.646	78.735	Summer > Winter
Phenanthrene	South	14.831	27.603	8.952	Summer > Spring/Fall > Winter
	HS	13.615	28.557	8.147	Summer > Spring/Fall > Winter
Pyrene	South	2.137	3.330	1.868	Summer > Spring/Fall > Winter
	HS	2.101	3.340	1.794	Summer > Spring/Fall > 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	7.167	12.613	3.825	Summer > Spring/Fall > Winter
	HS	6.425	16.562	2.764	Summer > Spring/Fall > Winter
Acenaphthylene	South	2.942	1.885	3.883	Spring/Fall > Summer; Winter > Summer
	HS	2.370	1.539	3.409	Spring/Fall > Summer; Winter > Summer
Fluoranthene	South	3.111	5.569	2.303	Summer > Spring/Fall; Summer > Winter
	HS	3.078	6.888	2.330	Summer > Spring/Fall; Summer > Winter
Fluorene	South	8.394	14.213	5.245	Summer > Spring/Fall > Winter
	HS	6.721	16.329	4.219	Summer > Spring/Fall > Winter
Naphthalene	South	77.295	67.106	82.225	
	HS	82.284	81.489	85.251	
Phenanthrene	South	15.741	30.841	9.123	Summer > Spring/Fall > Winter
	HS	14.298	35.981	8.576	Summer > Spring/Fall > Winter
Pyrene	South	2.438	3.395	2.072	Summer > Spring/Fall; Summer > Winter
	HS	2.171	3.425	2.025	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	36.239	75.926	17.738	Summer > Spring/Fall > Winter
	HS	34.322	71.191	15.654	Summer > Spring/Fall > Winter
Congener 15	South	6.471	13.526	2.454	Summer > Spring/Fall > Winter
	HS	4.681	10.432	1.984	Summer > Spring/Fall > Winter
Congener 18	South	33.625	58.885	11.838	Summer > Spring/Fall > Winter
	HS	19.196	39.873	7.427	Summer > Spring/Fall > Winter
Congener 28	South	23.183	45.874	7.984	Summer > Spring/Fall > Winter
	HS	13.716	29.942	5.277	Summer > Spring/Fall > Winter
Congener 31	South	24.692	48.567	8.584	Summer > Spring/Fall > Winter
	HS	14.191	30.236	5.348	Summer > Spring/Fall > Winter
Sum PCBs	South	124.141	243.651	45.701	Summer > Spring/Fall > Winter
	HS	84.715	173.471	32.458	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	37.192	77.673	17.454	Summer > Spring/Fall > Winter
	HS	33.763	69.486	20.304	Summer > Spring/Fall > Winter
Congener 15	South	6.350	15.575	3.118	Summer > Spring/Fall > Winter
	HS	4.239	9.662	2.984	Summer > Spring/Fall > Winter
Congener 18	South	30.515	69.593	15.281	Summer > Spring/Fall > Winter
	HS	17.113	35.359	14.097	Summer > Spring/Fall > Winter
Congener 28	South	21.655	65.475	10.378	Summer > Spring/Fall > Winter
	HS	12.259	29.104	9.236	Summer > Spring/Fall > Winter
Congener 31	South	22.336	63.106	10.588	Summer > Spring/Fall > Winter
	HS	12.466	28.775	9.585	Summer > Spring/Fall > Winter
Sum PCBs	South	122.430	261.408	50.873	Summer > Spring/Fall > Winter
	HS	80.678	162.013	48.794	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	1.1617	1.3129	1.3259	
	HS	1.3455	1.5192	1.4509	
Toluene	South	1.7337	2.8654	1.9586	Summer > Spring/Fall; Summer > Winter
	HS	1.9481	3.1095	2.2221	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	1.0836	1.3864	1.0847	
	HS	1.0890	1.4947	1.5197	
Toluene	South	2.0660	2.9122	1.6323	Summer > Winter; Summer > Spring/Fall
	HS	2.3170	3.4103	2.2660	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	0.317	0.368	0.177	Summer > Spring/Fall > Winter
