



Post-Katrina Air Quality Monitoring Report

March 2008
Final Report

EPA-454/R-08-004
March 2008

Post-Katrina Air Quality Monitoring Report

Prepared By:
Eastern Research Group, Inc.
Research Triangle Park, North Carolina

Prepared for:
Margaret Dougherty and Mike Jones
Office of Air Quality Planning and Standards
Research Triangle Park, NC 27711

Contract No. 68-D-03-049
Delivery Orders 11 and 12

U.S. Environmental Protection Agency
Office of Air Quality Planning and Standards
Emissions, Monitoring and Analysis Division
Research Triangle Park, NC 27711

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Prepared for:

Margaret Dougherty and Mike Jones
Office of Air Quality Planning and Standards
U.S. Environmental Protection Agency
Research Triangle Park, NC 27711

Prepared by:

Eastern Research Group, Inc.
1600 Perimeter Park
Morrisville, NC 27560

March 2008

Executive Summary

The U.S. Environmental Protection Agency evaluated the air quality in and around areas affected by Hurricane Katrina to characterize the magnitude and composition of potentially toxic air pollution. The post-Katrina Monitoring Network consisted of 30 monitoring stations that collected 24-hour air samples, typically on 1-, 3-, and/or 6-day schedules, for up to 12 months of monitoring. Five sites were designated as comprehensive sites and analyzed ambient air samples for concentrations of 60 volatile organic compounds (VOC) and 15 carbonyl compounds. Three of the comprehensive sites also analyzed for 80 speciated nonmethane organic compounds (SNMOC), 106 semivolatile compounds (SVOC), and hexavalent chromium. Four of the comprehensive sites analyzed 13 metal compounds. The remaining 25 non-comprehensive sites analyzed metal compounds only. Overall, nearly 155,000 ambient air concentrations were measured from October 2005 to September 2006.

A complete description of the monitoring network, sampling schedule, test methods, and statistical analyses of the ambient air monitoring data are presented in the enclosed report. The final data are also included as appendices.

DISCLAIMER

Through its Office of Air Quality Planning and Standards, the U.S. Environmental Protection Agency funded and managed the research described in this report under EPA Contract No. 68-D-03-049 to Eastern Research Group, Inc. This report has been subjected to the Agency's peer and administrative review and has been approved for publication as an EPA document. Mention of trade names or commercial products in this report does not constitute endorsement or recommendation for their use.

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LIST OF ACRONYMS

AQS	Air Quality Subsystem
CV	Coefficient of variation
DNPH	Dinitrophenylhydrazine
EPA	U.S. Environmental Protection Agency
ERG	Eastern Research Group
GC/MS-FID	gas chromatography incorporating mass selective detection and flame ionization detection
GC/MS-SCAN	Gas Chromatography/Mass Spectrometry in the full data acquisition Mode
GC/MS SIM	Gas Chromatography/Mass Spectrometry in the Selective Ion Monitoring Mode
HPLC	High-performance liquid chromatography
IC	Ion chromatography
L	Liter
m ³	Cubic meter
MDL	Method Detection Limit
mm	Millimeter
ng/m ³	nanogram per cubic meter
PAH	Polycyclic aromatic hydrocarbons
pg/m ³	picograms per cubic meter
ppbC	Parts per billion carbon
ppbv	parts per billion by volume
PT	Proficiency test
PUF	polyurethane foam
QAPP	Quality Assurance Project Plan
RPD	Relative percent difference
SNMOC	Speciated Non-methane Organic Compound(s)
SVOC	Semivolatile Organic Compound(s)
TNMOC	Total NMOC
UATMP	Urban Air Toxics Monitoring Program
µg/m ³	micrograms per cubic meter
VOC	Volatile Organic Compound(s)

1.0 Introduction

On August 29, 2005 the United States Gulf Coast region experienced the worst natural disaster in its history when it was struck by Hurricane Katrina. Hurricane Katrina peaked in intensity over the Gulf of Mexico as a category 5 hurricane, the strongest level on the Saffir-Simpson scale (NCDC, 2005). Although the massive hurricane underwent weakening as it approached land, the storm brought heavy winds and rain, resulting in the breaching of several levees and flooding of up to 80 percent of the city of New Orleans (USEPA, 2005a). Prior to and immediately after the hurricane, several hundred thousand people were displaced from counties in Mississippi and Louisiana. According to the Census Bureau (U.S. Census Bureau, 2006), the net change in population for affected counties in Louisiana from July 2005 to January 2006 was over 344,000 residents, including nearly 279,000 in Orleans Parish alone.

During the recovery and rebuilding efforts in Louisiana and Mississippi, new environmental challenges were encountered. The wind and flood damage caused previously contained pollutants to be released into the environment and created tremendous quantities of refuse including building materials, trees, and other vegetation. Disposal of the huge volume of debris posed a significant challenge. In Louisiana alone, it is estimated that more than 55 million cubic yards of debris were directly created by the storm (LDEQ, 2006). In Mississippi, nearly 16 million cubic yards of debris had been collected by the end of October 2005 (DHS, 2005). Mass burning, grinding, and landfilling were the principle disposal methods.

To better understand the potential air quality impacts on human health that the condition of the area and the disposal methods might have, the U.S. Environmental Protection Agency (EPA), in cooperation with Louisiana and Mississippi state authorities, set up and operated a network of 30 ambient air monitoring sites known as the post-Katrina monitoring network. A significant portion of the post-Katrina air quality monitoring was conducted as part of the EPA National Monitoring Program.

Samples were collected for one year beginning in October 2005. During Phase 1 (October – December 2005), samples were collected daily and analyzed for over 250 targeted compounds/species (organics and metals) at four comprehensive sites and one background site.

Also during Phase 1, 22 other sites sampled daily for metals only. Sampling continued on a less intensive schedule for the remainder of the year-long period, approximately three-day intervals during Phase 2 (January 2006-March 2006), and six-day intervals during Phase 3 (April 2006-September 2006) for most sites. Three new sites began sampling during Phase 3, while several sites stopped sampling prior to the end of September 2006.

This report provides a quantitative analysis of the ambient air samples collected during the 12 months following Hurricane Katrina. To facilitate further assessment of the monitoring data, the complete set of measured concentrations of all compounds/species is presented as appendices of this report. In addition, these data are publicly available in electronic format in EPA's Air Quality Subsystem (AQS) at <http://www.epa.gov/ttn/airs/airsaqs/>.

This report comprises 11 text sections and 15 appendices. Table 1-1 highlights the contents of each section.

Table 1-1. Organization of the Post-Katrina Air Quality Monitoring Report

Report Section	Section Title	Overview of Contents
1	Introduction	Introduction to the Post-Katrina Air Quality Monitoring Report
2	The Post-Katrina Monitoring Network	Provides background information on the scope of the Post-Katrina Air Quality Report and includes information about the: <ul style="list-style-type: none"> • Monitoring locations • Pollutants selected for monitoring • Sampling and analytical methods • Sampling schedules • Completeness of the air monitoring program.
3	Summary of the Post-Katrina Monitoring Network	Provides an overall summary of the ambient measurements and the various analyses conducted on the dataset.
4	Volatile Organic Compounds (VOC)/ Speciated Nonmethane Organic Compounds (SNMOC) Results	Provides analysis of the VOC and SNMOC ambient monitoring data.
5	Carbonyl Results	Provides analysis of the carbonyl ambient monitoring data.
6	Metals Results	Provides analysis of the metals ambient monitoring data.
7	Semivolatile Organic Compounds (SVOC) Results	Provides analysis of the SVOC ambient monitoring data.
8	Hexavalent Chromium Results	Provides analysis of the hexavalent chromium ambient monitoring data.
9	Data Quality	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 Post-Katrina Monitoring Network data.
10	Conclusions	Summarizes the most significant findings of the report.
11	References	Lists the references cited throughout the report.
A1	Site Information for the Post-Katrina Monitoring Network	Provides physical and geographical characteristics of the sites.
A2	Site Maps for the Post-Katrina Monitoring Network	Includes topographical maps and 10 mile facility maps for each of the sites.

Table 1-1. Organization of the Post-Katrina Air Quality Monitoring Report (continued)

Report Section	Section Title	Overview of Contents
B	Invalids	Provides information on each invalid sample.
C	VOC Sampling Statistics	Provides site-specific statistical information for each VOC pollutant.
D	SNMOC Sampling Statistics	Provides site-specific statistical information for each SNMOC pollutant.
E	Carbonyl Compound Sampling Statistics	Provides site-specific statistical information for each carbonyl compound pollutant.
F	SVOC Sampling Statistics	Provides site-specific statistical information for each SVOC pollutant.
G	Metal Sampling Statistics	Provides site-specific statistical information for each metal pollutant.
H	Hexavalent Chromium Sampling Statistics	Provides site-specific statistical information for hexavalent chromium.
I	VOC Raw Data	Provides site-specific raw data for each VOC sample.
J	SNMOC Raw Data	Provides site-specific raw data for each SNMOC sample.
K	Carbonyl Compound Raw Data	Provides site-specific raw data for each carbonyl sample.
L	SVOC Raw Data	Provides site-specific raw data for each SVOC sample.
M	Metals Raw Data	Provides site-specific raw data for each metal sample.
N	Hexavalent Chromium Raw Data	Provides site-specific raw data for each hexavalent chromium sample.
O	Range of Detection Limits	Provides the site-specific range of detection limits for each pollutant.

2.0 The Post-Katrina Monitoring Network

The post-Katrina monitoring network included 30 monitoring sites that collected 24-hour integrated ambient air samples at one-, three-, or six-day sampling intervals for up to 12 months following Hurricane Katrina. All samples were analyzed in a central laboratory, Eastern Research Group, Inc (ERG) in Morrisville, NC, with the exception of metals, which were analyzed by ERG's subcontractor laboratory (Research Triangle Institute, Research Triangle Park, NC). For the purposes of this report, the following terminology will be followed.

- VOC are compounds sampled and analyzed by *Compendium Method TO-15*.
- SNMOC are compounds sampled and analyzed following the *Technical Assistance Document for Sampling and Analysis of Ozone Precursors*.
- Carbonyls are compounds sampled and analyzed by *Compendium Method TO-11A*.
- Metals are elements sampled and analyzed by *Compendium Method IO-3.5*.
- Hexavalent chromium as sampled and analyzed by *EPA/ERG Hexavalent Chromium Method*.
- SVOC PUF are compounds sampled and analyzed by *Compendium Method TO-13A*.
- SVOC XAD-2[®] are compounds sampled by *Compendium Method TO-13A* and analyzed following *SW846 Method 8270*.

Section 2.5 provides further details on each of the sampling methodologies. The following discussion reviews the monitoring locations, pollutants, schedules, methods, and completeness of the post-Katrina monitoring network dataset.

2.1 Monitoring Locations

EPA selected sampling sites located throughout the areas most affected by Hurricane Katrina. Twenty-five of these sites collected only particulate matter; the remaining five sites were designated as comprehensive ambient air monitoring sites and sampled for additional pollutant types to include VOCs, SNMOCs, carbonyls, SVOCs, metals, and hexavalent chromium. Three of these sites (GPMS, PGMS, and TUMS) were existing EPA sites, already

part of EPA’s ambient air monitoring network (USEPA, 2007). One of the five sites, TUMS, was located inland, in northern Mississippi, and served as an indicator of background levels of the pollutants.

Locations of the 30 monitoring sites are presented in Figure 2-1. Corresponding location information such as site code, land use, and coordinates for each site is presented in Table 2-1. Appendix A provides detailed information on the surroundings near the post-Katrina monitoring network locations.

Figure 2-1. Monitoring Site Locations for the Post-Katrina Monitoring Network

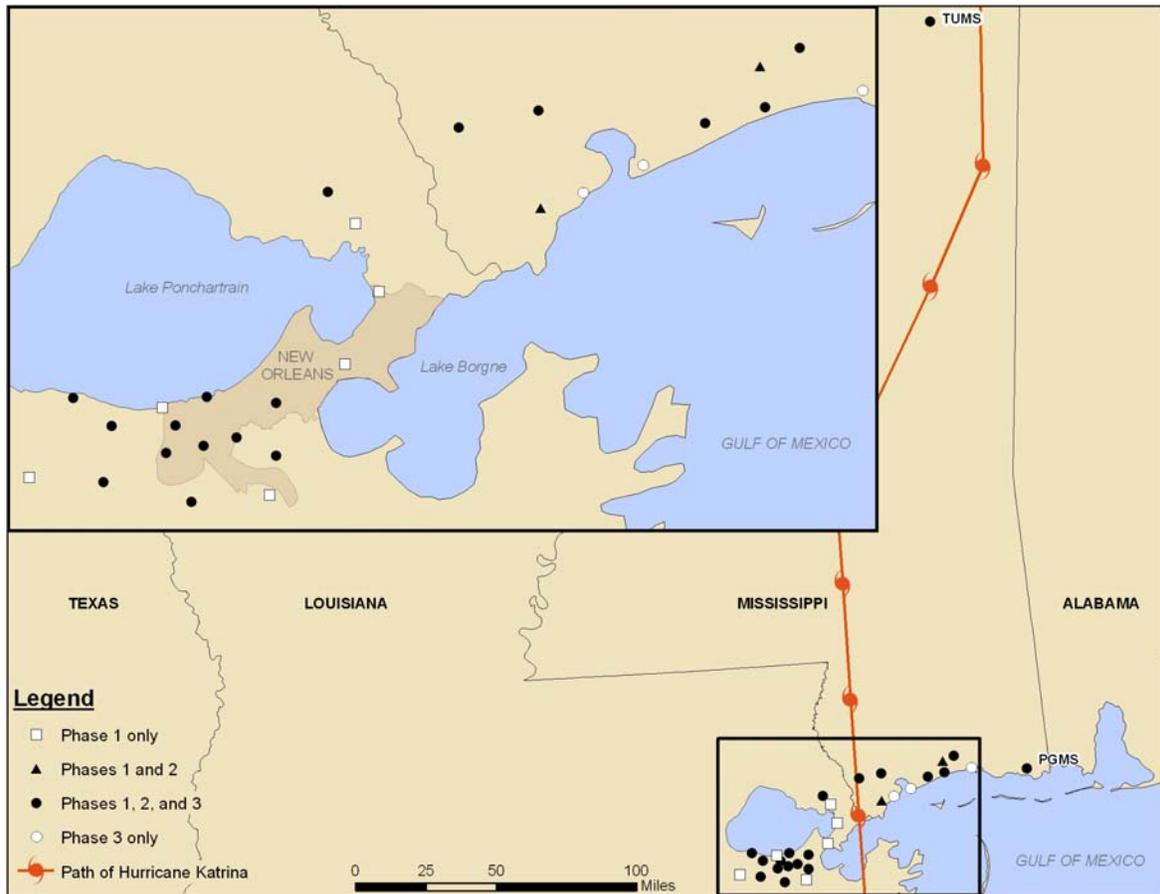


Table 2-1. Physical Location Information for the Post-Katrina Monitoring Network Sites

Post-Katrina Site Code	Monitoring Site Location	Land Use	Location Setting	AQS Site ID	Census Tract ID	Latitude (decimal degrees)	Longitude (decimal degrees)
ARLA	Mustang Dr., Arabi, LA	Commercial	Urban and City Center	22-087-8103	22087030300	29.971	-89.999
BSMS	Woolmarket Rd., Biloxi, MS	Residential	Suburban	28-047-8103	28047003402	30.471	-88.983
BYMS	Division St., Biloxi, MS	Residential	Urban and City Center	28-047-8106	28047000300	30.403	-88.880
CGLA	Coast Guard Reservation, New Orleans, LA	Commercial	Urban and City Center	22-075-8400	22075050200	29.885	-89.950
COMS	Dedeaux Rd., Gulfport, MS	Residential	Suburban	28-047-8102	28047003203	30.449	-89.053
CPLA	Florida Ave., New Orleans, LA	Residential	Urban and City Center	22-071-0012	22071005604	29.994	-90.103
FMLA	French Market Area, New Orleans, LA	Commercial	Urban and City Center	22-071-8401	22071002600	29.962	-90.057
FPLA	Fort Pike, New Orleans, LA	Commercial	Urban and City Center	22-071-8109	22071001734	30.166	-89.737
FSMS	Klondyke Rd. Long Beach, MS	Residential	Suburban	28-047-8101	28047003101	30.374	-89.155
FTLA	Venetian Isles, New Orleans, LA	Commercial	Urban and City Center	22-071-8110	22071001734	30.066	-89.805
GPMS	Maple St., Gulfport, MS	Commercial	Rural	28-047-0008	28047001700	30.390	-89.050
HEMS	Lakeshore Dr., Bay St. Louis, MS	Residential	Suburban	28-045-8104	28045030300	30.269	-89.449
KELA	West Temple Pl., Kenner, LA	Residential	Suburban	22-051-1001	22051020511	30.043	-90.275
KIMS	Fire Dept. Road, Kiln, LA	Residential	Rural	28-045-8105	28045030600	30.410	-89.441
KWLA	Kawk Park, Waggaman, LA	Commercial	Urban and City Center	22-051-8107	22051027502	29.920	-90.232
LALA	River Rd., Luling, LA	Residential	Suburban	22-089-0005	22089062900	29.933	-90.359
LFLA	Lafreniere Park, Metairie, LA	Commercial	Urban and City Center	22-051-8106	22051021600	29.999	-90.212
MALA	Patriot St., Marrero, LA	Residential	Suburban	22-051-2001	22051026400	29.883	-90.083

Bold site codes indicate existing EPA sites, already part of EPA's ambient air monitoring network

**Table 2-1. Physical Location Information for the Post-Katrina Monitoring Network Sites
(continued)**

Post-Katrina Site Code	Monitoring Site Location	Land Use	Location Setting	AQS Site ID	Census Tract ID	Latitude (decimal degrees)	Longitude (decimal degrees)
MELA	Numez St., Meraux, LA	Residential	Suburban	22-087-0004	22087030208	29.942	-89.933
MFLA	Old Gentilly Rd. New Orleans, LA	Commercial	Urban and City Center	22-071-8105	22071001733	30.017	-89.927
NGLA	Engineer Rd., Slidell, LA	Commercial	Urban and City Center	22-103-8400	22103040701	30.314	-89.814
PCMS	West North St., Pass Christian, MS	Residential	Suburban	28-047-8107	28047003000	30.320	-89.267
PGMS	Hospital Rd., Pascagoula, MS	Commercial	Urban and City Center	28-059-0006	28059042200	30.378	-88.534
SAMS	Stennis Space Center, Hancock County, MS	Military Reservation	Suburban	28-045-8201	28045030600	30.393	-89.580
SWLA	Terrace Ave., Slidell, LA	Commercial	Urban and City Center	22-103-8401	22103040900	30.266	-89.770
TUMS	Tupelo Airport Tupelo, MS	Commercial	Suburban	28-081-0005	28081950600	34.265	-88.766
UNLA	Univ. of New Orleans, New Orleans, LA	Commercial	Urban and City Center	22-071-8106	22071013302	30.032	-90.045
USLA	Coast Guard Station, Metairie, LA	Commercial	Urban and City Center	22-051-8105	22051020101	30.021	-90.123
WALA	Eagle St., New Orleans, LA	Residential	Urban and City Center	22-071-0010	22071013200	29.956	-90.122
WAMS	Central Ave., Waveland, MS	Residential	Suburban	28-045-8108	28045030200	30.287	-89.374

Bold site codes indicate existing EPA sites, already part of EPA's ambient air monitoring network

At every comprehensive post-Katrina monitoring network site, air sampling equipment was installed in a temperature-controlled enclosure (usually a trailer or a shed) with the sampling inlet probe extended into the ambient air. All sampling probe inlets were positioned five to 20 feet above local ground level.

For record keeping and reporting purposes, each of the sites was assigned the following:

- A unique four-digit site code: used to track samples from the monitoring sites to the central laboratory; and

- A unique nine-digit AQS site code: used to index monitoring results in the AQS database.

This report cites the unique four-digit code when presenting monitoring results. Sites ending in LA are located in Louisiana, sites ending in MS are located in Mississippi.

2.2 Pollutants Selected for Monitoring

As mentioned in Section 2.0, six pollutant types (VOCs, SNMOCs, carbonyls, SVOCs, metals, and hexavalent chromium) were selected for monitoring.

Tables 2-2 through 2-7 identify the specific target pollutants, their corresponding experimentally derived average method detection limits (MDL) and corresponding range of detection limits. MDLs were determined at the central laboratory using 40 CFR, Part 136 Appendix B procedures (USEPA, 2005b). This procedure involves analyzing at least seven individual standards prepared on/in the appropriate sampling media (per analytical method).

Table 2-2. VOC Detection Limits

Target Pollutant	Average Detection Limit Across the Network (ppbv)	Range of Detection Limits	
		Minimum (ppbv)	Maximum (ppbv)
Acetonitrile	0.052	0.030	0.198
Acetylene	0.035	0.020	0.090
Acrolein	0.055	0.030	0.214
Acrylonitrile	0.046	0.040	0.114
Amyl Methyl Ether, <i>tert</i> -	0.038	0.010	0.100
Benzene	0.015	0.005	0.040
Bromochloromethane	0.020	0.019	0.040
Bromodichloromethane	0.023	0.007	0.060
Bromoform	0.019	0.017	0.040
Bromomethane	0.038	0.010	0.100
Butadiene, 1,3-	0.036	0.006	0.090
Carbon Tetrachloride	0.031	0.009	0.080
Chlorobenzene	0.015	0.005	0.040
Chloroethane	0.037	0.008	0.100
Chloroform	0.022	0.004	0.060
Chloromethane	0.046	0.010	0.130
Chloromethylbenzene	0.022	0.005	0.060
Chloroprene	0.028	0.020	0.060
Dibromochloromethane	0.017	0.010	0.050
Dibromoethane, 1,2-	0.026	0.018	0.060
Dichlorobenzene, <i>m</i> -	0.029	0.004	0.080
Dichlorobenzene, <i>o</i> -	0.043	0.005	0.130
Dichlorobenzene, <i>p</i> -	0.043	0.006	0.110
Dichlorodifluoromethane	0.009	0.005	0.030
Dichloroethane, 1,1-	0.016	0.006	0.040
Dichloroethane, 1,2-	0.026	0.015	0.050
Dichloroethene, 1,1-	0.032	0.010	0.070
Dichloroethylene, <i>cis</i> -1,2-	0.019	0.016	0.050
Dichloroethylene, <i>trans</i> -1,2-	0.033	0.018	0.080
Dichloromethane	0.033	0.017	0.080
Dichloropropane, 1,2-	0.031	0.030	0.066
Dichloropropene, <i>cis</i> -1,3-	0.018	0.010	0.050
Dichloropropene, <i>trans</i> -1,3-	0.031	0.009	0.080
Dichlorotetrafluoroethane	0.008	0.003	0.030
Ethyl Acrylate	0.038	0.010	0.110
Ethyl <i>tert</i> -Butyl Ether	0.030	0.007	0.080
Ethylbenzene	0.015	0.005	0.040
Hexachloro-1,3-butadiene	0.232	0.010	0.660
Methyl Ethyl Ketone	0.035	0.030	0.088
Methyl Isobutyl Ketone	0.037	0.007	0.100
Methyl Methacrylate	0.030	0.006	0.080

Table 2-2. VOC Detection Limits (continued)

Target Pollutant	Average Detection Limit Across the Network (ppbv)	Range of Detection Limits	
		Minimum (ppbv)	Maximum (ppbv)
Methyl <i>tert</i> -Butyl Ether	0.042	0.002	0.120
Octane, <i>n</i> -	0.023	0.006	0.060
Propylene	0.031	0.009	0.080
Styrene	0.024	0.010	0.050
Tetrachloroethane, 1,1,2,2-	0.032	0.010	0.070
Tetrachloroethylene	0.017	0.010	0.050
Toluene	0.015	0.005	0.050
Trichlorobenzene, 1,2,4-	0.102	0.015	0.280
Trichloroethane, 1,1,1-	0.015	0.003	0.040
Trichloroethane, 1,1,2-	0.016	0.006	0.050
Trichloroethylene	0.031	0.010	0.080
Trichlorofluoromethane	0.016	0.007	0.050
Trichlorotrifluoroethane	0.025	0.010	0.060
Trimethylbenzene, 1,2,4-	0.042	0.003	0.110
Trimethylbenzene, 1,3,5-	0.022	0.004	0.060
Vinyl chloride	0.030	0.008	0.080
Xylene, <i>m,p</i> -	0.024	0.009	0.060
Xylene, <i>o</i> -	0.022	0.004	0.050

Table 2-3. Carbonyl Method Detection Limits

Target Pollutant	Average Detection Limit Across the Network (ppbv)	Range of Detection Limits	
		Minimum (ppbv)	Maximum (ppbv)
Acetaldehyde	0.011	0.004	0.027
Acetone	0.008	0.006	0.016
Benzaldehyde	0.003	0.002	0.006
Butyraldehyde	0.004	0.001	0.010
Crotonaldehyde	0.003	0.001	0.008
Dimethylbenzaldehyde, 2,5-	0.002	0.001	0.005
Formaldehyde	0.013	0.005	0.031
Hexaldehyde	0.002	0.002	0.005
Isovaleraldehyde	0.003	0.001	0.007
Propionaldehyde	0.004	0.002	0.010
Tolualdehydes	0.004	0.003	0.008
Valeraldehyde	0.003	0.001	0.007

Table 2-4a. PM₁₀ Metals Method Detection Limits (IO-3.5)

Target Pollutant	Average Detection Limit Across the Network (ng/m ³)	Range of Detection Limits	
		Minimum (ng/m ³)	Maximum (ng/m ³)
Antimony	1.07	0.62	3.00
Arsenic	1.10	0.62	3.00
Beryllium	1.10	0.62	3.00
Cadmium	0.15	0.08	0.40
Chromium	0.72	0.41	2.00
Cobalt	0.37	0.21	1.00
Lead	0.72	0.41	2.00
Manganese	0.37	0.21	1.00
Mercury	1.10	0.62	3.00
Nickel	0.72	0.41	2.00
Potassium	18.19	10.00	50.00
Selenium	0.72	0.41	2.00
Sodium	36.58	21.00	100.00

Table 2-4b. PM_{2.5} Metals Method Detection Limits (IO-3.5)

Target Pollutant	Average Detection Limit Across the Network (ng/m ³)	Range of Detection Limits	
		Minimum (ng/m ³)	Maximum (ng/m ³)
Antimony	0.67	0.60	2.30
Arsenic	0.64	0.60	0.79
Beryllium	0.64	0.60	0.79
Cadmium	0.09	0.08	0.11
Chromium	0.43	0.40	0.53
Cobalt	0.22	0.20	0.26
Lead	0.43	0.40	0.53
Manganese	0.22	0.20	0.26
Mercury	0.64	0.60	0.79
Nickel	0.43	0.40	0.53
Potassium	10.68	10.00	13.00
Selenium	0.43	0.40	0.53
Sodium	21.56	20.00	26.00

Table 2-5. SNMOC Method Detection Limits

Target Pollutant	Average Detection Limit Across the Network (ppbC)	Range of Detection Limits	
		Minimum (ppbC)	Maximum (ppbC)
Acetylene	0.072	0.060	0.200
Benzene	0.261	0.260	0.520
Butadiene, 1,3-	0.434	0.220	0.520
Butane, <i>n</i> -	0.423	0.180	0.520
Butene, <i>cis</i> -2-	0.157	0.130	0.440
Butene, <i>trans</i> -2-	0.113	0.080	0.380
Cyclohexane	0.283	0.260	0.520
Cyclopentane	0.144	0.120	0.400
Cyclopentene	0.322	0.320	0.640
Decane, <i>n</i> -	0.260	0.200	0.800
Decene, 1-	0.329	0.260	0.980
Diethylbenzene, <i>m</i> -	0.329	0.260	0.980
Diethylbenzene, <i>p</i> -	0.258	0.160	0.980
Dimethylbutane, 2,2-	0.250	0.150	0.300
Dimethylbutane, 2,3-	0.266	0.250	0.500
Dimethylpentane, 2,3-	0.418	0.380	0.760
Dimethylpentane, 2,4-	0.288	0.280	0.600
Dodecane, <i>n</i> -	0.757	0.710	1.420
Dodecene, 1-	0.757	0.710	1.420
Ethane	0.166	0.080	0.200
Ethyl-1-butene, 2-	0.342	0.290	0.920
Ethylbenzene	0.209	0.190	0.500
Ethylene	0.073	0.070	0.160
Ethyltoluene, <i>m</i> -	0.209	0.140	0.740
Ethyltoluene, <i>o</i> -	0.210	0.150	0.700
Ethyltoluene, <i>p</i> -	0.276	0.210	0.860
Heptane, <i>n</i> -	0.256	0.240	0.480
Heptene, 1-	0.418	0.380	0.760
Hexane, <i>n</i> -	0.126	0.090	0.420
Hexene, 1-	0.321	0.260	0.920
Hexene, <i>cis</i> -2-	0.342	0.290	0.920
Hexene, <i>trans</i> -2-	0.342	0.290	0.920
Isobutane	0.079	0.070	0.200
Isobutene/1-Butene	0.266	0.180	0.360
Isopentane	0.280	0.180	0.360
Isoprene	0.201	0.170	0.540
Isopropylbenzene	0.356	0.340	0.680
Methyl-1-butene, 2-	0.322	0.320	0.640
Methyl-1-butene, 3-	0.322	0.320	0.640
Methyl-1-pentene, 2-	0.342	0.290	0.920
Methyl-1-pentene, 4-	0.342	0.290	0.920

Table 2-5. SNMOC Method Detection Limits (continued)

Target Pollutant	Average Detection Limit Across the Network (ppbC)	Range of Detection Limits	
		Minimum (ppbC)	Maximum (ppbC)
Methyl-2-butene, 2-	0.322	0.320	0.640
Methylcyclohexane	0.148	0.130	0.380
Methylcyclopentane	0.150	0.120	0.440
Methylheptane, 2-	0.345	0.230	0.460
Methylheptane, 3-	0.249	0.170	0.340
Methylhexane, 2-	0.216	0.180	0.600
Methylhexane, 3-	0.231	0.230	0.460
Methylpentane, 2-	0.249	0.170	0.340
Methylpentane, 3-	0.237	0.230	0.500
Nonane, <i>n</i> -	0.222	0.150	0.780
Nonene, 1-	0.398	0.360	0.960
Octane, <i>n</i> -	0.240	0.210	0.420
Octene, 1-	0.714	0.470	0.940
Pentane, <i>n</i> -	0.114	0.090	0.340
Pentene, 1-	0.214	0.210	0.440
Pentene, <i>cis</i> -2-	0.180	0.120	0.640
Pentene, <i>trans</i> -2-	0.183	0.140	0.280
Pinene, <i>a</i> -	0.329	0.260	0.980
Pinene, <i>b</i> -	0.329	0.260	0.980
Propane	0.160	0.110	0.220
Propylbenzene, <i>n</i> -	0.236	0.170	0.780
Propylene	0.121	0.120	0.240
Propyne	0.163	0.120	0.240
Styrene	0.714	0.470	0.940
Toluene	0.331	0.280	0.560
Tridecane, <i>n</i> -	0.757	0.710	1.420
Tridecene, 1-	0.757	0.710	1.420
Trimethylbenzene, 1,2,3-	0.196	0.130	0.700
Trimethylbenzene, 1,2,4-	0.291	0.210	0.960
Trimethylbenzene, 1,3,5-	0.198	0.150	0.620
Trimethylpentane, 2,2,3-	0.714	0.470	0.940
Trimethylpentane, 2,2,4-	0.370	0.220	0.440
Trimethylpentane, 2,3,4-	0.318	0.210	0.420
Undecane, <i>n</i> -	0.514	0.320	0.640
Undecene, 1-	0.514	0.320	0.640
Xylene, <i>m,p</i> -	0.274	0.220	0.800
Xylene, <i>o</i> -	0.215	0.190	0.540

Table 2-6a. SVOC PUF Method Detection Limits

Target Pollutant	Average Detection Limit Across the Network (pg/m ³)	Range of Detection Limits	
		Minimum (pg/m ³)	Maximum (pg/m ³)
Acenaphthene	0.121	0.090	0.162
Acenaphthylene	0.738	0.547	0.985
Anthracene	0.440	0.327	0.588
Benzo (a) anthracene	0.232	0.172	0.310
Benzo (a) pyrene	0.427	0.317	0.570
Benzo (b) fluoranthene	0.185	0.137	0.247
Benzo (e) pyrene	0.205	0.152	0.273
Benzo (g,h,i) perylene	0.160	0.119	0.214
Benzo (k) fluoranthene	0.168	0.125	0.225
Chrysene	0.122	0.091	0.163
Coronene	0.195	0.145	0.261
Dibenz (a,h) anthracene	0.179	0.133	0.239
Fluoranthene	0.192	0.142	0.256
Fluorene	0.168	0.125	0.225
Indeno(1,2,3-cd)pyrene	0.202	0.150	0.270
Naphthalene	0.121	0.090	0.162
Perylene	0.268	0.199	0.358
Phenanthrene	0.138	0.102	0.184
Pyrene	0.192	0.142	0.256

Note: These samples were prepared and analyzed following TO-13A Method with Gas Chromatography/Mass Spectrometry in the Selective Ion Monitoring Mode (GC/MS SIM)

Table 2-6b. SVOC XAD-2[®] Method Detection Limits

Target Pollutant	Average Detection Limit Across the Network (µg/m ³)	Range of Detection Limits	
		Minimum (µg/m ³)	Maximum (µg/m ³)
Acenaphthene	0.060	0.015	0.143
Acenaphthylene	0.052	0.013	0.125
Acetophenone	0.078	0.013	0.197
Acetylaminofluorene, 2-	0.050	0.013	0.107
Aminobiphenyl, 4-	0.284	0.014	0.768
Aniline	0.143	0.013	0.375
Anthracene	0.076	0.021	0.179
Azobenzene	0.067	0.005	0.179
Benzidine	0.919	0.176	1.449
Benzo (a) anthracene	0.047	0.013	0.107
Benzo (a) pyrene	0.042	0.005	0.107
Benzo (b) fluoranthene	0.077	0.011	0.197
Benzo (g,h,i) perylene	0.071	0.020	0.161

Table 2-6b. SVOC XAD-2[®] Method Detection Limits (continued)

Target Pollutant	Average Detection Limit Across the Network ($\mu\text{g}/\text{m}^3$)	Range of Detection Limits	
		Minimum ($\mu\text{g}/\text{m}^3$)	Maximum ($\mu\text{g}/\text{m}^3$)
Benzo (k) fluoranthene	0.068	0.018	0.161
Benzyl alcohol	0.099	0.015	0.251
Bis(2-chloroethoxy)methane	0.077	0.012	0.197
Bis(2-chloroethyl)ether	0.077	0.012	0.197
Bis(2-chloroisopropyl)ether	0.066	0.013	0.161
Bis(2-ethylhexyl)phthalate	0.061	0.017	0.143
Bromophenyl phenyl ether, 4-	0.078	0.022	0.179
Butyl benzyl phthalate	0.067	0.016	0.161
Carbazole	0.070	0.020	0.161
Chloro-3-methylphenol, 4-	0.079	0.015	0.197
Chloroaniline, 4-	0.105	0.014	0.269
Chlorobenzilate	0.039	0.011	0.089
Chloronaphthalene, 2-	0.053	0.014	0.125
Chlorophenol, 2-	0.085	0.014	0.215
Chlorophenyl phenyl ether, 4-	0.062	0.017	0.143
Chrysene	0.071	0.013	0.179
Diallate	0.059	0.013	0.143
Dibenz (a,h) anthracene	0.061	0.017	0.143
Dibenzofuran	0.040	0.011	0.089
Dichlorobenzene, 1,2-	0.071	0.013	0.179
Dichlorobenzene, 1,3-	0.058	0.012	0.143
Dichlorobenzene, 1,4-	0.066	0.014	0.161
Dichlorobenzidine, 3,3'	0.084	0.012	0.215
Dichlorophenol, 2,4-	0.067	0.015	0.161
Dichlorophenol, 2,6-	0.067	0.015	0.161
Diethyl phthalate	0.057	0.015	0.125
Dimethyl phthalate	0.053	0.013	0.125
Dimethylaminoazobenzene, 4-	0.049	0.007	0.125
Dimethylbenz(a)anthracene, 7,12-	0.068	0.018	0.161
Dimethylbenzidine, 3,3'	0.568	0.083	1.449
Dimethylphenol, 2,4-	0.347	0.011	0.948
Di-n-butyl phthalate	0.060	0.015	0.143
Dinitro-2-methylphenol, 4,6-	0.078	0.013	0.197
Dinitrobenzene, 1,3-	0.087	0.018	0.215
Dinitrophenol, 2,4-	0.113	0.028	0.233
Dinitrotoluene, 2,4-	0.081	0.017	0.197
Dinitrotoluene, 2,6-	0.077	0.012	0.197
Di-n-octyl phthalate	0.051	0.011	0.125
Dinoseb	0.075	0.019	0.179
Diphenylamine	0.284	0.014	0.768
Ethyl Methanesulfonate	0.088	0.019	0.215

Table 2-6b. SVOC XAD-2[®] Method Detection Limits (continued)

Target Pollutant	Average Detection Limit Across the Network ($\mu\text{g}/\text{m}^3$)	Range of Detection Limits	
		Minimum ($\mu\text{g}/\text{m}^3$)	Maximum ($\mu\text{g}/\text{m}^3$)
Fluoranthene	0.048	0.013	0.107
Fluorene	0.053	0.013	0.125
Hexachlorobenzene	0.059	0.013	0.143
Hexachlorobutadiene	0.086	0.015	0.215
Hexachlorocyclopentadiene	0.119	0.017	0.303
Hexachloroethane	0.061	0.017	0.143
Hexachloropropene	0.079	0.014	0.197
Indeno(1,2,3-cd)pyrene	0.017	0.003	0.031
Isodrin	0.054	0.015	0.125
Isophorone	0.065	0.012	0.161
Isosafrole	0.067	0.015	0.161
Methyl Methanesulfonate	0.148	0.028	0.233
Methylcholanthrene, 3-	0.076	0.021	0.179
Methylnaphthalene, 2-	0.074	0.017	0.179
Methylphenol, 2-	0.107	0.019	0.269
Methylphenol, 3,4-	0.100	0.018	0.251
Naphthalene	0.081	0.017	0.197
Naphthoquinone, 1,4-	0.072	0.020	0.161
Naphthylamine, 1-	0.269	0.022	0.717
Naphthylamine, 2-	0.258	0.013	0.699
Nitroaniline, 2-	0.074	0.016	0.179
Nitroaniline, 3-	0.057	0.010	0.143
Nitroaniline, 4-	0.072	0.013	0.179
Nitrobenzene	0.065	0.013	0.161
Nitro-o-toluidine, 5-	0.065	0.012	0.161
Nitrophenol, 2-	0.104	0.013	0.269
Nitrophenol, 4-	0.087	0.024	0.197
Nitrosodiethylamine	0.139	0.026	0.221
Nitrosodimethylamine, <i>N</i> -	0.125	0.024	0.197
Nitrosodi-n-butylamine, <i>N</i> -	0.061	0.017	0.143
Nitrosodi-n-propylamine, <i>N</i> -	0.071	0.020	0.161
Nitrosomethylethylamine, <i>N</i> -	0.125	0.024	0.197
Nitrosopiperidine, <i>N</i> -	0.061	0.016	0.143
Nitrosopyrrolidine, <i>N</i> -	0.091	0.023	0.215
Pentachlorobenzene	0.061	0.016	0.143
Pentachloroethane	0.100	0.018	0.251
Pentachloronitrobenzene	0.089	0.021	0.215
Pentachlorophenol	0.088	0.019	0.215
Phenacetin	0.061	0.017	0.143
Phenanthrene	0.067	0.016	0.161
Phenol	0.091	0.013	0.233

Table 2-6b. SVOC XAD-2[®] Method Detection Limits (continued)

Target Pollutant	Average Detection Limit Across the Network ($\mu\text{g}/\text{m}^3$)	Range of Detection Limits	
		Minimum ($\mu\text{g}/\text{m}^3$)	Maximum ($\mu\text{g}/\text{m}^3$)
Picoline, 2-	0.348	0.024	0.930
Pronamide	0.074	0.016	0.179
Pyrene	0.066	0.014	0.161
Pyridine	0.216	0.041	0.339
Safrole	0.073	0.015	0.179
Tetrachlorobenzene, 1,2,4,5-	0.075	0.018	0.179
Tetrachlorophenol, 2,3,4,6-	0.078	0.013	0.197
Toluidine, <i>o</i> -	0.086	0.016	0.215
Trichlorobenzene, 1,2,4-	0.066	0.014	0.161
Trichlorophenol, 2,4,5-	0.079	0.015	0.197
Trichlorophenol, 2,4,6-	0.059	0.013	0.143

Note: These samples were prepared following TO-13A Method and analyzed following SW 846 Method 8270 with Gas Chromatography/Mass Spectrometry in the SCAN Mode (GC/MS SCAN)

Table 2-7. Hexavalent Chromium Method Detection Limit (EPA/ERG Hexavalent Chromium Method)

Target Pollutant	Average Detection Limit Across the Network (ng/m^3)	Range of Detection Limits	
		Minimum (ng/m^3)	Maximum (ng/m^3)
Hexavalent Chromium	0.015	0.010	0.025

2.3 Sampling Schedules and Pollutants Collected

The types of pollutants that were sampled at each site varied. The five comprehensive sampling sites collected samples of additional pollutant types than the remaining 25 sites, as illustrated in Table 2-8. The remaining 25 sites only collected samples for metals analysis.

