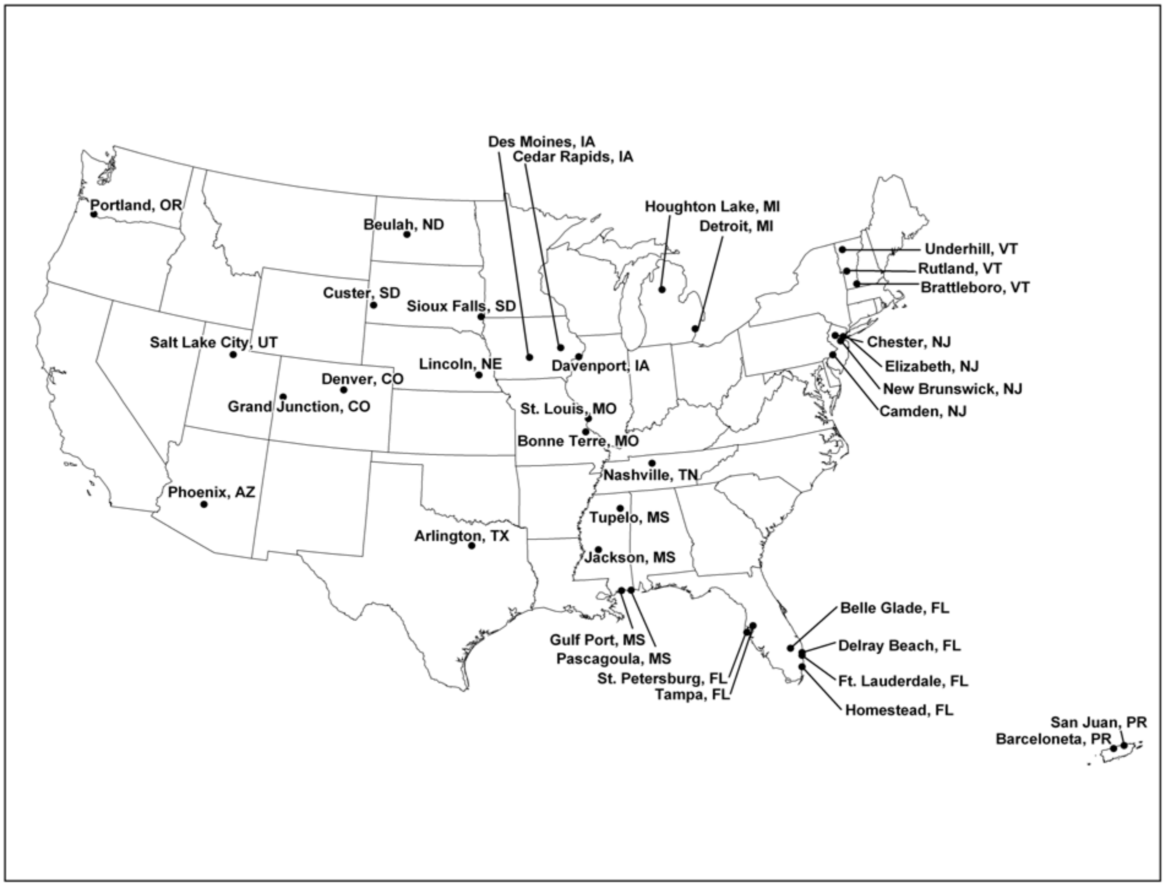
2002 Urban Air Toxics Monitoring Program (UATMP)

October 2003
Final Report



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2002 Urban Air Toxics Monitoring Program(UATMP)

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LIST OF ABBREVIATIONS

AIRS	Aerometric Information and Retrieval System
AQS	Air Quality Subsystem (of the Aerometric Information and Retrieval System)
BTEX	benzene, toluene, ethylbenzene, and xylenes (*o*-, *m*-, and *p*-xylene)
CAA	Clean Air Act
CFR	code of federal regulation
CV	Coefficient of Variation
DNPH	2,4-dinitrophenylhydrazine
EPA	U.S. Environmental Protection Agency
FID	flame ionization detection
GC	gas chromatography
GC/MS	Gas Chromatography/Mass Spectrometry
HAP	Hazardous Air Pollutant
HPLC	high-performance liquid chromatography
HYSPLIT	Hybrid Single-Particle Lagrangian Integrated Trajectory
MACT	Maximum Achievable Control Technology
MEK	methyl ethyl ketone
MDL	Method Detection Limit
MTBE	methyl *tert*-butyl ether
NAAQS	National Ambient Air Quality Standards
NATA	National Air Toxics Assessment
NATTS	National Air Toxics Trends System
NA	not applicable
ND	nondetect
NEI	National Emissions Inventory
NESHAP	National Emissions Standards for Hazardous Air Pollution
NLEV	National Low Emissions Vehicles
NMOC	Nonmethane Organic Compounds
NOAA	National Oceanic and Atmospheric Administration
NO_x	oxides of nitrogen
NSPS	New Source Standards of Performance
NTI	National Toxics Inventory
OTC	Ozone Transport Commission
ppbC	parts per billion Carbon
ppbv	parts per billion (by volume)
PM	particulate matter
RFG	Reformulated Gasoline

LIST OF ABBREVIATIONS (Continued)

R_{max}	maximum radius of concern
RPD	relative percent difference
SIC	Standard Industrial Classification
SNMOC	Speciated Nonmethane Organic Compound
SVOC	Semivolatile Organic Compounds
UATMP	Urban Air Toxics Monitoring Program
VOC	Volatile Organic Compound(s)
TNMOC	Total Nonmethane Organic Compound(s)
tpy	tons per year
WBAN	Weather Bureau/Army/Navy ID

LIST OF ABBREVIATIONS (Continued)

Monitoring Stations

ANTX	Arlington, Texas
APMI	Allen Park in Detroit, Michigan
AZFL	Azalea Park in St. Petersburg, Florida
BAPR	Barceloneta, Puerto Rico
BGFL	Belle Glade, Florida
BRVT	Brattleboro, Vermont
BTMO	Bonne Terre, Missouri
BUND	Beulah, North Dakota
C2IA	Cedar Rapids, Iowa
CANJ	Camden, New Jersey
CHNJ	Chester, New Jersey
CUSD	Custer, South Dakota
CWFL	Clearwater, Florida
DAIA	Davenport, Iowa
DBFL	Delray Beach, Florida
DECO	Denver, Colorado (Site #1)
DEMI	Dearborn in Detroit, Michigan
DMIA	Des Moines, Iowa
DNFL	Dunedin in St. Petersburg, Florida
E7MI	E7 Mile in Detroit, Michigan
EATN	Nashville, Tennessee (Site #1)
ELNJ	Elizabeth, New Jersey
FLFL	Pompano Beach, Florida
G2CO	Grand Junction, Colorado (Site #2)
GAFL	Gandy in Tampa, Florida
GJCO	Grand Junction, Colorado (Site #1)
GPMS	Gulfport, Mississippi
HOMI	Houghton Lake, Michigan
JAMS	Jackson, Mississippi
LEFL	Lewis in Tampa, Florida
LINE	Lincoln, Nebraska (Site #1)
LOMI	Lodge in Detroit, Michigan
LONE	Lincoln, Nebraska (Site #2)
LOTN	Nashville, Tennessee (Site #2)
MDFL	Miami, Florida

LIST OF ABBREVIATIONS (Continued)

NBNJ	New Brunswick, New Jersey
PGMS	Pascagoula, Mississippi
PLOR	Portland, Oregon
PSAZ	Supersite in Phoenix, Arizona
QVAZ	Queen Valley in Phoenix, Arizona
RRMI	River Rouge in Detroit, Michigan
RUVT	Rutland, Vermont
S2MO	St. Louis, Missouri (Site #2)
S3MO	St. Louis, Missouri (Site #3)
S4MO	St. Louis, Missour (Site #4)
SFSD	Sioux Falls, South Dakota
SJPR	San Juan, Puerto Rico
SLCU	Salt Lake City, Utah
SLMO	St. Louis, Missouri (Site #1)
SPAZ	South Phoenix, Arizona
SWCO	Denver, Colorado (Site #3)
SWMI	South West High School in Detroit, Michigan
TUMS	Tupelo, Mississippi
UNVT	Underhill, Vermont
WECO	Denver, Colorado (Site #2)
YFMI	Yellow Freight in Detroit, Michigan

Executive Summary

This report presents the results and conclusions from the ambient air monitoring conducted as part of the 2002 Urban Air Toxics Monitoring Program (UATMP)—a program designed to characterize the magnitude and composition of potentially toxic air pollution in, or near, urban locations. The 2002 UATMP included 56 monitoring stations that collected 24-hour air samples, typically on a 6- or 12-day schedule. Thirty-four sites analyzed ambient air samples for concentrations of 59 volatile organic compounds (VOC) and 16 carbonyl compounds. Thirteen sites also analyzed for 80 speciated nonmethane organic compounds (SNMOC). Twelve sites analyzed for 92 semivolatile compounds (SVOC). Six sites analyzed metal compounds, while five sites analyzed hexavalent chromium. Overall, nearly 300,000 ambient air concentrations were measured during the 2002 UATMP. The summary presented in this report uses various graphical, numerical, and statistical analyses to put the vast amount of ambient air monitoring data collected into perspective.

Not surprisingly, the ambient air concentrations measured during the program varied significantly from city to city and from season to season. This report describes and interprets these spatial and temporal variations separately for halogenated hydrocarbons, hydrocarbons, polar compounds, and carbonyls.

The ambient air monitoring data collected during the 2002 UATMP serve a wide range of purposes. Not only do these data characterize the nature and extent of urban air pollution close to the 56 monitoring stations participating in this study, but they also indicate some trends and patterns that may be common to all urban environments. Therefore, this report presents some results that are specific to particular monitoring locations and presents other results that are apparently common to urban environments. These results should ultimately provide additional insight into the complex nature of urban air pollution. The final data are also included in the appendices to this report.

1.0 Introduction

Air pollution in urban locations incorporates many components that originate from a wide range of industrial, motor vehicle, and natural emissions sources. Because some of these components include toxic compounds known or suspected to be carcinogenic, the U.S. Environmental Protection Agency (EPA) continues to encourage state and local agencies to understand and appreciate the nature and extent of potentially toxic air pollution in urban locations. To achieve this goal, EPA sponsors the Urban Air Toxics Monitoring Program (UATMP) to characterize the composition and magnitude of urban air pollution through extensive ambient air monitoring. Since its inception in 1987, many environmental and health agencies have participated in the UATMP to assess the causes and effects of air pollution within their jurisdictions. This report summarizes and interprets the 2002 UATMP monitoring effort, which included 12 months of six- and twelve-day measurements of ambient air quality at 55 monitoring sites in or near 32 urban locations. An additional site (PLOR) only measured hexavalent chromium which is included in this report. Much of the analysis and data interpretation in this report focuses on compound-specific data trends.

Note: In previous years, the UATMP sampling typically began in September and ended in August of the following calendar year. However, for the 2001 “program year”, ERG began sampling in January 2001 and ended all sampling at the end of December 2001. The 2002 “program year” follows the same convention as last year.

The contents of this report provide both a qualitative overview of air pollution at selected urban locations and a quantitative analysis of the factors that appear to affect urban air quality most significantly. This report also focuses on data trends at each of the 56 different air sampling locations (including PLOR), a site-specific approach that allows for much more detailed analyses of the factors (e.g., motor vehicle emission sources, industrial sources, natural sources) that affect air quality differently from one urban center to the next.

Ultimately, the contents of this report should offer participating agencies useful insights into important air quality issues. For example, participating agencies can use trends and patterns in the UATMP monitoring data to determine whether levels of air pollution present public health concerns, to identify which emissions sources contribute most strongly to air pollution, or to forecast whether proposed pollution control initiatives might significantly improve air quality. Recently, EPA has been actively participating in the National Air Toxics Assessment (NATA) which uses air toxic emissions to model ambient monitoring concentrations across the nation. UATMP monitoring data may be used to compare modeling results, similar to those of NATA. Though they are extensive, the analyses in this report should not be viewed as a comprehensive account of urban air pollution at every UATMP monitoring station. State and local environmental agencies are encouraged to perform additional analyses of the monitoring data so that the many factors that affect ambient air quality can be appreciated fully.

To facilitate examination of the 2002 UATMP monitoring data, the complete set of measured concentrations is presented in appendices of this report. In addition, these data are publicly available in electronic format from the Air Quality Subsystem (AQS) of EPA's Aerometric Information Retrieval System (AIRS) at http://www.epa.gov/ttn/airs/airaqs/index.htm.

The remainder of this report is organized into twenty-three text sections and 14 appendices. Table 1-1 highlights the contents of each section. As with previous UATMP annual reports, all figures and tables in this report appear at the end of their respective sections (figures first, followed by tables).

Table 1-1
Organization of the 2002 UATMP Report

Report Section	Section Title	Overview of Contents
2	The 2002 UATMP	This section provides background information on the scope of the 2002 UATMP and includes information about the: • Monitoring locations • Compounds selected for monitoring • Sampling and analytical methods • Sampling schedules • Completeness of the air monitoring program.
3	Overview of Compounds	These sections, which present and discuss significant trends and relationships in the UATMP data, characterize how ambient air concentrations varied with monitoring location and with time, then interpret the significance of the observed spatial and temporal variations.
4	Monitoring results for Phoenix, AZ (PSAZ, QVAZ, and SPAZ)	These sections summarize the 2002 UATMP monitoring data collected in the respective cities and analyze in detail ambient air concentrations of selected nitriles and oxygenated compounds.
5	Monitoring results for Denver (DECO, SWCO, and WECO) and Grand Junction, CO (G2CO and GJCO)	
6	Monitoring results for South Florida (BGFL, DBFL, FLFL, and MDFL), St. Petersburg (AZFL, CWFL, and DNFL) and Tampa, FL (GAFL and LEFL)	
7	Monitoring results for Cedar Rapids (C2IA), Davenport (DAIA), and Des Moines (DMIA)	
8	Monitoring results for Detroit, MI (APMI, DEMI, E7MI, HOMI, LOMI, RRMI, SWMI, and YFMI)	
9	Monitoring results for St. Louis, MO (BTMO, S2MO, S3MO, S4MO, and SLMO)	
10	Monitoring results for Gulfport (GPMS), Jackson (JAMS), Pascagoula (PGMS), and Tupelo, MS (TUMS)	

Table 1-1. (Continued)

Report Section	Section Title	Overview of Contents
11	Monitoring results for Beulah, ND (BUND)	
12	Monitoring results for Lincoln, NE (LINE and LONE)	
13	Monitoring results for Camden (CANJ), Chester (CHNJ), Elizabeth (ELNJ), and New Brunswick, NJ (NBNJ)	
14	Monitoring results for Portland, OR (PLOR)	
15	Monitoring results for Barceloneta (BAPR) and San Juan, PR (SJPR)	
16	Monitoring results for Custer (CUSD) and Sioux Falls, SD (SFSD)	
17	Monitoring results for Nashville, TN (EATN and LOTN)	
18	Monitoring results for Arlington, TX (ANTX)	
19	Monitoring results for Salt Lake City, UT (SLCU)	
20	Monitoring results for Brattleboro (BRVT), Rutland (RUVT), and Underhill, VT (UNVT)	
21	Data Quality	This section defines and discusses the concepts of precision and accuracy. Based on quantitative and qualitative analyses, this section comments on the precision and accuracy of the 2002 UATMP ambient air monitoring data.
22	Conclusions and Recommendations	This section summarizes the most significant findings of the report and makes several recommendations for future projects that will involve ambient air monitoring in urban locations.
23	References	This section lists the references cited throughout the report.

2.0 The 2002 UATMP

The 2002 UATMP included 56 monitoring stations that collected 24-hour integrated canister and cartridge samples of ambient air for up to 12 months at six and twelve day sampling intervals. One site, DEMI, changed its sampling intervals from every day, three, six, and twelve days, every quarter. All UATMP samples were analyzed in a central laboratory for concentrations of selected hydrocarbons, halogenated hydrocarbons, and polar compounds from the canister samples, carbonyl compounds from the cartridge samples, semivolatiles from the XAD-2® thimbles, hexavalent chromium from pre-treated filters, and metal compounds from filters. The following discussion reviews the monitoring locations, the compounds selected for monitoring, the sampling schedules, the completeness of the 2002 UATMP, and the sampling and analytical methods.

2.1 Monitoring Locations

Although EPA sponsors the UATMP, EPA does not dictate where the UATMP monitoring stations are located. Rather, representatives from the state and local agencies that voluntarily participate in the program and contribute to the overall monitoring costs select the monitoring locations. Some monitors were placed near the centers of heavily populated cities (e.g., Denver, CO and Phoenix, AZ), while others were placed in moderately populated areas (e.g., Beulah, ND and Des Moines, IA). The monitoring stations participating in previous UATMP programs are listed in Table 2-1.

Figure 2-1 shows the 37 cities participating in the 2002 program. The site descriptions in Table 2-2 and in Appendix A provide detailed information on the surroundings at the 2002 UATMP monitoring locations. Monitors that are designated as EPA National Air Toxic Trend System (NATTS) sites are bolded in Table 2-2. Sections 4 through 20 contain topographic maps for each of the sites, if available. Industrial facilities within 10 miles of the monitoring sites were plotted in these sections, as well. The locations and category descriptions of these industrial emission sources were report in the 1999 National Emission Inventory (NEI) (EPA, 2002).

As Figure 2-1 shows, the 2002 UATMP monitoring sites were distributed across the country. The monitoring data from these stations may indicate certain air quality trends that are common to all urban environments, but may also show distinct geographic trends. The analyses in this report differentiate those trends that appear to be site-specific from those that appear to be common to urban environments.

Chemical concentrations measured during the 2002 UATMP varied significantly from monitoring location to monitoring location. As discussed throughout this report, the proximity of the monitoring locations to different emissions sources, especially industrial facilities and heavily traveled roadways, often explains the observed spatial variations in ambient air quality. To provide a first approximation of the respective contributions of motor vehicle emissions and industrial emissions on ambient air quality at each site, Table 2-3 lists the number of people living within 10 miles of each monitoring location, as well as the stationary source emissions in the monitor's residing county, according to the 1999 NEI.

At every UATMP monitoring location, the air sampling equipment was installed in a small temperature-controlled enclosure (usually a trailer or a shed) with the sampling inlet probe protruding through the roof. With this common setup, every UATMP monitor sampled ambient air at heights approximately 5 to 20 feet above local ground level.

For record keeping and reporting purposes, each of these locations was assigned:

- A unique four-character UATMP site code – used to track samples from the monitoring locations to the laboratory; and
- A unique nine-digit AQS site code – used to index monitoring results in the AQS database.

This report often cites these codes when presenting selected monitoring results.

2.2 Compounds Selected for Monitoring

Urban air pollution typically contains hundreds of components, including, but not limited to, volatile organic compounds (VOC), metals, inorganic acids, and particulate matter. Because the sampling and analysis to monitor for every component of air pollution has been prohibitively expensive, the UATMP instead focuses on measuring ambient levels of 59 VOCs (13 hydrocarbons, 37 halogenated hydrocarbons, and 9 polar compounds), 13 carbonyl compounds, 80 Speciated Nonmethane Organic Compounds (SNMOC), 106 Semivolatile Compounds (SVOC), 11 metals, and hexavalent chromium. Tables 2-4, 2-5, 2-6, 2-7a and b, and 2-8 identify the specific compounds of interest.

2.3 Sampling Schedules

Tables 2-9a and 2-9b present the dates on which sampling began and ended for each monitoring location. With the following exceptions, the UATMP monitoring locations started sampling in January 2002 and stopped sampling in December 2002. The following fifteen sites did not start at the beginning of the sampling period:

- Arlington, Texas site started in June 2002;
- Denver, Colorado sites 2 and 3 (SWCO and WECO) started in July 2002 and May 2002, respectively;
- St. Petersburg site in Clearwater started in July 2002;
- The South Florida sites (Homestead, Fort Lauderdale, Delray Beach, and Belle Glade) started in November 2002;
- Houghton Lake site in Michigan started in August 2002;
- St. Louis, Missouri site 4 (S4MO) and Bonne Terre started in December 2002;
- Lincoln site 2 (LONE) started in October 2002;
- Custer, South Dakota site started in March 2002;
- Nashville, TN sites (EATN and LOTN) started in May and April 2002, respectively.

Ten sites ended sampling before December 2002: Grand Junction sites ended in April 2002; Dunedin-St. Petersburg site ended in July 2002; Des Moines, Iowa finished in June 2002; Lodge-Detroit site ended in May 2002; E7Mile-Detroit site ended in August 2002; Allen Park- and Yellow Freight-Detroit sites ended in September 2002; and St. Louis sites 2 and 3 ended in May 2002. One site, Lincoln, NE site 1, began sampling in March and ended in September.

According to the UATMP schedule, 24-hour integrated samples were to be collected at every monitoring location approximately once every 6 or 12 days and each sample collection began and ended at midnight, local standard time. At each test site, VOC and carbonyl samples were collected concurrently, except for: South Florida (Belle Glade, Delray Beach, Fort Lauderdale, and Homestead)-carbonyl only; St. Petersburg, Florida (Azalea Park, Clearwater, and Dunedin); Tampa, Florida (Gandy and Lewis)-carbonyl only; Detroit, Michigan (East 7 Mile for SVOCs and Houghton Lake for VOC); St. Louis sites 2, 3, 4-VOC only, and Bonne Terre-carbonyl only; the Phoenix sites (South Phoenix, Supersite, and Queen Valley)-VOC only; and the Vermont sites (Brattleboro, Rutland, and Underhill)-VOC only. The following thirteen sites also collected SNMOC samples:

- Barceloneta, Puerto Rico;
- Beulah, North Dakota;
- Cedar Rapids, Iowa;
- Custer, South Dakota;
- Davenport, Iowa;
- Des Moines, Iowa;
- Detroit (East 7 Mile only), Michigan;
- Salt Lake City, Utah;
- San Juan, Puerto Rico;

- Sioux Falls, South Dakota; and
- St. Louis (Bonne Terre, Site 1, and Site 4 only), Missouri.

Twelve sites collected SVOC samples:

- All seven Detroit, Michigan sites;
- All four New Jersey sites; and
- St. Louis (Site 1 only), Missouri.

Six sites collected Metals samples:

- All Colorado sites; and
- Detroit, Michigan (South West High School only)

Five sites collected Hexavalent Chromium samples:

- Detroit, Michigan (Allen Park, Dearborn, Lodge 696, and River Rouge); and
- Portland, Oregon.

As part of the sampling schedule, site operators were instructed to collect duplicate samples on roughly 10 percent of the sampling days. Sampling calendars were distributed to help site operators schedule the collection of samples, duplicates, and field blanks. In cases where monitors failed to collect valid samples on a scheduled sampling day, site operators sometimes rescheduled samples for other days. This practice explains why some monitoring locations periodically strayed from the 6- or 12-day sampling schedule. The state of Michigan prepared a schedule that allowed the Michigan's Department of Environmental Quality's laboratory to share samples with ERG's laboratory.

The 6- or 12-day sampling schedule permits cost-effective data collection for characterization (annual-average concentrations) of toxic compounds in ambient air and ensures that sampling days are evenly distributed among the 7 days of the week to allow comparison of air quality on weekdays to air quality on weekends.

2.4 Completeness

Completeness refers to the number of valid samples collected compared to the number of samples expected from a 6- or 12-day sampling cycle. Monitoring programs that consistently generate valid results have higher completeness than programs that consistently invalidate samples. The completeness of an air monitoring program, therefore, is a qualitative measure of the reliability of air sampling equipment and laboratory analytical equipment and a measure of the efficiency with which the program was managed.

Appendix B identifies samples that were invalidated and lists the specific reasons why the samples were invalidated. Tables 2-9a and 2-9b summarize the completeness of the monitoring data sets collected during the 2002 UATMP:

- For VOC sampling, the completeness ranged from 69 to 100 percent, with an overall completeness of 91 percent;
- For carbonyl sampling, the completeness ranged from 63 to 100 percent with an overall completeness of 93 percent;
- For SNMOC sampling, the completeness ranged from 75 to 100 percent with an overall completeness of 92 percent for all sites;
- For SVOC sampling, the completeness ranged from 60 to 100 percent with an overall completeness of 92 percent;
- For Metals sampling, the completeness ranged from 97 to 100 percent with an overall completeness of 99 percent; and
- For Hexavalent Chromium, the completeness ranged from 90 to 100 percent with an overall completeness of 96 percent.

The UATMP data quality objectives are based on the 2002 Quality Assurance Plan, 85-100% completeness for a given monitoring station must be analyzed successfully to generate a sufficiently complete data set for estimating annual average air concentrations. The data in Tables 2-9a and 2-9b show that 18 data sets (from a total of 131 data sets) from the 2002 UATMP monitoring stations did not meet this data quality objective. Thirteen sites which measured carbonyls (out of 46 sites), 4 VOC sites (out of 45), 3 SNMOC sites (out of 13), 2 SVOC sites (out of 12), 5 Metals sites (out of 6), and 4 Hexavalent Chromium sites (out of 5) achieved 100% completeness.

2.5 Sampling and Analytical Methods

During the 2002 UATMP, five EPA-approved methods were used to characterize urban air pollution:

- *Compendium Method TO-15* was used to measure ambient air concentrations of 59 VOC and 80 SNMOC;
- *Compendium Method TO-11A* was used to measure ambient air concentrations of 15 carbonyl compounds; and
- *Compendium Method TO-13A* was used to collect ambient air concentrations of 91 SVOC. Analysis was performed following SW-846 Method 8270 protocols.
- *Compendium Method IO-3.0* was used to collect ambient concentration of 11 metals. Analysis was performed following Conpendium Method IO-3.5 protocols.
- *Modified CARB Method 039* and ERGs revised method was used to collect ambient air concentrations of hexavalent chromium.

The following discussion presents an overview of these sampling and analytical methods. For detailed descriptions of the methods, readers should refer to EPA’s original documentation of the Compendium Methods (USEPA, 1999a).

2.5.1 VOC Sampling and Analytical Method

As specified in the EPA method, ambient air samples for VOC analysis were collected in passivated stainless steel canisters. The central laboratory distributed the prepared (i.e., cleaned and evacuated) canisters to the UATMP monitoring stations before each scheduled sampling event, and site operators connected the canisters to air sampling equipment prior to each sampling day. Before their use in the field, the passivated canisters had internal sea level pressures much lower than atmospheric. Because of this sea level pressure differential, ambient air naturally flowed into the canisters once they were opened, and pumps were not needed to collect ambient air for VOC analysis. A flow controller on the sampling device ensured that ambient air entered the canister at a constant rate across the collection period. At the end of the 24-hour sampling period, a solenoid valve automatically stopped ambient air from flowing into the canister, and site operators returned the canisters to the central laboratory for analysis.

By analyzing each sample with gas chromatography incorporating mass selective detection and flame ionization detection (GC/MS-FID), laboratory staff determined ambient air concentrations of 59 VOC (13 hydrocarbons, 37 halogenated hydrocarbons, and 9 polar compounds) and 80 SNMOC within the sample. Because isobutene and 1-butene as well as *m*-xylene and *p*-xylene elute from the GC column at the same time, the VOC analytical method reports only the sum of the concentrations for these compounds, and not the separate concentrations for each compound.

Table 2-4 lists the method detection limits for the laboratory analysis of the VOC samples and Table 2-5 lists the method detection limits for the SNMOC samples. Although the sensitivity of the analytical method varies from compound to compound, the detection limit for VOC reported for every compound is lower than 0.53 parts per billion by volume (ppbv); most of the detection limits were below 0.20 ppbv. Speciated Nonmethane Organic Compound (SNMOC) detection limits are expressed in parts per billion carbon (ppbC). Most detection limits were less than 0.30 ppbC, while all were less than 0.77 ppbC.

Because nondetect results significantly limit the range of data interpretations for ambient air monitoring programs, participating agencies should note that the approach for treating nondetects may slightly affect the magnitude of the calculated central tendency concentrations, especially for compounds with a low prevalence. Following the approach used to process the 1995 - 2001 UATMP monitoring data, *data analysts replaced all nondetect observations with concentrations equal to one-half of the compound's corresponding method detection limit*. This approach is recommended for risk assessments involving environmental monitoring data (USEPA, 1988).

Similar to last year, the reportable SNMOC analysis option was combined with the standard VOC sampling. These data are presented in Appendix D.

2.5.2 Carbonyl Sampling and Analytical Method

Following the specifications of EPA Compendium Method TO-11A, ambient air samples for carbonyl analysis were collected by passing ambient air over silica gel cartridges coated with 2,4-dinitrophenylhydrazine (DNPH), a compound known to react selectively and reversibly with many aldehydes and ketones. Carbonyl compounds in ambient air remain within the sampling cartridge, while other compounds pass through the cartridge without reacting with the DNPH-coated matrix. As with the VOC sampling, the central laboratory distributed the silica gel cartridges to the monitoring locations, and site operators connected the cartridges to the air sampling equipment. After each 24-hour sampling period, site operators returned the cartridges to the central laboratory for chemical analysis.

To quantify concentrations of carbonyls in the sampled ambient air, laboratory analysts eluted the exposed silica gel cartridges with acetonitrile. This solvent elution liberated a solution of DNPH derivatives of the aldehydes and ketones collected from the ambient air. High-performance liquid chromatography (HPLC) analysis and ultraviolet detection of these solutions determined the relative amounts of individual carbonyls present in the original air sample. Because butyraldehyde and isobutyraldehyde elute from the HPLC column at the same time, the carbonyl analytical method can report only the sum of the concentrations for these compounds, and not the separate concentrations for each compound. For the same reason, the analytical method reports only the sum of the concentrations for the three tolualdehyde isomers, as opposed to reporting separate concentrations for the three individual compounds.

Appreciating Detection Limits

The detection limit of an analytical method must be considered carefully when interpreting the corresponding ambient air monitoring data. By definition, detection limits represent the lowest concentrations at which laboratory equipment can *reliably* quantify concentrations of selected compounds to a specific confidence level. If a chemical concentration in ambient air does not exceed the method sensitivity (as gauged by the detection limit), the analytical method might not differentiate the compound from other compounds in the sample or from the random "noise" inherent in laboratory analyses. Therefore, when samples contain concentrations at levels below their respective detection limits, multiple analyses of the same sample may lead to a wide range of results, including highly variable concentrations or "nondetect" observations. *Because analytical methods do not quantify concentrations at levels below the detection limits accurately or precisely, data analysts must exercise caution when interpreting monitoring data with many reported concentrations at levels near or below the corresponding detection limits.*

Method detection limits are determined at the analytical laboratory by analyzing up to 9 replicate standards prepared on/in the appropriate sampling media (per analytical method). Instrument detection limits are not determined (9 replicates of standards only) because sample preparation procedures are not considered.

Table 2-6 lists the method detection limits reported by the analytical laboratory for measuring concentrations of 13 carbonyl compounds. Although the sensitivity of the analytical method varies from compound to compound and from site to site, the average detection limit reported by the analytical laboratory for every compound is less than or equal to 0.16 ppbv.

When reviewing these data, readers should keep in mind that data analysts replaced all nondetect observations with concentrations equal to one-half of the compound's corresponding detection limit.

2.5.3 Semivolatile and Metals Sampling and Analytical Method

Semivolatile sampling is performed completely by the sites in accordance with EPA Compendium Method TO-13A for semivolatiles and Compendium Method IO-3.5 for inorganic compounds (metals). Table 2-10 summarizes the HAP inorganics and semivolatiles sampled for in 2002. ERG supplies prepared sampling media and receives the samples from the sites for analysis only. Sampling modules containing XAD-2® and petri dishes containing filters, together with Chain of Custody forms and all associated documentation, are shipped to the ERG laboratory from the field. Upon receipt at the laboratory, sample preparation and analysis procedures are based on SW-846 Method 3542 and SW-846 Method 8270.

Table 2-7a lists the method detection limits for the laboratory analysis of the SVOC samples. The detection limits decreased after June 1, 2002 because of an analytical improvements. However, only two sites, SLMO and YFMI, were affected. These new MDLs are given in Table 2-7b. Method detection limits for semivolatile organic compounds ranged from 0.02 to 0.25µg/m^3, with most falling below 0.10 µg/m^3 in an average sample volume of 200 m^3.

2.5.4 Metals and Hexavalent Chromium Sampling and Analytical Data

Sodium bicarbonate-impregnated filters were connected to the hexavalent chromium sampler as shown in Figure 2-2. Ambient air was drawn through the filters through a glass sampling probe using Teflon® sampling lines at a point as close to the ambient air monitoring point as possible. A total of 30 samples for the 12-day sampling will be analyzed per site. Additionally, duplicate samples and field blanks were collected and analyzed at a rate of 10% of the volume of samples.

ERG shipped bicarbonate-impregnated sodium filters to each site in coolers. The samples were collected for a 24-hour period. After sampling, the filters were removed from the sampling apparatus, sealed, and returned to the ERG laboratory in the coolers in which they were received. Disposable polyethylene gloves were used by the field operators when handling the filters to reduce background contamination levels. Additional details of the hexavalent chromium sampling and analysis procedures are presented in the California Air Resources Board Method 039(30) and in ERG's SOP (ERG-MOR-063).

Table 2-8 lists the method detection limits for the laboratory analysis of the metal and hexavalent chromium samples. Method Detection limits for metals ranged from 0.5 ng/filter to 100 ng/filter, while the hexavalent chromium method detection limit was 0.013 ng/m^3 in an average sample volume of 12 m^3.

Figure 2-1. Cities Participating in the 2002 Program

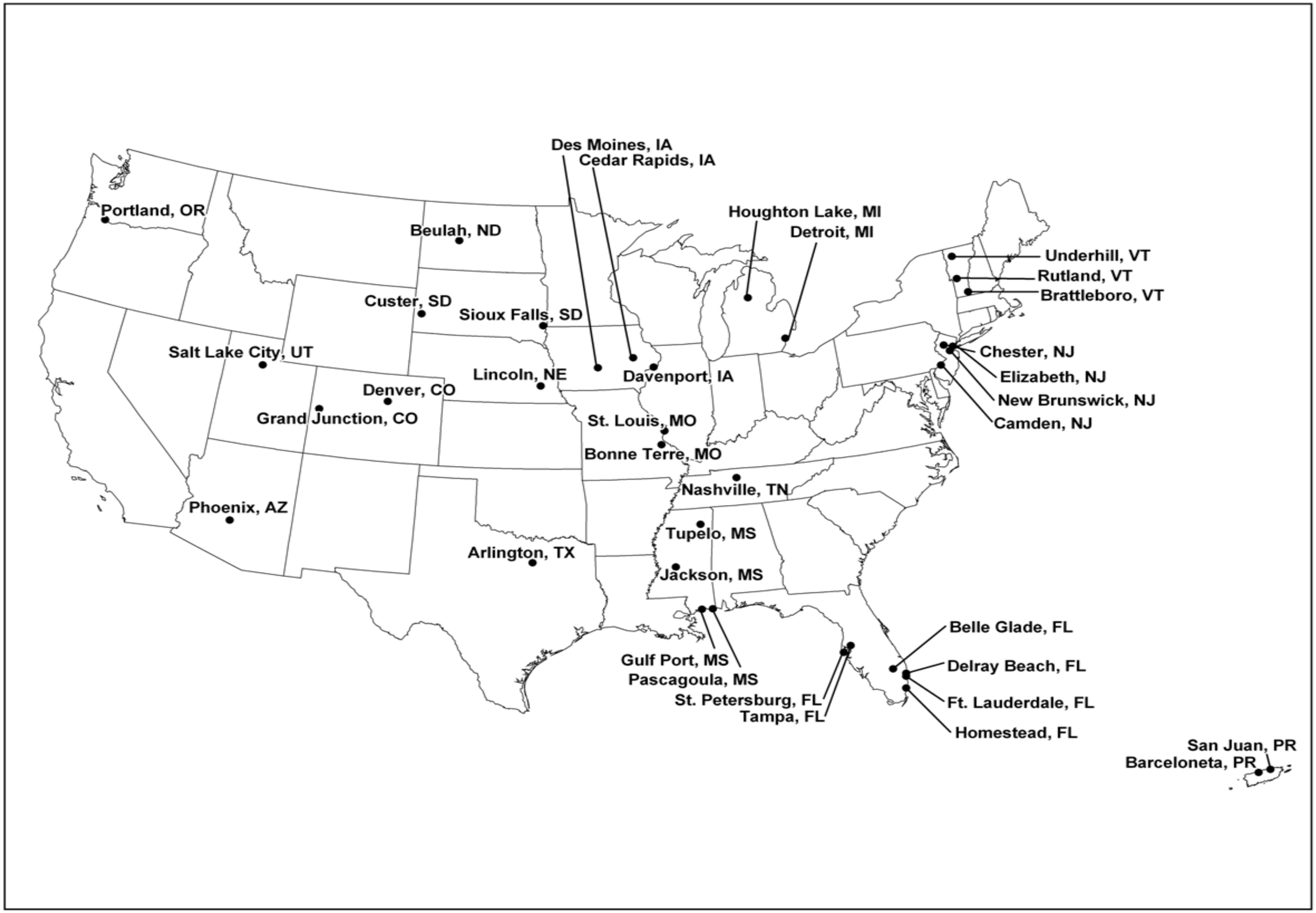


Figure 2-2. Hexavalent Chromium Sampling System

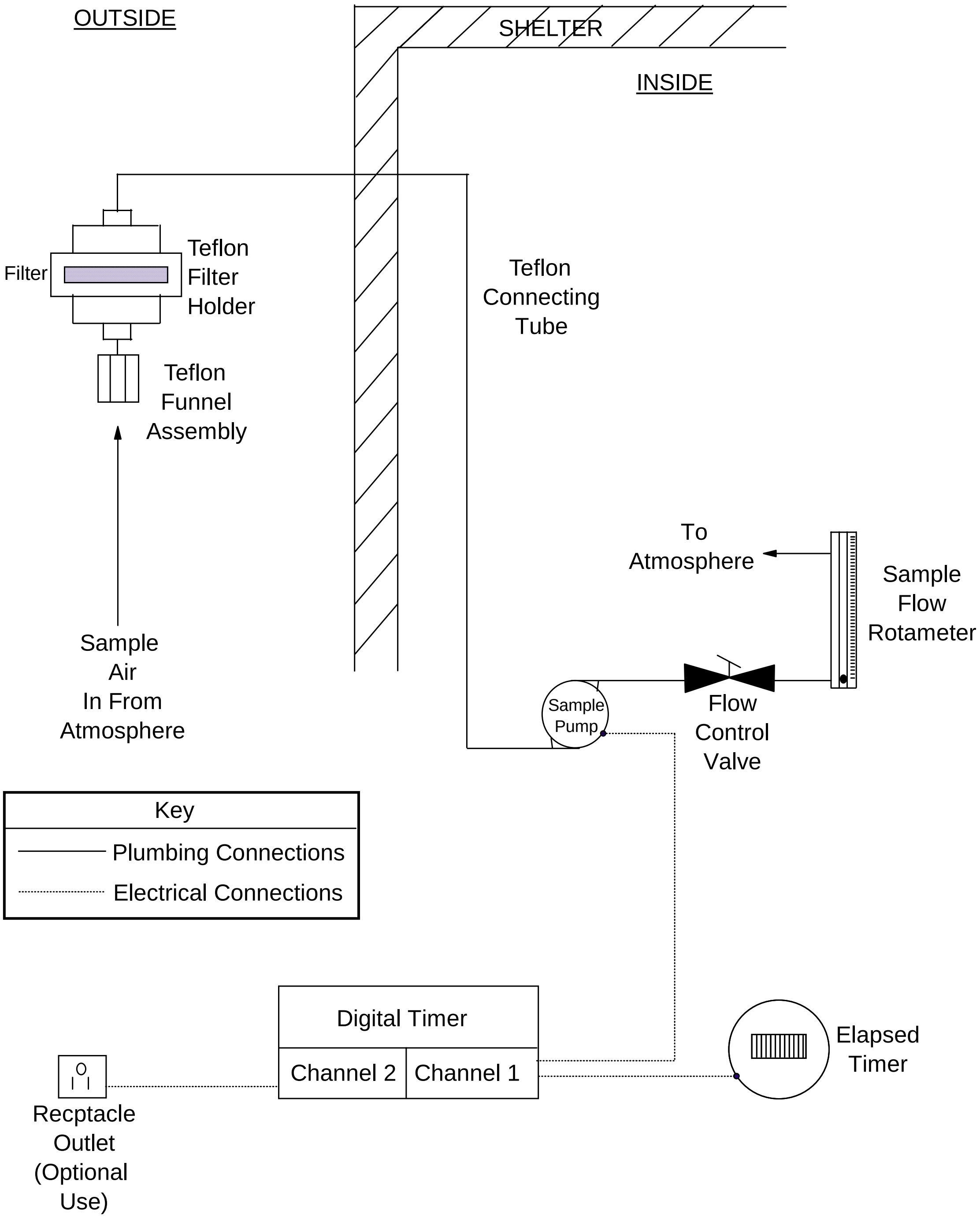


Table 2-1. Monitoring Stations with Past Participation in the UATMP

Monitoring Station	Program Years During Which Station Past Participated in the UATMP						
	1994	1995	1996	1997	1998	1999 2000	2001
Allen Park, Detroit, MI (APMI)							✓
Azalea Park, St. Petersburg, FL (AZFL)							✓
Barceloneta, Puerto Rico (BAPR)							✓
Beulah, ND (BUND)					✓	✓	✓
Camden, NJ (CANJ)	✓	✓	✓	✓	✓	✓	✓
Cedar Rapids, IA Site 2 (C2IA)							✓
Chester, NJ (CHNJ)							✓
Davenport, IA (DAIA)						✓	✓
Dearborn, Detroit, MI (DEMI)							✓
Denver, CO (DECO)						✓	✓
Des Moines, IA (DMIA)						✓	✓
Dunedin, St. Petersburg, FL (DNFL)							✓
E7 Mile, Detroit, MI (E7MI)							✓
Elizabeth, NJ (ELNJ)						✓	✓
Grand Junction, CO Site 2 (G2CO)							✓
Gandy, Tampa, FL (GAFL)							✓
Grand Junction, CO Site 1 (GJCO)							✓
Gulf Port, MS (GPMS)							✓
Jackson, MS (JAMS)							✓
Lewis, Tampa, FL (LEFL)							✓
Lodge, Detroit, MI (LOMI)							✓
New Brunswick, NJ (NBNJ)							✓
Pascagoula, MS (PGMS)							✓

Table 2-1. (Continued)

Monitoring Station	Program Years During Which Station Past Participated in the UATMP						
	1994	1995	1996	1997	1998	1999 2000	2001
Portland, OR (PLOR)						✓	
Queen Valley, Phoenix, AZ (QVAZ)							✓
River Rouge, Detroit, MI (RRMI)							✓
Salt Lake City, UT (SLCU)						✓	✓
San Juan, Puerto Rico (SJPR)							✓
Sioux Falls, SD (SFSD)						✓	✓
South Phoenix, AZ (SPAZ)							✓
Southwest High School, Detroit, MI (SWMI)							✓
St. Louis, MO Site 1 (SLMO)							✓
St. Louis, MO Site 2 (S2MO)							✓
St. Louis, MO Site 3 (S3MO)							✓
Supersite, Phoenix, AZ (PSAZ)							✓
Tupelo, MS (TUMS)							✓
Yellow Freight, Detroit, MI (YFMI)							✓

Note: Some of the stations shown in the table participated in UATMP prior to the 1994 program. However, this report considers only ambient air monitoring data collected during the current and previous EPA contracts (i.e., UATMP program years 1994 through 2001).

Table 2-2. Text Descriptions of the 2002 UATMP Monitoring Locations

UATMP Code	Monitoring Location	Land Use	Location Setting	Estimated Traffic	Traffic Year	Description of the Immediate Surroundings
ANTX	Arlington, TX	Commercial	Suburban	14,310	1999	Arlington, Texas is located in Tarrant county, approximately 20 miles west of Dallas. A roadway that averages more than 17,000 vehicles per day is 73 meters from the site. The monitoring site is located in a residential and light commercial area of up to one and a half miles. The monitor itself is located in the TNRCC building with the probe through the top of the roof, approximately 15 feet from the ground.
APMI	Allen Park, Detroit, MI	Commercial	Suburban	60,000	Unknown	The Allen Park site is an intermediate site located in a residential neighborhood 300 feet away from Interstate 75. Historically, this site has been used to detect impacts from mobile sources. There are no major industrial sources near the site. Of all the population-oriented sites in the Detroit MSA, Allen Park has the highest PM_{10} levels. Therefore, it has been selected as the $PM_{2.5}$ trend speciation site and the collocated site for the federal reference method (FRM) monitors. Other criteria pollutant measurements that are collected at Allen Park include CO, O_3, SO_2, and $PM_{10.}$
AZFL	Azalea Park, St. Petersburg, FL	Residential	Suburban	51,000	Unknown	A neighborhood spatial scale of representativeness characterizes this monitoring site selected for the Tampa Bay pilot project. This monitor is sited in an area of high population density with uniform mixed land use, consisting of residential, commercial, and industrial properties. Major point sources are located approximately 8 to 15 kilometers from the monitoring site. In addition, this site is at least 150 meters from major roadways. However, given the proximity of motor vehicle traffic it is expected that mobile sources will contribute appreciably to the measured samples.
BAPR	Barceloneta, PR	Residential	Rural	10	1994	The Barceloneta site is a residential area surrounded by 5 pharmaceutical plants. The greater area outside the city is rural in character and the city itself is within 2 miles of the Atlantic Ocean.

Table 2-2. (Continued)

UATMP Code	Monitoring Location	Land Use	Location Setting	Estimated Traffic	Traffic Year	Description of the Immediate Surroundings
BGFL	Belle Glade, FL	Industrial	Rural	12,200	Unknown	Belle Glade is a city located in Broward County, FL. This is a rural location with possible pollution come from mobile and hospital sources as well as sugar cane burning areas (major source). Broward and Miami-Dade Counties are ranked high in the range of the air toxics monitoring criteria ranking document draft. It is the interest of the Southeast Florida Regional Air Toxics Program to conduct ambient carbonyl sampling in the Southeast Florida area to assess the potential health treat and cancer risk.
BRVT	Brattleboro, VT	Commercial	Suburban	16,578	1996	Brattleboro, a small city in Vermont, is located north of the town in a vacant lot adjacent to a farm and garden center. The monitoring station is in a moderately industrial area, not immediately adjacent to heavily traveled roadways. Interstate 91 passes within one mile of the monitoring station.
BTMO	Bonne Terre, MO	Agricultural	Rural	4,360	1995	The Bonne Terre site is located on a farm approximately one hundred miles due south of downtown St. Louis and is used for our St. Louis area upwind site. It's purpose is to measure transport of various pollutants into the St. Louis area; it houses ozone, PM2.5 Speciation, and Air Toxics monitors. There are no nearby sources, except VOCs/Formaldehyde from nearby forests.

Table 2-2. (Continued)

UATMP Code	Monitoring Location	Land Use	Location Setting	Estimated Traffic	Traffic Year	Description of the Immediate Surroundings
BUND	Beulah, ND	Agricultural	Rural	1,350	1998	Beulah, North Dakota, located in Mercer County, is a rural, agricultural area with primarily wheat, small grains, and cattle farms. There are six lignite coal-fired power plants within thirty miles of Beulah, one to the east-southeast; one to the northeast; two to the east; one to the northwest; and one to the southwest. A petroleum refinery and a lignite coal-fired power plant are fifty miles southeast of Beulah. Lignite coal mines are located north of the town, south-southwest of town and southeast of town. The monitoring station is located in the approximate area of two coal-fired power plants and a coal gasification plant (the only functioning coal gasification plant in the nation). A power plant is located seven miles to the southwest of the monitoring station; another is six miles to the northwest; and the gasification plant is five miles to the northwest.
C2IA	Cedar Rapids, IA (Site #2)	Residential	Urban	1,500	1994	This site is considered an EPA Urban Scale site with residential population. Cedar Rapids is a community-wide exposure area where spatial uniformity in comparison to the CRIA site is important. This site is located at the Army Reserve Government building - on the roof with $PM_{2.5}$ samplers, on the northeast quadrant of Cedar Rapids.
CANJ	Camden, NJ	Residential	Suburban	62,000	1986	Although this monitoring site in Camden, NJ is in a residential area, numerous industrial facilities and busy roadways are located within a ten mile radius. The monitors are situated in a parking lot of a business complex.
CHNJ	Chester, NJ	Agricultural	Rural	12,623	1995	The Chester, NJ site is located in a rural-agricultural, residential section and is topographically rolling. The data is located near Lucent Laboratory Building #1. There is potential population, ozone, NO_2, and SO_2 exposure.

Table 2-2. (Continued)

UATMP Code	Monitoring Location	Land Use	Location Setting	Estimated Traffic	Traffic Year	Description of the Immediate Surroundings
CUSD	Custer, SD	Residential	Suburban	1,940	2002	The site is located on the edge of an urban area, in a pasture across the road from the last housing development on the east side of the City of Custer. The city has a population of 1,860 and is the largest city in the county. The city is located in a river valley in the Black Hills with pine covered hills on the north and south sides of the valley. The site is located in the center of the valley on the east side of the city. Major sources near the site include vehicles (highest traffic counts from May through September, forest fires (mainly during July through September, wood burning for heat, and wild land health fires (during the winter months). The main industries in the area include tourism, logging, and mining of feldspar/quartz.
CWFL	Clearwater, FL	Commercial	Suburban	1,000	Unknown	This was a replacement site for our Dunedin site, at St. Petersburg, FL. In addition to carbonyls, we also monitor VOCs, toxic metals, and ozone at the Clearwater site. Our objective is to measure HAPs (and ozone) in an area of high population density. Therefore we are monitoring population exposure not any specific sources. Clearwater is a "Neighborhood" spatial scale.
DAIA	Davenport, IA	Residential	Urban	1,000	Unknown	The Davenport, Iowa site, located in Scott County, in a metropolitan area approximately 650 yards from the Mississippi valley, is considered a major residential/general commercial site. Davenport is a core site for $PM_{2.5}$ monitoring. A meat processing plant, as well as a military manufacturing arsenal, is within five miles of the sampling site. An aluminum roll processing plant is located within 10 miles of the site.

Table 2-2. (Continued)

UATMP Code	Monitoring Location	Land Use	Location Setting	Estimated Traffic	Traffic Year	Description of the Immediate Surroundings
DBFL	Delray Beach, FL	Commercial	Urban	201,032	1995	Delray Beach is located in Broward County, FL. This is a rural location with possible pollution coming from a major highway (mobile) and hospital sources. Broward and Miami-Dade Counties are ranked high in the range of the air toxics monitoring criteria ranking document draft. It is the interest of the Southeast Florida Regional Air Toxics Program to conduct ambient carbonyl sampling in the Southeast Florida area to assess the potential health treat and cancer risk.
DECO	Denver, CO	Commercial	Urban	44,200	1995	The Denver site, designated as the Denver-CAMP site by the State of Colorado, is on the northern edge of downtown Denver on a small triangle of land bounded by Broadway, Champa St. and 21st St. The site was originally established in 1965 as a maximum concentration site for the Denver downtown area. The site provides a measure of the air pollution levels to which a large working population is exposed. Next to a major road in the downtown Denver area, the primary influences on the site are motor vehicles. Some industrial facilities are located to the north of the site, but no large facilities lie within a one or two mile radius. Residential areas are located a quarter- to a half- mile to the northeast and east.
DEMI	Dearborn in Detroit, MI	Industrial	Suburban	12,791	1990	Dearborn, MI, an addition to the State network, is located in a residential neighborhood with industrial impacts. An auto and steel manufacturing plant is located in close proximity to the monitoring station. Previous violations of the PM_{10} standard have also occurred at this site. The site lies between Interstate 75 and Interstate 94. This site is expected to show some of the highest levels of air toxics in the Detroit Pilot program area. The SO_2 and PM_{10} measurements are also made there.

Table 2-2. (Continued)

UATMP Code	Monitoring Location	Land Use	Location Setting	Estimated Traffic	Traffic Year	Description of the Immediate Surroundings
DMIA	Des Moines, IA	Commercial	Urban	12,400	1996	The Des Moines site is located in Polk County, Iowa, central to the downtown area and atop a one-story building. The elevation is slightly higher than the surrounding terrain is approximately a half mile from an Interstate highway. No major manufacturers are located in the area, 2-3 miles away from a major facility.
DNFL	Dunedin in St. Petersburg, FL	Residential	Suburban	16,281	1997	The neighborhood spatial scale of representativeness characterizes this monitoring site for the Tampa Bay pilot project. This monitor is in an area of high population density with less commercial and industrial influences at the neighborhood scale. Major point sources are located approximately 8 to 15 kilometers from the monitoring site and at least 150 meters from major roadways. Given the proximity of motor vehicle traffic it is expected that mobile sources will contribute appreciably to the measured samples.
E7MI	E7 Mile in Detroit, MI	Residential	Suburban	6,999	Unknown	The East 7 Mile site represents a location downwind from the Detroit urban center city area and is located in a residential neighborhood near Interstate 94. Criteria pollutants that include NO_2, O_3, SO_2, $PM_{2.5}$, and PAMS are also measured at East 7 Mile.
EATN	Nashville, TN (Site #1)	Residential	Urban	38,450	1993	This site is located in Nashville, TN and is located on the roof of East Health Center. The site is north (predominately downwind) of downtown Nashville and is a population oriented site predominantly influenced by primarily commercial and mobile sources.
ELNJ	Elizabeth, NJ	Industrial	Suburban	170,000	Unknown	Elizabeth is located in Union County, NJ, at an urban-industrial site where the topography is relatively smooth. The monitoring site is located 75 yards away from the Toll Plaza and about one mile from Bayway Refinery. The neighborhood scale is at maximum concentration. The location has a PM_{10} filter analyzer for sulfates and nitrates as well as the UATMP site.

Table 2-2. (Continued)

UATMP Code	Monitoring Location	Land Use	Location Setting	Estimated Traffic	Traffic Year	Description of the Immediate Surroundings
FLFL	Pompano Beach, FL	Commercial	Suburban	1,000	1989	The City of Pompano Beach is located in Broward County, FL. This is a urban, residential location in a neighborhood with pollution sources coming from a major traffic artery (source) as well as other minor area sources. Broward and Miami-Dade Counties are ranked high in the range of the air toxics monitoring criteria ranking document draft. It is the interest of the Southeast Florida Regional Air Toxics Program to conduct ambient carbonyl sampling in the Southeast Florida area to assess the potential health treat and cancer risk.
G2CO	Grand Junction, CO (Site #2)	Industrial	Urban	2,200	2001	The Grand Junction Site #2 is located at the Mesa County Health Department north of the Grand Junction downtown area, a residential area that is exposed to major roadways. A hospital is located next door to the site and is the only significant point source in the surrounding area. The site is also the primary neighborhood PM_{10} and $PM_{2.5}$ monitoring site for Grand Junction.
GAFL	Gandy in Tampa, FL	Commercial	Suburban	81,460	Unknown	A neighborhood spatial scale of representativeness characterizes this monitoring site selected for the Tampa Bay Region Air Toxics Study Monitoring Stations (TBRATS) pilot project. This monitor is sited in an area of high population density with uniform mixed land use, consisting of residential, commercial, and industrial properties. Major point sources are located approximately 8 to 15 kilometers from the monitoring site. Since the emission points from these sources are elevated and not proximate to the monitor, concentrations measured during this study should not be dominated by a single source. In addition, this site is at least 150 meters from major roadways. However, given the proximity of motor vehicle traffic mobile sources are expected to contribute appreciably to the measured samples.

Table 2-2. (Continued)

UATMP Code	Monitoring Location	Land Use	Location Setting	Estimated Traffic	Traffic Year	Description of the Immediate Surroundings
GJCO	Grand Junction, CO (Site #1)	Residential	Suburban	10,000	Unknown	Grand Junction Site #1 is southeast of the Grand Junction downtown area at the Mesa County Traffic Services. GJCO located in a light industrial area that contains pockets of residential areas. A variety of industries are located in the area, including a cement plant, metal fabricators, plating operations, a linen cleaner, a pump repair facility, and oil and chemical distributors. This site represents a maximum concentration neighborhood scale for Grand Junction.
GPMS	Gulf Port, MS	Commercial	Rural	17,000	1995	The Gulf Port site is in a light commercial and residential area. This site was selected because this area is believed to have high ambient air toxic concentrations based upon information from the NATA study and Mississippi's major source emission inventories.
HOMI	Houghton Lake, MI	Forest/ Agricultural	Rural	7,000	2002	The Houghton Lake station is located in Mississaukee County in the north central portion of Michigan's lower peninsula. Primary industries in the area include year-round tourism (boating, fishing, hunting and snow mobileing) as well as Christmas tree farming. The county is sparsely populated, but attracts many tourists as it is a prime recreational area containing many lakes, rivers and streams. The station is located at a deer research facility just west of US Route 27. Though not located close to the site, oil and natural gas production occurs in counties to the south and north, as Michigan is the nation's 4th largest oil and gas producer.
JAMS	Jackson, MS	Commercial	Suburban	12,500	Unknown	The Jackson site is located in a light commercial and residential area, selected because this area is believed to have high ambient air toxic concentrations based upon information from the NATA study and Mississippi's major source emission inventories.

Table 2-2. (Continued)

UATMP Code	Monitoring Location	Land Use	Location Setting	Estimated Traffic	Traffic Year	Description of the Immediate Surroundings
LEFL	Lewis in Tampa, FL	Residential	Urban	1,055	1999	This monitor is located in an area of moderate population density with fewer commercial and industrial influences at the neighborhood scale. Major point sources are located approximately 8 to 15 kilometers and at least 150 meters from major roadways. Given the proximity of motor vehicle traffic mobile sources are expected to contribute appreciably to the measured samples.
LINE	Lincoln, NE (Site #1)	Residential	Suburban	6,100	2000	The monitoring network for Lancaster County focuses on a large transportation corridor which includes the Lincoln Municipal Airport, a large railroad switching yard, various high volume roadways. This site was set up at a fire station located within the target during the warmer months (April though September), the monitor will be placed at a north location (Fire Station 14) to sample for concentrations affected by southerly wind flows.
LOMI	Lodge in Detroit, MI	Mobile	Urban	100,000	1990	LOMI is a mobile source oriented site established in Southfield, in the southeast portion of Oakland County. The site is located at the nexus of 696, Telegraph Road, and the Lodge Freeway.
LONE	Lincoln, NE (Site #2)	Residential	Suburban	6,200	2000	The monitoring network for Lancaster County focuses on a large transportation corridor which includes the Lincoln Municipal Airport, a large railroad switching yard, various high volume roadways. This site was set up at a different fire station (from LINE) from October through March. The monitor was placed at a south location (Fire Station 13) in order to sample the affects of notherly wind flows.
LOTN	Nashville, TN (Site #2)	Industrial	Urban	3,000	Unknown	This is a core site is located on the roof of Lockland School, which is located in the heart of downtown Nashville. This is also a population oriented site influenced primarily by commercial and mobile sources.

Table 2-2. (Continued)

UATMP Code	Monitoring Location	Land Use	Location Setting	Estimated Traffic	Traffic Year	Description of the Immediate Surroundings
MDFL	Miami, FL	Commercial	Urban	15,200	2002	Miami is a city located in Dade County, FL. The monitoring station is located in a urban, commercial and residential section of town. Pollution sources can come from mobile, area and hospital sources. Broward and Miami-Dade Counties are ranked high in the range of the air toxics monitoring criteria ranking document draft. It is the interest of the Southeast Florida Regional Air Toxics Program to conduct ambient carbonyl sampling in the Southeast Florida area to assess the potential health treat and cancer risk.
NBNJ	New Brunswick, NJ	Agricultural	Rural	63,000	Unknown	The New Brunswick site is located in a suburban-agricultural, residential area and is topographically smooth. The actual site location is in Rutgers University's Horticultural Farm.
PGMS	Pascagoula, MS	Commercial	Urban	8,600	2,000	The Pascagoula site is mostly in a commercial area in proximity to perhaps the largest industrial area in Mississippi. The industries near the Pascagoula site include chemical processes, petroleum refining, and ship building.
PLOR	Porltand, OR	Residential	Urban	1,000	1989	The Northeast Portland site is a neighborhood scale site located in a primarily residential area. Surrounding housing is mostly single-family with some nearby apartment buildings. Within a mile of the site are three elementary schools, a middle school, a high school, and a major hospital. The site is located between an arterial street couplet, and within a quarter of a mile of major arterials having significant commercial activity, as well as bus and truck traffic. No major point sources are located in close proximity to the site, although it is a only a few miles downwind (summertime) of several Title V sources in the North and Northwest parts of Portland.

Table 2-2. (Continued)

UATMP Code	Monitoring Location	Land Use	Location Setting	Estimated Traffic	Traffic Year	Description of the Immediate Surroundings
PSAZ	Supersite in Phoenix, AZ	Residential	Urban	250	1993	Maricopa County established the South Phoenix site at its current location in 1999 and operates CO, O_3 and PM_{10} monitors. The state of Arizona also operates PAMS and air toxics monitors. The site is at the edge of a residential area, but also borders on a mixture of commercial properties (retail stores, restaurants and offices). Industrial areas are located approximately one mile north of the site.
QVAZ	Queen Valley in Phoenix, AZ	Desert	Rural	200	2001	The state of Arizona established the Queen Valley Water Tank site in 2001, near the Superstition Wilderness Class I area, as a state Class I visibility monitoring location and a PAMS Type 3 monitoring location. The Queen Valley site consists of an IMPROVE aerosol sampler, a nephelometer and meteorological monitoring equipment. The state also operates O_3, trace level $NO_{x/y}$, PAMS and air toxics monitors. The area surrounding the site is primarily undeveloped desert. The town of Queen Valley is located approximately 0.5 miles north of the site.
RRMI	River Rouge in Detroit, MI	Industrial	Suburban	500	Unknown	River Rouge, in Detroit, MI, has been part of the state of Michigan's network since the end of 1993. RRMI is located in a residential neighborhood that is also impacted by industrial sources, near Interstate 75 and Southwest High School. Emissions from a steel plant, which occupies a few miles along the riverfront, impact the site. There are drywall manufacturing companies, the waste water treatment plant, a sewage incinerator, an asphalt plant, an oil refinery, coke batteries, coke by-product production facilities, various types of power generation plants, coal and oil fired combustion sources, paint shops, and assembly plants. The SO_2 and PM_{10} are also monitored at this location.
RUVT	Rutland, VT	Commercial	Urban	5,700	2001	Rutland is a moderately sized city in central Vermont. The monitoring station is located in a parking lot in downtown Rutland. A heavily traveled state highway and several busy city streets run within one mile of the monitoring station.

Table 2-2. (Continued)

UATMP Code	Monitoring Location	Land Use	Location Setting	Estimated Traffic	Traffic Year	Description of the Immediate Surroundings
S2MO	St. Louis, MO (Site #2)	Residential	Urban	1,000	1999	The St. Louis, Grant Street site has residential influences to the east and commercial influences to the north/northeast. Wind speed, direction, temperature, relative humidity, solar radiation, and barometric pressure are also measured at this site.
S3MO	St. Louis, MO (Site #3)	Residential	Urban	8,532	1998	The site S3MO at Keokuk Street in St. Louis is a residential site. Volatile organic compounds were monitored in 2001.
S4MO	St. Louis, MO (Site #4)	Residential	Urban	22,840	1995	Blair has some industry around it and a fair amount of industry to the east. It is also only about 250 meters from 1-70 (at its closest point).
SFSD	Sioux Falls, SD	Residential	Urban	4,320	1999	The SFSD monitoring site is located in Sioux Falls, SD, the largest city in the state, near two grade schools north of the site and residential areas on the west, east, and south. The area within 1 mile of the site is mostly residential with a few retail businesses. The main industrial area of the city is about 3 miles northwest and 2 miles to the west of the site. The site was selected because it represents population exposure to chemical and particulate emissions from the industrial parts of the city. The predominant wind direction is northwest for most of the year with southeast winds during the summer months.
SJPR	San Juan, PR	Commercial	Suburban	51,000	Unknown	The Site at the Bayamon Regional Jail, in San Juan, conducts monitoring for VOC and carbonyls. The prevailing sources within a 3 mile radius of the site include the San Juan power plant, highways with a nearby toll gate, an asphalt plant, a sewage authority facility, and industry. Additionally, the San Juan area has a large number of automobiles.

Table 2-2. (Continued)

UATMP Code	Monitoring Location	Land Use	Location Setting	Estimated Traffic	Traffic Year	Description of the Immediate Surroundings
SLCU	Salt Lake City, UT	Residential	Suburban	20,485	1995	The West Valley site, where the UATMP sampler is located, is in the southeast corner of the staff parking lot behind Hillsdale Elementary School. The sampler is north of the school playground and west of a large, open residential lot. The site is a neighborhood scale SLAMS site for $PM_{2.5}$, CO, and O_3 sampling, not near any point sources of air toxics, but approximately 100 yards from the nearest street - 12,000 cars per day on average. The site is several city blocks away from the nearest major street or freeway. A variety of light industries and trucking companies are also located in the area, but not within 2 or 3 blocks.
SLMO	St. Louis, MO (Site #1)	Residential	Urban	15,016	2,000	The SLMO site at Grant School in St. Louis is a residential site. Commercial influences are approximately 200 yards east. Volatile organic compounds, carbonyls, hydrocarbons, meteorological parameters, metals, and $PM_{2.5}$ speciation were conducted at this site in 2001.
SPAZ	South Phoenix, AZ	Residential	Urban	50,000	1995	The Supersite is intended to represent the central core of the Phoenix metropolitan area in a high emissions area, and is a PAMS Type 2 site. The site houses a variety of air monitoring equipment including criteria pollutant samplers and analyzers, PAMS and air toxics, total NMHC, meteorology, visibility/urban haze, and has been selected for several state and national air monitoring studies. The area surrounding the site is primarily residential neighborhoods. There is an interstate highway approximately one mile west of the site, as well as commercial and industrial areas within five miles of the site.

Table 2-2. (Continued)

UATMP Code	Monitoring Location	Land Use	Location Setting	Estimated Traffic	Traffic Year	Description of the Immediate Surroundings
SWCO	Denver, CO (Site #3)	Residential	Urban	1,366	1993	Located 3 miles northeast of downtown Denver, Swansea Elementary School is located in an old residential neighborhood. The site is one block north of I-70, a major interstate highway, and many old industrial sites are located within a few blocks. These include metal fabrication facilities, smelters and trucking firms. The site is also within the Vasquez Boulevard - I-70 Superfund area. This location is midway between the DECO and WECO sampling locations and provides a different and unique mix of air toxics sources.
SWMI	South West High School in Detroit, MI	Commercial	Urban	18,437	Unknown	Southwest High School has been part of the Michigan network since 1990 and serves as the long term trend location for the air toxics network. SWMI is located in a residential neighborhood that is impacted by industrial sources, near Interstate 75. The major sources include two steel mills, a used oil reclamation plant, and various manufacturing companies. The recent empowerment zone status achieved by the area will bring in new industries and businesses. The Detroit Waste Water Treatment plant is also close. Measurements for $PM_{2.5}$, SO_2 and PM_{10} are also collected at the site.
TUMS	Tupelo, MS	Commercial	Suburban	4,900	1997/1995	The Tupelo site is in a light commercial and residential area. This site was selected because this area is believed to have high ambient air toxic concentrations based upon information from the NATA study and Mississippi's major source emission inventories.
UNVT	Underhill, VT	Forest	Rural	1,000	1999	The Underhill monitoring site is located in a rural area, about 20 miles east of Burlington, VT. The site is at the base of Mount Mansfield, a remote field surrounded by forest.

Table 2-2. (Continued)

UATMP Code	Monitoring Location	Land Use	Location Setting	Estimated Traffic	Traffic Year	Description of the Immediate Surroundings
WECO	Denver, CO (Site #2)	Agricultural	Rural	1,500	Unknown	Located 7 miles north-northeast of downtown Denver on the bank of the South Platte River, this site is ideally located to measure nighttime drainage of the air mass from the Denver metropolitan area and the thermally driven, daytime upvalley flows. This site is located next to agricultural and open space areas, with residential areas located within one mile. In addition, major industrial sources are located about one mile upvalley, including a power plant, sewage treatment plant and refineries.
YFMI	Yellow Freight, MI	Industrial	Urban	500	Unknown	The Yellow Freight site currently collects SO_2 measurements and is located in the center of a highly industrialized area. The primary influence is from a nearby car battery plant. The site is about 2.25 miles away from the Dearborn and 0.75 miles away from the Southwest High School sites. Its inclusion in the study provides information about the degree of heterogeneity of toxic air contaminants across a small scale.

BOLD = EPA-designated National Air Toxics Trend System (NATTS) site.

Table 2-3. Site Descriptions for the 2002 UATMP Monitoring Stations

2002 UATMP Code	AQS Site Code	Location	Population Residing Within 10 Miles of the Monitoring Station [a]	County-level Stationary Source HAP Emissions in the 1999 NEI[b] (tpy)	Closest National Weather Service Station
ANTX	48-439-3011	Arlington, TX	614,071	5,996	Dallas Fort Worth International Airport
APMI	26-163-0001	Allen Park in Detroit, MI	1,024,363	15,026	Detroit/Metropolitan Airport
AZFL	12-103-0018	Azalea Park in St. Petersburg, FL	592,642	6,783	St. Petersburg/Whitted Airport
BAPR	72-017-0003	Barceloneta, PR	4,253[c]	1,477	San Juan, PR
BGFL	12-099-0008	Belle Glade, FL	34,175	4,774	Hollywood Int'l Airport
BRVT	50-025-0004	Brattleboro, VT	27,420	441	Springfield, VT/Hartness State Airport
BTMO	29-187-0005	Bonne Terre, MO	34,068	203	Cahokia/St. Louis, IL
BUND	38-057-0004	Beulah, ND	7,415	3,258	Bismarck Municipal Airport
C2IA	19-113-0037	Cedar Rapids, IA (Site #2)	175,516	2,307	Cedar Rapids Municipal
CANJ	34-007-0003	Camden, NJ	1,946,547	1,606	Philadelphia, PA
CHNJ	34-027-3001	Chester, NJ	237,587	1,724	Somerville, NJ
CUSD	46-033-0003	Custer, SD	4,214	383	Custer County Airport
CWFL	12-103-0004	Clearwater, FL	445,472	6,783	St. Petersburg/Clearwater
DAIA	19-163-0015	Davenport, IA	269,372	1,077	Davenport Nexrad

Table 2-3. (Continued)

2002 UATMP Code	AQS Site Code	Location	Population Residing Within 10 Miles of the Monitoring Station [a]	County-level Stationary Source HAP Emissions in the 1999 NEI[b] (tpy)	Closest National Weather Service Station
DBFL	12-099-2005	Delray Beach, FL	479,805	4,774	Palm Beach International
DECO	08-031-0002	Denver, CO	1,278,037	1,912	Denver/Centennial Airport
DEMI	26-163-0033	Dearborn in Detroit, MI	1,225,014	15,026	Detroit City Airport
DMIA	19-153-0030	Des Moines, IA	383,791	2,201	Des Moines International Airport
DNFL	12-103-1008	Dunedin in St. Petersburg, FL	454,645	6,783	New Port Ritchie, FL
E7MI	26-163-0019	E7 Mile in Detroit, MI	1,167,765	15,026	Detroit City Airport
EATN	47-037-0011	Nashville, TN (Site #2)	518,357	5,483	Nashville/Metro Airport
ELNJ	34-039-0004	Elizabeth, NJ	2,189,897	2,778	Newark International
FLFL	12-011-2004	Pompano Beach, FL	987,475	4,601	Hollywood International Airport
G2CO	08-077-0016	Grand Junction, CO (Site #2)	103,561	821	Grand Junction, CO
GAFL	12-057-1065	Gandy in Tampa, FL	458,652	14,368	Tampa, FL International
GJCO	08-077-0003	Grand Junction, CO (Site #1)	113,004	821	Grand Junction, CO
GPMS	28-047-0008	Gulf Port, MS	166,963	6,697	Gulf Port, MS

Table 2-3. (Continued)

2002 UATMP Code	AQS Site Code	Location	Population Residing Within 10 Miles of the Monitoring Station [a]	County-level Stationary Source HAP Emissions in the 1999 NEI[b] (tpy)	Closest National Weather Service Station
HOMI	26-113-0001	Houghton Lake, MI	10,391	82	Houghton Lake/Roscommon County Airport
JAMS	28-049-0010	Jackson, MS	262,477	1,643	Jackson/Allen C. Thompson Field
LEFL	12-057-1075	Lewis in Tampa, FL	592,533	14,368	New Port Ritchie, FL
LINE	31-109-0023	Lincoln, NE (Site #1)	239,999	15,474	Lincoln Municipal Airport
LOMI	26-125-0010	Lodge in Detroit, MI	1,146,230	11,294	Pontiac, MI
LONE	31-109-0024	Lincoln, NE (Site #2)	240,340	15,474	Lincoln Municipal Airport
LOTN	47-037-0023	Nashville, TN (Site #2)	552,749	5,483	Nashville Metro Airport
MDFL	12-086-4002	Miami, FL	1,152,632	7,727	Miami International Airport
NBNJ	34-023-0006	New Brunswick, NJ	856,367	4,119	Somerville, NJ
PGMS	28-059-0006	Pascagoula, MS	58,345	4,564	Pascagoula, MS
PLOR	41-051-0246	Portland, OR	894,082	3,824	Portland International Airport
PSAZ	04-013-9997	Supersite in Phoenix, AZ	1,377,479	9,621	Phoenix/Deer Valley Municipal Airport

Table 2-3. (Continued)

2002 UATMP Code	AQS Site Code	Location	Population Residing Within 10 Miles of the Monitoring Station [a]	County-level Stationary Source HAP Emissions in the 1999 NEI[b] (tpy)	Closest National Weather Service Station
QVAZ	04-021-8001	Queen Valley in Phoenix, AZ	87,103	1,131	Phoenix/Sky Harbor Airport
RRMI	26-163-0005	River Rouge in Detroit, MI	893,937	15,026	Detroit City Airport
RUVT	50-021-0002	Rutland, VT	35,880	402	Burlington International Airport
S2MO	29-510-0090	St. Louis, MO (Site #2)	796,761	4,348	Cahokia/St. Louis
S3MO	29-510-0091	St. Louis, MO (Site #3)	714,905	4,348	Cahokia/St. Louis
S4MO	29-510-0085	St. Louis, MO (Site #4)	838,460	4,348	Cahokia/St. Louis
SFSD	46-099-0007	Sioux Falls, SD	148,522	705	Joe Foss Field Airport
SJPR	72-127-0006	San Juan, PR	421,958[c]	1,196	San Juan, PR
SLCU	49-035-3007	Salt Lake City, UT	827,442	3,955	Salt Lake City International Airport
SLMO	29-510-0089	St. Louis, MO (Site # 1)	714,905	4,348	Cahokia/St Louis
SPAZ	04-013-4003	South Phoenix, AZ	847,178	9,621	Phoenix - Deer Valley Municipal Airport
SWCO	08-031-0023	Denver, Co (Site #3)	1,275,463	1,912	Denver/Centennial Airport

Table 2-3. (Continued)

2002 UATMP Code	AQS Site Code	Location	Population Residing Within 10 Miles of the Monitoring Station [a]	County-level Stationary Source HAP Emissions in the 1999 NEI[b] (tpy)	Closest National Weather Service Station
SWMI	26-163-0015	South West High School in Detroit, MI	1,179,491	15,026	Detroit City Airport
TUMS	28-081-0005	Tupelo, MS	71,430	2,946	Tupelo, MS
UNVT	50-007-0007	Underhill, VT	48,938	798	Burlington International Airport
WECO	08-031-3001	Denver, CO (Site #2)	852,751	1,995	Denver/Centennial Airport
YFMI	26-163-0027	Yellow Freight in Detroit, MI	1,196,371	15,026	Detroit City Airport

[a] Reference: http://zipnet.htm
[b] Reference: NEI, 2002.
[c] For the two Puerto Rico sites, population data reflect county-level, or zona urbana, population from the 2002 Census.

Table 2-4. VOC Method Detection Limits

Compound	Method Detection Limit (ppbv)
Hydrocarbons	
Acetylene	0.06
Benzene	0.06
1,3-Butadiene	0.10
Ethylbenzene	0.11
n-Octane	0.10
Propylene	0.05
Styrene	0.12
Toluene	0.08
1,2,4-Trimethylbenzene	0.12
1,3,5-Trimethylbenzene	0.11
m-,*p*-Xylene	0.13
o-Xylene	0.14
Halogenated Hydrocarbons	
Bromochloromethane	0.12
Bromodichloromethane	0.07
Bromoform	0.13
Bromomethane	0.11
Carbon Tetrachloride	0.06
Chlorobenzene	0.09
Chloroethane	0.13
Chloroform	0.06
Chloromethane	0.09
Chloromethylbenzene	0.14
Chloroprene	0.05
Dibromochloromethane	0.10
1,2-Dibromoethane	0.11
m-Dichlorobenzene	0.18
o-Dichlorobenzene	0.17
p-Dichlorobenzene	0.15
1,1-Dichloroethane	0.08
1,2-Dichloroethane	0.10
1,1-Dichloroethene	0.10
cis-1,2-Dichloroethylene	0.11
trans-1,2-Dichloroethylene	0.06
1,2-Dichloropropane	0.07
cis-1,3-Dichloropropene	0.11

Table 2-4. (Continued)

Compound	Method Detection Limit (ppbv)
Halogenated Hydrocarbons (Continued)	
trans-1,3-Dichloropropene	0.11
Dichlorodifluoromethane	0.07
Dichlorotetrafluoroethane	0.06
Hexachloro-1,3-butadiene	0.15
Methylene Chloride	0.07
1,1,2,2-Tetrachloroethane	0.19
Tetrachloroethylene	0.06
1,2,4-Trichlorobenzene	0.11
1,1,1-Trichloroethane	0.05
1,1,2-Trichloroethane	0.19
Trichloroethylene	0.10
Trichlorofluoromethane	0.14
Trichlorotrifluoroethane	0.07
Vinyl Chloride	0.09
Polar Compounds	
Acetonitrile	0.46
Acrylonitrile	0.52
Ethyl Acrylate	0.33
Ethyl *tert*-Butyl Ether	0.18
Methyl Ethyl Ketone (MEK)	0.34
Methyl Isobutyl Ketone	0.22
Methyl Methacrylate	0.36
Methyl *tert*-Butyl Ether (MTBE)	0.23
tert-Amyl Methyl Ether	0.18

Because *m*-xylene and *p*-xylene elute from the GC column at the same time, the VOC analytical method can only report the sum of *m*-xylene and *p*-xylene concentrations and not concentrations of the individual compounds.

Table 2-5. SNMOC Method Detection Limits

Compound	Method Detection Limit	Compound	Method Detection Limit
	ppbC		ppbC
Acetylene	0.17	3-Methyl-1-butene	0.24
Benzene	0.11	Methylcyclohexane	0.16
1,3-Butadiene	0.26	Methylcyclopentane	0.14
n-Butane	0.26	2-Methylheptane	0.25
cis-2-Butene	0.21	3-Methylheptane	0.17
trans-2-Butene	0.19	2-Methylhexane	0.19
Cyclohexane	0.15	3-Methylhexane	0.18
Cyclopentane	0.14	2-Methylpentane	0.13
Cyclopentene	0.24	3-Methylpentane	0.18
n-Decane	0.18	2-Methyl-1-pentene	0.26
1-Decene	0.30	4-Methyl-1-pentene	0.26
m-Diethylbenzene	0.30	*n*-Nonane	0.15
p-Diethylbenzene	0.14	1-Nonene	0.35
2,2-Dimethylbutane	0.11	*n*-Octane	0.16
2,3-Dimethylbutane	0.13	1-Octene	0.35
2,3-Dimethylpentane	0.30	*n*-Pentane	0.16
2,4-Dimethylpentane	0.21	1-Pentene	0.20
n-Dodecane	0.76	*cis*-2-Pentene	0.20
1-Dodecene	0.76	*trans*-2-Pentene	0.14
Ethane	0.16	α-Pinene	0.30
2-Ethyl-1-butene	0.26	β-Pinene	0.30
Ethylbenzene	0.16	Propane	0.16
Ethylene	0.17	*n*-Propylbenzene	0.29

Table 2-5. (Continued)

Compound	Method Detection Limit	Compound	Method Detection Limit
	ppbC		ppbC
m-Ethyltoluene	0.16	Propylene	0.17
o-Ethyltoluene	0.29	Propyne	0.17
p-Ethyltoluene	0.35	Styrene	0.05
n-Heptane	0.23	Toluene	0.25
1-Heptene	0.25	*n*-Tridecane	0.76
n-Hexane	0.14	1-Tridecene	0.76
1-Hexene	0.26	1,2,3-Trimethylbenzene	0.13
cis-2-Hexene	0.26	1,2,4-Trimethylbenzene	0.17
trans-2-Hexene	0.26	1,3,5-Trimethylbenzene	0.19
Isobutane	0.26	2,2,3-Trimethylpentane	0.23
Isobutene/1-Butene	0.24	2,2,4-Trimethylpentane	0.23
Isopentane	0.24	2,3,4-Trimethylpentane	0.20
Isoprene	0.13	*n*-Undecane	0.33
Isopropylbenzene	0.30	1-Undecene	0.33
2-Methyl-1-Butene	0.24	*m-,p*-Xylene	0.14
2-Methyl-2-Butene	0.24	*o*-Xylene	0.15

Concentration in ppbC = concentration in ppbv x number of carbon atoms in compound.

Because Isobutene and 1-Butene elute from the GC column at the same time, the SNMOC analytical method can only report the sum of concentrations for these two compounds and not concentrations of the individual compounds. For the same reason, the *m*-xylene and *p*-xylene concentrations are reported together as a sum.

Table 2-6. Carbonyl Method Detection Limits

Compound	Method Detection Limit (ppbv)
Acetaldehyde	0.015
Acetone	0.010
Benzaldehyde	0.002
Butyr/Isobutyraldehyde	0.16
Crotonaldehyde	0.011
2,5-Dimethylbenzaldehyde	0.002
Formaldehyde	0.030
Hexaldehyde	0.005
Isovaleraldehyde	0.003
Propionaldehyde	0.012
Tolualdehydes	0.006
Valeraldehyde	0.003

Notes: The carbonyl detection limits vary from site to site. Therefore, the above MDLs are averages.

Because butyraldehyde and isobutyraldehyde elute from the HPLC column at the same time, the carbonyl analytical method can only report the sum of concentrations for these two compounds and not concentrations of the individual compounds. For the same reason, the analytical method also reports only the sum of concentrations for the three tolualdehyde isomers, as opposed to reporting separate concentrations for the three individual compounds.

Table 2-7a. Semivolatile Organic Compound Method Detection Limits Prior to 6/1/02

Compound	Method Detection Limit Total µg/m^3	Compound	Method Detection Limit Total µg/m^3
Acenaphthene	0.03	2,4-Dinitrotoluene	0.05
Acenaphthylene	0.04	2,6-Dinitrotoluene	0.05
Acetophenone	0.07	Diphenylamine	0.13
2-Acetylaminofluorene	0.05	Ethyl methanesulfonate	0.15
4-Aminobiphenyl	0.05	Fluoranthene	0.07
Aniline	0.08	Fluorene	0.05
Anthracene	0.09	Hexachlorobenzene	0.07
Azobenzene	0.09	Hexachlorobutadiene	0.07
Benzidine	0.07	Hexachlorocyclopentadiene	0.11
Benzo(a)anthracene	0.04	Hexachloroethane	0.03
Benzo(a)pyrene	0.09	Hexachloropropene	0.08
Benzo(b)fluoranthene	0.09	Indeno(1,2,3-cd)pyrene	0.07
Benzo(g,h,i)perylene	0.08	Isodrin	0.07
Benzo(k)fluoranthene	0.12	Isophorone	0.11
Benzyl alcohol	0.04	Isosafrole	0.08
bis(2-Chloroethyl)ether	0.06	3-Methylcholanthrene	0.05
bis(2-Chloroethoxy)methane	0.07	Methyl methanesulfonate	0.08
bis(2-Chloroisopropyl)ether	0.06	2-Methylnaphthalene	0.06
bis(2-Ethylhexyl)phthalate	0.06	Naphthalene	0.08
4-Bromophenyl phenyl ether	0.06	1,4-Naphthoquinone	0.15
Butyl benzyl phthalate	0.06	1-Naphthylamine	0.03
Carbazole	0.06	2-Naphthylamine	0.05
4-Chloroaniline	0.08	2-Nitroaniline	0.06
Chlorobenzilate	0.06	3-Nitroaniline	0.04
4-Chloro-3-methylphenol	0.08	4-Nitroaniline	0.05
2-Chloronaphthalene	0.09	Nitrobenzene	0.12
2-Chlorophenol	0.05	2-Nitrophenol	0.05
4-Chlorophenylphenyl ether	0.03	4-Nitrophenol	0.04
Chrysene	0.05	N-Nitrosodibutylamine	0.11

Table 2-7a. (Continued)

Compound	Method Detection Limit Total µg/m^3	Compound	Method Detection Limit Total µg/m^3
o-Cresol (2-Methylphenol)	0.05	N-Nitrosodiethylamine	0.10
o-Toludine	0.07	N-Nitrosomethylethylamine	0.07
m, p-Cresol (3,4-Methylphenol)	0.04	N-Nitrosodimethylamine	0.13
Diallate	0.07	N-Nitrosodipropylamine	0.07
Dibenz(a,h)anthracene	0.08	N-Nitrosopiperidine	0.09
Dibenzofuran	0.05	N-Nitrosopyrrolidine	0.11
Di-*n*-butyl phthalate	0.07	5-Nitro-*o*-toluidine	0.05
Di-*n*-octyl phthalate	0.07	Pentachlorobenzene	0.05
Dinoseb	0.07	Pentachloroethane	0.09
1,2-Dichlorobenzene	0.05	Pentachloronitrobenzene	0.05
1,3-Dichlorobenzene	0.06	Pentachlorophenol	0.07
1,4-Dichlorobenzene	0.05	Phenacetin	0.08
3,3'-Dichlorobenzidine	0.04	Phenanthrene	0.05
2,4-Dichlorophenol	0.07	Phenol	0.11
2,6-Dichlorophenol	0.09	2-Picoline	0.06
Diethyl phthalate	0.04	Pronamide	0.06
4-Dimethylaminoazobenzene	0.07	Pyrene	0.05
7,12-Dimethylbenz(a)anthracene	0.10	Pyridine	0.14
3,3'-Dimethylbenzidine	0.06	Safrole	0.07
2,4-Dimethylphenol	0.09	1,2,4,5-Tetrachlorobenzene	0.05
Dimethyl phthalate	0.05	2,3,4,6-Tetrachlorophenol	0.05
1,3-Dintrobenzene	0.05	1,2,4-Trichlorobenzene	0.07
4,6-Dinitro-2-methylphenol	0.06	2,4,5-Trichlorophenol	0.03
2,4-Dinitrophenol	0.05	2,4,6-Trichlorophenol	0.04

Table 2-7b. Semivolatile Organic Compound Method Detection Limits After 6/1/02

Compound	Method Detection Limit Total µg/m^3	Compound	Method Detection Limit Total µg/m^3
Acenaphthene	0.023	2,4-Dinitrotoluene	0.033
Acenaphthylene	0.022	2,6-Dinitrotoluene	0.033
Acetophenone	0.034	Diphenylamine	0.132
2-Acetylaminofluorene	0.017	Ethyl methanesulfonate	0.035
4-Aminobiphenyl	0.132	Fluoranthene	0.019
Aniline	0.066	Fluorene	0.021
Anthracene	0.031	Hexachlorobenzene	0.023
Azobenzene	0.030	Hexachlorobutadiene	0.036
Benzidine	0.250	Hexachlorocyclopentadiene	0.051
Benzo(a)anthracene	0.019	Hexachloroethane	0.025
Benzo(a)pyrene	0.018	Hexachloropropene	0.032
Benzo(b)fluoranthene	0.035	Indeno(1,2,3-cd)pyrene	0.040
Benzo(g,h,i)perylene	0.028	Isodrin	0.023
Benzo(k)fluoranthene	0.028	Isophorone	0.028
Benzyl alcohol	0.042	Isosafrole	0.029
bis(2-Chloroethyl)ether	0.035	3-Methylcholanthrene	0.032
bis(2-Chloroethoxy)methane	0.035	Methyl methanesulfonate	0.040
bis(2-Chloroisopropyl)ether	0.028	2-Methylnaphthalene	0.029
bis(2-Ethylhexyl)phthalate	0.024	Naphthalene	0.034
4-Bromophenyl phenyl ether	0.030	1,4-Naphthoquinone	0.029
Butyl benzyl phthalate	0.028	1-Naphthylamine	0.122
Carbazole	0.029	2-Naphthylamine	0.121
4-Chloroaniline	0.047	2-Nitroaniline	0.032
Chlorobenzilate	0.016	3-Nitroaniline	0.024
4-Chloro-3-methylphenol	0.034	4-Nitroaniline	0.030
2-Chloronaphthalene	0.020	Nitrobenzene	0.029
2-Chlorophenol	0.038	2-Nitrophenol	0.046
4-Chlorophenylphenyl ether	0.024	4-Nitrophenol	0.034
Chrysene	0.029	N-Nitrosodibutylamine	0.025

Table 2-7b. (Continued)

Compound	Method Detection Limit Total µg/m^3	Compound	Method Detection Limit Total µg/m^3
o-Cresol (2-Methylphenol)	0.046	N-Nitrosodiethylamine	0.036
o-Toludine	0.038	N-Nitrosomethylethylamine	0.035
m, *p*-Cresol (3,4-Methylphenol)	0.042	N-Nitrosodimethylamine	0.033
Diallate	0.023	N-Nitrosodipropylamine	0.028
Dibenz(a,h)anthracene	0.026	N-Nitrosopiperidine	0.024
Dibenzofuran	0.016	N-Nitrosopyrrolidine	0.037
Di-*n*-butyl phthalate	0.024	5-Nitro-*o*-Toluidine	0.026
Di-*n*-octyl phthalate	0.022	Pentachlorobenzene	0.026
Dinoseb	0.031	Pentachloroethane	0.044
1,2-Dichlorobenzene	0.031	Pentachloronitrobenzene	0.036
1,3-Dichlorobenzene	0.025	Pentachlorophenol	0.038
1,4-Dichlorobenzene	0.029	Phenacetin	0.024
3,3'-Dichlorobenzidine	0.036	Phenanthrene	0.028
2,4-Dichlorophenol	0.028	Phenol	0.040
2,6-Dichlorophenol	0.028	2-Picoline	0.161
Diethyl phthalate	0.023	Pronamide	0.029
4-Dimethylaminoazobenzene	0.022	Pyrene	0.027
7,12-Dimethylbenz(a)anthracene	0.028	Pyridine	0.059
3,3'-Dimethylbenzidine	0.250	Safrole	0.029
2,4-Dimethylphenol	0.164	1,2,4,5-Tetrachlorobenzene	0.030
Dimethyl phthalate	0.022	2,3,4,6-Tetrachlorophenol	0.035
1,3-Dintrobenzene	0.038	1,2,4-Trichlorobenzene	0.027
4,6-Dinitro-2-methylphenol	0.032	2,4,5-Trichlorophenol	0.033
2,4-Dinitrophenol	0.040	2,4,6-Trichlorophenol	0.024

* These MDLs reflect a reduction in volume from 5 mL to 1 mL.

Table 2-8. Metals and Hexavalent Chromium Method Detection Limits

Compound	DL
Antimony	10 ng/filter
Arsenic	20 ng/filter
Beryllium	5 ng/filter
Cadmium	50 ng/filter
Cobalt	10 ng/filter
Chromium (total Chromium	100 ng/filter
Lead	100 ng/filter
Manganese	100 ng/filter
Mercury	0.5 ng/filter
Nickel	100 ng/filter
Selenium	25 ng/filter
Cr^{+6}	0.013 ng/m^3

Table 2-9a. Sampling Schedules and Completeness for Carbonyl Compounds, VOC, SNMOC, and SVOC

Site	Monitoring Location	Sampling Period		Carbonyl Data			VOC Data			SNMOC			SVOC		
		Starting Date	Ending Date	A	B	C	A	B	C	A	B	C	A	B	C
ANTX	Arlington, TX	6/13/02	12/22/02	22	23	96	22	23	96	---	---	---	---	---	---
APMI	Allen Park in Detroit, MI	1/02/02	9/23/02	10	10	100	67	80	84	---	---	---	36	36	100
AZFL	Azalea Park in St. Petersburg, FL	1/2/02	12/28/02	59	61	97	---	---	---	---	---	---	---	---	---
BAPR	Barceloneta, PR	1/02/02	12/28/02	64	81	79	68	79	86	54	63	86	---	---	---
BGFL	Belle Glade, FL	11/4/02	12/22/02	5	5	100	---	---	---	---	---	---	---	---	---
BRVT	Brattleboro, VT	1/8/02	12/22/02	---	---	---	82	90	91	---	---	---	---	---	---
BTMO	Bonne Terre, MD	12/10/02	12/28/02	3	4	75	---	---	---	3	4	75	---	---	---
BUND	Beulah, ND	1/2/02	12/28/02	78	79	99	76	79	96	78	79	99	---	---	---
C2IA	Cedar Rapids, IA (Site #2)	1/2/02	12/28/02	79	79	100	74	77	96	78	79	99	---	---	---
CANJ	Camden, NJ	1/8/02	12/28/02	72	81	89	74	80	93	---	---	---	20	22	91
CHNJ	Chester, NJ	1/2/02	12/28/02	69	76	91	69	75	92	---	---	---	20	23	87
CUSD	Custer Park, SD	3/21/02	12/28/02	59	59	100	60	60	100	60	60	100	---	---	---
CWFL	Clearwater, FL	7/25/02	12/28/02	69	69	100	---	---	---	---	---	---	---	---	---
DAIA	Davenport, IA	1/8/02	12/22/02	31	36	86	31	36	86	31	36	86	---	---	---
DBFL	Delray Beach, FL	11/04/02	12/22/02	5	5	100	---	---	---	---	---	---	---	---	---

Table 2-9a. (Continued)

Site	Monitoring Location	Sampling Period		Carbonyl Data			VOC Data			SNMOC			SVOC		
		Starting Date	Ending Date	A	B	C	A	B	C	A	B	C	A	B	C
DECO	Denver, CO	1/2/02	12/28/02	48	51	94	50	51	98	---	---	---	---	---	---
DEMI	Dearborn in Detroit, MI	1/1/02	12/28/02	198	203	98	183	192	95	---	---	---	12	20	60
DMIA	Des Moines, IA	1/2/02	6/13/02	19	20	95	14	18	78	14	16	88	---	---	---
DNFL	Dunedin in St. Petersburg, FL	1/2/02	7/31/02	77	81	95	---	---	---	---	---	---	---	---	---
E7MI	E7 Mile in Detroit, MI	1/8/02	8/30/02	---	---	---	4	4	100	8	8	100	6	9	67
EATN	Nashville, TN	5/14/02	12/16/02	24	27	89	23	28	82	---	---	---	---	---	---
ELNJ	Elizabeth, NJ	1/2/02	12/4/02	73	76	96	73	79	92	---	---	---	22	23	96
FLFL	Ft. Lauderdale, FL	11/4/02	12/10/02	4	4	100	---	---	---	---	---	---	---	---	---
G2CO	Grand Junction, CO (Site #2)	1/2/02	4/26/02	53	53	100	46	49	94	---	---	---	---	---	---
GAFL	Gandy in Tampa, FL	1/2/02	12/28/02	69	77	90	---	---	---	---	---	---	---	---	---
GJCO	Grand Junction, CO (Site #1)	1/2/02	4/26/02	24	25	96	24	26	92	---	---	---	---	---	---
GPMS	Gulf Port, MS	1/8/02	12/22/02	38	39	97	38	39	97	---	---	---	---	---	---
HOMI	Houghton Lake, MI	8/12/02	12/22/02	---	---	---	11	15	73	---	---	---	---	---	---
JAMS	Jackson, MS	1/8/02	12/22/02	39	39	100	35	39	90	---	---	---	---	---	---

Table 2-9a. (Continued)

Site	Monitoring Location	Sampling Period		Carbonyl Data			VOC Data			SNMOC			SVOC		
		Starting Date	Ending Date	A	B	C	A	B	C	A	B	C	A	B	C
LEFL	Lewis in Tampa, FL	1/2/02	12/28/02	80	85	94	---	---	---	---	---	---	---	---	---
LINE	Lincoln, NE Fire Station #13	3/21/02	9/29/02	41	43	95	37	40	93	---	---	---	---	---	---
LOMI	Lodge in Detroit, MI	1/2/02	5/22/02	10	10	100	18	20	90	---	---	---	19	20	95
LONE	Lincoln, NE Fire Station #14	10/05/02	12/28/02	20	21	95	21	21	100	---	---	---	---	---	---
LOTN	Nashville, TN	4/20/02	12/16/02	21	26	81	18	26	69	---	---	---	---	---	---
MDFL	Miami-Dade, FL	11/16/02	12/22/02	4	5	80	---	---	---	---	---	---	---	---	---
NBNJ	New Brunswick, NJ	1/2/02	12/28/02	71	81	88	70	81	86	---	---	---	23	23	100
PGMS	Pascagoula, MS	1/8/02	12/22/02	38	39	97	38	39	97	---	---	---	---	---	---
PSAZ	Supersite in Phoenix, AZ	1/2/02	12/22/02	---	---	---	52	58	90	---	---	---	---	---	---
QVAZ	Queen Valley in Phoenix, AZ	1/2/02	12/28/02	---	---	---	47	57	82	---	---	---	---	---	---
RRMI	River Rouge in Detroit, MI	1/2/02	12/28/02	21	21	100	10	11	91	---	---	---	8	9	89
RUVT	Rutland, VT	1/8/02	12/22/02	---	---	---	29	30	97	---	---	---	---	---	---
S2MO	St. Louis, MO (Site #2)	1/14/02	5/14/02	---	---	---	30	32	94	---	---	---	---	---	---

Table 2-9a. (Continued)

Site	Monitoring Location	Sampling Period		Carbonyl Data			VOC Data			SNMOC			SVOC		
		Starting Date	Ending Date	A	B	C	A	B	C	A	B	C	A	B	C
S3MO	St. Louis, MO (Site #3)	1/02/02	5/14/02	---	---	---	31	32	97	---	---	---	---	---	---
S4MO	Denver, CO Site #4	12/4/02	12/22/02	5	5	100	---	---	---	5	5	100	---	---	---
SFSD	Sioux Falls, SD	1/2/02	12/28/02	33	52	63	64	77	83	64	77	83	---	---	---
SJPR	San Juan, PR	1/2/02	12/28/02	71	80	89	72	79	91	54	61	89	---	---	---
SLCU	Salt Lake City, UT	1/2/02	12/28/02	74	85	87	75	82	91	73	82	89	---	---	---
SLMO	St. Louis, MO (Site #1)	1/2/02	12/28/02	57	67	85	63	67	94	63	67	94	35	36	97
SPAZ	South Phoenix, AZ	1/2/02	12/28/02	---	---	---	51	58	88	---	---	---	---	---	---
SWCO	Denver, CO Site #3	7/1/02	12/28/02	35	36	97	36	38	95	---	---	---	---	---	---
SWMI	South West High School in Detroit, MI	1/8/02	12/28/02	19	19	100	13	18	72	---	---	---	8	9	89
TUMS	Tupelo, MS	1/8/02	12/22/02	38	39	97	37	39	95	---	---	---	---	---	---
UNVT	Underhill, VT	1/8/02	12/22/02	---	---	---	30	31	97	---	---	---	---	---	---
WECO	Denver, CO Site #2	5/8/02	12/28/02	46	51	90	45	51	88	---	---	---	---	---	---
YFMI	Yellow Freight in Detroit, MI	1/02/02	9/11/02	14	18	78	20	20	100	---	---	---	60	63	95

Table 2-9a. (Continued)

Site	Monitoring Location	Sampling Period		Carbonyl Data			VOC Data			SNMOC			SVOC		
		Starting Date	Ending Date	A	B	C	A	B	C	A	B	C	A	B	C
---	**Overall**	**---**	**—**	**1,989**	**2,146**	**93**	**2,031**	**2,226**	**91**	**585**	**637**	**92**	**269**	**293**	**92**

A = Days With Valid Samples
B = Days When Samples Were Collected
C = Completeness (%)

Note: The completeness data only indicate the number of days when samples were collected.

Table 2-9b. Sampling Schedules and Completeness for Metals and Hexavalent Chromium

Code	Monitoring Location	Sampling Period		Metals			Hexavalent Chromium		
		Starting Date	Ending Date	A	B	C	A	B	C
APMI	Allen Park in Detroit, MI	1/02/02	9/23/02	---	---	---	10	10	100
DECO	Denver, CO	1/2/02	12/28/02	24	24	100	---	---	---
DEMI	Dearborn in Detroit, MI	1/1/02	12/28/02	---	---	---	10	10	100
G2CO	Grand Junction, CO (Site #2)	1/2/02	4/26/02	31	31	100	---	---	---
GJCO	Grand Junction, CO (Site #1)	1/2/02	4/26/02	25	25	100	---	---	---
LOMI	Lodge in Detroit, MI	1/2/02	5/22/02	---	---	---	10	10	100
PLOR	Portland, OR	9/5/02	12/28/02	---	---	---	20	20	100
RRMI	River Rouge in Detroit, MI	1/2/02	12/28/02	---	---	---	36	40	90
SWCO	Denver, CO Site #3	7/1/02	12/28/02	18	18	100	---	---	---
SWMI	South West High School in Detroit, MI	1/8/02	12/28/02	26	26	100	---	---	---
WECO	Denver, CO Site #2	5/8/02	12/28/02	36	37	97	---	---	---
---	**Overall**	**---**	**—**	**160**	**161**	**99**	**86**	**90**	**96**

A = Days With Valid Samples
B = Days When Samples Were Collected
C = Completeness (%)
Note: The completeness data only indicate the number of days when samples were collected.

Table 2-10. Semi-volatile and Inorganics (Metals) Which Are HAPs

HAP	Analytical Method	HAP	Analytical Method
Category IV		**Category V**	
Acenaphthene	TO-13A	Antimony & Compounds	IO-3.5(29)
Acenaphthylene	TO-13A	Arsenic & Compounds	IO-3.5(29)
Anthracene	TO-13A	Beryllium & Compounds	IO-3.5(29)
Benzo(ghi)perylene	TO-13A	Cadmium & Compounds	IO-3.5(29)
Fluoranthene	TO-13A	Chromium & Compounds*	IO-3.5(29)
Fluorene	TO-13A	Lead & Compounds	IO-3.5(29)
Naphthalene	TO-13A	Manganese & Compounds	IO-3.5(29)
Phenanthrene	TO-13A	Mercury & Compounds	IO-3.5(29)
Pyrene	TO-13A	Nickel & Compounds	IO-3.5(29)
Benz(a)anthracene	TO-13A	Antimony & Compounds	IO-3.5(29)
Benzo(a)pyrene	TO-13A	Selenium & Compounds	IO-3.5(29)
Benzo(b)fluoranthene	TO-13A	Cobalt & Compounds	IO-3.5(29)
Benzo(k)fluoranthene	TO-13A	Hexavalent Chromium	CARB 039(30)
Chrysene	TO-13A		
Dibenz(a,h)anthracene	TO-13A		
Indeno(1,2,3-cd)pyrene	TO-13A		
Phenol	TO-13A		
p-Cresol	TO-13A		
o-Cresol	TO-13A		
Quinoline	TO-13A		

3.0 Summary of the 2002 UATMP Data

This section summarizes the data gathered during the 2002 UATMP reporting year. A total of 72 VOC and carbonyl compounds were sampled during this program reporting year. (Unlike previous years, acrolein was not analyzed.) Within the VOCs, three distinct groups of compounds were identified: 1) hydrocarbons; 2) halogenated hydrocarbons; and 3) polar compounds. All four of the these compound groups (including carbonyls) are discussed in greater detail in Sections 3.2 through 3.5.

A complete presentation of the data is found in Appendices C through N. Specifically:

- Appendix C: 2002 Summary Tables for VOC Monitoring;
- Appendix D: 2002 Summary Tables for SNMOC Monitoring;
- Appendix E: 2002 Summary Tables for Carbonyl Monitoring;
- Appendix F: 2002 Summary Tables for SVOC Monitoring;
- Appendix G: 2002 Summary Tables for Metals Monitoring;
- Appendix H: 2002 Summary Tables for Hexavalent Chromium Monitoring;
- Appendix I: 2002 VOC Raw Monitoring Data;
- Appendix J: 2002 SNMOC Raw Monitoring Data;
- Appendix K: 2002 Carbonyl Raw Monitoring Data;
- Appendix L: 2002 SVOC Raw Monitoring Data;
- Appendix M: 2002 Metal Raw Monitoring Data; and
- Appendix N: 2002 Hexavalent Chromium Raw Monitoring Data.

Nearly 141,700 urban air toxics VOC and carbonyl data concentrations (including duplicate and replicate samples) were collected at the fifty-five sites for the 2002 UATMP reporting year. Additionally, thirteen sites chose to sample for speciated nonmethane organic compounds

(SNMOC) accounting for another 45,630 data concentrations. Semivolatile data were collected at twelve sites totaling nearly 28,500 data concentrations (data listed in Appendix F). Metals data were collected at six sites totaling nearly 1760 data concentrations (listed in Appendix F). Finally, Hexavalent Chromium data were collected at five sites totaling over 86 data concentrations (listed in Appendix H). These data will be analyzed on a site-specific basis in sections four through twenty of this document. Although there are fifty-six stations listed in Section 2 of this document, the Portland, OR site (PLOR) did not sample for either VOCs or carbonyls, however, an Oregon state section is included to summarize the data gathered at this site.

3.1 Data Summary Parameters

The summary tables in Appendices C through H were uploaded into a database for air quality analysis. This section will examine five different data summary parameters: 1) number of sampling detects; 2) concentration range; 3) geometric means; 4) prevalence; and 5) correlation. The following paragraphs review the basic findings indicated by the summary tables.

3.1.1 Number of Sampling Detects

Tables 3-1 and 3-2 are sampling detect summaries of the seventy-two VOC and carbonyl concentrations. Less than 37% of the pollutants sampled were found to be above the method detection limit (MDL). Of those that were detected:

- 33.2% were hydrocarbons;
- 24.6% were halogenated hydrocarbons;
- 4.5% were polar compounds; and
- 37.7% were carbonyl compounds.

These numbers resemble those from the 2001 report. Benzene and dichlorodifluoromethane had the greatest number of detectable values reported in samples (2,029 and 2030, respectively), while eleven compounds had zero detects (see Tables 3-1 and 3-2).

3.1.2 Concentration Range

Nearly 83% of the detects had concentration values less than 1 ppbv, consistent with the values from the 2001 report. Less than 2% had concentrations greater than 5 ppbv. Polar compounds were observed in the highest number of samples with concentrations greater than 5 ppbv (423); halogenated hydrocarbons had the lowest (107). There was at least one compound sampled at a concentration greater than 5 ppbv on 148 of 310 total sampling days. An interesting note is that 34 of the seventy compounds never exceeded 1 ppbv.

The range of detectable values for each site is listed in Table 3-3. The APMI, BAPR, CHNJ, DEMI, GPMS, LOMI, PGMS, SFSD, SJPR,SLCU, SPAZ, SWCO, TUMS, and WECO sites had maximum concentration values of over 100 ppbv, unusually high when compared to the other sites. DEMI, which sampled nearly every day for the first quarter of 2002, had the greatest number of detects (4,381), and also had the greatest number of samples with concentrations greater than 5 ppbv (96).

3.1.3 Geometric Means

The geometric mean is the central tendency of lognormally distributed data, and can be calculated by taking the “n^{th}” root of the product of the “n” concentrations. The geometric mean is a useful parameter for calculating a central tendency of a concentration data set, whose arithmetic mean may be skewed by an usually high concentration value. Geometric means for each site of the four different pollutant groups are presented in Table 3-4 and shown graphically in Figure 3-1. The SWCO site had the highest geometric mean for total polar compounds (114.80 ppbv); the G2CO had the highest geometric mean for total hydrocarbons (17.11 ppbv). The highest total halogenated hydrocarbon geometric mean was at APMI (17.59 ppbv). The SLMO site has the highest total carbonyl geometric mean (23.61 ppbv).

3.1.4 Prevalence

In the context of the UATMP, *prevalence* refers to the frequency with which an air pollutant is found at levels detectable by the corresponding sampling and analytical method. By indicating the frequency of detection, prevalence can help participating agencies identify compounds of concern in urban air pollution, as well as investigate sources of these compounds. Because part of this report is organized to evaluate trends in ambient air quality primarily on the basis of compound groups, the prevalent compounds are identified on a program-wide, not site-specific, basis. More importantly, the number of nondetects for a given compound (indicated by low prevalence) must be considered when interpreting air monitoring results. Specifically, annual average concentrations cannot be accurately estimated for compounds that are not detected in a majority of samples.

When reviewing the data summary tables, readers should note that a prevalence of zero does not necessarily indicate that a compound is not present in ambient air. Rather, compounds with a prevalence of zero may be present in the air, but at levels consistently below method detection limits.

For the purposes of this report, a group of program-wide prevalent compounds was identified for each of the VOC and carbonyl compound groups listed in Section 3.0. These groups of program-wide prevalent compounds are discussed in detail in Sections 3.2 through 3.5, and throughout the remaining chapters of this report on a site-specific basis. Because the UATMP does not characterize every component of air pollution, many compounds known to be prevalent in urban air (e.g., ozone and nitrous oxides) are not considered in this report. Readers should be careful not to confuse the most prevalent compounds program-wide identified by the 2002 UATMP with the most prevalent compounds in urban air pollution.

In previous UATMP reports, program-wide prevalent compounds were identified using two statistical parameters: the count of the number of nondetects (ND); and the percent contribution of their mass concentrations. If a compound was detected in at least 75 percent of all the samples, and if the compound contributed to at least 90 percent of the mass concentration within a compound group, then that compound was considered “program-wide prevalent”. Due to the significant increase in the number of participating sites during the 2001 program year (from 15 to 41), this identification scheme was re-evaluated to ensure an acceptable number of VOC prevalent compounds are identified. Thus the criteria were revised for 2001: 1) to be considered prevalent, the compound must be identified and quantified in at least 60% of samples collected by a site; 2) the compounds must satisfy the first criterion in 34 of the 45 sites sampling for carbonyls and 33 of 44 sites sampling for VOCs (or 75% for each of the respective sites); 3) the compounds satisfying the first and second criteria must contribute to at least 90% of their compound group's mass concentration; and 4) the third criterion must satisfy the same 75% criteria as stated above. The 2002 program year followed this same schema. Twelve compounds met both of these criteria (3 halogenated hydrocarbons, 8 hydrocarbons, and 1 carbonyl compound).

For the 2002 UATMP, the program-wide prevalent compounds are:

- **HYDROCARBONS**
    - 1,2,4-Trimethylbenzene
    - Acetylene
    - Benzene
    - Ethylbenzene
    - *m,p*-xylene
    - *o*-xylene
    - Propylene
    - Toluene
- **HALOGENATED HYDROCARBONS**
    - Chloromethane
    - Dichlorodifluoromethane
    - Trichlorofluoromethane
- **POLAR COMPOUNDS**
    - No polar compounds were considered prevalent. This mirrors the low number of sampling detects in Section 3.1.1.
- **CARBONYL COMPOUNDS**
    - Formaldehyde

Because these compounds were consistently present at detectable levels, the UATMP monitoring data characterize ambient levels for these compounds much more accurately than they characterize ambient levels for the VOCs and carbonyls with lower prevalence. Further, the high prevalence allows for a meaningful statistical analysis of data correlations and a thorough review of spatial variations and temporal variations in ambient air quality.

Readers interested in closer examination of data trends for the less program-wide prevalent compounds should refer to the summary tables in Appendices F through I, and the raw monitoring data in Appendices J through M. However, the reader should note the limitations posed by data sets with many nondetect observations.

Figures 3-2 through 3-13 illustrate how geometric mean concentrations for the program-wide prevalent VOCs and carbonyls varied from one monitoring location to the next.

3.1.5 Pearson Correlations

This report uses Pearson correlation coefficients to measure the degree of correlation between two variables. By definition, Pearson correlation coefficients always lie between -1 and +1. Three qualification statements may be made:

- A correlation coefficient of -1 indicates a perfectly “negative” relationship, indicating that increases in the magnitude of one variable are associated with proportionate decreases in the magnitude of the other variable, and vice versa;
- A correlation coefficient of +1 indicates a perfectly “positive” relationship, indicating that the magnitudes of two variables both increase and both decrease proportionately.
- Data that are completely uncorrelated have Pearson correlation coefficients of zero.

Therefore, the sign (positive or negative) and magnitude of the Pearson correlation coefficient indicate the direction and strength, respectively, of data correlations. Generally, correlations greater than 0.75 or less than -0.75 are classified as very strong; correlation between 0.50 and 0.75 and -0.50 and -0.75 are classified as strong; and correlations between 0.25 and 0.50 and -0.25 and -0.50 are classified as moderately strong. Correlations between -0.25 and 0.25 are classified as weak.

When calculating correlations among the UATMP data, several measures were taken to identify spurious correlations and to avoid introducing bias to the correlations:

- The statistical significance of the Pearson correlation coefficients was evaluated using a standard t-test—a test commonly used for this purpose (Harnett, 1982). In this report, Pearson correlation coefficients were tested for statistical significance using the 5 percent level of significance. Whenever possible, a 95 percent confidence interval was calculated around the estimated correlation coefficient. If zero did not fall within the interval, the coefficient was considered statistically significantly different from zero.

- Data correlations were calculated only for the most program-wide prevalent compounds listed in this report. Because the UATMP monitoring data are least precise for compounds having many nondetect observations (see Section 21), eliminating the less program-wide prevalent compounds improves the correlation analysis.

- Correlations were calculated from the processed UATMP monitoring database in which each compound has just one numerical concentration for each successful sampling date. Nondetect observations, duplicate sampling events, and replicate laboratory analyses were all replaced with appropriate surrogate values. With these data quality measures, data analysts ensured that the calculated correlations characterize actual trends in the UATMP air monitoring data.

3.2 UATMP Compound Groups

The seventy-two UATMP compounds listed in section 2 are grouped into four compound groups: hydrocarbons; halogenated hydrocarbons; polar compounds; and carbonyls. Each member of the compound groups shares similar chemical makeup, as well as exhibits similar tendencies.

3.2.1 Hydrocarbons

Hydrocarbons are organic compounds that contain only carbon and hydrogen. Hydrocarbons are derived mostly from crude petroleum sources and are classified according to the arrangement of the atoms, as alicyclic, aliphatic, and aromatic. Hydrocarbons are of prime economic importance because they encompass the constituents of the major fossil fuels, petroleum and natural gas, as well as plastics, waxes, and oils. In urban air pollution, these components--along with oxides of nitrogen (NO_x) and sunlight--contribute to the formation of tropospheric ozone.

As stated above, hydrocarbons in the atmosphere originate from natural sources and from various anthropogenic sources, such as combustion of fuel and biomass, petroleum refining, petrochemical manufacturing, solvent use, and gas and oil production and use. Studies have shown that emissions from different anthropogenic sources vary significantly from location to location. For example, on a nationwide basis, EPA estimates that 50 percent of anthropogenic nonmethane volatile organic compound releases in 1996 came from industrial processes, 42 percent from transportation, 6 percent from fuel combustion, and the rest from other sources (USEPA, 1997). In urban areas, however, the estimated contributions of different source categories differ from these national averages. For instance, a 1987 study in the Los Angeles area estimated that 49 percent of nonmethane hydrocarbon emissions come from vehicle exhaust, 11 percent from liquid gasoline, 10 percent from gasoline vapor, and 30 percent from sources other than motor vehicles (Fujita et al., 1994). These figures suggest that motor vehicles may play a greater role in hydrocarbon emissions in urban areas than national statistics indicate.

3.2.2 Halogenated Hydrocarbons

Halogenated hydrocarbons are organic compounds that contain carbon, hydrogen, and halogens - the chemical group that includes chlorine, bromine, and fluorine. Most halogenated hydrocarbons are used for industrial purposes and as solvents, though some are produced naturally (Godish, 1997). Once emitted to the air, many volatile halogenated hydrocarbons resist photochemical breakdown and therefore persist in the atmosphere for relatively long periods of time (Godish, 1997; Ramamoorthy and Ramamoorthy, 1997). These compounds can cause chronic health effects as well as contribute to the formation of tropospheric ozone. Similar to hydrocarbons, only the halogenated hydrocarbons with lower molecular weights are volatile, and the sampling and analytical methods used in the 2002 UATMP measure a subset of 37 of these volatile compounds.

3.2.3 Polar Compounds

Polar compounds (i.e., oxygenated compounds such as methyl *tert*-butyl ether, methyl ethyl ketone, etc.) were added to the UATMP analyte list that already included the volatile halogenated hydrocarbons and selected hydrocarbons because of the nation-wide use of these types of compounds as gasoline additives and their toxicity. Because of the prevalence of compounds characteristic of motor vehicle emissions, any compounds used as gasoline additives would be expected to be correspondingly prevalent. Other polar compounds such as acetonitrile were added to the analyte list because the compounds were observed at high concentrations at one or more monitoring sites.

3.2.4 Carbonyl Compounds

Carbonyl compounds are organic compounds characterized by their composition of carbon, hydrogen, and oxygen, and by the presence of at least one carbon-oxygen double bond. Several different factors are known to affect ambient air concentrations of carbonyl compounds, most notably:

- Combustion sources, motor vehicles, and various industrial processes that emit carbonyl compounds directly to the atmosphere;
- Photochemical reactions that *form* carbonyl compounds in the air, typically from airborne hydrocarbons; and
- Photochemical reactions that *consume* carbonyl compounds from the air, generally by photolysis or by reaction with hydroxyl radicals (Seinfeld, 1986).

3.3 Correlations with Selected Meteorological Parameters

Ambient air concentration tendencies often correlate favorably with ambient meteorological observations. The following three sections summarize how each of the prevalent compound concentrations correlated with eight meteorological parameters: maximum daily temperature; average daily temperature; average daily dew point temperature; average daily wet bulb temperature; average daily relative humidity; average daily sea level pressure; and average wind information. Additionally, for the monitors identified as a NATTS site (Table 1-4), back trajectory analysis were performed to identify where air flow originated 24 and 48 hours prior to being sampled.

3.3.1 Maximum and Average Temperature

Temperature is often a component of high ambient air concentrations for some compounds, such as ozone. The temperature will help speed up the kinetics as compounds react with each other. According to Table 3-5, the program-wide prevalent compounds had mostly weak correlations with maximum temperature and average temperature. Formaldehyde had the strongest correlation with maximum temperature (0.39), as well as the strongest correlation with average temperature (0.37).

The poor correlation across the majority of the sites is not surprising due to the complex and diverse local meteorology associated within the monitoring locations. In the previous UATMP report, 43 sites are spread across eleven states and one U.S. territory. For this report, 56 sites are spread across sixteen states and one U.S. territory. As discussed in Sections 4 through 20, the temperature parameters correlate much better at certain individual sites.

3.3.2 Moisture Parameters

Three moisture parameters were used in this study for correlation with the prevalent compounds. The *dew point temperature* is the temperature to which moist air must be cooled for it to reach saturation with respect to water. The *wet-bulb temperature* is the temperature to which moist air must be cooled by evaporating water into it at constant pressure until saturation is reached. The *relative humidity* is the ratio of the mixing ratio to its saturation value at the same temperature and pressure (Rogers and Yau, 1989). All three of these parameters provide an indication of how much moisture is presently in the air.

As can be seen in Table 3-5, the three moisture parameters had mostly weak correlations with the prevalent compounds. Only dew point and wet bulb temperatures had correlations greater than 0.25 or less than -0.25 (with acetylene, chloromethane, and formaldehyde). The sites used for sampling in this program year were located in different climatic zones ranging from a desert climate (Arizona) to a very moist climate (Puerto Rico). Chloromethane concentrations had the strongest correlation with dew point and wet bulb temperatures (0.31 with dew point temperature and 0.33 with wet-bulb temperature). As discussed in Sections 4 through 20, the moisture parameters correlate much better at certain individual sites.

3.3.3 Wind and Pressure Information

Surface wind observations include two primary components: wind speed and wind direction. *Wind speed*, by itself, is a scalar value and is usually measured in nautical miles or knots. *Wind direction* describes where the wind is coming from, and is measured in degrees where 0° is from the north, 90° is from the east, 180° is from the south, and 270° is from the west. Together, the wind speed and wind direction are described as a vector, and the hourly values can now be averaged.

The *u-component* of the wind speed is the vector value traveling toward the x-axis in a Cartesian grid coordinate system. The u-component is calculated as follows:

u-component = -1* (wind speed) * sin(wind direction, degrees)

Similarly, the *v-component* of the wind speed is the vector value traveling toward the y-axis in a Cartesian grid coordinate system. The v-component is calculated as follows:

v-component = -1* (wind speed) * cos(wind direction, degrees)

Using the u- and v- components of the wind speed allows averaging and correlation analyses with the measured concentrations.

As shown in Table 3-5, the u- and v- components of the wind speed have very weak correlations with the prevalent compounds across all sites, which is consistent with the temperature and moisture parameter observations. Geographical features such as mountains or valleys influence wind speed and wind direction. The sites used for sampling in the 2002 program year were located in different geographic zones ranging from a mountainous region (Colorado) to a plains region (Iowa). Additionally, sites located downwind may correlate better with the measured concentrations than sites upwind. Formaldehyde concentrations had the strongest correlation with the u-component of the wind speed (-0.14), while chloromethane had the strongest correlation with the v-component of the wind speed (0.09). As discussed in Sections 4 through 20, the u- and v- components correlate much better at certain individual sites.

Wind is created through changes in pressure. The magnitude of the pressure difference (or pressure gradient) over an area is directly proportional to the magnitude of the wind speed. The direction of the wind flow is governed by the direction of the pressure gradient. Sea level pressure is the local station pressure corrected for elevation, in effect bringing all geographic locations down to sea-level, thus making different topographical areas comparable.

Overall, sea level pressure correlated weakly with ambient concentration. The strongest positive correlation occurred with acetylene (0.15), while the strongest negative correlation occurred with chloromethane and formaldehyde (-0.10).

3.4 The Impact of Motor Vehicle Emissions on Spatial Variations

Motor vehicles contribute significantly to air pollution in urban environments. Pollutants found in motor vehicle exhaust generally result from incomplete combustion of vehicle fuels. Although modern vehicles and, more recently, vehicle fuels have been engineered to minimize air emissions, all motor vehicles with internal combustion engines emit a wide range of chemical pollutants. The magnitude of these emissions in urban areas primarily depends on the volume of traffic, while the chemical profile of these emissions depends more on vehicle design and fuel content. This report uses three parameters to evaluate the impact of motor vehicle emissions on ambient air quality:

- Estimated motor vehicle ownership data;
- Motor vehicle emissions profiles; and
- Estimated daily traffic estimates.

3.4.1 Motor Vehicle Ownership Data

As an indicator of motor vehicle emissions near the UATMP monitoring locations, Table 3-6 presents estimates of the number of cars owned by residents within 10 miles of each monitoring location. The total number of motor vehicles owned within a 10-mile radius was estimated based on a ratio of 0.74 cars per person (U.S. population estimate of 288,368,968 and total number of motor vehicles in U.S. of 213,393,036).

For purposes of comparison, both motor vehicle ownership data and the geometric mean of total program-wide prevalent hydrocarbons are presented in Table 3-6. The data in the table indicate a positive linear correlation between motor vehicle ownership and ambient air concentrations of hydrocarbons. However, readers should keep in mind other factors that might impact the reliability of motor vehicle ownership data as an indicator of ambient air monitoring data results:

- Estimates of higher car ownership within a 10-mile radius do not necessarily imply increased motor vehicle use in the immediate vicinity of a monitoring location. Conversely, sparsely populated regions often contain heavily traveled roadways.
- Emissions sources in the area other than motor vehicles may significantly affect levels of hydrocarbons in the ambient air.

3.4.2 Motor Vehicles Emissions Profiles

The *magnitude* of emissions from motor vehicles generally depends on the volume of traffic in urban areas, but the *composition* of these emissions depends more on vehicle design. Because the distribution of vehicle design (i.e., the relative number of motor vehicles of different styles) is probably quite similar from one urban area to the next, the composition of air pollution resulting from motor vehicle emissions is not expected to exhibit significant spatial variations. In support of this hypothesis, previous air monitoring studies have observed relatively constant composition of ambient air samples collected along heavily traveled urban roadways (Conner et al., 1995). Roadside studies have found particularly consistent proportions of four hydrocarbons (benzene, toluene, ethylbenzene, and the xylene isomers - the “BTEX” compounds) both in motor vehicle exhaust and in ambient air near roadways.

To examine the impact of motor vehicle emissions on air quality at the 2002 UATMP monitoring sites, Figure 3-14 compares concentration ratios for the BTEX compounds measured during the 2002 UATMP to the ratios reported in a roadside study (Conner et al., 1995). This comparison provides a qualitative depiction of how greatly motor vehicle emissions affect air quality at the UATMP monitoring locations: the more similar the concentration ratios at a particular monitoring location are to those of the roadside study, the more likely that motor vehicle emissions impact ambient levels of hydrocarbons at that location.

As Figure 3-14 shows, the concentration ratios for BTEX compounds measured at nearly every UATMP monitoring station bear some resemblance to the ratios reported in the roadside study. The BTEX ratios at the CHNJ monitoring site appear to be the most similar to the roadside study profile. For all monitoring locations the toluene:ethylbenzene ratio is clearly the largest value of the four ratios, with the exceptions of QVAZ and YFMI; the *o*-xylene:ethylbenzene ratio is clearly the smallest value of the ratios, with the exceptions of BAPR, LINE, NBNJ, PGMS, QVAZ, and UNVT. These observations suggest, though certainly do not prove, that emissions from motor vehicles significantly affect levels of hydrocarbons in urban ambient air.

3.4.3 Estimated Traffic Data

When a site is being characterized, a parameter often recorded is the number of vehicles which daily pass the monitor. For 47 of the fifty-six UATMP monitors, traffic data were available; for the unknown traffic data count, local agencies were contacted to provide an estimation. Table 3-6 contains the estimated daily traffic values, as well as county-level on-road and non-road HAP (Hazardous Air Pollutant) emissions.

The highest traffic volume occurs at the DBFL site, with over 200,000 vehicles passing by this monitor. However, hydrocarbons were not measured at this site. For the sites that measured hydrocarbons, both ELNJ and LOMI experienced the highest amounts of traffic, yet their hydrocarbon geometric means rank 13th and 32nd across the sites, respectively. The highest geometric means were at G2CO, E7MI, and SPQZ, yet the traffic count is ranked 31ST, 24th, and

7th, respectively. Specific characterizations for these sites appear in the separate state sections. Estimated on-road county emissions were highest in Wayne County, MI, which is the location of six UATMP sites: APMI, DEMI, E7MI, RRMI, SWMI, and YFMI. Although hydrocarbon geometric means in Wayne County varied from 4.51 ppbv (RRMI) to 16.44 ppbv (E7MI), the highest exposure to traffic occurred at the APMI site. Estimated non-road county emissions were highest in Maricopa County, AZ, which is the location of two UATMP sites: PSAZ and SPAZ. Non-road emission sources include, but are not limited to, activities from airplanes, construction vehicles, and lawn and garden equipment. There does not appear to be any direct correlation between traffic counts and geometric hydrocarbon concentrations.

3.5 Variability Analysis

Two types of variability were analyzed for this report. The first type examines the coefficient of variation analysis for each of the prevalent compounds across the UATMP sites. Figures 3-15 to 3-26 are graphical displays of site standard deviation versus average concentration. Most of the prevalent compounds are either in a cluster (such as benzene), exhibit a positive linear correlation (such as propylene), or are spread randomly (such as toluene). The coefficient of variation provides a relative measure of variability by expressing variations to the magnitude of the arithmetic mean. This analysis is better suited for comparing variability across data distributions for different sites and compounds.

Seasonal variability was the second type of variability analyzed in this report. The UATMP concentration data were divided into the four seasons: spring (March, April, May); summer (June, July, August); fall (September, October, November); and winter (December, January, and February). Figures 3-27 to 3-38 provide a graphical display of the average concentrations by season for the prevalent compounds.

Higher concentration of the prevalent compounds were sampled in winter, although summer and fall were close. Spring is the season where the lowest concentrations were measured. Some compound-specific trends were also noted, such as high concentration of: 1) acetylene and benzene were sampled in winter; 2) chloromethane and formaldehyde in summer; and 3) dichlorodifluoromethane and trichlorofluoromethane in autumn. However, a quick review of the profiles reveals most compounds experienced noticeable "spikes" across all sites, while few exhibited a relatively uniform profile (chloromethane, for example). This observation validates the variabilities for each of the sites.

3.6 UATMP NATTS Sites

Additional analyses were provided on the EPA-designated pilot sites. These sites will be used by EPA as participants in the National Air Toxics Trends System (NATTS), which will be a national monitoring network of air toxic monitors. The monitors will be used to evaluate air quality, similar to the National Ambient Air Quality Standard (NAAQS) monitors that measure criteria pollutants. The two additional analyses are: 1) back trajectory analysis; and 2) federal regulation analysis (NATTS sites are designated in bold in Table 2-2).

3.6.1 Back Trajectory Analysis

A back trajectory analysis traces the origin of an air parcel in relation to the location where it is currently being examined. The method of constructing a back trajectory uses the Lagrangian frame of reference. In simplest terms, an air parcel can be traced back one hour to a new point of reference based on the current measured wind speed and direction. At this new point of reference that is now one hour prior to the current observation, the wind speed and direction are used again to determine where the air was one hour before. Each time segment is referred to as a "time step." Typical back trajectories go 24- to 48- hours prior using surface and upper air meteorological observations, which is what was used for this report. Back trajectory calculations are also governed by other meteorological parameters, such as pressure and temperature.

Gridded meteorological data and the model used for back trajectory analyses were prepared and developed by the National Oceanic and Atmospheric Administration (NOAA). The model used is the Hybrid Single-Particle Lagrangian Integrated Trajectory (HYSPLIT). More information on the model can be found at http://www.arl.noaa.gov/ready/hysplit4.html. The meteorological data represented the 2002 sampling year. Back trajectories were constructed

24- and 48-hours prior to the sampling day, and a wind regime designation was assigned to characterize the general location for the origin of the sampled air parcel. The eight wind regimes are similar to the classifications of a standard eight-point compass (north, northeast, east, etc.). The individual state section discusses these results in full detail.

3.6.2 Federal Regulation Analysis

As stated earlier, urban air toxics are emitted from a variety of stationary industrial and commercial processes and mobile sources. Many of these emission sources in the areas surrounding the monitoring stations are already subject to emission limitations. Consequently, the ambient concentrations of UATMP compounds recorded at the monitoring stations reflect, to some degree, the emission limitations achieved by facilities and mobile sources in response to existing air regulations. As additional regulations are implemented, the concentrations of urban air toxic compounds in the ambient air surrounding the monitoring stations should decrease as facilities and mobile sources achieve compliance with the new regulations.

3.6.2.1 Regulations for Stationary Sources

The national regulations that have the potential to reduce emissions of UATMP pollutants from stationary sources are grouped into two categories: standards for VOC developed under section 183(e) of the Clean Air Act (CAA) (Federal Ozone Measures, Control of Emissions From Certain Sources), and standards for air toxics developed under section 112(d) of the CAA (Hazardous Air Pollutants, Emission Standards).

As required by section 183 of the CAA, EPA conducted a study of VOC emissions from consumer and commercial products and developed categories of products that account for at least 80 percent of the total VOC emissions (on a reactivity-adjusted basis) in areas that violate the national ambient air quality standards (NAAQS) for ground-level ozone. The EPA divided the list into four groups for developing regulations based on the best available controls (as defined by the CAA). In March 1995, EPA included architectural coatings, automobile refinishing, consumer products, and commercial products among the highest priority consumer and commercial product categories listed for regulation. Table 3-7 provides a brief summary of the national VOC regulations.

As required by section 112 of the CAA, EPA published a list of industrial source categories that emit one or more of the 188 air toxics (listed in the section 112(b) of the CAA). (The initial list was published on July 16, 1992 and has undergone several revisions since that date.). The EPA has developed (or is in the process of developing) standards for all major sources (those that emit 10 tons/year or more of a listed pollutant or 25 tons/year or more of a combination of listed pollutants) of air toxics and some area sources that are of particular concern. Currently, the EPA has promulgated 56 national emission standards for hazardous air pollutants (NESHAP) and proposed 31 NESHAP to regulate air toxic emissions from the listed source categories. Table 3-8 provides an overview of the NESHAP that were identified during this analysis.

3.6.2.2 Mobile Sources

For mobile sources, there are two applicable programs that have the potential to reduce ambient concentrations of UATMP pollutants: National Low Emissions Vehicles (NLEV)and PhaseII Reformulated Gasoline (RFG).

The NLEV program is a voluntary nationwide program designed to reduce non-methane organic compound (NMOC) emissions and NO_x emissions from new cars. The NLEV program is also expected to reduce emissions of air toxics such as benzene, formaldehyde, acetaldehyde, and 1,3-butadiene. The program started in the northeastern states that are part of the Ozone Transport Commission (OTC) in model year 1999 and nationally in 2001. The standards are enforceable in the same manner that other federal motor vehicle emissions control requirements are enforceable.

Under the NLEV program, car manufacturers voluntarily agreed to meet tailpipe standards for cars and light-duty trucks that are more stringent than EPA can mandate prior to model year 2004. The EPA projects that vehicles produced under the NLEV program will be approximately 70 percent cleaner than 1998 model year cars. These cleaner vehicles will achieved reductions of approximately 311 tons of VOC per day in 2007 (based on a program start date of model year 1999 in the Northeast and model year 2001 nationwide).

For some areas of the country that exceed the national air quality standard for ozone, the Clean Air Act (CAA) requires that gasoline that had been “reformulated” to achieve reductions in ozone-forming compounds and toxic air pollutants be made commercially available. For gasoline to be considered reformulated, it must have an oxygen content of at least 2.0 percent by weight, a benzene content no greater than 1.0 percent by volume, and no heavy metals. The use of RFG has been implemented in two phases. Phase I began in January 1, 1995 and Phase II began in 2000. Emissions of VOC and air toxics from vehicles using Phase I RFG are projected to be 15 percent less than those that would occur from the use of conventional gasoline. For vehicles using Phase II RFG, VOC and air toxics are reduced by an additional 20 to 25 percent.

3.6.2.3 Regulation Analysis

To assess the potential reduction in ambient concentrations of UATMP compounds attributable to future regulations, an analysis of the facilities, emissions, and potentially applicable regulations was conducted for the areas surrounding each of the pilot monitoring stations. For this analysis, a list of stationary facilities that emit UATMP compounds within a 10-mile radius of each monitoring station was obtained from the National Emissions Inventory for HAPs database. The list of facilities from the NEI database was restricted to those facilities that account for approximately the top 90 percent of the UATMP pollutant emissions in the 10-mile areas.

For these facilities, the various air regulations were reviewed to determine if they could potentially be applicable. The regulations reviewed were limited to those with compliance dates that occur after 1999. This date was selected to coincide with the year of the emissions data in the NTI database. Regulations with earlier compliance dates would already be in place and no future emission reduction would be achieved. For this analysis, Standards of Performance for New Sources (NSPS) were not included since projections of new source construction are not available for the target areas. Additionally, since data on traffic patterns around the monitoring stations are not available, projections of the emission trends associated with the mobile source regulations were also not included in this analysis.

To determine the applicability of the various regulations to the facilities in the 10-mile areas, the type of process or operation in use at each facility was obtained from the standard industrial classification (SIC) codes in the NEI database. Additionally, searches of facility names were conducted on the World Wide Web to obtain additional information regarding a facility's activities. For the NESHAP, the preambles that accompany the promulgated regulations typically identify the SIC codes for the industrial categories and entities that are potentially subject to the NESHAP. Consequently, the SIC codes were used directly to assign NESHAP to specific facilities. Unlike the NESHAP, the preambles to the national VOC regulations do not explicitly identify the SIC codes to which the rules apply. Rather, the general types of manufacturers or products that the rules are expected to cover are identified in the preambles. Consequently, the VOC regulations were assigned using facility names, supplemented by descriptive information obtained from web searches of the facility names.

To determine the potential emission reductions attributable to the regulations, the average emission reductions that are expected to be achieved by the regulations were obtained from the rule preambles. These average emission reductions were applied to the urban air toxic compounds covered by the particular regulation. For example, if a regulation covered emissions of toluene and xylene and the rule was projected to achieve an average emission reduction of 60 percent, then the toluene and xylene emissions from facilities potentially subject to that rule were reduced by 60 percent.

For each of the individual monitoring stations, the major contributors to emissions of UATMP HAP pollutants and the expected trend in emissions are discussed fully in the individual state sections. Table 3-9 provides a summary of the pollutants and sources regulated for the NATTS sites.

3.7 Metals Analysis

Figure 3-39 is a profile of the average metals concentrations that were sampled during the 2002 UATMP. Six sites opted to sample for metal compounds, of which five are located in Colorado (DECO, SWCO, WECO, GJCO, and G2CO). The sixth is located in Detroit, Michigan (SWMI). (Only GJCO and G2CO sampled for metals during the 2001 program year). WECO and SWCO (216,331 and 172,142 ng/filter, respectively) had the highest metal concentrations of all six sites. These Denver sites are located relatively close to each other, although in separate counties. GJCO had a considerably lower average concentration when compared to the other sites (56,464 ng/filter). G2CO had a significantly higher average metal concentration than GJCO, nearly three times as much. Interestingly, GJCO is located to the north of G2CO, in a less urban area, whereas G2CO is located near a major highway and in a more industrial part of town.

3.8 Trends Analysis

Table 2-1 represents past UATMP participation for sites also participating in this year's program. For sites that participated prior to 2001 and are still participants through the 2002 program year, a trends analysis was conducted. Sites included in the analysis are: BUND (1999-2003); CANJ (1994-2003); DAIA (2000-2003); DECO (2000-2003); DMIA (2000-2003); ELNJ (2000-2003); SFSD (2000-2003); and SLCU (1999-2003). The trends analyzed are annual averages and seasonal averages at each site for three compounds, 1,3-butadiene, benzene, and formaldehyde.

3.8.1 Trends in Annual Averages

Figures 3-40a thru 3-40h show a comparison of the yearly average concentrations of 1,3-butadiene, benzene, and formaldehyde for each of the eight sites. At each site analyzed, formaldehyde consistently had the highest average annual concentrations while 1,3-butadiene consistently had the lowest.

Of the eight sites, DMIA measured the highest average annual formaldehyde concentrations, with 2001 having the highest average concentration. Formaldehyde concentrations were highest in 2001 for three of the seven sites (SFSD did not sample for carbonyls until 2002). For CANJ, the site with the most years of participation, the highest average annual formaldehyde concentration was sampled in 1997.

Average annual concentrations of 1,3-butadiene were highest at SLCU. It is important to note that samples of this compound were consistently below the method detection limit (MDL), resulting in low average concentrations for this compound. The highest average 1,3-butadiene concentrations were generally after 1999. CANJ sampled its highest average 1,3-butadiene concentration in 1998.

Average annual concentrations of benzene were highest at DECO and SLCU. Average benzene concentrations were greater than 1.00 ppbv during 2000 at DECO and both 1999 and 2000 for SLCU. The distribution of the highest average benzene concentrations for the sites was spread fairly evenly across the years. CANJ sampled its highest average benzene concentration in 1998.

3.8.2 Trends in Seasonal Averages

Figures 3-41a thru 3-41h show a comparison of the seasonal average concentrations for each year of participation for each of the eight sites. Again, average formaldehyde concentrations were the highest of the three compounds for each site, year, and season, while 1,3-butadiene had the lowest. For 1,3-butadiene and benzene, the seasons with the highest average concentrations tended to be autumn and winter. For formaldehyde, the seasons with the highest average concentrations tended to be summer and autumn.

Figure 3-1a. Comparison of the Geometric Means of the Compound Groups (ANTX-HOMI)

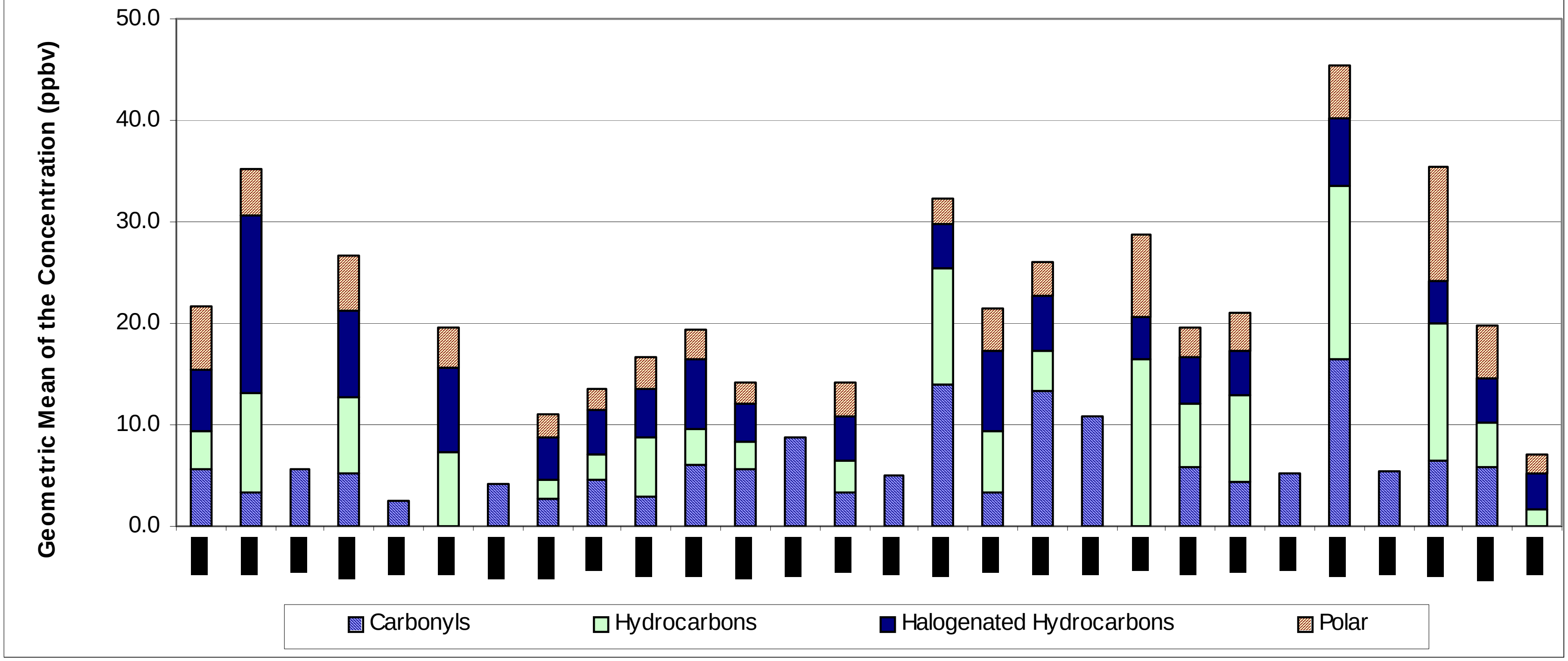


Figure 3-1b. Comparison of the Geometric Means of the Compound Groups (JAMS-YFMI)