	HS	0.321	0.375	0.174	Summer > Spring/Fall > Winter
Arsenic	South	0.00188	0.00177	0.00132	Spring/Fall > Winter; Summer > Winter
	HS	0.00161	0.00174	0.00131	Summer > Spring/Fall > Winter
Barium	South	0.0174	0.0242	0.0143	Summer > Spring/Fall > Winter
	HS	0.0177	0.0257	0.0148	Summer > Spring/Fall > Winter
Chromium	South	0.00508	0.00558	0.00331	Spring/Fall > Winter; Summer > Winter
	HS	0.00490	0.00531	0.00322	Spring/Fall > Winter; Summer > Winter
Cobalt	South	0.00073	0.00090	0.00073	Summer > Winter; Summer > Spring/Fall
	HS	0.00072	0.00091	0.00064	
Copper	South	0.0768	0.1175	0.0910	Summer > Spring/Fall; Summer > Winter
	HS	0.0964	0.1565	0.0708	Summer > Spring/Fall > Winter
Iron	South	0.952	1.124	0.621	Summer > Spring/Fall > Winter
	HS	0.936	1.069	0.609	Spring/Fall > Winter; Summer > Winter
Lead	South	0.0187	0.0221	0.0140	Summer > Spring/Fall > Winter
	HS	0.0163	0.0183	0.0126	Summer > Spring/Fall > Winter
Manganese	South	0.0888	0.1066	0.0543	Spring/Fall > Winter; Summer > Winter
	HS	0.0848	0.0991	0.0514	Spring/Fall > Winter; Summer > Winter
Nickel	South	0.00186	0.00194	0.00154	Summer > Winter; Spring/Fall > Winter
	HS	0.00185	0.00186	0.00157	Summer > Winter; Spring/Fall > Winter
Selenium	South	0.00219	0.00180	0.00168	Spring/Fall > Summer
	HS	0.00238	0.00173	0.00159	Spring/Fall > Summer
Zinc	South	0.107	0.111	0.085	Summer > Winter
	HS	0.100	0.098	0.077	Summer > Winter
TSP (g/m^3)	South	4.60E-05	5.49E-05	3.52E-05	Summer > Spring/Fall > Winter
	HS	4.60E-05	5.53E-05	3.52E-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/m³)**			**Statistical Significance***
		Spring/Fall	Summer	Winter	
Aluminum	South	0.317	0.406	0.198	Summer > Spring/Fall > Winter
	HS	0.316	0.363	0.199	Summer > Winter; Spring/Fall > Winter
Arsenic	South	0.00234	0.00169	0.00124	Spring/Fall > Winter; Summer > Winter
	HS	0.00211	0.00163	0.00153	Summer > Winter
Barium	South	0.0194	0.0209	0.0184	
	HS	0.0197	0.0237	0.0197	
Chromium	South	0.00534	0.00583	0.00385	Summer > Winter
	HS	0.00497	0.00543	0.00385	
Cobalt	South	0.00134	0.00067	0.00061	
	HS	0.00115	0.00068	0.00064	
Copper	South	0.0852	0.1122	0.0787	Summer > Winter; Summer > Spring/Fall
	HS	0.0698	0.1217	0.0876	Summer > Spring/Fall
Iron	South	0.892	1.327	0.668	Summer > Spring/Fall; Summer > Winter
	HS	0.839	1.213	0.652	Summer > Spring/Fall; Summer > Winter
Lead	South	0.0222	0.0241	0.0152	Summer > Winter; Summer > Spring/Fall
	HS	0.0193	0.0220	0.0156	Summer > Spring/Fall; Summer > Winter
Manganese	South	0.0838	0.1144	0.0515	Summer > Spring/Fall; Summer > Winter
	HS	0.0783	0.1033	0.0487	Summer > Spring/Fall > Winter
Nickel	South	0.00275	0.00209	0.00151	Summer > Winter
	HS	0.00235	0.00206	0.00166	
Selenium	South	0.00227	0.00181	0.00161	
	HS	0.00203	0.00185	0.00164	Spring/Fall > Summer
Zinc	South	0.088	0.104	0.069	Summer > Spring/Fall; Summer > Winter
	HS	0.075	0.099	0.064	Summer > Spring/Fall; Summer > Winter
TSP (g/m³)	South	4.76E-05	5.98E-05	3.48E-05	Summer > Spring/Fall > Winter
	HS	4.62E-05	5.39E-05	3.41E-05	Summer > Winter; Summer > Spring/Fall

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