Table 2-8. Pollutant Types Collected by the Comprehensive Sites

Site	VOC	Carbonyl	Metals	SNMOC	SVOC	Hexavalent Chromium
KELA	✓	✓	✓	✓	✓	✓
GPMS	✓	✓	✓	✓	✓	✓
SAMS	✓	✓	✓	✓	✓	✓
PGMS	✓	✓	✓			
TUMS	✓	✓				

The sampling period began in October 2005 and ended in September 2006. Figure 2-2 shows the sampling schedule and pollutant types that were collected for the five comprehensive sites. Figure 2-3 shows the sampling schedule and pollutant types for the remaining 25 sites.

Many sites began sampling after October 2005 and many sites ended sampling before September 2006. However, two sampling sites (GPMS and TUMS) collected samples continuously for the entire 12-month period. Samples were collected at various frequencies for 12 months, beginning in October 2005. Sampling frequencies varied by phase; although some sites periodically deviated from this schedule, the following sampling schedule was employed:

- Phase 1 (October-December 2005), 1-day intervals (daily);
- Phase 2 (January-March 2006), 3-day intervals; and
- Phase 3 (April-September 2006), 6-day intervals.

In accordance with the post-Katrina monitoring network schedule, 24-hour integrated samples were collected daily at most monitoring sites during Phase 1. A reduced frequency sampling schedule was applied during Phase 2 and Phase 3. Sample collections generally began and ended at midnight, local standard time, although collection times varied at the onset of sampling.

As part of the sampling schedule, site operators were instructed to collect duplicate samples on approximately 10 percent of the scheduled sampling days. Sampling schedules were distributed to help site operators complete the collection of samples, duplicates, and field blanks. In cases where monitors failed to collect valid samples on a scheduled sampling day, site operators attempted to reschedule collections for other days.

2.4 Completeness

Completeness refers to the number of valid samples *actually* collected, compared to the number of samples *scheduled* to be collected. The completeness of an air monitoring program

Figure 2-2. Schedule and Pollutants Collected by the Comprehensive Sites

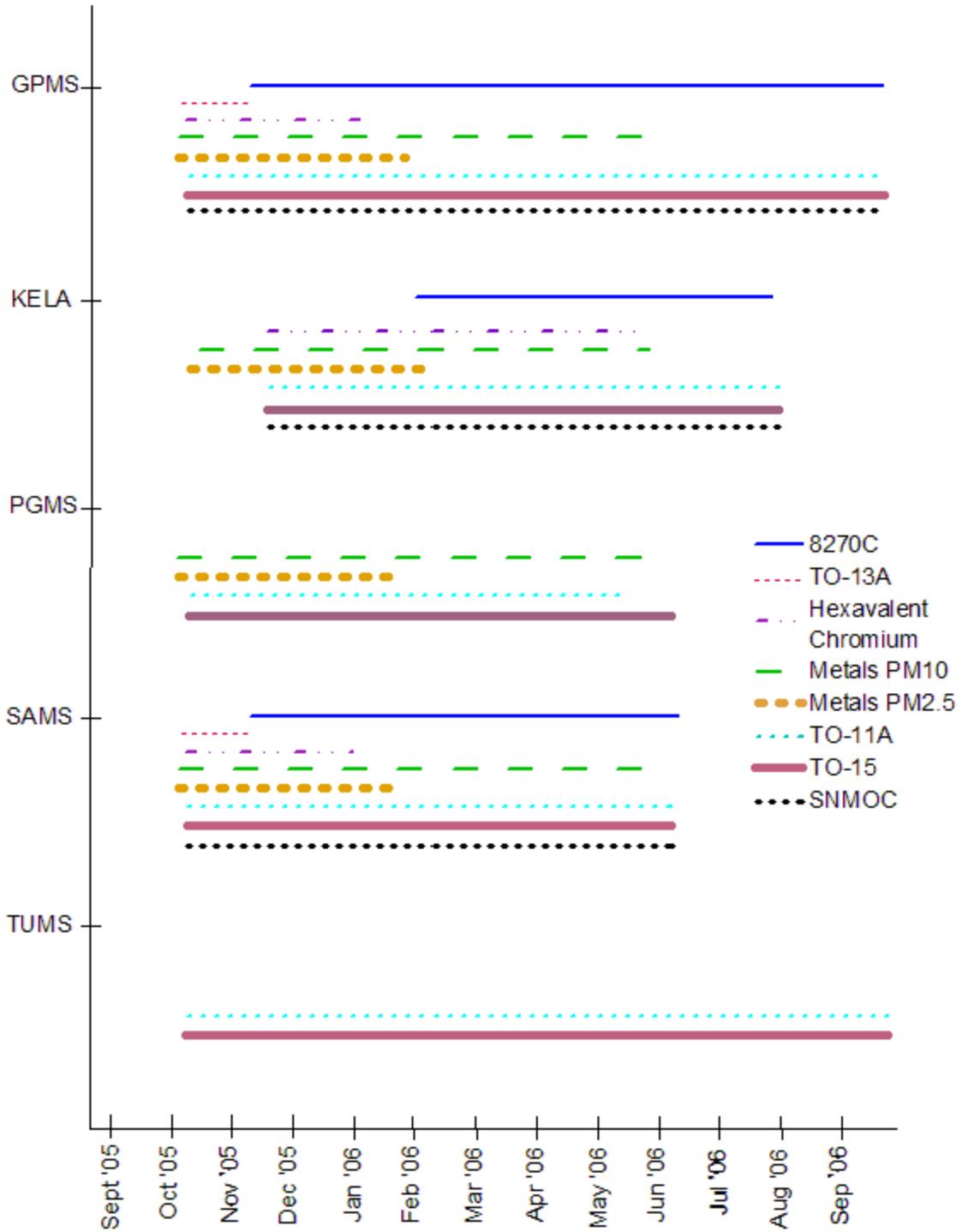
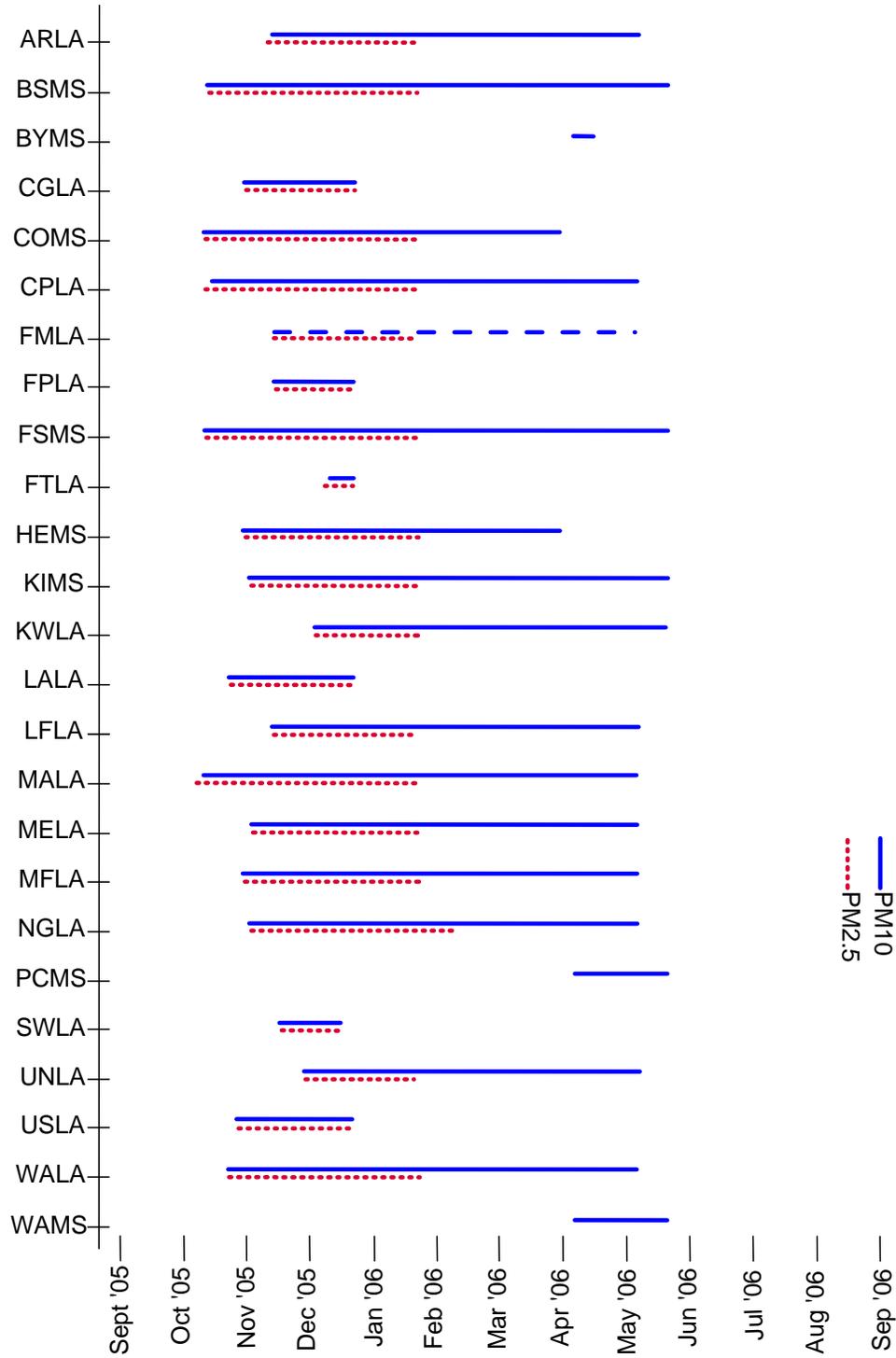


Figure 2-3. Schedule and Pollutants Collected by the Remaining Sites



can be a quantitative 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 the samples were invalidated.

A large portion of the post-Katrina Air Quality Monitoring was conducted as part of the EPA National Monitoring Programs. Data quality objectives were based on an EPA-approved Level V Quality Assurance Project Plan (QAPP) (ERG, 2005). According to the QAPP, data for 85-100 percent of samples collected at a given monitoring station must be valid to be appropriate for use in data characterization. Table 2-9 shows that all site specific data sets met this data quality objective.

- For VOC sampling, the completeness ranged from 93 to 98 percent, with an overall completeness of 95 percent for all sites;
- For carbonyl sampling, the completeness ranged from 97 to 100 percent with an overall completeness of 99 percent for all sites;
- For SNMOC sampling, the completeness ranged from 93 to 96 percent with an overall completeness of 95 percent for all sites;
- For SVOC sampling, the completeness was 95 to 98 percent with an overall completeness of 97 percent for all sites;
- For metals sampling, the completeness was 86 to 100 percent with an overall completeness of 95 percent for all sites;
- For hexavalent chromium sampling, the completeness was 96 to 100 percent with an overall completeness of 98 percent for all sites.

2.5 Sampling and Analytical Methods

This section describes the five EPA-approved methods that were used to characterize ambient concentrations from the post-Katrina monitoring network. For more detailed descriptions refer to EPA's original method documentation.

Table 2-9. Sampling Schedules and Completeness

Site	Sampling Period ^a		Carbonyl			VOC			Metals			Hex Chrome			SNMOC			SVOC			
	Starting Date	Ending Date	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	
ARLA	11/5/05	5/8/06	--	--	--	115	132	87	--	--	--	--	--	--	--	--	--	--	--	--	--
BSMS	10/6/05	5/23/06	--	--	--	197	204	97	--	--	--	--	--	--	--	--	--	--	--	--	--
BYMS	4/5/06	4/11/06	--	--	--	2	2	100	--	--	--	--	--	--	--	--	--	--	--	--	--
CGLA	10/30/05	12/21/05	--	--	--	88	89	99	--	--	--	--	--	--	--	--	--	--	--	--	--
COMS	10/5/05	3/30/06	--	--	--	199	202	99	--	--	--	--	--	--	--	--	--	--	--	--	--
CPLA	10/5/05	5/8/06	--	--	--	121	130	93	--	--	--	--	--	--	--	--	--	--	--	--	--
FMLA	11/7/05	5/5/06	--	--	--	93	99	94	--	--	--	--	--	--	--	--	--	--	--	--	--
FPLA	11/11/05	12/20/05	--	--	--	25	26	96	--	--	--	--	--	--	--	--	--	--	--	--	--
FSMS	10/5/05	5/23/06	--	--	--	210	215	98	--	--	--	--	--	--	--	--	--	--	--	--	--
FTLA	12/9/05	12/20/05	--	--	--	19	21	90	--	--	--	--	--	--	--	--	--	--	--	--	--
GPMS	10/1/05	9/26/06	138	143	97	129	209	95	129	138	93	85	87	98	129	138	93	140	144	97	97
HEMS	10/29/05	3/30/06	--	--	--	--	160	98	--	--	--	--	--	--	--	--	--	--	--	--	--
KELA	10/5/05	7/31/06	109	109	100	102	133	97	102	107	95	109	113	96	102	107	95	59	60	98	98
KIMS	11/1/05	5/23/06	--	--	--	--	145	92	--	--	--	--	--	--	--	--	--	--	--	--	--
KWLA	12/2/05	5/5/06	--	--	--	--	58	92	--	--	--	--	--	--	--	--	--	--	--	--	--

^a Begins with 1st valid sample and may include any of the pollutant types
A = Valid Samples; B = Total Number of Samples; C = Completeness (%)

Table 2-9. Sampling Schedules and Completeness (continued)

Site	Sampling Period ^a		Carbonyl			VOC			Metals			Hex Chrome			SNMOC			SVOC		
	Starting Date	Ending Date	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C
LALA	10/21/05	12/21/05	--	--	--	31	36	86	--	--	--	--	--	--	--	--	--	--	--	--
LFLA	11/7/05	5/8/06	--	--	--	47	51	92	--	--	--	--	--	--	--	--	--	--	--	--
MALA	10/5/05	5/5/06	--	--	--	62	66	94	--	--	--	--	--	--	--	--	--	--	--	--
MELA	11/3/05	5/8/06	--	--	--	145	159	91	--	--	--	--	--	--	--	--	--	--	--	--
MFLA	10/30/05	5/8/06	--	--	--	147	154	95	--	--	--	--	--	--	--	--	--	--	--	--
NGLA	11/2/05	5/8/06	--	--	--	52	57	91	--	--	--	--	--	--	--	--	--	--	--	--
PCMS	4/5/06	5/23/06	--	--	--	9	9	100	--	--	--	--	--	--	--	--	--	--	--	--
PGMS	10/1/05	6/4/06	113	114	99	102	110	93	212	224	95	--	--	--	--	--	--	--	--	--
SAMS	10/1/05	6/4/06	124	126	98	121	126	96	220	223	99	86	86	100	121	126	96	120	126	95
SWLA	11/17/05	12/15/06	--	--	--	--	--	--	50	56	89	--	--	--	--	--	--	--	--	--
TUMS	10/7/05	9/26/06	59	59	100	59	60	98	--	--	--	--	--	--	--	--	--	--	--	--
UNLA	11/28/05	5/5/06	--	--	--	--	--	--	72	76	95	--	--	--	--	--	--	--	--	--
USLA	10/26/05	12/21/06	--	--	--	--	--	--	35	36	97	--	--	--	--	--	--	--	--	--
WALA	10/20/05	5/8/06	--	--	--	--	--	--	97	98	99	--	--	--	--	--	--	--	--	--
WAMS	4/5/06	5/23/06	--	--	--	--	--	--	9	9	100	--	--	--	--	--	--	--	--	--
Totals			543	551	99	513	541	95	2,962	3,115	95	280	286	98	352	371	95	319	330	97

^a Begins with 1st valid sample and may include any of the pollutant types

A = Valid Samples; B = Total Number of Samples; C = Completeness (%)

2.5.1 VOC and SNMOC Sampling and Analytical Methods

VOC and SNMOC sampling and analysis was performed in accordance with EPA Compendium Method TO-15 (USEPA, 1999a) and the procedure presented in EPAs “Technical Assistance Document for Sampling and Analysis of Ozone Precursors” (USEPA, 1998), respectively. Ambient air samples for analysis were collected in passivated stainless steel canisters. The central laboratory distributed the prepared canisters (i.e., cleaned and evacuated) to the monitoring sites before each scheduled sampling event, and site operators connected the canisters to air sampling equipment prior to each sampling day. Before use in the field, the passivated canisters had internal pressures much lower than atmospheric pressure (i.e., ~ 29.5" Hg). Using this pressure differential, ambient air flowed into the canisters once sampling was initiated. A flow controller on the sampling device inlet 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 terminated sample collection. Site operators then returned the canisters to the central laboratory for analysis.

By analyzing each sample with gas chromatography incorporating mass spectrometry and flame ionization detection (GC/MS-FID), laboratory staff measured ambient air concentrations of 60 VOC, 80 SNMOC, and total NMOC (TNMOC). TNMOC is the sum of all of the individual hydrocarbon species concentrations within the sample. Because isobutene and 1-butene elute from the GC column at the same time, the VOC analytical method reports only the sum of the concentrations for these compounds. The same measurement applies to *m*-xylene and *p*-xylene.

Table 2-2 summarizes the MDLs for the laboratory analysis of the VOC samples and Table 2-5 summarizes the MDLs for the SNMOC samples. Although the sensitivity of the analytical method varies from pollutant-to-pollutant, the average detection limit for VOC reported for every pollutant is lower than 0.25 parts per billion by volume (ppbv). SNMOC detection limits are expressed in parts per billion carbon (ppbC). All of the average detection limits were less than 0.80 ppbC.

2.5.2 Carbonyl Sampling and Analytical Method

Carbonyl sampling and analysis was performed in accordance with EPA Compendium Method TO-11A (USEPA, 1999b). Ambient air samples for carbonyl analysis were collected by passing ambient air through a cartridge filled with silica gel, which was coated with 2,4-dinitrophenylhydrazine (DNPH). DNPH is known to react selectively and reversibly with many aldehydes and ketones. During collection, carbonyl compounds were captured while other compounds passed through the cartridge without reacting with the DNPH-coated media. As with the VOC sampling, the central laboratory distributed the DNPH cartridges to the monitoring sites, and site operators connected the cartridges to the air sampling equipment. After each 24-hour sampling period, site operators recovered the cartridges and returned them to the central laboratory for chemical analysis.

To quantify concentrations of carbonyls in each sample, laboratory analysts eluted the exposed silica gel cartridges with acetonitrile. This acetonitrile elution process provided a sample solution of DNPH derivatives of the aldehydes and ketones for analysis. High-performance liquid chromatography (HPLC) analysis and ultraviolet detection of these sample solutions determined the relative amounts of individual carbonyl compounds present in the original ambient air. Because butyraldehyde/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.

Table 2-3 lists the MDLs reported by the central laboratory for measuring concentrations of 15 carbonyl compounds. Although the sensitivity of the analytical method varies from pollutant-to-pollutant and from site-to-site, the experimentally-determined average detection limit reported by the central laboratory for every pollutant is less than or equal to 0.02 ppbv for a 1000 liter (L) sample volume.

2.5.3 Metals Sampling and Analytical Method

Metals sampling and analysis was performed in accordance with EPA Compendium Method IO-3.5 (USEPA, 1999c). Metals filters, together with chain-of-custody forms (and all associated documentation), were shipped to the field by ERG's subcontractor laboratory (Research Triangle Institute) prior to sample collection. The filters were returned to ERG's subcontractor laboratory for analysis after collection was completed.

Tables 2-4a (PM₁₀) and 2-4b (PM_{2.5}) list the MDLs for the laboratory analysis of the metal samples. The monitoring sites used 47 millimeter (mm) diameter filters. For typical sample volume of 20 cubic meter (m³), the MDLs ranged from 0.15 to 36.58 nanogram per cubic meter (ng/m³) for PM₁₀ and 0.09 to 21.56 ng/m³ for PM_{2.5}.

2.5.4 Semivolatile Sampling and Analytical Method

Semivolatile sampling and analysis was performed in accordance with EPA Compendium Method TO-13A and SW846/Method 8270C (U.S. EPA, 1999d). Semivolatile sampling modules containing either prepared polyurethane foam (PUF) or prepared XAD-2[®] resin, and petri dishes containing filters, together with chain-of-custody forms (and all associated documentation), were shipped to the field prior to collection. They were returned to the central laboratory after collection was completed. Upon receipt at the central laboratory, sample preparation and analytical procedures were conducted, based on which collection media was applied during a given collection event.

Tables 2-6a (TO-13) and 2-6b (SW846/Method 8270C) list the MDLs for analysis of the SVOC samples. The average MDL for SVOC measured by Method TO-13 ranged from 0.0121 to 0.0738 picograms per cubic meter (pg/m³), in an average sample volume of 300 m³. The average MDL for compounds measured by SW846/Method 8270C ranged from 0.017 to 0.919 micrograms per cubic meter (µg/m³), in an average sample volume of 300 m³.

2.5.5 Hexavalent Chromium Sampling and Analytical Method

Hexavalent chromium sampling and analysis was performed using the EPA-approved EPA/ERG Hexavalent Chromium Method. For a detailed description of the method, refer to the

Standard Operating Procedure for the Determination of Hexavalent Chromium in Ambient Air Analyzed by Ion Chromatography (IC) (USEPA, 2006a). MDLs were experimentally determined for each individual monitoring site. The differences in the volumes pulled through the filters cause the MDLs to vary from site-to-site. The MDLs were determined using the procedures set forth in 40 CFR Part 136, Appendix B (USEPA, 2005b). Table 2-7 shows hexavalent chromium MDLs ranged from 0.010 ng/m³ to 0.025 ng/m³. The average MDL for the network was 0.015 ng/m³.

3.0 Summary of the Post-Katrina Monitoring Network Dataset

This section describes the statistical treatments that were completed on the post-Katrina monitoring network dataset. First, this section describes the contents of the dataset and identifies where different elements of the dataset can be found in this report; then it describes the various statistical treatments that were completed, results of which are presented by pollutant type in Sections 4.0 through 8.0 of this report.

3.1 Dataset and Standardization

A total of 88,701 pollutant concentrations (including duplicate, replicate, and collocated samples, as well as non-detects) were collected at 27 sites during Phase 1 sampling and 66,309 pollutant concentrations were collected at 24 sites during Phase 2 and 3 sampling.

Approximately 42 percent of the pollutants sampled across the network were above the MDL.

Table 3-1 summarizes the dataset and identifies where the information is located in this report.

Table 3-1. Summary of Dataset and Location of Information in this Report

Pollutant type	Pollutant concentrations collected		% above MDL (all phases)	Discussion of data analysis (Section#)	Summary tables (Appendix#)	Raw monitoring data (Appendix#)
	Phase 1	Phases 2 and 3				
VOC	22,007	18,054	34	4	C	I
Carbonyls	4,728	3,960	87	5	D	J
Metals	29,289	11,401	63	6	E	K
SNMOC	20,979	16,362	43	4	F	L
SVOC	11,468	16,450	7	7	G	M
Hexavalent Chromium	230	82	44	8	H	N
Totals	88,701	66,309	42			

The raw data tables in Appendices I through N were uploaded into a database for air quality statistical analysis. To improve the presentation and understanding of data in this report, the following standardizations were made to the dataset:

Single or summed concentrations. Statistical analysis required one concentration per pollutant per day per site. Thus, all duplicate and replicate (or collocated) samples were averaged to provide a single concentration for each pollutant for each sample day at each site.

For xylenes, results are broken down into *m,p*-xylene and *o*-xylene and the individual pollutant concentrations are listed. Also, if a pollutant was measured by two separate methods that produce similar results, such as benzene with the VOC and SNMOC methods, then the two concentrations were averaged together. If a pollutant was measured by two separate methods that do not produce similar results, such as SVOC measured under TO-13A and 8270C methods, then the two concentrations were not averaged together, but were viewed separately. For the purpose of clarity, this processed single concentration is referred to as a *preprocessed daily measurement*.

Unit of measure. To compare concentrations across multiple sampling methods, all concentrations were converted to a common unit of measure, $\mu\text{g}/\text{m}^3$. However, if a particular method was considered separately from others, then the unit of measure associated with the particular sampling method was used. Consequently, readers should pay close attention to the unit of measure associated with each analysis.

The remainder of this section describes the various statistical and non-statistical data analysis techniques applied to each pollutant type. Results of analyses by pollutant type are presented in Sections 4.0 through 8.0 of this report.

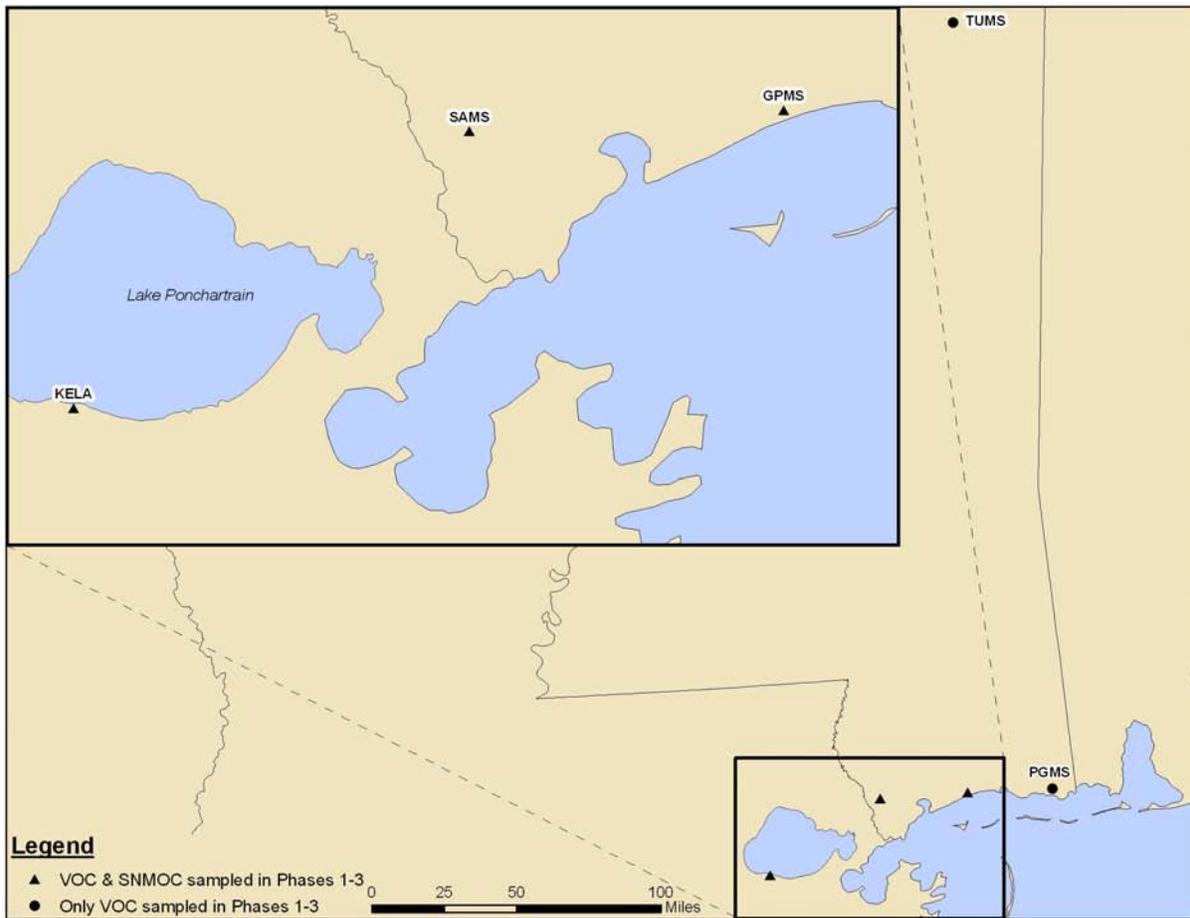
3.2 Statistical Treatment

The post-Katrina monitoring network dataset was statistically examined to characterize the distribution of the data, and to identify patterns in geographical distributions of pollutants. Statistical treatment was performed on the dataset to determine central tendencies and data distributions. Central tendencies were determined by calculating the arithmetic mean, geometric mean, mode, and median values. Data distributions were determined by calculating detection frequency (or number of detects), percentiles (e.g., quartiles), standard deviation, minimum/maximum concentration, and coefficient of variation.

4.0 VOC/SNMOC Results

This section summarizes results for the VOC and SNMOC samples. As discussed in Section 2.0 and shown in Figure 4-1, VOC measurements were taken at the five comprehensive monitoring sites: SAMS, GPMS, PGMS, TUMS, and KELA. SNMOC measurements were taken at three of the five comprehensive monitoring sites: SAMS, GPMS, and KELA.

Figure 4-1. VOC and SNMOC Monitoring Locations



4.1 VOC

Statistical and mobile source analyses were completed on the VOC data. Table 4-1 summarizes the statistical analyses completed on the VOC data. Statistical analysis included the number of detects, central tendency, and data distribution. A total of 513 valid VOC samples were collected. The following VOCs had at least a 95 percent (i.e., at least 487 detects) detection rate:

- Benzene, carbon tetrachloride, chloromethane, dichlorodifluoromethane, ethylbenzene, propylene, toluene, trichlorofluoromethane, trichlorotrifluoroethane, and xylenes (*m*-, *o*-, *p*-) at 513 detects;
- Acetylene at 511 detects;
- Dichlorotetrafluoroethane at 509 detects;
- 1,1,1-Trichloroethane at 508 detects;
- Dichloromethane at 497 detects;
- 1,2,4-Trimethylbenzene at 490 detects; and
- Bromomethane at 488 detects.

Five other VOCs had at least a 75 percent detection rate (i.e., at least 385 detects):

- Styrene at 479 detects;
- 1,3,5-Trimethylbenzene at 473 detects;
- *n*-Octane at 457 detects;
- 1,3-Butadiene at 403 detects; and
- Acetonitrile at 401 detects.

The following 11 VOCs were not detected:

- Bromochloromethane;
- Bromodichloromethane;
- Bromoform;
- Dibromochloromethane;
- *trans*-1,2-Dichloroethylene;
- 1,1-Dichloroethane;

Table 4-1. Statistical Summaries of the VOC Concentrations

Pollutant	# Detects	Minimum (ppbv)	Maximum (ppbv)	Arithmetic Mean (ppbv)	Mode (ppbv)	Median (ppbv)	Geometric Mean (ppbv)	1st Quartile (ppbv)	3rd Quartile (ppbv)	Standard Deviation	Coefficient of Variation
Acetonitrile	401	0.13	1,270.00	18.31	1.85	2.77	3.63	1.36	8.18	82.57	4.51
Acetylene	511	0.12	6.33	0.72	0.50	0.52	0.56	0.35	0.80	0.67	0.93
Acrolein	356	0.06	2.33	0.46	0.26	0.41	0.38	0.25	0.59	0.31	0.68
Acrylonitrile	12	0.06	1.26	0.47	0.11	0.23	0.28	0.11	0.83	0.42	0.91
<i>tert</i> -Amyl Methyl Ether	2	0.02	0.03	0.03	N/A	0.03	0.02	0.02	0.03	0.01	0.20
Benzene	513	0.06	2.71	0.31	0.19	0.23	0.25	0.17	0.33	0.27	0.88
Bromochloromethane	0						N/A				
Bromodichloromethane	0						N/A				
Bromoform	0						N/A				
Bromomethane	488	0.01	0.07	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.51
1,3-Butadiene	403	0.01	0.38	0.05	0.02	0.03	0.03	0.02	0.05	0.05	1.15
Carbon Tetrachloride	513	0.04	0.20	0.10	0.10	0.10	0.10	0.09	0.12	0.02	0.24
Chlorobenzene	11	0.01	0.06	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.91
Chloroethane	338	0.01	0.29	0.02	0.01	0.01	0.01	0.01	0.02	0.02	1.19
Chloroform	380	0.01	0.39	0.03	0.02	0.02	0.02	0.02	0.03	0.03	0.86
Chloromethane	513	0.36	2.64	0.72	0.65	0.69	0.70	0.61	0.79	0.20	0.28
Chloromethylbenzene	1						N/A				
Chloroprene	7	0.01	0.30	0.13	N/A	0.09	0.07	0.05	0.20	0.11	0.86
Dibromochloromethane	0						N/A				
1,2-Dibromoethane	39	0.01	1.23	0.07	0.01	0.02	0.02	0.01	0.06	0.19	2.83
<i>m</i> -Dichlorobenzene	17	0.01	0.15	0.02	0.01	0.01	0.01	0.01	0.01	0.03	1.69
<i>o</i> -Dichlorobenzene	16	0.01	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.29
<i>p</i> -Dichlorobenzene	313	0.01	9.45	0.09	0.01	0.02	0.02	0.01	0.04	0.57	6.35
Dichlorodifluoromethane	513	0.22	0.98	0.62	0.53	0.61	0.61	0.54	0.71	0.12	0.18
1,1-Dichloroethane	0						N/A				
1,2-Dichloroethane	0						N/A				
1,1-Dichloroethene	2	0.14	0.17	0.15	N/A	0.15	0.15	0.14	0.16	0.02	0.11
<i>cis</i> -1,2-Dichloroethylene	4	0.11	0.55	0.23	N/A	0.14	0.18	0.12	0.25	0.18	0.79
<i>trans</i> -1,2-Dichloroethylene	0						N/A				

Table 4-1. Statistical Summaries of the VOC Concentrations (continued)

Pollutant	# Detects	Minimum (ppbv)	Maximum (ppbv)	Arithmetic Mean (ppbv)	Mode (ppbv)	Median (ppbv)	Geometric Mean (ppbv)	1st Quartile (ppbv)	3rd Quartile (ppbv)	Standard Deviation	Coefficient of Variation	
Dichloromethane	497	0.02	59.00	0.34	0.05	0.06	0.09	0.05	0.11	2.75	8.16	
1,2-Dichloropropane	0	N/A										
cis-1,3-Dichloropropene	0	N/A										
trans-1,3-Dichloropropene	0	N/A										
Dichlorotetrafluoroethane	509	0.01	0.04	0.02	0.02	0.02	0.02	0.02	0.02	0.00	0.16	
Ethyl Acrylate	2	0.01	0.03	0.02	N/A	0.02	0.02	0.02	0.03	0.01	0.50	
Ethyl <i>tert</i> -Butyl Ether	5	0.02	0.06	0.04	0.04	0.04	0.04	0.03	0.04	0.01	0.35	
Ethylbenzene	513	0.01	0.67	0.09	0.05	0.06	0.06	0.04	0.10	0.09	1.01	
Hexachloro-1,3-butadiene	241	0.01	0.04	0.02	0.02	0.02	0.02	0.01	0.02	0.01	0.31	
Methyl Ethyl Ketone	239	0.05	3.12	0.48	0.43	0.39	0.39	0.27	0.56	0.39	0.81	
Methyl Isobutyl Ketone	164	0.01	0.32	0.05	0.04	0.04	0.04	0.03	0.06	0.04	0.71	
Methyl Methacrylate	6	0.01	5.20	0.92	N/A	0.09	0.10	0.03	0.14	1.91	2.07	
Methyl <i>tert</i> -Butyl Ether	18	0.01	0.21	0.05	0.02	0.03	0.03	0.02	0.04	0.05	1.09	
<i>n</i> -Octane	457	0.01	0.77	0.04	0.02	0.03	0.03	0.02	0.04	0.05	1.29	
Propylene	513	0.07	3.93	0.47	0.18	0.31	0.35	0.21	0.53	0.48	1.02	
Styrene	479	0.01	3.03	0.12	0.03	0.05	0.06	0.03	0.10	0.27	2.16	
1,1,2,2-Tetrachloroethane	4	0.01	0.03	0.02	0.01	0.02	0.02	0.01	0.03	0.01	0.50	
Tetrachloroethylene	304	0.01	0.33	0.03	0.01	0.01	0.02	0.01	0.02	0.04	1.56	
Toluene	513	0.06	6.53	0.62	0.14	0.36	0.39	0.21	0.69	0.80	1.28	
1,2,4-Trichlorobenzene	58	0.01	0.06	0.03	0.02	0.03	0.03	0.02	0.03	0.01	0.35	
1,1,1-Trichloroethane	508	0.01	0.05	0.03	0.02	0.03	0.02	0.02	0.03	0.01	0.25	
1,1,2-Trichloroethane	0	N/A										
Trichloroethylene	94	0.01	0.07	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.73	
Trichlorofluoromethane	513	0.10	0.58	0.30	0.26	0.29	0.30	0.26	0.36	0.07	0.22	
Trichlorotrifluoroethane	513	0.05	0.19	0.12	0.09	0.12	0.12	0.09	0.14	0.03	0.24	
1,2,4-Trimethylbenzene	490	0.01	0.75	0.09	0.02	0.05	0.05	0.03	0.09	0.11	1.25	
1,3,5-Trimethylbenzene	473	0.01	0.27	0.03	0.01	0.02	0.02	0.01	0.03	0.03	1.13	
Vinyl chloride	68	0.01	0.06	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.60	
<i>m,p</i> -Xylene	513	0.03	1.91	0.23	0.11	0.14	0.16	0.09	0.26	0.26	1.11	
<i>o</i> -Xylene	513	0.01	0.86	0.10	0.05	0.06	0.07	0.04	0.11	0.11	1.06	

- 1,2-Dichloroethane;
- 1,2-Dichloropropane;
- *cis*-1,3-Dichloropropane
- *trans*-1,3-Dichloropropane; and
- 1,1,2-Trichloroethane.

Of the pollutants with at least a 75 percent detection rate, the following constitute the top five average daily concentrations:

- Acetonitrile (18.31 ppbv);
- Acetylene (0.72 ppbv);
- Chloromethane (0.72 ppbv);
- Dichlorodifluoromethane (0.62 ppbv); and
- Toluene (0.62 ppbv).

Although the average acetonitrile concentration is significantly greater than the next highest average pollutant concentration, data for acetonitrile may have limitations. High acetonitrile values have been observed in the Urban Air Toxics Monitoring Program (UATMP) program for at least two years. It is believed that acetonitrile from concurrent carbonyl sampling could potentially be contaminating the air toxic samples. Thus, acetonitrile results could be artificially high.

One indication of the consistency of the data measurements is the relative closeness of the calculated central tendency measurements—specifically, the arithmetic mean compared to the median, mode, and geometric mean. For most of the VOC results, the mode, median, and geometric mean were generally close to each other and similar to the arithmetic mean, as shown in Table 4-1. This observation suggests that VOC data measurements were representative of air pollutant concentrations following Hurricane Katrina.

For acetonitrile, dichloromethane, and *p*-dichlorobenzene, the mode, median, and geometric mean were generally close to each other, but were not close to the arithmetic mean.

This observation, in addition to the wide range of concentrations measured for these pollutants, indicates that these statistics are influenced by a few outliers. The relatively high coefficients of variation indicate that the data are widely dispersed about the mean.

For the five comprehensive sites, site-specific daily measurements of benzene, ethylbenzene, toluene, and xylenes throughout Phase 1, 2, and 3 sampling are presented in Figures 4-2 through 4-6. Across each of the five comprehensive sites, ethylbenzene tended to have the lowest measured concentrations, followed by xylenes, then benzene. Conversely, toluene tended to have the highest concentrations. However, toluene and xylene concentrations were higher at the onset of sampling (Phase 1) than during Phase 2 and 3 at GPMS and PGMS. A similar observation is seen for SAMS, although the concentrations of all the compounds at this site were generally lower than at the other two. At KELA, spikes in the toluene concentrations were measured during the summer months rather than in the fall. The selected compound concentrations at TUMS tended to vary less throughout the sampling duration.