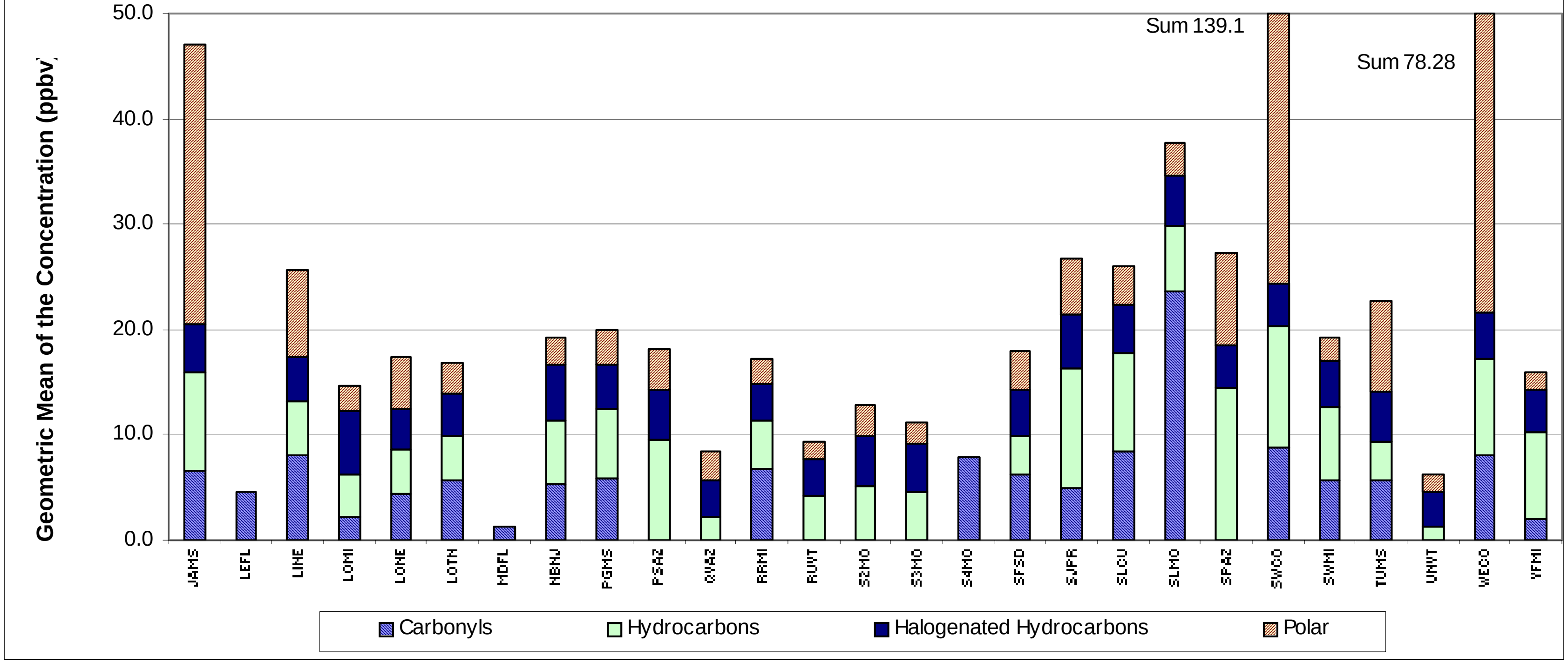


Figure 3-2. Geometric Mean of 1,2,4-Trimethylbenzene by Monitoring Location

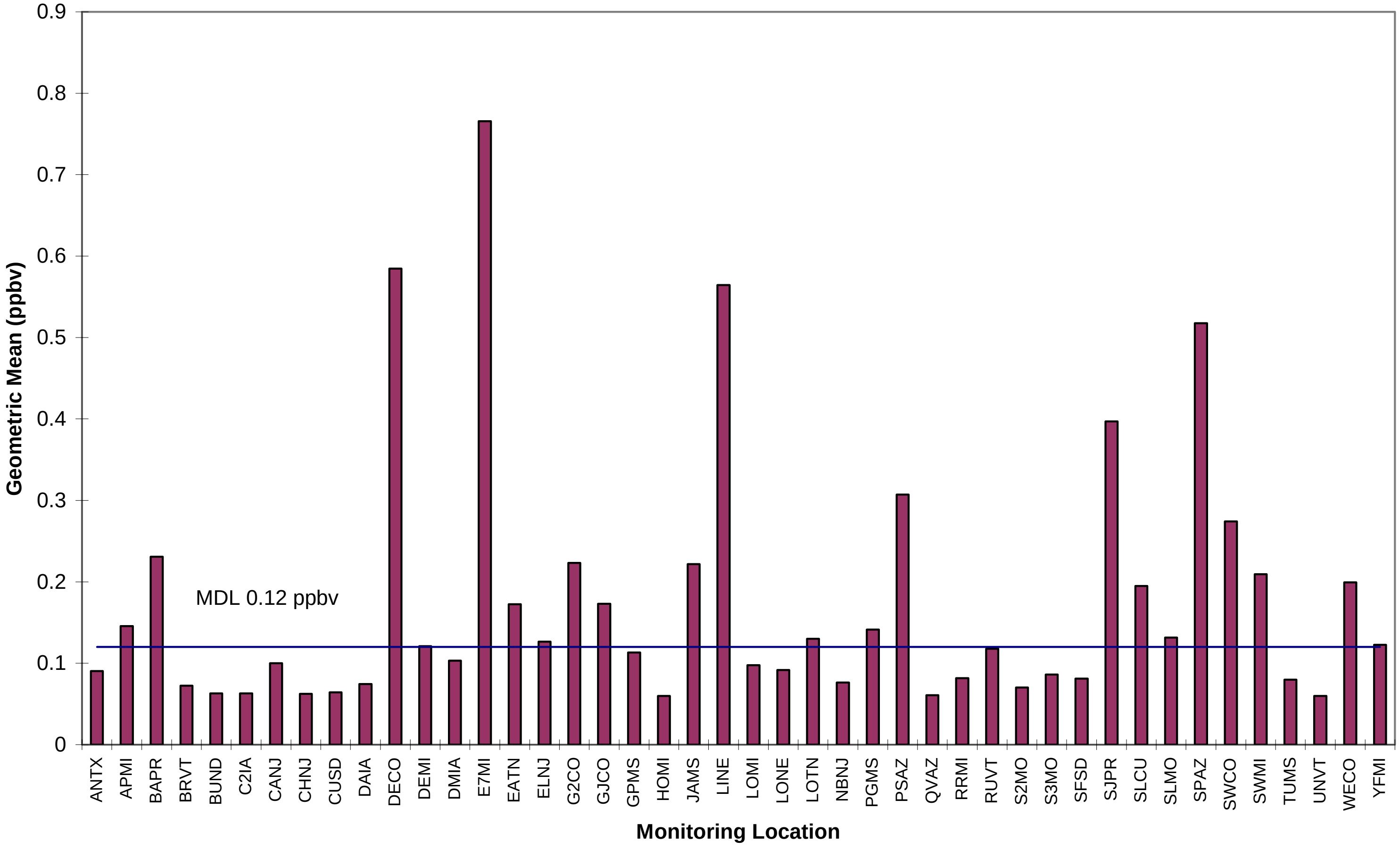


Figure 3-3. Geometric Mean of Acetylene by Monitoring Location

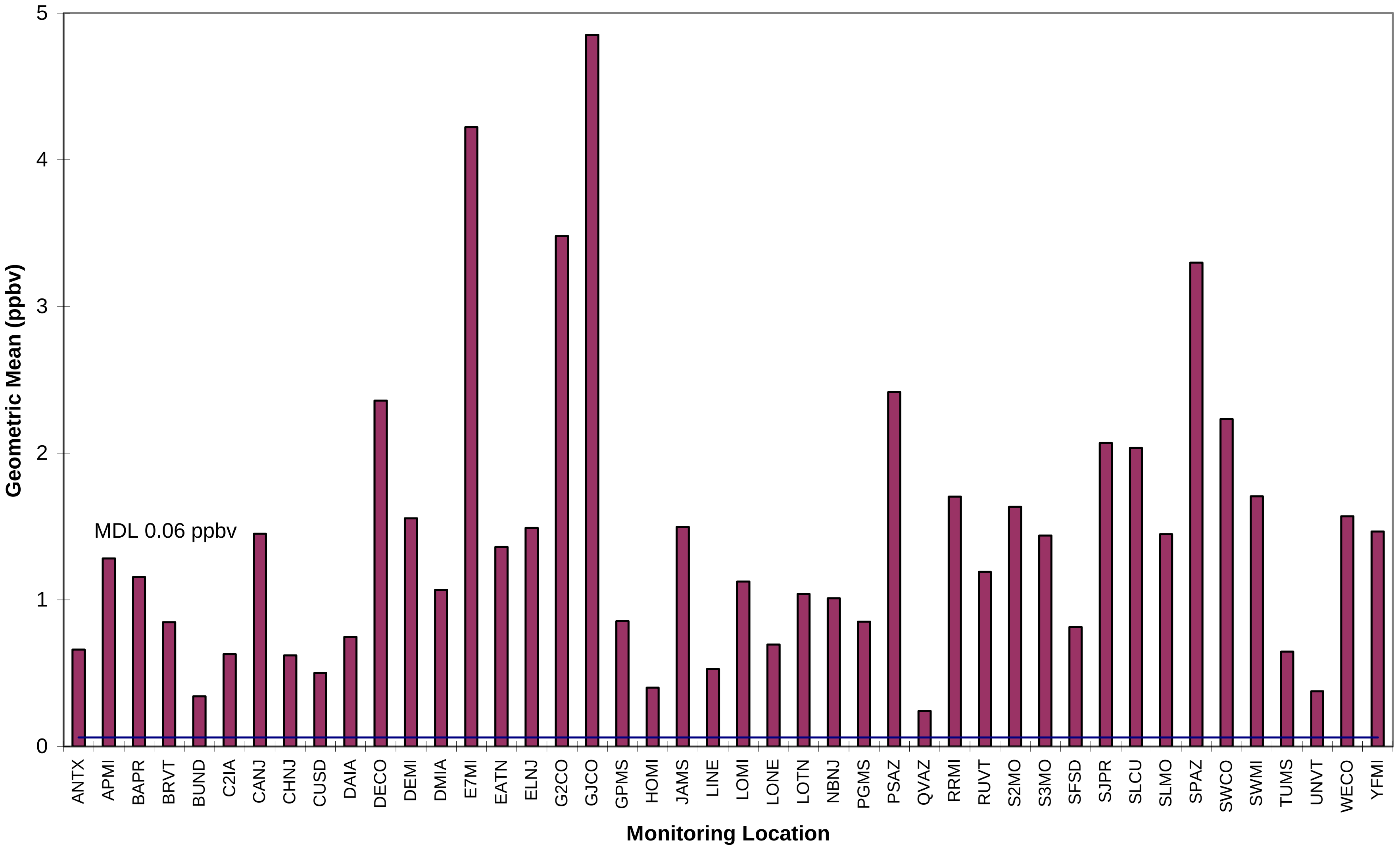


Figure 3-4. Geometric Mean of Benzene by Monitoring Location

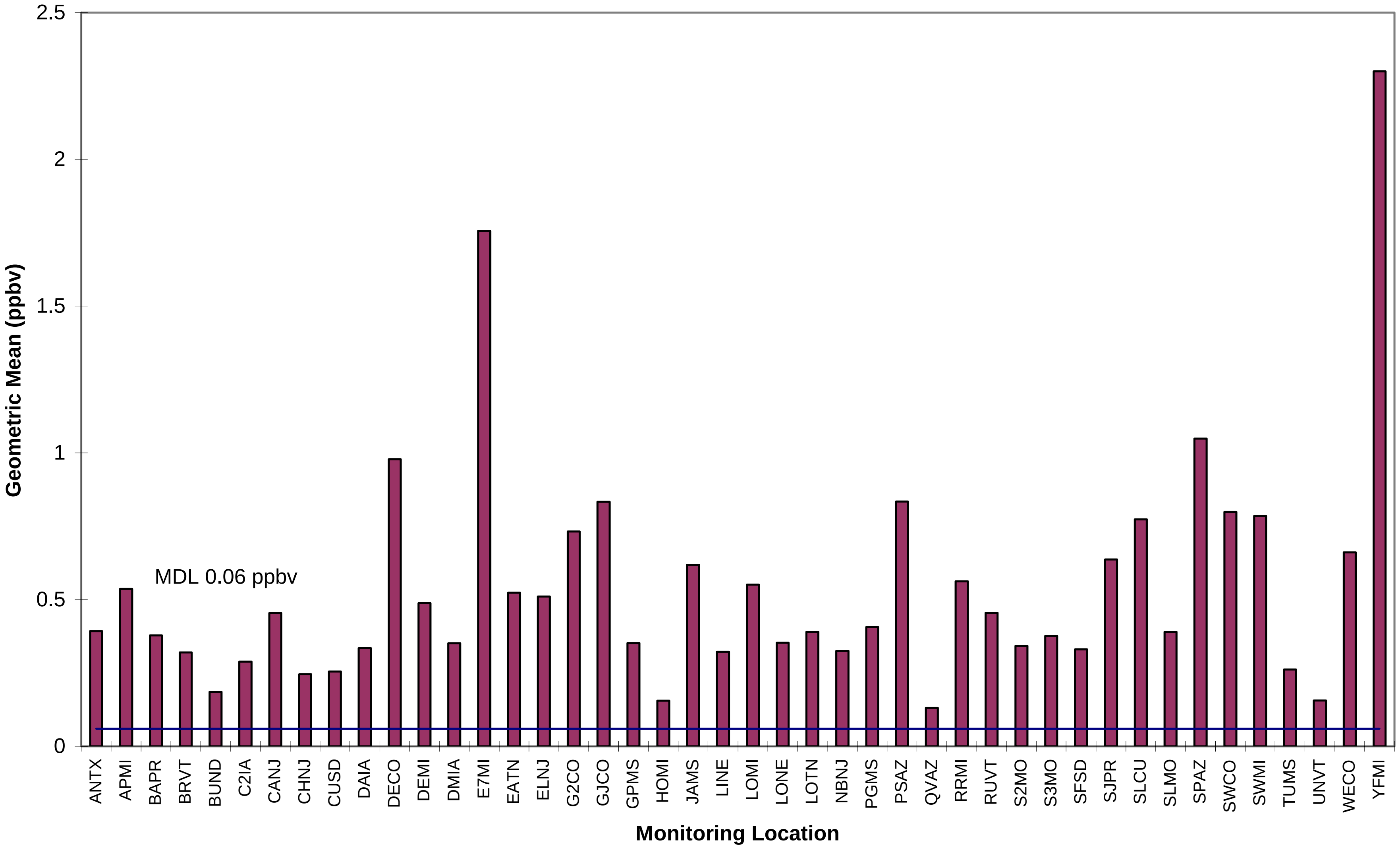


Figure 3-5. Geometric Mean of Chloromethane by Monitoring Location

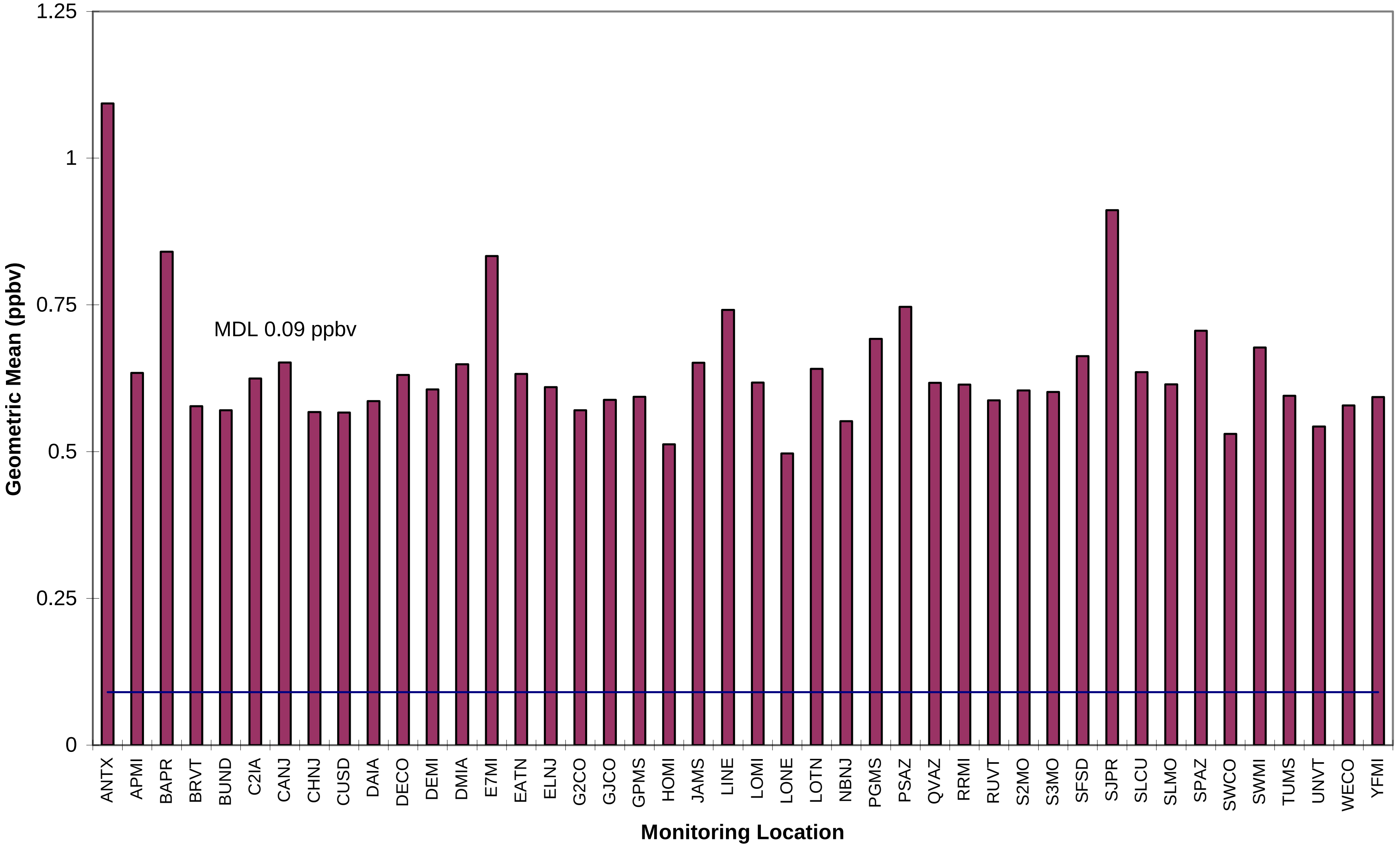


Figure 3-6. Geometric Mean of Dichlorodifluoromethane by Monitoring Location

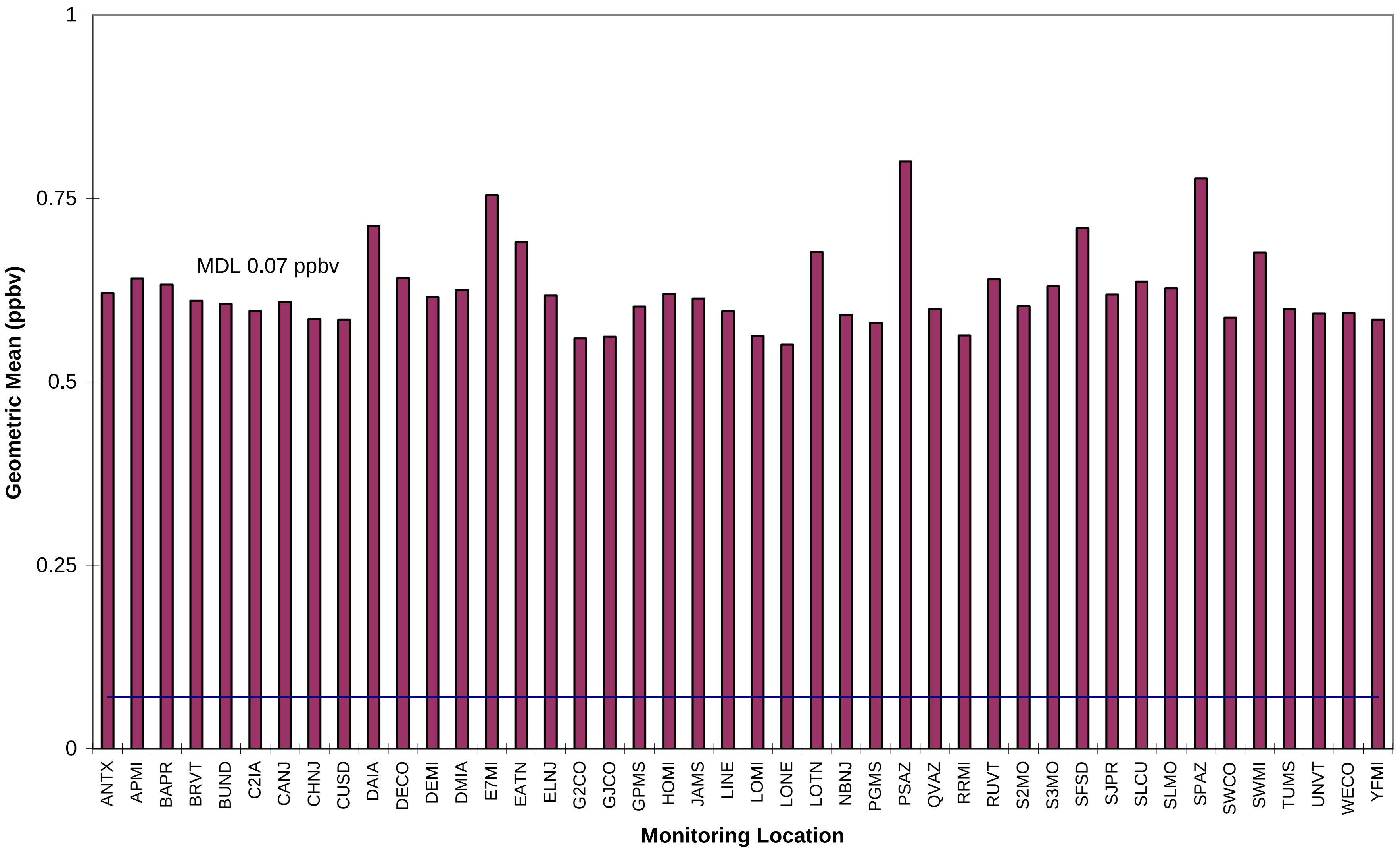


Figure 3-7. Geometric Mean of Ethylbenzene by Monitoring Location

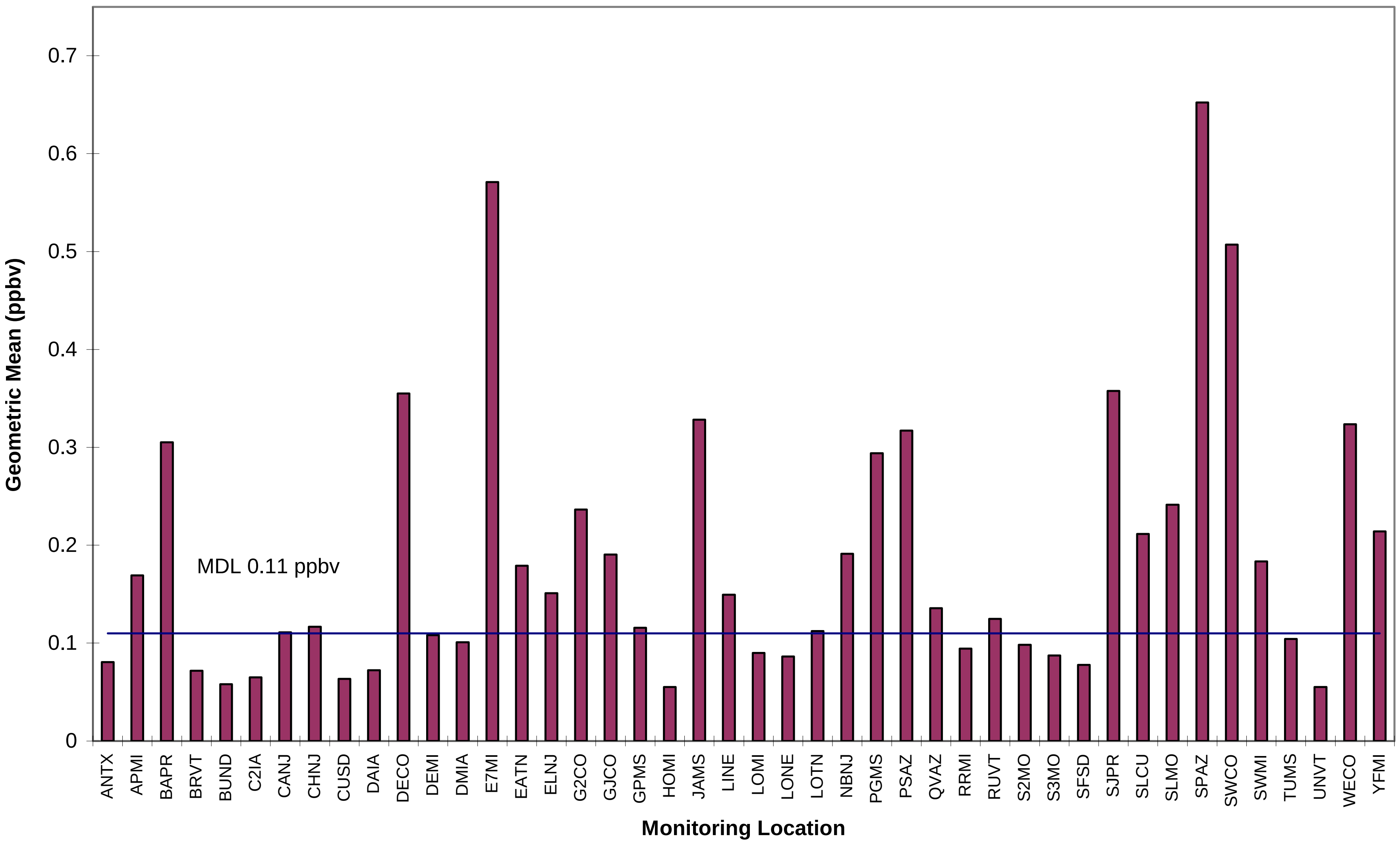


Figure 3-8. Geometric Mean of Formaldehyde by Monitoring Location

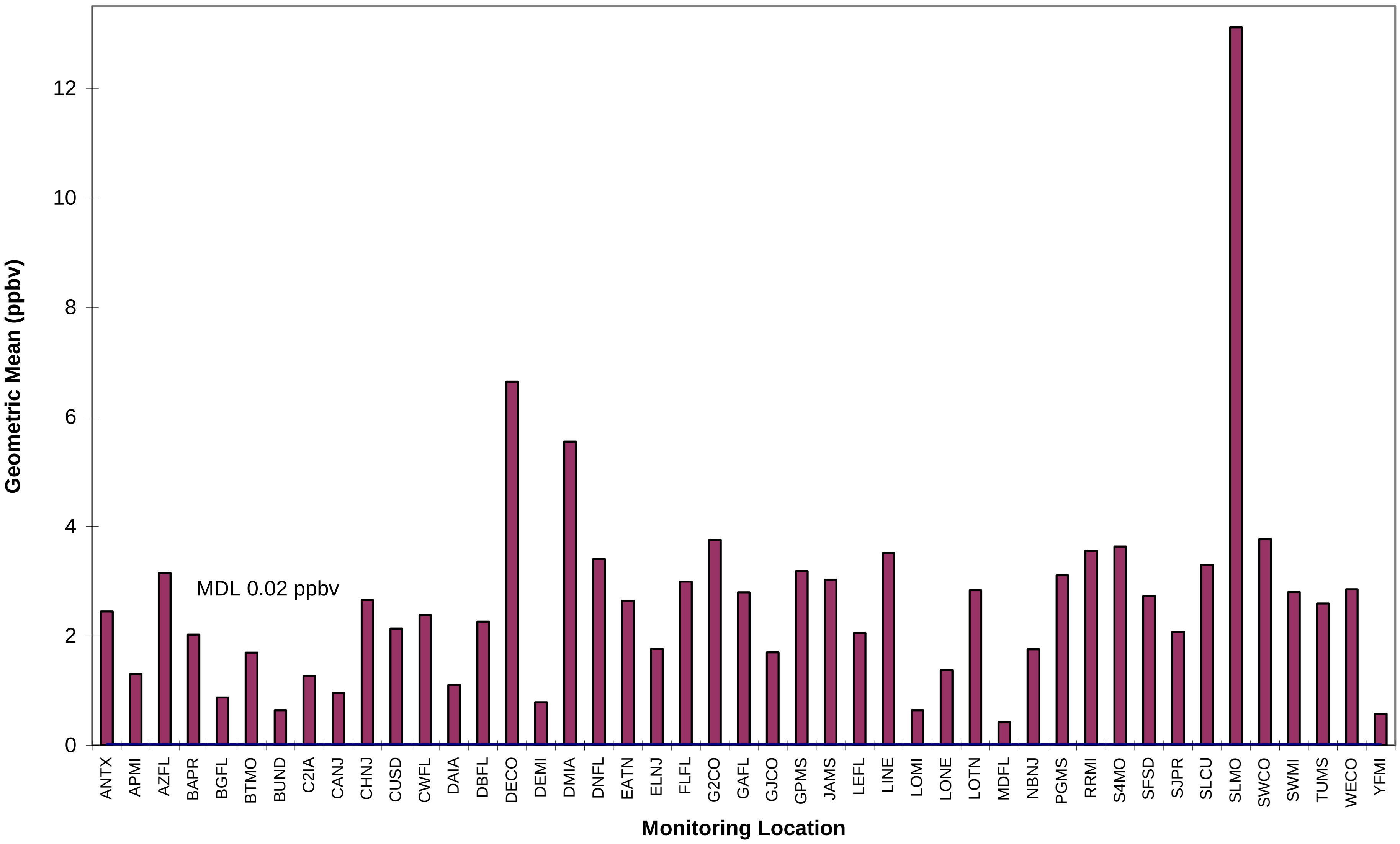


Figure 3-9. Geometric Mean of *m,p-* Xylene by Monitoring Location

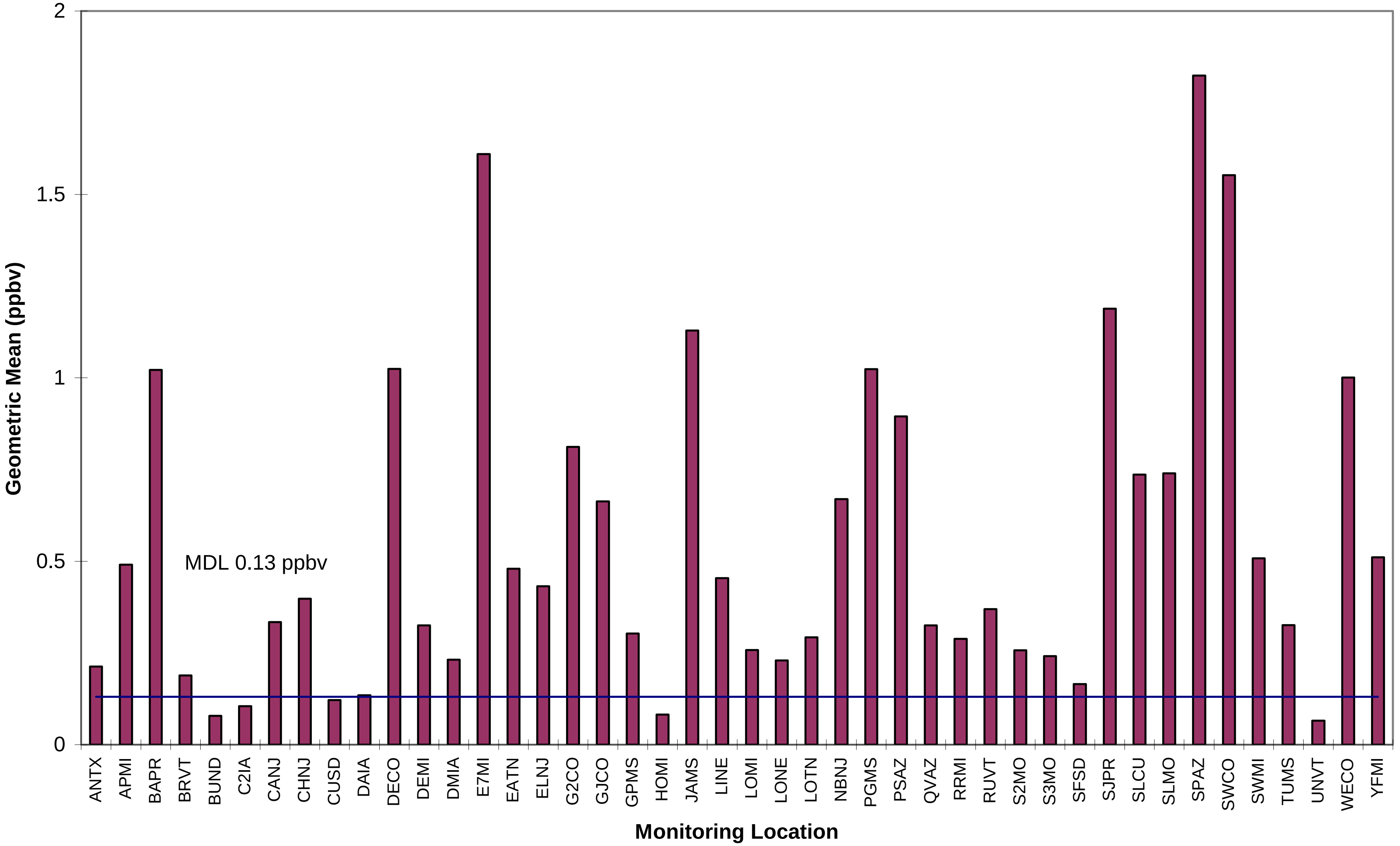


Figure 3-10. Geometric Mean of *o*- Xylene by Monitoring Location

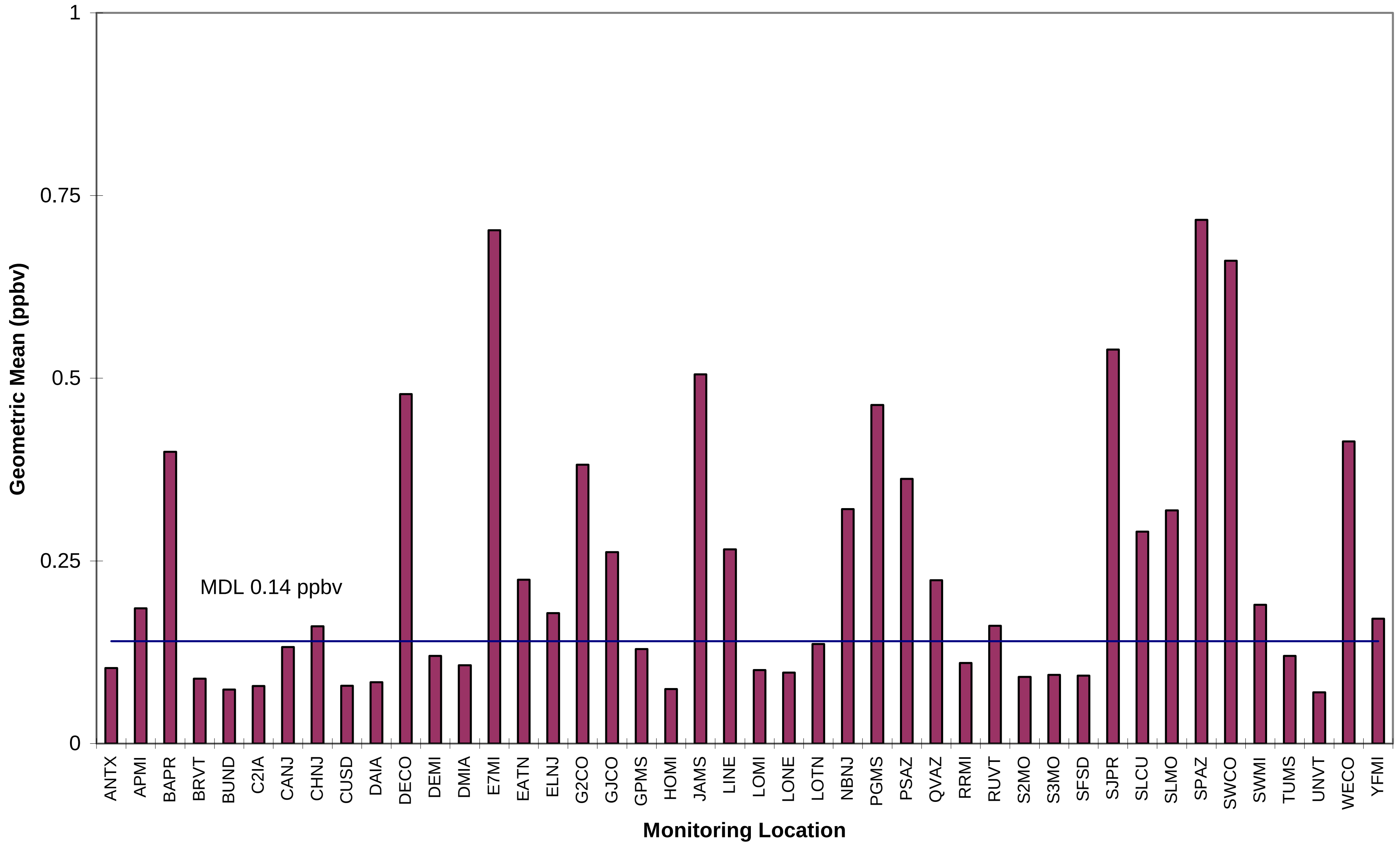


Figure 3-11. Geometric Mean of Propylene by Monitoring Location

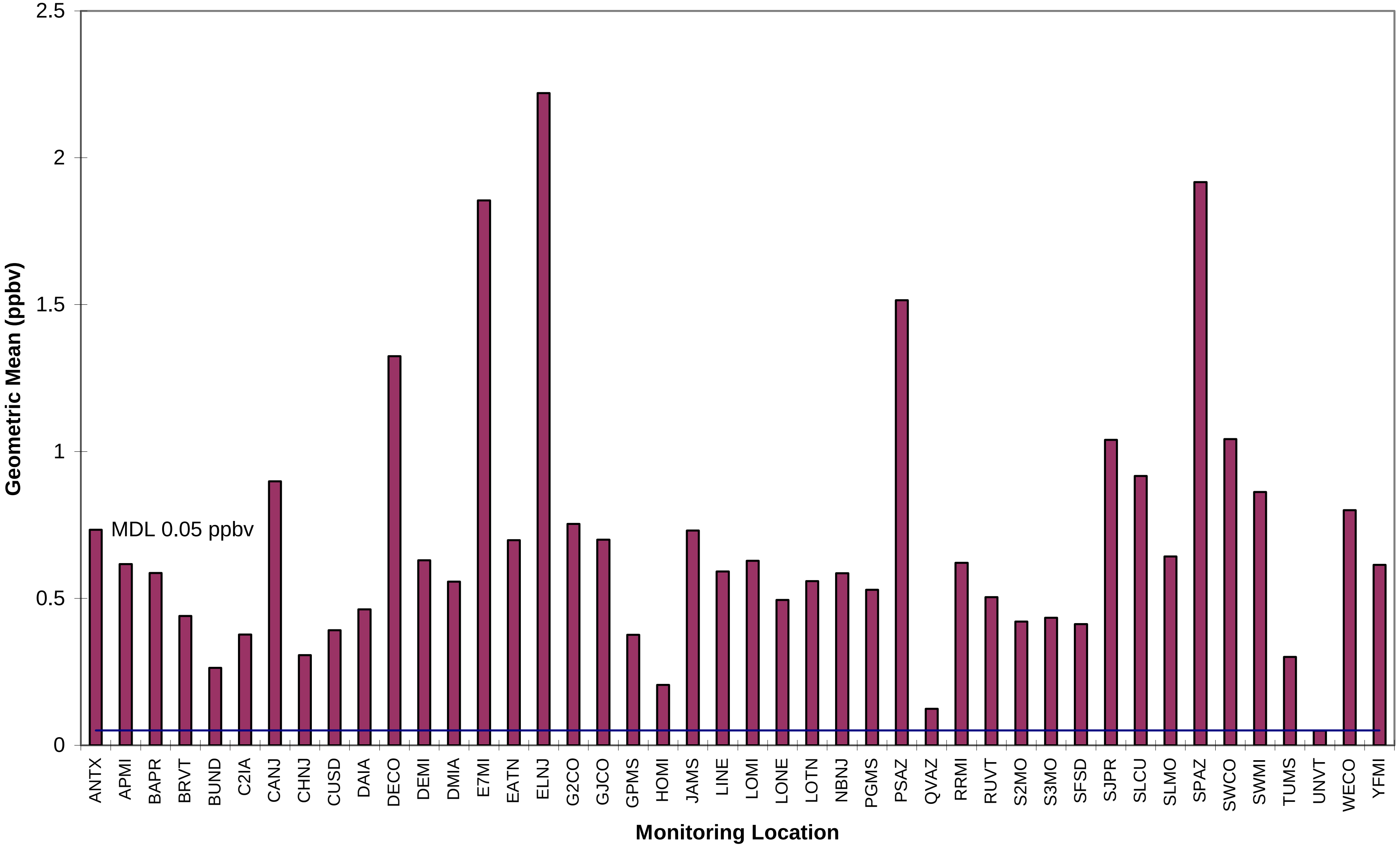


Figure 3-12. Geometric Mean of Toluene by Monitoring Location

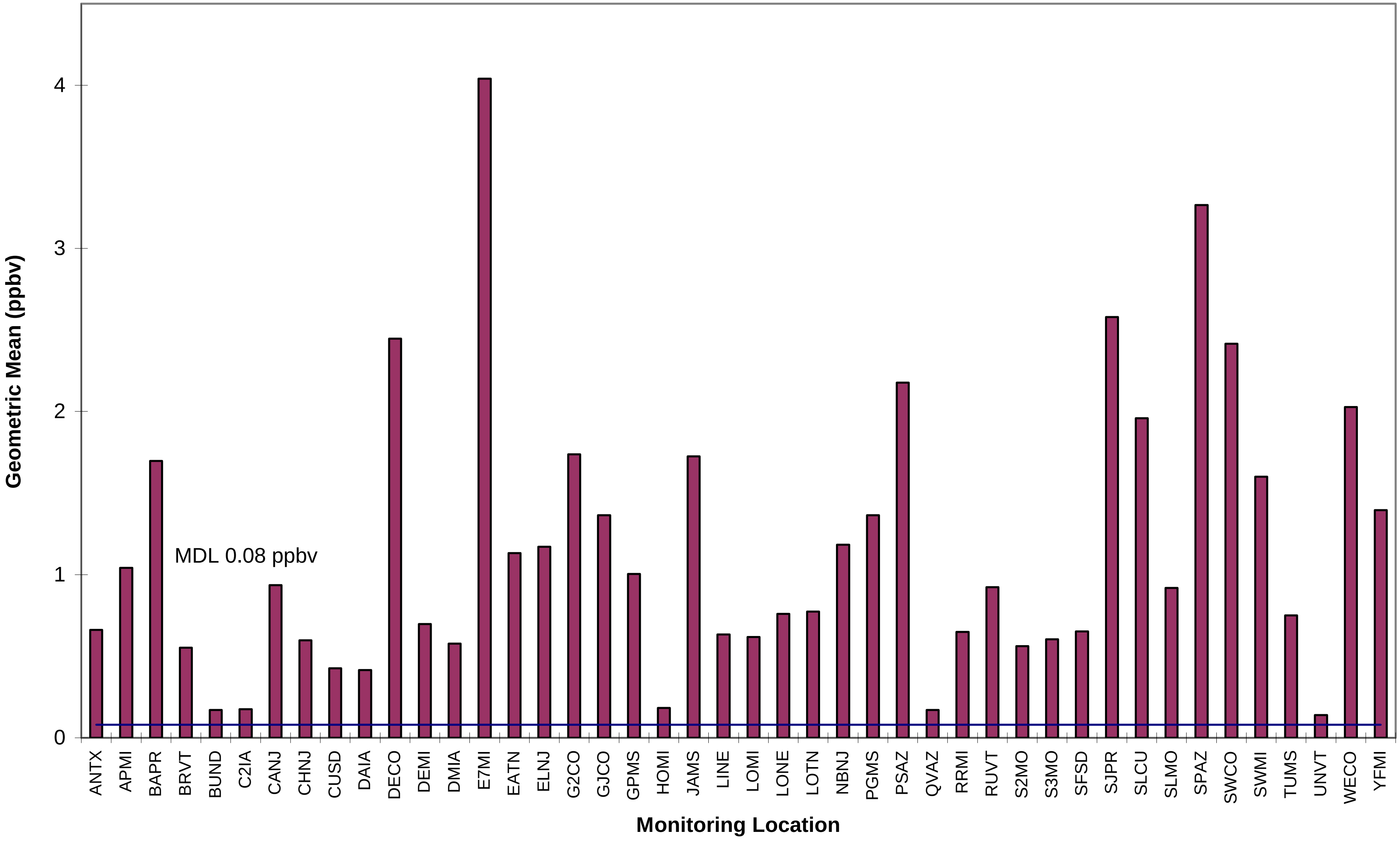


Figure 3-13. Geometric Mean of Trichlorofluoromethane by Monitoring Location

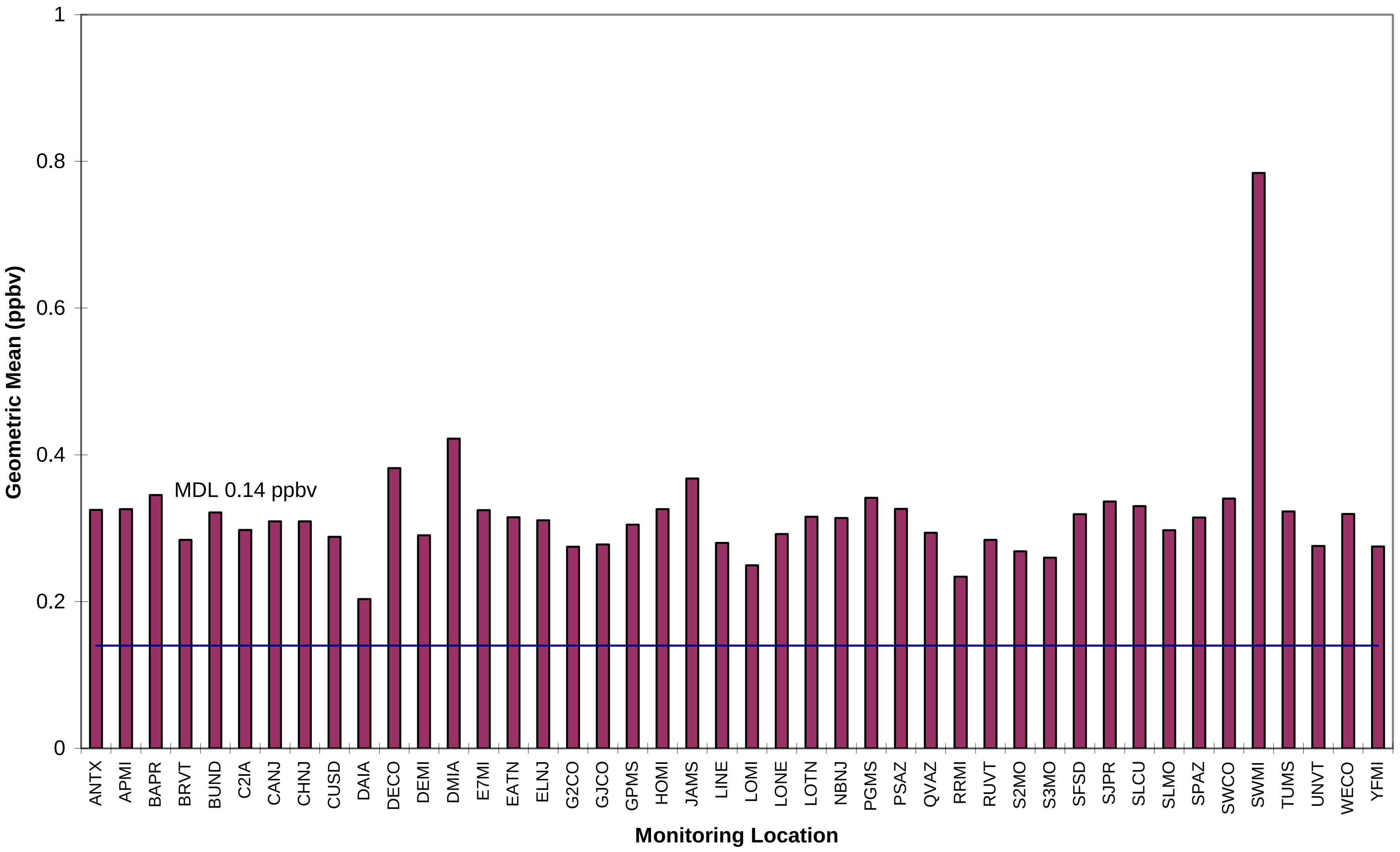


Figure 3-14. Comparison of Concentration Ratios for BTEX Compounds vs. Roadside Study

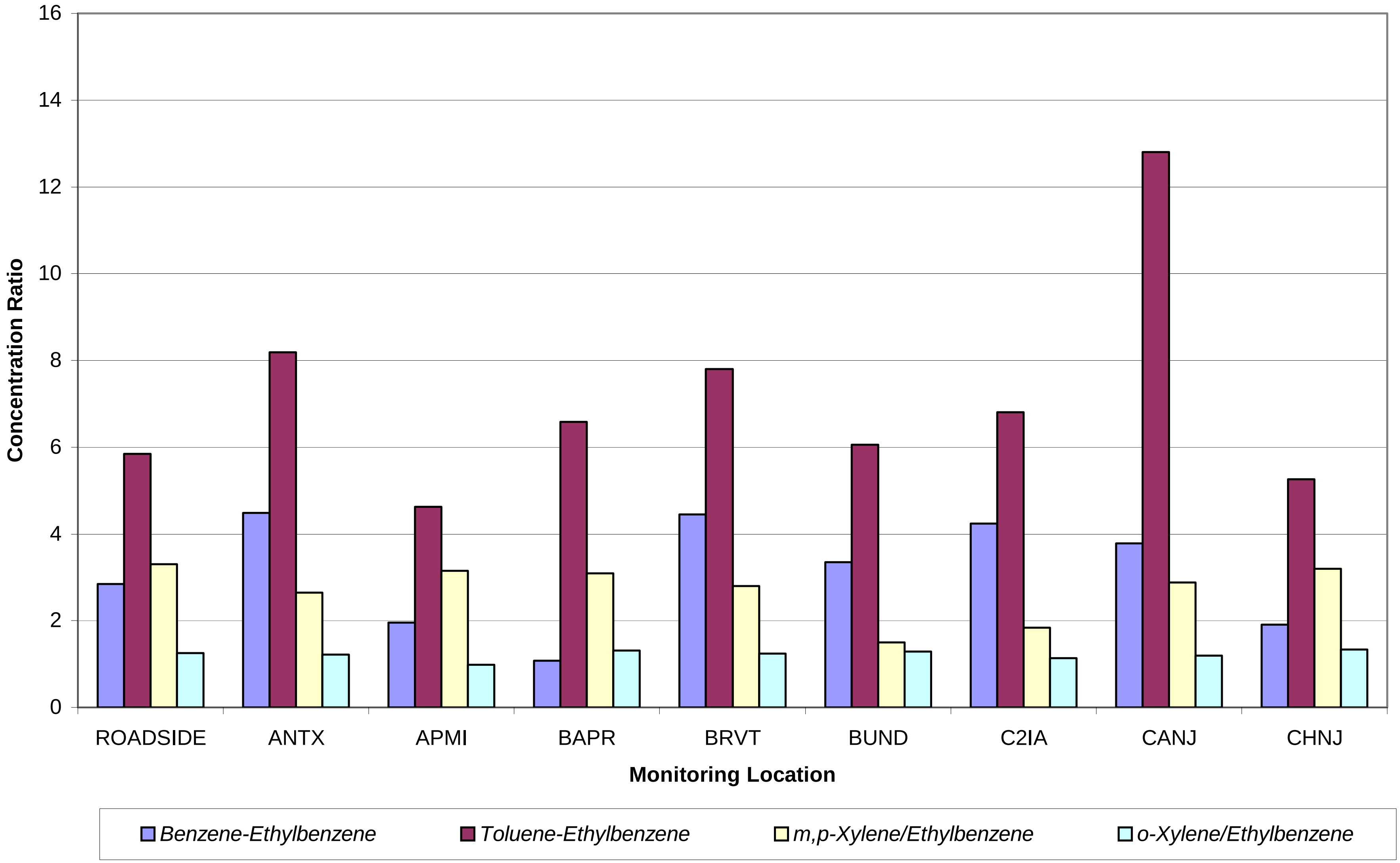
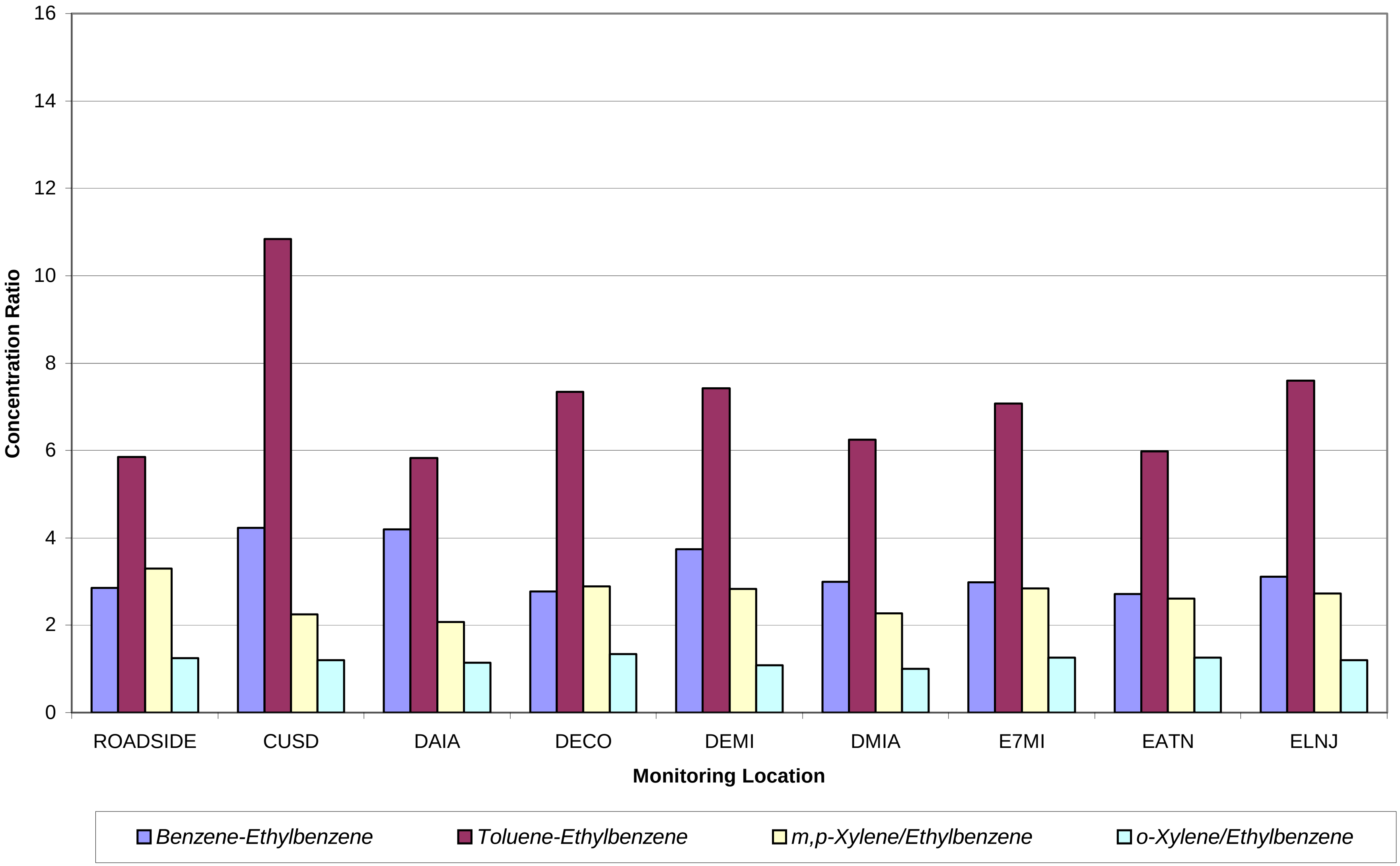


Figure 3-14 (Continued)



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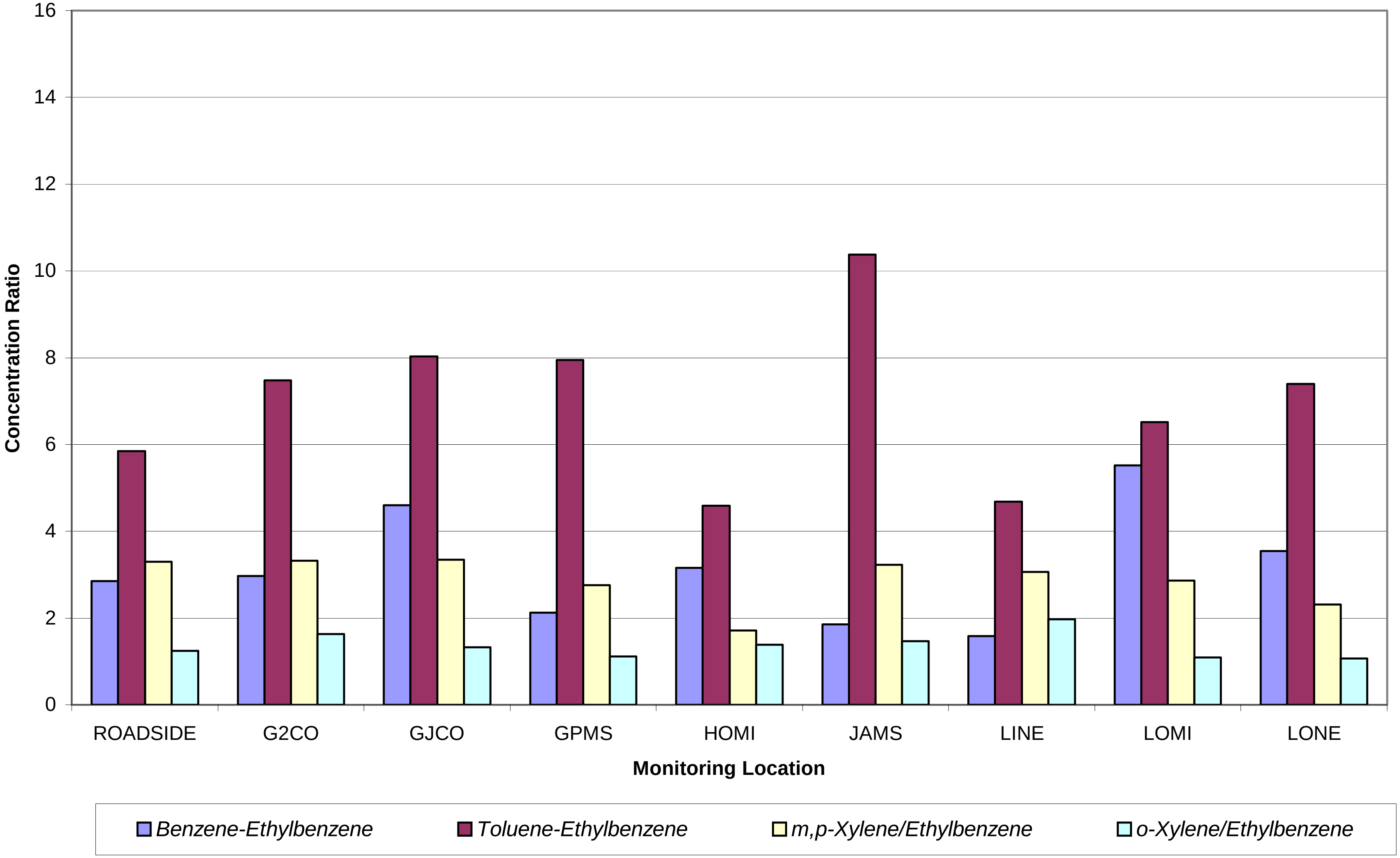

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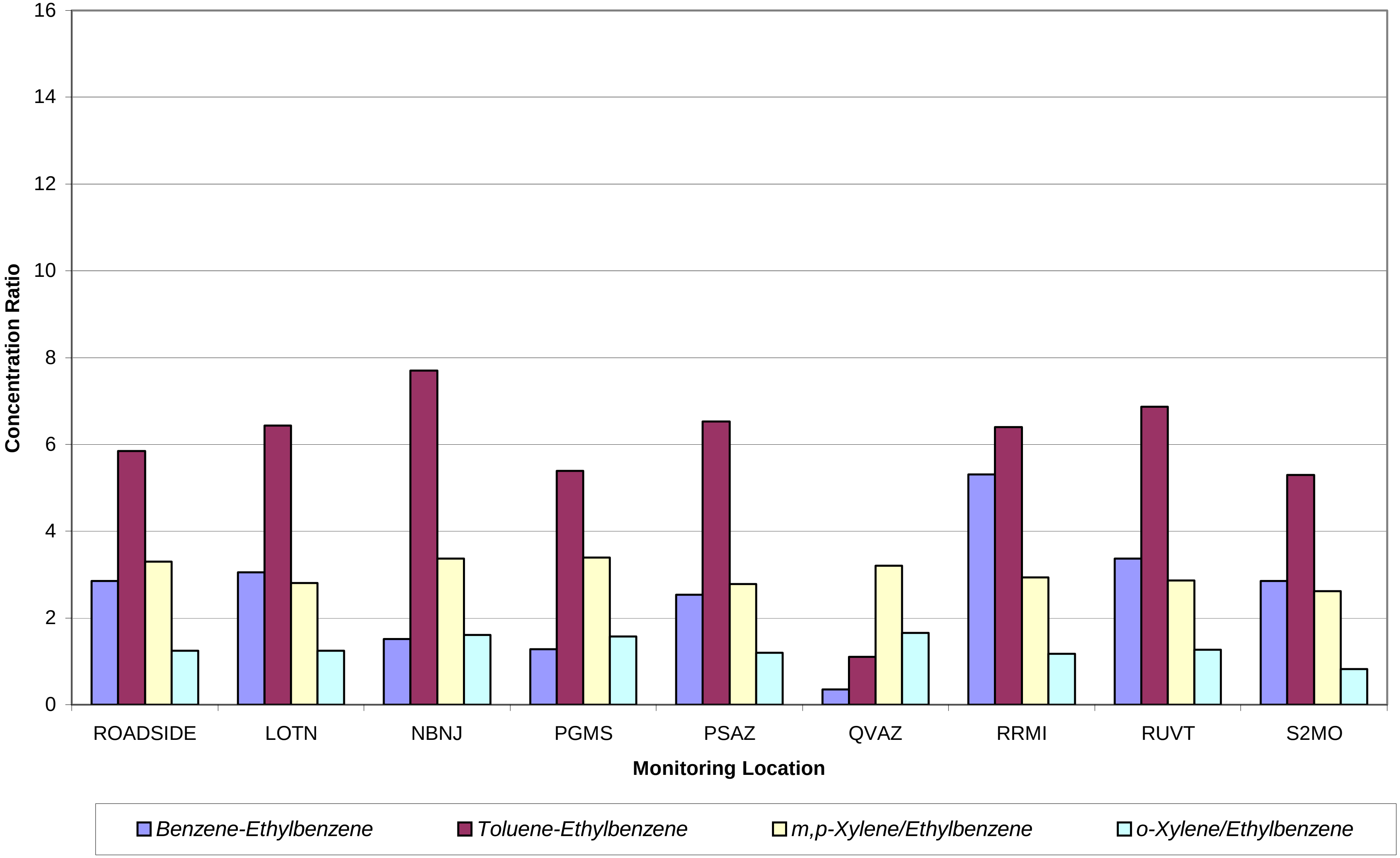

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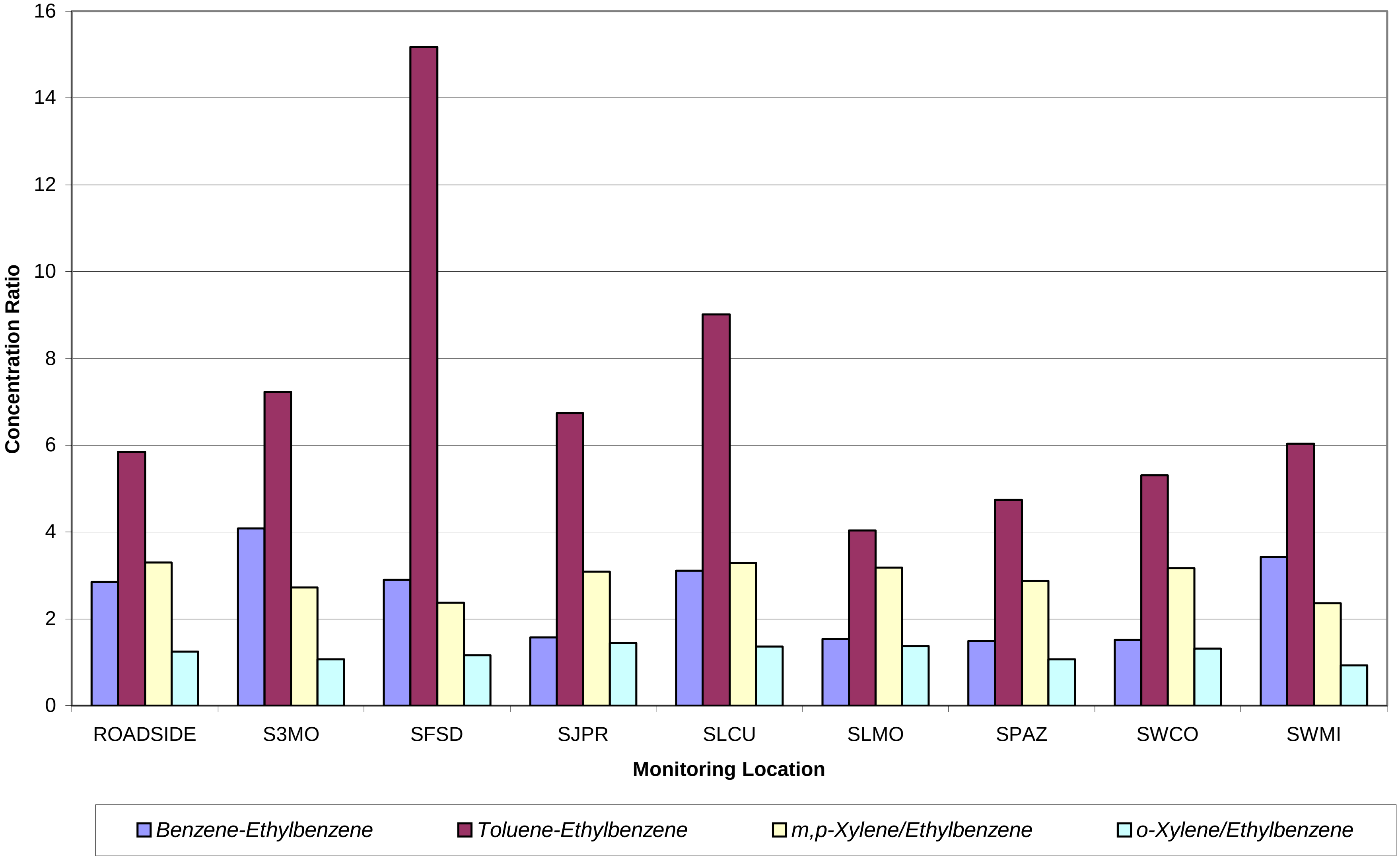


Figure 3-14 (Continued)

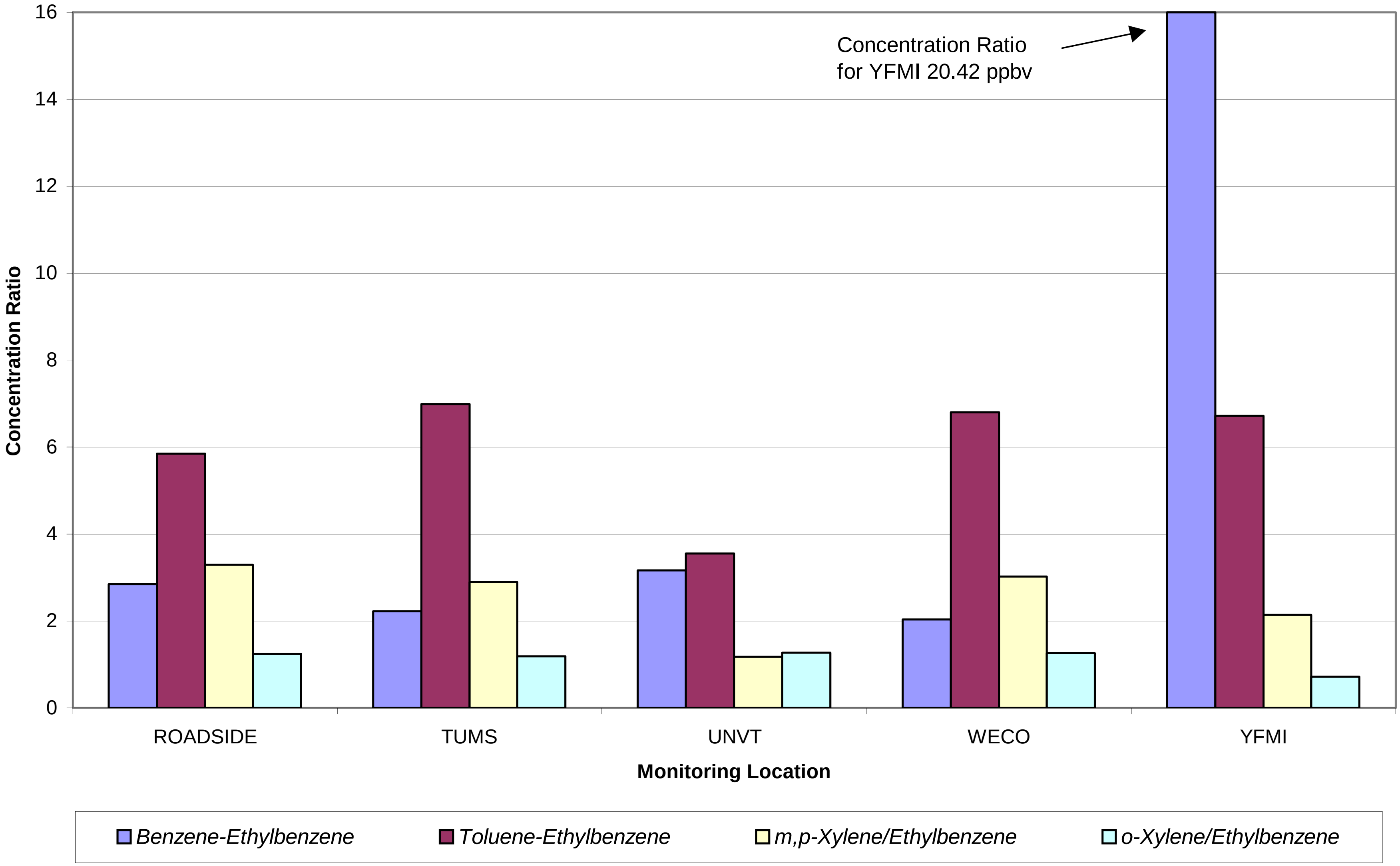


Figure 3-15. Coefficient of Variation Analysis of 1,2,4-Trimethylbenzene Across 44 Sites

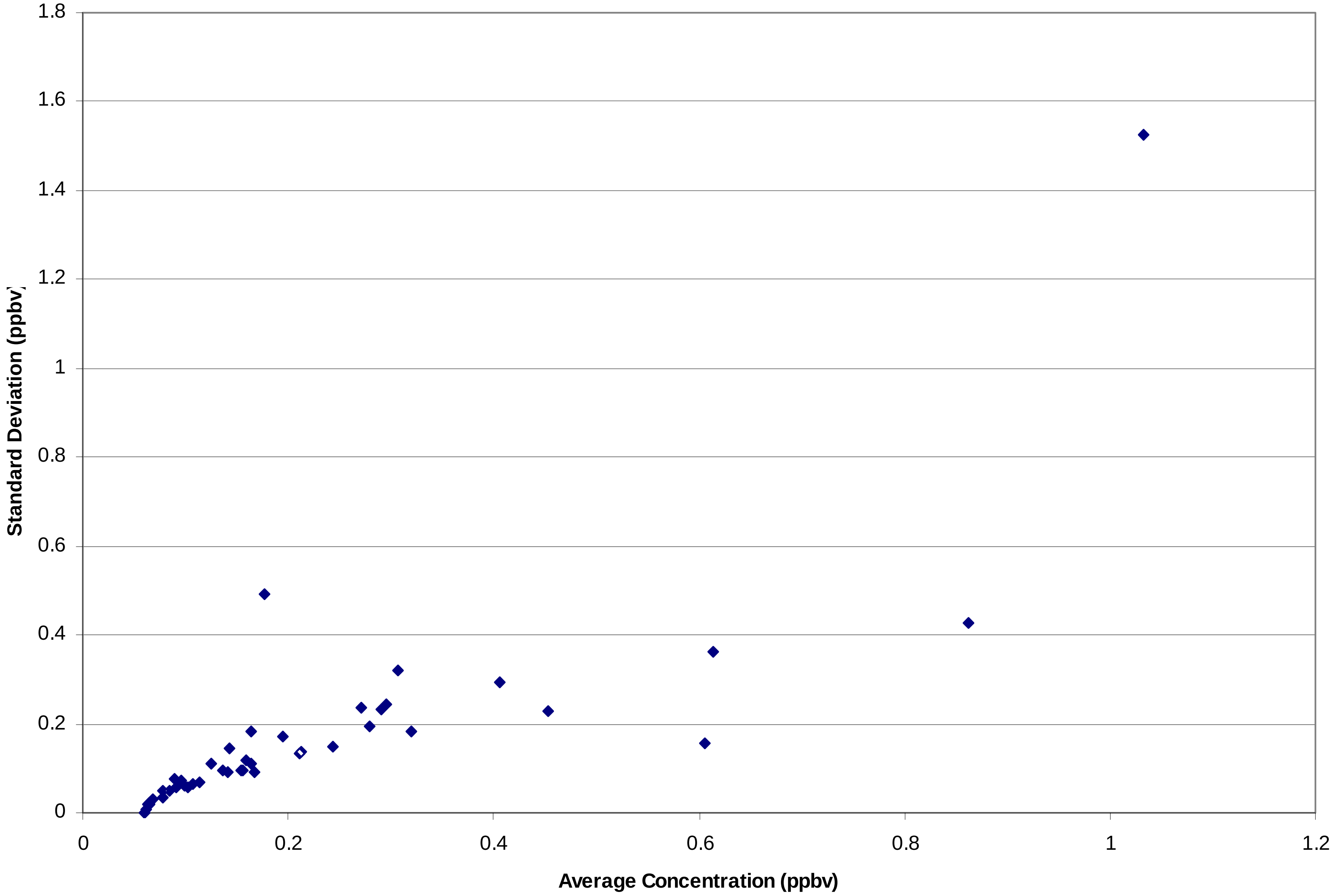


Figure 3-16. Coefficient of Variation Analysis of Acetylene Across 44 Sites

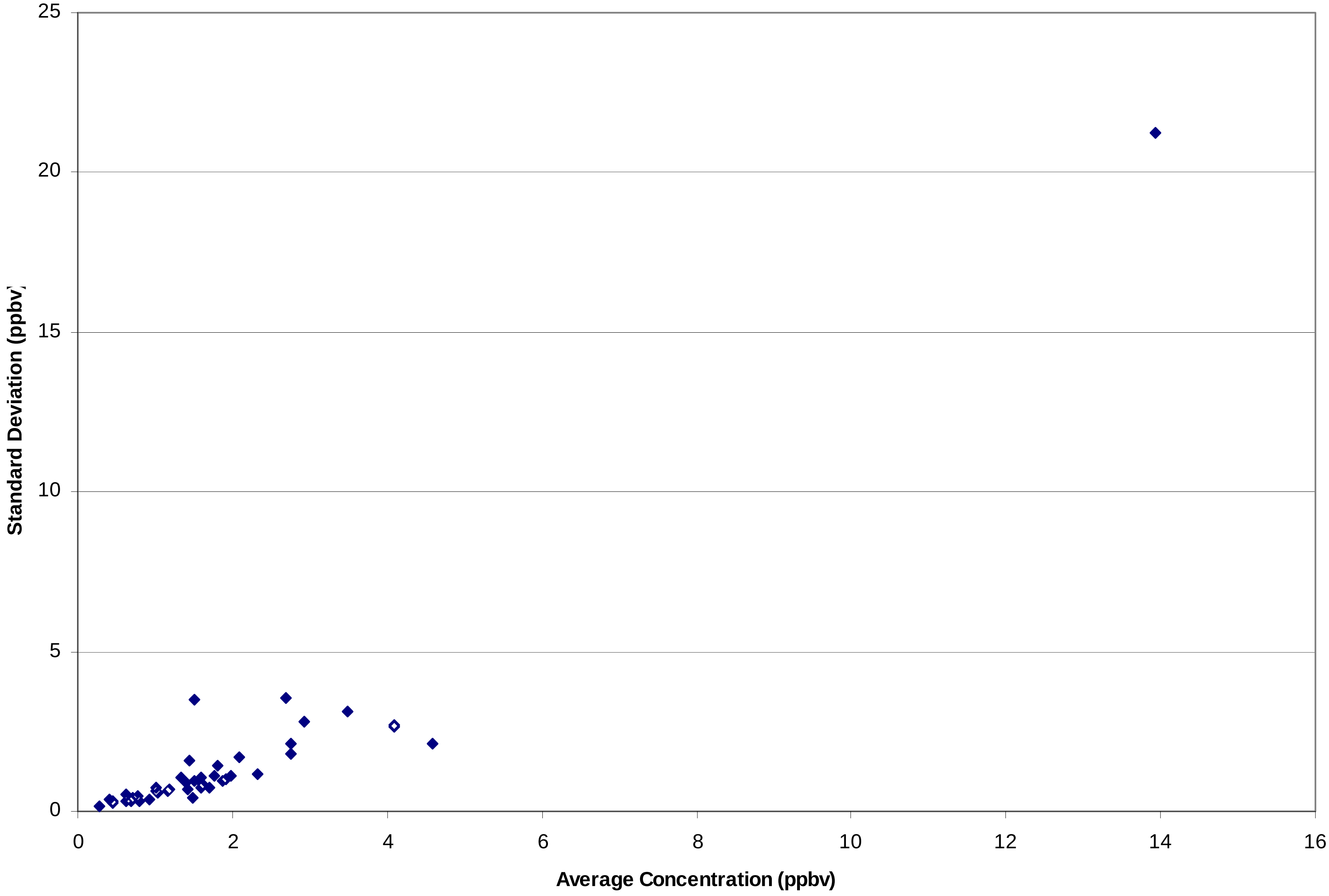


Figure 3-17. Coefficient of Variation Analysis of Benzene Across 44 Sites

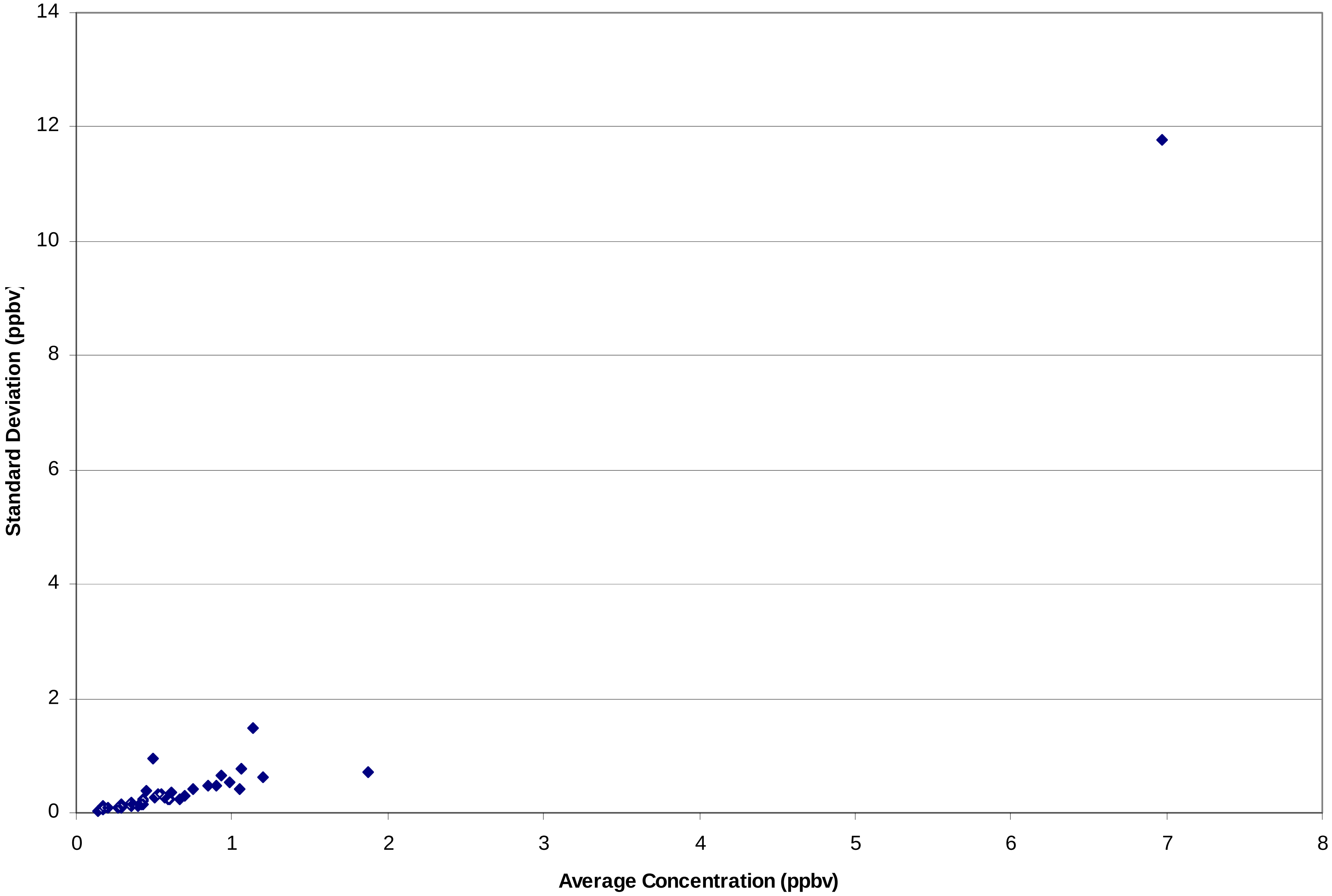


Figure 3-18. Coefficient of Variation Analysis of Chloromethane Across 44 Sites

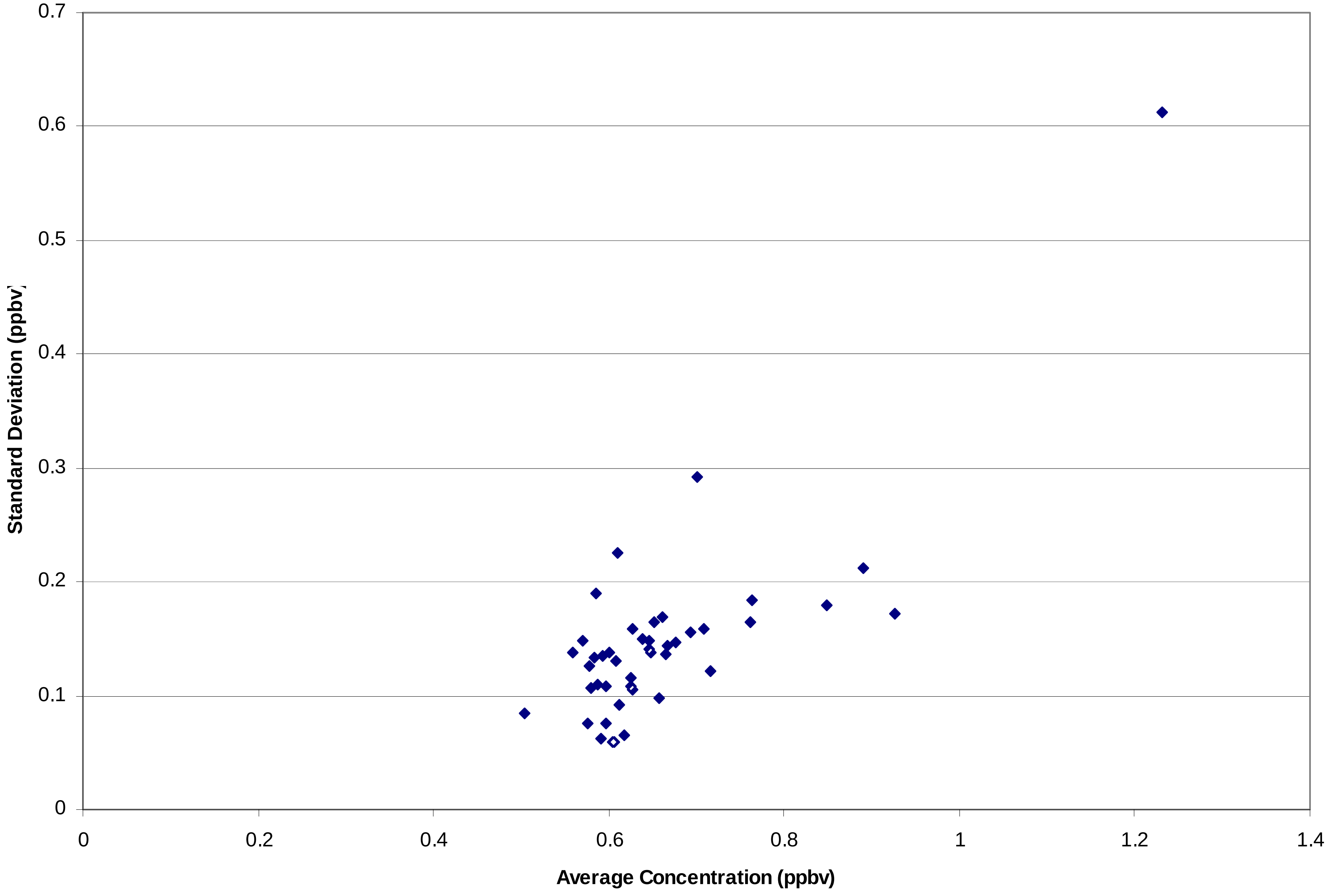


Figure 3-19. Coefficient of Variation Analysis of Dichlorodifluoromethane Across 44 Sites

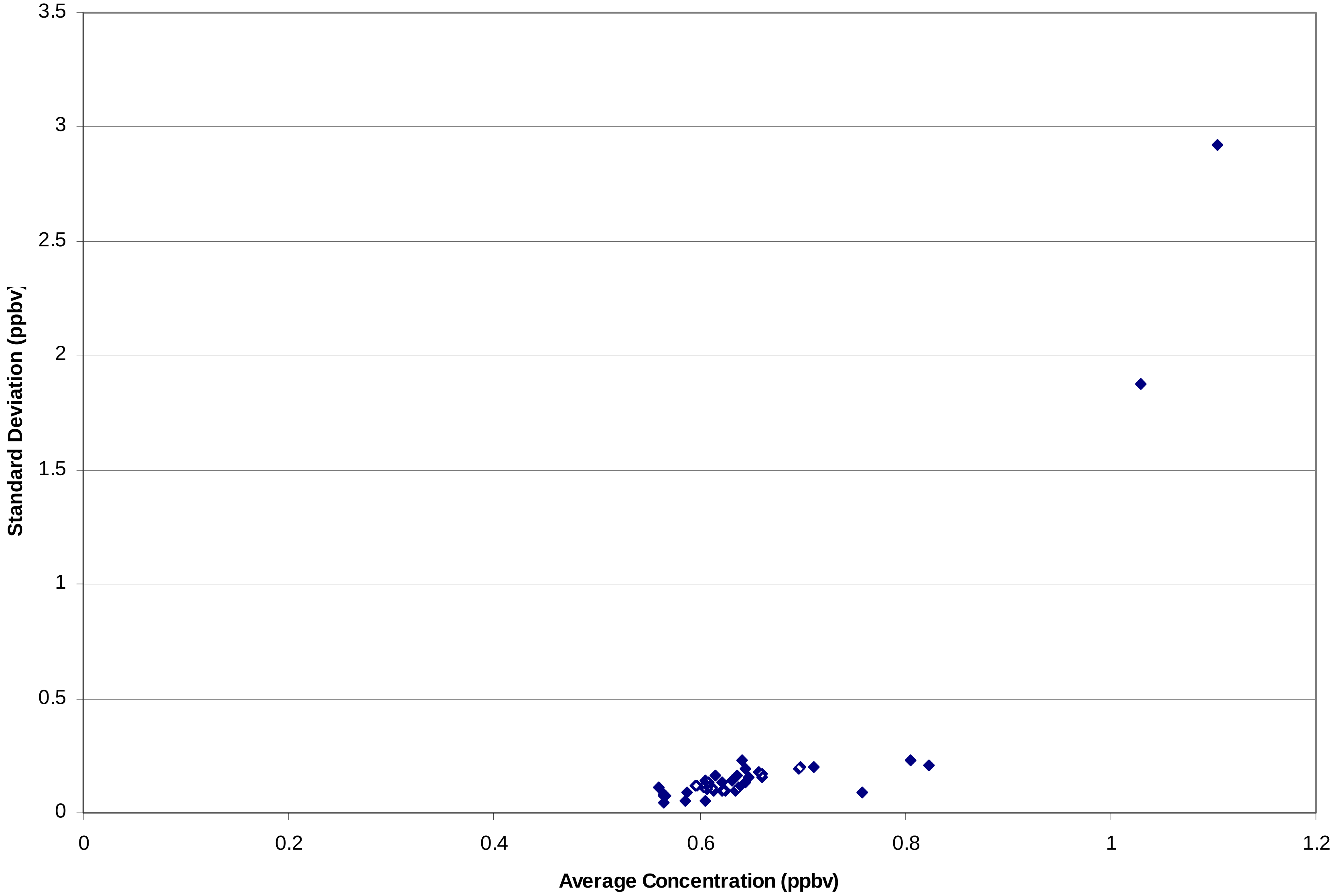


Figure 3-20. Coefficient of Variation Analysis of Ethylbenzene Across 44 Sites

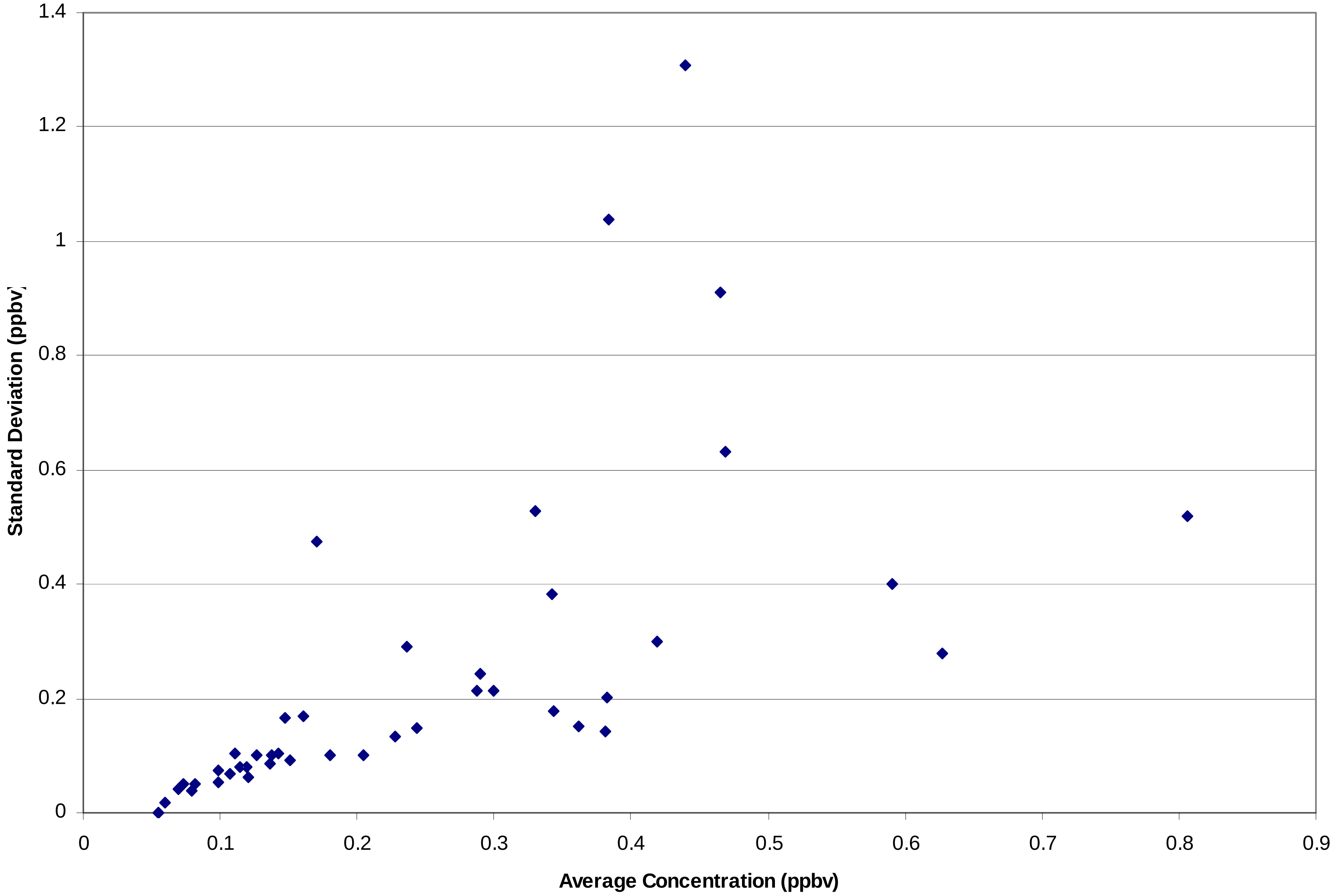


Figure 3-21. Coefficient of Variation Analysis of Formaldehyde Across 45 Sites

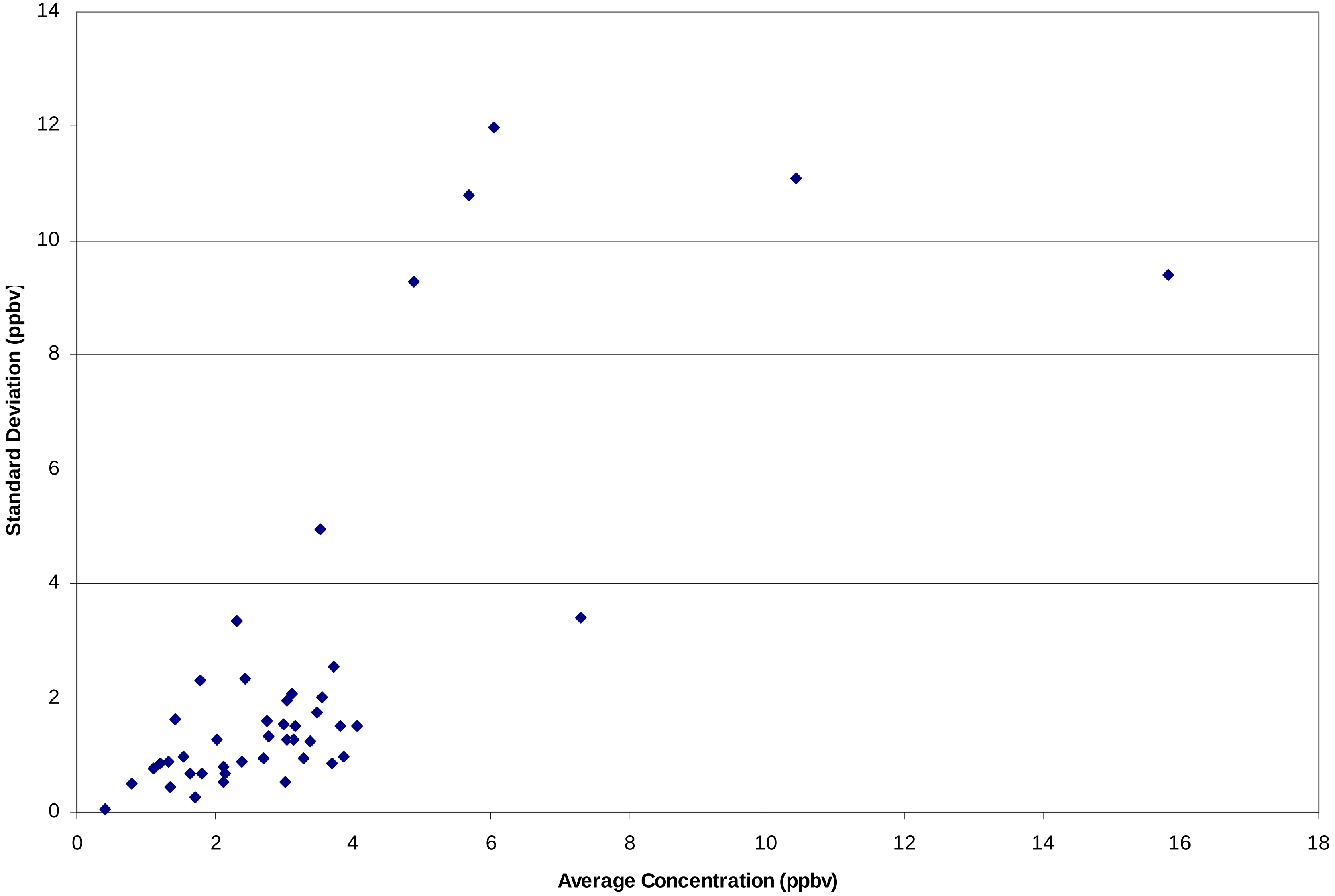


Figure 3-22. Coefficient of Variation Analysis of *m,p*-Xylene Across 44 Sites

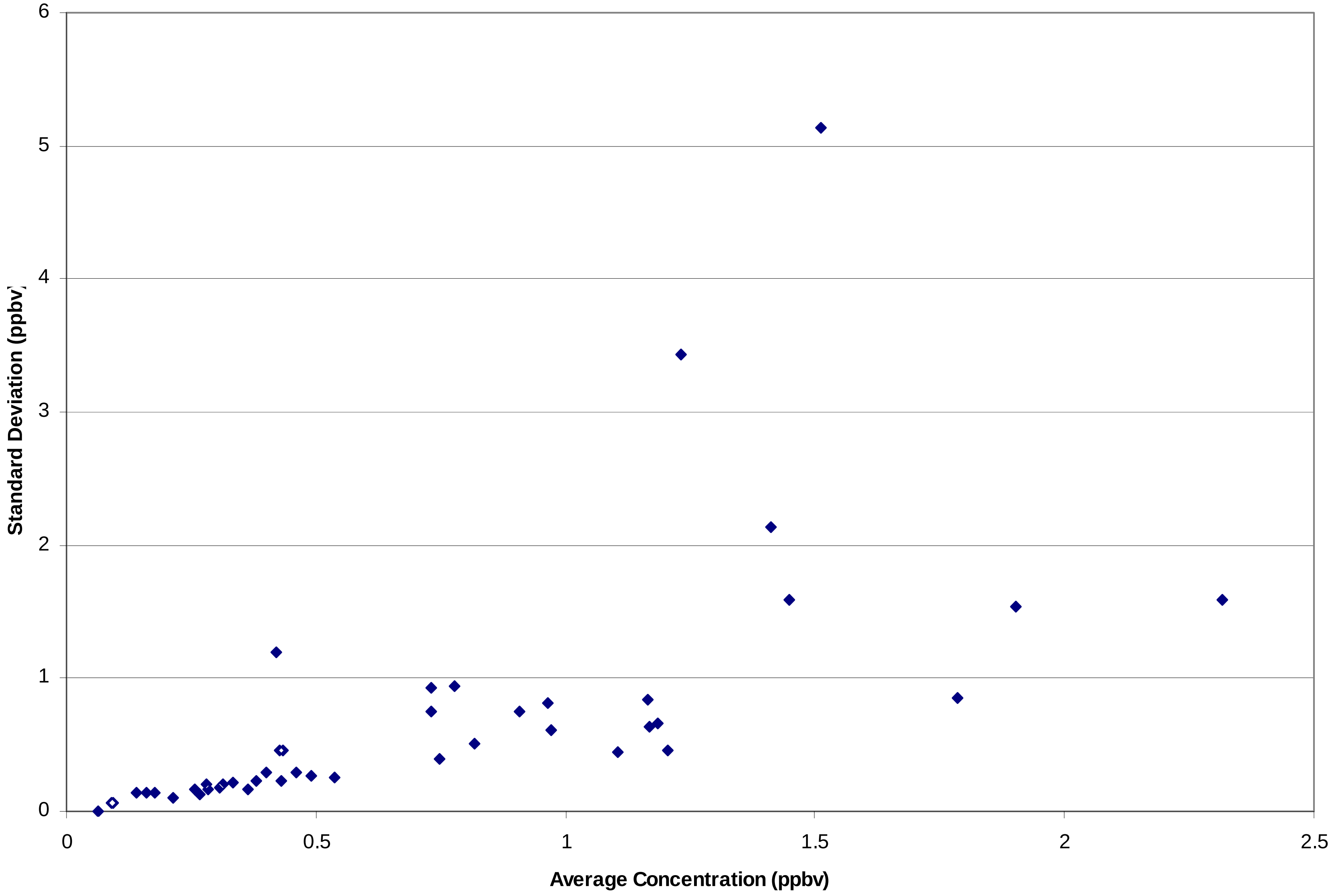


Figure 3-23. Coefficient of Variation Analysis of *o*-Xylene Across 44 Sites

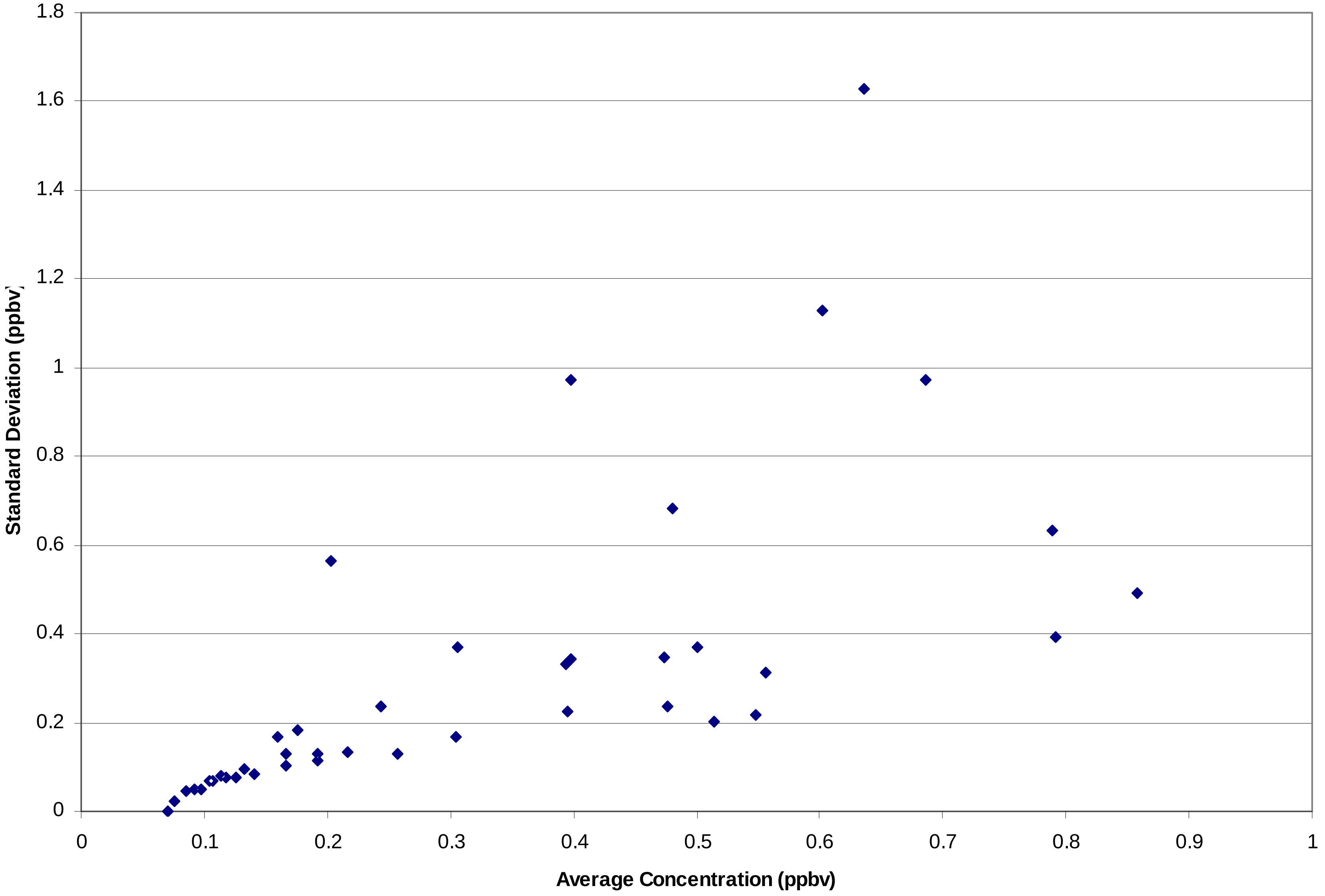


Figure 3-24. Coefficient of Variation Analysis of Propylene Across 44 Sites

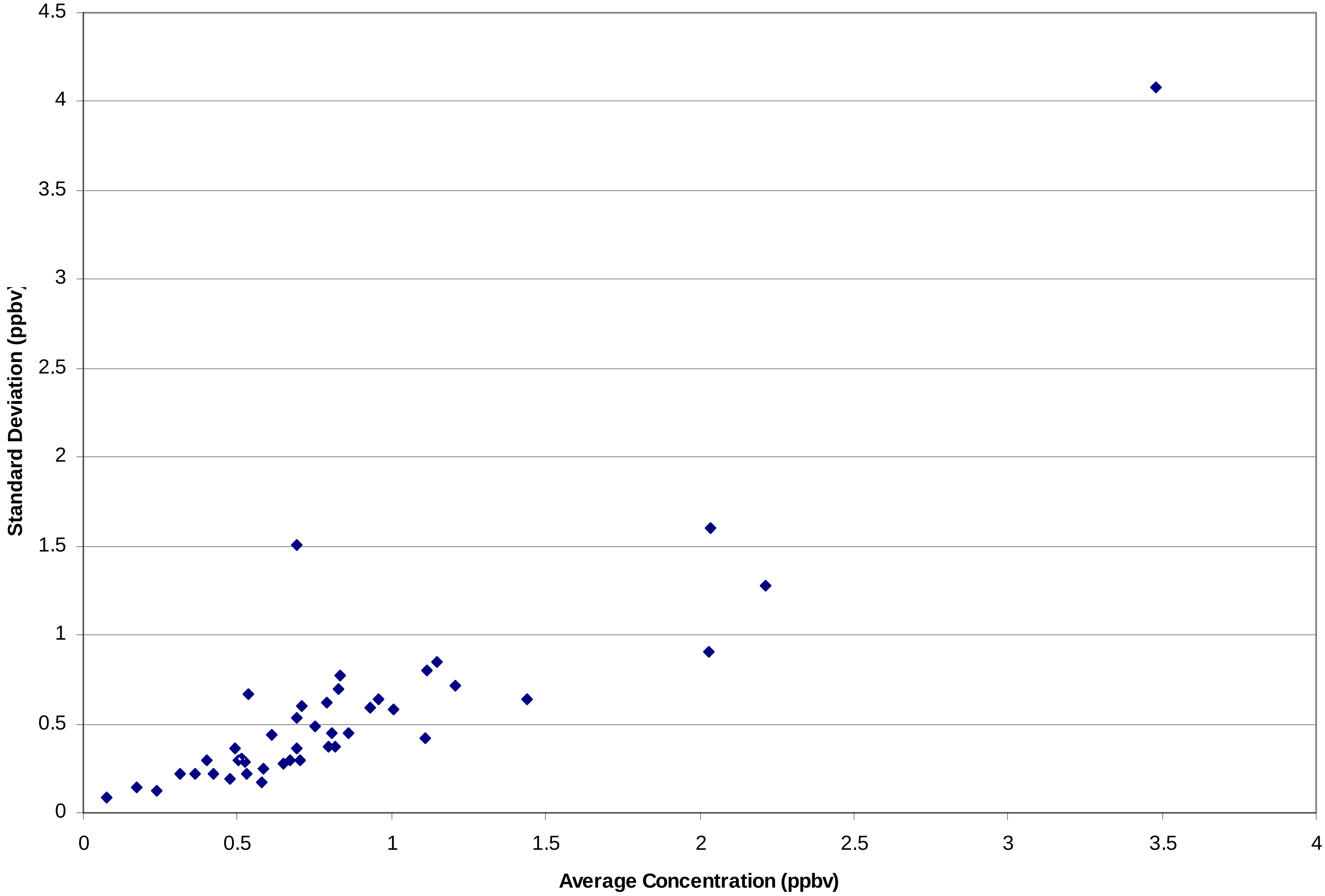


Figure 3-25. Coefficient of Variation Analysis of Toluene Across 44 Sites

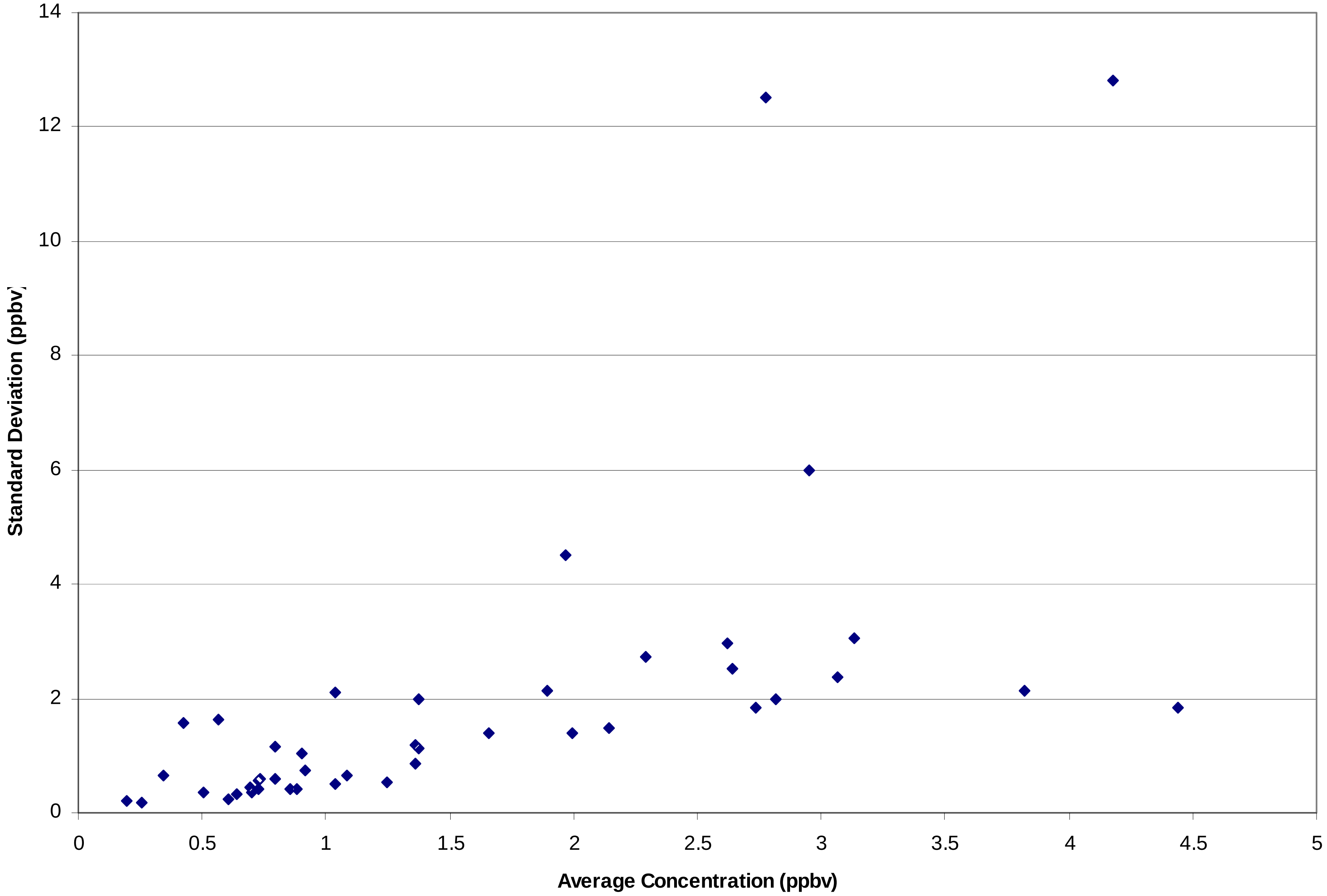


Figure 3-26. Coefficient of Variation Analysis of Trichlorofluoromethane Across 44 Sites

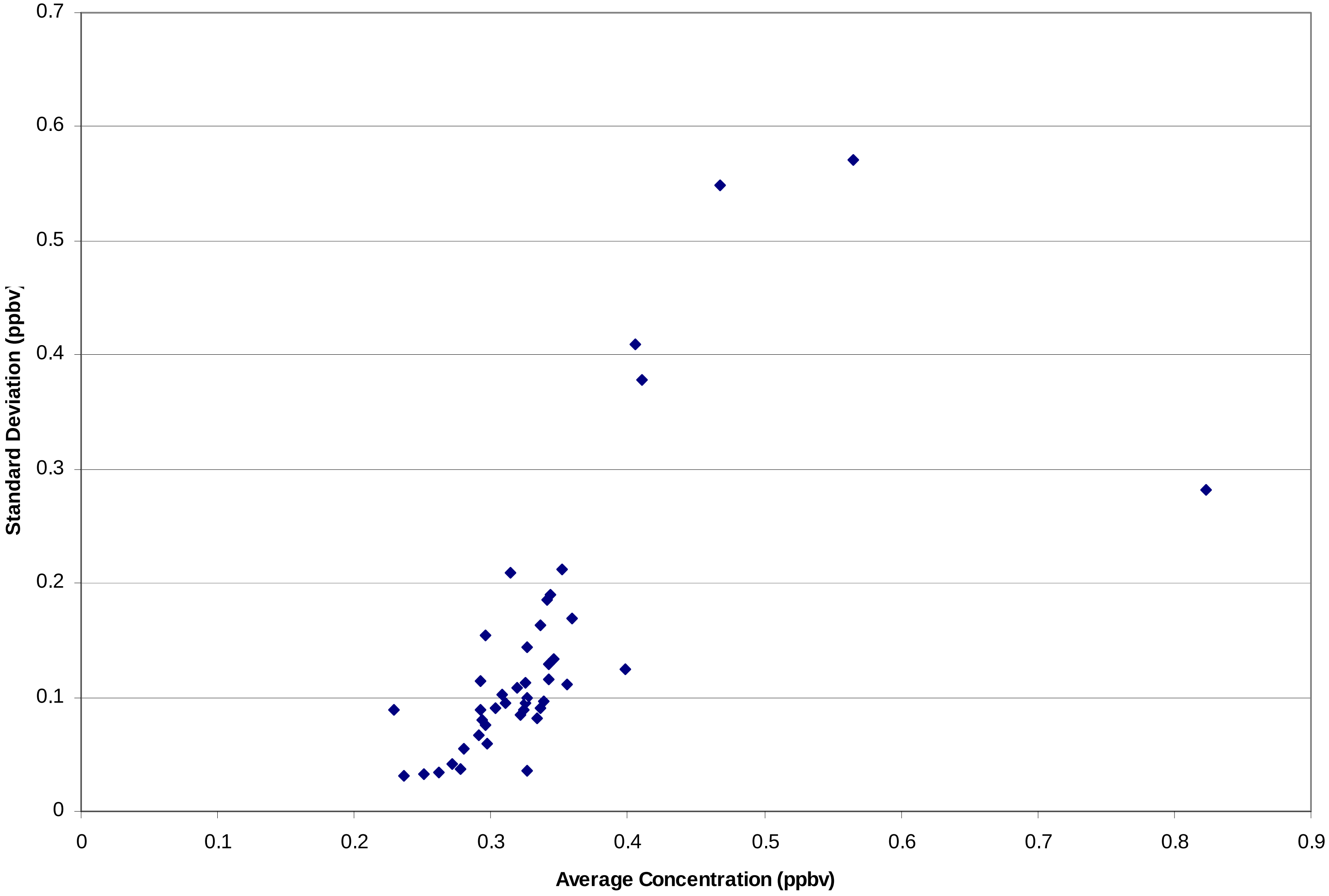


Figure 3-27a. Average 1,2,4-Trimethylbenzene Concentration by Season (ANTX-LINE)

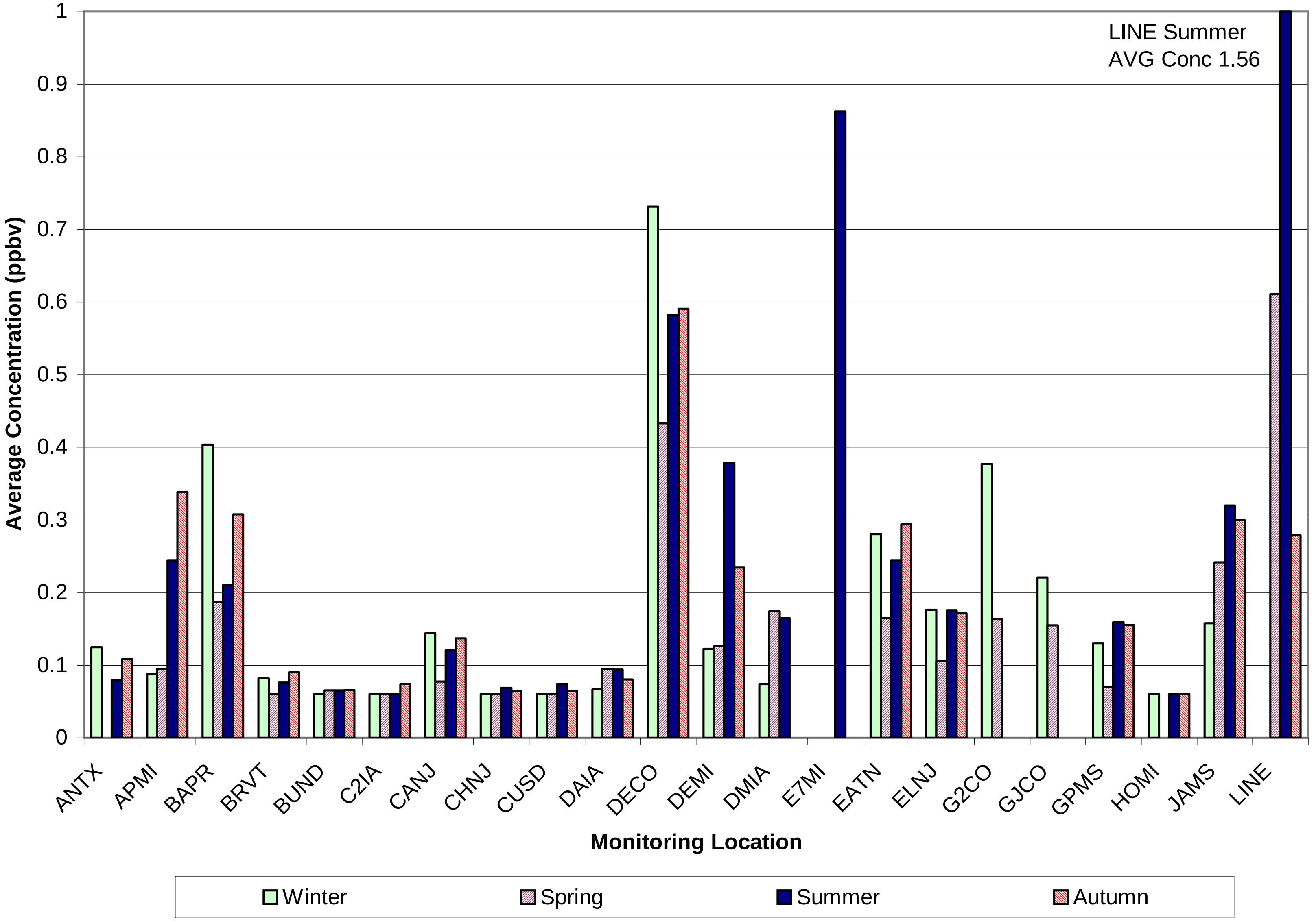


Figure 3-27b. Average 1,2,4-Trimethylbenzene Concentration by Season (LOMI-YFMI)

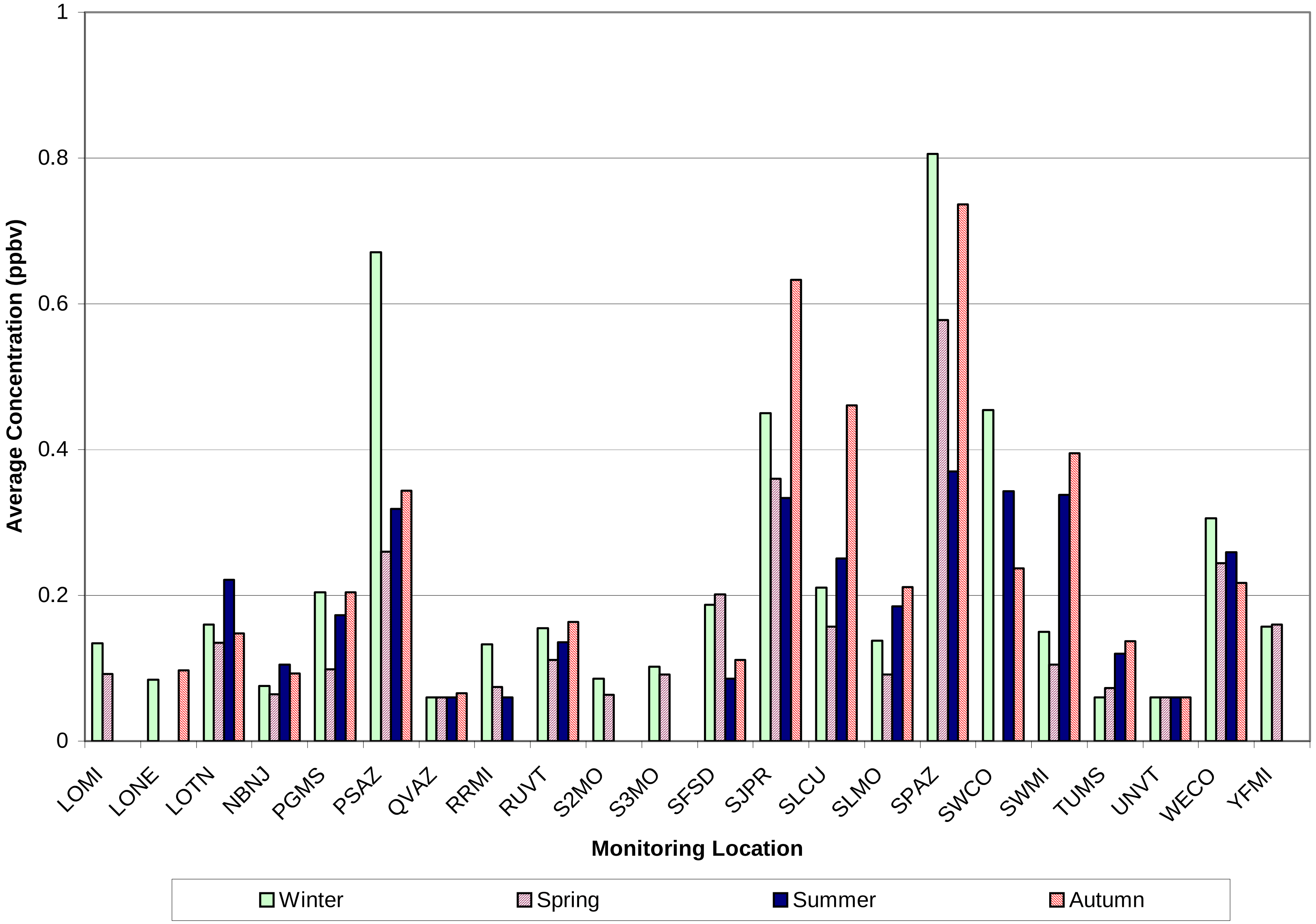


Figure 3-28a. Average Acetylene Concentration by Season (ANTX-LINE)

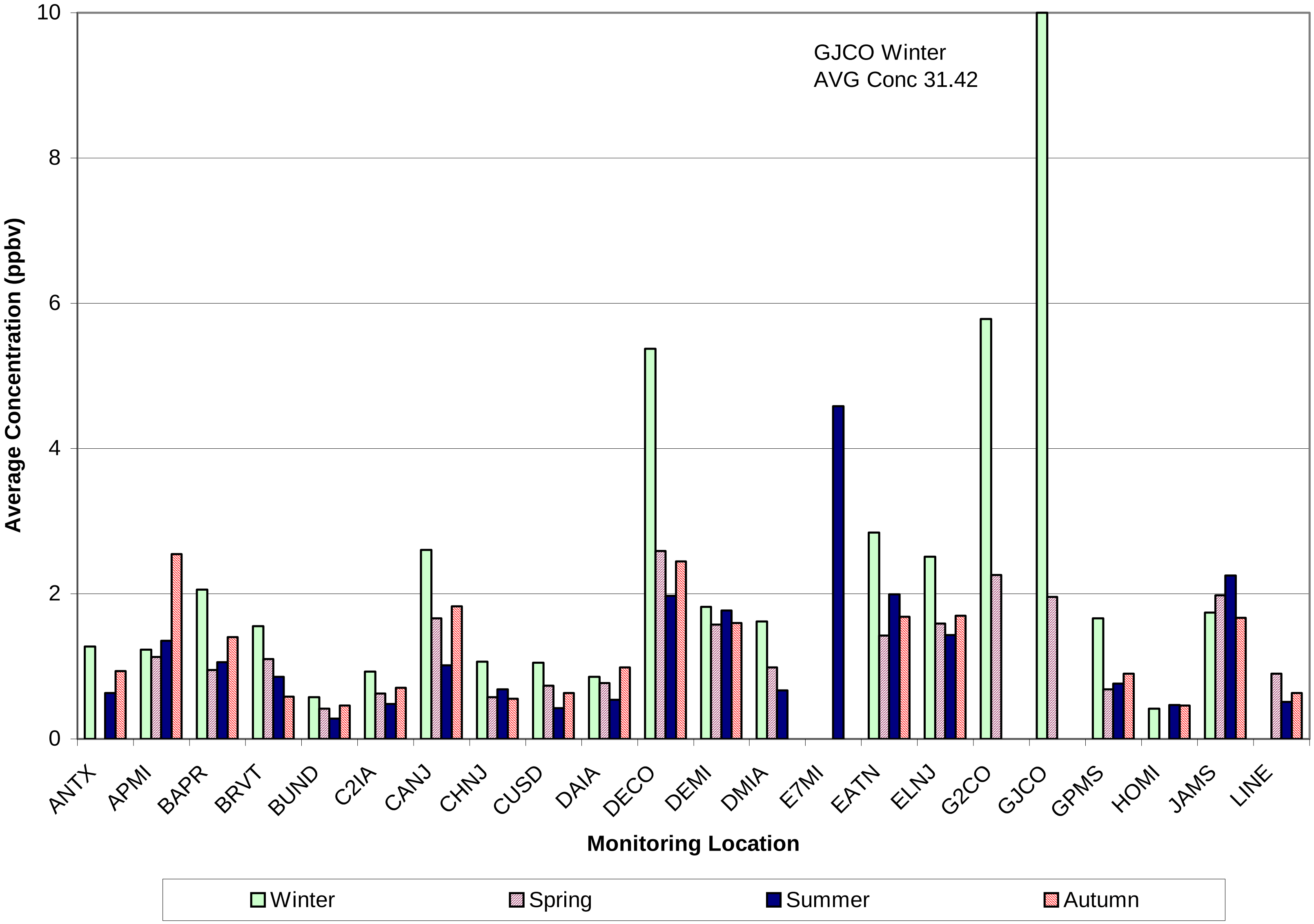


Figure 3-28b. Average Acetylene Concentration by Season (LOMI-YFMI)

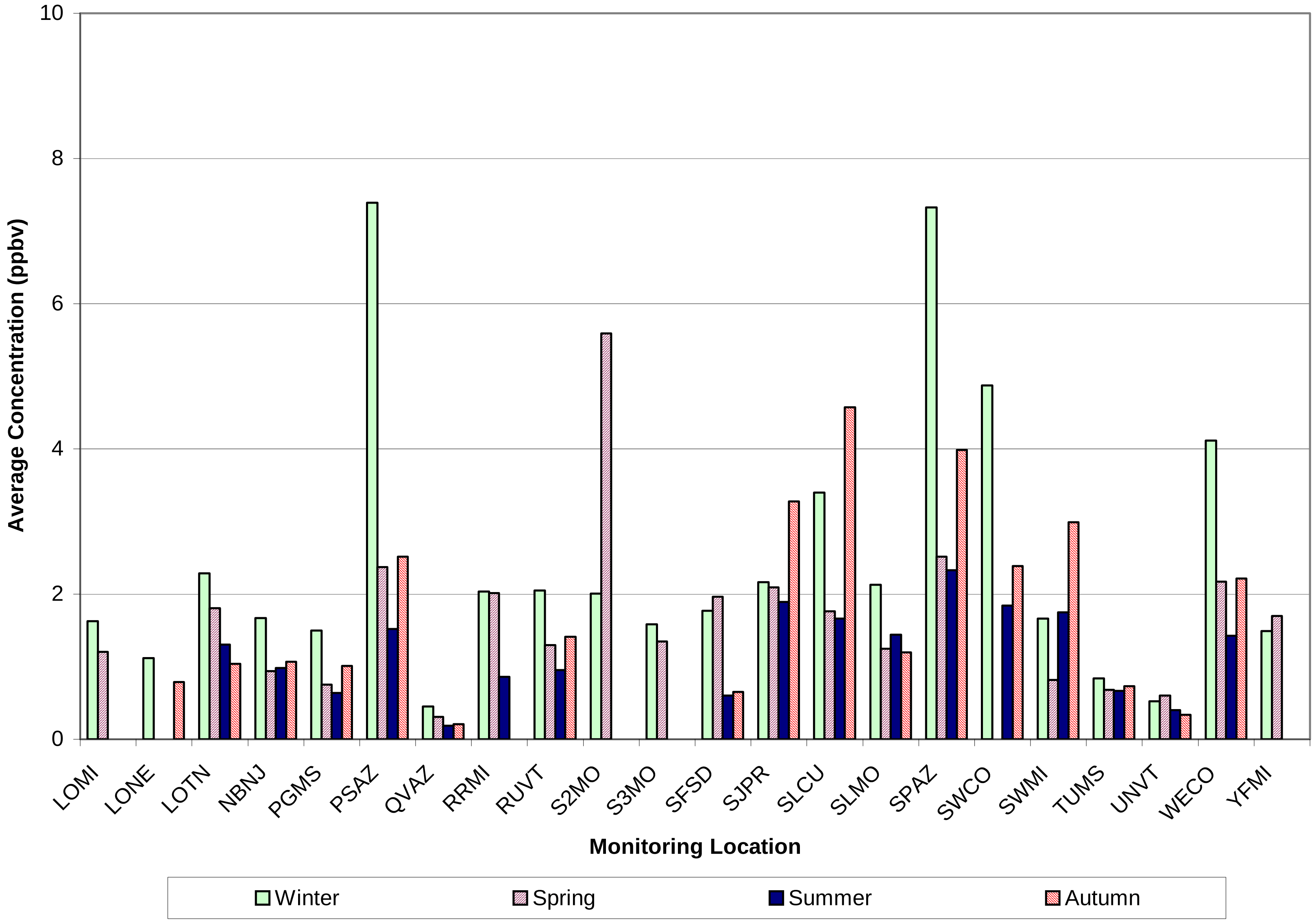


Figure 3-29a. Average Benzene Concentration by Season (ANTX-LINE)

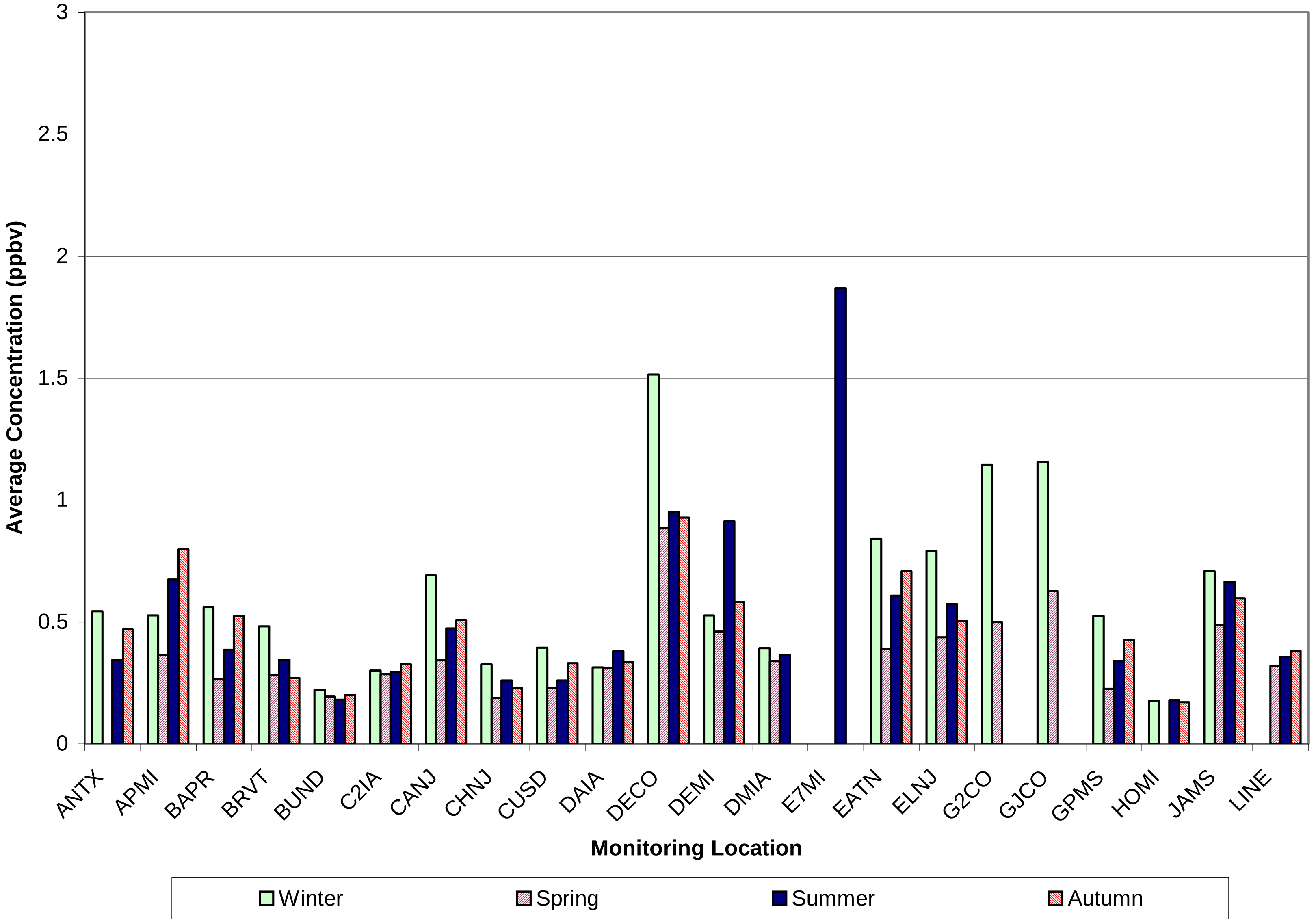


Figure 3-29b. Average Benzene Concentration by Season (LOMI-YFMI)

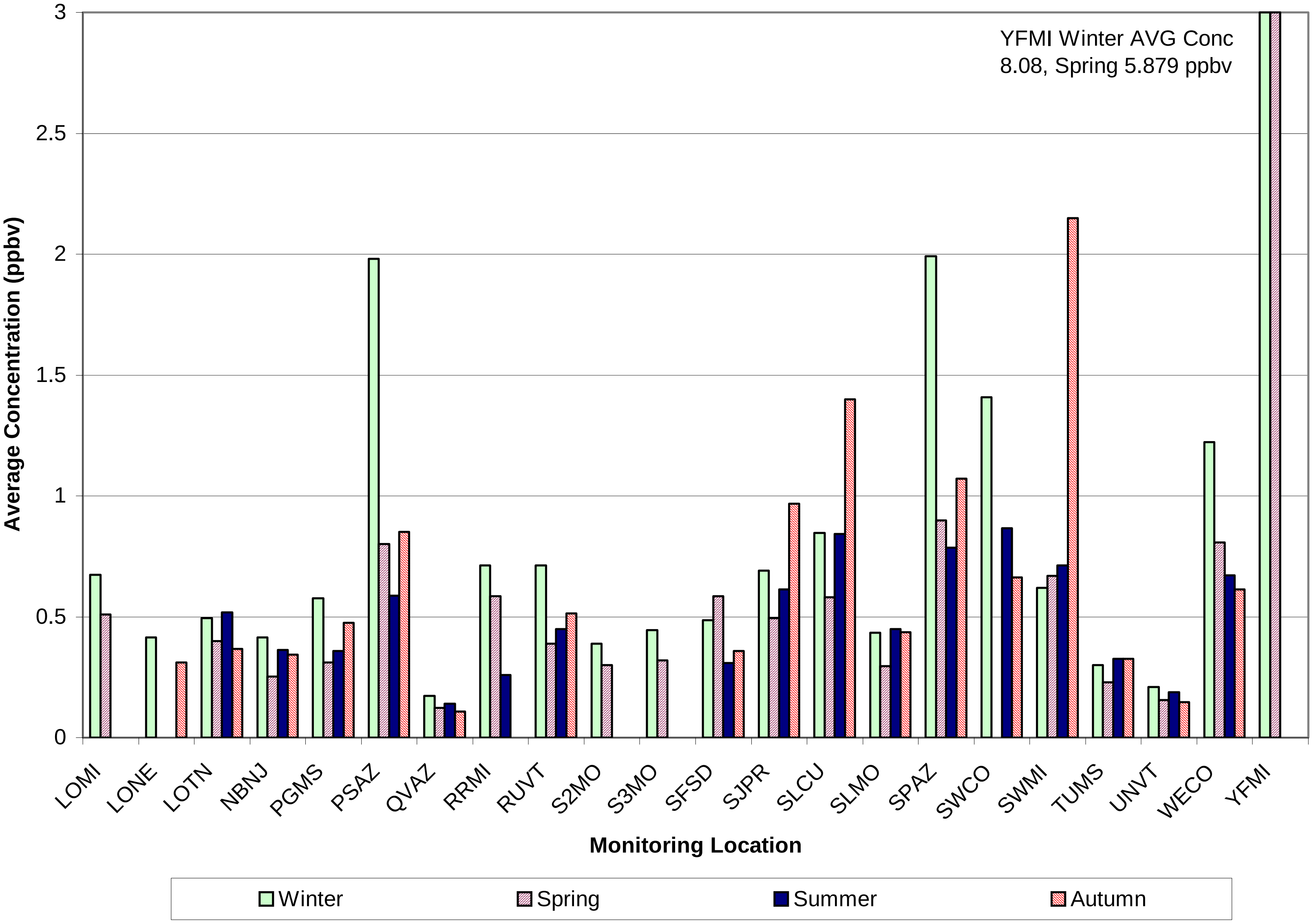


Figure 3-30a. Average Chloromethane Concentration by Season (ANTX-LINE)

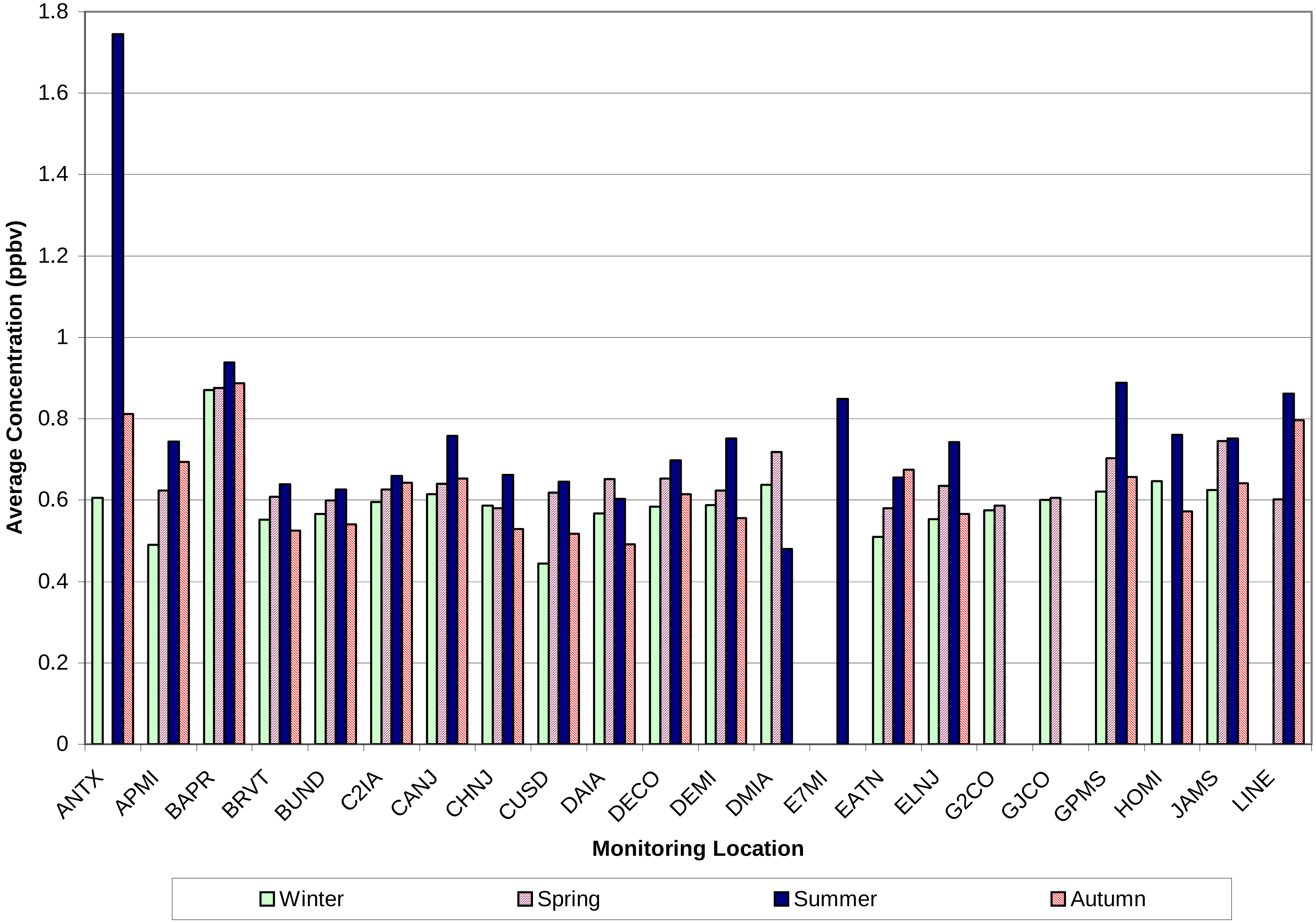


Figure 3-30b. Average Chloromethane Concentration by Season (LOMI-YFMI)

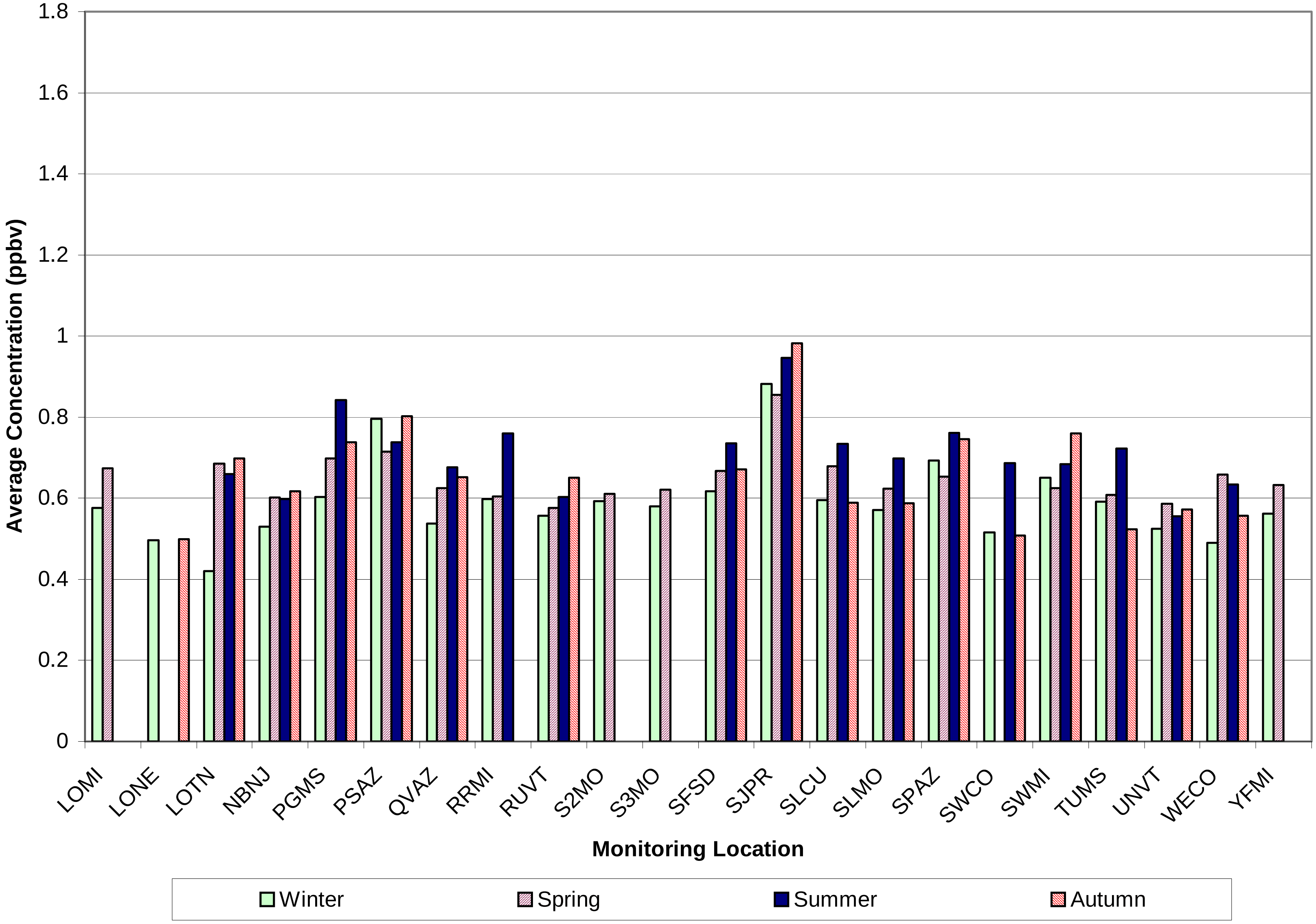


Figure 3-31a. Average Dichlorodifluoromethane Concentration by Season (ANTX-LINE)

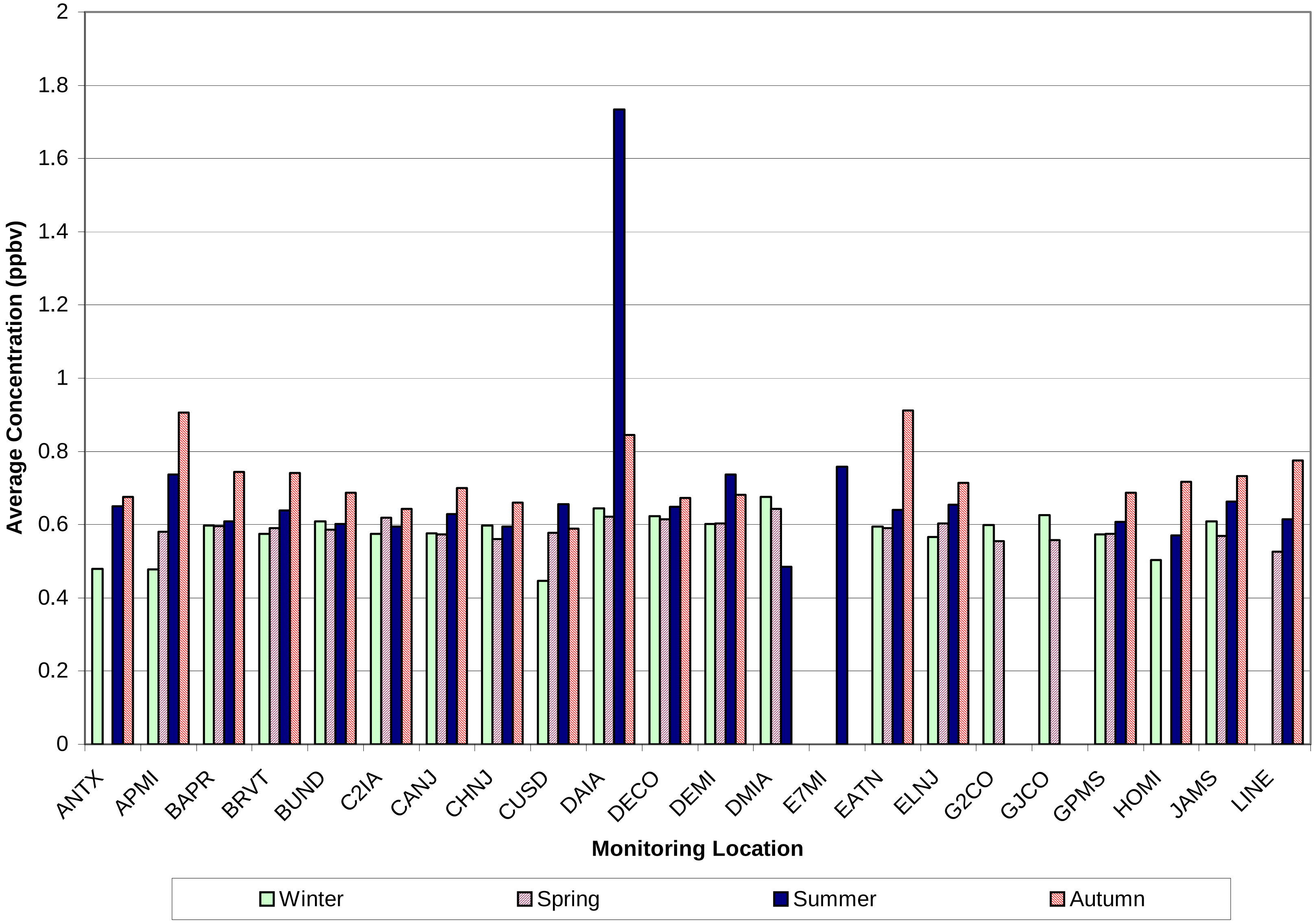


Figure 3-31b. Average Dichlorodifluoromethane Concentration by Season (LOMI-YFMI)

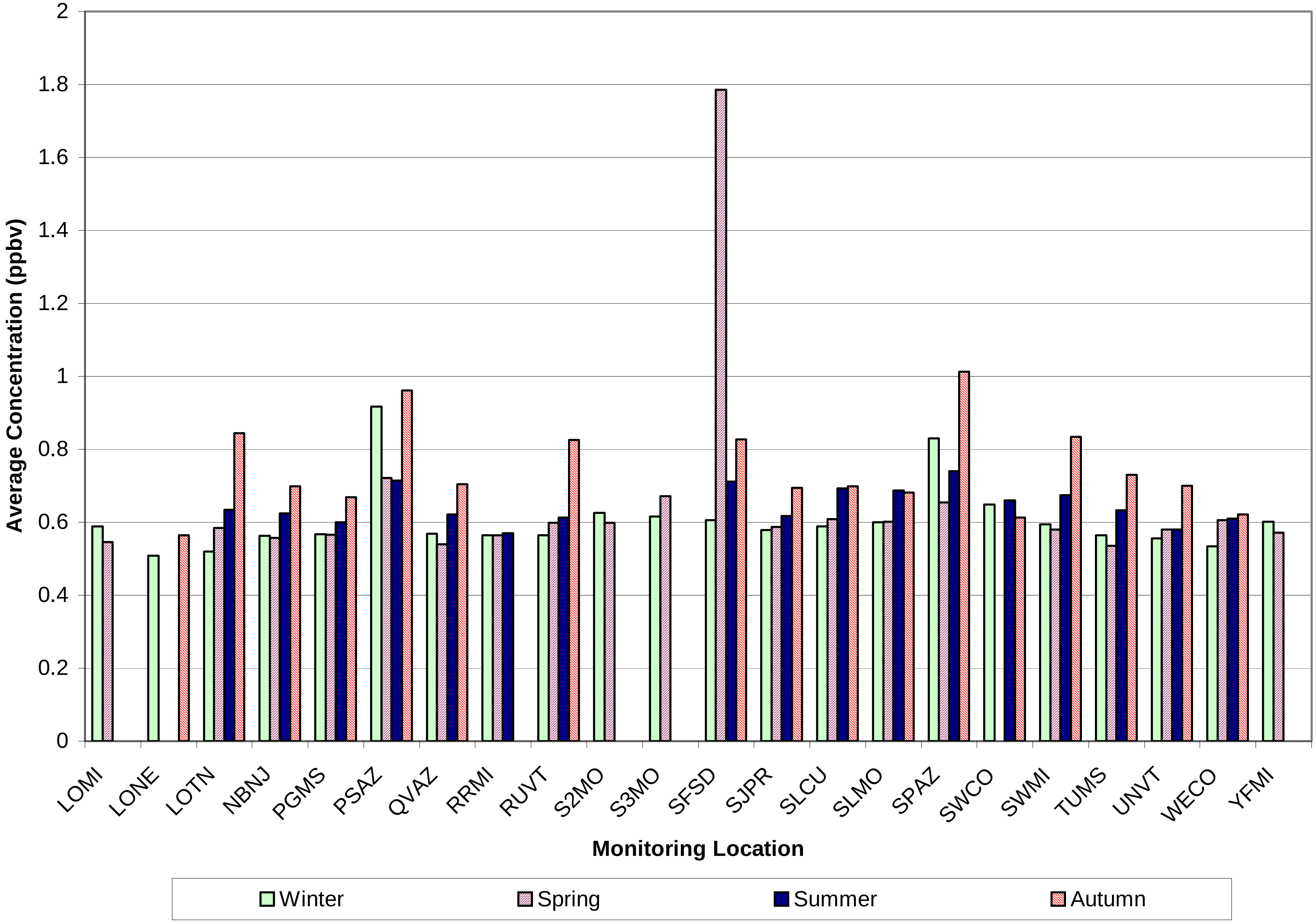


Figure 3-32a. Average Ethylbenzene Concentration by Season (ANTX-LINE)

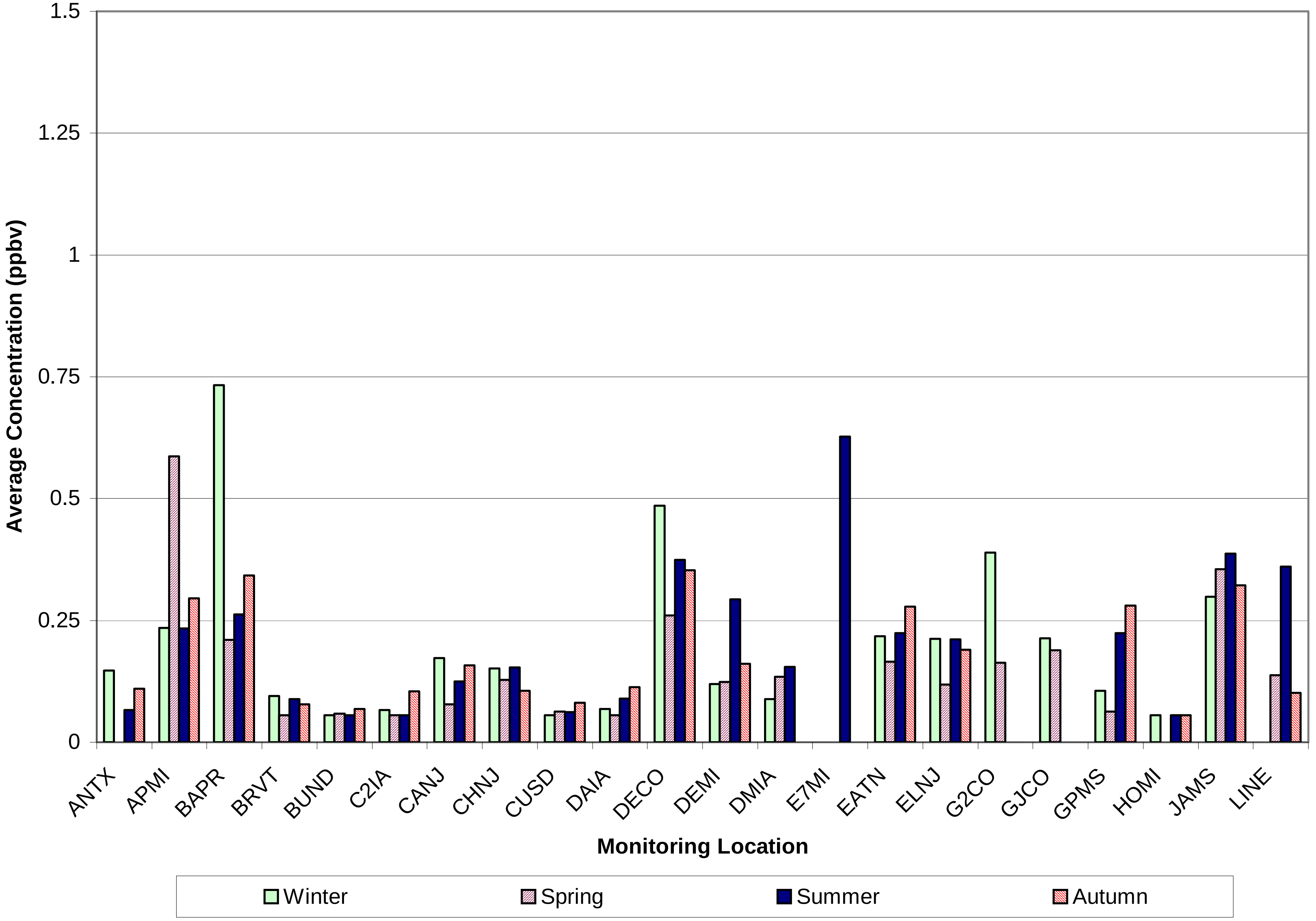


Figure 3-32b. Average Ethylbenzene Concentration by Season (LOMI-YFMI)

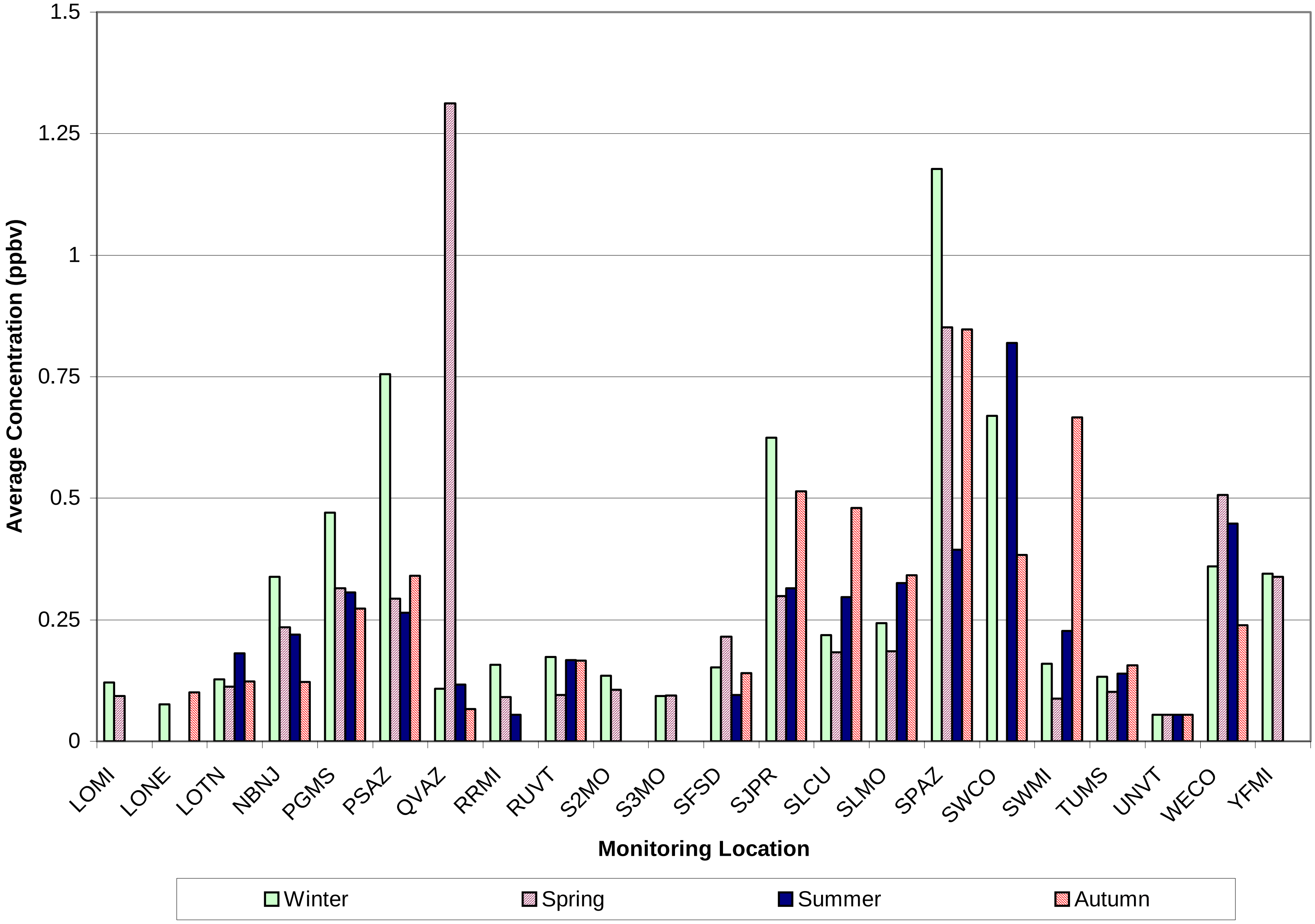
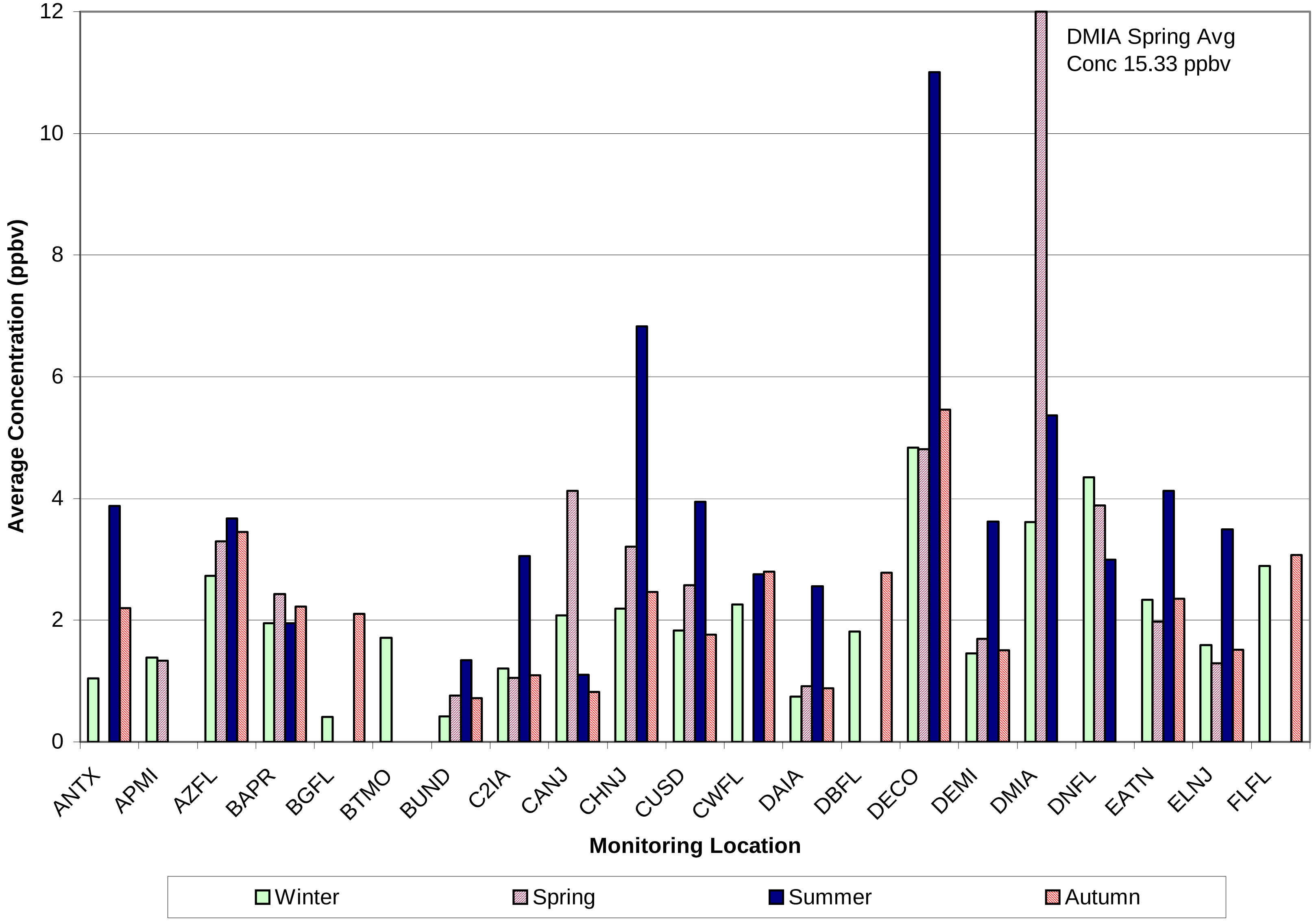


Figure 3-33a. Average Formaldehyde Concentration by Season (ANTX-FLFL)



DMIA Spring Avg Conc 15.33 ppbv

Figure 3-33b. Average Formaldehyde Concentration by Season (G2CO-YFMI)

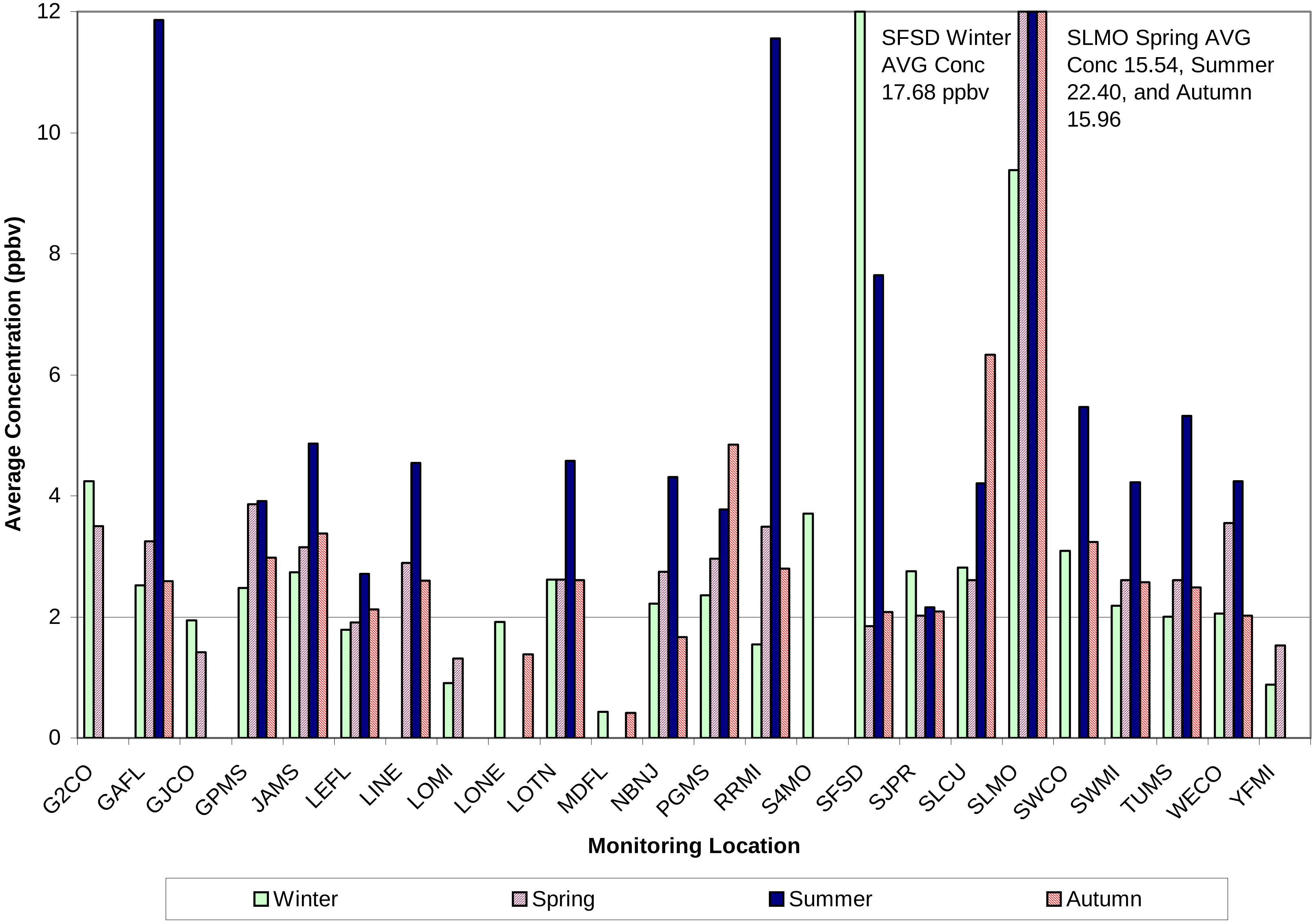


Figure 3-34a. Average *m,p* -Xylene Concentration by Season (ANTX-LINE)

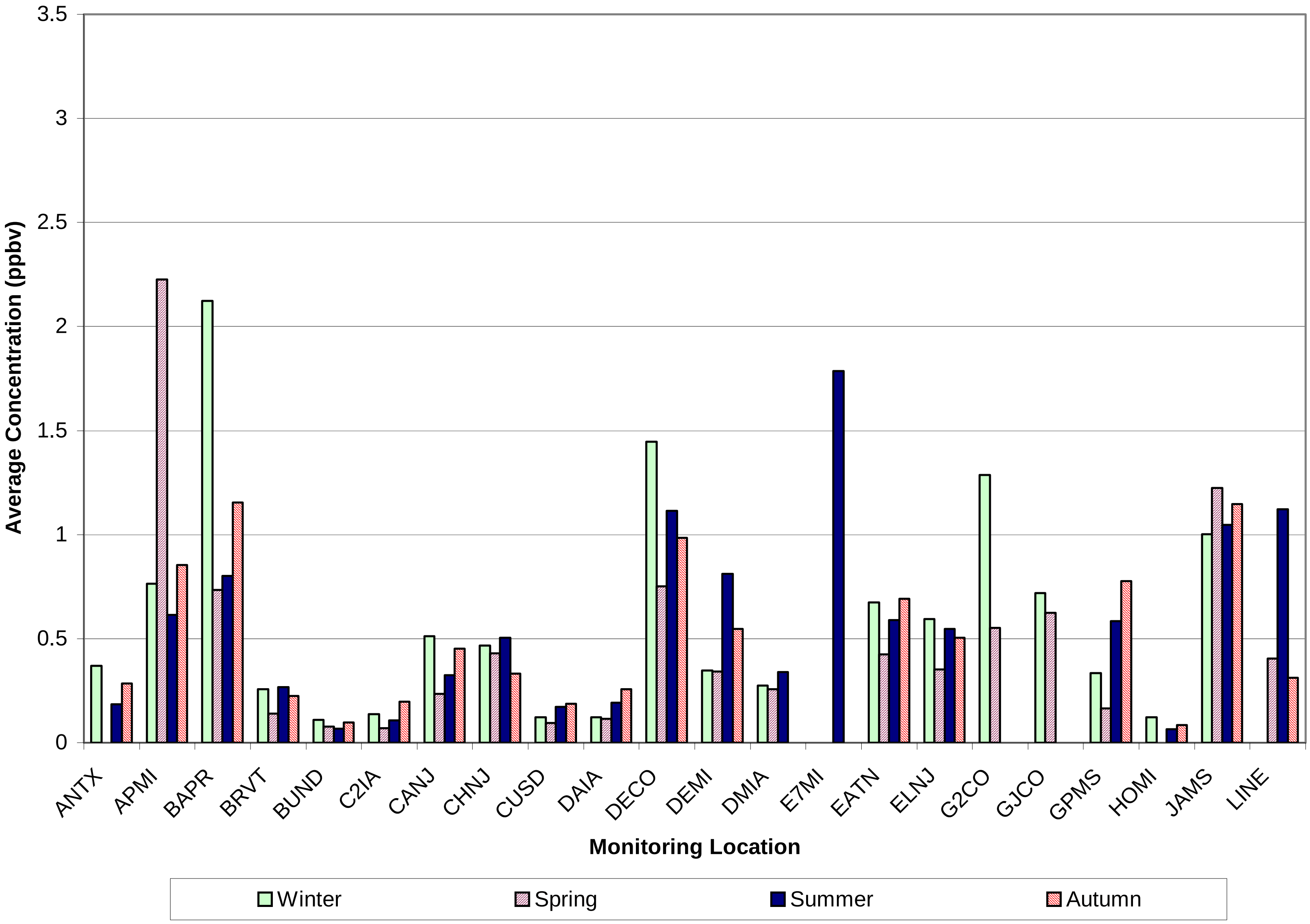


Figure 3-34b. Average *m,p-* Xylene Concentration by Season (LOMI-YFMI)

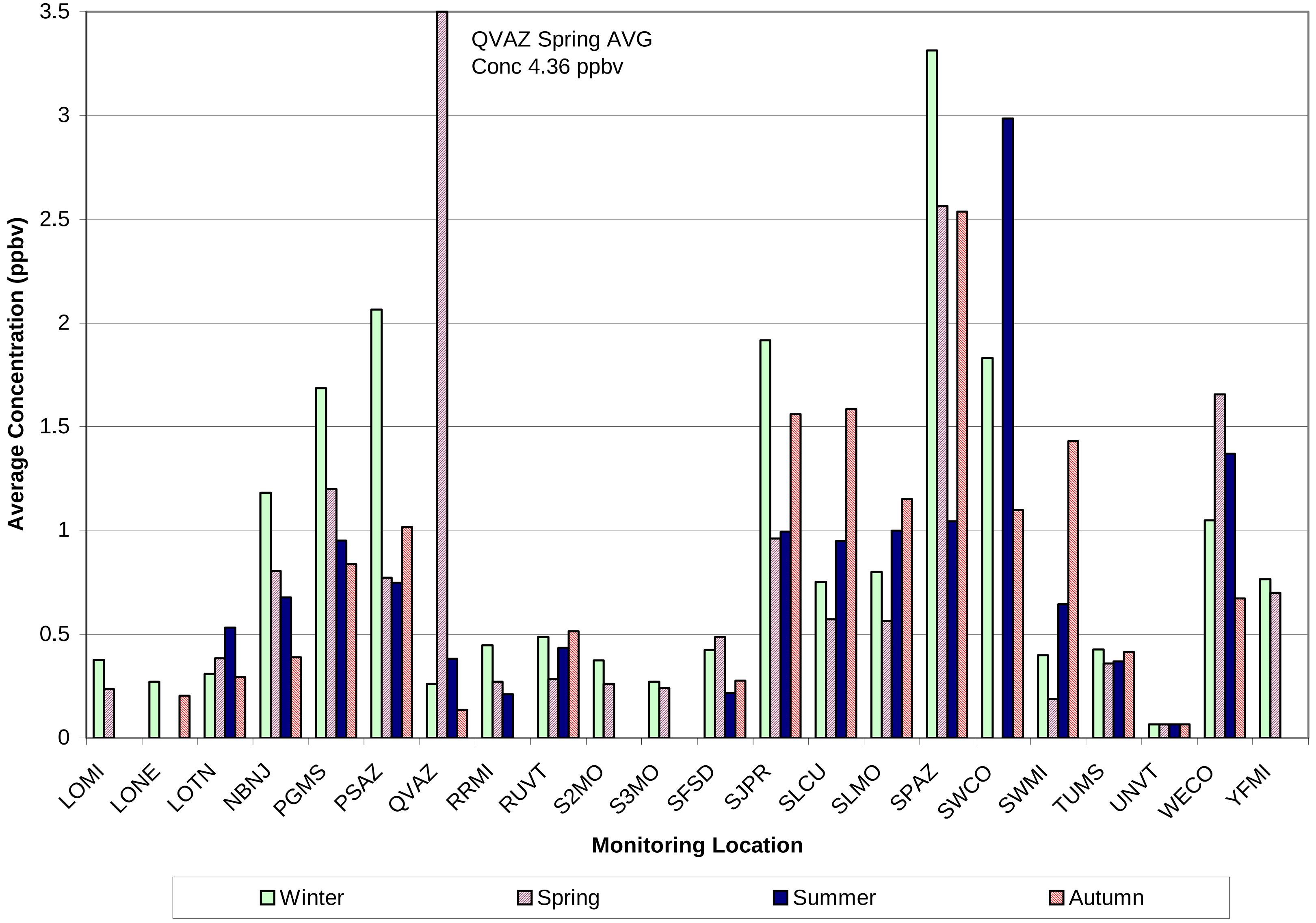


Figure 3-35a. Average *o*-Xylene Concentration by Season (ANTX-LINE)

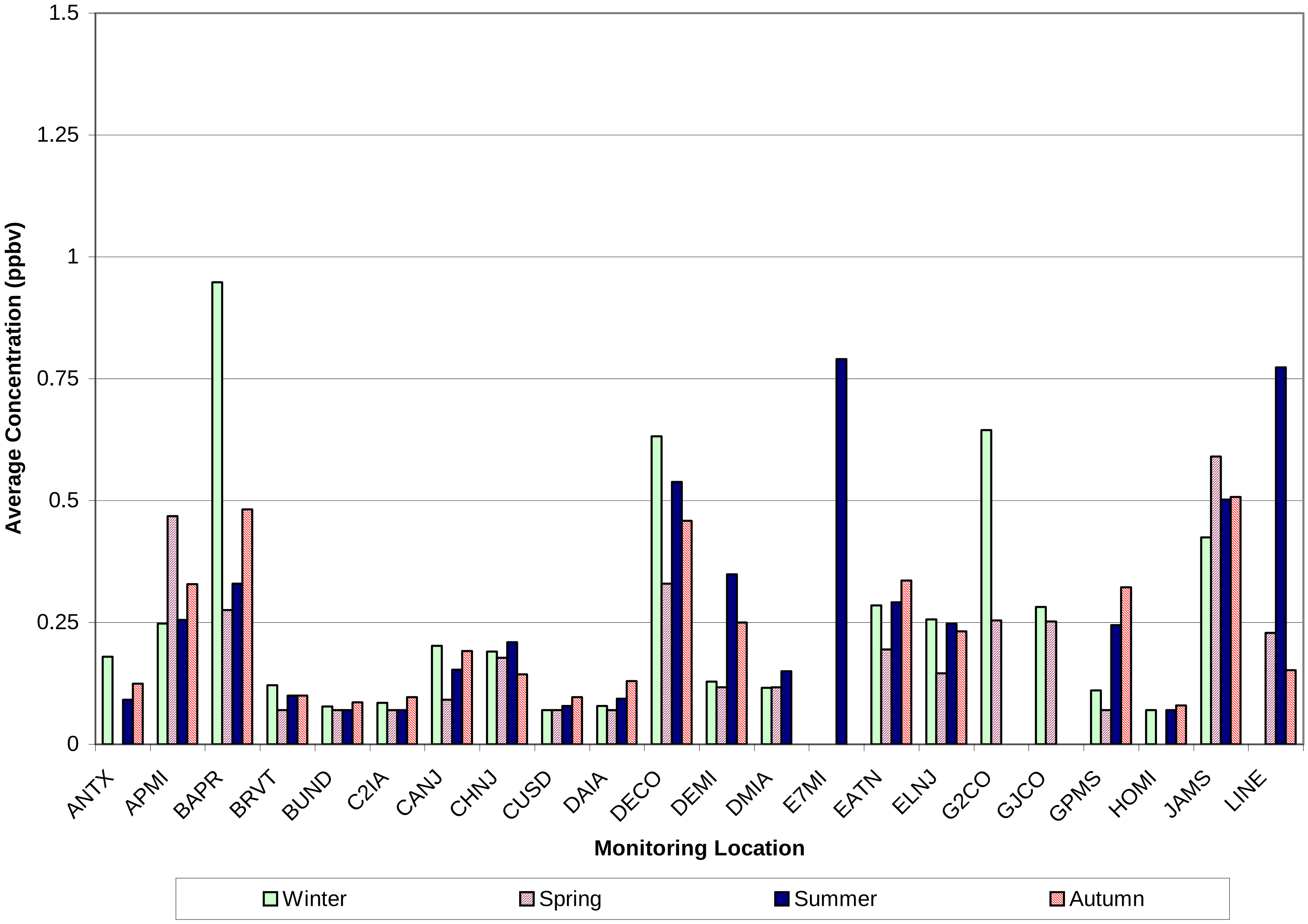


Figure 3-35b. Average *o*-Xylene Concentration by Season (LOMI-YFMI)

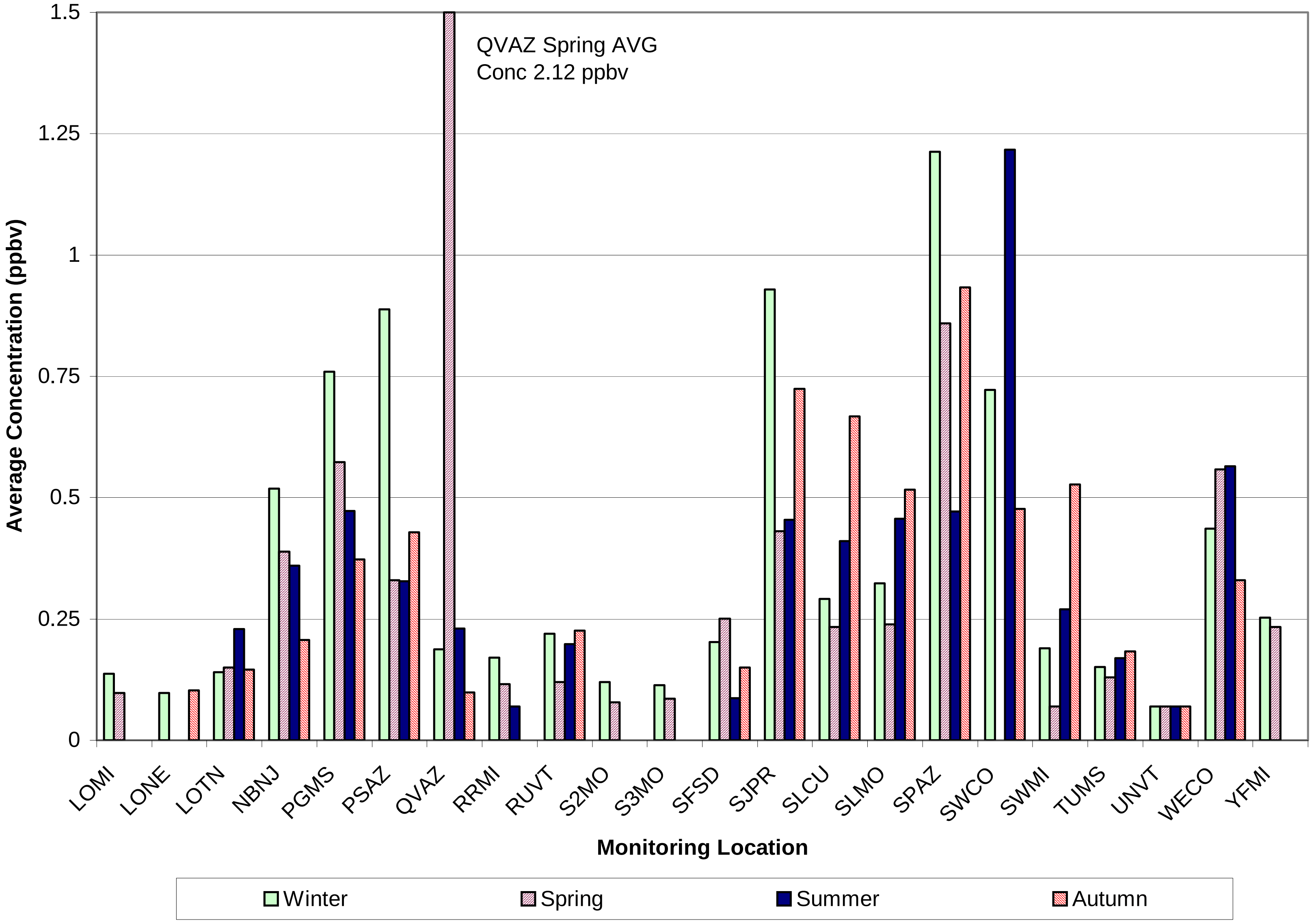


Figure 3-36a. Average Propylene Concentration by Season (ANTX-LINE)

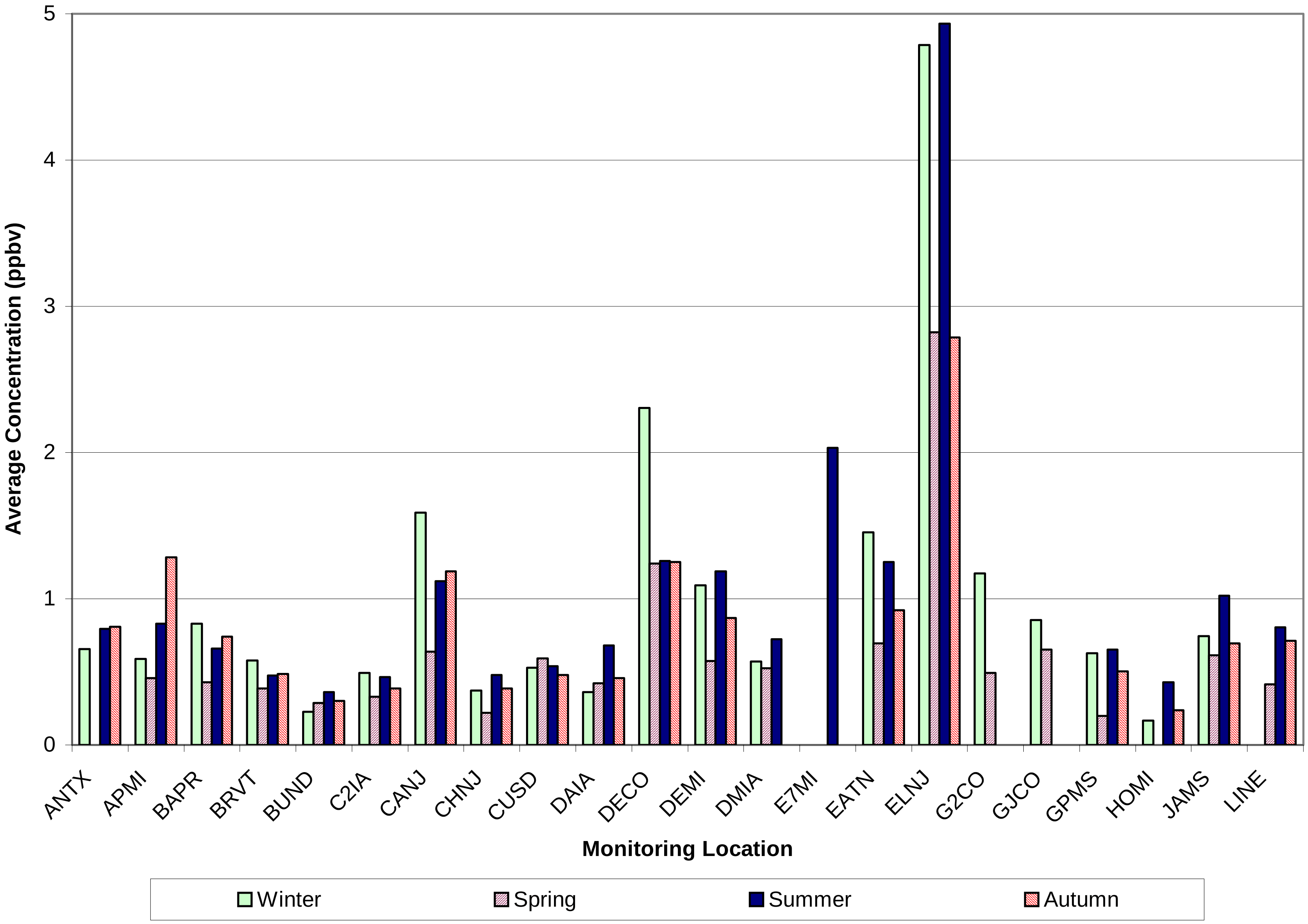


Figure 3-36b. Average Propylene Concentration by Season (LOMI-YFMI)