4.2 SNMOC

Statistical analyses were completed on the SNMOC data. Table 4-2 summarizes the statistical analyses completed on the SNMOC data. Statistical analysis included the number of detects, central tendency, and data distribution. A total of 352 valid SNMOC samples were collected. The following SNMOC pollutants had at least a 95 percent (i.e., at least 335 detects) detection rate:

- Benzene, *n*-butane, *n*-hexane, isobutane, 2-methylpentane, *n*-pentane, propane, propylene, and toluene at 352 detects;
- Methylcyclopentane, and *o*-xylene at 351 detects;
- Acetylene, ethylbenzene, and *n*-heptane at 350 detects;
- Ethane and 3-methylpentane at 349 detects;
- *n*-Octane at 348 detects;

Figure 4-2. Daily Measurements of Selected Compounds at GPMS

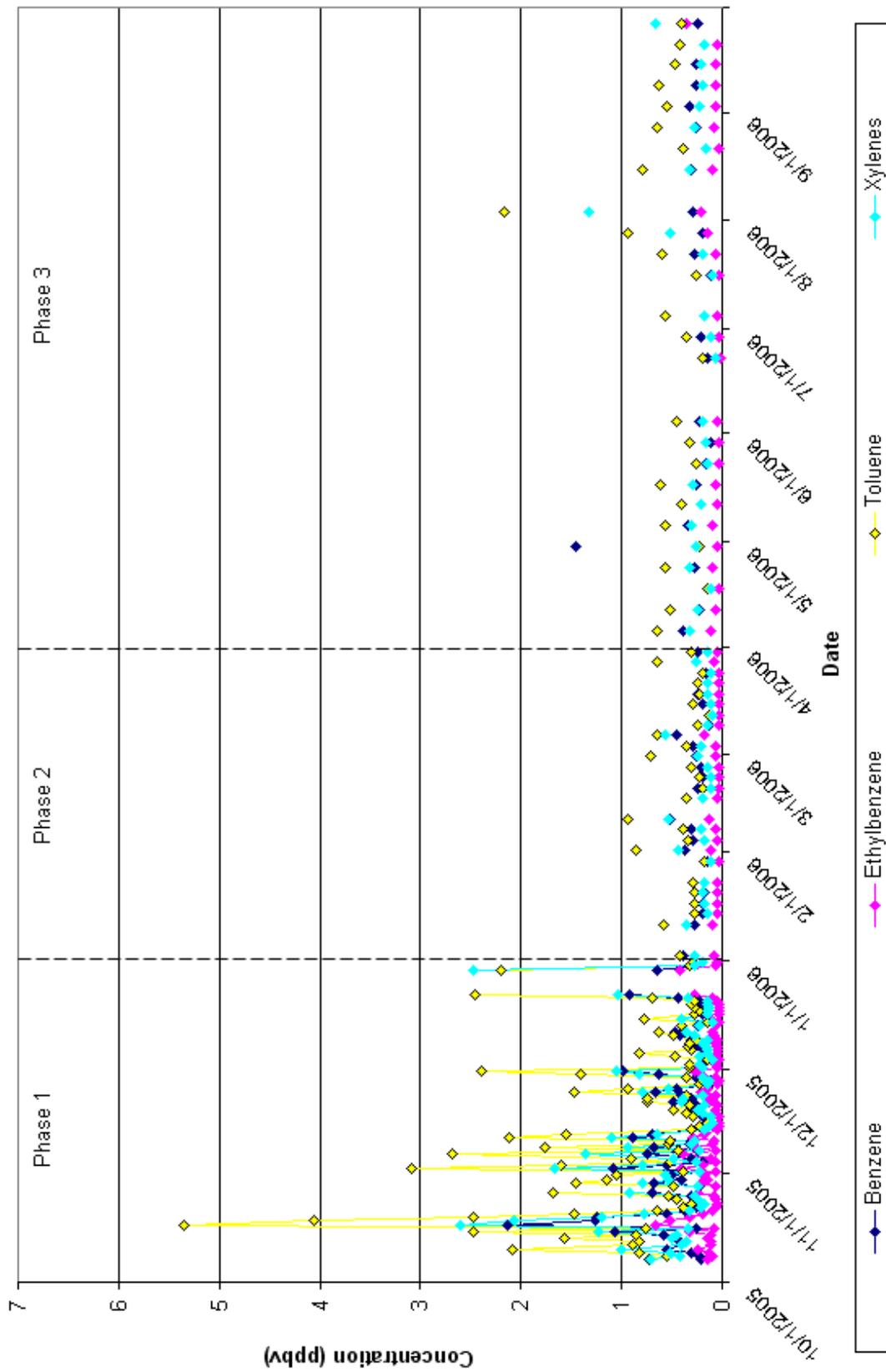


Figure 4-3. Daily Measurements of Selected Compounds at KEELA

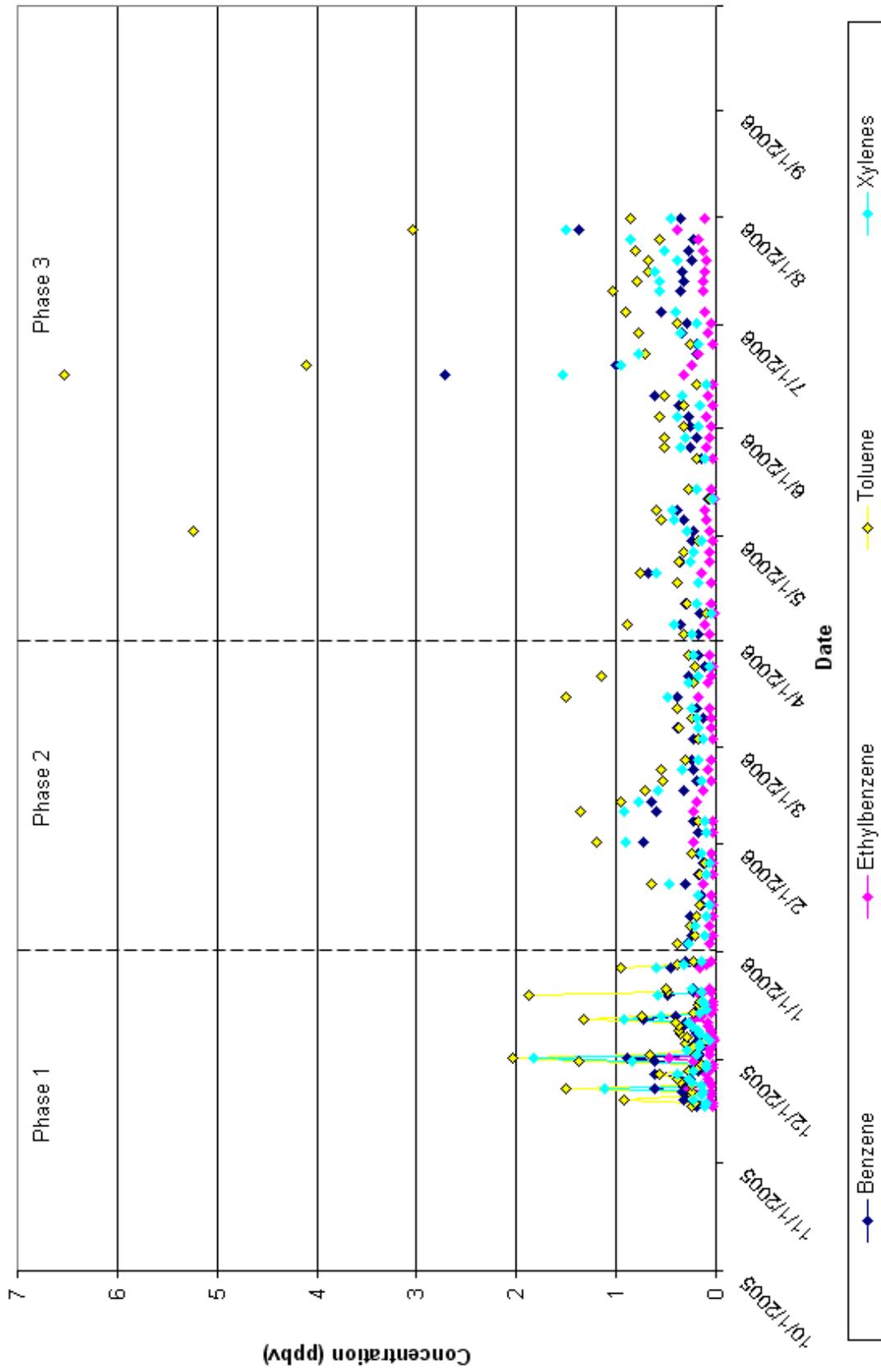


Figure 4-4. Daily Measurements of Selected Compounds at PGMS

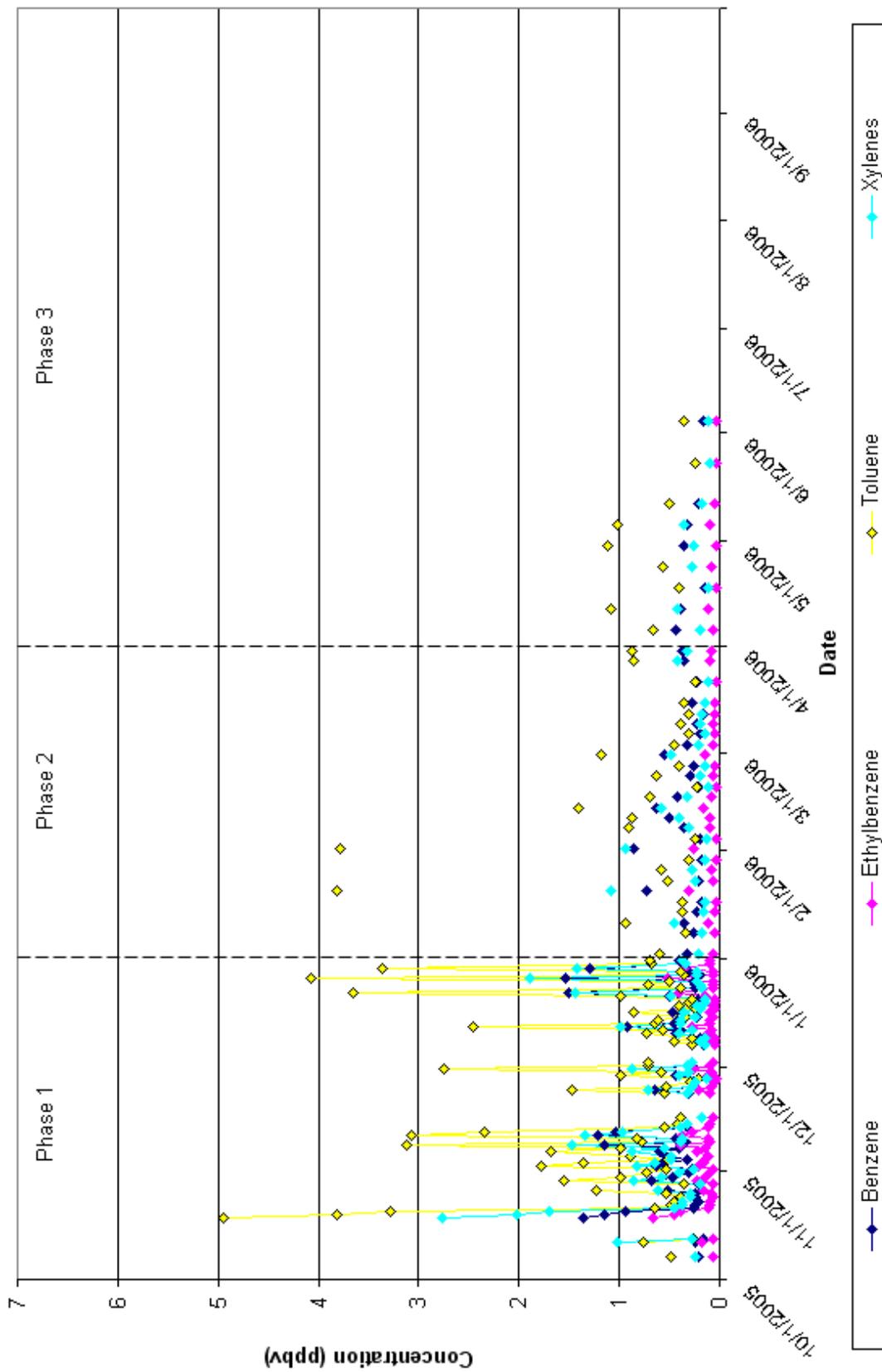


Figure 4-5. Daily Measurements of Selected Compounds at SAMS

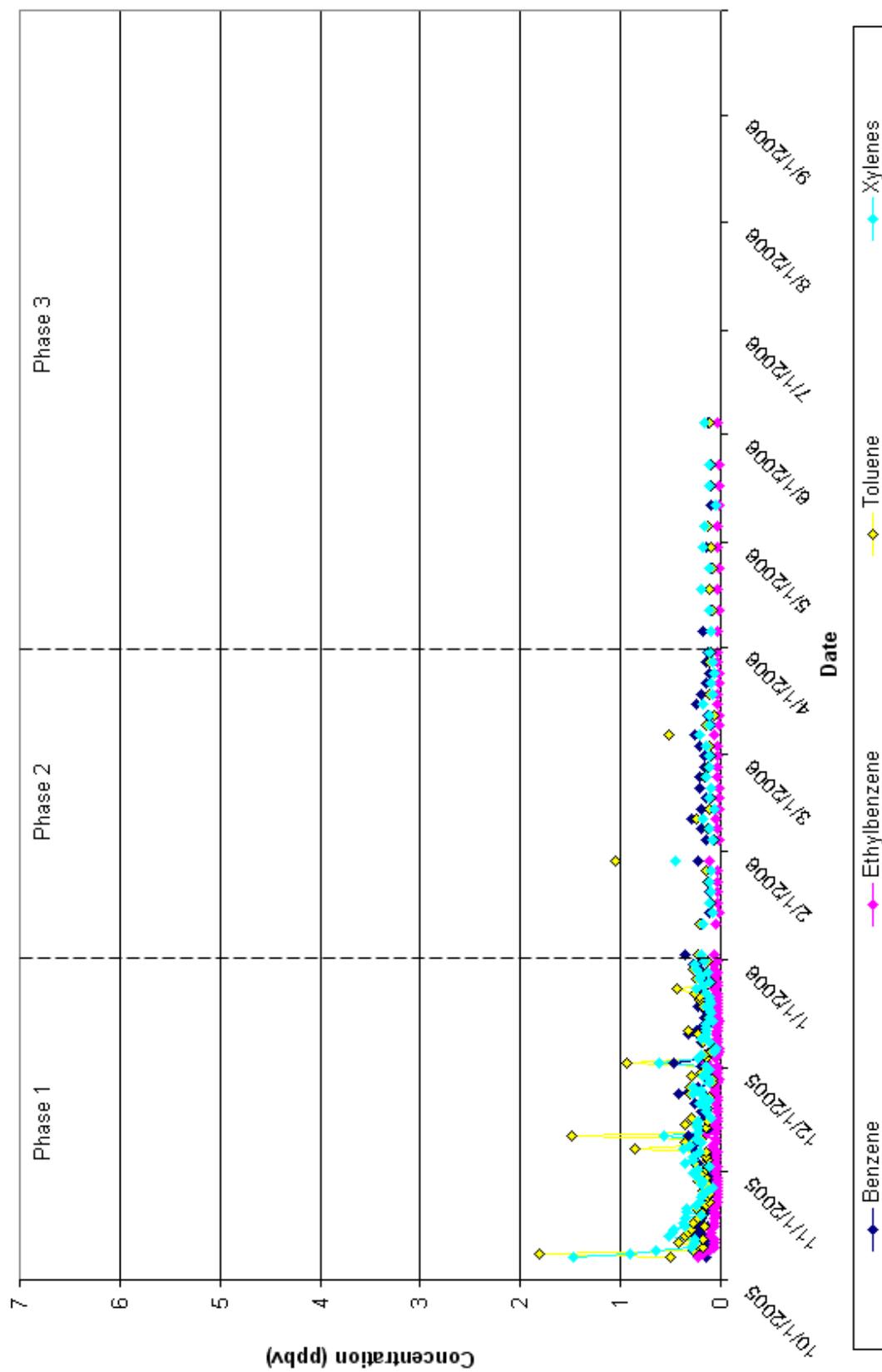


Figure 4-6. Daily Measurements of Selected Compounds at TUMS

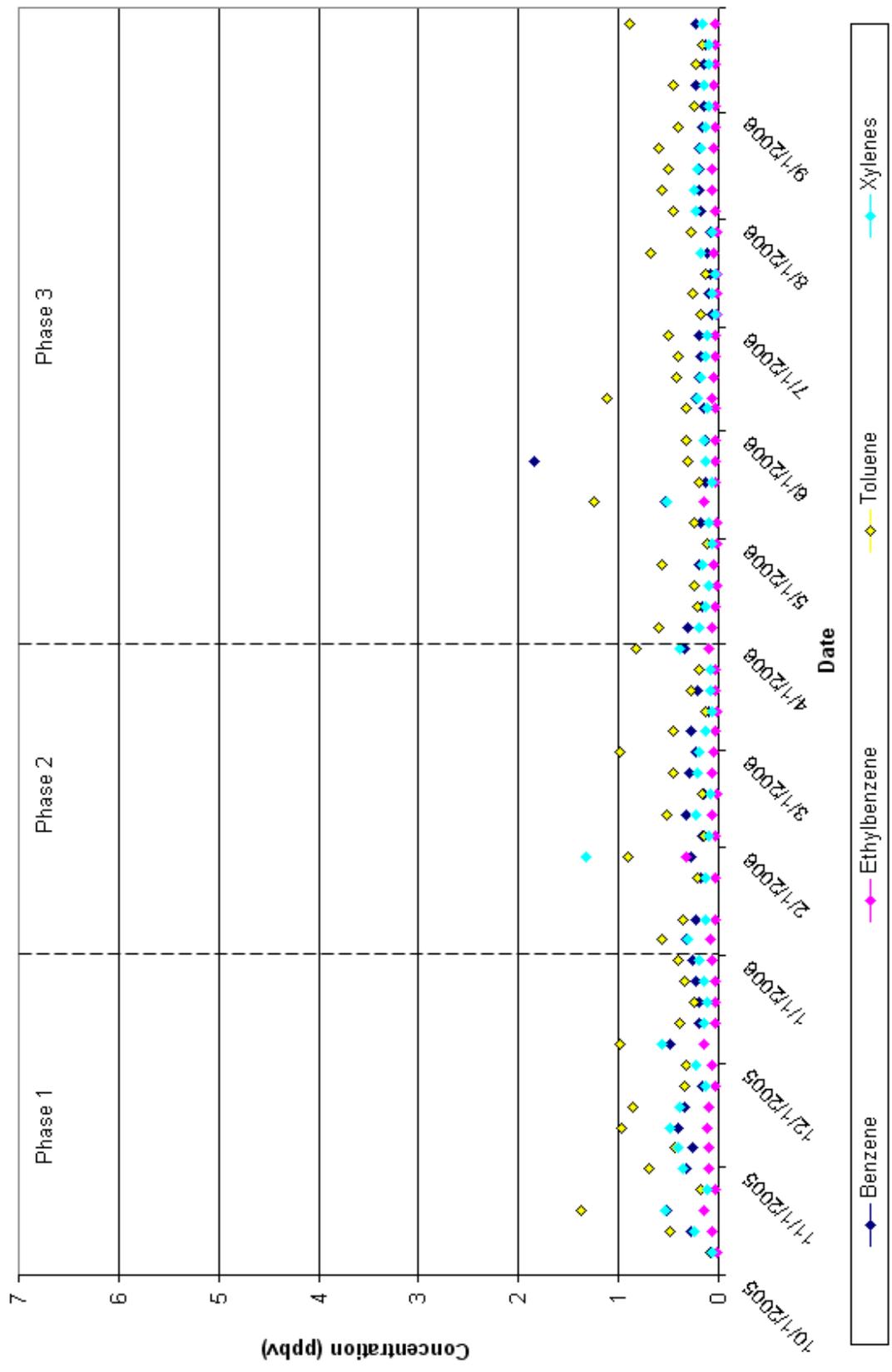


Table 4-2. Statistical Summaries of the SNMOC Concentrations

Pollutant	# Detects	Minimum (ppbC)	Maximum (ppbC)	Arithmetic Mean (ppbC)	Mode (ppbC)	Median (ppbC)	Geometric Mean (ppbC)	1st Quartile (ppbC)	3rd Quartile (ppbC)	Standard Deviation	Coefficient of Variation
Acetylene	350	0.15	9.82	1.72	1.16	1.35	1.38	0.89	1.92	1.38	0.80
Benzene	352	0.32	14.90	1.38	1.03	0.97	1.10	0.73	1.53	1.41	1.02
1,3-Butadiene	146	0.03	1.77	0.27	0.11	0.17	0.20	0.12	0.29	0.25	0.96
<i>n</i> -Butane	352	0.77	42.50	5.99	3.00	4.42	4.56	2.82	6.84	5.42	0.91
<i>cis</i> -2-Butene	183	0.02	1.96	0.28	0.13	0.20	0.22	0.14	0.33	0.27	0.95
<i>trans</i> -2-Butene	172	0.04	1.82	0.30	0.17	0.21	0.23	0.13	0.39	0.27	0.90
Cyclohexane	307	0.05	3.18	0.41	0.27	0.29	0.30	0.18	0.47	0.42	1.03
Cyclopentane	322	0.07	6.68	0.61	0.11	0.27	0.36	0.16	0.80	0.79	1.28
Cyclopentene	45	0.02	2.55	0.32	0.26	0.22	0.23	0.14	0.32	0.39	1.23
<i>n</i> -Decane	262	0.06	26.90	0.70	0.26	0.30	0.35	0.18	0.57	2.06	2.94
1-Decene	0										
N/A											
<i>m</i> -Diethylbenzene	237	0.04	5.47	0.43	0.10	0.25	0.29	0.16	0.47	0.54	1.24
<i>p</i> -Diethylbenzene	274	0.07	25.20	1.37	1.84	0.76	0.81	0.45	1.60	2.12	1.54
2,2-Dimethylbutane	283	0.10	3.37	0.38	0.15	0.28	0.30	0.18	0.44	0.40	1.04
2,3-Dimethylbutane	312	0.09	11.00	0.49	0.26	0.28	0.32	0.19	0.52	0.86	1.74
2,3-Dimethylpentane	249	0.10	6.13	0.41	0.26	0.27	0.29	0.17	0.46	0.56	1.36
2,4-Dimethylpentane	236	0.08	5.67	0.31	0.10	0.21	0.22	0.13	0.34	0.45	1.48
<i>n</i> -Dodecane	139	0.08	9.12	0.44	0.16	0.23	0.25	0.13	0.41	0.99	2.24
1-Dodecene	35	0.07	2.66	0.73	N/A	0.60	0.46	0.18	1.04	0.64	0.88
Ethane	349	0.10	33.50	6.94	4.26	6.14	5.47	4.33	8.35	4.44	0.64
N/A											
2-Ethyl-1-butene	0										
Ethylbenzene	350	0.11	4.03	0.58	0.33	0.36	0.43	0.25	0.67	0.57	0.99
Ethylene	293	0.16	14.60	2.38	1.50	1.82	1.89	1.31	2.69	1.96	0.83
<i>m</i> -Ethyltoluene	342	0.10	3.91	0.57	0.30	0.38	0.41	0.22	0.70	0.57	1.00
<i>o</i> -Ethyltoluene	214	0.09	4.73	0.37	0.10	0.24	0.27	0.15	0.42	0.44	1.18
<i>p</i> -Ethyltoluene	299	0.07	10.50	0.35	0.11	0.21	0.24	0.14	0.38	0.66	1.87
<i>n</i> -Heptane	350	0.10	6.67	0.52	0.22	0.33	0.37	0.22	0.59	0.64	1.24
1-Heptene	220	0.07	1.31	0.21	0.10	0.17	0.18	0.12	0.25	0.16	0.75
<i>n</i> -Hexane	352	0.14	206.00	2.15	1.10	0.80	0.95	0.48	1.66	11.18	5.20

Table 4-2. Statistical Summaries of the SNMOC Concentrations (continued)

Pollutant	# Detects	Minimum (ppbC)	Maximum (ppbC)	Arithmetic Mean (ppbC)	Mode (ppbC)	Median (ppbC)	Geometric Mean (ppbC)	1st Quartile (ppbC)	3rd Quartile (ppbC)	Standard Deviation	Coefficient of Variation
1-Hexene	226	0.06	1.83	0.26	0.10	0.22	0.22	0.15	0.30	0.23	0.86
<i>cis</i> -2-Hexene	12	0.03	0.78	0.23	N/A	0.12	0.15	0.09	0.26	0.23	0.99
<i>trans</i> -2-Hexene	31	0.05	1.35	0.23	0.16	0.17	0.17	0.14	0.22	0.25	1.08
Isobutane	352	0.37	23.80	3.14	2.29	2.17	2.33	1.42	3.83	2.97	0.94
Isobutene/1-Butene	339	0.14	9.77	0.93	1.20	0.66	0.70	0.41	1.06	0.98	1.05
Isopentane	322	0.63	105.00	6.41	3.48	3.48	4.02	2.05	7.18	9.46	1.48
Isoprene	309	0.10	13.60	0.90	0.44	0.42	0.50	0.21	1.11	1.24	1.38
Isopropylbenzene	136	0.04	1.28	0.16	0.10	0.12	0.13	0.10	0.16	0.14	0.89
2-Methyl-1-butene	179	0.05	6.11	0.49	0.12	0.26	0.31	0.15	0.58	0.68	1.39
3-Methyl-1-butene	24	0.08	2.64	0.41	0.21	0.20	0.23	0.13	0.26	0.67	1.63
2-Methyl-1-pentene	41	0.07	2.07	0.25	0.13	0.13	0.17	0.12	0.20	0.36	1.45
4-Methyl-1-pentene	10	0.08	0.75	0.22	0.12	0.12	0.16	0.10	0.25	0.20	0.92
2-Methyl-2-butene	197	0.08	11.20	0.48	0.13	0.26	0.30	0.15	0.51	0.88	1.82
Methylcyclohexane	320	0.08	6.32	0.43	0.11	0.30	0.32	0.18	0.53	0.49	1.15
Methylcyclopentane	351	0.07	13.60	0.69	0.21	0.42	0.45	0.25	0.73	1.09	1.59
2-Methylheptane	224	0.09	1.73	0.29	0.13	0.22	0.24	0.14	0.37	0.23	0.79
3-Methylheptane	194	0.06	1.40	0.24	0.10	0.17	0.19	0.12	0.28	0.20	0.82
2-Methylhexane	255	0.07	9.48	0.66	0.22	0.39	0.41	0.20	0.81	0.98	1.48
3-Methylhexane	336	0.10	11.60	1.06	0.17	0.64	0.62	0.26	1.44	1.34	1.26
2-Methylpentane	352	0.14	34.30	1.73	1.16	0.97	1.08	0.58	1.96	2.81	1.62
3-Methylpentane	349	0.10	21.60	1.04	1.40	0.63	0.67	0.40	1.06	1.74	1.68
<i>n</i> -Nonane	298	0.08	3.41	0.29	0.10	0.21	0.23	0.14	0.34	0.30	1.03
1-Nonene	210	0.04	2.68	0.22	0.15	0.17	0.18	0.12	0.24	0.23	1.06
<i>n</i> -Octane	348	0.09	5.77	0.31	0.17	0.23	0.24	0.16	0.34	0.36	1.18
1-Octene	84	0.05	1.26	0.21	0.11	0.17	0.18	0.12	0.25	0.15	0.73
<i>n</i> -Pentane	352	0.50	476.00	5.78	1.16	2.31	2.56	1.41	4.11	29.93	5.18
1-Pentene	245	0.06	3.67	0.37	0.22	0.27	0.28	0.18	0.43	0.38	1.03
<i>cis</i> -2-Pentene	175	0.05	4.41	0.28	0.11	0.17	0.20	0.13	0.29	0.42	1.51
<i>trans</i> -2-Pentene	233	0.06	9.04	0.41	0.11	0.23	0.27	0.15	0.43	0.74	1.81
<i>α</i> -Pinene	341	0.10	20.50	3.29	2.06	2.01	1.92	0.86	4.23	3.63	1.10

Table 4-2. Statistical Summaries of the SNMOC Concentrations (continued)

Pollutant	# Detects	Minimum (ppbC)	Maximum (ppbC)	Arithmetic Mean (ppbC)	Mode (ppbC)	Median (ppbC)	Geometric Mean (ppbC)	1st Quartile (ppbC)	3rd Quartile (ppbC)	Standard Deviation	Coefficient of Variation
<i>b</i> -Pinene	12	0.37	2.15	1.27	N/A		1.12	0.91	1.70	0.55	0.44
Propane	352	2.08	45.10	8.62	6.17	6.97	7.30	4.92	10.13	5.79	0.67
<i>n</i> -Propylbenzene	219	0.05	1.82	0.25	0.11	0.18	0.20	0.13	0.30	0.21	0.85
Propylene	352	0.17	8.72	1.15	0.68	0.85	0.88	0.54	1.33	1.03	0.90
Propyne	0						N/A				
Styrene	324	0.07	13.25	1.12	0.22	0.49	0.58	0.25	1.18	1.77	1.58
Toluene	352	0.28	34.70	3.22	2.06	1.84	2.06	1.00	3.96	4.07	1.26
<i>n</i> -Tridecane	21	0.09	6.92	0.81	N/A	0.23	0.35	0.16	0.69	1.51	1.85
1-Tridecene	0						N/A				
1,2,3-Trimethylbenzene	147	0.06	1.60	0.33	0.12	0.25	0.26	0.15	0.42	0.26	0.80
1,2,4-Trimethylbenzene	339	0.10	10.20	0.82	1.62	0.53	0.55	0.31	0.98	0.97	1.19
1,3,5-Trimethylbenzene	237	0.07	2.86	0.34	0.14	0.21	0.25	0.14	0.39	0.36	1.06
2,2,3-Trimethylpentane	79	0.06	1.44	0.32	0.17	0.24	0.26	0.16	0.42	0.26	0.79
2,2,4-Trimethylpentane	339	0.09	21.10	0.80	0.17	0.38	0.43	0.20	0.78	1.58	1.99
2,3,4-Trimethylpentane	269	0.07	5.47	0.39	0.13	0.24	0.27	0.15	0.47	0.52	1.32
<i>n</i> -Undecane	182	0.03	18.50	0.56	0.19	0.29	0.31	0.18	0.53	1.61	2.90
1-Undecene	85	0.03	2.23	0.31	0.14	0.18	0.21	0.13	0.30	0.36	1.19
<i>m</i> -Xylene/ <i>p</i> -Xylene	345	0.26	10.70	1.56	1.12	1.04	1.15	0.68	1.73	1.53	0.98
<i>o</i> -Xylene	351	0.12	5.15	0.70	0.38	0.47	0.53	0.33	0.77	0.66	0.95
Sum of Knowns	352	12.70	880.00	73.86	42.20	54.35	59.50	40.65	78.83	72.53	0.98
Sum of Unknowns	352	0.06	2,220.00	100.26	62.50	64.15	67.01	40.30	109.39	163.93	1.64
TNMOC	352	31.40	2,270.00	174.13	120.00	128.00	137.26	88.30	193.00	183.84	1.06

- *m,p*-Xylene at 345 detects;
- *m*-Ethyltoluene at 342 detects;
- *a*-Pinene at 341 detects;
- Isobutene/1-butene, 1,2,4-trimethylbenzene, and 2,2,4-trimethylpentane at 339 detects; and
- 3-Methylhexane at 336 detects.

Thirteen other compounds had at least a 75 percent detection rate (i.e., at least 264 detects):

- Styrene at 324 detects;
- Cyclopentane and isopentane at 322 detects;
- Methylcyclohexane at 320 detects;
- 2,3-Dimethylbutane at 312 detects;
- Isoprene at 309 detects;
- Cyclohexane at 307 detects;
- *p*-Ethyltoluene at 299 detects;
- *n*-Nonane at 298 detects;
- Ethylene at 293 detects;
- 2,2-Dimethylbutane at 283 detects;
- *p*-Diethylbenzene at 274 detects; and
- 2,3,4-Trimethylpentane at 269 detects.

The following SNMOC were not detected:

- 1-Decene;
- 2-Ethyl-1-butene;
- Propyne; and
- 1-Tridecene.

Of the pollutants with at least a 75 percent detection rate, the following pollutants constitute the top five average daily concentrations:

- Propane (8.62 ppbC);
- Ethane (6.94 ppbC);
- Isopentane (6.41 ppbC);
- *n*-Butane (5.99 ppbC); and
- *n*-Pentane (5.78 ppbC).

One indication of the consistency of the data measurements is the relative closeness of the calculated central tendency measurements—specifically, the arithmetic mean compared to the median, mode, and geometric mean. For most of the SNMOC results, the mode, median, and geometric mean were generally close to each other and similar to the arithmetic mean, as shown in Table 4-5. This observation suggests that SNMOC data measurements were fairly representative of air pollution concentrations following Hurricane Katrina.

Isopentane, *n*-hexane, and *n*-pentane had maximum concentrations greater than 100 ppbC. These high concentrations led to the associated high overall daily average concentrations, as indicated by the differences in the geometric and arithmetic means (greater than 1 ppbC in each case).

Figures 4-7 through 4-9 present time-series plots for propane, ethane, and isopentane at three of the five comprehensive monitoring sites (GPMS, KELA, and SAMS). For all three pollutants, concentrations were generally not consistent through all three phases. The highest concentrations of propane and ethane occurred during Phase 1 Sampling, while the highest isopentane concentration was measured during Phase 3 Sampling.

Figure 4-7. Daily Concentrations of Propane

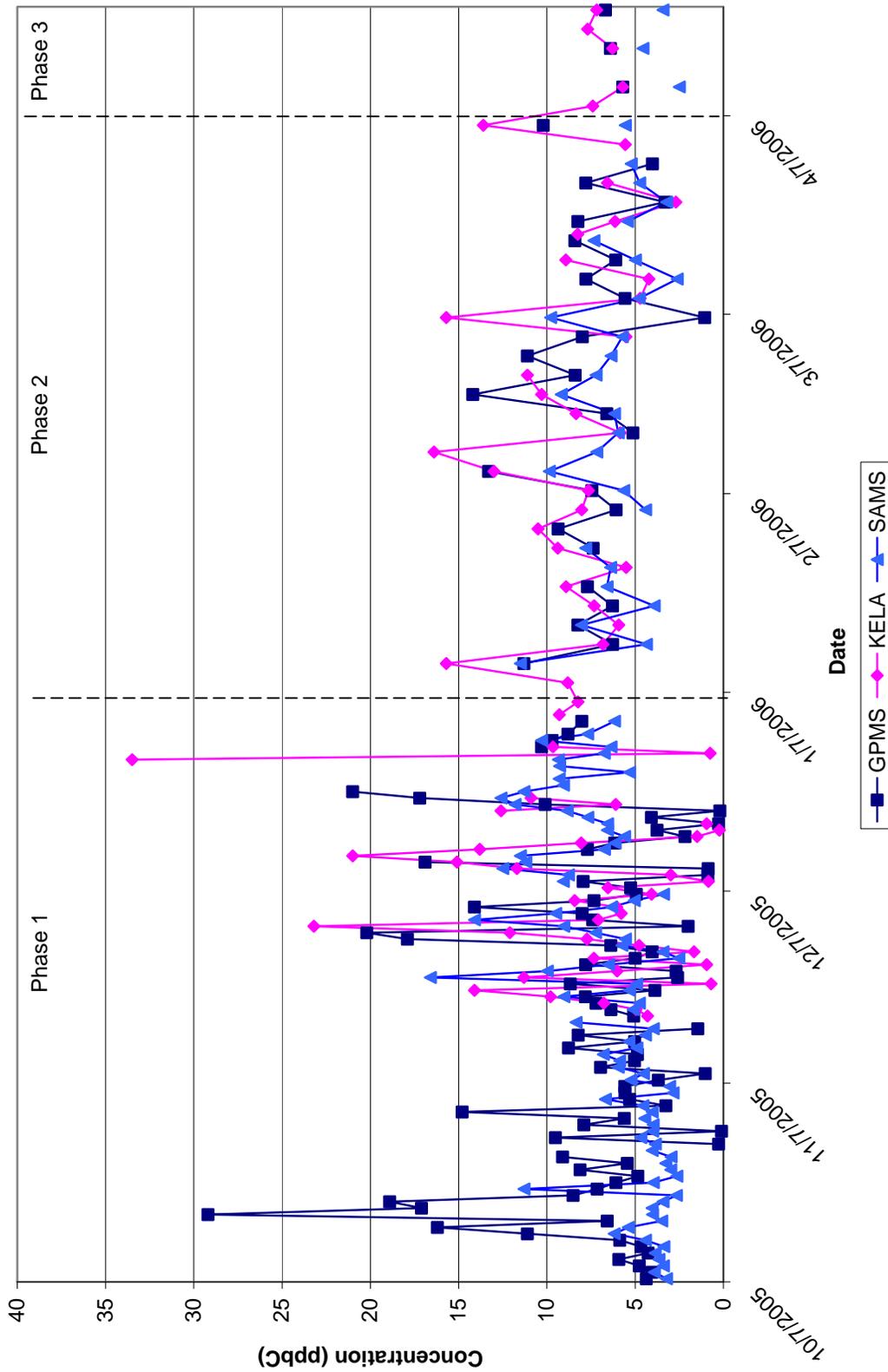


Figure 4-8. Daily Concentrations of Ethane

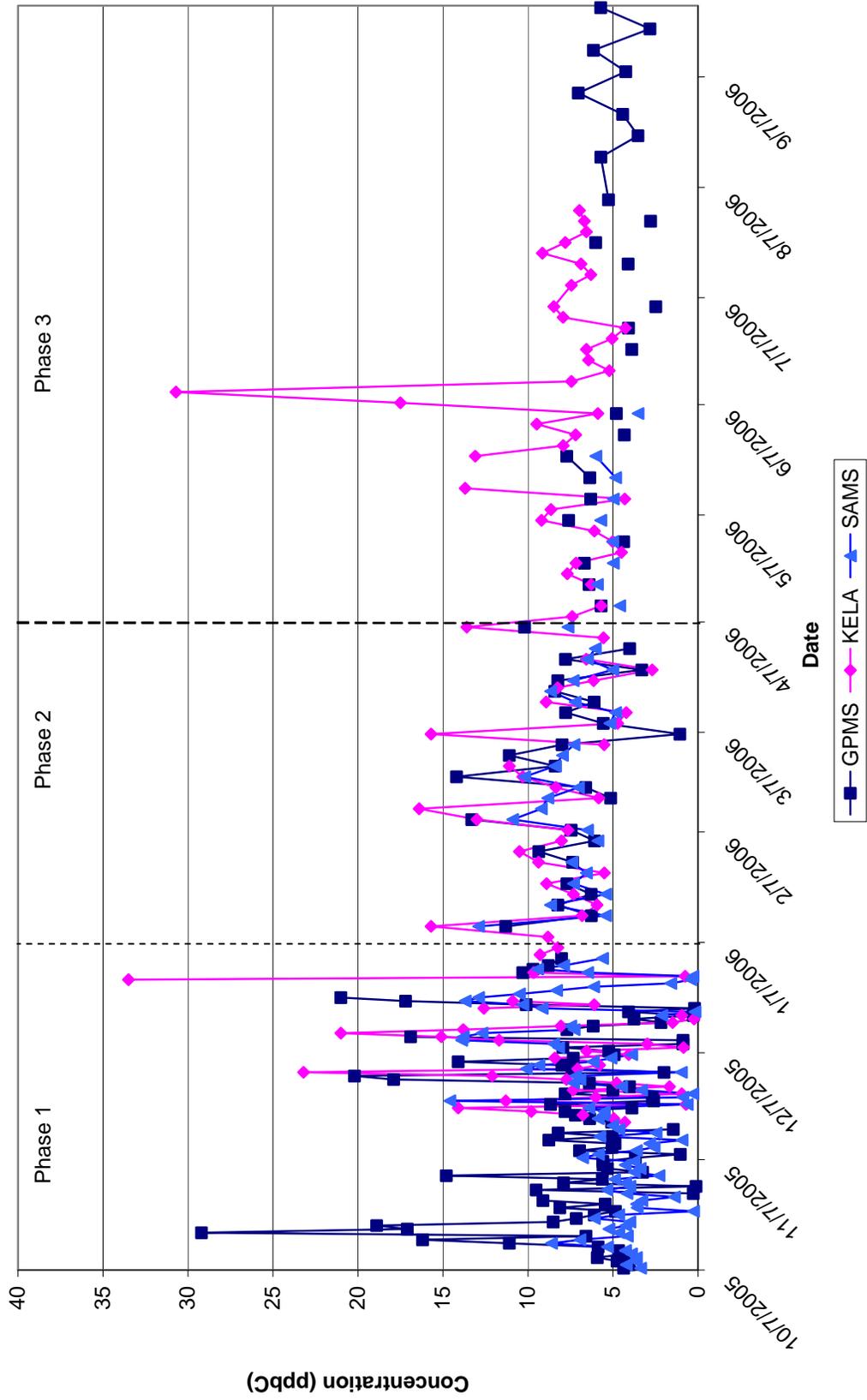
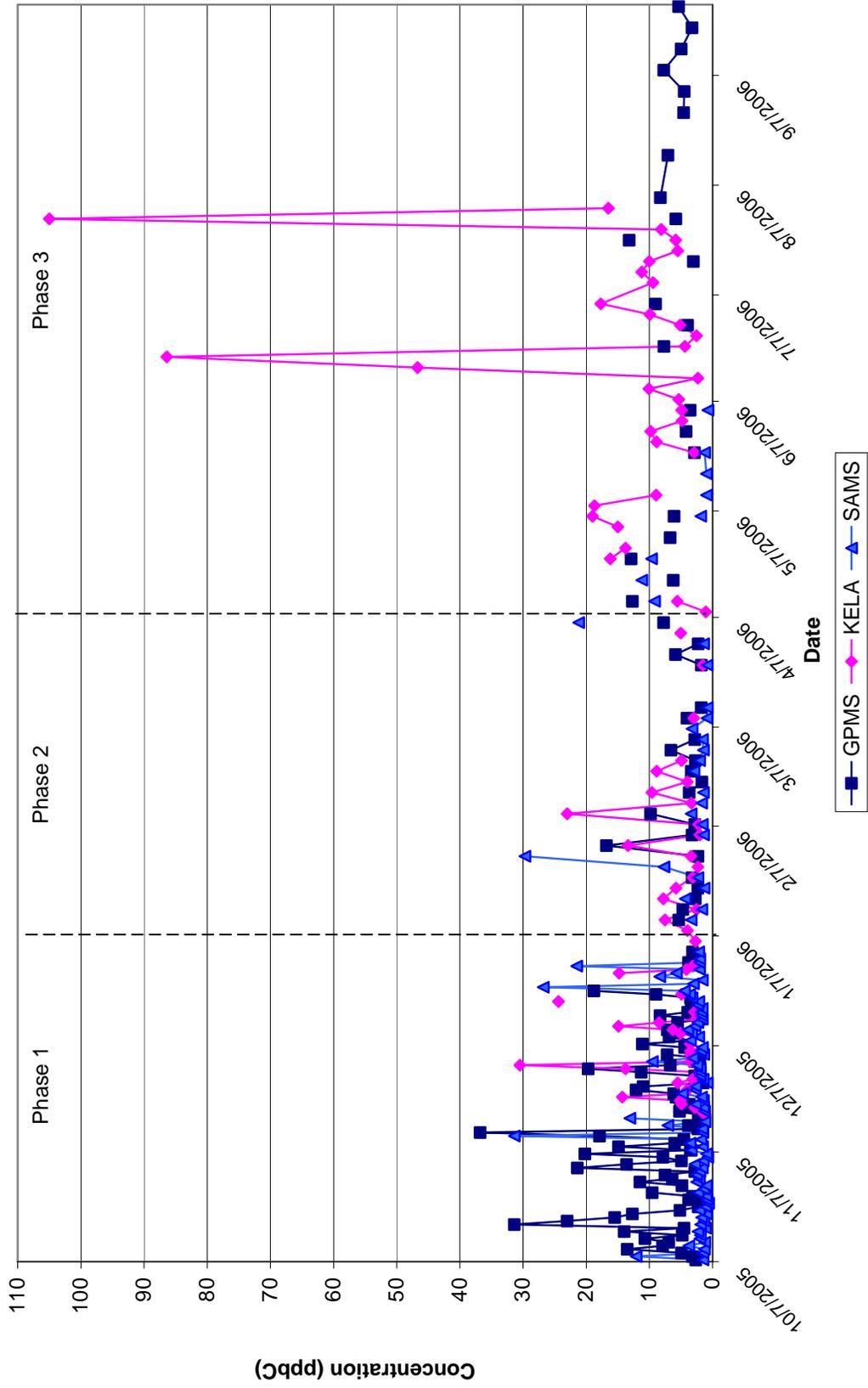


Figure 4-9. Daily Concentrations of Isopentane

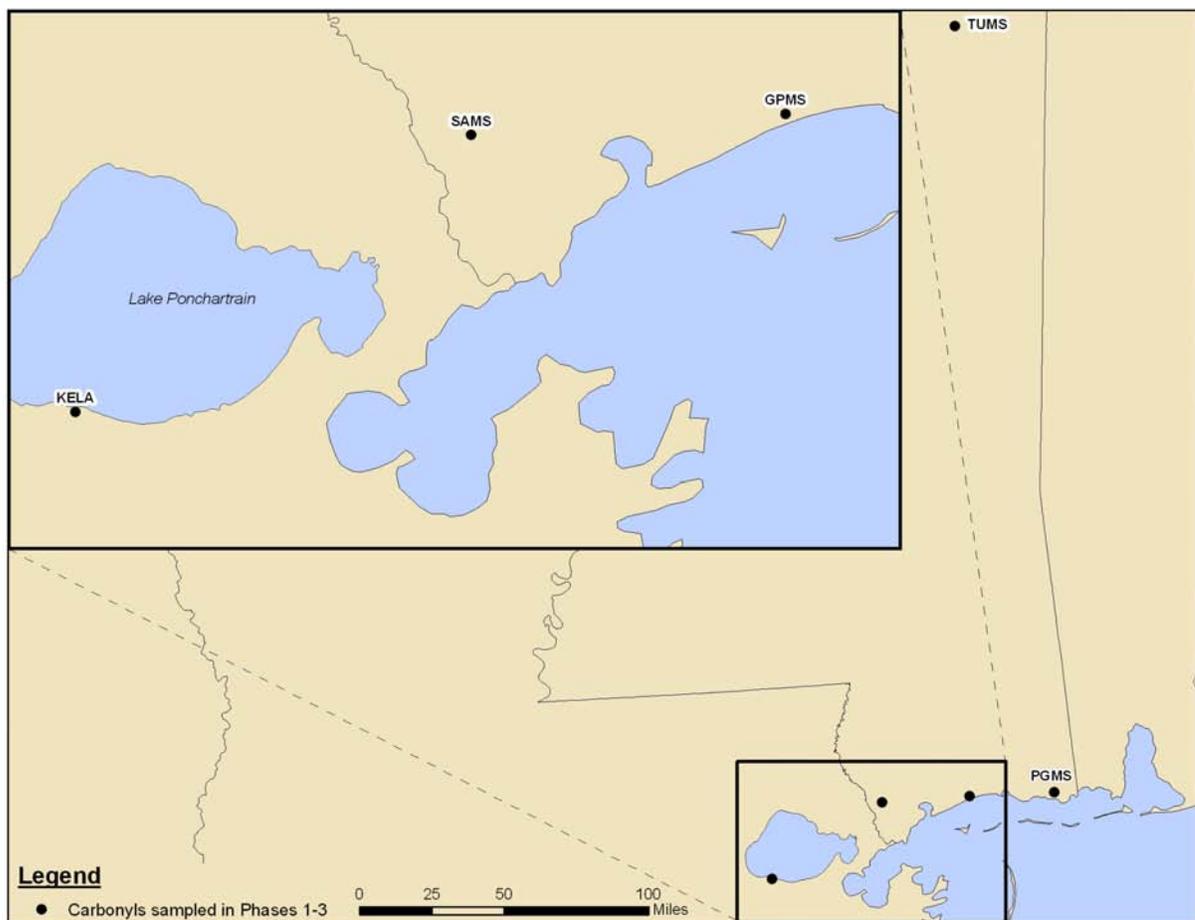


5.0 Carbonyl Compound Results

This section summarizes results for the carbonyl compound samples. As summarized in Section 2.0, and shown in Figure 5-1, carbonyl measurements were taken at the five comprehensive monitoring sites: SAMS, GPMS, PGMS, TUMS, and KELA.

Statistical analyses were completed on the carbonyl compounds data.

Figure 5-1. Carbonyl Compound Monitoring Locations



5.1 Statistical Summary for Carbonyl Compounds

Table 5-1 summarizes the statistical analyses completed on the carbonyl compounds data. Statistical analysis included number of detects, central tendency, and

Table 5-1. Statistical Summaries of the Carbonyl Compounds Concentrations

Pollutant	# Detects	Minimum (ppbv)	Maximum (ppbv)	Arithmetic Mean (ppbv)	Mode (ppbv)	Median (ppbv)	Geometric Mean (ppbv)	1st Quartile (ppbv)	3rd Quartile (ppbv)	Standard Deviation	Coefficient of Variation
Acetaldehyde	543	0.12	7.46	1.23	1.46	1.08	1.07	0.77	1.54	0.70	0.57
Acetone	543	0.04	4.81	0.75	1.07	0.65	0.58	0.36	1.03	0.54	0.72
Benzaldehyde	539	0.01	0.25	0.04	0.02	0.03	0.03	0.02	0.05	0.03	0.82
Butyraldehyde	543	0.01	2.08	0.10	0.06	0.08	0.08	0.05	0.12	0.12	1.13
Crotonaldehyde	538	0.01	0.60	0.06	0.02	0.03	0.04	0.02	0.06	0.08	1.30
2,5-Dimethylbenzaldehyde	5	0.01	0.03	0.02	N/A	0.01	0.01	0.01	0.02	0.01	0.49
Formaldehyde	542	0.30	226.00	6.04	1.95	2.59	2.83	1.61	4.04	21.70	3.59
Hexaldehyde	539	0.00	1.84	0.07	0.02	0.02	0.03	0.02	0.04	0.18	2.54
Isovaleraldehyde	293	0.00	0.05	0.01	0.01	0.01	0.01	0.01	0.02	0.01	0.47
Propionaldehyde	543	0.01	1.44	0.12	0.10	0.11	0.10	0.07	0.16	0.11	0.86
Tolualdehydes	507	0.00	1.15	0.04	0.02	0.03	0.03	0.02	0.04	0.09	2.25
Valeraldehyde	536	0.00	0.70	0.06	0.02	0.03	0.04	0.02	0.06	0.08	1.38

data distribution. A total of 543 valid carbonyl samples were taken. The following carbonyl compounds had at least a 95 percent (i.e., at least 516 detects) detection rate:

- Acetaldehyde, acetone, butyraldehyde, and propionaldehyde at 543 detects;
- Formaldehyde at 542 detects;
- Benzaldehyde and hexaldehyde at 539 detects;
- Crotonaldehyde at 538 detects; and
- Valeraldehyde at 536 detects.

Only one additional compound (tolualdehydes at 507 detects) had at least a 75 percent detection rate (i.e., at least 407 detects). The only remaining pollutants detected were isovaleraldehyde (at 293 detects) and 2,5-dimethylbenzaldehyde (at five detects).

Of the pollutants with at least a 75 percent detection rate, the following constitute the top three average daily concentrations:

- formaldehyde (6.04 ppbv);
- acetaldehyde (1.23 ppbv); and
- acetone (0.75 ppbv).

One indication of the consistency of the data measurements is the relative closeness of the calculated central tendency measurements—specifically, the arithmetic mean compared to the median, mode, and geometric mean. For most of the carbonyl compounds results, the mode, median, and geometric mean were generally close to each other and similar to the arithmetic mean, as shown in Table 5-1. This observation suggests that the carbonyl data measurements were representative of conditions following Hurricane Katrina.

For formaldehyde, the mode, median, and geometric mean were generally close to each other, but were not close to the arithmetic mean. This observation, in addition to the wide range of concentrations measured, indicates that these statistics are influenced by outliers. This is also shown with the large variation when comparing the standard deviation, 1st and 3rd quartiles, and coefficient of variation statistics for formaldehyde. The relatively high coefficient of variation (3.59) indicates that the data are widely dispersed about the mean.

Figures 5-2 through 5-6 are time-series plots of select carbonyl compounds (acetaldehyde, acetone, and formaldehyde) at the five comprehensive monitoring sites. At GPMS (Figure 5-2) and TUMS (Figure 5-3), concentrations of the three selected pollutants were generally consistent throughout the entire sampling period, as no concentrations were greater than 10 ppbv. At KELA, no concentrations of the selected pollutants were greater than 15 ppbv (Figure 5-4). Acetaldehyde and acetone concentrations were fairly consistent throughout the entire sampling period (less than 4 ppbv), whereas several formaldehyde concentrations experienced some atypical peaks during Phase 1 and Phase 2 Sampling.

At SAMS and PGMS, nearly all concentrations of the selected pollutants were less than 30 ppbv (Figures 5-5 and 5-6). However, a few formaldehyde concentrations were measured at greater than 170 ppbv at each of these sites. The highest formaldehyde concentrations at SAMS were measured during Phase 2 Sampling, while at PGMS, the highest formaldehyde concentrations occurred during Phase 1 Sampling.

Figure 5-2. GPMS D aily Concentration of Carbonyl Compounds

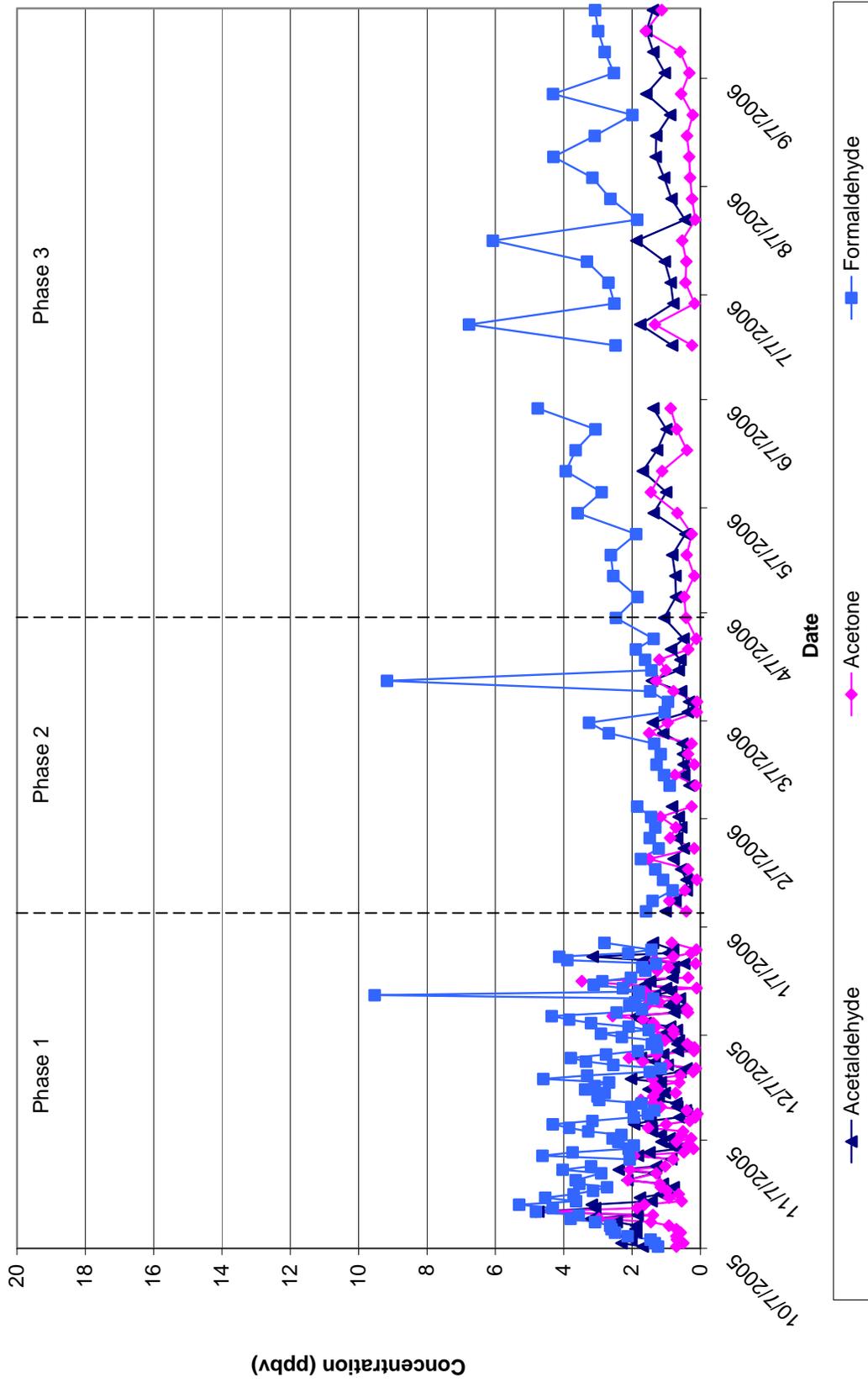


Figure 5-3. TUMS Daily Concentration of Carbonyl Compounds

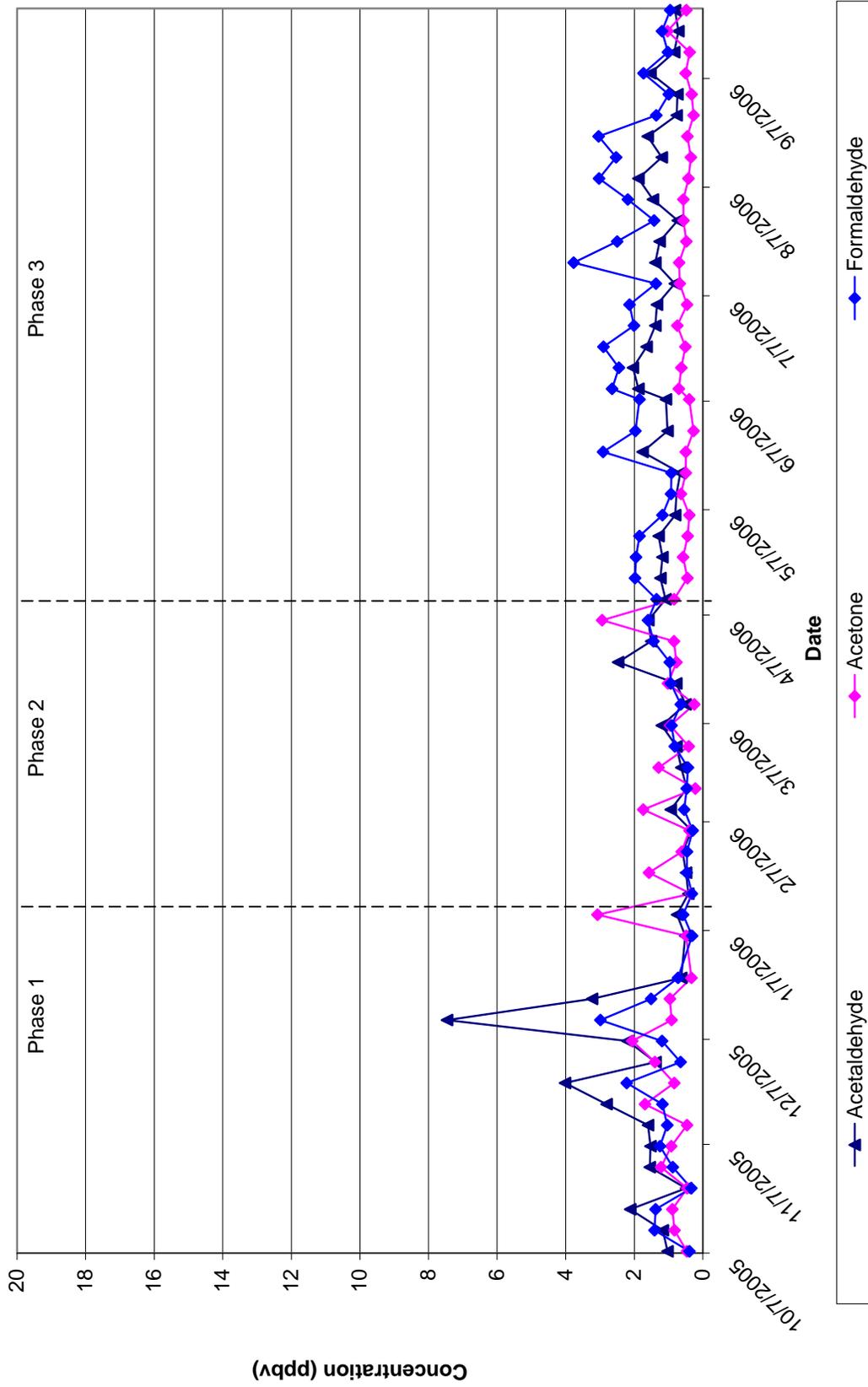


Figure 5-4. KE LA Daily Concentration of Carbonyl Compounds

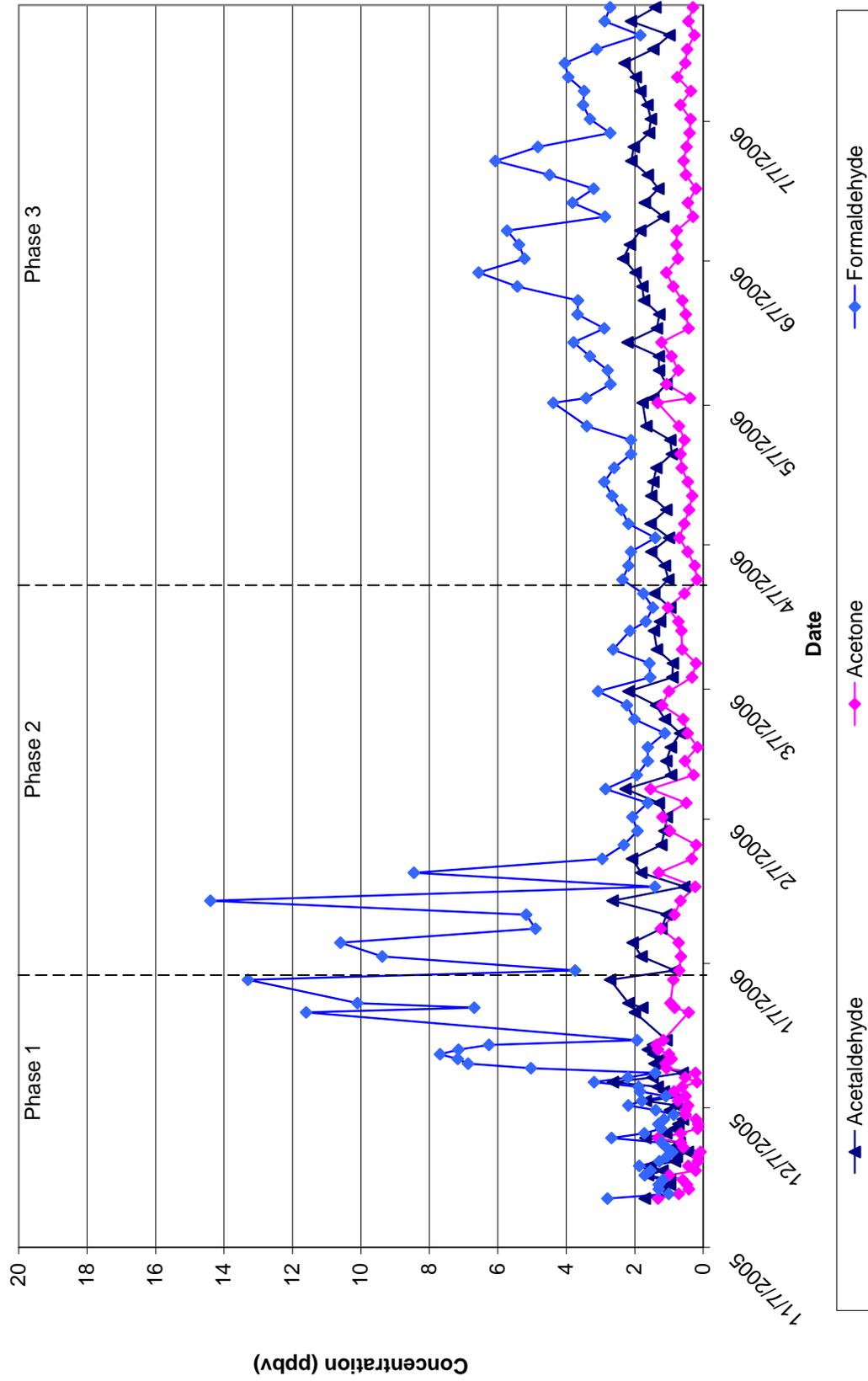


Figure 5-5. SAMS Daily Concentration of Carbonyl Compounds

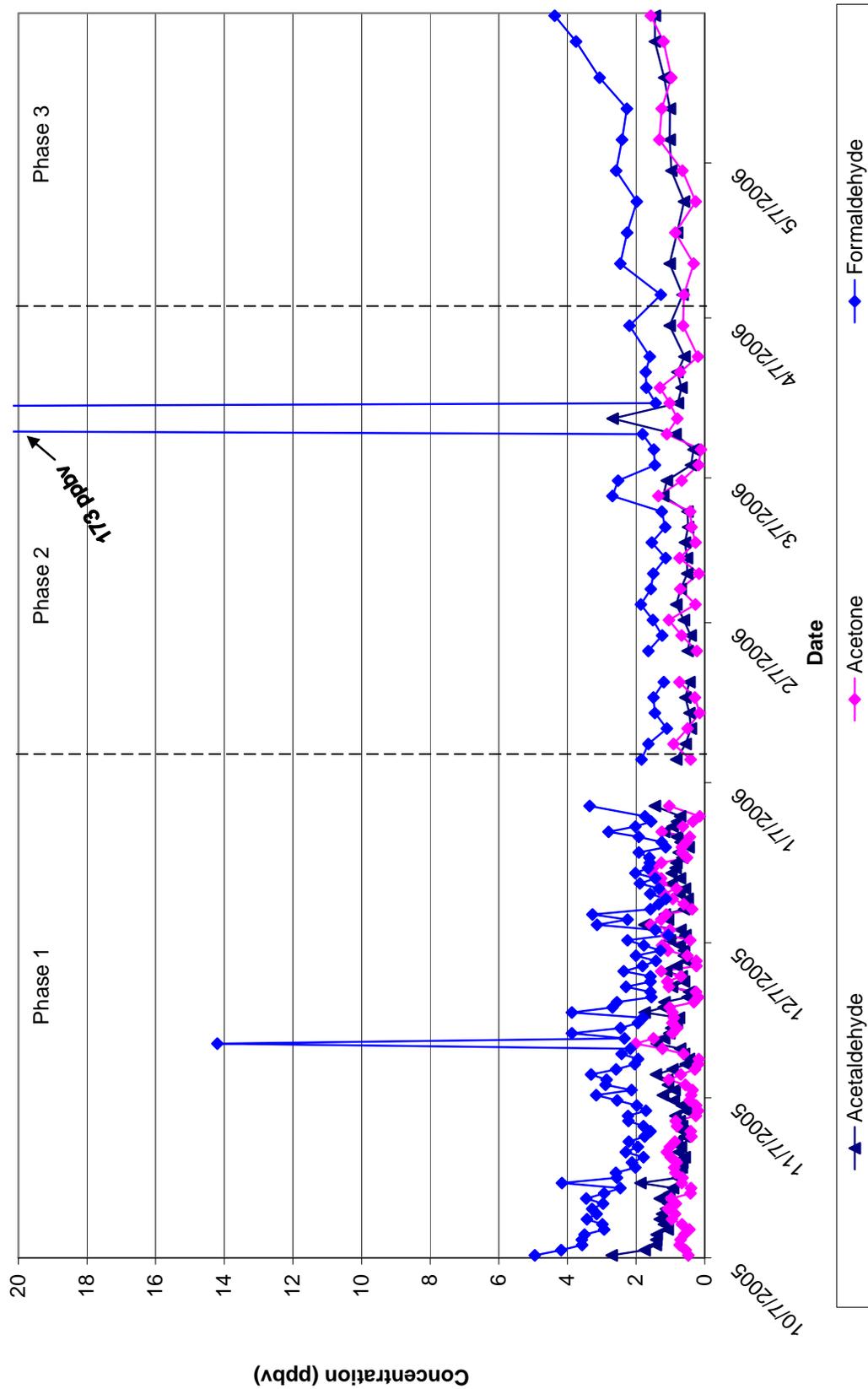
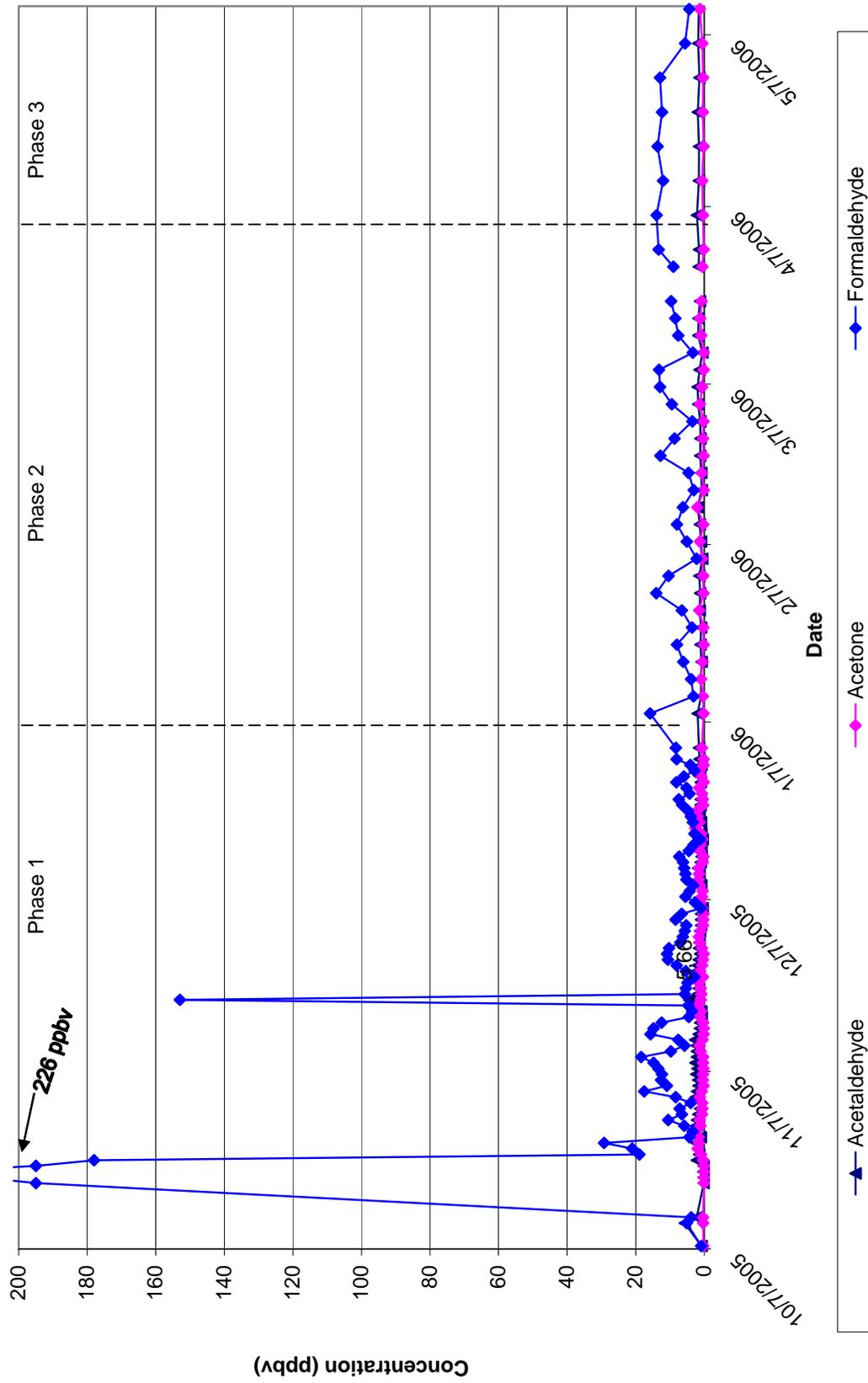


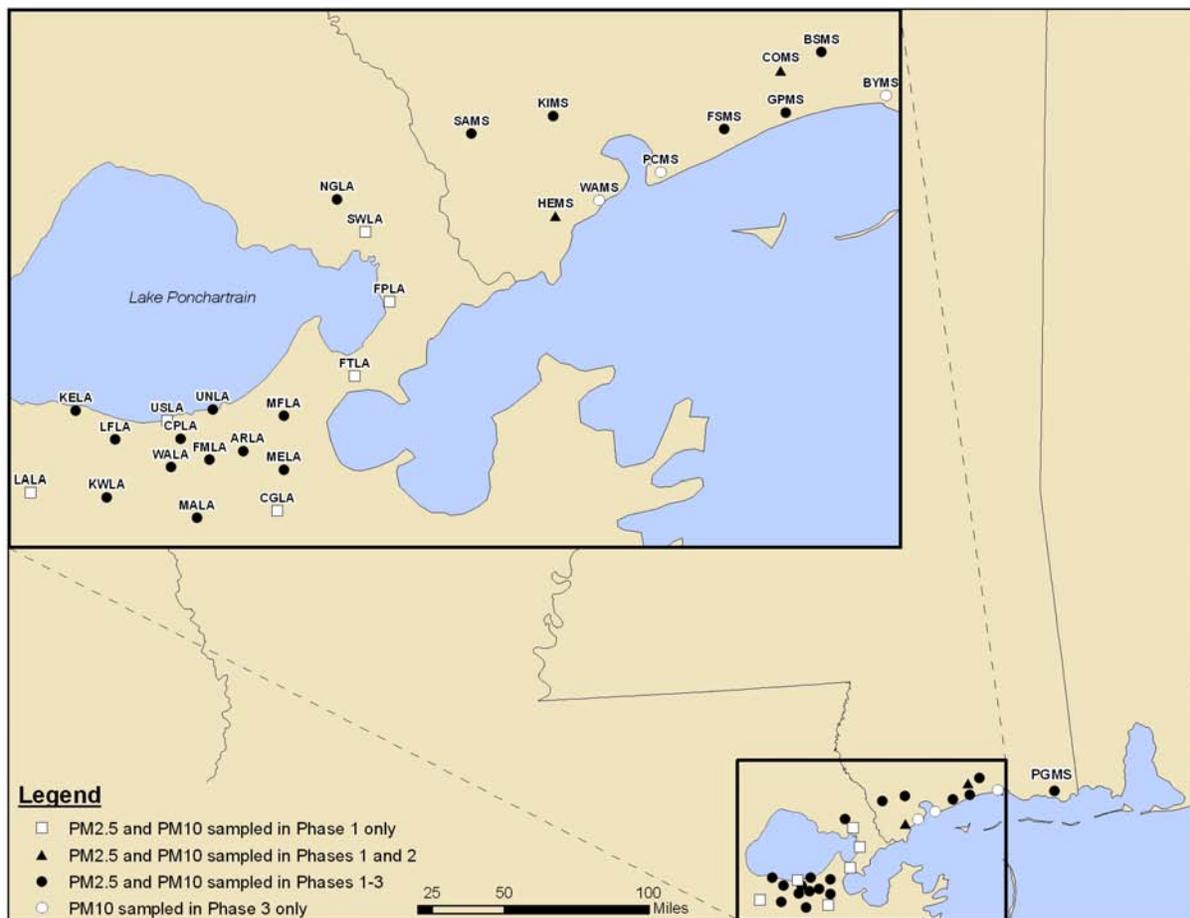
Figure 5-6. PGMS Daily Concentration of Carbonyl Compounds



6.0 Metals Results

This section summarizes metals results. As summarized in Section 2 and shown in Figure 6-1, sampling for metals took place at all monitoring sites along coastal Louisiana and Mississippi, with the exception of TUMS. Start-up and shut-down of the metal monitoring sites varies significantly from site-to-site. Table 2-8 identifies start-up and shut-down dates. Two different collection methods (PM_{10} and $PM_{2.5}$) were utilized to collect particulate size-specific samples for metals analysis.

Figure 6-1. Metals Monitoring Locations



Typically, inhalable particles (PM_{10}) are the result of smoke, dirt, and dust from factories, farming, and roads. Inhalable particles can also exist in the form of mold, spores, and pollen. The respirable particles ($PM_{2.5}$) are typically toxic organic compounds and heavy metals

produced by automobiles, burning plants, trees and yard waste, and from smelting and processing metals. Mass burning of debris resulting from the devastation and clean-up in the wake of Hurricane Katrina presented unique air quality concerns. Many of the monitoring sites that sampled metals were located strategically to capture and characterize the air quality effects of these mass burn sites.

6.1 PM₁₀ Metals

Statistical observations for metals sampled with PM₁₀ filters are presented in this section. Table 6-1 summarizes the statistical analyses completed on the 13 PM₁₀ metals concentrations presented in units of ng/m³ for ease of viewing. The analytical method, however, reports these concentrations in µg/m³. Statistical analysis included number of detects, central tendency, and data distribution. Several metals were detected consistently throughout Phase 1, 2, and 3 sampling. A total of 1,748 valid PM₁₀ metal samples were taken. The pollutants with over 1,660 detects (95 percent detection rate) include the following:

- Sodium at 1,744 detects;
- Potassium at 1,736 detects;
- Chromium at 1,732 detects;
- Lead at 1,725 detects; and
- Manganese at 1,719 detects.

Other compounds with at least 75 percent detects (at least 1,311 detects) include the following:

- Mercury at 1,613 detects;
- Cadmium at 1,608 detects;
- Nickel at 1,500 detects;
- Antimony at 1,424 detects; and
- Arsenic at 1,383 detects.

Selenium, beryllium, and cobalt were detected in less than 75 percent of samples taken.

Table 6-1. Statistical Summaries of the PM₁₀ Metal Concentrations

Pollutant	# Detects	Minimum (ng/m ³)	Maximum (ng/m ³)	Arithmetic Mean (ng/m ³)	Mode (ng/m ³)	Median (ng/m ³)	Geometric Mean (ng/m ³)	1st Quartile (ng/m ³)	3rd Quartile (ng/m ³)	Standard Deviation	Coefficient of Variation
Antimony	1,424	0.003	33.30	1.57	1.05	1.05	0.92	0.55	1.92	2.06	1.31
Arsenic	1,383	0.002	38.30	1.41	1.18	0.96	0.81	0.49	1.68	2.03	1.44
Beryllium	1,211	0.00004	2.01	0.28	0.12	0.18	0.16	0.09	0.32	0.32	1.16
Cadmium	1,608	0.003	5.72	0.43	0.31	0.31	0.29	0.18	0.51	0.43	1.01
Chromium	1,732	0.032	123	2.43	1.31	1.79	1.84	1.20	3.06	3.42	1.41
Cobalt	873	0.0002	5.69	0.73	1.07	0.44	0.39	0.24	1.04	0.84	1.14
Lead	1,725	0.006	170	5.26	1.47	3.37	3.28	2.05	5.36	8.78	1.67
Manganese	1,719	0.029	340	5.88	5.09	4.14	3.84	2.51	6.68	12.52	2.13
Mercury	1,613	0.0001	5.98	0.42	0.19	0.27	0.24	0.14	0.53	0.50	1.18
Nickel	1,500	0.010	53	2.20	2.12	1.58	1.51	0.89	2.79	2.41	1.10
Potassium	1,736	4.44	1,970	155.53	120.00	137.00	136.75	98.81	187.00	94.48	0.61
Selenium	1,307	0.0002	1,320	12.45	1.08	0.65	0.60	0.37	1.05	106.79	8.58
Sodium	1,744	12.9	6,720	812.21	126.00	358.50	400.04	147.00	1,040.00	1,068.63	1.32

Of the pollutants with at least a 75 percent detection rate, the following constitute the top five average daily concentrations:

- Sodium (812.21 ng/m³);
- Potassium (155.53 ng/m³);
- Manganese (5.88 ng/m³);
- Lead (5.26 ng/m³); and
- Chromium (2.43 ng/m³).

One indication of the consistency of the data measurements is the relative closeness of the calculated central tendency measurements—specifically, the arithmetic mean compared to the median, mode, and geometric mean. For most PM₁₀ metals, the mode, median, and geometric mean were relatively close to each other and similar to the arithmetic mean, as shown in Table 6-1. This observation suggests that the metals data measurements were representative of conditions following Hurricane Katrina. A few notable exceptions include potassium, selenium, and sodium.

The range of concentrations measured for potassium, selenium, and sodium, as shown by the minimum and maximum concentrations, which span several orders of magnitude, indicates that these statistics may be influenced by outliers. For example, the arithmetic mean, mode, median, and geometric mean for selenium were calculated as 12.45 ng/m³, 1.08 ng/m³, 0.65 ng/m³, and 0.60 ng/m³, respectively. This observation suggests that outliers were driving the average selenium concentration. This is also shown with the large variations when comparing the standard deviation, 1st and 3rd quartiles, and coefficient of variation statistics for selenium and other pollutants. In the case of sodium, a closer examination of the quartiles shows that the range of concentrations is very large, as opposed to simply containing a few outliers. Over 25 percent of sodium measurements were greater than 1000 ng/m³.