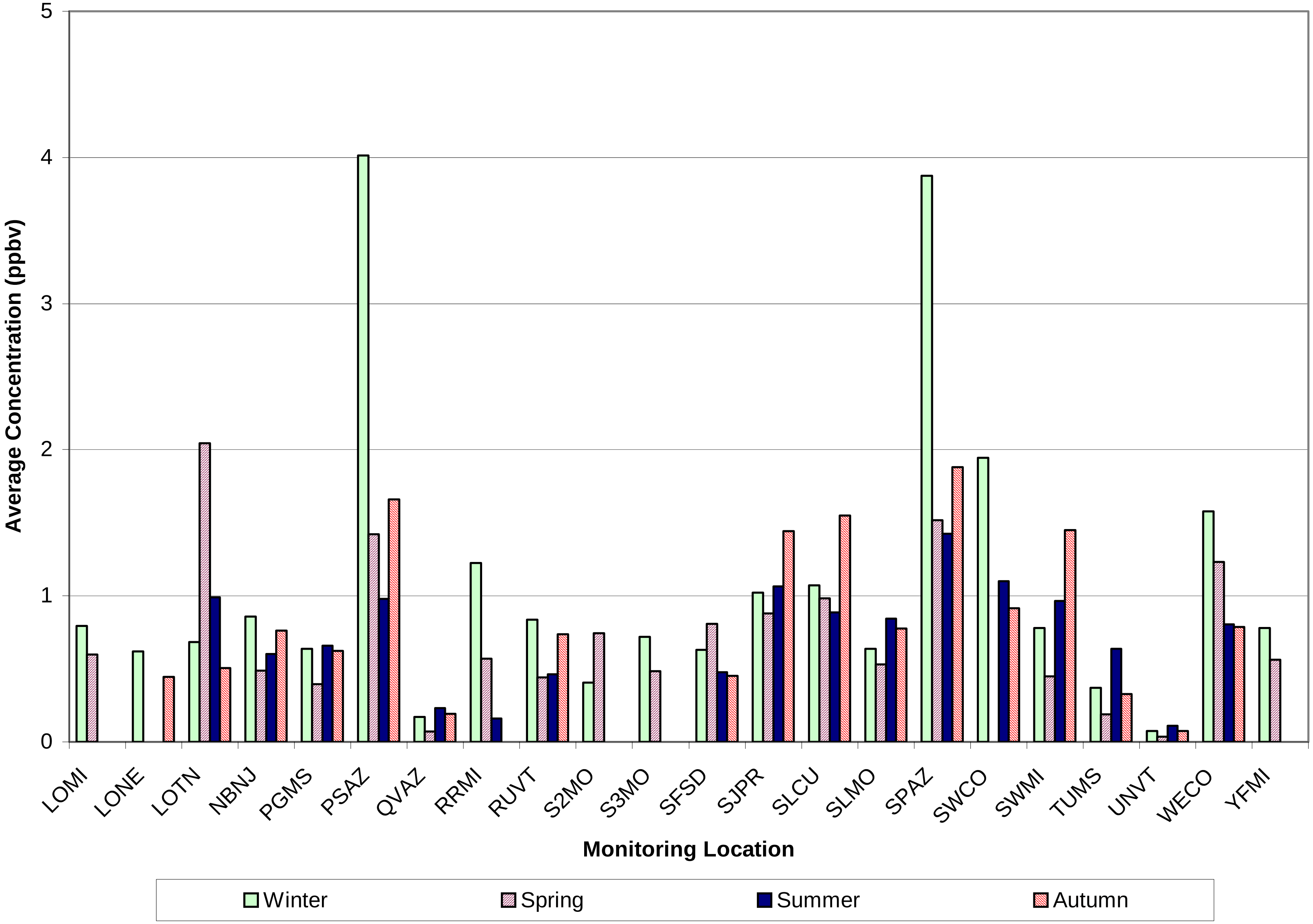
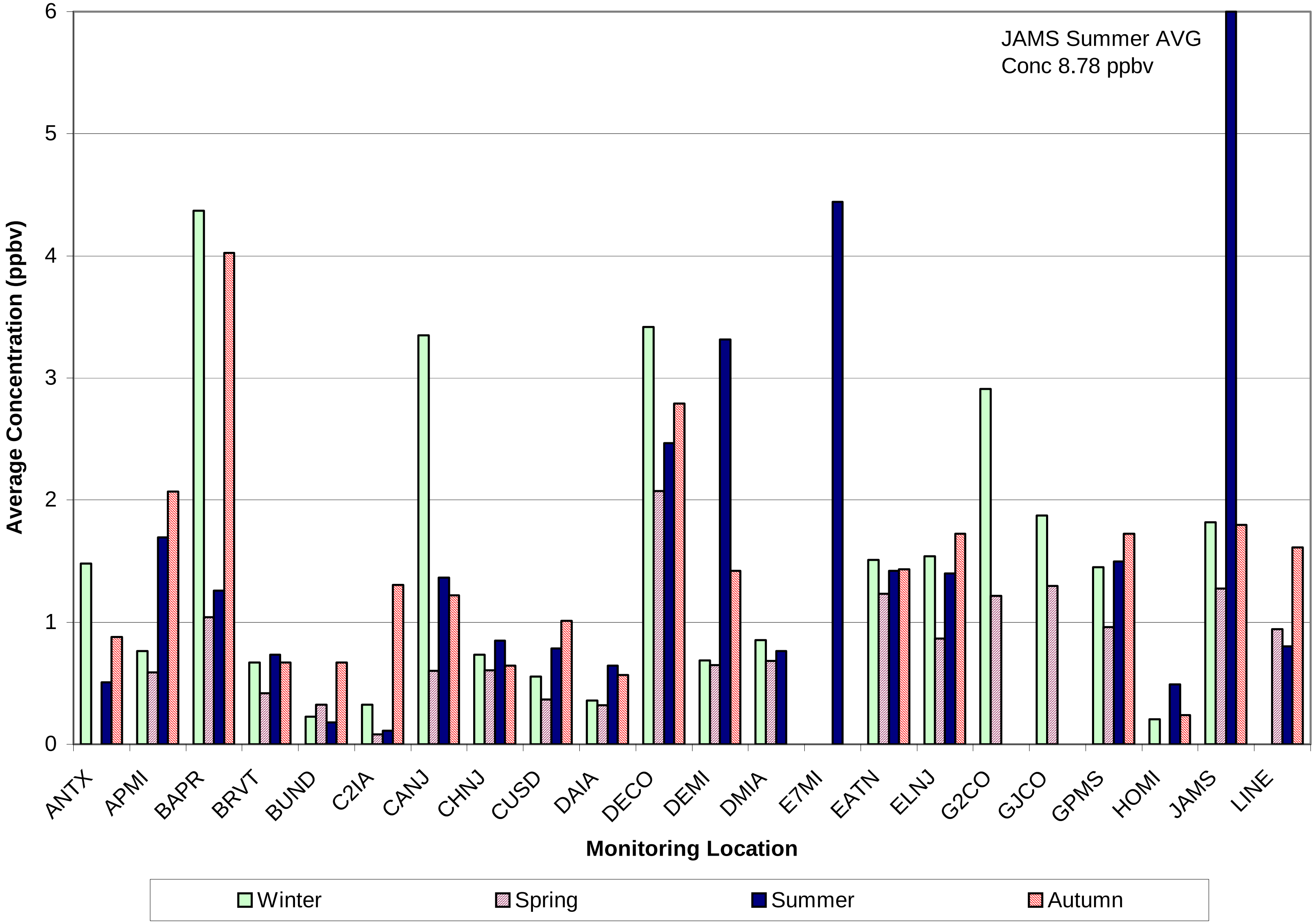


Figure 3-37a. Average Toluene Concentration by Season (ANTX-LINE)



JAMS Summer AVG
Conc 8.78 ppbv

Figure 3-37b. Average Toluene Concentration by Season (LOMI-YFMI)

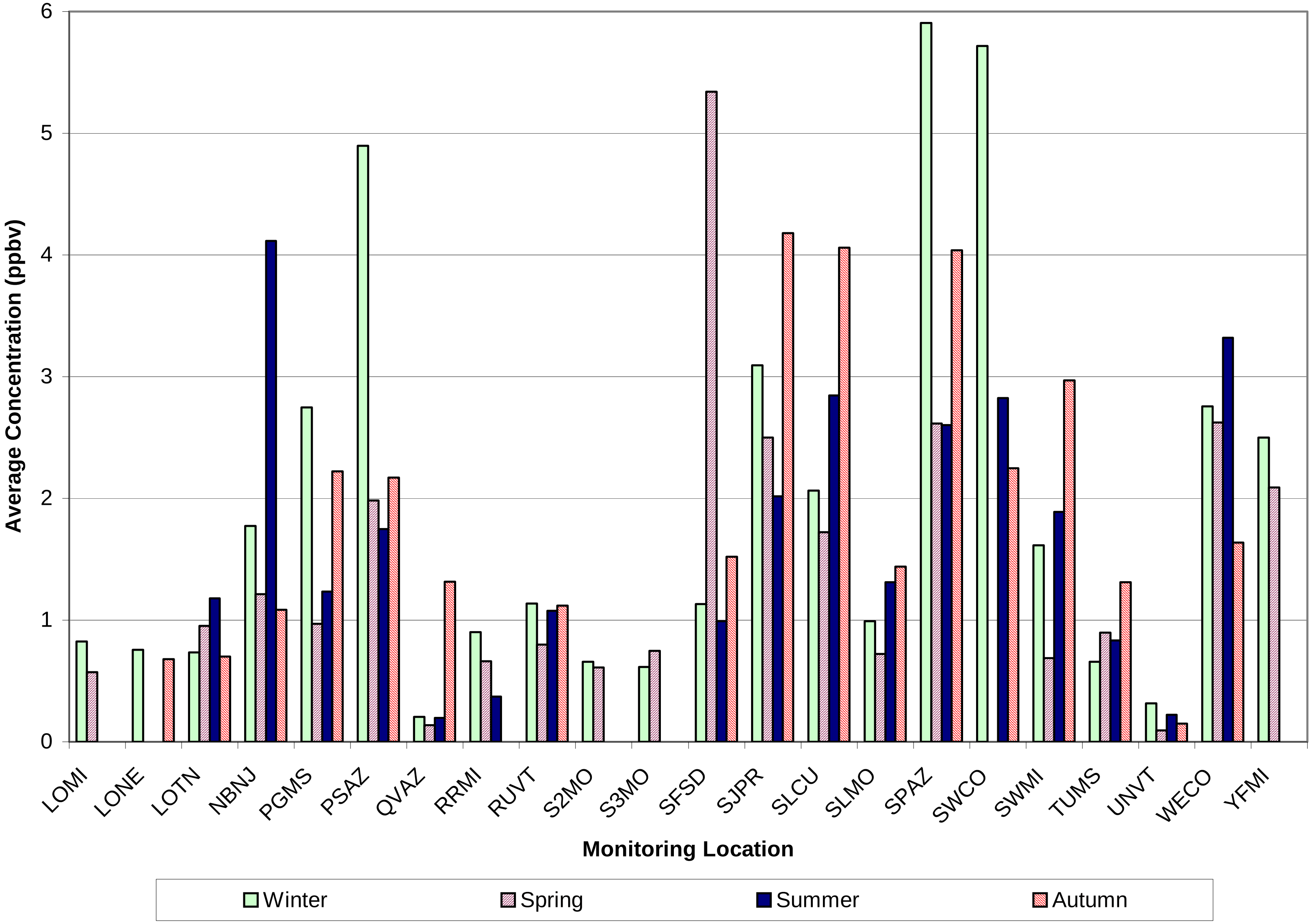


Figure 3-38a. Average Trichlorofluoromethane Concentration by Season (ANTX-LINE)

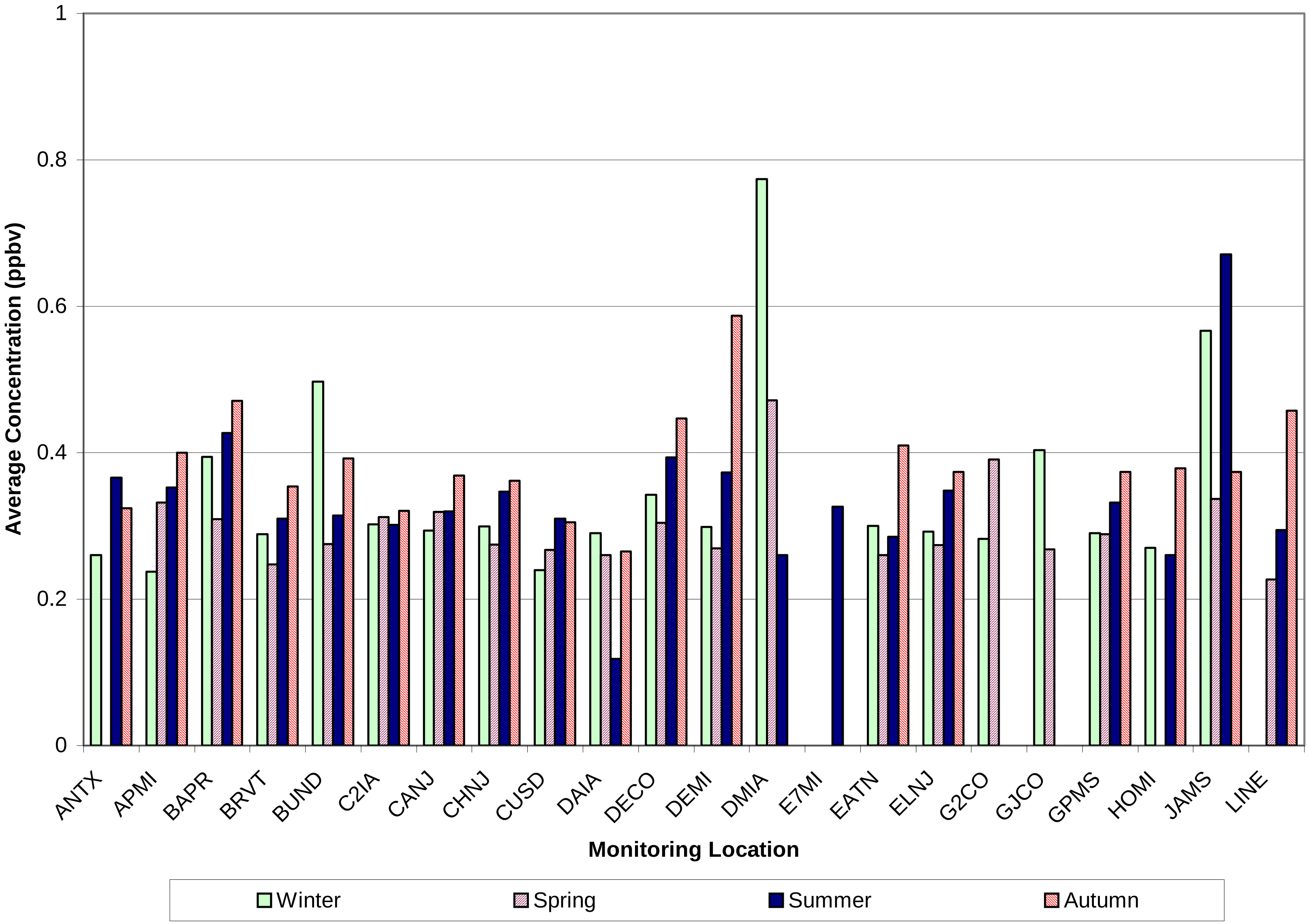


Figure 3-38b. Average Trichlorofluoromethane Concentration by Season (LOMI-YFMI)

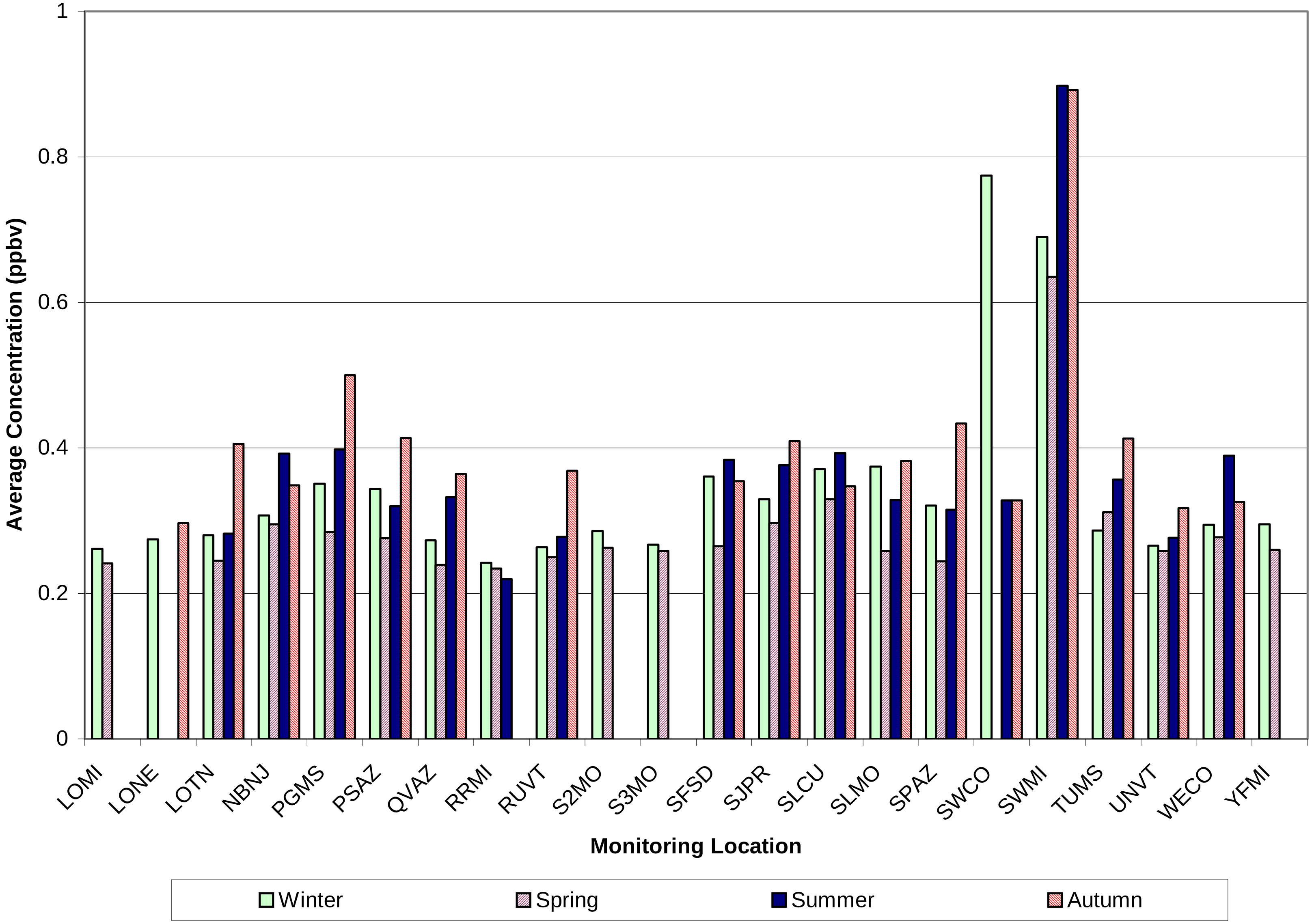


Figure 3-39. Average Metals Concentration

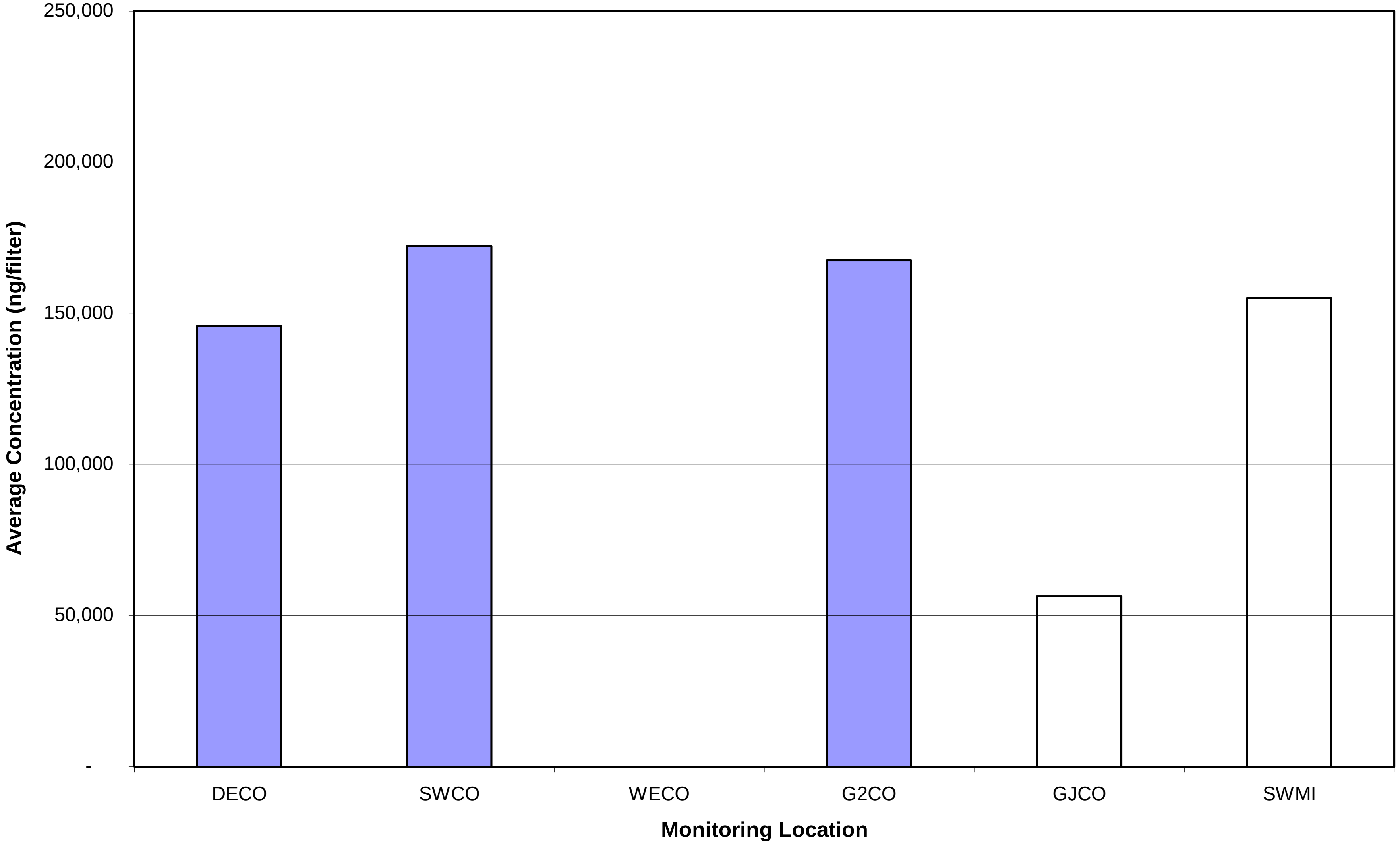


Figure 3-40a. Comparison of Yearly Averages for the BUND Monitoring Station

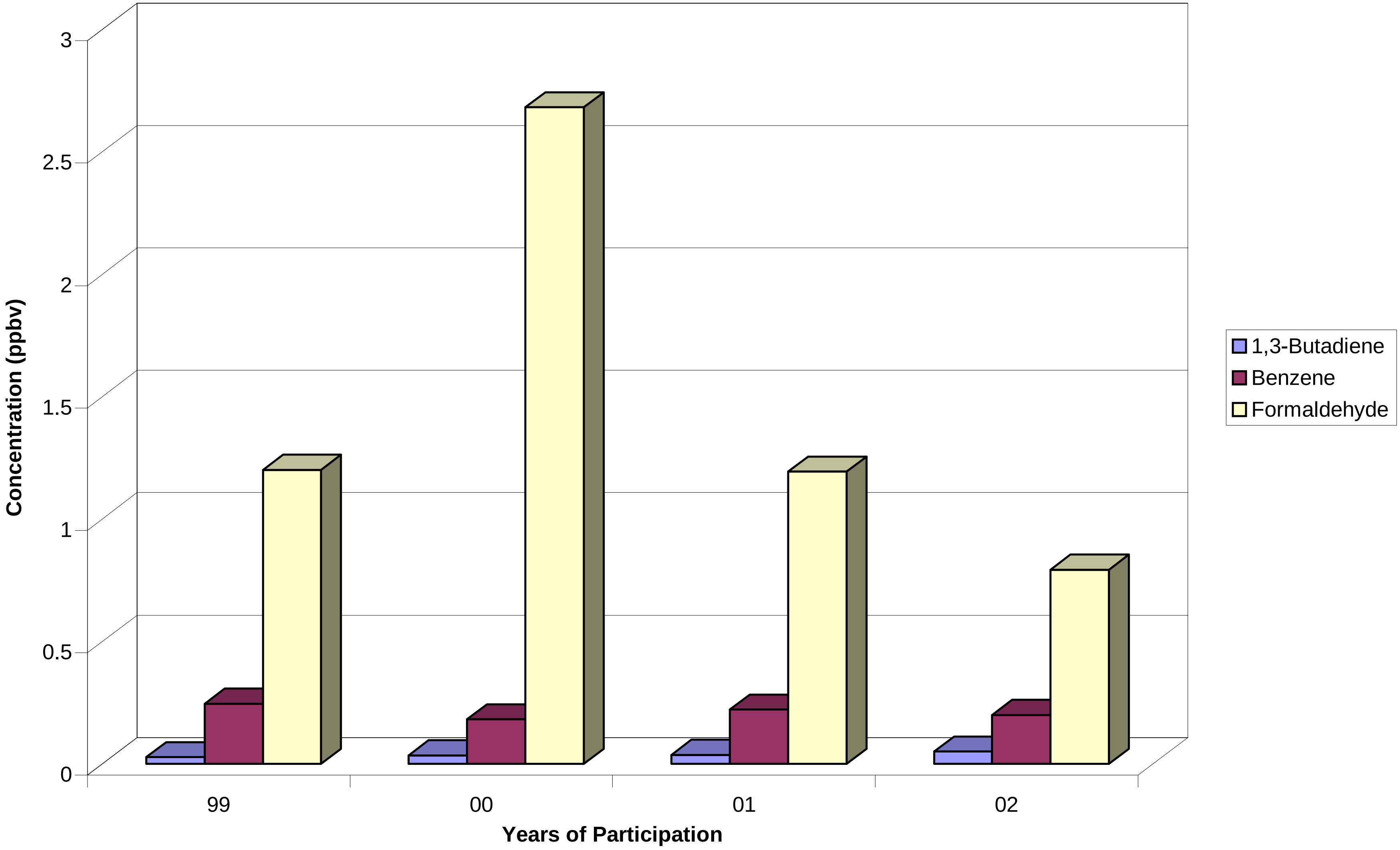


Figure 3-40b. Comparison of Yearly Averages for the CANJ Monitoring Station

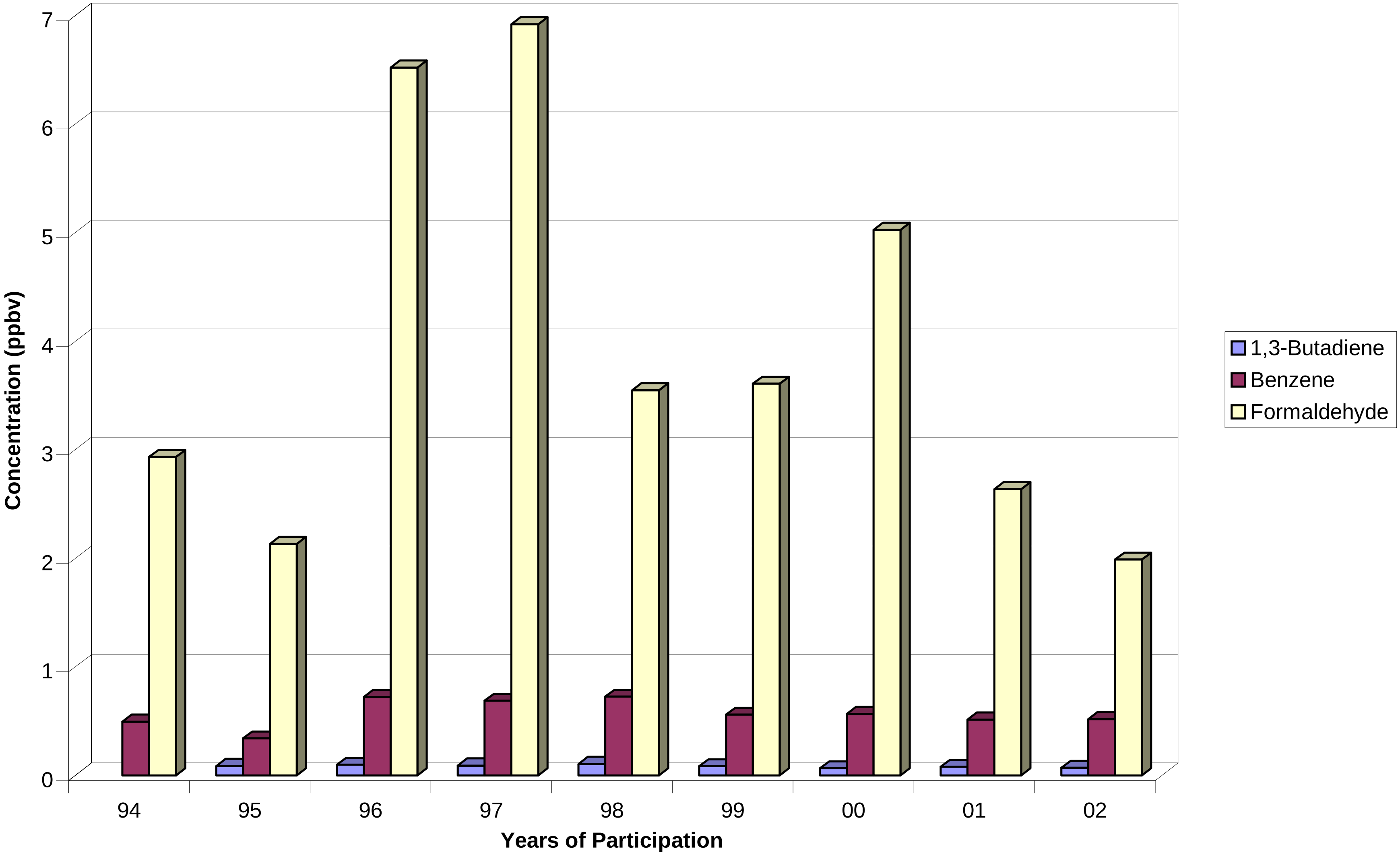


Figure 3-40c. Comparison of Yearly Averages for the DAIA Monitoring Station

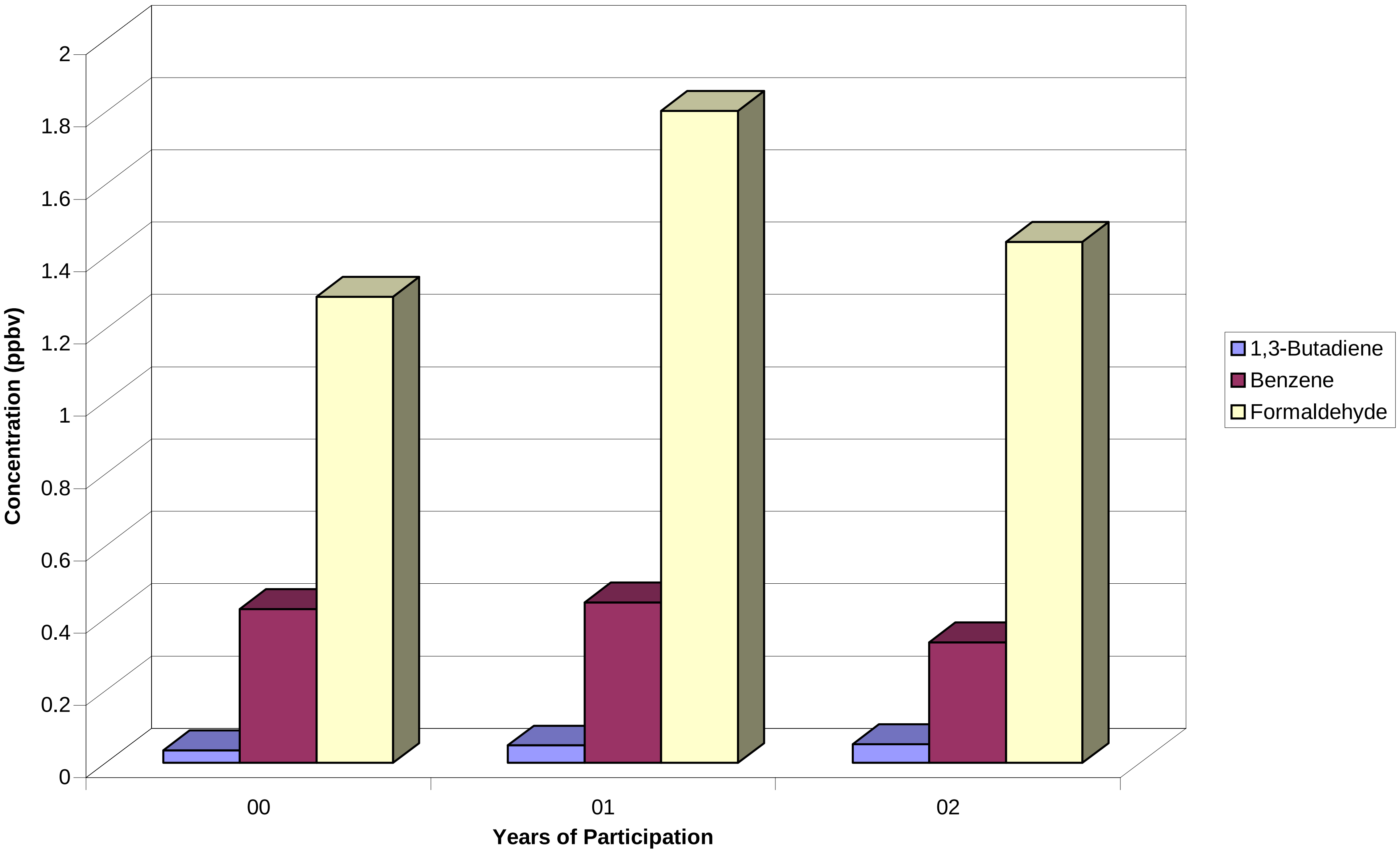


Figure 3-40d. Comparison of Yearly Averages for the DECO Monitoring Station

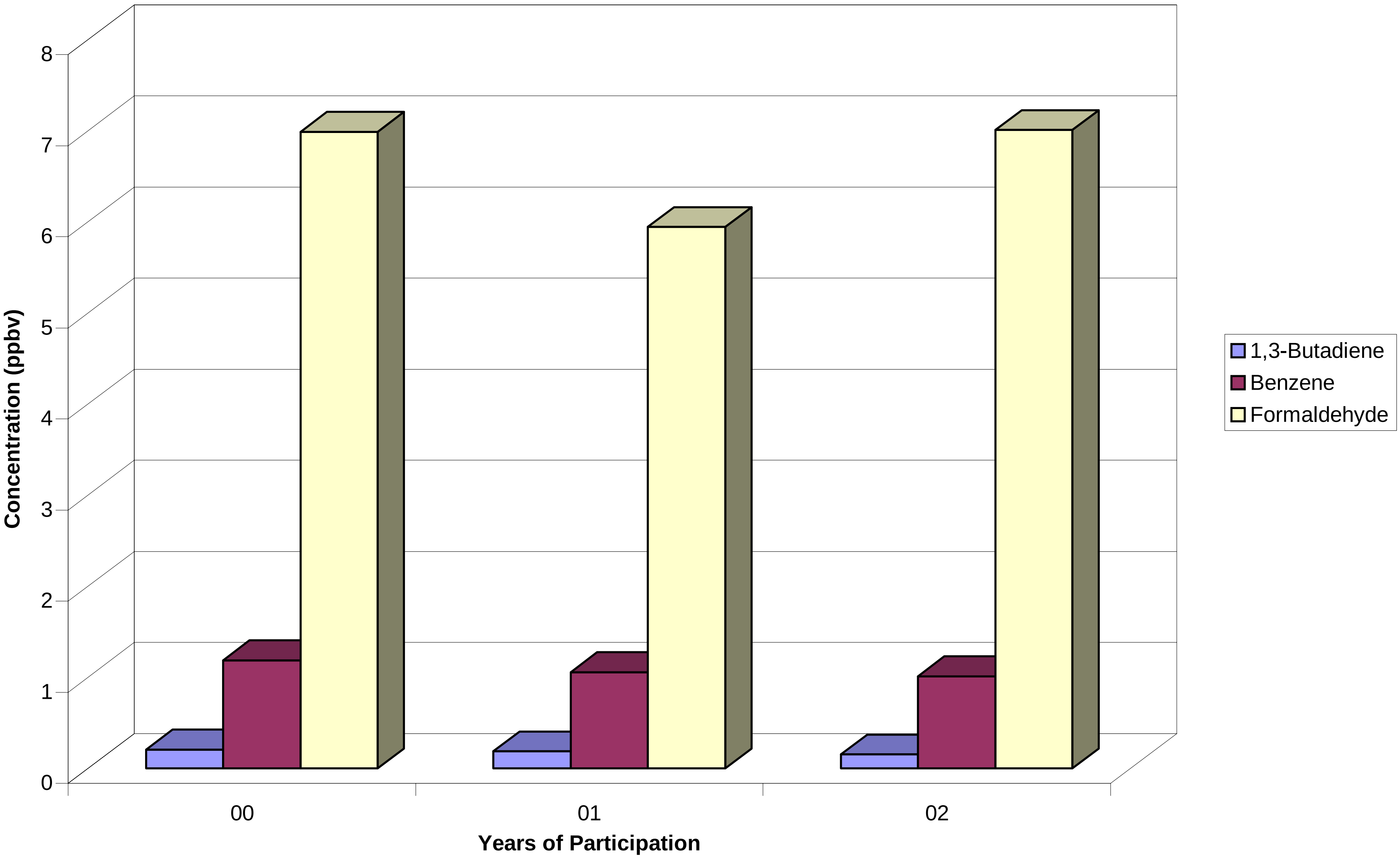


Figure 3-40e. Comparison of Yearly Averages for the DMIA Monitoring Station

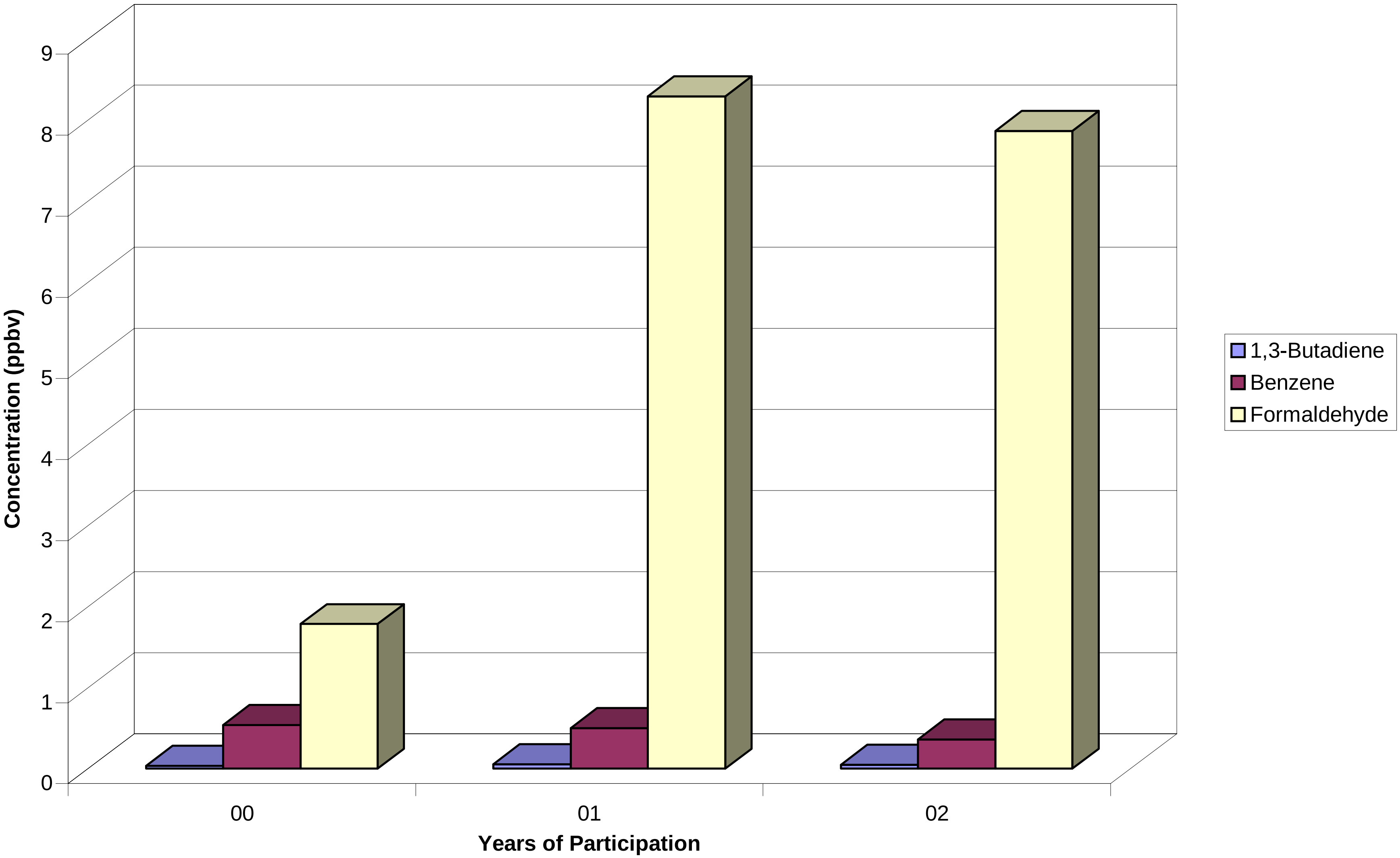


Figure 3-40f. Comparison of Yearly Averages for the ELNJ Monitoring Station

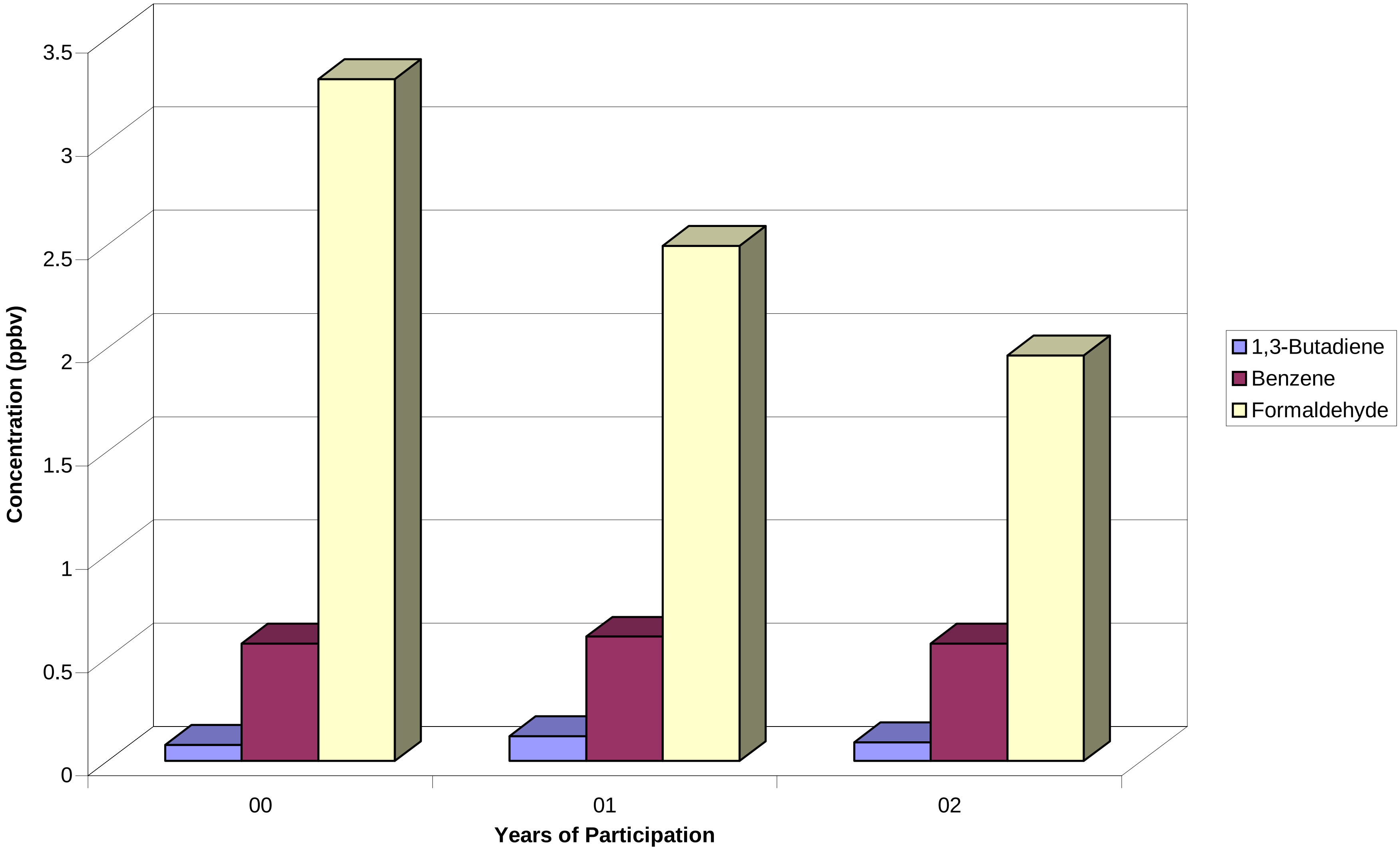


Figure 3-40g. Comparison of Yearly Averages for the SFSD Monitoring Station

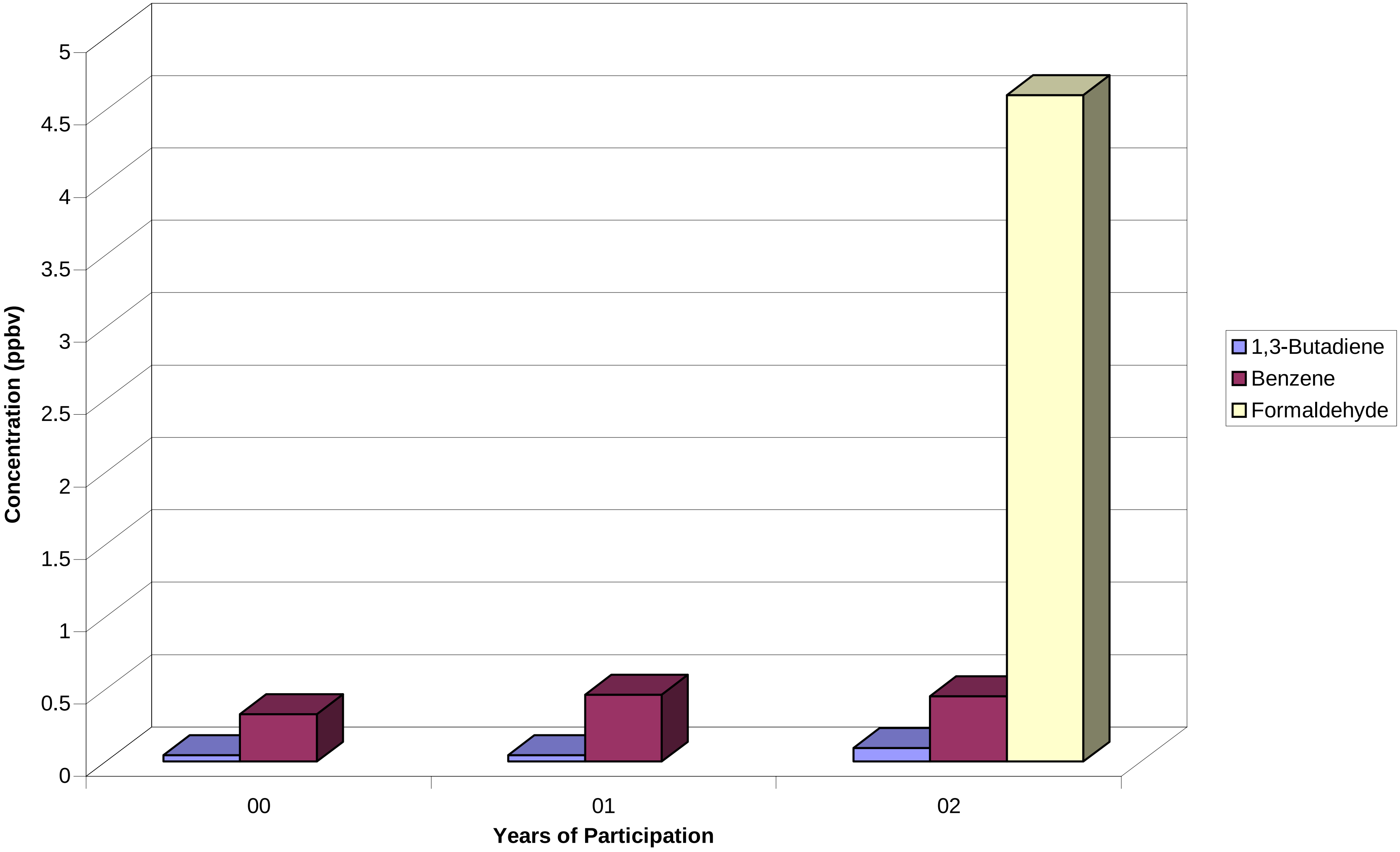


Figure 3-40h. Comparison of Yearly Averages for the SLCU Monitoring Station

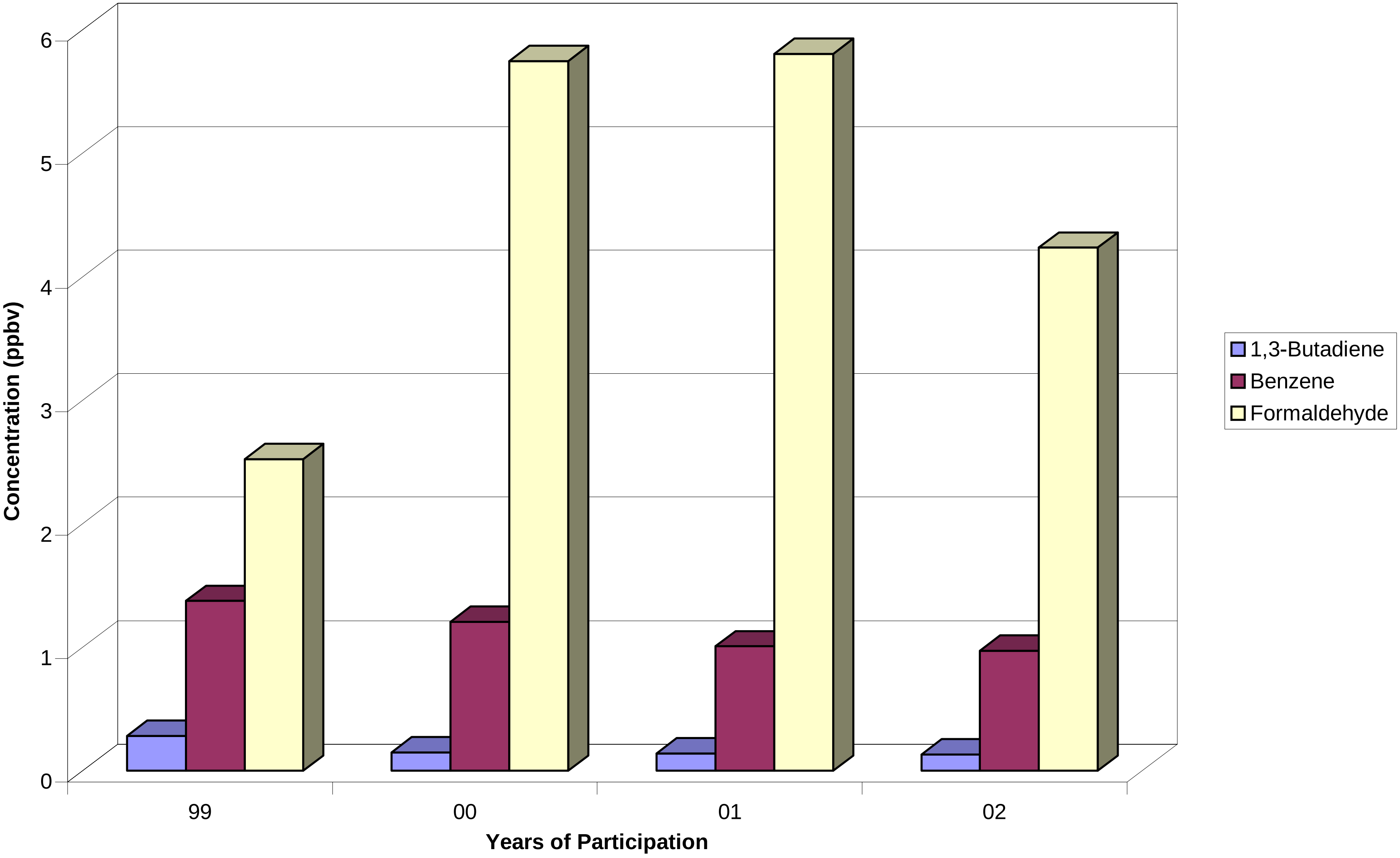


Figure 3-41a. Comparison of Seasonal Averages for the BUND Monitoring Station

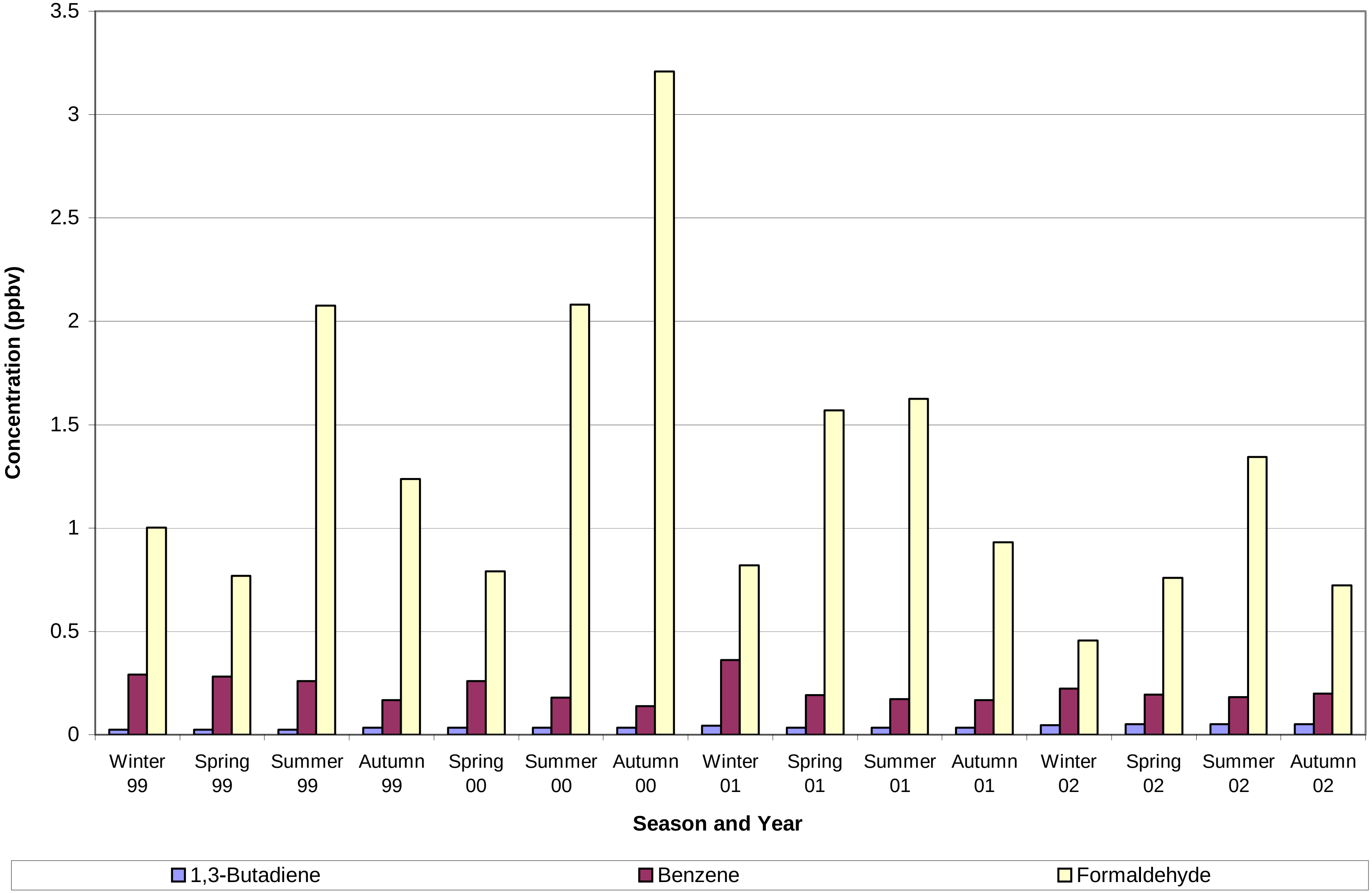


Figure 3-41b. Comparison of Seasonal Averages for the CANJ Monitoring Station (1994-1998)

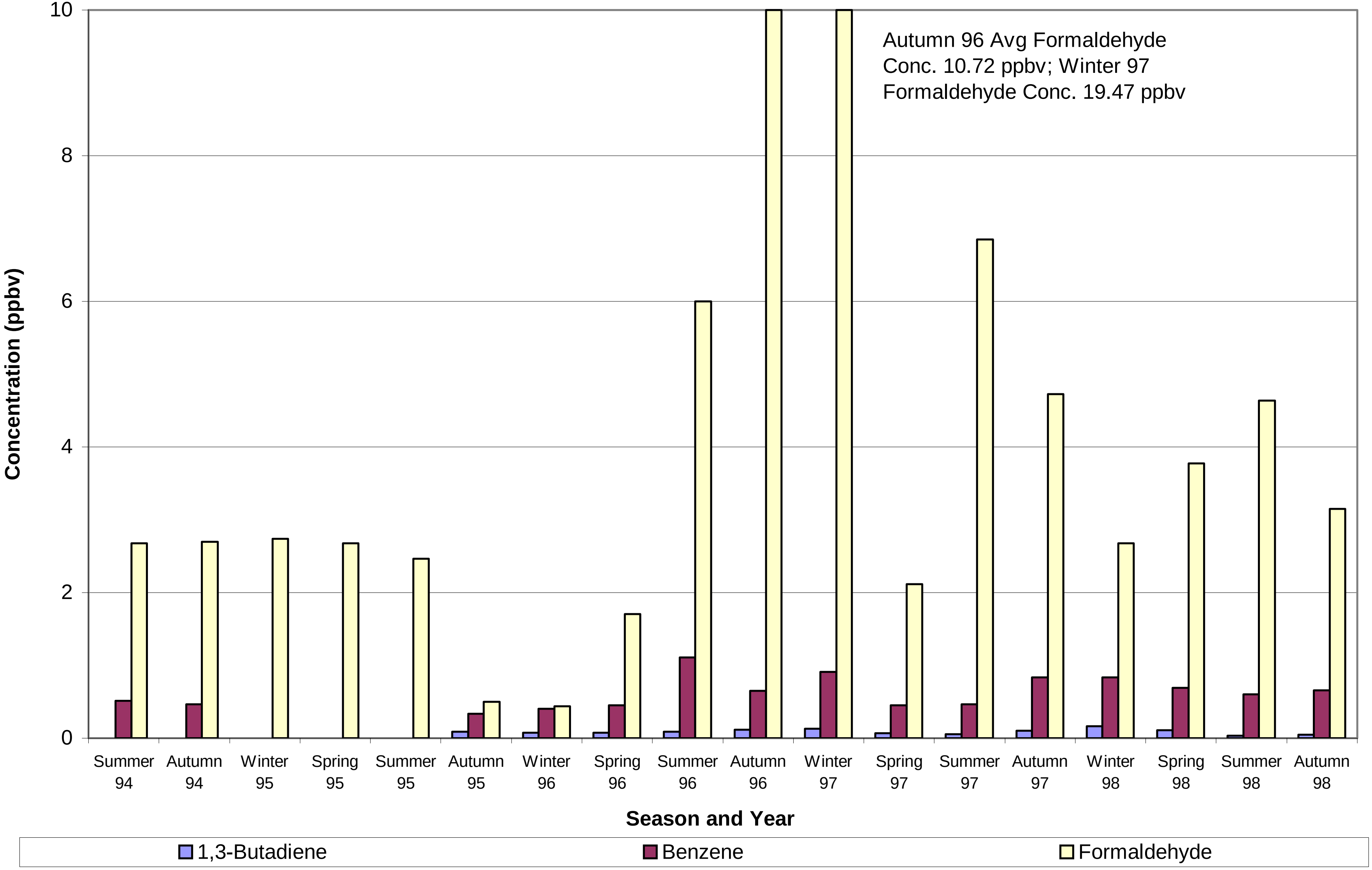

Autumn 96 Avg Formaldehyde Conc. 10.72 ppbv; Winter 97 Formaldehyde Conc. 19.47 ppbv

Figure 3-41c. Comparison of Seasonal Averages for the DAIA Monitoring Station

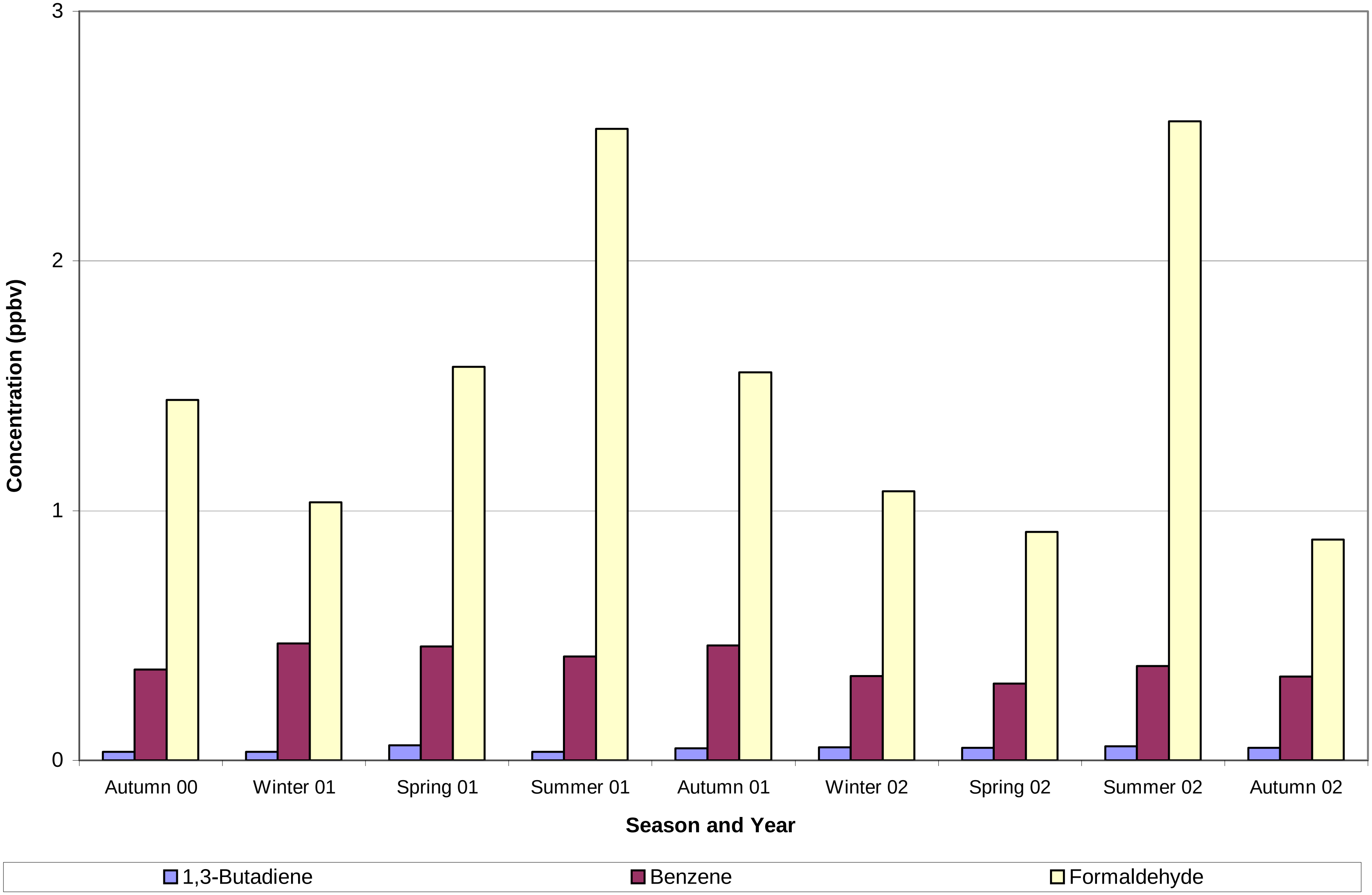


Figure 3-41d. Comparison of Seasonal Averages for the DECO Monitoring Station

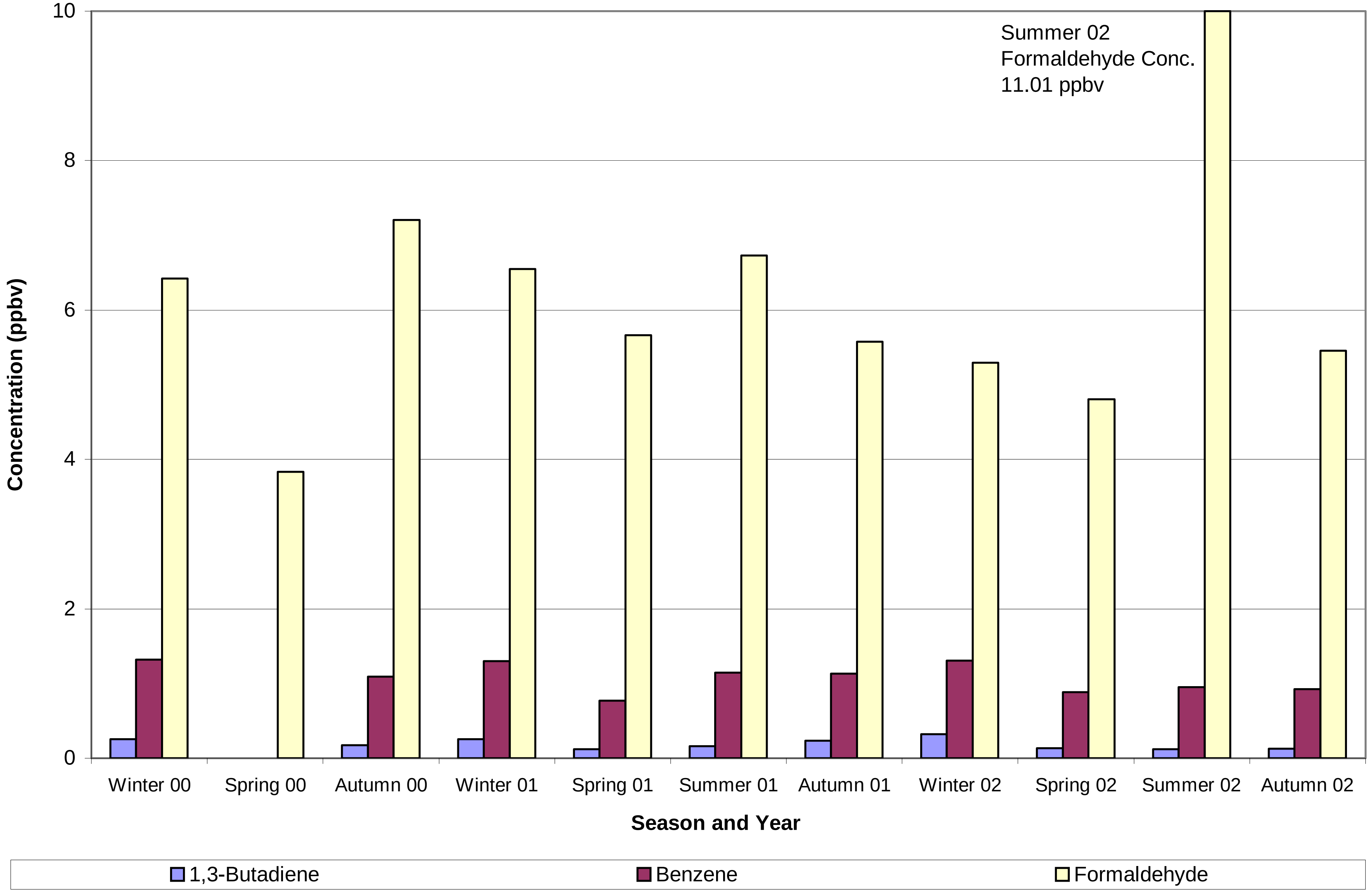
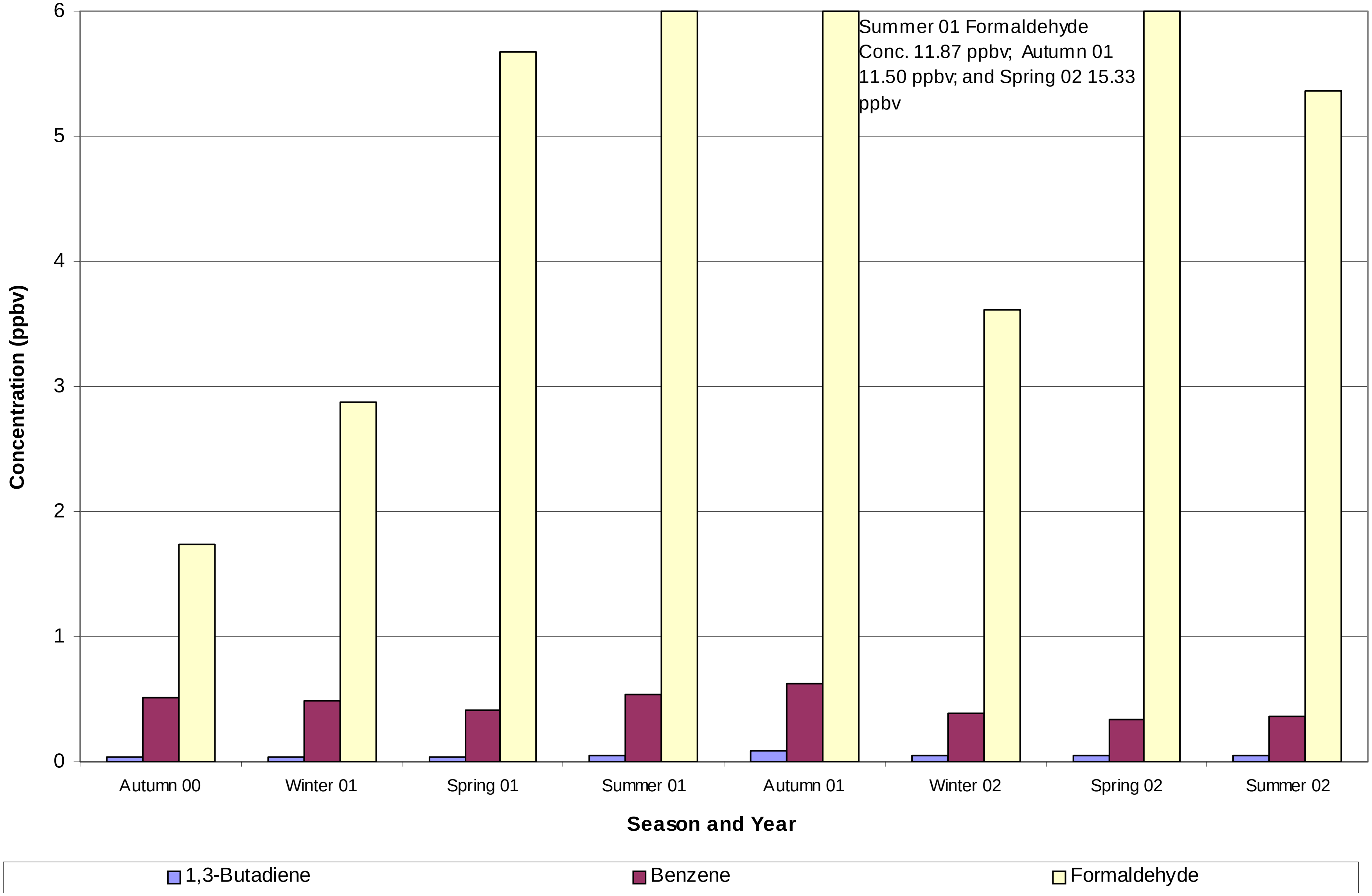


Figure 3-41e. Comparison of Seasonal Averages for the DMIA Monitoring Station



Summer 01 Formaldehyde Conc. 11.87 ppbv; Autumn 01 11.50 ppbv; and Spring 02 15.33 ppbv

Figure 3-41f. Comparison of Seasonal Averages for the ELNJ Monitoring Station

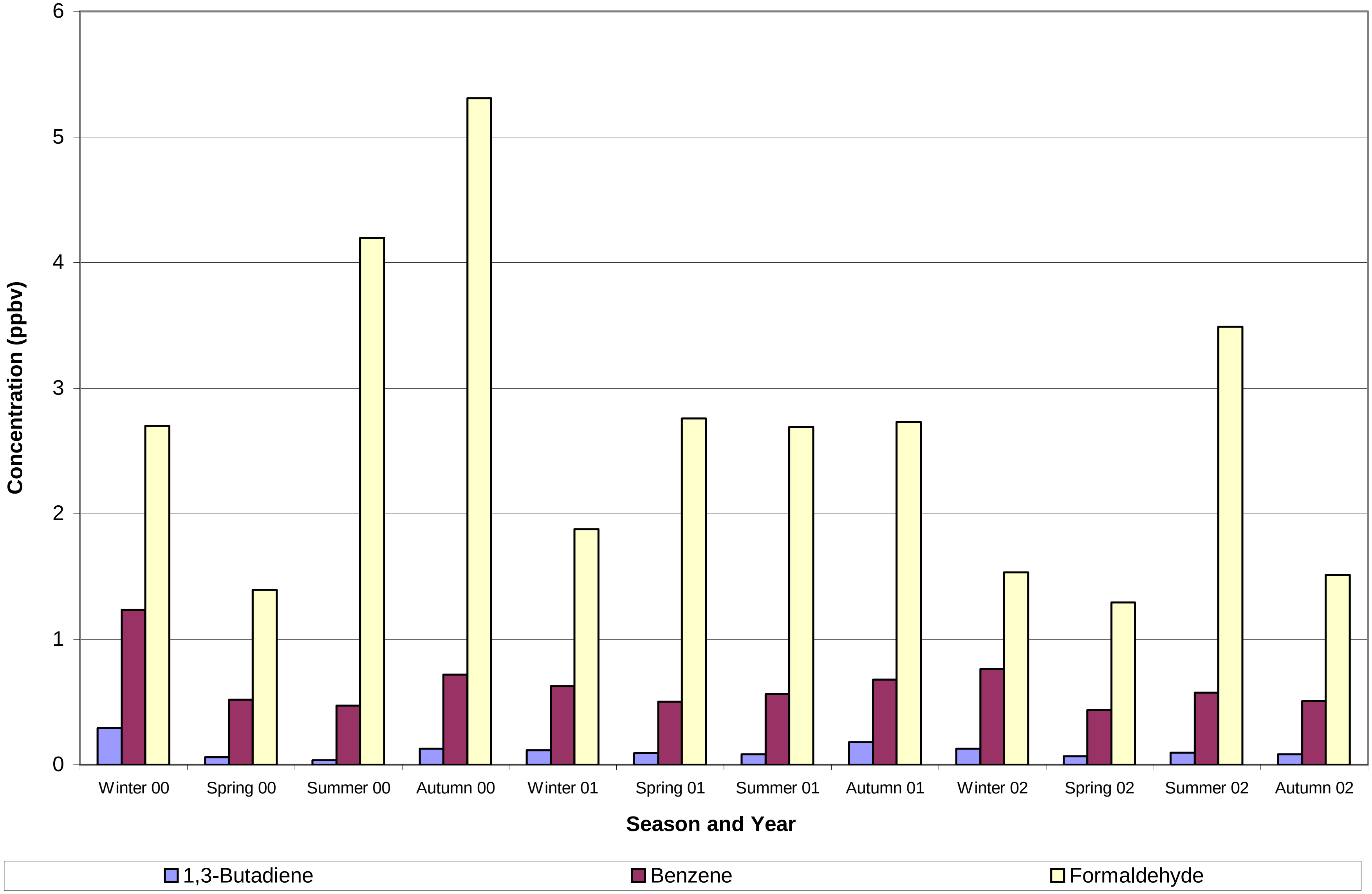
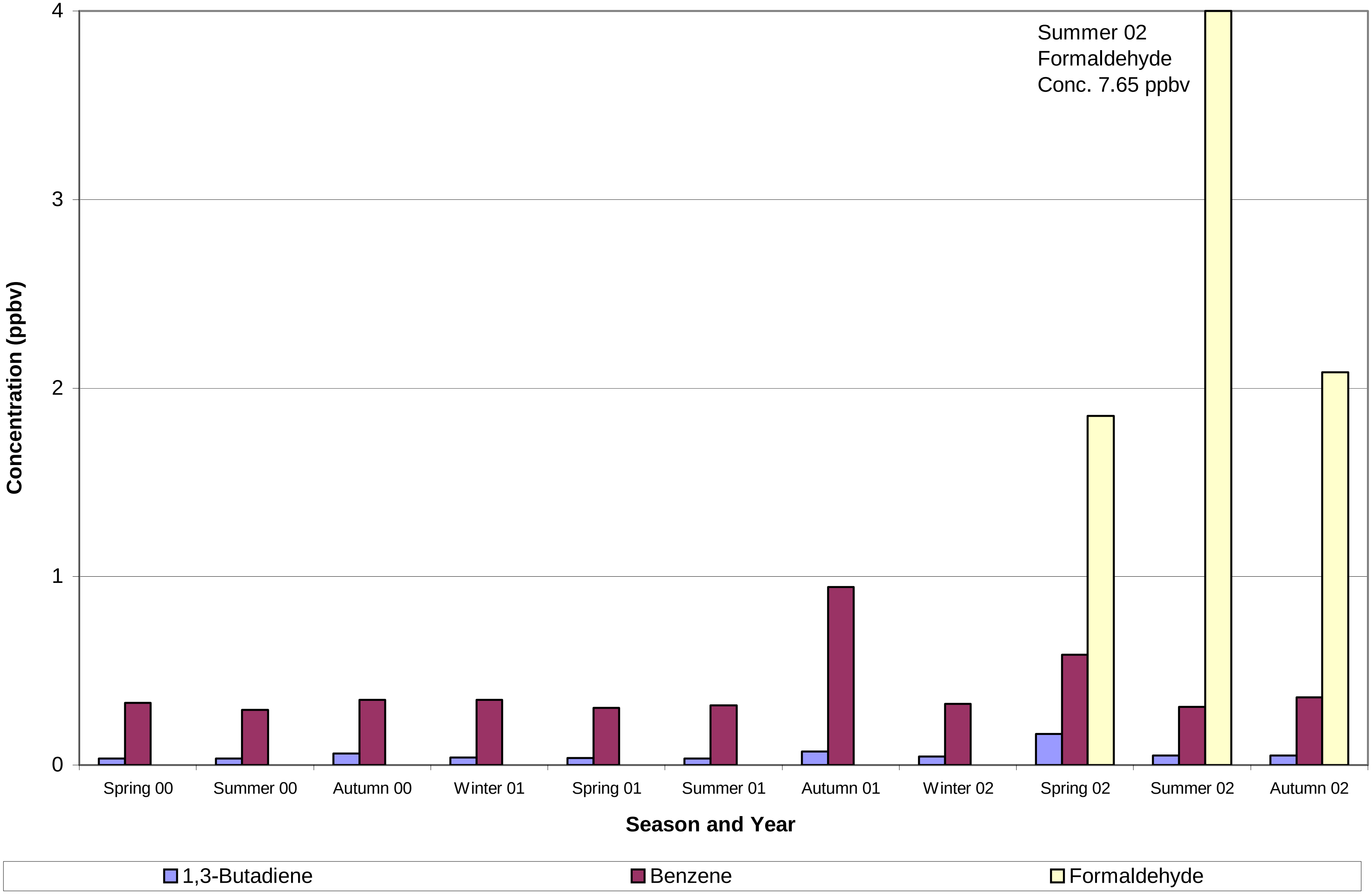


Figure 3-41g. Comparison of Seasonal Averages for the SFSD Monitoring Station



Summer 02
Formaldehyde
Conc. 7.65 ppbv

Figure 3-41h. Comparison of Seasonal Averages for the SLCU Monitoring Station

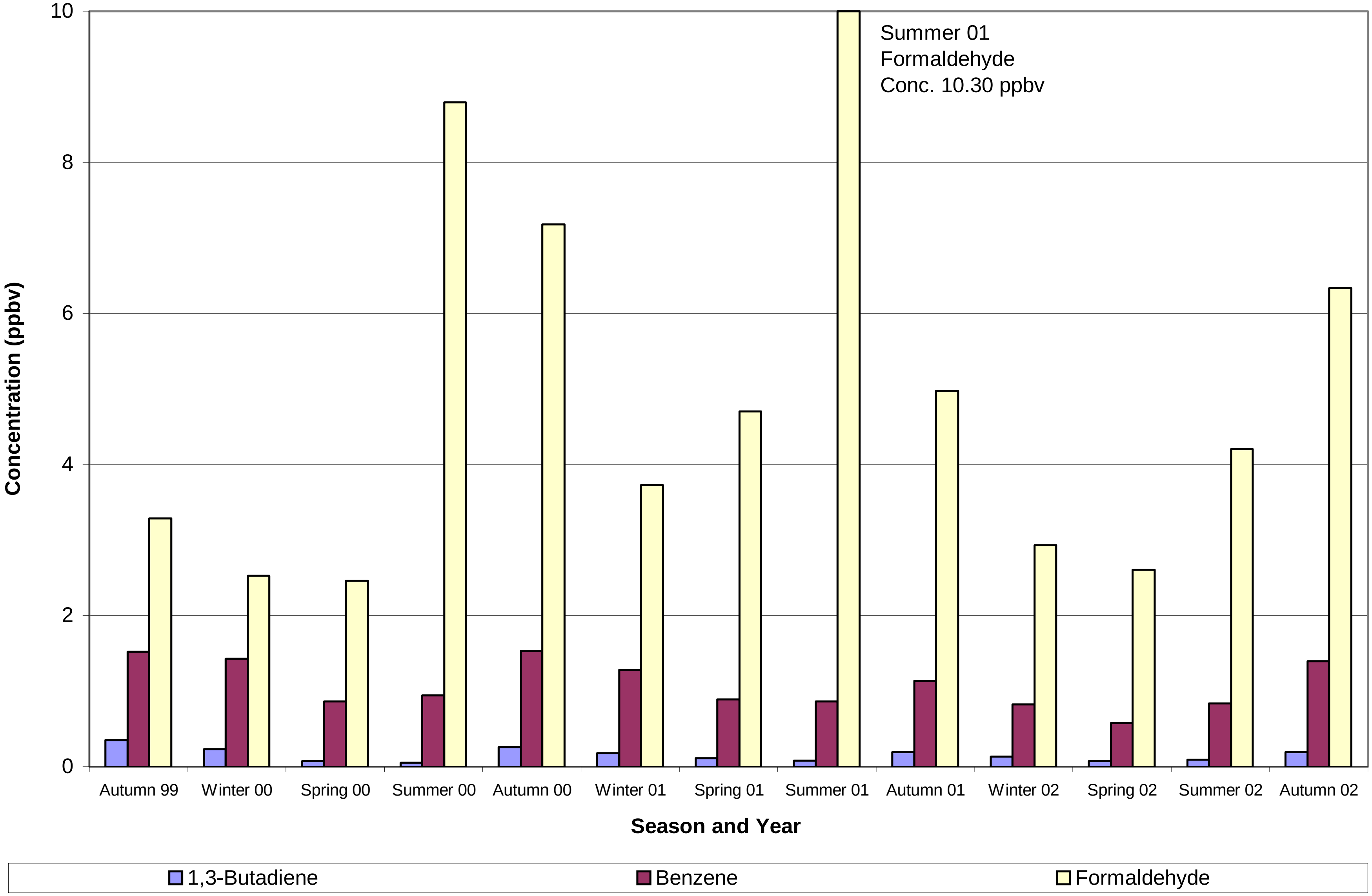


Table 3-1. Sampling Detect Summaries of the VOC Concentrations

Chemical[1]	# of Detects	Min. Value (ppbv)	Max. Value (ppbv)	Average Value (ppbv)	Geometric Mean (ppbv)	Median (ppbv)	1st Quartile (ppbv)	3rd Quartile (ppbv)	Standard Deviation (ppbv)	Coefficient of Variation
Hydrocarbons										
Acetylene	2019	0.08	84.41	1.72	1.53	1.51	1.14	2.03	1.00	0.58
Benzene	2028	0.064	49.75	0.57	0.51	0.51	0.38	0.67	0.30	0.54
1,3-Butadiene	373	0.11	2.12	0.20	0.19	0.17	0.15	0.23	0.08	0.42
Ethylbenzene	1227	0.12	7.19	0.30	0.26	0.26	0.17	0.37	0.20	0.67
n-Octane	384	0.11	3.79	0.25	0.22	0.21	0.16	0.27	0.14	0.58
Propylene	1996	0.06	19.74	0.86	0.71	0.73	0.44	1.10	0.59	0.69
Styrene	136	0.13	13.71	0.40	0.26	0.20	0.16	0.32	0.68	1.71
Toluene	1977	0.09	87.44	1.26	0.91	0.88	0.55	1.35	1.47	1.39
1,2,4-Trimethylbenzene	1001	0.13	8.05	0.29	0.26	0.26	0.18	0.37	0.14	0.47
1,3,5-Trimethylbenzene	351	0.12	2.481	0.22	0.20	0.20	0.16	0.24	0.08	0.36
_m_-,_p_-Xylene	1711	0.14	28.07	0.61	0.49	0.47	0.30	0.78	0.47	0.77
_o_-Xylene	1173	0.15	9.1	0.41	0.36	0.38	0.26	0.49	0.24	0.59
Halogenated Hydrocarbons										
Bromochloromethane	NA									
Bromodichloromethane	1	NA								
Bromoform	NA									
Bromomethane	17	0.12	13.94	2.79	0.71	0.67	0.16	1.21	5.04	1.80
Carbon Tetrachloride	1592	0.063	0.25	0.10	0.09	0.09	0.11	0.02	0.18	0.21
Chlorobenzene	4	0.095	0.18	0.13	0.12	0.11	0.15	0.04	0.33	0.88
Chloroethane	10	0.15	0.38	0.28	0.27	0.23	0.33	0.08	0.28	0.79

Table 3-1. Sampling Detect Summaries of the VOC Concentrations (Continued)

Chemical[1]	# of Detects	Min. Value (ppbv)	Max. Value (ppbv)	Average Value (ppbv)	Geometric Mean (ppbv)	Median (ppbv)	1st Quartile (ppbv)	3rd Quartile (ppbv)	Standard Deviation (ppbv)	Coefficient of Variation
Chloroform	93	0.07	0.93	0.12	0.11	0.11	0.09	0.12	0.06	0.53
Chloromethane	2024	0.26	2.32	0.63	0.62	0.62	0.58	0.67	0.09	0.14
Chloromethylbenzene	NA									
Chloroprene	2	0.12	0.16	0.14	0.14	0.14	0.14	0.14	0	0
Dibromochloromethane	NA									
1,2-Dibromoethane	NA									
m-Dichlorobenzene	NA									
o-Dichlorobenzene	NA									
p-Dichlorobenzene	85	0.16	13.28	0.44	0.28	0.21	0.20	0.32	0.81	1.82
1,1-Dichloroethane	NA									
1,2-Dichloroethane	NA									
1,1-Dichloroethene	NA									
cis-1,2-Dichloroethylene	15	0.16	0.45	0.37	0.31	0.37	0.29	0.38	0.09	0.27
trans-1,2-Dichloroethylene	2	1.14	1.82	1.48	1.44	1.48	1.31	1.65	0.48	0.32
1,2-Dichloropropane	NA									
cis-1,3-Dichloropropene	1	NA								
trans-1,3-Dichloropropene	NA									
Dichlorodifluoromethane	2030	0.27	21.07	0.64	0.63	0.61	0.58	0.68	0.13	0.20
Dichlorotetrafluoroethane	3	0.09	0.15	0.11	0.11	0.10	0.10	0.13	0.03	0.28
Hexachloro-1,3-Butadiene	NA									
Methylene Chloride	1286	0.08	1210.22	4.51	1.48	1.32	0.50	4.12	7.76	1.72

Table 3-1. Sampling Detect Summaries of the VOC Concentrations (Continued)

Chemical[1]	# of Detects	Min. Value (ppbv)	Max. Value (ppbv)	Average Value (ppbv)	Geometric Mean (ppbv)	Median (ppbv)	1st Quartile (ppbv)	3rd Quartile (ppbv)	Standard Deviation (ppbv)	Coefficient of Variation
1,1,2,2-Tetrachloroethane	NA									
Tetrachloroethylene	315	0.06	2.57	0.20	0.17	0.17	0.12	0.22	0.15	0.77
1,2,4-Trichlorobenzene	NA									
1,1,1-Trichloroethane	100	0.051	0.76	0.09	0.08	0.07	0.06	0.09	0.06	0.63
1,1,2-Trichloroethane	NA									
Trichloroethylene	19	0.11	54.6	6.12	0.45	0.18	0.18	0.31	17.10	2.79
Trichlorofluoromethane	2021	0.17	3.03	0.32	0.30	0.29	0.26	0.34	0.13	0.41
Trichlorotrifluoroethane	1745	0.076	0.89	0.11	0.11	0.11	0.10	0.13	0.03	0.29
Vinyl Chloride	NA									
Polar Compounds										
Acetonitrile	554	0.49	1241.63	27.16	11.64	12.59	3.65	38.08	41.76	1.54
Acrylonitrile	62	0.53	10.70	2.42	1.98	1.95	1.31	2.90	1.91	0.79
tert-Amyl Methyl Ether	27	0.20	0.72	0.35	0.33	0.30	0.26	0.44	0.12	0.35
Ethyl Acrylate	NA									
Ethyl *tert*-Butyl Ether	NA									
Methyl Ethyl Ketone	961	0.35	42.09	1.51	1.24	1.41	0.80	1.88	1.00	0.67
Methyl Isobutyl Ketone	77	0.23	14.0	0.92	0.60	0.50	0.32	1.00	1.35	1.46
Methyl Methacrylate	11	0.38	5.65	1.22	0.68	0.48	0.41	0.62	1.95	1.60
Methyl *tert*-Butyl Ether	460	0.24	7.02	1.13	0.93	0.86	0.64	1.24	0.90	0.80

[1] = **BOLD** indicates the compound is prevalent for 2002 Program Year.
Italics indicates the chemical is an urban air toxics strategy HAP.

Table 3-2. Sampling Detect Summaries of the Carbonyl Concentrations

Chemical[1]	# of Detects	Min. Value (ppbv)	Max. Value (ppbv)	Average Value (ppbv)	Geometric Mean (ppbv)	Median (ppbv)	1st Quartile (ppbv)	3rd Quartile (ppbv)	Standard Deviation (ppbv)	Coefficient of Variation
Carbonyl Compounds										
Acetaldehyde	1986	0.016	10.41	0.86	0.61	0.94	0.50	1.16	0.52	0.61
Acetone	1980	0.012	11.62	0.97	0.76	1.04	0.65	1.27	0.52	0.53
Benzaldehyde	1979	0.002	0.65	0.04	0.03	0.03	0.02	0.05	0.03	0.67
Butyr/Isobutyraldehyde	1972	0.009	1.68	0.14	0.12	0.14	0.10	0.17	0.071	0.49
Crotonaldehyde	770	0.007	0.82	0.020	0.017	0.016	0.012	0.020	0.017	0.87
2,5-Dimethylbenzaldehyde	1986	0.002	0.72	0.017	0.009	0.008	0.006	0.012	0.045	2.57
Formaldehyde	1969	0.027	57.93	2.56	1.92	2.26	1.48	3.32	1.73	0.67
Hexaldehyde	951	0.004	2.87	0.049	0.035	0.036	0.022	0.064	0.043	0.86
Isovaleraldehyde	254	0.003	0.27	0.021	0.014	0.013	0.007	0.025	0.024	1.19
Propionaldehyde	1875	0.010	1.44	0.107	0.093	0.094	0.073	0.11	0.089	0.83
Tolualdehydes	1939	0.005	0.82	0.034	0.029	0.031	0.022	0.043	0.018	0.55
Valeraldehyde	1915	0.003	1.44	0.037	0.031	0.032	0.023	0.049	0.023	0.62

[1] = **BOLD** indicates the compound is prevalent for 2002 Program Year.
Italics indicates the chemical is an urban air toxics strategy HAP.

Table 3-3. Range of Detectable Values by Site

UATMP Site	Range of Detectable Values (ppbv)	Number of Sampling Days		Number of Detects	Number of Samples > 5ppbv
		Carbonyl	VOC		
ANTX	0.0065-34.42	22	22	476	7
APMI	0.0026-1210.22	10	67	1075	15
AZFL	0.0050-6.37	59	N/A	551	1
BAPR	0.0037-143.92	64	68	1601	44
BGFL	0.0058-4.14	5	N/A	46	0
BRVT	0.0600-2.42	N/A	82	898	0
BTMO	0.0041-1.99	3	N/A	29	0
BUND	0.0039-5.29	78	76	1428	1
C2IA	0.0044-10.97	79	74	1512	7
CANJ	0.0035-23.28	72	74	1680	27
CHNJ	0.0029-264.01	69	69	1485	28
CUSD	0.0033-7.83	59	60	1120	8
CWFL	0.0044-4.59	69	N/A	620	0
DAIA	0.0036-16.81	31	31	607	10
DBFL	0.0089-3.59	5	N/A	45	0
DECO	0.0098-14.81	48	50	1354	43
DEMI	0.0022-147.77	198	183	4381	96
DMIA	0.0035-42.09	19	14	375	19
DNFL	0.0038-54.59	77	N/A	718	3
E7MI	0.0700-16.58	N/A	4	79	7
EATN	0.0081-6.27	24	23	577	5
ELNJ	0.0024-19.74	73	73	1820	34
FLFL	0.0054-3.62	4	N/A	37	0
G2CO	0.0045-27.69	53	46	1245	32
GAFL	0.0043-54.03	69	N/A	607	11
GJCO	0.0065-84.41	24	24	618	27
GPMS	0.0081-459.63	38	38	851	23
HOMI	0.0800-11.60	N/A	11	104	1
JAMS	0.0028-96.73	39	35	943	37
LEFL	0.0034-3.82	80	N/A	735	0
LINE	0.0025-23.25	41	37	1007	40
LOMI	0.0038-177.68	10	18	334	6
LONE	0.0033-58.80	20	21	397	5
LOTN	0.0044-6.39	21	18	447	7
MDFL	0.0030-0.87	4	N/A	32	0
NBNJ	0.0048-41.11	71	70	1612	18
PGMS	0.0085-444.38	38	38	871	16
PSAZ	0.0600-32.38	N/A	52	984	28
QVAZ	0.0600-19.08	N/A	47	536	12

Table 3-3. Range of Detectable Values by Site (Continued)

UATMP Site	Range of Detectable Values (ppbv)	Number of Sampling Days		Number of Detects	Number of Samples > 5ppbv
		Carbonyl	VOC		
RRMI	0.0060-57.93	21	10	343	3
RUVT	0.0700-4.04	N/A	29	371	0
S2MO	0.0627-17.65	N/A	30	387	12
S3MO	0.0600-17.07	N/A	31	379	1
S4MO	0.0053-4.66	5	N/A	55	0
SFSD	0.0039-779.21	33	64	1060	31
SJPR	0.0042-496.92	71	72	1857	32
SLCU	0.0048-104.76	74	75	1858	45
SLMO	0.0031-52.05	57	63	1474	68
SPAZ	0.0600-381.57	N/A	51	1032	52
SWCO	0.0039-238.64	35	36	925	50
SWMI	0.0044-5.91	19	13	378	5
TUMS	0.0045-121.83	38	37	872	32
UNVT	0.0700-1.68	N/A	30	246	0
WECO	0.0025-1241.63	46	45	1186	55
YFMI	0.0031-49.75	14	20	406	10

Table 3-4. Geometric Means by Site

UATMP Site	Geometric Mean (ppbv)			
	Carbonyls	Halogenated Hydrocarbons	Hydrocarbons	Polar
ANTX	5.53	6.03	3.94	6.10
APMI	3.35	17.59	9.74	4.62
AZFL	5.54	N/A	N/A	N/A
BAPR	5.20	8.47	7.55	5.50
BGFL	2.52	N/A	N/A	N/A
BRVT	N/A	8.30	7.23	4.07
BTMO	4.27	N/A	N/A	N/A
BUND	2.77	4.12	1.89	2.19
C2IA	4.53	4.25	2.63	2.19
CANJ	2.86	4.80	5.96	3.06
CHNJ	6.13	6.77	3.52	2.97
CUSD	5.65	3.82	2.72	1.92
CWFL	8.80	N/A	N/A	N/A
DAIA	3.41	4.26	3.10	3.30
DBFL	5.01	N/A	N/A	N/A
DECO	13.93	4.31	11.53	2.44
DEMI	3.31	8.09	5.99	4.12
DMIA	13.43	5.46	3.77	3.34
DNFL	10.76	N/A	N/A	N/A
E7MI	N/A	4.20	16.44	8.17
EATN	5.85	4.38	6.33	3.08
ELNJ	4.46	4.35	8.52	3.63
FLFL	5.21	N/A	N/A	N/A
G2CO	16.52	6.66	17.11	5.03
GAFL	5.38	N/A	N/A	N/A
GJCO	6.48	4.17	13.58	11.15
GPMS	5.80	4.31	4.39	5.35
HOMI	N/A	3.57	1.57	1.98
JAMS	6.57	4.63	9.35	26.58
LEFL	4.65	N/A	N/A	N/A
LINE	8.06	4.15	5.16	8.24
LOMI	2.16	6.09	4.05	2.29
LONE	4.47	3.93	4.07	5.01
LOTN	5.66	4.03	4.28	2.94
MDFL	1.26	N/A	N/A	N/A
NBNJ	5.33	5.28	6.20	2.66
PGMS	5.95	4.14	6.57	3.38
PSAZ	N/A	4.77	9.49	3.92
QVAZ	N/A	3.47	2.19	2.85
RRMI	6.81	3.58	4.51	2.37

Table 3-4. Geometric Means by Site (Continued)

UATMP Site	Geometric Mean (ppbv)			
	Carbonyls	Halogenated Hydrocarbons	Hydrocarbons	Polar
RUVT	N/A	3.54	4.23	1.66
S2MO	N/A	4.73	5.13	3.01
S3MO	N/A	4.61	4.50	1.99
S4MO	7.96	N/A	N/A	N/A
SFSD	6.18	4.43	3.63	3.77
SJPR	4.90	5.13	11.31	5.41
SLCU	8.47	4.50	9.33	3.70
SLMO	23.61	4.82	6.16	3.13
SPAZ	N/A	4.08	14.38	8.75
SWCO	8.83	4.05	11.41	114.80
SWMI	5.65	4.45	6.95	2.18
TUMS	5.76	4.68	3.63	8.69
UNVT	N/A	3.37	1.30	1.49
WECO	8.05	4.33	9.23	56.67
YFMI	3.34	3.62	10.87	1.43

Table 3-5. Summary of Pearson Correlation Coefficients for Selected Meteorological Parameters and Prevalent Compounds

Prevalent Compound	Maximum Temperature	Average Temperature	Dew Point Temperature	Wet Bulb Temperature	Relative Humidity	Sea Level Pressure	u-component of wind speed	v-component of wind speed
1,2,4-Trimethylbenzene	0.06	0.06	0.05	0.03	0.05	-0.03	-0.13	-0.05
Acetylene	-0.25	-0.28	-0.27	-0.31	0.08	0.15	-0.07	-0.04
Benzene	-0.12	-0.15	-0.15	-0.17	0.07	0.09	-0.11	-0.03
Chloromethane	0.31	0.31	0.31	0.33	-0.01	-0.10	-0.06	0.09
Dichlorodifluoromethane	0.13	0.13	0.11	0.11	0.01	-0.05	-0.05	-0.01
Ethylbenzene	-0.01	-0.02	-0.05	-0.05	0.01	0.01	-0.11	-0.03
Formaldehyde	0.39	0.37	0.29	0.32	-0.15	-0.10	-0.14	-0.01
m-,p - Xylene	-0.01	-0.03	-0.05	-0.06	0.01	0.00	-0.11	0.00
o - Xylene	0.01	-0.01	-0.03	-0.04	0.02	0.01	-0.12	-0.03
Propylene	0.04	0.03	0.01	0.00	0.06	-0.01	-0.13	-0.01
Toluene	0.05	0.04	0.05	0.03	0.05	-0.02	-0.12	-0.03
Trichlorofluoromethane	0.07	0.07	0.04	0.04	0.02	-0.02	0.02	-0.01

Table 3-6. Summary of Mobile Information by Site

UATMP Site	Estimated No. of Motor Vehicles Owned	Estimated Traffic	County-Level On-Road Emissions (tpy)	County-Level Non-Road Emissions (tpy)	Hydrocarbon Geometric Mean (ppbv)
ANTX	454,413	14,310	7,752	2,255	3.94
APMI	758,029	60,000	12,015	2,016	9.74
AZFL	438,555	51,000	4,692	2,183	N/A
BAPR	N/A	10	104	127	7.55
BGFL	25,290	12,200	5,091	3,890	N/A
BRVT	20,291	16,578	342	130	7.23
BTMO	25,210	4,360	336	62	N/A
BUND	5,487	1,350	34	60	1.89
C2IA	129,882	1,500	906	352	2.63
CANJ	1,440,445	62,000	2,100	663	5.96
CHNJ	175,814	12,623	1,719	1,368	3.52
CUSD	3,118	1,940	50	35	2.72
CWFL	329,649	1,000	4,692	2,183	N/A
DAIA	199,335	1,000	822	347	3.10
DBFL	355,056	201,032	5,091	3,890	N/A
DECO	945,747	44,200	2,754	874	11.53
DEMI	906,510	12,791	12,015	2,016	5.99
DMIA	284,005	12,400	1,974	1,087	3.77
DNFL	336,437	16,281	4,692	2,183	N/A
E7MI	864,146	6,999	12,015	2,016	16.44
EATN	383,584	38,540	4,014	1,083	6.33
ELNJ	1,620,524	170,000	1,866	669	8.52
FLFL	730,732	1,000	7,608	2,825	N/A
G2CO	76,635	2,200	556	227	17.11
GAFL	339,402	81,460	4,958	2,274	N/A
GJCO	83,623	10,000	556	227	13.58
GPMS	123,553	17,000	1,080	1,455	4.39
HOMI	7,689	7,000	55	292	1.57
JAMS	194,233	12,500	1,488	259	9.35
LEFL	438,474	1,055	4,958	2,274	N/A
LINE	177,599	6,100	1,203	360	5.16
LOMI	848,210	100,000	6,296	2,103	4.05
LONE	177,852	6,200	1,203	360	4.07
LOTN	409,034	3,000	4,014	1,083	4.28
MDFL	852,948	15,200	8,665	3,891	N/A
NBNJ	633,712	63,000	2,625	1,331	6.02
PGMS	43,175	8,600	803	1,165	6.57
PLOR	661,621	1,000	3,110	870	N/A
PSAZ	1,019,334	250	10,839	4,894	9.49

Table 3-6. Summary of Mobile Information by Site (Continued)

UATMP Site	Estimated No. of Motor Vehicles Owned	Estimated Traffic	County-Level On-Road Emissions (tpy)	County-Level Non-Road Emissions (tpy)	Hydrocarbon Geometric Mean (ppbv)
QVAZ	64,456	200	1,134	141	2.19
RRMI	661,513	500	12,015	2,016	4.51
RUVT	26,551	5,700	364	160	4.23
S2MO	589,603	1,000	2,013	352	5.13
S3MO	529,030	8,532	2,013	352	4.50
S4MO	620,460	22,840	2,013	352	N/A
SFSD	109,906	4,320	670	219	3.63
SJPR	322,887	51,000	1,787	2,183	11.31
SLCU	612,307	20,485	4,059	1,915	9.33
SLMO	529,030	15,016	2,013	352	6,16
SPAZ	626,912	50,000	10,839	4,894	14.38
SWCO	943,843	1,366	2,754	874	11.41
SWMI	872,823	18,437	12,015	2,016	6.95
TUMS	52,858	4,900	540	170	3.63
UNVT	36,214	1,000	1,095	379	1.30
WECO	631,036	1,500	1,783	353	9.23
YFMI	872,823	500	12,015	2,016	8.30

Table 3-7. Summary of the National Emission Standards for Volatile Organic Compounds

Rule Title	Applicability	Affected Equipment	Overall Percent Reduction	Compliance Date
National Volatile Organic Compound Emission Standards for Architectural Coatings (40 CFR part 59, subpart D	Manufacturers and importers of architectural coatings (e.g., interior and exterior paints, traffic markings, sign paints, industrial maintenance coatings) that are recommended for field application to stationary structures and their appurtenances.	The rule establishes VOC content limits in coatings rather than VOC emission limits for process equipment	20	Coatings that are manufactured after September 13, 1999, and for any architectural coating registered under the Federal Insecticide, Fungicide, and Rodenticide Act (7 U.S.C. Section 136, et seq.), the rule applies to any such coating manufactured on or after March 13, 2000 for sale or distribution in the United States.)
National Volatile Organic Compound Emission Standards for Consumer Products (40 CFR part 59, subpart C)	The rule applies to manufacturers, importers, and distributors of subject consumer products[a] manufactured or imported on or after December 10, 1998 for sale or distribution in the United States, including the District of Columbia and all United States territories.	The rule establishes VOC content limits in products rather than VOC emission limits for process equipment	20	Consumer products manufactured or imported on or after December 10, 1998
National Volatile Organic Compound Emission Standards for Automobile Refinish Coatings (40 CFR part 59, subpart B)	The provisions of the rule apply to automobile refinish coatings and coating components that are manufactured on or after January 11, 1999 for sale or distribution in the United States, including the District of Columbia and all U.S. territories.	The rule establishes VOC content limits in refinish coatings and coating components rather than VOC emission limits for process equipment	33	Refinish coatings and coating components that are manufactured on or after January 11, 1999

[a] Consumer product means any household or institutional product (including paints, coatings, and solvents), or substance, or article (including any container or packaging) held by any person, the use, consumption, storage, disposal, destruction, or decomposition of which may result in the release of VOC.

Table 3-8. Summary of Potentially Applicable National Emission Standards for Hazardous Air Pollutants

SIC Description	Regulation Citation	Regulation Title	UAT Pollutants Covered by Regulation	Overall Percent Reduction	Compliance Date
Crude Petroleum and Natural Gas (SIC Code 1311)	40 CFR part 63, subpart HH	Oil and Natural Gas Production and Natural Gas Transmission and Storage NESHAP	Benzene, ethylbenzene, toluene, and xylene	77	2002
Office Furniture, Except Wood (SIC Code 2522) Miscellaneous Publishing (SIC Code 2741) Ordnance and Accessories, NEC (SIC Code 3489)	40 CFR part 63, subpart RRRR	Surface Coating of Metal Furniture NESHAP	Ethylbenzene, methyl ethyl ketone, toluene, and xylene	70	2005
Commercial Printing, NEC (SIC Code 2759) Commercial Printing, Gravure (SIC Code 2754)	40 CFR part 63, subpart KK	Printing and Publishing Industry NESHAP	Ethylbenzene, methyl ethyl ketone, methyl isobutyl ketone, toluene, and xylene	69	1999
Medicinal Chemicals and Botanical Products (SIC Code 2833) Pharmaceutical Preparations (SIC Code 2834)	40 CFR part 63, subpart GGG	Pharmaceuticals Production NESHAP	Hexane, methylene chloride, and toluene	65	2001
Cyclic Organic Crudes and Intermediates, and Organic Dyes and Pigments (SIC Code 2865)	40 CFR part 63, subpart EEEE	Organic Liquids Distribution (Non-Gasoline) NESHAP	Benzene, ethylbenzene, toluene, vinyl chloride, and xylene	28	2002
Fabricated Rubber Products, NEC (SIC Code 3069)	40 CFR part 63, subpart OOOO	Printing, Coating, and Dyeing of Fabrics and Other Textiles NESHAP (Proposed Rule)	Ethylbenzene, methyl ethyl ketone, methyl isobutyl ketone, toluene, and xylene	60	2002
Plastics Foam Products (SIC Code 3086) Manufacturing Industries, NEC (SIC Code 3999)	40 CFR part 63, subpart MMMMM	Flexible Polyurethane Foam Production NESHAP (Proposed Rule)	Methylene chloride	70	2001

Table 3-8. Summary of Potentially Applicable National Emission Standards for Hazardous Air Pollutants (Continued)

SIC Description	Regulation Citation	Regulation Title	UAT Pollutants Covered by Regulation	Overall Percent Reduction	Compliance Date
Plastics Plumbing Fixtures (SIC Code 3088) Plastics Products, NEC (SIC Code 3089) Sporting and Athletic Goods, NEC (SIC Code 3949)	40 CFR part 63, subpart WWWW	Reinforced Plastic Composites Production NESHAP (Proposed Rule)	Methylene chloride, methyl methacrylate, and styrene	65	2006
Metal Cans (SIC Code 3411)	40 CFR part 63, subpart KKKK	Surface Coating of Metal Cans NESHAP (Proposed Rule)	Hexane, ethylbenzene, methyl ethyl ketone, methyl isobutyl ketone, toluene, and xylene	71	2005
Metal Shipping Barrels, Drums, Kegs, and Pails (SIC Code 3412) Fabricated Structural Metal (SIC Code 3441) Farm Machinery and Equipment (SIC Code 3523) Construction Machinery and Equipment (SIC Code 3531) Motor Vehicles and Passenger Car Bodies (SIC Code 3711) Motor Vehicle Parts and Accessories (SIC Code 3714) Railroad Equipment (SIC Code 3743) Automatic Controls for Regulating Residential and Commercial Environments and Appliances (SIC Code 3822)	40 CFR part 63, subpart MMMM	Surface Coating of Miscellaneous Metal Parts and Products NESHAP (Proposed Rule)	Ethylbenzene, methyl ethyl ketone, methyl isobutyl ketone, phenol, styrene, toluene, and xylene	48	2002

Table 3-8. Summary of Potentially Applicable National Emission Standards for Hazardous Air Pollutants (Continued)

SIC Description	Regulation Citation	Regulation Title	UAT Pollutants Covered by Regulation	Overall Percent Reduction	Compliance Date
Coating, Engraving, and Allied Services, NEC (SIC Code 3479)	40 CFR part 63, subpart SSSS	Surface Coating of Metal Coil NESHAP	Methyl ethyl ketone, toluene, and xylene	53	2005
Boat Building and Repairing (SIC Code 3732) Ship Building and Repairing (SIC Code 3731)	40 CFR part 63, subpart VVVV	Boat Manufacturing NESHAP	Hexane, methylene chloride, methyl ethyl ketone, methyl isobutyl ketone, methyl methacrylate, styrene, toluene, and xylene	35 (from 1997 emission levels)	2004
2522, 3086, 3089, 3579, 3663, 3711, 3714, 3715, 3716, 3792, 3799, 3841, 3949, 3993, and 3999	40 CFR part 60, subpart PPPP	National Emission Standards for Hazardous Air Pollutants: Surface Coating of Plastic Parts and Products (Proposed Rule)	Methyl ethyl ketone, methyl isobutyl ketone, toluene, and xylene	80	2004

Table 3-9. Summary of Pollutants and Sources Regulated

Monitoring Station	Ten Mile Point UAT Emissions (tpy)	Number of Point Source Facilities Within Ten Miles	Number of Point Source Facilities Subject to Future Regulations	UATMP Pollutants Covered in New Regulations	Expected Reduction (%)
Colorado: GJCO/G2CO	83.46	16	5	Benzene	56
				Ethylbenzene	63
				Methyl Ethyl Ketone	56
				Styrene	56
				Toluene	22
				Xylene	33
Florida: AZFL	329.34	12	8	Methyl Methacrylate	35
				Styrene	99
Florida: CWFL	566.46	16	9	Ethylbenzene	54
				Styrene	51
				Xylene	54
Florida: DNFL	303.97	10	7	Ethylbenzene	35
				Methyl Ethyl Ketone	65
				Methyl Methacrylate	35
				Styrene	55
				Toluene	35

Table 3-9. Summary of Pollutants and Sources Regulated (Continued)

Monitoring Station	Ten Mile Point UAT Emissions (tpy)	Number of Point Source Facilities Within Ten Miles	Number of Point Source Facilities Subject to Future Regulations	UATMP Pollutants Covered in New Regulations	Expected Reduction (%)
Florida: GAFL	238.22	25	14	Benzene	21
				Ethylbenzene	10
				Methylene Chloride	57
				Methyl Ethyl Ketone	12
				Methyl Isobutyl Ketone	33
				Styrene	54
				Toluene	19
				Xylene	13
Florida: LEFL	182.78	15	6	Benzene	14
				Ethylbenzene	1
				Styrene	65
				Toluene	2
				Xylene	15
Iowa: C2IA	121.18	4	3	Ethylbenzene	20
				Methyl Ethyl Ketone	53
				Styrene	61
				Toluene	20
				Xylene	44

Table 3-9. Summary of Pollutants and Sources Regulated (Continued)

Monitoring Station	Ten Mile Point UAT Emissions (tpy)	Number of Point Source Facilities Within Ten Miles	Number of Point Source Facilities Subject to Future Regulations	UATMP Pollutants Covered in New Regulations	Expected Reduction (%)
Michigan: APMI	909.41	10	6	Ethylbenzene	54
				Methyl Ethyl Ketone	43
				Methyl Isobutyl Ketone	58
				Toluene	10
				Xylene	58
Michigan: DEMI	843.46	11	5	Ethylbenzene	51
				Methyl Ethyl Ketone	47
				Methyl Isobutyl Ketone	58
				Toluene	14
				Xylene	58
Michigan: E7MI	448.96	11	7	Ethylbenzene	37
				Methyl Ethyl Ketone	52
				Methyl Isobutyl Ketone	52
				Methyl Methacrylate	52

Table 3-9. Summary of Pollutants and Sources Regulated (Continued)

Monitoring Station	Ten Mile Point UAT Emissions (tpy)	Number of Point Source Facilities Within Ten Miles	Number of Point Source Facilities Subject to Future Regulations	UATMP Pollutants Covered in New Regulations	Expected Reduction (%)
Michigan: E7MI (Cont.)				Styrene	52
				Toluene	33
				Xylene	52
Michigan: HOMI	8.35	5	0		
Michigan: RRMI	646.13	12	4	Ethylbenzene	49
				Methyl Ethyl Ketone	43
				Methyl Isobutyl Ketone	58
				Toluene	8
				Xylene	56
Michigan: SWMI	856.49	12	5	Ethylbenzene	51
				Methyl Ethyl Ketone	47
				Methyl Isobutyl Ketone	52
				Toluene	12
				Xylene	58
Michigan: YFMI				Ethylbenzene	51
				Methyl Ethyl Ketone	47

Table 3-9. Summary of Pollutants and Sources Regulated (Continued)

Monitoring Station	Ten Mile Point UAT Emissions (tpy)	Number of Point Source Facilities Within Ten Miles	Number of Point Source Facilities Subject to Future Regulations	UATMP Pollutants Covered in New Regulations	Expected Reduction (%)
Michigan: YFMI (Cont.)				Methyl Ethyl Ketone	47
				Methyl Isobutyl Ketone	58
Puerto Rico: BAPR	2,213.46	4	4	Methylene Chloride	65
				Toluene	65
Puerto Rico: SJPR	469.69	4	3	Benzene	28
				Ethylbenzene	28
				Methyl Isobutyl Ketone	71
				Methylene Chloride	70
				Toluene	2
				Xylene	28

4.0 Sites in Arizona

This section focuses on meteorological, concentration, and spatial trends for the three UATMP sites in Arizona (PSAZ, QVAZ, and SPAZ). All three of these sites are located in the Phoenix metropolitan statistical area. Figures 4-1 through 4-3 are topographical maps showing the monitoring stations in their urban locations. Figures 4-4 and 4-5 are maps identifying facilities within ten miles of the sites that reported to the 1999 NEI. The PSAZ and SPAZ sites are within a few miles of each other, with numerous sources between them, while the QVAZ site has only three nearby industries. PSAZ and SPAZ are located near two main types of industries: surface coating and fuel combustion. QVAZ is nearest to a surface coating facility.

Hourly meteorological data were retrieved for all of 2002 at two weather stations near these sites with the purpose of calculating correlations of meteorological data with ambient air concentration measurements. The two weather stations are Phoenix-Sky Harbor and Phoenix-Deer Valley (WBAN 23183 and 3184, respectively).

Table 4-1 highlights the average UATMP concentration (VOC only) at each of these sites, along with temperature (average maximum and average), moisture (average dew point temperature, average wet-bulb temperature, and average relative humidity), wind information (average u- and v- components of the wind), and pressure (average sea level pressure) for the entire year and on days samples were taken. Normally, the Phoenix area is extremely hot and dry, and the high average temperature and low average relative humidity values in Table 4-1 also confirm this observation. Wind speeds were also very light for each site, as the city resides in a valley, but the wind generally flows from the south and east. The pressures for this area are some of the lowest compared to other participating sites in this report. This information can be found in The Weather Almanac, fifth edition (Ruffner and Bair, 1987).

4.1 Meteorological and Concentration Averages at the Arizona Sites

Carbonyl compounds were not measured at any of the three sites, as indicated in Tables 3-3 and 3-4. PSAZ had a hydrocarbon compound geometric mean more than double its halogenated hydrocarbon geometric mean (9.49 ppbv vs. 4.77 ppbv, respectively), while SPAZ's hydrocarbon geometric mean was more than three times its halogenated hydrocarbon geometric mean (14.38 ppbv vs. 4.08 ppbv). QVAZ measured the lowest geometric mean for hydrocarbons at 2.19 ppbv. The average total UATMP daily concentration at QVAZ was also significantly lower compared to the other two sites and was computed to be 10.66 (±1.84) ppbv; at PSAZ, the value was more than double (22.08 ±2.80 ppbv) and at SPAZ, the value was almost quadruple (42.64 ±19.09 ppbv). This trend is fairly consistent with the 2001 report. Table 4-1 also lists the averages for selected meteorological parameters from January 2002 to December 2002, which is the same time period covered in this report.

Tables 4-2a-c are the summary of calculated Pearson Correlation coefficients for each of the prevalent compounds and selected meteorological parameters by site. Identification of the prevalent compounds is discussed in Section 3 of this report. At PSAZ, nearly all of the correlations between maximum and average temperature, dew point and wet bulb temperature and the compounds were negative. The Pearson Correlation coefficients for acetylene, benzene, and propylene were strong, and for ethylbenzene, the xylenes, and toluene were moderately strong. Acetylene, benzene, ethylbenzene, *m*-,*p*-xylene, *o*-xylene, propylene, and toluene all had at least one correlation which was considered strong. Over half of the compounds had moderately strong correlations with pressure, and all but one was positive. The u- and v-components of the wind speed were all negative for each of the eleven compounds, with seven compounds with strong negative correlations with the v-component. The prevalent compounds generally increase when the temperature, moisture content, and wind speeds are decreasing and pressure is increasing.

At QVAZ, the correlations were generally not as strong. However, acetylene had strong to very strong negative correlations with maximum and average temperature, dew point and wet bulb temperature, and the v-component of the wind, and a strong positive correlation with sea level pressure, while chloromethane had strong positive correlations with maximum and average temperature and the wet bulb temperature. Both positive and negative moderately strong correlations were seen with sea level pressure. Overall, the correlations at this site were rather weak correlations, making it difficult to ascertain when UATMP concentrations will increase.

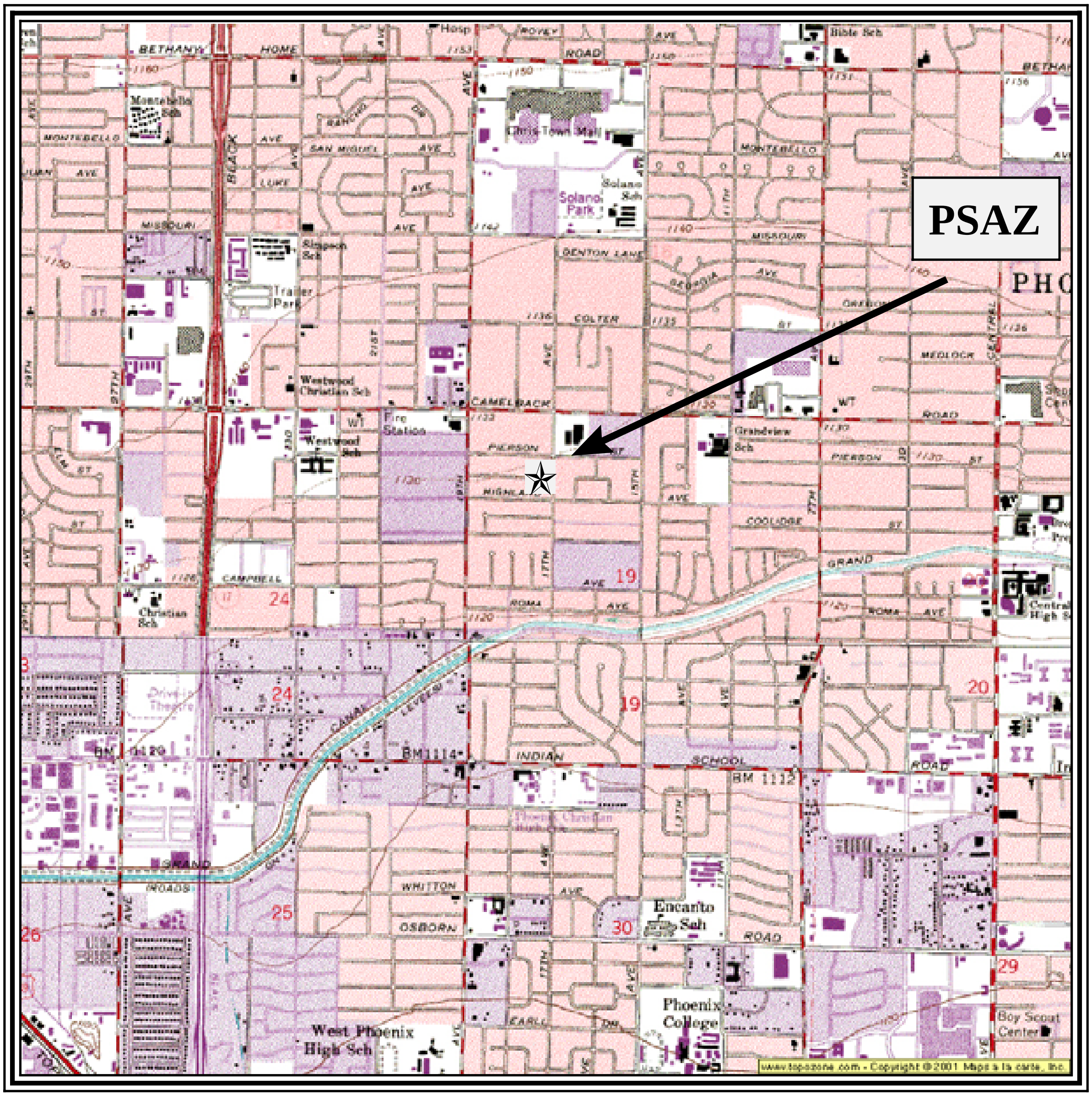
The compounds at the SPAZ site had many strong and moderately strong negative correlations with the maximum, average, dew point and wet bulb temperatures and the wind components. The strongest correlations were with the v-component of the wind speed. Acetylene, benzene, and *o*-xylene all had correlations less than -0.70 with the v-component. These same compounds, as well as *m,p*-xylene and propylene, also had strong positive correlations with sea level pressure. This observation indicates that prevalent compounds generally increase when the temperature and wind speeds are decreasing and sea level pressure is increasing.

4.2 Spatial Analysis

Using the population within ten miles of each site, an estimate of the number of motor vehicles operating in proximity to the monitoring station can be established. The ratio used in this report is 0.74 motor vehicles to every one person (refer to section 3.4.1 for more information on this ratio). At the time of this report, the population near the PSAZ site is 1,377,479 people, all of whom are estimated to be operating approximately 1,019,334 vehicles. A population of 847,178 people is driving 626,912 motor vehicles near the SPAZ site, while a considerably lower population of 87,103 people is driving 64,456 vehicles near the QVAZ site. This information is compared to the average daily concentration of the prevalent compounds at each Arizona site in Table 4-3. Also included in Table 4-3 is average daily traffic data, or more specifically, the average number of cars passing the monitoring sites on the nearest roadway to each site on a daily basis. The SPAZ site has the largest amount of traffic passing by on a daily basis.

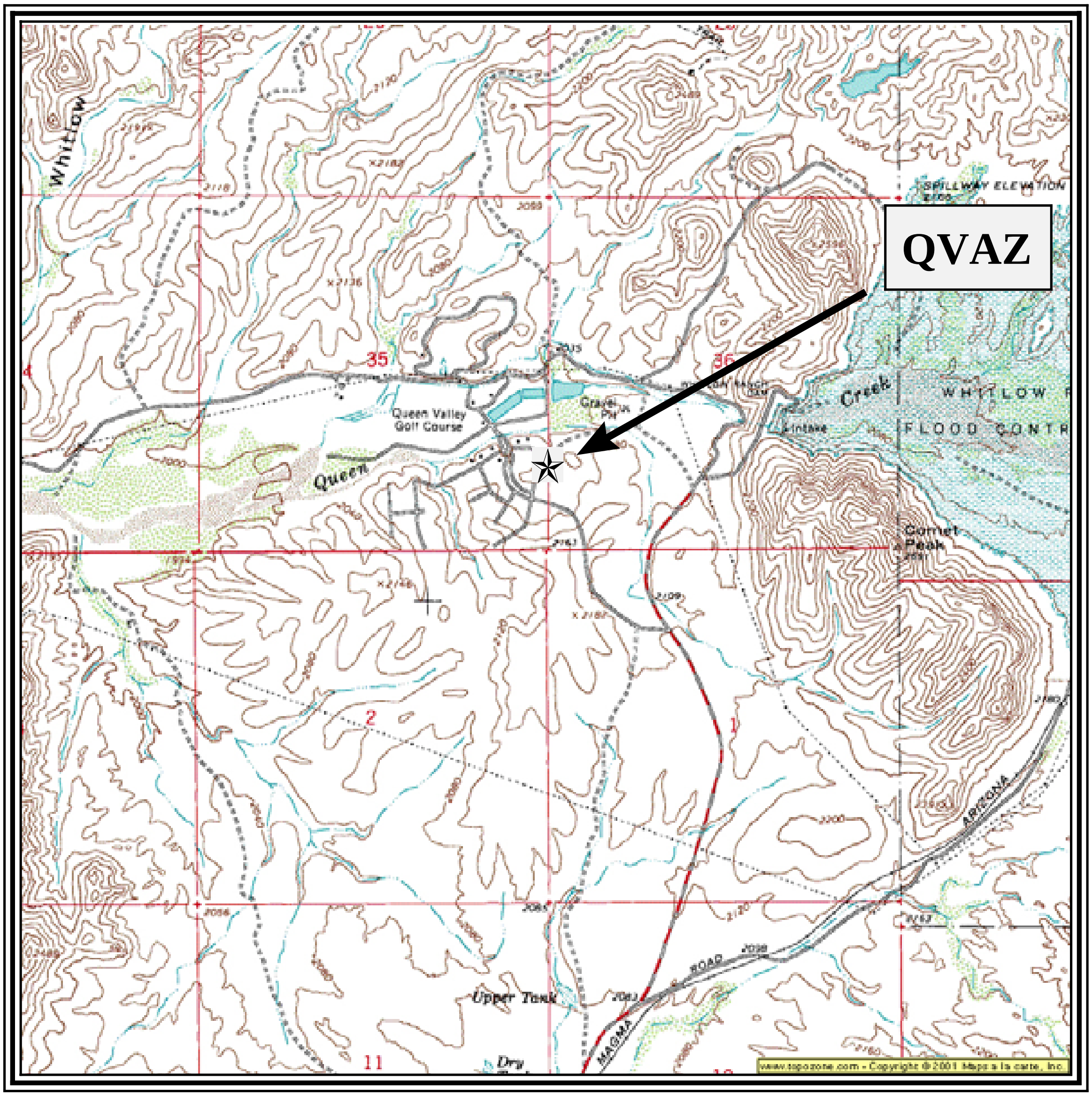
A roadside study conducted to measure emissions from motor vehicles determined that the concentration ratios of the BTEX compounds were relatively consistent from urban area to urban area. (For more information on this study, refer to section 3.4.2.) Figure 3-14 depicts the average concentration ratios of the roadside study and compares them to the concentration ratios at each of the monitoring sites. SPAZ and PSAZ resemble the ratios of the roadside study while the QVAZ site does not resemble these ratios at all. The highest and lowest ratios for the roadside study, PSAZ, and SPAZ were toluene-ethylbenzene and *o*-xylene-ethylbenzene, respectively. QVAZ’s highest ratio is the *m,p*-xylene-ethylbenzene ratio and its lowest is benzene-ethylbenzene, while the toluene-ethylbenzene ratio is second lowest.

Figure 4-1. Phoenix, Arizona Site 1 (PSAZ) Monitoring Station



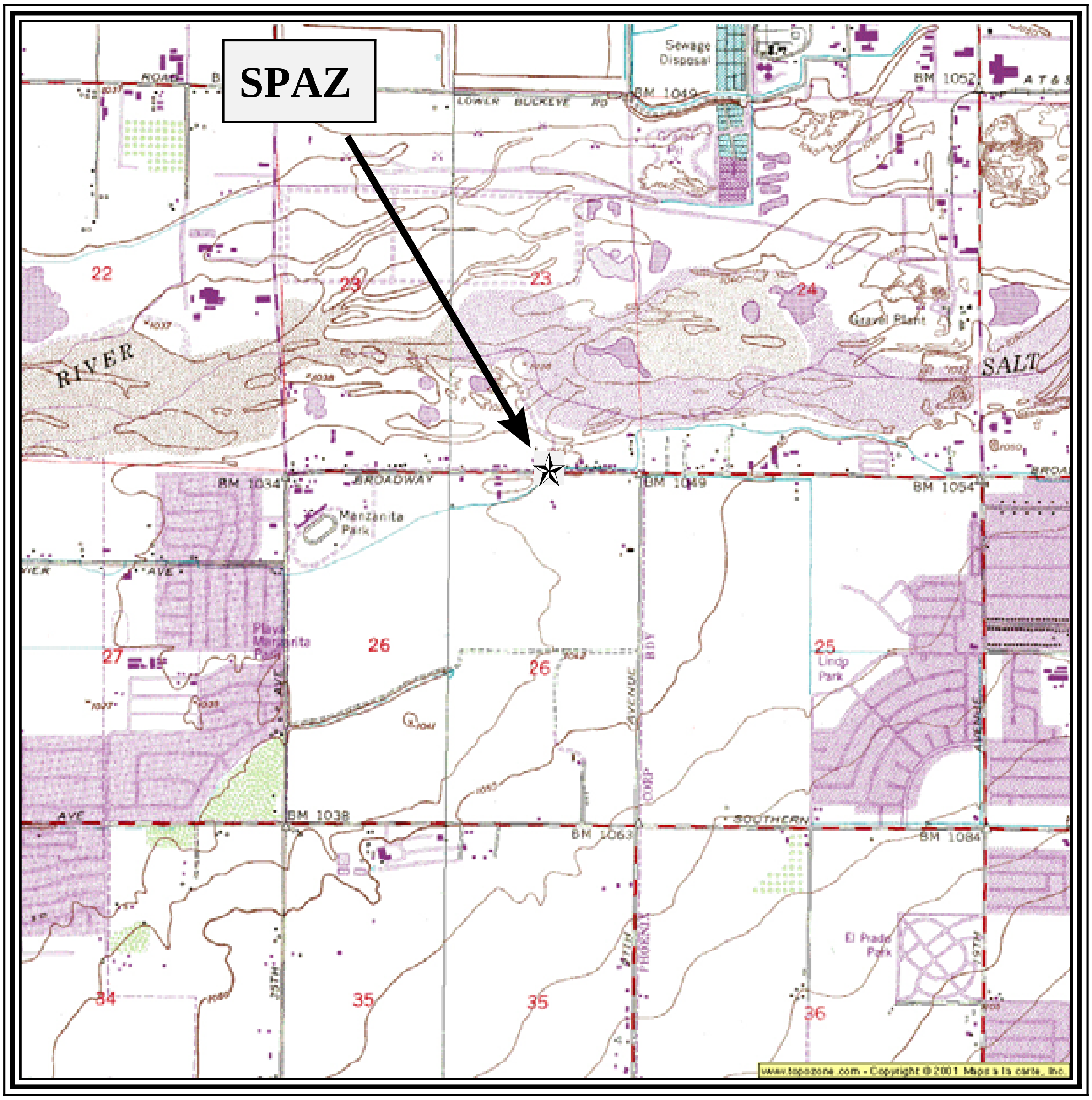
Source: USGS 7.5 Minute Series. Map Scale: 1:24,000.

Figure 4-2. Phoenix, Arizona Site 2 (QVAZ) Monitoring Station



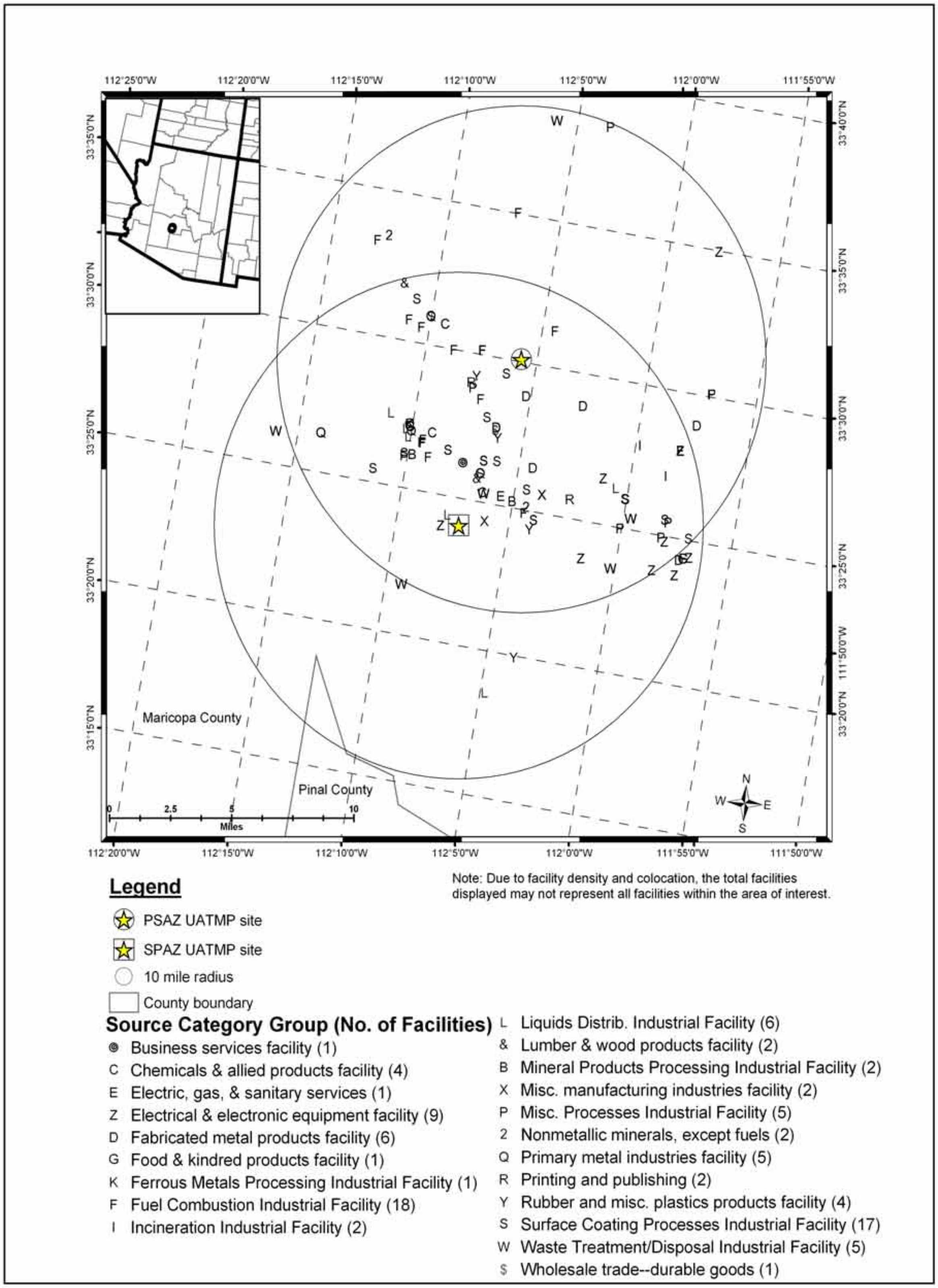
Source: USGS 7.5 Minute Series. Map Scale: 1:24,000.

Figure 4-3. Phoenix, Arizona Site 3 (SPAZ) Monitoring Station



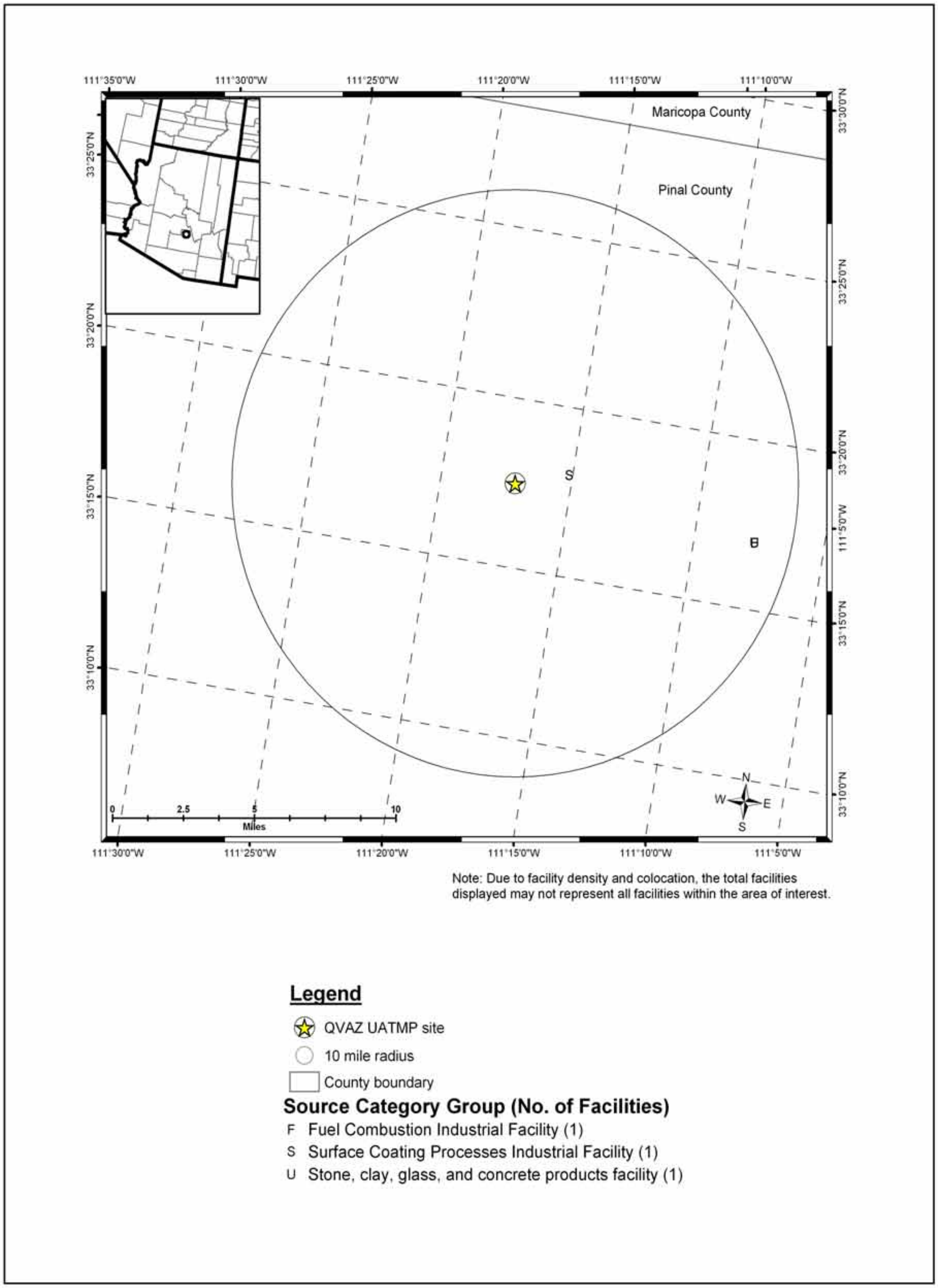
Source: USGS 7.5 Minute Series. Map Scale: 1:24,000.

Figure 4-4. Facilities Located Within 10 Miles of PSAZ and SPAZ



Note: Due to facility density and colocation, the total facilities displayed may not represent all facilities within the area of interest.

Figure 4-5. Facilities Located Within 10 Miles of QVAZ



Note: Due to facility density and colocation, the total facilities displayed may not represent all facilities within the area of interest.

Table 4-1. Average Concentration and Meteorological Parameters for Sites in Arizona

Site Name	Type	Average UATMP Concentration (ppbv)	Average Maximum Temperature (°F)	Average Temperature (°F)	Average Dewpoint Temperature (°F)	Average Wet Bulb Temperature (°F)	Average Relative Humidity (%)	Average Sea Level Pressure (mb)	Average u-component of the Wind (kts)	Average v-component of the Wind (kts)
PSAZ	All 2002	▨	84.04 (±1.63)	73.41 (±1.59)	33.60 (±1.53)	53.48 (±1.06)	27.57 (±1.54)	1011.8 (±5.52)	-2.15 (±0.14)	1.65 (±0.16)
	sample day	22.08 (±2.80)	83.62 (±4.41)	72.74 (±4.39)	32.18 (±4.45)	52.75 (±3.00)	26.33 (±3.77)	1011.9 (±14.90)	-1.29 (±0.39)	1.52 (±0.43)
QVAZ	All 2002	▨	87.04 (±1.64)	76.11 (±1.60)	35.52 (±1.32)	55.21 (±0.97)	27.77 (±1.49)	1012.1 (±5.60)	-1.44 (±0.18)	2.54 (±0.15)
	sample day	10.66 (±1.84)	89.62 (±4.56)	78.12 (±4.64)	35.35 (±4.01)	55.93 (±2.92)	25.27 (±3.51)	1011.1 (±15.87)	-0.33 (±0.53)	2.12 (±0.45)
SPAZ	All 2002	▨	84.04 (±1.63)	73.41 (±1.59)	33.60 (±1.53)	53.48 (±1.06)	27.57 (±1.54)	1011.8 (±5.52)	-2.15 (±0.14)	1.65 (±0.16)
	sample day	42.64 (±19.09)	84.10 (±4.53)	73.14 (±4.52)	32.06 (±4.32)	52.78 (±2.99)	25.84 (±3.76)	1011.9 (±15.40)	-1.35 (±0.38)	1.46 (±0.44)

Table 4-2a - Prevalent Compound Concentration Correlations with Selected Meteorological Parameters at Supersite in Phoenix, Arizona (PSAZ)

Compound	Maximum Temperature	Average Temperature	Dew Point Temperature	Wet Bulb Temperature	Relative Humidity	Sea Level Pressure	u-component of wind speed	v-component of wind speed
1,2,4-Trimethylbenzene	-0.26	-0.30	-0.16	-0.29	0.14	0.21	-0.20	-0.45
Acetylene	-0.60	-0.64	-0.35	-0.58	0.31	0.49	-0.40	-0.66
Benzene	-0.52	-0.57	-0.42	-0.57	0.14	0.45	-0.46	-0.66
Chloromethane	-0.05	-0.05	0.09	0.00	0.22	0.03	-0.22	-0.24
Dichlorodifluoromethane	-0.30	-0.30	-0.05	-0.23	0.30	0.25	-0.32	-0.41
Ethylbenzene	-0.41	-0.46	-0.34	-0.47	0.11	0.38	-0.39	-0.63
m-,*p* - Xylene	-0.38	-0.44	-0.31	-0.44	0.12	0.36	-0.36	-0.61
o - Xylene	-0.37	-0.42	-0.31	-0.43	0.09	0.34	-0.36	-0.60
Propylene	-0.56	-0.59	-0.35	-0.55	0.25	0.47	-0.43	-0.67
Toluene	-0.43	-0.48	-0.33	-0.48	0.15	0.40	-0.42	-0.66
Trichlorofluoromethane	-0.06	-0.03	0.34	0.14	0.49	-0.02	-0.04	-0.14

Table 4-2b - Prevalent Compound Concentration Correlations with Selected Meteorological Parameters at Queen Valley in Phoenix, Arizona (QVAZ)

Compound	Maximum Temperature	Average Temperature	Dew Point Temperature	Wet Bulb Temperature	Relative Humidity	Sea Level Pressure	u-component of wind speed	v-component of wind speed
1,2,4-Trimethylbenzene	0.03	0.03	0.01	0.02	-0.05	0.00	-0.15	-0.04
Acetylene	-0.73	-0.76	-0.50	-0.73	0.35	0.69	-0.34	-0.61
Benzene	-0.38	-0.40	-0.21	-0.36	0.26	0.47	-0.15	-0.45
Chloromethane	0.50	0.53	0.49	0.58	-0.06	-0.49	0.41	0.44
Dichlorodifluoromethane	0.32	0.33	0.52	0.46	0.19	-0.34	0.13	0.18
Ethylbenzene	-0.23	-0.24	-0.32	-0.29	-0.10	0.44	-0.17	-0.07
m-,*p* - Xylene	-0.23	-0.23	-0.32	-0.28	-0.11	0.43	-0.16	-0.06
o - Xylene	-0.23	-0.23	-0.32	-0.28	-0.11	0.43	-0.15	-0.06
Propylene	0.28	0.27	0.21	0.27	0.06	-0.10	0.05	-0.02
Toluene	0.12	0.11	0.16	0.15	0.02	-0.15	0.05	0.22
Trichlorofluoromethane	0.28	0.31	0.41	0.39	0.13	-0.33	0.05	0.14

Table 4-2c - Prevalent Compound Concentration Correlations with Selected Meteorological Parameters at South Phoenix, Arizona (SPAZ)

Compound	Maximum Temperature	Average Temperature	Dew Point Temperature	Wet Bulb Temperature	Relative Humidity	Sea Level Pressure	u-component of wind speed	v-component of wind speed
1,2,4-Trimethylbenzene	-0.29	-0.33	-0.19	-0.30	0.19	0.31	-0.32	-0.63
Acetylene	-0.54	-0.58	-0.30	-0.51	0.31	0.52	-0.38	-0.72
Benzene	-0.49	-0.56	-0.42	-0.57	0.14	0.53	-0.43	-0.72
Chloromethane	0.31	0.30	0.30	0.32	0.00	-0.19	0.05	0.15
Dichlorodifluoromethane	-0.09	-0.10	0.05	-0.04	0.17	0.06	-0.15	-0.30
Ethylbenzene	-0.54	-0.57	-0.44	-0.56	0.17	0.56	-0.50	-0.68
m-,p - Xylene	-0.52	-0.55	-0.43	-0.55	0.15	0.54	-0.51	-0.65
o - Xylene	-0.48	-0.52	-0.42	-0.53	0.13	0.52	-0.51	-0.72
Propylene	-0.51	-0.57	-0.38	-0.55	0.17	0.53	-0.38	-0.69
Toluene	-0.31	-0.37	-0.24	-0.36	0.14	0.35	-0.36	-0.68
Trichlorofluoromethane	0.10	0.12	0.34	0.23	0.27	-0.06	0.01	-0.12

Table 4-3. Motor Vehicle Information vs. Daily Concentration for Arizona Monitoring Sites

Monitoring Station	Population within Ten Miles	Estimated Number of Vehicles Owned	Traffic Data (Daily Average)	Average Daily UATMP Concentration (ppbv)
PSAZ	1,377,479	1,019,334	250	22.08 (±2.80)
QVAZ	87,103	64,456	200	10.66(±1.84)
SPAZ	847,178	626,912	50,000	42.64 (±19.09)

5.0 Sites in Colorado

This section focuses on meteorological, concentration, and spatial trends for the five UATMP sites in Colorado (DECO, SWCO, WECO, G2CO, and GJCO). Two of the five sites are located in Grand Junction; the others are located in Denver. Figures 5-1 through 5-5 are topographical maps showing the monitoring stations in their urban locations. Figures 5-6 through 5-9 are maps identifying facilities within ten miles of the sites that reported to the 1999 NEI. The Denver sites are surrounded by numerous sources. A large number of sources near DECO fall into four categories: liquid distribution; surface coating; personal services; and fuel combustion. SWCO and WECO have an extremely large number of fuel combustion industrial facilities, liquids distribution facilities, surface coating processes, and personal service sites nearby. The G2CO site is to the south of GJCO and both are surrounded by fewer industrial sites, most of which are liquid distribution facilities.

Hourly meteorological data were retrieved for all of 2002 at two weather stations near these sites with the purpose of calculating correlations of meteorological data with ambient air concentration measurements. The two weather stations are Denver-Centennial and Grand Junction (WBAN 93067 and 23066, respectively).

Table 5-1 highlights the average UATMP concentration at each of the sites, along with temperature (average maximum and average), moisture (average dew point temperature, average wet-bulb temperature, and average relative humidity), wind information (average u- and v-components of the wind), and pressure (average sea level pressure) for the entire year and on days samples were taken. Climatologically, the Denver area is rather dry, as the relative humidity in Table 5-1 indicates, and the daily temperatures can fluctuate drastically between the seasons, providing the area with rather cold winters and warm summers. Wind speeds can vary for the site, but the wind flows from the south-southeast on average. Grand Junction is located in a mountain valley, and is slightly warmer than Denver, as the average maximum and average temperatures indicate in Table 5-1. Grand Junction tends to be just as dry, if not drier, with a somewhat similar wind pattern. This information can be found in The Weather Almanac, fifth edition (Ruffner and Bair, 1987).

5.1 Meteorological and Concentration Averages at the Colorado Sites

Carbonyl compounds and VOC were sampled at each of the sites. Carbonyl, halogenated hydrocarbons, and hydrocarbon compounds had the highest geometric means at G2CO (16.52 ppbv, 6.66 ppbv, and 17.11 ppbv, respectively), while polar compounds were highest at SWCO (114.80 ppbv). Polar compound geometric means ranged between 2.44 ppbv (DECO) and 114.80 ppbv (SWCO), halogenated hydrocarbon geometric means ranged from 4.05 ppbv (SWCO) to 6.66 ppbv (G2CO), the hydrocarbon geometric means varied from 9.23 ppbv (WECO) and 17.11 ppbv (G2CO), and carbonyl geometric means ranged from 6.48 ppbv (GJCO) to 16.52 ppbv (G2CO) among the sites. The average total UATMP daily concentration at the sites varied significantly, between 30.09 ±2.39 ppbv (DECO) and 162.32 ±287.71 ppbv (WECO). Table 5-1 also lists the averages for selected meteorological parameters from January 2002 to December 2002, which is the same time period covered in this report. The Colorado sites also opted to have metals sampled during their air toxic sampling. The average concentration ranged from 56,463.71 (±10,741.58) ng/filter at GJCO to 172,142.02 (±27,098.23) ng/filter at SWCO. This information is given in Table 5-3. Unfortunately, ozone concentrations were not sampled at any of these sites.

Tables 5-2a-e present the summary of calculated Pearson Correlation coefficients for each of the prevalent compounds and selected meteorological parameters by site. Identification of the prevalent compounds is discussed in Section 3 of this report. At DECO, the majority of correlations are relatively weak, with the exception of formaldehyde, with strong positive correlations with maximum, average, dew point and wet bulb temperatures, and chloromethane, with moderately strong positive correlations with the same parameters. These two compounds also exhibited this behavior at the other two Denver sites, SWCO and WECO. At SWCO and WECO, formaldehyde’s correlations were greater than 0.80 for maximum and average temperatures, indicating a very strong correlation. Also at SWCO, the xylenes had strong positive correlations with maximum and average temperature. Acetylene had a strong negative correlation with the dew point at all three sites, as well as with wet bulb temperature at WECO. At all three sites, many compounds had moderately strong negative correlations with relative humidity. Also at all three Denver sites, most compounds had negative correlations with the u-component and positive correlations with the v-component. As relative humidity and the east-west wind decrease and the north-south wind increases, UATMP concentrations tend to increase at the Denver sites.

Very few of the compounds exhibited strong correlations at either Grand Junction site. Only chloromethane and dichlorodifluoromethane registered correlations that were considered strong at G2CO, both negative and with the dew point. Neither demonstrated this correlation at the other site. Interestingly, the correlations between the compounds and maximum, average, and wet bulb temperatures at G2CO were all negative. Acetylene and dichlorodifluoromethane both had moderately strong to strong negative correlations with maximum, average, dew point, and wet bulb temperatures at G2CO and GJCO. GJCO measured a higher number of correlations between weather parameters and compounds that were considered strong. Benzene and formaldehyde both measured strong positive correlations with relative humidity. The overall weak and inconsistent correlations between the compounds and weather parameters make it difficult to ascertain when UATMP concentrations will increase.

As part of the 2002 UATMP report, back trajectory analyses were conducted for the EPA-designated NATTS sites to determine whether where a parcel came from could be a contributor to its air toxics concentration. A back trajectory analysis was performed on sample days for the Grand Junction sites, which are both pilot sites. The highest concentrations of UATMP compounds typically occurred during the winter period, in January and February. Table 5-4 is a summary of the back trajectory analyses. Generally, these high concentrations occurred when air originated west, northwest, and north of the monitors. As seen in Figure 5-9, there are numerous industrial facilities to the northwest, north, and northeast of the monitors. Figures 5-10 and 5-11 are back trajectory maps for each site when the highest concentration occurred, 31.58 ppbv at G2CO and 74.05 ppbv at GJCO.

5.2 Spatial Analysis

Using the population within ten miles of each site, an estimate of the number of cars operating in proximity to the monitoring station can be established. The ratio used in this report is 0.74 automobiles to every one person (refer to section 3.4.1 for more information on this ratio). At the time of this report, the population near the DECO site is 1,278,037 people, all of whom are estimated to be operating approximately 945,747 vehicles; SWCO's 1,275,463 population is operating 943,843 vehicles; and WECO's 852,751 residents drive 631,036 automobiles. A population of 113,004 people is driving 83,623 automobiles near the GJCO site, while a slightly lower population of 103,561 people is driving 76,635 vehicles near the G2CO site. This information is compared to the average daily concentration of the prevalent compounds at each Colorado site in Table 5-4. Also included in Table 5-5 are average daily traffic data, or more specifically, the average number of cars passing the monitoring sites on the nearest roadway to each site on a daily basis. The site with the largest population, DECO, also had the highest traffic volume passing the site on a daily basis.

A roadside study conducted to measure emissions from motor vehicles determined that the concentration ratios of the BTEX compounds were relatively consistent from urban area to urban area. (For more information on this study, refer to section 3.4.2.) Figure 3-14 depicts the average concentration ratios of the roadside study and compares them to the concentration ratios at each of the monitoring sites. The ratios for the Denver sites all generally resemble those of the roadside study. The DECO and WECO sites had higher toluene-ethylbenzene ratios than the roadside study, while the SWCO site exhibited a lower benzene-ethylbenzene ratio than the roadside study. The G2CO site's ratios also resemble the roadside study's, but with a larger toluene-ethylbenzene ratio. However, GJCO appears different in that its benzene-ethylbenzene ratio is the next highest after toluene-ethylbenzene, rather than *m,p*-xylene-ethylbenzene like the roadside study.

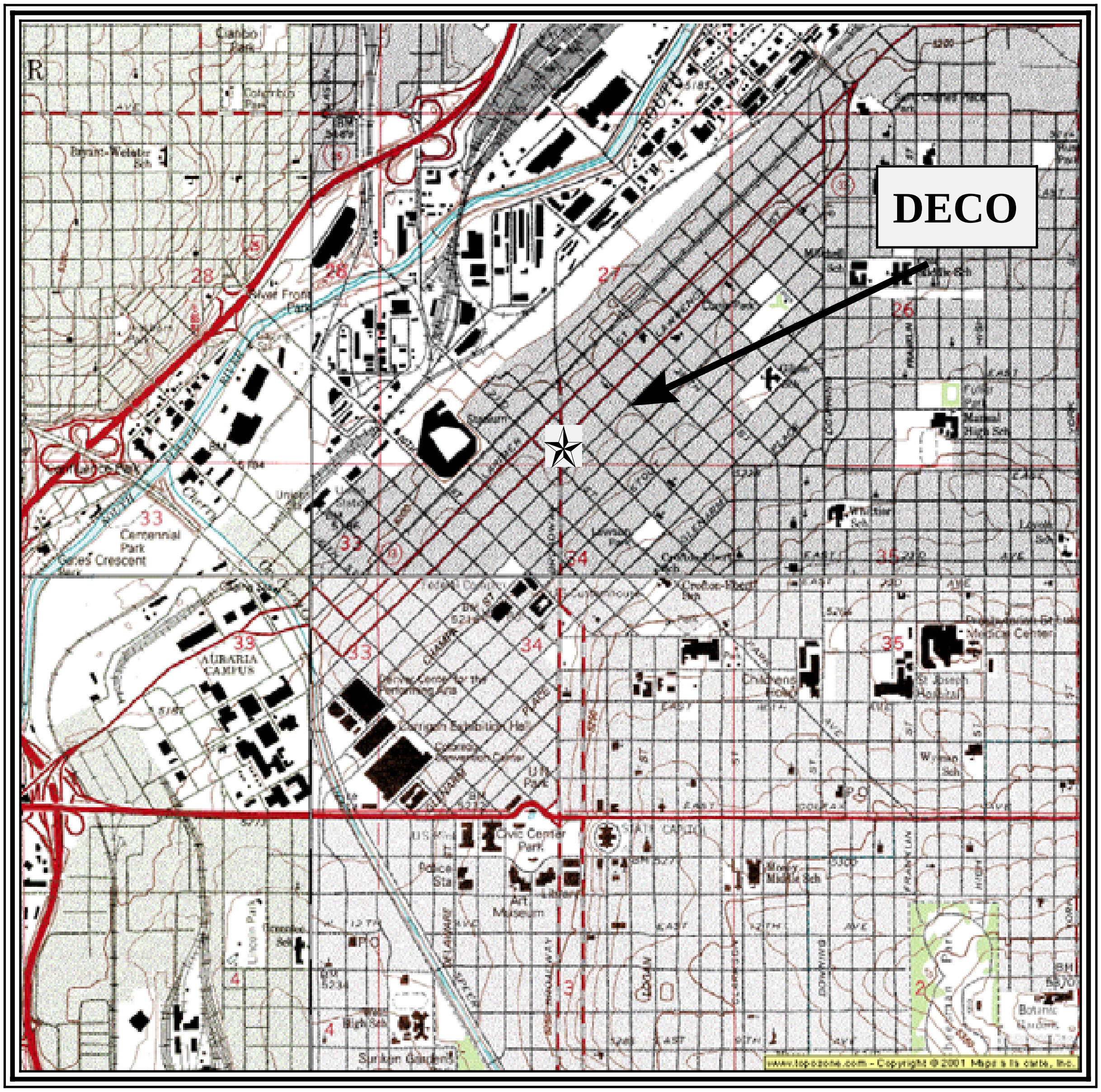
5.3 Regulation Analysis

There are two NATTS sites in Grand Junction, Colorado: GJCO and G2CO. Since these two sites are located in close proximity to each other, the analysis of the industries in the 10-mile areas around the two monitoring sites produces the same list of facilities. Table 3-9 shows that sixteen facilities within 10 miles around these two monitoring sites account for approximately 90 percent of the total UATMP pollutant emissions. Only five facilities are potentially subject to future regulations. Table 5-6 summarizes the regulations that are potentially applicable.

The regulations shown in Table 5-6 are expected to achieve emission reductions of the following UATMP pollutants: benzene, ethylbenzene, methyl ethyl ketone, styrene, toluene, and xylene. Based on this approach, benzene, methyl ethyl ketone, and styrene emissions are projected to be reduced by 56 percent. Ethylbenzene emissions are projected to be reduced by 63 percent. Toluene and xylene are projected to be reduced to lesser degrees (22 and 33 percent, respectively).

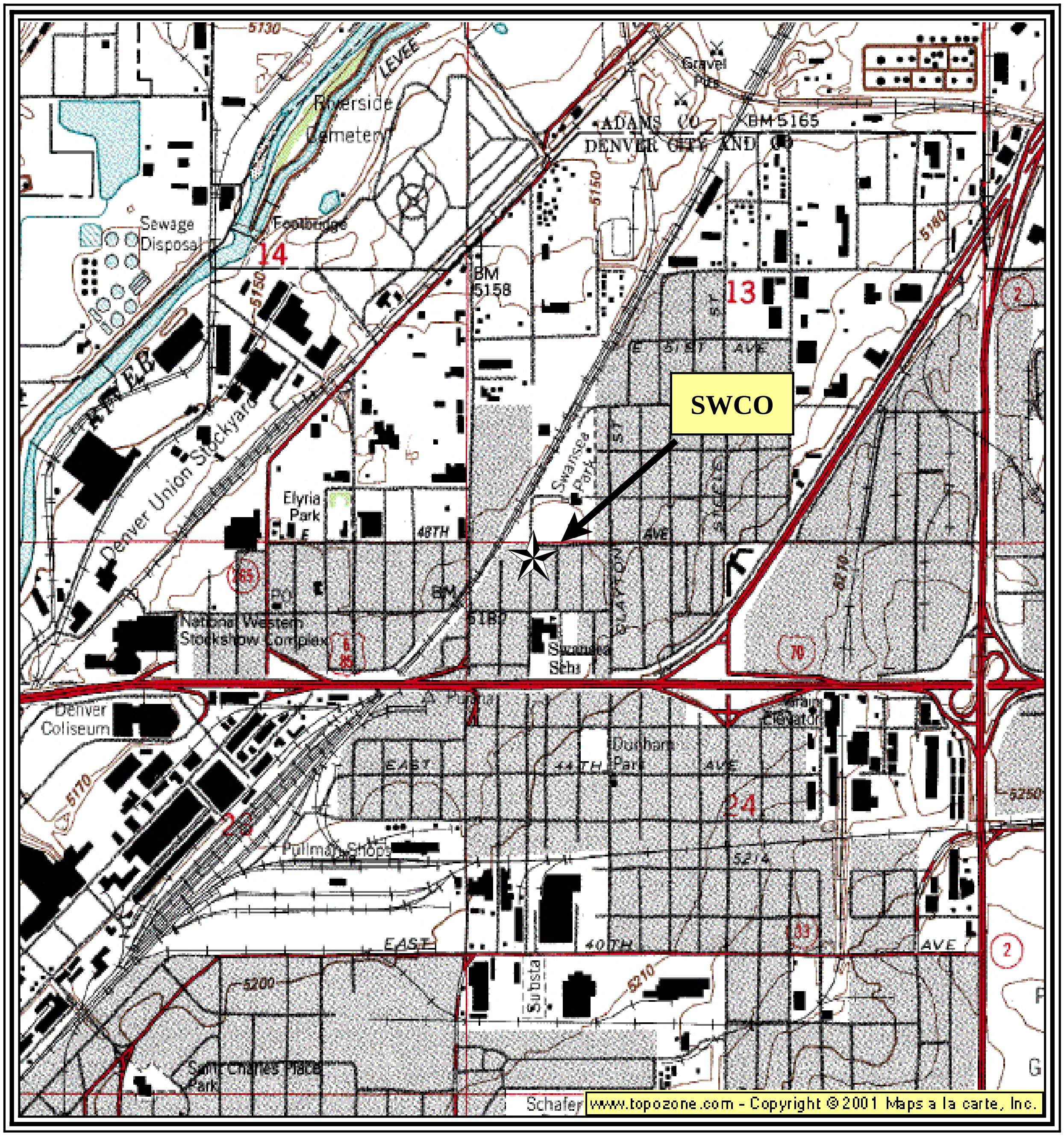
The reductions of benzene, ethylbenzene, and toluene are attributable to two facilities projected to comply with the NESHAP for organic liquids and oil and natural gas distribution (the latest compliance date is 2007). The methyl ethyl ketone reductions are attributable to a single facility projected to comply with the NESHAP for fabric printing and dyeing in 2003. The reduction in styrene emissions is attributable to a single facility projected to comply with the reinforced plastic composites production NESHAP in 2006. Xylene reductions are projected to occur from four facilities complying with regulations for organic liquids and oil and natural gas distribution; fabric printing and dyeing; and surface coating of metal products.

Figure 5-1. Denver, Colorado (DECO) Monitoring Station



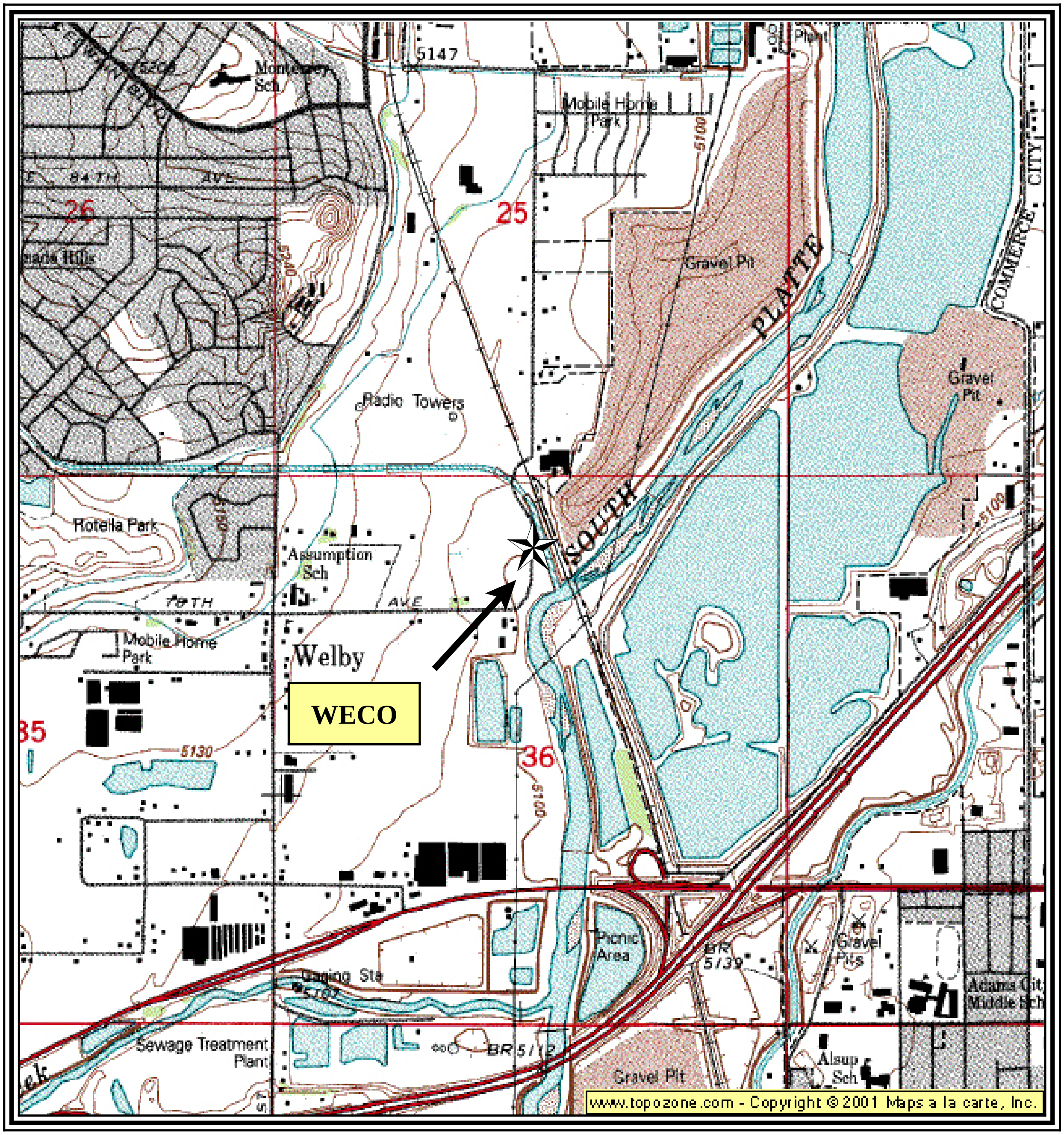
Source: USGS 7.5 Minute Series. Map Scale: 1:24,000.