Figures 6-2 through 6-5 are time-series plots of select PM₁₀ metals (lead, manganese, and chromium) at four comprehensive monitoring sites (PM₁₀ metals were not sampled at TUMS). At GPMS (Figure 6-2) and KELA (Figure 6-3), nearly all concentrations of the three selected pollutants were less than 20 ng/m³ throughout the entire sampling period, with the exception of a

Figure 6-2. GPMS Daily Concentration of PM₁₀ Metals

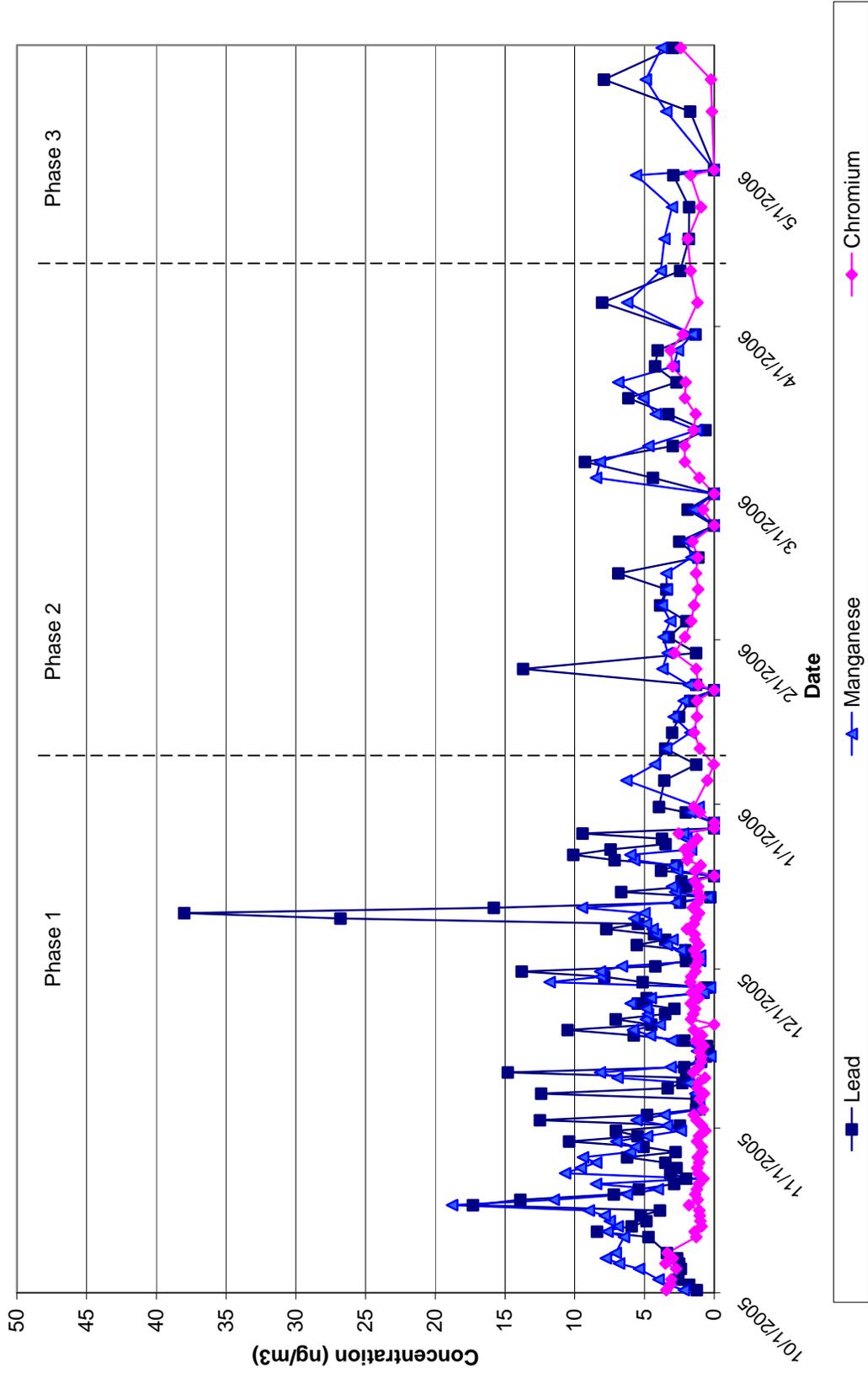


Figure 6-3. KELA Daily Concentration of PM₁₀ Metals

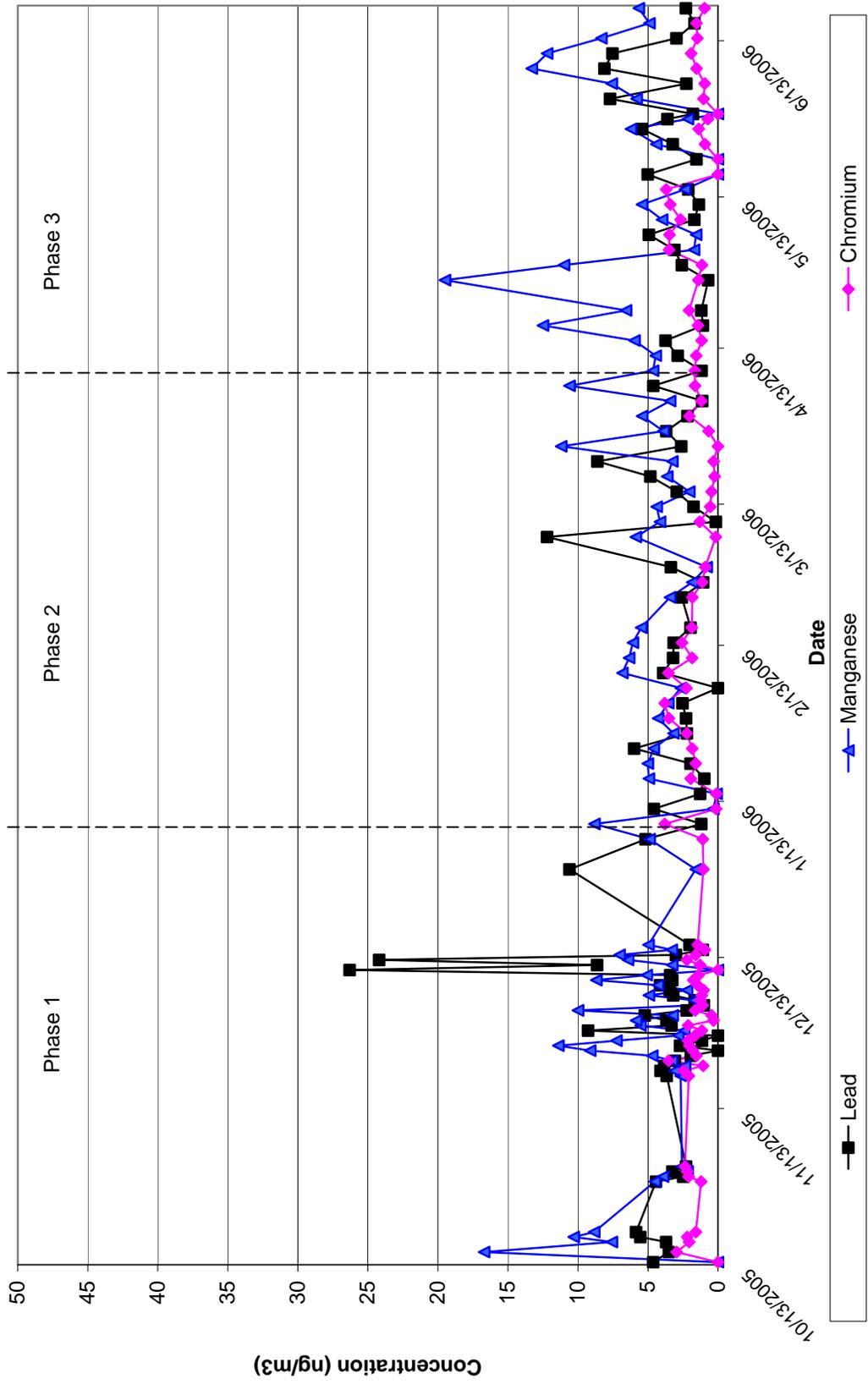


Figure 6-4. PGMS Daily Concentration of PM₁₀ Metals

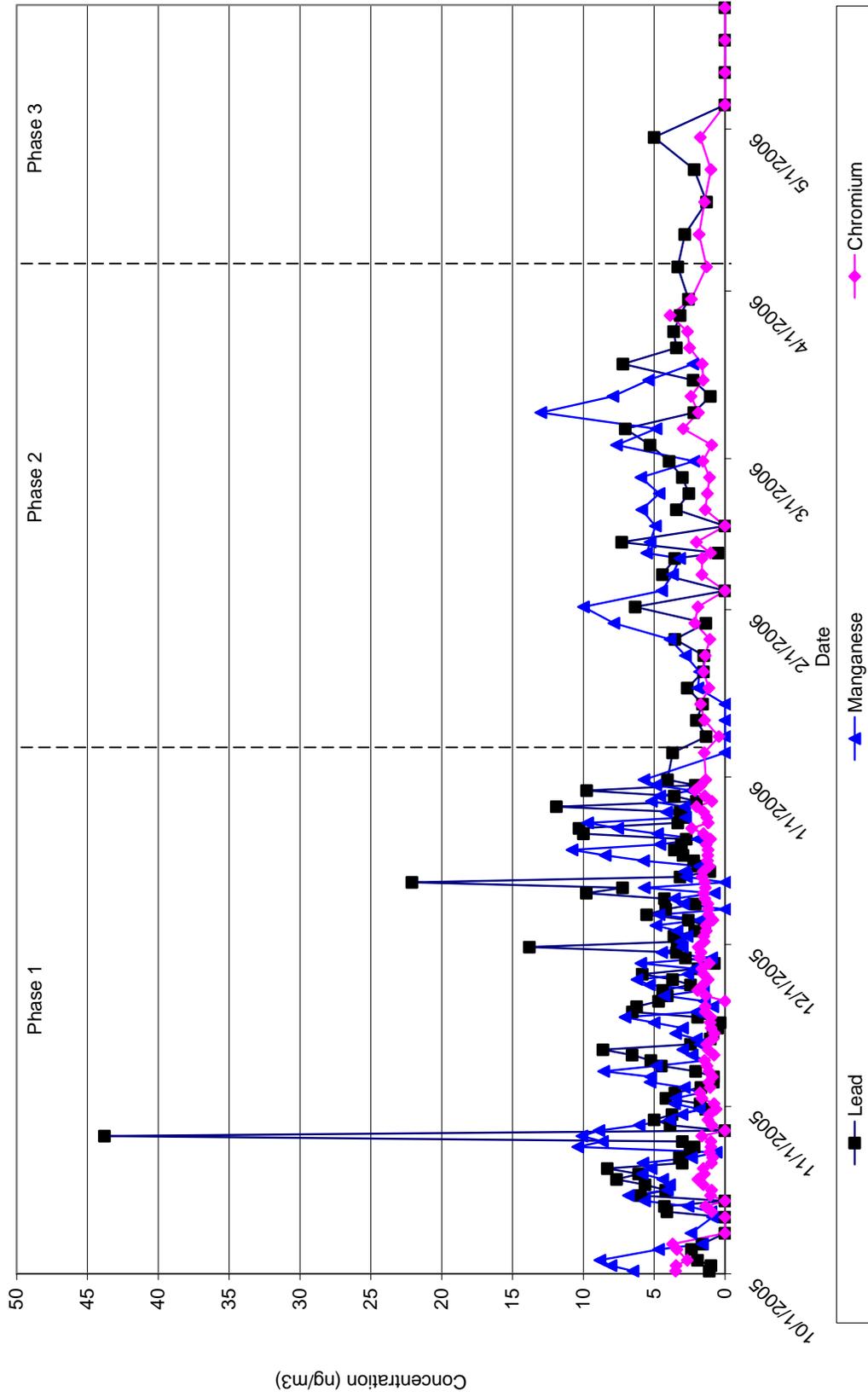
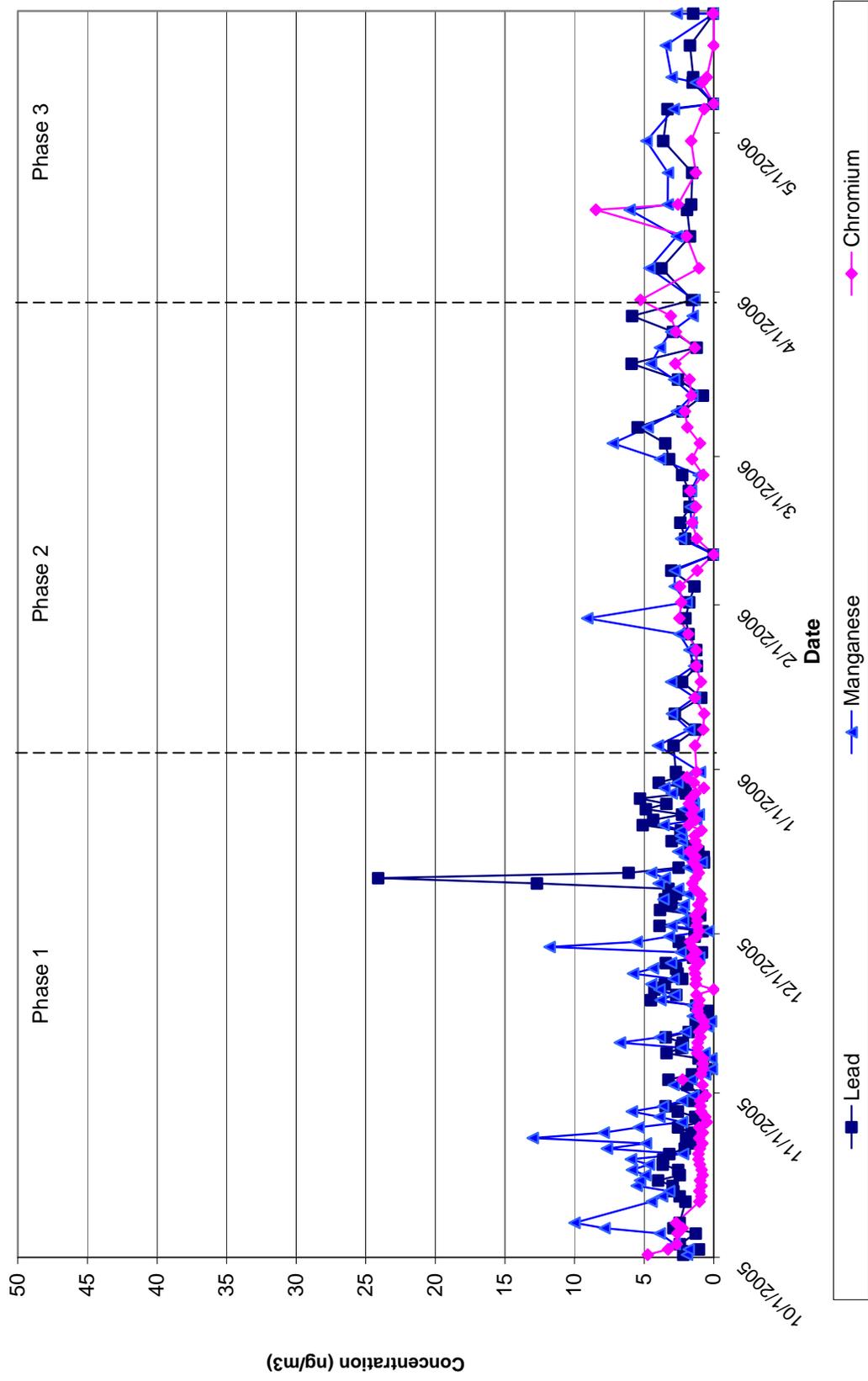


Figure 6-5. SAMS Daily Concentration of PM₁₀ Metals



few lead measurements recorded during Phase 1 Sampling. Similarly, at PGMS (Figure 6-4) and SAMS (Figure 6-5), nearly all concentrations of the three selected pollutants were less than 15 ng/m³ throughout the entire sampling period, with the exception of a few lead measurements recorded during Phase 1 Sampling.

6.2 PM_{2.5} Metals

Statistical observations for metals sampled with PM_{2.5} filters are presented in this section. Table 6-2 summarized the statistical analyses completed on the 13 PM_{2.5} metals concentrations, presented in units of ng/m³ for ease of viewing. The analytical method, however, reports these concentrations in µg/m³. Several metals were detected consistently throughout Phase 1, 2, and 3 sampling. A total of 1,214 valid PM_{2.5} metal samples were taken. The pollutants with a 95 percent detection rate (i.e., over 1,153 detects) include the following:

- Sodium at 1,214 detects;
- Potassium and lead, each at 1,213 detects;
- Chromium at 1,196 detects; and
- Manganese at 1,167 detects.

Other compounds with at least 75 percent detects (at least 911 detects) include the following:

- Cadmium (1,091);
- Mercury (1,061);
- Arsenic (1,033);
- Nickel (1,019);
- Selenium (965), and
- Antimony (931).

Beryllium and cobalt were detected in less than 75 percent of samples taken.

Of the pollutants with at least a 75 percent detection rate, the following constitute the top five average daily concentrations:

Table 6-2. Statistical Summaries of the PM_{2.5} Metal Concentrations

Pollutant	# Detects	Minimum (ng/m ³)	Maximum (ng/m ³)	Arithmetic Mean (ng/m ³)	Mode (ng/m ³)	Median (ng/m ³)	Geometric Mean (ng/m ³)	1st Quartile (ng/m ³)	3rd Quartile (ng/m ³)	Standard Deviation	Coefficient of Variation
Antimony	931	0.001	89.6	1.45	1.12	0.86	0.73	0.43	1.52	4.03	2.77
Arsenic	1,033	0.002	31.5	1.43	1.21	0.97	0.82	0.46	1.68	2.05	1.44
Beryllium	815	0.009	4.57	0.19	0.18	0.18	0.14	0.09	0.25	0.20	1.04
Cadmium	1,091	0.006	27.7	0.38	0.19	0.29	0.26	0.16	0.46	0.92	2.43
Chromium	1,196	0.035	28.7	1.32	1.35	1.13	1.17	0.87	1.47	1.04	0.79
Cobalt	433	0.002	4.25	0.29	0.26	0.22	0.20	0.11	0.37	0.32	1.11
Lead	1,213	0.014	187	4.32	2.23	2.59	2.60	1.58	3.86	8.36	1.94
Manganese	1,167	0.001	24.9	1.54	1.18	1.29	1.09	0.80	1.83	1.50	0.97
Mercury	1,061	0.002	7.28	0.29	0.18	0.23	0.21	0.14	0.37	0.35	1.20
Nickel	1,019	0.005	168	1.89	1.03	0.91	1.02	0.56	1.71	6.47	3.42
Potassium	1,213	6.78	2170	99.59	101.00	86.40	83.85	59.60	117.00	95.94	0.96
Selenium	965	0.003	33.9	0.75	1.13	0.58	0.46	0.29	0.94	1.31	1.76
Sodium	1,214	11.7	14,800	144.93	112.00	89.15	101.18	62.60	155.00	449.36	3.10

- Sodium (144.93 ng/m³);
- Potassium (99.59 ng/m³);
- Lead (4.32 ng/m³);
- Nickel (1.89 ng/m³); and
- Manganese (1.54 ng/m³).

One indication of the consistency of the data measurements is the relative closeness of the calculated central tendency measurements – specifically, the arithmetic mean compared to the median, mode, and geometric mean. For most PM_{2.5} metals, the mode, median, and geometric mean were relatively close to each other and similar to the arithmetic mean, as shown in Table 6-3. This observation suggests that the metals data measurements were representative of conditions following Hurricane Katrina.

The range of concentrations measured for potassium, lead, and sodium, as shown by the minimum and maximum concentrations, which span several orders of magnitude, indicates that these statistics were influenced by outliers. For example, the arithmetic mean, mode, median, and geometric mean for potassium were calculated as 99.59 ng/m³, 101.00 ng/m³, 86.40 ng/m³, and 83.85 ng/m³, respectively. This observation suggests that outliers are driving the average potassium concentration. This is also shown with the large variations when comparing the standard deviation, 1st and 3rd quartiles, and coefficient of variation statistics for these three pollutants. Unlike sodium sampled with PM₁₀, the PM_{2.5} sodium statistics are driven by outliers with less than one percent of concentrations exceeding 1000 ng/m³.

Figures 6-6 through 6-9 are time-series plots of select PM_{2.5} metals (lead, manganese, and chromium) at four comprehensive monitoring sites (PM_{2.5} metals were not sampled at TUMS). At SAMS (Figure 6-6) and KELA (Figure 6-7), all of the recorded concentrations were less than 16 ng/m³, with only four measuring more than 5 ng/m³. Similar behavior of the three selected compounds is observed at GPMS (Figure 6-8) and PGMS (Figure 6-9); however, two high concentrations were recorded at each of the sites during Phase 1 Sampling. While most concentrations at GPMS and PGMS are less than 15 ng/m³, a concentration of 35.5 ng/m³ was recorded at GPMS and a concentration of 42.7 ng/m³ was recorded at PGMS.

Figure 6-6. SAMS Daily Concentration of PM_{2.5} Metals

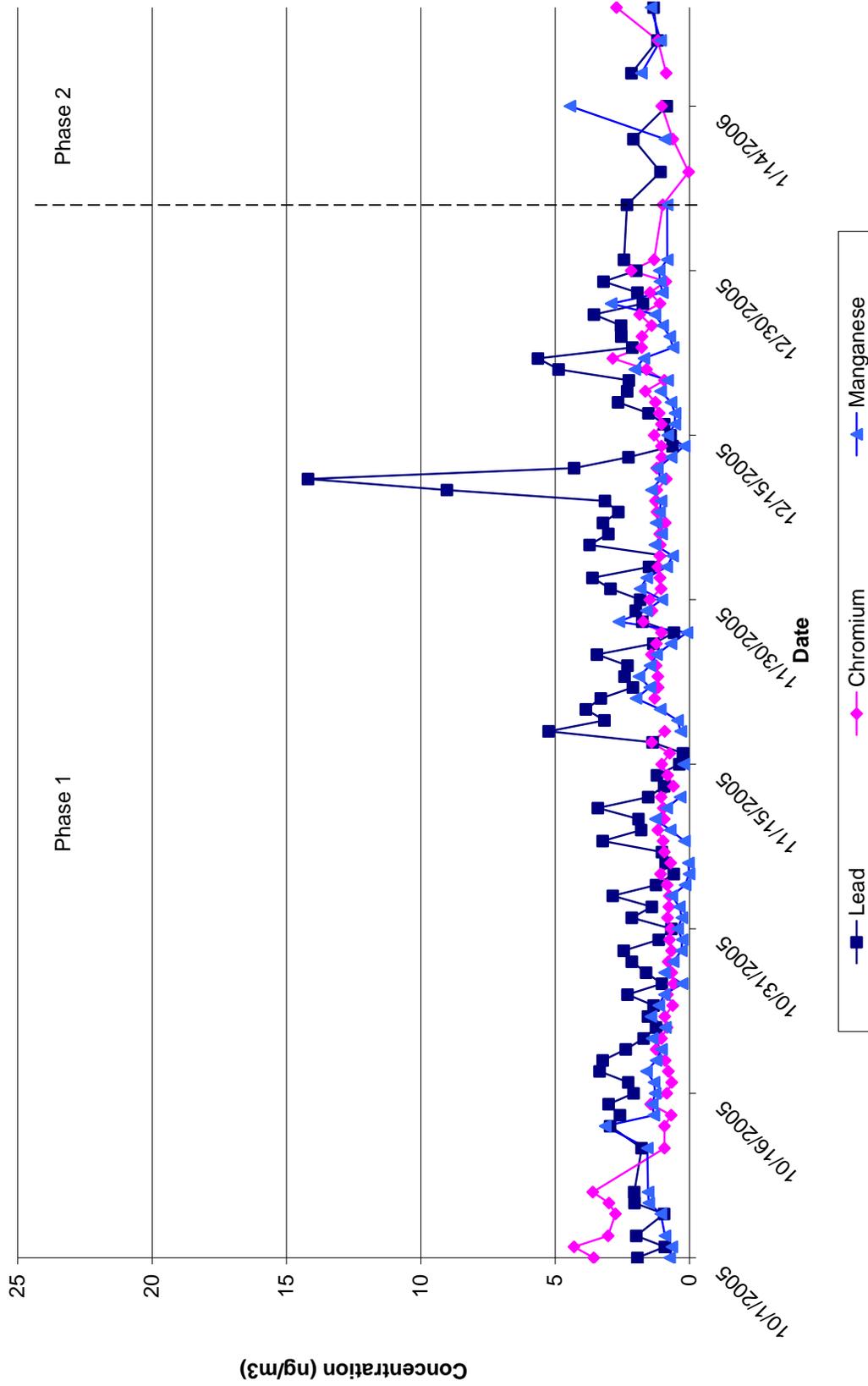


Figure 6-7. KELA Daily Concentration of PM_{2.5} Metals

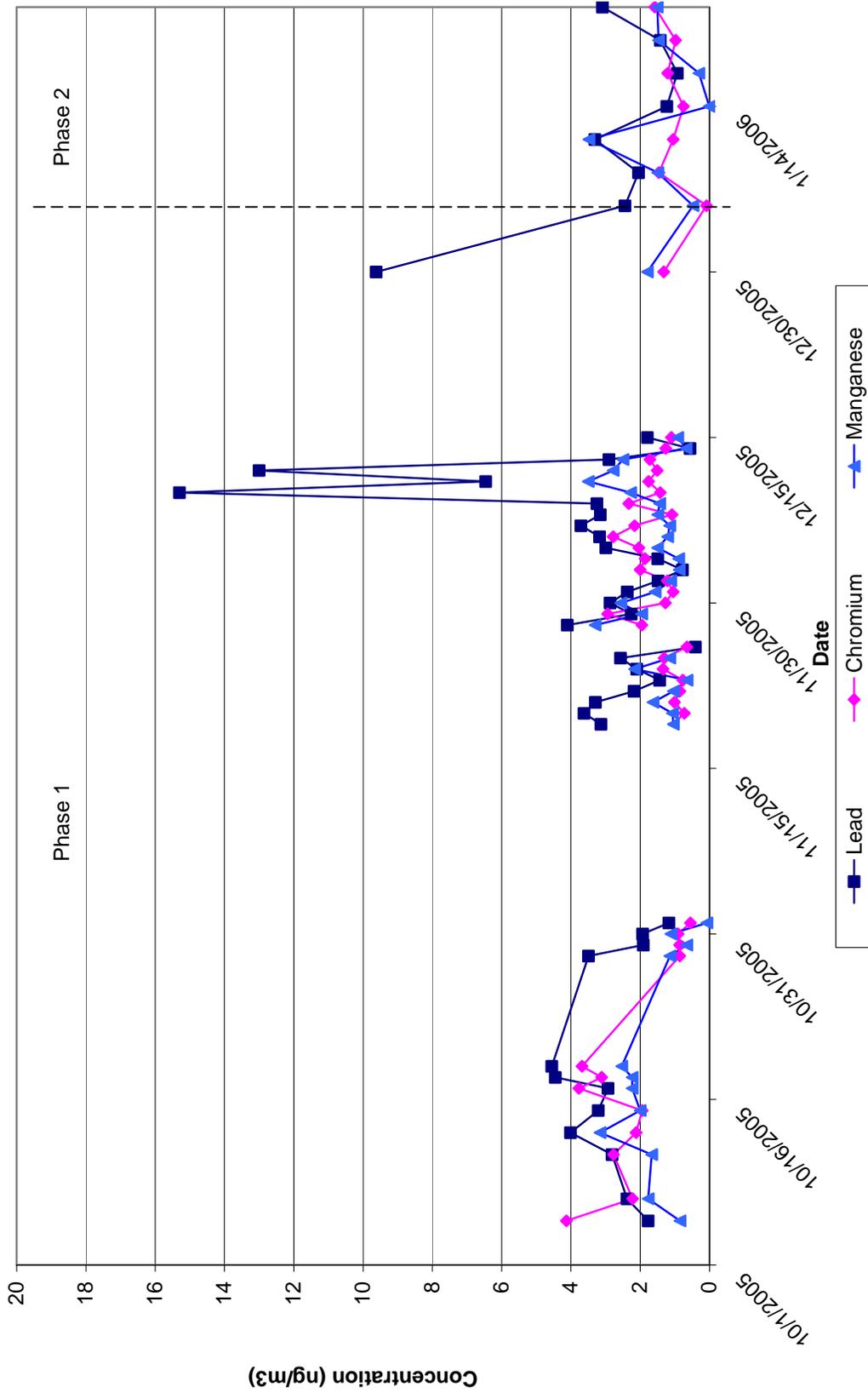


Figure 6-8. GPMS Daily Concentration of PM_{2.5} Metals

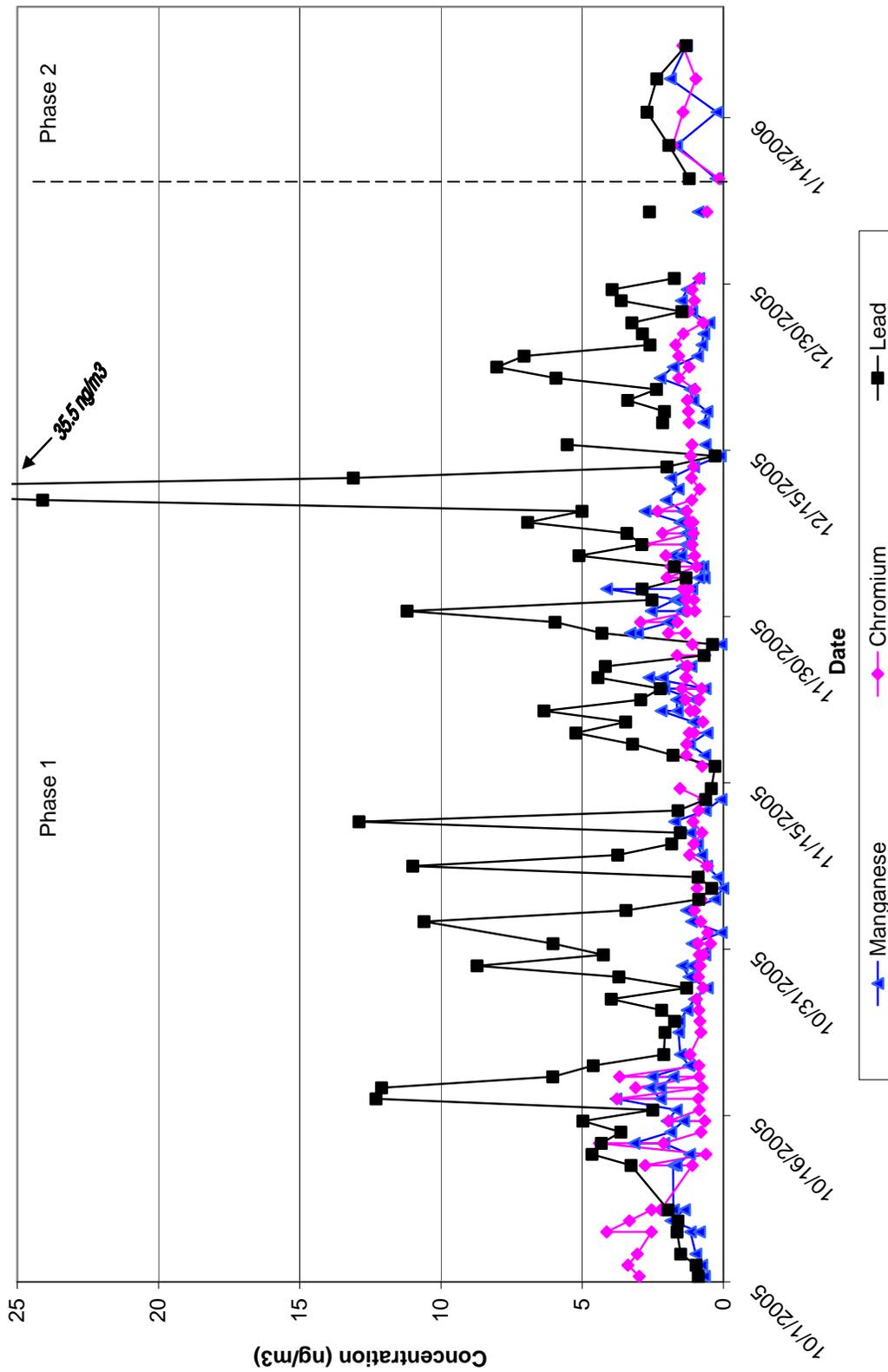
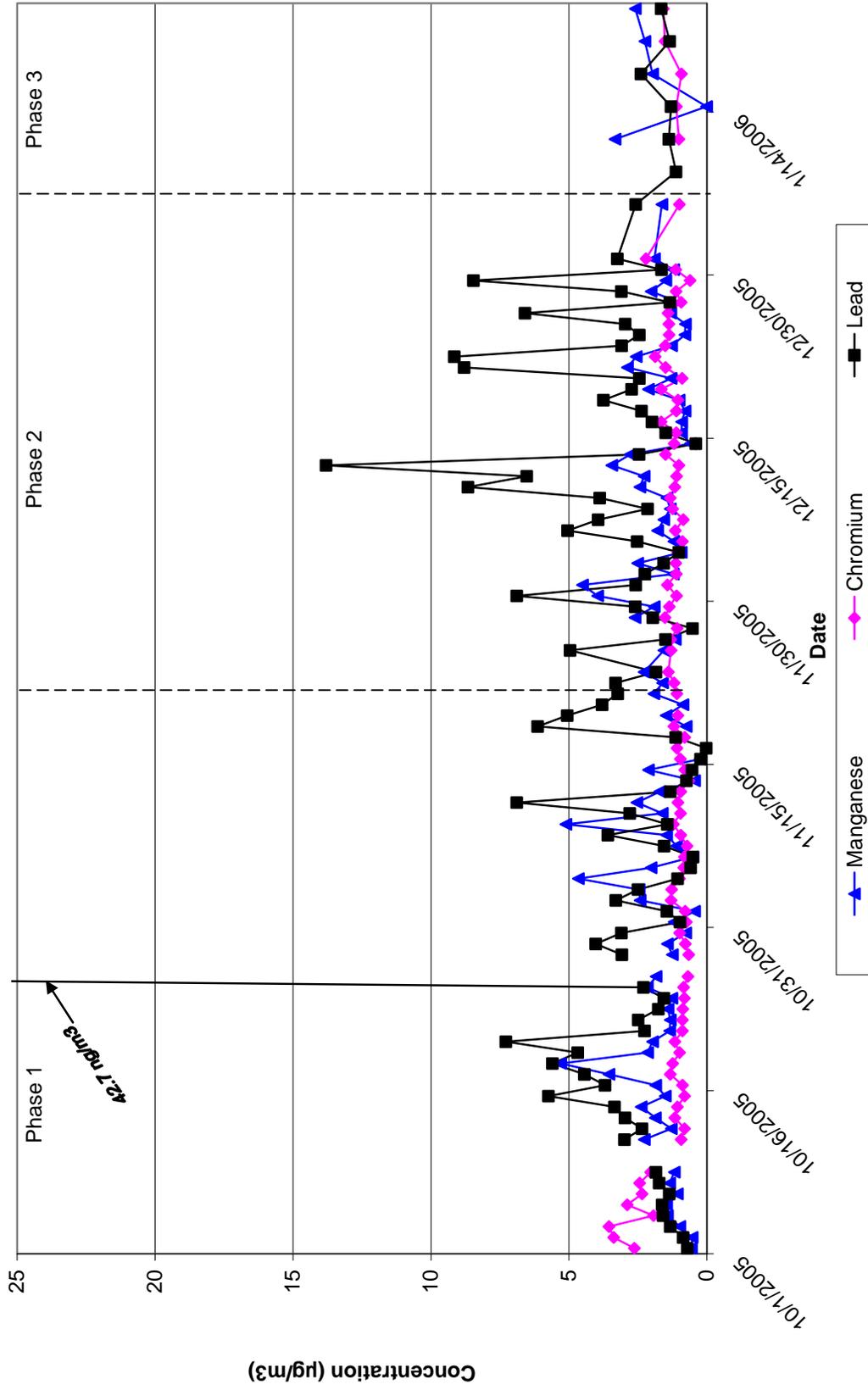


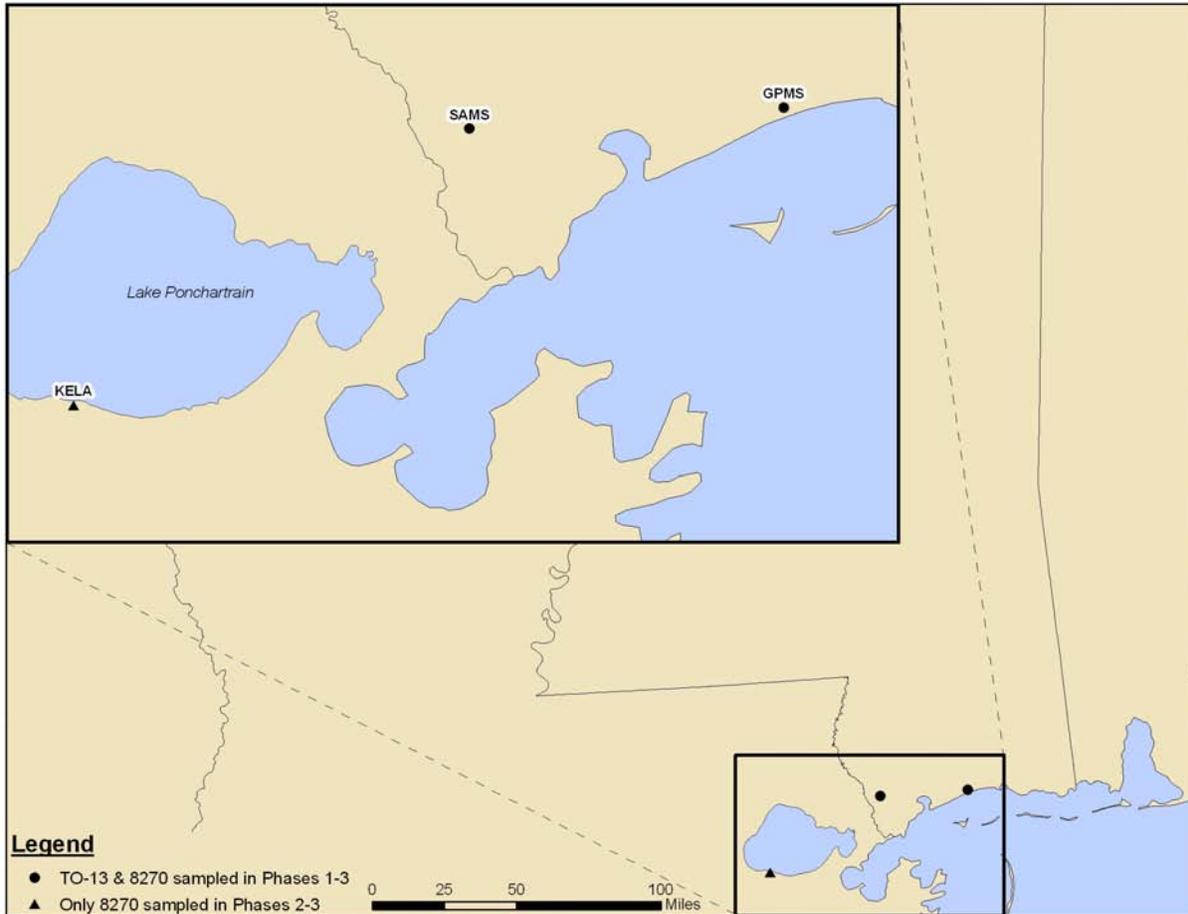
Figure 6-9. PGMS Daily Concentration of PM_{2.5} Metals



7.0 SVOC Results

This section summarizes results for the SVOC samples. As discussed in Section 2, and shown in Figure 7-1, SVOC measurements were taken at three monitoring sites: GPMS, KELA, and SAMS.

Figure 7-1. SVOC Monitoring Locations



Two different SVOC sample collection media were utilized during the post-Katrina monitoring effort. GPMS and SAMS sampled SVOC from PUF sorbent, which was sampled and analyzed by GC/MS SIM (following Compendium Method TO-13A) in October 2006. For reasons discussed below, EPA decided to use the larger SVOC list (SW846/Method 8270C compound list), which was sampled using XAD-2[®] resin and was analyzed with a GC/MS using a full data acquisition (SCAN) mode. In November 2006, GPMS and SAMS stopped sampling

SVOC with PUF sorbent and started to analyze SVOC using the Method 8270C compound list. The KELA site began sampling SVOC using the Method 8270C compound list in February 2006. This section is separated into two subsections to distinguish between these method types.