Figure 5-2. Denver, Colorado (SWCO) Monitoring Station



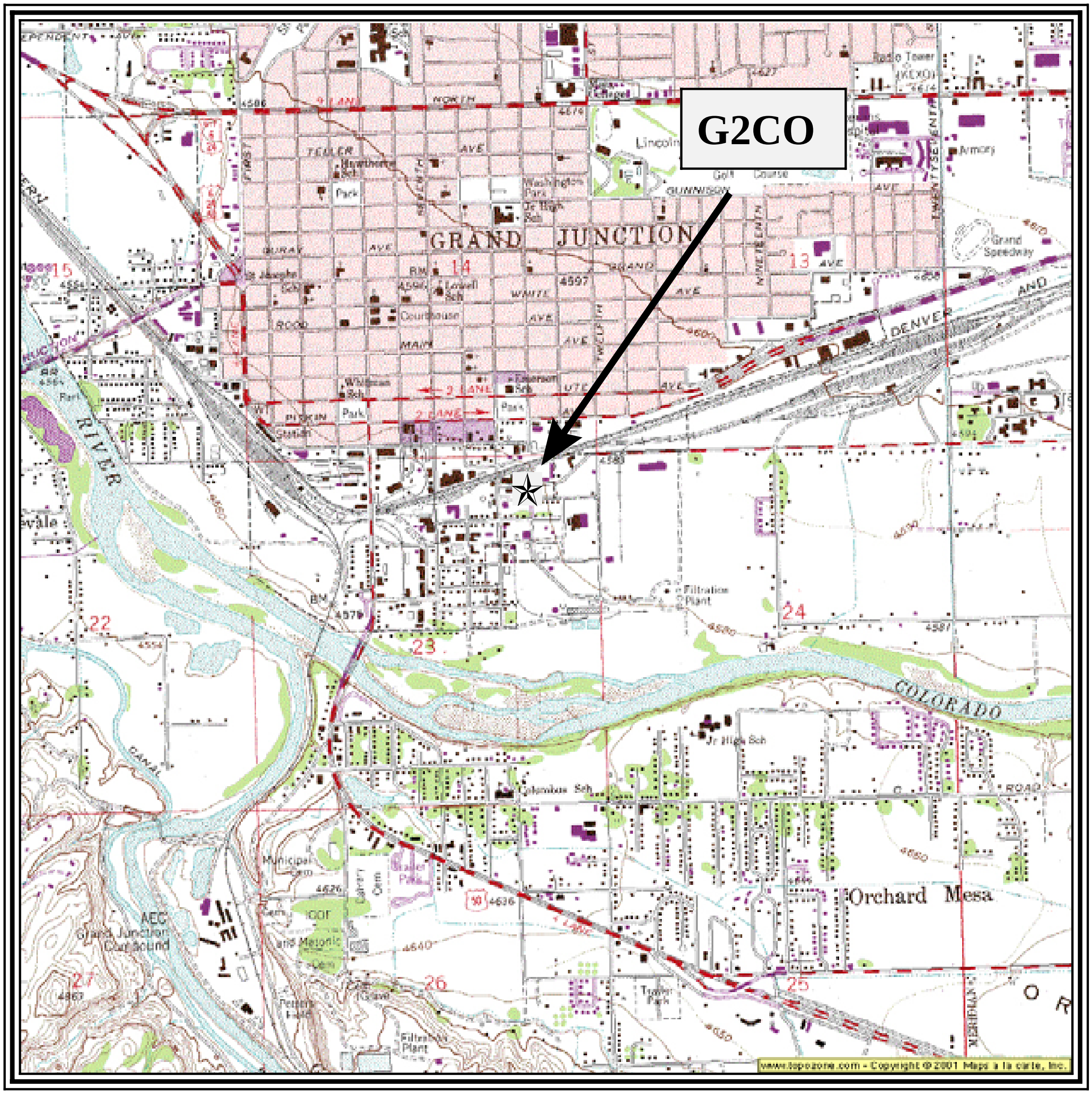
Source: USGS 7.5 Minute Series. Map Scale: 1:25,000.

Figure 5-3. Denver, Colorado (WECO) Monitoring Station



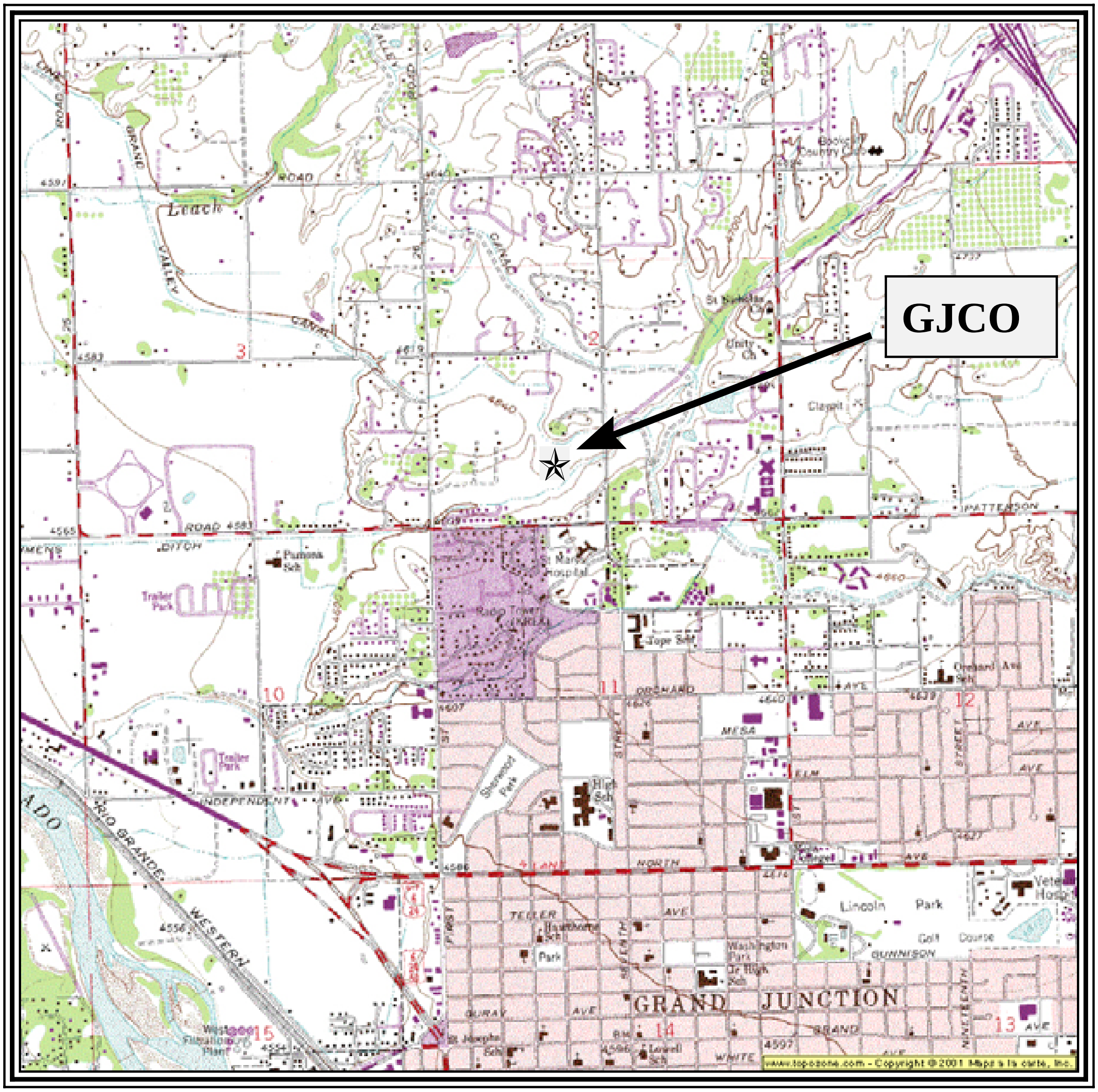
Source: USGS 7.5 Minute Series. Map Scale: 1:25,000.

Figure 5-4. Grand Junction, Colorado Site 2 (G2CO) Monitoring Station



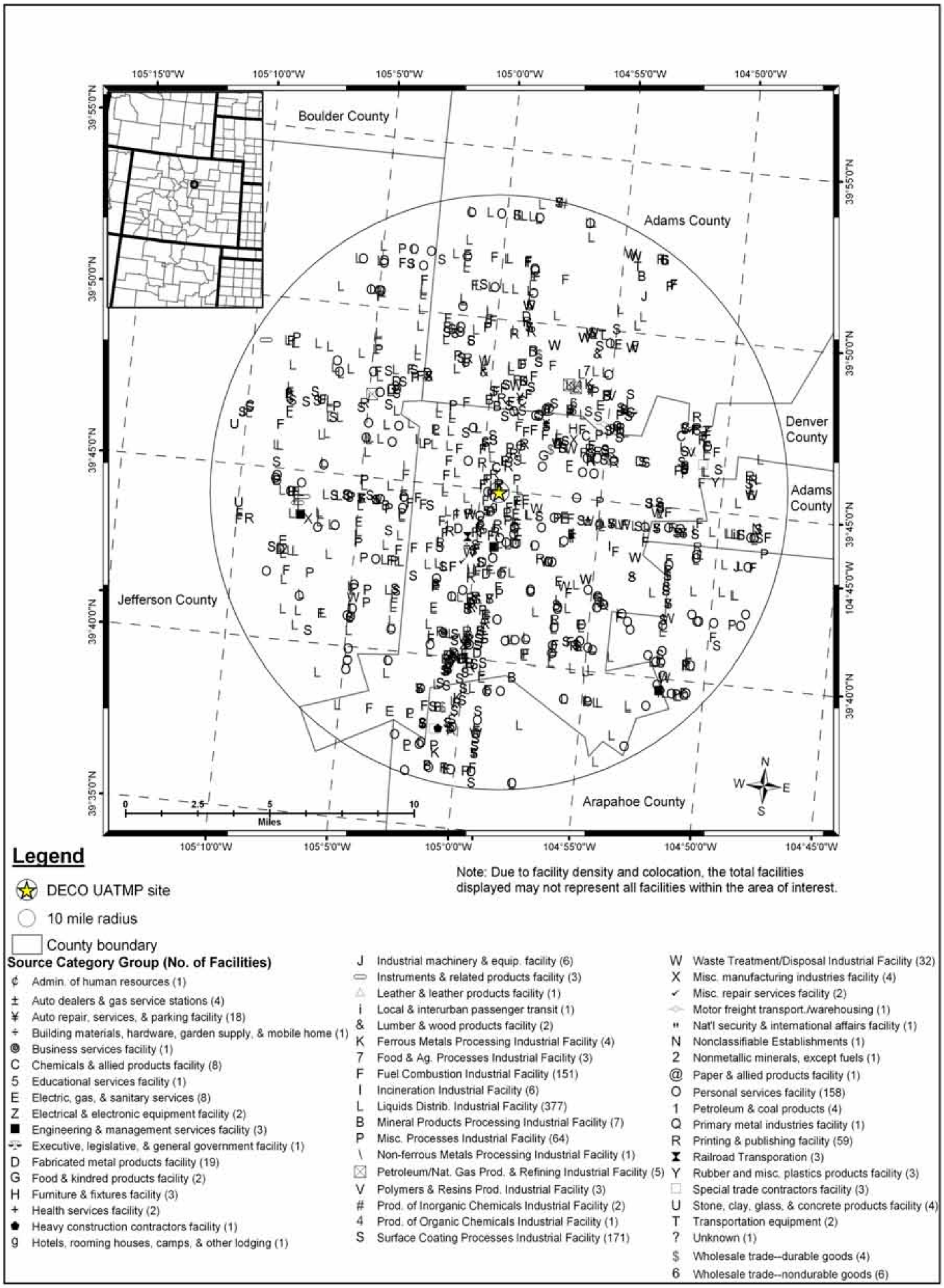
Source: USGS 7.5 Minute Series. Map Scale: 1:24,000.

Figure 5-5. Grand Junction, Colorado Site 1 (GJCO) Monitoring Station



Source: USGS 7.5 Minute Series. Map Scale: 1:24,000.

Figure 5-6. Facilities Located Within 10 Miles of DECO



Note: Due to facility density and colocation, the total facilities displayed may not represent all facilities within the area of interest.

Figure 5-7. Facilities Located Within 10 Miles of SWCO

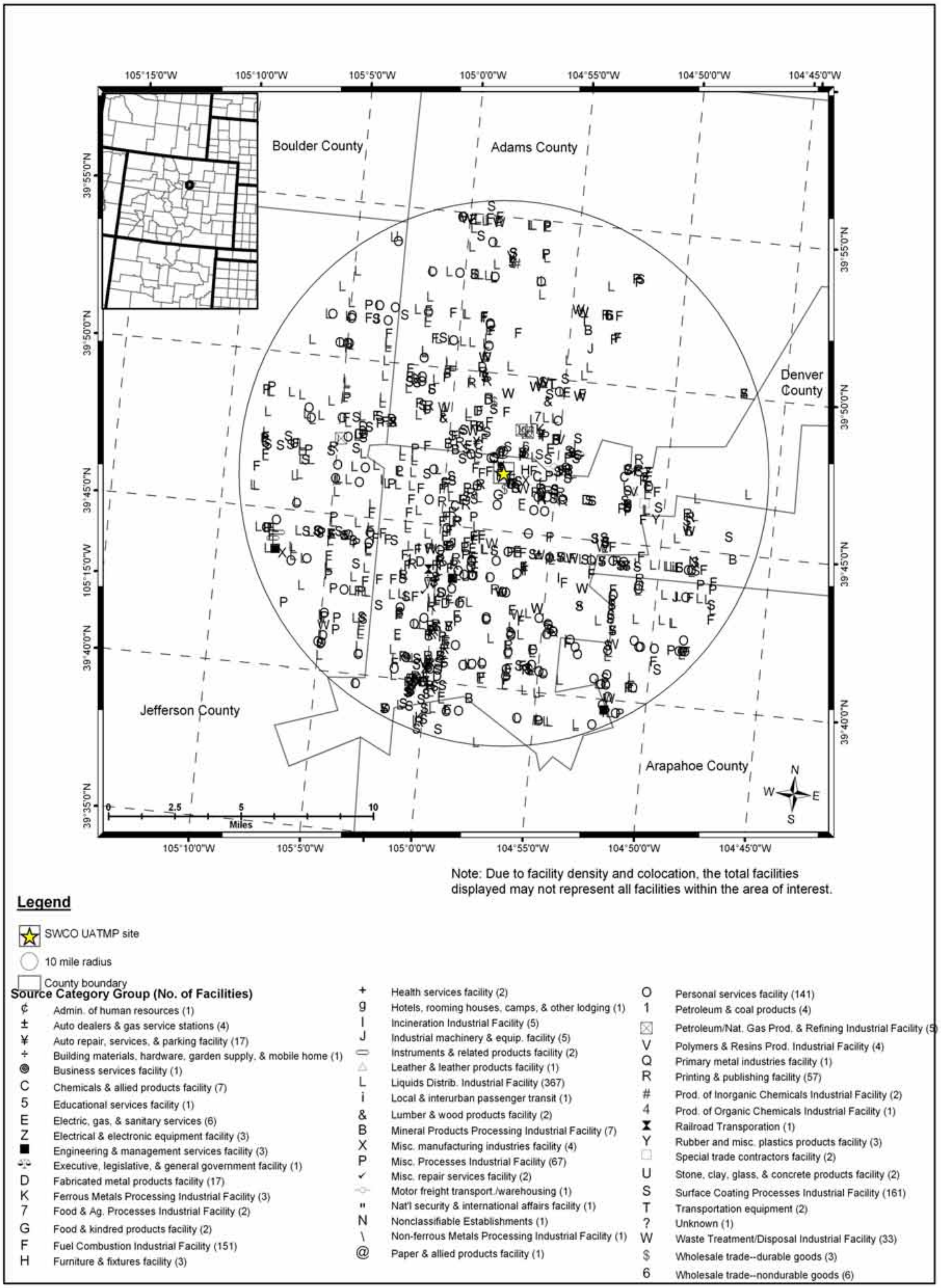
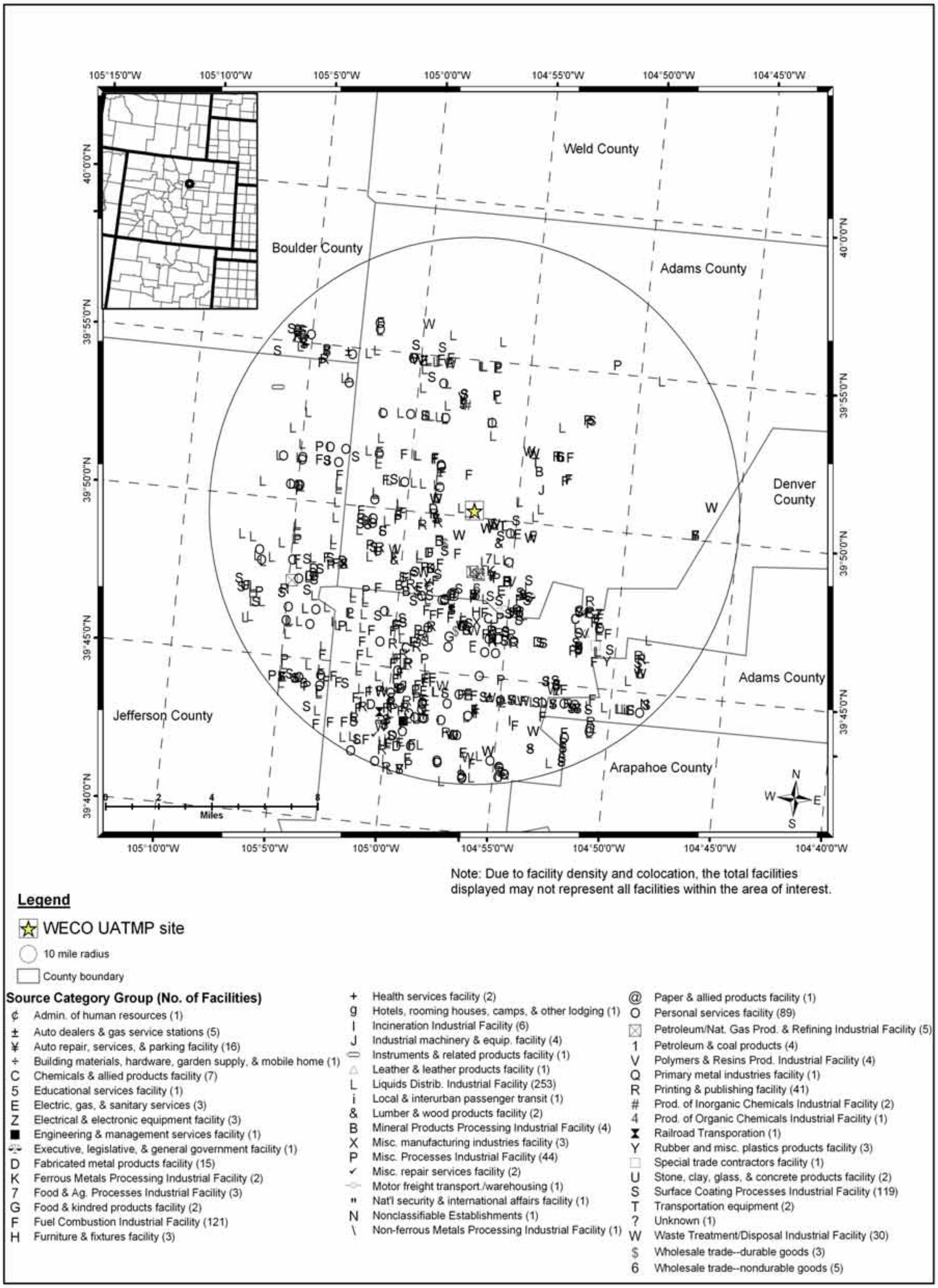
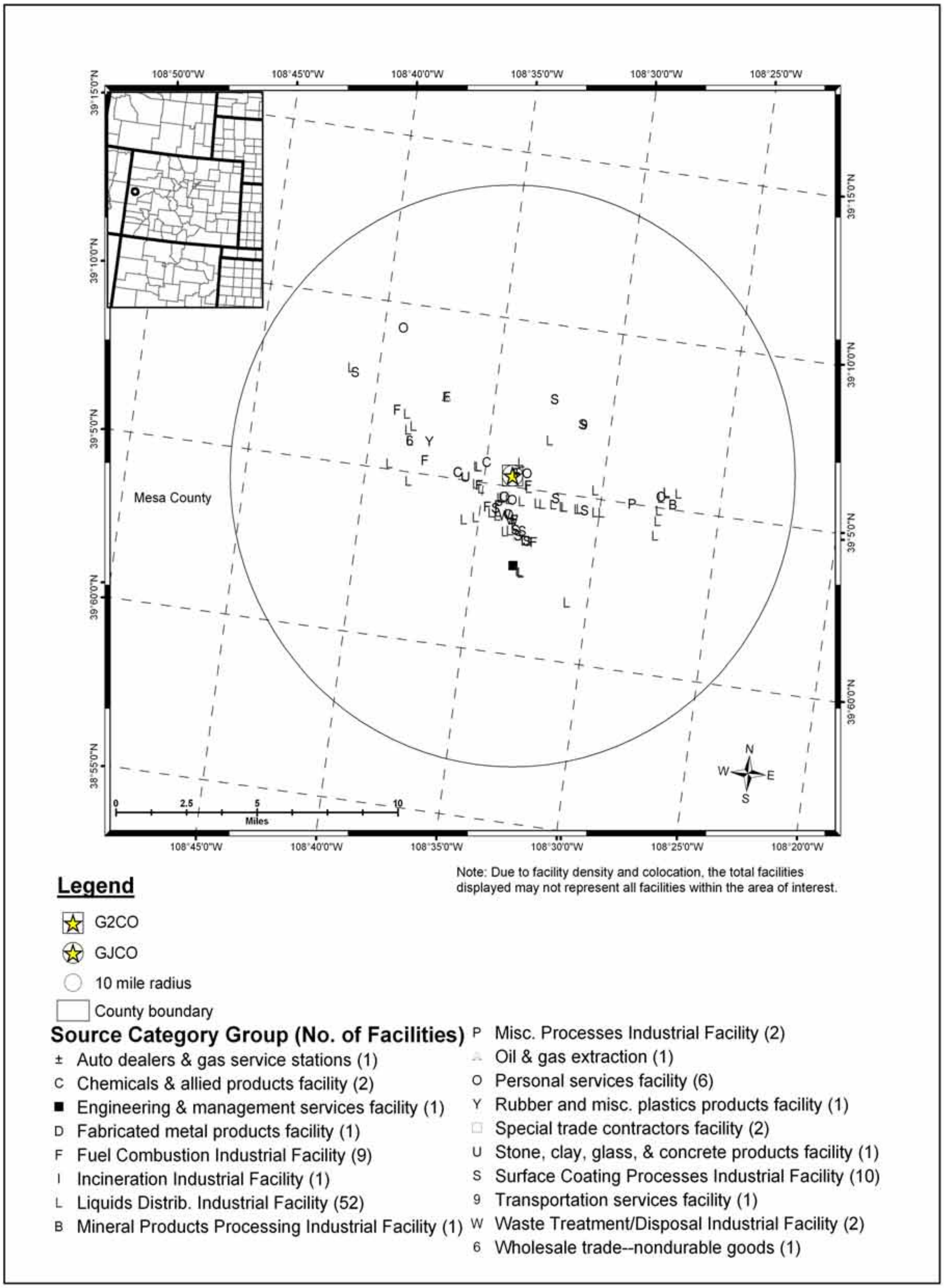


Figure 5-8. Facilities Located Within 10 Miles of WECO



Note: Due to facility density and colocation, the total facilities displayed may not represent all facilities within the area of interest.

Figure 5-9. Facilities Located Within 10 Miles of G2CO and GJCO



Note: Due to facility density and colocation, the total facilities displayed may not represent all facilities within the area of interest.

Figure 5-10. Back Trajectory Map Corresponding to G2CO's Highest Concentration

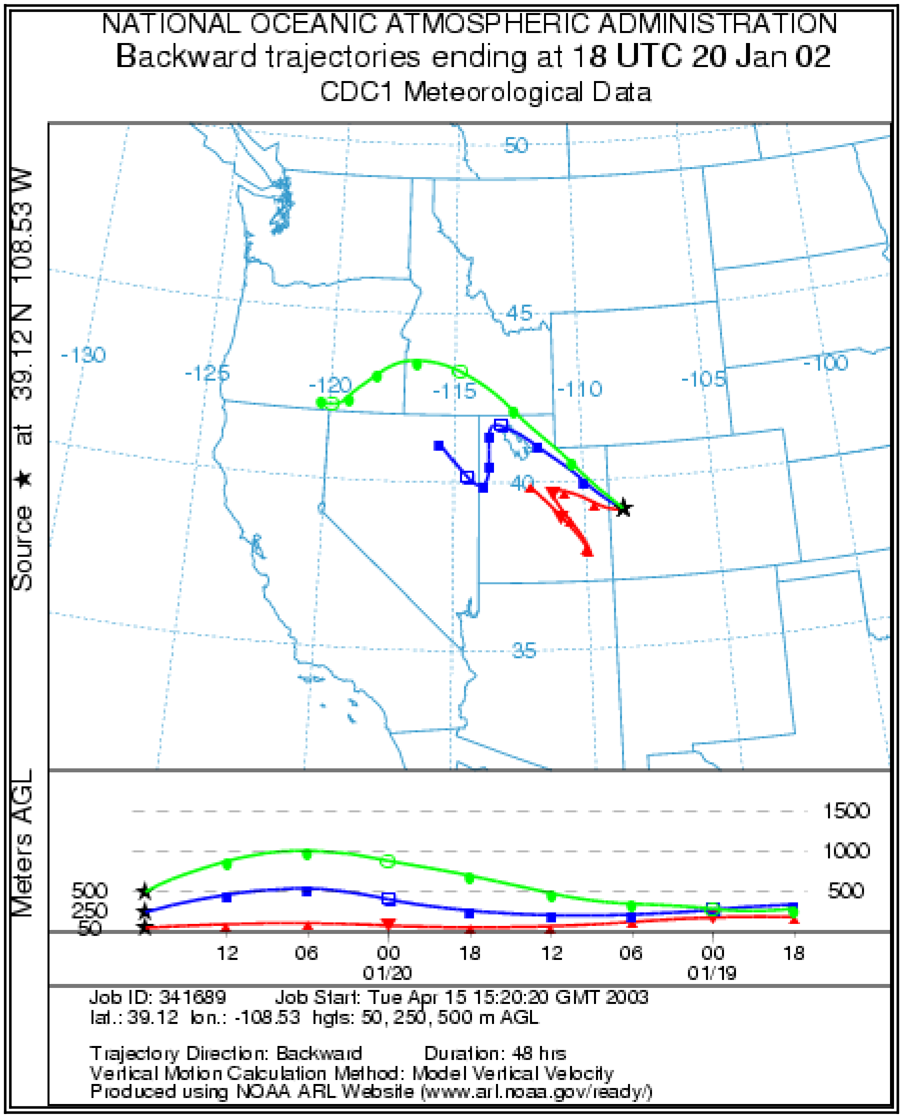


Figure 5-11. Back Trajectory Map Corresponding to GJCO's Highest Concentration

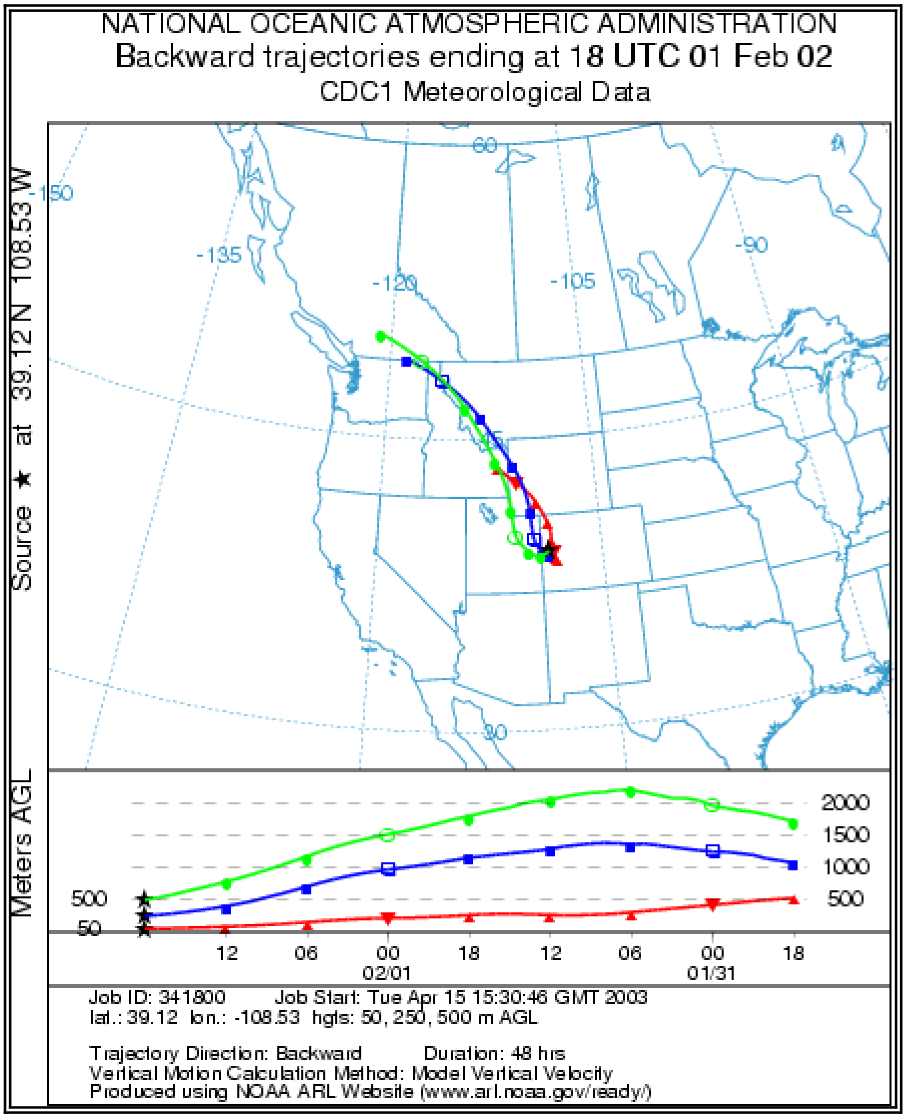


Table 5-1. Average Concentration and Meteorological Parameters for Sites in Colorado

Site Name	Type	Average UATMP Concentration (ppbv)	Average Maximum Temperature (°F)	Average Temperature (°F)	Average Dewpoint Temperature (°F)	Average Wet Bulb Temperature (°F)	Average Relative Humidity (%)	Average Sea Level Pressure (mb)	Average u-component of the Wind (kts)	Average v-component of the Wind (kts)
DECO	All 2002	▨	62.81 (±2.05)	50.01 (±1.88)	26.23 (±1.56)	39.08 (±1.42)	46.50 (±1.88)	1018.4 (±11.44)	-0.63 (±0.23)	3.79 (±0.17)
	sample day	30.09 (±2.39)	69.56 (±5.89)	56.48 (±5.38)	29.88 (±4.34)	43.47 (±3.88)	42.72 (±5.81)	1015.3 (±19.45)	-0.13 (±0.70)	2.65 (±0.51)
G2CO	All 2002	▨	66.20 (±2.22)	53.38 (±2.04)	26.89 (±1.30)	40.87 (±1.33)	44.90 (±2.26)	1017.7 (±11.74)	-1.88 (±0.16)	2.91 (±0.18)
	sample day	23.15 (±2.62)	50.05 (±6.69)	37.17 (±6.01)	16.46 (±4.19)	29.21 (±4.34)	48.61 (±7.06)	1022.6 (±45.91)	-1.01 (±0.98)	1.83 (±0.75)
GJCO	All 2002	▨	66.20 (±2.22)	53.38 (±2.04)	26.89 (±1.30)	40.87 (±1.33)	44.90 (±2.26)	1017.7 (±11.74)	-1.88 (±0.16)	2.91 (±0.18)
	sample day	54.85 (±13.55)	51.39 (±7.16)	38.50 (±6.39)	17.02 (±4.57)	30.16 (±4.62)	47.54 (±7.64)	1022.9 (±50.81)	-1.08 (±1.07)	1.85 (±0.82)
SWCO	All 2002	▨	62.81 (±2.05)	50.01 (±1.88)	26.23 (±1.56)	39.08 (±1.42)	46.50 (±1.88)	1018.4 (±11.44)	-0.63 (±0.23)	3.79 (±0.17)
	sample day	148.09 (±19.29)	68.63 (±7.10)	55.29 (±6.40)	28.94 (±5.29)	42.59 (±4.63)	43.25 (±7.25)	1015.7 (±x.xx)	0.00 (±0.79)	2.50 (±0.65)
WECO	All 2002	▨	62.81 (±2.05)	50.01 (±1.88)	26.23 (±1.56)	39.08 (±1.42)	46.50 (±1.88)	1018.4 (±11.44)	-0.63 (±0.23)	3.79 (±0.17)
	sample day	162.32 (±87.71)	70.44 (±6.67)	57.31 (±5.99)	31.22 (±4.89)	44.38 (±4.31)	43.90 (±6.70)	1015.8 (±20.00)	-0.35 (±0.76)	2.64 (±0.55)

Table 5-2a - Prevalent Compound Concentration Correlations with Selected Meteorological Parameters at Denver, Colorado (DECO)

Compound	Maximum Temperature	Average Temperature	Dew Point Temperature	Wet Bulb Temperature	Relative Humidity	Sea Level Pressure	u-component of wind speed	v-component of wind speed
1,2,4-Trimethylbenzene	-0.05	-0.12	-0.30	-0.20	-0.17	0.20	-0.21	-0.03
Acetylene	-0.35	-0.40	-0.52	-0.47	-0.08	0.53	-0.04	-0.07
Benzene	-0.09	-0.16	-0.46	-0.29	-0.33	0.23	-0.18	-0.03
Chloromethane	0.45	0.46	0.38	0.46	-0.15	-0.11	-0.11	0.19
Dichlorodifluoromethane	0.22	0.20	0.14	0.19	-0.09	-0.11	-0.11	0.10
Ethylbenzene	0.11	0.05	-0.23	-0.07	-0.31	0.13	-0.12	-0.02
Formaldehyde	0.69	0.72	0.67	0.74	-0.21	-0.38	-0.08	0.29
m-,*p* - Xylene	0.12	0.07	-0.21	-0.05	-0.33	0.12	-0.11	0.03
o - Xylene	0.21	0.16	-0.13	0.05	-0.37	0.04	-0.13	0.07
Propylene	-0.17	-0.23	-0.46	-0.33	-0.22	0.29	-0.09	0.00
Toluene	0.03	-0.03	-0.11	-0.06	-0.13	0.23	-0.17	0.05
Trichlorofluoromethane	0.36	0.33	0.24	0.31	-0.16	-0.23	0.04	0.23

Table 5-2b - Prevalent Compound Concentration Correlations with Selected Meteorological Parameters at Denver, Colorado (SWCO)

Compound	**Maximum Temperature**	**Average Temperature**	**Dew Point Temperature**	**Wet Bulb Temperature**	**Relative Humidity**	**Sea Level Pressure**	**u-component of wind speed**	**v-component of wind speed**
1,2,4-Trimethylbenzene	0.18	0.12	-0.22	-0.01	-0.45	-0.11	-0.37	0.14
Acetylene	-0.35	-0.41	-0.54	-0.48	-015	0.22	-0.29	-0.10
Benzene	0.04	-0.04	-0.40	-0.18	-0.46	0.13	-0.33	0.08
Chloromethane	0.69	0.69	0.45	0.66	-0.46	-0.32	-0.40	0.57
Dichlorodifluoromethane	0.39	0.38	0.16	0.33	-0.42	-0.22	-0.43	0.62
Ethylbenzene	0.43	0.41	0.12	0.32	-0.39	-0.20	-0.30	0.14
Formaldehyde	0.86	0.84	0.50	0.74	-0.53	-0.45	-0.25	0.37
m-,p - Xylene	0.51	0.51	0.27	0.44	-0.37	-0.23	-0.27	0.20
o - Xylene	0.50	0.51	0.27	0.43	-0.36	-0.25	-0.27	0.19
Propylene	-0.04	-0.11	-0.42	-0.23	-0.37	0.10	-0.39	0.00
Toluene	0.07	0.01	-0.32	-0.11	-0.40	-0.13	-0.25	0.13
Trichlorofluoromethane	-0.06	-0.11	-0.35	-0.19	-0.28	-0.04	-0.19	0.05

Table 5-2c - Prevalent Compound Concentration Correlations with Selected Meteorological Parameters at Denver, Colorado (WECO)

Compound	Maximum Temperature	Average Temperature	Dew Point Temperature	Wet Bulb Temperature	Relative Humidity	Sea Level Pressure	u-component of wind speed	v-component of wind speed
1,2,4-Trimethylbenzene	0.12	0.08	-0.26	-0.06	-0.41	-0.06	-0.10	0.11
Acetylene	-0.36	-0.42	-0.62	-0.53	-0.21	0.18	-0.01	-0.08
Benzene	-0.08	-0.16	-0.52	-0.31	-0.44	0.13	-0.16	0.06
Chloromethane	0.28	0.31	0.37	0.35	0.06	-0.09	-0.42	-0.11
Dichlorodifluoromethane	0.06	0.07	0.17	0.10	0.14	-0.01	-0.09	-0.18
Ethylbenzene	0.40	0.39	0.04	0.26	-0.46	-0.24	-0.31	0.19
Formaldehyde	0.88	0.89	0.57	0.80	-0.55	-0.51	-0.23	0.45
m-,p - Xylene	0.39	0.38	0.07	0.27	-0.41	-0.22	-0.38	0.17
o - Xylene	0.39	0.38	0.05	0.25	-0.42	-0.24	-0.28	0.15
Propylene	-0.11	-0.17	-0.50	-0.31	-0.38	0.11	-0.26	-0.02
Toluene	0.22	0.21	0.01	0.13	-0.28	-0.07	-0.14	0.09
Trichlorofluoromethane	0.21	0.22	0.12	0.18	-0.13	-0.06	-0.11	0.03

Table 5-2d - Prevalent Compound Concentration Correlations with Selected Meteorological Parameters at Grand Junction, Colorado Site 1 (GJCO)

Compound	Maximum Temperature	Average Temperature	Dew Point Temperature	Wet Bulb Temperature	Relative Humidity	Sea Level Pressure	u-component of wind speed	v-component of wind speed
1,2,4-Trimethylbenzene	0.03	0.04	0.34	0.16	0.39	-0.11	-0.06	-0.12
Acetylene	-0.57	-0.62	-0.40	-0.61	0.41	0.29	-0.35	-0.48
Benzene	-0.30	-0.32	0.01	-0.24	0.51	0.00	-0.32	-0.38
Chloromethane	0.15	0.19	0.09	0.18	-0.15	0.23	0.43	0.02
Dichlorodifluoromethane	-0.52	-0.53	-0.45	-0.54	0.20	0.49	0.00	-0.45
Ethylbenzene	0.10	0.08	0.33	0.18	0.31	-0.18	-0.16	-0.08
Formaldehyde	-0.20	-0.25	0.19	-0.14	0.59	0.10	-0.49	-0.28
m-,p - Xylene	0.03	0.01	0.27	0.11	0.34	-0.13	-0.16	-0.11
o - Xylene	0.04	0.02	0.30	0.13	0.36	-0.11	-0.20	-0.11
Propylene	-0.04	-0.01	0.30	0.11	0.41	-0.14	0.06	-0.20
Toluene	0.01	0.01	0.36	0.13	0.44	0.01	-0.13	-0.17
Trichlorofluoromethane	-0.26	-0.30	-0.28	-0.33	0.07	0.32	-0.20	-0.24

Table 5-2e - Prevalent Compound Concentration Correlations with Selected Meteorological Parameters at Grand Junction, Colorado Site 2 (G2CO)

Compound	Maximum Temperature	Average Temperature	Dew Point Temperature	Wet Bulb Temperature	Relative Humidity	Sea Level Pressure	u-component of wind speed	v-component of wind speed
1,2,4-Trimethylbenzene	-0.15	-0.16	-0.10	-0.15	0.10	0.08	-0.09	-0.06
Acetylene	-0.43	-0.43	-0.27	-0.41	0.28	0.20	-0.02	-0.23
Benzene	-0.25	-0.27	0.06	-0.19	0.45	0.12	-0.14	-0.16
Chloromethane	-0.11	-0.09	-0.55	-0.22	-0.49	0.22	0.19	-0.13
Dichlorodifluoromethane	-0.42	-0.41	-0.53	-0.46	-0.03	0.44	0.05	-0.38
Ethylbenzene	-0.20	-0.22	-0.06	-0.18	0.23	0.10	-0.17	-0.09
Formaldehyde	-0.08	-0.07	0.17	-0.01	0.30	-0.14	0.08	-0.35
m-,*p* - Xylene	-0.23	-0.24	-0.04	-0.19	0.28	0.07	-0.12	-0.06
o - Xylene	-0.23	-0.24	-0.07	-0.20	0.24	0.05	-0.08	-0.04
Propylene	-0.30	-0.31	-0.05	-0.24	0.35	0.15	-0.08	-0.25
Toluene	-0.17	-0.19	0.00	-0.14	0.25	0.05	-0.10	-0.02
Trichlorofluoromethane	-0.20	-0.23	-0.27	-0.25	0.03	0.40	-0.18	-0.18

Table 5-3. Average Metal Concentrations Measured by the Colorado Monitoring Stations

Monitoring Station	Average Metals Concentration (ng/filter)
DECO	145,831.74 (±16,717.90)
G2CO	113,505.14 (±17,567.66)
GJCO	56,463.71 (±10,741.58)
SWCO	172,142.02 (±27,098.23)
WECO	144,220.91 (±21,783.17)

Table 5-4. Average UATMP Concentrations By Wind Regime for the Grand Junction Sites

Wind Regime	G2CO		GJCO	
	24 hr	**48 hr**	**24 hr**	**48 hr**
North	17.38*	15.23	45.38*	38.55*
Northeast	ND	ND	ND	ND
East	ND	ND	ND	ND
Southeast	ND	ND	ND	ND
South	ND	ND	ND	ND
Southwest	11.76	10.25	9.22	10.16
West	9.86	22.42*	7.70	28.48
Northwest	15.44	14.85	16.40	23.31

ND = Not Detected
* = highest for the site

Table 5-5. Motor Vehicle Information vs. Daily Concentration for Colorado Monitoring Sites

Monitoring Station	Population within Ten Miles	Estimated Number of MotorVehicles Owned	Traffic Data (Daily Average)	Average Daily UATMP Concentration (ppbv)
DECO	1,278,037	945,747	44,200	30.09 (±2.39)
G2CO	103,561	76,635	2,200	23.15 (±2.62)
GJCO	113,004	83,623	10,000	54.85 (±13.55)
SWCO	1,275,463	943,843	1,366	148.09 (±19.29)
WECO	852,751	631,036	1,500	162.32 (±87.71)

Table 5-6. Summary of Future Regulations That May be Applicable for Nearby Facilities Surrounding GJCO and G2CO

Facility Name	Primary SIC Code	SIC Code Description	Regulation Citation	Regulation Name
Wesfrac, Inc.	1311	Oil And Gas Extraction, Crude Petroleum And Natural Gas, Crude petroleum and natural gas	40 CFR part 63, subpart HH	National Emission Standards for Hazardous Air Pollutants from Oil and Natural Gas Transmission and Storage (proposed rule)
Western Filament Inc.	2269	Textile Mill Products, Textile Finishing, except Wool, Finishing plants, NEC	40 CFR part 63, subpart OOOO	National Emission Standards for Hazardous Air Pollutants from Fabric Printing and Dyeing
ABC Industries, Inc.	3089	Rubber And Misc. Plastics Products, Miscellaneous Plastics Products, NEC, Plastics products, NEC	40 CFR part 63, subpart WWWW	National Emission Standards for Hazardous Air Pollutants from Reinforced Plastic Composites Production (proposed rule)
Colorado Bridge & Iron, Inc.	3441	Fabricated Metal Products, Fabricated Structural Metal Products, Fabricated structural metal	40 CFR part 63, subpart MMMM	National Emission Standards for Hazardous Air Pollutants from Surface Coating of Miscellaneous Metal Parts and Products (proposed rule)
Wescourt Group, Inc. - Fruita Terminal	5171	Wholesale Trade--Nondurable Goods, Petroleum and Petroleum Products, Petroleum bulk stations & terminals	40 CFR part 63, subpart EEEE	National Emission Standards for Hazardous Air Pollutants from Organic Liquids Distribution

6.0 Sites in Florida

This section focuses on meteorological, concentration, and spatial trends for the five UATMP sites in and near the Tampa/St. Petersburg, FL area (AZFL, CWFL, DNFL, GAFL, LEFL) and four South Florida sites (BGFL, DBFL, FLFL, MDFL). Two of these sites are located in St. Petersburg, two in Tampa, one in Clearwater, and the south Florida sites are scattered among Belle Glade, Delray Beach, Pompano Beach and in Miami. Figures 6-1 through 6-9 are topographical maps showing the monitoring stations in their urban locations. Figures 6-10 through 6-13 are maps identifying facilities within ten miles of the sites and that reported to the 1999 NEI. The Tampa-St. Petersburg sites are clustered around each other, with a majority of the facilities between CWFL, AZFL, and GAFL, and between GAFL and LEFL. A large number of fuel combustion and surface coating sources are located in this region. BGFL is located south of Lake Okeechobee, with only five facilities within ten miles of the monitoring station, of which two are food and kindred product facilities, two are fuel combustion facilities, and one is a liquid distribution facility. DBFL and FLFL are both located on the east coast of Florida, with DBFL to the north of FLFL. There are more facilities near FLFL, most of which are fuel combustion or waste treatment and disposal facilities. MDFL is located in Miami. Due to its coastal location, most of the facilities are located to the west of the monitoring station. Most of the facilities located within ten miles of MDFL are surface coating, incineration, and fuel combustion sources.

Hourly meteorological data were retrieved for all of 2002 at six weather stations near these sites with the purpose of calculating correlations of meteorological data with ambient air concentration measurements. The six weather stations are Tampa-International, St. Petersburg, St. Petersburg/Clearwater, Hollywood International, Palm Beach International, and Miami International (WBAN 12842, 92806, 12873, 12849,12844, and 12839, respectively).

Table 6-1 highlights the average UATMP concentration at each of the sites, along with temperature (average maximum and average), moisture (average dew point temperature, average wet-bulb temperature, and average relative humidity), wind information (average u- and v-components of the wind), and pressure (average sea level pressure) for the entire year and on days samples were taken. The Tampa/St. Petersburg area is located on Florida’s Gulf Coast, Belle Glade is in south central Florida, and the remaining sites are located along the east coast of southern Florida. Florida's climate is subtropical, with very mild winters and warm, muggy summers as Table 6-1 confirms. The annual average maximum temperature is in the 80s for all of the locations and relative humidity is in the 70 to 80 percent range. Although land and sea breezes affect each of the locations, wind generally blows from a southeasterly direction due to high pressure offshore. This information can be found in The Weather Almanac, fifth edition (Ruffner and Bair, 1987).

6.1 Meteorological and Concentration Averages at the Florida Sites

Only carbonyl compounds were measured at the nine sites, as indicated in Tables 3-3 and 3-4. Geometric means of the carbonyl compounds ranged from 1.26 ppbv (MDFL) to 10.76 ppbv (DNFL), while the average daily UATMP concentration had a greater range of 1.28 ±0.23 ppbv (MDFL) to 7.13 ±2.49 ppbv (GAFL). Table 6-1 also lists the averages for selected meteorological parameters from January 2002 to December 2002, which is the same time period covered in this report.

Table 6-2 is the summary of calculated Pearson Correlation coefficients for the prevalent carbonyl compound (formaldehyde) and selected meteorological parameters by site. Identification of the prevalent compounds is discussed in Section 3 of this report. Formaldehyde had moderately strong to very strong positive correlations with maximum, average, dew point, and wet bulb temperatures at AZFL, BGFL, CWFL, and LEFL. However, this compound also had moderately strong to very strong negative correlations with the same four weather parameters at both DNFL and FLFL. Moderately strong negative correlations between formaldehyde and dewpoint and wet bulb temperature were also calculated at DBFL. With the exception of GAFL, all of the sites had negative correlations with relative humidity. DBFL registered a nearly perfect negative correlation between formaldehyde and relative humidity (-0.99). FLFL also registered a nearly perfect positive correlation between formaldehyde and sea level pressure (0.99). BGFL, DBFL, FLFL, and MDFL each had a strong correlation between formaldehyde and either the u- or v-component of the wind. These four sites are also the four sites not located on the west coast of Florida. UATMP concentrations (formaldehyde) tend to increase at the Florida sites as relative humidity decreases. However, predicting concentration increases based on the remainder of the meteorological parameters would be difficult.

As part of the 2002 UATMP report, back trajectory analyses were conducted for EPA-designated NATTS sites to determine whether where a parcel originated could be a contributor to its air toxics concentration. A back trajectory analysis was performed on sample days for the Tampa/St. Petersburg sites, all of which are pilot sites. The highest concentrations of UATMP compounds typically occurred during the spring and summer months, from April through September. These high concentrations occurred when air originated from a variety of directions, not a single direction. Table 6-3 is a summary of the back trajectory analyses. As seen in Figure 6-10, the monitors are clustered around each other and industrial facilities are located in all directions in relation to the monitors. Figures 6-14 through 6-16 are sample back trajectory maps for the each of the participating sites, on days where the highest concentration occurred (6.36 ppbv for AZFL; 4.59 ppbv for CWFL; 54.59 ppbv for DNFL; 38.03 ppbv for GAFL; and 3.82 ppbv for LEFL).   For three of the five sites, the highest concentration occurred on the same day, September 17, 2002.

6.2 Spatial Analysis

Using the population within ten miles of each site, an estimate of the number of motor vehicles operating in proximity to the monitoring station can be established. The ratio used in this report is 0.74 automobiles to every one person (refer to section 3.4.1 for more information on this ratio). The population is the highest near the MDFL site, with 1,152,632 people operating approximately 852,948 vehicles. The lowest population of the Florida sites is near BGFL, where 34,175 people are driving 25,290 automobiles. This information is compared to the average daily concentration of the prevalent compounds at each Florida site in Table 6-3. Also included in Table 6-4 is average daily traffic data, or more specifically, the average number of cars passing the monitoring sites on the nearest roadway to each site on a daily basis. The largest amount of traffic passes by the GAFL monitoring station (81,460).

A roadside study conducted to measure emissions from motor vehicles determined that the concentration ratios of the BTEX compounds were relatively consistent from urban area to urban area. (For more information on this study, refer to section 3.4.2.) Figure 3-14 depicts the average concentration ratios of the roadside study and compares them to the concentration ratios at each of the monitoring sites. As the Florida sites only measured carbonyl compounds, these nine sites are not included in Figure 3-14.

6.3 Regulation Analysis

Five NATTS sites are located in Tampa/St. Petersburg, FL: AZFL, CWFL, DNFL, GAFL and LEFL, all within close proximity to each other. Consequently, many of the facilities identified in the 10-mile areas around the monitoring sites overlap. Table 3-9 lists the number of facilities within 10 miles that account for approximately 90 percent of the total UATMP pollutant emissions.

At AZFL, of the twelve facilities listed in Table 3-9, eight facilities are potentially subject to future regulations. Table 6-5 identifies the regulations that are potentially applicable. Based on this analysis, the ambient concentrations of methyl methacrylate and styrene recorded by monitoring station AZFL are expected to decrease. The regulations shown in Table 6-5 are projected to achieve emission reductions of methyl methacrylate (35 percent) and styrene (49 percent). These reductions are attributable to regulation of facilities that manufacture reinforced plastic products (e.g., spas, boats) projected to comply with the applicable regulations by 2006.

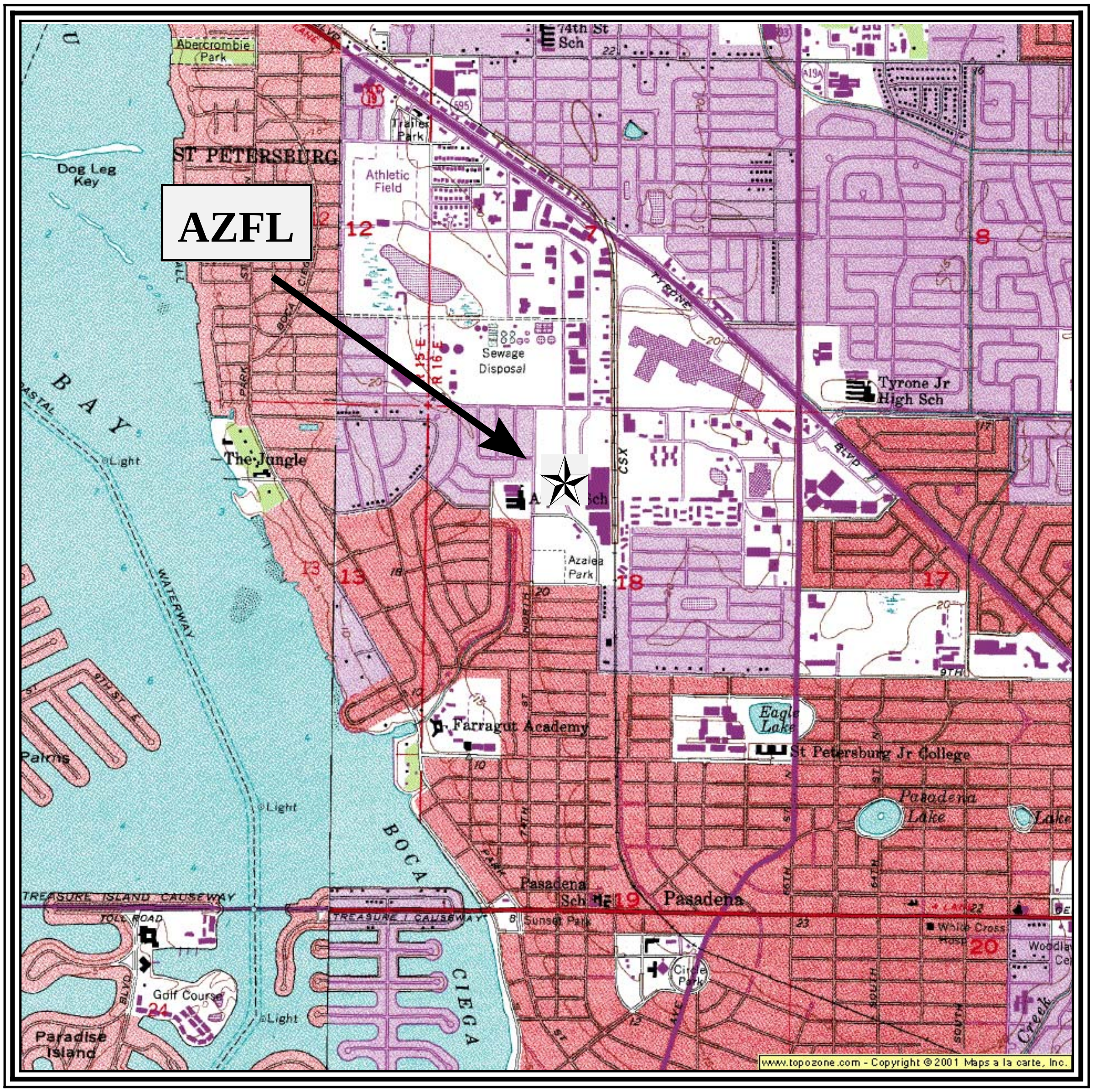
At CWFL, of the sixteen facilities listed shown in Table 3-9, nine facilities are potentially subject to future regulations. Table 6-6 identifies the regulations that are potentially applicable. Based on this analysis, the ambient concentration of ethylbenzene, styrene, and xylene recorded by monitoring station CWFL are expected to decrease. The regulations shown in Table 6-5 are projected to achieved a 51 percent decrease in emissions of styrene and 54 percent decrease in xylene emissions. The styrene reductions are attributable to regulation of facilities that manufacture reinforced plastic products (e.g., spas, boats) (the latest compliance date of the applicable regulations is 2006). The reductions of ethylbenzene and xylene emissions are primarily attributable to a single facility projected to have complied with the printing and publishing NESHAP in 1999. Additional reductions of UATMP compound emissions are possible from the Florida Power Corporation facility, due to compliance with the combustion turbine and reciprocating engine standards. However, sufficient information is not available to estimate those potential reductions.

At DNFL, of the ten facilities listed in Table 3-9, seven facilities are potentially subject to future regulations. Table 6-7 identifies the regulations that are potentially applicable. The regulations shown are projected to achieved a 55 percent decrease in emissions of styrene and a 65 percent decrease in methyl ethyl ketone emissions. Based on this analysis, the ambient concentrations of styrene and methyl ethyl ketone recorded by the monitoring station have the potential to decrease (particularly for methyl ethyl ketone). These reductions are attributable to regulation of facilities that apply surface coatings to metal products and facilities that manufacture reinforced plastic products (e.g., spas, boats). Ethylbenzene, methyl methacrylate, and toluene are all expected to have a 35 percent decrease in emissions. The latest compliance date of those applicable regulations is 2006.

At GAFL, of the twenty-five facilities listed in Table 3-9, fourteen facilities are potentially subject to future regulations. Table 6-8 identifies the regulations that are potentially applicable. Based on this analysis, reductions are projected for methylene chloride (57 percent) and styrene (54 percent) emissions. The reductions in methylene chloride emissions are attributable to a single facility projected to have complied with the printing and publishing NESHAP. The styrene emission reductions are primarily attributed to reductions achieved by boat and reinforced plastic product (e.g., spas) manufacturing facilities. Benzene and methyl isobutyl ketone emissions are projected to decrease by 21 and 33 percent, respectively. The benzene emission reductions are primarily attributed to facilities projected to be subject to the organic liquid distribution NESHAP. Consequently, ambient concentrations of these four compounds recorded by the station should decrease as the regulations are implemented (the latest compliance date is 2006). Lower reductions are projected for ethylbenzene (10 percent), methyl ethyl ketone (12 percent), toluene (19), and xylene (13 percent). Therefore, decreases in ambient concentrations of these compounds may not be significant.

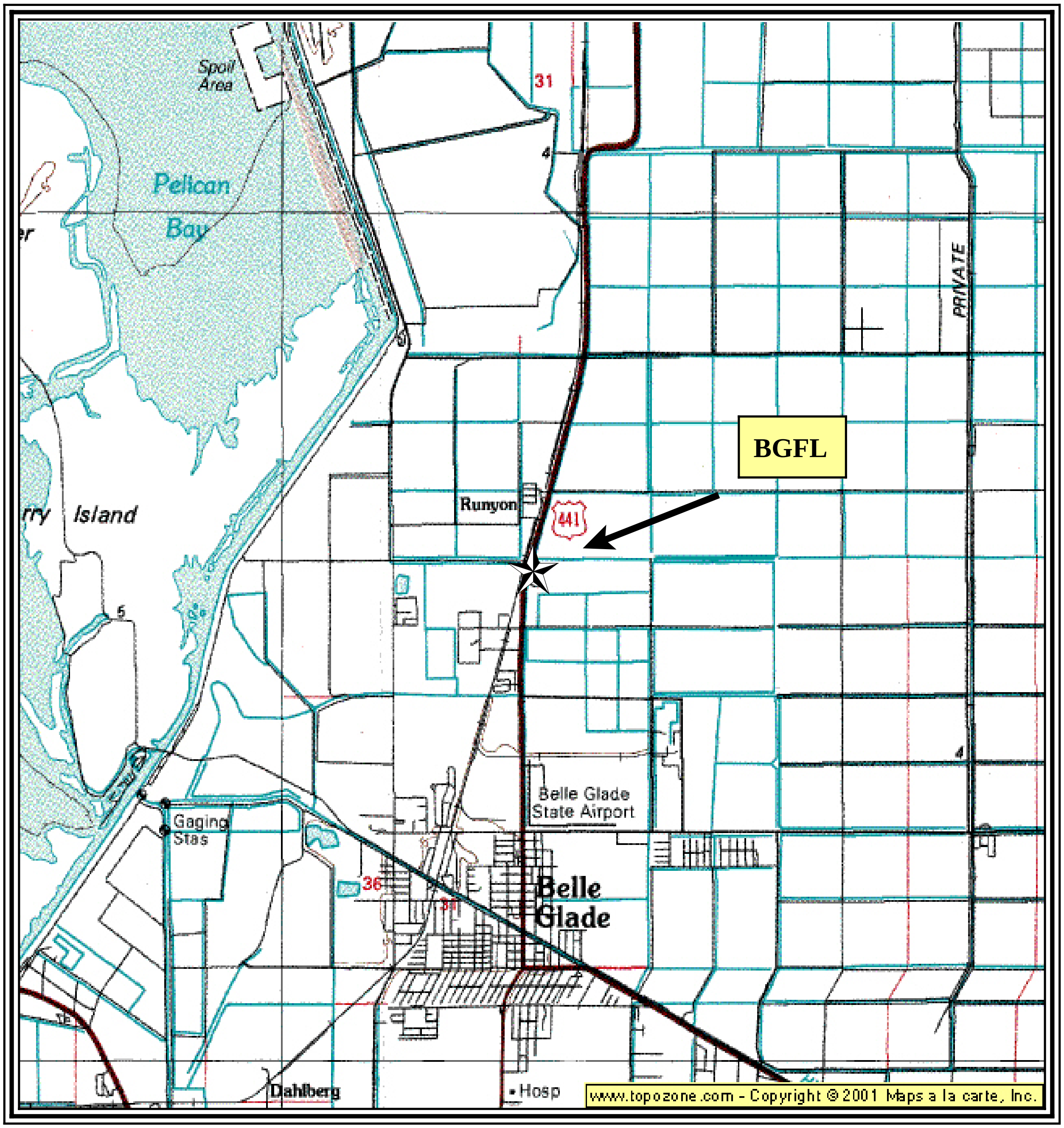
At LEFL, of the fifteen facilities listed in Table 3-9, six facilities are potentially subject to future regulations. Table 6-9 identifies the regulations that are potentially applicable. Significant reductions are projected for styrene (65 percent). This reduction is attributable to a single facility that is projected to comply with the reinforced plastics composite NESHAP in 2006. Consequently, ambient styrene concentrations are expected to decrease in this area. Much lower reductions are projected for benzene (14 percent), ethylbenzene (1 percent), toluene (2 percent) and xylene (15 percent). These reductions in emissions may not lead to reductions in measured concentrations.

Figure 6-1. St. Petersburg, Florida (AZFL) Monitoring Station



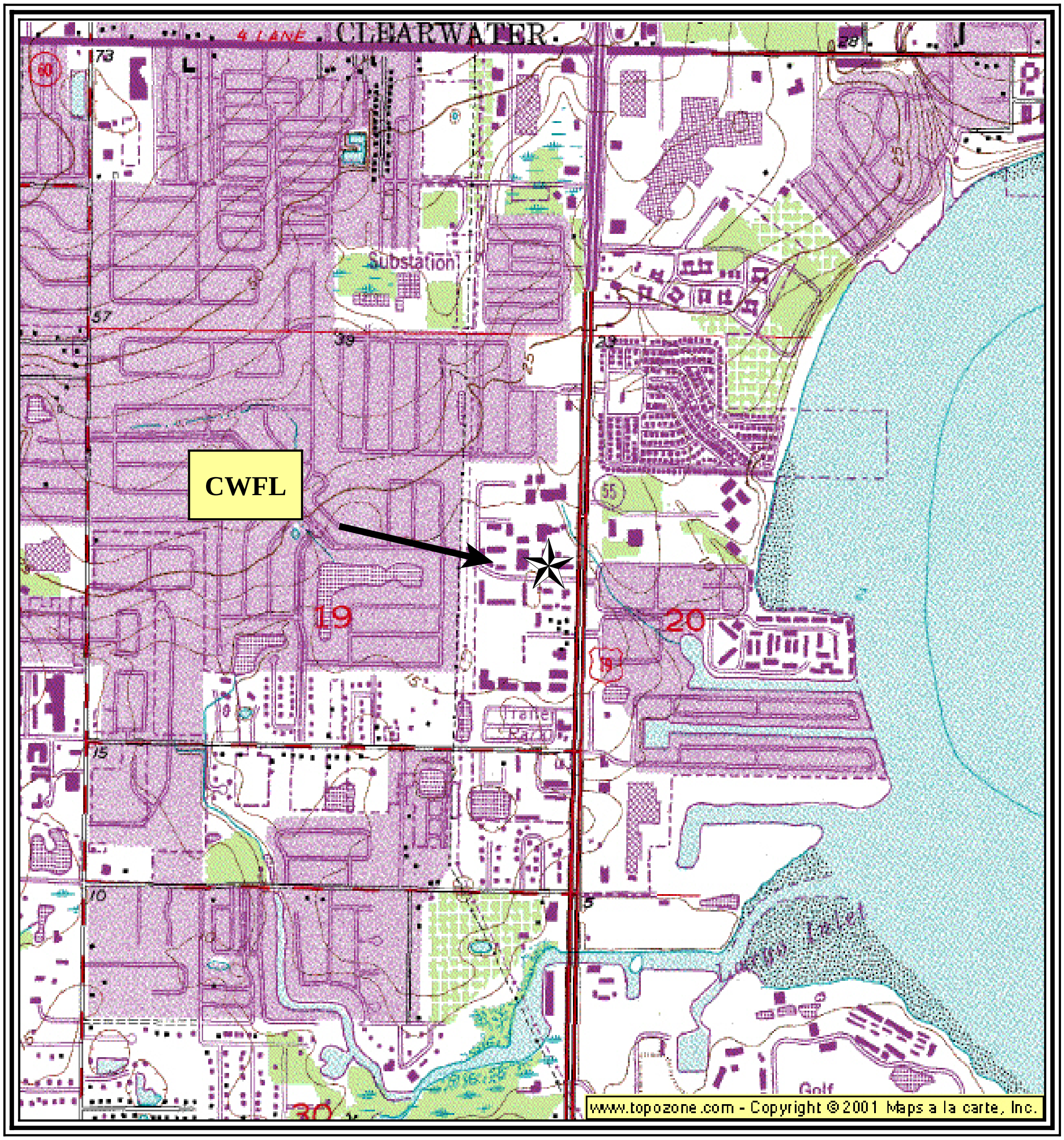
Source: USGS 7.5 Minute Series. Map Scale: 1:24,000.

Figure 6-2. Belle Glade, Florida (BGFL) Monitoring Station



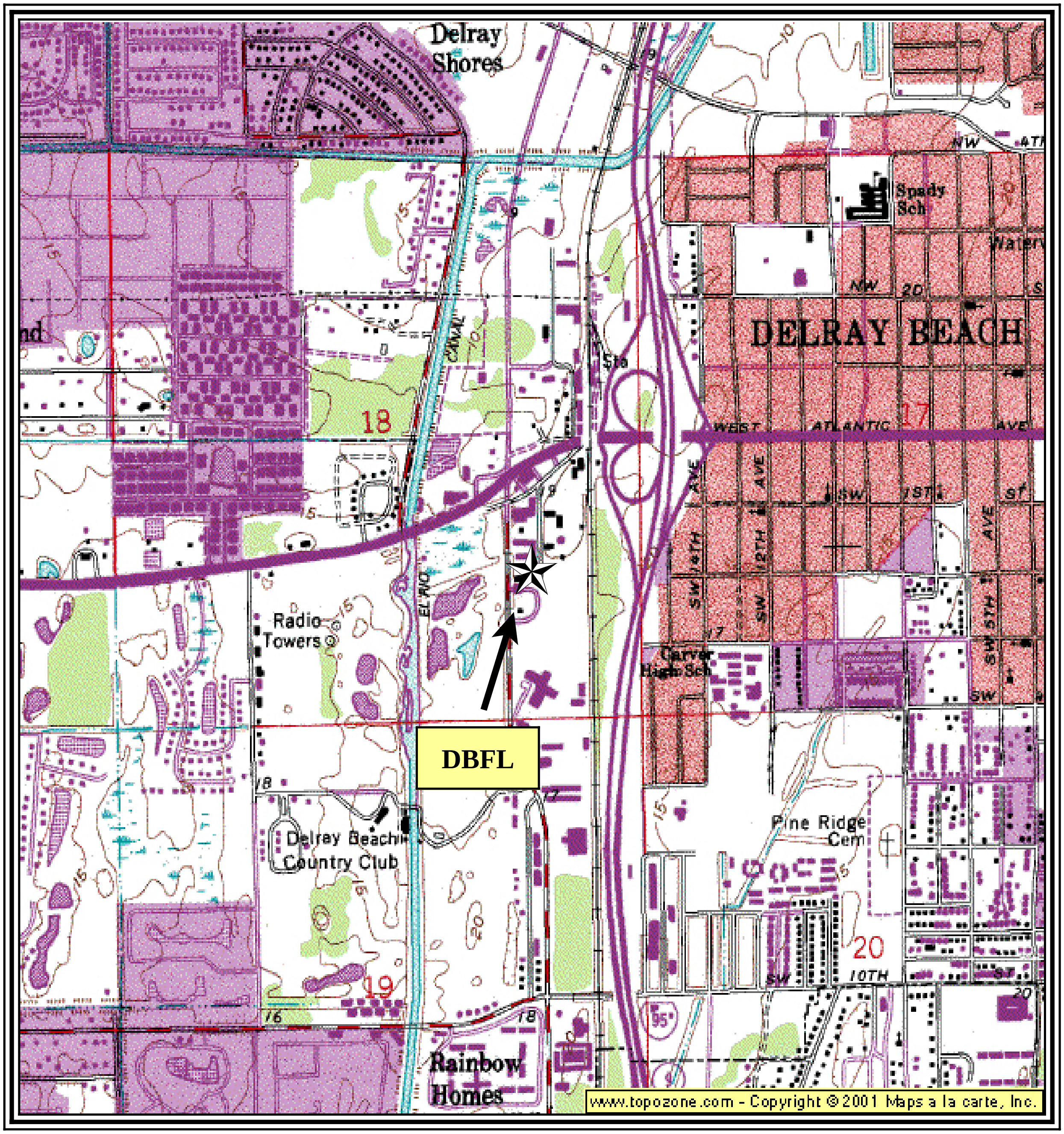
Source: USGS 7.5 Minute Series. Map Scale: 1:100,000.

Figure 6-3. Clearwater, Florida (CWFL) Monitoring Station



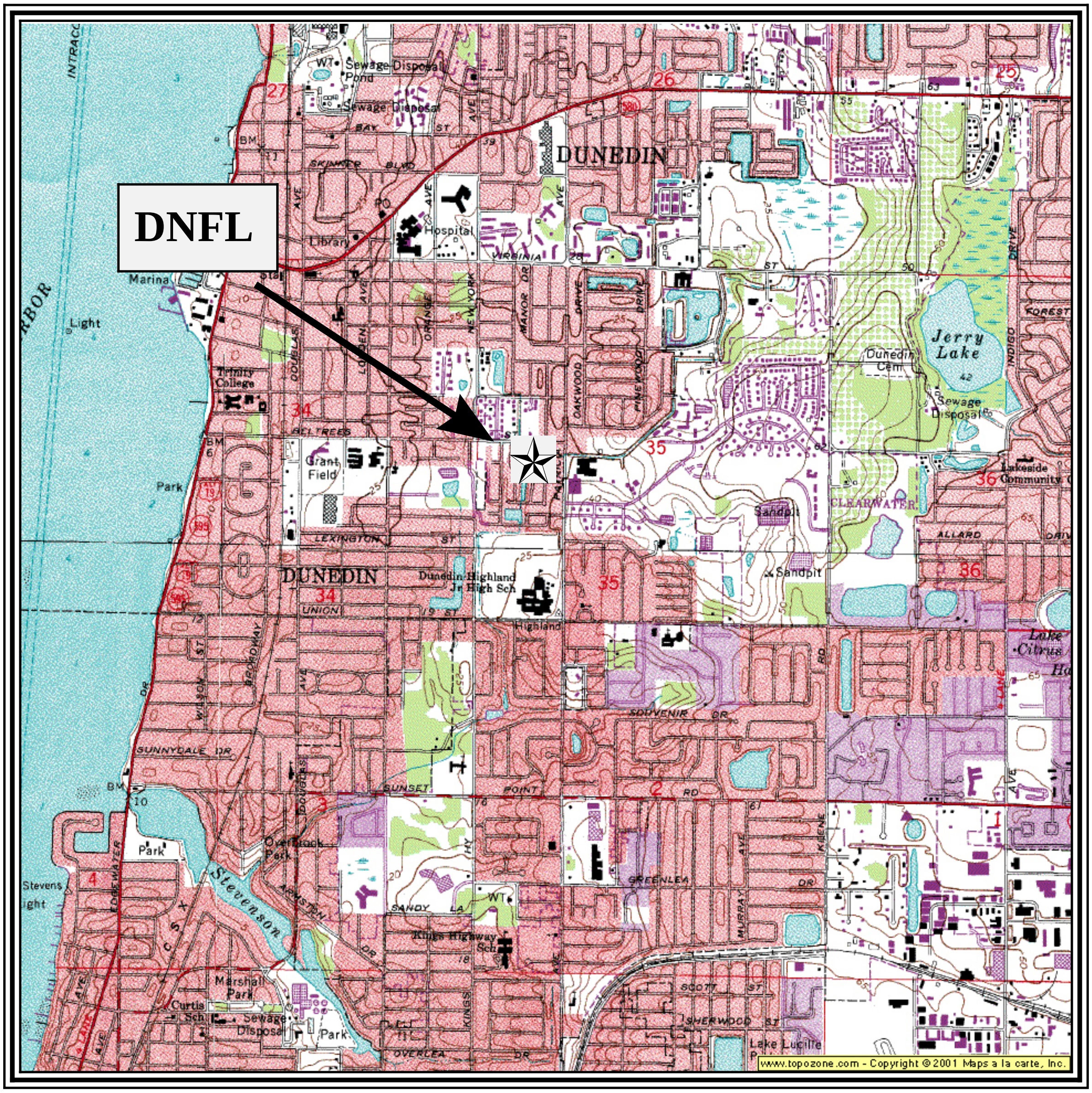
Source: USGS 7.5 Minute Series. Map Scale: 1:25,000.

Figure 6-4. Delray Beach, Florida (DBFL) Monitoring Station



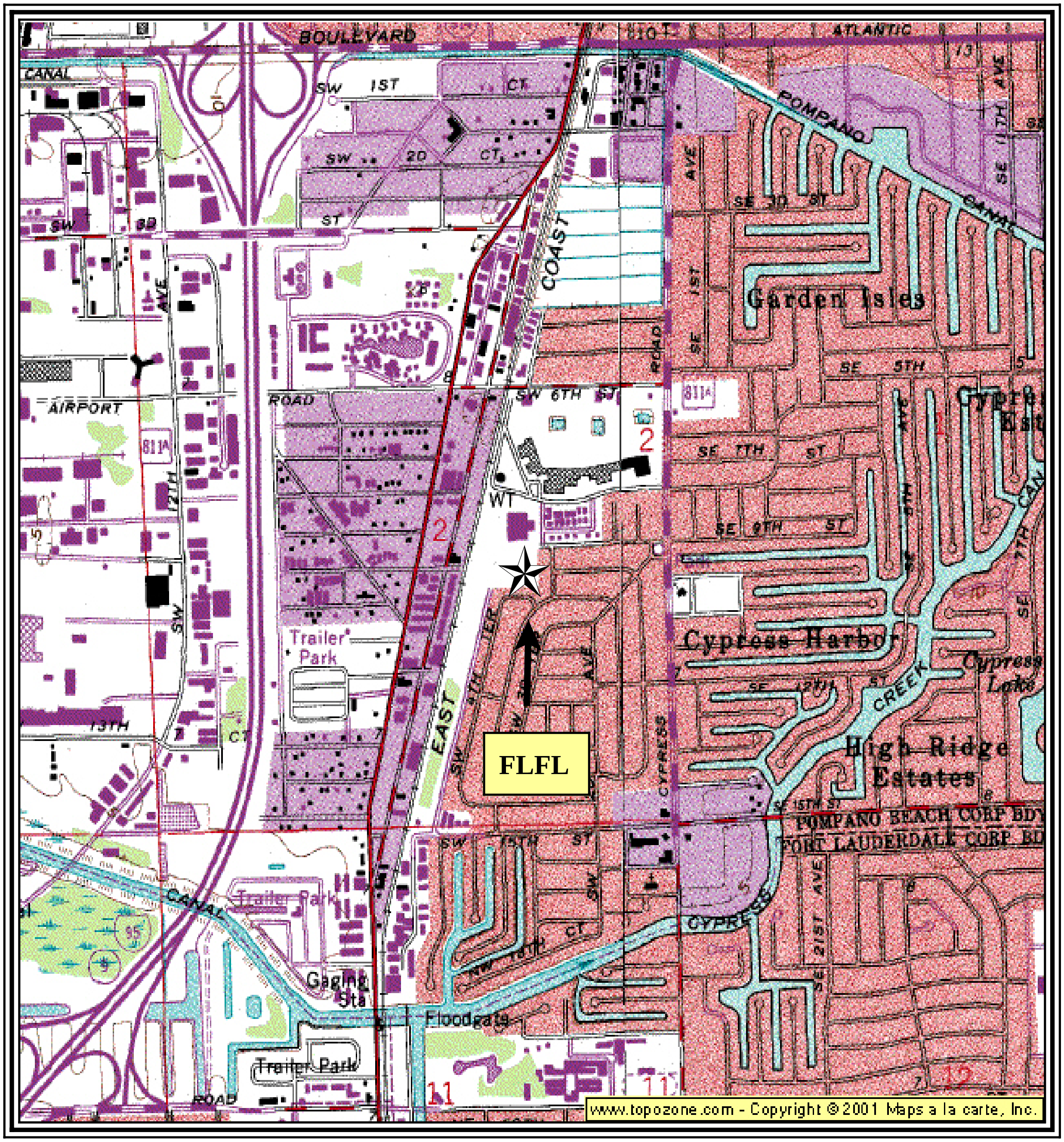
Source: USGS 7.5 Minute Series. Map Scale: 1:25,000.

Figure 6-5. St. Petersburg, Florida Site 2 (DNFL) Monitoring Station



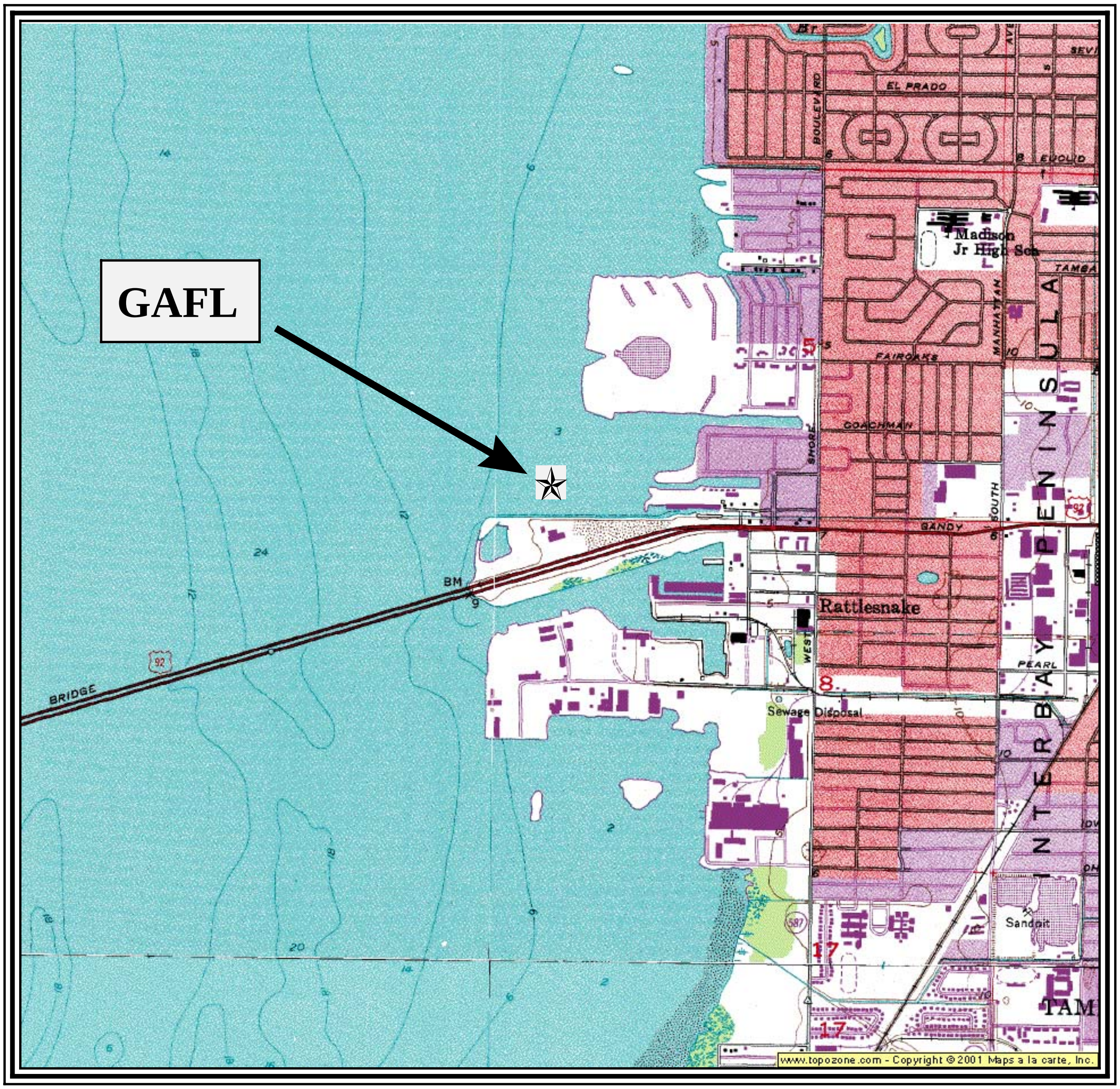
Source: USGS 7.5 Minute Series. Map Scale: 1:24,000.

Figure 6-6. Pompano Beach, Florida (FLFL) Monitoring Station



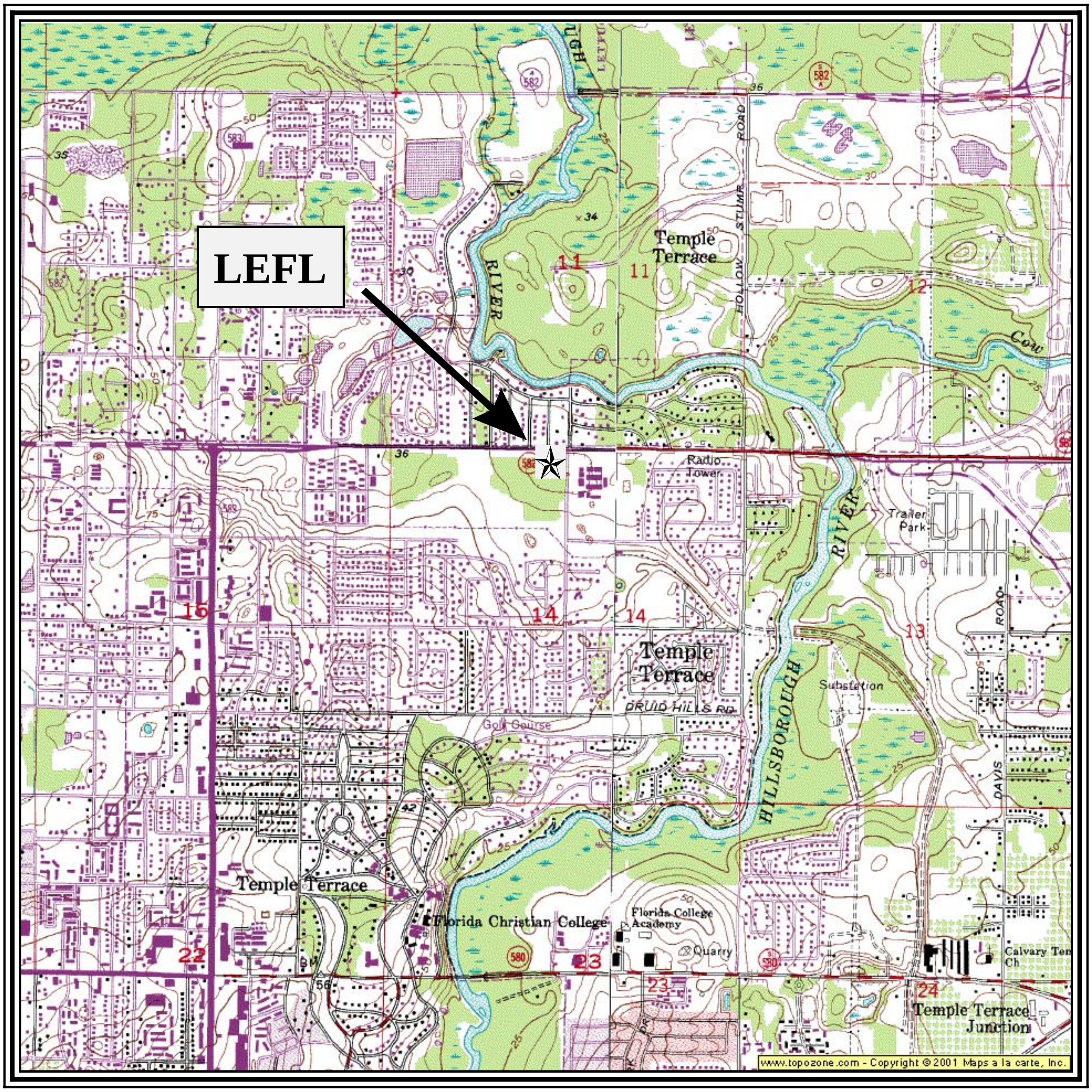
Source: USGS 7.5 Minute Series. Map Scale: 1:25,000.

Figure 6-7. Tampa, Florida Site 1 (GAFL) Monitoring Station



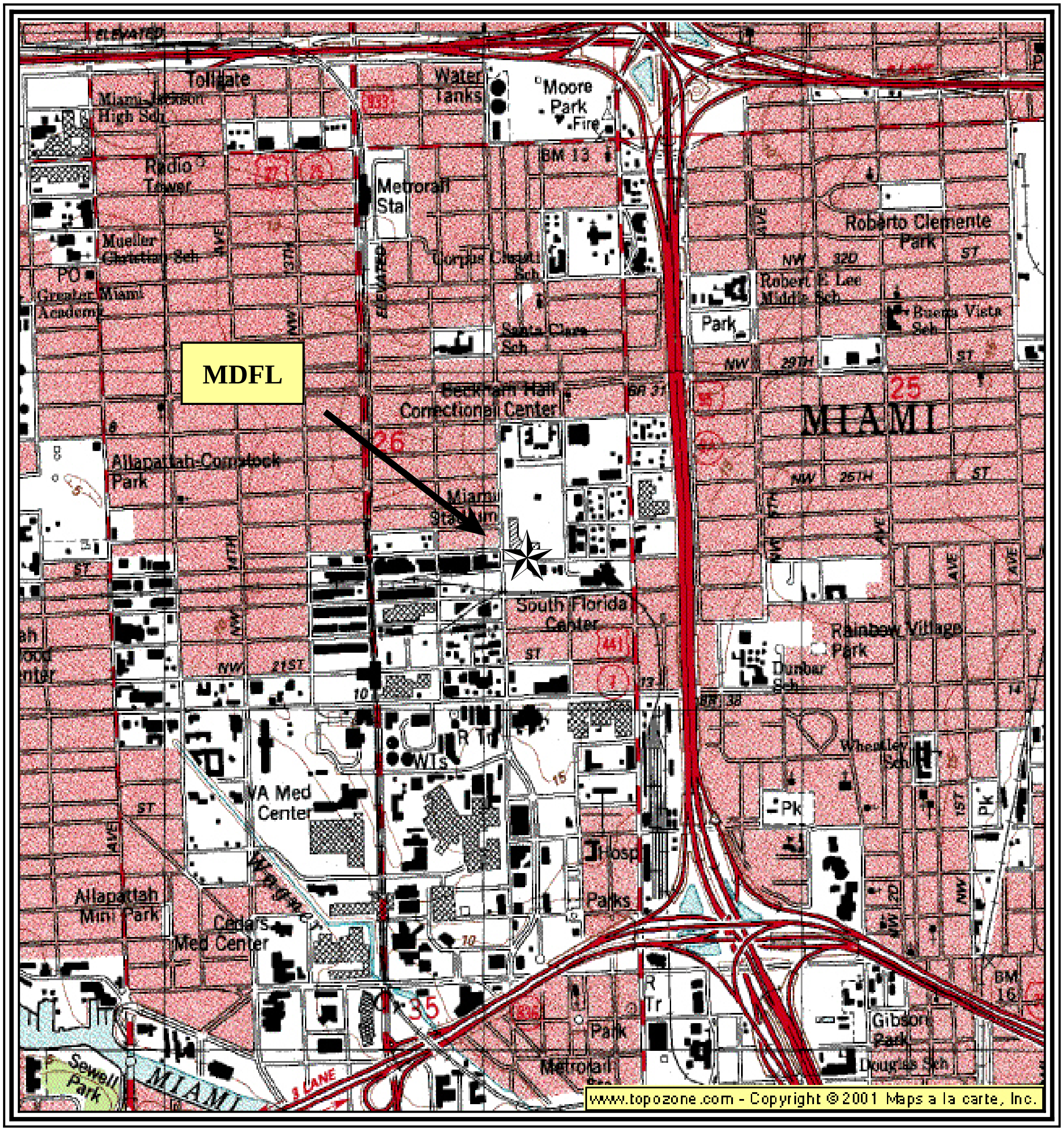
Source: USGS 7.5 Minute Series. Map Scale: 1:24,000.

Figure 6-8. Tampa, Florida Site 2 (LEFL) Monitoring Station



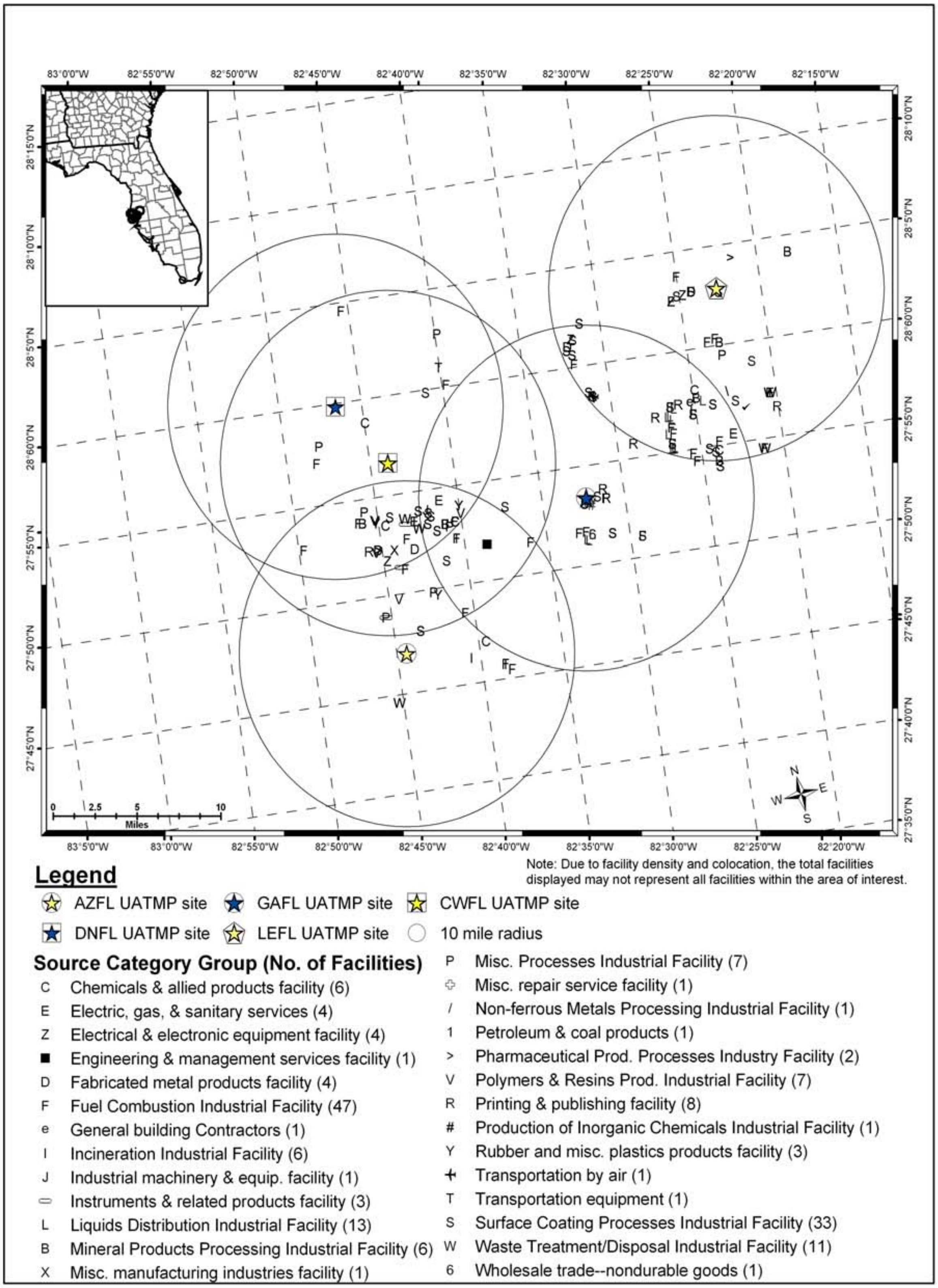
Source: USGS 7.5 Minute Series. Map Scale: 1:24,000.

Figure 6-9. Miami, Florida (MDFL) Monitoring Station



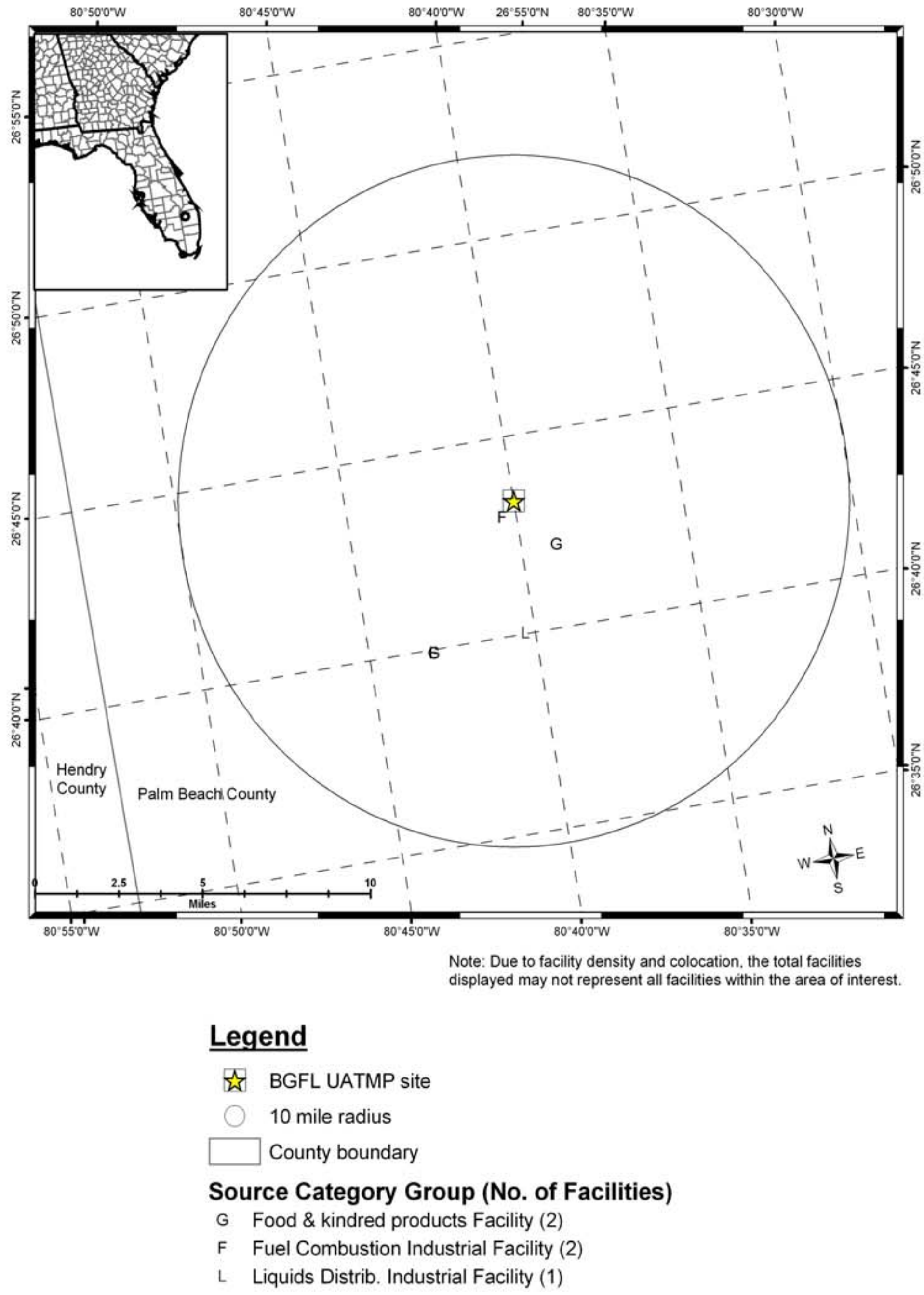
Source: USGS 7.5 Minute Series. Map Scale: 1:25,000.

Figure 6-10. Facilities Located Within 10 Miles of AZFL, DNFL, GAFL, LEFL, CWFL



Note: Due to facility density and colocation, the total facilities displayed may not represent all facilities within the area of interest.

Figure 6-11. Facilities Located Within 10 Miles of BGFL



Note: Due to facility density and colocation, the total facilities displayed may not represent all facilities within the area of interest.

Figure 6-12. Facilities Located Within 10 Miles of DBFL and FLFL

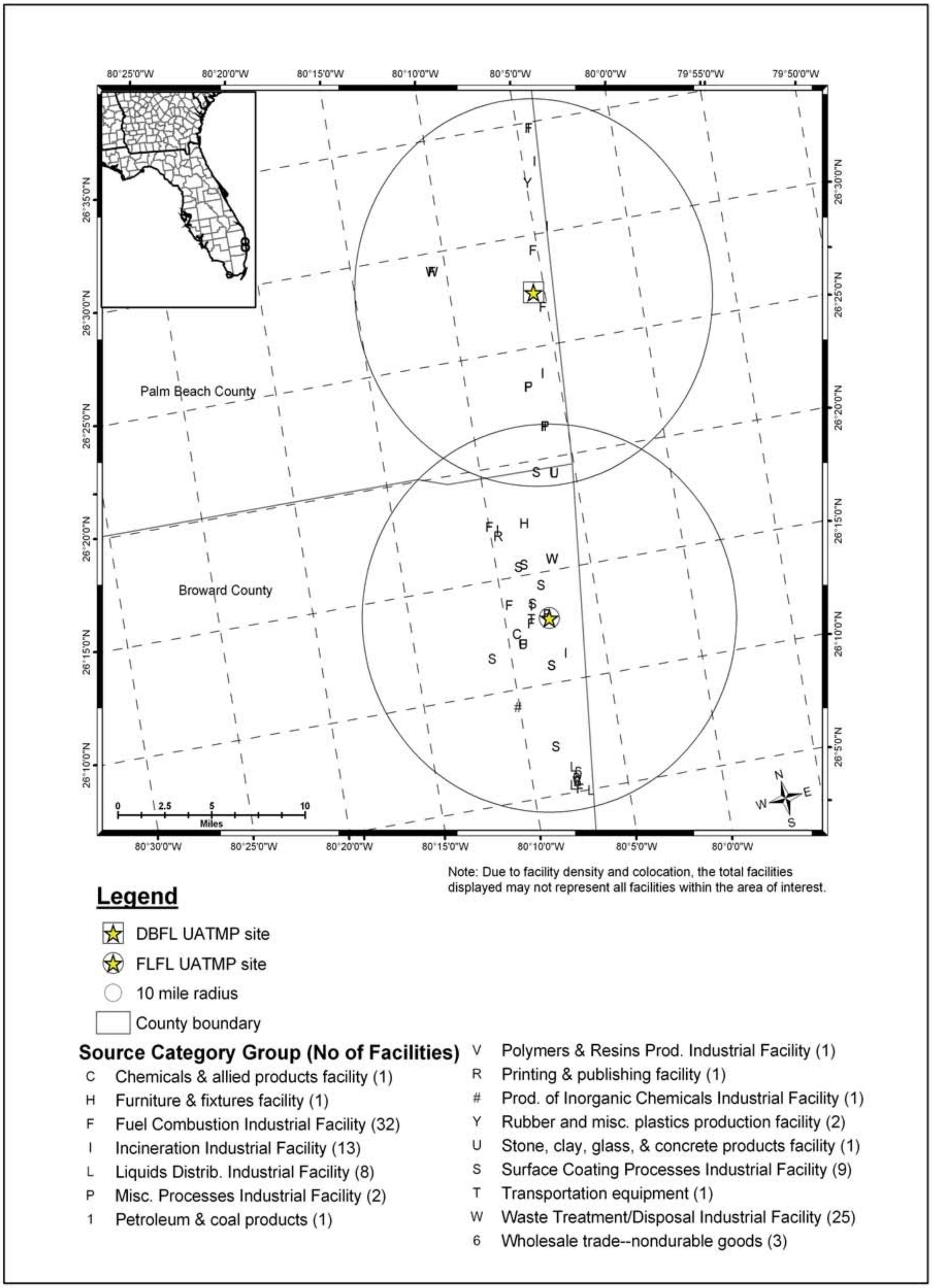


Figure 6-13. Facilities Located Within 10 Miles of MDFL

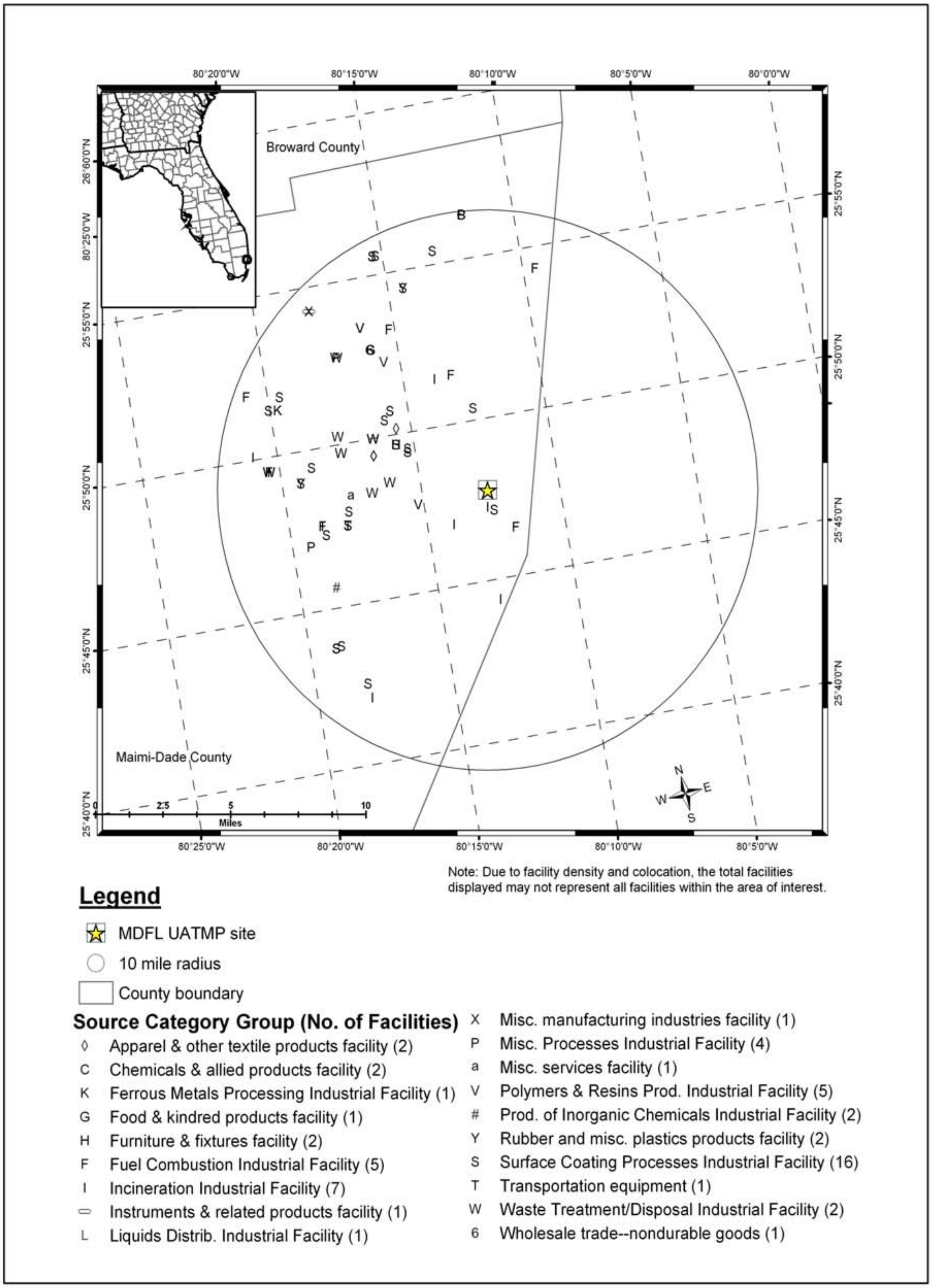


Figure 6-14. Back Trajectory Map Corresponding to AZFL, CWFL, and LEFL's Highest Concentrations

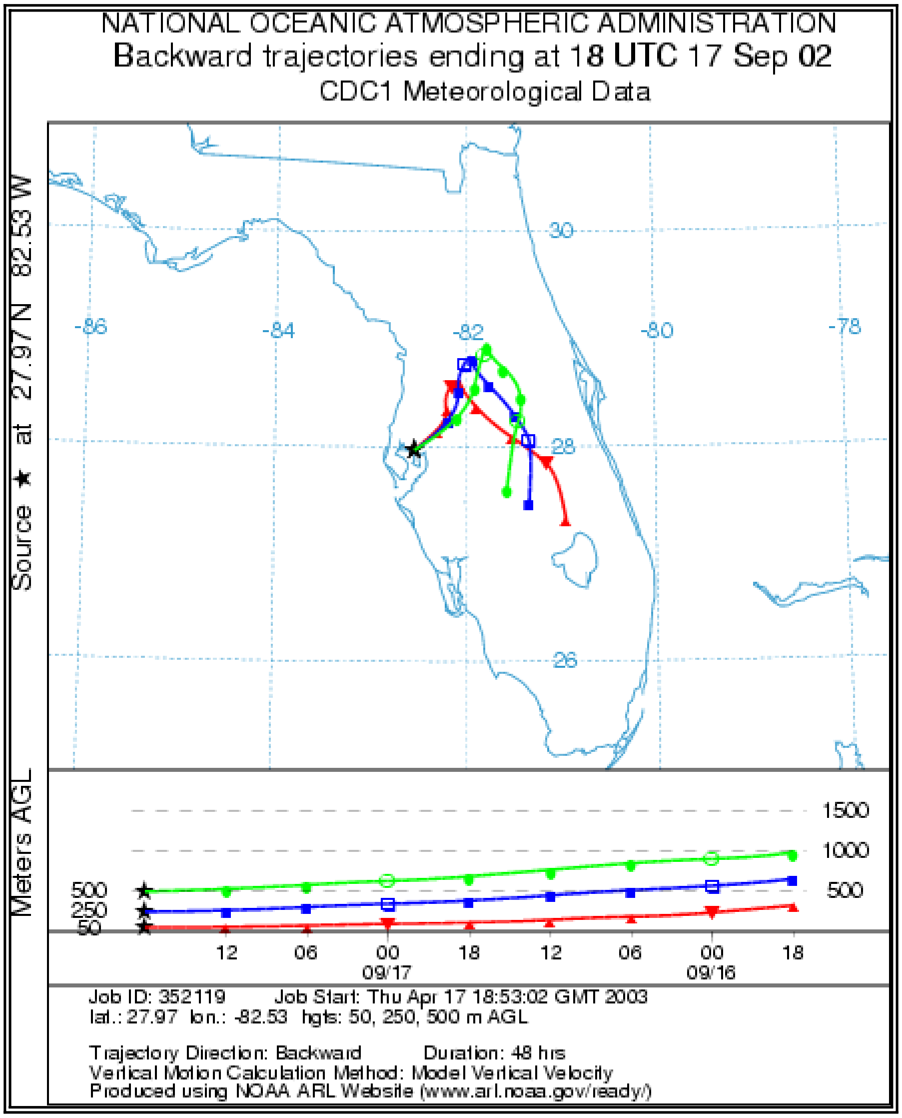


Figure 6-15. Back Trajectory Map Corresponding to DNFL's Highest Concentration

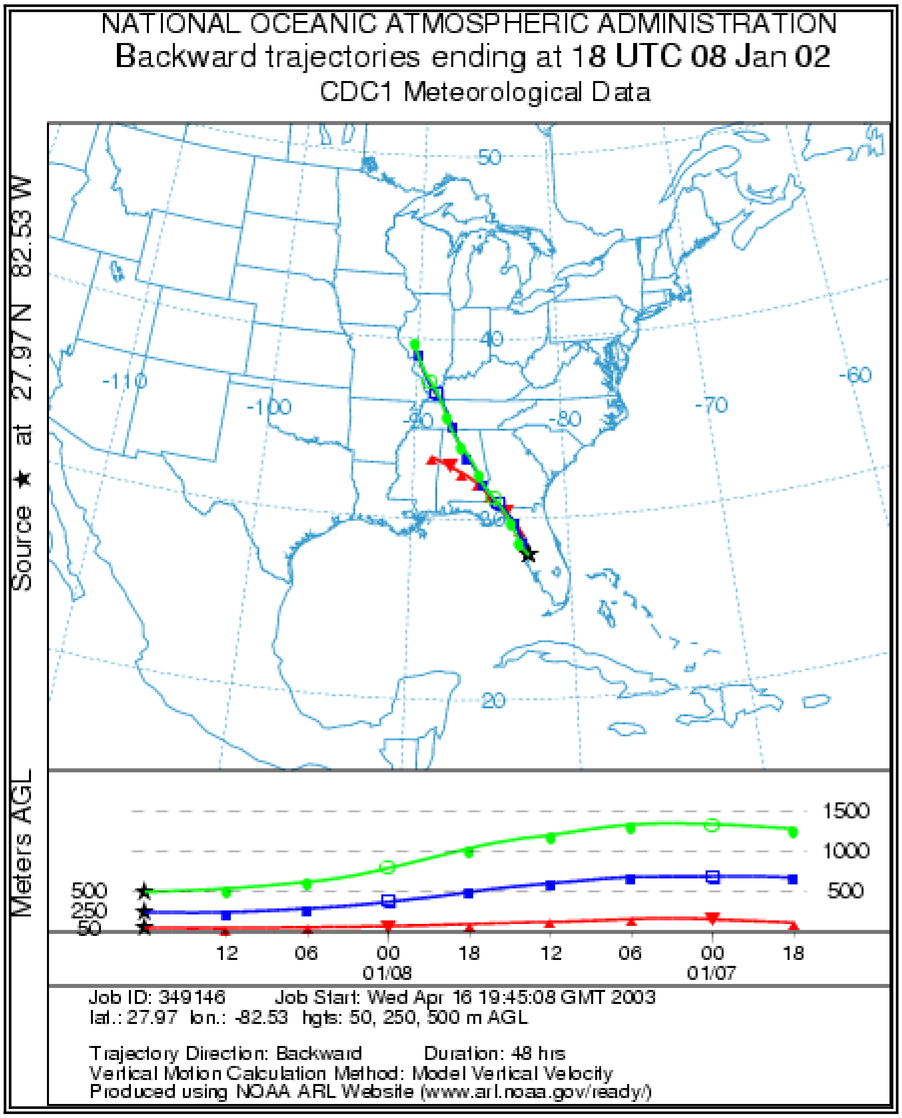


Figure 6-16. Back Trajectory Map Corresponding to GAFL's Highest Concentration

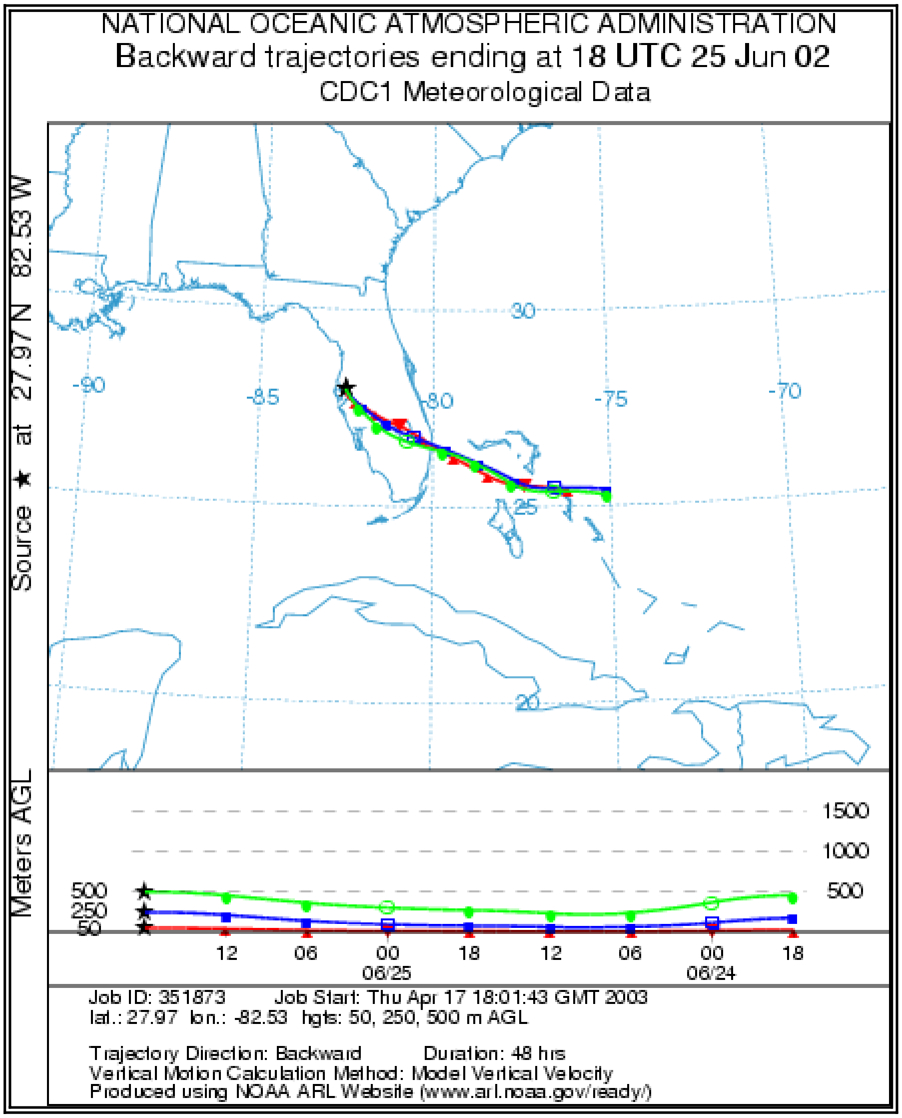


Table 6-1. Average Concentration and Meteorological Parameters for Sites in Florida

Site Name	Type	Average UATMP Concentration (ppbv)	Average Maximum Temperature (°F)	Average Temperature (°F)	Average Dewpoint Temperature (°F)	Average Wet Bulb Temperature (°F)	Average Relative Humidity (%)	Sea Level Pressure (mb)	Average u-component of the Wind (kts)	Average v-component of the Wind (kts)
AZFL	All 2002	▨	80.33 (±0.94)	73.45 (±0.96)	64.98 (±1.13)	68.22 (±0.96)	76.43 (±1.08)	1017.5 (±3.71)	-1.70 (±0.30)	3.63 (±0.24)
	sample day	5.72 (±0.36)	79.95 (±2.24)	73.51 (±2.27)	66.05 (±2.62)	68.83 (±2.25)	78.91 (±2.51)	1016.9 (±9.43)	-0.88 (±0.70)	1.99 (±0.52)
BGFL	All 2002	▨	82.40 (±0.58)	76.70 (±0.67)	68.69 (±0.78)	71.46 (±0.67)	77.41 (±0.91)	1017.2 (±3.31)	-2.36 (±0.28)	3.13 (±0.19)
	sample day	3.40 (±2.15)	80.20 (±2.44)	73.44 (±3.78)	65.98 (±4.50)	68.61 (±3.90)	78.56 (±7.02)	1016.6 (±33.82)	-0.05 (±1.69)	2.03 (±2.10)
CWFL	All 2002	▨	81.26 (±0.97)	72.86 (±0.99)	66.15 (±1.13)	68.66 (±1.00)	81.10 (±0.96)	1017.9 (±3.75)	-1.96 (±0.28)	3.12 (±0.21)
	sample day	4.72 (±2.64)	82.26 (±3.53)	74.33 (±3.68)	68.28 (±4.19)	70.45 (±3.77)	82.69 (±2.94)	1016.5 (±14.59)	-1.31 (±0.76)	1.63 (±0.69)
DBFL	All 2002	▨	82.55 (±0.66)	75.81 (±0.75)	67.46 (±0.83)	70.38 (±0.73)	76.59 (±0.78)	1017.7 (±3.39)	-2.09 (±0.30)	3.28 (±0.20)
	sample day	5.25 (±0.57)	79.80 (±3.06)	71.10 (±4.68)	64.53 (±5.17)	66.93 (±4.68)	81.10 (±5.71)	1017.0 (±34.40)	0.10 (±1.73)	1.24 (±2.34)
DNFL	All 2002	▨	80.33 (±0.94)	73.45 (±0.96)	64.98 (±1.13)	68.22 (±0.96)	76.43 (±1.08)	1017.5 (±3.71)	-1.70 (±0.30)	3.63 (±0.24)
	sample day	5.95 (±1.85)	78.81 (±2.86)	72.05 (±2.79)	64.23 (±3.43)	67.27 (±2.82)	78.14 (±3.79)	1017.8 (±11.08)	-0.71 (±1.06)	2.29 (±0.63)
FLFL	All 2002	▨	82.40 (±0.58)	76.70 (±0.67)	68.69 (±0.78)	71.46 (±0.67)	77.41 (±0.91)	1017.2 (±3.31)	-2.36 (±0.28)	3.13 (±0.19)
	sample day	5.29 (±0.93)	81.25 (±2.01)	74.90 (±3.49)	67.70 (±4.17)	70.16 (±3.49)	79.39 (±8.59)	1015.5 (±34.30)	0.22 (±2.02)	1.82 (±2.59)

Table 6-1. Average Concentration and Meteorological Parameters for Sites in Florida (Continued)

Site Name	Type	Average UATMP Concentration (ppbv)	Average Maximum Temperature (°F)	Average Temperature (°F)	Average Dewpoint Temperature (°F)	Average Wet Bulb Temperature (°F)	Average Relative Humidity (%)	Sea Level Pressure (mb)	Average u-component of the Wind (kts)	Average v-component of the Wind (kts)
GAFL	All 2002	▨	81.30 (±0.94)	72.93 (±0.99)	64.33 (±1.13)	67.58 (±0.99)	76.22 (±0.92)	1018.0 (±3.73)	-1.81 (±0.21)	2.21 (±0.17)
	sample day	7.13 (±2.49)	80.59 (±2.36)	72.41 (±2.50)	64.95 (±2.83)	67.74 (±2.50)	78.95 (±2.24)	1017.6 (±9.72)	-0.75 (±0.56)	1.31 (±0.39)
LEFL	All 2002	▨	81.30 (±0.94)	72.93 (±0.99)	64.33 (±1.13)	67.58 (±0.99)	76.22 (±0.92)	1018.0 (±3.73)	-1.81 (±0.21)	2.21 (±0.17)
	sample day	3.89 (01.21)	81.38 (±2.26)	73.26 (±2.33)	65.44 (±2.61)	68.31 (±2.29)	78.16 (±2.26)	1017.4 (±9.71)	-0.65 (±0.56)	1.39 (±0.38)
MDFL	All 2002	▨	83.50 (±0.61)	77.16 (±0.66)	68.75 (±0.78)	71.65 (±0.67)	76.44 (±0.78)	1017.5 (±3.25)	-2.35 (±0.26)	2.68 (±0.17)
	sample day	1.28 (±0.23)	80.00 (±2.08)	72.73 (±3.70)	66.91 (±5.63)	69.04 (±4.68)	83.02 (±6.39)	1016.7 (±39.26)	0.65 (±1.38)	1.61 (±2.27)

Table 6-2. Formaldehyde Concentration Correlations with Selected Meteorological Parameters in Florida

Site	Maximum Temperature	Average Temperature	Dew Point Temperature	Wet Bulb Temperature	Relative Humidity	Sea Level Pressure	u-component of wind speed	v-component of wind speed
AZFL	0.49	0.48	0.32	0.38	-0.27	0.02	-0.37	-0.16
BGFL	0.72	0.80	0.31	0.47	-0.59	-0.17	-0.76	0.09
CWFL	0.50	0.47	0.39	0.42	-0.07	-0.06	-0.14	-0.12
DBFL	0.20	0.01	-0.42	-0.28	-0.99	0.54	-0.28	-0.82
DNFL	-0.48	-0.43	-0.43	-0.43	-0.21	0.29	0.16	0.22
FLFL	-0.72	-0.56	-0.87	-0.85	-0.53	0.99	0.08	-0.93
GAFL	0.16	0.15	0.15	0.16	0.07	0.07	-0.05	-0.03
LEFL	0.55	0.51	0.35	0.41	-0.29	-0.15	-0.05	-0.18
MDFL	0.30	0.17	0.08	0.12	-0.05	0.11	0.94	-0.34

Table 6-3. Average UATMP Concentrations By Wind Regime for the Tampa/St.Petersburg Sites

Wind Regime	**AZFL**		**CWFL**		**DNFL**		**GAFL**		**LEFL**	
	24 hr	**48 hr**	**24 hr**	**48 hr**	**24 hr**	**48 hr**	**24 hr**	**48 hr**	**24 hr**	**48 hr**
North	3.37	3.07	2.47	ND	3.45	2.76	2.97	2.86	2.12	1.94
Northeast	3.97*	3.91*	3.75*	2.80	2.91	3.24	3.21	3.31	2.45	2.34*
East	3.61	3.40	2.07	3.11	3.65	3.43	3.14	2.76	1.98	2.15
Southeast	3.14	3.24	2.71	2.83	2.75	7.10	5.13*	5.40*	2.18	2.24
South	2.60	3.02	1.80	2.12	9.85	2.72	2.65	2.28	1.73	2.12
Southwest	3.53	3.33	ND	3.30*	2.41	2.41	2.71	3.42	2.22	2.29
West	3.55	2.33	3.04	ND	1.98	2.00	3.35	2.36	2.63*	0.98
Northwest	3.05	3.01	2.54	2.14	15.85*	29.15*	3.27	2.46	2.21	1.97

ND = Not Detected
* = Highest for the site

Table 6-4. Motor Vehicle Information vs. Daily Concentration for Florida Monitoring Sites

Monitoring Station	Population within Ten Miles	Estimated Number of Motor Vehicles Owned	Traffic Data (Daily Average)	Average Daily UATMP Concentration (ppbv)
AZFL	592,642	438,555	51,000	5.72 (±0.36)
BGFL	34,175	25,290	12,200	3.40 (±2.15)
CWFL	445,472	329,649	1000	4.72 (±0.25)
DBFL	479,805	355,056	44,200	5.25 (±0.57)
DNFL	454,645	336,437	16,281	5.95 (±1.85)
FLFL	987,475	730,732	1,000	7.13 (±2.49)
GAFL	458,652	339,402	81,460	3.89 (±0.21)
LEFL	592,533	438,472	1,055	5.56 (±1.14)
MDFL	1,152,632	852,948	15,200	1.28 (±0.23)

Table 6-5. Summary of Future Regulations That May be Applicable for Nearby Facilities Surrounding AZFL

Facility Name	Primary SIC Code	SIC Code Description	Regulation Citation	Regulation Name
Quality Acrylic Baths Of Clearwater, Inc.	3089	Rubber And Misc. Plastics Products, Miscellaneous Plastics Products, NEC, Plastics products, NEC	40 CFR part 63, subpart WWWW	National Emission Standards for Hazardous Air Pollutants from Reinforced Plastic Composites Production (proposed rule)
Shakespeare Products Group				
Hydro Spa				
Catalina Yachts	3732	Transportation Equipment, Ship and Boat Building and Repairing, Boat Building and Repairing	40 CFR part 63, subpart VVVV	National Emission Standards for Hazardous Air Pollutants from Boat Manufacturing
Intrepid Powerboats, Inc.				
Traditional Watercraft DBA Island Packet				
Endeavour Catamaran Corporation				
Blue Hawaiian Products	3949	Miscellaneous Manufacturing Industries, Toys and Sporting Goods, Sporting and Athletic Goods, NEC	40 CFR part 63, subpart WWWW	National Emission Standards for Hazardous Air Pollutants from Reinforced Plastic Composites Production (proposed rule)

Table 6-6. Summary of Future Regulations That May be Applicable for Nearby Facilities Surrounding CWFL

Facility Name	Primary SIC Code	SIC Code Description	Regulation Citation	Regulation Name
GSP Marketing Technologies, Inc.	2759	Printing And Publishing, Commercial Printing, Commercial Printing, NEC	40 CFR part 63, subpart KK	National Emission Standards for Hazardous Air Pollutants from Printing and Publishing
Quality Acrylic Baths Of Clearwater, Inc.	3089	Rubber And Misc. Plastics Products, Miscellaneous Plastics Products, NEC, Plastics Products, NEC	40 CFR part 63, subpart WWWW	National Emission Standards for Hazardous Air Pollutants from Reinforced Plastic Composites Production (proposed rule)
Shakespeare Products Group				
Hydro Spa				
Catalina Yachts	3732	Transportation Equipment, Ship and Boat Building and Repairing, Boat Building and Repairing	40 CFR part 63, subpart VVVV	National Emission Standards for Hazardous Air Pollutants from Boat Manufacturing
Intrepid Powerboats, Inc.				
Traditional Watercraft DBA Island Packet				
Endeavour Catamaran Corporation				
Florida Power Corporation	4911	Electric, Gas, And Sanitary Services, Electric Services, Electric services	40 CFR part 63, subparts YYYY and ZZZZ	National Emission Standards for Hazardous Air Pollutants from Stationary Combustion Turbines (proposed rule) and from Reciprocating Internal Combustion Engines (proposed rule)

Table 6-6. Summary of Future Regulations That May be Applicable for Nearby Facilities Surrounding CWFL (Continued)

Facility Name	Primary SIC Code	SIC Code Description	Regulation Citation	Regulation Name
Blue Hawaiian Products	3949	Miscellaneous Manufacturing Industries, Toys and Sporting Goods, Sporting and Athletic Goods, NEC	40 CFR part 63, subpart WWWW	National Emission Standards for Hazardous Air Pollutants from Reinforced Plastic Composites Production (proposed rule)

Table 6-7. Summary of Future Regulations That May be Applicable for Nearby Facilities Surrounding DNFL

Facility Name	Primary SIC Code	SIC Code Description	Regulation Citation	Regulation Name
Quality Acrylic Baths Of Clearwater, Inc.	3089	Rubber And Misc. Plastics Products, Miscellaneous Plastics Products, NEC, Plastics Products, NEC	40 CFR part 63, subpart WWWW	National Emission Standards for Hazardous Air Pollutants from Reinforced Plastic Composites Production (proposed rule)
Shakespeare Products Group				
Hydro Spa				
Catalina Yachts	3732	Transportation Equipment, Ship and Boat Building and Repairing, Boat Building and Repairing	40 CFR part 63, subpart VVVV	National Emission Standards for Hazardous Air Pollutants from Boat Manufacturing
Traditional Watercraft DBA Island Packet				
Endeavour Catamaran Corporation				
Blue Hawaiian Products	3949	Miscellaneous Manufacturing Industries, Toys and Sporting Goods, Sporting and Athletic Goods, NEC	40 CFR part 63, subpart WWWW	National Emission Standards for Hazardous Air Pollutants from Reinforced Plastic Composites Production (proposed rule)

Table 6-8. Summary of Future Regulations That May be Applicable for Nearby Facilities Surrounding GAFL

Facility Name	Primary SIC Code	SIC Code Description	Regulation Citation	Regulation Name
Quality Acrylic Baths Of Clearwater, Inc.	3089	Rubber And Misc. Plastics Products, Miscellaneous Plastics Products, NEC, Plastics Products, NEC	40 CFR part 63, subpart WWWW	National Emission Standards for Hazardous Air Pollutants from Reinforced Plastic Composites Production (proposed rule)
Tampa Fiberglass, Inc.				
Spa Manufacturers, Inc.				
Lazzara Yachts, Inc.	3732	Transportation Equipment, Ship and Boat Building and Repairing, Boat Building and Repairing	40 CFR part 63, subpart VVVV	National Emission Standards for Hazardous Air Pollutants from Boat Manufacturing
Endeavour Catamaran Corporation				
Citgo Petroleum Corporation	5171	Wholesale Trade--Nondurable Goods, Petroleum and Petroleum Products, Petroleum Bulk Stations & Terminals	40 CFR part 63, subpart EEEE	National Emission Standards for Hazardous Air Pollutants from Organic Liquids Distribution
Central Florida Pipeline				
Sifco Turbine Component Services	3724	Transportation Equipment, Aircraft and Parts, Aircraft Engines and Engine Parts	40 CFR part 63, subpart PPPPP	National Emission Standard for Hazardous Air Pollutants from Engine Test Cells

Table 6-8. Summary of Future Regulations That May be Applicable for Nearby Facilities Surrounding GAFL (Continued)

Facility Name	Primary SIC Code	SIC Code Description	Regulation Citation	Regulation Name
Tampa Steel Erecting Company	3441	Fabricated Metal Products, Fabricated Structural Metal Products, Fabricated Structural Metal	40 CFR part 63, subpart MMMM	National Emission Standards for Hazardous Air Pollutants from Surface Coating of Miscellaneous Metal Parts and Products (proposed rule)
Pops Painting, Inc.				
Misener Marine Construction				
Premdor				
Master Packaging Inc	2759	Printing And Publishing, Commercial Printing, Commercial Printing, NEC	40 CFR part 63, subpart KK	National Emission Standards for Hazardous Air Pollutants from Printing and Publishing
GSP Marketing Technologies, Inc.				

Table 6-9. Summary of Future Regulations That May be Applicable for Nearby Facilities Surrounding LEFL

Facility Name	Primary SIC Code	SIC Code Description	Regulation Citation	Regulation Name
Tampa Fiberglass, Inc.	3089	Rubber And Misc. Plastics Products, Miscellaneous Plastics Products, NEC, Plastics Products, NEC	40 CFR part 63, subparts PPPP and WWWW	National Emission Standards for Hazardous Air Pollutants from Surface Coating of Plastic Parts and Products and Reinforced Plastic Composites Production (proposed rule)
Group Technologies Corporation	3663	Electronic & Other Electric Equipment, Communications Equipment, Radio & TV Communications Equipment	40 CFR part 63, subpart PPPP	National Emission Standards for Hazardous Air Pollutants from Surface Coating of Plastic Parts and Products
Citgo Petroleum Corporation	5171	Wholesale Trade--Nondurable Goods, Petroleum and Petroleum Products, Petroleum Bulk Stations & Terminals	40 CFR part 63, subpart EEEE	National Emission Standards for Hazardous Air Pollutants from Organic Liquids Distribution
Central Florida Pipeline				
Tampa Can Plant	3411	Fabricated Metal Products, Metal Cans and Shipping Containers, Metal Cans	40 CFR part 63, subpart KKKK	National Emission Standard for Hazardous Air Pollutants from Surface Coating of Metal Cans (proposed rule)
Sifco Turbine Component Services	3724	Transportation Equipment, Aircraft and Parts, Aircraft Engines and Engine Parts	40 CFR part 63, subpart PPPPP	National Emission Standard for Hazardous Air Pollutants from Engine Test Cells

7.0 Sites in Iowa

This section focuses on meteorological, concentration, and spatial trends for the three UATMP sites in Iowa (C2IA, DAIA, and DMIA). Two of these sites are located in eastern Iowa (C2IA and DAIA), while the third is located in central Iowa (DMIA). The Iowa cities participating in the 2002 UATMP report include Cedar Rapids (C2IA), Davenport (DAIA), and Des Moines (DMIA). Figures 7-1 through 7-3 are topographical maps showing the monitoring stations in their urban locations. Figures 7-4 through 7-6 are maps identifying facilities within ten miles of the sites that reported to the 1999 NEI. The bulk of the industrial facilities located near C2IA are mostly fuel combustion and food product industries. DAIA has the largest number of industrial facilities nearby, generally located to the east and southeast. DMIA has a number of facilities to its northeast and east, and just three to its west and west-southwest.

Hourly meteorological data were retrieved for all of 2002 at three weather stations near these sites with the purpose of calculating correlations of meteorological data with ambient air concentration measurements. The three weather stations are Cedar Rapids Municipal Airport, Des Moines International, and Davenport (WBAN 14990, 14933, and 94982, respectively).

Table 7-1 highlights the average UATMP concentration at each of these sites, along with temperature (average maximum and average), moisture (average dew point temperature, average wet-bulb temperature, and average relative humidity), wind information (average u- and v-components of the wind), and pressure (average sea level pressure) for the entire year and on days samples were taken. Typically, Iowa experiences cold, rather dry winters and warm, moist summers, thanks to its continental climate. The seasons show marked contrast, producing variable weather. Table 7-1 shows that the weather parameters vary little among the stations. This information can be found in The Weather Almanac, fifth edition (Ruffner and Bair, 1987).

7.1 Meteorological and Concentration Averages at the Iowa Sites

Carbonyl compounds and VOC (volatile organic compounds) were measured at all of the sites, as indicated in Tables 3-3 and 3-4. With the exception of the carbonyls, there was little variation in geometric means among the sites. Carbonyl compound geometric means ranged from 3.41 ppbv (DAIA) to 13.43 ppbv (DMIA), consistent with last year's report. C2IA had the lowest geometric means and DMIA had the highest for all three types of VOC. Halogenated hydrocarbons ranged from 4.25 ppbv to 5.46 ppbv; hydrocarbons ranged from 2.63 ppbv to 3.77 ppbv; and polar compounds ranged from 2.19 ppbv to 3.34 ppbv. This trend is also seen in daily average UATMP concentrations. DMIA had the highest average, 24.51 (±12.87) ppbv, approximately twice the concentration of both C2IA and DAIA. This information is listed in Table 7-1. Table 7-1 also lists the averages for selected meteorological parameters from January 2002 to December 2002, which is the same time period covered in this report.

These sites also opted to have total and speciated nonmethane organic compounds (TNMOC/SNMOC) sampled during air toxic sampling. SNMOC/NMOC compounds are of particular interest because of their role in ozone formation. Readers are encouraged to review EPA's *2001 Nonmethane Organic Compounds (NMOC) and Speciated Nonmethane Organic Compounds (SNMOC) Monitoring Program, Final Report* (EPA, 2002) for more information on SNMOC/NMOC trends and concentrations. The average total NMOC value for C2IA was 146.24 (±26.23) ppbC, of which nearly 59% could be identified through speciation; the average total NMOC for DAIA was 219.66(±59.53) ppbC, of which nearly 53% could be identified; the average total NMOC for DMIA was 278.32 (±88.29) ppbC, of which nearly 46% could be identified. Of the speciated compounds, ethane, *n*-hexane, and *n*-undecane measured the highest concentrations at the Iowa sites. These values are included in Table 7-3. Ozone concentrations were also sampled on 214 sample days at sites within the same counties as the three Iowa sites, and were retrieved from the U.S. EPA's AIRS database. The average ozone concentration for each sample day at C2IA was 47.75 (±1.89) ppbv, 53.42 (±2.11) ppbv at DAIA, and 40.05 (±1.81) ppbv at DMIA. This information is also summarized in Table 7-3.

Tables 7-2a-c are the summary of calculated Pearson Correlation coefficients for each of the prevalent compounds and selected meteorological parameters by site. Identification of the prevalent compounds is discussed in Section 3 of this report. At C2IA, formaldehyde had strong positive correlations with maximum, average, dew point, and wet bulb temperatures, chloromethane also had moderately strong positive correlations with these variables, and acetylene had moderately strong to strong negative correlations with these same parameters. Also at C2IA, nearly all the compounds had negative, albeit weak, correlations with sea level pressure and the u-component of the wind, and positive correlations with relative humidity. At this site, as relative humidity increases, and pressure and the east-west wind speed decreases, UATMP concentrations tend to increase.

With the exception of acetylene and trichlorofluoromethane, all of the compounds at DAIA had weak, moderate, or strong positive correlations with the maximum, average, dew point, and wet bulb temperatures. These two compounds had strong negative correlations with these parameters. Like C2IA, most of the compounds at DAIA demonstrated negative correlations with sea level pressure and the u-component of the wind. All of the compounds, with the exception of trichlorofluoromethane, had positive correlations with the v-component of the wind. UATMP concentrations tend to increase at DAIA when temperature and the north-south wind increase, and pressure and the east-west wind decrease.

The compounds at the DMIA site had mostly strong or moderately strong correlations with the temperature and moisture variables, but were split between positive and negative. Several compounds exhibited a moderately strong or strong negative correlation with the u-component of the wind, and a moderately strong or strong positive correlation with the v-component of the wind. Depending on direction, as the wind speed increases at DMIA, UATMP concentrations may increase or decrease.

As part of the 2002 UATMP report, back trajectory analyses were conducted for the EPA-designated NATTS sites to determine whether where a parcel came from could be a contributor to its air toxics concentration. A back trajectory analysis was performed on sample days for the Cedar Rapids site (C2IA). Generally, the highest concentrations occurred when the air originated from a southerly direction, and the lowest concentrations occurred when the air originated over from a northerly or northwesterly direction. Table 7-4 is a summary of the back trajectory analyses. As seen in Figure 7-4, the majority of the industrial sites are located to the south of the monitoring station, and there are no facilities to the north or northwest. Figure 7-7 is an example of a back trajectory map, and is the trajectory for the date with the highest UATMP concentration at C2IA (17.83 ppbv).

7.2 Spatial Analysis

Using the population within ten miles of each site, an estimate of the number of motor vehicles operating in proximity to the monitoring station can be established. The ratio used in this report is 0.74 automobiles to every one person (refer to section 3.4.1 for more information on this ratio). The population near the DMIA site is the highest with 383,791 people operating approximately 284,005 vehicles. The lowest population of the Iowa sites is near C2IA, with 175,516 people driving 129,882 automobiles. This information is compared to the average daily concentration of the prevalent compounds at each Iowa site in Table 7-5. Also included in this table are average daily traffic data, or more specifically, the average number of cars passing the monitoring sites on the nearest roadway to each site on a daily basis. DMIA, by far, has the largest amount of traffic volume passing by the site on a daily basis.

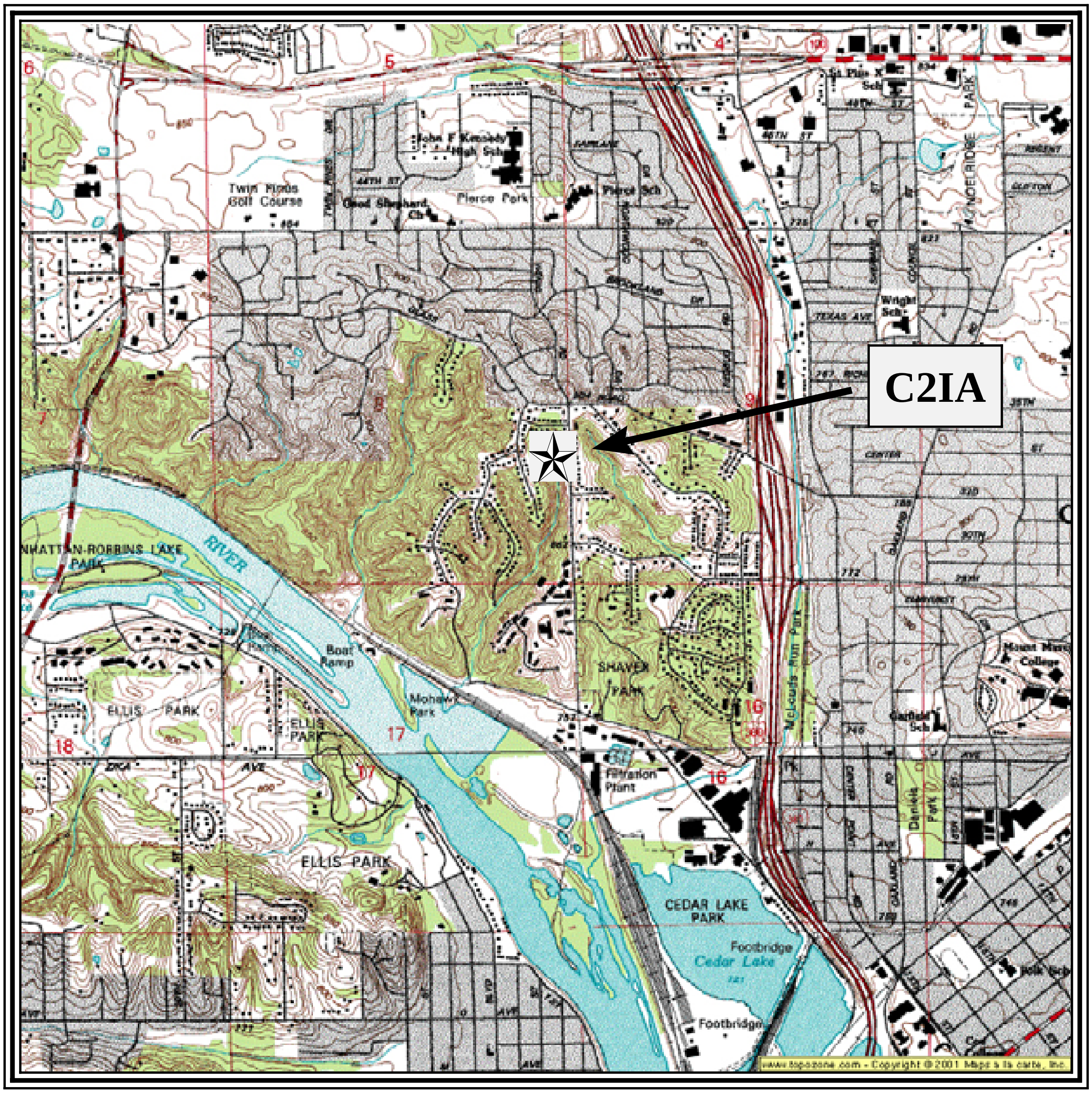
A roadside study conducted to measure emissions from motor vehicles determined that the concentration ratios of the BTEX compounds were relatively consistent from urban area to urban area. (For more information on this study, refer to section 3.4.2.) Figure 3-14 depicts the average concentration ratios of the roadside study and compares them to the concentration ratios at each of the monitoring sites. All three Iowa sites' concentration ratios somewhat resemble those of the roadside study. However, both C2IA and DAIA have larger benzene-ethylbenzene ratios than the roadside study, C2IA and DMIA have greater toluene-ethylbenzene ratios, and all three sites have lower *m,p*-xylene-ethylbenzene ratios.

7.3 Regulation Analysis

One NATTS site (C2IA) is located in Cedar Rapids, Iowa. Table 3-9 lists the number of facilities that account for approximately 90 percent of the total UATMP pollutant emissions in the 10-mile areas around this monitoring site. Of the four facilities shown in Table C2IA, three facilities are potentially subject to future regulations. Table 7-5 identifies the regulations that are potentially applicable.

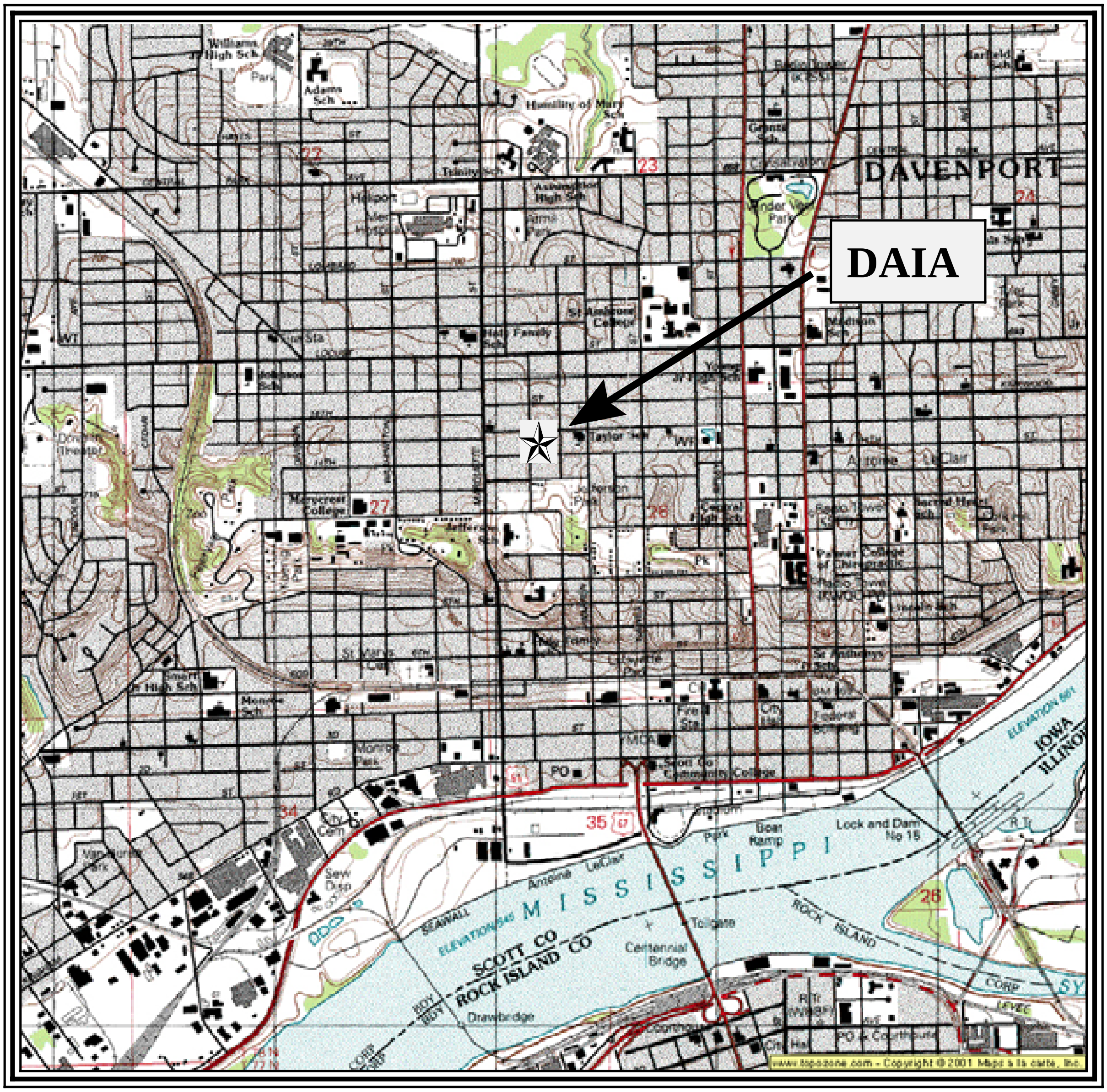
Based on this analysis, methyl ethyl ketone, styrene, and xylene emissions are expected to be reduced to the greatest degree (53, 61, and 44 percent, respectively). Both ethyl benzene and toluene emissions are estimated to be reduced by only 20 percent. The reductions are projected to come from compliance with coating and reinforced plastic product standards (the latest compliance date of the regulations is 2006).

Figure 7-1. Cedar Rapids, Iowa (C2IA) Monitoring Station



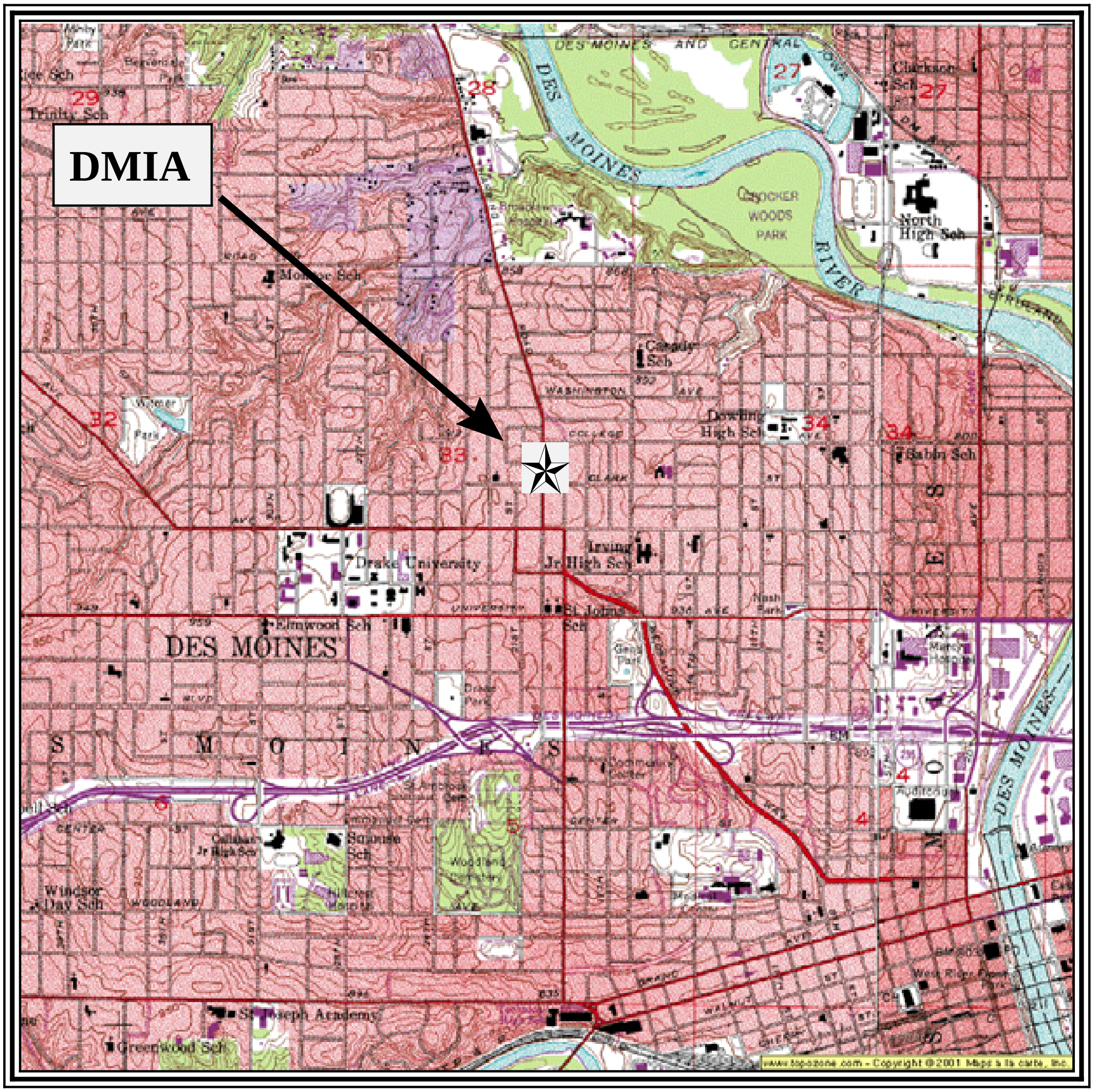
Source: USGS 7.5 Minute Series. Map Scale: 1:24,000.

Figure 7-2. Davenport, Iowa (DAIA) Monitoring Station



Source: USGS 7.5 Minute Series. Map Scale: 1:24,000.

Figure 7-3. Des Moines, Iowa (DMIA) Monitoring Station



Source: USGS 7.5 Minute Series. Map Scale: 1:24,000.

Figure 7-4. Facilities Located Within 10 Miles of C2IA

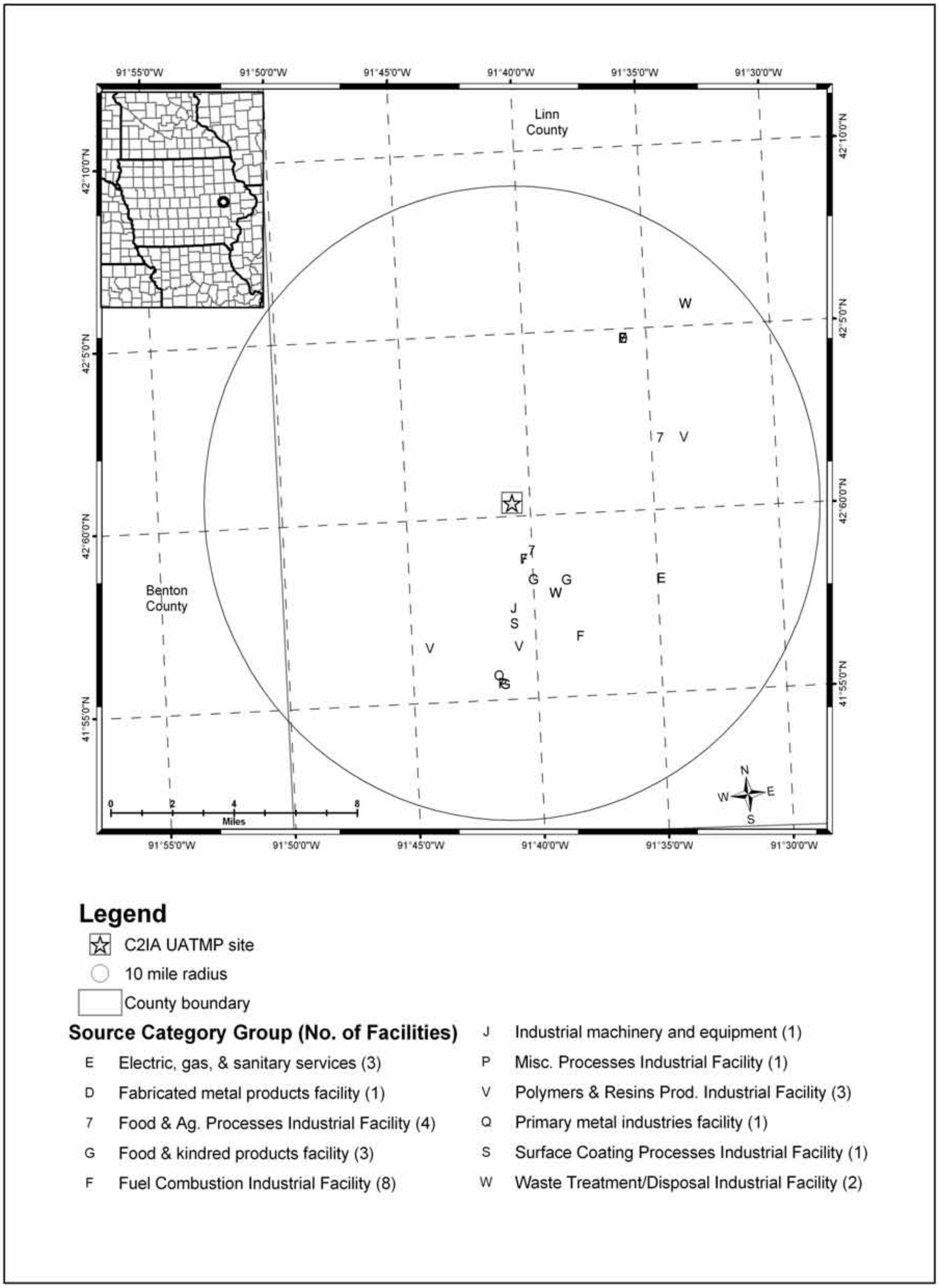
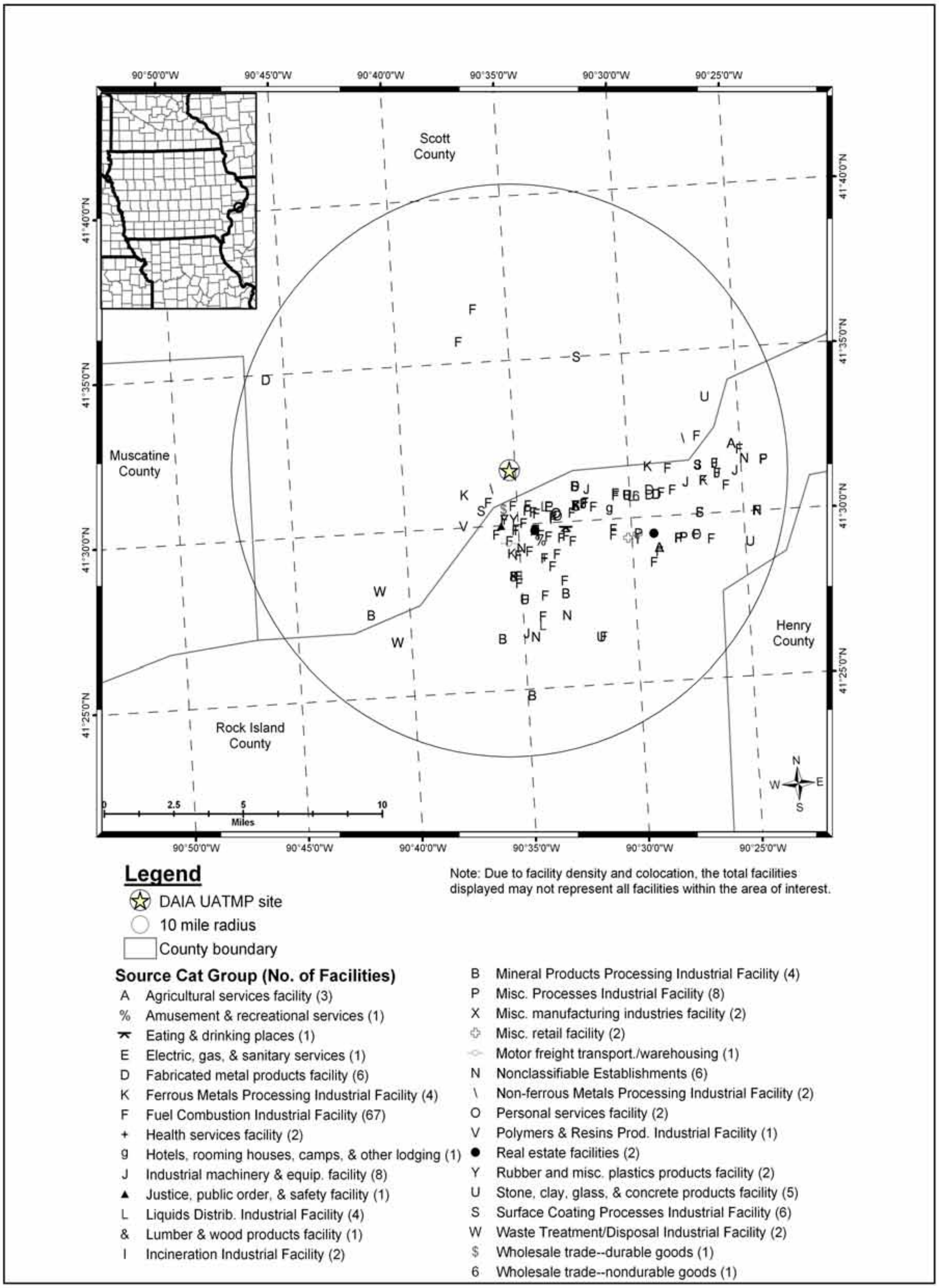
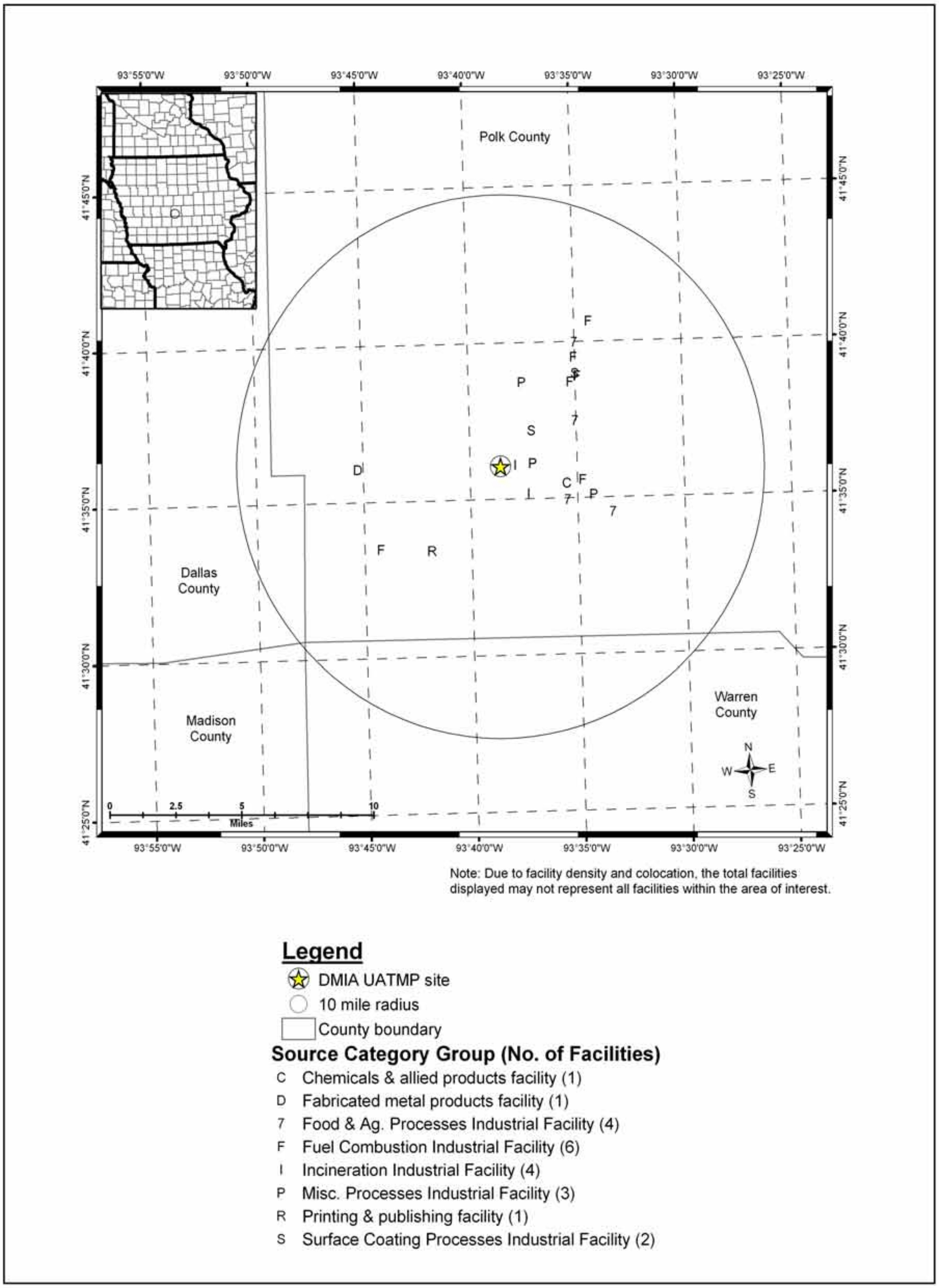


Figure 7-5. Facilities Located Within 10 Miles of DAIA



Note: Due to facility density and colocation, the total facilities displayed may not represent all facilities within the area of interest.

Figure 7-6. Facilities Located Within 10 Miles of DMIA



Note: Due to facility density and colocation, the total facilities displayed may not represent all facilities within the area of interest.

Figure 7-7. Back Trajectory Map Corresponding to Cedar Rapids' Highest Concentration

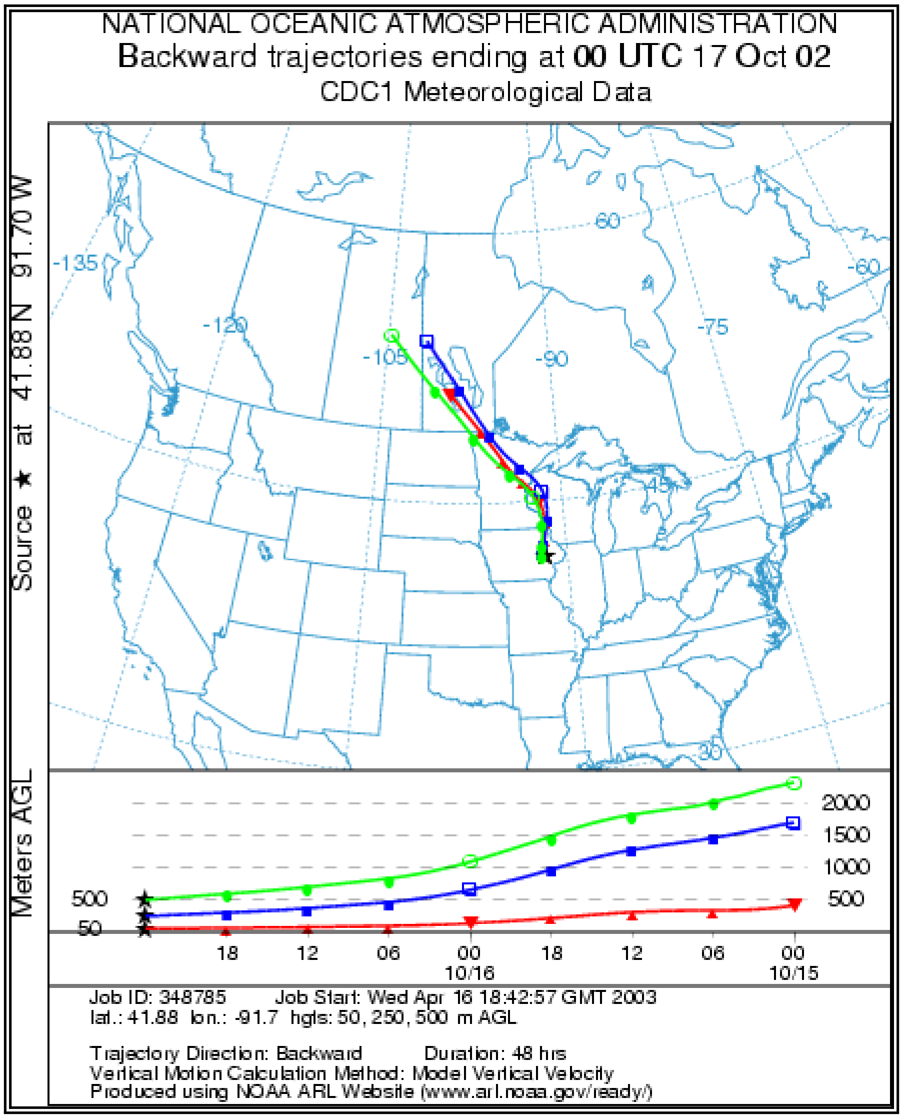


Table 7-1. Average Concentration and Meteorological Parameters for Sites in Iowa

Site Name	Type	Average UATMP Concentration (ppbv)	Average Maximum Temperature (°F)	Average Temperature (°F)	Average Dewpoint Temperature (°F)	Average Wet Bulb Temperature (°F)	Average Relative Humidity (%)	Average Sea Level Pressure (mb)	Average u-component of the Wind (kts)	Average v-component of the Wind (kts)
C2IA	All 2002	▨	59.12 (±2.05)	49.38 (±1.98)	40.23 (±2.02)	45.02 (±1.87)	73.32 (±1.17)	1018.1 (±8.94)	0.84 (±0.36)	4.26 (±0.27)
	sample day	11.92 (±0.94)	58.16 (±5.41)	48.04 (±5.07)	38.75 (±5.05)	43.64 (±4.72)	72.96 (±2.90)	1018.8 (±23.24)	1.01 (±0.95)	1.48 (±0.74)
DAIA	All 2002	▨	59.62 (±2.07)	50.21 (±1.97)	41.07 (±1.98)	45.78 (±1.85)	73.26 (±1.11)	1018.2 (±8.31)	1.02 (±0.37)	4.53 (±0.28)
	sample day	12.82 (±1.95)	57.92 (±7.87)	47.62 (±7.72)	39.03 (±7.73)	43.59 (±7.23)	74.02 (±3.91)	1019.5 (±45.48)	2.12 (±1.53)	1.74 (±1.25)
DMIA	All 2002	▨	60.70 (±2.11)	51.27 (±2.03)	40.05 (±2.04)	45.86 (±1.87)	68.34 (±1.26)	1018.4 (±9.00)	0.95 (±0.35)	4.42 (±0.29)
	sample day	24.51 (±12.87)	55.64 (±12.22)	45.82 (±11.41)	32.51 (±10.75)	39.86 (±10.10)	62.69 (±5.23)	1018.6 (±51.04)	2.09 (±2.17)	-0.07 (±2.37)

Table 7-2a - Prevalent Compound Concentration Correlations with Selected Meteorological Parameters at Cedar Rapids, Iowa (C2IA)

Compound	Maximum Temperature	Average Temperature	Dew Point Temperature	Wet Bulb Temperature	Relative Humidity	Sea Level Pressure	u-component of wind speed	v-component of wind speed
1,2,4-Trimethylbenzene	-0.02	0.02	0.08	0.05	0.26	-0.09	-0.18	-0.08
Acetylene	-0.36	-0.38	-0.33	-0.36	0.17	0.02	0.02	0.08
Benzene	0.00	-0.01	0.03	0.01	0.18	-0.13	-0.16	0.20
Chloromethane	0.27	0.25	0.27	0.26	0.13	-0.12	-0.09	-0.12
Dichlorodifluoromethane	0.08	0.06	0.09	0.07	0.15	-0.08	0.07	-0.18
Ethylbenzene	-0.06	-0.03	0.04	0.00	0.32	-0.05	-0.16	0.00
Formaldehyde	0.73	0.75	0.73	0.74	0.05	-0.32	-0.36	0.38
m-,*p* - Xylene	-0.05	-0.05	0.01	-0.02	0.25	-0.08	-0.20	0.05
o - Xylene	-0.12	-0.10	-0.03	-0.07	0.29	-0.12	-0.13	0.02
Propylene	0.12	0.12	0.11	0.12	0.03	-0.18	-0.20	0.20
Toluene	-0.06	-0.03	0.02	-0.01	0.26	-0.06	-0.04	0.06
Trichlorofluorobenzene	0.08	-0.05	-0.02	-0.04	0.13	0.09	0.32	-0.05

Table 7-2b - Prevalent Compound Concentration Correlations with Selected Meteorological Parameters at Davenport, Iowa (DAIA)

Compound	Maximum Temperature	Average Temperature	Dew Point Temperature	Wet Bulb Temperature	Relative Humidity	Sea Level Pressure	u-component of wind speed	v-component of wind speed
1,2,4-Trimethylbenzene	0.35	0.28	0.19	0.23	-0.33	-0.27	-0.15	0.22
Acetylene	-0.46	-0.50	-0.50	-0.50	-0.07	0.09	0.03	0.14
Benzene	0.35	0.32	0.28	0.30	-0.14	-0.15	-0.35	0.25
Chloromethane	0.29	0.20	0.25	0.23	0.28	-0.18	-0.16	0.16
Dichlorodifluoromethane	0.24	0.26	0.31	0.29	0.25	-0.08	-0.07	0.20
Ethylbenzene	0.14	0.11	0.03	0.06	-0.32	-0.04	-0.04	0.12
Formaldehyde	0.78	0.81	0.74	0.78	-0.13	-0.46	-0.32	0.40
m-,*p* - Xylene	0.24	0.21	0.12	0.16	-0.32	-0.14	-0.15	0.30
o - Xylene	0.09	0.06	-0.03	0.00	-0.35	0.00	0.04	0.05
Propylene	0.43	0.42	0.32	0.37	-0.40	-0.11	-0.33	0.05
Toluene	0.41	0.41	0.33	0.36	-0.29	-0.18	-0.31	0.29
Trichlorofluorobenzene	-0.61	-0.70	-0.74	-0.73	-0.25	0.15	0.41	-0.09

Table 7-2c- Prevalent Compound Concentration Correlations with Selected Meteorological Parameters at Des Moines, Iowa (DMIA)

Compound	Maximum Temperature	Average Temperature	Dew Point Temperature	Wet Bulb Temperature	Relative Humidity	Sea Level Pressure	u-component of wind speed	v-component of wind speed
1,2,4-Trimethylbenzene	0.57	0.55	0.48	0.52	-0.31	-0.32	-0.54	0.40
Acetylene	-0.24	-0.31	-0.29	-0.31	0.15	0.19	-0.14	0.42
Benzene	0.33	0.27	0.28	0.26	0.06	-0.25	-0.44	0.55
Chloromethane	-0.35	-0.41	-0.42	-0.41	-0.09	0.28	0.13	0.00
Dichlorodifluoromethane	-0.73	-0.75	-0.71	-0.74	0.26	0.54	0.40	-0.18
Ethylbenzene	0.39	0.41	0.29	0.36	-0.46	0.10	-0.61	0.23
Formaldehyde	-0.23	-0.20	-0.14	-0.18	0.28	0.00	0.62	-0.41
m-,*p* - Xylene	0.45	0.44	0.39	0.42	-0.16	-0.08	-0.67	0.52
o - Xylene	0.36	0.36	0.30	0.32	-0.20	0.01	-0.53	0.35
Propylene	0.61	0.58	0.54	0.56	-0.16	-0.35	-0.63	0.57
Toluene	0.24	0.25	0.17	0.22	-0.34	0.15	-0.53	0.10
Trichlorofluorobenzene	-0.45	-0.41	-0.31	-0.39	0.52	0.25	0.28	-0.02

Table 7-3. TNMOC and Ozone Measured by the Iowa Monitoring Stations

Monitoring Location	Average Ozone Concentrations (ppbv)	Total Number of Ozone Sampling Days	Average TNMOC speciated (ppbC)	Average TNMOC w/ unknowns (ppbC)	% TNMOC Identified	SNMOC Compound with the Highest Concentration (ppbC)
C2IA	47.75 (±1.89)	214	89.44 (±22.24)	146.24 (±26.23)	59 %	Ethane (6.82)
DAIA	53.42 (±2.11)	214	124.01 (±57.70)	219.66(±59.53)	53 %	*n*-Hexane (30.66)
DMIA	40.05(±1.81)	214	142.89 (±83.81)	278.32 (±88.29)	46 %	*n*-Undecane (20.45)

Table 7-4. Average UATMP Concentrations By Wind Regime for the Cedar Rapids Site

Wind Regime	C2IA	
	24 hr	**48 hr**
North	4.87	4.67
Northeast	4.13	4.40
East	5.37	7.79*
Southeast	5.74	5.69
South	7.01*	5.54
Southwest	5.94	5.92
West	4.46	4.96
Northwest	4.84	5.38

Table 7-5. Motor Vehicle Information vs. Daily Concentration for Iowa Monitoring Sites

Monitoring Station	Population within Ten Miles	Estimated Number of MotorVehicles Owned	Traffic Data (Daily Average)	Average Daily UATMP Concentration (ppbv)
C2IA	175,516	129,882	1,500	11.92 (±0.94)
DAIA	269,372	199,335	1,000	12.82(±1.95)
DMIA	383,791	284,005	12,400	24.51 (±12.87)

Table 7-6. Summary of Future Regulations That May be Applicable for Nearby Facilities Surrounding C2IA

Facility Name	Primary SIC Code	SIC Code Description	Regulation Citation	Regulation Name
Cedar Manufacturing	3088	Rubber And Misc. Plastics Products, Miscellaneous Plastics Products, NEC, Plastics Plumbing Fixtures	40 CFR part 63, subpart WWWW	National Emission Standards for Hazardous Air Pollutants from Reinforced Plastic Composites Production (proposed rule)
Blastcoating Technologies, Inc.	3479	Fabricated Metal Products, Metal Services, NEC, Metal Coating and Allied Services	40 CFR part 63, subpart SSSS	National Emission Standards for Hazardous Air Pollutants from Surface Coating of Metal Coil (proposed rule)
Klinger Paint Co., Inc.	2851	Chemicals And Allied Products, Paints and Allied Products, Paints and Allied Products	40 CFR part 59, subpart D	National Volatile Organic Compound Emission Standards for Architectural Coatings

8.0 Sites in Michigan

This section focuses on meteorological, concentration, and spatial trends for the eight UATMP sites in Michigan (APMI, DEMI, E7MI, HOMI, LOMI, RRMI, SWMI, and YFMI). Seven of these sites are located in the Detroit metropolitan statistical area, while the eighth, HOMI, is located in northern Michigan, just south of Houghton Lake. Figures 8-1 through 8-8 are topographical maps showing the monitoring stations in their urban locations. Figures 8-9 through 8-11 are maps identifying facilities within ten miles of the sites that reported to the 1999 NEI. The E7MI and LOMI sites are farther north of the city than the other five monitoring locations, and the majority of the industrial sites are fuel combustion and surface coating industries. The bulk of the industrial facilities is to the south of E7MI and LOMI. The DEMI, RRMI, SWMI, and YFMI sites are close to each other, and are surrounded by numerous sources, most of which are fuel combustion and incineration facilities. APMI is just to the southwest of the cluster of other sites. HOMI, located in north-central Michigan, has very few nearby facilities.

Hourly meteorological data were retrieved for all of 2002 at four weather stations near the sites with the purpose of calculating correlations of meteorological data with ambient air concentration measurements. The weather stations are Pontiac, Detroit-Metropolitan, Detroit City Airport, and Houghton Lake/Roscommon Airport (WBAN 94817, 94847, 14822, and 94814, respectively).

Table 8-1 highlights the average UATMP concentration at each of the sites, along with temperature (average maximum and average), moisture (average dew point temperature, average wet-bulb temperature, and average relative humidity), wind information (average u- and v-components of the wind), and pressure (average sea level pressure) for the entire year and on days samples were taken. The Detroit area is located in the Great Lakes region, a place for active weather, as several storm tracks run across the region. Hence, winters can be cold and wet, while summers are generally mild. The urbanization of the area along with Lake St. Clair to the east are two major influences on the city’s weather. The lake tends to keep Detroit warmer in the winter and cooler in the summer than more inland areas. The urban heat island tends to keep the city warmer than outlying areas. Winds are often breezy and generally flow from the southwest on average, as can be confirmed by Table 8-1. Houghton Lake is a small lake in north-central Michigan and does not have quiet the moderating effect of Lake St. Clair. The area is rural, without an urban heat island effect, which allows a greater temperature fluctuation than in the Detroit area. This information can be found in The Weather Almanac, fifth edition (Ruffner and Bair, 1987), and at the following web site: http://meetings.sixcontinentshotels.com/destinations/detroit/weather.html.

8.1 Meteorological and Concentration Averages at the Michigan Sites

Carbonyl compounds and VOC were measured at six of the eight sites, with E7MI and HOMI measuring only VOC, as indicated in Tables 3-3 and 3-4. Of the sites that measured carbonyls, RRMI had the highest geometric mean (6.81 ppbv) while YFMI had the lowest (1.93 ppbv). APMI had the highest geometric mean (17.59 ppbv) for halogenated hydrocarbons, more than double and triple the geometric means of the other sites. E7MI had the highest geometric mean for the hydrocarbons (16.44 ppbv), a value much higher than the other sites. This site also had the largest value for polar compounds (8.17 ppbv), again significantly more than the other sites. HOMI consistently had the lowest geometric means for each of the VOC types, 3.57 ppbv for the halogenated hydrocarbons, 1.57 ppbv for the hydrocarbons, and 1.98 ppbv for the polar compounds. The average total UATMP daily concentration at APMI was the highest of the stations, 38.34 (±33.60) ppbv, similar to last year, while the remaining sites ranged between 7.93 ±2.04 ppbv (HOMI) and 32.62 ±7.79 ppbv (E7MI). Table 8-1 also lists the averages for selected meteorological parameters from January 2002 to December 2002, which is the same time period covered in this report.

SVOC concentrations were sampled at all seven of the Detroit sites. Average SVOC concentrations ranged from 3.87 (±0.20) $\mu g/m^3$ at RRMI to 21.22 (±6.03) $\mu g/m^3$ at YFMI. E7MI also opted to have total NMOC and SNMOC measured during its sampling. SNMOC/NMOC compounds are of particular interest because of their role in ozone formation. Readers are encouraged to review EPA's *2001 Nonmethane Organic Compounds (NMOC) and Speciated Nonmethane Organic Compounds (SNMOC) Monitoring Program, Final Report* (EPA, 2002) for more information on SNMOC/NMOC trends and concentrations. The average total NMOC value for E7MI was 307.47 (±127.71)ppbC, of which 69% could be identified through speciation. Of the speciated compounds, ethane measured the highest concentration at the E7MI site (24.28 ppbC). Ozone concentrations were also sampled at E7MI on 183 sample days, and were retrieved from the U.S. EPA's AQS database. The average ozone concentration for each sample day was 51.45 (±2.79)ppbv. Unfortunately, ozone concentrations were not sampled at the other sites. Four sites (APMI, DEMI, LOMI, and RRMI) also sampled hexavalent chromium. Hexavalent chromium concentrations ranged from 0.029 (±0.02) ng/m^3 at DEMI to 0.055 (±0.020) ng/m^3 at RRMI. SWMI also sampled metals from May 2001 through April 2002. The average concentration was 155,107.63 (±45,898.47) ng/filter. Information on SVOC, TNMOC, hexavalent chromium, metals, and ozone concentrations is given in Table 8-4.

Tables 8-2a-h are the summaries of calculated Pearson Correlation coefficients for each of the prevalent compounds and selected meteorological parameters by site. Identification of the prevalent compounds is discussed in Section 3 of this report. At APMI, very few strong correlations were calculated. Only ethylbenzene and the xylenes had strong positive correlations with the v-component of the wind. However, moderately strong positive correlations were found between 1,2,4-trimethylbenzene, benzene, chloromethane, dichlorodifluoromethane, propylene, and toluene and maximum, average, dew point, and wet bulb temperatures. Formaldehyde had moderately strong negative correlations with maximum, average, and wet bulb temperatures. While DEMI also had very few strong correlations, nearly all of the compounds had moderately strong positive correlations with maximum, average, dew point, and wet bulb temperatures, and all of the correlations with these parameters were positive for all of the compounds. All of the correlations between the compounds and the u-component of the wind speed were negative, albeit weak, at DEMI. UATMP concentrations generally increase at APMI and DEMI as the temperature and moisture content increases, and as the east-west wind decreases at DEMI.

With the exception of chloromethane and formaldehyde, only weak correlations with the temperature parameters were found at LOMI. Interestingly, all of the compounds exhibited weak, moderate, or strong positive correlations with the three moisture parameters. Moderately strong to strong negative correlations were established between all of the compounds and sea level pressure. Mostly moderately strong to strong negative correlations with the u-component of the wind and weak, moderate, or strong positive correlations with the v-component of the wind were also calculated. Generally, UATMP concentrations tend to increase as moisture content and the north-south wind increases, and pressure and the east-west wind decreases at LOMI.

At RRMI, with the exception of chloromethane, dichlorodifluoromethane, and formaldehyde, moderately strong to strong negative correlations with maximum, average, dew point, and wet bulb temperatures and the compounds were established. Moderately strong to strong positive correlations were also found between most of the compounds and relative humidity. Mostly negative correlations exist between the compounds and the v-component of the wind and mostly positive correlations exist between the compounds and the u-component of the wind. As temperature and the north-south wind speed decrease, relative humidity and the east-west wind increase, UATMP concentrations tend to increase at RRMI.

Formaldehyde had strong positive correlations with maximum, average, dew point, and wet bulb temperatures at SWMI, and trichlorofluoromethane had moderately strong positive correlations with the same four parameters. All of the compounds had negative correlations with relative humidity and sea level pressure, except acetylene and benzene, both of which had moderately strong or strong positive correlations with these two parameters. Most of the compounds also had positive correlations with the u-component of the wind and negative correlations with the v-component of the wind. As relative humidity, pressure, and the north-south wind decrease, and the east-west wind increases, UATMP concentration of the prevalent compounds generally tend to increase.

Nearly all of the compounds at YFMI had positive correlations with maximum, average, dew point, and wet bulb temperatures, with chloromethane having the strongest correlations. Most of the compounds also had negative correlations with relative humidity and sea level pressure, and positive correlations with the v-component of the wind. Increasing temperature and the north-south wind speed, and decreasing relative humidity and pressure generally result in increasing UATMP concentrations at this site.

With the exception of chloromethane, all of the compounds had strong to very strong positive correlations with maximum and average temperatures, strong to very strong negative correlations with dew point, wet bulb temperature, and the wind components at the E7MI site. Many compounds also had moderately strong positive correlations with sea level pressure and moderately strong to very strong negative correlations with the v-component of the wind. An important thing to note is that this site only took samples on four days.

At HOMI, 1,2,4-trimethylbenzene and ethylbenzene were not detectable and therefore have no correlations listed in Table 8-2d. *o*-Xylene, and propylene had moderately strong positive correlations with maximum, average, dew point, and wet bulb temperatures, while benzene, chloromethane, and *m,p*-xylene had moderately strong negative correlations with the same four parameters. Nearly all of the compounds had negative correlations with relative humidity, and all of the compounds had negative correlations with sea level pressure. The strongest correlation at this site was between dichlorodifluoromethane and the u-component of the wind.

Pearson correlation coefficients were also calculated between the aforementioned weather parameters and hexavalent chromium, which can be found in Table 8-3. With the exception of relative humidity at RRMI, all of the participating Michigan sites had weak, moderate, or strong positive correlations with the temperature and moisture parameters. The strongest correlation was between hexavalent chromium and relative humidity at LOMI. The four sites also had weak, moderate, or strong negative correlations with sea level pressure. With the exception of the u-component of the wind at DEMI and LOMI, all of the participating Michigan sites had weak or moderately strong negative correlations with both components of the wind speed. Generally, hexavalent chromium concentrations tend to increase as temperature and moisture content increase, and pressure and wind speed decrease.

As part of the 2002 UATMP report, back trajectory analyses were conducted for the EPA-designated NATTS sites to determine whether where a parcel came from could be a contributor to its air toxics concentration. A back trajectory analysis was performed on sample days for all of the Detroit sites and the Houghton Lake site. Tables 8-5 and 8-6 are summaries of the back trajectory analyses. At HOMI, the highest UATMP concentrations occurred when air originated out of the southwest. However, the HOMI site only sampled air toxics on ten days, which makes it difficult to establish a connection between wind direction and UATMP concentrations. For the Detroit sites, the largest concentrations generally occurred when the air originated from the south. As illustrated in Figures 8-9 and 8-10, APMI, DEMI, RRMI, SWMI, and YFMI are surrounded by numerous facilities, and are located to the south of E7MI and LOMI, both of which are surrounded by a large number of industrial sites as well. Figures 8-11 and 8-17 are the back trajectory maps for each site where the highest concentration occurred (48.56 ppbv at APMI; 29.88 ppbv at DEMI; 26.33 ppbv at E7MI; 13.36 ppbv at LOMI; 57.93 ppbv at RRMI; 25.57 ppbv at SWMI; 71.34 ppbv at YFMI; and 3.89 ppbv at HOMI).

8.2 Spatial Analysis

Using the population within ten miles of each site, an estimate of the number of motor vehicles operating in proximity to the monitoring station can be established. The ratio used in this report is 0.74 motor vehicles to every one person (refer to section 3.4.1 for more information on this ratio). The Michigan site with the highest population is the DEMI site, where 1,225,014 people are estimated to be operating approximately 906,510 vehicles. Not surprisingly, the HOMI site had the lowest population of the Michigan sites, with only 10,391 people driving 7,689 automobiles. This information is compared to the average daily concentration of the prevalent compounds at each Michigan site in Table 8-7. Also included in Table 8-7 are average daily traffic data, or more specifically, the average number of cars passing the monitoring sites on the nearest roadway to each site on a daily basis. The LOMI site had the most traffic passing by the site on a daily basis.

A roadside study conducted to measure emissions from motor vehicles determined that the concentration ratios of the BTEX compounds were relatively consistent from urban area to urban area. (For more information on this study, refer to section 3.4.2.) Figure 3-14 depicts the average concentration ratios of the roadside study and compares them to the concentration ratios at each of the monitoring sites. The concentration ratios at APMI look very similar to those of the roadside study, with just slightly lower values for each of the ratios. DEMI's toluene-ethylbenzene ratio is larger than the roadside study's value for the same ratio. Also at DEMI, the benezene-ethylbenzene ratio is greater than its *m,p*-xylene-ethylbenzene ratio, where the opposite is true for the roadside study. Similar to DEMI, E7MI, HOMI, LOMI, RRMI, and SWMI also had greater b-e ratios. Another interesting difference at both LOMI and RRMI is that the benzene-ethylbenzene and toluene-ethylbenzene ratios are closer together and have higher values than the roadside study. YFMI looks the least like the roadside study, having a benzene-ethylbenzene ratio more than triple that of the roadside study. In fact, its concentration ratio for these two compounds is the largest in compared to all of the sites participating in the 2002 UATMP.

8.3 Regulation Analysis

There are seven NATTS sites in Michigan. Six NATTS sites are located in the Detroit area (APMI, DEMI, E7MI, RRMI, SFMI, and YFMI) and one NATTS site (HOMI) is located in Houghton Lake. Most of the pilot monitoring stations in the Detroit area are located in close proximity to each other. Consequently, many of the facilities identified in the 10-mile areas around the monitoring stations overlap. Table 3-9 summarizes the number of facilities that account for approximately 90 percent of the total UATMP pollutant emissions in the 10-mile area around the monitoring stations

At APMI, of the ten facilities listed, six are potentially subject to future regulations. Table 8-8 identifies the regulations that are potentially applicable. Based on this analysis, the regulations shown are expected to achieve reductions in ambient concentrations of the following UATMP pollutants: ethylbenzene, methyl ethyl ketone, methyl isobutyl ketone, and xylene. Reductions in toluene concentrations may not be measured. Reductions are projected for ethylbenzene (54 percent), methyl ethyl ketone (43 percent), methyl isobutyl ketone (58 percent), and xylene (58 percent) as the regulations are implemented (the latest compliance date is 2004). Emissions of toluene are estimated to be reduced to a lesser degree (10 percent). The emission reductions are primarily attributed to regulation of surface coating operations at automobile and metal coil manufacturing facilities.

At DEMI, of the eleven facilities listed, eight are potentially subject to future regulations. Table 8-9 identifies the regulations that are potentially applicable. Based on this analysis, the regulations shown are expected to achieve emission reductions of ethylbenzene (51 percent), methyl ethyl ketone (47 percent), methyl isobutyl ketone (58 percent), and xylene (58 percent) as they are implemented (the latest compliance date is 2005). Emissions of toluene are estimated to be reduced to a lesser degree (14 percent). The emission reductions are primarily attributed to regulation of surface coating operations at automobile and metal coil manufacturing facilities.

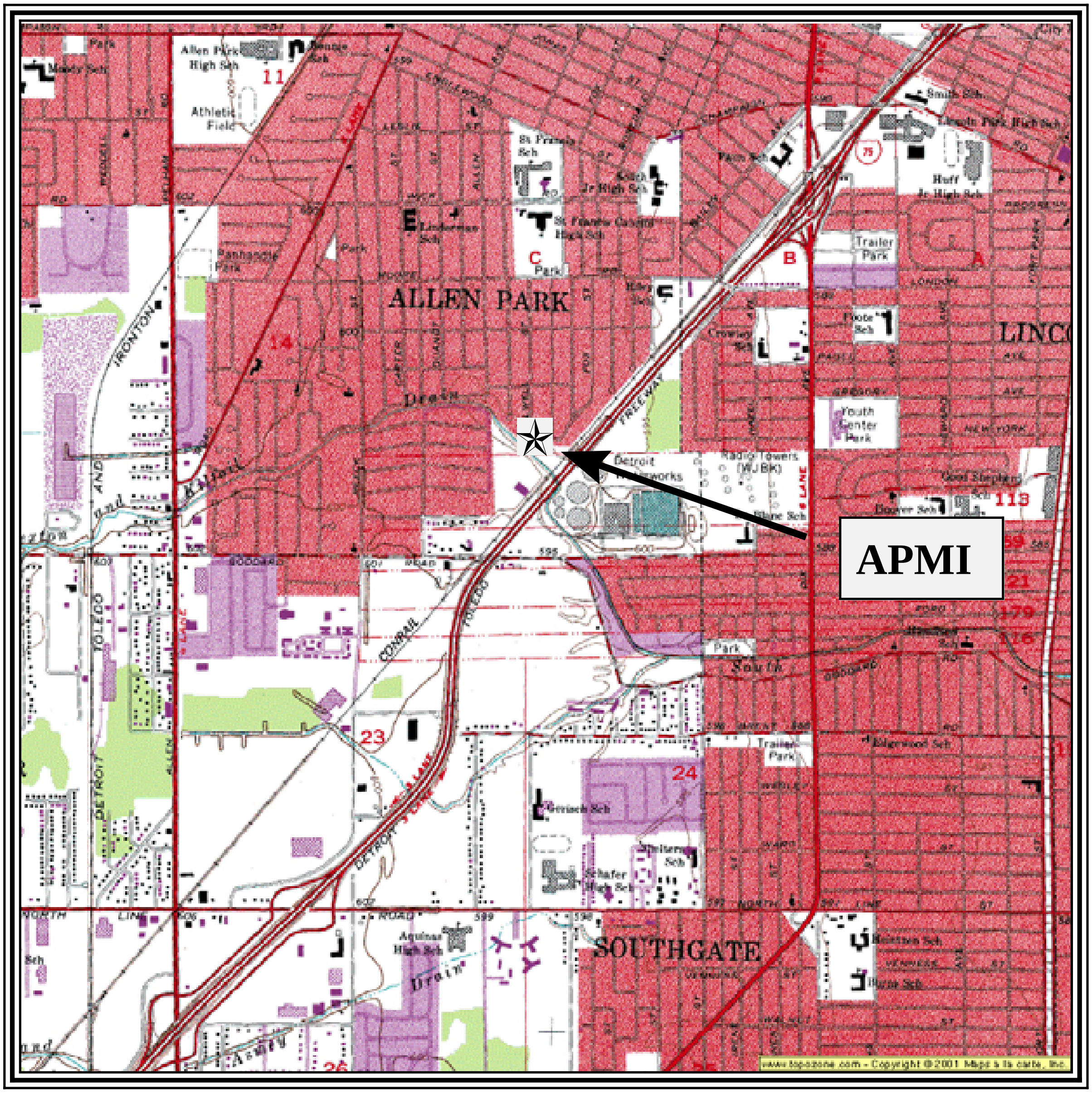
At E7MI, of the eleven facilities listed, seven are potentially subject to future regulations. Table 8-10 identifies the regulations that are potentially applicable. For this area, the regulations shown are expected to achieve emission reductions of methyl ethyl ketone (52 percent), methyl isobutyl ketone (52 percent), methyl methacrylate (52 percent), styrene (52 percent), and xylene (52 percent) as the regulations are implemented. The emission reductions, which could lead to decrease ambient concentrations of these compounds, are primarily attributed to regulation of metal surface coating operations (the latest compliance date is 2005). Lesser reductions of ethylbenzene and toluene emissions (37 and 33 percent, respectively) are projected to be achieved by automobile coating operations.

At HOMI, of the five facilities listed, none are potentially subject to future regulations although all of the solid waste disposal facilities are potentially subject to the emission guidelines for large and small municipal waste combustors (40 CFR part 60, subpart Cb (large MWC) and subpart BBBB (small MWC)). However, those regulations do not directly regulate emissions of UATMP compounds. Consequently, the ambient concentration of UATMP pollutants is not projected to decrease in this area.

At RRMI, of the twelve facilities listed, only four are potentially subject to future regulations. Table 8-11 identifies the regulations that are potentially applicable. The regulations shown are expected to achieve emission reductions of the following UATMP pollutants: ethylbenzene, methyl ethyl ketone, methyl isobutyl ketone, toluene, and xylene. Based on this analysis, the regulations are projected to achieve reductions of ethylbenzene (49 percent), methyl ethyl ketone (43 percent), methyl isobutyl ketone (58 percent), and xylene (56 percent). These emission reductions, which could lead to decrease ambient concentrations of these compounds, are primarily attributed to regulation of surface coating operations at automobile and metal coil manufacturing facilities (the latest compliance date is 2005). Emissions of toluene are estimated to be reduced to a lesser degree (8 percent).

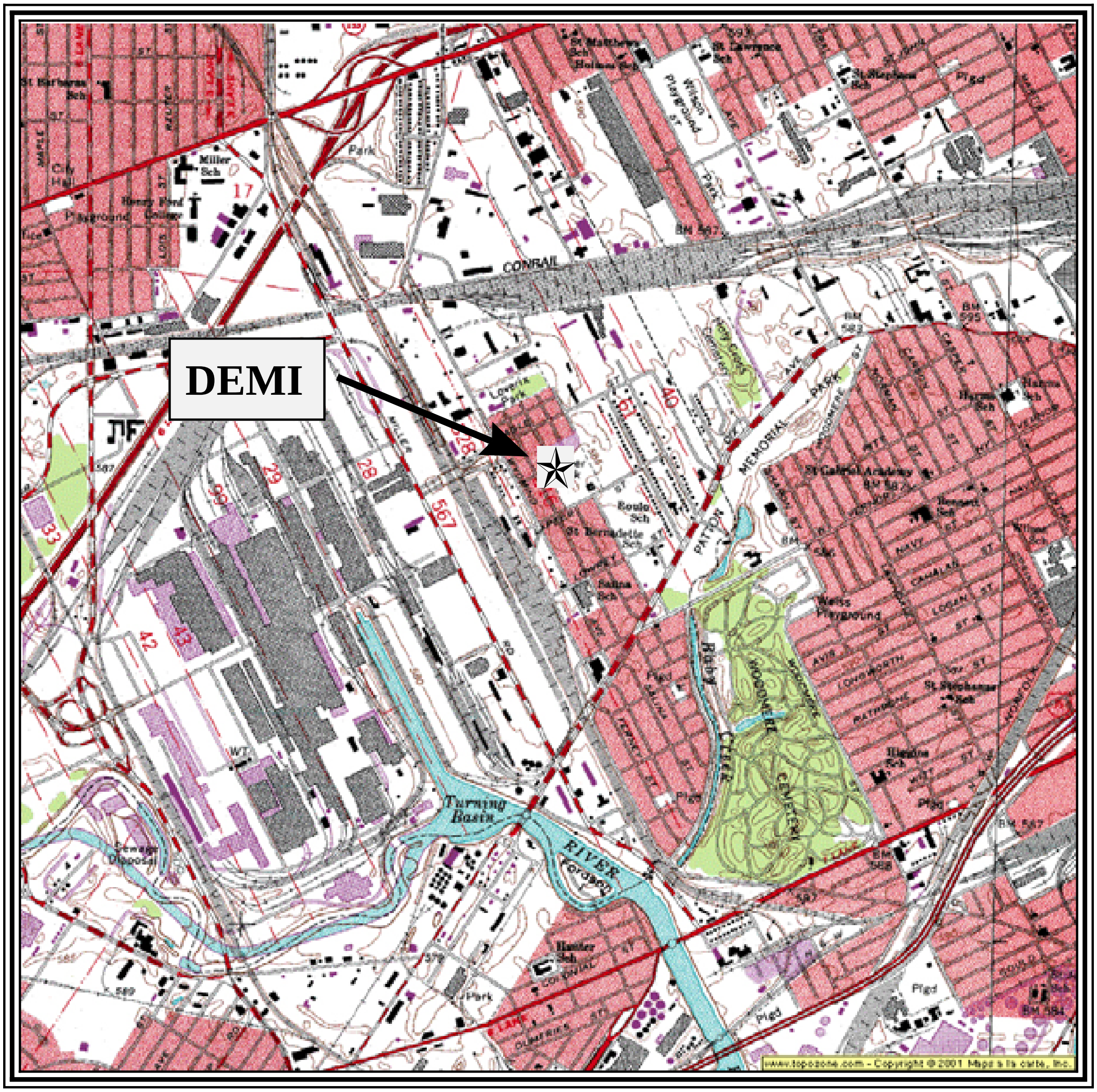
At SWMI and YFMI, of the twelve facilities listed, only five are potentially subject to future regulations. Table 8-12 identifies the regulations that are potentially applicable. The regulations shown are expected to achieve emission reductions of ethylbenzene (51 percent), methyl ethyl ketone (47 percent), methyl isobutyl ketone (52 percent), toluene, and xylene (58 percent) as the regulations are implemented (the latest compliance date is 2005). These emission reductions, which could lead to decrease ambient concentrations of these compounds, are primarily attributed to regulation of surface coating operations at automobile and metal coil manufacturing facilities (the latest compliance date is 2005). Emissions of toluene are estimated to be reduced to a lesser degree (12 percent).

Figure 8-1. Detroit, Michigan Site 1 (APMI) Monitoring Station



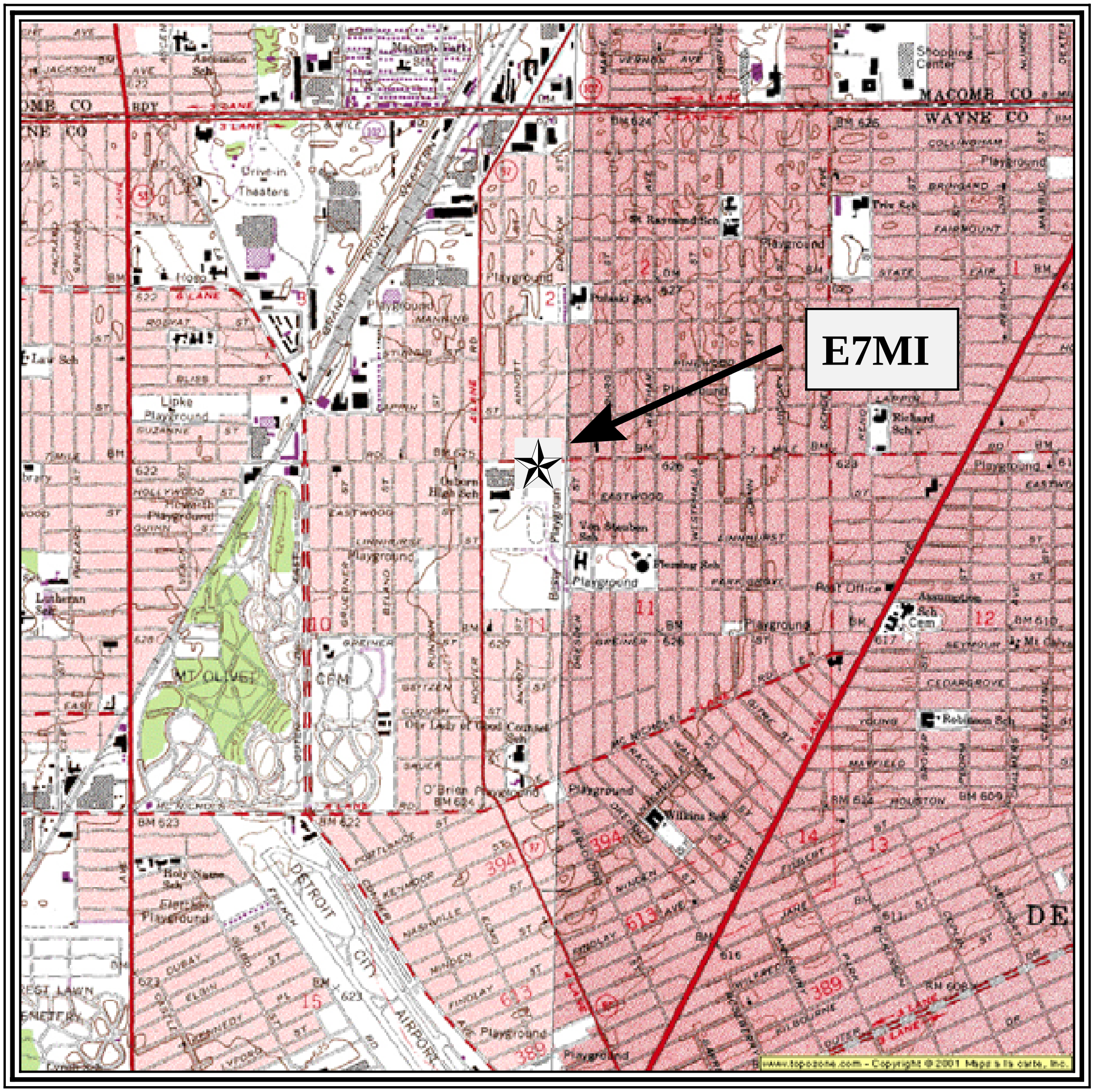
Source: USGS 7.5 Minute Series. Map Scale: 1:24,000.

Figure 8-2. Detroit, Michigan Site 2 (DEMI) Monitoring Station



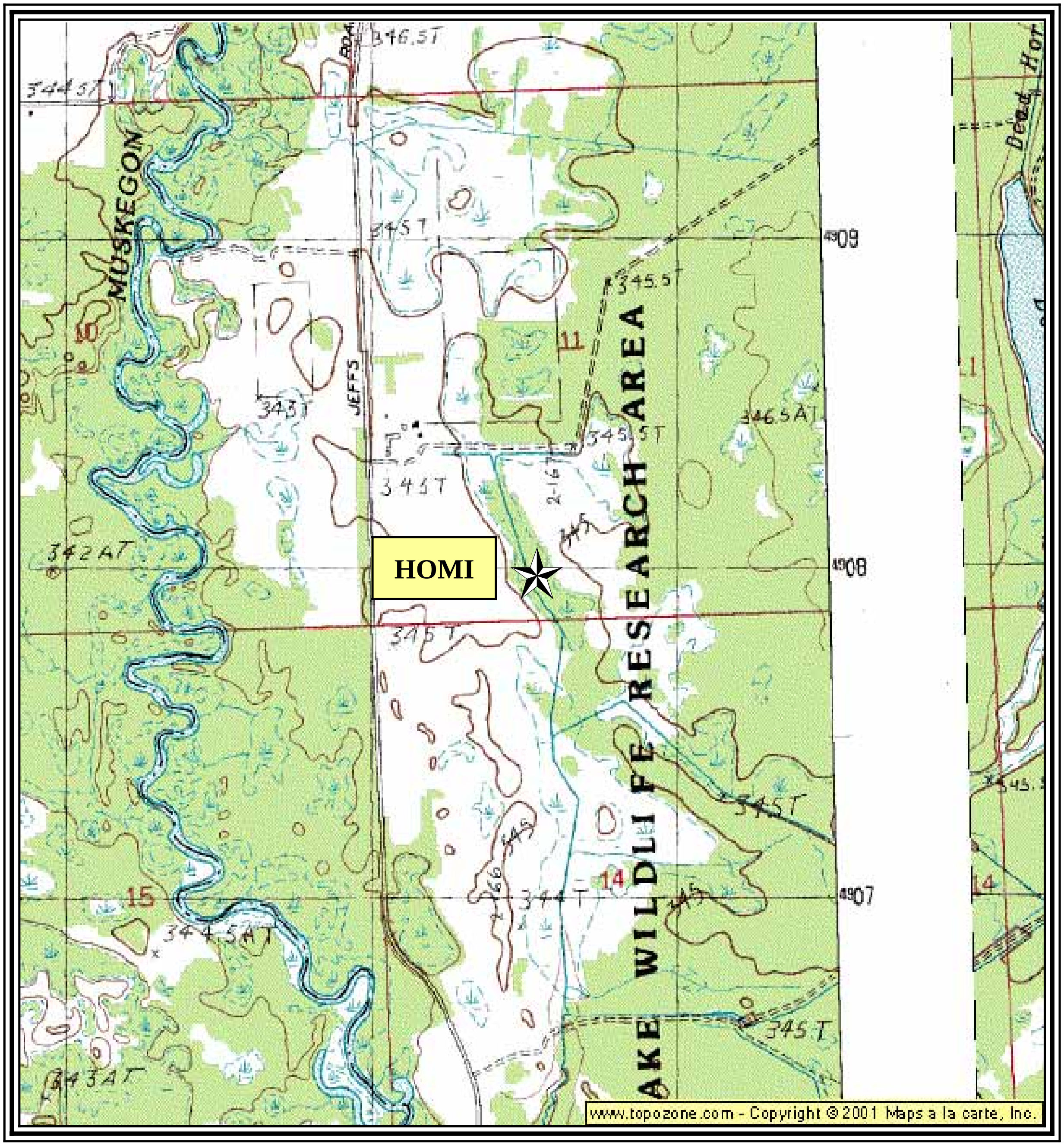
Source: USGS 7.5 Minute Series. Map Scale: 1:24,000.

Figure 8-3. Detroit, Michigan Site 3 (E7MI) Monitoring Station



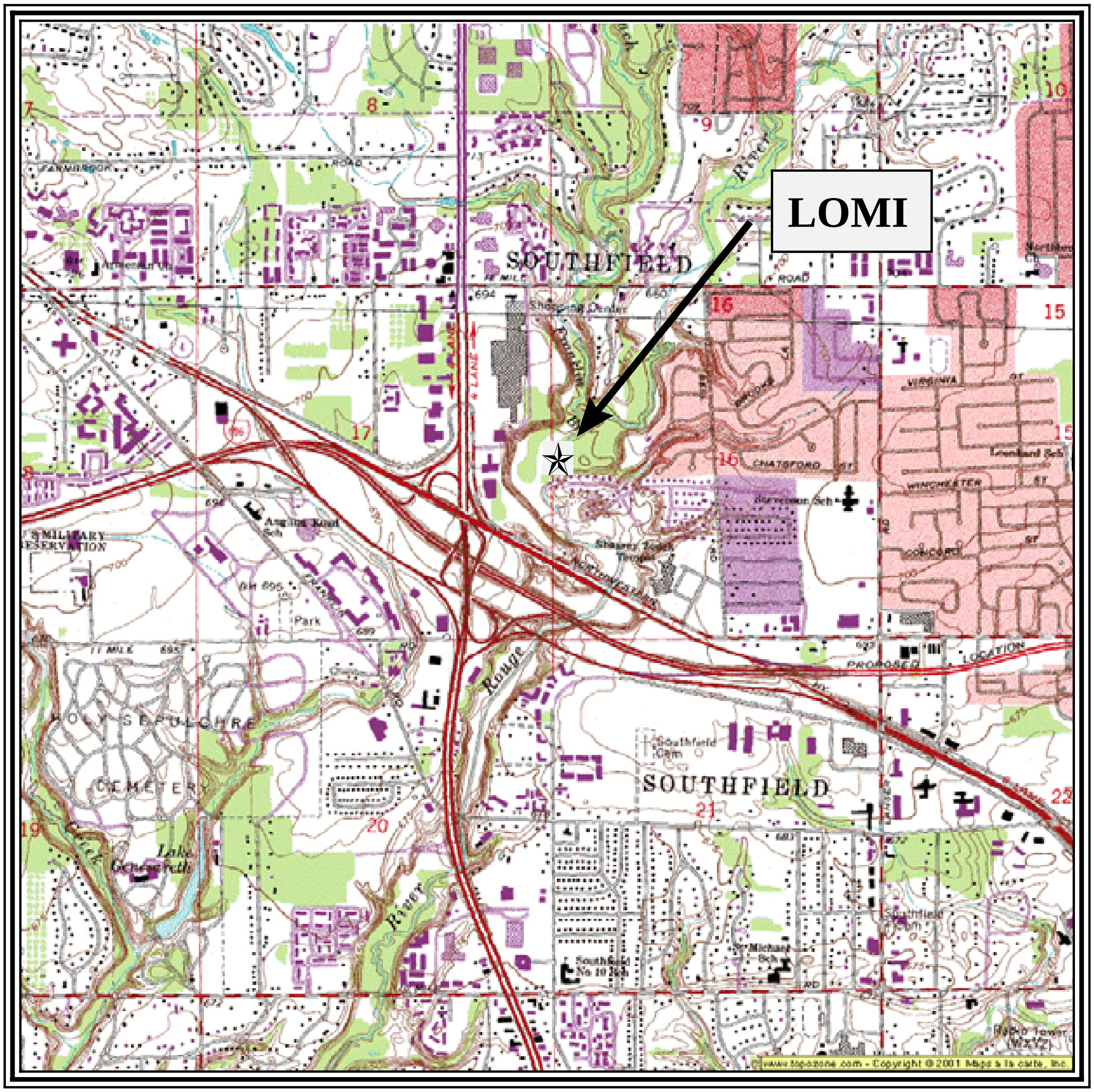
Source: USGS 7.5 Minute Series. Map Scale: 1:24,000.

Figure 8-4. Houghton Lake, Michigan (HOMI) Monitoring Station



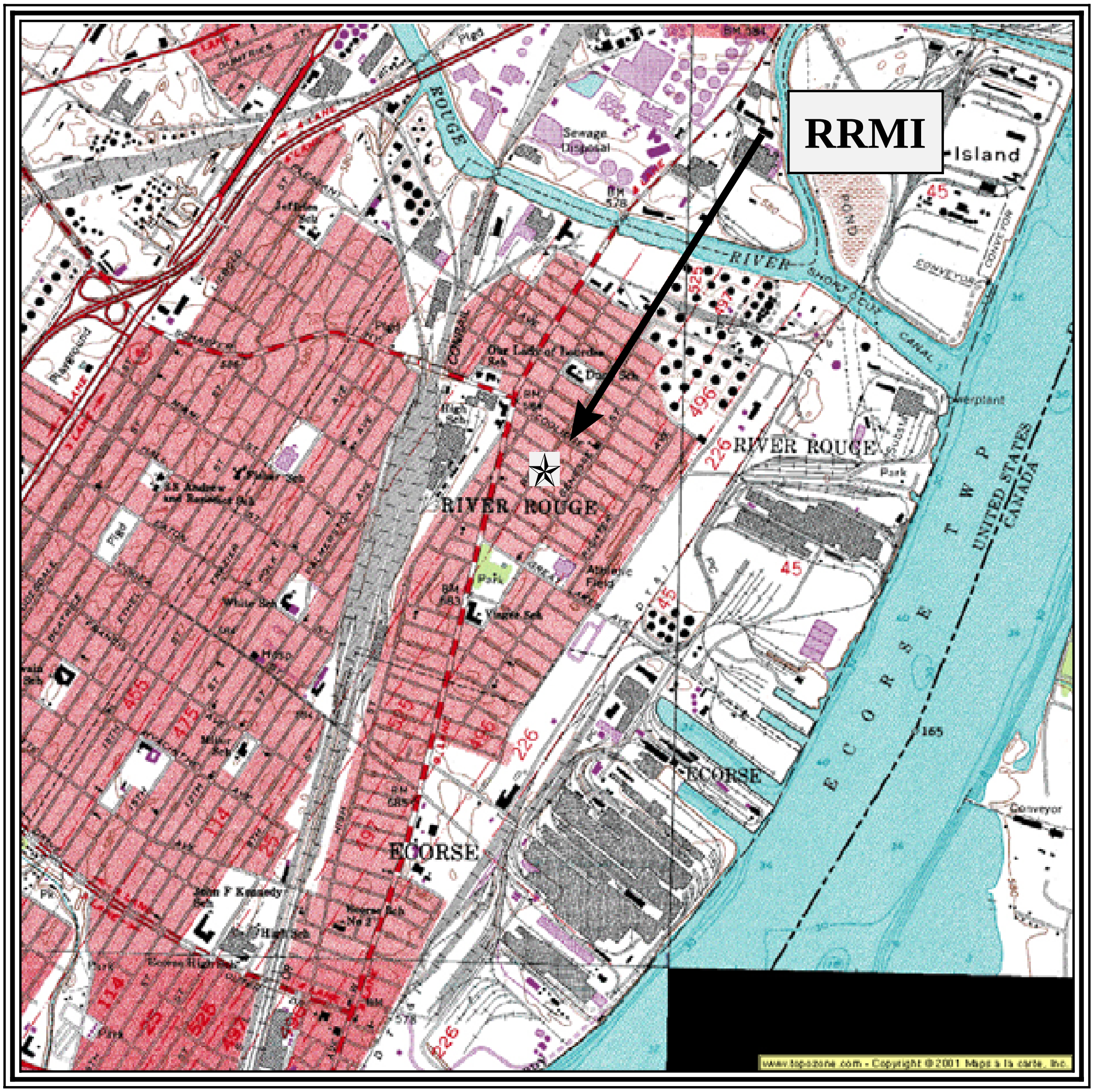
Source: USGS 7.5 Minute Series. Map Scale: 1:25,000.

Figure 8-5. Detroit, Michigan Site 4 (LOMI) Monitoring Station



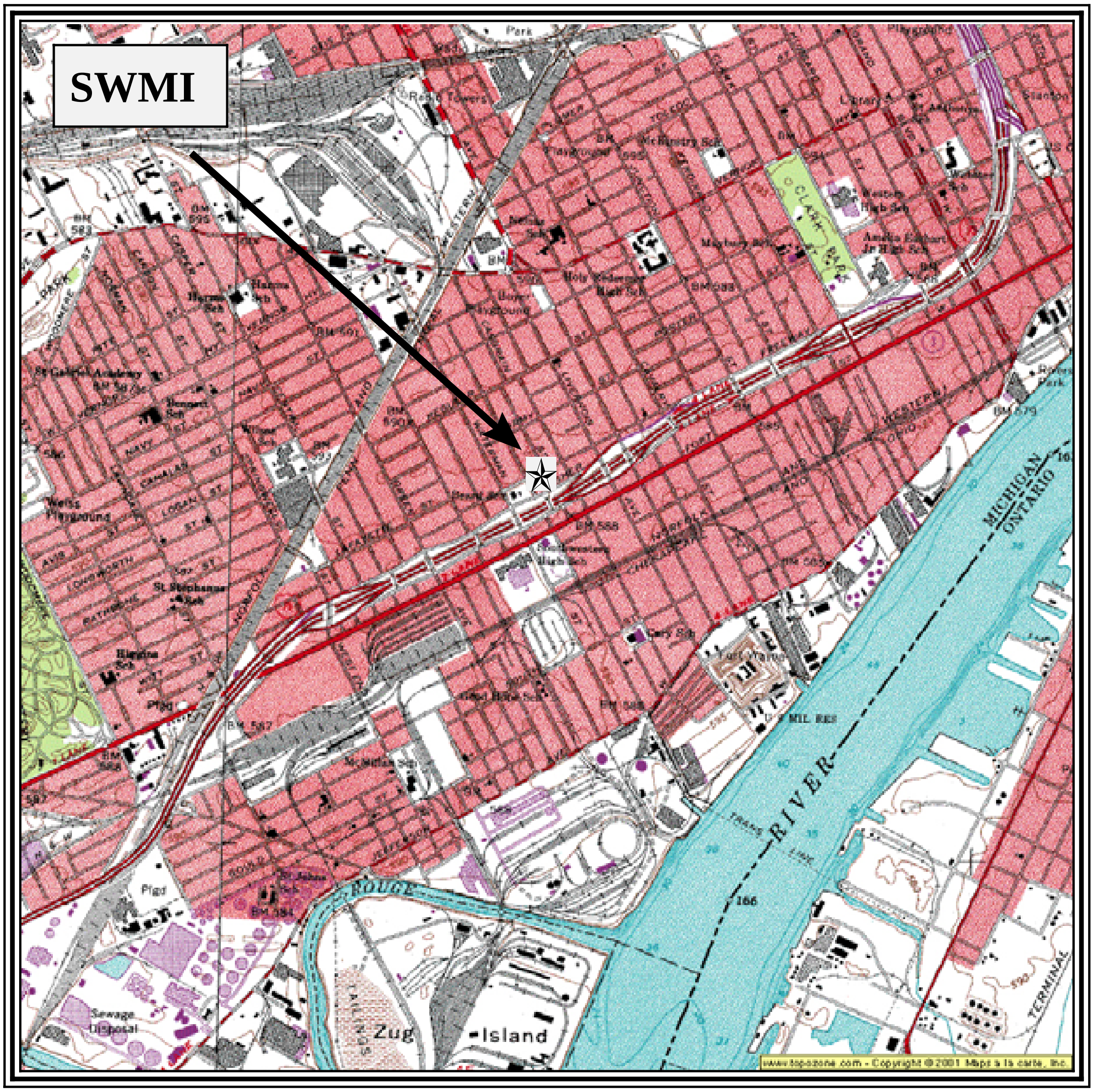
Source: USGS 7.5 Minute Series. Map Scale: 1:24,000.

Figure 8-6. Detroit, Michigan Site 5 (RRMI) Monitoring Station



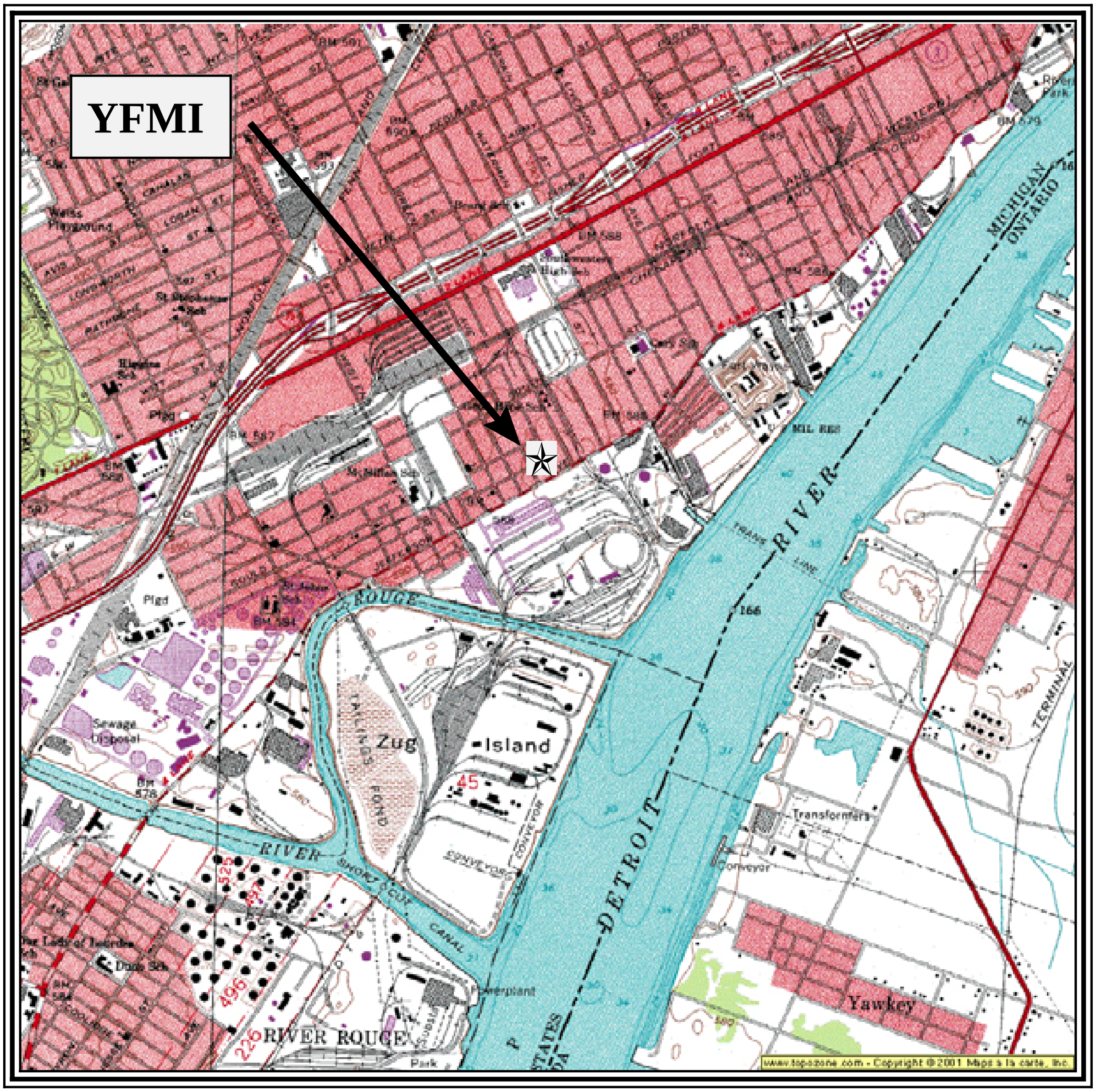
Source: USGS 7.5 Minute Series. Map Scale: 1:24,000.

Figure 8-7. Detroit, Michigan Site 6 (SWMI) Monitoring Station



Source: USGS 7.5 Minute Series. Map Scale: 1:24,000.

Figure 8-8. Detroit, Michigan Site 7 (YFMI) Monitoring Station



Source: USGS 7.5 Minute Series. Map Scale: 1:24,000.

Figure 8-9. Facilities Located Within 10 Miles of APMI, DEMI, RRMI, SWMI, and YFMI

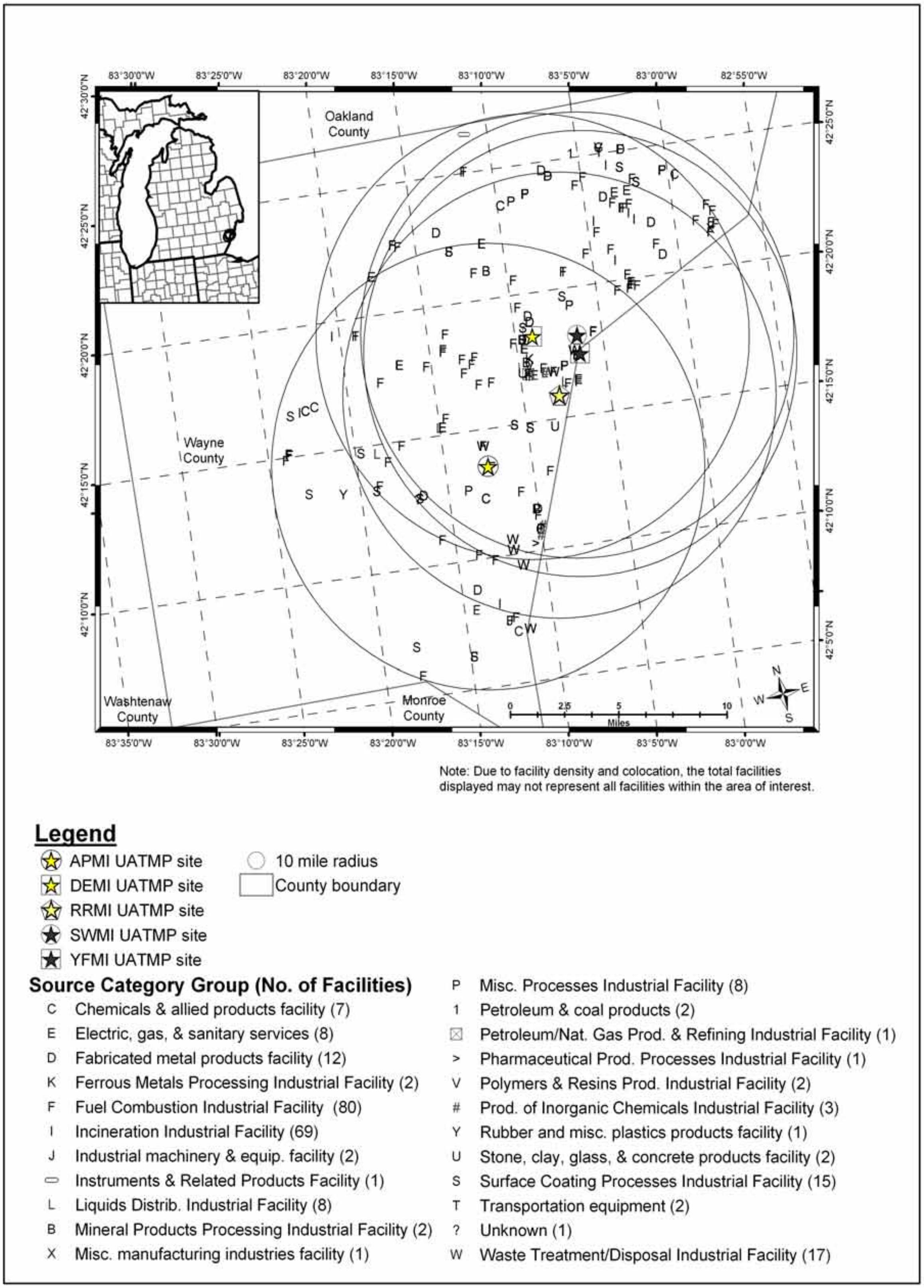
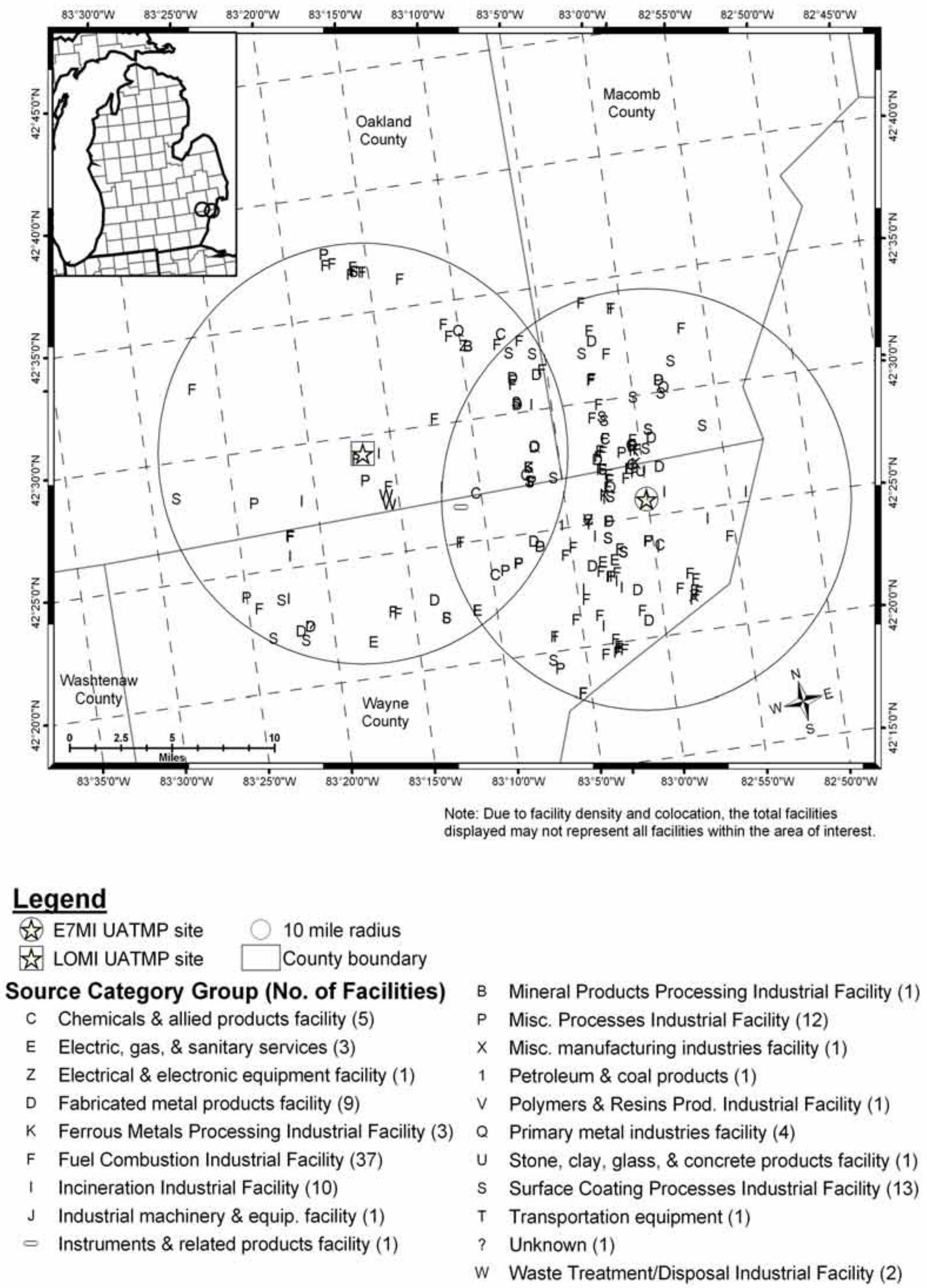
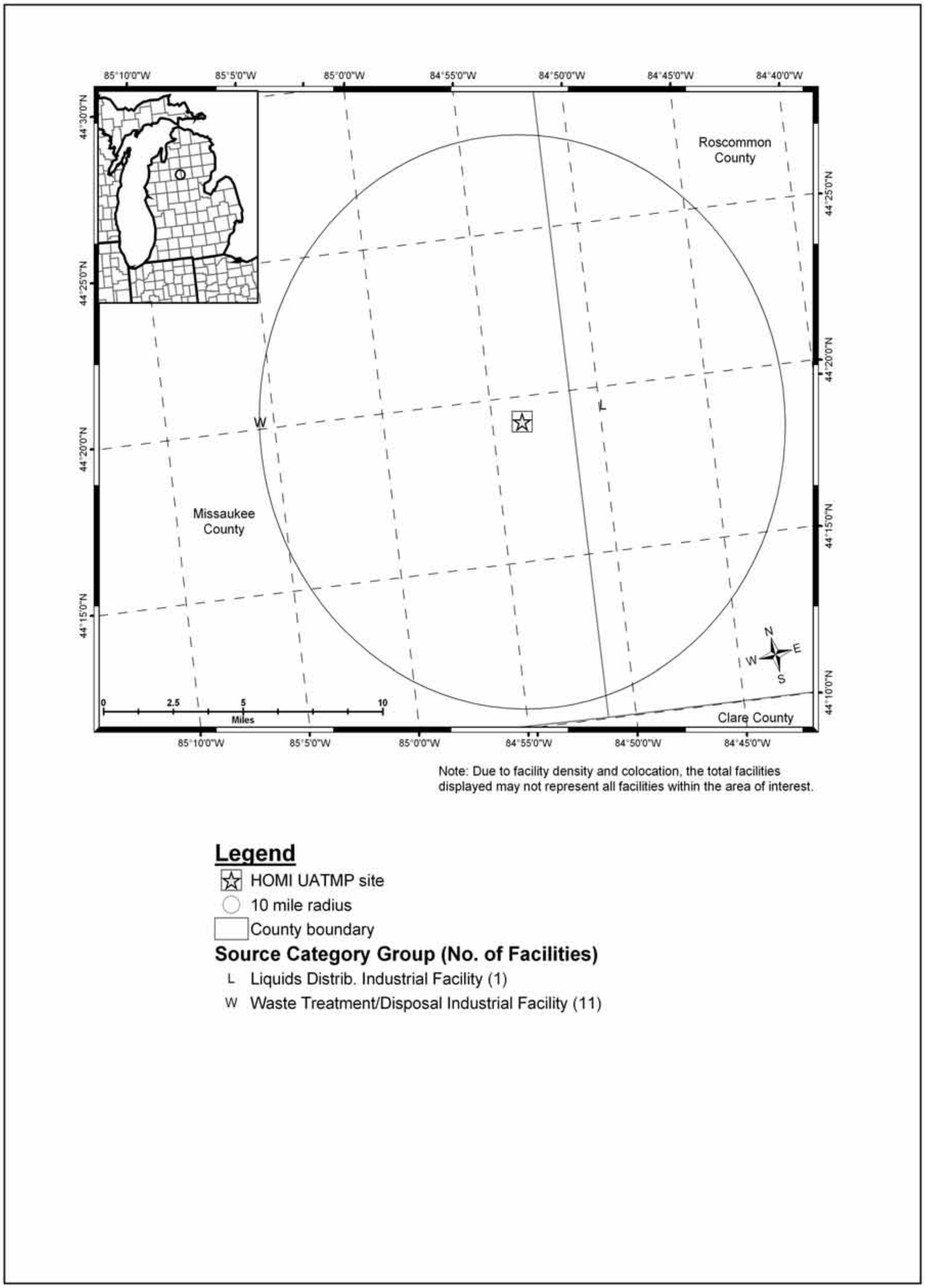


Figure 8-10. Facilities Located Within 10 Miles of E7MI and LOMI



Note: Due to facility density and colocation, the total facilities displayed may not represent all facilities within the area of interest.

Figure 8-11. Facilities Located Within 10 Miles of HOMI



Note: Due to facility density and colocation, the total facilities displayed may not represent all facilities within the area of interest.

Figure 8-12. Back Trajectory Map Corresponding to APMI's Highest Concentration

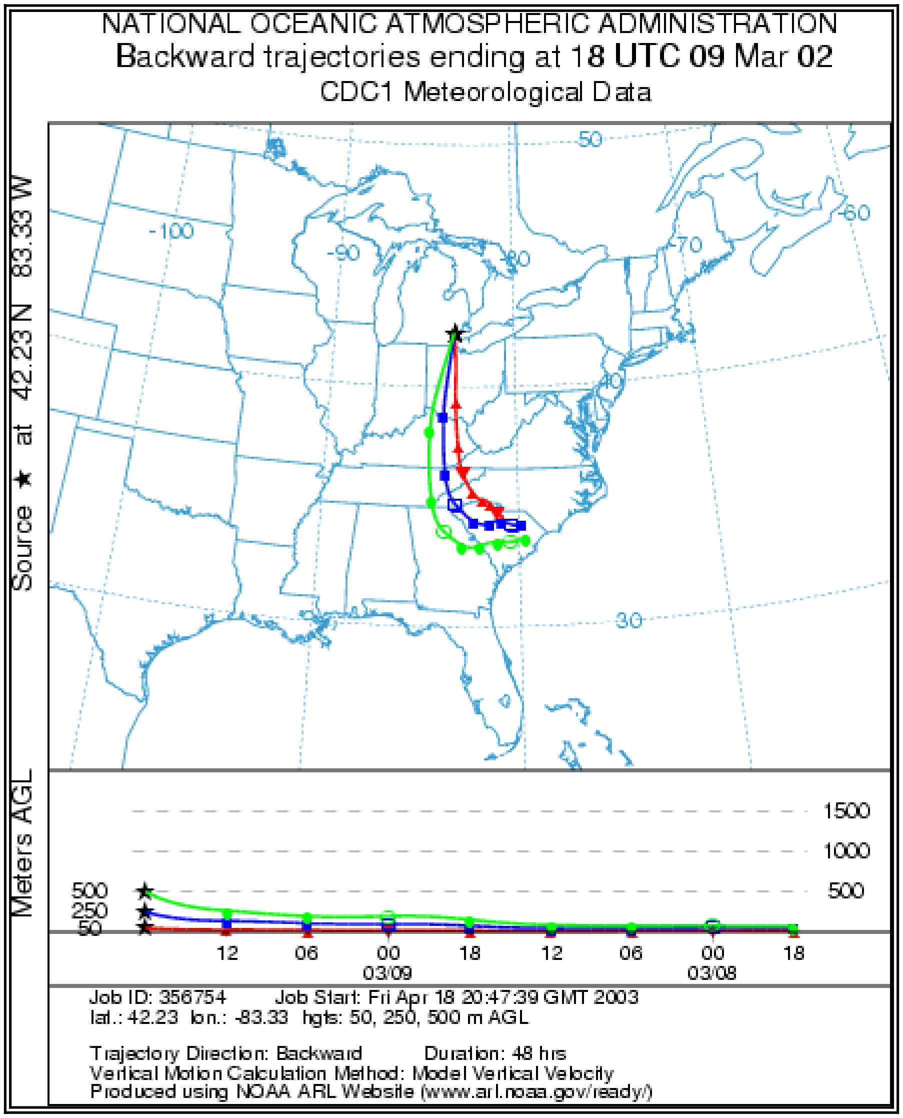


Figure 8-13. Back Trajectory Map Corresponding to DEMI's Highest Concentration

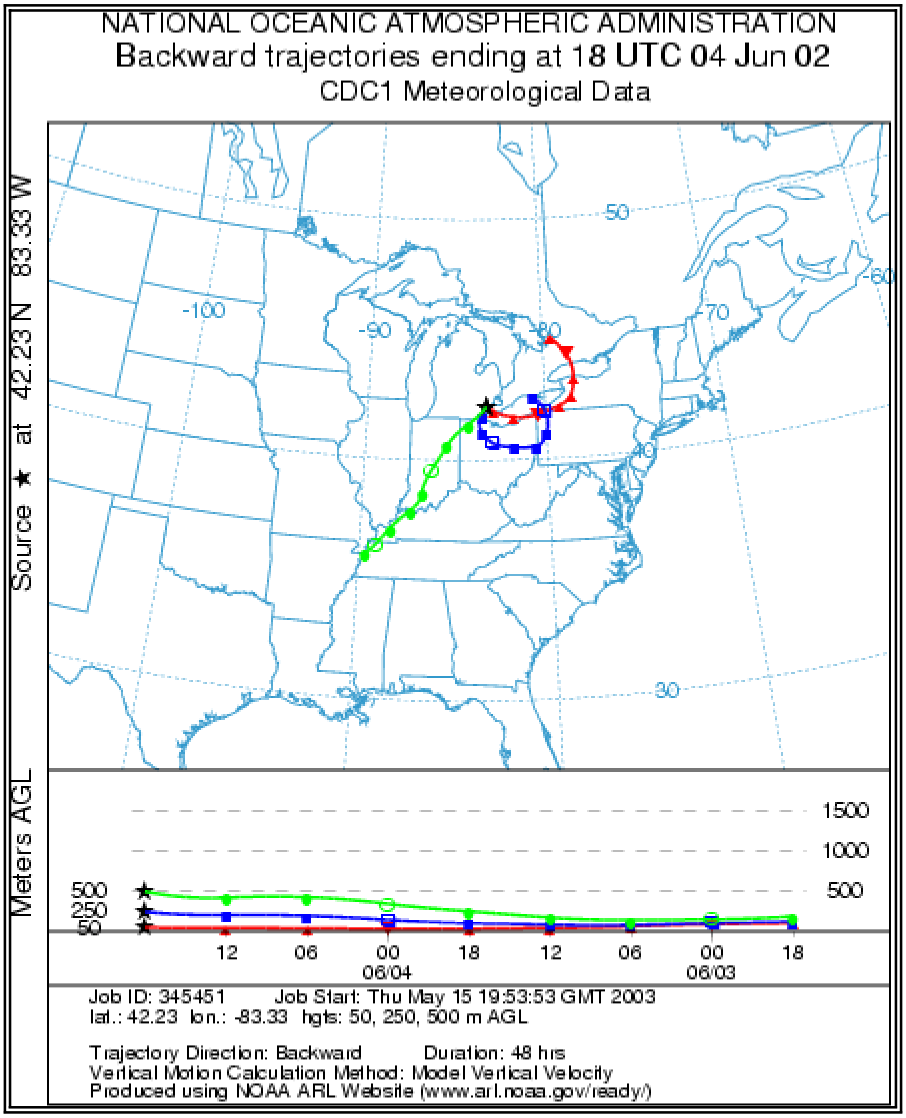


Figure 8-14. Back Trajectory Map Corresponding to E7MI and RRMI's Highest Concentration

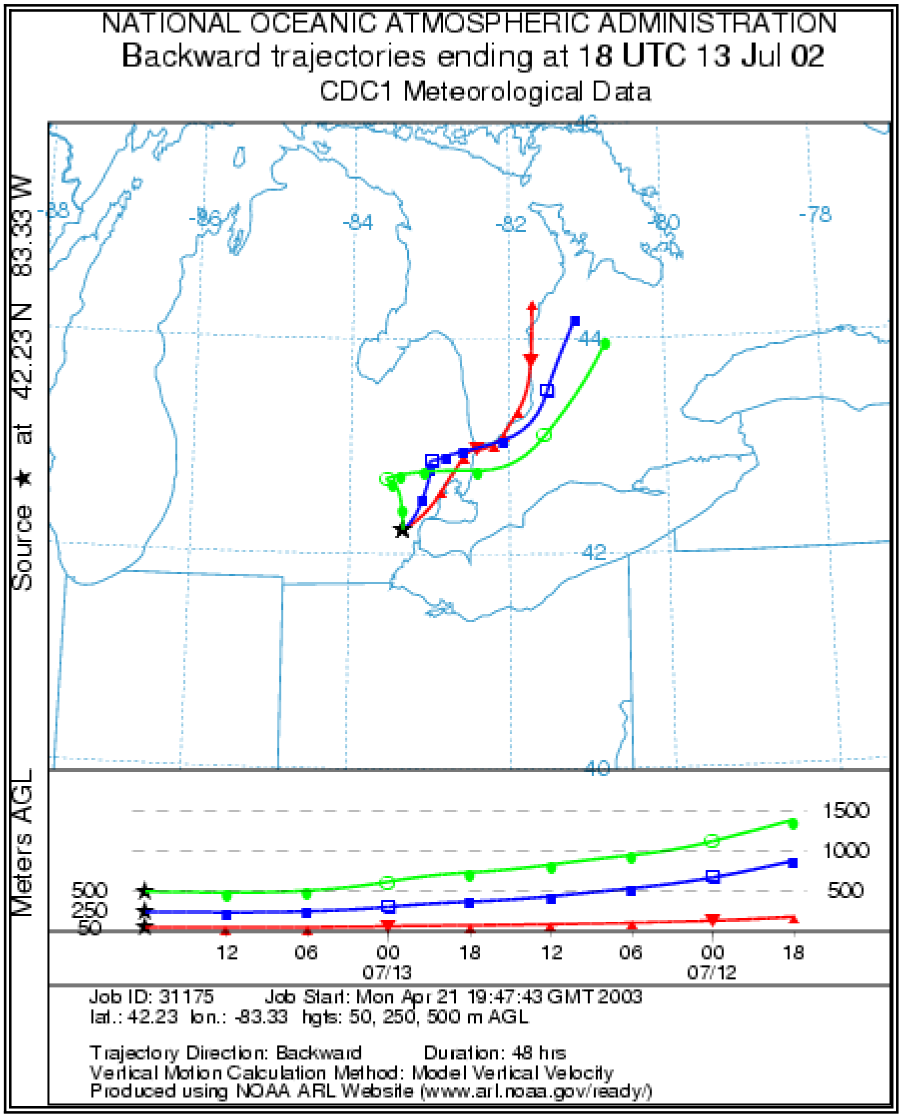


Figure 8-15. Back Trajectory Map Corresponding to LOMI's Highest Concentration

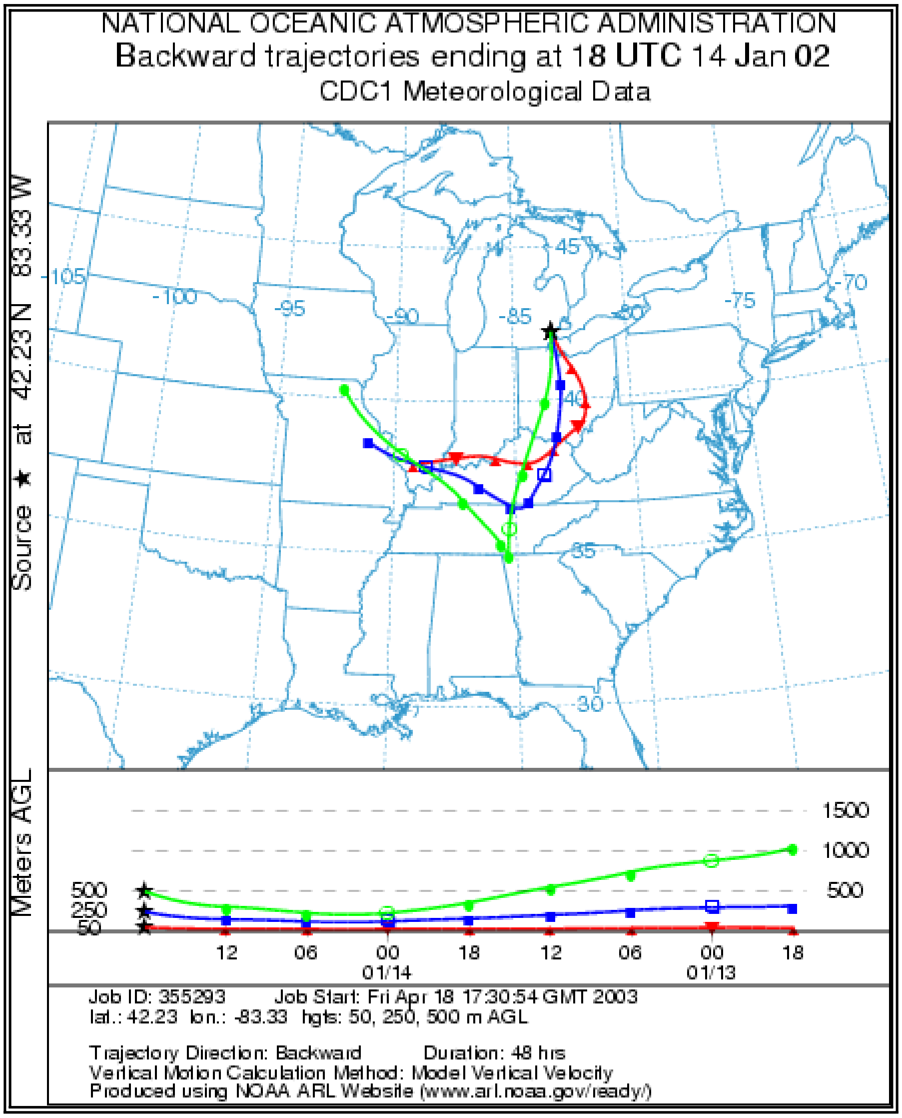
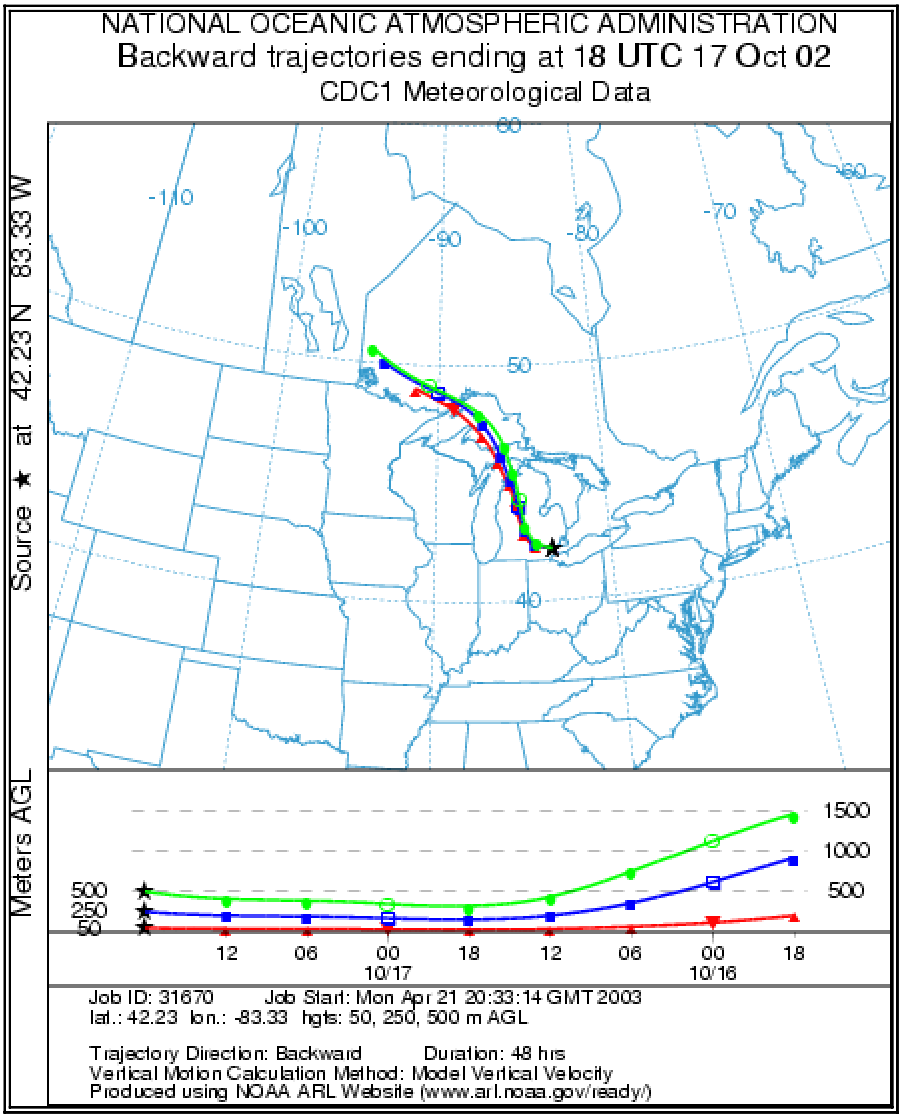


Figure 8-16. Back Trajectory Map Corresponding to SWMI's Highest Concentration



Job ID: 31670 Job Start: Mon Apr 21 20:33:14 GMT 2003
lat.: 42.23 lon.: -83.33 hgts: 50, 250, 500 m AGL

Trajectory Direction: Backward Duration: 48 hrs
Vertical Motion Calculation Method: Model Vertical Velocity
Produced using NOAA ARL Website (www.arl.noaa.gov/ready/)

Figure 8-17. Back Trajectory Map Corresponding to YFMI's Highest Concentration

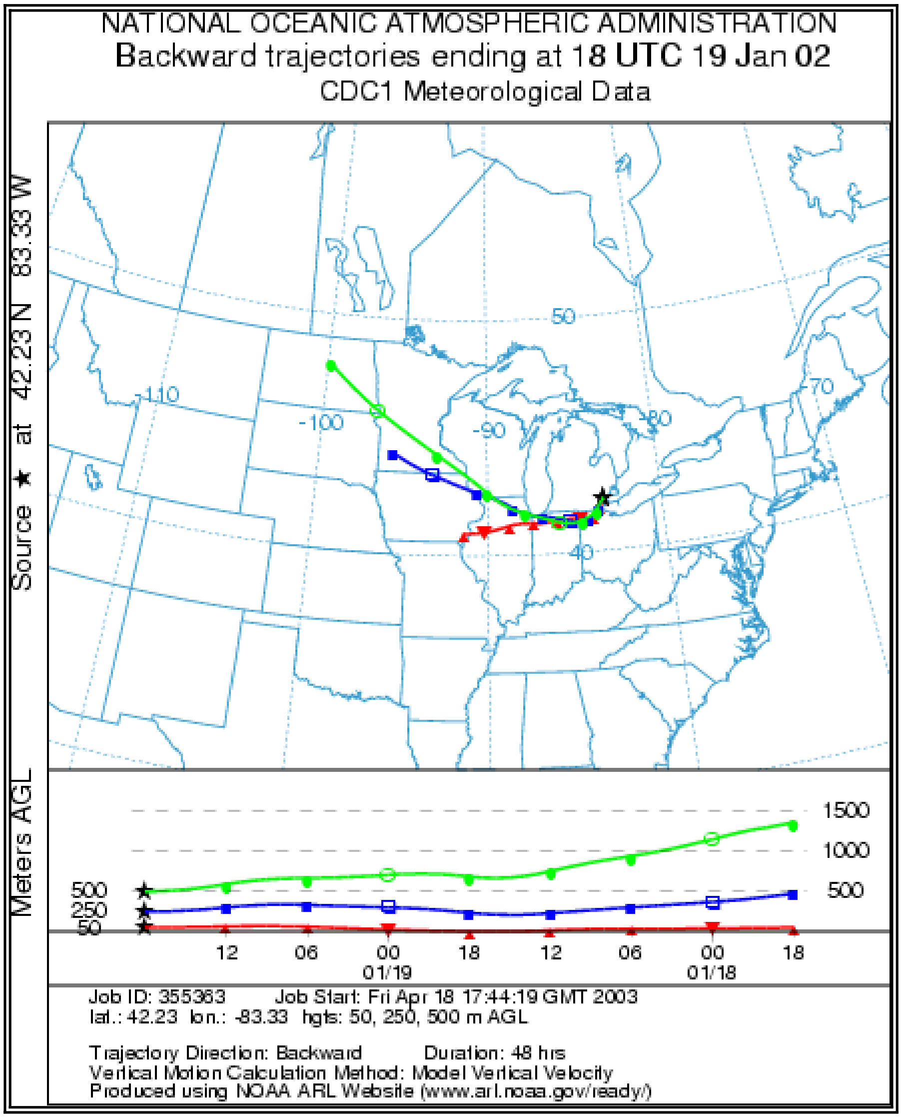


Figure 8-18. Back Trajectory Map Corresponding to HOMI's Highest Concentration

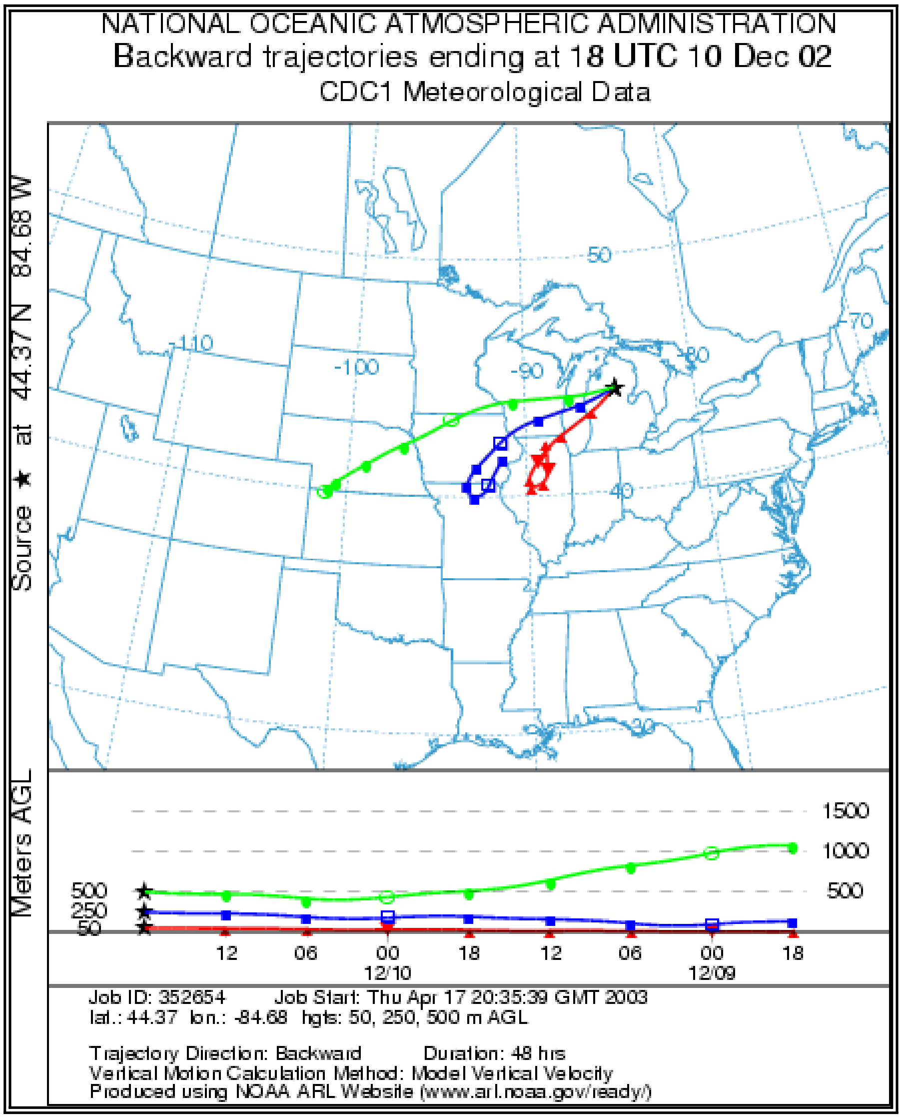


Table 8-1. Average Concentration and Meteorological Parameters for Sites in Michigan

Site Name	Type	Average UATMP Concentration (ppbv)	Average Maximum Temperature (°F)	Average Temperature (°F)	Average Dewpoint Temperature (°F)	Average Wet Bulb Temperature (°F)	Average Relative Humidity (%)	Average Sea Level Pressure (mb)	Average u-component of the Wind (kts)	Average v-component of the Wind (kts)
APMI	All 2002	▨	59.05 (±2.09)	51.05 (±1.91)	41.34 (±1.82)	46.25 (±1.73)	71.79 (±1.09)	1018.7 (±9.21)	0.33 (±0.33)	4.22 (±0.25)
	sample day	38.34 (±33.40)	61.82 (±5.76)	53.29 (±5.45)	42.73 (±5.13)	47.99 (±4.88)	69.84 (±3.10)	1017.4 (±20.20)	1.26 (±1.04)	1.84 (±0.78)
DEMI	All 2002	▨	58.72 (±2.08)	51.53 (±1.91)	39.04 (±1.78)	45.58 (±1.68)	65.08 (±1.21)	1018.7 (±9.42)	0.18 (±0..32)	3.81 (±0.21)
	sample day	17.65 (±2.62)	49.99 (±3.03)	43.15 (±2.77)	30.88 (±2.49)	38.02 (±2.39)	64.45 (±1.96)	1019.4 (±15.46)	1.40 (±0.56)	1.10 (±0.35)
E7MI	All 2002	▨	58.72 (±2.08)	51.53 (±1.91)	39.04 (±1.78)	45.58 (±1.68)	65.08 (±1.21)	1018.7 (±9.42)	0.18 (±0.32)	3.81 (±0.21)
	sample day	32.62 (±7.79)	82.25 (±2.44)	73.18 (±1.72)	58.38 (±4.38)	64.30 (±1.98)	63.19 (±12.19)	1018.8 (±53.31)	-1.25 (±0.70)	0.08 (±1.01)
HOMI	All 2002	▨	53.98 (±2.18)	45.02 (±1.94)	36.37 (±1.80)	40.93 (±1.75)	74.56 (±1.03)	1018.9 (±10.48)	0.58 (±0.30)	3.67 (±0.21)
	sample day	7.93 (±2.04)	51.20 (±11.69)	43.16 (±9.81)	36.25 (±9.90)	40.07 (±9.32)	78.07 (±4.33)	1025.2 (±145.59)	1.83 (±1.82)	1.70 (±0.65)
LOMI	All 2002	▨	57.36 (±2.14)	49.37 (±1.94)	39.03 (±1.78)	44.30 (±1.72)	70.44 (±1.12)	1018.5 (±9.77)	0.45 (±0.32)	3.88 (±0.21)
	sample day	24.71 (±18.43)	44.58 (±5.02)	36.17 (±4.37)	26.14 (±4.59)	32.38 (±4.12)	69.01 (±4.83)	1017.0 (±32.30)	2.34 (±1.47)	2.19 (±1.04)
RRMI	All 2002	▨	58.72 (±2.08)	51.53 (±1.91)	39.04 (±1.78)	45.58 (±1.68)	65.08 (±1.21)	1018.7 (±9.42)	0.18 (±0.32)	3.81 (±0.21)
	sample day	10.19 (±3.85)	57.17 (±6.47)	50.13 (±6.15)	36.35 (±5.24)	43.58 (±5.19)	61.82 (±4.01)	1022.8 (±54.32)	1.31 (±1.13)	0.90 (±0.77)

Table 8-1. Average Concentration and Meteorological Parameters for Sites in Michigan (Continued)

Site Name	Type	Average UATMP Concentration (ppbv)	Average Maximum Temperature (°F)	Average Temperature (°F)	Average Dewpoint Temperature (°F)	Average Wet Bulb Temperature (°F)	Average Relative Humidity (%)	Average Sea Level Pressure (mb)	Average u-component of the Wind (kts)	Average v-component of the Wind (kts)
SWMI	All 2002	▨	58.72 (±2.08)	51.53 (±1.91)	39.04 (±1.78)	45.58 (±1.68)	65.08 (±1.21)	1018.7 (±9.42)	0.18 (±0.32)	3.81 (±0.21)
	sample day	13.49 (±3.31)	61.17 (±8.14)	54.51 (±7.32)	40.80 (±6.02)	47.52 (±6.09)	63.03 (±5.17)	1023.2 (±69.10)	0.96 (±1.28)	0.91 (±0.83)
YFMI	All 2002	▨	58.72 (±2.08)	51.53 (±1.91)	39.04 (±1.78)	45.58 (±1.68)	65.08 (±1.21)	1018.7 (±9.42)	0.18 (±032)	3.81 (±0.21)
	sample day	21.03 (±6.94)	45.65 (±4.32)	37.83 (±3.74)	24.40 (±3.04)	33.14 (±3.25)	59.78 (±4.57)	1017.2 (±31.25)	2.43 (±1.35)	1.94 (±1.14)

Table 8-2a - Prevalent Compound Concentration Correlations with Selected Meteorological Parameters at Allen Park in Detroit, Michigan (APMI)

Compound	Maximum Temperature	Average Temperature	Dew Point Temperature	Wet Bulb Temperature	Relative Humidity	Sea Level Pressure	u-component of wind speed	v-component of wind speed
1,2,4-Trimethylbenzene	0.49	0.46	0.41	0.43	-0.15	0.02	-0.24	-0.18
Acetylene	0.23	0.17	0.16	0.17	0.01	0.00	-0.15	0.15
Benzene	0.38	0.34	0.29	0.31	-0.14	0.01	-0.16	-0.05
Chloromethane	0.35	0.34	0.35	0.35	0.02	-0.07	-0.27	-0.16
Dichlorodifluoromethane	0.39	0.39	0.38	0.38	-0.06	-0.08	-0.41	-0.31
Ethylbenzene	-0.08	-0.12	-0.10	-0.11	0.02	-0.11	0.06	0.60
Formaldehyde	-0.49	-0.31	-0.21	-0.27	0.18	0.28	-0.19	-0.30
m-,*p* - Xylene	-0.09	-0.13	-0.12	-0.13	0.02	-0.10	0.06	0.60
o - Xylene	-0.06	-0.10	-0.09	-0.10	0.00	-0.11	0.05	0.59
Propylene	0.32	0.28	0.24	0.25	-0.11	0.01	-0.24	0.06
Toluene	0.48	0.48	0.42	0.45	-0.18	-0.01	-0.08	-0.20
Trichlorofluoroethane	0.08	0.10	0.13	0.11	0.16	-0.16	-0.21	0.09

Table 8-2b - Prevalent Compound Concentration Correlations with Selected Meteorological Parameters at Dearborn in Detroit, Michigan (DEMI)

Compound	Maximum Temperature	Average Temperature	Dew Point Temperature	Wet Bulb Temperature	Relative Humidity	Sea Level Pressure	u-component of wind speed	v-component of wind speed
1,2,4-Trimethylbenzene	0.40	0.42	0.44	0.42	0.02	0.01	-0.20	-0.12
Acetylene	0.11	0.09	0.11	0.09	0.08	-0.04	-0.13	0.04
Benzene	0.39	0.38	0.40	0.39	0.02	0.07	-0.19	0.02
Chloromethane	0.41	0.43	0.43	0.47	-0.08	-0.05	-0.26	-0.13
Dichlorodifluoromethane	0.37	0.40	0.41	0.44	-0.04	-0.09	-0.13	-0.15
Ethylbenzene	0.26	0.25	0.26	0.27	-0.02	0.02	-0.15	-0.06
Formaldehyde	0.34	0.35	0.36	0.36	0.00	0.03	-0.10	0.11
m-,p - Xylene	0.28	0.28	0.28	0.29	-0.03	0.04	-0.15	-0.04
o - Xylene	0.37	0.39	0.42	0.41	0.06	0.07	-0.20	-0.09
Propylene	0.20	0.17	0.13	0.16	-0.14	0.01	-0.03	0.21
Toluene	0.32	0.32	0.39	0.36	0.14	0.01	-0.18	-0.09
Trichlorofluoroethane	0.04	0.08	0.12	0.11	0.09	-0.03	-0.14	-0.19

Table 8-2c - Prevalent Compound Concentration Correlations with Selected Meteorological Parameters at E7 Mile in Detroit, Michigan (E7MI)

Compound	Maximum Temperature	Average Temperature	Dew Point Temperature	Wet Bulb Temperature	Relative Humidity	Sea Level Pressure	u-component of wind speed	v-component of wind speed
1,2,4-Trimethylbenzene	0.76	0.81	-1.00	-0.97	-0.99	0.24	-0.78	-0.64
Acetylene	0.63	0.72	-0.95	-0.93	-0.92	-0.06	-0.57	-0.51
Benzene	0.84	0.88	-0.98	-0.92	-1.00	0.30	-0.80	-0.59
Chloromethane	0.30	0.16	0.38	0.49	0.19	0.44	-0.04	0.35
Dichlorodifluoromethane	0.96	0.94	-0.78	-0.67	-0.89	0.47	-0.78	-0.39
Ethylbenzene	0.84	0.87	-0.97	-0.92	-1.00	0.33	-0.82	-0.61
m-,p - Xylene	0.86	0.90	-0.97	-0.91	-1.00	0.27	-0.78	-0.55
o - Xylene	0.87	0.90	-0.96	-0.90	-1.00	0.30	-0.80	-0.56
Propylene	0.63	0.69	-0.99	-1.00	-0.95	0.22	-0.77	-0.72
Toluene	0.47	0.50	-0.90	-0.94	-0.83	0.56	-0.93	-0.93
Trichlorofluoroethane	0.90	0.83	-0.60	-0.50	-0.73	0.64	-0.78	-0.36

Table 8-2d - Prevalent Compound Concentration Correlations with Selected Meteorological Parameters at Houghton Lake, Michigan (HOMI)

Compound	Maximum Temperature	Average Temperature	Dew Point Temperature	Wet Bulb Temperature	Relative Humidity	Sea Level Pressure	u-component of wind speed	v-component of wind speed
1,2,4-Trimethylbenzene	N/A*	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Acetylene	0.35	0.26	0.24	0.24	0.00	-0.14	-0.25	-0.03
Benzene	-0.41	-0.37	-0.38	-0.37	-0.28	-0.25	0.25	0.17
Chloromethane	-0.41	-0.39	-0.43	-0.41	-0.47	-0.26	0.18	0.10
Dichlorodifluoromethane	0.22	0.13	0.06	0.10	-0.33	-0.26	-0.84	-0.27
Ethylbenzene	N/A*	N/A	N/A	N/A	N/A	N/A	N/A	N/A
m-,*p* - Xylene	-0.39	-0.45	-0.46	-0.46	-0.25	-0.16	0.30	0.14
o - Xylene	0.42	0.33	0.32	0.32	0.06	-0.02	-0.37	-0.04
Propylene	0.42	0.42	0.36	0.39	-0.20	-0.14	-0.44	0.44
Toluene	0.15	0.06	0.00	0.02	-0.42	-0.29	-0.14	0.54
Trichlorofluoroethane	-0.08	-0.19	-0.24	-0.22	-0.32	-0.25	-0.57	-0.04

*These compounds had no reportable values, only non-detects, and therefore have no correlations.

Table 8-2e - Prevalent Compound Concentration Correlations with Selected Meteorological Parameters at Lodge in Detroit, Michigan (LOMI)

Compound	Maximum Temperature	Average Temperature	Dew Point Temperature	Wet Bulb Temperature	Relative Humidity	Sea Level Pressure	u-component of wind speed	v-component of wind speed
1,2,4-Trimethylbenzene	-0.04	0.07	0.29	0.16	0.58	-0.48	-0.52	0.22
Acetylene	0.04	0.04	0.09	0.05	0.13	-0.40	-0.14	0.32
Benzene	0.00	0.09	0.27	0.17	0.48	-0.45	-0.36	0.22
Chloromethane	0.60	0.60	0.66	0.64	0.36	-0.24	-0.23	0.20
Dichlorodifluoromethane	-0.01	0.03	0.12	0.05	0.23	-0.54	0.03	0.63
Ethylbenzene	0.09	0.18	0.38	0.26	0.55	-0.48	-0.50	0.22
Formaldehyde	0.33	0.37	0.48	0.43	0.30	-0.42	-0.52	0.26
m-,p - Xylene	-0.02	0.10	0.27	0.17	0.47	-0.59	-0.43	0.35
o - Xylene	-0.07	0.00	0.17	0.07	0.43	-0.38	-0.46	0.20
Propylene	0.08	0.18	0.36	0.26	0.51	-0.47	-0.54	0.26
Toluene	0.06	0.18	0.35	0.25	0.50	-0.52	-0.49	0.38
Trichlorofluoroethane	-0.07	-0.07	-0.03	-0.07	0.07	-0.39	0.32	0.59

Table 8-2f - Prevalent Compound Concentration Correlations with Selected Meteorological Parameters at River Rouge in Detroit, Michigan (RRMI)

Compound	Maximum Temperature	Average Temperature	Dew Point Temperature	Wet Bulb Temperature	Relative Humidity	Sea Level Pressure	u-component of wind speed	v-component of wind speed
1,2,4-Trimethylbenzene	-0.60	-0.57	-0.49	-0.55	0.69	0.29	0.16	-0.25
Acetylene	-0.38	-0.43	-0.46	-0.45	0.23	-0.13	0.29	-0.04
Benzene	-0.66	-0.65	-0.65	-0.66	0.43	0.04	0.14	-0.46
Chloromethane	0.45	0.48	0.59	0.51	0.28	0.22	-0.45	-0.42
Dichlorodifluoromethane	0.12	0.13	0.15	0.13	0.06	-0.44	-0.01	0.38
Ethylbenzene	-0.55	-0.55	-0.51	-0.55	0.55	0.08	0.35	-0.15
Formaldehyde	0.35	0.34	0.27	0.31	-0.30	-0.14	-0.18	-0.18
m-,p - Xylene	-0.52	-0.51	-0.46	-0.51	0.55	0.10	0.21	-0.25
o - Xylene	-0.52	-0.53	-0.48	-0.52	0.56	0.10	0.28	-0.21
Propylene	-0.71	-0.65	-0.57	-0.64	0.72	0.10	0.16	-0.12
Toluene	-0.51	-0.51	-0.50	-0.52	0.44	0.03	0.16	-0.25
Trichlorofluoroethane	-0.27	-0.32	-0.28	-0.32	0.41	-0.06	0.47	0.30

Table 8-2g - Prevalent Compound Concentration Correlations with Selected Meteorological Parameters at South West High School in Detroit, Michigan (SWMI)

Compound	Maximum Temperature	Average Temperature	Dew Point Temperature	Wet Bulb Temperature	Relative Humidity	Sea Level Pressure	u-component of wind speed	v-component of wind speed
1,2,4-Trimethylbenzene	0.03	0.03	-0.16	-0.06	-0.49	-0.38	0.15	-0.39
Acetylene	-0.16	-0.12	-0.03	-0.07	0.32	0.57	0.14	0.26
Benzene	0.03	0.05	0.23	0.15	0.50	0.89	0.19	0.49
Chloromethane	0.26	0.27	0.27	0.27	-0.10	0.26	-0.12	0.20
Dichlorodifluoromethane	0.06	0.04	-0.02	0.02	-0.21	-0.07	-0.14	-0.16
Ethylbenzene	-0.22	-0.23	-0.31	-0.26	-0.11	-0.21	0.21	-0.32
Formaldehyde	0.64	0.62	0.54	0.59	-0.42	-0.19	-0.23	-0.17
m-,*p* - Xylene	-0.20	-0.20	-0.28	-0.24	-0.14	-0.19	0.22	-0.31
o - Xylene	-0.17	-0.17	-0.27	-0.22	-0.19	-0.28	0.21	-0.32
Propylene	-0.26	-0.25	-0.39	-0.32	-0.26	-0.29	0.29	-0.24
Toluene	-0.19	-0.18	-0.26	-0.22	-0.14	-0.10	0.21	-0.27
Trichlorofluoroethane	0.43	0.43	0.34	0.38	-0.39	-0.17	0.02	-0.06

Table 8-2h - Prevalent Compound Concentration Correlations with Selected Meteorological Parameters at Yellow Freight, Michigan (YFMI)

Compound	Maximum Temperature	Average Temperature	Dew Point Temperature	Wet Bulb Temperature	Relative Humidity	Sea Level Pressure	u-component of wind speed	v-component of wind speed
1,2,4-Trimethylbenzene	0.28	0.32	0.34	0.40	-0.14	-0.25	-0.29	0.49
Acetylene	0.03	0.05	0.14	0.04	0.16	0.13	-0.29	-0.01
Benzene	0.28	0.34	0.33	0.39	-0.19	-0.24	-0.22	0.41
Chloromethane	0.66	0.64	0.69	0.67	-0.07	-0.41	-0.37	0.09
Dichlorodifluoromethane	0.08	0.05	0.09	0.18	-0.05	-0.59	0.25	0.66
Ethylbenzene	0.35	0.40	0.37	0.46	-0.24	-0.27	-0.22	0.49
Formaldehyde	0.14	0.10	-0.04	0.04	-0.17	0.37	0.10	-0.45
m-,*p* - Xylene	0.32	0.37	0.35	0.43	-0.22	-0.25	-0.22	0.47
o - Xylene	0.32	0.37	0.34	0.42	-0.22	-0.21	-0.23	0.46
Propylene	-0.09	-0.06	0.02	-0.01	0.11	-0.06	-0.02	0.32
Toluene	0.35	0.40	0.36	0.45	-0.25	-0.26	-0.20	0.48
Trichlorofluoroethane	-0.20	-0.28	-0.29	-0.20	-0.01	-0.05	0.53	0.44

Table 8-3 - Hexavalent Chromium Concentration Correlations with Selected Meteorological Parameters with the Michigan Sites

Site	Maximum Temperature	Average Temperature	Dew Point Temperature	Wet Bulb Temperature	Relative Humidity	Sea Level Pressure	u-component of wind speed	v-component of wind speed
APMI	0.23	0.30	0.58	0.45	0.78	-0.33	-0.58	-0.41
DEMI	0.11	0.08	0.26	0.22	0.23	-0.42	-0.14	0.28
LOMI	0.36	0.40	0.69	0.54	0.84	-0.33	-0.30	0.10
RRMI	0.65	0.68	0.66	0.69	-0.14	-0.07	-0.52	-0.09

Table 8-4. TNMOC, SVOC, Hexavalent Chromium, Metal, and Ozone Measured by the Michigan Monitoring Stations

Monitoring Station	TNMOC speciated (ppbC)	TNMOC w/ unknowns (ppbC)	% of TNMOC identified	SNMOC Compound with the Highest Concentration (ppbC)	Average Hexavalent Chromium Concentration (ng/m^3)	Average Metal Concentration (ng/filter)	Average Ozone Concentration (ppbv)	Total Number of Ozone Sampling Days	Average SVOC Concentration (μg/m^3)
APMI	N/A	N/A	N/A	N/A	0.042 (±0.028)	N/A	N/A	N/A	3.93 (±0.09)
DEMI	N/A	N/A	N/A	N/A	0.029 (±0.018)	N/A	N/A	N/A	4.19 (±0.19)
E7MI	230.35 (±118.83)	307.47 (±127.71)	69%	ethane 24.28	N/A	N/A	51.45 (±2.79)	183	3.96 (±0.10)
LOMI	N/A	N/A	N/A	N/A	0.052 (±0.029)	N/A	N/A	N/A	3.95 (±0.11)
RRMI	N/A	N/A	N/A	N/A	0.055 (±0.020)	N/A	N/A	N/A	3.87 (±0.20)
SWMI	N/A	N/A	N/A	N/A	N/A	155,107.63 (±45898.47)	N/A	N/A	4.42 (±0.76)
YFMI	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	21.22 (±6.03)

Table 8-5. Average UATMP Concentrations By Wind Regime for the Detroit Sites

Wind Regime	**APMI**		**DEMI**		**E7MI**		**LOMI**		**RRMI**		**SWMI**		**YFMI**	
	24 hr	**48 hr**	**24 hr**	**48 hr**	**24 hr**	**48 hr**	**24 hr**	**48 hr**	**24 hr**	**48 hr**	**24 hr**	**48 hr**	**24 hr**	**48 hr**
North	7.87	6.42	7.18	6.05	19.61*	ND	5.48	4.91	12.52*	2.82	7.78	4.03	8.28	6.46
Northeast	8.50	8.68	8.85	8.29	16.89	19.61*	ND	6.06	3.57	17.50*	5.16	11.54	ND	10.10
East	2.85	11.94	3.98	28.13*	ND	16.89	ND	ND	3.92	4.86	8.76	5.70	ND	ND
Southeast	ND	25.01*	12.78*	11.33	ND	ND	ND	6.33	9.02	4.62	4.02	ND	ND	33.07
South	10.17*	2.99	9.91	9.69	ND	ND	8.30*	7.73*	4.04	3.75	17.23*	17.23*	30.83*	45.88*
Southwest	4.93	3.73	6.66	6.92	ND	ND	5.07	6.35	5.62	6.19	12.23	8.06	11.23	12.80
West	6.76	ND	6.64	7.66	ND	ND	4.26	ND	3.86	ND	7.41	12.51	5.66	ND
Northwest	1.85	5.57	6.24	6.12	ND	ND	4.56	4.68	4.91	4.58	8.91	8.22	6.36	6.04

ND = Not Detected

* = Highest for that site

Table 8-6. Average UATMP Concentrations By Wind Regime for the Houghton Lake Site

Wind Regime	HOMI	
	24 hr	**48 hr**
North	3.23	3.07
Northeast	ND	ND
East	ND	ND
Southeast	ND	ND
South	2.12	2.12
Southwest	3.53*	3.65*
West	ND	3.31
Northwest	2.94	3.03

ND = Not Detected
* = Highest for the site

Table 8-7. Motor Vehicle Information vs. Daily Concentration for Michigan Monitoring Sites

Monitoring Station	Population within Ten Miles	Estimated Number of Motor Vehicles Owned	Traffic Data (Daily Average)	Average Daily UATMP Concentration (ppbv)
APMI	1,024,363	758,029	60,000	38.34 (±33.60)
DEMI	1,225,014	906,510	12,791	17.65 (±2.62)
E7MI	1,167,765	864,146	6,999	32.62 (±7.79)
HOMI	10,391	7,689	7,000	7.93 (±2.04)
LOMI	1,146,230	848,210	100,000	24.71 (±18.43)
RRMI	893,937	661,513	500	10.19 (±3.85)
SWMI	1,179,491	872,823	18,437	13.49 (±3.31)
YFMI	1,179,491	872,823	500	21.03 (±6.94)

Table 8-8. Summary of Future Regulations That May be Applicable for Nearby Facilities Surrounding APMI

Facility Name	Primary SIC Code	SIC Code Description	Regulation Citation	Regulation Name
Autoalliance International, Inc.	3711	Transportation Equipment, Motor Vehicles and Equipment, Motor Vehicles and Car Bodies	40 CFR part 63, subpart IIII	National Emission Standards for Hazardous Air Pollutants from Surface Coating of Automobiles and Light-Duty Trucks (proposed rule)
Ford Motor Co. Dearborn Assembly Plant				
GMC MLCG Hamtramck Assembly Plant				
DaimlerChrysler AG, Warren Truck Assembly Plant				
Wolverine Coil Coating Inc.	3479	Fabricated Metal Products, Metal Services, Nec, Metal Coating and Allied Services	40 CFR part 63, subpart SSSS	National Emission Standards for Hazardous Air Pollutants from Surface Coating of Metal Coil (proposed rule)
Crown Group Detroit, MI Plant				

Table 8-9. Summary of Future Regulations That May be Applicable for Nearby Facilities Surrounding DEMI

Facility Name	Primary SIC Code	SIC Code Description	Regulation Citation	Regulation Name
Ford Motor Co. Dearborn Assembly Plant	3711	Transportation Equipment, Motor Vehicles and Equipment, Motor Vehicles and Car Bodies	40 CFR part 63, subpart IIII	National Emission Standards for Hazardous Air Pollutants from Surface Coating of Automobiles and Light-Duty Trucks (proposed rule)
GMC MLCG Hamtramck Assembly Plant				
DaimlerChrysler AG, Warren Truck Assembly Plant				
Wolverine Coil Coating Inc.	3479	Fabricated Metal Products, Metal Services, Nec, Metal Coating and Allied Services	40 CFR part 63, subpart SSSS	National Emission Standards for Hazardous Air Pollutants from Surface Coating of Metal Coil (proposed rule)
Crown Group Detroit, MI Plant				

Table 8-10. Summary of Future Regulations That May be Applicable for Nearby Facilities Surrounding E7MI

Facility Name	Primary SIC Code	SIC Code Description	Regulation Citation	Regulation Name
DaimlerChrysler AG, Warren Truck Assembly Plant	3711	Transportation Equipment, Motor Vehicles and Equipment, Motor Vehicles and Car Bodies	40 CFR part 63, subpart IIII	National Emission Standards for Hazardous Air Pollutants from Surface Coating of Automobiles and Light-Duty Trucks (proposed rule)
GMC MLCG Hamtramck Assembly Plant				
E/M Corporation	3479	Fabricated Metal Products, Metal Services, Nec, Metal Coating and Allied Services	40 CFR part 63, subpart SSSS	National Emission Standards for Hazardous Air Pollutants from Surface Coating of Metal Coils
Adelphia, Inc.				
Hi-Tech Coatings, Inc.				
Cambridge Industries, Inc.	3089	Rubber And Misc. Plastics Products, Miscellaneous Plastics Products, Nec, Plastics Products, Nec	40 CFR part 63, subpart WWWW	National Emission Standards for Hazardous Air Pollutants from Reinforced Plastic Composites Production (proposed rule)
Uni-Bond Brake, Inc.	3714	Transportation Equipment, Motor Vehicles and Equipment, Motor Vehicle Parts and Accessories	40 CFR part 63, subpart MMMM	National Emission Standards for Hazardous Air Pollutants from Surface Coating of Miscellaneous Metal Parts and Products (proposed rule)

Table 8-11. Summary of Future Regulations That May be Applicable for Nearby Facilities Surrounding RRMI

Facility Name	Primary SIC Code	SIC Code Description	Regulation Citation	Regulation Name
Ford Motor Co. Dearborn Assembly Plant	3711	Transportation Equipment, Motor Vehicles and Equipment, Motor Vehicles and Car Bodies	40 CFR part 63, subpart IIII	National Emission Standards for Hazardous Air Pollutants from Surface Coating of Automobiles and Light-Duty Trucks (proposed rule)
DaimlerChrysler AG, Warren Truck Assembly Plant				
Wolverine Coil Coating Inc.	3479	Fabricated Metal Products, Metal Services, Nec, Metal Coating and Allied Services	40 CFR part 63, subpart SSSS	National Emission Standards for Hazardous Air Pollutants from Surface Coating of Metal Coil (proposed rule)
Crown Group Detroit, MI Plant				

Table 8-12. Summary of Future Regulations That May be Applicable for Nearby Facilities Surrounding SWMI and YFMI

Facility Name	Primary SIC Code	SIC Code Description	Regulation Citation	Regulation Name
Ford Motor Co. Dearborn Assembly Plant	3711	Transportation Equipment, Motor Vehicles and Equipment, Motor Vehicles and Car Bodies	40 CFR part 63, subpart IIII	National Emission Standards for Hazardous Air Pollutants from Surface Coating of Automobiles and Light-Duty Trucks (proposed rule)
GMC MLCG Hamtramck Assembly Plant				
DaimlerChrysler AG, Warren Truck Assembly Plant				
Wolverine Coil Coating Inc.	3479	Fabricated Metal Products, Metal Services, Nec, Metal Coating and Allied Services	40 CFR part 63, subpart SSSS	National Emission Standards for Hazardous Air Pollutants from Surface Coating of Metal Coil (proposed rule)
Crown Group Detroit, MI Plant				

9.0 Sites in Mississippi

This section focuses on meteorological, concentration, and spatial trends for the four UATMP sites in Mississippi (GPMS, JAMS, PGMS, and TUMS). All four of these sites are located in different cities in Mississippi: Gulf Port; Jackson; Pascagoula; and Tupelo. Figures 9-1 through 9-4 are topographical maps showing the monitoring stations in their urban locations. Figures 9-5 through 9-8 are maps identifying facilities within ten miles of the sites that reported to the 1999 NEI. The GPMS and PGMS sites are the furthest south, with both locations along the Gulf Coast. Further east is PGMS, where the majority of the sources are located within a four mile radius of the monitoring station and are mostly chemical and surface coating facilities. GPMS is farther west along the Mississippi shoreline, and the few nearby sources, which are mainly involved in fuel combustion, are mainly to the north. JAMS, somewhat centrally located, also has few sites nearby. These sources are located to the southwest of the site and are mostly involved in surface coating processes. The industrial facilities within a ten mile radius of TUMS, which is located in northeast Mississippi, are mainly to the east of the site. A large number of the sources near the TUMS site are involved in rubber and plastic production.

Hourly meteorological data were retrieved for all of 2002 at four weather stations near these sites with the purpose of calculating correlations of meteorological data with ambient air concentration measurements. The weather observations were reported from each of the four cities' reporting stations (WBAN 93874, 3940, 53858, and 93862, respectively).

Table 9-1 highlights the average UATMP concentration at each site, along with temperature (average maximum and average), moisture (average dew point temperature, average wet-bulb temperature, and average relative humidity), wind information (average u- and v-components of the wind), and pressure (average sea level pressure) for the entire year and on days samples were taken. Climatologically, all four of the Mississippi cities can be considered warm and humid, especially Gulfport and Pascagoula, the two sites nearest the coast. Table 9-1 reflects this, as GPMS and PGMS have the highest maximum, average, dew point, and wet bulb temperatures and relative humidity. High temperatures and humidity, due to proximity to the Gulf of Mexico, can make the region very oppressive. Annual average wind direction tends to be from the east (PGMS) and southeast (GPMS, JAMS, and TUMS). This information can be found in The Weather Almanac, fifth edition (Ruffner and Bair, 1987).

9.1 Meteorological and Concentration Averages at the Mississippi Sites

Carbonyl compounds and VOC were measured at all of the sites, as indicated in Tables 3-3 and 3-4. JAMS and PGMS each sampled hydrocarbon compounds' geometric means nearly double that of the other sites (9.35 ppbv and 6.57 ppbv, respectively). JAMS also had the highest geometric means for carbonyl and polar compounds (6.57 ppbv and 26.58 ppbv, respectively). The range of the geometric means of the halogenated hydrocarbons was very small, with the lowest at PGMS (4.14 ppbv) and the highest at TUMS (4.68 ppbv). The average total UATMP daily concentration at TUMS was the lowest in comparison to the other three sites and was computed to be 22.85 (±6.44) ppbv. GPMS had the highest value with 65.42 (±39.86) ppbv, while the other sites' average daily concentration fell into the forties and fifties. Table 9-1 also lists the averages for selected meteorological parameters from January 2002 to December 2002, which is the same time period covered in this report.

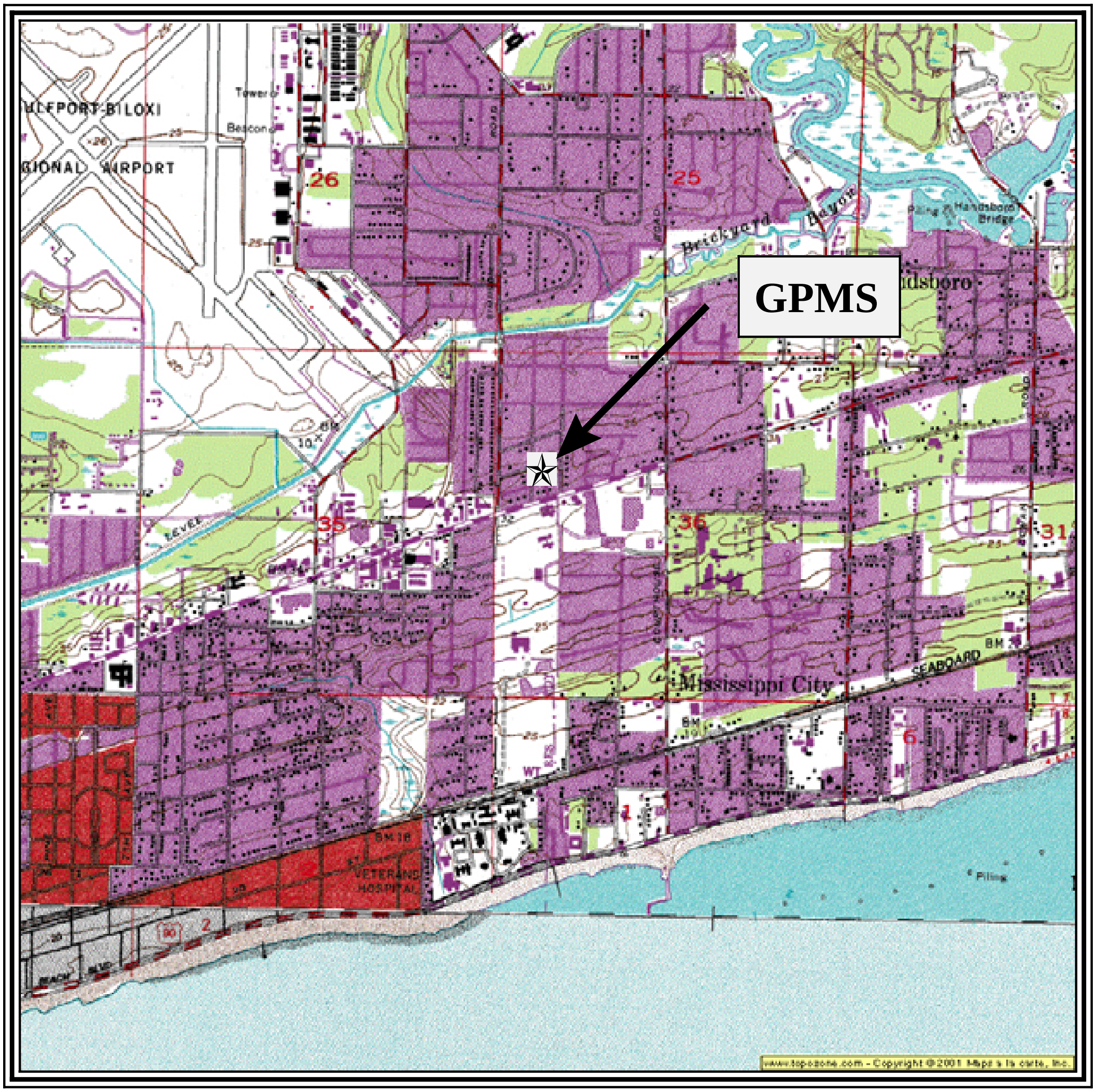
Tables 9-2a-d are the summary of calculated Pearson Correlation coefficients for each of the prevalent compounds and selected meteorological parameters by site. Identification of the prevalent compounds is discussed in Section 3 of this report. Formaldehyde and chloromethane had consistently moderately strong to strong positive correlations with the temperature parameters and two of the three moisture parameters (dew point and wet bulb temperatures) at all four Mississippi sites. Formaldehyde had the strongest correlation with maximum temperature at the TUMS site (0.81). Dichlorodifluoromethane and trichlorofluoromethane both had moderately strong positive correlations with these parameters as well. Acetylene and benzene had moderately strong to strong negative correlations with the same four parameters at both coastal sites. The compounds at the two coastal sites had mostly positive correlations with relative humidity. Otherwise, few patterns between the compounds and meteorological parameters exist, making it difficult to ascertain when UATMP concentrations will increase.

9.2 Spatial Analysis

Using the population within ten miles of each site, an estimate of the number of motor vehicles operating in proximity to the monitoring station can be established. The ratio used in this report is 0.74 motor vehicles to every one person (refer to section 3.4.1 for more information on this ratio). The population near the JAMS site is 262,477 people, all of whom are operating approximately 194,233 vehicles. This site had the largest population (and most motor vehicles) of the four Mississippi sites. The site with the lowest population was PGMS, with a population of 58,345 people driving 43,175 motor vehicles. This information is compared to the average daily concentration of the prevalent compounds at each Mississippi site in Table 9-3. Also included in Table 9-3 are average daily traffic data, or more specifically, the average number of cars passing the monitoring sites on the nearest roadway to each site on a daily basis. The largest traffic flow near a monitoring station occurred at GPMS.

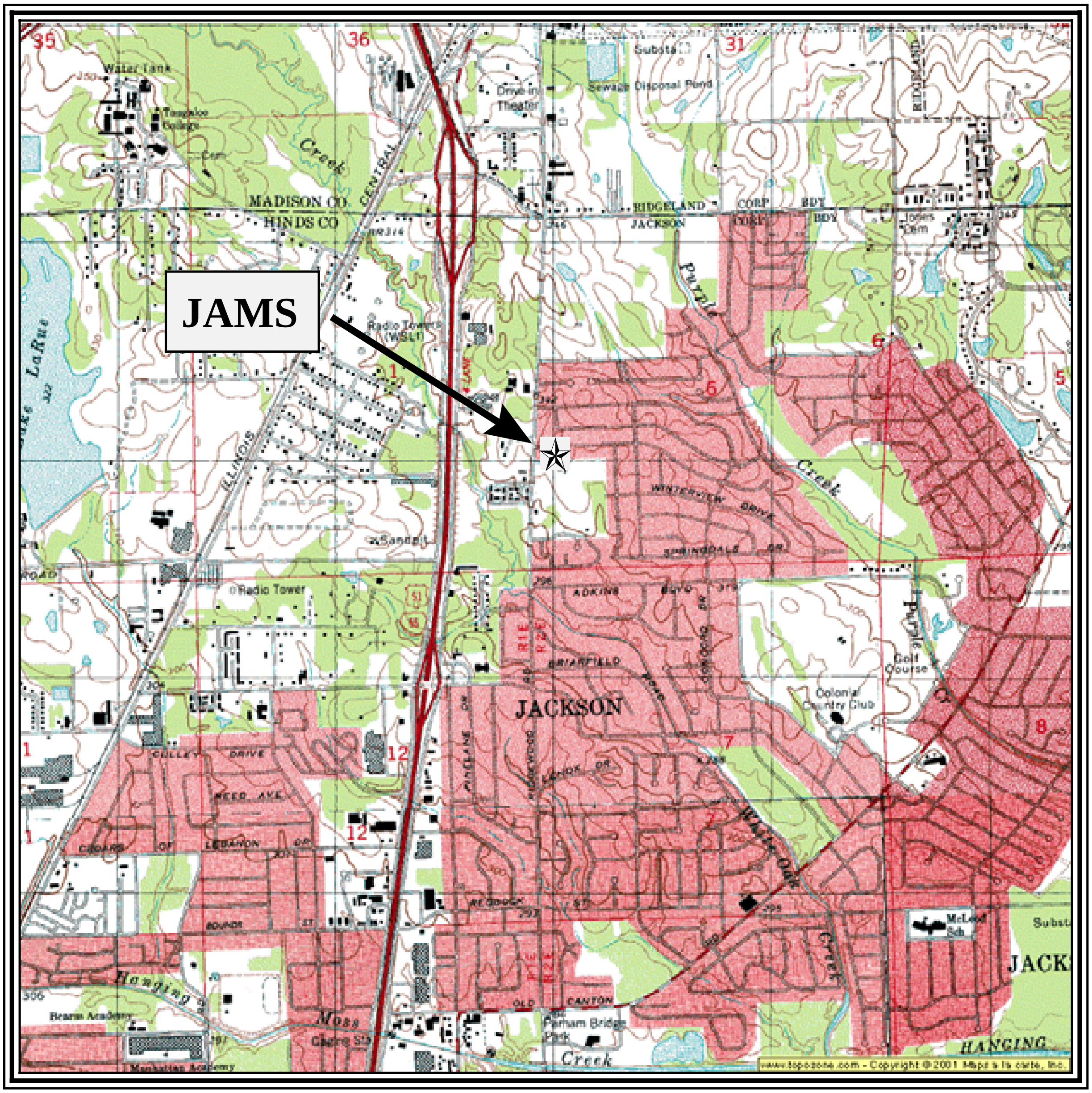
A roadside study conducted to measure emissions from motor vehicles determined that the concentration ratios of the BTEX compounds were relatively consistent from urban area to urban area. (For more information on this study, refer to section 3.4.2.) Figure 3-14 depicts the average concentration ratios of the roadside study and compares them to the concentration ratios at each of the monitoring sites. All four sites ratios looked relatively similar to those of the roadside study, although the toluene-ethylbenzene ratios at GPMS, JAMS, and TUMS exceeded those of the roadside study. Also, the benzene-ethylbenzene ratios at each of the Mississippi sites were all less than the roadside study’s benzene-ethylbenzene ratios.

Figure 9-1. Gulf Port, Mississippi (GPMS) Monitoring Station



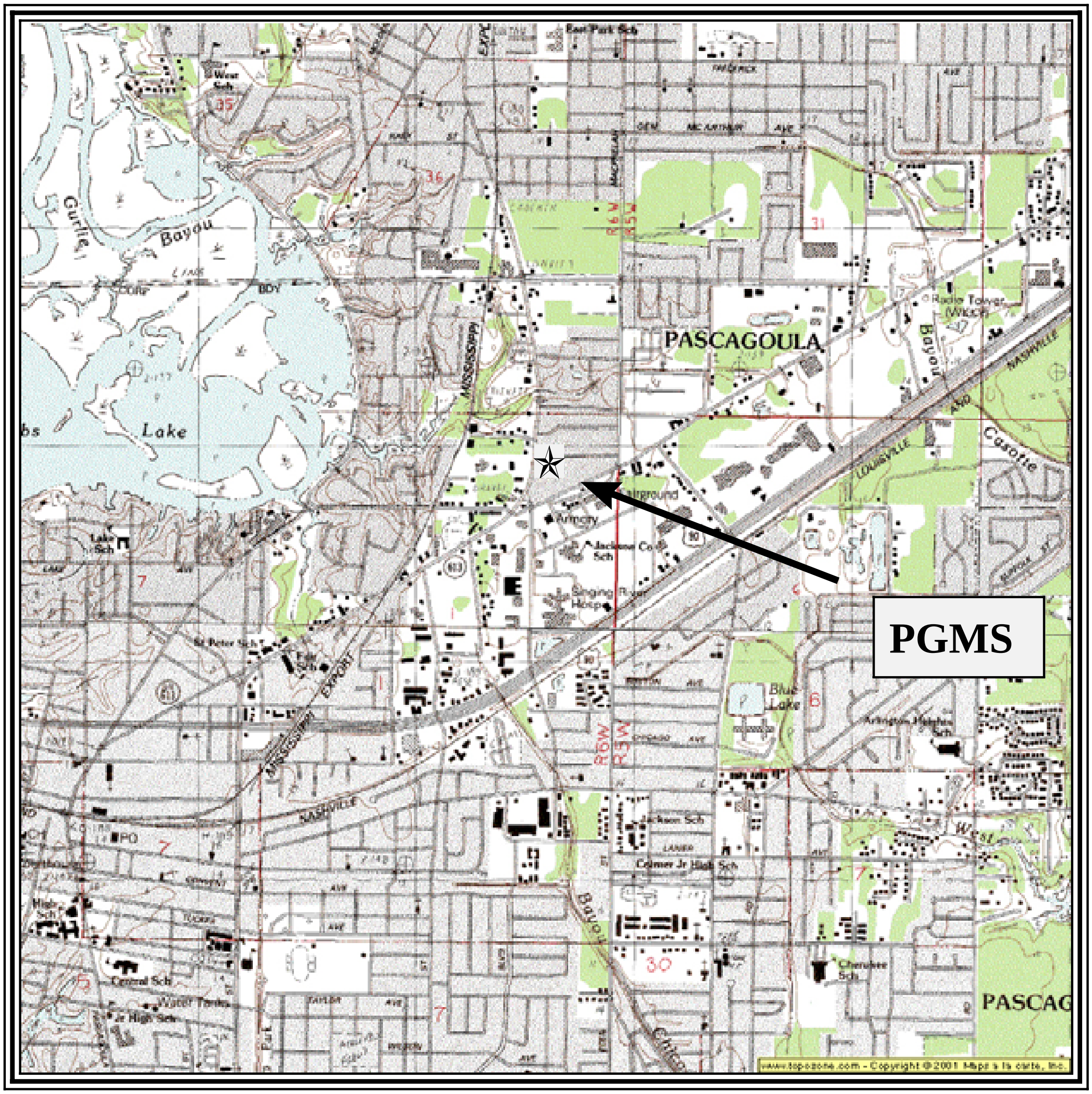
Source: USGS 7.5 Minute Series. Map Scale: 1:24,000.

Figure 9-2. Jackson, Mississippi (JAMS) Monitoring Station



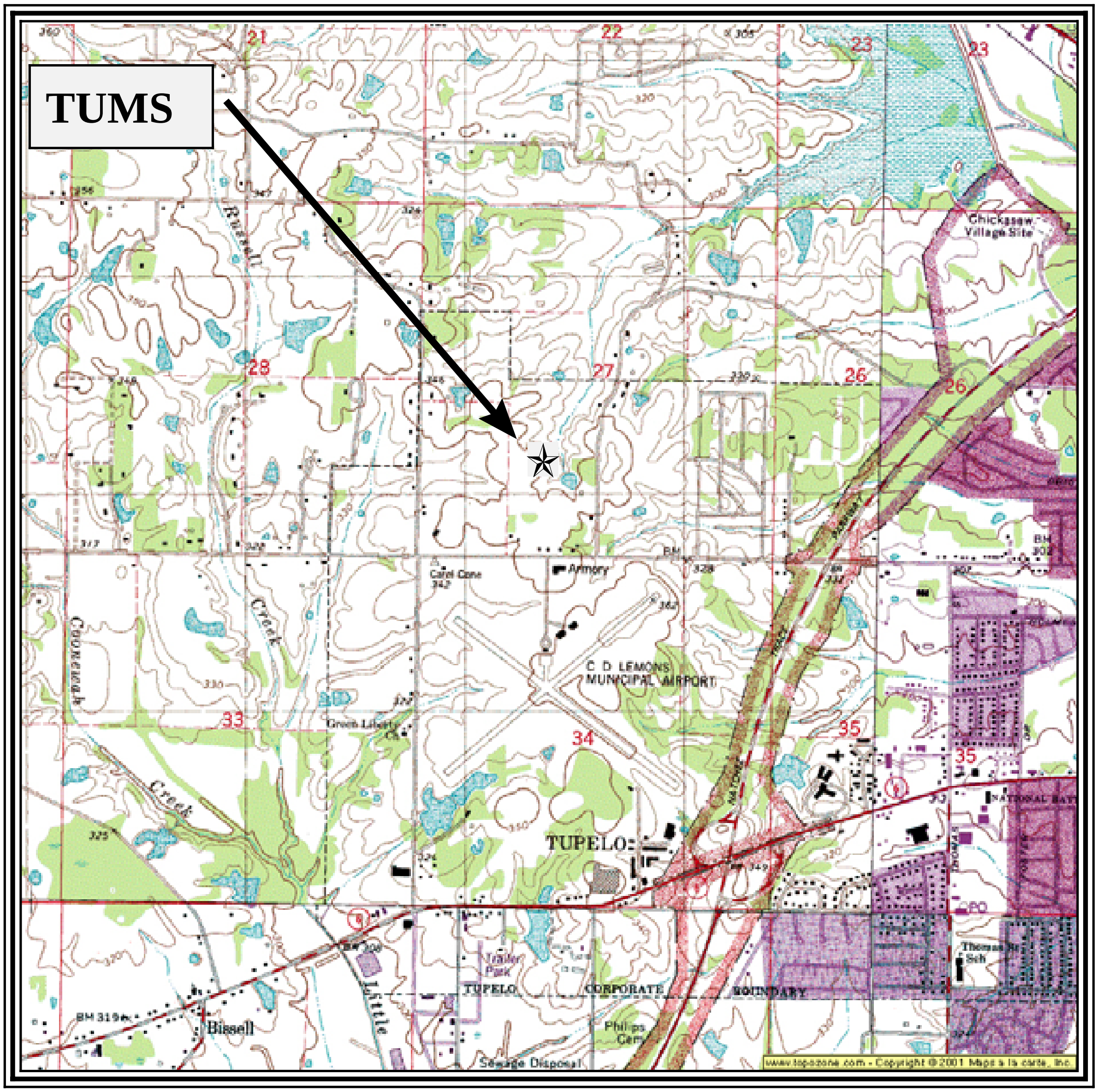
Source: USGS 7.5 Minute Series. Map Scale: 1:24,000.

Figure 9-3. Pascagoula, Mississippi (PGMS) Monitoring Station



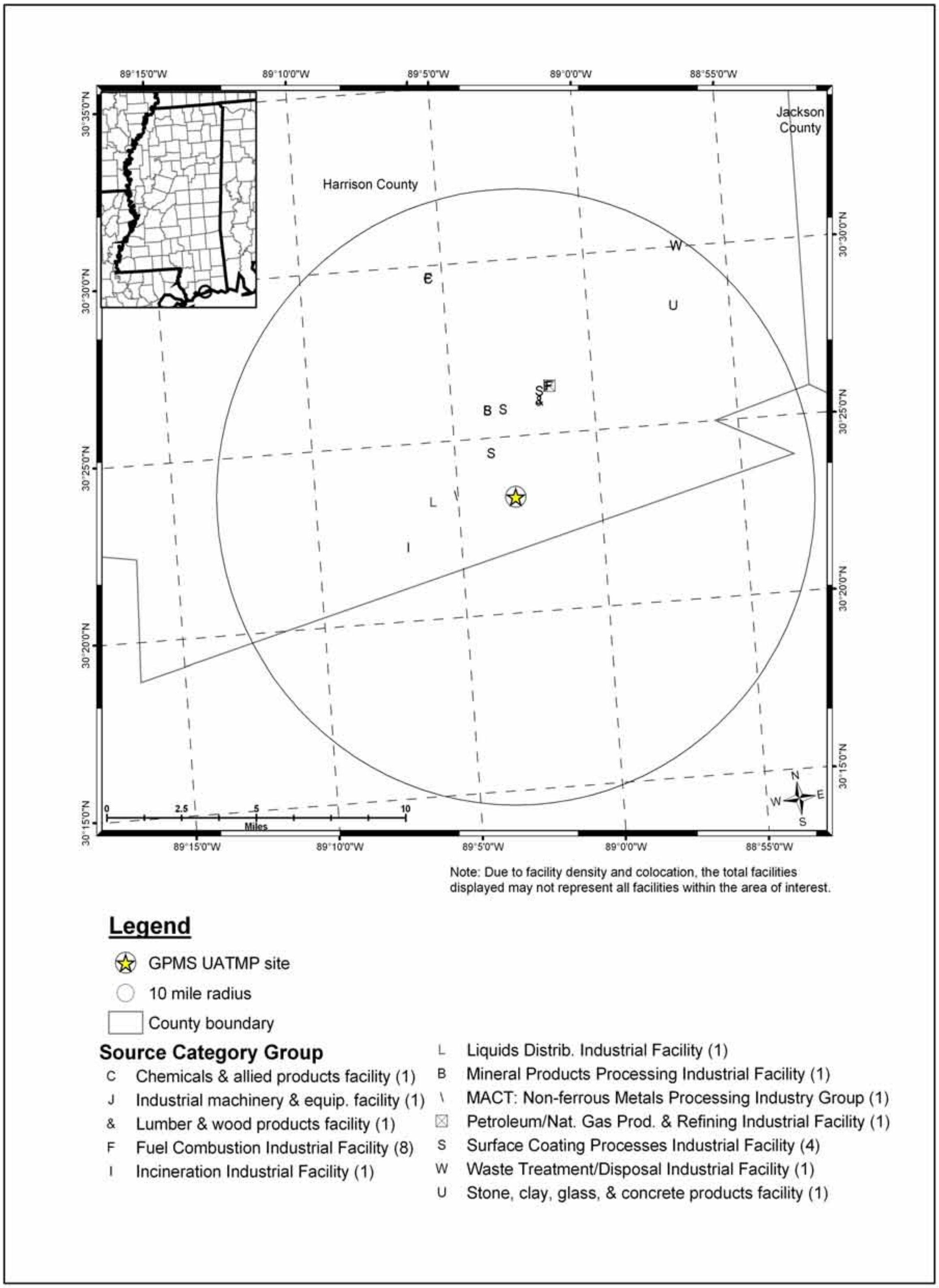
Source: USGS 7.5 Minute Series. Map Scale: 1:24,000.

Figure 9-4. Tupelo, Mississippi (TUMS) Monitoring Station



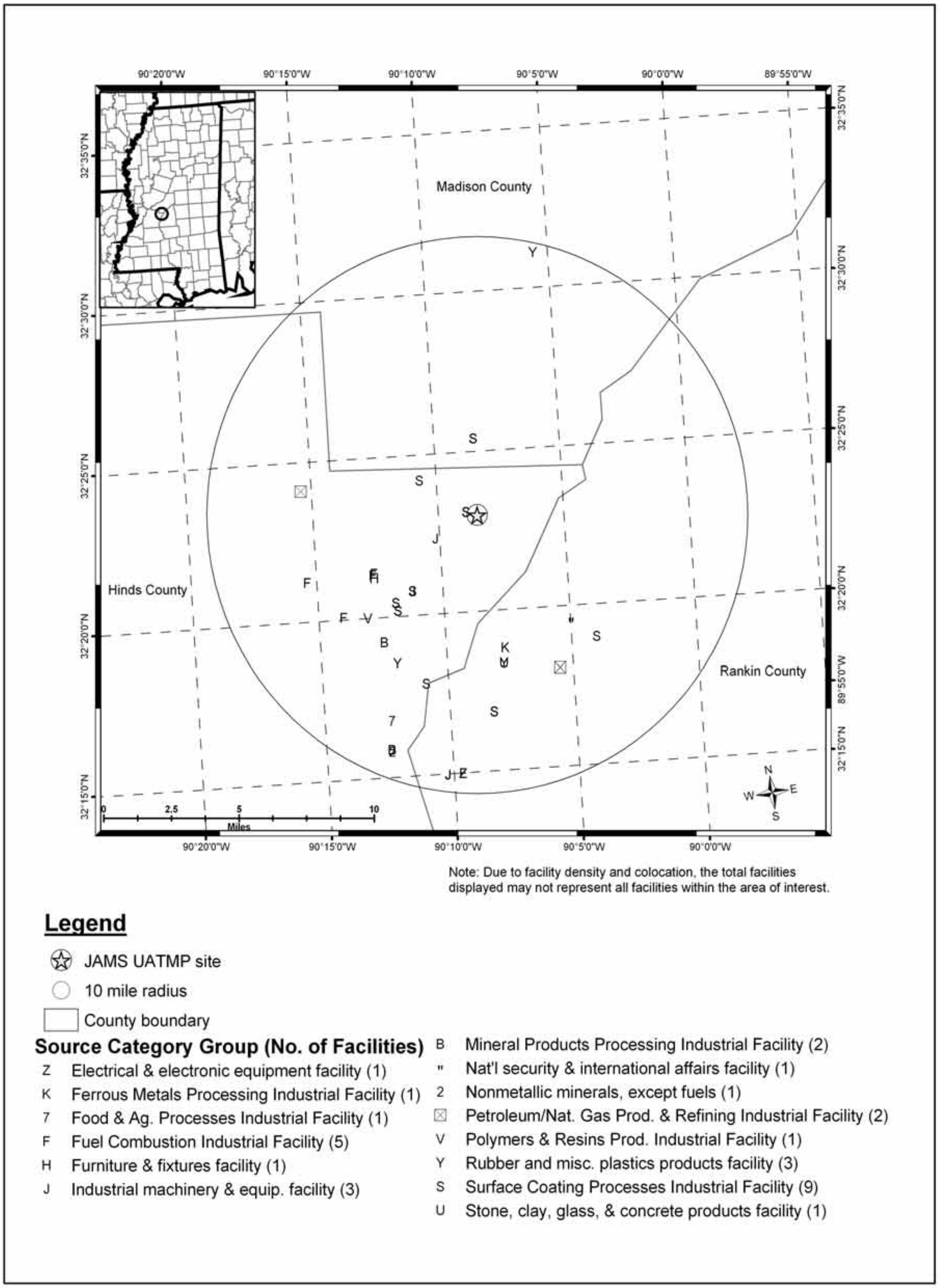
Source: USGS 7.5 Minute Series. Map Scale: 1:24,000.

Figure 9-5. Facilities Located Within 10 Miles of GPMS



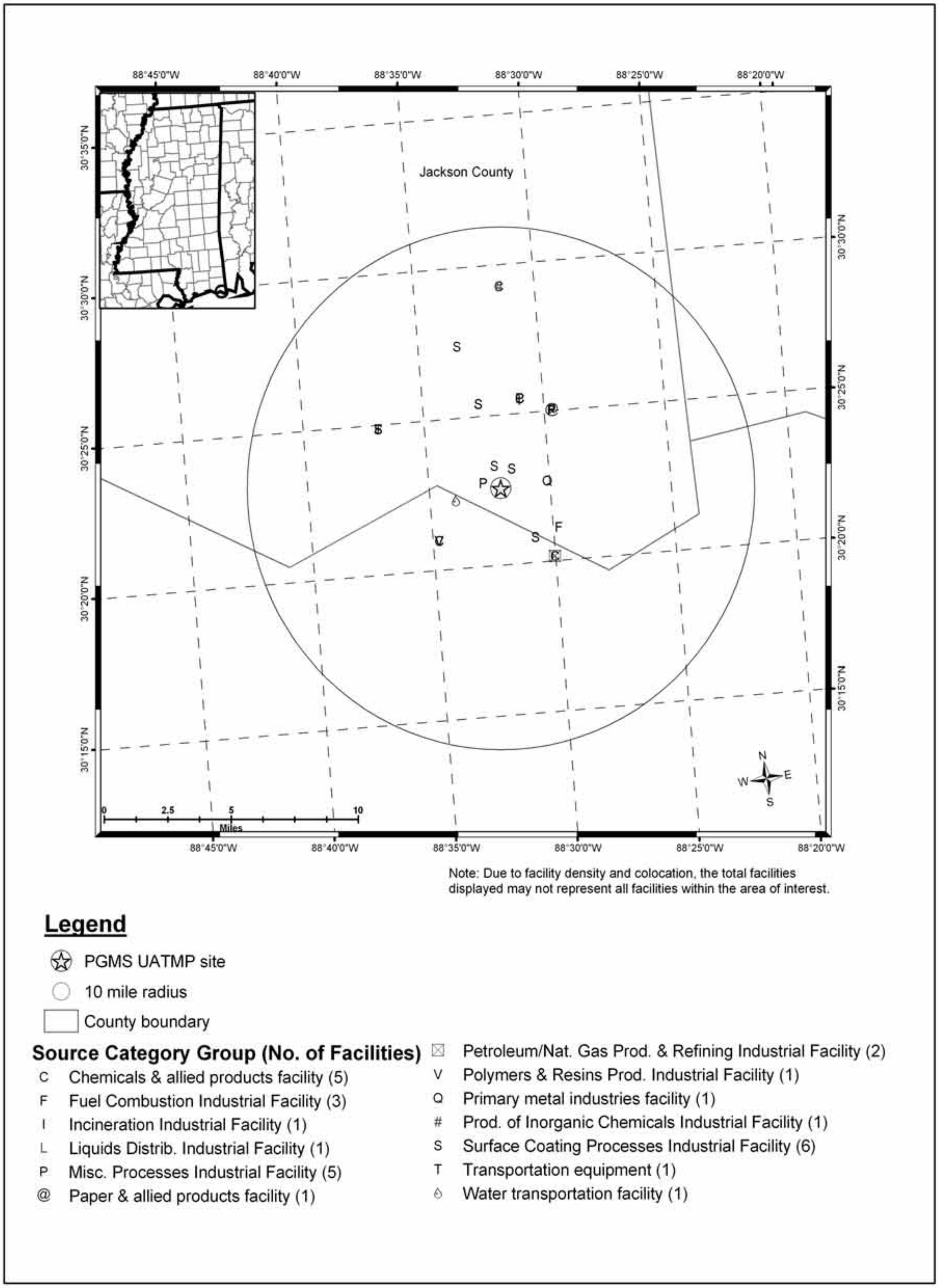
Note: Due to facility density and colocation, the total facilities displayed may not represent all facilities within the area of interest.

Figure 9-6. Facilities Located Within 10 Miles of JAMS



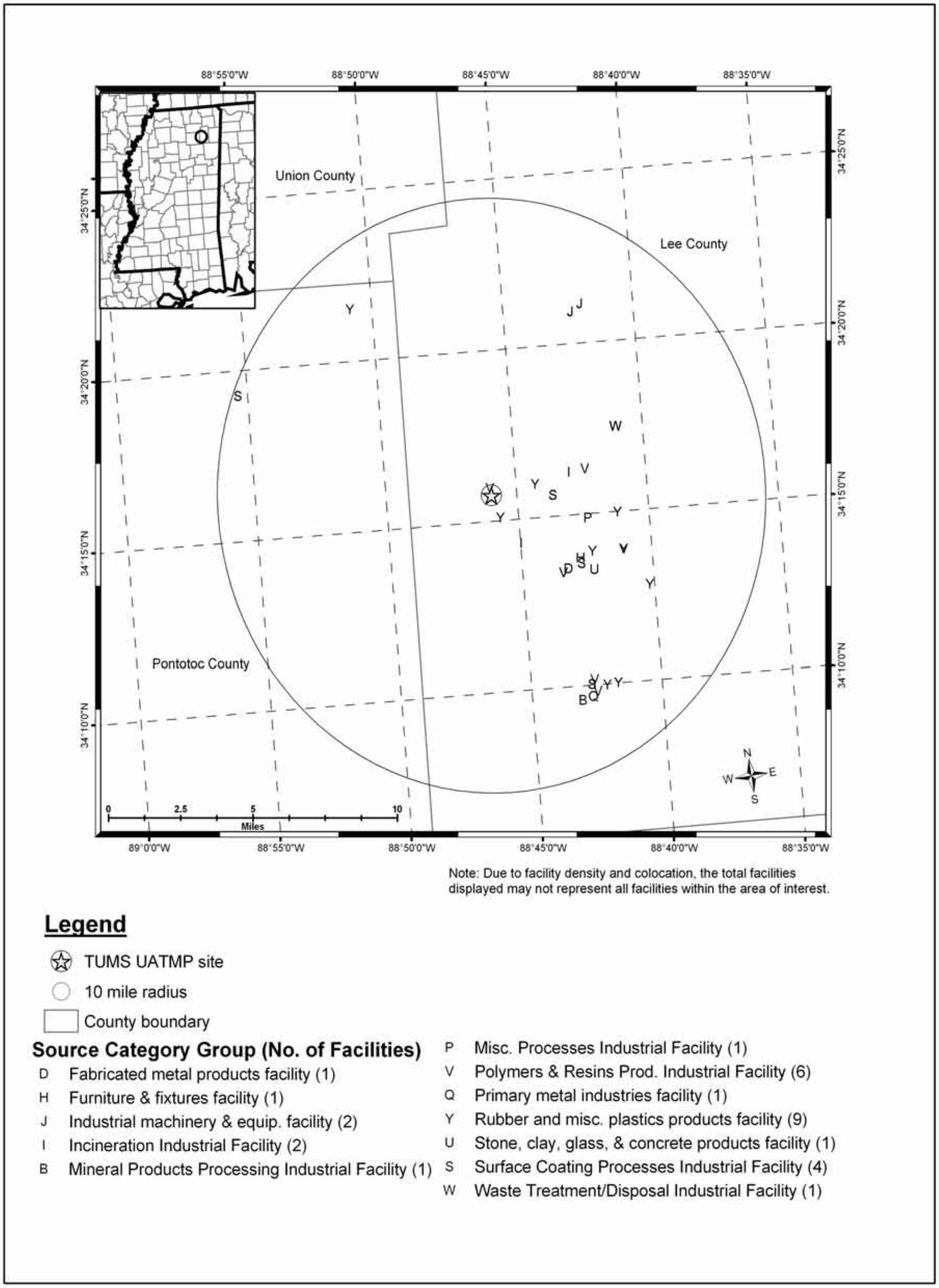
Note: Due to facility density and colocation, the total facilities displayed may not represent all facilities within the area of interest.

Figure 9-7. Facilities Located Within 10 Miles of PGMS



Note: Due to facility density and colocation, the total facilities displayed may not represent all facilities within the area of interest.

Figure 9-8. Facilities Located Within 10 Miles of TUMS



Note: Due to facility density and colocation, the total facilities displayed may not represent all facilities within the area of interest.

Table 9-1. Average Concentration and Meteorological Parameters for Sites in Mississippi

Site Name	Type	Average UATMP Concentration (ppbv)	Average Maximum Temperature (°F)	Average Temperature (°F)	Average Dewpoint Temperature (°F)	Average Wet Bulb Temperature (°F)	Average Relative Humidity (%)	Average Sea Level Pressure (mb)	Average u-component of the Wind (kts)	Average v-component of the Wind (kts)
GPMS	All 2002	▨	75.64 (±1.29)	67.32 (±1.38)	59.94 (±1.56)	63.05 (±1.37)	79.45 (±1.12)	1018.1 (±5.49)	-2.14 (±0.23)	2.15 (±0.21)
	sample day	65.42 (±39.86)	75.90 (±4.73)	67.63 (±4.83)	59.71 (±5.22)	63.03 (±4.69)	78.33 (±3.87)	1018.1 (±14.04)	-0.87 (±0.83)	0.35 (±0.70)
JAMS	All 2002	▨	74.90 (±1.52)	64.51 (±1.51)	55.40 (±1.67)	59.41 (±1.47)	75.29 (±1.12)	1018.3 (±5.90)	-2.16 (±0.19)	1.26 (±0.18)
	sample day	42.75 (±8.12)	74.03 (±5.54)	63.81 (±5.25)	54.75 (±5.40)	58.70 (±4.96)	75.12 (±3.03)	1018.8 (±15.52)	-0.56 (±0.74)	0.13 (±0.67)
PGMS	All 2002	▨	76.80 (±1.28)	66.36 (±1.37)	59.72 (±1.56)	62.49 (±1.38)	81.50 (±0.93)	1018.5 (±5.44)	-2.24 (±0.18)	0.19 (±0.17)
	sample day	52.50 (±20.99)	76.97 (±4.58)	67.10 (±4.58)	60.35 (±4.85)	63.03 (±4.44)	81.11 (±3.04)	1018.4 (±13.48)	-0.65 (±0.61)	-0.29 (±0.61)
TUMS	All 2002	▨	72.22 (±1.65)	62.33 (±1.61)	53.25 (±1.73)	57.33 (±1.54)	75.16 (±1.21)	1018.6 (±5.38)	-1.84 (±0.21)	2.35 (±0.20)
	sample day	22.85 (±6.44)	71.70 (±6.12)	62.00 (±5.72)	53.15 (±5.76)	57.06 (±5.34)	75.45 (±3.55)	1018.9 (±15.83)	-0.01 (±0.86)	1.71 (±0.56)

Table 9-2a - Prevalent Compound Concentration Correlations with Selected Meteorological Parameters at Gulf Port, Mississippi (GPMS)

Compound	Maximum Temperature	Average Temperature	Dew Point Temperature	Wet Bulb Temperature	Relative Humidity	Sea Level Pressure	u-component of wind speed	v-component of wind speed
1,2,4-Trimethylbenzene	0.16	0.11	0.17	0.15	0.24	-0.03	-0.18	0.05
Acetylene	-0.58	-0.64	-0.54	-0.59	0.11	0.55	0.17	0.05
Benzene	-0.32	-0.39	-0.32	-0.35	0.12	0.40	-0.06	-0.01
Chloromethane	0.26	0.30	0.33	0.33	0.19	-0.14	-0.12	0.12
Dichlorodifluoromethane	0.29	0.30	0.39	0.36	0.41	-0.16	-0.04	0.17
Ethylbenzene	0.08	0.07	0.17	0.13	0.34	0.01	-0.11	0.01
Formaldehyde	0.61	0.56	0.38	0.46	-0.38	-0.31	-0.30	0.13
m-,*p* - Xylene	0.07	0.07	0.17	0.13	0.35	0.03	-0.12	-0.02
o - Xylene	0.09	0.09	0.19	0.15	0.33	0.00	-0.13	-0.02
Propylene	0.03	-0.01	0.07	0.04	0.25	0.10	-0.02	0.07
Toluene	-0.02	-0.04	0.03	0.01	0.21	0.31	0.08	0.20
Trichlorofluoromethane	0.23	0.25	0.34	0.32	0.37	-0.03	0.13	0.17

Table 9-2b - Prevalent Compound Concentration Correlations with Selected Meteorological Parameters at Jackson, Mississippi (JAMS)

Compound	Maximum Temperature	Average Temperature	Dew Point Temperature	Wet Bulb Temperature	Relative Humidity	Sea Level Pressure	u-component of wind speed	v-component of wind speed
1,2,4-Trimethylbenzene	0.56	0.49	0.49	0.49	0.15	-0.48	-0.23	-0.04
Acetylene	0.05	-0.02	0.00	-0.01	0.14	-0.01	-0.31	0.15
Benzene	-0.11	-0.20	-0.14	-0.18	0.24	-0.01	-0.18	-0.01
Chloromethane	0.47	0.50	0.49	0.50	0.02	-0.32	0.03	0.41
Dichlorodifluoromethane	0.41	0.40	0.43	0.42	0.25	-0.30	-0.11	0.05
Ethylbenzene	0.09	0.04	0.02	0.03	-0.04	0.00	-0.12	0.25
Formaldehyde	0.67	0.64	0.56	0.59	-0.14	-0.54	-0.30	0.10
m-,*p* - Xylene	0.19	0.09	0.05	0.07	-0.12	-0.01	-0.02	0.21
o - Xylene	0.31	0.20	0.15	0.18	-0.14	-0.08	-0.05	0.19
Propylene	0.17	0.10	0.12	0.10	0.16	-0.21	-0.17	0.17
Toluene	0.25	0.26	0.28	0.27	0.11	-0.16	-0.04	-0.05
Trichlorofluoromethane	0.27	0.29	0.31	0.30	0.13	-0.20	-0.03	0.05

Table 9-2c - Prevalent Compound Concentration Correlations with Selected Meteorological Parameters at Pascagoula, Mississippi (PGMS)

Compound	Maximum Temperature	Average Temperature	Dew Point Temperature	Wet Bulb Temperature	Relative Humidity	Sea Level Pressure	u-component of wind speed	v-component of wind speed
1,2,4-Trimethylbenzene	0.06	0.00	0.05	0.02	0.22	-0.02	-0.16	-0.19
Acetylene	-0.47	-0.52	-0.46	-0.50	0.07	0.39	-0.03	0.02
Benzene	-0.42	-0.47	-0.43	-0.45	0.07	0.32	-0.01	-0.02
Chloromethane	0.66	0.69	0.71	0.71	0.32	-0.50	-0.10	-0.01
Dichlorodifluoromethane	0.29	0.34	0.39	0.37	0.33	-0.17	-0.12	0.21
Ethylbenzene	-0.29	-0.37	-0.31	-0.34	0.06	0.34	0.07	-0.28
Formaldehyde	0.61	0.58	0.51	0.54	-0.09	-0.34	-0.15	-0.08
m-,*p* - Xylene	-0.32	-0.42	-0.38	-0.40	-0.01	0.41	0.11	-0.25
o - Xylene	-0.30	-0.38	-0.34	-0.36	0.01	0.35	0.09	-0.26
Propylene	0.03	0.00	0.03	0.01	0.17	-0.09	-0.12	0.19
Toluene	0.01	-0.03	0.02	0.00	0.17	0.05	-0.10	-0.09
Trichlorofluoromethane	0.28	0.34	0.43	0.40	0.46	-0.22	-0.13	-0.02

Table 9-2d - Prevalent Compound Concentration Correlations with Selected Meteorological Parameters at Tupelo, Mississippi (TUMS)

Compound	Maximum Temperature	Average Temperature	Dew Point Temperature	Wet Bulb Temperature	Relative Humidity	Sea Level Pressure	u-component of wind speed	v-component of wind speed
1,2,4-Trimethylbenzene	0.15	0.18	0.22	0.20	0.15	-0.27	0.14	-0.35
Acetylene	-0.23	-0.25	-0.26	-0.26	-0.08	0.06	0.15	0.21
Benzene	-0.25	-0.29	-0.21	-0.25	0.22	0.10	0.08	-0.10
Chloromethane	0.66	0.64	0.56	0.60	-0.22	-0.42	-0.14	0.17
Dichlorodifluoromethane	0.42	0.43	0.38	0.40	-0.06	-0.18	-0.26	-0.30
Ethylbenzene	0.08	0.04	-0.04	-0.01	-0.32	-0.10	0.08	0.09
Formaldehyde	0.81	0.78	0.66	0.71	-0.30	-0.44	-0.36	0.04
m-,*p* - Xylene	-0.07	-0.12	-0.22	-0.17	-0.42	0.07	0.18	0.23
o - Xylene	0.08	0.03	-0.02	0.00	-0.25	-0.09	0.18	0.06
Propylene	0.24	0.28	0.34	0.31	0.26	-0.27	-0.12	-0.13
Toluene	0.00	0.02	0.02	0.02	0.00	-0.13	0.27	-0.04
Trichlorofluoromethane	0.41	0.43	0.38	0.40	-0.12	-0.19	-0.22	-0.20

Table 9-3. Motor Vehicle Information vs. Daily Concentration for Mississippi Monitoring Sites

Monitoring Station	Population within Ten Miles	Estimated Number of Motor Vehicles Owned	Traffic Data (Daily Average)	Average Daily UATMP Concentration (ppbv)
GPMS	166,963	123,553	17,000	65.42 (±39.86)
JAMS	262,477	194,233	12,500	42.75 (±8.12)
PGMS	58,345	43,175	8,600	52.50 (±30.99)
TUMS	71,430	52,858	4,900	22.85 (±6.44)

10.0 Sites in Missouri

This section focuses on meteorological, concentration, and spatial trends for the five UATMP sites in Missouri (BTMO, S2MO, S3MO, S4MO, and SLMO). Four of these sites are located in the St. Louis metropolitan statistical area, while the fifth (BTMO) is located to the south of the city. Figures 10-1 through 10-5 are topographical maps showing the monitoring stations in their urban locations. Figure 10-6 and 10-7 are maps identifying facilities within ten miles of the sites that reported to the 1999 NEI. Many of the sources near the St. Louis sites are fuel combustion, surface coating, and miscellaneous industries, while BTMO has very few nearby sources. Hourly meteorological data were retrieved for all of 2002 at a weather station near these sites with the purpose of calculating correlations of meteorological data with ambient air concentration measurements. The weather station is Cahokia-St. Louis (WBAN 3960).