A wide variety of sorbents including XAD-2[®] and PUF have been used to sample common polycyclic aromatic hydrocarbons (PAHs). The PUF is used in conjunction with the smaller TO-13A compound list, and has a higher retention efficiency for the less volatile PAHs. PUF has demonstrated a lower recovery efficiency and storage capability for naphthalene than XAD-2[®]. PUF cartridges, however, are easier to handle in the field and maintain faster flow rates during sampling. In general, XAD-2[®] resin, which is used in conjunction with the larger SW846/ Method 8270C compound list, has a higher collection efficiency for volatile PAHs, as well as a higher retention efficiency for both the more volatile and reactive PAHs.

7.1 SVOC Sampled with Method TO-13A and PUF Cartridges (SVOC PUF)

Statistical analyses were completed on the SVOC sampled with Method TO-13A PUF. Table 7-1 summarizes the statistical analyses completed on 19 pollutants sampled using SVOC PUF, presented in units of ng/m³ for ease of viewing. The analytical method, however, reports these concentrations in µg/m³. Statistical analysis included number of detects, central tendency, and data distribution. This method was used only at the onset (October 2006) of sampling at GPMS and SAMS. A total of 68 valid SVOC samples were collected. The following SVOC pollutants had at least a 95 percent (i.e., at least 65 detects) detection rate:

- Acenaphthene, fluoranthene, fluorine, naphthalene, phenanthrene, and pyrene at 68 detects; and
- Chrysene at 66 detects.

Only one other compound (acenaphthylene at 62 detects) had at least a 75 percent detection rate (i.e., at least 51 detects). Eleven compounds were detected in less than 75 percent of samples taken, but all SVOC measured had at least one detect.

Table 7-1. Statistical Summaries of the SVOC PUF Concentrations

Pollutant	# Detects	Minimum (ng/m ³)	Maximum (ng/m ³)	Arithmetic Mean (ng/m ³)	Mode (ng/m ³)	Median (ng/m ³)	Geometric Mean (ng/m ³)	1st Quartile (ng/m ³)	3rd Quartile (ng/m ³)	Standard Deviation	Coefficient of Variation
Acenaphthene	68	0.04	18.60	3.20	2.23	1.83	1.74	0.81	3.87	3.90	1.22
Acenaphthylene	62	0.04	13.60	1.11	0.161	0.47	0.44	0.15	1.24	2.01	1.81
Anthracene	41	0.03	9.30	1.17	N/A	0.34	0.37	0.11	1.02	2.09	1.79
Benzo (a) anthracene	48	0.03	1.84	0.17	0.0406	0.05	0.08	0.04	0.14	0.31	1.79
Benzo (a) pyrene	11	0.03	0.90	0.26	NA	0.20	0.18	0.11	0.27	0.24	0.92
Benzo (b) fluoranthene	45	0.03	1.05	0.16	0.148	0.08	0.10	0.05	0.15	0.19	1.21
Benzo (e) pyrene	27	0.03	0.94	0.18	N/A	0.10	0.12	0.08	0.22	0.20	1.08
Benzo (g,h,i) perylene	36	0.03	0.64	0.12	0.122	0.08	0.09	0.04	0.12	0.13	1.02
Benzo (k) fluoranthene	42	0.03	1.28	0.16	0.148	0.09	0.09	0.04	0.14	0.22	1.41
Chrysene	66	0.03	2.52	0.24	0.178	0.12	0.13	0.07	0.22	0.39	1.59
Coronene	5	0.07	0.18	0.11	N/A	0.10	0.10	0.08	0.12	0.04	0.35
Dibenz (a,h) anthracene	2	0.04	0.10	0.07	N/A	0.07	0.06	0.05	0.08	0.03	0.49
Fluoranthene	68	0.19	8.09	1.38	1.74	0.83	0.96	0.55	1.74	1.41	1.03
Fluorene	68	0.07	19.50	3.36	NA	2.03	2.12	0.95	4.20	3.47	1.03
Indeno (1,2,3-cd) pyrene	23	0.04	0.68	0.17	N/A	0.11	0.13	0.09	0.22	0.14	0.84
Naphthalene	68	2.93	278.00	29.89	10.00	19.20	16.31	6.80	29.65	44.45	1.49
Perylene	3	0.04	0.19	0.12	NA	0.14	0.10	0.09	0.16	0.06	0.51
Phenanthrene	68	0.96	29.00	5.60	3.68	3.35	3.74	1.81	7.44	5.69	1.02
Pyrene	68	0.12	7.68	0.99	1.46	0.54	0.61	0.30	1.11	1.27	1.29

Of the pollutants with at least a 75 percent detection rate, the following constitute the top five average daily concentrations:

- Naphthalene (29.89 ng/m³);
- Phenanthrene (5.60 ng/m³);
- Fluorene (3.36 ng/m³);
- Acenaphthene (3.20 ng/m³); and
- Fluoranthene (1.38 ng/m³).

One indication of the consistency of the data measurements is the relative closeness of the calculated central tendency measurements—specifically, the arithmetic mean compared to the median, mode, and geometric mean. For most of the SVOC results, the mode, median, and geometric mean were generally close to each other and similar to the arithmetic mean, as shown in Table 7-1. This observation suggests that the SVOC data measurements were representative of conditions following Hurricane Katrina.

The range of concentrations measured for naphthalene and acenaphthene, as shown by the minimum and maximum concentrations, indicates that these statistics may be influenced by outliers. For example, the arithmetic mean, mode, median, and geometric mean for naphthalene were calculated as 29.89 ng/m³, 10.00 ng/m³, 19.20 ng/m³, and 16.31 ng/m³, respectively. This observation suggests that outliers were driving the average naphthalene concentration. This is also shown with the large variations when comparing the standard deviation, 1st and 3rd quartiles, and coefficient of variation statistics for naphthalene and other pollutants. Naphthalene is a common pollutant released during combustion, such as from mobile sources or mass burning.

Time-series concentration plots of select SVOC concentrations (naphthalene, 2-methylnaphthalene, and 1,4-dichlorobenzene) are presented in Figures 7-2 through 7-4 for the GPMS, KELA, and SAMS monitoring sites. While several concentrations at GPMS during Phase 1 Sampling were greater than 0.15 µg/m³, no concentrations were greater than 0.15 µg/m³ during Phase 2 and Phase 3 Sampling. At the SAMS monitoring site, concentrations of the select SVOCs were fairly consistent during all three phases (all less than 0.10 µg/m³).

Figure 7-2. GPMS Daily Concentration of SVOC Compounds using Method 8270C

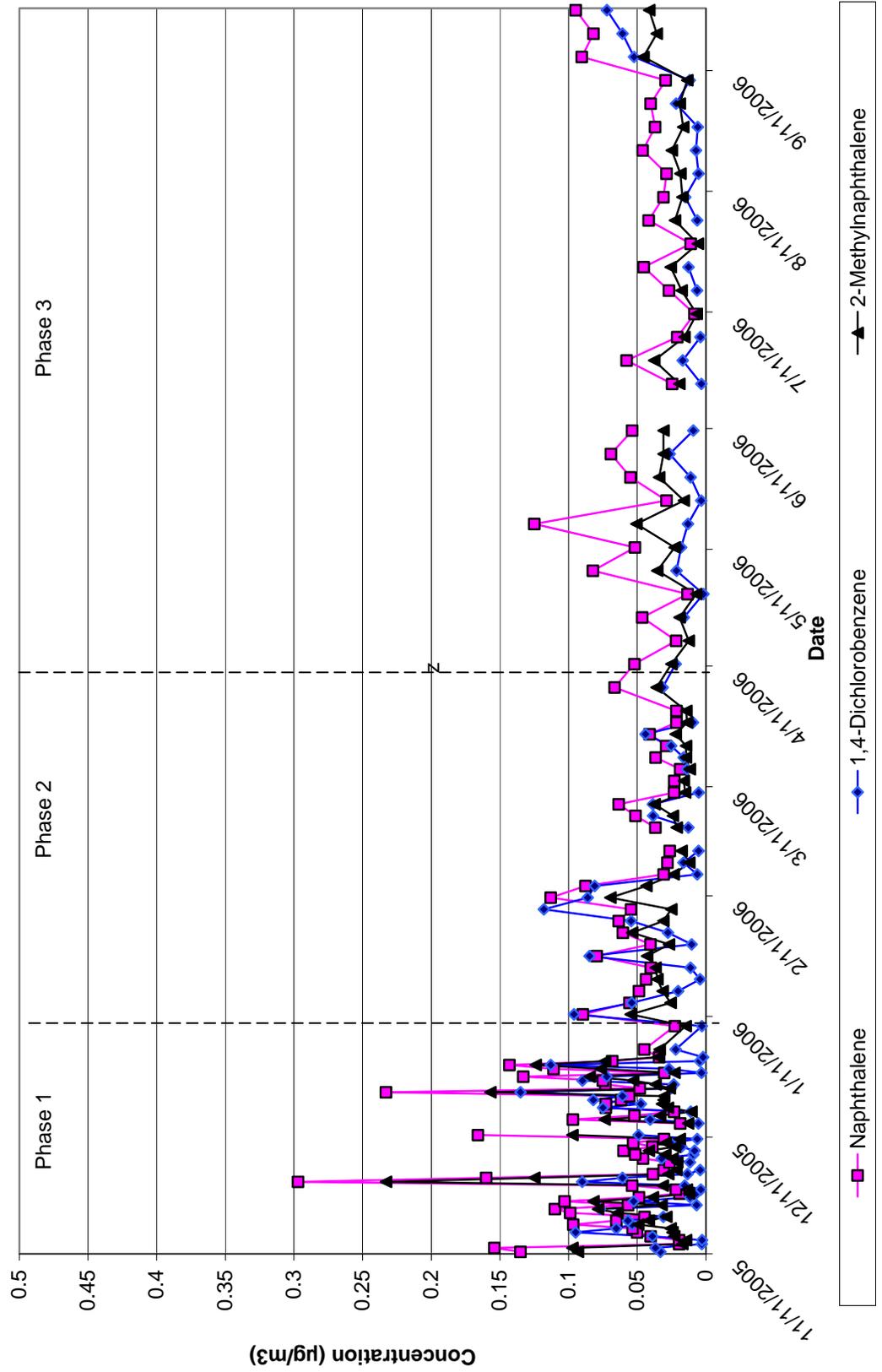


Figure 7-3. KELA Daily Concentration of SVOC Compounds

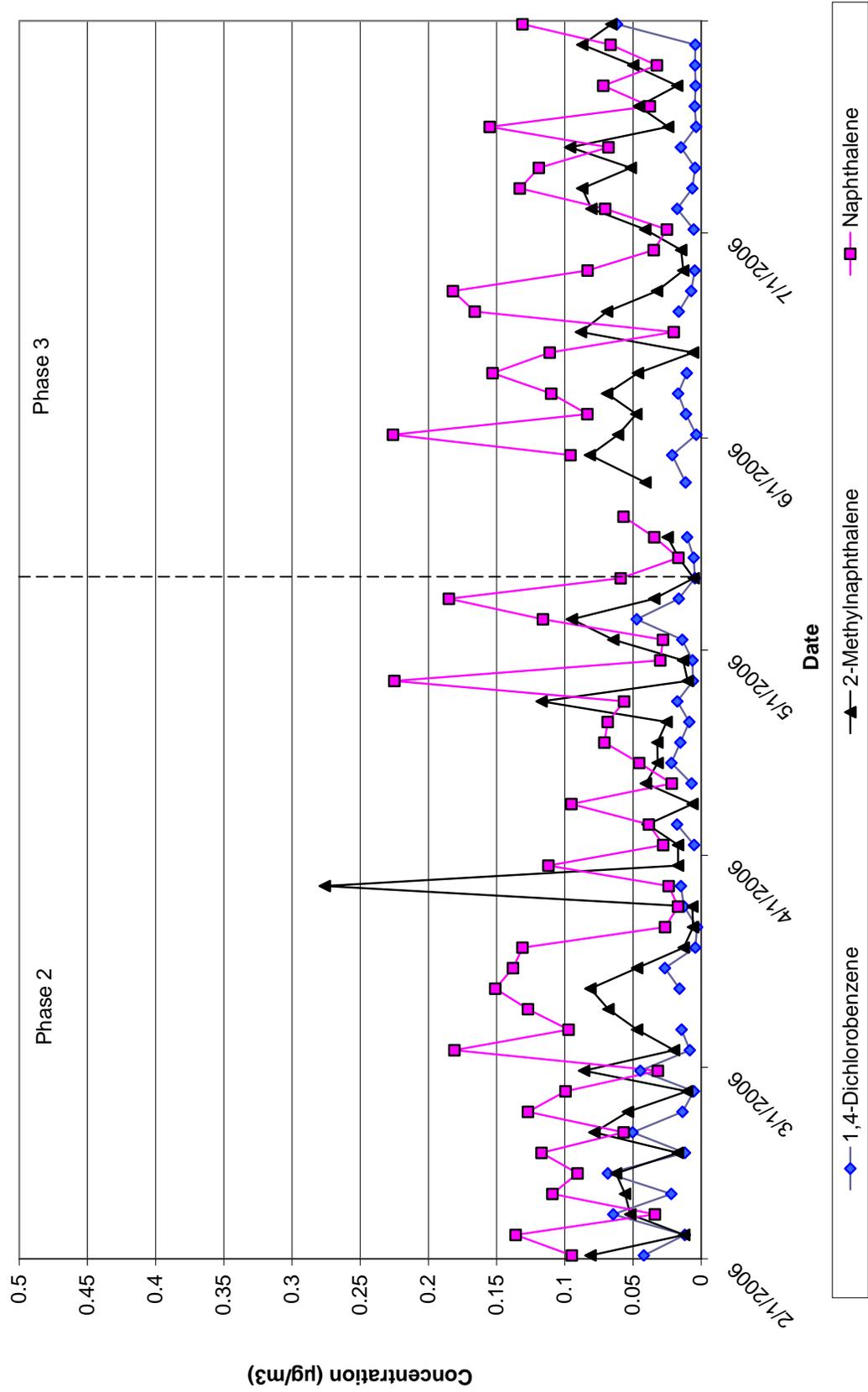
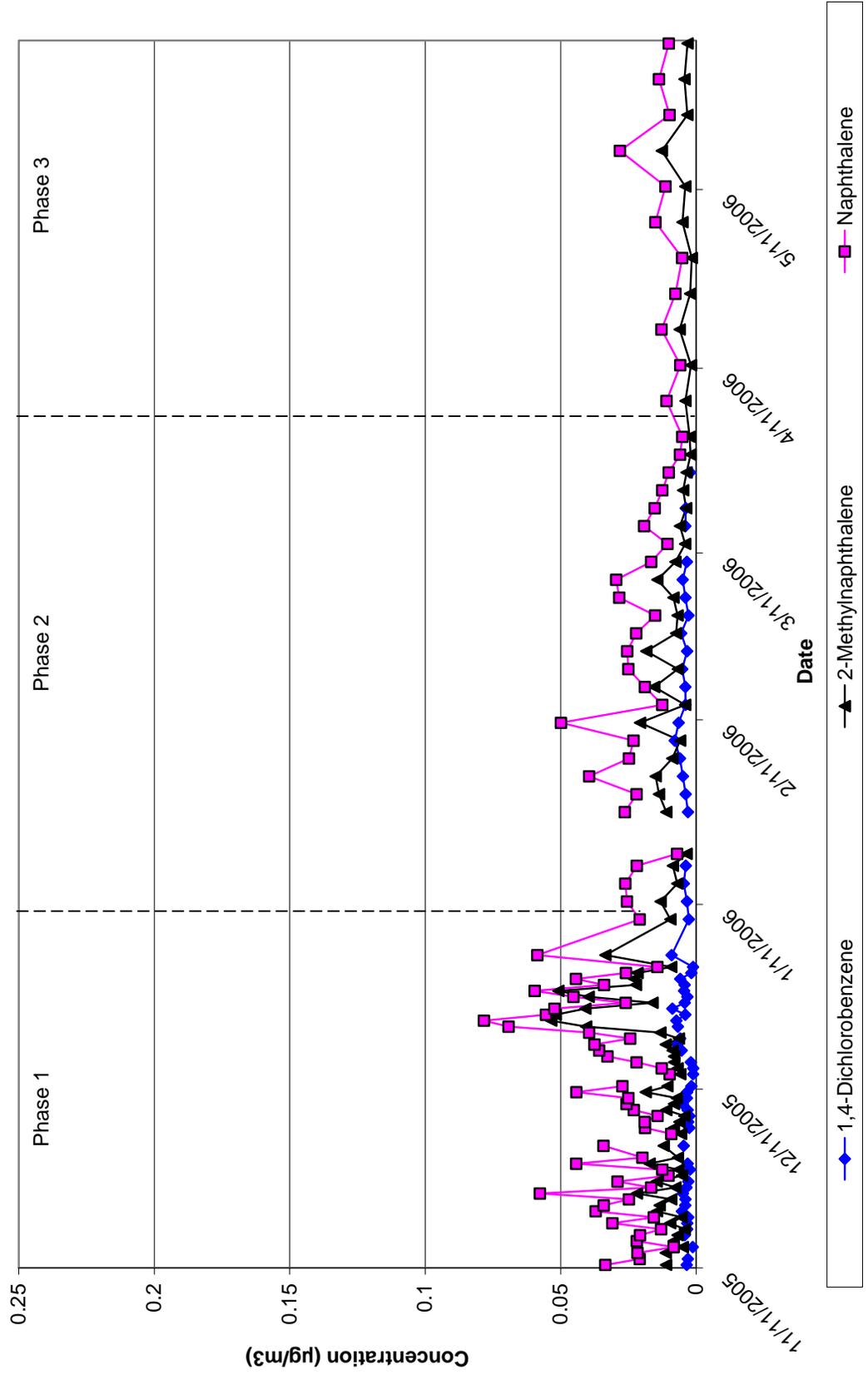


Figure 7-4. SAMS Daily Concentration of SVOC Compounds



7.2 SVOC Sampled with Method TO-13A and XAD-2[®] Cartridges (SVOC XAD-2[®])

Statistical analyses were completed on the SVOC sampled with Method TO-13A XAD-2[®]. Table 7-2 summarizes the statistical analyses completed on 106 pollutants sampled using SVOC XAD-2[®], presented in units of ng/m³ for ease of viewing. The analytical method, however, reports these concentrations in µg/m³. Statistical analysis included number of detects, central tendency, and data distribution. This method was used instead of SVOC PUF at GPMS and SAMS beginning in mid-November 2006. The KELA site began sampling using SVOC XAD-2[®] in February 2006.

A total of 251 valid SVOC samples were collected. The number of SVOC analyzed when using XAD-2[®] is much greater than when using the PUF method (106 vs. 19, respectively). As presented in Table 7-2, the method has the ability to detect a larger number of pollutants, but only about 20 pollutants were detected on a regular basis. The following SVOC pollutants had at least a 95 percent (i.e., at least 239 detects) detection rate:

- Naphthalene at 251 detects;
- 2-Methylnaphthalene at 250 detects; and
- Dibenzofuran and phenanthrene at 248 detects.

Seven other compounds had at least a 75 percent detection rate (i.e., at least 189 detects):

- Acenaphthene at 214 detects,
- Acetophenone at 233 detects,
- Bis (2-ethylhexyl) phthalate at 233 detects,
- 1,4-Dichlorobenzene at 216 detects,
- Diethyl phthalate at 227 detects,
- Fluoranthene at 211 detects, and
- Fluorene at 235 detects.

Twenty-one compounds (21) were detected in fewer than 75 percent of samples taken, and 77 compounds were not detected at all.

Table 7-2. Statistical Summaries of the SVOC XAD-2® Concentrations

Pollutant	# Detects	Minimum (ng/m ³)	Maximum (ng/m ³)	Arithmetic Mean (ng/m ³)	Mode (ng/m ³)	Median (ng/m ³)	Geometric Mean (ng/m ³)	1st Quartile (ng/m ³)	3rd Quartile (ng/m ³)	Standard Deviation	Coefficient of Variation
Acenaphthene	214	0.44	50.20	6.46	10.40	3.90	4.18	2.15	8.04	6.89	1.07
Acenaphthylene	36	0.75	19	3.75	N/A	2.10	2.64	1.54	4.56	3.82	1.02
Acetophenone	233	2.53	508	15.13	11.2	10.3	10.95	7.55	15.1	34.04	2.25
2-Acetylaminofluorene	0						N/A				
4-Aminobiphenyl	0						N/A				
Aniline	5	20.6	138	89.3	N/A	96.10	75.75	87.8	104	38.36	0.43
Anthracene	44	0.31	26.6	3.61	N/A	1.29	1.69	0.74	2.36	5.82	1.61
Azobenzene	0						N/A				
Benzidine	0						N/A				
Benzo (a) anthracene	48	0.33	15.40	1.35	0.71	0.71	0.83	0.51	0.91	2.37	1.76
Benzo (a) pyrene	8	0.51	13.70	3.60	N/A	2.37	2.18	1.10	3.80	4.04	1.12
Benzo (b) fluoranthene	78	0.25	21.70	3.74	1.17	1.92	1.97	0.96	2.66	5.14	1.37
Benzo (g,h,i) perylene	4	1.27	2.66	2.21	N/A	2.45	2.12	2.15	2.50	0.55	0.25
Benzo (k) fluoranthene	13	0.07	8.28	1.58	N/A	0.60	0.70	0.39	2.44	2.21	1.39
Benzyl alcohol	0						N/A				
Bis(2-chloroethoxy)methane	0						N/A				
Bis(2-chloroethyl)ether	0						N/A				
Bis(2-chloroisopropyl)ether	0						N/A				
Bis(2-ethylhexyl)phthalate	233	1.62	63.9	10.98	11.80	8.54	8.21	4.72	12.80	9.73	0.89
4-Bromophenyl phenyl ether	0						N/A				
Butyl benzyl phthalate	53	0.75	6.48	1.77	1.06	1.52	1.60	1.19	1.99	0.95	0.54
Carbazole	0						N/A				
4-Chloro-3-methylphenol	0						N/A				
4-Chloroaniline	0						N/A				
Chlorobenzilate	0						N/A				
2-Chloronaphthalene	0						N/A				
2-Chlorophenol	0						N/A				

Table 7-2. Statistical Summaries of the SVOC XAD-2[®] Concentrations (continued)

Pollutant	# Detects	Minimum (ng/m ³)	Maximum (ng/m ³)	Arithmetic Mean (ng/m ³)	Mode (ng/m ³)	Median (ng/m ³)	Geometric Mean (ng/m ³)	1st Quartile (ng/m ³)	3rd Quartile (ng/m ³)	Standard Deviation	Coefficient of Variation
4-Chlorophenyl phenyl ether	0						N/A				
Chrysene	48	0.06	18.90	1.50	2.10	0.55	0.63	0.29	1.18	3.10	2.06
Diallylate	0						N/A				
Dibenz (a,h) anthracene	0						N/A				
Dibenzofuran	248	0.95	41.40	7.48	4.60	5.96	5.91	3.70	9.20	5.72	0.76
1,2-Dichlorobenzene	0						N/A				
1,3-Dichlorobenzene	0						N/A				
1,4-Dichlorobenzene	216	1.06	135	19.70	60.70	8.03	10.16	4.09	22	25.26	1.28
3,3'-Dichlorobenzidine	0						N/A				
2,4-Dichlorophenol	2	7	30.80	18.90	N/A	18.90	14.68	12.95	24.85	11.9	0.63
2,6-Dichlorophenol	0						N/A				
Diethyl phthalate	227	1.09	29.80	4.50	4.70	3.66	3.71	2.56	4.86	3.58	0.80
Dimethyl phthalate	3	5.93	38.60	18.81	N/A	11.90	13.97	8.92	25.25	14.20	0.76
4-Dimethylaminoazobenzene	0						N/A				
7,12-Dimethylbenz (a) anthracene	0						N/A				
3,3'-Dimethylbenzidine	0						N/A				
2,4-Dimethylphenol	8	2.09	21	10.82	N/A	8.17	8.17	4.95	18.80	7.21	0.67
Di-n-butyl phthalate	0						N/A				
4,6-Dinitro-2-methylphenol	0						N/A				
1,3-Dinitrobenzene	0						N/A				
2,4-Dinitrophenol	0						N/A				
2,4-Dinitrotoluene	0						N/A				
2,6-Dinitrotoluene	0						N/A				
Di-n-butyl phthalate	0						N/A				
Di-n-octyl phthalate	0						N/A				
Dinoseb	0						N/A				
Diphenylamine	0						N/A				

Table 7-2. Statistical Summaries of the SVOC XAD-2[®] Concentrations (continued)

Pollutant	# Detects	Minimum (ng/m ³)	Maximum (ng/m ³)	Arithmetic Mean (ng/m ³)	Mode (ng/m ³)	Median (ng/m ³)	Geometric Mean (ng/m ³)	1st Quartile (ng/m ³)	3rd Quartile (ng/m ³)	Standard Deviation	Coefficient of Variation	
Ethyl Methanesulfonate	0	N/A										
Fluoranthene	211	0.38	38.20	2.77	1.33	1.85	1.98	1.22	2.88	3.57	1.29	
Fluorene	235	0.67	32.10	5.73	4.33	3.92	4.23	2.47	7.59	4.98	0.87	
2-Fluorobiphenyl	0	N/A										
2-Fluorophenol	0	N/A										
Hexachlorobenzene	0	N/A										
Hexachlorobutadiene	0	N/A										
Hexachlorocyclopentadiene	0	N/A										
Hexachloroethane	0	N/A										
Hexachloropropene	0	N/A										
Indeno(1,2,3-cd)pyrene	0	N/A										
Isodrin	0	N/A										
Isophorone	0	N/A										
Isosafrole	0	N/A										
Methyl Methanesulfonate	0	N/A										
3-Methylcholanthrene	0	N/A										
2-Methylnaphthalene	250	1.64	276	31.17	14.50	21.05	20.05	10.45	40.60	33.35	1.07	
2-Methylphenol	67	0.92	44.50	6.53	4.59	4.59	4.65	2.73	6.56	7.06	1.08	
3 & 4-Methylphenol	87	1.43	104	15.02	11.70	10.10	9.99	5.52	14.95	17.69	1.18	
Naphthalene	251	5.13	297	54.63	21.90	38.60	39.64	22.80	69.20	46.80	0.86	
1,4-Naphthoquinone	0	N/A										
1-Naphthylamine	0	N/A										
2-Naphthylamine	0	N/A										
2-Nitroaniline	4	9.23	65.70	33.03	N/A	28.60	25.98	17.61	44.03	21.26	0.64	
3-Nitroaniline	0	N/A										
4-Nitroaniline	0	N/A										
Nitrobenzene	3	16.50	35.90	23.50	N/A	18.10	22.05	17.30	27	8.79	0.37	

Table 7-2. Statistical Summaries of the SVOC XAD-2[®] Concentrations (continued)

Pollutant	# Detects	Minimum (ng/m ³)	Maximum (ng/m ³)	Arithmetic Mean (ng/m ³)	Mode (ng/m ³)	Median (ng/m ³)	Geometric Mean (ng/m ³)	1st Quartile (ng/m ³)	3rd Quartile (ng/m ³)	Standard Deviation	Coefficient of Variation
5-Nitro-o-toluidine	0						N/A				
2-Nitrophenol	32	2.84	39.70	12.67	N/A	10.95	10.79	7.83	16.45	7.56	0.60
4-Nitrophenol	0						N/A				
N-Nitrosodimethylamine	0						N/A				
N-Nitrosodimethylamine	0						N/A				
N-Nitrosodi-n-butylamine	0						N/A				
N-Nitrosodi-n-propylamine	0						N/A				
N-Nitrosomethylethylamine	0						N/A				
N-Nitrosopiperidine	0						N/A				
N-Nitrosopyrrolidine	0						N/A				
Pentachlorobenzene	0						N/A				
Pentachloroethane	0						N/A				
Pentachloronitrobenzene	0						N/A				
Pentachlorophenol	10	0.95	4.43	2.73	N/A	3.16	2.43	1.65	3.41	1.14	0.42
Phenacetin	0						N/A				
Phenanthrene	248	1.11	78.40	11.97	21	8.47	8.66	5.19	14.83	10.85	0.91
Phenol	127	2.18	117	13.92	11.30	7.95	9.01	4.80	12.85	17.79	1.28
2-Picoline	0						N/A				
Pronamide	0						N/A				
Pyrene	167	0.39	28.90	1.81	1.04	1.17	1.35	0.86	1.89	2.54	1.41
Pyridine	0						N/A				
Safrole	0						N/A				
1,2,4,5-Tetrachlorobenzene	0						N/A				
2,3,4,6-Tetrachlorophenol	0						N/A				
o-Toluidine	0						N/A				
2,4,6-Tribromophenol	0						N/A				
1,2,4-Trichlorobenzene	0						N/A				

Table 7-2. Statistical Summaries of the SVOC XAD-2[®] Concentrations (continued)

Pollutant	# Detects	Minimum (ng/m³)	Maximum (ng/m³)	Arithmetic Mean (ng/m³)	Mode (ng/m³)	Median (ng/m³)	Geometric Mean (ng/m³)	1st Quartile (ng/m³)	3rd Quartile (ng/m³)	Standard Deviation	Coefficient of Variation
2,4,5-Trichlorophenol	0										N/A
2,4,6-Trichlorophenol	0										N/A

Of the pollutants with at least a 75 percent detection rate, the following constitute the top five average daily concentrations:

- Naphthalene (54.63 ng/m³);
- 2-Methylnaphthalene (31.17 ng/m³);
- 1,4-Dichlorobenzene (19.70 ng/m³);
- Acetophenone (15.13 ng/m³); and
- Phenanthrene (11.97 ng/m³).

One indication of the consistency of the data measurements is the relative closeness of the calculated central tendency measurements—specifically, the arithmetic mean compared to the median, mode, and geometric mean. For most of the SVOC XAD-2[®] results, the mode, median, and geometric mean were generally close to each other and similar to the arithmetic mean, as shown in Table 7-2. This observation suggests that SVOC data measurements were representative of air pollutant concentrations following Hurricane Katrina.

For some of the frequently detected SVOC, the mode, median, and geometric mean show variability among themselves, as well as differ from the arithmetic mean. The range of concentrations measured is large for some pollutants, as shown by the minimum and maximum concentration, which indicates that the parameters are driven by outliers. For example, the arithmetic mean, mode, median, and geometric mean for acetophenone were calculated as 15.13 ng/m³, 11.20 ng/m³, 10.30 ng/m³, and 10.95 ng/m³, respectively. This observation suggests that outliers are driving the average acetophenone concentration. This is also shown with the large variations when comparing the standard deviation, 1st and 3rd quartiles, and coefficient of variation statistics.

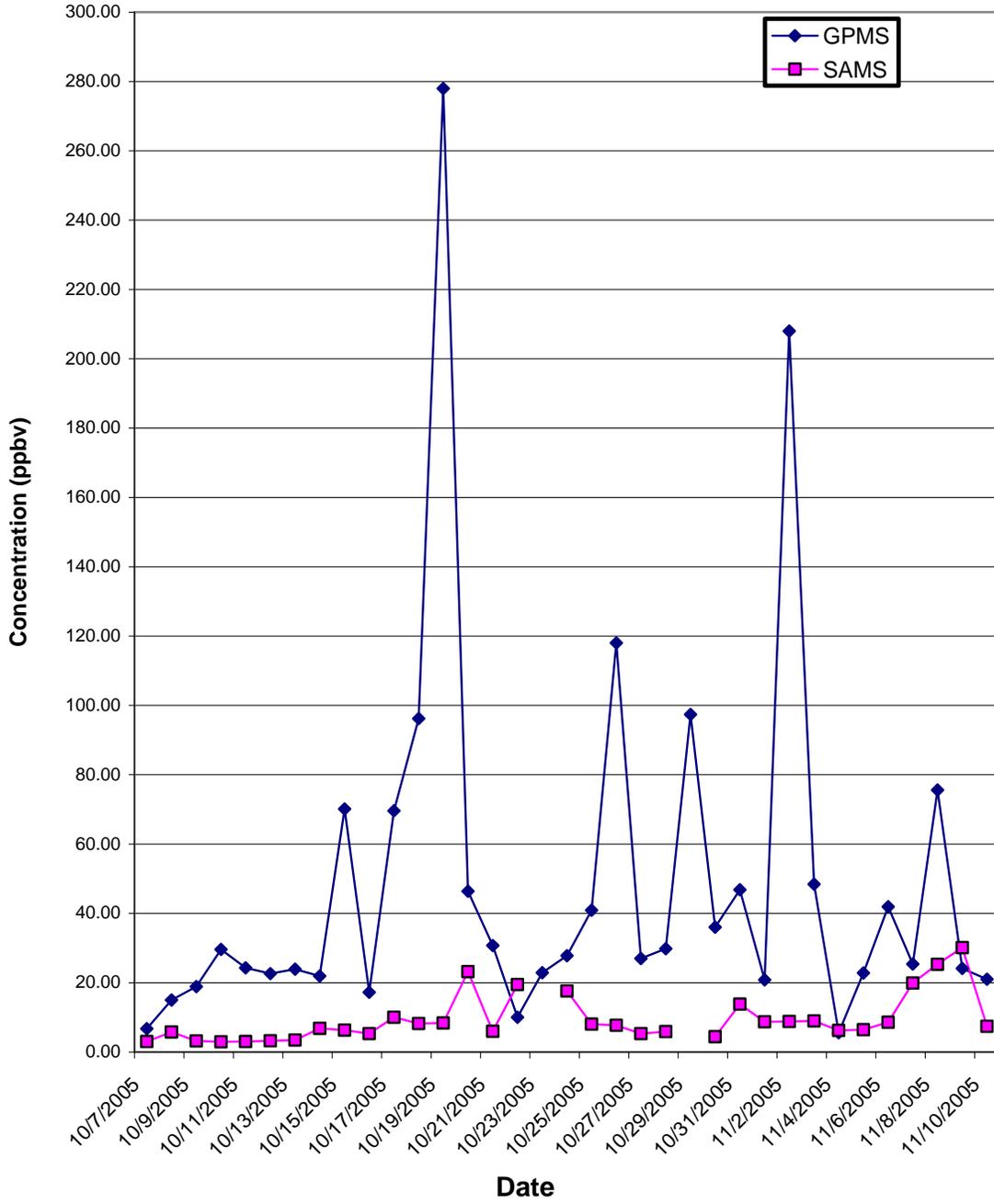
In some cases, the range of concentrations measured is wide for some pollutants, although the maximum concentration is not necessarily an outlier. For example, the arithmetic mean, mode, median, and geometric mean for 1,4-dichlorobenzene were calculated as 19.70 ng/m³, 60.70 ng/m³, 8.03 ng/m³, and 10.16 ng/m³, respectively. The mode, which is the most frequently measured concentration, is greater than any of the other parameters. Of the 216 detects of this pollutant, 29 measurements (13 percent) were greater than 50 ng/m³, and 13 of

those (six percent) were greater than 75 ng/m^3 . This suggests that, rather than having one or two outliers driving the average 1,4-dichlorobenzene concentration, there was a wide range of concentrations measured for this compound. This was also shown in the difference between the 1st and 3rd quartiles. Statistics for the naphthalene concentrations also follow this pattern.

At KELA, concentrations of 2-methylnaphthalene and naphthalene were not consistent during Phase 2 and Phase 3 Sampling. No concentrations were greater than $0.3 \text{ } \mu\text{g/m}^3$.

Time-series concentration plots of naphthalene at GPMS and SAMS are presented in Figure 7-5. Concentrations were fairly consistent at SAMS, with no recorded concentrations greater than 40 ng/m^3 . At GPMS, several recorded concentrations were greater than 40 ng/m^3 , with the two highest measured over 200 ng/m^3 . The overall measurement profile at GPMS was generally inconsistent.

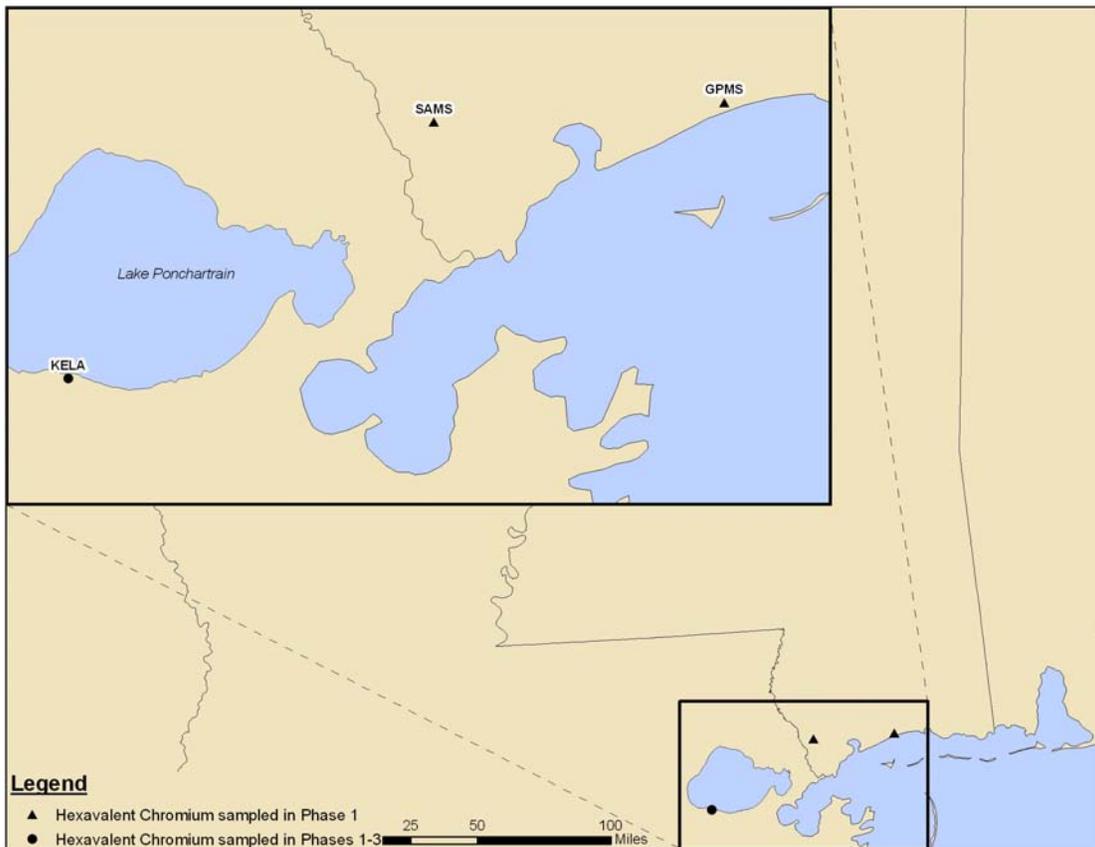
Figure 7-5. Naphthalene Concentrations by Method TO-13



8.0 Hexavalent Chromium Results

This section summarizes results for the hexavalent chromium samples. As discussed in Section 2.0, and shown in Figure 8-1, hexavalent chromium measurements were taken at three monitoring sites: SAMS, GPMS, and KELA. Statistical analyses were completed on the hexavalent chromium data.