Table 10-1 highlights the average UATMP concentration at each of these sites, along with temperature (average maximum and average), moisture (average dew point temperature, average wet-bulb temperature, and average relative humidity), wind information (average u- and v- components of the wind), and pressure (average sea level pressure) for the entire year and on days samples were taken. St. Louis has a climate that is continental in nature, with cold, rather dry winters, warm, somewhat wetter summers, and a significant seasonal variability. Wind speeds are generally light and wind flows from the southeast on average, as indicated in Table 10-1. This information can be found in <u>The Weather Almanac</u>, fifth edition (Ruffner and Bair, 1987).

10.1 Meteorological and Concentration Averages at the Missouri Sites

Carbonyl compounds were measured at BTMO and S4MO, VOC compounds were measured at S2MO and S3MO, and both types of compounds were sampled at SLMO, as indicated in Tables 3-3 and 3-4. For the sites that measured carbonyls, the range of concentrations was between 4.27 ppbv (BTMO) and 23.61 ppbv (SLMO). For the sites that measured VOC, the ranges were much smaller. The lowest geometric mean for the hydrocarbons was 4.50 at S3MO while the highest was 6.16 ppbv at SLMO. The polar compounds had the lowest geometric means for the sites that measured VOC, ranging from 1.99

ppbv at S3MO to 3.13 ppbv at SLMO. The range for the halogenated hydrocarbons was the smallest, ranging from 4.61 ppbv at S3MO to 4.82 ppbv at SLMO. The average total UATMP daily concentration at SLMO was nearly three times the concentration of the other sites (33.21 ±3.03 ppbv vs. 13.75 ±2.40 ppbv at S2MO, 9.77 ±1.47 ppbv at S3MO, 8.19 ±1.81 ppbv at S4MO, and 4.31 ±0.16 ppbv at BTMO). Table 10-1 also lists the averages for selected meteorological parameters from January 2002 to December 2002, which is the same time period covered in this report.

SLMO also opted to have total NMOC, SNMOC, and SVOC sampled during its air toxic sampling. S4MO and BTMO opted to sample total NMOC and SNMOC as well. SNMOC/NMOC compounds are of particular interest because of their role in ozone formation. Readers are encouraged to review EPA's *2001 Nonmethane Organic Compounds (NMOC) and Speciated Nonmethane Organic Compounds (SNMOC) Monitoring Program, Final Report* (EPA, 2002) for more information on SNMOC/NMOC trends and concentrations. The average total NMOC value for SLMO was 210 (±25.80) ppbC, of which nearly 63% could be identified through speciation. Of the speciated compounds, ethane measured the highest concentration at the SLMO site (10.74 ppbC). The average total NMOC value for S4MO was 368 (±189.39) ppbC, of which nearly 67% could be identified through speciation. Of the speciated compounds, ethane measured the highest concentration at the S4MO site (32.51 ppbC). The average total NMOC value for BTMO was 122 (±41.24) ppbC, of which nearly 46% could be identified through speciation. Of the speciated compounds at BTMO, propane measured the highest concentration (9.11 ppbC). This information is given in Table 10-3. Ozone concentrations were also sampled near SLMO and S4MO on 214 days and were retrieved from the U.S. EPA's AQS database. The average ozone concentration near these sites was 52.27 (±2.89) ppbv. The average SVOC concentration at SLMO was 3.81 (±0.24) ug/m^3 and is also listed in Table 10-3.

Tables 10-2a-d are the summaries of calculated Pearson Correlation coefficients for each of the prevalent compounds and selected meteorological parameters by site. Identification of the prevalent compounds is discussed in Section 3 of this report. As indicated in Table 10-2a, BTMO and S4MO only sampled carbonyls, and therefore only have correlations listed for formaldehyde. At BTMO, a strong positive correlation between formaldehyde and maximum temperature and a strong negative correlation between formaldehyde and the u-component of the wind were found. Otherwise, the correlations at BTMO were weak. However, at S4MO, almost all of the correlations were strong or moderately strong. Strong positive correlations with dew point, wet bulb, and relative humidity and moderately strong positive correlations with maximum and average temperature were found. Also, strong negative correlations with sea level pressure and the v-component of the wind were found at S4MO. One thing to note is that both of these sites only sampled on a few days in December.

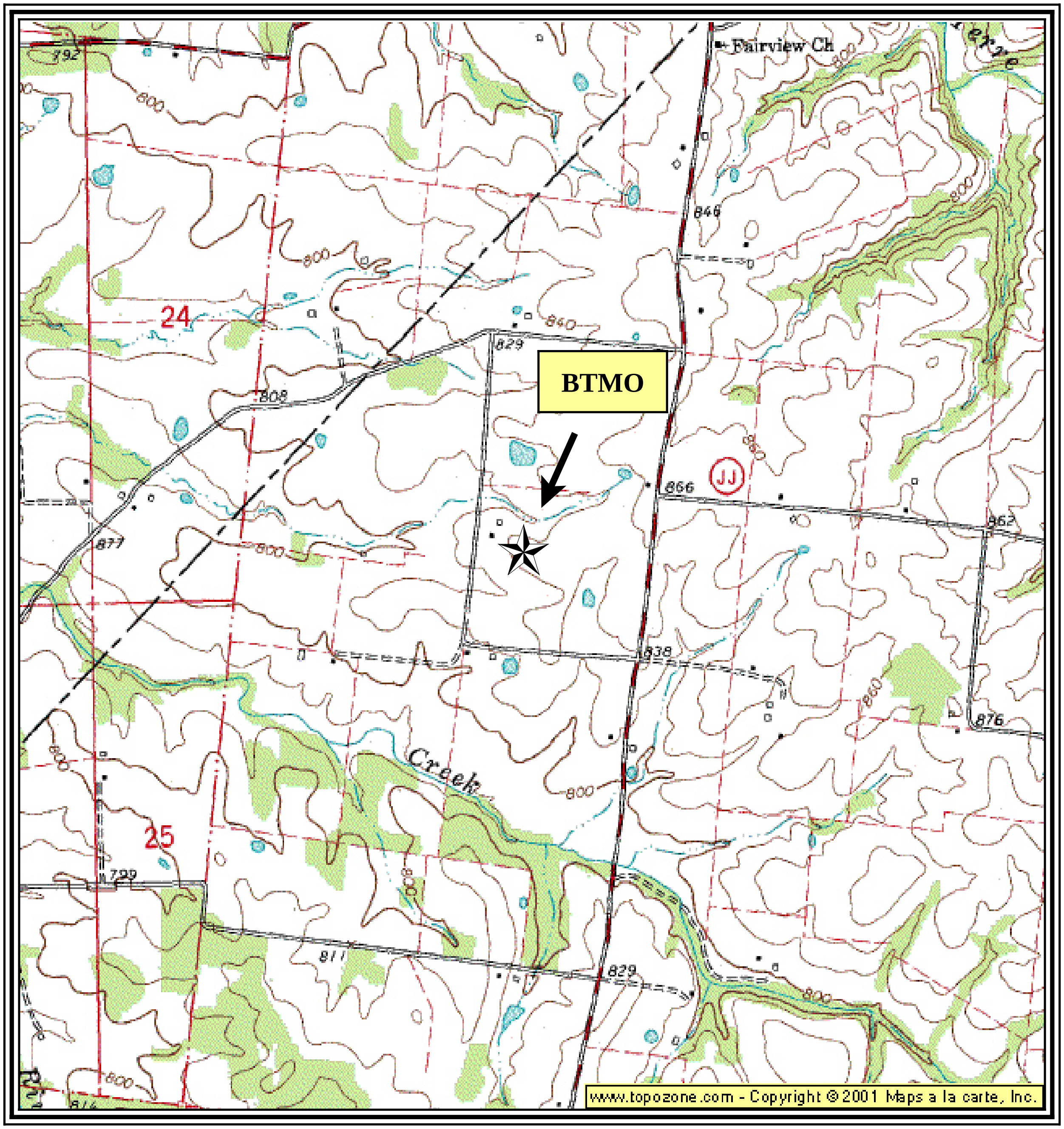
At S2MO, most of the correlations with maximum, average, dew point, and wet bulb temperatures were negative. Dichlorodifluoromethane and trichlorofluoromethane both registered moderately strong to strong negative correlations with these parameters. This trend continues at S3MO, where the correlations tended to be stronger. One exception was chloromethane, where moderately strong to strong positive correlations were established at S3MO. Moderately strong positive correlations were also noted between chloromethane and these parameters at S2MO. This trend is not exhibited at SLMO, where most of the correlations are positive, rather than negative. Chloromethane and formaldehyde had the strongest correlations with these four parameters at this site. Also of interest at SLMO is the negative correlation with the u-component of the wind speed with all of the compounds. S2MO and S3MO had a similar trends, but between most of the compounds and the v-component of the wind. These two sites also exhibited a positive correlation with sea level pressure and all of the compounds except chloromethane. UATMP concentrations tend to increase with decreasing temperature and humidity at S2MO and S3MO, while the opposite is true at SLMO. As pressure increases at S2MO and S3MO, UATMP concentrations also increase. UATMP concentrations generally increase as wind speeds decrease at all of the sites, but wind direction is an important factor.

10.2 Spatial Analysis

Using the population within ten miles of each site, an estimate of the number of motor vehicles operating in proximity to the monitoring station can be established. The ratio used in this report is 0.74 motor vehicles to every one person (refer to section 3.4.1 for more information on this ratio). The population near the S3MO and SLMO sites is 714,905 people, all of whom are operating approximately 529,030 motor vehicles. The S2MO site is populated with 796,761 people driving 589,603 motor vehicles. The most populous site is S4MO, with 838,460 people driving 620,460 vehicles, while BTMO is the least populated, with 34,068 people operating 25,210 automobiles. This information is compared to the average daily concentration of the prevalent compounds at each Missouri site in Table 10-4. Also included in Table 10-4 are average daily traffic data, or more specifically, the average number of cars passing the monitoring sites on the nearest roadway to each site on a daily basis. The number of vehicles passing the S4MO site daily is 22,840, making it the site with the highest traffic volume.

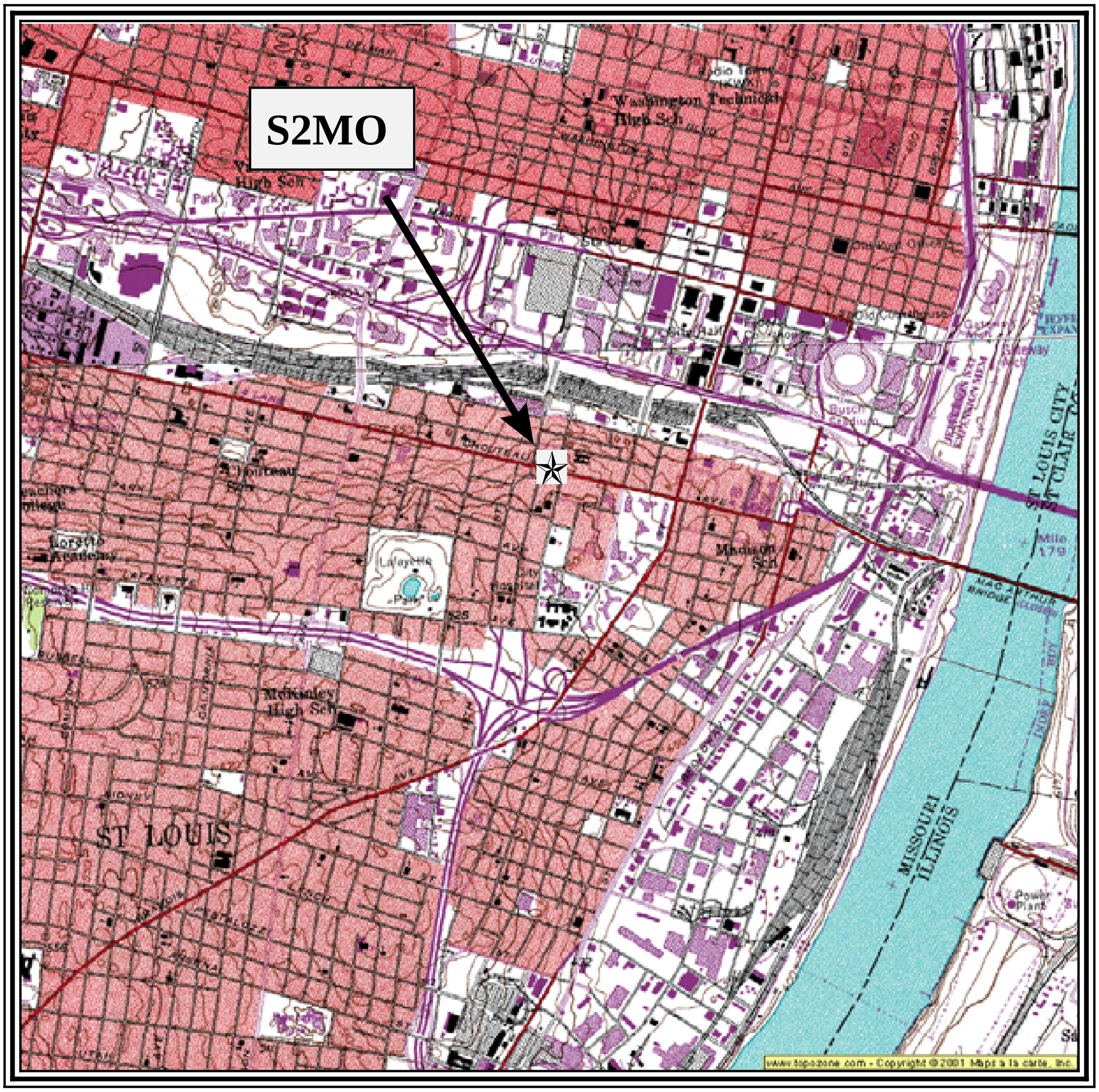
A roadside study conducted to measure emissions from motor vehicles determined that the concentration ratios of the BTEX compounds were relatively consistent from urban area to urban area. (For more information on this study, refer to section 3.4.2.) Figure 3-14 depicts the average concentration ratios of the roadside study and compares them to the concentration ratios at each of the monitoring sites. BTMO and S4MO did not measure VOCs and are therefore not represented in Figure 3-14. SLMO's concentration ratios most resembles those of the roadside study, although its toluene-ethylbenzene and benzene-ethylbenzene ratios are lower than those of the study. The concentration ratios at S3MO also somewhat resemble the roadside study's ratios, but its toluene-ethylbenzene and benzene-ethylbenzene ratios are higher and its *m,p*-xylene-ethylbenzene and *o*-xylene-ethylbenzene ratios are lower. At S2MO, most of the values are slightly lower than those of the roadside study, the exception being benzene-ethylbenzene. Also, the benzene-ethylbenzene ratio is higher than the *m,p*-xylene-ethylbenzene ratio at this site, where the opposite is true for the roadside study.

Figure 10-1. Bonne Terre, Missouri (BTMO) Monitoring Station



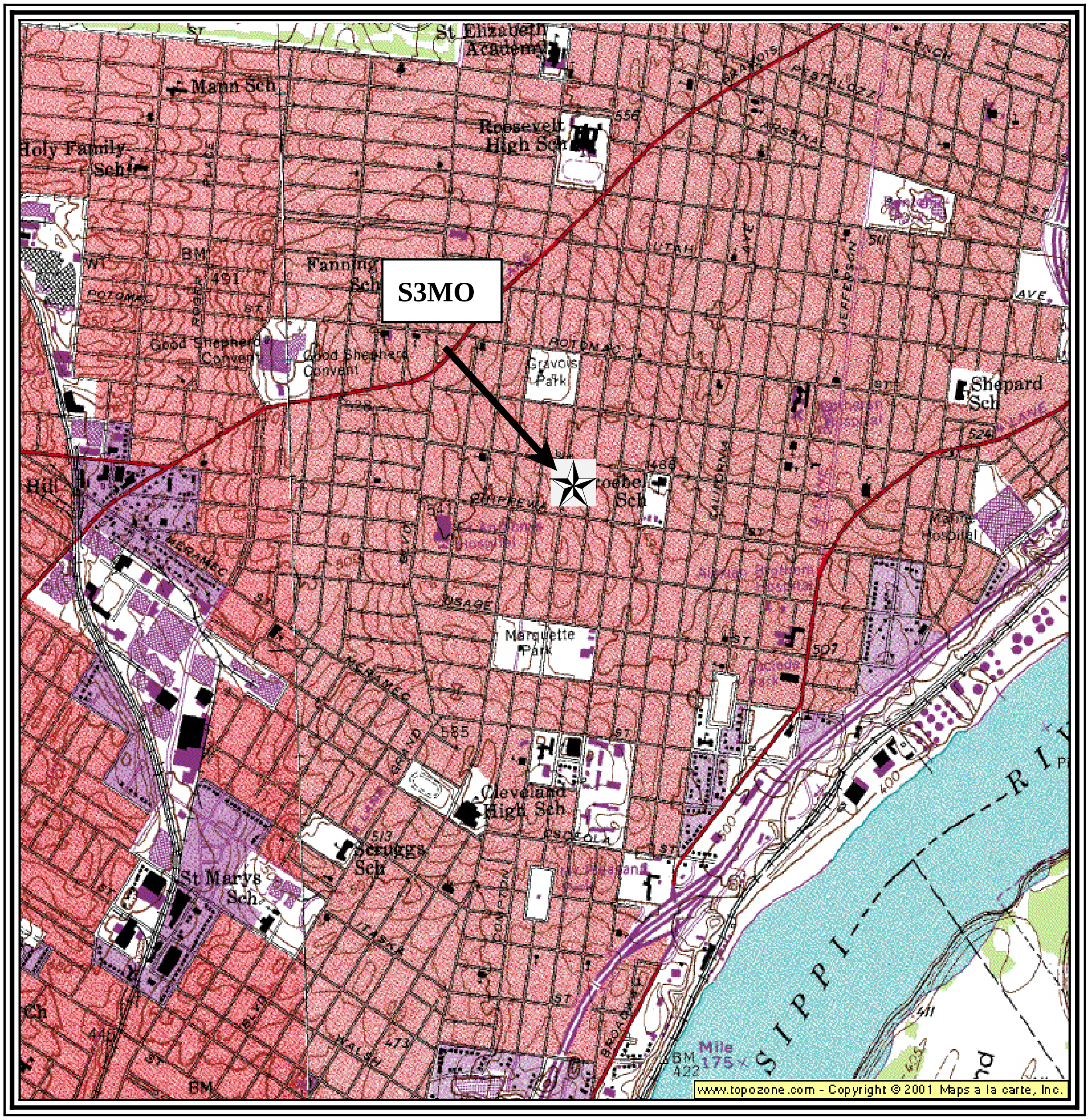
Source: USGS 7.5 Minute Series. Map Scale: 1:25,000.

Figure 10-2. St. Louis, Missouri Site 2 (S2MO) Monitoring Station



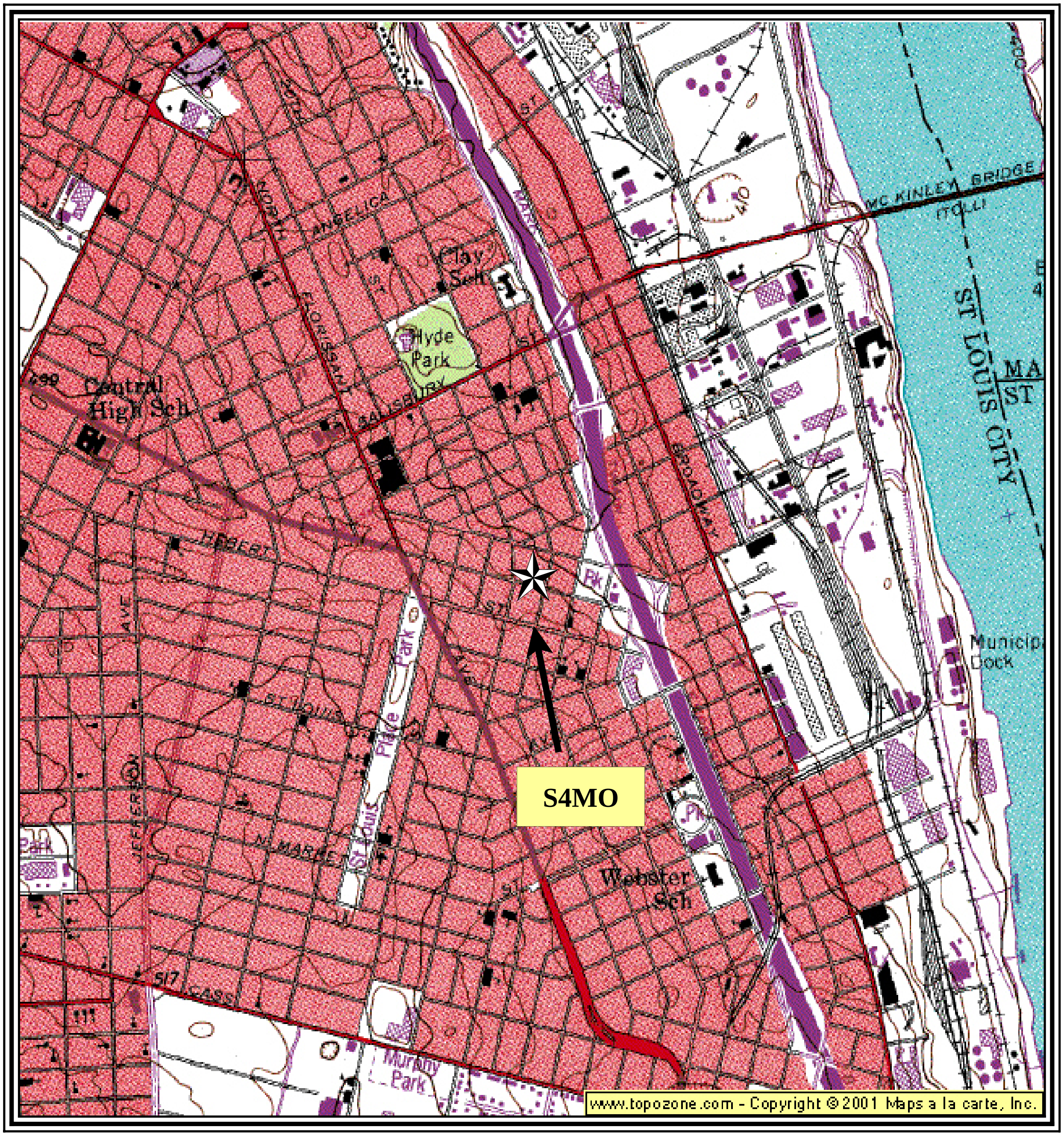
Source: USGS 7.5 Minute Series. Map Scale: 1:24,000.

Figure 10-3. St. Louis, Missouri Site 3 (S3MO) Monitoring Station



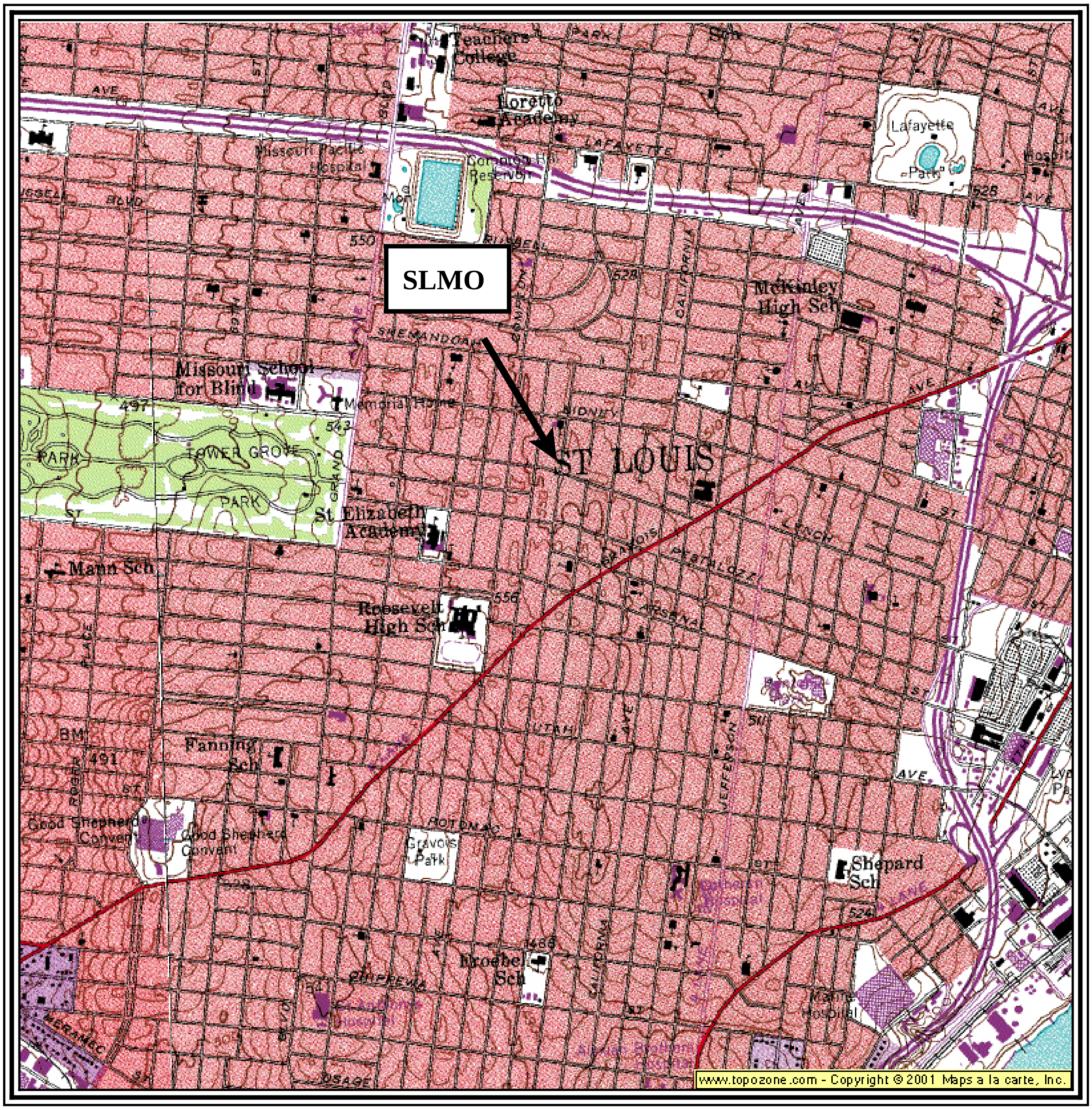
Source: USGS 7.5 Minute Series. Map Scale: 1:24,000.

Figure 10-4. St. Louis, Missouri Site 4 (S4MO) Monitoring Station



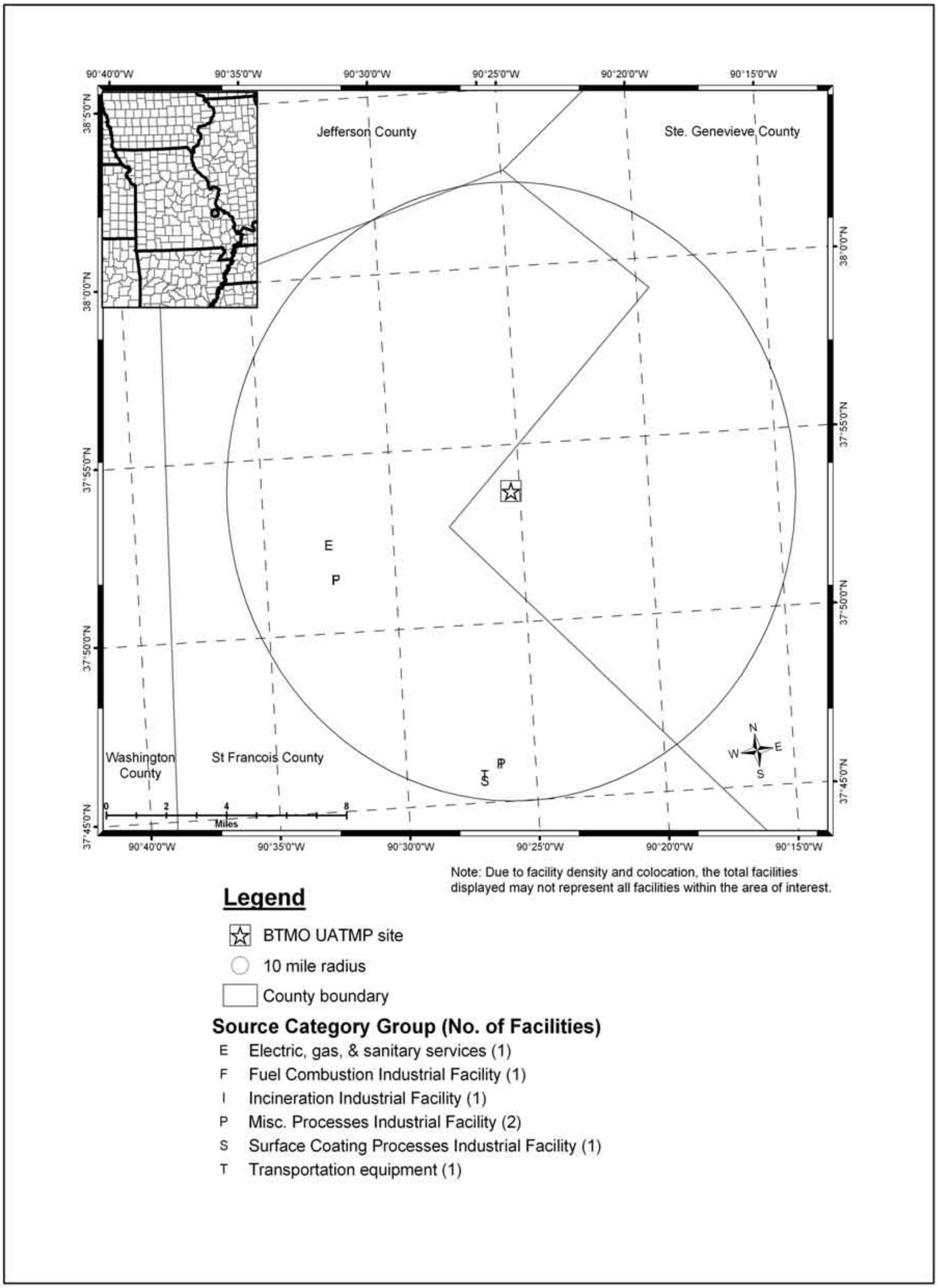
Source: USGS 7.5 Minute Series. Map Scale: 1:25,000.

Figure 10-5. St. Louis, Missouri Site 1 (SLMO) Monitoring Station



Source: USGS 7.5 Minute Series. Map Scale: 1:24,000.

Figure 10-6. Facilities Located Within 10 Miles of BTMO



Note: Due to facility density and colocation, the total facilities displayed may not represent all facilities within the area of interest.

Figure 10-7. Facilities Located Within 10 Miles of SLMO, S2MO, S3MO, and S4MO

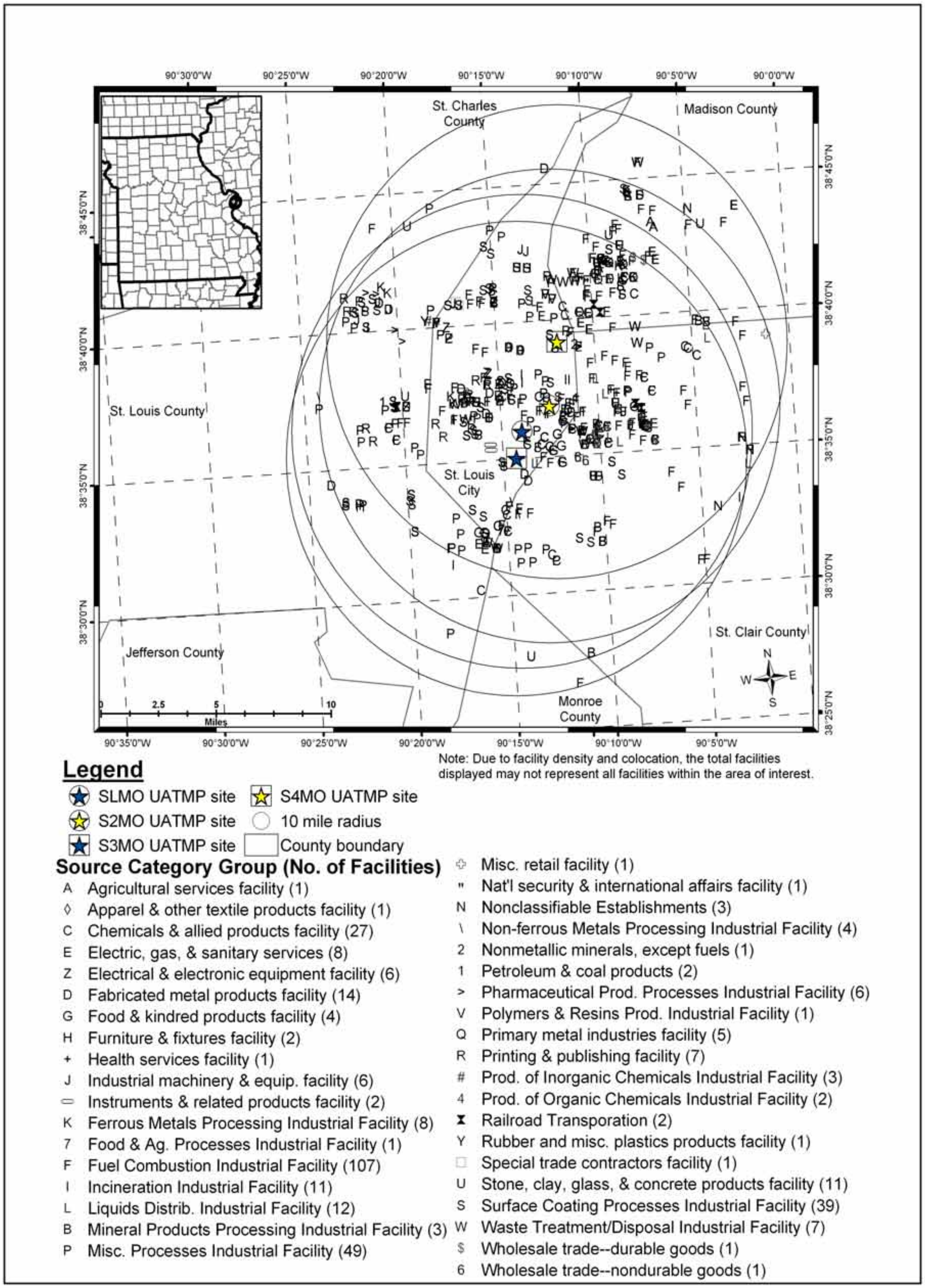


Table 10-1. Average Concentration and Meteorological Parameters for Sites in Missouri

Site Name	Type	Average UATMP Concentration (ppbv)	Average Maximum Temperature (°F)	Average Temperature (°F)	Average Dewpoint Temperature (°F)	Average Wet Bulb Temperature (°F)	Average Relative Humidity (%)	Average Sea Level Pressure (mb)	Average u-component of the Wind (kts)	Average v-component of the Wind (kts)
BTMO	All 2002	▨	66.83 (±1.98)	56.86 (±1.86)	47.14 (±1.90)	51.80 (±1.73)	72.82 (±1.14)	1018.6 (±6.60)	-1.39 (±0.25)	2.66 (±0.19)
	sample day	4.31 (±0.61)	46.67 (±4.37)	35.40 (±2.96)	23.30 (±0.56)	30.74 (±1.96)	64.11 (±5.64)	1020.3 (±19.48)	1.10 (±2.21)	1.41 (±1.44)
S2MO	All 2002	▨	66.83 (±1.98)	56.86 (±1.86)	47.14 (±1.90)	51.80 (±1.73)	72.82 (±1.14)	1018.6 (±6.60)	-1.39 (±0.25)	2.66 (±0.19)
	sample day	13.75 (±2.40)	55.38 (±6.24)	45.77 (±5.72)	37.06 (±6.18)	41.98 (±5.49)	73.99 (±4.83)	1018.0 (±30.60)	2.10 (±1.48)	1.52 (±0.85)
S3MO	All 2002	▨	66.83 (±1.98)	56.86 (±1.86)	47.14 (±1.90)	51.80 (±1.73)	72.82 (±1.14)	1018.6 (±6.60)	-1.39 (±0.25)	2.66 (±0.19)
	sample day	9.77 (±1.47)	54.14 (±6.39)	44.49 (±5.90)	35.66 (±6.38)	40.73 (±5.68)	73.39 (±4.70)	1018.2 (±31.10)	2.20 (±1.39)	1.61 (±0.81)
S4MO	All 2002	▨	66.83 (±1.98)	56.86 (±1.86)	47.14 (±1.90)	51.80 (±1.73)	72.82 (±1.14)	1018.6 (±6.60)	-1.39 (±0.25)	2.66 (±0.19)
	sample day	8.19 (±1.81)	43.00 (±7.08)	34.43 (±4.35)	24.94 (±5.16)	30.90 (±4.18)	71.66 (±9.16)	1020.5 (±42.42)	-1.00 (±2.66)	0.58 (±1.26)
SLMO	All 2002	▨	66.83 (±1.98)	56.86 (±1.86)	47.14 (±1.90)	51.80 (±1.73)	72.82 (±1.14)	1018.6 (±6.60)	-1.39 (±0.25)	2.66 (±0.19)
	sample day	33.21 (±3.03)	66.10 (±5.50)	55.95 (±5.23)	46.32 (±5.24)	50.97 (±4.85)	73.01 (±2.75)	1018.3 (±16.36)	0.35 (±0.86)	0.97 (±0.46)

Table 10-2a - Formaldehyde Concentration Correlations with Selected Meteorological Parameters at Bonne Terre (BTMO) and St. Louis, Site 4 (S4MO)

Site	Maximum Temperature	Average Temperature	Dew Point Temperature	Wet Bulb Temperature	Relative Humidity	Sea Level Pressure	u-component of wind speed	v-component of wind speed
BTMO	0.75	0.18	0.09	0.06	0.19	-0.01	-0.88	0.07
S4MO	0.38	0.36	0.65	0.51	0.53	-0.50	-0.19	-0.64

Table 10-2b - Prevalent Compound Concentration Correlations with Selected Meteorological Parameters at St. Louis, Missouri Site 2 (S2MO)

Compound	Maximum Temperature	Average Temperature	Dew Point Temperature	Wet Bulb Temperature	Relative Humidity	Sea Level Pressure	u-component of wind speed	v-component of wind speed
1,2,4 Trimethylbenzene	-0.20	-0.29	-0.23	-0.27	0.13	0.34	-0.02	-0.16
Acetylene	0.02	0.03	-0.03	-0.01	-0.18	0.20	0.14	-0.08
Benzene	-0.22	-0.25	-0.15	-0.22	0.32	0.26	-0.35	0.01
Chloromethane	0.24	0.34	0.33	0.35	0.09	-0.14	-0.18	0.15
Dichlorodifluoromethane	-0.39	-0.52	-0.48	-0.51	-0.08	0.24	0.55	-0.31
Ethylbenzene	-0.20	-0.29	-0.25	-0.29	0.05	0.40	0.19	-0.42
m-,*p* - Xylene	-0.15	-0.23	-0.16	-0.21	0.17	0.31	0.03	-0.31
o - Xylene	-0.22	-0.33	-0.24	-0.30	0.18	0.35	0.04	-0.17
Propylene	0.18	0.18	0.15	0.15	0.00	0.11	-0.11	-0.13
Toluene	-0.08	-0.10	-0.03	-0.08	0.20	0.18	0.06	-0.33
Trichlorofluoromethane	-0.43	-0.54	-0.52	-0.54	-0.14	0.43	0.42	-0.38

Table 10-2c - Prevalent Compound Concentration Correlations with Selected Meteorological Parameters at St. Louis, Missouri Site 3 (S3MO)

Compound	Maximum Temperature	Average Temperature	Dew Point Temperature	Wet Bulb Temperature	Relative Humidity	Sea Level Pressure	u-component of wind speed	v-component of wind speed
1,2,4 Trimethylbenzene	-0.31	-0.33	-0.31	-0.33	-0.08	0.41	0.11	-0.14
Acetylene	-0.51	-0.58	-0.52	-0.57	0.00	0.56	0.19	-0.49
Benzene	-0.49	-0.52	-0.45	-0.50	0.07	0.47	-0.07	-0.17
Chloromethane	0.48	0.50	0.47	0.50	0.05	-0.31	-0.10	0.14
Dichlorodifluoromethane	-0.32	-0.35	-0.36	-0.35	-0.23	0.20	0.47	-0.31
Ethylbenzene	-0.28	-0.26	-0.26	-0.27	-0.11	0.48	-0.01	-0.29
m-,p - Xylene	-0.28	-0.27	-0.23	-0.27	0.04	0.39	-0.08	-0.22
o - Xylene	-0.36	-0.37	-0.34	-0.36	-0.03	0.47	0.12	-0.20
Propylene	-0.02	-0.09	-0.04	-0.08	0.19	0.18	0.05	-0.54
Toluene	0.11	0.14	0.21	0.17	0.32	0.07	-0.37	-0.13
Trichlorofluoromethane	-0.24	-0.27	-0.24	-0.26	0.02	0.28	0.27	-0.22

Table 10-2d - Prevalent Compound Concentration Correlations with Selected Meteorological Parameters at St. Louis, Missouri Site 1 (SLMO)

Compound	Maximum Temperature	Average Temperature	Dew Point Temperature	Wet Bulb Temperature	Relative Humidity	Sea Level Pressure	u-component of wind speed	v-component of wind speed
1,2,4 Trimethylbenzene	0.29	0.26	0.25	0.26	0.06	0.07	-0.31	-0.08
Acetylene	-0.38	-0.40	-0.38	-0.40	0.08	0.22	-0.05	-0.20
Benzene	0.02	-0.01	-0.02	-0.02	0.05	0.19	-0.34	-0.25
Chloromethane	0.40	0.42	0.44	0.43	0.17	-0.12	-0.16	-0.08
Dichlorodifluoromethane	0.31	0.28	0.27	0.27	-0.01	0.13	-0.08	-0.20
Ethylbenzene	0.20	0.20	0.23	0.22	0.18	-0.02	-0.14	0.02
Formaldehyde	0.47	0.50	0.45	0.47	-0.21	-0.06	-0.17	0.07
m-,p - Xylene	0.16	0.16	0.19	0.18	0.17	-0.01	-0.11	0.06
o - Xylene	0.22	0.22	0.25	0.24	0.18	-0.02	-0.15	0.04
Propylene	0.26	0.25	0.25	0.25	0.09	0.02	-0.34	-0.17
Toluene	0.32	0.30	0.31	0.30	0.15	0.04	-0.31	-0.11
Trichlorofluoromethane	0.22	0.16	0.13	0.14	-0.11	0.11	-0.28	-0.06

Table 10-3. SVOC, Ozone, and SNMOC Measured by the Missouri Monitoring Stations

Site	Average Ozone Concentrations (ppbv)	Total Number of Ozone Sampling Days	Average SVOC Concentration ($\mu g/m^3$)	TNMOC speciated (ppbC)	TNMOC with unknowns (ppbC)	% of TNMOC Identified	SNMOC Compound with the Highest Concentration (ppbC)
BTMO	N/A	N/A	N/A	53.75 (±14.02)	121.60 (±41.24)	46%	propane (9.11)
S4MO	52.27 (±2.89)	214	N/A	230.62 (±96.18)	367.98 (±189.39)	67%	ethane (32.51)
SLMO	52.27 (±2.89)	214	3.81 (±0.24)	126.59 (±12.10)	210.00 (±25.80)	63%	ethane (10.74)

Table 10-4. Motor Vehicle Information vs. Daily Concentration for Missouri Monitoring Sites

Monitoring Station	Population within Ten Miles	Estimated Number of Motor Vehicles Owned	Traffic Data (Daily Average)	Average Daily UATMP Concentration (ppbv)
BTMO	34,068	25,210	4,360	4.31 (±0.61)
S2MO	796,761	589,603	1,000	13.75 (±2.40)
S3MO	714,905	529,030	8,532	9.77 (±1.47)
S4MO	838,460	620,460	22,840	8.19 (±1.81)
SLMO	714,905	529,030	15,016	33.21 (±3.03)

11.0 Sites in Nebraska

This section focuses on meteorological, concentration, and spatial trends for the UATMP sites in Nebraska (LINE and LONE). Both sites are located in Lincoln, situated in southeastern Nebraska. Although both of these sites are in Lincoln, it is not possible to accurately compare the measured values with each other. The LINE site sampled for the first part of the year (3/21/02 - 9/29/02), while the LONE site sampled the latter part of the year (10/05/02 - 12/28/02). Figures 11-1 and 11-2 are topographical maps showing the monitoring stations in their urban locations. Figure 11-3 is a map identifying facilities within ten miles of the sites that reported to the 1999 NEI. The map shows that the sites are in close proximity to each other, oriented north-south, and that most of the industrial facilities are to the east of the sites. Fuel combustion, surface coating, and miscellaneous industrial sites make up the majority of the nearby sources. Hourly meteorological data were retrieved for all of 2002 at the Lincoln Municipal Airport weather station (WBAN 14939) near the sites with the purpose of calculating correlations of meteorological data with ambient air concentration measurements.

Table 11-1 highlights the UATMP average concentration at each site, along with temperature (average maximum and average), moisture (average dew point temperature, average wet-bulb temperature, and average relative humidity), wind information (average u- and v-components of the wind), and pressure (average sea level pressure) for the entire year and on days samples were taken. The Lincoln area has a continental climate, with cold winters and warm summers. Lincoln is affected by most storm systems that track across the country, allowing day to day weather fluctuations. Precipitation varies throughout the year, but is typically concentrated in the springtime. On average, wind blows from a southerly direction, as indicated in Table 11-1. This information can be found in The Weather Almanac, fifth edition (Ruffner and Bair, 1987).

11.1 Meteorological and Concentration Averages at the Nebraska Sites

Carbonyl compounds and VOC were measured at this site, as indicated in Tables 3-3 and 3-4. The polar compounds had the highest geometric means at both LINE and LONE (8.24 ppbv and 5.01 ppbv, respectively), while the halogenated hydrocarbons had the lowest geometric means at both sites (4.15 ppbv and 3.93 ppbv, respectively). The average total UATMP daily concentration at LINE was higher than at LONE, 23.58 (±3.57) ppbv vs. 16.06 (±5.27) ppbv, respectively. Table 11-1 also lists the averages for selected meteorological parameters from January 2002 to December 2002, which is the same time period covered in this report.

Tables 11-2a and b are the summaries of calculated Pearson Correlation coefficients for each of the prevalent compounds and selected meteorological parameters. Identification of the prevalent compounds is discussed in Section 3 of this report. At the LINE monitoring station, strong positive correlations were found between chloromethane, formaldehyde, and propylene and maximum, average, dew point, and wet bulb temperatures, while 1,2,4-trimethylbenzene, dichlorodifluoromethane, the xylenes, and trichlorofluoromethane all had moderately strong positive correlations with the same four weather parameters. In fact, only acetylene and toluene had negative correlations with these parameters. With the exception of acetylene, benzene, and toluene, all of the compounds had negative correlations with sea level pressure. At LINE, as temperature, dew point, and wet bulb temperature increase and sea level pressure decreases, UATMP concentrations of the prevalent compounds tend to increase.

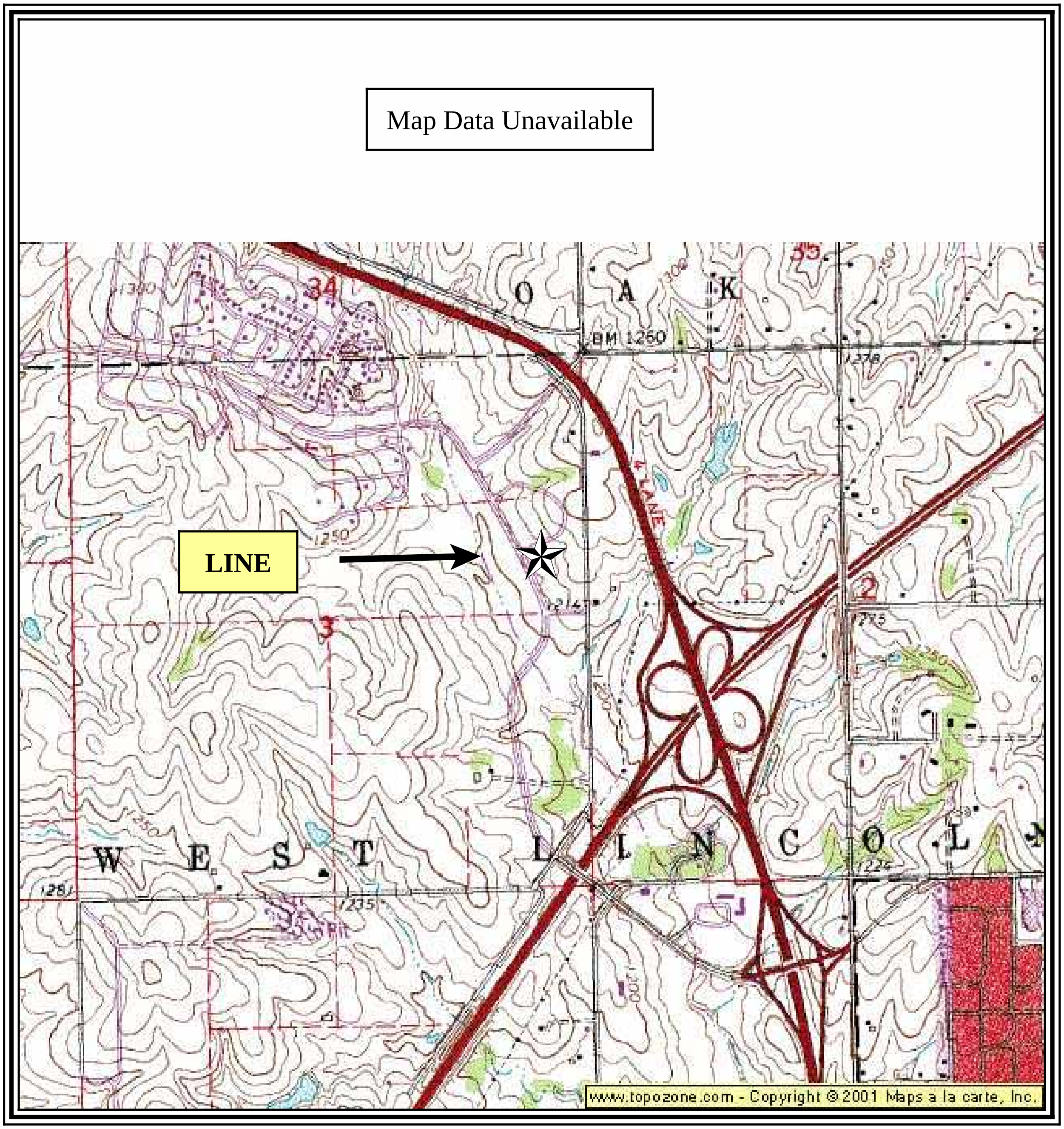
At LONE some similarities exist, but not nearly as strong. Only chloromethane, dichlorodifluoromethane, and trichlorofluoromethane had moderately strong positive correlations with maximum, average, dew point, and wet bulb temperatures, while formaldehyde had moderately strong positive correlations with maximum and average temperatures. With the exception of acetylene, all of the compounds had negative correlations with sea level pressure, and all of the compounds had negative correlations with the u-component of the wind. Nearly half of each of these correlations registered as at least moderately strong. At LONE, UATMP concentrations of the prevalent compounds tend to increase as the pressure and u-component of the wind decrease.

11.2 Spatial Analysis

Using the population within ten miles of each site, an estimate of the number of cars operating in proximity to the monitoring station can be established. The ratio used in this report is 0.74 automobiles to every one person (refer to section 3.4.1 for more information on this ratio). The populations near LINE and LONE are very similar, with 239,999 people operating approximately 177,599 vehicles near LINE and 240,340 people driving 177,852 vehicles near LONE. This information is compared to the average daily concentration of the prevalent compounds at the Nebraska sites in Table 11-3. Also included in Table 11-3 are average daily traffic data, or more specifically, the average number of cars passing the monitoring sites on the nearest roadway to each site on a daily basis. Like population, traffic flow near the sites is fairly similar.

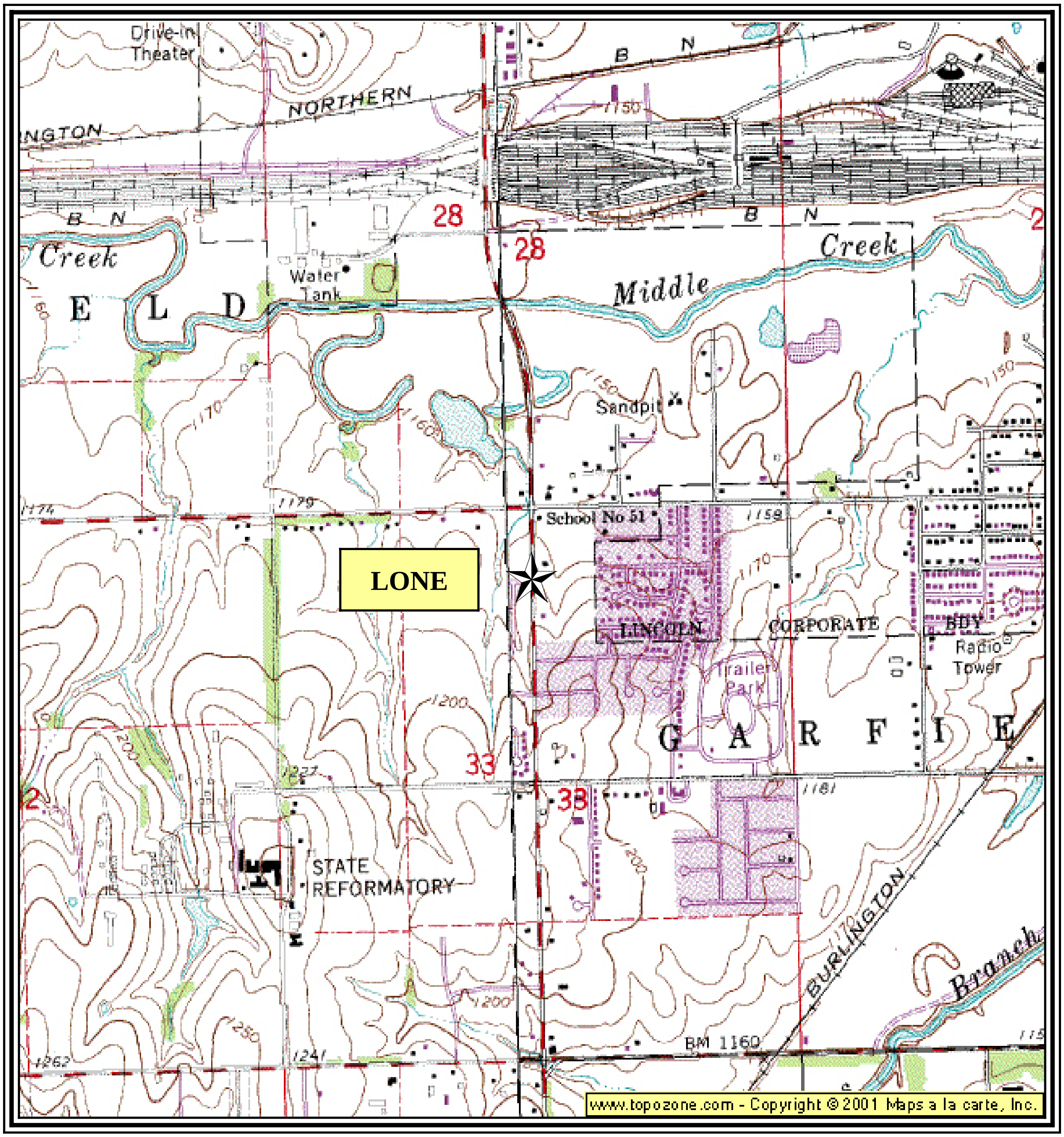
A roadside study conducted to measure emissions from motor vehicles determined that the concentration ratios of the BTEX compounds were relatively consistent from urban area to urban area. (For more information on this study, refer to section 3.4.2.) Figure 3-14 depicts the average concentration ratios of the roadside study and compares them to the concentration ratios at each of the monitoring sites. The concentrations ratios at LINE resemble those of the roadside study, but the values of benzene-ethylbenzene and toluene-ethylbenzene tended to be less, while the *o*-xylene-ethylbenzene value was greater at LINE than for the roadside study. At LONE, the benzene-ethylbenzene ratio was higher than the *m,p*-xylene-ethylbenzene ratio, while the opposite is true for the roadside study. The toluene-ethylbenzene ratio is higher at LONE than the roadside study, while the *o*-xylene-ethylbenzene ratios are similar.

Figure 11-1. Lincoln, Nebraska Site 1 (LINE) Monitoring Station



Source: USGS 7.5 Minute Series. Map Scale: 1:25,000.

Figure 11-2. Lincoln, Nebraska Site 2 (LONE) Monitoring Station



Source: USGS 7.5 Minute Series. Map Scale: 1:25,000.

Figure 11-3. Facilities Located Within 10 Miles of LINE and LONE

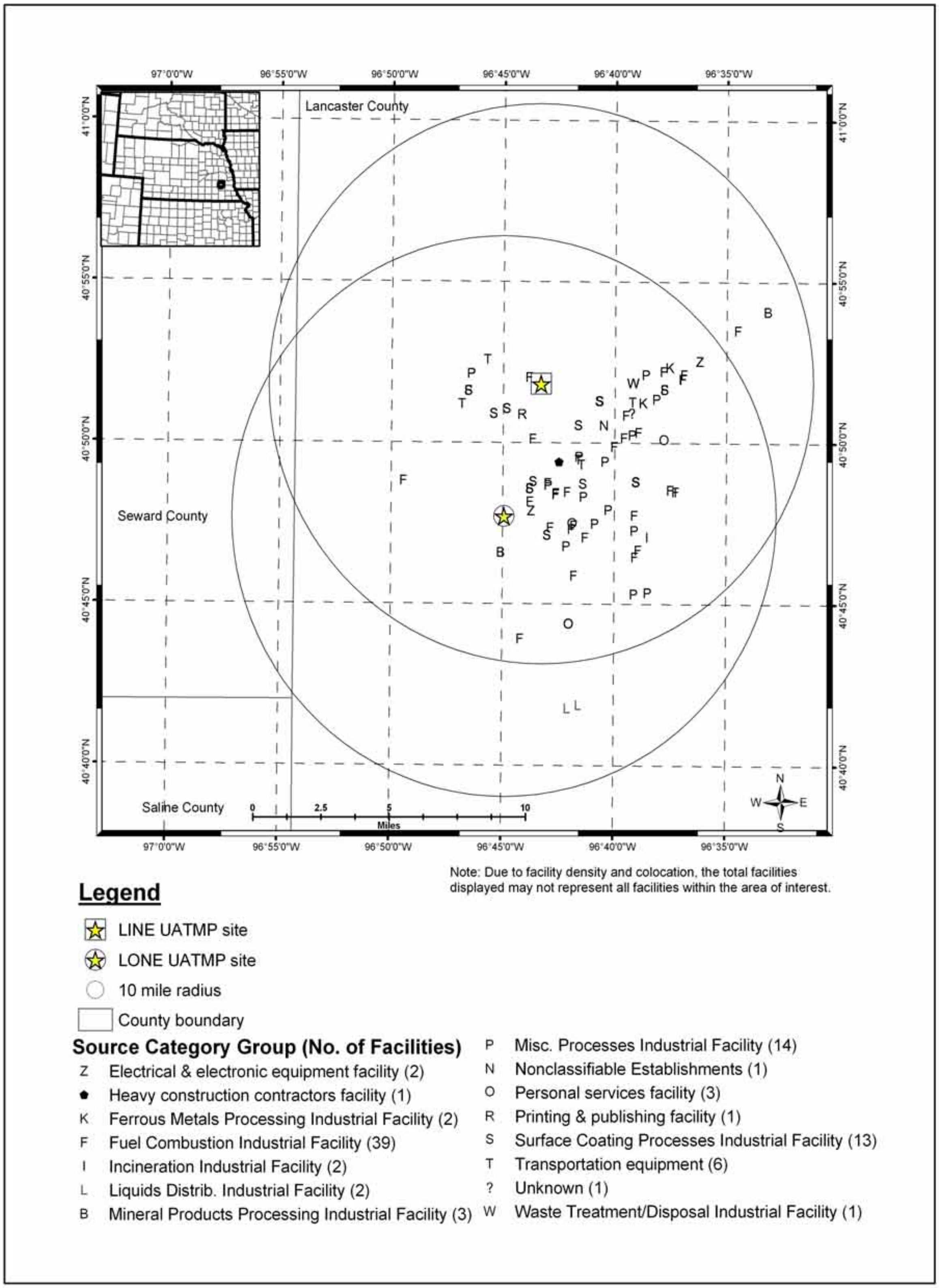


Table 11-1. Average Concentration and Meteorological Parameters for the Sites in Nebraska

Site Name	Type	Average UATMP Concentration (ppbv)	Average Maximum Temperature (°F)	Average Temperature (°F)	Average Dewpoint Temperature (°F)	Average Wet Bulb Temperature (°F)	Average Relative Humidity (%)	Sea Level Pressure (mb)	Average u-component of the Wind (kts)	Average v-component of the Wind (kts)
LINE	All 2002	▨	63.79 (±2.24)	52.33 (±2.13)	39.49 (±1.99)	45.91 (±1.87)	65.46 (±1.23)	1018.7 (±10.31)	0.00 (±0.32)	4.63 (±0.32)
	sample day	23.58 (±3.57)	78.59 (±6.11)	67.25 (±5.50)	52.28 (±5.53)	58.65 (±4.83)	62.12 (±3.20)	1015.5 (±24.88)	-0.39 (±1.10)	2.56 (±1.37)
LONE	All 2002	▨	63.79 (±2.24)	52.33 (±2.13)	39.49 (±1.99)	45.91 (±1.87)	65.46 (±1.23)	1018.7 (±10.31)	0.00 (±0.32)	4.63 (±0.82)
	sample day	16.06 (±5.27)	49.67 (±6.36)	39.26 (±5.07)	30.65 (±5.24)	35.67 (±4.72)	74.10 (±6.36)	1019.7 (±32.86)	0.55 (±1.32)	1.05 (±1.45)

Table 11-2a - Prevalent Compound Concentration Correlations with Selected Meteorological Parameters at Lincoln, Nebraska Site 1 (LINE)

Compound	Maximum Temperature	Average Temperature	Dew Point Temperature	Wet Bulb Temperature	Relative Humidity	Sea Level Pressure	u-component of wind speed	v-component of wind speed
1,2,4-Trimethylbenzene	0.27	0.28	0.23	0.25	-0.12	-0.24	0.24	0.02
Acetylene	-0.43	-0.45	-0.48	-0.47	-0.22	0.36	-0.11	-0.28
Benzene	0.10	0.11	0.09	0.10	-0.05	0.13	-0.07	-0.07
Chloromethane	0.58	0.62	0.69	0.66	0.35	-0.35	-0.25	0.20
Dichlorodifluoromethane	0.39	0.37	0.42	0.40	0.28	-0.20	-0.19	0.19
Ethylbenzene	0.23	0.26	0.22	0.24	-0.16	-0.17	0.25	-0.11
Formaldehyde	0.76	0.77	0.67	0.72	-0.26	-0.35	0.03	0.41
m-,*p* - Xylene	0.26	0.28	0.24	0.26	-0.13	-0.20	0.23	-0.08
o - Xylene	0.27	0.30	0.26	0.28	-0.14	-0.21	0.23	-0.05
Propylene	0.46	0.50	0.51	0.51	0.11	-0.12	-0.23	0.07
Toluene	-0.01	-0.03	-0.11	-0.07	-0.28	0.24	-0.06	-0.07
Trichloromethane	0.39	0.36	0.37	0.37	0.14	-0.17	-0.22	0.18

Table 11-2b - Prevalent Compound Concentration Correlations with Selected Meteorological Parameters at Lincoln, Nebraska Site 2 (LONE)

Compound	Maximum Temperature	Average Temperature	Dew Point Temperature	Wet Bulb Temperature	Relative Humidity	Sea Level Pressure	u-component of wind speed	v-component of wind speed
1,2,4-Trimethylbenzene	0.15	0.31	0.47	0.40	0.45	-0.50	-0.37	-0.04
Acetylene	-0.21	-0.37	-0.32	-0.37	0.06	0.03	-0.11	0.11
Benzene	-0.13	-0.31	-0.29	-0.31	0.00	-0.11	-0.05	0.17
Chloromethane	0.29	0.31	0.27	0.29	-0.02	-0.17	-0.24	0.33
Dichlorodifluoromethane	0.37	0.44	0.49	0.46	0.13	-0.09	-0.16	0.34
Ethylbenzene	-0.10	0.06	0.26	0.16	0.48	-0.28	-0.35	-0.30
Formaldehyde	0.31	0.25	0.13	0.21	-0.21	-0.28	-0.06	0.44
m-,p - Xylene	-0.07	0.07	0.24	0.16	0.43	-0.39	-0.39	-0.09
o - Xylene	-0.22	-0.08	0.12	0.02	0.45	-0.21	-0.36	-0.31
Propylene	-0.06	-0.07	0.05	-0.02	0.29	-0.34	-0.23	0.20
Toluene	0.20	0.26	0.37	0.31	0.31	-0.33	-0.17	0.26
Trichloromethane	0.38	0.42	0.46	0.44	0.13	-0.20	-0.05	0.43

Table 11-3. Motor Vehicle Information vs. Daily Concentration for the Nebraska Monitoring Sites

Monitoring Station	Population within Ten Miles	Estimated Number of Vehicles Owned	Traffic Data (Daily Average)	Average Daily UATMP Concentration (ppbv)
LINE	239,999	177,599	6100	23.58 (±3.57)
LONE	240,340	177,852	6200	16.06 (±5.27)

12.0 Sites in New Jersey

This section focuses on meteorological, concentration, and spatial trends for the four UATMP sites in New Jersey (CANJ, CHNJ, ELNJ, and NBNJ). Each of the four sites is located in different cities (Camden, Chester, Elizabeth, and New Brunswick, respectively). Figures 12-1 through 12-4 are topographical maps showing the monitoring stations in their urban locations. Figures 12-5 through 12-7 are maps identifying facilities within ten miles of the sites that reported to the 1999 NEI. CANJ is located on the southeast side of the state, near the PA/NJ border and east of Philadelphia. A number of sources are located mainly to its north and west, most of which are involved in fuel combustion. CHNJ is located in the north-central part of New Jersey and has only twelve industrial sites nearby, most of which lie just within the ten mile radius from the site and are also involved in fuel combustion. ELNJ and NBNJ are somewhat closer to each other, with the outer portions of their ten mile radius intersecting. These two sites are near the New Jersey/New York border, just west of Staten Island, and have a number of sources in the vicinity, most of which are fuel combustion and chemicals and allied product facilities.

Hourly meteorological data were retrieved for all of 2002 at three weather stations near these sites with the purpose of calculating correlations of meteorological data with ambient air concentration measurements. The weather stations are Philadelphia, Newark International Airport, and Somerville, NJ (WBAN 94732, 14734, and 54785, respectively).

Table 12-1 highlights the average UATMP concentration at each of these sites, along with temperature (average maximum and average), moisture (average dew point temperature, average wet-bulb temperature, and average relative humidity), wind information (average u- and v- components of the wind), and pressure (average sea level pressure) for the entire year and on days samples were taken. New Jersey is located in a region where most storm systems track across, allowing its weather to be somewhat variable. However, its proximity to the Atlantic Ocean has a moderating effect. Hence, summers along the coast tend to be cooler than areas farther inland, while winters tend to be warmer. The location of New Jersey also tends to allow for ample annual precipitation and often high humidity. Annual average wind speed and direction tend to vary among the sites, as indicated in Table 12-1. A southwesterly wind is most common in the summer and a northwesterly wind is typical in the winter. This information can be found in The Weather Almanac, fifth edition (Ruffner and Bair, 1987).

12.1 Meteorological and Concentration Averages at the New Jersey Sites

Carbonyl compound and VOC were measured at all four of the sites, as indicated in Tables 3-3 and 3-4. CHNJ has the highest carbonyl and halogenated hydrocarbon geometric means of the four sites (6.13 ppbv and 6.77 ppbv, respectively). The highest hydrocarbon geometric mean was measured at ELNJ (8.52 ppbv). The polar compounds have the lowest range of geometric means out of the four classifications and ranged from 2.66 ppbv at NBNJ and 3.63 ppbv at ELNJ. The average total UATMP daily concentration at CHNJ was the highest of the four at 44.05 (±17.52) ppbv, while the remaining three sites were all relatively similar in value, ranging from 17.82 (±2.17) ppbv at CANJ to 19.73 (±1.93) ppbv at ELNJ. Table 12-1 also lists the averages for selected meteorological parameters from January 2002 to December 2002, which is the same time period covered in this report. SVOC concentrations were sampled at all four of the sites. Average SVOC concentrations ranged from 3.69 (±0.07) μg/m^3 at NBNJ to 4.20 (±0.18) μg/m^3 at ELNJ. Information on SVOC concentrations is given in Table 12-3.

Tables 12-2a-d are the summary of calculated Pearson Correlation coefficients for each of the prevalent compounds and selected meteorological parameters by site. Identification of the prevalent compounds is discussed in Section 3 of this report. Overall, very few correlations between the sites and compounds were considered strong. Yet many fell into the moderately strong category. At CANJ, chloromethane had strong positive correlations with maximum, average, dew point, and wet bulb temperatures, while dichlorofluoromethane had moderately strong positive correlations with the same parameters. Acetylene, benzene, ethylbenzene, and the xylenes measured moderately strong negative correlations with the aforementioned four weather variables. Interestingly, nearly all of the compounds at CANJ exhibited a moderately strong positive correlation with sea level pressure, a weak negative correlation with the u-component of the wind and a weak to moderately strong positive correlation with the v-component of the wind. The prevalent compounds tend to increase during periods of increasing pressure, decreasing east-west wind speeds, and increasing north-south wind speeds.

Formaldehyde registered a strong positive correlation with the temperature (maximum and average) and moisture (dew point and wet bulb temperatures) variables at CHNJ, while chloromethane registered a moderately strong correlation with the same four variables. Similar to CANJ, benzene and acetylene at CHNJ had moderately strong negative correlations with these same parameters. Aside from these correlations, the majority of the correlations at CHNJ were relatively weak, making it difficult to determine when UATMP concentrations will increase, based on the weather parameters.

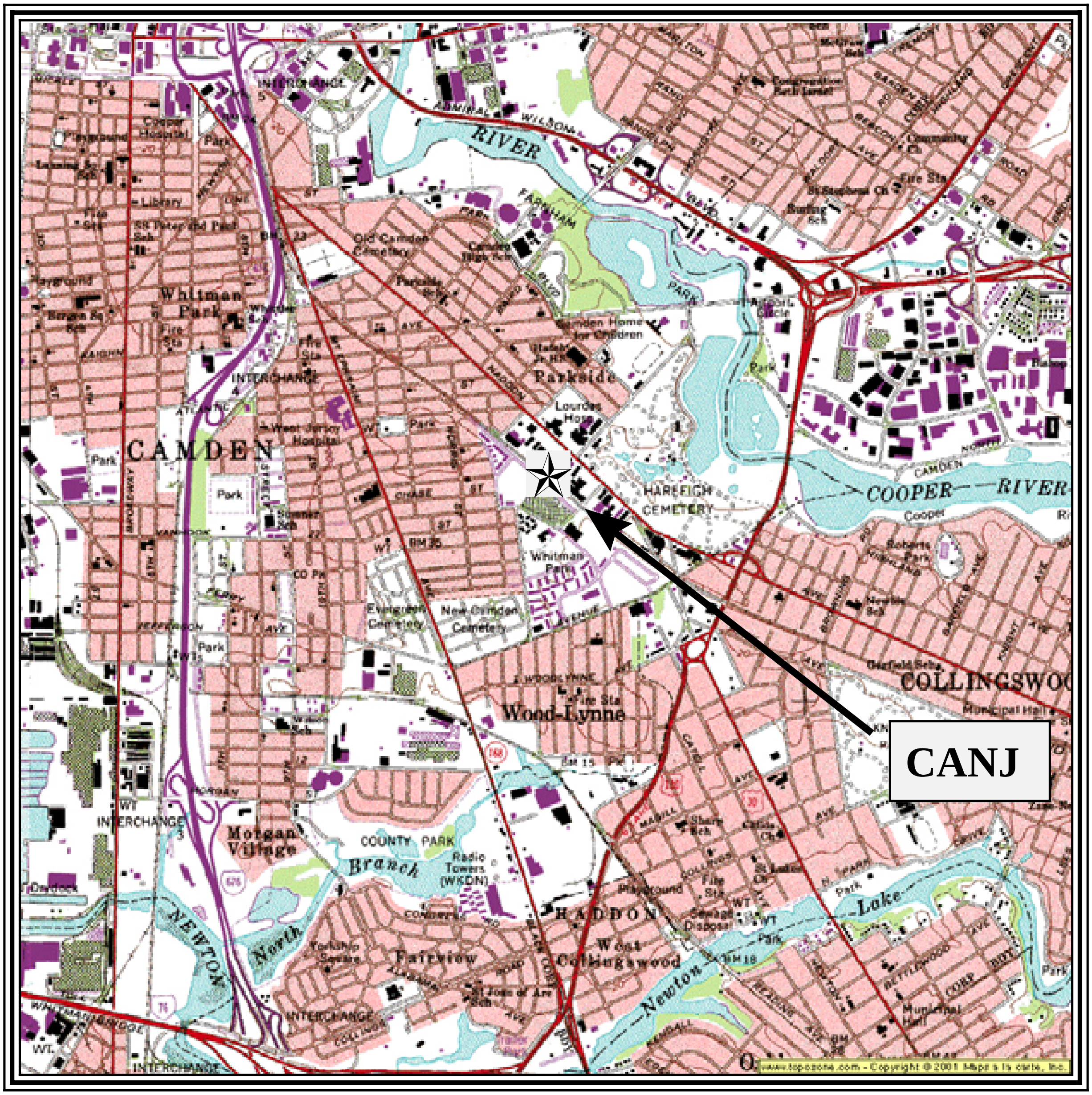
The two sites closest together are ELNJ and NBNJ. Chloromethane and formaldehyde had strong positive correlations with the same temperature and moisture variables mentioned above at ELNJ, while dichlorodifluoromethane and formaldehyde registered moderately strong positive correlations at NBNJ. With the exception of acetylene and benzene, all the compounds at ELNJ had positive correlations with the temperature and moisture parameters, but the same does not hold true at NBNJ. In fact, at NBNJ, acetylene, benzene, ethylbenzene, and *m,p*-xylene all have at least one moderately strong negative correlation with the previously mentioned variables. Interestingly, at least half of the compounds at both ELNJ and NBNJ have moderately strong positive corrrelations with relative humidity, while the remaining compounds have weak positive and negative correlations. The ambiguity in the correlations between weather parameters and compounds makes it difficult to determine when UATMP concentrations will increase at these two monitoring stations.

12.2 Spatial Analysis

Using the population within ten miles of each site, an estimate of the number of motor vehicles operating in proximity to the monitoring station can be established. The ratio used in this report is 0.74 motor vehicles to every one person (refer to section 3.4.1 for more information on this ratio). The population near the ELNJ site is 2,189,897 people, all of whom are operating approximately 1,620,524 motor vehicles. This site had the largest population (and vehicles) of the four New Jersey sites. The site with the lowest population was CHNJ, with a population of 237,587 people driving 175,814 motor vehicles. This information is compared to the average daily concentration of the prevalent compounds at each New Jersey site in Table 12-4. Also included in Table 12-4 are average daily traffic data, or more specifically, the average number of cars passing the monitoring sites on the nearest roadway to each site on a daily basis. Not surprisingly, the site closest to Newark and New York City, ELNJ, had the largest amount of traffic passing by the monitoring station.

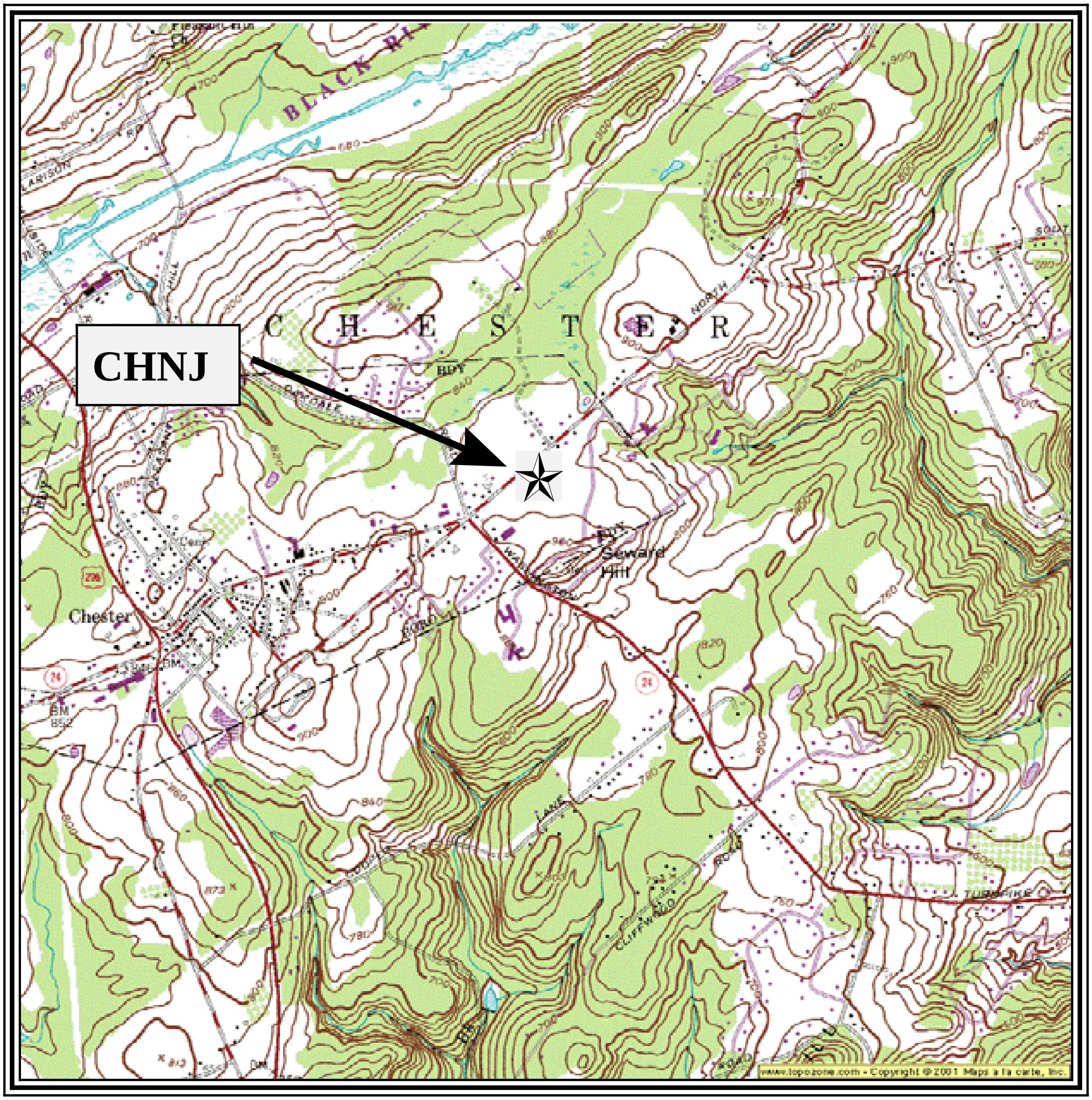
A roadside study conducted to measure emissions from motor vehicles determined that the concentration ratios of the BTEX compounds were relatively consistent from urban area to urban area. (For more information on this study, refer to section 3.4.2.) Figure 3-14 depicts the average concentration ratios of the roadside study and compares them to the concentration ratios at each of the monitoring sites. CHNJ's concentration ratios most resemble those of the roadside study of the four sites, with just slightly lower toluene-ethylbenzene and benzene-ethylbenzene ratios. NBNJ has a higher toluene-ethylbenzene ratio and a lower benzene-ethylbenzene ratio than does the roadside study. ELNJ has a higher toluene-ethylbenzene and benzene-ethylbenzene ratio in comparison to the those of the roadside study. Also, ELNJ's benzene-ethylbenzene ratio is higher than its *m,p*-xylene-ethylbenzene ratio, which isn't true for the roadside study. The concentration ratios for CANJ resemble the roadside study the least, with a toluene-ethylbenzene ratio more than double that of the roadside study, and a higher benzene-ethylbenzene ratio than its *m,p*-xylene-ethylbenzene ratio.

Figure 12-1. Camden, New Jersey (CANJ) Monitoring Station



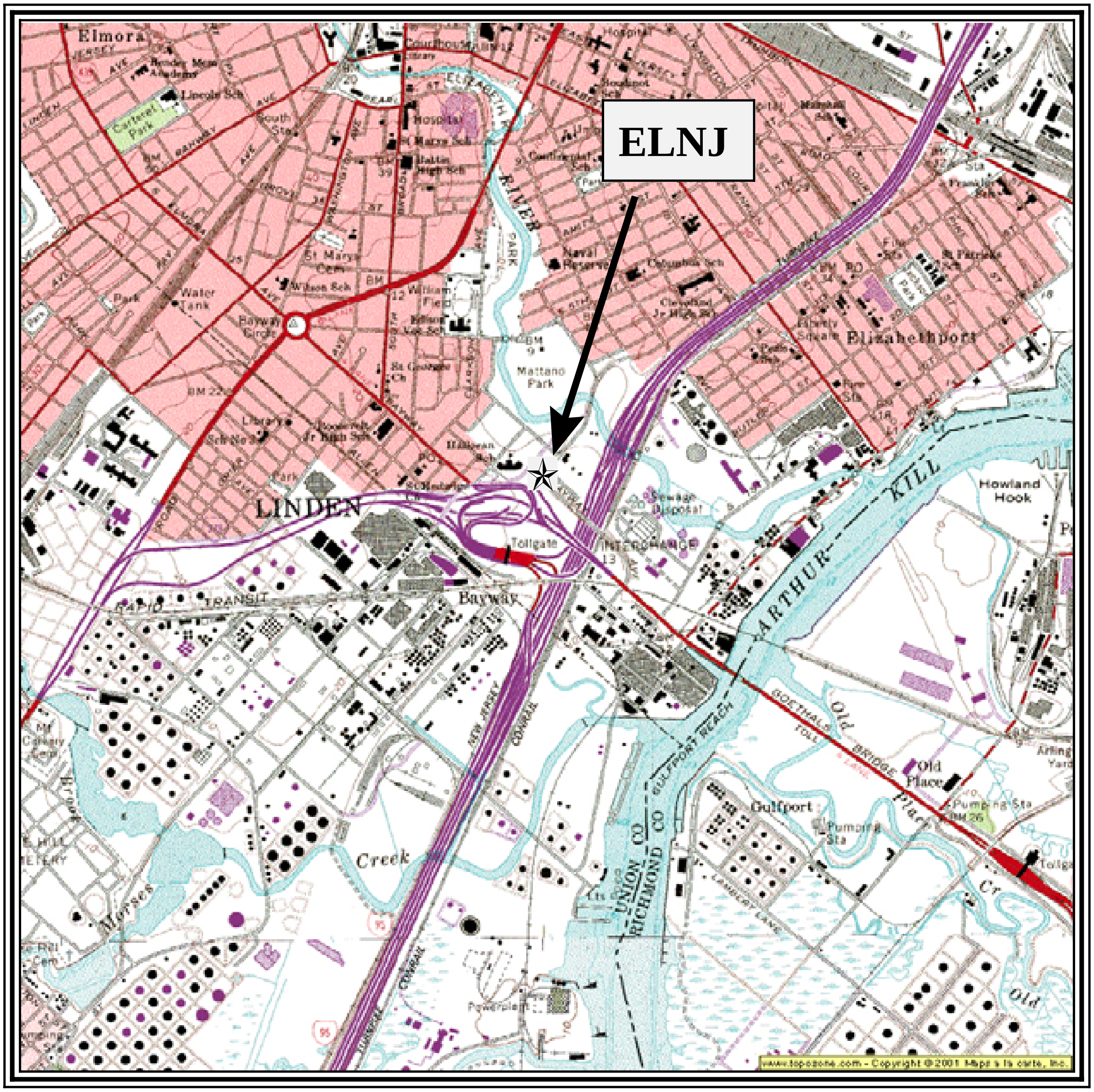
Source: USGS 7.5 Minute Series. Map Scale: 1:24,000.

Figure 12-2. Chester, New Jersey (CHNJ) Monitoring Station



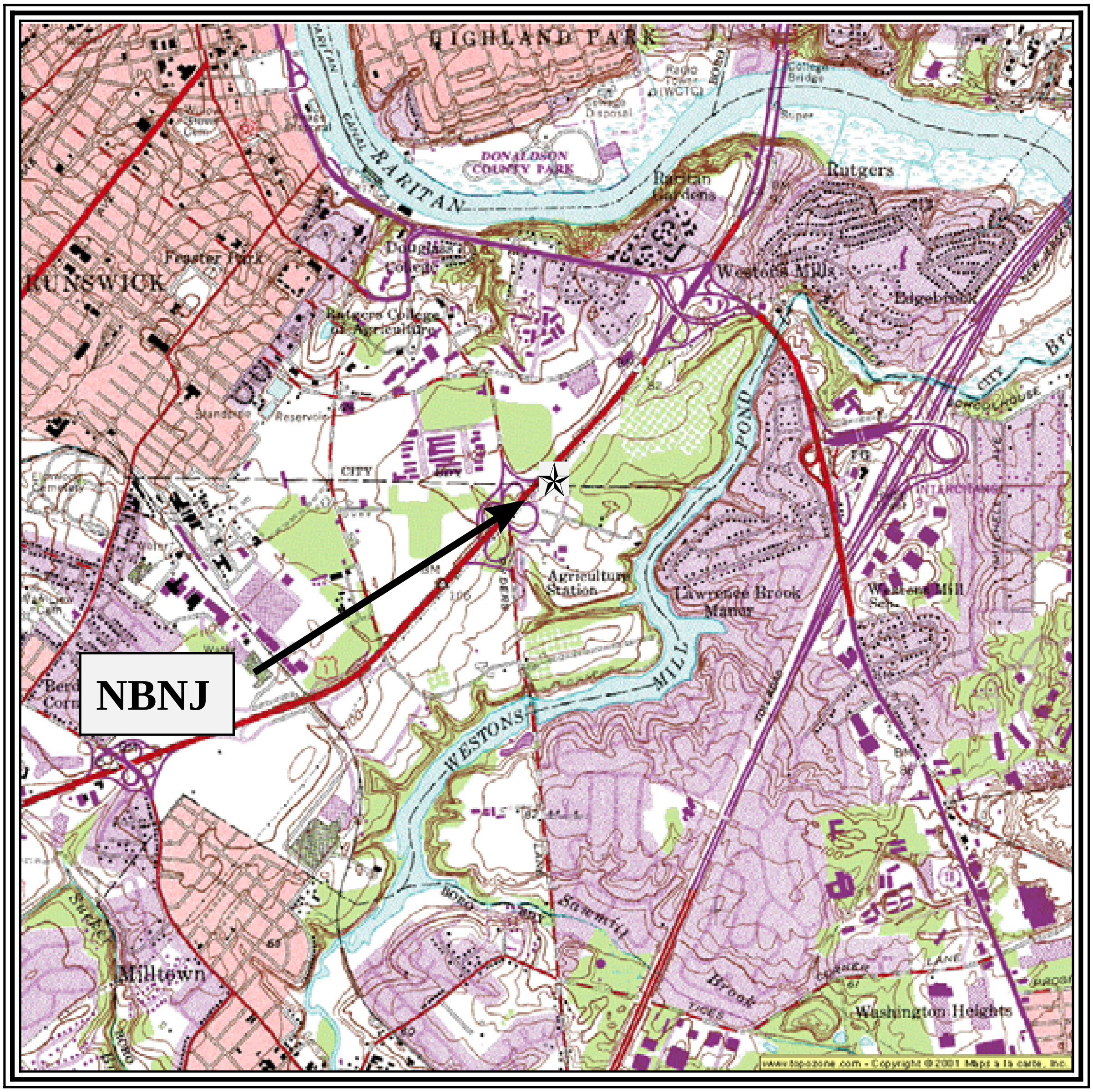
Source: USGS 7.5 Minute Series. Map Scale: 1:24,000.

Figure 12-3. Elizabeth, New Jersey (ELNJ) Monitoring Station



Source: USGS 7.5 Minute Series. Map Scale: 1:24,000.

Figure 12-4. New Brunswick, New Jersey (NBNJ) Monitoring Station



Source: USGS 7.5 Minute Series. Map Scale: 1:24,000.

Figure 12-5. Facilities Located Within 10 Miles of CANJ

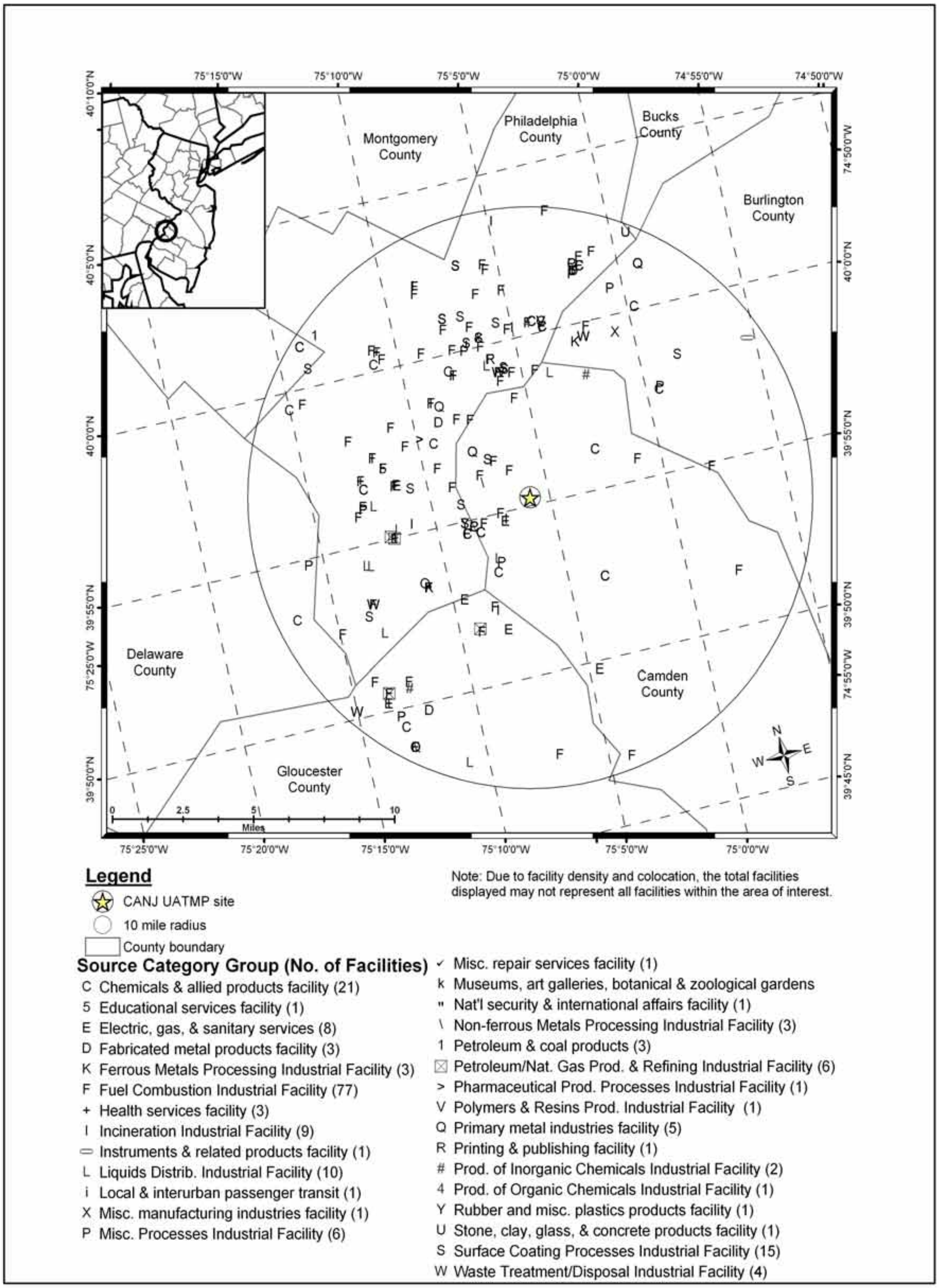


Figure 12-6. Facilities Located Within 10 Miles of CHNJ

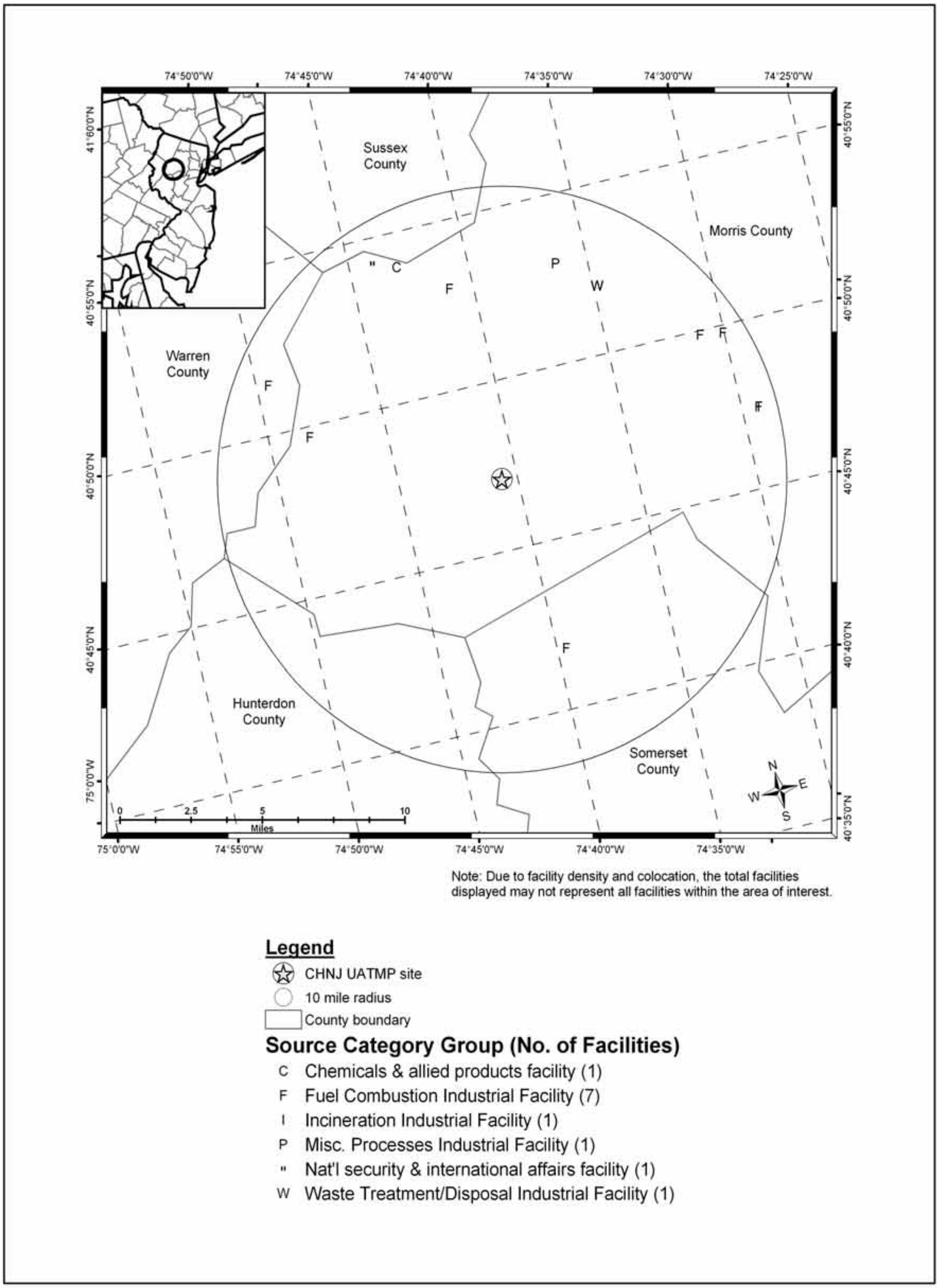


Figure 12-7. Facilities Located Within 10 Miles of ELNJ and NBNJ

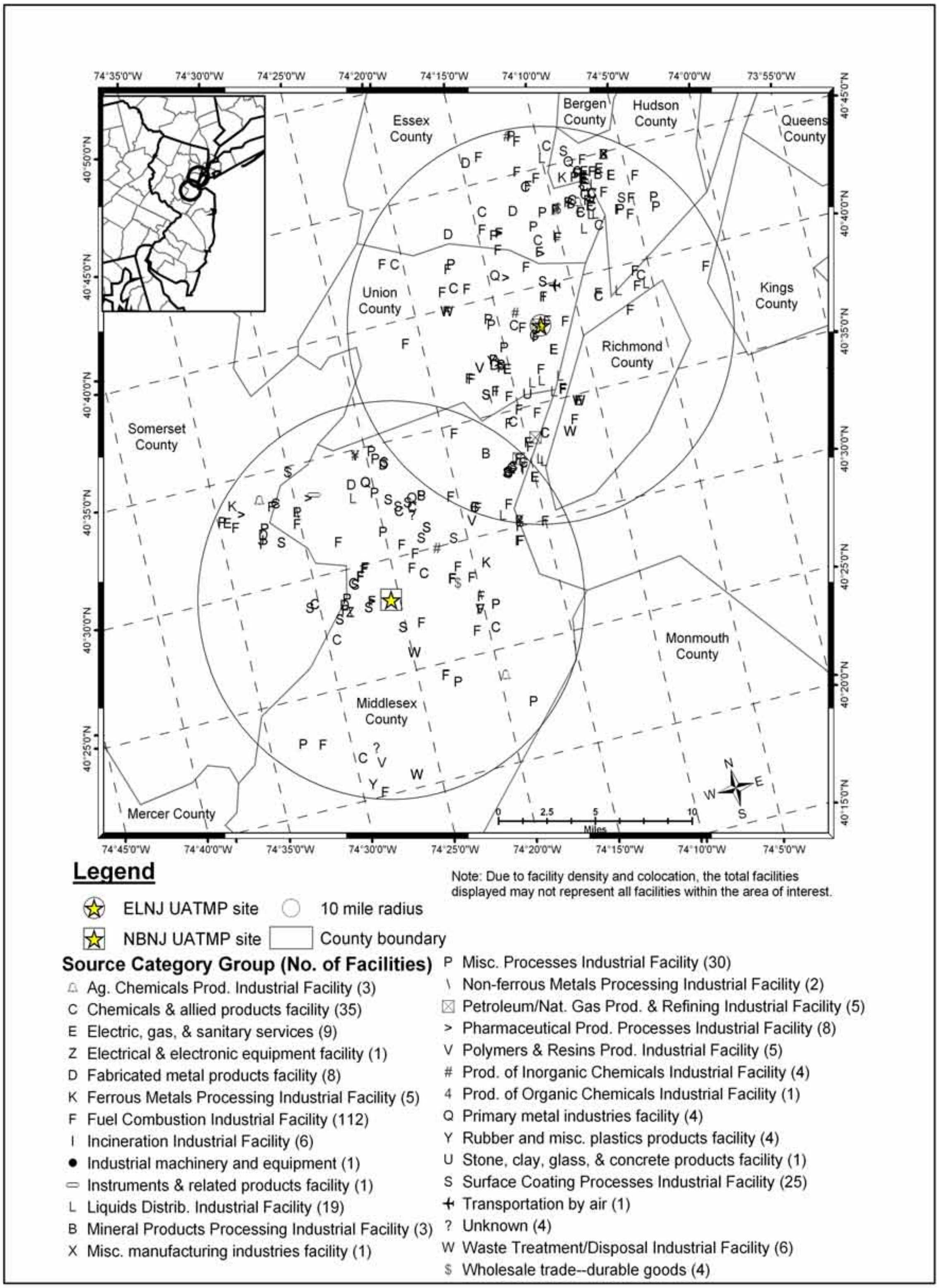


Table 12-1. Average Concentration and Meteorological Parameters for Sites in New Jersey

Site Name	Type	Average UATMP Concentration (ppbv)	Average Maximum Temperature (°F)	Average Temperature (°F)	Average Dewpoint Temperature (°F)	Average Wet Bulb Temperature (°F)	Average Relative Humidity (%)	Sea Level Pressure (mb)	Average u-component of the Wind (kts)	Average v-component of the Wind (kts)
CANJ	All 2002	▨	64.73 (±1.85)	56.29 (±1.73)	42.34 (±1.80)	49.53 (±1.55)	63.12 (±1.51)	1019.5 (±8.94)	0.54 (±0.31)	3.63 (±0.22)
	sample day	17.82 (±2.17)	64.02 (±4.51)	55.38 (±4.27)	42.23 (±4.45)	49.04 (±3.87)	64.29 (±3.57)	1018.9 (±23.30)	0.81 (±0.78)	1.06 (±0.60)
CHNJ	All 2002	▨	63.64 (±1.88)	53.13 (±1.73)	42.26 (±1.85)	47.91 (±1.63)	70.42 (±1.30)	1019.2 (±9.68)	-1.95 (±0.16)	0.36 (±0.14)
	sample day	44.05 (±17.52)	60.25 (±4.38)	49.95 (±4.27)	39.86 (±4.57)	45.28 (±4.05)	71.67 (±3.07)	1020.1 (±27.25)	-0.83 (±0.46)	0.19 (±0.34)
ELNJ	All 2002	▨	64.17 (±1.87)	56.56 (±1.74)	42.64 (±1.81)	49.80 (±1.56)	62.80 (±1.51)	1019.3 (±9.65)	1.50 (±0.36)	4.30 (±0.27)
	sample day	19.73 (±1.93)	65.49 (±4.20)	58.03 (±4.07)	44.99 (±4.08)	51.47 (±3.58)	65.07 (±3.76)	1019.7 (±24.82)	0.90 (±0.95)	0.98 (±0.67)
NBNJ	All 2002	▨	63.64 (±1.88)	53.13 (±1.73)	42.26 (±1.85)	47.91 (±1.63)	70.42 (±1.30)	1019.2 (±9.68)	-1.95 (±0.16)	0.36 (±0.14)
	sample day	19.59 (±2.98)	60.77 (±4.13)	50.62 (±3.98)	40.47 (±4.28)	45.90 (±3.78)	71.69 (±2.99)	1019.5 (±27.12)	-0.83 (±0.47)	0.26 (±0.39)

Table 12-2a - Prevalent Compound Concentration Correlations with Selected Meteorological Parameters at Camden, New Jersey (CANJ)

Compound	Maximum Temperature	Average Temperature	Dew Point Temperature	Wet Bulb Temperature	Relative Humidity	Sea Level Pressure	u-component of wind speed	v-component of wind speed
1,2,4-Trimethylbenzene	-0.22	-0.22	-0.17	-0.21	0.10	0.35	-0.26	0.02
Acetylene	-0.40	-0.45	-0.41	-0.44	-0.01	0.37	-0.21	0.14
Benzene	-0.33	-0.35	-0.33	-0.35	-0.05	0.29	-0.07	0.05
Chloromethane	0.55	0.53	0.54	0.55	0.17	0.12	-0.09	0.24
Dichlorodifluoromethane	0.32	0.32	0.31	0.32	0.06	0.35	0.04	0.14
Ethylbenzene	-0.30	-0.30	-0.25	-0.29	0.07	0.29	-0.17	0.00
Formaldehyde	0.12	0.04	0.04	0.05	0.03	0.26	-0.16	0.34
m-,*p* - Xylene	-0.36	-0.37	-0.34	-0.36	-0.01	0.29	-0.15	0.01
o - Xylene	-0.27	-0.27	-0.22	-0.26	0.07	0.26	-0.24	0.07
Propylene	-0.21	-0.23	-0.28	-0.26	-0.17	0.23	-0.16	0.04
Toluene	-0.22	-0.22	-0.17	-0.20	0.05	0.03	0.08	-0.07
Trichlorofluorormethane	0.08	0.11	0.14	0.13	0.10	0.01	0.21	0.16

Table 12-2b - Prevalent Compound Concentration Correlations with Selected Meteorological Parameters at Chester, New Jersey (CHNJ)

Compound	Maximum Temperature	Average Temperature	Dew Point Temperature	Wet Bulb Temperature	Relative Humidity	Sea Level Pressure	u-component of wind speed	v-component of wind speed
1,2,4-Trimethylbenzene	0.02	0.07	0.13	0.11	0.25	-0.12	0.00	-0.17
Acetylene	-0.38	-0.40	-0.33	-0.37	0.11	0.20	-0.05	-0.14
Benzene	-0.39	-0.39	-0.31	-0.36	0.12	-0.05	0.00	0.02
Chloromethane	0.41	0.35	0.30	0.33	-0.06	-0.08	-0.07	-0.12
Dichlorodifluoromethane	0.18	0.17	0.17	0.16	0.05	-0.07	0.11	0.09
Ethylbenzene	0.07	0.03	0.02	0.03	-0.02	-0.16	0.07	-0.13
Formaldehyde	0.70	0.66	0.55	0.61	-0.11	-0.09	-0.04	-0.18
m-,p - Xylene	0.12	0.06	0.04	0.05	-0.06	-0.18	0.04	-0.10
o - Xylene	0.11	0.06	0.07	0.07	0.03	-0.18	0.05	-0.14
Propylene	0.21	0.21	0.27	0.24	0.33	0.03	-0.19	-0.16
Toluene	0.18	0.19	0.24	0.22	0.21	-0.06	0.08	-0.10
Trichlorofluorormethane	0.15	0.16	0.20	0.18	0.19	-0.05	0.06	0.02

Table 12-2c - Prevalent Compound Concentration Correlations with Selected Meteorological Parameters at Elizabeth, New Jersey (ELNJ)

Compound	Maximum Temperature	Average Temperature	Dew Point Temperature	Wet Bulb Temperature	Relative Humidity	Sea Level Pressure	u-component of wind speed	v-component of wind speed
1,2,4-Trimethylbenzene	0.13	0.15	0.25	0.20	0.30	-0.08	-0.31	0.19
Acetylene	-0.31	-0.33	-0.22	-0.29	0.25	0.22	-0.33	0.21
Benzene	-0.07	-0.10	-0.07	-0.09	0.08	-0.06	-0.15	0.16
Chloromethane	0.60	0.60	0.58	0.61	0.03	-0.26	-0.08	0.16
Dichlorodifluoromethane	0.35	0.37	0.40	0.40	0.12	-0.10	-0.14	-0.02
Ethylbenzene	0.12	0.14	0.24	0.19	0.28	-0.07	-0.33	0.10
Formaldehyde	0.68	0.66	0.55	0.61	-0.21	-0.20	0.00	0.17
m-,*p* - Xylene	0.08	0.09	0.20	0.15	0.30	-0.06	-0.42	0.20
o - Xylene	0.08	0.10	0.22	0.16	0.32	-0.06	-0.38	0.13
Propylene	0.17	0.15	0.15	0.16	0.03	-0.22	0.13	0.36
Toluene	0.06	0.09	0.22	0.16	0.34	0.00	-0.37	0.02
Trichlorofluorormethane	0.29	0.31	0.32	0.32	0.05	-0.12	-0.10	-0.18

Table 12-2d - Prevalent Compound Concentration Correlations with Selected Meteorological Parameters at New Brunswick, New Jersey (NBNJ)

Compound	Maximum Temperature	Average Temperature	Dew Point Temperature	Wet Bulb Temperature	Relative Humidity	Sea Level Pressure	u-component of wind speed	v-component of wind speed
1,2,4-Trimethylbenzene	0.08	0.13	0.22	0.17	0.43	0.37	-0.09	-0.21
Acetylene	-0.27	-0.32	-0.25	-0.29	0.17	0.23	-0.04	0.01
Benzene	-0.24	-0.25	-0.17	-0.22	0.24	0.34	-0.07	-0.12
Chloromethane	0.14	0.17	0.25	0.21	0.33	0.44	-0.06	-0.04
Dichlorodifluoromethane	0.30	0.30	0.35	0.33	0.32	0.34	-0.15	-0.14
Ethylbenzene	-0.24	-0.29	-0.29	-0.29	-0.10	-0.01	0.21	0.15
Formaldehyde	0.47	0.43	0.34	0.39	-0.10	-0.25	-0.02	0.06
m-,*p* - Xylene	-0.26	-0.31	-0.34	-0.32	-0.19	-0.07	0.22	0.21
o - Xylene	-0.16	-0.21	-0.24	-0.22	-0.14	-0.05	0.20	0.17
Propylene	-0.13	-0.12	-0.04	-0.08	0.32	0.48	-0.16	-0.11
Toluene	0.02	0.07	0.14	0.12	0.27	-0.09	0.05	-0.08
Trichlorofluorormethane	0.21	0.24	0.32	0.29	0.38	0.07	-0.20	-0.06

Table 12-3. SVOC Measured by the New Jersey Monitoring Stations

Monitoring Station	**Average SVOC Concentration (μg/m^3)**
CANJ	4.17 (±0.22)
CHNJ	3.69 (±0.04)
ELNJ	4.20 (±0.18)
NBNJ	3.83 (±0.07)

Table 12-4. Motor Vehicle Information vs. Daily Concentration for New Jersey Monitoring Sites

Monitoring Station	Population within Ten Miles	Estimated Number of Motor Vehicles Owned	Traffic Data (Daily Average)	Average Daily UATMP Concentration (ppbv)
CANJ	1,946,547	1,440,445	62,000	17.82 (±2.17)
CHNJ	237,587	175,814	12,623	44.05 (±17.52)
ELNJ	2,189,897	1,620,524	170,000	19.73 (±1.93)
NBNJ	856,367	633,712	63,000	19.59 (±2.98)

13.0 Site in North Dakota

This section focuses on meteorological, concentration, and spatial trends for the UATMP site in North Dakota (BUND). This site is located in Beulah, and Figure 13-1 is a topographical map showing the monitoring station in its urban location. Figure 13-2 is a map identifying facilities within ten miles of the site and that reported to the 1999 NEI. The BUND site has very few sources nearby, mainly in fuel combustion industries. Hourly meteorological data were retrieved for all of 2002 at the Bismarck Municipal Airport (WBAN 24011) with the purpose of calculating correlations of meteorological data with ambient air concentration measurements.

Table 13-1 highlights the average UATMP concentration at the site, along with temperature (average maximum and average), moisture (average dew point temperature, average wet-bulb temperature, and average relative humidity), wind information (average u- and v-components of the wind), and pressure (average sea level pressure) for the entire year and on sampling days. Beulah is located to the northwest of Bismarck, and Beulah's climate is continental in nature. Cold, dry winters and generally mild summers are normally expected. Climatologically, moderate northerly winds are expected in the winter, with southerly winds in the summer. This information can be found in The Weather Almanac, fifth edition (Ruffner and Bair, 1987).

13.1 Meteorological and Concentration Averages at the North Dakota Site

Carbonyl compounds and VOC were measured at the site, as indicated in Tables 3-3 and 3-4. BUND's lowest geometric mean was 1.89 ppbv for the hydrocarbons, and the highest geometric mean was 4.12 ppbv for the halogenated hydrocarbons. Polar and carbonyl compound values fell between these values. The average total UATMP daily concentration at BUND was 9.71 (±0.57) ppbv. Table 13-1 also lists the averages for selected meteorological parameters from January 2002 to December 2002, which is the same time period covered in this report.

This site also opted to have total and speciated nonmethane organic compounds (TNMOC/SNMOC) measured during its air toxic sampling. SNMOC/NMOC compounds are of particular interest because of their role in ozone formation. Readers are encouraged to review

EPA's *2001 Nonmethane Organic Compounds (NMOC) and Speciated Nonmethane Organic Compounds (SNMOC) Monitoring Program, Final Report* (EPA, 2002) for more information on SNMOC/NMOC trends and concentrations. The average total NMOC value for BUND was 223 (±180.67) ppbC, of which nearly 66% could be identified through speciation. Of the speciated compounds, isopentane measured the highest concentration at the BUND site (39.05 ppbC). Ozone concentrations were also sampled at BUND on 365 sample days, and were retrieved from the U.S. EPA's AQS database. The average ozone concentration for each sample day was 40.36 (±1.15) ppbv. This information is available in Table 13-3.

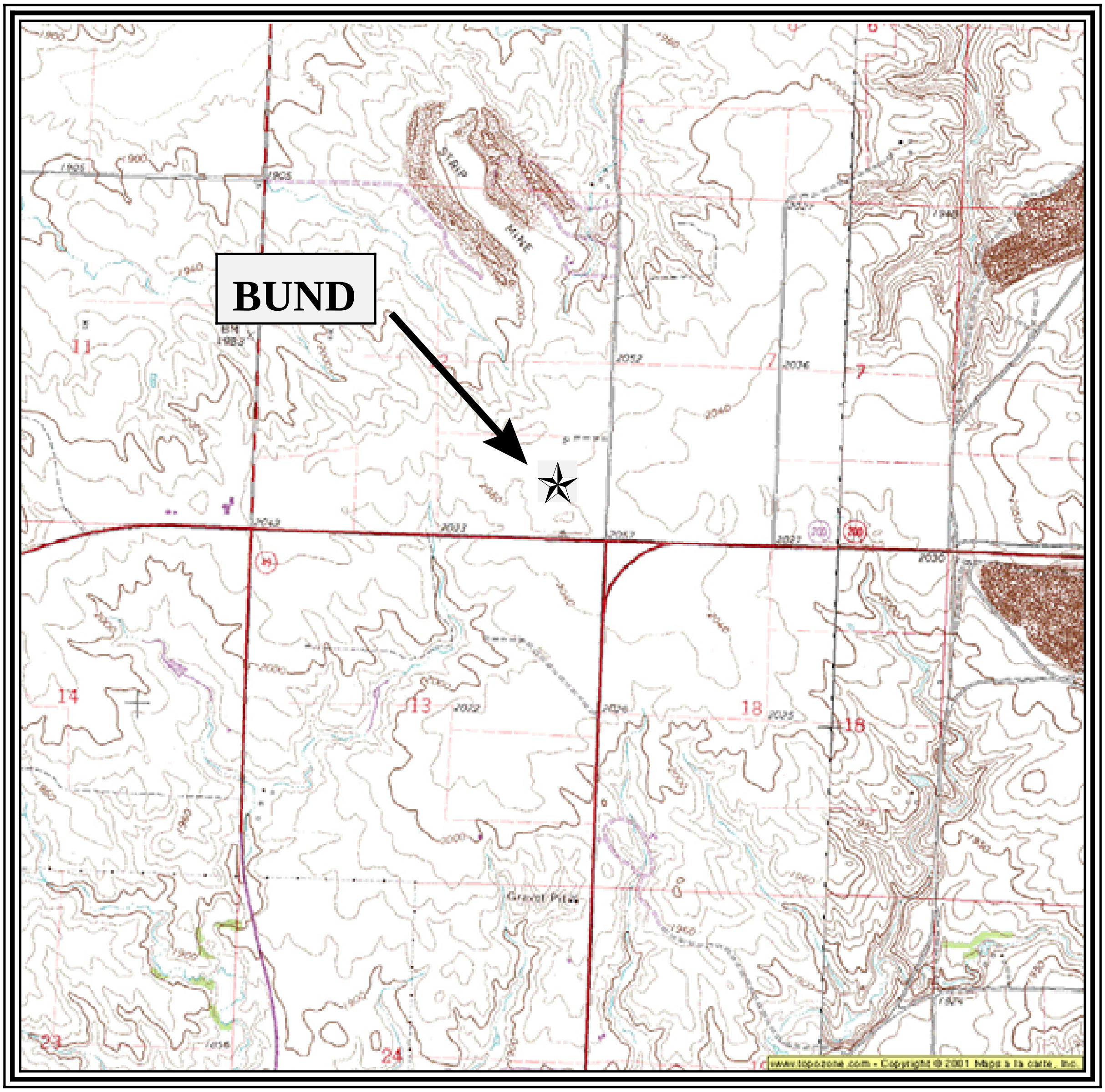
Table 13-2 is the summary of calculated Pearson Correlation coefficients for each of the prevalent compounds and selected meteorological parameters. Identification of the prevalent compounds is discussed in Section 3 of this report. Formaldehyde was the only compound to measure correlations that were considered strong. Strong positive correlations were indicated between maximum, average, dew point, and wet bulb temperatures and formaldehyde, all of which were greater than or equal to 0.71. A moderately strong negative correlation between benzene and acetylene and the same four meteorological parameters also exists at BUND. Chloromethane exhibited a moderately strong positive correlation with dew point and wet bulb temperature. Aside from these compounds, no other correlations between concentration and weather parameter appear to exist, making a prediction of when UATMP concentrations will increase, based on meteorology, difficult at best.

13.2 Spatial Analysis

Using the population within ten miles of each site, an estimate of the number of motor vehicles operating in proximity to the monitoring station can be established. The ratio used in this report is 0.74 motor vehicles to every one person (refer to section 3.4.1 for more information on this ratio). The population near the BUND site is 7,415 people, all of whom are operating approximately 5,487 motor vehicles. This information is compared to the average daily concentration of the prevalent compounds at the North Dakota site in Table 13-4. Also included in Table 13-4 are average daily traffic data, or more specifically, the average number of cars passing the monitoring sites on the nearest roadway to each site on a daily basis.

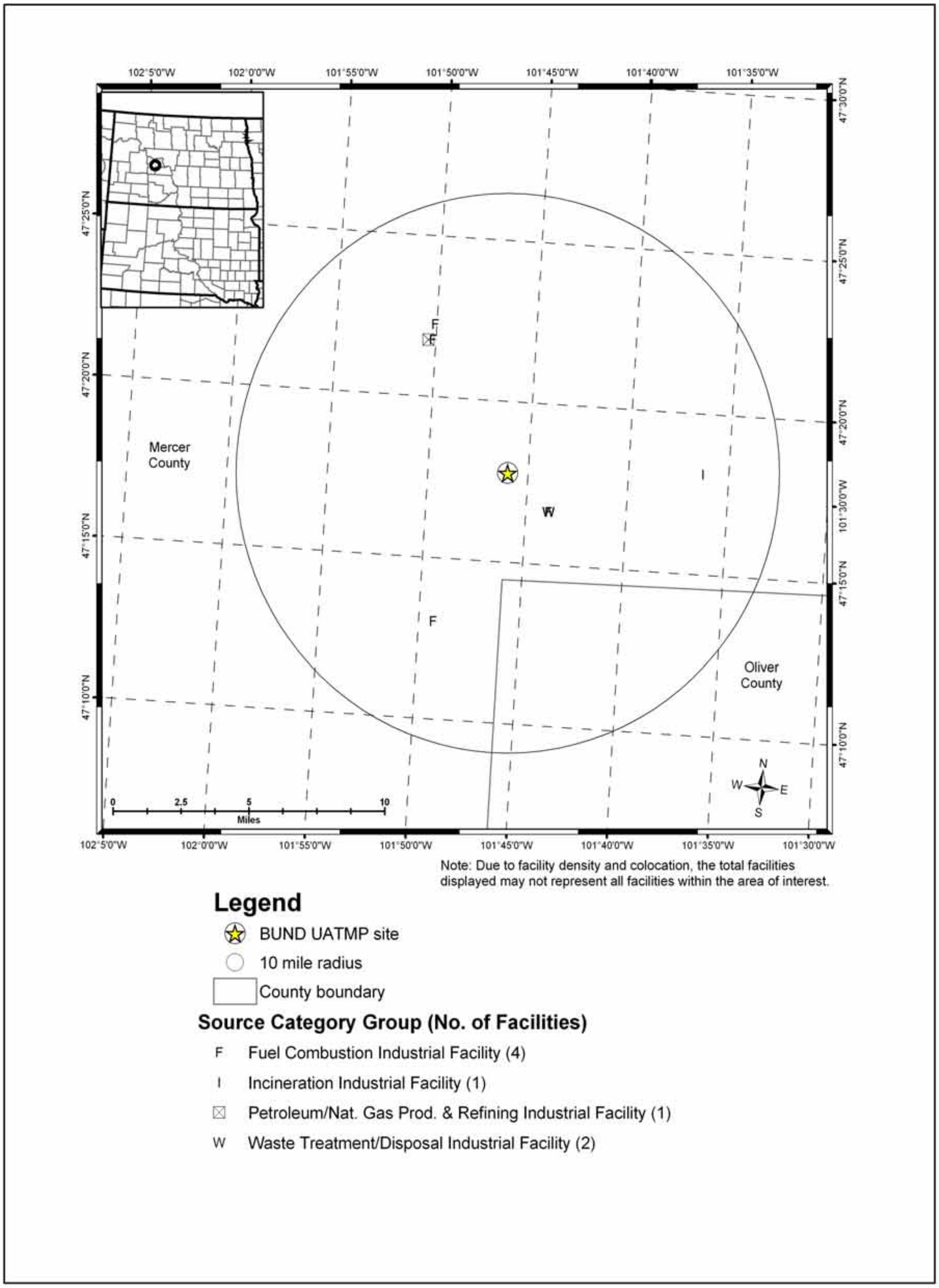
A roadside study conducted to measure emissions from motor vehicles determined that the concentration ratios of the BTEX compounds were relatively consistent from urban area to urban area. (For more information on this study, refer to section 3.4.2.) Figure 3-14 depicts the average concentration ratios of the roadside study and compares them to the concentration ratios at the monitoring site. The BUND site's concentration ratios look somewhat different than those of the roadside study. The *m,p*-xylene-ethylbenzene ratio is significantly lower than that of the roadside study, and is not the second highest concentration as in the roadside study, but the third highest behind benzene-ethylbenzene. Also, the benzene-ethylbenzene and toluene-ethylbenzene ratios are slightly higher than the roadside study's ratios for the same compounds. Only the ratio for *o*-xylene-ethylbenzene appears similar to that of the roadside study.

Figure 13-1. Beulah, North Dakota (BUND) Monitoring Station



Source: USGS 7.5 Minute Series. Map Scale: 1:24,000.

Figure 13-2. Facilities Located Within 10 Miles of BUND



Note: Due to facility density and colocation, the total facilities displayed may not represent all facilities within the area of interest.

Table 13-1. Average Concentration and Meteorological Parameters for the Site in North Dakota

Site Name	Type	Average UATMP Concentration (ppbv)	Average Maximum Temperature (°F)	Average Temperature (°F)	Average Dewpoint Temperature (°F)	Average Wet Bulb Temperature (°F)	Average Relative Humidity (%)	Sea Level Pressure (mb)	Average u-component of the Wind (kts)	Average v-component of the Wind (kts)
BUND	All 2002	▨	54.86 (±2.51)	43.48 (±2.28)	31.34 (±1.90)	37.74 (±1.93)	66.83 (±1.32)	1019.0 (±13.38)	-0.09 (±0.37)	4.21 (±0.26)
	sample day	9.71 (±0.57)	53.82 (±6.28)	42.48 (±5.75)	30.89 (±4.96)	37.07 (±4.98)	67.97 (±3.40)	1018.1 (±32.72)	0.17 (±0.89)	1.14 (±0.76)

Table 13-2. Prevalent Compound Concentration Correlations with Selected Meteorological Parameters at Beulah, North Dakota (BUND)

Compound	Maximum Temperature	Average Temperature	Dew Point Temperature	Wet Bulb Temperature	Relative Humidity	Sea Level Pressure	u-component of wind speed	v-component of wind speed
1,2,4-Trimethylbenzene	0.06	0.08	0.04	0.07	-0.16	-0.02	-0.18	0.12
Acetylene	-0.32	-0.36	-0.33	-0.35	0.25	0.03	-0.11	-0.18
Benzene	-0.43	-0.42	-0.43	-0.43	0.11	0.16	0.11	-0.24
Chloromethane	0.21	0.24	0.30	0.28	0.10	-0.01	-0.16	0.11
Dichlorodifluoromethane	0.01	0.03	0.10	0.06	0.19	0.06	-0.13	0.07
Ethylbenzene	-0.09	-0.05	-0.05	-0.05	0.03	0.03	-0.16	0.21
Formaldehyde	0.75	0.76	0.71	0.75	-0.39	0.01	-0.22	0.27
m-,*p* - Xylene	-0.21	-0.21	-0.21	-0.22	0.12	0.05	-0.11	-0.03
o - Xylene	-0.23	-0.20	-0.16	-0.18	0.19	0.02	0.05	-0.05
Propylene	0.05	0.05	0.02	0.04	-0.14	0.01	0.09	-0.10
Toluene	0.00	0.01	0.00	0.01	-0.02	-0.11	-0.17	0.04
Trichlorofluoromethane	-0.21	-0.21	-0.17	-0.20	0.23	0.00	-0.01	-0.18

Table 13-3. TNMOC and Ozone Measured by the Beulah, ND (BUND) Monitoring Station

Average Ozone Concentrations (ppbv)	Total Number of Ozone Sampling Days	Average TNMOC speciated (ppbC)	Average TNMOC w/ unknowns (ppbC)	% TNMOC Identified	SNMOC Compound with the Highest Concentration (ppbC)
40.36 (±1.15)	365	181 (±173.29)	223 (±180.67)	66 %	Isopentane (39.05)

Table 13-4. Motor Vehicle Information vs. Daily Concentration for the North Dakota Monitoring Site

Monitoring Station	Population within Ten Miles	Estimated Number of Motor Vehicles Owned	Traffic Data (Daily Average)	Average Daily UATMP Concentration (ppbv)
BUND	7,415	5,487	1,350	9.71 (±0.57)

14.0 Site in Oregon

This section focuses on a few specific meteorological, concentration, and spatial trends for the UATMP site in Oregon (PLOR), located in Portland. Figure 14-1 is a topographical map showing the monitoring station in its urban location. Figure 14-2 is a map identifying facilities within ten miles of the site that reported to the 1999 NEI. Most of the industrial facilities within ten miles of the site are to the west and northwest, many of which are surface coating and miscellaneous industries. Hourly meteorological data were retrieved for all of 2002 at the Portand International Airport weather station (WBAN 24229) with the purpose of calculating correlations of meteorological data with ambient air concentration measurements.

The Portland site sampled only hexavalent chromium and therefore does not have an average UATMP concentration to report in Table 14-1, like the other state sections. However, Table 14-1 does list temperature (average maximum and average), moisture (average dew point temperature, average wet-bulb temperature, and average relative humidity), wind information (average u- and v- components of the wind), and pressure (average sea level pressure) for the entire year and on days samples were taken. Portland is nestled between the Cascades to the east and the coast range to the west. The proximity to the Pacific Ocean has a moderating effect on Portland's temperatures, while the mountains can act as both a barrier and an enhancer for temperatures and precipitation. The rainy season occurs during the winter months, while summer is rather dry. This information can be found in The Weather Almanac, fifth edition (Ruffner and Bair, 1987).

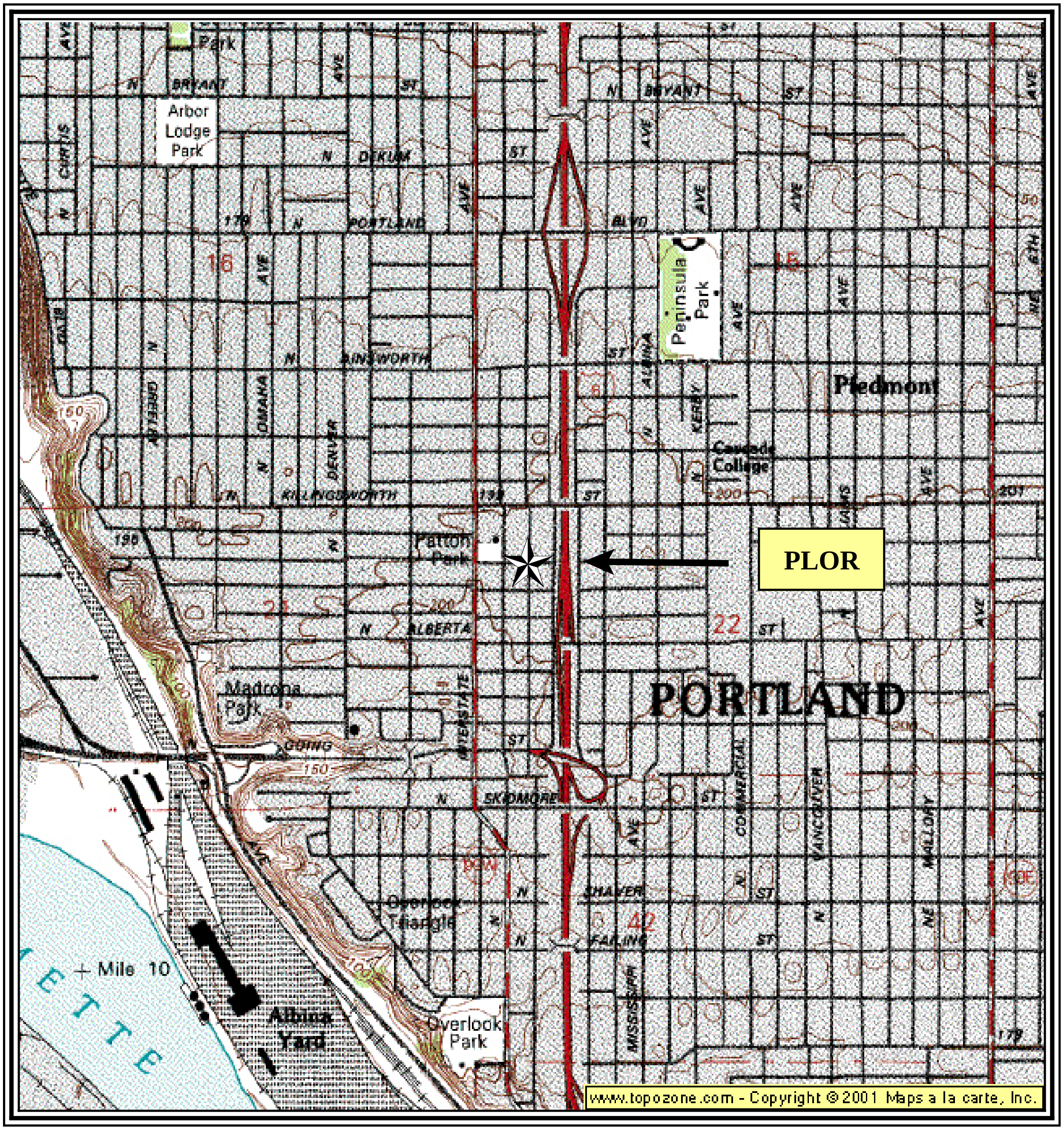
14.1 Meteorological and Concentration Averages at the Oregon Site

Carbonyl compounds and VOC were not measured at this site; only hexavalent chromium was sampled. The average hexavalent chromium concentration at PLOR was 0.260 (±0.049) ng/m^3, and is summarized in Table 14-3. Pearson Correlation coefficients were calculated for this site for hexavalent chromium and are listed in Table 14-2. Moderately strong to strong negative correlations were found between hexavalent chromium concentrations and maximum, average, dew point, and wet bulb temperatures, as well as with the u-component of the wind. A moderately strong positive correlation is also noted with relative humidity. As temperature and wind speed decrease, and relative humidity increases, hexavalent chromium concentrations tend to increase at PLOR.

14.2 Spatial Analysis

Using the population within ten miles of each site, an estimate of the number of motor vehicles operating in proximity to the monitoring station can be established. The ratio used in this report is 0.74 motor vehicles to every one person (refer to section 3.4.1 for more information on this ratio). The population near the PLOR site is 894,082 people, all of whom are operating approximately 661,621 motor vehicles. This information is listed in Table 14-3. Also included in Table 14-3 are average daily traffic data, or more specifically, the average number of cars passing the monitoring sites on the nearest roadway to each site on a daily basis.

Figure 14-1. Portland, Oregon (PLOR) Monitoring Station



Source: USGS 7.5 Minute Series. Map Scale: 1:25,000.

Figure 14-2. Facilities Located Within 10 Miles of PLOR

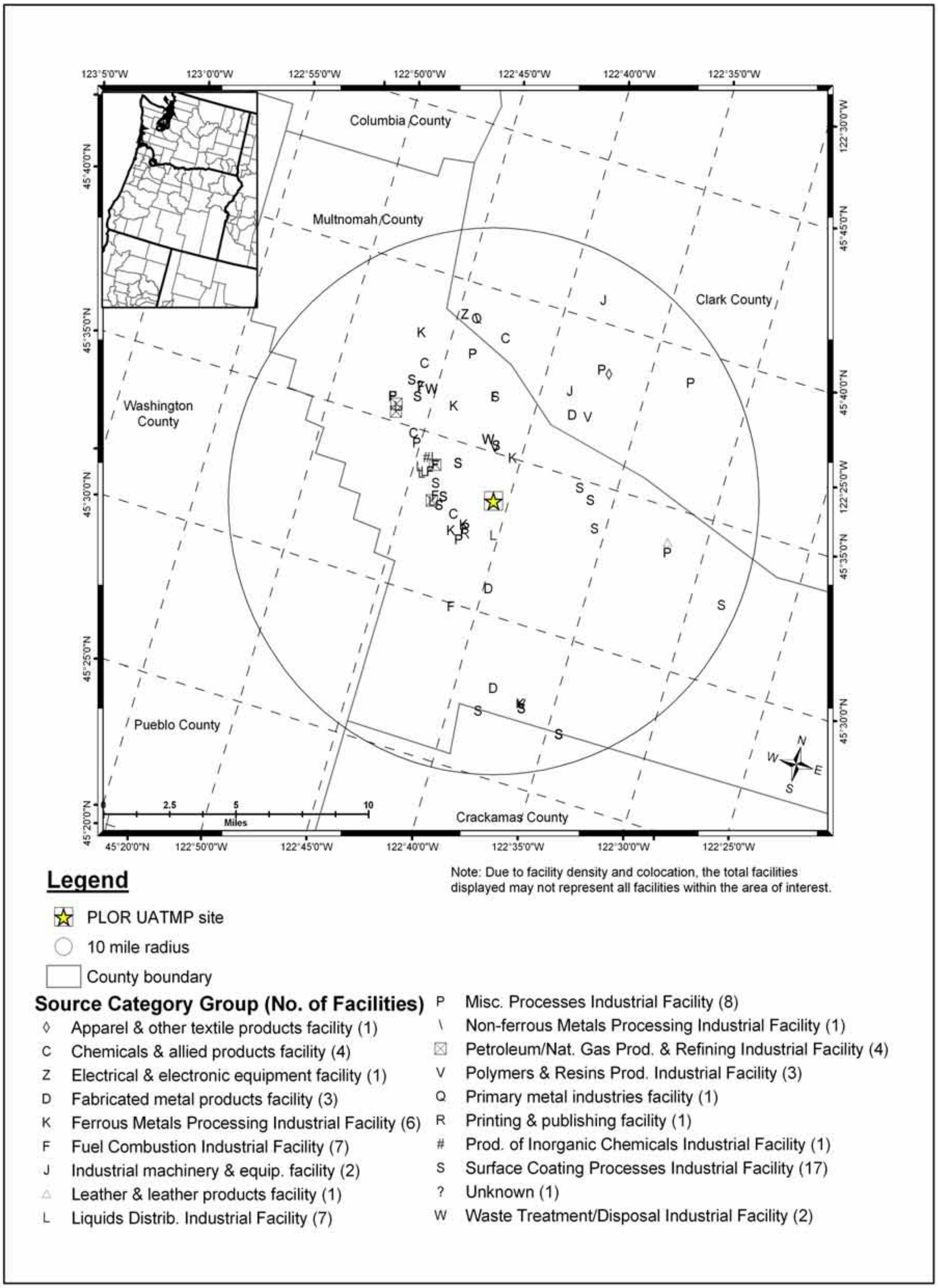


Table 14-1. Average Concentration and Meteorological Parameters for the Site in Oregon

Site Name	Type	Average Hexavalent Chromium Concentration (ng/m^3)	Average Maximum Temperature (°F)	Average Temperature (°F)	Average Dewpoint Temperature (°F)	Average Wet Bulb Temperature (°F)	Average Relative Humidity (%)	Sea Level Pressure (mb)	Average u-component of the Wind (kts)	Average v-component of the Wind (kts)
PLOR	All 2002	▨	62.68 (±1.44)	53.95 (±1.10)	44.09 (±0.89)	48.91 (±0.87)	72.96 (±1.38)	1020.1 (±9.53)	1.05 (±0.27)	3.18 (±0.20)
	sample day	0.260 (±0.049)	59.70 (±5.48)	51.79 (±3.62)	44.11 (±2.88)	47.96 (±2.82)	78.57 (±5.59)	1021.5 (±58.48)	-0.73 (±0.93)	1.84 (±0.66)

Table 14-2. Hexavalent Chromium Concentration Correlations with Selected Meteorological Parameters at Portland, Oregon (PLOR)

Site	Maximum Temperature	Average Temperature	Dew Point Temperature	Wet Bulb Temperature	Relative Humidity	Sea Level Pressure	u-component of wind speed	v-component of wind speed
PLOR	-0.48	-0.55	-0.35	-0.48	0.39	0.00	-0.40	-0.01

Table 14-3. Motor Vehicle Information vs. Daily Concentration for the Oregon Monitoring Site

Monitoring Station	Population within Ten Miles	Estimated Number of Motor Vehicles Owned	Traffic Data (Daily Average)	Average Daily Hexavalent Chromium Concentration (ng/m^3)
PLOR	894,082	661,621	1000	0.260 (±0.049)

15.0 Sites in Puerto Rico

This section focuses on meteorological, concentration, and spatial trends for the two UATMP sites in Puerto Rico (BAPR and SJPR). These sites reside along Puerto Rico's northern coastline, with SJPR in San Juan and BAPR further west in Barceloneta. No topographical maps are available for these sites, but Figures 15-1 through 15-2 are maps identifying facilities within ten miles of the sites that reported to the 1999 NEI. There are a number of pharmaceutical production and fuel combustion industrial facilities just to the east of BAPR. SJPR has nearly as many facilities nearby but they are more scattered around the monitoring site, and are mostly involved in fuel combustion. Hourly meteorological data were retrieved for all of 2002 at the San Juan weather station (WBAN 11641) with the purpose of calculating correlations of meteorological data with ambient air concentration measurements.

Table 15-1 highlights the average UATMP concentration at each of these sites, along with temperature (average maximum and average), moisture (average dew point temperature, average wet-bulb temperature, and average relative humidity), wind information (average u- and v- components of the wind), and pressure (average sea level pressure) for the entire year and on days samples were taken. Puerto Rico is located in the northern Caribbean and experiences a tropical climate, where the air is warm and humid year-round (as Table 15-1 confirms). Breezy winds flow from the northeast to the east on average with the aid of the sub-tropical high pressure that resides over the tropical Atlantic.

15.1 Meteorological and Concentration Averages at the Puerto Rico Sites

Carbonyl compounds and VOC were measured at the two Puerto Rican sites, as indicated in Tables 3-3 and 3-4. The largest geometric mean calculated was at the SJPR site for hydrocarbons (11.31 ppbv). The smallest of the means was also calculated at the SJPR site for carbonyls (4.90 ppbv). The other geometric means were located within the range. The average total UATMP daily concentration at the two sites demonstrated a large difference in the sampled compounds, with SJPR's average (59.28 ±25.30 ppbv) nearly twice that of BAPR (30.38 ±8.24 ppbv). Table 15-1 also lists the averages for selected meteorological parameters from January 2002 to December 2002, which is the same time period covered in this report.

These sites also opted to have total NMOC and SNMOC sampled during its air toxic sampling. SNMOC/NMOC compounds are of particular interest because of their role in ozone formation. Readers are encouraged to review EPA's *2001 Nonmethane Organic Compounds (NMOC) and Speciated Nonmethane Organic Compounds (SNMOC) Monitoring Program, Final Report* (EPA, 2002) for more information on SNMOC/NMOC trends and concentrations. The average total NMOC value for BAPR was 280 (±31.67) ppbC, of which nearly 56% could be identified through speciation, and the average total NMOC value for SJPR was 377 (±36.91) ppbC, of which nearly 68% could be identified through speciation. Of the speciated compounds, propane measured the highest concentrations at the BAPR and SJPR sites (18.36 ppbC and 34.40 ppbC, respectively). This information is given in Table 15-3. Unfortunately, ozone concentrations were not sampled at these sites.

Tables 15-2a-b are the summary of calculated Pearson Correlation coefficients for each of the prevalent compounds and selected meteorological parameters by site. Identification of the prevalent compounds is discussed in Section 3 of this report. The calculated Pearson Correlations for the sites in Puerto Rico resembled each other. While BAPR had no strong correlations, SJPR only had one, between propylene and dew point. At the BAPR monitoring station, dichlorodifluoromethane had moderately strong positive correlations with maximum, average, dew point, and wet bulb temperatures. Many compounds exhibited a moderately strong positive corrrelation to the three moisture parameters at SJPR. In fact, all but one compound, formaldehyde, had at least a positive correlation with the moisture variables. This trend continues at BAPR with a majority of the compounds. At BAPR, all of the compounds exhibited a negative correlation with sea level pressure, and a positive correlation with the wind components. With the exception of formaldehyde, this trend holds true at the SJPR site as well. The prevalent compounds generally increase with increasing moisture content, decreasing pressure, and increasing winds.

15.2 Spatial Analysis

Data used to estimate the number of motor vehicles operating in proximity to the monitoring stations were not available for the Puerto Rico sites. However, the average daily traffic data, or, more specifically, the average number of motor vehicles passing the monitoring sites on the nearest roadway to each site on a daily basis was available. This information is compared to the average daily concentration of the prevalent compounds at the Puerto Rico sites in Table 15-4. As evident in Table 15-4, the San Juan site has significantly more nearby traffic than the Barceloneta site.

A roadside study conducted to measure emissions from motor vehicles determined that the concentration ratios of the BTEX compounds were relatively consistent from urban area to urban area. (For more information on this study, refer to section 3.4.2.) Figure 3-14 depicts the average concentration ratios of the roadside study and compares them to the concentration ratios at the monitoring sites. Overall, the two Puerto Rican sites' concentration ratios resemble those of the roadside study. However, the benzene-ethylbenzene concentration ratio is significantly lower at both BAPR and SJPR than at the roadside study.

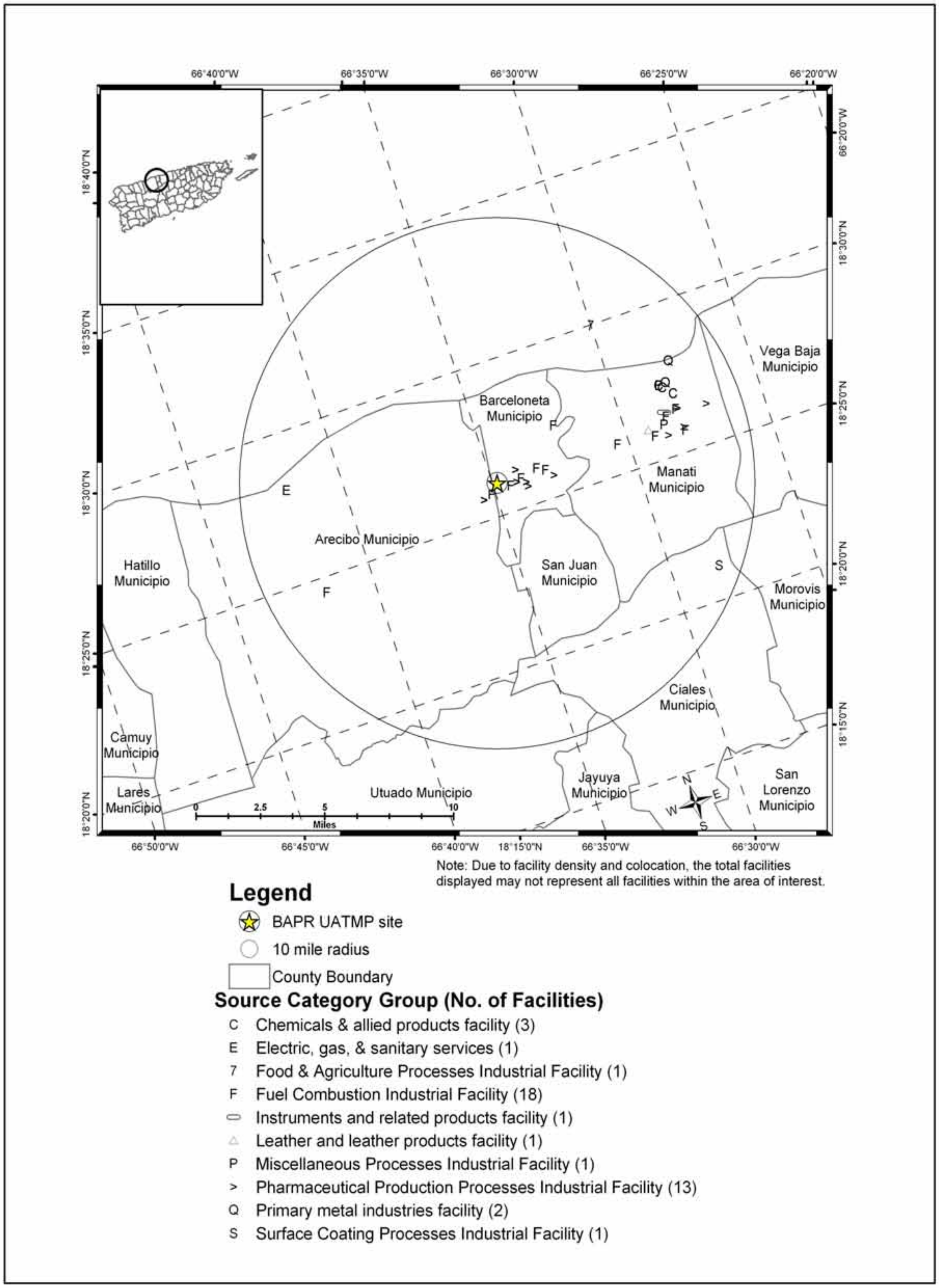
15.3 Regulation Analysis

There are two NATTS sites in Puerto Rico: Barceloneta (BAPR) and San Juan (SJPR). The monitoring locations are sufficiently far apart so that the facilities identified in each of the 10-mile areas do not overlap. Table 3-9 shows the number of facilities that account for approximately 90 percent of the total UATMP pollutant emissions in the 10-mile area around the monitoring stations

At BAPR, all of the facilities shown are potentially subject to a future regulation. Table 15-5 identifies the regulation that is potentially applicable. The regulation is expected to achieve emission reductions of methylene chloride and toluene. By applying the national average percent reductions that are projected for the regulation to the NTI emissions for the potentially subject facilities, significant reductions are projected for both methylene chloride and toluene (65 percent) due to compliance with the pharmaceuticals production NESHAP in 2001.

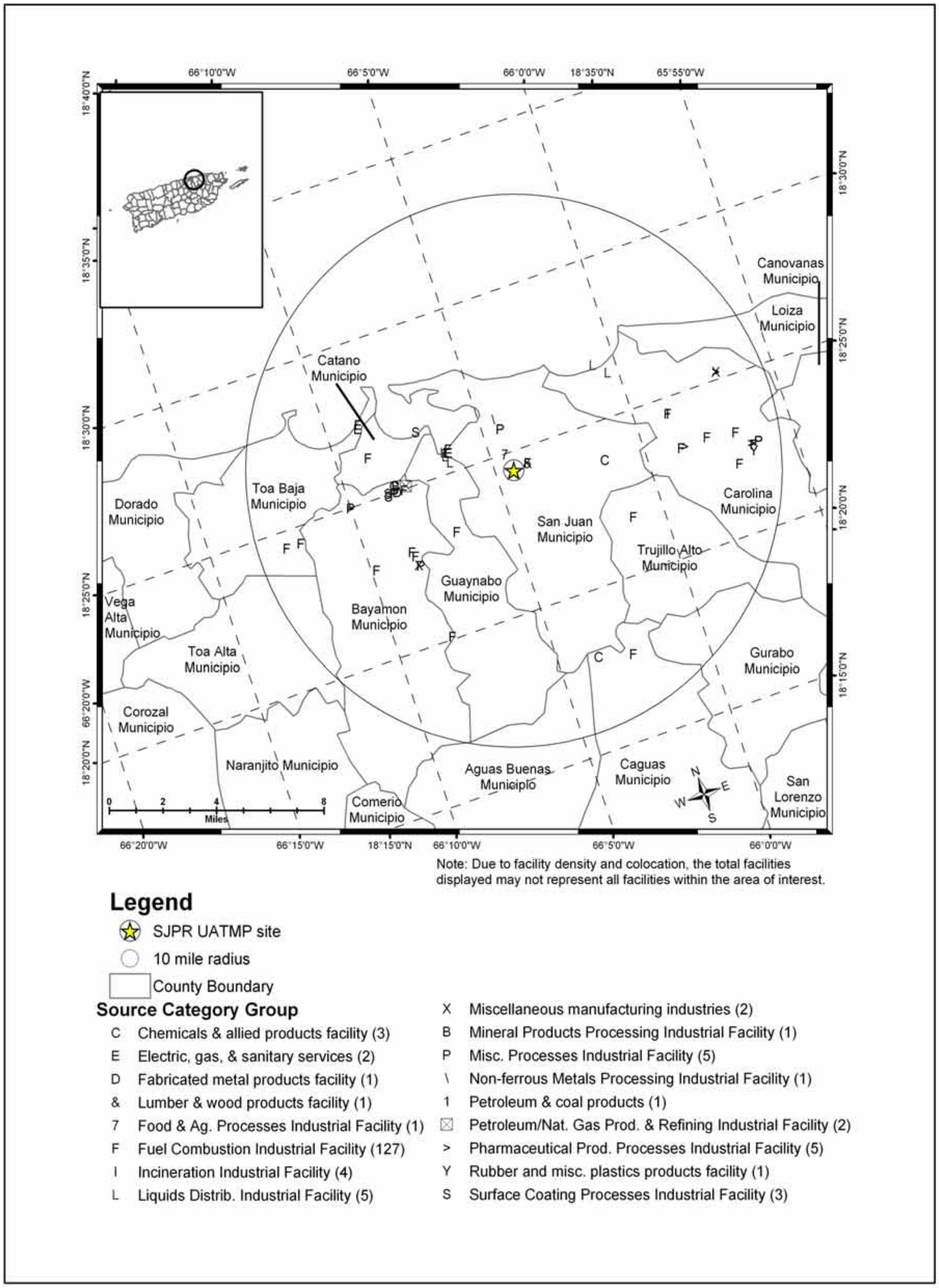
At SJPR, three of the four facilities shown are potentially subject to future regulations. Table 15-6 identifies the regulations that are potentially applicable. The regulations are projected to achieve emission reductions of methyl isobutyl ketone (71 percent) and methylene chloride (70 percent). The reduction of methyl isobutyl ketone is attributable to a single facility projected to comply with the NESHAP for metal can coating by 2005. The reduction of methylene chloride is attributable to a single facility projected to comply with the flexible polyurethane foam production NESHAP in 2001. Benzene, ethylbenzene, and xylene emissions are estimated to be reduced to a lesser degree (28 percent) with minimal reductions in toluene emissions (2 percent).

Figure 15-1. Facilities Located Within 10 Miles of BAPR



Note: Due to facility density and colocation, the total facilities displayed may not represent all facilities within the area of interest.

Figure 15-2. Facilities Located Within 10 Miles of SJPR



Note: Due to facility density and colocation, the total facilities displayed may not represent all facilities within the area of interest.

Table 15-1. Average Concentration and Meteorological Parameters for Sites in Puerto Rico

Site Name	Type	Average UATMP Concentration (ppbv)	Average Maximum Temperature (°F)	Average Temperature (°F)	Average Dewpoint Temperature (°F)	Average Wet Bulb Temperature (°F)	Average Relative Humidity (%)	Sea Level Pressure (mb)	Average u-component of the Wind (kts)	Average v-component of the Wind (kts)
BAPR	All 2002	▨	85.99 (±0.29)	79.89 (±0.24)	72.56 (±0.31)	74.86 (±0.24)	79.17 (±0.61)	1016.1 (±1.87)	-3.27 (±0.13)	-1.07 (±0.11)
	sample day	30.38 (±8.24)	86.11 (±0.77)	79.93 (±0.61)	72.67 (±0.64)	74.93 (±0.53)	79.40 (±1.53)	1016.1 (±4.63)	-3.18 (±0.34)	-1.04 (±0.31)
SJPR	All 2002	▨	85.99 (±0.29)	79.89 (±0.24)	72.56 (±0.31)	74.86 (±0.24)	79.17 (±0.61)	1016.1 (±1.87)	-3.27 (±0.13)	-1.07 (±0.11)
	sample day	59.28 (±25.30)	86.27 (±0.77)	80.05 (±0.61)	72.94 (±0.62)	75.14 (±0.52)	79.80 (±1.46)	1016.0 (±4.67)	-3.02 (±0.33)	-0.98 (±0.31)

Table 15-2a - Prevalent Compound Concentration Correlations with Selected Meteorological Parameters at Barceloneta, Puerto Rico (BAPR)

Compound	Maximum Temperature	Average Temperature	Dew Point Temperature	Wet Bulb Temperature	Relative Humidity	Sea Level Pressure	u-component of wind speed	v-component of wind speed
1,2,4-Trimethylbenzene	-0.15	-0.15	0.17	0.08	0.34	-0.21	0.36	0.19
Acetylene	-0.06	-0.17	0.09	0.01	0.27	-0.20	0.33	0.14
Benzene	-0.01	-0.10	0.20	0.12	0.32	-0.24	0.36	0.17
Chloromethane	-0.05	-0.05	0.17	0.12	0.25	-0.09	0.23	0.07
Dichlorodifluoromethane	0.26	0.31	0.35	0.39	0.06	-0.34	0.09	0.15
Ethylbenzene	-0.10	-0.19	0.07	-0.01	0.27	-0.17	0.24	0.06
Formaldehyde	0.08	0.00	-0.15	-0.12	-0.16	-0.30	0.18	0.07
m-,*p* - Xylene	-0.14	-0.22	0.07	-0.03	0.30	-0.17	0.24	0.05
o - Xylene	-0.11	-0.19	0.07	-0.02	0.27	-0.18	0.24	0.06
Propylene	0.04	-0.03	0.28	0.20	0.34	-0.20	0.33	0.23
Toluene	-0.12	-0.17	0.14	0.05	0.34	-0.22	0.24	0.03
Trichlorofluoromethane	0.15	0.20	0.13	0.17	-0.07	-0.08	0.03	0.10

Table 15-2b - Prevalent Compound Concentration Correlations with Selected Meteorological Parameters at San Juan, Puerto Rico (SJPR)

Compound	Maximum Temperature	Average Temperature	Dew Point Temperature	Wet Bulb Temperature	Relative Humidity	Sea Level Pressure	u-component of wind speed	v-component of wind speed
1,2,4-Trimethylbenzene	0.09	0.09	0.41	0.33	0.36	-0.37	0.47	0.24
Acetylene	0.07	0.03	0.28	0.23	0.28	-0.28	0.38	0.17
Benzene	0.12	0.09	0.46	0.37	0.42	-0.29	0.41	0.21
Chloromethane	0.11	0.15	0.28	0.26	0.14	-0.05	0.17	0.02
Dichlorodifluoromethane	0.23	0.29	0.34	0.37	0.05	-0.29	0.13	0.16
Ethylbenzene	-0.08	-0.15	0.12	0.03	0.30	-0.20	0.24	0.11
Formaldehyde	0.17	0.03	-0.14	-0.11	-0.15	0.27	-0.08	0.02
m-,*p* - Xylene	-0.10	-0.17	0.13	0.04	0.34	-0.19	0.26	0.13
o - Xylene	-0.07	-0.15	0.10	0.02	0.29	-0.19	0.24	0.11
Propylene	0.18	0.19	0.51	0.45	0.37	-0.27	0.37	0.27
Toluene	0.02	-0.02	0.30	0.23	0.37	-0.37	0.31	0.20
Trichlorofluoromethane	0.14	0.27	0.35	0.37	0.09	-0.20	0.16	0.08

Table 15-3. TNMOC Measured by the Puerto Rico Monitoring Stations

Monitoring Station	Average TNMOC speciated (ppbC)	Average TNMOC w/ unknowns (ppbC)	% TNMOC Identified	SNMOC Compound with the Highest Concentration (ppbC)
BAPR	149 (±18.72)	280 (±31.67)	56%	Propane (18.3)
SJPR	249 (±26.45) ppbC	377 (±36.91)	68%	Propane (34.40)

Table 15-4. Motor Vehicle Information vs. Daily Concentration for Puerto Rico Monitoring Sites

Monitoring Station	County Population[a]	Estimated Number of Motor Vehicles Owned	Traffic Data (Daily Average)	Average Daily UATMP Concentration (ppbv)
BAPR	4,253	N/A	10	30.38 (±8.24)
SJPR	421,958	N/A	51,000	59.28 (±25.30)

[a] Population based on “zona urbana” for each city from the 2002 Census, and is available at http://factfinder.census.gov/servlet/BasicFactsServlet

Table 15-5. Summary of Future Regulations That May be Applicable for Nearby Facilities Surrounding BAPR

Facility Name	Primary SIC Code	SIC Code Description	Regulation Citation	Regulation Name
Abbott Chemicals, Inc.	2833	Chemicals And Allied Products, Drugs, Medicinals and Botanicals	40 CFR part 63, subpart GGG	National Emission Standards for Hazardous Air Pollutants from Pharmaceuticals Production
Abbott Health Products, Inc.				
Upjohn Manufacturing Co.	2834	Chemicals And Allied Products, Drugs, Pharmaceutical Preparations		
Pharmacia & Upjohn Caribe, Inc.				

Table 15-6. Summary of Future Regulations That May be Applicable for Nearby Facilities Surrounding SJPR

Facility Name	Primary SIC Code	SIC Code Description	Regulation Citation	Regulation Name
Caribbean Petroleum Corp.	2911	Petroleum And Coal Products, Petroleum Refining, Petroleum Refining	40 CFR part 63, subpart EEEE	National Emission Standards for Hazardous Air Pollutants from Organic Liquids Distribution
Island Can Caribbean, Inc.	3411	Fabricated Metal Products, Metal Cans and Shipping Containers, Metal Cans	40 CFR part 63, subpart KKKK	National Emission Standard for Hazardous Air Pollutants from Surface Coating of Metal Cans (proposed rule)
Tech Aerofoam Products International, Inc.	3086	Rubber And Misc. Plastics Products, Miscellaneous Plastics Products, NEC, Plastics Foam Products	40 CFR part 63, subpart MMMMM	National Emission Standard for Hazardous Air Pollutants from Flexible Polyurethane Foam Production (proposed rule)

16.0 Sites in South Dakota

This section focuses on meteorological, concentration, and spatial trends for the UATMP sites in South Dakota (CUSD and SFSD). One site is located in Sioux Falls, situated in southeastern South Dakota, and the other in Custer, in western South Dakota, south of Rapid City. Figures 16-1 and 16-2 are topographical maps showing the monitoring stations in their urban locations. Figures 16-3 and 16-4 are maps identifying facilities within ten miles of the sites that reported to the 1999 NEI. The SFSD map shows that there are very few industrial facilities near the monitoring site, most of which are to the northwest. The CUSD site shows no facilities nearby. Hourly meteorological data were retrieved for all of 2002 at the Sioux Falls weather station (WBAN 14944) and the Custer City Airport weather station (WBAN 94032) near the sites with the purpose of calculating correlations of meteorological data with ambient air concentration measurements.

Table 16-1 highlights the UATMP average concentration at each site, along with temperature (average maximum and average), moisture (average dew point temperature, average wet-bulb temperature, and average relative humidity), wind information (average u- and v-components of the wind), and pressure (average sea level pressure) for the entire year and on days samples were taken. The Sioux Falls area has a continental climate, with cold winters, warm summers, and often drastic day to day variations. Precipitation varies throughout the year, but is typically sufficient for the springtime growing season. On average, a south wind blows in the summer and a northwesterly wind blows in the winter. The weather in Custer is considered semi-arid continental; annual precipitation is light. Warm summers and relatively mild winters are characteristic of this area, thanks to the Black Hills to the west, allowing winters to be more mild in comparison to the rest of the state. This information can be found in The Weather Almanac, fifth edition (Ruffner and Bair, 1987).

16.1 Meteorological and Concentration Averages at the South Dakota Sites

Carbonyl compounds and VOC were measured at this site, as indicated in Tables 3-3 and 3-4. The highest computed geometric means belonged to the carbonyls at both CUSD and SFSD (5.65 ppbv and 6.18 ppbv, respectively). The halogenated hydrocarbons shared the second highest geometric means while the polar compounds and hydrocarbons split the lowest geometric mean designation, with 1.92 ppbv at CUSD for polar compounds and 3.63 ppbv at SFSD for the hydrocarbons. The average total UATMP daily concentration at SFSD was 74.72 (±37.53) ppbv, while at CUSD it was considerably lower, 14.01 (±1.21) ppbv. Table 16-1 also lists the averages for selected meteorological parameters from January 2002 to December 2002, which is the time period covered in this report.

These sites also opted to have total and speciated nonmethane organic compounds (TNMOC/SNMOC) sampled during their air toxic sampling. SNMOC/NMOC compounds are of particular interest because of their role in ozone formation. Readers are encouraged to review EPA's *2001 Nonmethane Organic Compounds (NMOC) and Speciated Nonmethane Organic Compounds (SNMOC) Monitoring Program, Final Report* (EPA, 2002) for more information on SNMOC/NMOC trends and concentrations. The average total NMOC value for SFSD was 336 (±202.93) ppbC, of which nearly 54% could be identified through speciation. Of the speciated compounds, isopentane measured the highest concentration at the SFSD site (31.03 ppbC). The average total NMOC value for CUSD was 130(±17.95) ppbC, of which nearly 71% could be identified through speciation. Of the speciated compounds, propane measured the highest concentration at the CUSD site (21.71 ppbC). This information is given in Table 16-3. Ozone concentrations were also sampled at the SFSD site on 110 sample days, and were retrieved from the U.S. EPA's AIRS database. The average ozone concentration for each sample day was 50.70 (±2.16) ppbv.

Tables 16-2a and 16-2b are the summaries of calculated Pearson Correlation coefficients for each of the prevalent compounds and selected meteorological parameters. Identification of the prevalent compounds is discussed in Section 3 of this report. At CUSD, only three correlations could be deemed strong. Formaldehyde had strong positive correlations with maximum, average, and wet bulb temperatures, while its correlation with dew point can be considered moderately strong and positive. Dichlorodifluoromethane and chloromethane both had moderately strong positive correlations with the same four parameters. Interestingly, all of the correlations with relative humidity were negative, some moderately so. Also, all of the correlations with the v-component of the wind were positive, with the exception of 1,2,4-trimethylbenzene. Increasing winds from the north or south and decreasing relative humidity seem to occur with increasing UATMP concentrations at the CUSD monitoring site.

At the SFSD site, no correlations registered as strong. In fact, only chloromethane had calculated correlations that are considered moderately strong. Chloromethane had moderately strong positive correlations with the maximum and average temperature, dew point and wet bulb temperature, and the v-component of the wind. All other correlations were weak, regardless of their sign. The large number of weak correlations makes it difficult to determine when UATMP concentrations will increase, based on meteorological factors.

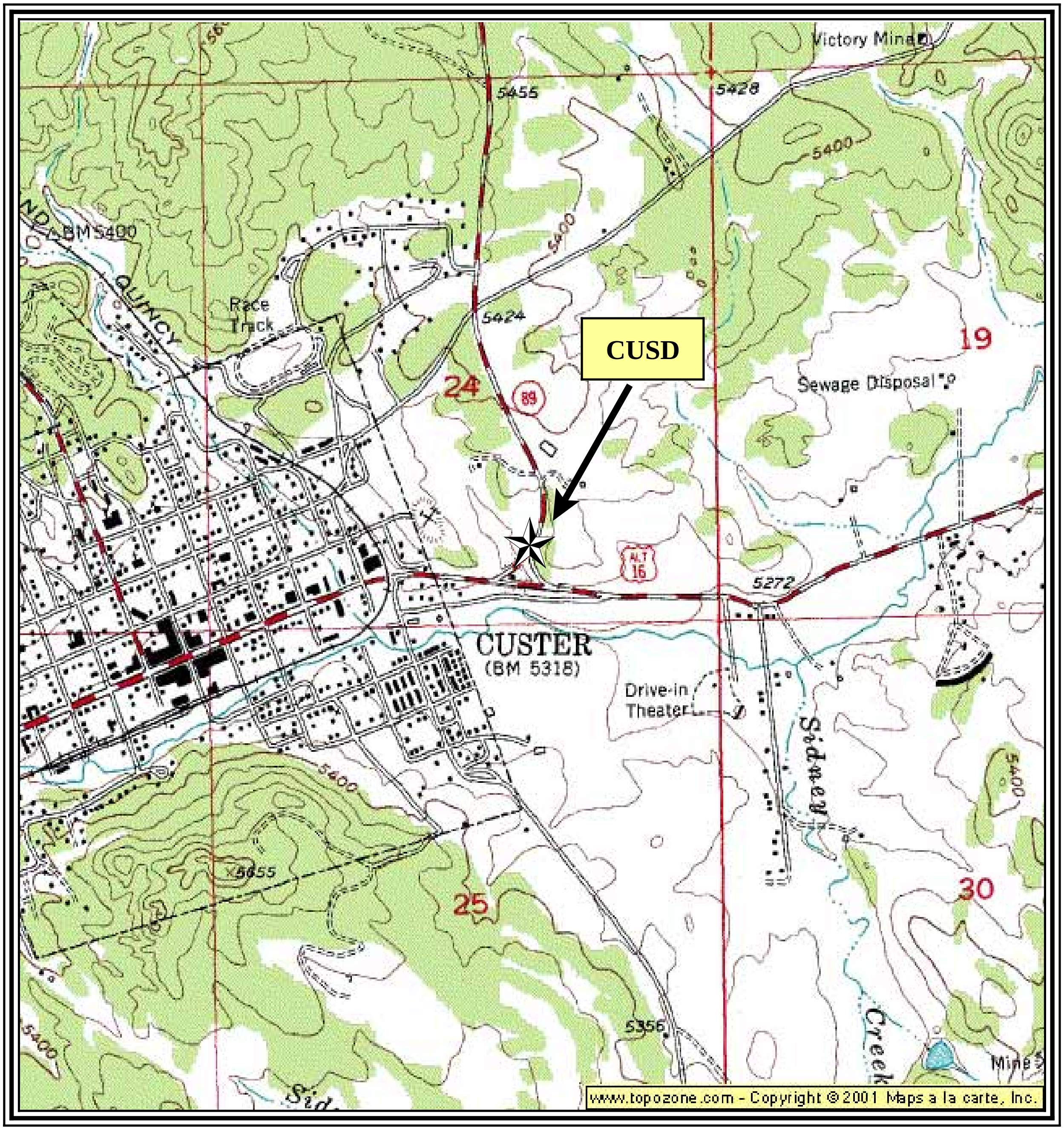
16.2 Spatial Analysis

Using the population within ten miles of each site, an estimate of the number of cars operating in proximity to the monitoring station can be established. The ratio used in this report is 0.74 automobiles to every one person (refer to section 3.4.1 for more information on this ratio). The population near the SFSD site is 148,522 people, all of whom are operating approximately 109,906 vehicles, while a considerably lower population of 4,214 is driving 3,118 vehicles in Custer. This information is compared to the average daily concentration of the prevalent compounds at the South Dakota sites in Table 16-3. Also included in Table 16-3 are average daily traffic data, or more specifically, the average number of cars passing the monitoring sites on the nearest roadway to each site on a daily basis. As expected, more traffic passes by the SFSD monitoring station than the CUSD monitoring station.

A roadside study conducted to measure emissions from motor vehicles determined that the concentration ratios of the BTEX compounds were relatively consistent from urban area to urban area. (For more information on this study, refer to section 3.4.2.) Figure 3-14 depicts the average concentration ratios of the roadside study and compares them to the concentration ratios at each of the monitoring sites. The concentration ratios for CUSD and SFSD tend to resemble one another, rather than those of the roadside study. CUSD’s toluene-ethylbenzene ratio is nearly double that of the roadside study and SFSD’s toluene-ethylbenzene ratio is nearly triple.

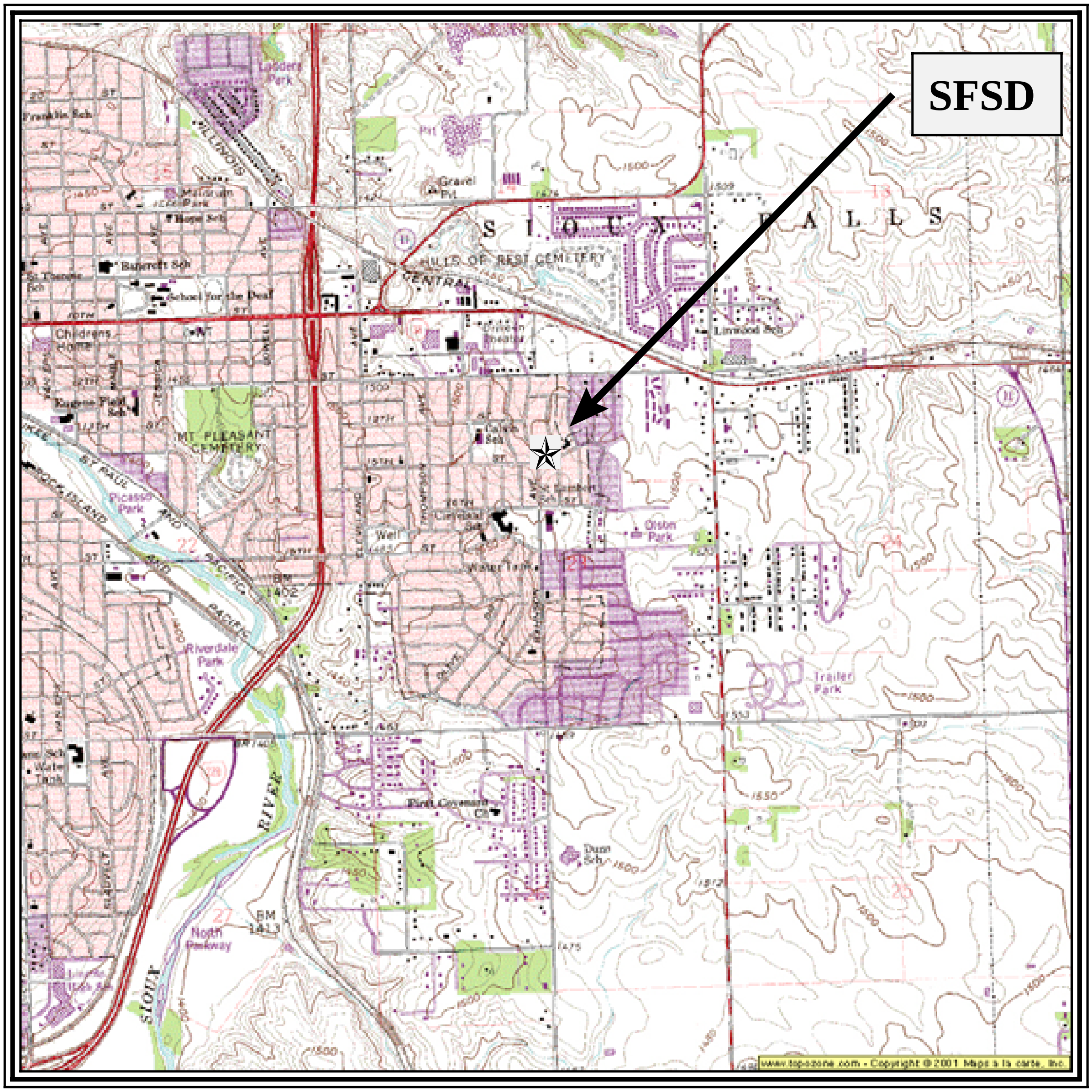
Both CUSD and SFSD's benzene-ethylbenzene ratios are larger than their *m,p*-xylene-ethylbenzene ratios, where for the roadside study, the opposite is true. However, similar to the roadside study, the toluene-ethylbenzene ratio is the largest ratio and *o*-xylene-ethylbenzene is the smallest ratio for both CUSD and SFSD.

Figure 16-1. Custer, South Dakota (CUSD) Monitoring Station



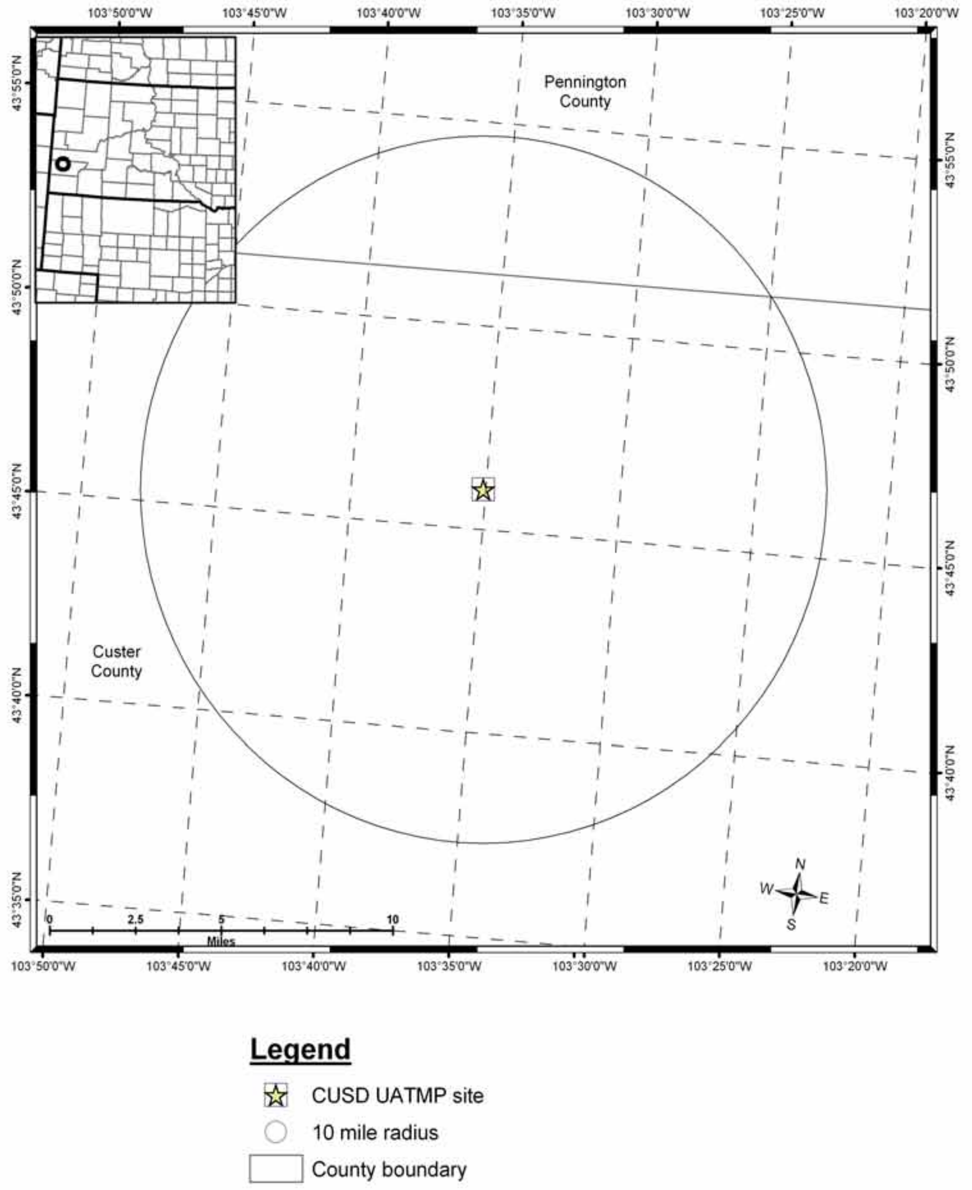
Source: USGS 7.5 Minute Series. Map Scale: 1:25,000.

Figure 16-2. Sioux Falls, South Dakota (SFSD) Monitoring Station



Source: USGS 7.5 Minute Series. Map Scale: 1:24,000.

Figure 16-3. Facilities Located Within 10 Miles of CUSD



*There were no point facilities from the 1999 NEI within 10 miles of CUSD.

Figure 16-4. Facilities Located Within 10 Miles of SFSD

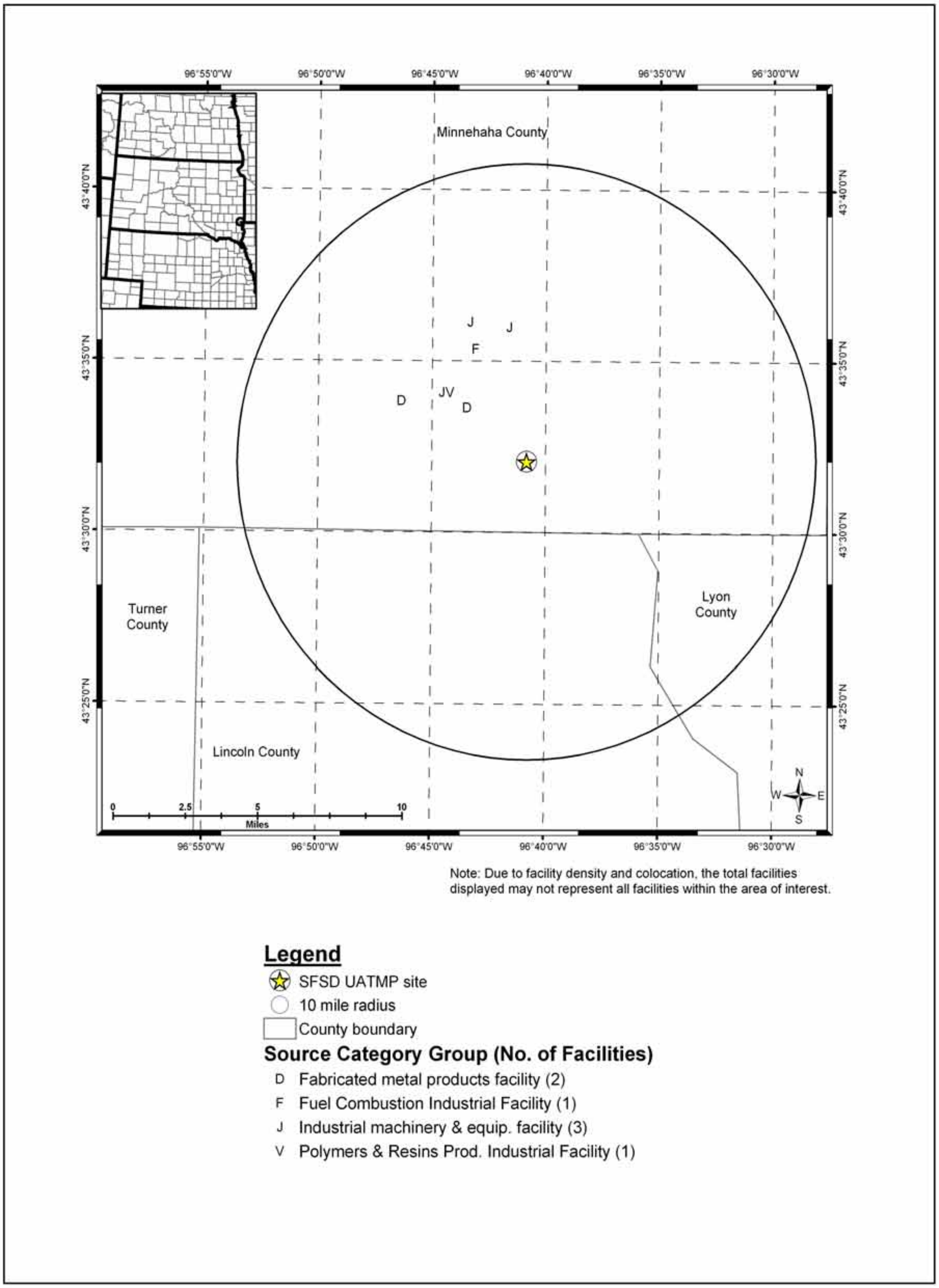


Table 16-1. Average Concentration and Meteorological Parameters for the Sites in South Dakota

Site Name	Type	Average UATMP Concentration (ppbv)	Average Maximum Temperature (°F)	Average Temperature (°F)	Average Dewpoint Temperature (°F)	Average Wet Bulb Temperature (°F)	Average Relative Humidity (%)	Sea Level Pressure (mb)	Average u-component of the Wind (kts)	Average v-component of the Wind (kts)
CUSD	All 2002	▨	52.48 (±2.08)	42.17 (±1.90)	26.28 (±1.59)	35.05 (±1.55)	58.65 (±1.72)	1017.6 (±12.89)	0.92 (±0.28)	3.19 (±0.16)
	sample day	14.01 (±1.21)	57.77 (±5.74)	47.10 (±5.16)	29.68 (±3.98)	38.80 (±4.04)	56.43 (±4.41)	1017.2 (±32.52)	0.95 (±0.81)	1.33 (±0.43)
SFSD	All 2002	▨	57.61 (±2.31)	47.29 (±2.20)	36.82 (±2.03)	42.19 (±1.96)	70.08 (±1.13)	1018.3 (±11.97)	-0.28 (±0.37)	4.64 (±0.31)
	sample day	74.72 (±37.53)	55.61 (±6.65)	44.84 (±6.19)	33.56 (±5.61)	39.53 (±5.46)	68.11 (±3.19)	1016.5 (±24.65)	0.59 (±1.00)	1.59 (±1.05)

Table 16-2a - Prevalent Compound Concentration Correlations with Selected Meteorological Parameters at Custer, South Dakota (CUSD)

Compound	Maximum Temperature	Average Temperature	Dew Point Temperature	Wet Bulb Temperature	Relative Humidity	Sea Level Pressure	u-component of wind speed	v-component of wind speed
1,2,4-Trimethylbenzene	0.16	0.16	0.14	0.16	-0.09	-0.16	-0.29	-0.06
Acetylene	-0.12	-0.16	-0.35	-0.23	-0.25	0.48	0.23	0.22
Benzene	0.03	-0.02	-0.22	-0.10	-0.30	0.05	0.09	0.30
Chloromethane	0.36	0.33	0.29	0.32	-0.14	-0.07	-0.07	0.15
Dichlorodifluoromethane	0.38	0.35	0.34	0.35	-0.15	-0.24	-0.10	0.15
Ethylbenzene	-0.01	-0.04	-0.12	-0.08	-0.12	-0.15	-0.24	0.13
Formaldehyde	0.62	0.62	0.45	0.56	-0.45	0.07	-0.10	0.16
m-,*p* - Xylene	0.23	0.19	0.06	0.14	-0.28	-0.26	-0.17	0.25
o - Xylene	0.01	-0.02	-0.09	-0.05	-0.12	-0.16	-0.25	0.17
Propylene	0.20	0.19	0.01	0.12	-0.35	0.42	0.18	0.10
Toluene	0.23	0.18	0.06	0.14	-0.27	-0.29	0.13	0.22
Trichloromethane	0.26	0.22	0.17	0.21	-0.18	-0.30	0.05	0.16

Table 16-2b - Prevalent Compound Concentration Correlations with Selected Meteorological Parameters at Sioux Falls, South Dakota (SFSD)

Compound	Maximum Temperature	Average Temperature	Dew Point Temperature	Wet Bulb Temperature	Relative Humidity	Sea Level Pressure	u-component of wind speed	v-component of wind speed
1,2,4-Trimethylbenzene	-0.11	-0.12	-0.13	-0.13	0.02	0.14	-0.05	0.10
Acetylene	-0.16	-0.19	-0.20	-0.19	0.00	0.09	0.01	0.03
Benzene	-0.08	-0.11	-0.12	-0.12	-0.03	0.05	-0.02	0.09
Chloromethane	0.31	0.35	0.32	0.34	-0.22	-0.03	0.06	0.28
Dichlorodifluoromethane	0.05	0.02	-0.02	0.00	-0.15	-0.09	0.05	0.11
Ethylbenzene	-0.07	-0.09	-0.10	-0.10	-0.03	0.07	-0.01	0.10
Formaldehyde	-0.11	-0.05	0.02	-0.02	0.22	-0.20	-0.10	-0.03
m-,*p* - Xylene	-0.08	-0.10	-0.11	-0.11	-0.01	0.07	-0.03	0.09
o - Xylene	-0.10	-0.12	-0.13	-0.13	-0.01	0.09	-0.02	0.08
Propylene	-0.05	-0.08	-0.09	-0.08	-0.05	0.01	-0.02	0.11
Toluene	0.01	-0.02	-0.05	-0.03	-0.12	-0.05	0.03	0.11
Trichloromethane	0.10	0.13	0.16	0.14	0.05	-0.23	0.19	-0.06

Table 16-3. TNMOC and Ozone Measured by the Custer (CUSD) and Sioux Falls, SD (SFSD) Monitoring Stations

Monitoring Station	Average Ozone Concentrations (ppbv)	Total Number of Ozone Sampling Days	Average TNMOC speciated (ppbC)	Average TNMOC w/ unknowns (ppbC)	% TNMOC Identified	SNMOC Compound with the Highest Concentration (ppbC)
CUSD	N/A	N/A	89 (±11.01)	130 (±17.95)	71 %	Propane (21.71)
SFSD	50.70 (±2.16)	110	214 (±177.76)	336 (±202.93)	54 %	Isopentane (31.03)

Table 16-4. Motor Vehicle Information vs. Daily Concentration for the South Dakota Monitoring Sites

Monitoring Station	Population within Ten Miles	Estimated Number of Vehicles Owned	Traffic Data (Daily Average)	Average Daily UATMP Concentration (ppbv)
CUSD	4,214	3,118	1,940	14.01(±1.21)
SFSD	148,522	109,906	4,320	74.72 (±37.53)

17.0 Sites in Tennessee

This section focuses on meteorological, concentration, and spatial trends for the UATMP sites in Tennessee (EATN and LOTN), both located in Nashville. Figures 17-1 and 17-2 are topographical maps showing the monitoring stations in their urban locations. Figure 17-3 is a map identifying facilities within ten miles of the sites that reported to the 1999 NEI. The sites are very close to each other, with a majority of the industrial sites located to the southeast, south, and southwest of the UATMP sites. Most of these industrial sites are surface coating, printing and publishing, and fuel combustion sources. Hourly meteorological data were retrieved for all of 2002 at the Nashville Municipal Airport weather station (WBAN 13897) near the sites with the purpose of calculating correlations of meteorological data with ambient air concentration measurements.

Table 17-1 highlights the UATMP average concentration at each site, along with temperature (average maximum and average), moisture (average dew point temperature, average wet-bulb temperature, and average relative humidity), wind information (average u- and v-components of the wind), and pressure (average sea level pressure) for the entire year and on days samples were taken. Nashville's climate is rather moderate in nature, lacking extreme fluctuations in temperature. The city has a long growing season and boasts four distinct seasons. As indicated in Table 17-1, though, humidity can make the air uncomfortable. This information can be found in The Weather Almanac, fifth edition (Ruffner and Bair, 1987), and at the following website: http://www.blueshoenashville.com/weather.html.

17.1 Meteorological and Concentration Averages at the Tennessee Sites

Carbonyl compounds and VOC were measured at these sites, as indicated in Tables 3-3 and 3-4. At EATN, the hydrocarbons had the highest geometric mean (6.33 ppbv), while the carbonyls had the highest geometric mean at LOTN (5.66 ppbv). The lowest geometric means for both sites were polar compounds, 3.08 ppbv at EATN and 2.94 ppbv at LOTN. The average total UATMP daily concentration at EATN was 18.98 (±2.09) ppbv, while at LOTN it was slightly lower, 15.61 (±2.96) ppbv. Table 17-1 also lists the averages for selected meteorological parameters from January 2002 to December 2002, which is the same time period covered in this report.

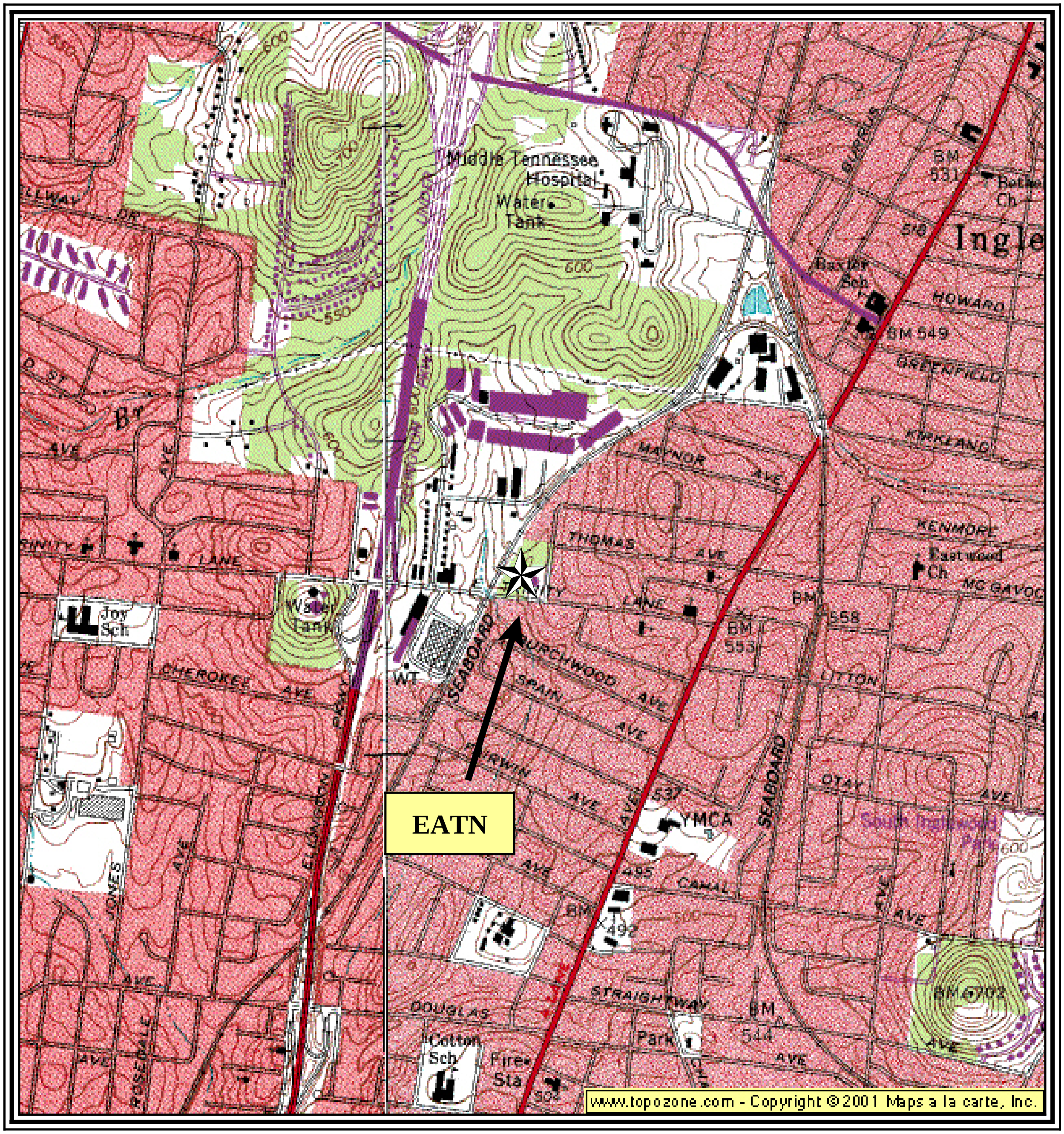
Tables 17-2a and b are the summaries of calculated Pearson Correlation coefficients for each of the prevalent compounds and selected meteorological parameters. Identification of the prevalent compounds is discussed in Section 3 of this report. The Pearson Correlations for the two sites look very similar. At both sites, formaldehyde had strong positive correlations with maximum, average, and wet bulb temperatures, and moderately strong positive correlations with the dew point. At LOTN, toluene also exhibited moderately strong positive correlations with these four parameters. Also at both sites, moderately strong to strong negative correlations were found with dichlorodifluoromethane and trichlorofluoromethane and the previously mentioned four weather parameters, as well as relative humidity. Interestingly, nearly all of the compounds had a negative correlation with relative humidity and most had a negative correlation with sea level pressure at both sites. Dichlorodifluoromethane, chloromethane, and trichlorofluoromethane each had a moderately strong to strong positive correlation with the u-component of the wind at both sites. Generally, as relative humidity and sea level pressure decrease, UATMP concentrations of the prevalent compounds increase.

17.2 Spatial Analysis

Using the population within ten miles of each site, an estimate of the number of cars operating in proximity to the monitoring station can be established. The ratio used in this report is 0.74 automobiles to every one person (refer to section 3.4.1 for more information on this ratio). The population near the EATN site is 518,357 people, all of whom are operating approximately 383,584 vehicles, while a somewhat higher population of 552,749 is driving 409,034 vehicles near LOTN. This information is compared to the average daily concentration of the prevalent compounds at the Tennessee sites in Table 17-3. Also included in Table 17-3 are average daily traffic data, or more specifically, the average number of cars passing the monitoring sites on the nearest roadway to each site on a daily basis. The EATN site has a significantly higher volume of traffic passing by than does the LOTN site.

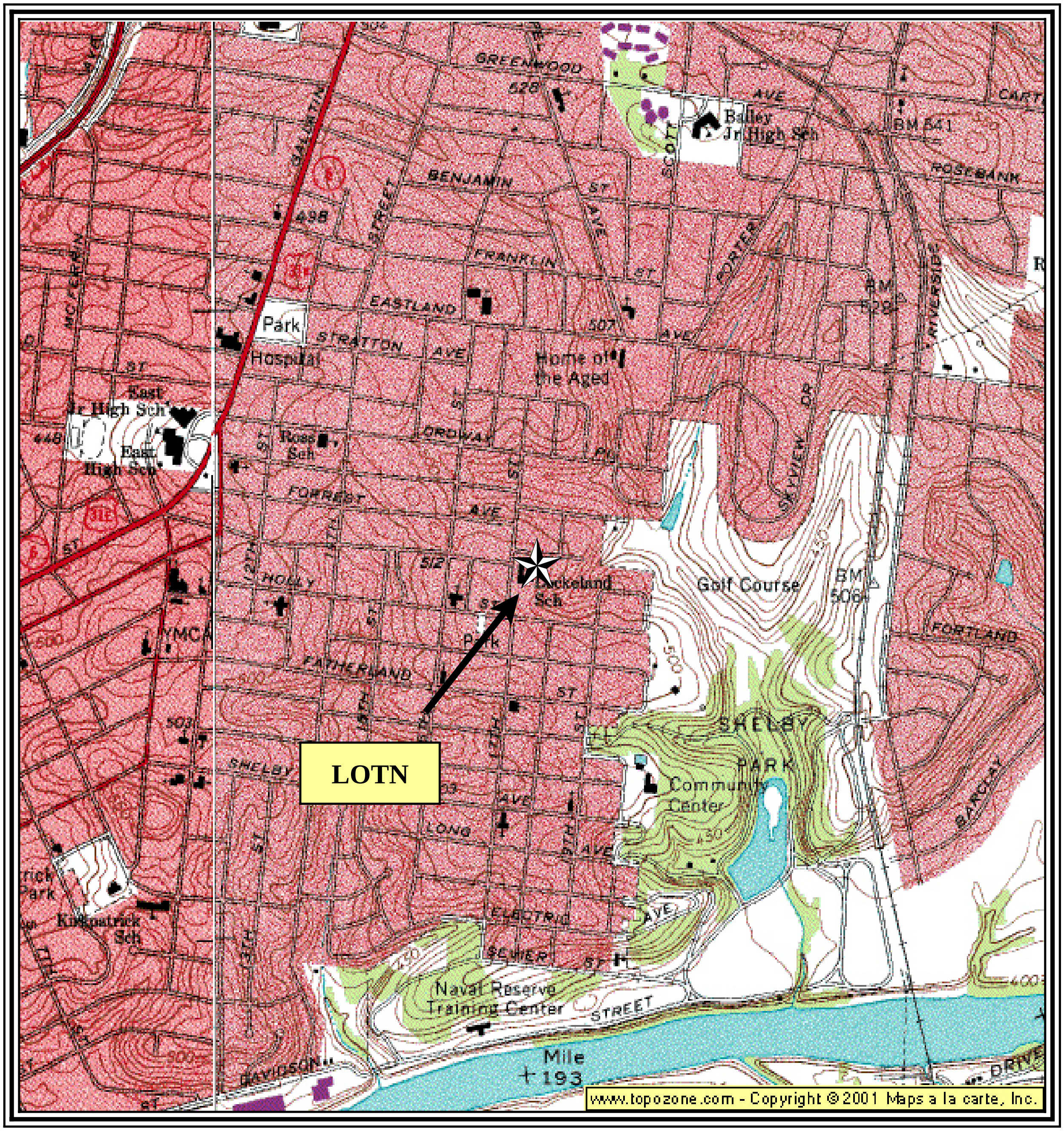
A roadside study conducted to measure emissions from motor vehicles determined that the concentration ratios of the BTEX compounds were relatively consistent from urban area to urban area. (For more information on this study, refer to section 3.4.2.) Figure 3-14 depicts the average concentration ratios of the roadside study and compares them to the concentration ratios at each of the monitoring sites. The concentration ratios for both EATN and LOTN resemble those of the roadside study with one exception. The roadside study found that *m,p*-xylene-ethylbenzene ratios tend to be slightly higher than benzene-ethylbenzene ratios, while the two Nashville sites had slightly benzene-ethylbenzene ratios.

Figure 17-1. Nashville Site 1, Tennessee (EATN) Monitoring Station



Source: USGS 7.5 Minute Series. Map Scale: 1:25,000.

Figure 17-2. Nashville Site 2, Tennessee (LOTN) Monitoring Station



Source: USGS 7.5 Minute Series. Map Scale: 1:25,000.

Figure 17-3. Facilities Located Within 10 Miles of EATN and LOTN

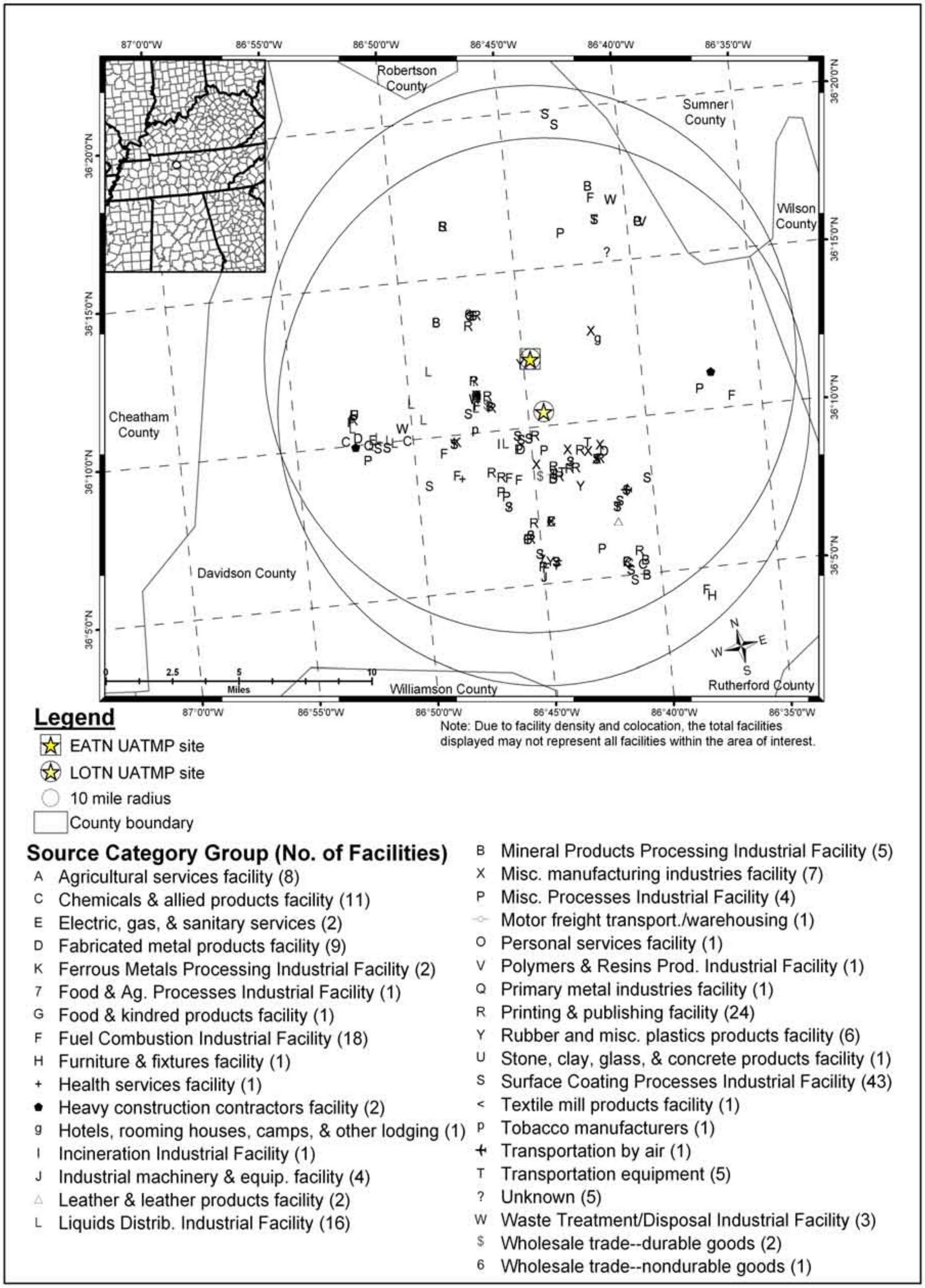


Table 17-1. Average Concentration and Meteorological Parameters for the Sites in Tennessee

Site Name	Type	Average UATMP Concentration (ppbv)	Average Maximum Temperature (°F)	Average Temperature (°F)	Average Dewpoint Temperature (°F)	Average Wet Bulb Temperature (°F)	Average Relative Humidity (%)	Sea Level Pressure (mb)	Average u-component of the Wind (kts)	Average v-component of the Wind (kts)
EATN	All 2002	▨	69.26 (±1.77)	60.20 (±1.70)	50.22 (±1.81)	54.89 (±1.61)	72.53 (±1.33)	1018.8 (±5.01)	-1.22 (±0.21)	2.78 (±0.21)
	sample day	18.98 (±2.09)	75.44 (±6.90)	66.78 (±6.45)	57.26 (±6.29)	61.10 (±5.87)	73.89 (±5.03)	1017.6 (±19.56)	-0.53 (±0.96)	1.27 (±0.83)
LOTN	All 2002	▨	69.26 (±1.77)	60.20 (±1.70)	50.22 (±1.81)	54.89 (±1.61)	72.53 (±1.33)	1018.8 (±5.01)	-1.22 (±0.21)	2.78 (±0.21)
	sample day	15.61 (±2.96)	74.72 (±6.60)	65.96 (±6.10)	56.60 (±5.96)	60.42 (±5.52)	74.24 (±5.64)	1017.1 (±22.32)	-0.51 (±0.93)	1.24 (±0.91)

Table 17-2a - Prevalent Compound Concentration Correlations with Selected Meteorological Parameters at Nashville, Tennessee Site 1 (EATN)

Compound	Maximum Temperature	Average Temperature	Dew Point Temperature	Wet Bulb Temperature	Relative Humidity	Sea Level Pressure	u-component of wind speed	v-component of wind speed
1,2,4-Trimethylbenzene	0.04	0.01	-0.06	-0.03	-0.24	-0.16	0.03	0.16
Acetylene	-0.10	-0.14	-0.14	-0.15	0.00	-0.16	-0.03	0.00
Benzene	-0.23	-0.25	-0.27	-0.26	-0.08	-0.24	0.16	0.03
Chloromethane	-0.10	-0.06	-0.14	-0.09	-0.34	0.10	0.35	-0.26
Dichlorodifluoromethane	-0.44	-0.41	-0.50	-0.44	-0.34	-0.11	0.50	-0.07
Ethylbenzene	0.06	0.01	-0.06	-0.02	-0.26	-0.33	0.18	0.14
Formaldehyde	0.63	0.64	0.49	0.56	-0.50	-0.12	-0.33	0.18
m-,p - Xylene	0.00	-0.04	-0.10	-0.07	-0.21	-0.28	0.11	0.10
o - Xylene	0.10	0.06	-0.01	0.03	-0.26	-0.24	0.05	0.09
Propylene	0.18	0.14	0.11	0.11	-0.07	-0.04	-0.36	-0.12
Toluene	0.12	0.07	0.05	0.06	-0.08	-0.25	-0.02	0.03
Trichloromethane	-0.53	-0.49	-0.57	-0.52	-0.32	-0.07	0.49	-0.06

Table 17-2b - Prevalent Compound Concentration Correlations with Selected Meteorological Parameters at Nashville, Tennessee Site 2 (LOTN)

Compound	Maximum Temperature	Average Temperature	Dew Point Temperature	Wet Bulb Temperature	Relative Humidity	Sea Level Pressure	u-component of wind speed	v-component of wind speed
1,2,4-Trimethylbenzene	0.10	0.09	0.00	0.04	-0.24	-0.07	0.07	0.20
Acetylene	-0.13	-0.18	-0.14	-0.16	0.09	-0.39	0.19	0.30
Benzene	0.01	0.00	-0.02	-0.01	-0.06	-0.20	0.06	0.09
Chloromethane	-0.01	0.01	-0.09	-0.02	-0.35	-0.20	0.56	0.03
Dichlorodifluoromethane	-0.38	-0.37	-0.54	-0.44	-0.52	0.09	0.46	-0.14
Ethylbenzene	0.12	0.11	0.03	0.06	-0.23	-0.07	0.05	0.17
Formaldehyde	0.64	0.65	0.46	0.54	-0.47	0.01	-0.26	0.11
m-,*p* - Xylene	0.30	0.29	0.20	0.24	-0.28	-0.19	0.00	0.14
o - Xylene	0.20	0.19	0.08	0.13	-0.33	0.03	0.11	0.12
Propylene	0.24	0.21	0.22	0.21	0.05	-0.51	0.14	0.38
Toluene	0.37	0.36	0.28	0.32	-0.23	-0.21	-0.16	0.00
Trichloromethane	-0.52	-0.51	-0.68	-0.59	-0.53	0.16	0.33	-0.22

Table 17-3. Motor Vehicle Information vs. Daily Concentration for the Tennessee Monitoring Sites

Monitoring Station	Population within Ten Miles	Estimated Number of Vehicles Owned	Traffic Data (Daily Average)	Average Daily UATMP Concentration (ppbv)
EATN	518,357	383,584	38,450	18.98 (±2.09)
LOTN	552,749	409,034	3,000	15.61 (±2.96)

18.0 Site in Texas

This section focuses on meteorological, concentration, and spatial trends for the UATMP site in Texas (ANTX), located in Arlington, wedged between Dallas and Ft. Worth. Figure 18-1 is a topographical map showing the monitoring station in its urban location. Figure 18-2 is a map identifying facilities within ten miles of the site that reported to the 1999 NEI. Most of the sources within ten miles of the site are well to the north and northeast or to the south. Many of these sources are surface coating and miscellaneous industries. Hourly meteorological data were retrieved for all of 2002 at the Dallas/Ft. Worth weather station (WBAN 3927) with the purpose of calculating correlations of meteorological data with ambient air concentration measurements.

Table 18-1 highlights the average UATMP concentration at the site, along with temperature (average maximum and average), moisture (average dew point temperature, average wet-bulb temperature, and average relative humidity), wind information (average u- and v-components of the wind), and pressure (average sea level pressure) for the entire year and on days samples were taken. Arlington is located in north central Texas, and experiences both a continental climate, due to its centralized location, and a subtropical humid climate in the summer due to the Gulf of Mexico's influence: long, hot, often humid summers, and mild, yet variable winters. Winds blow from the south and southeast, on average. This information can be found in The Weather Almanac, fifth edition (Ruffner and Bair, 1987).

18.1 Meteorological and Concentration Averages at the Texas Site

Carbonyl compounds and VOC (volatile organic compounds) were measured at the site, as indicated in Tables 3-3 and 3-4. ANTX's lowest geometric mean was 3.94 ppbv for the hydrocarbons, and the highest geometric mean was 6.10 ppbv for the polar compounds. Halogenated hydrocarbons and carbonyl compound values fell between these values. The average total UATMP daily concentration at ANTX was 18.91 (±3.58) ppbv. Table 18-1 also lists the averages for selected meteorological parameters from January 2002 to December 2002, which is the same time period covered in this report.

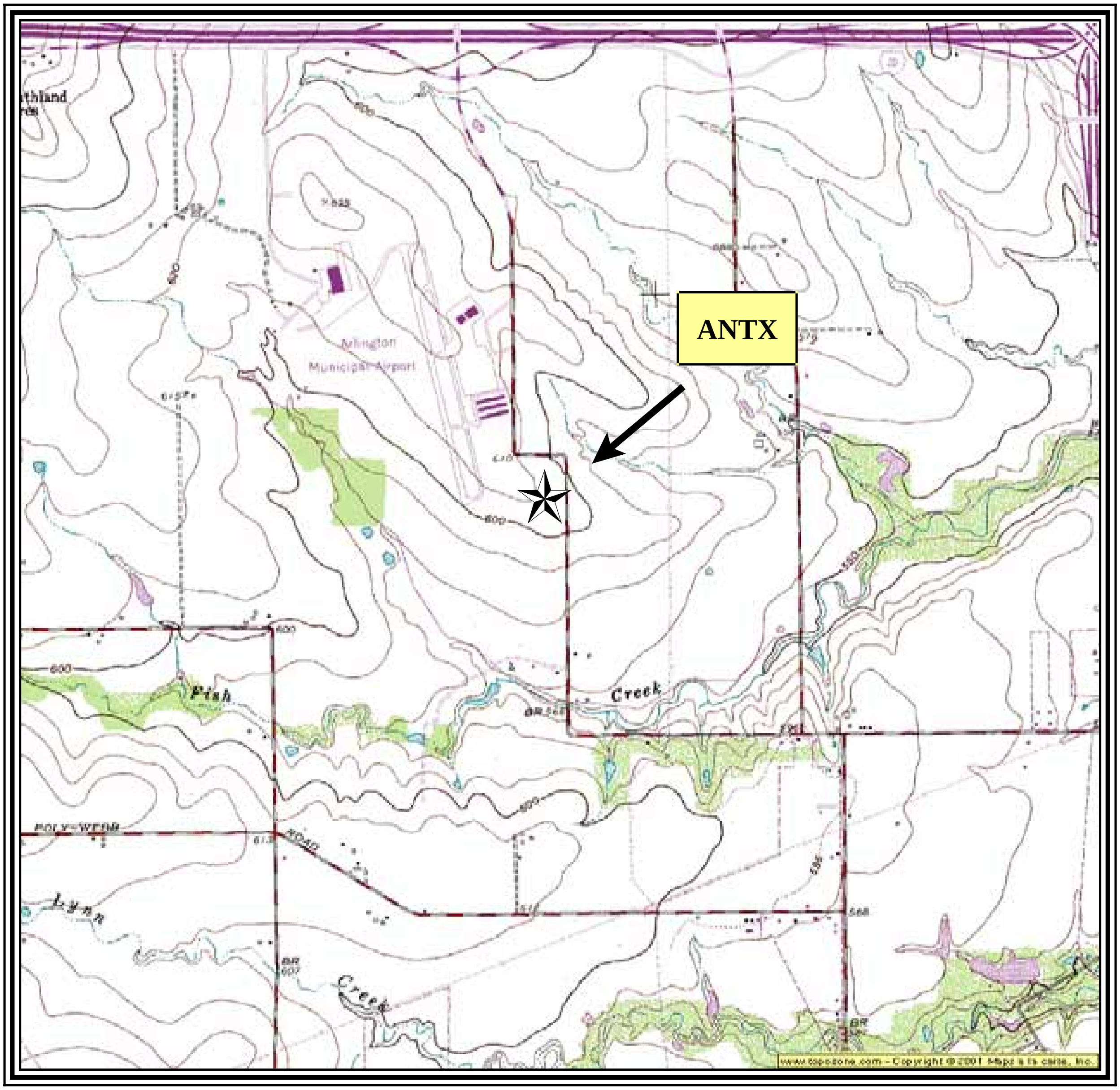
Table 18-2 is the summary of calculated Pearson Correlation coefficients for each of the prevalent compounds and selected meteorological parameters. Identification of the prevalent compounds is discussed in Section 3 of this report. With few exceptions, nearly all of the correlations between the compounds and maximum, average, dew point, and wet bulb temperatures, relative humidity, sea level pressure, and the v-component of the wind were calculated to be at least moderately strong, if not stronger. 1,2,4-Trimethylbenzene, acetylene, benzene, ethylbenzene, the xylenes, and toluene had moderately strong to strong negative correlations with maximum, average, dew point, and wet bulb temperatures. However, chloromethane, dichlorodifluoromethane, formaldehyde, and trichlorofluoromethane all had moderately strong to very strong positive correlations with the same four parameters. With the exception of chloromethane, dichlorodifluoromethane, formaldehyde, and trichlorofluoromethane, the prevalent compounds had moderately strong to strong positive correlations with pressure. In fact, three of those four compounds had moderately strong to strong negative correlations with pressure. The wide range in negative and positive correlations for the same weather parameters makes it difficult to predict whether the UATMP concentrations will increase or decrease.

18.2 Spatial Analysis

Using the population within ten miles of each site, an estimate of the number of motor vehicles operating in proximity to the monitoring station can be established. The ratio used in this report is 0.74 motor vehicles to every one person (refer to section 3.4.1 for more information on this ratio). The population near the ANTX site is 614,071 people, all of whom are operating approximately 454,413 motor vehicles. This information is compared to the average daily concentration of the prevalent compounds at the Texas site in Table 18-3. Also included in Table 18-3 are average daily traffic data, or more specifically, the average number of cars passing the monitoring sites on the nearest roadway to each site on a daily basis.

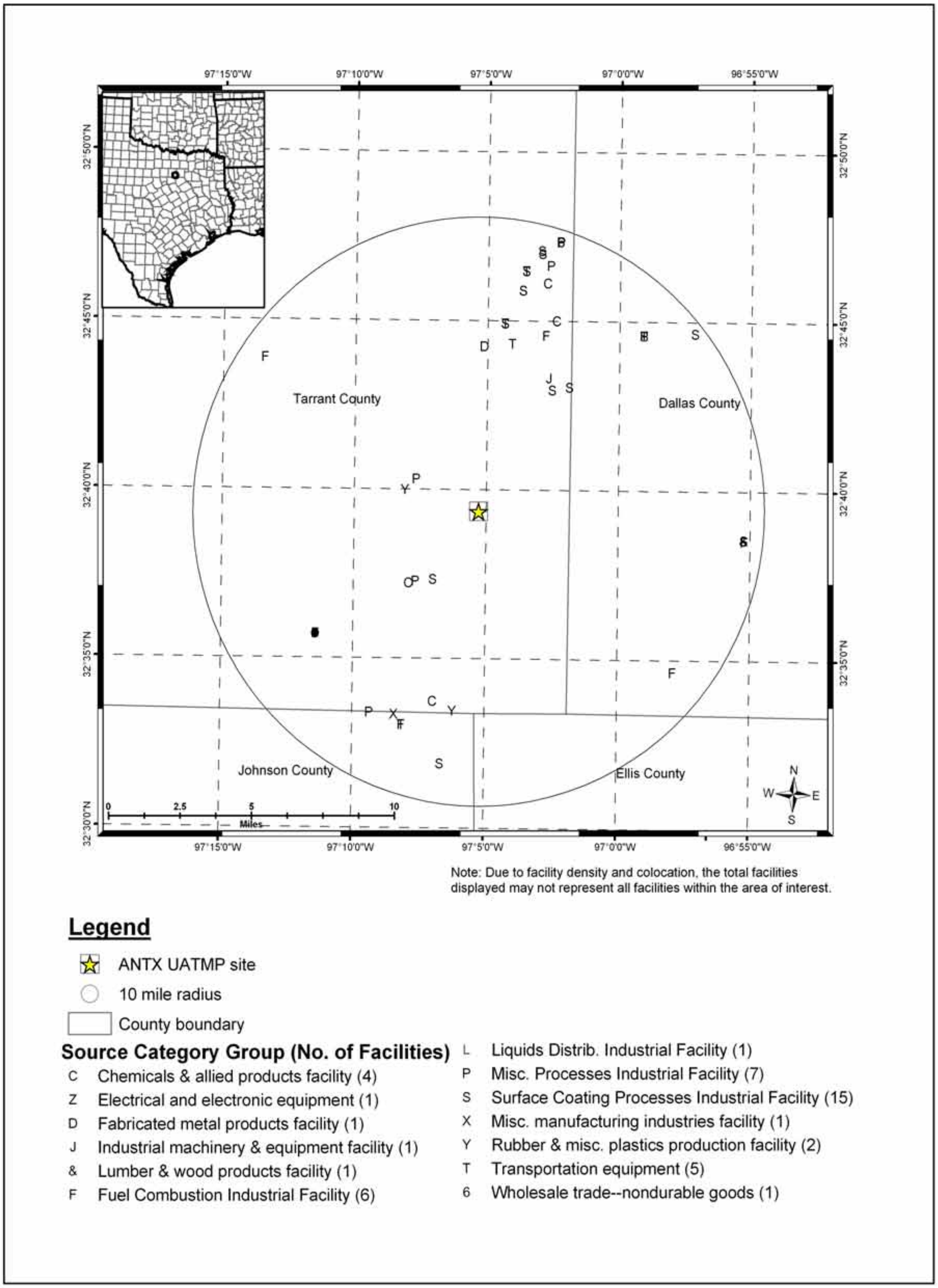
A roadside study conducted to measure emissions from motor vehicles determined that the concentration ratios of the BTEX compounds were relatively consistent from urban area to urban area. (For more information on this study, refer to section 3.4.2.) Figure 3-14 depicts the average concentration ratios of the roadside study and compares them to the concentration ratios at the monitoring site. Generally, the ANTX concentration ratios resemble those of the roadside study. The *o*-xylene-ethylbenzene ratios are very similar. The benzene-ethylbenzene and toluene-ethylbenzene ratios are both higher than those of the roadside study, while the *m,p*-xylene-ethylbenzene ratio at ANTX is slightly lower than the roadside study's ratio.

Figure 18-1. Arlington, Texas (ANTX) Monitoring Station



Source: USGS 7.5 Minute Series. Map Scale: 1:25,000.

Figure 18-2. Facilities Located Within 10 Miles of ANTX



Note: Due to facility density and colocation, the total facilities displayed may not represent all facilities within the area of interest.

Table 18-1. Average Concentration and Meteorological Parameters for the Site in Texas

Site Name	Type	Average UATMP Concentration (ppbv)	Average Maximum Temperature (°F)	Average Temperature (°F)	Average Dewpoint Temperature (°F)	Average Wet Bulb Temperature (°F)	Average Relative Humidity (%)	Sea Level Pressure (mb)	Average u-component of the Wind (kts)	Average v-component of the Wind (kts)
ANTX	All 2002	▨	74.76 (±1.61)	65.09 (±1.61)	52.96 (±1.70)	58.31 (±1.48)	68.12 (±1.38)	1016.7 (±5.95)	-1.18 (±0.28)	4.46 (±0.31)
	sample day	18.91 (±3.58)	79.59 (±8.29)	70.29 (±7.95)	58.08 (±7.39)	62.80 (±6.87)	68.25 (±5.46)	1016.8 (±21.47)	-1.21 (±0.89)	1.86 (±1.02)

Table 18-2. Prevalent Compound Concentration Correlations with Selected Meteorological Parameters at Arlington, Texas (ANTX)

Compound	Maximum Temperature	Average Temperature	Dew Point Temperature	Wet Bulb Temperature	Relative Humidity	Sea Level Pressure	u-component of wind speed	v-component of wind speed
1,2,4-Trimethylbenzene	-0.42	-0.45	-0.36	-0.41	0.30	0.65	0.23	-0.43
Acetylene	-0.68	-0.73	-0.73	-0.73	0.04	0.84	0.08	-0.67
Benzene	-0.59	-0.64	-0.64	-0.65	0.07	0.88	0.29	-0.40
Chloromethane	0.82	0.81	0.79	0.82	-0.12	-0.61	-0.14	0.36
Dichlorodifluoromethane	0.53	0.51	0.51	0.52	-0.06	-0.32	-0.09	0.34
Ethylbenzene	-0.44	-0.43	-0.37	-0.41	0.26	0.62	0.11	-0.24
Formaldehyde	0.85	0.83	0.72	0.77	-0.43	-0.49	-0.12	0.17
m-,p - Xylene	-0.58	-0.59	-0.51	-0.56	0.36	0.75	0.19	-0.43
o - Xylene	-0.40	-0.39	-0.27	-0.34	0.42	0.48	-0.02	-0.27
Propylene	-0.12	-0.20	-0.23	-0.22	-0.05	0.56	0.37	0.03
Toluene	-0.62	-0.59	-0.48	-0.55	0.43	0.66	0.17	-0.36
Trichlorofluoromethane	0.46	0.48	0.47	0.48	-0.09	-0.14	-0.02	0.09

Table 18-3. Motor Vehicle Information vs. Daily Concentration for the Texas Monitoring Site

Monitoring Station	Population within Ten Miles	Estimated Number of Motor Vehicles Owned	Traffic Data (Daily Average)	Average Daily UATMP Concentration (ppbv)
ANTX	614,071	454,413	14,310	18.91 (±3.58)

19.0 Site in Utah

This section focuses on meteorological, concentration, and spatial trends for the UATMP site in Utah (SLCU), located in Salt Lake City, in north central Utah. Figure 19-1 is a topographical map showing the monitoring station in its urban location. Figure 19-2 is a map identifying facilities within ten miles of the site that reported to the 1999 NEI. The map shows that there are numerous industrial facilities, mostly fuel combustion facilities, near the monitoring site, and most of them are to the northeast and east. Hourly meteorological data were retrieved for all of 2002 at Salt Lake City International Airport's weather station (WBAN 24124) near the site with the purpose of calculating correlations of meteorological data with ambient air concentration measurements.

Table 19-1 highlights the average UATMP concentration at the site, along with the temperature (average maximum and average), moisture (average dew point temperature, average wet-bulb temperature, and average relative humidity), wind information (average u- and v-components of the wind), and pressure (average sea level pressure) for the entire year and on days samples were taken. The Salt Lake City area has a semi-arid continental climate, with large seasonal variations. The area is dry, located on the west side of the Wasatch Mountains, and the Great Salt Lake tends to have a moderating influence on the city's temperature. Moderate winds flow out of the southeast on average. This information can be found in The Weather Almanac, fifth edition (Ruffner and Bair, 1987).

19.1 Meteorological and Concentration Averages at the Utah Site

Carbonyl compounds and VOC were measured at this site, as indicated in Tables 3-3 and 3-4. The highest computed geometric mean belonged to the hydrocarbons (9.33 ppbv). The polar compounds had the lowest geometric mean, with a value of 3.70 ppbv, and the carbonyls and halogenated hydrocarbons' geometric means fell between with values of 8.47 ppbv and 4.50 ppbv, respectively. The average total UATMP daily concentration at SLCU was 29.72 (±6.54) ppbv. Table 19-1 also lists the averages for selected meteorological parameters from January 2002 to December 2002, which is the time period covered in this report. This site also opted to have total and speciated nonmethane organic compounds (TNMOC/SNMOC) sampled during its air toxic sampling. SNMOC/NMOC compounds are of particular interest because of their role in ozone formation. Readers are encouraged to review EPA's *2001 Nonmethane Organic Compounds (NMOC) and Speciated Nonmethane Organic Compounds (SNMOC) Monitoring Program, Final Report* (EPA, 2002) for more information on SNMOC/NMOC trends and concentrations. The average total NMOC value for SLCU was 345 (±53.45) ppbC, of which nearly 63% could be identified through speciation. Of the speciated compounds, toluene measured the highest concentration at the SLCU (17.42 ppbC). This information is given in Table 19-3. Ozone concentrations were also sampled at this site on 153 sample days, and were retrieved from the U.S. EPA's AQS database. The average ozone concentration for each sample day was 63.69 (±2.32) ppbv.

Table 19-2 is the summary of calculated Pearson Correlation coefficients for each of the prevalent compounds and selected meteorological parameters. Identification of the prevalent compounds is discussed in Section 3 of this report. Acetylene and propylene both had moderately strong to strong negative correlations with maximum, average, and wet bulb temperatures, while chloromethane and dichlorodifluoromethane each had moderately strong positive correlations with the previously mentioned parameters (with the exception of dew point for chloromethane). Seven compounds had moderately strong to strong positive correlations with the relative humidity and nine compounds had moderately strong negative correlations with the v-component of the wind. As humidity increases and the north-south wind decreases, concentrations of the prevalent UATMP compounds tend to increase.

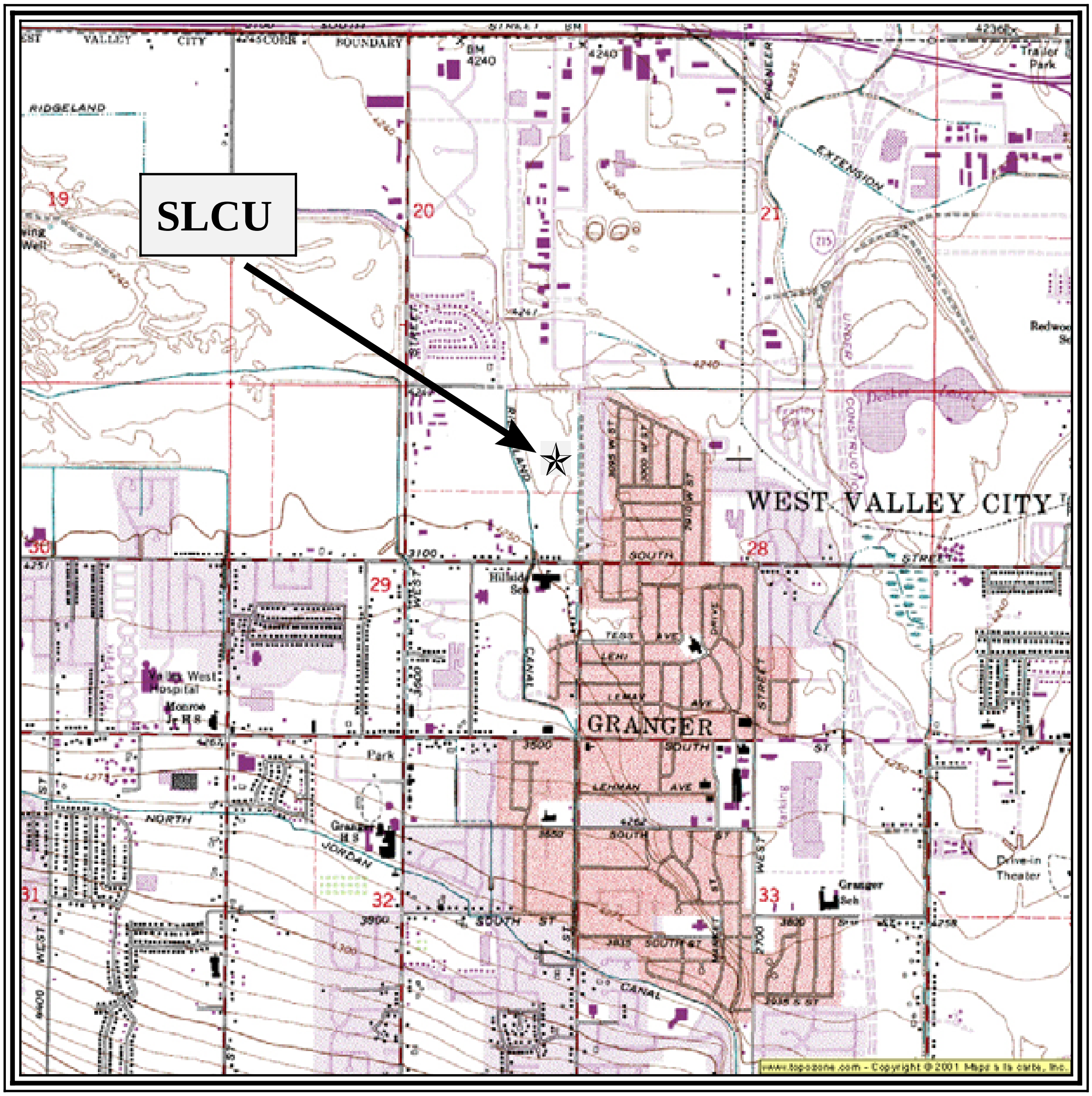
19.2 Spatial Analysis

Using the population within ten miles of each site, an estimate of the number of motor vehicles operating in proximity to the monitoring station can be established. The ratio used in this report is 0.74 motor vehicles to every one person (refer to section 3.4.1 for more information on this ratio). The population near the SLCU site is 827,442 people, all of whom are operating approximately 612,307 motor vehicles. This information is compared to the average daily concentration of the prevalent compounds at the Utah site in Table 19-4. Also included in Table

19-4 are average daily traffic data, or more specifically, the average number of cars passing the monitoring sites on the nearest roadway to each site on a daily basis.

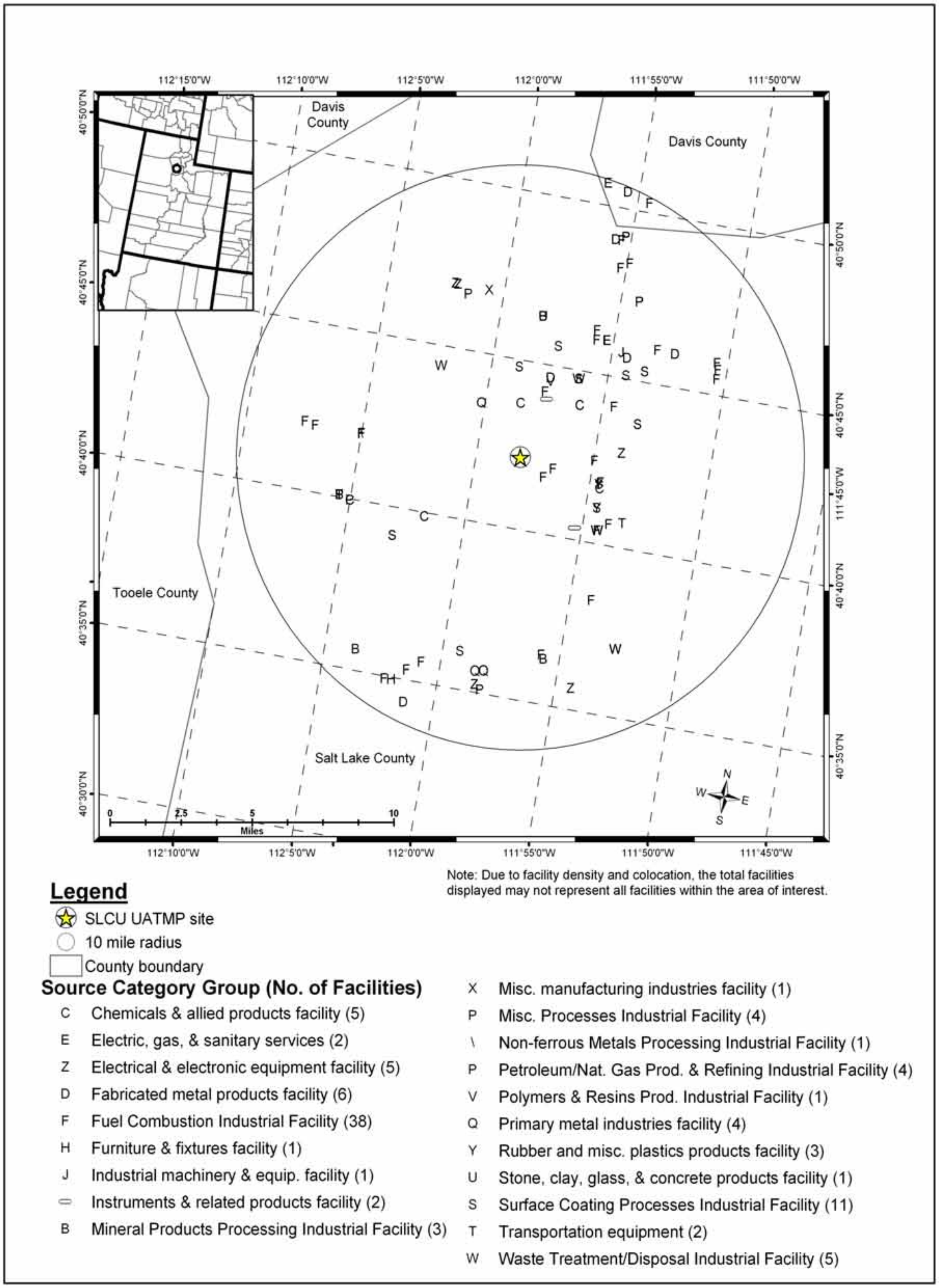
A roadside study conducted to measure emissions from motor vehicles determined that the concentration ratios of the BTEX compounds were relatively consistent from urban area to urban area. (For more information on this study, refer to section 3.4.2.) Figure 3-14 depicts the average concentration ratios of the roadside study and compares them to the concentration ratios at each of the monitoring sites. The SLCU site's concentration ratios look somewhat similar to those of the roadside study. However, the values for each of the ratios are higher for SLCU. The ratio for toluene-ethylbenzene is considerably higher than those of the roadside study, while the remaining concentration ratios are only slightly higher.

Figure 19-1. Salt Lake City, Utah (SLCU) Monitoring Station



Source: USGS 7.5 Minute Series. Map Scale: 1:24,000.

Figure 19-2. Facilities Located Within 10 Miles of SLCU



Note: Due to facility density and colocation, the total facilities displayed may not represent all facilities within the area of interest.

Table 19-1. Average Concentration and Meteorological Parameters for the Site in Utah

Site Name	Type	Average UATMP Concentration (ppbv)	Average Maximum Temperature (°F)	Average Temperature (°F)	Average Dewpoint Temperature (°F)	Average Wet Bulb Temperature (°F)	Average Relative Humidity (%)	Sea Level Pressure (mb)	Average u-component of the Wind (kts)	Average v-component of the Wind (kts)
SLCU	All 2002	▨	62.46 (±2.26)	52.31 (±2.03)	31.61 (±1.01)	41.89 (±1.31)	53.28 (±2.20)	1017.4 (±9.50)	0.09 (±0.20)	3.62 (±0.17)
	sample day	29.72 (±6.54)	62.60 (±5.72)	53.06 (±5.26)	31.55 (±2.70)	42.28 (±3.38)	51.94 (±5.80)	1017.7 (±27.27)	-0.37 (±0.55)	3.21 (±0.55)

Table 19-2. Prevalent Compound Concentration Correlations with Selected Meteorological Parameters at Salt Lake City, Utah (SLCU)

Compound	Maximum Temperature	Average Temperature	Dew Point Temperature	Wet Bulb Temperature	Relative Humidity	Sea Level Pressure	u-component of wind speed	v-component of wind speed
1,2,4-Trimethylbenzene	-0.03	-0.09	0.18	-0.01	0.35	0.10	0.01	-0.30
Acetylene	-0.47	-0.52	-0.24	-0.48	0.65	0.24	-0.13	-0.37
Benzene	-0.19	-0.25	0.03	-0.18	0.47	0.09	-0.06	-0.34
Chloromethane	0.45	0.44	0.24	0.38	-0.43	-0.21	-0.01	0.31
Dichlorodifluoromethane	0.34	0.32	0.29	0.32	-0.23	-0.25	0.07	0.09
Ethylbenzene	0.00	-0.05	0.17	0.01	0.29	0.05	0.00	-0.30
Formaldehyde	0.06	0.02	0.25	0.10	0.21	-0.10	-0.11	-0.21
m-,p - Xylene	-0.03	-0.08	0.15	-0.02	0.32	0.01	0.01	-0.32
o - Xylene	0.01	-0.05	0.17	0.01	0.29	-0.02	0.00	-0.30
Propylene	-0.33	-0.40	-0.17	-0.36	0.50	0.20	-0.11	-0.29
Toluene	0.04	-0.02	0.12	0.02	0.15	-0.03	0.07	-0.32
Trichlorofluoromethane	0.19	0.18	0.04	0.15	-0.24	0.01	0.39	-0.34

Table 19-3. TNMOC and Ozone Measured by the Salt Lake City, UT (SLCU) Monitoring Station

Average Ozone Concentrations (ppbv)	Total Number of Ozone Sampling Days	Average TNMOC speciated (ppbC)	Average TNMOC w/ unknown (ppbC)	% TNMOC Identified	SNMOC Compound with the Highest Concentration (ppbC)
63.69 (±2.32)	153	205 (±26.41)	345 (±53.45)	63%	Toluene (17.42)

Table 19-4. Motor Vehicle Information vs. Daily Concentration for the Utah Monitoring Site

Monitoring Station	Population within Ten Miles	Estimated Number of Motor Vehicles Owned	Traffic Data (Daily Average)	Average Daily UATMP Concentration (ppbv)
SLCU	827,442	612,307	20,485	29.72 (±6.54)

20.0 Sites in Vermont

This section focuses on meteorological, concentration, and spatial trends for the three UATMP sites in Vermont (BRVT, RUVT, and UNVT). The northernmost site is UNVT, in Underhill, to the east of Burlington. The RUVT site is in Rutland, located in central Vermont, while the BRVT site is in Brattleboro, located in the southeast corner of the state. Figures 20-1 through 20-3 are topographical maps showing the monitoring stations in their urban locations. Figures 20-4 through 20-6 are maps identifying facilities within ten miles of the sites that reported to the 1999 NEI. None of the sites have a large amount of facilities nearby. Most of the industries are to the north or south of BRVT; to the southeast and southwest of RUVT, and scattered about UNVT on the outer perimeter of the ten mile radius. The most numerous type of source surrounding all three sites is fuel combustion.

Hourly meteorological data were retrieved for all of 2002 at two weather stations near these sites with the purpose of calculating correlations of meteorological data with ambient air concentration measurements. The two weather stations are Springfield/Hartness State Airport and Burlington International Airport (WBAN 54740 and 14742, respectively).

Table 20-1 highlights the average UATMP concentration (VOC only) at each of these sites, along with temperature (average maximum and average), moisture (average dew point temperature, average wet-bulb temperature, and average relative humidity), wind information (average u- and v- components of the wind), and pressure (average sea level pressure) for the entire year and on days samples were taken. The sites in Vermont see some of the chilliest yearly temperatures compared to the other participating sites, as indicated in Table 20-1. Vermont is affected by most storm systems that track across the country, producing variable weather. Average annual winds come from the south, ahead of advancing weather systems. This information can be found in The Weather Almanac, fifth edition (Ruffner and Bair, 1987).

20.1 Meteorological and Concentration Averages at the Vermont Sites

Carbonyl compounds were not measured at any of the three sites, as indicated in Tables 3-3 and 3-4. BRVT had the largest geometric mean for all three types of VOC, while UNVT consistently had the lowest. Halogenated hydrocarbons ranged from 3.37 ppbv at UNVT to 8.30 ppbv at BRVT. Hydrocarbons ranged from 1.30 ppbv at UNVT to 7.23 ppbv at BRVT. Polar compounds ranged from 1.49 ppbv at UNVT to 4.07 ppbv at BRVT. The average total UATMP daily concentration was largest at RUVT, at 9.98 (±1.02) ppbv, while the lowest concentration was at UNVT, at 6.26 (±0.30) . Table 20-1 also lists the averages for selected meteorological parameters from January 2002 to December 2002, which is the same time period covered in this report.

Tables 20-2a-c are the summary of calculated Pearson Correlation coefficients for each of the prevalent compounds and selected meteorological parameters by site. Identification of the prevalent compounds is discussed in Section 3 of this report. At BRVT, chloromethane, dichlorodifluoromethane, and trichlorofluoromethane had moderately strong positive correlations with maximum, average, dew point, and wet bulb temperatures, while acetylene had moderately strong negative correlations with the same four parameters. All of the compounds had positive correlations with relative humidity, of which five were moderately strong and three were considered strong. Most of the compounds had negative correlations with sea level pressure and the wind components. The UATMP concentrations of prevalent compounds tend to increase as pressure and wind speed decrease and relative humidity increases.

At RUVT, acetylene, benzene, and propylene had moderately strong negative correlations with maximum, average, dew point, and wet bulb temperatures, while the remaining compounds had mostly weak positive correlations with these parameters. With the exception of trichlorofluoromethane, all of the compounds had weak to moderate negative correlations with sea level pressure. With the exception of chloromethane, all of the compounds had moderately strong to strong negative correlations with the u-component of the wind, and most of the compounds had weak to moderate positive correlations with the v-component of the wind. The UATMP concentrations of prevalent compounds tend to increase as pressure and the east-west wind speed decreases and the north-south wind speed increases.

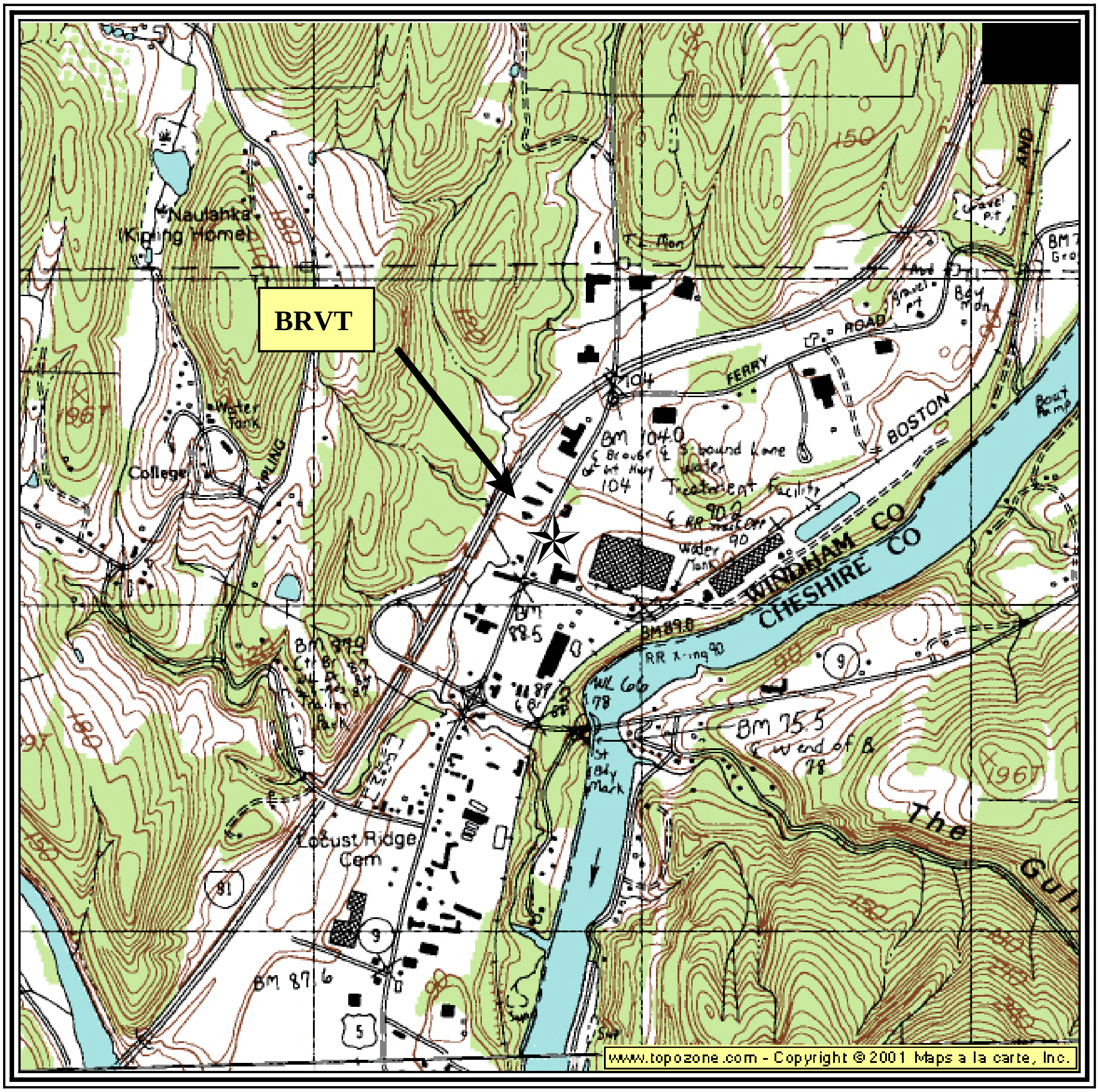
1,2,4-Trimethylbenzene, ethylbenzene, and the xylenes did not measure any detectable values at UNVT, and therefore do not have reportable correlations. Very few of the compounds and weather variables registered correlations that could be considered moderately strong. The strongest correlations were with acetylene and the v-component of the wind speed, and toluene and the u-component of the wind speed. The weak correlations between the compounds and the weather parameters make it difficult to ascertain when UATMP concentrations will increase at UNVT.

20.2 Spatial Analysis

Using the population within ten miles of each site, an estimate of the number of motor vehicles operating in proximity to the monitoring station can be established. The ratio used in the this report is 0.74 motor vehicles to every one person (refer to section 3.4.1 for more information on this ratio). The site with the largest population is UNVT, where 48,938 people are operating approximately 36,214 vehicles. A population of 35,880 people is driving 26,551 motor vehicles near the RUVT site, while a lower population of 27,420 people is driving 20,291 vehicles near the BRVT site. This information is compared to the average daily concentration of the prevalent compounds at each Vermont site in Table 20-3. Also included in Table 20-3 is average daily traffic data, or more specifically, the average number of cars passing the monitoring sites on the nearest roadway to each site on a daily basis. The site with the largest traffic volume is BRVT and, as indicated in Figure 20-1, BRVT is located near an interstate highway.

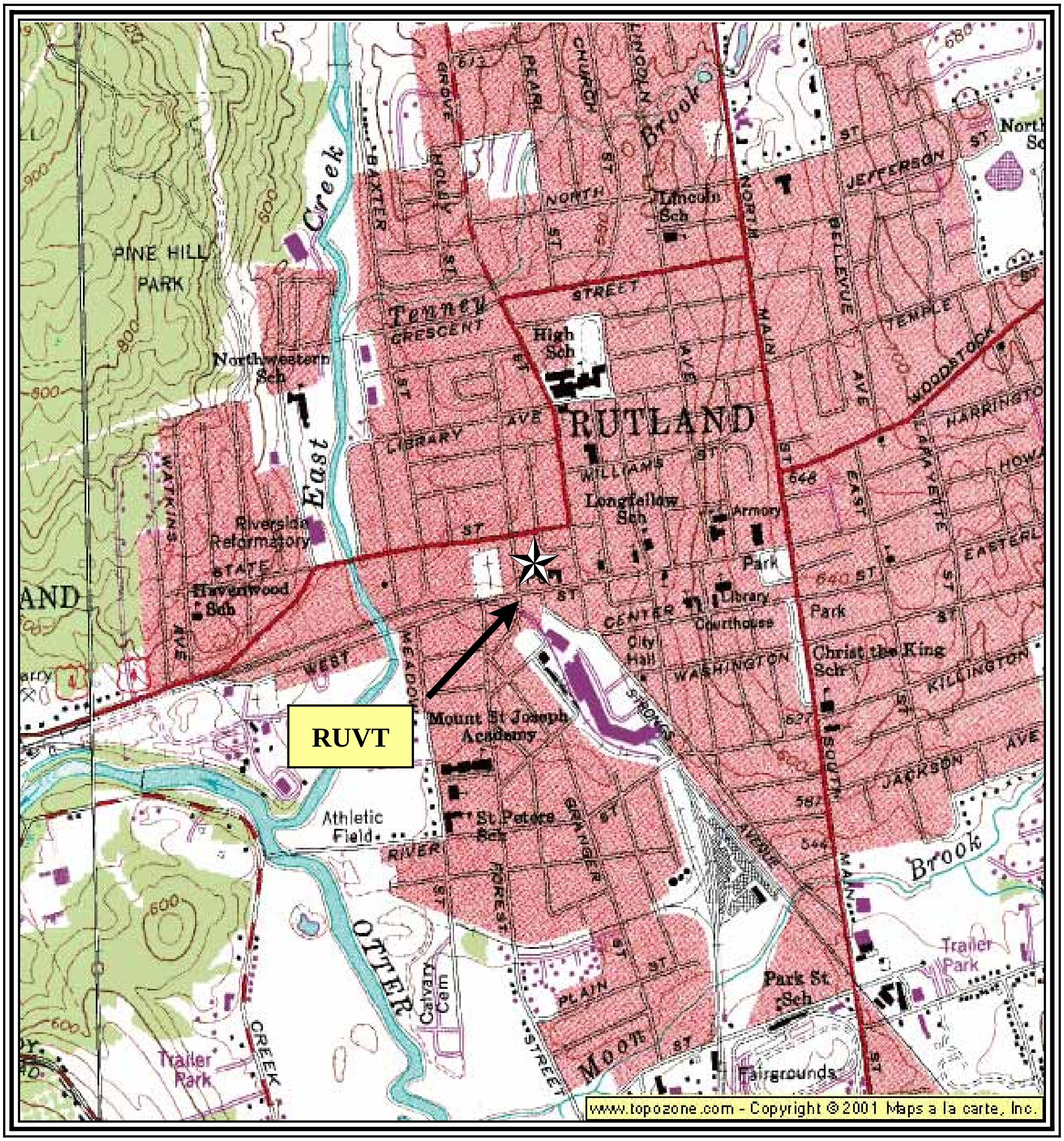
A roadside study conducted to measure emissions from motor vehicles determined that the concentration ratios of the BTEX compounds were relatively consistent from urban area to urban area. (For more information on this study, refer to section 3.4.2.) Figure 3-14 depicts the average concentration ratios of the roadside study and compares them to the concentration ratios at each of the monitoring sites. The RUVT site's concentration ratios most resemble those of the roadside study. BRVT's toluene-ethylbenzene and benzene-ethylbenzene ratios are higher than those of the roadside study. BRVT's benzene-ethylbenzene ratio is higher than its *m,p*-xylene-ethylbenzene ratio, which is the reverse of those from the roadside study. The only ratio that resembles the roadside study for the UNVT site is the toluene-ethylbenzene ratio, only in that it is the largest for both sets. The toluene-ethylbenzene and benzene-ethylbenzene ratios are very close at UNVT, with a considerably lower toluene-ethylbenzene ratio, and a slightly higher benzene-ethylbenzene ratio at UNVT compared with the roadside study. Also at UNVT, the *m,p*-xylene-ethylbenzene and *o*-xylene-ethylbenzene ratios are very close, with the *o*-xylene-ethylbenzene ratio slightly higher. The opposite is true for the roadside study in both instances.

Figure 20-1. Brattleboro, Vermont (BRVT) Monitoring Station



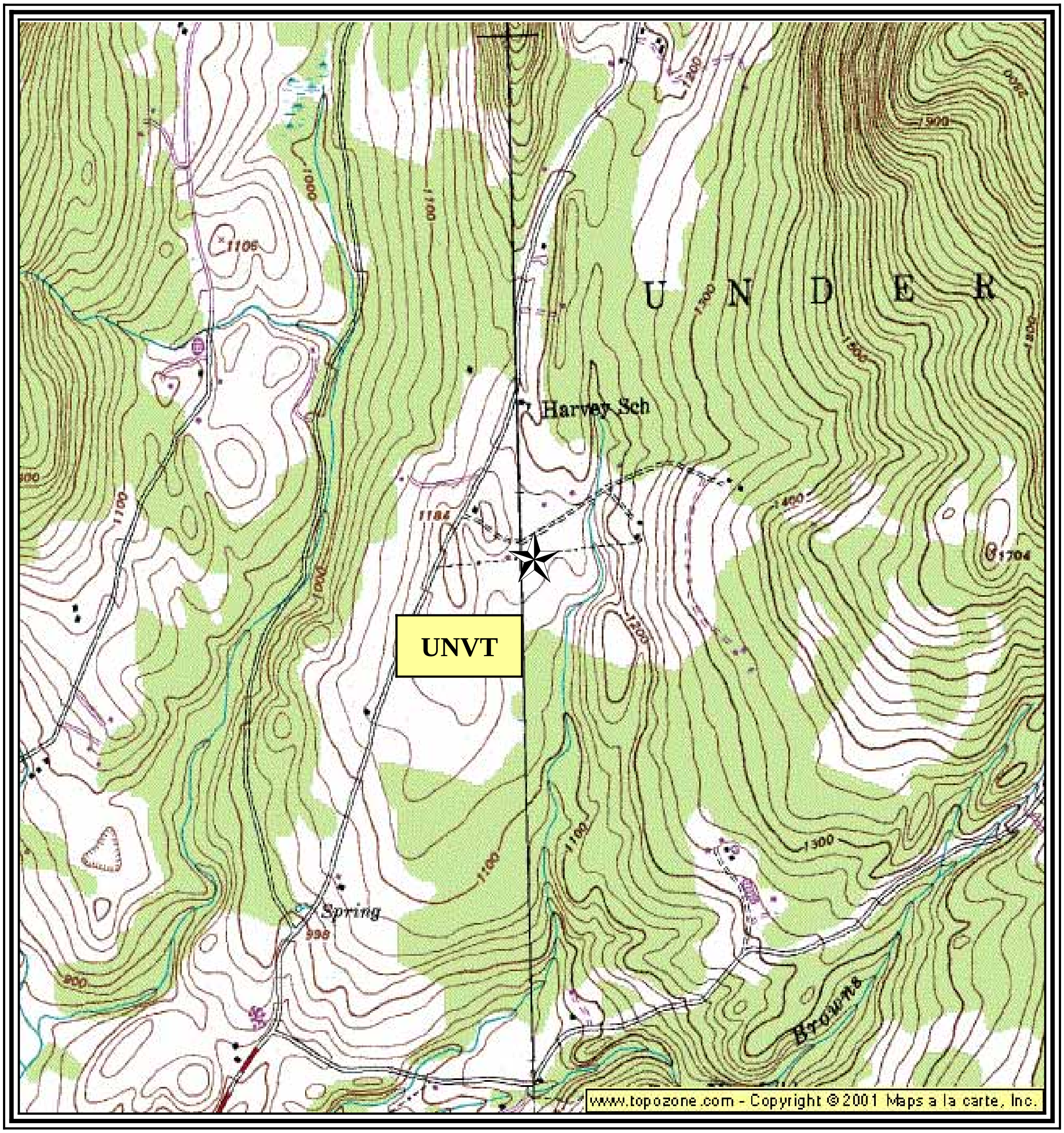
Source: USGS 7.5 Minute Series. Map Scale: 1:25,000.

Figure 20-2. Rutland, Vermont (RUVT) Monitoring Station



Source: USGS 7.5 Minute Series. Map Scale: 1:25,000.

Figure 20-3. Underhill, Vermont (UNVT) Monitoring Station



Source: USGS 7.5 Minute Series. Map Scale: 1:25,000.

Figure 20-4. Facilities Located Within 10 Miles of BRVT

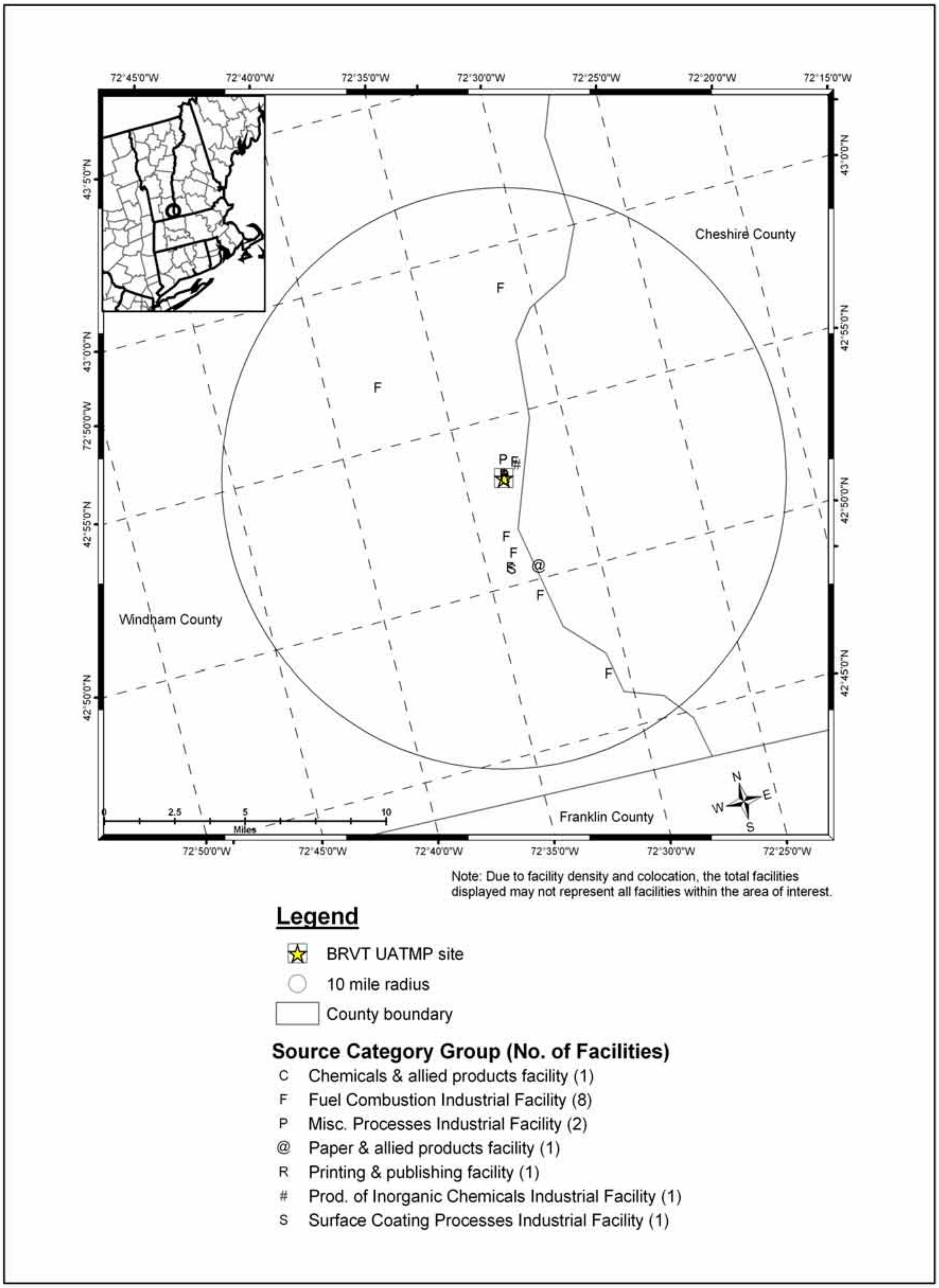


Figure 20-5. Facilities Located Within 10 Miles of RUVT

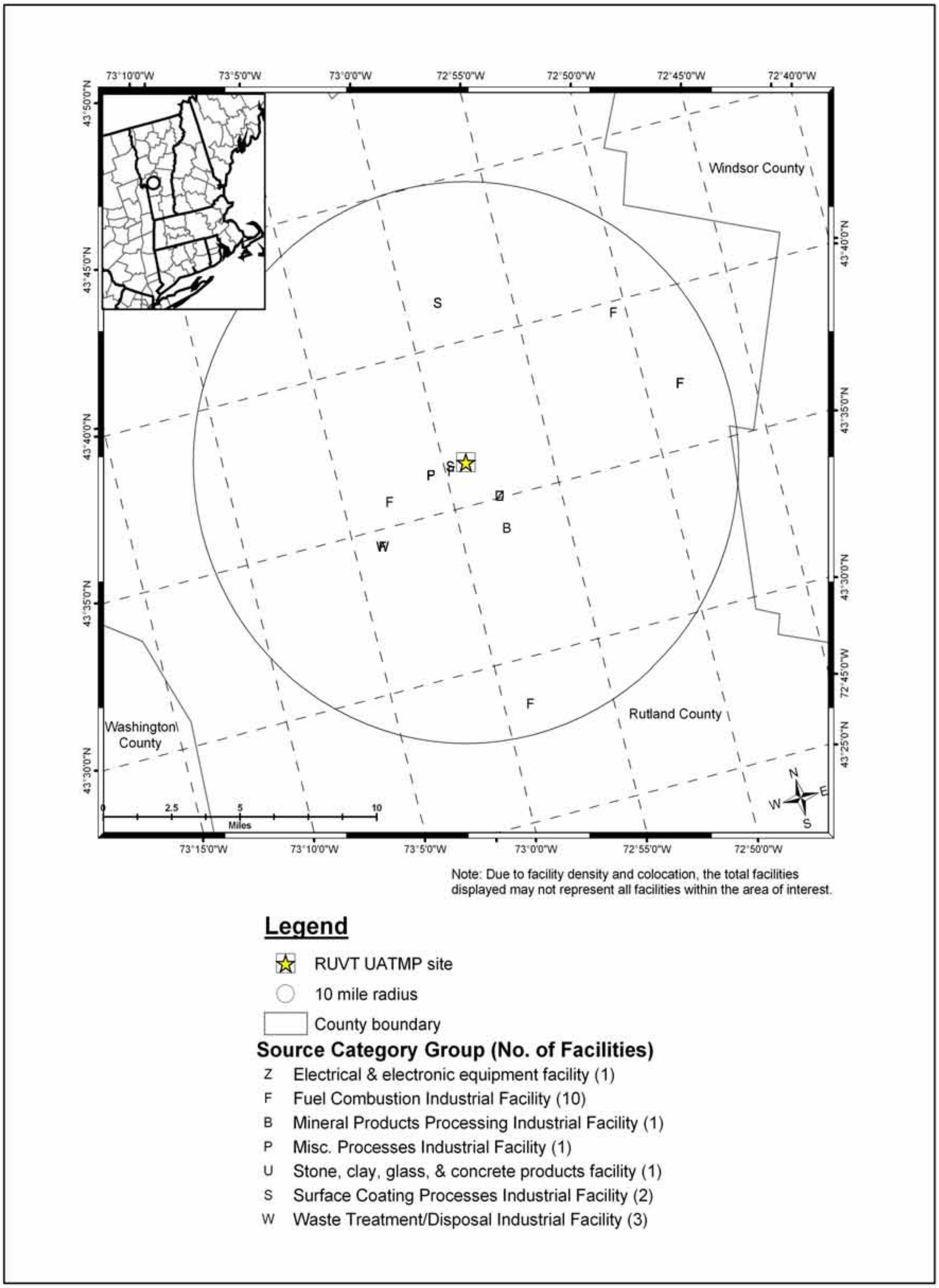
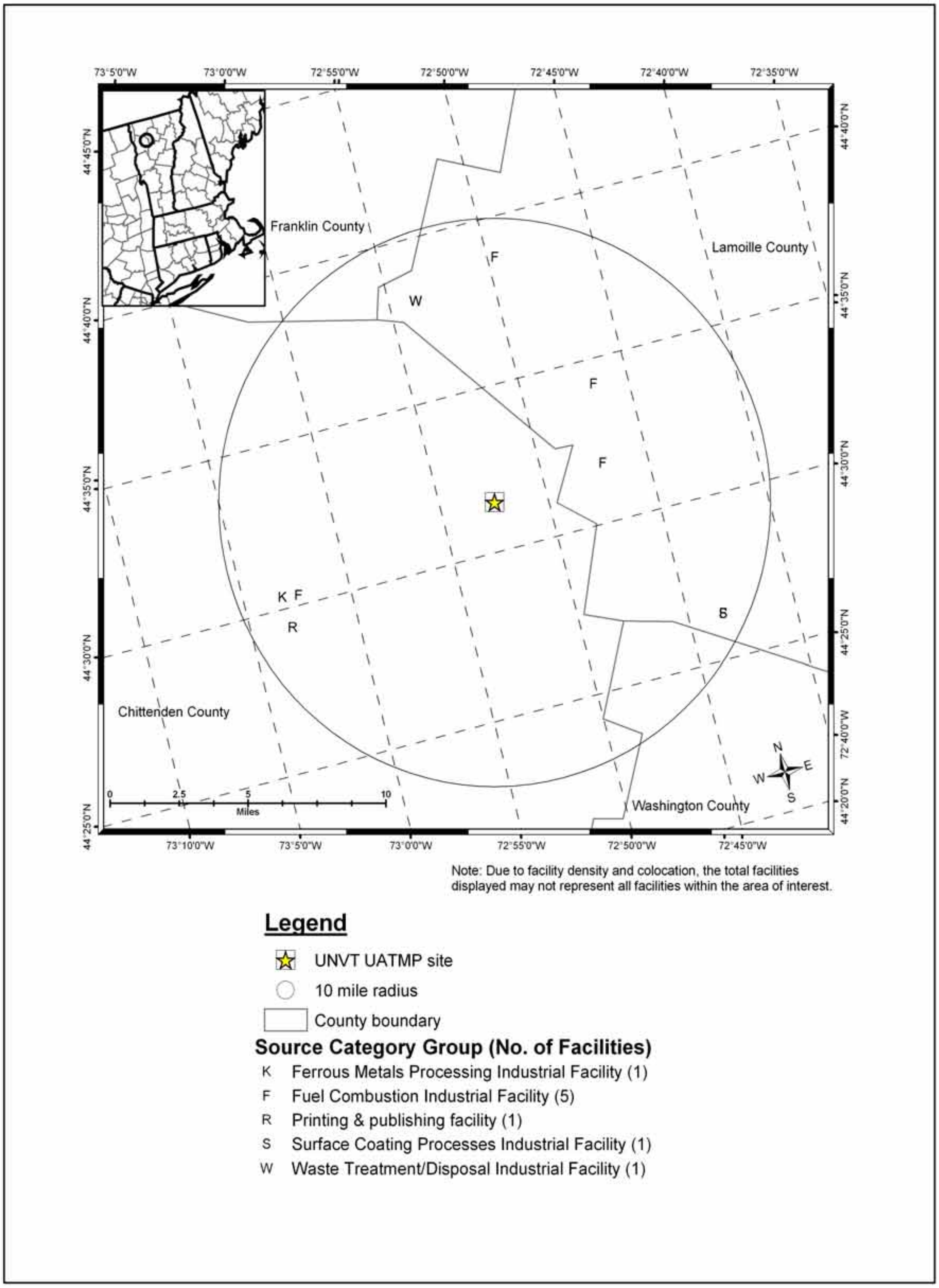


Figure 20-6. Facilities Located Within 10 Miles of UNVT



Note: Due to facility density and colocation, the total facilities displayed may not represent all facilities within the area of interest.

Table 20-1. Average Concentration and Meteorological Parameters for Sites in Vermont

Site Name	Type	Average UATMP Concentration (ppbv)	Average Maximum Temperature (°F)	Average Temperature (°F)	Average Dewpoint Temperature (°F)	Average Wet Bulb Temperature (°F)	Average Relative Humidity (%)	Average Sea Level Pressure (mb)	Average u-component of the Wind (kts)	Average v-component of the Wind (kts)
BRVT	All 2002	▨	56.29 (±2.08)	46.29 (±1.82)	36.22 (±1.80)	41.74 (±1.66)	71.93 (±1.33)	1020.0 (±10.91)	-1.72 (±0.61)	0.65 (±0.13)
	sample day	8.32 (±0.28)	56.07 (±7.01)	46.10 (±6.28)	35.46 (±6.17)	41.34 (±5.69)	70.40 (±4.59)	1019.3 (±36.54)	-0.42 (±0.53)	0.55 (±0.55)
RUVT	All 2002	▨	55.53 (±2.11)	47.47 (±1.92)	37.19 (±1.85)	42.73 (±1.74)	70.27 (±1.18)	1019.5 (±12.16)	-0.01 (±0.25)	3.72 (±0.23)
	sample day	9.98 (±1.02)	55.69 (±6.83)	47.54 (±6.35)	36.61 (±6.17)	42.56 (±5.77)	68.58 (±3.83)	1021.1 (±57.18)	0.49 (±0.83)	2.73 (±0.82)
UNVT	All 2002	▨	55.53 (±2.11)	47.47 (±1.92)	37.19 (±1.85)	42.73 (±1.74)	70.27 (±1.18)	1019.5 (±12.16)	-0.01 (±0.25)	3.72 (±0.23)
	sample day	6.26 (±0.30)	54.67 (±6.83)	46.46 (±6.38)	35.57 (±6.27)	41.61 (±5.81)	68.36 (±3.61)	1021.2 (±55.41)	0.55 (±0.81)	2.52 (±0.85)

Table 20-2a - Prevalent Compound Concentration Correlations with Selected Meteorological Parameters at Brattleboro, Vermont (BRVT)

Compound	Maximum Temperature	Average Temperature	Dew Point Temperature	Wet Bulb Temperature	Relative Humidity	Sea Level Pressure	u-component of wind speed	v-component of wind speed
1,2,4-Trimethylbenzene	-0.12	-0.08	0.07	-0.01	0.48	-0.03	-0.15	-0.27
Acetylene	-0.29	-0.32	-0.28	-0.31	0.06	-0.33	-0.09	0.03
Benzene	-0.15	-0.17	-0.06	-0.13	0.33	-0.22	-0.09	-0.11
Chloromethane	0.44	0.45	0.43	0.45	0.01	-0.04	-0.18	0.02
Dichlorodifluoromethane	0.26	0.25	0.35	0.30	0.37	0.13	-0.21	-0.29
Ethylbenzene	-0.16	-0.17	-0.02	-0.12	0.45	-0.18	-0.23	-0.25
m-,*p* - Xylene	-0.04	-0.05	0.12	0.01	0.56	-0.18	-0.26	-0.20
o - Xylene	-0.18	-0.18	-0.04	-0.13	0.44	-0.13	-0.21	-0.22
Propylene	-0.12	-0.15	0.01	-0.09	0.51	-0.27	-0.33	-0.19
Toluene	0.05	0.06	0.23	0.13	0.58	-0.11	-0.25	-0.24
Trichlorofluoromethane	0.30	0.28	0.30	0.31	0.12	0.19	0.13	-0.20

Table 20-2b - Prevalent Compound Concentration Correlations with Selected Meteorological Parameters in Rutland, Vermont (RUVT)

Compound	Maximum Temperature	Average Temperature	Dew Point Temperature	Wet Bulb Temperature	Relative Humidity	Sea Level Pressure	u-component of wind speed	v-component of wind speed
1,2,4-Trimethylbenzene	0.03	0.07	-0.01	0.04	-0.26	-0.04	-0.37	0.26
Acetylene	-0.39	-0.36	-0.38	-0.37	-0.13	-0.25	-0.28	0.51
Benzene	-0.29	-0.28	-0.28	-0.29	0.01	-0.23	-0.42	0.29
Chloromethane	0.06	0.10	0.09	0.10	0.00	-0.04	-0.15	0.04
Dichlorodifluoromethane	0.13	0.16	0.11	0.14	-0.12	-0.06	-0.26	-0.08
Ethylbenzene	0.09	0.10	0.07	0.09	-0.04	-0.13	-0.57	0.18
m-,*p* - Xylene	0.07	0.07	0.03	0.05	-0.08	-0.14	-0.61	0.12
o - Xylene	0.07	0.08	0.04	0.06	-0.07	-0.12	-0.58	0.15
Propylene	-0.29	-0.26	-0.29	-0.27	-0.13	-0.22	-0.38	0.33
Toluene	0.10	0.12	0.05	0.09	-0.17	-0.14	-0.60	0.23
Trichlorofluoromethane	0.14	0.15	0.13	0.15	-0.02	0.05	-0.29	-0.07

Table 20-2c - Prevalent Compound Concentration Correlations with Selected Meteorological Parameters at Underhill, Vermont (UNVT)

Compound	Maximum Temperature	Average Temperature	Dew Point Temperature	Wet Bulb Temperature	Relative Humidity	Sea Level Pressure	u-component of wind speed	v-component of wind speed
1,2,4-Trimethylbenzene	N/A*	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Acetylene	-0.10	-0.08	-0.04	-0.06	0.14	-0.18	-0.22	0.46
Benzene	-0.10	-0.07	-0.02	-0.05	0.19	-0.04	-0.08	0.16
Chloromethane	0.10	0.15	0.15	0.15	0.02	-0.20	0.04	-0.09
Dichlorodifluoromethane	0.20	0.22	0.20	0.22	-0.01	-0.12	-0.20	-0.10
Ethylbenzene	N/A*	N/A	N/A	N/A	N/A	N/A	N/A	N/A
m-,*p* - Xylene	N/A*	N/A	N/A	N/A	N/A	N/A	N/A	N/A
o - Xylene	N/A*	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Propylene	0.12	0.15	0.16	0.16	0.07	-0.01	0.07	-0.29
Toluene	-0.10	-0.09	-0.04	-0.08	0.27	0.02	-0.38	0.09
Trichlorofluoromethane	0.22	0.22	0.20	0.21	-0.02	0.13	-0.26	0.00

* These compounds had no reportable values, only non-detects, and therefore have no correlations.

Table 20-3. Motor Vehicle Information vs. Daily Concentration for Vermont Monitoring Sites

Monitoring Station	Population within Ten Miles	Estimated Number of Vehicles Owned	Traffic Data (Daily Average)	Average Daily UATMP Concentration (ppbv)
BRVT	27,420	20,291	16,578	8.32 (±0.28)
RUVT	35,880	26,551	5,700	9.98 (±1.02)
UNVT	48,938	36,214	1,000	6.26 (±0.30)

21.0 Data Quality

This section discusses the precision and accuracy of ambient air concentration measurements during the 2002 UATMP. As indicators of the reliability of experimental measurements, both precision and accuracy must be considered when interpreting ambient air monitoring results. In general, this section shows that the 2002 UATMP monitoring data are of a known and high quality, particularly for the most program-wide prevalent compounds in urban air. Collocated duplicate samples were collected in the State of Michigan. The precision and accuracy of these collocated samples are discussed further in Sections 21.1.1 and 21.2. All calculations were based on sample concentrations detected above the method detection limits for each compound. The precision level is well within the UATMP data quality objectives (USEPA, 2002) and guidelines in the Compendium Methods (USEPA, 1999) which is 15 percent coefficient of variation for each site and each compound.

Method precision for the UATMP is determined by repeated analysis of duplicate samples. A duplicate sample is a sample collected simultaneously with a primary sample using the same sampling system(i.e., two separate samples through the same sampling system at the same time). This simultaneous collection is typically achieved by teeing the line from the sampler to each of the two canisters and doubling the flow rate applied to achieve integration over the 24-hour collection period. Ten percent of all sample collections were duplicate samples.

The only exceptions to this approach were one site for the State of Vermont, two sites for Tennessee, and two sites in Michigan. At these sites, collocated samples were collected and analyzed in replicate. The difference between duplicate and collocated samples is that the duplicate samples are collected from two canisters using one collection system, whereas collocated samples are collected at the same time but using two completely separate collection systems.

Both approaches provide valuable, but different, assessments of method precision:

- Replicate analysis of duplicate samples provides information on the potential for variability (or precision) expected from a single collection system, but does not provide information on the variability expected between different collection systems.

- Replicate analysis of collocated samples provide information on the potential for variability (or precision) expected between different collection systems, but does not provide information on the variability expected from single collection systems.

21.1 Precision

Precision refers to the agreement between independent measurements performed according to identical protocols and procedures. To quantify "sampling and analytical precision" (i.e., how precisely the sampling and analytical methods measure ambient air concentrations), concentrations measured during analysis of duplicate samples are compared.

Applied to ambient air monitoring data, precision is a measurement of random errors inherent to the process of sampling and analyzing ambient air.

21.1.1 Analytical Precision

Analytical precision is a measurement of random errors associated with laboratory analysis of environmental samples. These errors may result from various factors, but typically originate from random "noise" inherent to analytical instruments. Laboratories can easily evaluate analytical precision by comparing concentrations measured during replicate analysis of the same ambient air samples. This report uses three parameters to quantify random errors indicated by replicate analyses of 2002 UATMP samples:

S ***Average concentration difference*** simply quantifies how duplicate or replicate analytical results differ, on average, for each compound and each sample. When interpreting central tendency estimates for specific compounds sampled during the 2002 UATMP, participating agencies are encouraged to compare central tendencies to the average concentration differences. If a compound's average concentration difference exceeds or nearly equals its central tendency, the analytical method may not be capable of precisely characterizing annual concentrations. Therefore, data interpretation for these compounds should be made with caution. Average concentration differences are calculated by subtracting the first analytical result from the second analytical result and averaging the difference for each compound.

- ***Relative percent difference (RPD)*** expresses average concentration differences relative to the average concentrations detected during replicate analyses. The RPD is calculated as follows:

$$RPD = \frac{|X_1 - X_2|}{\bar{X}} \times 100 \qquad \textbf{(1)}$$

Where:

X_1 is the ambient air concentration of a given compound measured in one sample;
X_2 is the concentration of the same compound measured during replicate analysis; and
$\bar{X}$ is the arithmetic mean of X_1 and X_2.

As Equation 1 shows, replicate analyses with low variability have lower RPDs (and better precision), and replicate analyses with high variability have higher RPDs (and poorer precision).

- ***Coefficient of Variation (CV)*** provides a relative measure of data dispersion compared to the mean.

$$Cv = \frac{\sigma}{\bar{X}} \times 100 \qquad \textbf{(2)}$$

Where:

σ is the standard deviation of the sets or duplicate or replicate results;
$\bar{X}$ is the arithmetic mean of the sets or duplicate or replicate results;

The CV is used to measure the imprecision in survey estimates introduced from analysis. A low coefficient of 1 percent would indicate that the analytical results could vary slightly due to sampling error, while a variation of 50% means that the results are more imprecise.

The following approach was employed to estimate how precisely the central laboratory analyzed 2002 UATMP samples:

S CVs, RPDs and concentration differences were calculated for every replicate analyses performed during the program. In cases where compounds were not detected during replicate analyses, these parameters were not calculated.

S Second, to make an overall estimate of method precision, program-average CVs, RPDs, and absolute concentration differences were calculated for each compound by averaging the values from the individual replicate analyses.

Tables 21-1, 21-2, and 21-3 use absolute average concentration differences, RPDs, and CVs to characterize the analytical precision representing all sites for VOC, representing all replicate analyses in duplicate and collocated samples, replicate analyses of collocated samples and replicate analyses of duplicate samples, respectively.

In Table 21-1, the replicate analyses for duplicate and collocated samples show that laboratory VOC analysis precision was within the control limits of 85 to 115 percent for CV, with the exception of 1,3-butadiene, acetonitrile, methylene chloride, and *n*-octane at 15.86, 18.41, 20.04 and 18.08 percent, respectively. The method was most precise when measuring air concentrations for the program-wide prevalent compounds (i.e., compounds consistently found at levels exceeding their detection limits). The poor precision for 1,3-butadiene was due to poor agreement from replicate samples from the Nashville, TN site (EATN). The slightly high variability for *n*-octane resulted from poor agreement from replicate analyses from Camden, NJ (CANJ), Denver, CO (DECO), Elizabeth, NJ (ELNJ), and Salt Lake City, UT (SLCU). *n*-Octane and 1,3-butadiene were detected in less than 20% of all replicate samples analyzed (114 samples for *n*-octane and 125 for 1,3-butadiene). In terms of average concentration difference, the precision of the VOC analytical method ranged from 0.01 ppbv for chlorobenzene to 10.87 ppbv for acetonitrile.

Table 21-2 shows the results from replicate analyses of collocated VOC samples taken at the Dearborn site in Detroit, Michigan, two sites in Nashville, TN (EATN and LOTN), and Brattleboro, VT (BRVT). The replicate results from collocated samples showed variation for the compounds ranging from 2.45 percent to 28.57 percent. The four highest CVs calculated (1,3-butadiene at 16.23%, acetonitrile at 26.85%, methylene chloride at 28.57%, methyl ethyl ketone at 15.29%, and *n*-octane at 22.59%) had average concentration differences of 0.08, 0.92, 0.11, 0.56, and 0.09 ppbv, showing a low precision and variation for 1,3-butadiene, methylene chloride, and *n*-octane, but medium variation for acetonitrile and methyl ethyl ketone. This variation is likely due to the polar nature of these compounds.

Table 21-3 shows the results from replicate analyses of duplicate VOC samples. The replicate results from duplicate samples vary little for the majority of the compounds, ranging from 1.57 percent to 15.49 percent. The highest CVs (15.49% for 1,3-butadiene and 15.06% for acrylonitrile) had average concentration differences of 0.08 and 0.64 ppbv, showing a low to mid variability between compounds.

Tables 21-4 through 21-7 present results from VOC replicate analyses for all of the duplicate and collocated samples at the NATTS sites that sampled VOC (BAPR and SJPR, G2CO and GJCO, C2IA, and DEMI). Table 21-8 presents the overall CV for each site separately, giving the average CV per compound and per site. The replicate results from duplicate samples vary little for the majority of the compounds and show low to mid-level variability between compounds.

Table 21-9 presents replicate analytical data for all duplicate SNMOC samples. Twenty-six out of 78 SNMOCs showed greater variation than the target 15 percent. The average concentration differences observed for replicate analyses of SNMOC compounds ranged from 0.11 to 1.58 ppbC. The total speciated and total hydrocarbons (speciated and unspeciated) showed the greater average concentration differences, 11.95 and 31.93 ppbC, respectively.

Tables 21-10 and 21-11 present the results from SNMOC replicate analyses for all of the NATTS sites (BAPR, SJPR, and C2IA). Table 21-12 presents the overall CV for each site separately, giving the average CV per compound and per site. The replicate results from duplicate samples vary little for the majority of the compounds and show low to mid-level variability between compounds.

In Table 21-13, the replicate analyses for duplicate and collocated samples show that laboratory carbonyl analysis precision was within the control limits of 15 percent CV, with the exception of isovaleraldehyde and 2,5-dimethylbenzaldehyde at 17.45 and 19.43 percent, respectively. The method was most precise when measuring air concentrations for the program-wide prevalent compounds (i.e., compounds consistently found at levels exceeding their detection limits). The poor precision for isovaleraldehyde was due to poor agreement from replicate samples from the Detroit, MI (DEMI), St. Petersburg, FL (CWFL), and Tampa, FL (GAFL) sites. The slightly high variability for 2,5-dimethylbenzaldehyde resulted from poor agreement from replicate analyses from Detroit, MI (DEMI), Grand Junction, CO (G2CO), Salt Lake City, UT (SLCU), San Juan, PR (SJPR), and Sioux Falls, SD (SFSD). Isovaleraldehyde and 2,5-dimethylbenzaldehyde were detected in less than 12% of all replicate samples analyzed (81 samples for isovaleraldehyde and 47 for 2,5-dimethylbenzaldehyde out of 722 possible analyses). In terms of average concentration difference, the precision of the carbonyl analytical method ranged from 0.003 ppbv for valeraldehyde to 0.02 ppbv for formaldehyde, acetone, isovaleraldehyde, and 2,5-dimethylbenzaldehyde.

Table 21-14 shows the results from replicate analyses of collocated carbonyl samples taken at the Dearborn site in Detroit, Michigan, and two sites in Nashville, TN (EATN and LOTN). The replicate results from collocated samples showed variation for the compounds ranging from 0.22 percent to 21.37 percent. The highest CVs calculated (isovaleraldehyde at 21.37% and 2,5-dimethylbenzaldehyde at 15.53%) had average concentration differences of 0.004 and 0.03 ppbv, showing a low-level variation.

Table 21-15 shows the results from replicate analyses of duplicate carbonyl samples. The replicate results from duplicate samples vary little for the majority of the compounds, ranging from 0.57 percent to 23.33 percent. The highest CV (23.33% for 2,5-dimethylbenzaldehyde) had average concentration differences of 0.01, showing a low-level of variability between compounds.

Tables 21-16 through 21-20 present the CV results from replicate analyses for all of the NATTS sites that sampled for CARBS (BAPR, SJPR, G2CO, GJCO, C2IA, DEMI, CWFL, DNFL, GAFL and LEFL) samples. Table 21-21 presents the overall CV for each site separately, giving the average CV per compound and per site. The replicate results from duplicate and collocated samples vary little and have a 15% overall variability for each site for the year 2002.

Replicate analytical data for semivolatile analyses are presented in Table 21-22. The CV was calculated for the two collocated Michigan sites that sampled for semivolatiles in 2002. All replicate analyses were less than 15.0 percent for all detected compounds. The average concentration differences observed for all replicate analyses were 6.02 total µg or less.

Replicate analytical data for hexavalent chromium (Cr^{6+}) analyses are presented in Table 21-23. The CV was calculated for only one of the four sites that sampled for Cr^{6+} in 2002. This site was at River Rouge in Michigan, with collocated samplers. All replicate analyses CV were less than 14.82 percent. The average concentration differences observed on the replicate analyses were less than 0.015 $\mu g/m^3$.

Overall, replicate analyses for both duplicate and collocated of VOC, SNMOC, carbonyl compounds, semivolatile, and hexavalent chromium samples suggest the precision level is well within the UATMP data quality objectives (USEPA, 2002) and guidelines in the Compendium Methods (USEPA, 1999).

21.1.2 Sampling and Analytical Precision

Sampling and analytical precision quantifies random errors associated not only with analyzing ambient air samples in the laboratory but also with collecting the samples in the field. This form of precision is most easily evaluated by comparing concentrations measured in duplicate samples collected from the same manifold. During the 2002 UATMP, duplicate samples were collected on approximately 10 percent of the scheduled sampling days, and most of these samples were analyzed in replicate. Collocated samples were collected on a schedule designed by the State of Michigan.

To calculate sampling and analytical precision, data analysts first averaged the results from each replicate analyses performed, then compared these average concentrations between the two samples in each duplicate. Also, the CV for two duplicate samples was calculated for each compound and each site - the target recovery being 15%, similar to the replicate analyses. Tables 21-24 through 21-26, 21-31, 21-35 through 21-35 through 21-37, and 21-44 through 21-46 present average concentration differences, RPDs, and CVs as estimates of duplicate and collocated sampling and analytical variability for VOC, SNMOC, carbonyls, semivolatiles, metals, and hexavalent chromium measurements, respectively. The number of observations from Tables 21-1 through 21-26, in comparison to the respective tables listed for duplicate analyses in Tables 21-27 through 21-46, is approximately twice as high.

Table 21-24 presents the sampling and analytical data for VOC and shows that the total duplicate and collocated samples collected during the 2002 UATMP were in agreement (i.e., below 15 percent average CV), with the exception of acetonitrile, acrylonitrile, methylene chloride, methyl ethyl ketone, *n*-octane, tetrachloroethylene, and 1,3,5-trimethylbenzene at 48.38, 24.00, 27.23, 15.84, 19.71, 25.60 and 21.01, respectively. The average concentration difference ranged from 0.02 ppbv for *cis*-1,2-dichloroethylene to 11.61 ppbv for acetonitrile.

The collocated VOC sampling and analytical data are presented in Table 21-25, and the duplicate samples are shown in Table 21-26. The greatest differences in average CV for collocated samples (Table 21-25) were measured for acetylene (16.72%), propylene (19.67%), acetonitrile (74.38%), methylene chloride (28.54%), benzene (16.32%), carbon tetrachloride (15.23%), toluene (16.68%), *n*-octane (27.05%), tetrachloroethylene (15.88%), and 1,3,5-trimethylbenzene (17.19%). Acetylene, propylene, benzene, carbon tetrachloride, and toluene were collected in greater than 99% of the samples, whereas all of the other compounds with CVs over 15% were collected in less than 23% of the samples (exception, methylene chloride at 68%).

The greatest differences in average CV for duplicate samples (Table 21-26) were measured for acetonitrile (22.38%), acrylonitrile (24.00%), methylene chloride (25.92%), methyl ethyl ketone (MEK) (18.30%), 1,1,1-trichloroethane (15.18%), tetrachloroethylene (35.31%), 1,3,5-trimethylbenzene (24.84%), and 1,2,4-trimethylbenzene (15.15%). The samples that are represented as Not Applicable ("NA"), and have a RPD for the corresponding duplicate or collocated sample, are also flagged with an "NA".

Tables 21-27 through 21-29 present the results from VOC duplicate analysis for all of the NATTS sites (BAPR, SJPR, C2IA, and DEMI) that sampled VOC. Table 21-30 presents the overall CV for each site separately, giving the average CV per compound and per site. The duplicate samples vary little for the majority of the compounds and show low to mid-level variability between compounds.

The SNMOC precision for duplicate samples is presented in Table 21-31. Coefficient of variation for duplicate samples ranged from 2.38 % for propane to 44.86 % for *n*-undecane. This variation is due to the low detections - less than 5 times the detection limit. The VOC and SNMOC sampling and analytical precision data do not differ significantly from the analytical precision data as presented in tables above. This similarity suggests that limitations associated with laboratory analysis of the VOC and SNMOC samples during the 2002 UATMP probably outweighed random errors associated with sampling procedures.

Tables 21-32 and 21-33 present the results from SNMOC duplicate analysis for the NATTS sites (BAPR, SJPR, and C2IA) that sampled SNMOC. Table 21-34 presents the overall CV for each site separately, giving the average CV per compound and per site. The duplicate samples vary little for the majority of the compounds and show low to mid-level variability between compounds.

Table 21-35, presenting the sampling and analytical data for carbonyl compounds, shows that the total duplicate and collocated samples collected during the 2002 UATMP varied greatly with 6 compounds below the 15% target criterion and 6 above (acetone (15.79%), benzaldehyde (15.96%), isovaleraldehyde (23.48%), tolualdehydes (16.72%), hexaldehyde (18.88%), and 2,5-dimethylbenzaldehyde (60.94%)). Of the four sites that collected 2,5-dimethylbenzaldehyde, two were out of control at 68.75% (DEMI) and 72.03% (SLCU). Both of these sites collected 2,5-

dimethylbenzaldehyde in less than 14% of the duplicate samples possible. The average concentration difference ranged from 0.01 for crotonaldehyde, benzaldehyde, isovaleraldehyde, valeraldehyde, and tolualdehydes to 0.53 ppbv for formaldehyde.

The collocated carbonyl sampling and analytical data are presented in Table 21-36, and the duplicate samples results are shown in Table 21-37. All carbonyl compounds exceeded the 15% target with the exception of propionaldehyde, crotonaldehyde, and butyr/isobutyraldehyde. The greatest differences in average CV for duplicate samples (Table 21-37) showed a better agreement, with isovaleraldehyde (23.37%), hexaldehyde (16.82%), and 2,3-dimethylbenzaldehyde (53.12%). The samples that are represented as Not Applicable (“NA”), with RPD for the corresponding duplicate or collocated sample, are also flagged with an “NA”.

The duplicate sampling results presented in Table 21-37 show that the results for carbonyl compounds were relatively precise in relation to amount detected. The high variability (RPD above 30 percent) is due to detection at low concentrations. Variability is higher at these low concentrations because measurement of small values is inherently less reproducible. High variability is also shown for the collocated samples presented in Table 21-36, but the variability is not caused by low concentrations in the samples. For most compounds, the CVs for duplicate sampling and analysis (see Table 21-37) were notably higher than the CVs for analytical precision (see Table 21-15) — a trend that differs from the trend observed for VOC or SNMOC. This observation suggests that random errors associated with collecting air samples and random errors associated with analyzing these samples both contributed significantly to overall imprecision in the carbonyl compound sampling and analytical method. As the estimates of sampling and analytical precision show, however, such sources of contamination did not have significant impacts on the carbonyl compound monitoring results.

Tables 21-38 through 21-42 present the results from carbonyl duplicate analysis for the NATTS sites that sampled for CARBS (BAPR, SJPR, G2CO, GJCO, C2IA, DEMI, CWFL, DNFL, GAFL and LEFL). Table 21-43 presents the overall CV for each site separately, giving the average CV per compound and per site. The duplicate samples vary little for the majority of the compounds and show low to mid precision and variability between compounds.

The sampling and analytical variation for collocated semivolatile samples is presented in Table 21-44, and was less than 15 percent for all compounds detected. The greatest differences in average CV for duplicate samples were shown by pyridine (31.82%), 2-methylphenol (18.76%), di-*n*-butyl phthalate (121.51%), bis(2-ethylhexyl) phthalate (33.08%), benzo(a)anthracene (24.33%), and benzo(k)fluoranthene (15.18%). The samples that are represented as Not Applicable ("NA") and have a RPD for the corresponding duplicate or collocated sample are also flagged with an "NA".

Duplicate analytical data for hexavalent chromium (Cr^{6+}) samples are presented in Table 21-45. The CV is 36.34 percent for this collocated site. Similarly to the carbonyl precision data, duplicate sampling and analytical CVs were notably higher than the analytical precision CVs (see Table 21-23). This observation suggests that random errors associated with collecting air samples and random errors associated with analyzing these samples both contributed significantly to overall imprecision in the Cr^{6+} sampling and analytical method. As the estimates of sampling and analytical precision show, however, such sources of contamination did not have significant impacts on the Cr^{6+} monitoring results.

The sampling and analytical variation for duplicate metals samples are presented in Table 21-46. The average CV values, as well as the average RPD values, are relatively low, with the exception of the values for cadmium and mercury. The greatest differences in average CV for duplicate samples are 18.10% and 21.00%, for cadmium and mercury, respectively.

Measurements from collocated samplers have higher variations than the standard duplicate sampling as performed by the National UATMP. Because collocated sampling varies the sampling media as well as the sampler (including sampling probes), higher RPD values should be expected.

21.2 Accuracy

Highly accurate air sampling and analytical methods can measure air concentrations in very close agreement to actual ambient levels. Laboratories typically evaluate their accuracy by analyzing external audit samples and comparing measured concentrations to the known concentrations of the audit samples.

> *Accuracy* indicates the extent to which experimental measurements represent their corresponding “true” or “actual” values.

Air Toxics Pilot Laboratory Intercomparison studies were performed in November 2002. A Quality Assurance Report for all laboratories that participated in this study is available on EPA’s web site: http://www.epa.gov/ttn/amtic/files/ambient/airtox/atpilot.pdf. ERG has also prepared audit standards for different State laboratories.

The accuracy of the 2002 UATMP monitoring data can also be assessed qualitatively by reviewing the accuracy of the monitoring methods and how they were implemented:

- The sampling and analytical methods used in the 2002 UATMP (i.e., Compendium Methods TO-11A and TO-15) have been approved by EPA for accurately measuring ambient levels of VOC and carbonyl compounds, respectively—an approval that is based on many years of research into the development of ambient air monitoring methodologies.

- When collecting and analyzing ambient air samples, all field sampling staff and laboratory analysts strictly followed quality control and quality assurance guidelines detailed in the respective monitoring methods. This strict adherence to the well-documented sampling and analytical methods suggests, though certainly does not prove, that the 2002 UATMP monitoring data accurately represent ambient air quality.

Table 21-1. VOC Sampling and Analytical Precision: 640 Replicate Analyses for all Duplicate and Collocated Samples

Compound	Number of Observations	Average RPD for Replicate Analyses (%)	Average Concentration Difference for Replicate Analyses (ppbv)	Coefficient of Variation (%)
Acetylene	634	12.34	0.79	8.97
Propylene	638	17.51	0.57	8.70
Dichlorodifluoromethane	640	7.63	0.59	5.74
Chloromethane	639	11.93	0.60	7.45
Dichlorotetrafluoroethane	0	NA	NA	NA
Vinyl Chloride	0	NA	NA	NA
1,3-Butadiene	125	18.61	1.11	**21.58**
Bromomethane	4	2.26	0.30	1.57
Chloroethane	0	NA	NA	NA
Acetonitrile	170	21.30	10.87	11.93
Trichlorofluoromethane	639	10.51	0.70	7.60
Acrylonitrile	10	9.87	0.33	10.86
1,1-Dichloroethene	0	NA	NA	NA
Methylene Chloride	419	70.62	0.58	13.59
Trichlorotrifluoroethane	570	14.76	1.14	8.86
trans-1,2-Dichloroethylene	0	NA	NA	NA
1,1 - Dichloroethane	0	NA	NA	NA
Methyl *tert*-Butyl Ether	126	6.15	0.07	7.82
Methyl Ethyl Ketone (MEK)	283	16.55	0.73	12.44
Chloroprene	2	NA	0.14	NA
cis-1,2-Dichloroethylene	4	NA	0.16	NA
Bromochloromethane	0	NA	NA	NA
Chloroform	31	12.32	0.06	10.11
Ethyl *tert*-Butyl Ether	0	NA	NA	NA
1,2-Dichloroethane	0	NA	NA	NA
1,1,1-Trichloroethane	41	16.72	0.04	**15.17**
Benzene	638	14.20	0.45	7.23
Carbon Tetrachloride	519	16.01	1.38	11.37
tert-Amyl Methyl Ether	0	NA	NA	NA
1,2-Dichloropropane	0	NA	NA	NA
Ethyl Acrylate	0	NA	NA	NA
Bromodichloromethane	0	NA	NA	NA
Trichloroethylene	6	11.00	0.08	8.72
Methyl Methacrylate	5	3.16	0.27	2.28
cis-1,3-Dichloropropene	0	NA	NA	NA

Table 21-1. Continued

Compound	**Number of Observations**	**Average RPD for Replicate Analyses (%)**	**Average Concentration Difference for Replicate Analyses (ppbv)**	**Coefficient of Variation (%)**
Methyl Isobutyl Ketone	15	5.95	0.32	4.09
trans-1,3-Dichloropropene	0	NA	NA	NA
1,1,2-Trichloroethane	0	NA	NA	NA
Toluene	632	8.52	0.68	6.47
Dibromochloromethane	0	NA	NA	NA
1,2-Dibromoethane	0	NA	NA	NA
n-Octane	114	23.54	0.11	**15.33**
Tetrachloroethylene	88	14.64	2.24	13.32
Chlorobenzene	4	5.94	0.01	4.08
Ethylbenzene	403	8.12	0.63	6.42
m,p-Xylene	553	7.67	0.76	6.04
Bromoform	0	NA	NA	NA
Styrene	27	10.52	0.10	**15.43**
1,1,2,2-Tetrachloroethane	0	NA	NA	NA
o-Xylene	381	8.77	0.57	6.84
1,3,5-Trimethylbenzene	108	13.31	1.85	9.58
1,2,4-Trimethylbenzene	330	13.96	0.94	8.36
m-Dichlorobenzene	0	NA	NA	NA
Chloromethylbenzene	0	NA	NA	NA
p-Dichlorobenzene	19	11.65	0.13	8.69
o-Dichlorobenzene	0	NA	NA	NA
1,2,4-Trichlorobenzene	0	NA	NA	NA
Hexachloro-1,3-Butadiene	0	NA	NA	NA

NA = Not applicable

NOTE: Coefficients of variation greater than the program target of 15 percent are presented in bold font.

Table 21-2. VOC Sampling and Analytical Precision: Total 184 Replicate Analyses of Collocated Samples

Compound	Number of Observations	Average RPD for Replicate Analyses (%)	Average Concentration Difference for Replicate Analyses (ppbv)	Coefficient of Variation (%)
Acetylene	178	12.28	0.22	8.82
Propylene	184	14.23	0.17	10.29
Dichlorodifluoromethane	184	8.22	0.06	6.05
Chloromethane	184	15.54	0.10	11.96
Dichlorotetrafluoroethane	0	NA	NA	NA
Vinyl Chloride	0	NA	NA	NA
1,3-Butadiene	33	19.48	0.08	**16.23**
Bromomethane	0	NA	NA	NA
Chloroethane	0	NA	NA	NA
Acetonitrile	31	33.52	0.92	**26.85**
Trichlorofluoromethane	184	10.67	0.03	6.84
Acrylonitrile	2	3.53	0.03	2.45
1,1-Dichloroethene	0	NA	NA	NA
Methylene Chloride	105	66.75	0.11	**28.57**
Trichlorotrifluoroethane	180	19.42	0.03	13.62
trans-1,2-Dichloroethylene	0	NA	NA	NA
1,1 - Dichloroethane	0	NA	NA	NA
Methyl *tert*-Butyl Ether	8	0.54	0.01	0.40
Methyl Ethyl Ketone (MEK)	75	18.19	0.56	**15.29**
Chloroprene	0	NA	NA	NA
cis-1,2-Dichloroethylene	3	NA	0.02	NA
Bromochloromethane	0	NA	NA	NA
Chloroform	15	9.75	0.03	6.40
Ethyl *tert*-Butyl Ether	0	NA	NA	NA
1,2-Dichloroethane	0	NA	NA	NA
1,1,1-Trichloroethane	9	NA	0.03	NA
Benzene	184	18.39	0.06	7.34
Carbon Tetrachloride	175	19.96	0.04	14.20
tert-Amyl Methyl Ether	0	NA	NA	NA
1,2-Dichloropropane	0	NA	NA	NA
Ethyl Acrylate	0	NA	NA	NA
Bromodichloromethane	0	NA	NA	NA
Trichloroethylene	0	NA	NA	NA
Methyl Methacrylate	0	NA	NA	NA
cis-1,3-Dichloropropene	0	NA	NA	NA
Methyl Isobutyl Ketone	5	NA	0.25	NA
trans-1,3-Dichloropropene	0	NA	NA	NA
1,1,2-Trichloroethane	0	NA	NA	NA

Table 21-2. Continued

Compound	Number of Observations	Average RPD for Replicate Analyses (%)	Average Concentration Difference for Replicate Analyses (ppbv)	Coefficient of Variation (%)
Toluene	184	7.80	0.11	5.66
Dibromochloromethane	0	NA	NA	NA
1,2-Dibromoethane	0	NA	NA	NA
n-Octane	20	42.66	0.09	**22.59**
Tetrachloroethylene	31	17.13	0.03	13.29
Chlorobenzene	0	NA	NA	NA
Ethylbenzene	109	7.59	0.02	5.25
m,p-Xylene	162	7.42	0.05	5.41
Bromoform	0	NA	NA	NA
Styrene	4	6.11	0.08	4.48
1,1,2,2-Tetrachloroethane	0	NA	NA	NA
o-Xylene	96	8.33	0.03	6.10
1,3,5-Trimethylbenzene	26	20.25	0.04	13.78
1,2,4-Trimethylbenzene	94	18.04	0.05	11.10
m-Dichlorobenzene	0	NA	NA	NA
Chloromethylbenzene	0	NA	NA	NA
p-Dichlorobenzene	0	NA	NA	NA
o-Dichlorobenzene	0	NA	NA	NA
1,2,4-Trichlorobenzene	0	NA	NA	NA
Hexachloro-1,3-Butadiene	0	NA	NA	NA

NA = Not Applicable

NOTE: Coefficients of variation greater than the program target of 15 percent are presented in bold font.

Table 21-3. VOC Sampling and Analytical Precision: Total 456 Replicate Analyses of Duplicate Samples

Compound	Number of Observations	Average RPD for Replicate Analyses (%)	Average Concentration Difference for Replicate Analyses (ppbv)	Coefficient of Variation (%)
Acetylene	456	13.16	0.26	8.78
Propylene	454	21.45	0.13	8.38
Dichlorodifluoromethane	456	7.99	0.05	5.73
Chloromethane	455	9.25	0.07	6.76
Dichlorotetrafluoroethane	0	NA	NA	NA
Vinyl Chloride	0	NA	NA	NA
1,3-Butadiene	92	19.81	0.08	**15.49**
Bromomethane	4	2.26	0.30	1.57
Chloroethane	0	NA	NA	NA
Acetonitrile	139	15.81	16.16	9.98
Trichlorofluoromethane	455	11.60	0.05	7.69
Acrylonitrile	8	16.21	0.64	**15.06**
1,1-Dichloroethene	0	NA	NA	NA
Methylene Chloride	314	72.25	0.24	11.50
Trichlorotrifluoroethane	390	12.32	0.03	8.04
trans-1,2-Dichloroethylene	0	NA	NA	NA
1,1 - Dichloroethane	0	NA	NA	NA
Methyl *tert*-Butyl Ether	118	11.77	0.13	8.54
Methyl Ethyl Ketone (MEK)	208	15.29	0.50	11.94
Chloroprene	2	NA	0.14	NA
cis-1,2-Dichloroethylene	1	NA	0.29	NA
Bromochloromethane	0	NA	NA	NA
Chloroform	16	14.89	0.09	11.80
Ethyl *tert*-Butyl Ether	0	NA	NA	NA
1,2-Dichloroethane	0	NA	NA	NA
1,1,1-Trichloroethane	32	16.72	0.06	13.08
Benzene	454	10.72	0.05	7.47
Carbon Tetrachloride	344	14.74	0.03	11.21
tert-Amyl Methyl Ether	0	NA	NA	NA
1,2-Dichloropropane	0	NA	NA	NA
Ethyl Acrylate	0	NA	NA	NA
Bromodichloromethane	0	NA	NA	NA
Trichloroethylene	6	11.00	0.08	8.72
Methyl Methacrylate	5	3.16	0.27	2.28
cis-1,3-Dichloropropene	0	NA	NA	NA
Methyl Isobutyl Ketone	10	5.95	0.39	4.09

Table 21-3. Continued

Compound	Number of Observations	Average RPD for Replicate Analyses (%)	Average Concentration Difference for Replicate Analyses (ppbv)	Coefficient of Variation (%)
trans-1,3-Dichloropropene	0	NA	NA	NA
1,1,2-Trichloroethane	0	NA	NA	NA
Toluene	448	10.25	0.12	6.64
Dibromochloromethane	0	NA	NA	NA
1,2-Dibromoethane	0	NA	NA	NA
n-Octane	94	18.62	0.13	13.58
Tetrachloroethylene	57	16.52	0.06	12.72
Chlorobenzene	4	5.94	0.01	4.08
Ethylbenzene	294	9.82	0.04	6.76
m,*p*-Xylene	391	9.25	0.07	6.27
Bromoform	0	NA	NA	NA
Styrene	23	14.94	0.13	12.47
1,1,2,2-Tetrachloroethane	0	NA	NA	NA
o-Xylene	285	10.22	0.05	7.30
1,3,5-Trimethylbenzene	82	11.09	0.09	7.48
1,2,4-Trimethylbenzene	236	11.63	0.05	7.68
m-Dichlorobenzene	0	NA	NA	NA
Chloromethylbenzene	0	NA	NA	NA
p-Dichlorobenzene	19	11.65	0.13	8.69
o-Dichlorobenzene	0	NA	NA	NA
1,2,4-Trichlorobenzene	0	NA	NA	NA
Hexachloro-1,3-Butadiene	0	NA	NA	NA

NA = Not Applicable

NOTE: Coefficients of variation greater than the program target of 15 percent are presented in bold font.

Table 21-4. VOC Sampling and Analytical Precision: Total 48 Replicate Analyses of Duplicate Samples in Puerto Rico

Compound	Number of Observations	Average RPD for Replicate Analyses (%)	Average Concentration Difference for Replicate Analyses (ppbv)	Coefficient of Variation (%)
Acetylene	48	8.32	0.13	5.56
Propylene	48	12.50	0.10	8.34
Dichlorodifluoromethane	48	6.35	0.04	4.43
Chloromethane	48	9.12	0.08	6.34
Dichlorotetrafluoroethane	0	NA	NA	NA
Vinyl Chloride	0	NA	NA	NA
1,3-Butadiene	18	15.18	0.04	12.00
Bromomethane	0	NA	NA	NA
Chloroethane	0	NA	NA	NA
Acetonitrile	13	25.72	41.52	**15.34**
Trichlorofluoromethane	48	8.48	0.03	5.55
Acrylonitrile	0	NA	NA	NA
1,1-Dichloroethene	0	NA	NA	NA
Methylene Chloride	41	9.37	0.08	7.41
Trichlorotrifluoroethane	36	14.56	0.04	10.17
trans-1,2-Dichloroethylene	0	NA	NA	NA
1,1 - Dichloroethane	0	NA	NA	NA
Methyl *tert*-Butyl Ether	4	30.96	0.17	**26.49**
Methyl Ethyl Ketone (MEK)	18	10.68	0.50	9.15
Chloroprene	0	NA	NA	NA
cis-1,2-Dichloroethylene	0	NA	NA	NA
Bromochloromethane	0	NA	NA	NA
Chloroform	0	NA	NA	NA
Ethyl *tert*-Butyl Ether	0	NA	NA	NA
1,2-Dichloroethane	0	NA	NA	NA
1,1,1-Trichloroethane	1	NA	0.08	NA
Benzene	48	12.95	0.06	8.19
Carbon Tetrachloride	29	10.15	0.03	7.38
tert-Amyl Methyl Ether	0	NA	NA	NA
1,2-Dichloropropane	0	NA	NA	NA
Ethyl Acrylate	0	NA	NA	NA
Bromodichloromethane	0	NA	NA	NA
Trichloroethylene	0	NA	NA	NA
Methyl Methacrylate	0	NA	NA	NA
cis-1,3-Dichloropropene	0	NA	NA	NA
Methyl Isobutyl Ketone	5	7.36	0.41	5.11
trans-1,3-Dichloropropene	0	NA	NA	NA
1,1,2-Trichloroethane	0	NA	NA	NA

Table 21-4. Continued

Compound	Number of Observations	Average RPD for Replicate Analyses (%)	Average Concentration Difference for Replicate Analyses (ppbv)	Coefficient of Variation (%)
Toluene	48	10.44	0.17	7.02
Dibromochloromethane	0	NA	NA	NA
1,2-Dibromoethane	0	NA	NA	NA
n-Octane	5	8.35	0.11	5.66
Tetrachloroethylene	1	NA	0.10	NA
Chlorobenzene	0	NA	NA	NA
Ethylbenzene	41	11.78	0.08	7.06
m,p-Xylene	48	8.55	0.07	5.89
Bromoform	0	NA	NA	NA
Styrene	5	13.72	0.09	9.80
1,1,2,2-Tetrachloroethane	0	NA	NA	NA
o-Xylene	45	11.43	0.05	8.01
1,3,5-Trimethylbenzene	19	5.30	0.04	4.01
1,2,4-Trimethylbenzene	44	11.27	0.05	7.67
m-Dichlorobenzene	0	NA	NA	NA
Chloromethylbenzene	0	NA	NA	NA
p-Dichlorobenzene	10	12.19	0.13	9.16
o-Dichlorobenzene	0	NA	NA	NA
1,2,4-Trichlorobenzene	0	NA	NA	NA
Hexachloro-1,3-Butadiene	0	NA	NA	NA

NA = Not Applicable.

NOTE: Coefficients of variation greater than the program target of 15 percent are presented in bold font.

Table 21-5. VOC Sampling and Analytical Precision: Total 44 Replicate Analyses of Duplicate Samples in Grand Junction, CO

Compound	**Number of Observations**	**Average RPD for Replicate Analyses (%)**	**Average Concentration Difference for Replicate Analyses (ppbv)**	**Coefficient of Variation (%)**
Acetylene	44	3.78	1.67	2.48
Propylene	44	5.80	0.09	3.77
Dichlorodifluoromethane	44	2.84	0.06	1.88
Chloromethane	44	1.86	0.06	1.21
Dichlorotetrafluoroethane	0	NA	NA	NA
Vinyl Chloride	0	NA	NA	NA
1,3-Butadiene	18	4.12	0.09	2.94
Bromomethane	0	NA	NA	NA
Chloroethane	0	NA	NA	NA
Acetonitrile	14	9.25	2.61	3.39
Trichlorofluoromethane	44	10.79	0.12	6.15
Acrylonitrile	0	NA	NA	NA
1,1-Dichloroethene	0	NA	NA	NA
Methylene Chloride	36	53.10	0.28	**18.75**
Trichlorotrifluoroethane	44	6.06	0.02	4.01
trans-1,2-Dichloroethylene	0	NA	NA	NA
1,1 - Dichloroethane	0	NA	NA	NA
Methyl *tert*-Butyl Ether	8	9.22	0.04	6.49
Methyl Ethyl Ketone (MEK)	35	7.12	0.65	4.87
Chloroprene	0	NA	NA	NA
cis-1,2-Dichloroethylene	0	NA	NA	NA
Bromochloromethane	0	NA	NA	NA
Chloroform	0	NA	NA	NA
Ethyl *tert*-Butyl Ether	0	NA	NA	NA
1,2-Dichloroethane	0	NA	NA	NA
1,1,1-Trichloroethane	3	NA	0.08	NA
Benzene	44	2.62	0.07	1.78
Carbon Tetrachloride	34	6.96	0.03	5.15
tert-Amyl Methyl Ether	0	NA	NA	NA
1,2-Dichloropropane	0	NA	NA	NA
Ethyl Acrylate	0	NA	NA	NA
Bromodichloromethane	0	NA	NA	NA
Trichloroethylene	0	NA	NA	NA
Methyl Methacrylate	4	3.16	0.14	2.28
cis-1,3-Dichloropropene	0	NA	NA	NA
Methyl Isobutyl Ketone	1	NA	0.72	NA
trans-1,3-Dichloropropene	0	NA	NA	NA
1,1,2-Trichloroethane	0	NA	NA	NA

Table 21-5. Continued

Compound	Number of Observations	Average RPD for Replicate Analyses (%)	Average Concentration Difference for Replicate Analyses (ppbv)	Coefficient of Variation (%)
Toluene	44	3.19	0.14	2.20
Dibromochloromethane	0	NA	NA	NA
1,2-Dibromoethane	0	NA	NA	NA
n-Octane	15	16.71	0.23	6.53
Tetrachloroethylene	13	12.99	0.04	9.52
Chlorobenzene	0	NA	NA	NA
Ethylbenzene	38	3.21	0.02	2.21
m,p-Xylene	44	2.86	0.08	1.98
Bromoform	0	NA	NA	NA
Styrene	4	1.48	0.03	1.07
1,1,2,2-Tetrachloroethane	0	NA	NA	NA
o-Xylene	40	4.15	0.04	2.95
1,3,5-Trimethylbenzene	15	2.04	0.07	1.50
1,2,4-Trimethylbenzene	33	3.59	0.06	2.50
m-Dichlorobenzene	0	NA	NA	NA
Chloromethylbenzene	0	NA	NA	NA
p-Dichlorobenzene	0	NA	NA	NA
o-Dichlorobenzene	0	NA	NA	NA
1,2,4-Trichlorobenzene	0	NA	NA	NA
Hexachloro-1,3-Butadiene	0	NA	NA	NA

NA = Not Applicable.

NOTE: Coefficients of variation greater than the program target of 15 percent are presented in bold font.

Table 21-6. VOC Sampling and Analytical Precision: Total 24 Replicate Analyses of Duplicate Samples in Cedar Rapids, IA

Compound	Number of Observations	Average RPD for Replicate Analyses (%)	Average Concentration Difference for Replicate Analyses (ppbv)	Coefficient of Variation (%)
Acetylene	24	29.09	0.12	13.08
Propylene	24	25.33	0.08	14.62
Dichlorodifluoromethane	24	6.47	0.04	4.29
Chloromethane	24	7.24	0.05	5.37
Dichlorotetrafluoroethane	0	NA	NA	NA
Vinyl Chloride	0	NA	NA	NA
1,3-Butadiene	0	NA	NA	NA
Bromomethane	0	NA	NA	NA
Chloroethane	0	NA	NA	NA
Acetonitrile	0	NA	NA	NA
Trichlorofluoromethane	24	9.17	0.03	6.10
Acrylonitrile	0	NA	NA	NA
1,1-Dichloroethene	0	NA	NA	NA
Methylene Chloride	7	5.93	0.05	4.00
Trichlorotrifluoroethane	20	27.97	0.04	13.07
trans-1,2-Dichloroethylene	0	NA	NA	NA
1,1 - Dichloroethane	0	NA	NA	NA
Methyl *tert*-Butyl Ether	0	NA	NA	NA
Methyl Ethyl Ketone (MEK)	14	11.25	0.36	7.68
Chloroprene	0	NA	NA	NA
cis-1,2-Dichloroethylene	1	NA	0.29	NA
Bromochloromethane	0	NA	NA	NA
Chloroform	1	NA	0.11	NA
Ethyl *tert*-Butyl Ether	0	NA	NA	NA
1,2-Dichloroethane	0	NA	NA	NA
1,1,1-Trichloroethane	1	NA	0.08	NA
Benzene	24	16.62	0.04	9.98
Carbon Tetrachloride	16	11.04	0.03	8.08
tert-Amyl Methyl Ether	0	NA	NA	NA
1,2-Dichloropropane	0	NA	NA	NA
Ethyl Acrylate	0	NA	NA	NA
Bromodichloromethane	0	NA	NA	NA
Trichloroethylene	0	NA	NA	NA
Methyl Methacrylate	0	NA	NA	NA
cis-1,3-Dichloropropene	0	NA	NA	NA
Methyl Isobutyl Ketone	0	NA	NA	NA

Table 21-6. Continued

Compound	Number of Observations	Average RPD for Replicate Analyses (%)	Average Concentration Difference for Replicate Analyses (ppbv)	Coefficient of Variation (%)
trans-1,3-Dichloropropene	0	NA	NA	NA
1,1,2-Trichloroethane	0	NA	NA	NA
Toluene	16	44.91	0.08	**20.65**
Dibromochloromethane	0	NA	NA	NA
1,2-Dibromoethane	0	NA	NA	NA
n-Octane	3	NA	0.10	NA
Tetrachloroethylene	0	NA	NA	NA
Chlorobenzene	0	NA	NA	NA
Ethylbenzene	4	NA	0.12	NA
m,p-Xylene	8	3.57	0.12	2.44
Bromoform	0	NA	NA	NA
Styrene	0	NA	NA	NA
1,1,2,2-Tetrachloroethane	0	NA	NA	NA
o-Xylene	0	NA	NA	NA
1,3,5-Trimethylbenzene	0	NA	NA	NA
1,2,4-Trimethylbenzene	0	NA	NA	NA
m-Dichlorobenzene	0	NA	NA	NA
Chloromethylbenzene	0	NA	NA	NA
p-Dichlorobenzene	0	NA	NA	NA
o-Dichlorobenzene	0	NA	NA	NA
1,2,4-Trichlorobenzene	0	NA	NA	NA
Hexachloro-1,3-Butadiene	0	NA	NA	NA

NA = Not Applicable.

NOTE: Coefficients of variation greater than the program target of 15 percent are presented in bold font.

Table 21-7. VOC Sampling and Analytical Precision:
Total 104 Replicate Analyses of Collocated Samples in Detroit, Michigan

Compound	Number of Observations	Average RPD for Replicate Analyses (%)	Average Concentration Difference for Replicate Analyses (ppbv)	Coefficient of Variation (%)
Acetylene	104	7.97	0.13	5.74
Propylene	104	8.35	0.07	5.80
Dichlorodifluoromethane	104	7.12	0.05	4.91
Chloromethane	104	7.93	0.05	5.54
Dichlorotetrafluoroethane	0	NA	NA	NA
Vinyl Chloride	0	NA	NA	NA
1,3-Butadiene	25	21.18	0.09	**17.19**
Bromomethane	0	NA	NA	NA
Chloroethane	0	NA	NA	NA
Acetonitrile	26	20.52	1.91	10.84
Trichlorofluoromethane	104	8.56	0.03	5.92
Acrylonitrile	2	3.53	0.03	2.45
1,1-Dichloroethene	0	NA	NA	NA
Methylene Chloride	95	15.12	0.09	10.37
Trichlorotrifluoroethane	103	12.38	0.02	8.80
trans-1,2-Dichloroethylene	0	NA	NA	NA
1,1 - Dichloroethane	0	NA	NA	NA
Methyl *tert*-Butyl Ether	0	NA	NA	NA
Methyl Ethyl Ketone (MEK)	41	13.05	0.35	10.48
Chloroprene	0	NA	NA	NA
cis-1,2-Dichloroethylene	0	NA	NA	NA
Bromochloromethane	0	NA	NA	NA
Chloroform	9	19.21	0.04	12.61
Ethyl *tert*-Butyl Ether	0	NA	NA	NA
1,2-Dichloroethane	0	NA	NA	NA
1,1,1-Trichloroethane	7	NA	0.05	NA
Benzene	104	6.07	0.04	4.34
Carbon Tetrachloride	102	13.53	0.02	9.36
tert-Amyl Methyl Ether	0	NA	NA	NA
1,2-Dichloropropane	0	NA	NA	NA
Ethyl Acrylate	0	NA	NA	NA
Bromodichloromethane	0	NA	NA	NA
Trichloroethylene	0	NA	NA	NA
Methyl Methacrylate	0	NA	NA	NA
cis-1,3-Dichloropropene	0	NA	NA	NA
Methyl Isobutyl Ketone	1	NA	0.22	NA
trans-1,3-Dichloropropene	0	NA	NA	NA
1,1,2-Trichloroethane	0	NA	NA	NA

Table 21-7. Continued

Compound	Number of Observations	Average RPD for Replicate Analyses (%)	Average Concentration Difference for Replicate Analyses (ppbv)	Coefficient of Variation (%)
Toluene	104	6.94	0.09	5.04
Dibromochloromethane	0	NA	NA	NA
1,2-Dibromoethane	0	NA	NA	NA
n-Octane	13	8.39	0.11	5.90
Tetrachloroethylene	31	17.13	0.03	13.29
Chlorobenzene	0	NA	NA	NA
Ethylbenzene	74	7.13	0.02	5.53
m,p-Xylene	92	7.73	0.04	5.75
Bromoform	0	NA	NA	NA
Styrene	0	NA	NA	NA
1,1,2,2-Tetrachloroethane	0	NA	NA	NA
o-Xylene	63	7.51	0.03	6.02
1,3,5-Trimethylbenzene	20	16.69	0.03	12.19
1,2,4-Trimethylbenzene	68	10.18	0.03	7.87
m-Dichlorobenzene	0	NA	NA	NA
Chloromethylbenzene	0	NA	NA	NA
p-Dichlorobenzene	0	NA	NA	NA
o-Dichlorobenzene	0	NA	NA	NA
1,2,4-Trichlorobenzene	0	NA	NA	NA
Hexachloro-1,3-Butadiene	0	NA	NA	NA

NA = Not Applicable.

NOTE: Coefficients of variation greater than the program target of 15 percent are presented in bold font.

Table 21-8. VOC Sampling and Analytical Precision:
Coefficients of Variation for each Compound for all Replicate Analyses, all sites

Compound	Average	Arlington, TX (ANTX)	Barceloneta, PR (BAPR)	Beulah, ND (BUND)	Brattleboro, VT (BRVT)	Camden, NJ (CANJ)	Cedar Rapids, IA (C2IA)	Chester, NJ (CHNJ)	Custer, SD (CUSD)	Davenport, IA (DAIA)	Denver, CO (DECO)	Denver, CO (SWCO)
Acetylene	8.97	12.77	6.62	6.21	9.39	8.87	13.08	9.47	12.80	**24.50**	4.18	11.36
Propylene	8.70	13.69	6.32	**15.78**	10.67	3.75	14.62	9.18	10.40	9.64	6.06	3.85
Dichlorodifluoromethane	5.74	**15.53**	3.23	6.61	8.37	4.66	4.29	6.35	9.32	7.28	4.29	4.86
Chloromethane	7.45	13.67	5.60	**15.04**	10.40	5.22	5.37	6.34	8.81	4.31	7.80	6.22
Dichlorotetrafluoroethane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Vinyl Chloride	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,3-Butadiene	**21.58**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Bromomethane	1.57	NA	NA	NA	NA	1.57	NA	NA	NA	NA	NA	NA
Chloroethane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Acetonitrile	11.93	NA	**16.55**	NA	NA	NA	NA	11.17	NA	NA	NA	9.91
Trichlorofluoromethane	7.60	**26.42**	4.52	8.36	11.56	6.28	6.10	10.86	7.37	6.73	4.84	6.86
Acrylonitrile	10.86	NA	NA	NA	NA	NA	NA	NA	NA	NA	2.44	NA
1,1-Dichloroethene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Methylene Chloride	13.59	**15.87**	6.76	**18.89**	NA	8.35	4.00	9.86	NA	NA	12.37	**19.08**
Trichlorotrifluoroethane	8.86	NA	8.12	12.55	9.96	4.89	13.07	**15.02**	NA	7.53	7.15	**17.14**
trans - 1,2 - Dichloroethylene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,1 - Dichloroethane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Methyl *tert*-Butyl Ether	7.82	**26.44**	NA	NA	0.40	6.84	NA	2.73	NA	NA	NA	NA
Methyl Ethyl Ketone	12.44	10.71	**16.21**	NA	4.28	12.42	7.68	12.68	3.04	NA	**16.51**	6.20
Chloroprene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
cis-1,2-Dichloroethylene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table 21-8. Continued

Compound	**Average**	**Arlington, TX (ANTX)**	**Barceloneta, PR (BAPR)**	**Beulah, ND (BUND)**	**Brattleboro, VT (BRVT)**	**Camden, NJ (CANJ)**	**Cedar Rapids, IA (C2IA)**	**Chester, NJ (CHNJ)**	**Custer, SD (CUSD)**	**Davenport, IA (DAIA)**	**Denver, CO (DECO)**	**Denver, CO (SWCO)**
Bromochloromethane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chloroform	10.11	NA	NA	NA	0.20	NA	NA	NA	NA	NA	9.43	3.37
Ethyl *tert*-Butyl Ether	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2 - Dichloroethane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,1,1 - Trichloroethane	**15.17**	NA	NA	NA	NA	NA	NA	NA	NA	NA	6.80	NA
Benzene	7.23	**15.55**	10.08	**15.53**	12.61	4.06	9.98	7.18	8.67	5.69	3.88	11.26
Carbon Tetrachloride	11.37	6.73	3.84	**19.58**	11.28	8.96	8.08	8.74	**15.71**	7.07	12.56	4.16
tert-Amyl Methyl Ether	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2 - Dichloropropane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ethyl Acrylate	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Bromodichloromethane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Trichloroethylene	8.72	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Methyl Methacrylate	2.28	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
cis -1,3 - Dichloropropene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Methyl Isobutyl Ketone	4.09	NA	NA	NA	NA	NA	NA	NA	NA	NA	3.07	NA
trans - 1,3 - Dichloropropene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,1,2 - Trichloroethane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Toluene	6.47	**16.25**	7.69	**16.26**	7.41	2.87	**20.65**	4.74	3.96	5.54	4.41	12.31
Dibromochloromethane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2-Dibromoethane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
n-Octane	**15.33**	NA	NA	NA	NA	**28.51**	NA	12.12	NA	NA	**20.65**	NA

Table 21-8. Continued

Compound	Average	Arlington, TX (ANTX)	Barceloneta, PR (BAPR)	Beulah, ND (BUND)	Brattleboro, VT (BRVT)	Camden, NJ (CANJ)	Cedar Rapids, IA (C2IA)	Chester, NJ (CHNJ)	Custer, SD (CUSD)	Davenport, IA (DAIA)	Denver, CO (DECO)	Denver, CO (SWCO)
Tetrachloroethylene	13.32	NA	NA	NA	NA	NA	NA	NA	**29.91**	NA	**20.72**	NA
Chlorobenzene	4.08	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ethylbenzene	6.42	NA	9.19	NA	2.43	5.38	NA	9.90	6.15	NA	8.13	9.26
m,p - Xylene	6.04	**19.80**	5.93	6.43	4.87	3.80	2.44	5.91	13.82	NA	2.83	12.12
Bromoform	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Styrene	**15.43**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,1,2,2 - Tetrachloroethane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
o - Xylene	6.84	NA	6.89	4.88	2.55	6.34	NA	5.74	NA	NA	6.98	12.29
1,3,5-Trimethylbenzene	9.58	NA	NA	NA	NA	NA	NA	NA	NA	NA	8.46	NA
1,2,4-Trimethylbenzene	8.36	5.24	11.46	NA	2.55	5.44	NA	NA	NA	NA	5.67	**15.91**
m - Dichlorobenzene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chloromethylbenzene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
p - Dichlorobenzene	8.69	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
o - Dichlorobenzene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,4-Trichlorobenzene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Hexachloro-1,3-Butadiene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Average	9.25	**15.28**	8.06	12.18	6.81	7.12	9.11	8.71	10.83	8.70	8.15	9.77

Table 21-8. Continued

Compound	**Average**	**Denver, CO (WECO)**	**Detroit, MI (Allen Park) (APMI)**	**Detroit, MI (Dearborn) (DEMI)**	**Elizabeth, NJ (ELNJ)**	**Grand Junction, CO (G2CO)**	**Grand Junction, CO (GJCO)**	**Gulf Port, MS (GPMS)**	**Jackson, MS (JAMS)**	**Lincoln, NE (LINE)**	**Lincoln, NE (LONE)**	**Nashville, TN (EATN)**
Acetylene	8.97	8.45	7.61	3.87	8.32	2.01	2.95	7.95	8.96	4.13	**24.50**	7.42
Propylene	8.70	9.31	8.50	3.10	13.38	1.22	6.32	5.45	8.15	3.26	9.64	**15.90**
Dichlorodifluoromethane	5.74	9.73	6.03	3.79	4.88	1.10	2.66	3.86	6.58	2.41	7.28	6.05
Chloromethane	7.45	10.24	7.12	3.96	5.60	1.37	1.05	4.83	6.81	5.56	4.31	12.17
Dichlorotetrafluoroethane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Vinyl Chloride	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,3-Butadiene	**21.58**	NA	NA	12.86	NA	NA	NA	NA	NA	NA	NA	**30.30**
Bromomethane	1.57	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chloroethane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Acetonitrile	11.93	8.69	NA	10.84	NA	0.30	6.47	7.56	11.28	13.50	NA	NA
Trichlorofluoromethane	7.60	9.04	7.14	4.70	6.21	1.67	10.63	2.35	14.34	5.64	6.73	5.78
Acrylonitrile	10.86	NA	2.45	NA	NA	NA	NA	NA	NA	**27.68**	NA	NA
1,1-Dichloroethene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Methylene Chloride	13.59	12.21	**17.39**	3.35	11.13	3.42	**34.08**	**19.15**	**15.89**	NA	NA	**64.98**
Trichlorotrifluoroethane	8.86	14.72	8.78	8.82	6.48	1.79	6.24	1.86	9.52	3.54	7.53	**15.85**
trans - 1,2 - Dichloroethylene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,1 - Dichloroethane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Methyl *tert*-Butyl Ether	7.82	3.48	NA	NA	4.62	NA	6.49	4.98	4.58	NA	NA	NA
Methyl Ethyl Ketone	12.44	**39.22**	**16.17**	4.78	11.92	4.68	5.06	**15.79**	14.08	**23.08**	NA	**33.82**
Chloroprene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
cis-1,2-Dichloroethylene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Bromochloromethane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table 21-8. Continued

Compound	**Average**	**Denver, CO (WECO)**	**Detroit, MI (Allen Park) (APMI)**	**Detroit, MI (Dearborn) (DEMI)**	**Elizabeth, NJ (ELNJ)**	**Grand Junction, CO (G2CO)**	**Grand Junction, CO (GJCO)**	**Gulf Port, MS (GPMS)**	**Jackson, MS (JAMS)**	**Lincoln, NE (LINE)**	**Lincoln, NE (LONE)**	**Nashville, TN (EATN)**
Chloroform	10.11	NA	12.61	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ethyl *tert*-Butyl Ether	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2 - Dichloroethane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,1,1 - Trichloroethane	**15.17**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzene	7.23	**23.68**	5.79	2.88	5.81	0.85	2.71	3.17	2.93	2.99	5.69	10.01
Carbon Tetrachloride	11.37	**34.16**	9.47	9.26	8.32	2.90	7.41	12.05	14.88	7.94	7.07	**17.42**
tert-Amyl Methyl Ether	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2 - Dichloropropane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ethyl Acrylate	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Bromodichloromethane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Trichloroethylene	8.72	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Methyl Methacrylate	2.28	NA	NA	NA	NA	2.28	NA	NA	NA	NA	NA	NA
cis -1,3 - Dichloropropene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Methyl Isobutyl Ketone	4.09	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
trans - 1,3 - Dichloropropene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,1,2 - Trichloroethane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Toluene	6.47	7.14	5.70	4.38	6.14	1.10	3.29	2.14	4.51	1.84	5.54	5.22
Dibromochloromethane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table 21-8. Continued

Compound	Average	Denver, CO (WECO)	Detroit, MI (Allen Park) (APMI)	Detroit, MI (Dearborn) (DEMI)	Elizabeth, NJ (ELNJ)	Grand Junction, CO (G2CO)	Grand Junction, CO (GJCO)	Gulf Port, MS (GPMS)	Jackson, MS (JAMS)	Lincoln, NE (LINE)	Lincoln, NE (LONE)	Nashville, TN (EATN)
1,2-Dibromoethane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
n-Octane	**15.33**	12.12	5.90	NA	**20.19**	6.53	NA	6.73	NA	NA	NA	**39.28**
Tetrachloroethylene	13.32	**18.76**	**18.90**	7.69	2.62	1.35	**17.68**	NA	**18.45**	5.92	NA	NA
Chlorobenzene	4.08	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ethylbenzene	6.42	6.57	5.71	5.35	6.69	1.12	3.31	5.21	6.34	2.63	NA	11.04
m,p - Xylene	6.04	8.22	5.95	5.54	7.72	1.00	2.96	1.70	4.43	2.81	NA	5.88
Bromoform	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Styrene	**15.43**	NA	NA	NA	NA	1.07	NA	NA	NA	NA	NA	4.48
1,1,2,2 - Tetrachloroethane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
o - Xylene	6.84	8.53	6.68	5.36	8.56	1.08	4.82	7.73	12.52	2.76	NA	11.05
1,3,5-Trimethylbenzene	9.58	**17.56**	13.51	10.88	NA	1.50	NA	NA	NA	4.26	NA	**16.94**
1,2,4-Trimethylbenzene	8.36	7.37	8.09	7.65	7.19	1.53	3.48	13.96	10.27	5.21	NA	8.80
m - Dichlorobenzene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chloromethylbenzene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
p - Dichlorobenzene	8.69	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
o - Dichlorobenzene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,4-Trichlorobenzene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Hexachloro-1,3-Butadiene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Average	9.25	13.46	8.98	6.27	8.10	1.90	7.09	7.03	9.70	6.95	8.70	**16.97**

Table 21-8. Continued

Compound	Average	Nashville, TN (LOTN)	New Brunswick, NJ (NBNJ)	Pascagoula, MS (PGMS)	St. Louis, MO (SLMO)	St. Louis, MO (S2MO)	St. Louis, MO (S3MO)	Salt Lake City, UT (SLCU)	San Juan, PR (SJPR)	Sioux Falls, SD (SFSD)	Tupelo, MS (TUMS)
Acetylene	8.97	**15.81**	6.32	**15.98**	5.64	3.46	11.24	4.48	4.51	4.77	9.41
Propylene	8.70	13.30	7.06	5.41	6.81	3.28	**22.96**	4.34	10.37	11.09	5.56
Dichlorodifluoromethane	5.74	5.98	3.66	14.01	2.14	2.18	2.59	7.19	5.63	6.31	4.74
Chloromethane	7.45	**26.14**	4.02	**17.69**	4.62	4.96	4.17	4.62	7.08	8.29	5.13
Dichlorotetrafluoroethane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Vinyl Chloride	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,3-Butadiene	**21.58**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Bromomethane	1.57	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chloroethane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Acetonitrile	11.93	**42.86**	9.22	**16.81**	NA	NA	NA	7.57	14.13	3.62	12.39
Trichlorofluoromethane	7.60	5.05	4.74	**17.99**	6.59	2.68	2.31	11.44	6.58	5.17	6.43
Acrylonitrile	10.86	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,1-Dichloroethene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Methylene Chloride	13.59	NA	3.66	1.24	3.46	6.28	**34.04**	13.70	8.06	2.62	3.59
Trichlorotrifluoroethane	8.86	**24.69**	5.46	2.08	9.75	8.59	2.33	6.70	12.22	8.68	4.67
trans - 1,2 - Dichloroethylene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,1 - Dichloroethane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Methyl *tert*-Butyl Ether	7.82	NA	6.59	NA	8.94	3.86	NA	NA	**26.49**	NA	3.10
Methyl Ethyl Ketone	12.44	**17.38**	5.53	9.12	0.35	**15.73**	NA	**17.70**	2.08	12.16	9.88
Chloroprene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
cis-1,2-Dichloroethylene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table 21-8. Continued

Compound	**Average**	**Nashville, TN (LOTN)**	**New Brunswick, NJ (NBNJ)**	**Pascagoula, MS (PGMS)**	**St. Louis, MO (SLMO)**	**St. Louis, MO (S2MO)**	**St. Louis, MO (S3MO)**	**Salt Lake City, UT (SLCU)**	**San Juan, PR (SJPR)**	**Sioux Falls, SD (SFSD)**	**Tupelo, MS (TUMS)**
Bromochloromethane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chloroform	10.11	NA	NA	NA	NA	NA	NA	NA	NA	NA	**24.96**
Ethyl *tert*-Butyl Ether	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2 - Dichloroethane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,1,1 - Trichloroethane	**15.17**	NA	NA	NA	NA	NA	10.44	**28.28**	NA	NA	NA
Benzene	7.23	5.41	5.38	6.24	4.53	5.04	9.37	4.35	6.29	8.41	5.41
Carbon Tetrachloride	11.37	**23.57**	14.59	**20.76**	8.10	7.34	6.87	**17.11**	10.92	5.70	11.18
tert-Amyl Methyl Ether	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2 - Dichloropropane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ethyl Acrylate	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Bromodichloromethane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Trichloroethylene	8.72	NA	NA	NA	NA	8.72	NA	NA	NA	NA	NA
Methyl Methacrylate	2.28	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
cis -1,3 - Dichloropropene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Methyl Isobutyl Ketone	4.09	NA	NA	NA	NA	NA	NA	NA	5.11	NA	NA
trans - 1,3 - Dichloropropene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,1,2 - Trichloroethane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Toluene	6.47	5.60	4.78	6.18	4.92	5.81	4.44	5.61	6.35	8.32	6.06
Dibromochloromethane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2-Dibromoethane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
n-Octane	**15.33**	NA	5.66	NA	NA	NA	NA	**20.66**	5.66	NA	NA

Table 21-8. Continued

Compound	Average	Nashville, TN (LOTN)	New Brunswick, NJ (NBNJ)	Pascagoula, MS (PGMS)	St. Louis, MO (SLMO)	St. Louis, MO (S2MO)	St. Louis, MO (S3MO)	Salt Lake City, UT (SLCU)	San Juan, PR (SJPR)	Sioux Falls, SD (SFSD)	Tupelo, MS (TUMS)
Tetrachloroethylene	13.32	NA	NA	NA	4.51	NA	NA	NA	NA	NA	NA
Chlorobenzene	4.08	NA	NA	NA	NA	4.08	NA	NA	NA	NA	NA
Ethylbenzene	6.42	1.72	6.24	11.76	5.08	6.51	2.62	7.73	4.93	14.28	7.97
m,p - Xylene	6.04	4.79	4.26	8.17	3.61	7.42	3.61	4.52	5.85	5.87	8.85
Bromoform	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Styrene	**15.43**	NA	NA	**35.23**	NA	NA	NA	NA	9.80	**26.58**	NA
1,1,2,2 - Tetrachloroethane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
o - Xylene	6.84	4.88	2.79	8.59	9.09	NA	4.88	8.15	9.13	NA	8.70
1,3,5-Trimethylbenzene	9.58	NA	NA	NA	NA	NA	NA	9.06	4.01	NA	NA
1,2,4-Trimethylbenzene	8.36	**28.39**	NA	2.02	11.81	NA	4.64	7.34	3.88	NA	14.31
m - Dichlorobenzene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chloromethylbenzene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
p - Dichlorobenzene	8.69	NA	NA	NA	**16.44**	1.72	NA	7.44	9.16	NA	NA
o - Dichlorobenzene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,4-Trichlorobenzene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Hexachloro-1,3-Butadiene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Average	9.25	**15.04**	5.88	11.72	6.47	5.74	8.43	9.90	8.10	8.79	8.46

NA = Not applicable

NOTE: Coefficients of variation greater than the program target of 15 percent are presented in bold font.