Figure 8-1. Hexavalent Chromium Monitoring Locations



8.1 Statistical Summary for Hexavalent Chromium

Table 8-1 summarizes the statistical analyses completed on the hexavalent chromium data. Statistical analysis included number of detects, central tendency, and data distribution. Hexavalent chromium was detected consistently throughout Phase 1, 2,

Table 8-1. Statistical Summaries of the Hexavalent Chromium Concentrations

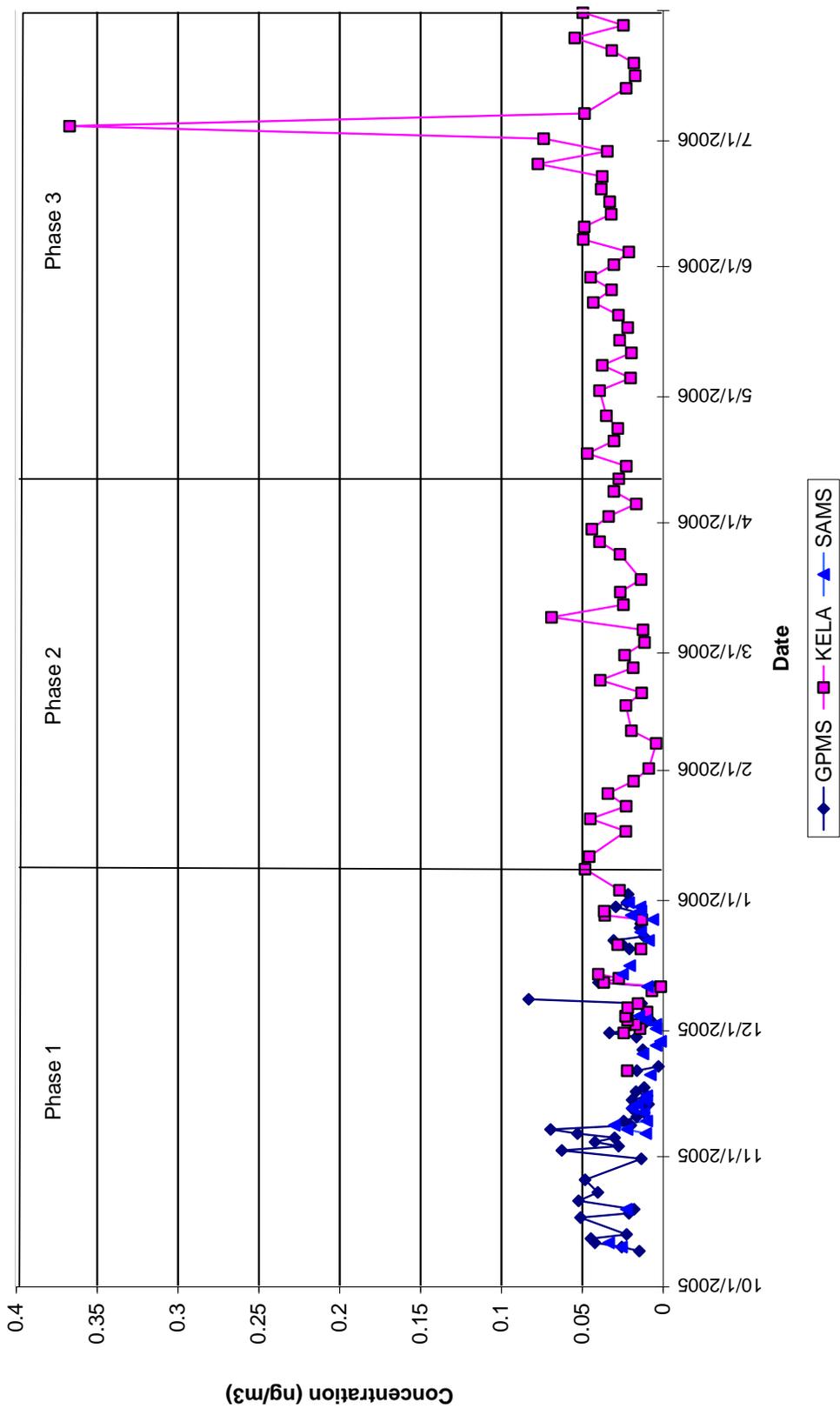
Pollutant	# Detects	Minimum (ng/m³)	Maximum (ng/m³)	Arithmetic Mean (ng/m³)	Mode (ng/m³)	Median (ng/m³)	Geometric Mean (ng/m³)	1st Quartile (ng/m³)	3rd Quartile (ng/m³)	Standard Deviation	Coefficient of Variation
Hexavalent Chromium	167	0.0014	0.367	0.027	0.019	0.021	0.021	0.014	0.034	0.030	1.115

and 3 sampling. A total of 280 valid hexavalent chromium samples were taken, and hexavalent chromium was detected in 167 samples (59.6 percent detection rate).

As presented in Table 8-1, the average daily concentration for hexavalent chromium was 0.027 ng/m³. The range of concentrations measured for this pollutant, as shown by the minimum and maximum values, spans three orders of magnitude. The mode, median, and geometric mean were fairly close to each other and similar to the arithmetic mean, as shown in Table 8-1. The maximum concentration measured (0.367 ng/m³) was greater than the next highest concentration by an order of magnitude.

Time-series plots of the hexavalent chromium concentrations at GPMS, KELA, and SAMS are presented in Figure 8-2. Throughout most of the sampling period, concentrations were fairly consistent as nearly all measurements were less than 0.10 ng/m³. The highest concentration recorded was during Phase 3 Sampling at KELA on July 4, 2006.

Figure 8-2. Hexavalent Chromium Concentrations



9.0 Data Quality

This section discusses the data quality for the ambient air concentrations for the post-Katrina Monitoring Network dataset. In accordance with the QAPP, the following data calculations were performed: completeness, precision, and bias (also called accuracy). Completeness statistics were presented in Section 2.0 of this report. The QAPP goal of 85 percent completeness was met by all sites. As indicators of the reliability and representativeness of experimental measurements, both precision and bias are considered when interpreting ambient air monitoring data. The quality assessment presented in this section show that the post-Katrina monitoring data are of a known and high quality. All calculations are based on sample concentrations detected above the MDLs for each pollutant. The overall precision level (the average for all sites) meets the data quality objectives, which are 15 percent coefficient of variation, and adheres to the guidelines in the Compendium Methods (USEPA, 1998; USEPA 1999a; USEPA 1999b; USEPA 1999c; USEPA 1999d).

9.1 Precision

Precision refers to the agreement between independent measurements performed according to identical protocols and procedures. Method precision, or *sampling and analytical precision*, quantifies random errors associated with collecting ambient air samples and analyzing the samples in the laboratory. This type of precision is most easily evaluated by comparing concentrations measured in duplicate or collocated samples collected from the same air parcel. 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 two canisters and doubling the flow rate applied to achieve integration over the 24-hour collection period. *Collocated* samples are samples collected simultaneously using two independent collection systems at the same location at the same time.

Both approaches provide valuable, but different, assessments of method precision:

- 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 (inter-system assessment).

- Analysis of collocated samples provides 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 (intra-system assessment).

During the post-Katrina monitoring effort, duplicate and collocated samples were collected at least 10 percent of the scheduled sampling days, as outlined in the QAPP. Most of these samples were analyzed in replicate. Duplicate/collocated samples were not collected for SVOC because there were no collocated samplers and the samplers used were not equipped to collect duplicate samples. Therefore, method precision for SVOC is not discussed in this section.

To calculate sampling and analytical precision, data analysts compare the concentrations of the two duplicates/collocates for each compound. This report uses three parameters to quantify random errors indicated by duplicate/collocated analyses of samples:

- **Average concentration difference** simply quantifies how duplicate or collocated analytical results differ, on average, for each pollutant and each sample. When interpreting central tendency estimates for specific pollutants sampled during the post-Katrina monitoring effort, participating agencies are encouraged to compare central tendencies to the average concentration differences. If a pollutant's average concentration difference exceeds or nearly equals its central tendency, the analytical method may not be capable of precisely characterizing the concentrations. Therefore, data interpretation for these pollutants 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 pollutant.
- **Relative percent difference (RPD)** expresses average concentration differences relative to the average concentrations detected during duplicate or collocated analyses. The RPD is calculated as follows:

$$\frac{X_1 - X_2}{\bar{X}} \times 100 = RPD$$

Where:

X_1 is the ambient air concentration of a given pollutant measured in one sample;

X_2 is the concentration of the same pollutant measured during duplicate or collocated analysis; and
 X is the arithmetic mean of X_1 and X_2 .

As this equation shows, duplicate analyses with low variability have lower RPDs (and better precision), and duplicate 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.

$$CV = \frac{\sigma}{\bar{X}} \times 100$$

Where:

σ is the standard deviation of the sets of duplicate or collocated results;
 \bar{X} is the arithmetic mean of the sets of duplicate or collocated results;

The CV is used to measure the imprecision in survey estimates introduced from analysis. A coefficient of one percent would indicate that the analytical results could vary slightly due to sampling error, while a variation of 50 percent means that the results are more imprecise. The CV for two duplicate samples was calculated for each pollutant and each site, with a CV of 15 percent.

The following approach was employed to estimate how precisely the central laboratory analyzed post-Katrina samples:

- CVs, RPDs, and concentration differences were calculated for every duplicate or collocated analyses performed during the program. In cases where pollutants were not detected during duplicate analyses, non-detects were replaced with half the MDL.
- To make an overall estimate of method precision, program-average CVs, RPDs, and absolute concentration differences were calculated for each pollutant by averaging the values from the individual duplicate or collocated analyses. The expression “average variability” or “median variability” for a given dataset refers to the average or median CV.

It is important to note that EPA has recently revised the methodology for assessing method precision in “Revisions to Ambient Air Monitoring Regulations; Final Rule,” finalized October 17, 2006 (USEPA, 2006b). The new methodology has been applied to the post-Katrina Monitoring Network report. The primary change includes the substitution of one-half MDLs for non-detects in calculating precision statistics. In some cases, this substitution affected the calculated RPDs and CVs by causing those values to increase.

Tables 9-1 through 9-6, 9-8 through 9-11, 9-13 through 9-18, and 9-20 through 9-25 present average concentration differences, RPDs, and CVs as estimates of duplicate sampling and analytical variability for VOC, SNMOC, carbonyls, and metal compounds, respectively. Tables 9-7, 9-12, 9-19, and 9-26 present the average CVs per pollutant and per site. Table 9-27 presents the average CV for hexavalent chromium per site. Table 9-1 presents the post-Katrina Monitoring Program average precision for VOC, SNMOC, Carbonyl Compounds, Hexavalent Chromium, and metals.

Table 9-1. Average Precision by Method

Method	Average Coefficient of Variation (%)
VOC	20.60
SNMOC	17.95
Carbonyl Compounds	8.54
Hexavalent Chromium	15.13
Metals	11.92

9.1.1 VOC Sampling and Analytical Precision

Table 9-2 presents the sampling and analytical data precision for duplicate VOC samples. Twenty-two out of 59 VOC show greater variation than the target of 15 percent. The average concentration differences observed for duplicate analyses of VOC range from 0.002 ppbv (dichlorotetrafluoroethane) to 8.58 ppbv (acetonitrile). Pollutants exceeding the 15 percent control limit for CV and a 25 percent control limit for RPD are bolded.

Table 9-2. VOC Sampling and Analytical Precision: 104 Duplicate Samples

Compound	Number of Observations	Average RPD for Duplicate Analyses (%)	Average Concentration Difference for Duplicate Analyses (ppbv)	Coefficient of Variation (%)
Acetonitrile	80	46.30	8.58	32.74
Acetylene	103	18.07	0.10	12.78
Acrolein	63	56.68	0.18	42.10
Acrylonitrile	NA	NA	NA	NA
<i>tert</i> -Amyl Methyl Ether	NA	NA	NA	NA
Benzene	104	11.97	0.04	8.22
Bromochloromethane	NA	NA	NA	NA
Bromodichloromethane	1	NA	NA	NA
Bromoform	NA	NA	NA	NA
Bromomethane	97	18.36	0.005	12.98
1,3-Butadiene	82	18.30	0.01	12.94

Table 9-2. VOC Sampling and Analytical Precision: 104 Duplicate Samples (continued)

Compound	Number of Observations	Average RPD for Duplicate Analyses (%)	Average Concentration Difference for Duplicate Analyses (ppbv)	Coefficient of Variation (%)
Carbon Tetrachloride	104	10.01	0.01	7.08
Chlorobenzene	NA	NA	NA	NA
Chloroethane	63	45.46	0.01	32.15
Chloroform	68	24.83	0.004	17.56
Chloromethane	104	7.66	0.06	5.42
Chloromethylbenzene	NA	NA	NA	NA
Chloroprene	NA	NA	NA	NA
Dibromochloromethane	NA	NA	NA	NA
1,2-Dibromoethane	NA	NA	NA	NA
<i>m</i> -Dichlorobenzene	3	66.67	0.01	47.14
<i>o</i> -Dichlorobenzene	3	100.00	0.02	70.71
<i>p</i> -Dichlorobenzene	58	32.06	0.005	22.67
Dichlorodifluoromethane	104	4.84	0.03	3.42
1,1-Dichloroethane	NA	NA	NA	NA
1,2-Dichloroethane	4	66.67	0.01	47.14
1,1-Dichloroethene	1	150.00	0.12	106.07
<i>cis</i> -1,2-Dichloroethylene	NA	NA	NA	NA
<i>trans</i> -1,2-Dichloroethylene	NA	NA	NA	NA
Dichloromethane	99	31.95	0.79	22.59
1,2-Dichloropropane	NA	NA	NA	NA
<i>cis</i> -1,3-Dichloropropene	NA	NA	NA	NA
<i>trans</i> -1,3-Dichloropropene	NA	NA	NA	NA
Dichlorotetrafluoroethane	101	14.12	0.002	9.99
Ethyl Acrylate	NA	NA	NA	NA
Ethyl <i>tert</i> -Butyl Ether	NA	NA	NA	NA
Ethylbenzene	104	11.42	0.01	8.08
Hexachloro-1,3-butadiene	43	24.44	0.004	17.28
Methyl Ethyl Ketone	46	41.81	0.14	29.57
Methyl Isobutyl Ketone	29	64.58	0.02	45.67
Methyl Methacrylate	1	66.67	0.01	47.14
Methyl <i>tert</i> -Butyl Ether	3	187.10	0.03	132.30
<i>n</i> -Octane	93	32.43	0.01	22.93
Propylene	104	12.63	0.04	8.93
Styrene	95	24.51	0.04	17.33
1,1,2,2-Tetrachloroethane	1	66.67	0.01	47.14
Tetrachloroethylene	65	15.61	0.003	11.04
Toluene	104	15.06	0.10	10.65
1,2,4-Trichlorobenzene	17	79.24	0.03	56.03
1,1,1-Trichloroethane	99	14.98	0.003	10.59
1,1,2-Trichloroethane	NA	NA	NA	NA
Trichloroethylene	24	29.63	0.004	20.95
Trichlorofluoromethane	104	5.00	0.02	3.53
Trichlorotrifluoroethane	104	5.65	0.01	4.00
1,2,4-Trimethylbenzene	97	31.90	0.01	22.56
1,3,5-Trimethylbenzene	95	11.69	0.004	8.26
Vinyl chloride	13	59.52	0.01	42.09

Table 9-2. VOC Sampling and Analytical Precision: 104 Duplicate Samples (continued)

Compound	Number of Observations	Average RPD for Duplicate Analyses (%)	Average Concentration Difference for Duplicate Analyses (ppbv)	Coefficient of Variation (%)
<i>m,p</i> -Xylene	104	14.72	0.03	10.41
<i>o</i> -Xylene	103	16.15	0.01	11.42

The duplicate VOC sampling and analytical data for GPMS are presented in Table 9-3. The range of variability was 2.83 percent (trichlorofluoromethane) to 47.14 percent (1,2-dichloroethane). The median variability is 9.12 percent, which is within the CV objectives.

Table 9-3. VOC Sampling and Analytical Precision: 28 Duplicate Samples for GPMS

Compound	Number of Observations	Average RPD for Duplicate Analyses (%)	Average Concentration Difference for Duplicate Analyses (ppbv)	Coefficient of Variation (%)
Acetonitrile	22	32.20	27.45	22.77
Acetylene	28	6.28	0.06	4.44
Acrolein	19	44.54	0.15	31.50
Acrylonitrile	NA	NA	NA	NA
<i>tert</i> -Amyl Methyl Ether	NA	NA	NA	NA
Benzene	28	8.82	0.04	5.94
Bromochloromethane	NA	NA	NA	NA
Bromodichloromethane	NA	NA	NA	NA
Bromoform	NA	NA	NA	NA
Bromomethane	26	10.26	0.002	7.25
1,3-Butadiene	26	6.11	0.01	4.32
Carbon Tetrachloride	28	9.15	0.01	6.47
Chlorobenzene	NA	NA	NA	NA
Chloroethane	22	20.00	0.003	14.14
Chloroform	23	37.89	0.01	26.79
Chloromethane	28	5.11	0.05	3.61
Chloromethylbenzene	NA	NA	NA	NA
Chloroprene	NA	NA	NA	NA
Dibromochloromethane	NA	NA	NA	NA
1,2-Dibromoethane	NA	NA	NA	NA
<i>m</i> -Dichlorobenzene	NA	NA	NA	NA
<i>o</i> -Dichlorobenzene	NA	NA	NA	NA
<i>p</i> -Dichlorobenzene	21	21.68	0.004	15.33
Dichlorodifluoromethane	28	4.43	0.03	3.13
1,1-Dichloroethane	NA	NA	NA	NA
1,2-Dichloroethane	1	66.67	0.01	47.14
1,1-Dichloroethene	NA	NA	NA	NA
<i>cis</i> -1,2-Dichloroethylene	NA	NA	NA	NA
<i>trans</i> -1,2-Dichloroethylene	NA	NA	NA	NA
Dichloromethane	28	25.55	0.03	18.06

**Table 9-3. VOC Sampling and Analytical Precision:
28 Duplicate Samples for GPMS (continued)**

Compound	Number of Observations	Average RPD for Duplicate Analyses (%)	Average Concentration Difference for Duplicate Analyses (ppbv)	Coefficient of Variation (%)
1,2-Dichloropropane	NA	NA	NA	NA
<i>cis</i> -1,3-Dichloropropene	NA	NA	NA	NA
<i>trans</i> -1,3-Dichloropropene	NA	NA	NA	NA
Dichlorotetrafluoroethane	28	4.76	0.001	3.37
Ethyl Acrylate	NA	NA	NA	NA
Ethyl <i>tert</i> -Butyl Ether	NA	NA	NA	NA
Ethylbenzene	28	14.03	0.01	9.92
Hexachloro-1,3-butadiene	12	22.22	0.003	15.71
Methyl Ethyl Ketone	12	40.55	0.16	28.67
Methyl Isobutyl Ketone	9	58.63	0.02	41.46
Methyl Methacrylate	NA	NA	NA	NA
Methyl <i>tert</i> -Butyl Ether	NA	NA	NA	NA
<i>n</i> -Octane	28	17.63	0.01	12.46
Propylene	28	10.62	0.05	7.51
Styrene	28	12.47	0.01	8.82
1,1,2,2-Tetrachloroethane	NA	NA	NA	NA
Tetrachloroethylene	22	9.70	0.002	6.86
Toluene	28	10.17	0.08	7.19
1,2,4-Trichlorobenzene	6	13.33	0.003	9.43
1,1,1-Trichloroethane	27	11.70	0.003	8.27
1,1,2-Trichloroethane	NA	NA	NA	NA
Trichloroethylene	5	22.22	0.003	15.71
Trichlorofluoromethane	28	4.00	0.01	2.83
Trichlorotrifluoroethane	28	5.39	0.01	3.81
1,2,4-Trimethylbenzene	27	28.49	0.01	20.14
1,3,5-Trimethylbenzene	28	17.33	0.01	12.25
Vinyl chloride	5	59.52	0.01	42.09
<i>m,p</i> -Xylene	28	10.62	0.03	7.51
<i>o</i> -Xylene	28	11.10	0.01	7.85

Table 9-4 presents the results from VOC duplicate analysis for SAMS. The variability ranges from 2.50 percent (trichlorotrifluoroethane) to 70.71 percent (*o*-dichlorobenzene). The average variability is 19.37 percent, however, the median variability is lower, 11.29 percent. This shows that most of the pollutants meet the target CV.

**Table 9-4. VOC Sampling and Analytical Precision:
20 Duplicate Samples for SAMS**

Compound	Number of Observations	Average RPD for Duplicate Analyses (%)	Average Concentration Difference for Duplicate Analyses (ppbv)	Coefficient of Variation (%)
Acetonitrile	14	78.08	5.25	55.21
Acetylene	19	35.44	0.13	25.06
Acrolein	11	67.68	0.25	48.89
Acrylonitrile	NA	NA	NA	NA
<i>tert</i> -Amyl Methyl Ether	NA	NA	NA	NA
Benzene	20	8.26	0.01	5.91
Bromochloromethane	NA	NA	NA	NA
Bromodichloromethane	NA	NA	NA	NA
Bromoform	NA	NA	NA	NA
Bromomethane	18	14.81	0.002	10.48
1,3-Butadiene	10	19.05	0.01	13.47
Carbon Tetrachloride	20	13.36	0.01	9.44
Chlorobenzene	NA	NA	NA	NA
Chloroethane	8	40.00	0.01	28.28
Chloroform	12	3.70	0.002	2.62
Chloromethane	20	7.62	0.07	5.39
Chloromethylbenzene	NA	NA	NA	NA
Chloroprene	NA	NA	NA	NA
Dibromochloromethane	NA	NA	NA	NA
1,2-Dibromoethane	NA	NA	NA	NA
<i>m</i> -Dichlorobenzene	1	66.67	0.01	47.14
<i>o</i> -Dichlorobenzene	1	100.00	0.02	70.71
<i>p</i> -Dichlorobenzene	3	53.85	0.004	38.07
Dichlorodifluoromethane	20	5.15	0.03	3.64
1,1-Dichloroethane	NA	NA	NA	NA
1,2-Dichloroethane	NA	NA	NA	NA
1,1-Dichloroethene	NA	NA	NA	NA
<i>cis</i> -1,2-Dichloroethylene	NA	NA	NA	NA
<i>trans</i> -1,2-Dichloroethylene	NA	NA	NA	NA
Dichloromethane	18	10.53	0.004	7.44
1,2-Dichloropropane	NA	NA	NA	NA
<i>cis</i> -1,3-Dichloropropene	NA	NA	NA	NA
<i>trans</i> -1,3-Dichloropropene	NA	NA	NA	NA
Dichlorotetrafluoroethane	18	NA	NA	NA
Ethyl Acrylate	NA	NA	NA	NA
Ethyl <i>tert</i> -Butyl Ether	NA	NA	NA	NA
Ethylbenzene	20	5.82	0.002	4.11
Hexachloro-1,3-butadiene	10	20.00	0.004	14.14
Methyl Ethyl Ketone	8	8.94	0.03	6.32
Methyl Isobutyl Ketone	2	40.00	0.01	28.28
Methyl Methacrylate	NA	NA	NA	NA
Methyl <i>tert</i> -Butyl Ether	NA	NA	NA	NA
<i>n</i> -Octane	18	22.22	0.004	15.71
Propylene	20	12.09	0.02	8.55

**Table 9-4. VOC Sampling and Analytical Precision:
20 Duplicate Samples for SAMS (continued)**

Compound	Number of Observations	Average RPD for Duplicate Analyses (%)	Average Concentration Difference for Duplicate Analyses (ppbv)	Coefficient of Variation (%)
Styrene	18	4.13	0.03	2.92
1,1,2,2-Tetrachloroethane	NA	NA	NA	NA
Tetrachloroethylene	9	NA	NA	NA
Toluene	20	17.11	0.04	12.10
1,2,4-Trichlorobenzene	4	55.22	0.03	39.05
1,1,1-Trichloroethane	20	NA	NA	NA
1,1,2-Trichloroethane	NA	NA	NA	NA
Trichloroethylene	2	NA	NA	NA
Trichlorofluoromethane	20	5.04	0.02	3.56
Trichlorotrifluoroethane	20	3.54	0.01	2.50
1,2,4-Trimethylbenzene	15	60.00	0.01	42.43
1,3,5-Trimethylbenzene	15	7.41	0.001	5.24
Vinyl chloride	4	NA	NA	NA
<i>m,p</i> -Xylene	20	10.15	0.01	7.17
<i>o</i> -Xylene	19	24.52	0.01	17.34

Table 9-5 presents the results from VOC duplicate analysis for PGMS. Variability ranges from 2.48 percent (styrene) to 132.30 percent (methyl *tert* butyl ether) with an average of 24.45 percent. The median variability is 14.80 percent.

**Table 9-5. VOC Sampling and Analytical Precision:
22 Duplicate Samples for PGMS**

Compound	Number of Observations	Average RPD for Duplicate Analyses (%)	Average Concentration Difference for Duplicate Analyses (ppbv)	Coefficient of Variation (%)
Acetonitrile	21	26.30	1.66	18.59
Acetylene	22	6.87	0.09	4.86
Acrolein	14	22.45	0.08	17.48
Acrylonitrile	NA	NA	NA	NA
<i>tert</i> -Amyl Methyl Ether	NA	NA	NA	NA
Benzene	22	11.17	0.04	7.27
Bromochloromethane	NA	NA	NA	NA
Bromodichloromethane	NA	NA	NA	NA
Bromoform	NA	NA	NA	NA
Bromomethane	21	18.18	0.003	12.86
1,3-Butadiene	22	7.89	0.01	5.58
Carbon Tetrachloride	22	12.63	0.01	8.93
Chlorobenzene	NA	NA	NA	NA

**Table 9-5. VOC Sampling and Analytical Precision:
22 Duplicate Samples for PGMS (continued)**

Compound	Number of Observations	Average RPD for Duplicate Analyses (%)	Average Concentration Difference for Duplicate Analyses (ppbv)	Coefficient of Variation (%)
Chloroethane	16	44.66	0.01	31.58
Chloroform	15	33.79	0.005	23.89
Chloromethane	22	10.49	0.07	7.42
Chloromethylbenzene	NA	NA	NA	NA
Chloroprene	NA	NA	NA	NA
Dibromochloromethane	NA	NA	NA	NA
1,2-Dibromoethane	NA	NA	NA	NA
<i>m</i> -Dichlorobenzene	2	66.67	0.01	47.14
<i>o</i> -Dichlorobenzene	2	100.00	0.02	70.71
<i>p</i> -Dichlorobenzene	12	31.30	0.01	22.14
Dichlorodifluoromethane	22	5.11	0.04	3.61
1,1-Dichloroethane	NA	NA	NA	NA
1,2-Dichloroethane	1	NA	NA	NA
1,1-Dichloroethene	NA	NA	NA	NA
<i>cis</i> -1,2-Dichloroethylene	NA	NA	NA	NA
<i>trans</i> -1,2-Dichloroethylene	NA	NA	NA	NA
Dichloromethane	20	37.23	0.06	26.32
1,2-Dichloropropane	NA	NA	NA	NA
<i>cis</i> -1,3-Dichloropropene	NA	NA	NA	NA
<i>trans</i> -1,3-Dichloropropene	NA	NA	NA	NA
Dichlorotetrafluoroethane	21	20.94	0.003	14.80
Ethyl Acrylate	NA	NA	NA	NA
Ethyl <i>tert</i> -Butyl Ether	NA	NA	NA	NA
Ethylbenzene	22	11.20	0.01	7.92
Hexachloro-1,3-butadiene	12	24.44	0.01	17.28
Methyl Ethyl Ketone	6	43.81	0.11	30.98
Methyl Isobutyl Ketone	4	136.94	0.03	96.83
Methyl Methacrylate	NA	NA	NA	NA
Methyl <i>tert</i> -Butyl Ether	1	187.10	0.03	132.30
<i>n</i> -Octane	20	48.23	0.01	34.10
Propylene	22	6.57	0.03	4.65
Styrene	22	3.51	0.003	2.48
1,1,2,2-Tetrachloroethane	1	66.67	0.01	47.14
Tetrachloroethylene	13	20.99	0.004	14.84
Toluene	22	9.67	0.08	6.84
1,2,4-Trichlorobenzene	6	98.41	0.04	69.59
1,1,1-Trichloroethane	20	20.94	0.003	14.80
1,1,2-Trichloroethane	NA	NA	NA	NA
Trichloroethylene	9	44.44	0.01	31.43
Trichlorofluoromethane	22	5.60	0.02	3.96
Trichlorotrifluoroethane	22	8.68	0.01	6.14
1,2,4-Trimethylbenzene	22	13.98	0.01	9.89
1,3,5-Trimethylbenzene	22	18.66	0.01	13.19
Vinyl chloride	NA	NA	NA	NA

**Table 9-5. VOC Sampling and Analytical Precision:
22 Duplicate Samples for PGMS (continued)**

Compound	Number of Observations	Average RPD for Duplicate Analyses (%)	Average Concentration Difference for Duplicate Analyses (ppbv)	Coefficient of Variation (%)
<i>m,p</i> -Xylene	22	9.60	0.03	6.79
<i>o</i> -Xylene	22	8.49	0.01	6.00

Table 9-6 presents the results from VOC duplicate analysis for TUMS. These results show a low to high level variability ranging from 2.53 percent (1,1,1-trichloroethane) to 106.07 percent (1,2,4-trichlorobenzene and 1,1-dichloroethene). The median CV, which slightly higher than the target CV, is 16.87 percent.

**Table 9-6. VOC Sampling and Analytical Precision:
16 Duplicate Samples for TUMS**

Compound	Number of Observations	Average RPD for Duplicate Analyses (%)	Average Concentration Difference for Duplicate Analyses (ppbv)	Coefficient of Variation (%)
Acetonitrile	10	30.31	0.74	21.43
Acetylene	16	23.77	0.10	16.81
Acrolein	7	78.64	0.19	55.61
Acrylonitrile	NA	NA	NA	NA
<i>tert</i> -Amyl Methyl Ether	NA	NA	NA	NA
Benzene	16	26.80	0.11	18.95
Bromochloromethane	NA	NA	NA	NA
Bromodichloromethane	1	NA	NA	NA
Bromoform	NA	NA	NA	NA
Bromomethane	14	NA	NA	NA
1,3-Butadiene	11	17.95	0.001	12.69
Carbon Tetrachloride	16	9.38	0.01	6.63
Chlorobenzene	NA	NA	NA	NA
Chloroethane	10	25.40	0.003	17.96
Chloroform	8	40.00	0.004	28.28
Chloromethane	16	4.81	0.03	3.40
Chloromethylbenzene	NA	NA	NA	NA
Chloroprene	NA	NA	NA	NA
Dibromochloromethane	NA	NA	NA	NA
1,2-Dibromoethane	NA	NA	NA	NA
<i>m</i> -Dichlorobenzene	NA	NA	NA	NA
<i>o</i> -Dichlorobenzene	NA	NA	NA	NA
<i>p</i> -Dichlorobenzene	8	NA	NA	NA
Dichlorodifluoromethane	16	4.34	0.03	3.07
1,1-Dichloroethane	NA	NA	NA	NA
1,2-Dichloroethane	NA	NA	NA	NA

**Table 9-6. VOC Sampling and Analytical Precision:
16 Duplicate Samples for TUMS (continued)**

Compound	Number of Observations	Average RPD for Duplicate Analyses (%)	Average Concentration Difference for Duplicate Analyses (ppbv)	Coefficient of Variation (%)
1,1-Dichloroethene	1	150.00	0.12	106.07
<i>cis</i> -1,2-Dichloroethylene	NA	NA	NA	NA
<i>trans</i> -1,2-Dichloroethylene	NA	NA	NA	NA
Dichloromethane	15	37.02	0.02	26.18
1,2-Dichloropropane	NA	NA	NA	NA
<i>cis</i> -1,3-Dichloropropene	NA	NA	NA	NA
<i>trans</i> -1,3-Dichloropropene	NA	NA	NA	NA
Dichlorotetrafluoroethane	16	16.67	0.003	11.79
Ethyl Acrylate	NA	NA	NA	NA
Ethyl <i>tert</i> -Butyl Ether	NA	NA	NA	NA
Ethylbenzene	16	20.50	0.02	14.49
Hexachloro-1,3-butadiene	5	22.22	0.003	15.71
Methyl Ethyl Ketone	8	74.92	0.12	52.98
Methyl Isobutyl Ketone	6	3.92	0.003	2.77
Methyl Methacrylate	1	66.67	0.01	47.14
Methyl <i>tert</i> -Butyl Ether	NA	NA	NA	NA
<i>n</i> -Octane	12	24.18	0.01	17.10
Propylene	16	15.41	0.03	10.90
Styrene	13	63.83	0.14	45.14
1,1,2,2-Tetrachloroethane	NA	NA	NA	NA
Tetrachloroethylene	12	18.41	0.004	13.02
Toluene	16	27.40	0.23	19.37
1,2,4-Trichlorobenzene	1	150.00	0.06	106.07
1,1,1-Trichloroethane	16	3.57	0.001	2.53
1,1,2-Trichloroethane	NA	NA	NA	NA
Trichloroethylene	2	NA	NA	NA
Trichlorofluoromethane	16	4.74	0.01	3.35
Trichlorotrifluoroethane	16	4.31	0.01	3.05
1,2,4-Trimethylbenzene	15	44.28	0.02	31.31
1,3,5-Trimethylbenzene	12	6.67	0.002	4.71
Vinyl chloride	2	NA	NA	NA
<i>m,p</i> -Xylene	16	30.63	0.07	21.66
<i>o</i> -Xylene	16	21.55	0.02	15.24

Table 9-7 presents the results from VOC duplicate analysis for KELA. The variability ranges from 3.01 percent (benzene) to 68.77 percent (chloroethane). The median variability is 13.06 percent.

**Table 9-7. VOC Sampling and Analytical Precision:
18 Duplicate Samples for KELA**

Compound	Number of Observations	Average RPD for Duplicate Analyses (%)	Average Concentration Difference for Duplicate Analyses (ppbv)	Coefficient of Variation (%)
Acetonitrile	13	64.64	7.79	45.71
Acetylene	18	17.99	0.12	12.72
Acrolein	12	70.11	0.23	57.02
Acrylonitrile	NA	NA	NA	NA
<i>tert</i> -Amyl Methyl Ether	NA	NA	NA	NA
Benzene	18	4.81	0.01	3.01
Bromochloromethane	NA	NA	NA	NA
Bromodichloromethane	NA	NA	NA	NA
Bromoform	NA	NA	NA	NA
Bromomethane	18	30.20	0.01	21.35
1,3-Butadiene	13	40.51	0.01	28.65
Carbon Tetrachloride	18	5.55	0.01	3.92
Chlorobenzene	NA	NA	NA	NA
Chloroethane	7	97.25	0.02	68.77
Chloroform	10	8.79	0.004	6.22
Chloromethane	18	10.28	0.07	7.27
Chloromethylbenzene	NA	NA	NA	NA
Chloroprene	NA	NA	NA	NA
Dibromochloromethane	NA	NA	NA	NA
1,2-Dibromoethane	NA	NA	NA	NA
<i>m</i> -Dichlorobenzene	NA	NA	NA	NA
<i>o</i> -Dichlorobenzene	NA	NA	NA	NA
<i>p</i> -Dichlorobenzene	14	21.43	0.01	15.15
Dichlorodifluoromethane	18	5.16	0.03	3.65
1,1-Dichloroethane	NA	NA	NA	NA
1,2-Dichloroethane	2	66.67	0.01	47.14
1,1-Dichloroethene	NA	NA	NA	NA
<i>cis</i> -1,2-Dichloroethylene	NA	NA	NA	NA
<i>trans</i> -1,2-Dichloroethylene	NA	NA	NA	NA
Dichloromethane	18	49.44	3.85	34.96
1,2-Dichloropropane	NA	NA	NA	NA
<i>cis</i> -1,3-Dichloropropene	NA	NA	NA	NA
<i>trans</i> -1,3-Dichloropropene	NA	NA	NA	NA
Dichlorotetrafluoroethane	18	NA	NA	NA
Ethyl Acrylate	NA	NA	NA	NA
Ethyl <i>tert</i> -Butyl Ether	NA	NA	NA	NA
Ethylbenzene	18	5.55	0.01	3.93
Hexachloro-1,3-butadiene	4	33.33	0.01	23.57
Methyl Ethyl Ketone	12	40.84	0.28	28.88
Methyl Isobutyl Ketone	8	83.41	0.02	58.98
Methyl Methacrylate	NA	NA	NA	NA
Methyl <i>tert</i> -Butyl Ether	2	NA	NA	NA
<i>n</i> -Octane	15	49.92	0.02	35.30
Propylene	18	18.46	0.08	13.06

**Table 9-7. VOC Sampling and Analytical Precision:
18 Duplicate Samples for KELA (continued)**

Compound	Number of Observations	Average RPD for Duplicate Analyses (%)	Average Concentration Difference for Duplicate Analyses (ppbv)	Coefficient of Variation (%)
Styrene	14	38.62	0.01	27.31
1,1,2,2-Tetrachloroethane	NA	NA	NA	NA
Tetrachloroethylene	9	13.33	0.002	9.43
Toluene	18	10.97	0.06	7.76
1,2,4-Trichlorobenzene	NA	NA	NA	NA
1,1,1-Trichloroethane	16	23.70	0.004	16.76
1,1,2-Trichloroethane	NA	NA	NA	NA
Trichloroethylene	6	22.22	0.003	15.71
Trichlorofluoromethane	18	5.61	0.02	3.96
Trichlorotrifluoroethane	18	6.34	0.01	4.49
1,2,4-Trimethylbenzene	18	12.76	0.02	9.03
1,3,5-Trimethylbenzene	18	8.37	0.004	5.92
Vinyl chloride	2	NA	NA	NA
<i>m,p</i> -Xylene	18	12.62	0.03	8.93
<i>o</i> -Xylene	18	15.07	0.02	10.65

Table 9-8 presents the average CV per pollutant, per pollutant per site, the average CV per site, and the overall average CV. The results from duplicate samples show low- to high-level variability among sites, ranging from 14.20 percent at GPMS to 24.45 percent at PGMS. The overall average is 20.60 percent. This is higher than the requested 15 percent overall CV per site.

**Table 9-8. VOC Sampling and Analytical Precision:
Coefficient of Variation for all Duplicate Samples, All Sites**

Compound	Average	Gulfport, MS GPMS	Stennis Airbase, MS SAMS	Pascagoula, MS PGMS	Tupelo, MS TUMS	Kenner, LA KELA
Acetonitrile	32.74	22.77	55.21	18.59	21.43	45.71
Acetylene	12.78	4.44	25.06	4.86	16.81	12.72
Acrolein	42.10	31.50	48.89	17.48	55.61	57.02
Acrylonitrile	NA	NA	NA	NA	NA	NA
<i>tert</i> -Amyl Methyl Ether	NA	NA	NA	NA	NA	NA
Benzene	8.22	5.94	5.91	7.27	18.95	3.01
Bromochloromethane	NA	NA	NA	NA	NA	NA

**Table 9-8. VOC Sampling and Analytical Precision:
Coefficient of Variation for all Duplicate Samples, All Sites (continued)**

Compound	Average	Gulfport, MS GPMS	Stennis Airbase, MS SAMS	Pascagoula, MS PGMS	Tupelo, MS TUMS	Kenner, LA KELA
Bromodichloromethane	NA	NA	NA	NA	NA	NA
Bromoform	NA	NA	NA	NA	NA	NA
Bromomethane	12.98	7.25	10.48	12.86	NA	21.35
1,3-Butadiene	12.94	4.32	13.47	5.58	12.69	28.65
Carbon Tetrachloride	7.08	6.47	9.44	8.93	6.63	3.92
Chlorobenzene	NA	NA	NA	NA	NA	NA
Chloroethane	32.15	14.14	28.28	31.58	17.96	68.77
Chloroform	17.56	26.79	2.62	23.89	28.28	6.22
Chloromethane	5.42	3.61	5.39	7.42	3.40	7.27
Chloromethylbenzene	NA	NA	NA	NA	NA	NA
Chloroprene	NA	NA	NA	NA	NA	NA
Dibromochloromethane	NA	NA	NA	NA	NA	NA
1,2-Dibromoethane	NA	NA	NA	NA	NA	NA
<i>m</i> -Dichlorobenzene	47.14	NA	47.14	47.14	NA	NA
<i>o</i> -Dichlorobenzene	70.71	NA	70.71	70.71	NA	NA
<i>p</i> -Dichlorobenzene	22.67	15.33	38.07	22.14	NA	15.15
Dichlorodifluoromethane	3.42	3.13	3.64	3.61	3.07	3.65
1,1-Dichloroethane	NA	NA	NA	NA	NA	NA
1,2-Dichloroethane	47.14	47.14	NA	NA	NA	47.14
1,1-Dichloroethene	106.07	NA	NA	NA	106.07	NA
<i>cis</i> -1,2-Dichloroethylene	NA	NA	NA	NA	NA	NA
<i>trans</i> -1,2-Dichloroethylene	NA	NA	NA	NA	NA	NA
Dichloromethane	22.59	18.06	7.44	26.32	26.18	34.96
1,2-Dichloropropane	NA	NA	NA	NA	NA	NA
<i>cis</i> -1,3-Dichloropropene	NA	NA	NA	NA	NA	NA
<i>trans</i> -1,3-Dichloropropene	NA	NA	NA	NA	NA	NA
Dichlorotetrafluoroethane	9.99	3.37	NA	14.80	11.79	NA
Ethyl Acrylate	NA	NA	NA	NA	NA	NA
Ethyl <i>tert</i> -Butyl Ether	NA	NA	NA	NA	NA	NA
Ethylbenzene	8.08	9.92	4.11	7.92	14.49	3.93
Hexachloro-1,3-butadiene	17.28	15.71	14.14	17.28	15.71	23.57
Methyl Ethyl Ketone	29.57	28.67	6.32	30.98	52.98	28.88
Methyl Isobutyl Ketone	45.67	41.46	28.28	96.83	2.77	58.98
Methyl Methacrylate	47.14	NA	NA	NA	47.14	NA
Methyl <i>tert</i> -Butyl Ether	132.30	NA	NA	132.30	NA	NA
<i>n</i> -Octane	22.93	12.46	15.71	34.10	17.10	35.30
Propylene	8.93	7.51	8.55	4.65	10.90	13.06
Styrene	17.33	8.82	2.92	2.48	45.14	27.31
1,1,2,2-Tetrachloroethane	47.14	NA	NA	47.14	NA	NA
Tetrachloroethylene	11.04	6.86	NA	14.84	13.02	9.43
Toluene	10.65	7.19	12.10	6.84	19.37	7.76

**Table 9-8. VOC Sampling and Analytical Precision:
Coefficient of Variation for all Duplicate Samples, All Sites (continued)**

Compound	Average	Gulfport, MS GPMS	Stennis Airbase, MS SAMS	Pascagoula, MS PGMS	Tupelo, MS TUMS	Kenner, LA KELA
1,2,4-Trichlorobenzene	56.03	9.43	39.05	69.59	106.07	NA
1,1,1-Trichloroethane	10.59	8.27	NA	14.80	2.53	16.76
1,1,2-Trichloroethane	NA	NA	NA	NA	NA	NA
Trichloroethylene	20.95	15.71	NA	31.43	NA	15.71
Trichlorofluoromethane	3.53	2.83	3.56	3.96	3.35	3.96
Trichlorotrifluoroethane	4.00	3.81	2.50	6.14	3.05	4.49
1,2,4-Trimethylbenzene	22.56	20.14	42.43	9.89	31.31	9.03
1,3,5-Trimethylbenzene	8.26	12.25	5.24	13.19	4.71	5.92
Vinyl chloride	42.09	42.09	NA	NA	NA	NA
<i>m,p</i> -Xylene	10.41	7.51	7.17	6.79	21.66	8.93
<i>o</i> -Xylene	11.42	7.85	17.34	6.00	15.24	10.65
Average	20.60	14.20	19.37	24.45	24.37	20.62

9.1.2 SNMOC Sampling and Analytical Precision

The SNMOC sampling and analytical precision for duplicate samples is presented in Table 9-9. The average concentration differences observed for duplicate sample analysis range from 0.01 ppbC (2-methyl-1-pentene) to 26.22 ppbC (TNMOC). The variation ranges from 3.27 percent (propane) to 54.58 percent (1,2,3-trimethylbenzene). The PGMS and TUMS sites did not collect any SNMOC samples.