Table 21-9. SNMOC Sampling and Analytical Precision: 184 Replicate Analyses for all Duplicate Samples

Compound	**Number of Observations**	**Average RPD for Replicate Analyses (%)**	**Average Concentration Difference for Replicate Analyses (ppbv)**	**Coefficient of Variation (%)**
Ethylene	184	11.93	0.34	7.04
Acetylene	184	11.56	0.25	7.43
Ethane	184	8.00	0.39	5.08
Propylene	184	23.28	0.26	11.97
Propane	184	9.13	0.98	6.01
Propyne	0	NA	NA	NA
Isobutane	184	12.60	0.27	7.10
Isobutene/1-Butene	184	18.30	0.26	10.44
1,3-Butadiene	65	11.61	0.11	7.85
n-Butane	184	9.86	0.42	5.81
trans-2-Butene	171	28.09	0.20	12.51
cis-2-Butene	172	26.53	0.24	13.11
3-Methyl-1-butene	13	4.04	0.25	2.74
Isopentane	170	18.32	1.34	8.
1-Pentene	148	29.46	0.23	**15.09**
2-Methyl-1-butene	105	17.35	0.16	10.45
n-Pentane	184	10.19	0.27	5.73
Isoprene	181	35.73	0.22	11.84
trans-2-Pentene	180	45.20	0.18	**16.96**
cis-2-Pentene	177	40.79	0.20	**16.22**
2-Methyl-2-butene	117	12.01	0.13	7.92
2,2-Dimethylbutane	177	50.90	0.27	**16.70**
Cyclopentene	35	11.43	0.24	8.59
4-Methyl-1-pentene	1	NA	0.38	NA
Cyclopentane	181	37.23	0.19	**17.76**
2,3-Dimethylbutane	183	45.44	0.35	**16.61**
2-Methylpentane	184	20.98	0.40	11.56
3-Methylpentane	184	31.88	0.38	14.34
2-Methyl-1-pentene	26	22.24	0.42	13.59
1-Hexene	181	56.24	0.32	**20.91**
2-Ethyl-1-butene	0	NA	NA	NA
n-Hexane	184	33.41	0.33	14.05
trans-2-Hexene	9	11.86	0.42	9.31
cis-2-Hexene	6	7.97	0.85	5.90
Methylcyclopentane	183	26.41	0.20	12.57

Table 21-9. Continued

Compound	Number of Observations	Average RPD for Replicate Analyses (%)	Average Concentration Difference for Replicate Analyses (ppbv)	Coefficient of Variation (%)
2,4-Dimethylpentane	180	53.53	0.26	**17.27**
Benzene	184	12.35	0.24	7.20
Cyclohexane	182	39.16	0.33	**16.74**
2-Methylhexane	172	49.88	0.42	**16.93**
2,3-Dimethylpentane	179	36.87	0.45	**16.42**
3-Methylhexane	182	33.19	0.40	14.92
1-Heptene	46	22.72	0.32	**15.08**
2,2,4-Trimethylpentane	184	28.44	0.26	13.02
n-Heptane	176	20.76	0.15	10.87
Methylcyclohexane	181	47.16	0.25	**17.51**
2,2,3-Trimethylpentane	66	16.14	0.20	11.79
2,3,4-Trimethylpentane	178	31.78	0.19	**15.27**
Toluene	176	12.41	0.64	7.30
2-Methylheptane	165	41.53	0.25	**19.73**
3-Methylheptane	179	29.98	0.17	14.37
1-Octene	33	13.45	0.18	10.57
n-Octane	183	30.34	0.17	13.45
Ethylbenzene	173	23.57	0.25	**16.54**
m-Xylene/p-Xylene	175	21.82	0.54	13.31
Styrene	144	96.47	0.40	**34.38**
o-Xylene	173	34.01	0.33	**17.44**
1-Nonene	20	11.19	0.75	7.69
n-Nonane	179	26.20	0.15	12.77
Isopropylbenzene	116	24.20	0.40	**16.39**
a-Pinene	63	26.44	1.05	**19.93**
n-Propylbenzene	109	39.24	0.30	**18.80**
m-Ethyltoluene	173	21.07	0.17	11.30
p-Ethyltoluene	119	14.63	0.33	10.73
1,3,5-Trimethylbenzene	144	43.63	0.20	**20.94**
o-Ethyltoluene	97	17.29	0.37	12.08
b-Pinene	40	17.76	0.99	14.59
1,2,4-Trimethylbenzene	174	28.35	0.26	**15.00**
1-Decene	0	NA	NA	NA
n-Decane	175	40.42	0.56	**18.59**

Table 21-9. Continued

Compound	Number of Observations	Average RPD for Replicate Analyses (%)	Average Concentration Difference for Replicate Analyses (ppbv)	Coefficient of Variation (%)
1,2,3-Trimethylbenzene	144	53.17	0.26	**24.40**
m-Diethylbenzene	61	28.19	0.58	**20.20**
p-Diethylbenzene	87	27.46	0.24	**19.87**
1-Undecene	16	6.60	0.22	4.57
n-Undecane	179	15.91	0.62	9.71
1-Dodecene	6	16.56	0.84	12.21
n-Dodecane	118	14.97	0.93	11.08
1-Tridecene	3	NA	1.37	NA
n-Tridecane	29	12.83	1.58	9.20
TNMOC (speciated)	176	16.63	11.95	8.52
TNMOC (w/ unknowns)	176	16.81	31.93	9.90

NA = Not applicable
NOTE: Coefficients of variation greater than the program target of 15 percent are presented in bold font.

Table 21-10. SNMOC Sampling and Analytical Precision: 40 Replicate Analyses for all Duplicate Samples in Puerto Rico

Compound	Number of Observations	Average RPD for Replicate Analyses (%)	Average Concentration Difference for Replicate Analyses (ppbv)	Coefficient of Variation (%)
Ethylene	40	8.06	0.38	5.28
Acetylene	40	6.83	0.24	5.23
Ethane	40	8.91	0.28	5.75
Propylene	40	13.32	0.27	7.59
Propane	40	6.70	1.63	4.70
Propyne	0	NA	NA	NA
Isobutane	40	7.43	0.35	4.96
Isobutene/1-Butene	40	11.57	0.25	7.29
1,3-Butadiene	27	17.19	0.14	11.27
n-Butane	40	7.89	0.55	5.37
trans-2-Butene	40	17.80	0.18	9.89
cis-2-Butene	40	18.68	0.21	10.15
3-Methyl-1-butene	3	NA	0.32	NA
Isopentane	36	6.22	0.66	4.50
1-Pentene	40	23.80	0.17	14.00
2-Methyl-1-butene	30	15.21	0.25	9.89
n-Pentane	40	5.56	0.21	3.75
Isoprene	40	6.66	0.24	4.81
trans-2-Pentene	40	18.44	0.22	9.28
cis-2-Pentene	40	21.54	0.19	11.62
2-Methyl-2-butene	35	8.69	0.11	6.16
2,2-Dimethylbutane	40	15.52	0.29	8.95
Cyclopentene	10	6.81	0.27	5.07
4-Methyl-1-pentene	0	NA	NA	NA
Cyclopentane	40	23.81	0.21	13.32
2,3-Dimethylbutane	40	23.24	0.39	11.98
2-Methylpentane	40	12.78	0.54	8.04
3-Methylpentane	40	13.90	0.36	8.57
2-Methyl-1-pentene	13	7.79	0.17	5.58
1-Hexene	40	39.32	0.29	**16.60**
2-Ethyl-1-butene	0	NA	NA	NA
n-Hexane	40	8.10	0.25	5.35
trans-2-Hexene	4	3.61	0.50	2.51
cis-2-Hexene	5	7.97	0.71	5.90

Table 21-10. Continued

Compound	Number of Observations	Average RPD for Replicate Analyses (%)	Average Concentration Difference for Replicate Analyses (ppbv)	Coefficient of Variation (%)
Methylcyclopentane	40	12.63	0.20	7.81
2,4-Dimethylpentane	40	28.82	0.25	14.33
Benzene	40	16.36	0.38	8.72
Cyclohexane	40	11.82	0.27	7.05
2-Methylhexane	40	22.96	0.58	13.61
2,3-Dimethylpentane	40	30.84	0.49	**16.21**
3-Methylhexane	40	15.37	0.29	9.91
1-Heptene	26	32.84	0.20	**21.39**
2,2,4-Trimethylpentane	40	13.07	0.26	9.23
n-Heptane	40	9.10	0.15	6.10
Methylcyclohexane	40	30.16	0.37	14.92
2,2,3-Trimethylpentane	22	17.88	0.14	11.28
2,3,4-Trimethylpentane	40	24.20	0.20	14.25
Toluene	40	7.38	0.89	5.87
2-Methylheptane	40	18.54	0.15	11.20
3-Methylheptane	40	18.96	0.18	11.81
1-Octene	9	8.30	0.16	6.06
n-Octane	40	11.67	0.18	7.37
Ethylbenzene	40	8.66	0.19	6.57
m-Xylene/p-Xylene	40	9.34	0.70	7.30
Styrene	40	49.16	0.38	**25.66**
o-Xylene	40	9.23	0.22	6.77
1-Nonene	2	23.52	0.11	14.88
n-Nonane	40	9.10	0.09	6.55
Isopropylbenzene	39	21.74	0.23	**15.40**
a-Pinene	16	39.12	0.40	**16.74**
n-Propylbenzene	40	9.75	0.07	7.08
m-Ethyltoluene	40	10.47	0.16	7.78
p-Ethyltoluene	40	10.05	0.10	7.04
1,3,5-Trimethylbenzene	40	13.78	0.14	10.33
o-Ethyltoluene	23	17.10	0.40	11.14
b-Pinene	14	14.90	0.89	12.84
1,2,4-Trimethylbenzene	40	8.36	0.21	6.10
1-Decene	0	NA	NA	NA
n-Decane	40	44.83	0.51	**17.28**
1,2,3-Trimethylbenzene	39	34.55	0.25	**20.16**

Table 21-10. Continued

Compound	Number of Observations	Average RPD for Replicate Analyses (%)	Average Concentration Difference for Replicate Analyses (ppbv)	Coefficient of Variation (%)
m-Diethylbenzene	7	NA	1.10	NA
p-Diethylbenzene	10	33.19	0.36	**28.17**
1-Undecene	0	NA	NA	NA
n-Undecane	40	13.70	0.23	7.32
1-Dodecene	5	16.56	0.58	12.21
n-Dodecane	38	11.48	0.44	8.37
1-Tridecene	2	NA	1.11	NA
n-Tridecane	22	12.15	1.80	9.14
TNMOC (speciated)	40	5.63	10.10	3.96
TNMOC (w/ unknowns)	40	26.77	83.76	**16.25**

NA = Not applicable

NOTE: Coefficients of variation greater than the program target of 15 percent are presented in bold font.

Table 21-11. SNMOC Sampling and Analytical Precision: 28 Replicate Analyses for all Duplicate Samples in Cedar Rapids, IA

Compound	Number of Observations	Average RPD for Replicate Analyses (%)	Average Concentration Difference for Replicate Analyses (ppbv)	Coefficient of Variation (%)
Ethylene	28	24.57	0.40	2.32
Acetylene	28	18.12	0.21	1.26
Ethane	28	14.12	0.61	5.60
Propylene	28	41.71	0.31	1.05
Propane	28	23.51	0.77	6.00
Propyne	0	NA	NA	NA
Isobutane	28	39.78	0.39	2.69
Isobutene/1-Butene	28	38.96	0.36	1.79
1,3-Butadiene	5	3.38	0.07	NA
n-Butane	28	31.61	0.60	3.63
trans-2-Butene	24	29.99	0.23	0.55
cis-2-Butene	24	34.52	0.30	0.73
3-Methyl-1-butene	0	NA	NA	NA
Isopentane	20	44.15	0.81	4.81
1-Pentene	22	30.50	0.33	0.70
2-Methyl-1-butene	15	30.79	0.09	0.32
n-Pentane	28	39.34	0.46	2.61
Isoprene	24	12.05	0.41	3.85
trans-2-Pentene	25	52.15	0.23	0.52
cis-2-Pentene	25	64.72	0.29	0.56
2-Methyl-2-butene	14	32.43	0.25	0.34
2,2-Dimethylbutane	24	67.34	0.21	0.80
Cyclopentene	3	NA	0.19	NA
4-Methyl-1-pentene	0	NA	NA	NA
Cyclopentane	26	60.79	0.25	0.51
2,3-Dimethylbutane	28	137.05	0.43	0.76
2-Methylpentane	28	41.43	0.52	1.50
3-Methylpentane	28	50.61	0.43	1.80
2-Methyl-1-pentene	1	NA	0.63	0.63
1-Hexene	26	27.87	0.42	1.14
2-Ethyl-1-butene	0	NA	NA	NA
n-Hexane	28	99.09	0.42	0.83
trans-2-Hexene	0	NA	NA	NA
cis-2-Hexene	0	NA	NA	NA

Table 21-11. Continued

Compound	Number of Observations	Average RPD for Replicate Analyses (%)	Average Concentration Difference for Replicate Analyses (ppbv)	Coefficient of Variation (%)
Methylcyclopentane	27	60.56	0.28	0.78
2,4-Dimethylpentane	26	83.73	0.35	0.66
Benzene	28	22.14	0.28	1.50
Cyclohexane	27	100.02	0.46	0.84
2-Methylhexane	23	33.19	0.39	1.04
2,3-Dimethylpentane	26	87.65	0.59	0.92
3-Methylhexane	27	34.25	0.40	1.06
1-Heptene	8	22.51	0.13	0.26
2,2,4-Trimethylpentane	28	78.12	0.32	0.73
n-Heptane	20	48.34	0.21	0.52
Methylcyclohexane	26	68.34	0.31	0.61
2,2,3-Trimethylpentane	7	22.79	0.18	NA
2,3,4-Trimethylpentane	26	64.51	0.25	0.51
Toluene	20	39.11	0.68	3.56
2-Methylheptane	24	13.36	0.22	0.60
3-Methylheptane	25	32.91	0.26	0.57
1-Octene	10	8.31	0.09	0.37
n-Octane	26	46.36	0.25	0.67
Ethylbenzene	18	59.87	0.25	0.81
m-Xylene/p-Xylene	20	73.72	0.50	1.50
Styrene	13	109.07	0.31	0.51
o-Xylene	19	93.77	0.40	0.79
1-Nonene	5	7.76	0.12	0.30
n-Nonane	26	53.75	0.22	0.63
Isopropylbenzene	16	15.83	0.37	0.55
a-Pinene	10	18.89	0.58	1.98
n-Propylbenzene	16	138.99	0.31	0.56
m-Ethyltoluene	18	60.77	0.32	1.24
p-Ethyltoluene	18	92.23	0.31	0.74
1,3,5-Trimethylbenzene	13	65.73	0.34	1.13
o-Ethyltoluene	15	70.94	0.33	1.07
b-Pinene	5	24.67	2.99	3.73
1,2,4-Trimethylbenzene	19	89.28	0.41	1.70
1-Decene	0	NA	NA	NA
n-Decane	25	45.33	1.20	2.98
1,2,3-Trimethylbenzene	11	33.58	0.32	0.67

Table 21-11. Continued

Compound	Number of Observations	Average RPD for Replicate Analyses (%)	Average Concentration Difference for Replicate Analyses (ppbv)	Coefficient of Variation (%)
m-Diethylbenzene	13	25.04	0.29	0.30
p-Diethylbenzene	7	23.54	0.27	0.48
1-Undecene	0	NA	NA	NA
n-Undecane	27	20.42	0.62	7.84
1-Dodecene	1	NA	0.58	0.58
n-Dodecane	23	43.30	0.54	11.72
1-Tridecene	5	13.33	0.17	0.69
n-Tridecane	11	27.69	0.57	1.67
TNMOC (speciated)	20	62.28	20.98	**76.03**
TNMOC (w/ unknowns)	20	41.64	22.08	**125.38**

NA = Not applicable

NOTE: Coefficients of variation greater than the program target of 15 percent are presented in bold font.

Table 21-12. SNMOC Sampling and Analytical Precision: Coefficient of Variation for all Replicate Analyses

Compound	Average	Barceloneta, PR (BAPR)	Beulah, ND (BUND)	Cedar Rapids, IA (C2IA)	Custer, SD (CUSD)	Davenport, IA (DAIA)	St. Louis, MO (SLMO)	Salt Lake City, UT (SLCU)	San Juan, PR (SJPR)	Sioux Falls, SD (SFSD)
Ethylene	7.04	4.61	5.48	12.38	12.38	6.84	5.08	2.29	5.96	8.28
Acetylene	7.43	6.86	5.08	9.37	**15.00**	**17.22**	1.98	4.81	3.60	2.97
Ethane	5.08	4.41	1.28	8.13	10.09	2.97	3.45	3.01	7.08	5.33
Propylene	11.97	4.15	10.16	**18.18**	10.32	**28.60**	6.53	4.97	11.02	13.79
Propane	6.01	4.55	3.70	12.30	5.26	5.60	9.80	3.01	4.85	5.04
Propyne	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Isobutane	7.10	5.17	7.78	**17.08**	8.40	7.46	4.43	3.43	4.75	5.43
Isobutene/1-Butene	10.44	6.52	12.72	**15.89**	12.87	**18.26**	9.02	4.51	8.06	6.12
1,3-Butadiene	7.85	11.74	NA	2.37	NA	NA	6.29	8.07	10.80	NA
n-Butane	5.81	5.73	4.04	14.05	6.19	5.94	2.22	4.51	5.01	4.62
trans-2-Butene	12.51	10.61	9.41	11.95	**28.83**	2.61	**15.19**	12.78	9.17	11.99
cis-2-Butene	13.11	8.38	10.80	13.12	**24.66**	11.92	10.18	12.42	11.91	14.56
3-Methyl-1-butene	2.74	NA	NA	NA	NA	NA	NA	2.74	NA	NA
Isopentane	8.20	7.01	6.50	**19.19**	**16.50**	12.97	1.96	2.14	2.00	5.52
1-Pentene	**15.09**	**15.51**	7.30	13.50	**23.68**	**31.29**	9.73	12.55	12.48	9.79
2-Methyl-1-butene	10.45	9.15	NA	13.43	6.54	NA	6.28	7.65	10.62	**19.47**
n-Pentane	5.73	4.94	7.91	**17.09**	6.49	0.42	2.46	5.20	2.56	4.50
Isoprene	11.84	7.12	13.07	**17.75**	8.78	**42.07**	4.45	5.99	2.51	4.78
trans-2-Pentene	**16.96**	12.82	9.48	**18.12**	**15.20**	**50.26**	7.26	7.81	5.74	**25.94**

Table 21-12. Continued

Compound	Average	Barceloneta, PR (BAPR)	Beulah, ND (BUND)	Cedar Rapids, IA (C2IA)	Custer, SD (CUSD)	Davenport, IA (DAIA)	St. Louis, MO (SLMO)	Salt Lake City, UT (SLCU)	San Juan, PR (SJPR)	Sioux Falls, SD (SFSD)
cis-2-Pentene	**16.22**	9.56	9.61	10.68	**21.24**	**46.70**	10.86	11.60	13.68	12.05
2-Methyl-2-butene	7.92	6.97	NA	7.69	**15.79**	NA	5.87	6.16	5.34	7.63
2,2-Dimethylbutane	**16.70**	6.87	11.68	11.14	**21.76**	**52.22**	11.88	10.26	11.04	13.46
Cyclopentene	8.59	5.07	5.51	NA	**19.81**	NA	5.69	6.87	NA	NA
4-Methyl-1-pentene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cyclopentane	**17.76**	10.51	13.23	**19.53**	**15.62**	**40.28**	11.54	6.27	**16.13**	**26.75**
2,3-Dimethylbutane	**16.61**	8.46	6.88	**26.82**	**18.05**	**39.27**	10.74	7.08	**15.50**	**16.65**
2-Methylpentane	11.56	9.66	13.83	**19.14**	**16.39**	14.73	8.85	4.70	6.42	10.32
3-Methylpentane	14.34	7.71	14.76	**20.18**	14.86	**27.26**	8.75	3.73	9.43	**22.35**
2-Methyl-1-pentene	13.59	5.87	NA	NA	NA	NA	NA	11.54	5.29	**31.68**
1-Hexene	**20.91**	8.34	**19.95**	12.79	**27.14**	**49.58**	11.98	13.10	**24.86**	**20.47**
2-Ethyl-1-butene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
n-Hexane	14.05	5.84	14.97	**29.83**	**23.57**	**26.87**	5.88	3.54	4.85	11.06
trans-2-Hexene	9.31	NA	NA	NA	NA	NA	NA	**16.10**	2.51	NA
cis-2-Hexene	5.90	NA	NA	NA	NA	NA	NA	NA	5.90	NA
Methylcyclopentane	12.57	7.04	8.32	**23.68**	**18.58**	**27.84**	4.01	4.26	8.58	10.84
Benzene	7.20	12.11	4.04	11.02	10.19	9.52	2.50	2.75	5.32	7.34
Cyclohexane	**16.74**	6.38	11.31	**31.35**	**28.33**	**30.47**	14.49	7.01	7.72	13.59
1-Heptene	**15.08**	**16.24**	12.72	8.14	NA	NA	NA	11.75	**26.54**	NA
2,2,4-Trimethylpentane	13.02	9.14	11.71	**23.70**	**20.15**	**27.58**	4.16	3.43	9.33	8.00

Table 21-12. Continued

Compound	Average	Barceloneta, PR (BAPR)	Beulah, ND (BUND)	Cedar Rapids, IA (C2IA)	Custer, SD (CUSD)	Davenport, IA (DAIA)	St. Louis, MO (SLMO)	Salt Lake City, UT (SLCU)	San Juan, PR (SJPR)	Sioux Falls, SD (SFSD)
n-Heptane	10.87	5.40	10.10	**16.88**	14.66	**25.40**	4.89	2.58	6.79	11.12
Methylcyclohexane	**17.51**	7.88	10.88	14.57	**24.16**	**43.48**	13.14	4.21	**21.95**	**17.31**
2,2,3-Trimethylpentane	11.79	10.64	NA	**24.51**	NA	NA	10.73	4.82	11.92	8.11
2,3,4-Trimethylpentane	**15.27**	13.45	11.61	11.98	**25.34**	**34.38**	4.17	4.51	**15.06**	**16.97**
Toluene	7.30	6.52	8.56	**16.76**	5.19	9.83	3.44	3.90	5.23	6.28
2-Methylheptane	**19.73**	7.32	**15.03**	7.82	10.61	**75.28**	13.74	9.39	**15.08**	**23.32**
3-Methylheptane	14.37	8.55	11.54	**15.85**	**18.13**	**37.06**	5.84	7.72	**15.07**	9.54
1-Octene	10.57	8.06	11.65	4.01	NA	**41.55**	0.53	4.13	4.06	NA
n-Octane	13.45	4.65	10.98	**19.54**	**15.83**	**31.45**	6.67	10.84	10.09	10.97
Ethylbenzene	**16.54**	7.65	14.62	**21.52**	12.78	**58.17**	7.97	6.64	5.50	14.01
m-Xylene/p-Xylene	13.31	7.07	8.41	**29.01**	9.74	**28.91**	9.36	6.04	7.53	13.73
Styrene	**34.38**	**23.43**	**22.47**	**31.74**	**49.17**	**54.32**	**53.11**	**28.42**	**27.88**	**18.90**
o-Xylene	**17.44**	7.42	**20.17**	**30.78**	**20.25**	**38.43**	7.57	6.43	6.11	**19.77**
1-Nonene	7.69	14.88	NA	3.94	NA	5.05	NA	6.87	NA	NA
n-Nonane	12.77	8.03	13.18	12.57	11.16	**26.76**	10.76	7.78	5.07	**19.59**
Isopropylbenzene	**16.39**	**17.33**	**27.39**	6.46	**25.43**	NA	13.47	12.01	13.48	**15.59**
a-Pinene	**19.93**	**30.52**	14.57	5.04	3.59	NA	2.91	12.13	2.96	**87.75**
n-Propylbenzene	**18.80**	7.51	**19.97**	8.05	NA	**72.92**	9.18	8.97	6.65	**17.13**

Table 21-12. Continued

Compound	Average	Barceloneta, PR (BAPR)	Beulah, ND (BUND)	Cedar Rapids, IA (C2IA)	Custer, SD (CUSD)	Davenport, IA (DAIA)	St. Louis, MO (SLMO)	Salt Lake City, UT (SLCU)	San Juan, PR (SJPR)	Sioux Falls, SD (SFSD)
o-Ethyltoluene	12.08	2.01	12.42	10.41	14.40	NA	**22.11**	8.96	**20.27**	6.09
b-Pinene	14.59	**23.15**	**18.43**	**20.74**	13.76	NA	NA	8.93	2.54	NA
1,2,4-Trimethylbenzene	**15.00**	7.92	**16.22**	**25.09**	10.11	**38.28**	4.69	8.35	4.29	**20.05**
1-Decene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
n-Decane	**18.59**	**24.94**	**18.30**	**25.26**	**28.65**	**23.16**	**21.79**	6.82	9.61	8.78
1,2,3-Trimethylbenzene	**24.40**	**26.46**	**27.06**	**20.02**	**42.11**	**33.96**	**21.58**	**16.42**	13.87	**18.12**
m-Diethylbenzene	**20.20**	NA	NA	9.56	NA	**20.81**	NA	**23.80**	NA	**26.63**
p-Diethylbenzene	**19.87**	**25.92**	**16.94**	**17.86**	NA	**19.93**	NA	**19.04**	**30.43**	8.97
1-Undecene	4.57	NA	NA	NA	NA	NA	3.76	5.37	NA	NA
n-Undecene	9.71	10.71	10.85	10.62	**18.52**	9.39	9.53	6.23	3.92	7.59
1-Dodecene	12.21	NA	NA	NA	NA	NA	NA	NA	12.21	NA
n-Dodecane	11.08	8.57	13.58	4.54	**25.89**	7.42	12.23	3.20	8.18	**16.13**
1-Tridecene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
n-Tridecane	9.20	11.72	NA	NA	NA	NA	NA	9.33	6.56	NA
TNMOC (speciated)	8.52	4.66	8.36	**23.41**	9.94	13.55	3.65	2.39	3.27	7.45
TNMOC (w/ unknowns)	9.90	**18.48**	7.05	**17.88**	**15.67**	5.29	3.44	2.62	14.03	4.67
Average	13.07	10.03	12.09	**15.74**	**17.55**	**28.58**	8.63	7.89	9.98	14.42

NA = Not applicable
NOTE: Coefficients of variation greater than the program target of 15 percent are presented in bold font.

Table 21-13. Carbonyl Compound Sampling and Analytical Precision: 722 Replicate Analyses for all Duplicate and Collocated Samples

Compound	Number of Observations	Average RPD for Replicate Analyses (%)	Average Concentration Difference for Replicate Analyses (ppbv)	Coefficient of Variation (%)
Formaldehyde	719	0.56	0.02	0.39
Acetaldehyde	722	7.61	0.01	1.42
Acetone	722	3.77	0.02	1.34
Propionaldehyde	693	6.95	0.01	4.87
Crotonaldehyde	290	13.72	0.01	9.19
Butyr/Isobutyraldehyde	716	4.40	0.01	3.14
Benzaldehyde	719	11.27	0.01	8.25
Isovaleraldehyde	81	28.25	0.02	**17.45**
Valeraldehyde	700	8.21	0.003	5.82
Tolualdehydes	710	11.73	0.01	8.60
Hexaldehyde	712	14.85	0.01	10.47
2,5-Dimethylbenzaldehyde	47	28.34	0.02	**19.43**

NA = Not applicable

NOTE: Coefficients of variation greater than the program target of 15 percent are presented in bold font.

Table 21-14. Carbonyl Compound Sampling and Analytical Precision: 96 Replicate Analyses for all Collocated Samples

Compound	Number of Observations	Average RPD for Replicate Analyses (%)	Average Concentration Difference for Replicate Analyses (ppbv)	Coefficient of Variation (%)
Formaldehyde	93	0.31	0.01	0.22
Acetaldehyde	96	0.73	0.01	0.51
Acetone	96	1.47	0.02	1.05
Propionaldehyde	85	7.30	0.01	5.11
Crotonaldehyde	70	10.32	0.004	7.47
Butyr/Isobutyraldehyde	96	4.30	0.01	3.12
Benzaldehyde	96	12.10	0.01	9.26
Isovaleraldehyde	15	30.09	0.004	**21.37**
Valeraldehyde	84	5.10	0.003	3.52
Tolualdehydes	92	9.57	0.01	7.06
Hexaldehyde	95	11.40	0.01	8.50
2,5-Dimethylbenzaldehyde	12	25.18	0.03	**15.53**

NA = Not applicable

NOTE: Coefficients of variation greater than the program target of 15 percent are presented in bold font.

Table 21-15. Carbonyl Compound Sampling and Analytical Precision: 626 Replicate Analyses for all Duplicate Samples

Compound	Number of Observations	Average RPD for Replicate Analyses (%)	Average Concentration Difference for Replicate Analyses (ppbv)	Coefficient of Variation (%)
Formaldehyde	626	0.81	0.03	0.57
Acetaldehyde	626	14.50	0.02	2.33
Acetone	626	6.06	0.01	1.63
Propionaldehyde	608	6.60	0.01	4.62
Crotonaldehyde	220	17.13	0.01	10.92
Butyr/Isobutyraldehyde	620	4.51	0.01	3.16
Benzaldehyde	623	10.44	0.01	7.23
Isovaleraldehyde	66	26.41	0.03	13.52
Valeraldehyde	616	11.32	0.004	8.13
Tolualdehydes	618	13.90	0.01	10.15
Hexaldehyde	617	18.31	0.01	12.43
2,5-Dimethylbenzaldehyde	35	31.50	0.01	**23.33**

NA = Not applicable

NOTE: Coefficients of variation greater than the program target of 15 percent are presented in bold font.

Table 21-16. Carbonyl Compound Sampling and Analytical Precision: 52 Replicate Analyses for all Duplicate Samples in Puerto Rico

Compound	Number of Observations	Average RPD for Replicate Analyses (%)	Average Concentration Difference for Replicate Analyses (ppbv)	Coefficient of Variation (%)
Formaldehyde	52	0.52	0.01	0.37
Acetaldehyde	52	0.79	0.01	0.56
Acetone	52	2.09	0.01	1.41
Propionaldehyde	50	4.20	0.00	3.04
Crotonaldehyde	8	16.11	0.01	10.41
Butyr/Isobutyraldehyde	52	2.19	0.00	1.57
Benzaldehyde	52	10.87	0.01	7.97
Isovaleraldehyde	21	24.15	0.00	10.67
Valeraldehyde	50	7.22	0.00	5.43
Tolualdehydes	50	11.55	0.00	8.79
Hexaldehyde	50	16.50	0.00	10.07
2,5-Dimethylbenzaldehyde	5	25.65	0.00	**22.70**

NA = Not applicable

NOTE: Coefficients of variation greater than the program target of 15 percent are presented in bold font.

Table 21-17. Carbonyl Compound Sampling and Analytical Precision: 52 Replicate Analyses in Grand Junction, CO

Compound	Number of Observations	Average RPD for Replicate Analyses (%)	Average Concentration Difference for Replicate Analyses (ppbv)	Coefficient of Variation (%)
Formaldehyde	52	0.47	0.01	0.33
Acetaldehyde	52	0.36	0.00	0.25
Acetone	52	0.67	0.01	0.48
Propionaldehyde	52	5.16	0.00	3.79
Crotonaldehyde	44	52.23	0.02	**28.44**
Butyr/Isobutyraldehyde	52	3.27	0.01	2.30
Benzaldehyde	52	7.30	0.00	5.28
Isovaleraldehyde	0			
Valeraldehyde	52	5.41	0.00	4.00
Tolualdehydes	52	10.59	0.00	7.38
Hexaldehyde	52	17.65	0.01	10.20
2,5-Dimethylbenzaldehyde	5	92.29	0.01	**50.11**

NA = Not applicable

NOTE: Coefficients of variation greater than the program target of 15 percent are presented in bold font.

Table 21-18. Carbonyl Compound Sampling and Analytical Precision: 28 Replicate Analyses in Cedar Rapids, IA

Compound	Number of Observations	Average RPD for Replicate Analyses (%)	Average Concentration Difference for Replicate Analyses (ppbv)	Coefficient of Variation (%)
Formaldehyde	28	2.10	0.04	1.45
Acetaldehyde	28	1.26	0.01	0.88
Acetone	28	4.97	0.07	4.42
Propionaldehyde	24	15.24	0.02	13.22
Crotonaldehyde	2	13.41	0.00	10.17
Butyr/Isobutyraldehyde	28	5.64	0.01	4.06
Benzaldehyde	28	16.31	0.00	10.49
Isovaleraldehyde	2	5.79	0.00	4.21
Valeraldehyde	27	7.11	0.00	5.09
Tolualdehydes	28	10.49	0.00	7.25
Hexaldehyde	28	21.16	0.00	13.54
2,5-Dimethylbenzaldehyde	0	NA	NA	NA

NA = Not applicable

Table 21-19. Carbonyl Compound Sampling and Analytical Precision: 84 Replicate Samples for all Collocated Samples in Detroit, MI

Compound	Number of Observations	Average RPD for Replicate Analyses (%)	Average Concentration Difference for Replicate Analyses (ppbv)	Coefficient of Variation (%)
Formaldehyde	81	0.61	0.01	0.43
Acetaldehyde	84	1.43	0.01	1.00
Acetone	84	0.85	0.01	0.60
Propionaldehyde	73	3.50	0.01	2.51
Crotonaldehyde	59	13.20	0.00	9.10
Butyr/Isobutyraldehyde	84	4.13	0.01	2.89
Benzaldehyde	84	10.86	0.00	8.62
Isovaleraldehyde	15	30.09	0.00	**21.37**
Valeraldehyde	72	7.24	0.00	4.99
Tolualdehydes	80	12.56	0.00	8.48
Hexaldehyde	83	8.91	0.01	6.47
2,5-Dimethylbenzaldehyde	11	25.18	0.02	**15.53**

NA = Not applicable

NOTE: Coefficients of variation greater than the program target of 15 percent are presented in bold font.

Table 21-20. Carbonyl Compound Sampling and Analytical Precision: 112 Replicate Analyses for all Duplicate Samples in Florida

Compound	**Number of Observations**	**Average RPD for Replicate Analyses (%)**	**Average Concentration Difference for Replicate Analyses (ppbv)**	**Coefficient of Variation (%)**
Formaldehyde	112	0.86	0.03	0.61
Acetaldehyde	112	1.33	0.01	0.93
Acetone	112	1.02	0.01	0.72
Propionaldehyde	112	5.57	0.00	3.63
Crotonaldehyde	20	7.21	0.00	5.01
Butyr/Isobutyraldehyde	112	5.13	0.01	3.34
Benzaldehyde	112	8.82	0.01	6.39
Isovaleraldehyde	5	89.87	0.09	**43.85**
Valeraldehyde	112	10.24	0.00	7.25
Tolualdehydes	111	12.35	0.00	8.83
Hexaldehyde	112	21.80	0.00	14.41
2,5-Dimethylbenzaldehyde	6	1.32	0.002	0.93

NA = Not applicable

NOTE: Coefficients of variation greater than the program target of 15 percent are presented in bold font.

Table 21-21. Carbonyl Compound Sampling and Analytical Precision: Coefficient of Variation for all Replicate Samples

Compound	Average	Arlington, TX (ANTX)	Barceloneta, PR (BAPR)	Beulah, ND (BUND)	Camden, NJ (CANJ)	Cedar Rapids, IA (C2IA)	Chester, NJ (CHNJ)	Custer, SD (CUSD)	Davenport, IA (DAIA)	Denver, CO (DECO)	Denver, CO (SWCO)	Denver, CO (WECO)
Formaldehyde	0.50	0.45	0.27	0.54	0.82	1.45	0.84	0.20	0.46	0.18	0.50	0.35
Acetaldehyde	2.72	**64.90**	0.20	1.39	4.03	0.88	0.33	0.45	1.03	0.37	0.17	0.13
Acetone	1.37	0.61	0.60	0.41	10.07	4.42	0.45	0.20	1.09	0.26	1.11	0.25
Propionaldehyde	5.14	12.01	2.41	10.54	7.47	13.22	6.06	3.38	10.40	1.25	1.87	4.49
Crotonaldehyde	11.17	NA	10.41	NA	4.62	10.17	NA	6.49	6.02	10.89	7.92	12.39
Butyr/Isobutyraldehyde	3.69	5.64	1.49	7.55	3.93	4.06	3.28	3.82	0.99	1.52	2.29	3.32
Benzaldehyde	7.17	3.95	6.13	12.58	14.54	10.49	4.07	7.97	1.60	4.34	8.08	13.26
Isovaleraldehyde	**15.17**	NA	NA	4.97	NA	4.21	NA	NA	NA	NA	NA	NA
Valeraldehyde	7.75	5.12	6.00	4.99	11.08	5.09	11.16	6.76	**20.31**	1.58	**18.60**	5.28
Tolualdehydes	9.84	4.77	5.52	**15.01**	11.08	7.25	6.20	**16.99**	9.01	7.34	7.78	12.43
Hexaldehyde	13.08	**23.24**	10.91	**17.84**	**16.68**	13.54	14.01	**18.25**	**34.92**	6.32	9.41	7.67
2,5-Dimethylbenzaldehyde	**22.88**	NA	NA	NA	6.35	NA	NA	NA	NA	NA	NA	NA
Average	8.37	13.41	4.39	7.58	8.24	6.80	5.16	6.45	8.58	3.41	5.77	5.96

Table 21-21. Continued

Compound	Average	Des Moines, IA (DMIA)	Detroit, MI (Dearborn) (DEMI)	Elizabeth, NJ (ELNJ)	Grand Junction, CO (G2CO)	Grand Junction, CO (GJCO)	Gulf Port, MS (GPMS)	Jackson, MS (JAMS)	Lincoln, NE (LINE)	Lincoln, NE (LONE)	Nashville, TN (EATN)	Nashville, TN (LOTN)
Formaldehyde	0.50	0.12	0.43	0.33	0.32	0.34	0.19	0.19	0.36	0.33	0.05	0.17
Acetaldehyde	2.72	1.30	1.00	0.67	0.34	0.17	0.60	0.72	0.46	0.16	0.31	0.22
Acetone	1.37	0.98	0.60	0.38	0.34	0.62	0.39	0.69	0.80	0.24	0.84	1.71
Propionaldehyde	5.14	10.29	2.51	3.17	2.76	4.82	7.30	3.32	3.87	3.15	9.31	3.51
Crotonaldehyde	11.17	12.79	9.10	14.35	**16.06**	**40.81**	NA	NA	**20.92**	NA	7.49	5.81
Butyr/Isobutyraldehyde	3.69	6.69	2.89	2.35	1.63	2.98	**18.90**	2.58	2.06	2.03	1.72	4.75
Benzaldehyde	7.17	9.62	8.62	6.03	5.18	5.39	2.42	6.38	4.07	7.21	2.71	**16.45**
Isovaleraldehyde	**15.17**	NA	**21.37**	NA	NA	NA	NA	NA	NA	NA	NA	NA
Valeraldehyde	7.75	10.88	4.99	**17.56**	2.76	5.24	9.67	12.04	5.85	5.79	2.27	3.29
Tolualdehydes	9.84	**18.16**	8.48	12.87	4.96	9.80	9.41	11.87	**17.60**	9.24	10.31	2.38
Hexaldehyde	13.08	13.07	6.47	**22.96**	4.90	**15.51**	5.24	13.53	2.09	12.85	11.11	7.92
2,5-Dimethylbenzaldehyde	**22.88**	NA	**15.53**	NA	**50.11**	NA	NA	NA	NA	NA	NA	NA
Average	8.37	8.39	6.83	8.07	8.12	8.57	6.01	5.70	5.81	4.56	4.61	4.62

Table 21-21. Continued

Compound	Average	New Brunswick, NJ (NBNJ)	Pascagoula, MS (PGMS)	St. Louis, MO (SLMO)	Salt Lake City, UT (SLCU)	St. Petersburg, FL (CWFL)	St. Petersburg, FL (DNFL)	San Juan, PR (SJPR)	Sioux Falls, SD (SFSD)	Tampa, FL (GAFL)	Tampa, FL (LEFL)	Tupelo, MS (TUMS)
Formaldehyde	0.50	0.82	2.11	0.32	0.40	0.52	0.72	0.47	0.47	0.55	0.55	0.53
Acetaldehyde	2.72	0.52	2.15	0.27	0.61	0.58	0.95	0.92	0.92	1.07	0.76	1.17
Acetone	1.37	0.33	9.00	0.29	0.44	0.74	0.88	2.22	2.22	0.65	0.64	0.85
Propionaldehyde	5.14	6.77	5.01	2.59	3.93	2.19	5.04	3.66	3.66	2.06	3.79	3.81
Crotonaldehyde	11.17	**16.90**	NA	8.04	9.56	NA	5.60	NA	NA	4.20	5.23	NA
Butyr/Isobutyraldehyde	3.69	3.37	6.93	1.81	1.49	3.35	4.73	1.66	1.66	2.13	3.16	5.03
Benzaldehyde	7.17	11.40	3.13	3.16	4.21	6.15	5.84	9.82	9.82	4.51	8.82	8.55
Isovaleraldehyde	**15.17**	NA	NA	3.26	NA	**22.37**	NA	10.67	10.67	**43.85**	NA	NA
Valeraldehyde	7.75	7.46	7.99	6.88	6.12	9.14	6.34	4.86	4.86	7.17	8.22	10.43
Tolualdehydes	9.84	**8.09**	11.20	8.97	8.84	10.48	11.88	12.05	12.05	8.07	6.55	8.09
Hexaldehyde	13.08	**24.58**	10.61	4.14	10.43	**17.98**	14.21	9.23	9.23	**17.20**	11.83	13.87
2,5-Dimethylbenzaldehyde	**22.88**	NA	NA	0.32	**64.40**	NA	0.93	**22.70**	**22.70**	NA	NA	NA
Average	8.37	8.02	6.46	3.34	10.04	7.35	5.19	7.11	7.11	8.31	4.96	5.81

NA = Not applicable

NOTE: Coefficients of variation greater than the program target of 15 percent are presented in bold font.

Table 21-22. SVOC Sampling and Analytical Precision: 35 Replicate Analyses for Collocated Samples in Michigan

Compound	Number of Observations	Average RPD for Replicate Analyses (%)	Average Concentration Difference for Replicate Analyses (μg)	Coefficient of Variation (%)
Phenol	2	8.25	2.96	5.61
1,4-Dichlorobenzene	5	18.82	6.02	14.76
Naphthalene	35	6.70	3.61	4.69
2-Methylnaphthalene	34	4.44	1.07	3.30
Di-*n*-butyl phthalate	10	5.90	2.93	6.10

Table 21-23. Hexavalent Chromium Sampling and Analytical Precision: Total 40 Replicates on Collocated Samples

Compound	Number of Observations	Average RPD for Replicate Analyses (%)	Average Concentration Difference for Replicate Analyses (μg/m^3)	Coefficient of Variation (%)
Hexavalent Chromium	21	18.51	0.015	**14.82**

NA = Not applicable

NOTE: Coefficients of variation greater than the program target of 15 percent are presented in bold font.

Table 21-24. VOC Sampling and Analytical Precision: Total 334 Duplicate and Collocated Samples

Compound	Number of Observations	Average RPD for Replicate Analyses (%)	Average Concentration Difference for Replicate Analyses (ppbv)	Coefficient of Variation (%)
Acetylene	332	19.15	0.55	11.95
Propylene	332	23.42	0.19	14.92
Dichlorodifluoromethane	334	10.08	0.07	7.74
Chloromethane	333	10.31	0.07	8.00
Dichlorotetrafluoroethane	0	NA	NA	NA
Vinyl Chloride	0	NA	NA	NA
1,3-Butadiene	69	11.88	0.09	7.07
Bromomethane	2	2.74	0.38	1.96
Chloroethane	1	NA	0.33	NA
Acetonitrile	100	61.90	11.61	**48.38**
Trichlorofluoromethane	332	14.79	0.06	11.35
Acrylonitrile	7	29.02	1.13	**24.00**
1,1-Dichloroethene	0	NA	NA	NA
Methylene Chloride	236	42.57	0.69	**27.23**
Trichlorotrifluoroethane	292	14.37	0.02	10.27
trans-1,2-Dichloroethylene	0	NA	NA	NA
1,1 - Dichloroethane	0	NA	NA	NA
Methyl *tert*-Butyl Ether	68	10.31	0.20	7.32
Methyl Ethyl Ketone (MEK)	155	25.00	0.52	**15.84**
Chloroprene	2	NA	0.14	NA
cis-1,2-Dichloroethylene	2	11.11	0.02	8.32
Bromochloromethane	0	NA	NA	NA
Chloroform	15	15.20	0.07	10.84
Ethyl *tert*-Butyl Ether	0	NA	NA	NA
1,2-Dichloroethane	0	NA	NA	NA
1,1,1-Trichloroethane	26	20.06	0.05	14.02
Benzene	334	17.83	0.10	11.39
Carbon Tetrachloride	276	17.12	0.03	12.39
tert-Amyl Methyl Ether	0	NA	NA	NA
1,2-Dichloropropane	0	NA	NA	NA
Ethyl Acrylate	0	NA	NA	NA
Bromodichloromethane	0	NA	NA	NA
Trichloroethylene	3	11.11	0.09	7.44
Methyl Methacrylate	3	13.33	0.23	0.32
cis-1,3-Dichloropropene	0	NA	NA	NA
Methyl Isobutyl Ketone	11	5.70	0.10	4.07
trans-1,3-Dichloropropene	0	NA	NA	NA
1,1,2-Trichloroethane	0	NA	NA	NA

Table 21-24. Continued

Compound	Number of Observations	Average RPD for Replicate Analyses (%)	Average Concentration Difference for Replicate Analyses (ppbv)	Coefficient of Variation (%)
Toluene	334	23.78	0.28	14.53
Dibromochloromethane	0	NA	NA	NA
1,2-Dibromoethane	0	NA	NA	NA
n-Octane	60	31.65	0.15	**19.71**
Tetrachloroethylene	49	74.78	0.09	**25.60**
Chlorobenzene	2	NA	NA	NA
Ethylbenzene	218	15.64	0.06	10.76
m,p-Xylene	294	17.10	0.14	12.08
Bromoform	0	NA	NA	NA
Styrene	17	6.63	0.10	4.86
1,1,2,2-Tetrachloroethane	0	NA	NA	NA
o-Xylene	209	15.25	0.09	10.46
1,3,5-Trimethylbenzene	70	39.75	1.39	**21.01**
1,2,4-Trimethylbenzene	185	20.24	1.80	13.84
m-Dichlorobenzene	0	NA	NA	NA
Chloromethylbenzene	0	NA	NA	NA
p-Dichlorobenzene	10	11.46	0.15	9.23
o-Dichlorobenzene	0	NA	NA	NA
1,2,4-Trichlorobenzene	0	NA	NA	NA
Hexachloro-1,3-Butadiene	0	NA	NA	NA

NA = Not applicable

NOTE: Coefficients of variation greater than the program target of 15 percent are presented in bold font.

Table 21-25. VOC Sampling and Analytical Precision: Total 102 Collocated Samples

Compound	Number of Observations	Average RPD for Replicate Analyses (%)	Average Concentration Difference for Replicate Analyses (ppbv)	Coefficient of Variation (%)
Acetylene	100	27.35	0.45	**16.72**
Propylene	102	33.28	0.28	**19.67**
Dichlorodifluoromethane	102	11.54	0.08	9.24
Chloromethane	102	13.12	0.08	10.31
Dichlorotetrafluoroethane	0	NA	NA	NA
Vinyl Chloride	0	NA	NA	NA
1,3-Butadiene	22	8.41	0.11	5.82
Bromomethane	0	NA	NA	NA
Chloroethane	1	NA	0.33	NA
Acetonitrile	24	89.49	2.90	**74.38**
Trichlorofluoromethane	102	14.36	0.05	11.18
Acrylonitrile	2	NA	1.00	NA
1,1-Dichloroethene	0	NA	NA	NA
Methylene Chloride	69	46.44	1.13	**28.54**
Trichlorotrifluoroethane	101	14.98	0.02	12.44
trans-1,2-Dichloroethylene	0	NA	NA	NA
1,1 - Dichloroethane	0	NA	NA	NA
Methyl *tert*-Butyl Ether	8	4.94	0.25	3.59
Methyl Ethyl Ketone (MEK)	48	21.47	0.44	13.38
Chloroprene	0	NA	NA	NA
cis-1,2-Dichloroethylene	0	NA	NA	NA
Bromochloromethane	0	NA	NA	NA
Chloroform	7	14.29	0.05	10.88
Ethyl *tert*-Butyl Ether	0	NA	NA	NA
1,2-Dichloroethane	0	NA	NA	NA
1,1,1-Trichloroethane	8	20.00	0.05	12.86
Benzene	102	26.01	0.15	**16.32**
Carbon Tetrachloride	101	19.75	0.02	**15.23**
tert-Amyl Methyl Ether	0	NA	NA	NA
1,2-Dichloropropane	0	NA	NA	NA
Ethyl Acrylate	0	NA	NA	NA
Bromodichloromethane	0	NA	NA	NA
Trichloroethylene	0	NA	NA	NA
Methyl Methacrylate	0	NA	NA	NA
cis-1,3-Dichloropropene	0	NA	NA	NA
Methyl Isobutyl Ketone	6	7.41	0.09	5.25
trans-1,3-Dichloropropene	0	NA	NA	NA
1,1,2-Trichloroethane	0	NA	NA	NA

Table 21-25. Continued

Compound	Number of Observations	Average RPD for Replicate Analyses (%)	Average Concentration Difference for Replicate Analyses (ppbv)	Coefficient of Variation (%)
Toluene	102	28.87	0.32	**16.68**
Dibromochloromethane	0	NA	NA	NA
1,2-Dibromoethane	0	NA	NA	NA
n-Octane	15	44.24	0.09	**27.05**
Tetrachloroethylene	22	29.24	0.07	**15.88**
Chlorobenzene	0	NA	NA	NA
Ethylbenzene	66	15.35	0.05	9.56
m,p-Xylene	92	20.84	0.14	13.54
Bromoform	0	NA	NA	NA
Styrene	4	9.16	0.12	6.79
1,1,2,2-Tetrachloroethane	0	NA	NA	NA
o-Xylene	60	17.27	0.06	10.42
1,3,5-Trimethylbenzene	21	22.43	0.08	**17.19**
1,2,4-Trimethylbenzene	60	20.54	0.08	12.52
m-Dichlorobenzene	0	NA	NA	NA
Chloromethylbenzene	0	NA	NA	NA
p-Dichlorobenzene	0	NA	NA	NA
o-Dichlorobenzene	0	NA	NA	NA
1,2,4-Trichlorobenzene	0	NA	NA	NA
Hexachloro-1,3-Butadiene	0	NA	NA	NA

NA = Not applicable

NOTE: Coefficients of variation greater than the program target of 15 percent are presented in bold font.

Table 21-26. VOC Sampling and Analytical Precision: Total 232 Duplicate Samples

Compound	Number of Observations	Average RPD for Replicate Analyses (%)	Average Concentration Difference for Replicate Analyses (ppbv)	Coefficient of Variation (%)
Acetylene	232	10.95	0.66	7.19
Propylene	230	13.56	0.09	10.17
Dichlorodifluoromethane	232	8.61	0.06	6.23
Chloromethane	231	7.51	0.07	5.68
Dichlorotetrafluoroethane	0	NA	NA	NA
Vinyl Chloride	0	NA	NA	NA
1,3-Butadiene	47	15.34	0.07	8.32
Bromomethane	2	2.74	0.38	1.96
Chloroethane	0	NA	NA	NA
Acetonitrile	76	34.32	20.33	**22.38**
Trichlorofluoromethane	230	15.23	0.07	11.52
Acrylonitrile	5	29.02	1.26	**24.00**
1,1-Dichloroethene	0	NA	NA	NA
Methylene Chloride	167	38.71	0.25	**25.92**
Trichlorotrifluoroethane	191	13.76	0.03	8.09
trans-1,2-Dichloroethylene	0	NA	NA	NA
1,1 - Dichloroethane	0	NA	NA	NA
Methyl *tert*-Butyl Ether	60	15.68	0.15	11.05
Methyl Ethyl Ketone (MEK)	107	28.52	0.60	**18.30**
Chloroprene	2	NA	0.14	NA
cis-1,2-Dichloroethylene	2	11.11	0.02	8.32
Bromochloromethane	0	NA	NA	NA
Chloroform	8	16.11	0.10	10.79
Ethyl *tert*-Butyl Ether	0	NA	NA	NA
1,2-Dichloroethane	0	NA	NA	NA
1,1,1-Trichloroethane	18	20.13	0.05	**15.18**
Benzene	232	9.66	0.04	6.47
Carbon Tetrachloride	175	14.50	0.03	9.55
tert-Amyl Methyl Ether	0	NA	NA	NA
1,2-Dichloropropane	0	NA	NA	NA
Ethyl Acrylate	0	NA	NA	NA
Bromodichloromethane	0	NA	NA	NA
Trichloroethylene	3	11.11	0.09	7.44
Methyl Methacrylate	3	13.33	0.23	0.32
cis-1,3-Dichloropropene	0	NA	NA	NA
Methyl Isobutyl Ketone	5	3.99	0.12	2.90
trans-1,3-Dichloropropene	0	NA	NA	NA
1,1,2-Trichloroethane	0	NA	NA	NA

Table 21-26. Continued

Compound	Number of Observations	Average RPD for Replicate Analyses (%)	Average Concentration Difference for Replicate Analyses (ppbv)	Coefficient of Variation (%)
Toluene	232	18.69	0.24	12.37
Dibromochloromethane	0	NA	NA	NA
1,2-Dibromoethane	0	NA	NA	NA
n-Octane	45	19.05	0.22	12.38
Tetrachloroethylene	27	120.32	0.11	**35.31**
Chlorobenzene	2	NA	NA	NA
Ethylbenzene	152	15.92	0.07	11.95
m,p-Xylene	202	13.37	0.14	10.62
Bromoform	0	NA	NA	NA
Styrene	13	4.10	0.09	2.94
1,1,2,2-Tetrachloroethane	0	NA	NA	NA
o-Xylene	149	13.23	0.12	10.50
1,3,5-Trimethylbenzene	49	57.06	2.71	**24.84**
1,2,4-Trimethylbenzene	125	19.93	3.53	**15.15**
m-Dichlorobenzene	0	NA	NA	NA
Chloromethylbenzene	0	NA	NA	NA
p-Dichlorobenzene	10	11.46	0.15	9.23
o-Dichlorobenzene	0	NA	NA	NA
1,2,4-Trichlorobenzene	0	NA	NA	NA
Hexachloro-1,3-Butadiene	0	NA	NA	NA

NA = Not applicable

NOTE: Coefficients of variation greater than the program target of 15 percent are presented in bold font.

Table 21-27. VOC Sampling and Analytical Precision: Total 26 Duplicate Samples from Two Sites in Puerto Rico

Compound	Number of Observations	Average RPD for Replicate Analyses (%)	Average Concentration Difference for Replicate Analyses (ppbv)	Coefficient of Variation (%)
Acetylene	26	8.93	0.20	6.27
Propylene	26	7.77	0.08	5.68
Dichlorodifluoromethane	26	10.19	0.06	7.23
Chloromethane	26	7.30	0.07	5.45
Dichlorotetrafluoroethane	0	NA	NA	NA
Vinyl Chloride	0	NA	NA	NA
1,3-Butadiene	11	19.88	0.05	13.75
Bromomethane	0	NA	NA	NA
Chloroethane	0	NA	NA	NA
Acetonitrile	7	35.28	49.11	**34.77**
Trichlorofluoromethane	26	20.44	0.06	13.04
Acrylonitrile	0	NA	NA	NA
1,1-Dichloroethene	0	NA	NA	NA
Methylene Chloride	24	14.81	0.07	10.00
Trichlorotrifluoroethane	19	11.15	0.02	7.87
trans-1,2-Dichloroethylene	0	NA	NA	NA
1,1 - Dichloroethane	0	NA	NA	NA
Methyl *tert*-Butyl Ether	2	29.51	0.18	**24.48**
Methyl Ethyl Ketone (MEK)	9	25.92	0.60	**21.68**
Chloroprene	0	NA	NA	NA
cis-1,2-Dichloroethylene	0	NA	NA	NA
Bromochloromethane	0	NA	NA	NA
Chloroform	0	NA	NA	NA
Ethyl *tert*-Butyl Ether	0	NA	NA	NA
1,2-Dichloroethane	0	NA	NA	NA
1,1,1-Trichloroethane	1	NA	0.08	NA
Benzene	26	9.36	0.05	6.91
Carbon Tetrachloride	17	26.22	0.05	**15.58**
tert-Amyl Methyl Ether	0	NA	NA	NA
1,2-Dichloropropane	0	NA	NA	NA
Ethyl Acrylate	0	NA	NA	NA
Bromodichloromethane	0	NA	NA	NA
Trichloroethylene	0	NA	NA	NA
Methyl Methacrylate	0	NA	NA	NA
cis-1,3-Dichloropropene	0	NA	NA	NA
Methyl Isobutyl Ketone	2	6.47	0.11	4.73
trans-1,3-Dichloropropene	0	NA	NA	NA
1,1,2-Trichloroethane	0	NA	NA	NA
Toluene	26	10.53	0.25	7.39

Table 21-27. Continued

Compound	Number of Observations	Average RPD for Replicate Analyses (%)	Average Concentration Difference for Replicate Analyses (ppbv)	Coefficient of Variation (%)
Dibromochloromethane	0	NA	NA	NA
1,2-Dibromoethane	0	NA	NA	NA
n-Octane	2	NA	1.10	NA
Tetrachloroethylene	0	NA	NA	NA
Chlorobenzene	0	NA	NA	NA
Ethylbenzene	24	11.66	0.03	8.23
m,p-Xylene	26	7.25	0.06	5.28
Bromoform	0	NA	NA	NA
Styrene	3	5.26	0.08	3.82
1,1,2,2-Tetrachloroethane	0	NA	NA	NA
o-Xylene	25	8.82	0.05	6.63
1,3,5-Trimethylbenzene	12	6.89	0.05	5.08
1,2,4-Trimethylbenzene	24	10.97	0.06	8.33
m-Dichlorobenzene	0	NA	NA	NA
Chloromethylbenzene	0	NA	NA	NA
p-Dichlorobenzene	6	20.83	0.17	**16.97**
o-Dichlorobenzene	0	NA	NA	NA
1,2,4-Trichlorobenzene	0	NA	NA	NA
Hexachloro-1,3-Butadiene	0	NA	NA	NA

NA = Not applicable

NOTE: Coefficients of variation greater than the program target of 15 percent are presented in bold font.

Table 21-28. VOC Sampling and Analytical Precision: Total 12 Duplicate Samples from Cedar Rapids, IA

Compound	Number of Observations	Average RPD for Replicate Analyses (%)	Average Concentration Difference for Replicate Analyses (ppbv)	Coefficient of Variation (%)
Acetylene	12	14.54	0.09	11.00
Propylene	12	25.31	0.09	**17.31**
Dichlorodifluoromethane	12	18.35	0.11	11.85
Chloromethane	12	19.27	0.14	13.93
Dichlorotetrafluoroethane	0	NA	NA	NA
Vinyl Chloride	0	NA	NA	NA
1,3-Butadiene	0	NA	NA	NA
Bromomethane	0	NA	NA	NA
Chloroethane	0	NA	NA	NA
Acetonitrile	0	NA	NA	NA
Trichlorofluoromethane	12	10.72	0.04	8.73
Acrylonitrile	0	NA	NA	NA
1,1-Dichloroethene	0	NA	NA	NA
Methylene Chloride	3	20.00	0.06	12.86
Trichlorotrifluoroethane	10	111.02	0.14	**31.12**
trans-1,2-Dichloroethylene	0	NA	NA	NA
1,1 - Dichloroethane	0	NA	NA	NA
Methyl *tert*-Butyl Ether	0	NA	NA	NA
Methyl Ethyl Ketone (MEK)	6	6.09	0.41	4.54
Chloroprene	0	NA	NA	NA
cis-1,2-Dichloroethylene	0	NA	NA	NA
Bromochloromethane	0	NA	NA	NA
Chloroform	1	NA	0.11	NA
Ethyl *tert*-Butyl Ether	0	NA	NA	NA
1,2-Dichloroethane	0	NA	NA	NA
1,1,1-Trichloroethane	0	NA	NA	NA
Benzene	12	13.58	0.04	9.30
Carbon Tetrachloride	7	20.59	0.04	**16.87**
tert-Amyl Methyl Ether	0	NA	NA	NA
1,2-Dichloropropane	0	NA	NA	NA
Ethyl Acrylate	0	NA	NA	NA
Bromodichloromethane	0	NA	NA	NA
Trichloroethylene	0	NA	NA	NA
Methyl Methacrylate	0	NA	NA	NA
cis-1,3-Dichloropropene	0	NA	NA	NA
Methyl Isobutyl Ketone	0	NA	NA	NA
trans-1,3-Dichloropropene	0	NA	NA	NA
1,1,2-Trichloroethane	0	NA	NA	NA
Toluene	8	5.96	0.02	4.41

Table 21-28. Continued

Compound	Number of Observations	Average RPD for Replicate Analyses (%)	Average Concentration Difference for Replicate Analyses (ppbv)	Coefficient of Variation (%)
Dibromochloromethane	0	NA	NA	NA
1,2-Dibromoethane	0	NA	NA	NA
n-Octane	1	NA	0.11	NA
Tetrachloroethylene	0	NA	NA	NA
Chlorobenzene	0	NA	NA	NA
Ethylbenzene	0	NA	NA	NA
m,p-Xylene	2	17.65	0.03	13.69
Bromoform	0	NA	NA	NA
Styrene	0	NA	NA	NA
1,1,2,2-Tetrachloroethane	0	NA	NA	NA
o-Xylene	0	NA	NA	NA
1,3,5-Trimethylbenzene	0	NA	NA	NA
1,2,4-Trimethylbenzene	0	NA	NA	NA
m-Dichlorobenzene	0	NA	NA	NA
Chloromethylbenzene	0	NA	NA	NA
p-Dichlorobenzene	0	NA	NA	NA
o-Dichlorobenzene	0	NA	NA	NA
1,2,4-Trichlorobenzene	0	NA	NA	NA
Hexachloro-1,3-Butadiene	0	NA	NA	NA

NA = Not applicable

NOTE: Coefficients of variation greater than the program target of 15 percent are presented in bold font.

Table 21-29. VOC Sampling and Analytical Precision: Total 62 Collocated Samples from Two Sites in Detroit Metropolitan Area, Michigan

Compound	Number of Observations	Average RPD for Replicate Analyses (%)	Average Concentration Difference for Replicate Analyses (ppbv)	Coefficient of Variation (%)
Acetylene	62	40.64	0.52	**21.68**
Propylene	62	59.39	0.35	**30.39**
Dichlorodifluoromethane	62	11.95	0.08	10.57
Chloromethane	62	14.61	0.09	11.83
Dichlorotetrafluoroethane	0	NA	NA	NA
Vinyl Chloride	0	NA	NA	NA
1,3-Butadiene	17	8.41	0.09	5.82
Bromomethane	0	NA	NA	NA
Chloroethane	1	NA	0.33	NA
Acetonitrile	21	94.48	5.24	**45.30**
Trichlorofluoromethane	62	15.42	0.05	12.66
Acrylonitrile	2	NA	1.00	NA
1,1-Dichloroethene	0	NA	NA	NA
Methylene Chloride	60	78.99	2.20	**46.22**
Trichlorotrifluoroethane	62	14.40	0.02	12.74
trans-1,2-Dichloroethylene	0	NA	NA	NA
1,1 - Dichloroethane	0	NA	NA	NA
Methyl *tert*-Butyl Ether	1	NA	0.42	NA
Methyl Ethyl Ketone (MEK)	31	32.79	0.47	**19.11**
Chloroprene	0	NA	NA	NA
cis-1,2-Dichloroethylene	0	NA	NA	NA
Bromochloromethane	0	NA	NA	NA
Chloroform	6	14.29	0.04	10.88
Ethyl *tert*-Butyl Ether	0	NA	NA	NA
1,2-Dichloroethane	0	NA	NA	NA
1,1,1-Trichloroethane	7	20.00	0.05	12.86
Benzene	62	40.85	0.20	**21.38**
Carbon Tetrachloride	62	20.48	0.02	**16.72**
tert-Amyl Methyl Ether	0	NA	NA	NA
1,2-Dichloropropane	0	NA	NA	NA
Ethyl Acrylate	0	NA	NA	NA
Bromodichloromethane	0	NA	NA	NA
Trichloroethylene	0	NA	NA	NA
Methyl Methacrylate	0	NA	NA	NA
cis-1,3-Dichloropropene	0	NA	NA	NA
Methyl Isobutyl Ketone	2	NA	0.22	NA
trans-1,3-Dichloropropene	0	NA	NA	NA

Table 21-29. Continued

Compound	Number of Observations	Average RPD for Replicate Analyses (%)	Average Concentration Difference for Replicate Analyses (ppbv)	Coefficient of Variation (%)
1,1,2-Trichloroethane	0	NA	NA	NA
Toluene	62	46.52	0.38	**22.80**
Dibromochloromethane	0	NA	NA	NA
1,2-Dibromoethane	0	NA	NA	NA
n-Octane	10	50.58	0.09	**27.32**
Tetrachloroethylene	22	29.24	0.07	**15.88**
Chlorobenzene	0	NA	NA	NA
Ethylbenzene	46	23.65	0.08	12.80
m,p-Xylene	57	31.95	0.17	**19.44**
Bromoform	0	NA	NA	NA
Styrene	0	NA	NA	NA
1,1,2,2-Tetrachloroethane	0	NA	NA	NA
o-Xylene	42	24.68	0.10	12.65
1,3,5-Trimethylbenzene	16	16.97	0.07	11.64
1,2,4-Trimethylbenzene	44	29.89	0.11	**16.22**
m-Dichlorobenzene	0	NA	NA	NA
Chloromethylbenzene	0	NA	NA	NA
p-Dichlorobenzene	0	NA	NA	NA
o-Dichlorobenzene	0	NA	NA	NA
1,2,4-Trichlorobenzene	0	NA	NA	NA
Hexachloro-1,3-Butadiene	0	NA	NA	NA

NA = Not applicable

NOTE: Coefficients of variation greater than the program target of 15 percent are presented in bold font.

Table 21-30. VOC Sampling and Analytical Precision: Coefficient of Variation for all Duplicate and Collocated Samples

Compound	Average	Arlington, TX (ANTX)	Barceloneta, PR (BAPR)	Beulah, ND (BUND)	Brattleboro, VT (BRVT)	Camden, NJ (CANJ)	Cedar Rapids, IA (C2IA)	Chester, NJ (CHNJ)	Custer, SD (CUSD)	Davenport, IA (DAIA)	Denver, CO (DECO)	Denver, CO (SWCO)
Acetylene	9.55	**14.24**	6.00	12.23	5.90	4.04	11.00	12.07	8.46	2.62	**17.15**	1.12
Propylene	12.07	**25.57**	4.35	**18.41**	7.70	2.77	**17.31**	**28.02**	9.89	5.24	9.46	6.94
Dichlorodifluoromethane	7.22	**35.75**	5.33	5.62	6.26	3.47	11.85	7.56	8.73	4.42	2.79	3.08
Chloromethane	6.90	**42.31**	7.25	4.08	5.86	3.25	13.93	**15.04**	7.72	1.94	3.42	0.83
Dichlorotetrafluoroethane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Vinyl Chloride	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,3-Butadiene	8.73	NA	10.10	NA	NA	6.15	NA	NA	NA	NA	11.45	NA
Bromomethane	1.96	NA	NA	NA	NA	1.96	NA	NA	NA	NA	NA	NA
Chloroethane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Acetonitrile	**27.52**	NA	**56.32**	NA	NA	NA	NA	6.73	NA	NA	NA	5.24
Trichlorofluoromethane	11.67	**40.05**	7.00	**30.54**	8.81	5.50	8.73	9.82	1.19	6.96	4.03	6.33
Acrylonitrile	**24.00**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,1-Dichloroethene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Methylene Chloride	**26.72**	**65.39**	8.59	**70.33**	8.84	**23.58**	12.86	**15.50**	NA	**24.96**	7.22	**32.64**
Trichlorotrifluoroethane	8.99	NA	6.08	3.58	8.80	5.29	**31.12**	**15.87**	NA	NA	3.07	6.73
trans - 1,2 - Dichloroethylene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,1 - Dichloroethane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Methyl *tert*-Butyl Ether	10.47	NA	NA	NA	3.59	5.38	NA	8.00	NA	NA	NA	NA
Methyl Ethyl Ketone	**18.17**	**58.89**	**29.22**	NA	9.11	**23.34**	4.54	**42.65**	**26.25**	NA	8.93	7.16
Chloroprene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table 21-30. Continued

Compound	Average	Arlington, TX (ANTX)	Barceloneta, PR (BAPR)	Beulah, ND (BUND)	Brattleboro, VT (BRVT)	Camden, NJ (CANJ)	Cedar Rapids, IA (C2IA)	Chester, NJ (CHNJ)	Custer, SD (CUSD)	Davenport, IA (DAIA)	Denver, CO (DECO)	Denver, CO (SWCO)
cis-1,2-Dichloroethylene	8.32	NA	NA	NA	NA	NA	NA	NA	NA	8.32	NA	NA
Bromochloromethane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chloroform	10.84	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	14.14
Ethyl *tert*-Butyl Ether	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2 - Dichloroethane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,1,1 - Trichloroethane	12.71	NA	NA	NA	NA	NA	NA	NA	NA	NA	**20.20**	NA
Benzene	8.00	**17.16**	5.67	11.99	5.30	4.14	9.30	7.38	9.27	1.33	3.12	6.66
Carbon Tetrachloride	10.46	NA	14.26	11.02	10.13	5.86	**16.87**	**15.01**	9.88	NA	7.44	**17.68**
tert-Amyl Methyl Ether	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2 - Dichloropropane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ethyl Acrylate	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Bromodichloromethane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Trichloroethylene	7.44	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Methyl Methacrylate	0.32	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
cis -1,3 - Dichloropropene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Methyl Isobutyl Ketone	4.07	NA	NA	NA	NA	NA	NA	NA	NA	NA	1.06	NA
trans - 1,3 - Dichloropropene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,1,2 - Trichloroethane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Toluene	11.44	**17.33**	6.61	**25.02**	8.53	6.11	4.41	10.50	11.09	4.59	3.36	9.51
Dibromochloromethane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table 21-30. Continued

Compound	Average	Arlington, TX (ANTX)	Barceloneta, PR (BAPR)	Beulah, ND (BUND)	Brattleboro, VT (BRVT)	Camden, NJ (CANJ)	Cedar Rapids, IA (C2IA)	Chester, NJ (CHNJ)	Custer, SD (CUSD)	Davenport, IA (DAIA)	Denver, CO (DECO)	Denver, CO (SWCO)
1,2-Dibromoethane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
n-Octane	**17.12**	NA	NA	NA	NA	NA	NA	NA	NA	NA	10.27	NA
Tetrachloroethylene	**31.50**	NA	NA	NA	NA	NA	NA	NA	**102.60**	NA	**22.33**	NA
Chlorobenzene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ethylbenzene	8.75	NA	11.45	NA	5.50	3.98	NA	5.99	NA	NA	4.29	7.40
m,p - Xylene	9.75	**50.70**	5.00	NA	3.84	5.17	13.69	5.33	4.29	NA	2.38	8.80
Bromoform	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Styrene	3.63	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,1,2,2 - Tetrachloroethane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
o - Xylene	7.70	NA	5.35	NA	10.25	6.77	NA	3.35	NA	NA	3.18	3.36
1,3,5-Trimethylbenzene	**19.18**	NA	NA	NA	NA	NA	NA	NA	NA	NA	2.62	NA
1,2,4-Trimethylbenzene	11.56	NA	10.27	NA	11.75	14.81	NA	NA	NA	NA	1.53	6.96
m - Dichlorobenzene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chloromethylbenzene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
p - Dichlorobenzene	9.23	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
o - Dichlorobenzene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,4-Trichlorobenzene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Hexachloro-1,3-Butadiene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Average	11.81	**36.74**	11.70	**19.28**	7.51	7.31	12.97	13.05	**18.12**	6.71	7.11	8.50

Table 21-30. Continued

Compound	Average	Denver, CO (WECO)	Detroit, MI (Allen Park) (APMI)	Detroit, MI (Dearborn) (DEMI)	Elizabeth, NJ (ELNJ)	Grand Junction, CO (G2CO)	Grand Junction, CO (GJCO)	Gulf Port, MS (GPMS)	Jackson, MS (JAMS)	Lincoln, NE (LINE)	Lincoln, NE (LONE)	Nashville, TN (EATN)
Acetylene	9.55	4.88	**16.73**	**26.64**	6.91	6.09	**20.46**	9.99	**25.58**	4.12	**16.31**	**19.59**
Propylene	12.07	10.98	**29.32**	**31.45**	5.55	5.61	13.44	14.19	**20.99**	14.57	11.12	**25.10**
Dichlorodifluoromethane	7.22	4.60	9.52	11.62	7.17	2.17	5.11	8.76	**16.44**	1.09	6.31	11.50
Chloromethane	6.90	5.18	6.17	**17.48**	7.59	2.78	1.84	2.33	7.98	3.52	4.62	11.72
Dichlorotetrafluoroethane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Vinyl Chloride	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,3-Butadiene	8.73	NA	5.45	6.20	3.02	11.72	NA	NA	NA	NA	NA	NA
Bromomethane	1.96	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chloroethane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Acetonitrile	**27.52**	5.31	NA	**45.30**	NA	3.74	6.04	13.49	**20.28**	**17.35**	NA	NA
Trichlorofluoromethane	11.67	1.91	12.00	13.31	6.34	14.72	**37.05**	9.99	**16.85**	4.40	3.62	6.73
Acrylonitrile	**24.00**	NA	NA	NA	NA	NA	NA	NA	NA	**24.00**	NA	NA
1,1-Dichloroethene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Methylene Chloride	**26.72**	**15.08**	**39.96**	**52.49**	5.17	**25.19**	**71.77**	**38.76**	**83.89**	**35.86**	NA	12.86
Trichlorotrifluoroethane	8.99	9.22	12.54	12.94	8.59	2.82	4.16	7.86	7.88	3.72	**22.33**	**18.60**
trans - 1,2 - Dichloroethylene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,1 - Dichloroethane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Methyl *tert*-Butyl Ether	10.47	2.51	NA	NA	3.66	NA	**18.89**	**16.90**	**21.56**	NA	NA	NA
Methyl Ethyl Ketone	**18.17**	**20.32**	12.65	**25.58**	3.74	**27.29**	**23.53**	NA	0.60	**18.93**	NA	9.53
Chloroprene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
cis-1,2-Dichloroethylene	8.32	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table 21-30. Continued

Compound	Average	Denver, CO (WECO)	Detroit, MI (Allen Park) (APMI)	Detroit, MI (Dearborn) (DEMI)	Elizabeth, NJ (ELNJ)	Grand Junction, CO (G2CO)	Grand Junction, CO (GJCO)	Gulf Port, MS (GPMS)	Jackson, MS (JAMS)	Lincoln, NE (LINE)	Lincoln, NE (LONE)	Nashville, TN (EATN)
Bromochloromethane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ethyl *tert*-Butyl Ether	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2 - Dichloroethane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,1,1 - Trichloroethane	12.71	12.86	NA	12.86	NA	NA	NA	NA	NA	NA	NA	NA
Benzene	8.00	3.72	**24.74**	**18.01**	2.72	2.98	**15.59**	3.05	10.65	2.96	3.01	**16.73**
Carbon Tetrachloride	10.46	**17.18**	11.78	**21.66**	5.97	2.37	4.71	7.86	6.84	**15.88**	6.73	**15.59**
tert-Amyl Methyl Ether	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2 - Dichloropropane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ethyl Acrylate	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Bromodichloromethane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Trichloroethylene	7.44	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Methyl Methacrylate	0.32	NA	NA	NA	NA	0.32	NA	NA	NA	NA	NA	NA
cis -1,3 - Dichloropropene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Methyl Isobutyl Ketone	4.07	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	5.05
trans - 1,3 - Dichloropropene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,1,2 - Trichloroethane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Toluene	11.44	4.70	**21.63**	**23.97**	7.88	4.01	10.75	3.94	**22.46**	**18.64**	**19.79**	13.54
Dibromochloromethane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2-Dibromoethane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
n-Octane	**17.12**	**24.01**	12.59	**42.04**	3.63	4.96	NA	NA	NA	NA	NA	**26.52**
Tetrachloroethylene	**31.50**	9.43	13.18	**18.59**	NA	NA	NA	NA	NA	**17.59**	NA	NA

Table 21-30. Continued

Compound	Average	Denver, CO (WECO)	Detroit, MI (Allen Park) (APMI)	Detroit, MI (Dearborn) (DEMI)	Elizabeth, NJ (ELNJ)	Grand Junction, CO (G2CO)	Grand Junction, CO (GJCO)	Gulf Port, MS (GPMS)	Jackson, MS (JAMS)	Lincoln, NE (LINE)	Lincoln, NE (LONE)	Nashville, TN (EATN)
Chlorobenzene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ethylbenzene	8.75	2.56	**15.96**	9.64	9.13	3.64	4.04	5.80	**25.49**	NA	NA	4.41
m,p - Xylene	9.75	3.24	**18.42**	**20.47**	9.20	3.20	11.27	3.36	**28.54**	5.65	NA	11.44
Bromoform	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Styrene	3.63	NA	NA	NA	NA	3.14	NA	NA	NA	NA	NA	6.79
1,1,2,2 - Tetrachloroethane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
o - Xylene	7.70	5.06	**15.10**	10.19	5.79	2.25	NA	10.31	9.08	3.66	NA	11.68
1,3,5-Trimethylbenzene	**19.18**	13.69	11.57	11.70	NA	5.87	NA	NA	**92.81**	2.62	NA	**28.28**
1,2,4-Trimethylbenzene	11.56	9.79	**19.38**	13.05	8.76	4.71	13.47	5.06	13.83	14.27	NA	12.25
m - Dichlorobenzene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chloromethylbenzene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
p - Dichlorobenzene	9.23	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
o - Dichlorobenzene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,4-Trichlorobenzene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Hexachloro-1,3-Butadiene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Average	11.81	8.87	**15.98**	**20.73**	6.16	6.65	**16.38**	10.10	**23.99**	11.60	10.43	14.10

Table 21-30. Continued

Compound	Average	Nashville, TN (LOTN)	New Brunswick, NJ (NBNJ)	Pascagoula, MS (PGMS)	St. Louis, MO (SLMO)	St. Louis, MO (S2MO)	St. Louis, MO (S3MO)	Salt Lake City, UT (SLCU)	San Juan, PR (SJPR)	Sioux Falls, SD (SFSD)	Tupelo, MS (TUMS)
Acetylene	9.55	14.73	4.55	7.16	2.46	1.36	2.40	5.84	6.54	1.63	6.76
Propylene	12.07	4.76	8.83	8.93	5.38	5.30	3.72	5.83	7.00	7.03	11.42
Dichlorodifluoromethane	7.22	7.31	3.94	5.30	7.83	1.12	4.71	4.05	9.13	4.50	3.83
Chloromethane	6.90	NA	4.86	9.16	2.44	3.50	1.17	4.62	3.66	5.47	2.26
Dichlorotetrafluoroethane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Vinyl Chloride	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,3-Butadiene	8.73	NA	NA	NA	NA	NA	NA	7.07	**17.39**	NA	NA
Bromomethane	1.96	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chloroethane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Acetonitrile	**27.52**	**103.45**	**33.06**	**73.32**	**57.67**	NA	NA	**15.68**	13.22	4.65	14.46
Trichlorofluoromethane	11.67	**15.04**	9.26	9.84	**28.61**	1.64	2.50	**15.47**	**19.08**	4.22	11.76
Acrylonitrile	**24.00**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,1-Dichloroethene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Methylene Chloride	**26.72**	NA	4.18	13.34	**22.19**	**27.43**	12.48	11.19	11.42	14.14	7.54
Trichlorotrifluoroethane	8.99	10.10	8.61	11.23	2.74	6.98	NA	2.48	9.67	6.34	2.24
trans - 1,2 - Dichloroethylene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,1 - Dichloroethane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Methyl *tert*-Butyl Ether	10.47	NA	2.60	NA	**18.83**	5.05	NA	NA	**24.48**	NA	4.62
Methyl Ethyl Ketone	**18.17**	10.02	**36.14**	4.49	5.77	7.95	NA	**17.23**	14.13	**33.81**	8.73
Chloroprene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
cis-1,2-Dichloroethylene	8.32	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table 21-30. Continued

Compound	Average	Nashville, TN (LOTN)	New Brunswick, NJ (NBNJ)	Pascagoula, MS (PGMS)	St. Louis, MO (SLMO)	St. Louis, MO (S2MO)	St. Louis, MO (S3MO)	Salt Lake City, UT (SLCU)	San Juan, PR (SJPR)	Sioux Falls, SD (SFSD)	Tupelo, MS (TUMS)
Bromochloromethane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chloroform	10.84	NA	NA	NA	NA	NA	NA	NA	NA	NA	7.44
Ethyl *tert*-Butyl Ether	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2 - Dichloroethane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,1,1 - Trichloroethane	12.71	NA	NA	NA	NA	NA	6.73	NA	NA	10.88	NA
Benzene	8.00	13.30	4.41	7.64	6.76	7.67	3.45	4.39	8.14	8.31	6.46
Carbon Tetrachloride	10.46	**16.97**	9.48	7.06	3.87	5.62	3.72	6.69	**16.90**	8.87	9.88
tert-Amyl Methyl Ether	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2 - Dichloropropane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ethyl Acrylate	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Bromodichloromethane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Trichloroethylene	7.44	NA	NA	NA	NA	7.44	NA	NA	NA	NA	NA
Methyl Methacrylate	0.32	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
cis -1,3 - Dichloropropene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Methyl Isobutyl Ketone	4.07	5.44	NA	NA	NA	NA	NA	NA	4.73	NA	NA
trans - 1,3 - Dichloropropene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,1,2 - Trichloroethane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Toluene	11.44	**15.71**	3.65	**19.12**	9.88	1.12	6.91	**25.42**	8.17	8.74	8.89
Dibromochloromethane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2-Dibromoethane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
n-Octane	**17.12**	NA	NA	NA	NA	NA	NA	12.92	NA	NA	NA
Tetrachloroethylene	**31.50**	NA	NA	NA	**36.82**	NA	NA	NA	NA	NA	NA

Table 21-30. Continued

Compound	Average	Nashville, TN (LOTN)	New Brunswick, NJ (NBNJ)	Pascagoula, MS (PGMS)	St. Louis, MO (SLMO)	St. Louis, MO (S2MO)	St. Louis, MO (S3MO)	Salt Lake City, UT (SLCU)	San Juan, PR (SJPR)	Sioux Falls, SD (SFSD)	Tupelo, MS (TUMS)
Chlorobenzene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ethylbenzene	8.75	12.30	3.18	8.38	8.40	1.81	5.24	**18.82**	5.01	**28.28**	8.04
m,p - Xylene	9.75	NA	9.39	2.75	3.53	1.65	4.25	13.74	5.55	7.76	10.49
Bromoform	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Styrene	3.63	NA	NA	2.60	NA	NA	NA	NA	3.82	1.79	NA
1,1,2,2 - Tetrachloroethane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
o - Xylene	7.70	4.88	7.94	3.87	12.81	13.69	NA	12.46	7.91	NA	8.22
1,3,5-Trimethylbenzene	**19.18**	NA	NA	NA	NA	NA	NA	**17.60**	5.08	NA	NA
1,2,4-Trimethylbenzene	11.56	6.15	NA	3.49	**18.65**	NA	**17.68**	14.14	6.38	NA	**28.01**
m - Dichlorobenzene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chloromethylbenzene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
p - Dichlorobenzene	9.23	NA	NA	NA	NA	1.49	NA	NA	**16.97**	NA	NA
o - Dichlorobenzene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,4-Trichlorobenzene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Hexachloro-1,3-Butadiene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Average	11.81	**17.15**	9.63	11.63	14.15	5.93	5.77	11.35	10.20	9.78	8.95

NA = Not applicable

NOTE: Coefficients of variation greater than the program target of 15 percent are presented in bold font.

Table 21-31. SNMOC Sampling and Analytical Precision: 98 Duplicate Samples

Compound	Number of Observations	Average RPD for Duplicate Analyses (%)	Average Concentration Difference for Duplicate Analyses (ppbv)	Coefficient of Variation (%)
Ethylene	98	12.02	0.30	7.62
Acetylene	98	9.69	0.14	5.39
Ethane	98	8.13	0.49	5.56
Propylene	98	16.04	0.23	10.43
Propane	98	11.09	1.01	7.97
Propyne	0	NA	NA	NA
Isobutane	98	34.95	0.77	13.86
Isobutene/1-Butene	98	24.74	0.32	**15.13**
1,3-Butadiene	37	9.45	0.07	6.38
n-Butane	98	15.04	0.62	8.40
trans-2-Butene	87	14.12	0.08	7.90
cis-2-Butene	88	16.15	0.12	9.01
3-Methyl-1-butene	6	5.45	0.28	3.74
Isopentane	90	28.69	1.54	**15.63**
1-Pentene	74	31.05	0.29	**16.91**
2-Methyl-1-butene	54	19.31	0.13	10.75
n-Pentane	98	35.86	1.90	**21.13**
Isoprene	95	33.53	0.38	**17.32**
trans-2-Pentene	94	23.64	0.12	11.90
cis-2-Pentene	92	11.21	0.08	6.61
2-Methyl-2-butene	60	18.29	0.21	12.20
2,2-Dimethylbutane	94	11.85	0.15	7.10
Cyclopentene	20	20.91	0.33	**16.42**
4-Methyl-1-pentene	1	NA	0.38	NA
Cyclopentane	95	25.26	0.20	**18.03**
2,3-Dimethylbutane	97	16.94	0.20	8.58
2-Methylpentane	98	18.56	0.33	11.82
3-Methylpentane	98	28.11	0.35	**15.71**
2-Methyl-1-pentene	17	15.75	0.27	10.36
1-Hexene	95	28.66	0.19	**15.52**
2-Ethyl-1-butene	0	NA	NA	NA
n-Hexane	98	23.87	0.49	**15.84**
trans-2-Hexene	5	39.62	0.52	**23.38**
cis-2-Hexene	4	10.80	1.03	8.07
Methylcyclopentane	97	16.41	0.22	11.71
2,4-Dimethylpentane	94	11.98	0.12	7.34
Benzene	98	8.47	0.19	5.68
Cyclohexane	96	32.22	0.63	**22.65**

Table 21-31. Continued

Compound	Number of Observations	Average RPD for Duplicate Analyses (%)	Average Concentration Difference for Duplicate Analyses (ppbv)	Coefficient of Variation (%)
2-Methylhexane	91	31.46	0.29	**16.49**
2,3-Dimethylpentane	93	18.55	0.27	11.46
3-Methylhexane	95	29.43	0.41	**23.55**
1-Heptene	26	19.66	0.39	14.79
2,2,4-Trimethylpentane	98	22.44	0.29	12.04
n-Heptane	94	19.18	0.19	12.77
Methylcyclohexane	95	25.79	0.24	12.83
2,2,3-Trimethylpentane	40	29.19	0.21	14.93
2,3,4-Trimethylpentane	94	23.64	0.16	**15.24**
Toluene	94	30.41	2.37	**18.83**
2-Methylheptane	86	24.94	0.27	11.06
3-Methylheptane	93	37.10	0.25	**17.18**
1-Octene	17	60.36	0.35	**30.35**
n-Octane	97	40.98	0.47	**16.31**
Ethylbenzene	91	19.71	0.20	12.20
m-Xylene/p-Xylene	93	18.33	0.51	11.91
Styrene	80	48.03	0.41	**27.55**
o-Xylene	92	25.17	0.37	**17.30**
1-Nonene	10	7.71	0.34	5.22
n-Nonane	94	42.45	0.29	**17.98**
Isopropylbenzene	57	24.65	0.26	14.63
a-Pinene	36	80.95	1.12	**37.25**
n-Propylbenzene	53	42.05	0.30	**19.73**
m-Ethyltoluene	91	29.93	0.27	14.90
p-Ethyltoluene	62	51.87	0.38	**20.32**
1,3,5-Trimethylbenzene	76	53.73	0.29	**20.05**
o-Ethyltoluene	44	71.29	0.50	**28.67**
b-Pinene	24	38.76	1.27	**35.26**
1,2,4-Trimethylbenzene	92	40.54	0.49	**20.14**
1-Decene	0	NA	NA	NA
n-Decane	92	86.46	1.45	**39.73**
1,2,3-Trimethylbenzene	78	47.57	0.25	**25.68**
m-Diethylbenzene	34	37.71	0.35	**25.17**
p-Diethylbenzene	44	24.41	0.20	**17.79**
1-Undecene	6	39.13	0.55	**23.14**
n-Undecane	94	111.31	3.09	**41.17**
1-Dodecene	3	NA	1.11	NA
n-Dodecane	62	122.23	3.07	**43.03**
1-Tridecene	2	NA	1.11	NA
n-Tridecane	20	109.71	2.29	**56.54**

Table 21-31. Continued

Compound	Number of Observations	Average RPD for Duplicate Analyses (%)	Average Concentration Difference for Duplicate Analyses (ppbv)	Coefficient of Variation (%)
TNMOC (speciated)	92	22.42	22.41	13.28
TNMOC (w/ unknowns)	92	29.79	59.32	**18.00**

NA = Not applicable

NOTE: Coefficients of variation greater than the program target of 15 percent are presented in bold font.

Table 21-32. SNMOC Sampling and Analytical Precision: 22 Duplicate Samples in Puerto Rico

Compound	Number of Observations	Average RPD for Duplicate Analyses (%)	Average Concentration Difference for Duplicate Analyses (ppbv)	Coefficient of Variation (%)
Ethylene	22	6.94	0.32	4.89
Acetylene	22	3.59	0.16	2.55
Ethane	22	7.38	0.23	4.91
Propylene	22	9.97	0.32	7.36
Propane	22	3.44	1.06	2.38
Propyne	0	NA	NA	NA
Isobutane	22	7.03	0.56	5.06
Isobutene/1-Butene	22	9.24	0.22	6.40
1,3-Butadiene	16	9.38	0.04	6.23
n-Butane	22	5.17	0.36	3.82
trans-2-Butene	22	9.39	0.11	6.16
cis-2-Butene	22	13.51	0.16	8.66
3-Methyl-1-butene	1	NA	0.46	NA
Isopentane	20	7.22	1.16	5.12
1-Pentene	22	27.46	0.23	**18.63**
2-Methyl-1-butene	16	10.26	0.06	7.50
n-Pentane	22	10.01	0.64	6.71
Isoprene	22	8.78	0.66	6.42
trans-2-Pentene	22	5.10	0.11	3.49
cis-2-Pentene	22	8.87	0.09	5.27
2-Methyl-2-butene	19	11.20	0.15	8.70
2,2-Dimethylbutane	22	10.71	0.23	6.57
Cyclopentene	7	13.99	0.30	11.28
4-Methyl-1-pentene	0	NA	NA	NA
Cyclopentane	22	12.51	0.13	8.64
2,3-Dimethylbutane	22	17.96	0.34	8.63
2-Methylpentane	22	10.97	0.48	7.68
3-Methylpentane	22	12.86	0.38	8.93
2-Methyl-1-pentene	10	22.18	0.08	14.44
1-Hexene	22	27.53	0.22	**15.23**
2-Ethyl-1-butene	0	NA	NA	NA
n-Hexane	22	8.93	0.43	6.16
trans-2-Hexene	2	NA	0.75	NA
cis-2-Hexene	3	10.80	1.06	8.07
Methylcyclopentane	22	11.09	0.22	8.13
2,4-Dimethylpentane	22	20.39	0.17	10.69
Benzene	22	7.60	0.24	5.31
Cyclohexane	22	25.31	1.03	**17.90**

Table 21-32. Continued

Compound	Number of Observations	Average RPD for Duplicate Analyses (%)	Average Concentration Difference for Duplicate Analyses (ppbv)	Coefficient of Variation (%)
2-Methylhexane	22	11.11	0.31	7.65
2,3-Dimethylpentane	22	20.27	0.30	11.89
3-Methylhexane	21	10.24	0.42	7.55
1-Heptene	16	22.78	0.20	**15.21**
2,2,4-Trimethylpentane	22	18.45	0.30	11.88
n-Heptane	22	9.67	0.25	5.96
Methylcyclohexane	22	46.80	0.65	**17.62**
2,2,3-Trimethylpentane	15	52.79	0.22	**22.70**
2,3,4-Trimethylpentane	22	22.57	0.15	12.55
Toluene	22	10.46	1.81	6.68
2-Methylheptane	22	72.52	0.65	**18.98**
3-Methylheptane	22	65.70	0.62	**18.20**
1-Octene	4	NA	0.39	NA
n-Octane	22	108.77	1.65	**18.36**
Ethylbenzene	22	10.19	0.21	7.24
m-Xylene/p-Xylene	22	4.98	0.44	3.74
Styrene	22	46.80	0.77	**31.36**
o-Xylene	22	10.03	0.24	6.42
1-Nonene	2	NA	0.43	NA
n-Nonane	22	76.15	0.66	**16.48**
Isopropylbenzene	22	43.58	0.33	**22.46**
a-Pinene	9	20.71	0.46	**17.70**
n-Propylbenzene	22	13.94	0.09	9.63
m-Ethyltoluene	22	10.26	0.19	7.01
p-Ethyltoluene	22	12.20	0.12	8.37
1,3,5-Trimethylbenzene	22	15.30	0.16	9.98
o-Ethyltoluene	12	17.47	0.36	12.58
b-Pinene	8	43.27	1.21	**37.97**
1,2,4-Trimethylbenzene	22	14.06	0.37	10.37
1-Decene	0	NA	NA	NA
n-Decane	22	78.06	1.13	**31.59**
1,2,3-Trimethylbenzene	22	20.83	0.17	**16.66**
m-Diethylbenzene	7	14.19	0.29	11.52
p-Diethylbenzene	6	13.39	0.31	10.72
1-Undecene	0	NA	NA	NA
n-Undecane	22	94.16	2.68	**44.86**
1-Dodecene	3	NA	1.11	NA
n-Dodecane	20	90.67	3.72	**44.04**
1-Tridecene	2	NA	1.11	NA
n-Tridecane	14	73.87	3.23	**41.71**

Table 21-32. Continued

Compound	Number of Observations	Average RPD for Duplicate Analyses (%)	Average Concentration Difference for Duplicate Analyses (ppbv)	Coefficient of Variation (%)
TNMOC (speciated)	22	11.03	20.92	7.77
TNMOC (w/ unknowns)	22	51.15	121.17	**25.36**

NA = Not applicable
NOTE: Coefficients of variation greater than the program target of 15 percent are presented in bold font.

Table 21-33. SNMOC Sampling and Analytical Precision: 14 Duplicate Samples in Cedar Rapids, IA

Compound	Number of Observations	Average RPD for Duplicate Analyses (%)	Average Concentration Difference for Duplicate Analyses (ppbv)	Coefficient of Variation (%)
Ethylene	14	21.01	0.49	12.76
Acetylene	14	20.86	0.27	11.44
Ethane	14	11.75	0.62	7.62
Propylene	14	21.76	0.25	12.87
Propane	14	14.59	0.77	9.16
Propyne	0	NA	NA	NA
Isobutane	14	113.34	1.55	**24.57**
Isobutene/1-Butene	14	40.67	0.43	**21.59**
1,3-Butadiene	2	1.13	0.00	0.80
n-Butane	14	28.93	0.98	**15.00**
trans-2-Butene	10	57.01	0.12	**19.51**
cis-2-Butene	10	55.46	0.17	**20.12**
3-Methyl-1-butene	0	NA	NA	NA
Isopentane	10	39.21	2.00	**17.10**
1-Pentene	10	52.11	0.20	**24.66**
2-Methyl-1-butene	7	39.96	0.13	**22.03**
n-Pentane	14	8.84	0.32	6.07
Isoprene	10	33.05	0.68	**18.63**
trans-2-Pentene	11	43.21	0.14	**17.58**
cis-2-Pentene	11	40.05	0.15	**17.62**
2-Methyl-2-butene	8	74.95	0.42	**36.83**
2,2-Dimethylbutane	12	5.43	0.04	3.83
Cyclopentene	1	NA	0.21	NA
4-Methyl-1-pentene	0	NA	NA	NA
Cyclopentane	12	10.94	0.06	6.92
2,3-Dimethylbutane	14	19.02	0.17	11.20
2-Methylpentane	14	19.95	0.43	13.50
3-Methylpentane	14	52.27	0.83	**25.78**
2-Methyl-1-pentene	1	NA	0.63	NA
1-Hexene	12	16.79	0.17	10.86
2-Ethyl-1-butene	0	NA	NA	NA
n-Hexane	14	27.71	0.34	**23.73**
trans-2-Hexene	0	NA	NA	NA
cis-2-Hexene	0	NA	NA	NA
Methylcyclopentane	13	23.69	0.18	13.72
2,4-Dimethylpentane	12	24.58	0.16	12.79

Table 21-33. Continued

Compound	Number of Observations	Average RPD for Duplicate Analyses (%)	Average Concentration Difference for Duplicate Analyses (ppbv)	Coefficient of Variation (%)
Benzene	14	14.87	0.23	9.74
Cyclohexane	13	34.13	0.21	**15.21**
2-Methylhexane	11	25.05	0.45	**23.77**
2,3-Dimethylpentane	12	31.67	0.36	**26.42**
3-Methylhexane	13	31.25	0.62	**28.26**
1-Heptene	4	14.76	0.19	11.27
2,2,4-Trimethylpentane	14	15.52	0.14	10.99
n-Heptane	10	18.15	0.10	11.47
Methylcyclohexane	12	17.96	0.19	13.63
2,2,3-Trimethylpentane	3	NA	0.66	NA
2,3,4-Trimethylpentane	12	31.49	0.13	**18.06**
Toluene	10	58.33	1.82	**23.32**
2-Methylheptane	10	18.39	0.08	10.81
3-Methylheptane	11	47.47	0.26	**25.92**
1-Octene	4	95.39	0.31	**45.67**
n-Octane	12	28.70	0.17	**16.91**
Ethylbenzene	8	67.29	0.39	**32.79**
m-Xylene/p-Xylene	10	64.95	0.97	**34.86**
Styrene	6	132.60	0.37	**48.79**
o-Xylene	9	23.36	0.18	**15.34**
1-Nonene	3	NA	0.33	NA
n-Nonane	12	30.49	0.17	**16.60**
Isopropylbenzene	6	19.99	0.08	12.08
a-Pinene	4	378.67	1.75	**92.54**
n-Propylbenzene	7	76.17	0.29	**31.65**
m-Ethyltoluene	8	131.38	0.80	**34.69**
p-Ethyltoluene	8	79.04	0.38	**24.19**
1,3,5-Trimethylbenzene	5	256.47	0.86	**63.72**
o-Ethyltoluene	6	169.18	0.57	**45.42**
b-Pinene	3	13.74	4.24	10.43
1,2,4-Trimethylbenzene	9	144.57	1.14	**33.39**
1-Decene	0	NA	NA	NA
n-Decane	11	284.56	4.15	**58.43**
1,2,3-Trimethylbenzene	5	89.72	0.36	**34.21**
m-Diethylbenzene	5	69.00	0.16	**36.21**
p-Diethylbenzene	2	NA	0.35	NA
1-Undecene	0	NA	NA	NA
n-Undecane	13	528.39	6.07	**35.86**
1-Dodecene	1	NA	0.58	NA
n-Dodecane	10	576.33	6.53	**47.66**

Table 21-33. Continued

Compound	**Number of Observations**	**Average RPD for Duplicate Analyses (%)**	**Average Concentration Difference for Duplicate Analyses (ppbv)**	**Coefficient of Variation (%)**
1-Tridecene	2	NA	0.47	NA
n-Tridecane	7	10.69	0.73	7.50
TNMOC (speciated)	10	47.75	34.75	**18.42**
TNMOC (w/ unknowns)	10	34.44	39.20	**15.96**

NA = Not applicable

NOTE: Coefficients of variation greater than the program target of 15 percent are presented in bold font.

Table 21-34. SNMOC Sampling and Analytical Precision Coefficient of Variation for all Duplicate Samples

Compound	Average	Barceloneta, PR (BAPR)	Beulah, ND (BUND)	Cedar Rapids, IA (C2IA)	Custer, SD (CUSD)	Davenport, IA (DAIA)	St. Louis, MO (SLMO)	Salt Lake City, UT (SLCU)	San Juan, PR (SJPR)	Sioux Falls, SD (SFSD)
Ethylene	7.78	5.44	11.73	12.76	13.78	6.19	1.95	3.83	4.33	9.97
Acetylene	5.81	2.35	**19.35**	11.44	1.49	5.27	1.33	4.34	2.74	3.95
Ethane	4.38	3.22	5.24	7.62	2.22	2.40	1.97	3.40	6.61	6.78
Propylene	9.42	4.99	14.51	12.87	9.06	12.15	3.60	4.31	9.73	13.58
Propane	6.43	1.04	9.88	9.16	1.71	3.66	12.54	3.43	3.72	12.69
Propyne	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Isobutane	10.70	4.84	**26.03**	**24.57**	3.63	4.61	2.53	**18.14**	5.28	6.63
Isobutene/1-Butene	14.87	6.43	**16.57**	**21.59**	**21.48**	**28.06**	8.54	8.14	6.37	**16.63**
1,3-Butadiene	6.38	5.75	NA	0.80	NA	NA	6.57	12.10	6.70	NA
n-Butane	7.45	5.64	**16.28**	**15.00**	2.89	5.67	2.55	8.64	2.01	8.34
trans-2-Butene	7.32	6.19	6.78	**19.51**	4.62	1.99	6.33	6.77	6.13	7.60
cis-2-Butene	9.08	7.59	4.49	**20.12**	14.13	5.71	4.61	9.36	9.74	5.95
3-Methyl-1-butene	3.74	NA	NA	NA	NA	NA	NA	3.74	NA	NA
Isopentane	11.61	5.05	**29.23**	**17.10**	11.37	12.26	2.41	**17.88**	5.20	3.93
1-Pentene	**17.21**	**18.37**	7.42	**24.66**	**16.22**	**27.45**	6.73	**22.25**	**18.89**	12.84
trans-2-Pentene	11.76	2.58	13.63	**17.58**	14.30	4.91	3.42	13.18	4.40	**31.84**
cis-2-Pentene	6.78	2.13	5.40	**17.62**	6.19	2.62	5.28	8.85	8.40	4.49
2-Methyl-2-butene	12.20	8.67	NA	**28.05**	11.62	NA	4.64	12.44	8.72	11.29

Table 21-34. Continued

Compound	Average	Barceloneta, PR (BAPR)	Beulah, ND (BUND)	Cedar Rapids, IA (C2IA)	Custer, SD (CUSD)	Davenport, IA (DAIA)	St. Louis, MO (SLMO)	Salt Lake City, UT (SLCU)	San Juan, PR (SJPR)	Sioux Falls, SD (SFSD)
2,2-Dimethylbutane	7.65	4.22	7.96	3.83	**20.41**	1.71	4.96	10.98	8.93	5.84
Cyclopentene	**16.42**	**21.29**	**29.95**	NA	NA	NA	NA	13.18	1.27	NA
4-Methyl-1-pentene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cyclopentane	11.65	6.85	**16.08**	6.92	7.58	10.90	12.22	11.37	10.43	**22.46**
2,3-Dimethylbutane	8.93	2.47	4.62	11.20	7.39	3.83	5.23	12.10	14.79	**18.71**
2-Methylpentane	10.64	7.93	**22.42**	13.50	5.86	**18.08**	4.58	5.01	7.44	10.89
3-Methylpentane	**15.12**	8.91	**22.22**	**25.78**	**23.30**	**17.57**	11.96	5.24	8.96	12.17
2-Methyl-1-pentene	10.36	**18.11**	NA	NA	NA	NA	NA	6.87	10.76	5.71
1-Hexene	**16.47**	7.04	**22.49**	10.86	**18.85**	**18.82**	10.41	8.61	**23.42**	**27.71**
2-Ethyl-1-butene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
n-Hexane	11.31	4.75	**18.89**	**23.73**	7.42	**15.04**	4.02	11.19	7.57	9.20
trans-2-Hexene	**23.38**	NA	NA	NA	NA	NA	NA	**23.38**	NA	NA
cis-2-Hexene	8.07	NA	NA	NA	NA	NA	NA	NA	8.07	NA
Cyclohexane	**18.86**	**20.59**	14.36	**15.21**	14.63	**40.07**	10.42	**15.58**	**15.20**	**23.66**
2-Methylhexane	**15.70**	6.05	**18.32**	**23.77**	**18.38**	**42.82**	4.43	7.51	9.25	10.75
2,3-Dimethylpentane	11.77	10.05	14.41	**18.94**	**17.01**	3.62	4.59	6.08	13.74	**17.45**
1-Heptene	10.86	13.57	NA	11.27	NA	NA	NA	1.74	**16.84**	NA
2,2,4-Trimethylpentane	12.62	13.09	**16.63**	10.99	**21.24**	13.68	4.88	3.39	10.68	**19.01**

Table 21-34. Continued

Compound	**Average**	**Barceloneta, PR (BAPR)**	**Beulah, ND (BUND)**	**Cedar Rapids, IA (C2IA)**	**Custer, SD (CUSD)**	**Davenport, IA (DAIA)**	**St. Louis, MO (SLMO)**	**Salt Lake City, UT (SLCU)**	**San Juan, PR (SJPR)**	**Sioux Falls, SD (SFSD)**
n-Heptane	9.42	3.87	**19.97**	11.47	10.77	5.14	4.56	5.78	8.06	**15.15**
Methylcyclohexane	12.56	9.14	**19.36**	13.63	5.62	7.84	5.37	8.11	**26.11**	**17.90**
2,2,3-Trimethylpentane	14.93	**17.27**	NA	NA	NA	13.23	5.99	8.60	**28.14**	**16.37**
2,3,4-Trimethylpentane	10.96	8.47	11.31	**15.56**	13.66	5.07	3.21	4.10	**16.62**	**20.61**
Toluene	12.58	3.46	**31.41**	**23.32**	9.61	2.34	5.88	**20.86**	9.89	6.42
2-Methylheptane	12.21	10.99	**17.14**	10.81	8.72	1.04	8.18	12.24	**26.98**	13.83
3-Methylheptane	**17.77**	11.14	12.53	**25.92**	**31.18**	14.86	10.19	8.58	**25.26**	**20.23**
1-Octene	**48.71**	NA	NA	NA	NA	NA	NA	**48.71**	NA	NA
n-Octane	14.57	9.66	12.36	**16.91**	7.81	2.97	6.32	**23.68**	**27.05**	**24.36**
Ethylbenzene	13.39	7.11	13.52	**32.79**	**16.25**	9.49	4.69	**15.68**	7.36	13.59
m-Xylene/p-Xylene	12.53	2.11	**16.72**	**34.86**	**18.78**	5.50	2.49	11.89	5.37	**15.01**
n-Nonane	**17.21**	10.29	10.76	**16.60**	12.29	11.56	**18.26**	**24.92**	**22.67**	**27.54**
Isopropylbenzene	14.27	**25.40**	4.04	**26.74**	**17.60**	NA	9.02	2.88	**19.52**	8.96
a-Pinene	**29.09**	NA	**16.83**	**92.54**	3.45	NA	12.82	**56.65**	**17.70**	3.65
n-Propylbenzene	**20.73**	8.78	NA	**68.25**	NA	NA	10.36	**18.77**	10.47	7.74
m-Ethyltoluene	**15.12**	8.71	**19.26**	**34.69**	**17.74**	12.51	9.73	**18.18**	5.32	9.98
p-Ethyltoluene	**20.79**	7.19	NA	**84.85**	13.74	NA	11.23	**17.79**	9.55	1.19
1,3,5-Trimethylbenzene	**20.44**	9.00	6.99	**63.72**	13.55	5.58	12.27	**19.97**	10.97	**41.88**

Table 21-34. Continued

Compound	Average	Barceloneta, PR (BAPR)	Beulah, ND (BUND)	Cedar Rapids, IA (C2IA)	Custer, SD (CUSD)	Davenport, IA (DAIA)	St. Louis, MO (SLMO)	Salt Lake City, UT (SLCU)	San Juan, PR (SJPR)	Sioux Falls, SD (SFSD)
o-Ethyltoluene	**28.67**	13.36	14.81	**88.56**	**34.86**	NA	NA	7.54	11.80	**29.78**
b-Pinene	**35.26**	**17.33**	10.51	10.43	**89.84**	NA	**43.44**	**16.66**	**58.61**	NA
1,2,4-Trimethylbenzene	**21.04**	10.27	**19.24**	**33.39**	**28.30**	**26.96**	10.31	**22.65**	10.46	**27.76**
1-Decene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
n-Decane	**34.42**	**23.13**	**46.57**	**58.43**	**41.49**	**31.82**	**29.26**	**28.57**	**40.05**	10.44
1,2,3-Trimethylbenzene	**24.55**	**21.31**	**40.94**	**34.21**	10.32	**26.08**	**22.66**	**33.99**	12.00	**19.42**
m-Diethylbenzene	**20.03**	0.99	NA	NA	NA	**37.07**	3.35	**36.66**	**22.05**	NA
p-Diethylbenzene	14.01	NA	4.19	10.39	7.62	**25.79**	NA	14.64	10.72	**24.70**
1-Undecene	**23.14**	NA	NA	NA	NA	NA	**23.14**	NA	NA	NA
n-Undecane	**34.79**	**47.90**	**28.38**	**35.86**	**60.70**	**35.73**	**18.55**	**26.09**	**41.82**	**18.08**
TNMOC (speciated)	10.27	7.88	**17.95**	**18.42**	9.92	3.54	1.83	11.51	7.66	13.76
TNMOC (w/ unknowns)	**15.88**	**37.23**	13.32	**15.96**	**25.70**	9.35	4.41	14.06	13.48	9.41
Average	**15.75**	11.12	**17.11**	**23.90**	**17.10**	13.85	8.62	**15.05**	14.02	**15.06**

NA = Not applicable

NOTE: Coefficients of variation greater than the program target of 15 percent are presented in bold font.

Table 21-35. Carbonyl Compound Sampling and Analytical Precision: 352 Replicate Samples for all Duplicate and Collocated Samples

Compound	Number of Observations	Average RPD for Duplicate Analyses (%)	Average Concentration Difference for Duplicate Analyses (ppbv)	Coefficient of Variation (%)
Formaldehyde	350	48.67	0.53	11.90
Acetaldehyde	352	52.40	0.13	11.70
Acetone	352	62.73	0.22	**15.79**
Propionaldehyde	339	25.00	0.03	13.32
Crotonaldehyde	155	18.52	0.01	12.81
Butyr/Isobutyraldehyde	349	24.74	0.02	10.65
Benzaldehyde	351	33.67	0.01	**15.96**
Isovaleraldehyde	31	44.92	0.01	**23.48**
Valeraldehyde	342	34.56	0.01	14.36
Tolualdehydes	346	28.41	0.01	**16.72**
Hexaldehyde	348	37.88	0.02	**18.88**
2,5-Dimethylbenzaldehyde	22	120.00	0.02	**60.94**

NA = Not applicable

NOTE: Coefficients of variation greater than the program target of 15 percent are presented in bold font.

Table 21-36. Carbonyl Compound Sampling and Analytical Precision: 48 Replicate Samples for all Collocated Samples

Compound	**Number of Observations**	**Average RPD for Collocated Analyses (%)**	**Average Concentration Difference for Collocated Analyses (ppbv)**	**Coefficient of Variation (%)**
Formaldehyde	46	80.49	0.59	**17.11**
Acetaldehyde	48	92.14	0.16	**15.90**
Acetone	48	102.52	0.34	**22.47**
Propionaldehyde	42	34.93	0.05	**18.51**
Crotonaldehyde	35	17.29	0.004	11.44
Butyr/Isobutyraldehyde	48	24.62	0.02	11.31
Benzaldehyde	48	46.22	0.01	**19.75**
Isovaleraldehyde	7	28.59	0.01	**23.58**
Valeraldehyde	42	48.92	0.01	**16.00**
Tolualdehydes	46	31.65	0.01	**18.63**
Hexaldehyde	48	46.43	0.02	**20.94**
2,5-Dimethylbenzaldehyde	6	189.23	0.02	**68.75**

NA = Not applicable

NOTE: Coefficients of variation greater than the program target of 15 percent are presented in bold font.

Table 21-37. Carbonyl Sampling and Analytical Precision: 304 Duplicate Samples

Compound	Number of Observations	Average RPD for Duplicate Analyses (%)	Average Concentration Difference for Duplicate Analyses (ppbv)	Coefficient of Variation (%)
Formaldehyde	304	16.84	0.48	6.69
Acetaldehyde	304	12.66	0.11	7.51
Acetone	304	22.93	0.10	9.10
Propionaldehyde	297	15.06	0.01	8.14
Crotonaldehyde	120	19.76	0.01	14.19
Butyr/Isobutyraldehyde	301	24.86	0.02	9.99
Benzaldehyde	303	21.12	0.01	12.17
Isovaleraldehyde	24	61.25	0.01	**23.37**
Valeraldehyde	300	20.20	0.01	12.71
Tolualdehydes	300	25.17	0.01	14.82
Hexaldehyde	300	29.33	0.02	**16.82**
2,5-Dimethylbenzaldehyde	16	50.77	0.02	**53.12**

NA = Not applicable

NOTE: Coefficients of variation greater than the program target of 15 percent are presented in bold font.

Table 21-38. Carbonyl Sampling and Analytical Precision: 26 Duplicate Samples in Puerto Rico

Compound	Number of Observations	Average RPD for Duplicate Analyses (%)	Average Concentration Difference for Duplicate Analyses (ppbv)	Coefficient of Variation (%)
Formaldehyde	26	47.53	0.67	14.19
Acetaldehyde	26	33.11	0.32	**16.48**
Acetone	26	21.92	0.09	**15.61**
Propionaldehyde	25	40.52	0.04	10.40
Crotonaldehyde	4	12.00	0.01	8.00
Butyr/Isobutyraldehyde	26	32.60	0.03	**17.10**
Benzaldehyde	26	44.98	0.02	**19.48**
Isovaleraldehyde	10	211.23	0.01	**51.70**
Valeraldehyde	25	34.82	0.01	**15.36**
Tolualdehydes	25	44.60	0.01	**16.88**
Hexaldehyde	25	56.79	0.01	**17.21**
2,5-Dimethylbenzaldehyde	2	NA	0.01	NA

NA = Not applicable

NOTE: Coefficients of variation greater than the program target of 15 percent are presented in bold font.

Table 21-39. Carbonyl Sampling and Analytical Precision: 26 Duplicate Samples in Grand Junction, CO

Compound	Number of Observations	Average RPD for Duplicate Analyses (%)	Average Concentration Difference for Duplicate Analyses (ppbv)	Coefficient of Variation (%)
Formaldehyde	26	3.50	0.11	2.48
Acetaldehyde	26	3.12	0.02	2.19
Acetone	26	4.79	0.10	3.48
Propionaldehyde	26	6.20	0.004	4.63
Crotonaldehyde	22	17.53	0.01	10.08
Butyr/Isobutyraldehyde	26	5.66	0.01	3.79
Benzaldehyde	26	6.09	0.003	4.39
Isovaleraldehyde	0	NA	NA	NA
Valeraldehyde	26	5.46	0.002	3.85
Tolualdehydes	26	12.67	0.01	9.49
Hexaldehyde	26	9.68	0.01	7.20
2,5-Dimethylbenzaldehyde	2	75.18	0.01	**85.18**

NA = Not applicable

NOTE: Coefficients of variation greater than the program target of 15 percent are presented in bold font.

Table 21-40. Carbonyl Sampling and Analytical Precision: 14 Duplicate Samples in Cedar Rapids, IA

Compound	**Number of Observations**	**Average RPD for Duplicate Analyses (%)**	**Average Concentration Difference for Duplicate Analyses (ppbv)**	**Coefficient of Variation (%)**
Formaldehyde	14	11.91	0.18	8.38
Acetaldehyde	14	11.34	0.13	8.23
Acetone	14	9.80	0.13	7.21
Propionaldehyde	12	23.11	0.02	**15.21**
Crotonaldehyde	1	NA	0.01	NA
Butyr/Isobutyraldehyde	14	14.97	0.02	11.53
Benzaldehyde	14	22.63	0.004	**16.77**
Isovaleraldehyde	1	NA	0.02	NA
Valeraldehyde	13	18.38	0.004	13.90
Tolualdehydes	14	19.96	0.01	14.80
Hexaldehyde	14	25.36	0.01	**19.05**
2,5-Dimethylbenzaldehyde	0	NA	NA	NA

NA = Not applicable

NOTE: Coefficients of variation greater than the program target of 15 percent are presented in bold font.

Table 21-41. Carbonyl Sampling and Analytical Precision: 42 Replicate Samples for all Collocated Samples in Michigan

Compound	Number of Observations	Average RPD for Collocated Analyses (%)	Average Concentration Difference for Collocated Analyses (ppbv)	Coefficient of Variation (%)
Formaldehyde	40	237.32	1.56	**48.37**
Acetaldehyde	42	272.52	0.41	**44.95**
Acetone	42	266.87	0.49	**41.59**
Propionaldehyde	36	73.52	0.08	**35.34**
Crotonaldehyde	29	28.04	0.01	**18.50**
Butyr/Isobutyraldehyde	42	68.07	0.06	**29.91**
Benzaldehyde	42	108.19	0.01	**35.07**
Isovaleraldehyde	7	28.59	0.01	**23.58**
Valeraldehyde	36	136.64	0.03	**41.03**
Tolualdehydes	40	53.67	0.02	**32.49**
Hexaldehyde	42	91.28	0.02	**31.00**
2,5-Dimethylbenzaldehyde	5	189.23	0.01	**68.75**

NA = Not applicable

NOTE: Coefficients of variation greater than the program target of 15 percent are presented in bold font.

Table 21-42. Carbonyl Sampling and Analytical Precision: 76 Duplicate Samples in Florida

Compound	Number of Observations	Average RPD for Duplicate Analyses (%)	Average Concentration Difference for Duplicate Analyses (ppbv)	Coefficient of Variation (%)
Formaldehyde	76	10.02	1.77	7.69
Acetaldehyde	76	10.62	0.21	7.63
Acetone	76	14.68	0.14	12.03
Propionaldehyde	76	11.14	0.01	7.33
Crotonaldehyde	16	47.61	0.01	**39.78**
Butyr/Isobutyraldehyde	75	15.00	0.03	11.35
Benzaldehyde	76	14.93	0.01	10.94
Isovaleraldehyde	6	15.32	0.01	12.43
Valeraldehyde	75	17.81	0.02	13.91
Tolualdehydes	75	28.46	0.01	**17.71**
Hexaldehyde	76	27.98	0.05	**20.26**
2,5-Dimethylbenzaldehyde	4	5.22	0.002	3.59

NA = Not applicable

NOTE: Coefficients of variation greater than the program target of 15 percent are presented in bold font.

Table 21-43. Carbonyl Sampling and Analytical Precision: Coefficient of Variation for all Duplicate Samples

Compound	**Average**	**Arlington, TX (ANTX)**	**Barceloneta, PR (BAPR)**	**Beulah, ND (BUND)**	**Camden, NJ (CANJ)**	**Cedar Rapids, IA (C2IA)**	**Chester, NJ (CHNJ)**	**Custer, SD (CUSD)**	**Davenport, IA (DAIA)**	**Denver, CO (DECO)**	**Denver, CO (SWCO)**	**Denver, CO (WECO)**
Formaldehyde	7.55	3.33	1.90	4.05	**22.18**	8.38	4.31	3.33	**19.80**	1.28	4.96	0.35
Acetaldehyde	8.82	**66.09**	1.50	3.59	**22.93**	8.23	4.62	4.77	**15.02**	0.41	3.63	0.13
Acetone	11.09	3.64	5.12	5.15	**36.55**	7.21	12.98	5.81	**25.64**	7.36	7.40	0.25
Propionaldehyde	10.23	**29.40**	2.22	12.59	4.22	**15.21**	13.22	5.48	10.13	3.99	4.41	4.49
Crotonaldehyde	**15.68**	NA	8.00	NA	12.52	NA	NA	10.87	NA	5.19	6.82	12.39
Butyr/Isobutyraldehyde	11.51	9.09	2.62	**20.73**	14.51	11.53	14.98	4.81	**59.84**	6.53	1.74	3.32
Benzaldehyde	13.68	11.06	8.91	**15.92**	**27.34**	**16.77**	10.71	6.19	**42.15**	7.08	8.60	13.26
Isovaleraldehyde	**23.40**	NA	NA	5.42	NA	NA	NA	NA	NA	NA	NA	NA
Valeraldehyde	13.21	13.71	9.78	9.62	9.48	13.90	**20.71**	8.48	5.70	5.67	**22.54**	5.28
Tolualdehydes	**15.98**	14.25	6.64	13.81	**30.57**	14.80	14.95	13.53	14.50	6.23	9.88	12.43
Hexaldehyde	**19.46**	**23.11**	10.92	**29.96**	**29.28**	**19.05**	**16.05**	**26.90**	**75.32**	6.73	14.38	7.67
2,5-Dimethylbenzaldehyde	**48.69**	NA	NA	NA	13.88	NA	NA	NA	NA	NA	NA	NA
Average	**16.61**	**19.30**	5.76	12.09	**20.32**	12.79	12.50	9.02	**29.79**	5.05	8.44	5.96

Table 21-43. Continued

Compound	**Average**	**Des Moines, IA (DMIA)**	**Detroit, MI (Dearborn) (DEMI)**	**Elizabeth, NJ (ELNJ)**	**Grand Junction, CO (G2CO)**	**Grand Junction, CO (GJCO)**	**Gulf Port, MS (GPMS)**	**Jackson, MS (JAMS)**	**Lincoln, NE (LINE)**	**Lincoln, NE (LONE)**	**Nashville, TN (EATN)**	**Nashville, TN (LOTN)**
Formaldehyde	7.55	4.16	**48.37**	10.14	3.91	1.04	8.82	2.48	7.62	2.86	1.06	1.90
Acetaldehyde	8.82	0.66	**44.95**	6.14	1.79	2.60	9.05	3.75	7.75	1.90	1.43	1.31
Acetone	11.09	11.65	**41.59**	9.23	2.18	4.77	**21.66**	5.72	9.25	2.24	**19.74**	6.08
Propionaldehyde	10.23	**18.68**	**35.34**	5.00	2.61	6.65	**34.19**	11.31	6.97	3.10	4.14	**16.04**
Crotonaldehyde	**15.68**	9.21	**18.50**	13.08	10.08	NA	NA	NA	**28.92**	NA	9.73	6.07
Butyr/Isobutyraldehyde	11.51	13.67	**29.91**	8.81	1.72	5.86	**34.60**	1.83	8.29	8.29	2.91	1.13
Benzaldehyde	13.68	**44.72**	**35.07**	10.37	6.06	2.72	6.52	4.52	13.94	**25.44**	3.68	**20.50**
Isovaleraldehyde	**23.40**	NA	**23.58**	NA	NA	NA	NA	NA	NA	NA	NA	NA
Valeraldehyde	13.21	**36.74**	**41.03**	**16.58**	4.56	3.13	11.46	**23.90**	11.98	**19.10**	5.16	1.82
Tolualdehydes	**15.98**	**22.58**	**32.49**	**23.17**	6.54	12.43	**21.30**	**18.37**	**31.45**	**16.03**	**17.56**	5.83
Hexaldehyde	**19.46**	**54.60**	**31.00**	13.44	5.80	8.60	10.87	10.15	**16.84**	14.84	**16.80**	**15.02**
2,5-Dimethylbenzaldehyde	**48.69**	NA	**68.75**	NA	**85.18**	NA	NA	NA	NA	NA	NA	NA
Average	**16.61**	**21.67**	**37.55**	11.60	11.86	5.31	**17.61**	9.11	14.30	10.42	8.22	7.57

Table 21-43. Continued

Compound	**Average**	**New Brunswick, NJ (NBNJ)**	**Pascagoula, MS (PGMS)**	**St. Louis, MO (SLMO)**	**Salt Lake City, UT (SLCU)**	**St. Petersburg, FL (CWFL)**	**St. Petersburg, FL (DNFL)**	**San Juan, PR (SJPR)**	**Sioux Falls, SD (SFSD)**	**Tampa, FL (GAFL)**	**Tampa, FL (LEFL)**	**Tupelo, MS (TUMS)**
Formaldehyde	7.55	0.81	2.11	10.09	2.70	3.10	3.50	**26.47**	6.30	**16.55**	7.62	3.62
Acetaldehyde	8.82	2.14	2.15	3.29	2.30	3.34	3.47	**31.46**	5.00	**15.97**	7.75	1.87
Acetone	11.09	9.61	9.00	3.42	3.74	12.72	7.96	**26.09**	7.48	**18.19**	9.25	7.42
Propionaldehyde	10.23	9.97	5.01	8.96	4.73	3.16	8.19	**18.57**	7.11	10.99	6.97	4.58
Crotonaldehyde	**15.68**	8.10	NA	7.97	11.19	NA	6.35	NA	NA	**84.08**	**28.92**	NA
Butyr/Isobutyraldehyde	11.51	6.18	6.93	7.95	3.69	9.54	10.27	**31.58**	6.43	**17.30**	8.29	4.94
Benzaldehyde	13.68	10.98	3.13	5.88	2.65	5.06	9.43	**30.05**	7.25	**15.32**	13.94	6.36
Isovaleraldehyde	**23.40**	NA	NA	**47.54**	NA	2.02	NA	**51.70**	10.72	**22.85**	NA	NA
Valeraldehyde	13.21	11.01	7.99	6.89	9.71	7.28	10.66	**20.94**	4.01	**25.71**	11.98	**19.38**
Tolualdehydes	**15.98**	13.61	11.20	9.52	10.93	9.46	11.16	**27.12**	11.32	**18.77**	**31.45**	13.49
Hexaldehyde	**19.46**	**41.04**	10.61	7.17	6.77	**15.07**	**19.32**	**23.51**	3.38	**29.81**	**16.84**	11.33
2,5-Dimethylbenzaldehyde	**48.69**	NA	NA	NA	**72.03**	NA	3.59	NA	NA	NA	NA	NA
Average	**16.61**	11.35	6.46	10.79	11.86	7.07	8.54	**28.75**	6.90	**25.05**	14.30	8.11

NA = Not applicable

NOTE: Coefficients of variation greater than the program target of 15 percent are presented in bold font.

Table 21-44. SVOC Sampling and Analytical Precision: Total 49 Collocated Samples in Michigan

Compound	Number of Observations	Average RPD for Replicate Analyses (%)	Average Concentration Difference for Replicate Analyses (ppbv)	Coefficient of Variation (%)
Pyridine	3	58.08	17.74	**31.82**
Phenol	24	7.91	21.84	5.66
1,4-Dichlorobenzene	35	10.92	4.16	7.29
Benzyl alcohol	3	5.04	4.65	3.48
2-Methylphenol	2	30.59	3.49	**18.76**
3&4-Methylphenol	16	17.43	11.57	12.77
Acetophenone	12	13.74	6.35	10.31
Naphthalene	49	13.36	310.94	9.42
2-Methylnaphthalene	49	10.16	42.19	7.18
1,4-Naphthoquinone	1	NA	10.88	NA
Acenaphthylene	13	6.99	1.05	4.66
4-Nitrophenol	1	NA	8.18	NA
Acenaphthene	24	9.51	9.14	6.48
Dibenzofuran	30	8.26	5.94	5.69
4-Nitroaniline	1	NA	6.38	NA
Fluorene	26	8.97	5.69	6.07
Phenanthrene	32	9.77	7.79	6.67
Anthracene	18	15.76	3.74	11.36
Carbazole	11	15.05	3.04	10.85
Di-*n*-butyl phthalate	23	796.26	44.16	**121.51**
Isodrin	1	NA	5.67	NA
Fluoranthene	25	17.45	5.13	11.25
Pyrene	18	14.39	4.69	9.64
bis(2-Ethylhexyl)phthalate	13	30.92	102.98	**33.08**
Benzo(a)anthracene	2	41.56	2.61	**24.33**
Chrysene	2	34.29	3.83	**20.70**
Benzo(b)fluoranthene	2	9.14	0.94	6.77
Benzo(k)fluoranthene	2	24.06	1.66	**15.18**
Benzo(a)pyrene	2	2.35	0.10	1.68
Benzo(g,h,i)perylene	1	NA	6.11	NA

NA = Not applicable

NOTE: Coefficients of variation greater than the program target of 15 percent are presented in bold font.

Table 21-45. Hexavalent Chromium Sampling and Analytical Precision: Total 20 Collocated Samples

Compound	Number of Observations	Average RPD for Replicate Analyses (%)	Average Concentration Difference for Replicate Analyses (μg/m^3)	Coefficient of Variation (%)
Hexavalent Chromium	10	39.28	0.09	**36.34**

Table 21-46. Metals Sampling and Analytical Precision for 22 Duplicate Samples

Compound	Number of Observations	Average RPD for Duplicate Analyses (%)	Average Concentration Difference for Duplicate Analyses (ppbv)	Coefficient of Variation (%)
Antimony	22	9.79	129.43	7.40
Arsenic	22	8.65	15.13	6.27
Beryllium	0	NA	NA	NA
Cadmium	20	31.82	77.69	**18.10**
Cobalt	22	10.09	134.96	7.60
Chromium	22	5.52	322.87	4.08
Lead	22	15.80	2842.89	12.46
Manganese	22	9.44	9081.34	6.95
Mercury	22	29.76	15.33	**21.00**
Nickel	22	21.51	552.96	11.00
Selenium	22	6.25	113.04	4.66

NA = Not applicable

NOTE: Coefficients of variation greater than the program target of 15 percent are presented in bold font.

22.0 Conclusions and Recommendations

As indicated throughout this report, UATMP monitoring data offer a wealth of information for evaluating trends and patterns in air quality and should ultimately help a wide range of audiences understand the complex nature of urban air pollution. The following discussion summarizes the main conclusions of this report and presents recommendations for ongoing urban air monitoring efforts.

22.1 Conclusions

Analyses of the 2002 UATMP monitoring data identified the following notable trends and patterns in national-level and state-by-state urban air pollution:

22.1.1 National-level Conclusions

- *Ambient air concentrations of hydrocarbons.* Levels of airborne hydrocarbons were highest at the two Grand Junction, CO monitoring locations and were lowest at the Underhill, VT monitoring location.

- *Ambient air concentrations of halogenated hydrocarbons.* Levels of airborne halogenated hydrocarbons were highest at the Allen Park, Detroit, MI monitoring location and were lowest at the Underhill, VT monitoring location. The Allen Park site had the same distinction in the 2001 UATMP report. The Allen Park site's concentration was more than double the next highest site's average concentration (Chester, NJ).

- *Ambient air concentrations of polar compounds.* No polar compounds were determined to be "prevalent" in this year's UATMP. Levels of airborne polar compounds were highest at two of the three Denver sites (SWCO and WECO) and were lowest at the Underhill, VT monitoring location. The Underhill, VT site had the lowest average concentrations for all three types of VOC.

- *Ambient air concentrations of carbonyl compounds.* Levels of airborne carbonyl compounds were highest at the St. Louis, MO (Site 1) monitoring location and were lowest at the Miami, FL monitoring location.

- *Completeness.* Completeness, or the number of valid samples collected compared to the number expected from a 6 or 12 day sampling schedule, measures the reliability of the sampling and analytical equipment as well as the efficiency of the program. Typically, a completeness 85-100% is desired for a complete data set. For sites sampling for carbonyl compounds, an overall completeness of 93% was determined. Twenty-five, or more than half, of these sites had a completeness of 95% or higher, while only three sites had a completeness of 75% or less. For sites sampling for VOC, an overall completeness of 91% was determined. Sixteen, or nearly one-third, of these sites had a completeness of 95% or higher, while only three sites had a completeness of 75% or less. For sites sampling for SNMOC, an overall completeness of 92% was determined. Five, or nearly one-third, of these sites had a completeness of 95% or higher, while only one site had a completeness of 75% or less. For sites sampling for SVOC, an overall completeness of 92% was determined. Six, or one-half, of these sites had a completeness of 95% or higher, while only two sites had a completeness of 75% or less. For sites sampling for metals, an overall completeness of 99% was determined. Five out of six of these sites had a completeness of 95% or higher. For sites sampling for hexavalent chromium, an overall completeness of 96% was determined. Five out of six of these sites had a completeness of 95% or higher.

- *Prevalence.* Using the schema described in section 3.1.4, twelve compounds were determined to be “prevalent”, that is, these compounds were consistently sampled at detectable levels and contributed to at least 90 percent of the mass concentration within its compound group. Three halogenated hydrocarbons (chloromethane, dichlorodifluoromethane, and trichlorofluoromethane), eight hydrocarbons (1,2,4-trimethylbenzene, acetylene, benzene, ethylbenzene, m,p-xylene, o-xylene, propylene, and toluene), and one carbonyl compound (formaldehyde) make up the prevalent compounds for the 2002 UATMP program year. In comparison to the 2001 report, trichlorofluoromethane, *m,p*-xylene, and 1,2,4-trimethylbenzene were added to the list and methylene chloride, methyl ethyl ketone, acetaldehyde, and acetone were removed.

- *Pearson Correlations.* The calculated average Pearson Correlation Coefficients between the eight meteorological parameters and the twelve prevalent compounds were not terribly strong, yet it is important to note several key points. Geography and climatology vary from geographic setting to geographic setting and are important influences in many factors that determine a location’s air quality. Wind regimes, temperatures, and pressure patterns all play key roles. Location of emissions sources in relation to the monitoring site is also an important factor. Therefore, it is extraordinarily difficult to forecast concentration increases based on meteorological factors on a nation-wide scale. However, a few general tendencies can be noted. Chloromethane and formaldehyde tended to have more positive correlations at a number of sites, while acetylene tended to have negative correlations with the temperature parameters and two of the three moisture parameters. The wind components, on average, tended to have more negative correlations with the prevalent compounds, indicating that as wind speeds increased, concentrations decreased. Stronger winds have a tendency to transport pollutants out of one area and advect them to another. However, the reverse is also true, and this is where the location of the monitor in relation to emission sources becomes vital. In addition, light winds associated with high pressure systems or stagnant air masses allow little movement of air within a layer.

- *Stationary emission sources of toxics.* Lancaster County, NE (sites LINE and LONE) had the highest stationary source emissions, followed by Wayne County, MI (sites APMI, DEMI, E7MI, RRMI, SWMI, and YFMI). Despite these high emissions, the geometric means for LINE and LONE were not ranked in the top five for carbonyl compounds, halogenated hydrocarbons, hydrocarbons, or polar compounds. The SWMI and DEMI sites ranked 1st and 4th for halogenated hydrocarbon geometric means, while E7MI ranked 2nd for hydrocarbons.

- *Mobile Emissions and Traffic Data*. It was estimated that the Elizabeth, NJ site had the highest number of cars within a 10-mile radius (1,620,523 cars), while the Custer, SD site had the fewest (3,118 cars). The Elizabeth site ranked fairly low for its average UATMP concentration, at 23rd highest overall. The Custer site's average UATMP concentration ranking was 34th highest out of 55 sites. It is estimated that the Delray Beach, FL site had the highest traffic volume passing the site (201,032 automobiles), but had the third-lowest average UATMP concentration. Elizabeth, New Jersey had the second highest traffic flow near the site (170,000). The Barceloneta, Puerto Rico site had the lowest number of vehicles (10) passing by the site, while its average UATMP concentration ranked fairly high, with the 12th highest average concentration. Performing a Pearson Correlation between the sites' hydrocarbon geometric means and the number of automobiles within a 10-mile radius of each site revealed a moderate positive correlation, while only a weak positive correlation existed between the hydrocarbon geometric means and the number of vehicular traffic passing each site on a daily basis. A comparison of the BTEX compounds (Benzene, Toluene, Ethylbenzene, and Xylenes) with a Roadside speciation profile suggests the high influence of motor vehicles as an emission source. The Chester, NJ site BETX profile bore the closest resemblance to the Roadside speciation profile, and this site's average UATMP concentration ranked 10th highest.

- *Trends Analysis*. Three compounds were further analyzed for a trends analysis: formaldehyde, benzene, and 1, 3-butadiene. Eight UATMP sites have participated continuously to the UATMP program prior to 2001. Formaldehyde consistently measured the highest concentrations among the three pollutants of interest, while 1, 3-butadiene measured the lowest. Seasonal highest average concentrations for benzene and butadiene were in autumn and winter; formaldehyde seasonal average concentrations were higher in summer and autumn.

22.1.2 State-level Conclusions

- *Arizona.* UATMP concentrations at the Phoenix sites tended to increase with increasing pressure, but tended to decrease with rising temperatures. Both positive and negative correlations were calculated for the moisture parameters, with mostly negative correlations with the dew point and wet bulb temperatures, and positive correlations with relative humidity. Average UATMP concentrations varied among the sites, with the South Phoenix site having the highest and the Queen Valley site having the lowest concentration. The South Phoenix and Supersite sites had higher average hydrocarbon concentrations than the Queen Valley site. There were eighteen nearby facilities that were sources of fuel combustion emissions. The Queen Valley site had lower average halogenated hydrocarbon concentrations than the Supersite and South Phoenix site. Average polar compound concentrations were highest at South Phoenix, the same site with the highest number of operating motor vehicles. Carbonyl compounds were not measured at these three sites.

- *Colorado.* At the Denver sites, with few exceptions, most of the compounds had positive correlations with the temperature variables, and were split between the moisture variables, similar to the Phoenix sites. UATMP concentrations increased or decreased as wind speeds increased, depending on direction. Few similarities in correlations existed between the Grand Junction sites. However, as relative humidity and pressure increased and wind speeds (those with a northerly or southerly component) decreased, UATMP concentrations tended to increase. Average UATMP concentrations varied among the sites. Denver Site 2 and 3's concentrations were nearly five times that of Site 1. In relation to other UATMP sites, the Colorado sites average UATMP concentrations were all in the 21 highest concentrations, with Denver's Site 2 and 3 claiming the highest two concentrations overall. All three Denver sites were surrounded by numerous emission sources, while the Grand Junction sites were surrounded by far fewer facilities. Liquid distribution facilities were the most numerous sources surrounding all five sites. Denver had a much higher population than Grand Junction, resulting in a higher number of vehicles owned. Traffic flow was much heavier near Denver's Site 1 than Site 2 and 3. In fact, both Grand Junction sites experienced heavier traffic flow than Denver's Site 2 and 3. As the two Grand Junction sites are EPA-designated NATTS sites, back trajectory analyses were performed. A comparison of NOAA's HYSPLIT model and UATMP concentrations indicated that the highest concentrations tended to occur when air originated from the west, northwest, and north. Metals were samples at all five Colorado sites, with the highest average concentration at Denver Site 2. A large difference in average metal concentrations was noted between the two Grand Junction sites.

- *Florida.* No clear pattern or consistencies among the St.Petersburg/Tampa sites or among the South Florida sites seemed to exist based on Pearson Correlation Coefficients between formaldehyde and the eight meteorological parameters. It is important to note that several of the Florida sites sampled for less than two months. With the exception of Underhill, VT, and Bonne Terre, MO, the Florida sites collectively had the lowest average UATMP concentrations of all the UATMP sites. However, carbonyl compounds were the only compounds sampled for at the Florida sites, which may attribute to this. Of the Florida sites, the Gandy site had the highest average UATMP concentration, while the Miami site had the lowest. In regards to average carbonyl compound concentrations, the Gandy site was the highest of the Florida sites and again the Miami site was the lowest. The Tampa/St. Petersburg sites had the most nearby emission sources, of which most were surface coating facilities. Several of the Florida sites had large traffic volumes passing the monitors, with the Delray Beach site having the highest not only of the Florida sites, but the highest among the UATMP sites. The Miami site had the highest population of the Florida sites and therefore number of estimated vehicles owned nearby. Of the three Florida sites that sampled year-round, the highest concentrations of formaldehyde tended occur in the summer. As the Tampa/St. Petersburg sites are EPA-designated NATTS sites, back trajectory analyses were performed. A comparison of NOAA's HYSPLIT model and UATMP concentrations indicated that the highest concentrations tended to occur when air originated in a variety of directions, which makes pin-pointing when concentrations will increase that much more difficult.

- *Iowa.* As temperature, wet bulb and dew point temperatures increased, concentrations of acetylene tended to decrease and propylene tended to increase at the Iowa sites. Also, as wind speeds increased from a northerly or southerly direction, UATMP concentrations tended to increase. The Des Moines site had the highest average UATMP concentration among the Iowa sites, while the Davenport and Cedar Rapids concentrations were lower and relatively similar to each other. The Davenport site had the largest number of emission sources nearby, mostly fuel combustion industrial facilities located to the south and east of the monitor, while the Cedar Rapids and Des Moines sites had only a few. The Des Moines site had, by far, the largest traffic volume passing the monitor. The populations, and therefore number of vehicles owned within 10 miles, near the sites were relatively similar. As the Cedar Rapids site is an EPA-designated NATTS site, back trajectory analysis was performed. A comparison of NOAA's HYSPLIT model and UATMP concentrations indicated that the highest concentrations tended to occur when air originated from a southerly direction, although the highest recorded concentration occurred on a day when air originated from the north and northwest. TNMOC and ozone were sampled at the Iowa sites. The highest average ozone concentration was sampled at the Davenport site, and the lowest at the Des Moines site. The Des Moines site sampled the largest average TNMOC concentrations, speciated and with unknowns, and Cedar Rapids sampled the lowest. The SNMOC compound with the highest concentration was different at each site.

- *Michigan.* The average UATMP concentration varied among the Michigan sites, with the Allen Park and E7 Mile sites having the highest concentrations and the Houghton Lake site having the lowest. Detroit is a fairly industrial area, and only Houghton Lake, located in north-central Michigan, had few emission sources surrounding it. Fuel combustion and incineration facilities were the most numerous source types in the Detroit area. The Lodge/696 site had the largest traffic volume passing the monitor of the Michigan sites.

  The River Rouge site had the highest average carbonyl compound concentration among the Michigan sites. For hydrocarbons, the E7 Mile and Yellow Freight sites had the highest average concentrations, while Houghton Lake had the lowest. Allen Park, Lodge/696, and Dearborn had the highest average halogenated hydrocarbon concentrations of the Michigan sites. Of the three Michigan sites that sampled year-round, the highest concentrations of the prevalent compounds were sampled during the summer and fall months. As all of the Michigan sites are EPA-designated NATTS sites, back trajectory analyses were performed. A comparison of NOAA's HYSPLIT model and UATMP concentrations indicated that the highest concentrations at the Detroit sites tended to occur when air originated from a southerly direction. Although the Houghton Lake site is also a NATTS site, only ten samples were taken at this site during the 2002 program year, making it difficult to establish a connection between wind direction and

UATMP concentration. TNMOC and ozone were sampled at the E7 Mile site. The SNMOC compound with the highest concentration at this site was ethane. The Detroit sites also sampled SVOC. The Yellow Freight site had the largest average SVOC concentration, while the remaining sites were approximately one-quarter of the Yellow Freight concentration and were relatively similar to each other. Four Detroit sites also sampled hexavalent chromium. The River Rouge site had the highest average concentration and the Dearborn site had the lowest.

- *Mississippi.* Chloromethane and formaldehyde concentrations tended to increase with increasing temperature, dew point, and wet bulb temperature at each of the Mississippi sites. Otherwise, few patterns seemed to exist across all four Mississippi sites between the prevalent compounds and the meteorological parameters. Average UATMP concentrations varied among the sites, with the Gulfport site having the highest and the Tupelo site having the lowest concentration. The Gulfport site had the highest traffic volume flowing past the monitoring site. The Jackson site had the largest number of vehicles owned within a ten-mile radius. The Jackson site had the highest average carbonyl compound concentration of the Mississippi sites. This site also had the highest average hydrocarbon concentration, while the Tupelo site had the lowest. The Tupelo site had the highest average halogenated hydrocarbon concentration. The Mississippi sites had relatively high average polar compound concentrations. Although differing among the compounds, the Gulfport, Jackson, and Tupelo sites tended to sample the highest concentration of prevalent compounds in the summer and fall, while the Pascagoula site sampled its highest concentrations during the fall and winter.

- *Missouri.* The Bonne Terre and St. Louis Site 4 sites sampled only carbonyl compounds; Site 2 and 3 sampled only VOC; and Site 1 sampled both carbonyl compounds and VOC. This makes it difficult to establish patterns in correlations between compounds and weather parameters. However, most compounds at the sites tended to have a positive correlation with relative humidity and sea level pressure; that is, as pressure and humidity levels increased, UATMP concentrations tended to increase as well. Also, chloromethane and formaldehyde concentrations tended to increase as maximum, average, dew point, and wet bulb temperatures increased. St. Louis Site 1 had the highest average UATMP concentration of the Missouri sites, more than double those of the remaining sites. However, as previously mentioned, the other sites did not sample VOC and carbonyl compounds, which could result in lower average concentrations. Few industrial emission sources were located near the Bonne Terre site, but a large number of sources were located around the St. Louis sites. A majority of these sites were fuel combustion industrial facilities. The site with the largest traffic volume passing the monitor was Site 4, while Site 2 had the least. The St. Louis sites had relatively similar vehicle ownership, while the Bonne Terre site had significantly less. It is difficult to compare the average compound concentrations by compound type for all five sites since each of the Missouri sites sampled differently. However, comparisons can be made between the Bonne Terre, Site 1, and Site 4 sites for carbonyl compounds, and Site 1, Site 2 and 3 for VOC. Site 1 had the highest average carbonyl compound concentration of the three Missouri sites. The Bonne Terre site had the lowest. Sites 1, 2, and 3 had relatively similar average halogenated hydrocarbon concentrations. Site 2 had the highest average hydrocarbon concentration, while Site 1 had the highest average polar compound concentration of the Missouri sites. For sites measuring VOC, a seasonal comparison was made. Site 2 and 3 only sampled during the winter and spring. Of the two seasons, the highest concentrations were sampled during the winter. Site 1 sampled year-round, and although differing among the compounds, the highest average concentrations were sampled in the summer and fall. Site 1 also sampled SVOCs. This site's average SVOC concentration was one of the lowest reported by those sites that sampled for these compounds. TNMOC was sampled at the three of the five Missouri sites. Site 4 had the highest TNMOC sampled, and Bonne Terre had the lowest. The SNMOC compound with the highest concentration was propane at Bonne Terre and ethane at Site1 and 4. Ozone was sampled near Site 4 and 1 as well, and was one of the highest average ozone concentrations.

- *Nebraska.* For both Nebraska sites, as average, dew point, and wet bulb temperatures increased and sea level pressure decreased, UATMP concentrations of the prevalent compounds tended to increase. The average UATMP concentration at Site 1 was higher than that of Site 2. The emission sources within 10 miles of the sites tended to be to the south and east of Site 1 and to the east and northeast of Site 2. The bulk of the emission sources were fuel combustion industries. Lincoln Site 1 had a higher carbonyl compound concentration than Site 2. Site 1 sampled during the spring, summer, and fall, and Site 2 sampled during the fall and winter. Therefore, a seasonal analysis was not performed.

- *New Jersey.* Average chloromethane, dichlorodifluoromethane, formaldehyde, and trichlorfluoromethane concentrations tended to increase as temperature and moisture increased at each of the New Jersey sites. The Chester site had the highest average UATMP concentration of the New Jersey sites, while the remaining sites concentrations were relatively similar. However, the Chester site had few industrial emission sources nearby. On the other hand, the New Brunswick, Camden, and Elizabeth sites had numerous facilities surrounding them, of which most were fuel combustion industrial facilities. The Elizabeth site had the most traffic volume passing the monitor on a daily basis, and was second only to Delray Beach, FL for highest traffic volume. The Chester site sampled the highest average carbonyl compound concentration of the New Jersey sites. Elizabeth sampled the highest average hydrocarbon concentration. Once again Chester had the highest average polar compound concentration of the New Jersey sites. Although differing among the compounds, the New Jersey sites tended to sample the highest concentration of prevalent compounds in the summer and winter. The New Jersey sites also sampled SVOC. The Elizabeth site had the largest average SVOC concentration, although the concentrations were relatively similar among all four sites.

- *North Dakota.* As maximum, average, dew point, and wet bulb temperatures increased, concentrations of formaldehyde tended to increase, while concentrations of acetylene and benzene tended to decrease. There were only seven emission sources within 10 miles of the site, and most were fuel combustion industrial facilities. Although the average concentrations of the prevalent compounds did not differ greatly from season to season, the highest concentrations tended to be sampled during the winter and fall. TNMOC and ozone were sampled at the Beulah site. The SNMOC compound with the highest concentration at this site was isopentane. This site had one of the lowest average ozone concentrations sampled.

- *Oregon.* The majority of the emission sources surrounding the monitor were surface coating processing facilities. Because hexavalent chromium was the only compound sampled for, no UATMP concentration is available. However, of the five sites that sampled for hexavalent chromium, the Portland site had the highest average concentration.

- *Puerto Rico.* As moisture content and wind speeds increased and as pressure decreased at the Puerto Rico sites, average UATMP concentrations of the prevalent compounds tended to increase. The average UATMP concentration at the San Juan site was significantly higher than the Barceloneta site. The emission sources within 10 miles of the San Juan tended to be to the east and west of the site, and those near Barceloneta were to the east of the site. The bulk of the emission sources were fuel combustion industries. The San Juan site had more traffic volume passing by than the Barceloneta site. Average carbonyl compound concentrations for the Puerto Rico sites were very similar. The Barceloneta site’s average halogenated hydrocarbon concentration was higher than the San Juan site’s, however, the San Juan site’s average hydrocarbon concentration was higher than the Barceloneta site’s. The San Juan site also had the highest average polar compound concentration of the two sites. The Barceloneta site sampled its highest concentrations during the winter months, while the San Juan site sampled its highest concentrations during the fall and winter seasons. TNMOC was sampled at the Puerto Rico sites. The average TNMOC concentration sampled at the San Juan site was significantly higher than that of the Barceloneta site. The SNMOC compound with the highest concentration at each site was propane.

- *South Dakota.* As relative humidity decreased and wind speeds increased (from a northerly or southerly direction), average UATMP concentrations of the prevalent compounds tended to increase. Also, as maximum, average, dew point, and wet bulb temperatures increased, concentrations of acetylene and ethylbenzene tended to decrease, and concentrations of chloromethane and triclorofluromethane tended to increase. The Sioux Falls site’s average UATMP concentration was significantly higher than that the Custer site. There were no emission sources within 10 miles of the Custer site, and there were only a few to the northwest of the Sioux Falls site. The South Dakota sites had similar traffic volumes passing the sites. The Sioux Falls site had a significantly higher population near the site than the Custer site, resulting in much higher vehicle ownership near the Sioux Falls site. The Sioux Falls site had the highest average concentration for each of the compound groups between the two South Dakota sites. The Sioux Falls site tended to sample its highest concentrations during the spring season, while the Custer site sampled its highest concentrations throughout the year. TNMOC was sampled at the South Dakota sites, and the average TNMOC concentration sampled at the Sioux Falls site was significantly higher than that of the Custer site. The SNMOC compound with the highest concentration at the Sioux Falls site was propane, and isopentane at the Custer site. Ozone was also sampled at Sioux Falls.

- *Tennessee.* As relative humidity and sea level pressure decreased and wind speeds increased, UATMP concentrations of the prevalent compounds tended to increase. Also, as maximum, average, dew point, and wet bulb temperatures increased, concentrations of formaldehyde tended to increase, and concentrations of dichlorodifluoromethane and trichloroflurormethane tended to decrease. Site 1's average UATMP concentration was higher than Site 2's. The majority of the emission sources within 10 miles of the sites were located to the south of the monitors. Most of these sources were facilities involved in surface coating processes. Site 1 had a significantly higher amount of traffic passing by the monitor than Site 2. Site 2 had slightly higher average carbonyl and polar compound concentrations while hydrocarbon and halogenated hydrocarbon concentrations were slightly higher at Site 1. Site 1 tended to sample its highest concentrations during the fall and winter, while Site 2 sampled its highest concentrations in the summer and fall.

- *Texas.* Most of the compounds and weather parameters had at least moderate correlations, and many were considered strong. Most of the emission sources near the site were located to north or south and were involved in surface coating processes. The Arlington site measured its highest average concentrations during the winter months, although it is important to consider that this site did not sample during the spring.

- *Utah.* As relative humidity increased and wind speeds decreased (from a northerly or southerly direction), UATMP concentrations of the prevalent compounds tended to increase at the Salt Lake City site. Most of the emission sources scattered around the site were located to northeast or east and were fuel combustion industrial facilities. The Salt Lake City site measured its highest average concentrations during the fall months. TNMOC was sampled at the Salt Lake City site. The SNMOC compound with the highest concentration was toluene. Of the sites that sampled TNMOC and ozone, Salt Lake City measured the highest average ozone concentration.

- *Vermont.* Pressure and wind speed were the predominant meteorological parameters affecting UATMP concentrations at the Vermont sites. However, the Underhill site failed to detect measurable quantities of certain compounds, and therefore have no Pearson Correlation Coefficients. None of the sites had many emission sources within a ten-mile radius of the monitor. Traffic flow varied among the Vermont sites, with the Brattleboro site having the highest of the three and Underhill having the lowest. The Vermont sites did not measure carbonyl compounds. The Rutland site sampled the highest average concentrations for each of the compound groups among the Vermont sites. For halogenated hydrocarbons and polar compounds, there was little variation in concentration. There was more variation in average hydrocarbon concentrations. Underhill had the lowest average concentrations for both hydrocarbons and polar compounds. The Brattleboro site measured its highest average concentrations during the winter, summer, and fall seasons while Rutland sampled its highest average concentrations during its fall and winter seasons. Average concentrations were evenly distributed throughout the year at Underhill.

22.1.3 Data Quality

The precision of the sampling methods and concentration measurements were analyzed for the 2002 UATMP using relative percent difference (RPD), coefficient of variation (CV), and average concentration difference calculations based on duplicate and collocated samples. The overall precision was well within UATMP data quality objectives and Compendium Method guidelines. Sampling and analytical method accuracy is assured by using proven methods and following strict quality control and quality assurance guidelines.

22.2 Recommendations

In light of the lessons learned from the 2002 UATMP, a number of recommendations for future ambient air monitoring are warranted:

- *Encourage state/local/tribal agencies to develop HAP emission inventories.* State/local/tribal agencies should use the data collected from the UATMP to develop and validate an emissions inventory, or at the very least, identify emission sources of concern. The next base year for the NEI is for 2002, and through the sampling and analysis efforts described in this report, the groundwork for preparing an emissions inventory has begun. Ideally, state/local/tribal agencies would compare the ambient monitoring results with an emission inventory for source category completeness. The emissions inventory would then be used to develop modeled concentrations useful to compare against ambient monitoring data.

- *Continue to identify and implement improvements to the sampling and analytical methods.* The improvements made to the analytical methods prior to the 1999-2000 UATMP allowed for measurement of ambient air concentrations of 11 compounds that were not measured during previous programs. This improvement provides sponsoring agencies and a variety of interested parties with important information about air quality within their urban areas. Further research is encouraged to identify other method improvements that would allow the UATMP to characterize an even wider range of components in urban air pollution.

- *Continue to strive to develop standard conventions for interpreting air monitoring data.* The lack of consistent approaches to present and summarize ambient air monitoring data complicates or invalidates comparisons between different studies. Additional research should be conducted on the feasibility of establishing standard approaches for analyzing and reporting air monitoring data.

- *Prepare a report* characterizing all years of the UATMP and then update it yearly to better assess trends and better understand the nature of U.S. urban air pollution.

- *Consider more rigorous study of the impact of automobile emissions on ambient air quality using the complete UATMP data set.* Because the UATMP has monitoring sites where years of continuous data are collected, a real opportunity exists to evaluate the importance and impact of automobile emissions on ambient air quality. Suggested areas of study include:

  1. *Signature Compound Assessment.* Sample data from each site should be evaluated to look for signature compounds from mobile sources—that is, species typically associated with only diesel and/or gasoline combustion. If the appropriate compounds are included in the UATMP speciation, sites lacking these compounds can be excluded from subsequent analyses. Desert Research Institute can provide a listing of potential signature compounds for mobile sources.

  2. *Micro-Climate Assessment.* An assessment is needed of the immediate micro-climate for a representative "urban" and "rural" site, to determine a reasonable geographic radius of influence. It is absolutely critical to determine a rough estimate of the maximum radius of concern (R_{max}) in order to know what sources need to be included in the characterization. A value for R_{max} may be determined with relatively little effort using simple dispersion models, such as CALINZ4 for urban settings. In these models R_{max} would be defined for non-reactive species such as CO or PM. Since most/all of the toxic compounds of concern have some level of reactivity, R_{max} would actually be somewhat less. Therefore this method would provide a conservative estimate for R_{max}.

  3. *Identify Roadways of Concern.* All roadways within a distance of R_{max} should be identified for each site. Local area maps are best suited for this purpose.

  4. *Parking Lot Characterizations.* Several monitoring locations are situated in or near parking lots. Evaporative emissions from parked gasoline vehicles could have a very significant impact on the monitors for these sites (depending upon the species of concern). Therefore we recommend determining the size of the lots in question in terms of number of spaces, as well as an average occupancy rate with total vehicles per day (to determine the number of start episodes). The occupancy rate should be a 24 hour annual average, and can be established either through observation or local "experts" (e.g., the lot operator). Also, it should be determined if the parking is covered or open—covered lots can significantly decrease crankcase temperatures and therefore lower evaporative emissions rates.

  5. *Site-Specific Information.* Additional information could be collected as needed to improve the quality of discussions of air quality at specific sites. For example, for the El Paso site from the 2001 report, the UATMP could obtain a vehicle count split for US versus Mexican vehicles. Mexican vehicles have dramatically higher pollution rates and should be considered separately. This estimate could be

obtained from the EPA or Texas Natural Resource Conservation Commission Border Liaisons.

- *Encourage continued participation in the UATMP.* Ongoing ambient air monitoring at fixed locations can provide insight into long-term trends in urban air quality and the potential for urban air pollution to cause adverse health effects among the general population. Therefore, state and local agencies should be strongly encouraged either to develop and implement their own ambient air monitoring programs or to participate in future UATMP monitoring efforts.

23.0 References

Conner, et al., 1995. "Transportation-Related Volatile Hydrocarbon Source Profiles Measured in Atlanta." Teri L. Conner, William A. Lonneman, Robert L. Seila. Journal of the Air and Waste Management Association, 45: 383-394. 1995.

Draxler, R.R. and Rolph, G.D., 2003. HYSPLIT (Hybrid Single-Particle Lagrangian Integrated Trajectory) Model access via NOAA ARL READY Website (http://www.arl.noaa.gov/ready/hysplit4.html). NOAA Air Resources Laboratory. Silver Spring. MD.

ERG, 1997. "1995 Urban Air Toxics Monitoring Program - Final Report." Eastern Research Group. Prepared for U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. January, 1997.

Fujita, et al., 1994. "Validation of the Chemical Mass Balance Receptor Model Applied to Hydrocarbon Source Apportionment in the Southern California Air Quality Study." Eric M. Fujita, John G. Watson, Judith C. Chow, and Zhiqiang Lu. Environmental Science and Technology, 28:1633-1649. 1994.

Godish, 1997. "Air Quality." Thad Godish. Lewis Publishers. 1997.

Harnett, 1982. "Statistical Methods." Donald L. Harnett, Addison-Wesley Publishing Company, Third Edition. 1982.

Ramamoorthy and Ramamoorthy, 1997. "Chlorinated Organic Compounds in the Environment: Regulatory and Monitoring Assessment." Sub Ramamoorthy and Sita Ramamoorthy. Lewis Publishers. 1997.

Rogers and Yau, 1989. "A Short Course in Cloud Physics." R. R. Rogers and M. K. Yau. Pergamon Press. 1989.

Ruffner and Bair, 1987. "The Weather Almanac." James A. Ruffner and Frank E. Bair. Gale Research Company. 1987.

Seinfeld, 1986. "Atmospheric Chemistry and Physics of Air Pollution." John H. Seinfeld. John Wiley & Sons, Inc. 1986.

Topozone. Maps a la Carte, Inc. 2002. www.topozone.com

USEPA, 1988. "Data Quality Objectives for the Urban Air Toxics Monitoring Program (Stages I and II)." U.S. Environmental Protection Agency, Office of Air and Radiation, Office of Air Quality Planning and Standards. June, 1988.

USEPA, 1997. “National Air Pollutant Emission Trends, 1900 - 1996.” U.S. Environmental Protection Agency, Office of Air and Radiation, Office of Air Quality Planning and Standards. December, 1997.

USEPA, 1999. “Compendium Method TO-11A: Determination of Formaldehyde in Ambient Air Using Adsorbent Cartridge Followed by High Performance Liquid Chromatography (HPLC).” U.S. Environmental Protection Agency, Center for Environmental Research and Information. EPA/625/R-96/010b. January, 1999.

USEPA, 1999. “Compendium Method TO-15: Determination of Volatile Organic Compounds (VOC) in Ambient Air Collected in Specially-Prepared Canisters and Analyzed by Gas Chromatography/Mass Spectrometry (GC/MS).” U.S. Environmental Protection Agency, Center for Environmental Research and Information. EPA/625/R-96/010b. January, 1999.

USEPA, 2002. 1999 National Emissions Inventory. United States Environmental Protection Agency, Emission Factors and Inventory Group. Downloaded from the internet at: ftp.epa.gov/Emis Inventory/

USEPA, 2002. “2001 Nonmethane Organic Compounds (NMOC) and Speciated Nonmethane Organic Compounds (SNMOC) Monitoring Program.” July 2002.

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