Table 9-9. SNMOC Sampling and Analytical Precision: 66 Duplicate Samples

Compound	Number of Observations	Average RPD for Duplicate Analyses (%)	Average Concentration Difference for Duplicate Analyses (ppbC)	Coefficient of Variation (%)
Acetylene	65	19.28	0.31	13.63
Benzene	57	12.76	0.13	9.02
1,3-Butadiene	29	32.10	0.06	22.70
<i>n</i> -Butane	66	5.41	0.30	3.82
<i>cis</i> -2-Butene	34	14.03	0.04	9.92
<i>trans</i> -2-Butene	29	38.95	0.09	27.54
Cyclohexane	60	22.02	0.07	15.57
Cyclopentane	57	32.57	0.25	23.03
Cyclopentene	5	20.47	0.04	14.47

Table 9-9. SNMOC Sampling and Analytical Precision: 66 Duplicate Samples (continued)

Compound	Number of Observations	Average RPD for Duplicate Analyses (%)	Average Concentration Difference for Duplicate Analyses (ppbC)	Coefficient of Variation (%)
<i>n</i> -Decane	44	29.92	0.09	21.16
1-Decene	NA	NA	NA	NA
<i>m</i> -Diethylbenzene	26	48.98	0.18	34.64
<i>p</i> -Diethylbenzene	44	35.91	0.35	25.39
2,2-Dimethylbutane	55	18.90	0.05	13.36
2,3-Dimethylbutane	58	10.46	0.04	7.39
2,3-Dimethylpentane	49	35.89	0.09	25.38
2,4-Dimethylpentane	44	23.45	0.05	16.58
<i>n</i> -Dodecane	21	59.64	0.21	42.17
1-Dodecene	6	54.00	0.34	38.19
Ethane	63	28.38	1.15	20.07
Ethylbenzene	66	15.04	0.06	10.63
2-Ethyl-1-butene	NA	NA	NA	NA
Ethylene	54	49.94	0.69	35.31
<i>m</i> -Ethyltoluene	65	20.70	0.10	14.64
<i>o</i> -Ethyltoluene	44	38.01	0.11	26.88
<i>p</i> -Ethyltoluene	52	22.50	0.06	15.91
<i>n</i> -Heptane	66	11.79	0.04	8.34
1-Heptene	41	36.75	0.07	25.98
<i>n</i> -Hexane	66	23.96	2.29	16.94
1-Hexene	40	29.11	0.06	20.59
<i>cis</i> -2-Hexene	NA	NA	NA	NA
<i>trans</i> -2-Hexene	7	18.86	0.04	13.34
Isobutane	66	11.95	0.28	8.45
Isobutene/1-Butene	64	24.11	0.19	17.86
Isopentane	64	19.91	1.16	14.08
Isoprene	56	20.11	0.16	14.22
Isopropylbenzene	17	50.23	0.08	35.52
2-Methyl-1-butene	37	16.01	0.06	11.32
2-Methyl-2-butene	40	18.49	0.13	13.07
3-Methyl-1-butene	8	19.68	0.03	13.91
Methylcyclohexane	59	17.97	0.06	12.70
Methylcyclopentane	66	16.93	0.07	8.59
2-Methylheptane	42	20.07	0.05	14.19
3-Methylheptane	34	23.05	0.07	16.30
2-Methylhexane	50	20.98	0.13	15.64
3-Methylhexane	63	28.50	0.45	20.15
3-Methylpentane	66	23.69	0.17	17.01
2-Methylpentane	66	16.38	0.21	11.58
4-Methyl-1-pentene	1	11.09	0.03	7.84
2-Methyl-1-pentene	13	9.76	0.01	6.90
<i>n</i> -Nonane	55	24.09	0.05	17.03
1-Nonene	30	24.79	0.04	16.58
<i>n</i> -Octane	66	14.15	0.03	10.00
1-Octene	22	54.90	0.13	38.82

Table 9-9. SNMOC Sampling and Analytical Precision: 66 Duplicate Samples (continued)

Compound	Number of Observations	Average RPD for Duplicate Analyses (%)	Average Concentration Difference for Duplicate Analyses (ppbC)	Coefficient of Variation (%)
<i>n</i> -Pentane	66	22.42	0.79	15.86
1-Pentene	47	35.30	0.10	24.96
<i>cis</i> -2-Pentene	29	31.73	0.06	22.43
<i>trans</i> -2-Pentene	44	15.38	0.04	10.88
<i>a</i> -Pinene	66	22.52	0.52	15.93
<i>b</i> -Pinene	12	20.02	0.20	14.16
Propane	66	4.62	0.33	3.27
<i>n</i> -Propylbenzene	34	27.49	0.07	19.44
Propylene	66	14.49	0.12	10.24
Propyne	NA	NA	NA	NA
Styrene	63	31.92	0.25	22.57
TNMOC (Speciated)	66	14.53	8.41	10.27
TNMOC (w/unknowns)	66	21.23	26.22	15.01
Toluene	66	15.66	0.36	11.07
<i>n</i> -Tridecane	4	9.87	0.03	6.98
1-Tridecene	NA	NA	NA	NA
1,2,3-Trimethylbenzene	34	77.19	0.26	54.58
1,2,4-Trimethylbenzene	59	28.76	0.13	20.34
1,3,5-Trimethylbenzene	47	16.85	0.04	11.91
2,2,3-Trimethylpentane	20	57.20	0.18	40.45
2,2,4-Trimethylpentane	63	12.44	0.06	8.82
2,3,4-Trimethylpentane	47	21.25	0.05	15.02
<i>n</i> -Undecane	26	28.48	0.13	20.14
1-Undecene	4	32.89	0.06	23.25
<i>m</i> -Xylene/ <i>p</i> -Xylene	66	11.51	0.13	8.14
<i>o</i> -Xylene	66	20.23	0.10	14.31

Table 9-10 shows the SNMOC results for the duplicate samples at GPMS. The variation ranges from 1.78 percent (propane) to 56.39 percent (*n*-dodecane). The average CV is 15.08 percent, which is just above the program objective.

Table 9-10. SNMOC Sampling and Analytical Precision: 28 Duplicate Samples for GPMS

Compound	Number of Observations	Average RPD for Duplicate Analyses (%)	Average Concentration Difference for Duplicate Analyses (ppbC)	Coefficient of Variation (%)
Acetylene	28	8.09	0.36	5.72
Benzene	19	22.59	0.22	15.97

**Table 9-10. SNMOC Sampling and Analytical Precision:
28 Duplicate Samples for GPMS (continued)**

Compound	Number of Observations	Average RPD for Duplicate Analyses (%)	Average Concentration Difference for Duplicate Analyses (ppbC)	Coefficient of Variation (%)
1,3-Butadiene	18	27.98	0.05	19.79
<i>n</i> -Butane	28	4.70	0.28	3.32
<i>cis</i> -2-Butene	21	17.55	0.05	12.41
<i>trans</i> -2-Butene	18	30.06	0.09	21.26
Cyclohexane	28	14.59	0.04	10.31
Cyclopentane	25	18.33	0.07	12.96
Cyclopentene	2	22.57	0.04	15.96
<i>n</i> -Decane	23	33.22	0.14	23.49
1-Decene	NA	NA	NA	NA
<i>m</i> -Diethylbenzene	12	43.43	0.19	30.71
<i>p</i> -Diethylbenzene	17	25.57	0.11	18.08
2,2-Dimethylbutane	27	16.50	0.06	11.67
2,3-Dimethylbutane	28	6.84	0.03	4.84
2,3-Dimethylpentane	26	22.66	0.08	16.02
2,4-Dimethylpentane	24	20.94	0.05	14.81
<i>n</i> -Dodecane	10	79.75	0.31	56.39
1-Dodecene	1	16.87	0.06	11.93
Ethane	28	18.24	0.66	12.90
Ethylbenzene	28	12.82	0.08	9.07
2-Ethyl-1-butene	NA	NA	NA	NA
Ethylene	24	34.79	0.43	24.60
<i>m</i> -Ethyltoluene	28	20.12	0.13	14.23
<i>o</i> -Ethyltoluene	22	31.36	0.11	22.17
<i>p</i> -Ethyltoluene	28	24.76	0.09	17.51
<i>n</i> -Heptane	28	8.03	0.04	5.68
1-Heptene	19	33.08	0.07	23.39
<i>n</i> -Hexane	28	15.92	0.14	11.26
1-Hexene	22	32.22	0.07	22.78
<i>cis</i> -2-Hexene	NA	NA	NA	NA
<i>trans</i> -2-Hexene	3	16.05	0.03	11.35
Isobutane	28	6.50	0.26	4.60
Isobutene/1-Butene	28	9.73	0.08	7.10
Isopentane	26	3.02	0.22	2.13
Isoprene	26	13.60	0.19	9.62
Isopropylbenzene	13	38.77	0.08	27.41
2-Methyl-1-butene	24	15.56	0.07	11.00
2-Methyl-2-butene	24	14.16	0.04	10.01
3-Methyl-1-butene	4	20.09	0.02	14.21
Methylcyclohexane	28	11.54	0.06	8.16
Methylcyclopentane	28	8.86	0.08	6.27
2-Methylheptane	24	16.17	0.04	11.44
3-Methylheptane	22	17.56	0.04	12.42
2-Methylhexane	26	18.88	0.08	14.13
3-Methylhexane	27	30.72	0.40	21.72

**Table 9-10. SNMOC Sampling and Analytical Precision:
28 Duplicate Samples for GPMS (continued)**

Compound	Number of Observations	Average RPD for Duplicate Analyses (%)	Average Concentration Difference for Duplicate Analyses (ppbC)	Coefficient of Variation (%)
3-Methylpentane	28	15.12	0.12	11.43
2-Methylpentane	28	13.72	0.24	9.70
4-Methyl-1-pentene	1	11.09	0.03	7.84
2-Methyl-1-pentene	11	11.52	0.01	8.15
<i>n</i> -Nonane	27	20.57	0.05	14.54
1-Nonene	16	41.28	0.07	29.66
<i>n</i> -Octane	28	13.25	0.04	9.37
1-Octene	12	45.97	0.10	32.51
<i>n</i> -Pentane	28	9.38	0.33	6.64
1-Pentene	26	43.64	0.15	30.86
<i>cis</i> -2-Pentene	17	40.12	0.06	28.37
<i>trans</i> -2-Pentene	25	20.27	0.06	14.33
<i>a</i> -Pinene	28	12.14	0.17	8.58
<i>b</i> -Pinene	12	20.02	0.20	14.16
Propane	28	2.51	0.24	1.78
<i>n</i> -Propylbenzene	20	43.36	0.13	30.66
Propylene	28	10.64	0.09	7.53
Propyne	NA	NA	NA	NA
Styrene	26	12.24	0.06	8.66
TNMOC (Speciated)	28	6.65	3.96	4.70
TNMOC (w/unknowns)	28	14.99	19.11	10.60
Toluene	28	6.65	0.34	4.70
<i>n</i> -Tridecane	NA	NA	NA	NA
1-Tridecene	NA	NA	NA	NA
1,2,3-Trimethylbenzene	21	60.59	0.27	42.85
1,2,4-Trimethylbenzene	27	23.72	0.16	16.77
1,3,5-Trimethylbenzene	25	19.23	0.06	13.60
2,2,3-Trimethylpentane	15	46.77	0.13	33.07
2,2,4-Trimethylpentane	28	13.95	0.08	10.54
2,3,4-Trimethylpentane	24	12.13	0.04	8.58
<i>n</i> -Undecane	14	37.00	0.18	26.16
1-Undecene	2	13.14	0.02	9.29
<i>m</i> -Xylene/ <i>p</i> -Xylene	28	8.54	0.15	6.04
<i>o</i> -Xylene	28	19.37	0.11	13.70

Table 9-11 shows the SNMOC results for the duplicate samples at SAMS. The results show low- to high-level variability, ranging from 1.59 percent (1-nonene) to 105.24 percent (1,2,3-trimethylbenzene). The average variability is 21.06 percent and the median variability is 17.67 percent, which is slightly over the target CV of 15 percent.

**Table 9-11. SNMOC Sampling and Analytical Precision:
20 Duplicate Samples for SAMS**

Compound	Number of Observations	Average RPD for Duplicate Analyses (%)	Average Concentration Difference for Duplicate Analyses (ppbC)	Coefficient of Variation (%)
Acetylene	19	40.99	0.38	28.99
Benzene	20	6.66	0.04	4.71
1,3-Butadiene	7	54.91	0.11	38.83
<i>n</i> -Butane	20	4.57	0.13	3.23
<i>cis</i> -2-Butene	NA	NA	NA	NA
<i>trans</i> -2-Butene	NA	NA	NA	NA
Cyclohexane	14	33.43	0.10	23.64
Cyclopentane	14	33.85	0.15	23.94
Cyclopentene	NA	NA	NA	NA
<i>n</i> -Decane	5	35.43	0.06	25.05
1-Decene	NA	NA	NA	NA
<i>m</i> -Diethylbenzene	4	38.43	0.07	27.17
<i>p</i> -Diethylbenzene	17	19.29	0.07	13.64
2,2-Dimethylbutane	11	25.56	0.04	18.08
2,3-Dimethylbutane	12	16.59	0.04	11.73
2,3-Dimethylpentane	5	53.90	0.09	38.11
2,4-Dimethylpentane	3	29.21	0.04	20.65
<i>n</i> -Dodecane	NA	NA	NA	NA
1-Dodecene	NA	NA	NA	NA
Ethane	17	63.70	2.50	45.04
Ethylbenzene	20	24.30	0.05	17.18
2-Ethyl-1-butene	NA	NA	NA	NA
Ethylene	13	83.35	1.18	58.94
<i>m</i> -Ethyltoluene	19	28.67	0.12	20.27
<i>o</i> -Ethyltoluene	9	62.38	0.12	44.11
<i>p</i> -Ethyltoluene	6	34.54	0.05	24.42
<i>n</i> -Heptane	20	19.88	0.04	14.06
1-Heptene	9	47.83	0.08	33.82
<i>n</i> -Hexane	20	12.81	0.12	9.06
1-Hexene	2	16.61	0.02	11.75
<i>cis</i> -2-Hexene	NA	NA	NA	NA
<i>trans</i> -2-Hexene	NA	NA	NA	NA
Isobutane	20	28.02	0.52	19.82
Isobutene/1-Butene	19	18.63	0.05	13.18
Isopentane	20	36.92	1.51	26.10
Isoprene	14	8.49	0.02	6.01
Isopropylbenzene	NA	NA	NA	NA
2-Methyl-1-butene	NA	NA	NA	NA
2-Methyl-2-butene	3	16.67	0.12	11.79
3-Methyl-1-butene	NA	NA	NA	NA
Methylcyclohexane	13	30.29	0.04	21.42
Methylcyclopentane	20	22.44	0.04	14.01
2-Methylheptane	2	22.22	0.04	15.71
3-Methylheptane	NA	NA	NA	NA

**Table 9-11. SNMOC Sampling and Analytical Precision:
20 Duplicate Samples for SAMS (continued)**

Compound	Number of Observations	Average RPD for Duplicate Analyses (%)	Average Concentration Difference for Duplicate Analyses (ppbC)	Coefficient of Variation (%)
2-Methylhexane	6	21.64	0.03	15.30
3-Methylhexane	18	19.33	0.04	13.67
3-Methylpentane	20	28.75	0.09	20.48
2-Methylpentane	20	21.39	0.10	15.13
4-Methyl-1-pentene	NA	NA	NA	NA
2-Methyl-1-pentene	NA	NA	NA	NA
<i>n</i> -Nonane	10	38.05	0.05	26.91
1-Nonene	5	9.17	0.00	1.59
<i>n</i> -Octane	20	17.31	0.02	12.24
1-Octene	6	64.24	0.16	45.42
<i>n</i> -Pentane	20	41.62	1.58	29.43
1-Pentene	6	32.15	0.05	22.73
<i>cis</i> -2-Pentene	NA	NA	NA	NA
<i>trans</i> -2-Pentene	4	8.57	0.01	6.06
<i>α</i> -Pinene	20	8.46	0.45	5.98
<i>β</i> -Pinene	NA	NA	NA	NA
Propane	20	9.50	0.58	6.72
<i>n</i> -Propylbenzene	1	13.47	0.01	9.53
Propylene	20	17.17	0.07	12.14
Propyne	NA	NA	NA	NA
Styrene	20	11.06	0.15	7.82
TNMOC (Speciated)	20	20.26	8.80	14.33
TNMOC (w/unknowns)	20	24.99	17.00	17.67
Toluene	20	31.14	0.49	22.02
<i>n</i> -Tridecane	NA	NA	NA	NA
1-Tridecene	NA	NA	NA	NA
1,2,3-Trimethylbenzene	2	148.83	0.47	105.24
1,2,4-Trimethylbenzene	14	32.58	0.06	23.04
1,3,5-Trimethylbenzene	4	19.15	0.03	13.54
2,2,3-Trimethylpentane	NA	NA	NA	NA
2,2,4-Trimethylpentane	17	13.61	0.02	8.93
2,3,4-Trimethylpentane	6	41.55	0.06	29.38
<i>n</i> -Undecane	NA	NA	NA	NA
1-Undecene	NA	NA	NA	NA
<i>m</i> -Xylene/ <i>p</i> -Xylene	20	17.10	0.09	12.09
<i>o</i> -Xylene	20	26.69	0.09	18.87

Table 9-12 shows the SNMOC results for the duplicate samples at KELA. The variation of the duplicate sample analyses ranges from 0.94 (isobutane) to 64.44 (1-dodecene) percent. The median variation, 14.11 percent, falls within the 15 percent program objective.

**Table 9-12. SNMOC Sampling and Analytical Precision:
18 Duplicate Samples for KELA**

Compound	Number of Observations	Average RPD for Duplicate Analyses (%)	Average Concentration Difference for Duplicate Analyses (ppbC)	Coefficient of Variation (%)
Acetylene	18	8.75	0.18	6.19
Benzene	18	9.03	0.12	6.38
1,3-Butadiene	4	13.41	0.02	9.48
<i>n</i> -Butane	18	6.94	0.51	4.91
<i>cis</i> -2-Butene	13	10.52	0.03	7.44
<i>trans</i> -2-Butene	11	47.84	0.10	33.83
Cyclohexane	18	18.06	0.06	12.77
Cyclopentane	18	45.53	0.54	32.19
Cyclopentene	3	18.37	0.03	12.99
<i>n</i> -Decane	16	21.12	0.05	14.93
1-Decene	NA	NA	NA	NA
<i>m</i> -Diethylbenzene	10	65.09	0.27	46.03
<i>p</i> -Diethylbenzene	10	62.86	0.87	44.45
2,2-Dimethylbutane	17	14.62	0.05	10.34
2,3-Dimethylbutane	18	7.95	0.04	5.62
2,3-Dimethylpentane	18	31.10	0.12	21.99
2,4-Dimethylpentane	17	20.21	0.06	14.29
<i>n</i> -Dodecane	11	39.53	0.10	27.95
1-Dodecene	5	91.14	0.62	64.44
Ethane	18	3.20	0.30	2.26
Ethylbenzene	18	8.00	0.06	5.66
2-Ethyl-1-butene	NA	NA	NA	NA
Ethylene	17	31.66	0.46	22.39
<i>m</i> -Ethyltoluene	18	13.32	0.06	9.42
<i>o</i> -Ethyltoluene	13	20.28	0.08	14.34
<i>p</i> -Ethyltoluene	18	8.21	0.04	5.80
<i>n</i> -Heptane	18	7.46	0.04	5.27
1-Heptene	13	29.33	0.06	20.74
<i>n</i> -Hexane	18	43.15	6.61	30.51
1-Hexene	16	38.51	0.09	27.23
<i>cis</i> -2-Hexene	NA	NA	NA	NA
<i>trans</i> -2-Hexene	4	21.67	0.05	15.32
Isobutane	18	1.33	0.05	0.94
Isobutene/1-Butene	17	43.97	0.44	33.30
Isopentane	18	19.80	1.76	14.00
Isoprene	16	38.24	0.27	27.04
Isopropylbenzene	4	61.70	0.08	43.63
2-Methyl-1-butene	13	16.46	0.05	11.64
2-Methyl-2-butene	13	24.65	0.24	17.43
3-Methyl-1-butene	4	19.27	0.04	13.62
Methylcyclohexane	18	12.07	0.08	8.54
Methylcyclopentane	18	19.49	0.07	5.51
2-Methylheptane	16	21.81	0.07	15.42
3-Methylheptane	12	28.53	0.11	20.17

**Table 9-12. SNMOC Sampling and Analytical Precision:
18 Duplicate Samples for KELA (continued)**

Compound	Number of Observations	Average RPD for Duplicate Analyses (%)	Average Concentration Difference for Duplicate Analyses (ppbC)	Coefficient of Variation (%)
2-Methylhexane	18	22.42	0.27	17.50
3-Methylhexane	18	35.45	0.90	25.07
3-Methylpentane	18	27.21	0.29	19.11
2-Methylpentane	18	14.03	0.29	9.92
4-Methyl-1-pentene	NA	NA	NA	NA
2-Methyl-1-pentene	2	8.00	0.01	5.66
<i>n</i> -Nonane	18	13.64	0.04	9.65
1-Nonene	9	23.92	0.05	18.48
<i>n</i> -Octane	18	11.88	0.04	8.40
1-Octene	4	54.50	0.12	38.54
<i>n</i> -Pentane	18	16.26	0.44	11.50
1-Pentene	15	30.11	0.10	21.29
<i>cis</i> -2-Pentene	12	23.33	0.05	16.50
<i>trans</i> -2-Pentene	15	17.30	0.04	12.23
<i>α</i> -Pinene	18	46.97	0.95	33.21
<i>β</i> -Pinene	NA	NA	NA	NA
Propane	18	1.85	0.18	1.31
<i>n</i> -Propylbenzene	13	25.65	0.08	18.14
Propylene	18	15.64	0.19	11.06
Propyne	NA	NA	NA	NA
Styrene	17	72.47	0.54	51.24
TNMOC (Speciated)	18	16.67	12.46	11.78
TNMOC (w/unknowns)	18	23.72	42.56	16.77
Toluene	18	9.19	0.24	6.50
<i>n</i> -Tridecane	4	9.87	0.03	6.98
1-Tridecene	NA	NA	NA	NA
1,2,3-Trimethylbenzene	11	22.15	0.06	15.66
1,2,4-Trimethylbenzene	18	29.98	0.17	21.20
1,3,5-Trimethylbenzene	18	12.16	0.04	8.60
2,2,3-Trimethylpentane	5	67.64	0.24	47.83
2,2,4-Trimethylpentane	18	9.75	0.07	6.98
2,3,4-Trimethylpentane	17	10.07	0.05	7.12
<i>n</i> -Undecane	12	19.96	0.07	14.11
1-Undecene	2	52.63	0.11	37.22
<i>m</i> -Xylene/ <i>p</i> -Xylene	18	8.90	0.16	6.29
<i>o</i> -Xylene	18	14.65	0.09	10.36

Table 9-13 presents the average CV per pollutant, per pollutant per site, the average CV per site, and the overall CV. The results from duplicate samples show low- to high-level variability among sites, ranging from 15.08 percent at GPMS to 21.06 percent at SAMS, with an average of 17.95 percent. This overall average exceeds the 15 percent CV control limit.

**Table 9-13. SNMOC Sampling and Analytical Precision:
Coefficient of Variation for all Duplicate Analyses, All Sites**

Compound	Average	Gulfport, MS (GPMS)	Stennis Airbase, MS (SAMS)	Kenner, LA (KELA)
Acetylene	13.63	5.72	28.99	6.19
Benzene	9.02	15.97	4.71	6.38
1,3-Butadiene	22.70	19.79	38.83	9.48
<i>n</i> -Butane	3.82	3.32	3.23	4.91
<i>cis</i> -2-Butene	9.92	12.41	NA	7.44
<i>trans</i> -2-Butene	27.54	21.26	NA	33.83
Cyclohexane	15.57	10.31	23.64	12.77
Cyclopentane	23.03	12.96	23.94	32.19
Cyclopentene	14.47	15.96	NA	12.99
<i>n</i> -Decane	21.16	23.49	25.05	14.93
1-Decene	NA	NA	NA	NA
<i>m</i> -Diethylbenzene	34.64	30.71	27.17	46.03
<i>p</i> -Diethylbenzene	25.39	18.08	13.64	44.45
2,2-Dimethylbutane	13.36	11.67	18.08	10.34
2,3-Dimethylbutane	7.39	4.84	11.73	5.62
2,3-Dimethylpentane	25.38	16.02	38.11	21.99
2,4-Dimethylpentane	16.58	14.81	20.65	14.29
<i>n</i> -Dodecane	42.17	56.39	NA	27.95
1-Dodecene	38.19	11.93	NA	64.44
Ethane	20.07	12.90	45.04	2.26
Ethylbenzene	10.63	9.07	17.18	5.66
2-Ethyl-1-butene	NA	NA	NA	NA
Ethylene	35.31	24.60	58.94	22.39
<i>m</i> -Ethyltoluene	14.64	14.23	20.27	9.42
<i>o</i> -Ethyltoluene	26.88	22.17	44.11	14.34
<i>p</i> -Ethyltoluene	15.91	17.51	24.42	5.80
<i>n</i> -Heptane	8.34	5.68	14.06	5.27
1-Heptene	25.98	23.39	33.82	20.74
<i>n</i> -Hexane	16.94	11.26	9.06	30.51
1-Hexene	20.59	22.78	11.75	27.23
<i>cis</i> -2-Hexene	NA	NA	NA	NA
<i>trans</i> -2-Hexene	13.34	11.35	NA	15.32
Isobutane	8.45	4.60	19.82	0.94
Isobutene/1-Butene	17.86	7.10	13.18	33.30
Isopentane	14.08	2.13	26.10	14.00
Isoprene	14.22	9.62	6.01	27.04
Isopropylbenzene	35.52	27.41	NA	43.63
2-Methyl-1-butene	11.32	11.00	NA	11.64
2-Methyl-2-butene	13.07	10.01	11.79	17.43
3-Methyl-1-butene	13.91	14.21	NA	13.62
Methylcyclohexane	12.70	8.16	21.42	8.54

**Table 9-13. SNMOC Sampling and Analytical Precision:
Coefficient of Variation for all Duplicate Analyses, All Sites (continued)**

Compound	Average	Gulfport, MS (GPMS)	Stennis Airbase, MS (SAMS)	Kenner, LA (KELA)
Methylcyclopentane	8.59	6.27	14.01	5.51
2-Methylheptane	14.19	11.44	15.71	15.42
3-Methylheptane	16.30	12.42	NA	20.17
2-Methylhexane	15.64	14.13	15.30	17.50
3-Methylhexane	20.15	21.72	13.67	25.07
3-Methylpentane	17.01	11.43	20.48	19.11
2-Methylpentane	11.58	9.70	15.13	9.92
4-Methyl-1-pentene	7.84	7.84	NA	NA
2-Methyl-1-pentene	6.90	8.15	NA	5.66
<i>n</i> -Nonane	17.03	14.54	26.91	9.65
1-Nonene	16.58	29.66	1.59	18.48
<i>n</i> -Octane	10.00	9.37	12.24	8.40
1-Octene	38.82	32.51	45.42	38.54
<i>n</i> -Pentane	15.86	6.64	29.43	11.50
1-Pentene	24.96	30.86	22.73	21.29
<i>cis</i> -2-Pentene	22.43	28.37	NA	16.50
<i>trans</i> -2-Pentene	10.88	14.33	6.06	12.23
<i>a</i> -Pinene	15.93	8.58	5.98	33.21
<i>b</i> -Pinene	14.16	14.16	NA	NA
Propane	3.27	1.78	6.72	1.31
<i>n</i> -Propylbenzene	19.44	30.66	9.53	18.14
Propylene	10.24	7.53	12.14	11.06
Propyne	NA	NA	NA	NA
Styrene	22.57	8.66	7.82	51.24
TNMOC (Speciated)	10.27	4.70	14.33	11.78
TNMOC (w/unknowns)	15.01	10.60	17.67	16.77
Toluene	11.07	4.70	22.02	6.50
<i>n</i> -Tridecane	6.98	NA	NA	6.98
1-Tridecene	NA	NA	NA	NA
1,2,3-Trimethylbenzene	54.58	42.85	105.24	15.66
1,2,4-Trimethylbenzene	20.34	16.77	23.04	21.20
1,3,5-Trimethylbenzene	11.91	13.60	13.54	8.60
2,2,3-Trimethylpentane	40.45	33.07	NA	47.83
2,2,4-Trimethylpentane	8.82	10.54	8.93	6.98
2,3,4-Trimethylpentane	15.02	8.58	29.38	7.12
<i>n</i> -Undecane	20.14	26.16	NA	14.11
1-Undecene	23.25	9.29	NA	37.22
<i>m</i> -Xylene/ <i>p</i> -Xylene	8.14	6.04	12.09	6.29
<i>o</i> -Xylene	14.31	13.70	18.87	10.36
Average	17.95	15.08	21.06	17.71

9.1.3 Carbonyl Compounds Sampling and Analytical Precision

Table 9-14, presenting the sampling and analytical data for carbonyl compounds, shows that the duplicate samples precision was within the control limits of 15 percent CV for all but one compound, tolualdehydes. The average concentration difference ranged from 0.003 ppbv for benzaldehyde and isovaleraldehyde to 0.20 ppbv for formaldehyde.

Table 9-14. Carbonyl Sampling and Analytical Precision: 118 Duplicate Samples

Compound	Number of Observations	Average RPD for Duplicate Analyses (%)	Average Concentration Difference for Duplicate Analyses (ppbv)	Coefficient of Variation (%)
Acetaldehyde	118	3.32	0.03	2.21
Acetone	118	16.73	0.13	11.24
Benzaldehyde	118	11.13	0.003	7.87
Butyraldehyde	118	8.17	0.01	5.78
Crotonaldehyde	116	8.39	0.005	5.93
2,5-Dimethylbenzaldehyde	NA	NA	NA	NA
Formaldehyde	118	6.58	0.20	4.65
Hexaldehyde	118	15.86	0.005	11.21
Isovaleraldehyde	52	18.38	0.003	12.99
Propionaldehyde	118	5.23	0.01	3.70
Tolualdehydes	116	28.49	0.01	20.14
Valeraldehyde	118	12.61	0.004	8.92

The duplicate carbonyl sampling and analytical data for GPMS are presented in Table 9-15. The CV for all pollutants was within the control limits of 15 percent, which range from 2.30 percent (acetaldehyde) to 14.96 percent (tolualdehydes). Table 9-16 presents results from carbonyl duplicate sample analyses for SAMS. The data show a low level of variability, ranging from 1.95 percent (acetaldehyde) to 14.44 percent (isovaleraldehyde), with an average of 6.62 percent. Table 9-17 shows the carbonyl results for the duplicate samples at PGMS. The duplicate results show a variation range from 3.06 percent (acetaldehyde) to 16.50 percent (isovaleraldehyde), with an average of 9.09 percent. Table 9-18 shows the carbonyl results for the duplicate samples at TUMS. The average concentration difference between duplicate samples ranged from 0.001 ppbv (propionaldehyde and hexaldehyde) to 0.29 ppbv (acetone), and the average variability was 9.64 percent. Table 9-19 shows the carbonyl results for the duplicate samples at KELA. The duplicate variability ranges from 2.71 percent (acetaldehyde) to 35.86

percent (tolualdehydes). The average variability is 10.66 percent, Each site is within the target CV of 15 percent.

Table 9-15. Carbonyl Sampling and Analytical Precision: 26 Duplicate Samples for GPMS

Compound	Number of Observations	Average RPD for Duplicate Analyses (%)	Average Concentration Difference for Duplicate Analyses (ppbv)	Coefficient of Variation (%)
Acetaldehyde	26	3.70	0.04	2.30
Acetone	26	12.02	0.09	7.15
Benzaldehyde	26	8.48	0.004	6.00
Butyraldehyde	26	10.79	0.01	7.63
Crotonaldehyde	26	11.92	0.01	8.43
2,5-Dimethylbenzaldehyde	NA	NA	NA	NA
Formaldehyde	26	3.84	0.15	2.71
Hexaldehyde	26	12.23	0.003	8.65
Isovaleraldehyde	12	8.50	0.003	6.01
Propionaldehyde	26	5.91	0.01	4.18
Tolualdehydes	26	21.15	0.01	14.96
Valeraldehyde	26	8.15	0.004	5.76

Table 9-16. Carbonyl Sampling and Analytical Precision: 24 Duplicate Samples for SAMS

Compound	Number of Observations	Average RPD for Duplicate Analyses (%)	Average Concentration Difference for Duplicate Analyses (ppbv)	Coefficient of Variation (%)
Acetaldehyde	24	2.76	0.02	1.95
Acetone	24	8.79	0.05	4.93
Benzaldehyde	24	10.82	0.003	7.65
Butyraldehyde	24	6.57	0.004	4.64
Crotonaldehyde	24	4.99	0.002	3.53
2,5-Dimethylbenzaldehyde	NA	NA	NA	NA
Formaldehyde	24	4.07	0.08	2.88
Hexaldehyde	24	12.29	0.002	8.69
Isovaleraldehyde	10	16.26	0.002	11.50
Propionaldehyde	24	4.10	0.003	2.90
Tolualdehydes	24	20.43	0.01	14.44
Valeraldehyde	24	13.78	0.003	9.75

Table 9-17. Carbonyl Sampling and Analytical Precision: 22 Duplicate Samples for PGMS

Compound	Number of Observations	Average RPD for Duplicate Analyses (%)	Average Concentration Difference for Duplicate Analyses (ppbv)	Coefficient of Variation (%)
Acetaldehyde	22	4.06	0.05	3.06
Acetone	22	17.54	0.15	11.40
Benzaldehyde	22	9.12	0.005	6.45
Butyraldehyde	22	7.52	0.01	5.32
Crotonaldehyde	22	9.96	0.01	7.04
2,5-Dimethylbenzaldehyde	NA	NA	NA	NA
Formaldehyde	22	12.11	0.56	8.57
Hexaldehyde	22	21.54	0.01	15.23
Isovaleraldehyde	10	23.33	0.004	16.50
Propionaldehyde	22	6.07	0.01	4.29
Tolualdehydes	22	19.51	0.01	13.80
Valeraldehyde	22	11.82	0.01	8.36

Table 9-18. Carbonyl Sampling and Analytical Precision: 16 Duplicate Samples for TUMS

Compound	Number of Observations	Average RPD for Duplicate Analyses (%)	Average Concentration Difference for Duplicate Analyses (ppbv)	Coefficient of Variation (%)
Acetaldehyde	16	1.48	0.01	1.05
Acetone	16	32.17	0.29	23.89
Benzaldehyde	16	15.86	0.002	11.22
Butyraldehyde	16	8.97	0.002	6.35
Crotonaldehyde	14	7.13	0.004	5.04
2,5-Dimethylbenzaldehyde	NA	NA	NA	NA
Formaldehyde	16	4.05	0.06	2.87
Hexaldehyde	16	14.96	0.001	10.58
Isovaleraldehyde	NA	NA	NA	NA
Propionaldehyde	16	3.27	0.001	2.31
Tolualdehydes	14	30.62	0.01	21.65
Valeraldehyde	16	16.14	0.002	11.41

Table 9-19. Carbonyl Sampling and Analytical Precision: 30 Duplicate Samples for KELA

Compound	Number of Observations	Average RPD for Duplicate Analyses (%)	Average Concentration Difference for Duplicate Analyses (ppbv)	Coefficient of Variation (%)
Acetaldehyde	30	4.64	0.03	2.71
Acetone	30	13.12	0.09	8.81
Benzaldehyde	30	11.35	0.003	8.03
Butyraldehyde	30	7.00	0.01	4.95
Crotonaldehyde	30	7.96	0.003	5.63
2,5-Dimethylbenzaldehyde	NA	NA	NA	NA
Formaldehyde	30	8.81	0.16	6.23
Hexaldehyde	30	18.28	0.01	12.92
Isovaleraldehyde	20	25.40	0.004	17.96
Propionaldehyde	30	6.80	0.01	4.81
Tolualdehydes	30	50.72	0.01	35.86
Valeraldehyde	30	13.18	0.004	9.32

Table 9-20 presents the average CV per pollutant, per pollutant per site, the average CV per site, and the overall CV. The duplicate sample results show low level variability among the sites, ranging from 6.62 percent at SAMS to 10.66 percent at KELA, with an average of 8.54 percent. This is well within the 15 percent control limit for CV.

Table 9-20. Carbonyl Sampling and Analytical Precision: Coefficient of Variation for all Duplicate Analyses, All Sites

Compound	Average	Gulfport, MS (GPMS)	Stennis Airbase, MS (SAMS)	Pascagoula, MS (PGMS)	Tupelo, MS (TUMS)	Kenner, LA (KELA)
Acetaldehyde	2.21	2.30	1.95	3.06	1.05	2.71
Acetone	11.24	7.15	4.93	11.40	23.89	8.81
Benzaldehyde	7.87	6.00	7.65	6.45	11.22	8.03
Butyraldehyde	5.78	7.63	4.64	5.32	6.35	4.95
Crotonaldehyde	5.93	8.43	3.53	7.04	5.04	5.63
2,5-Dimethylbenzaldehyde	NA	NA	NA	NA	NA	NA
Formaldehyde	4.65	2.71	2.88	8.57	2.87	6.23
Hexaldehyde	11.21	8.65	8.69	15.23	10.58	12.92
Isovaleraldehyde	12.99	6.01	11.50	16.50	NA	17.96
Propionaldehyde	3.70	4.18	2.90	4.29	2.31	4.81

**Table 9-20. Carbonyl Sampling and Analytical Precision:
Coefficient of Variation for all Duplicate Analyses, All Sites (continued)**

Compound	Average	Gulfport, MS (GPMS)	Stennis Airbase, MS (SAMS)	Pascagoula, MS (PGMS)	Tupelo, MS (TUMS)	Kenner, LA (KELA)
Tolualdehydes	20.14	14.96	14.44	13.80	21.65	35.86
Valeraldehyde	8.92	5.76	9.75	8.36	11.41	9.32
Average	8.54	6.71	6.62	9.09	9.64	10.66

9.1.4 Metals Sampling and Analytical Precision

In this section, only the metals samples at the SAMS, FSMS, MFLA, and WALA sites were characterized. Other metals sites took only one or two collocated samples but were not included in the precision calculations. These sites are: CPLA, GPMS, MALA, USLA, CGLA, and MELA.

The sampling and analytical variation for all collocated PM₁₀ metals samples are presented in Table 9-21. The average CV values, as well as the average RPD values, show low to high-level variability among the sites, with average CVs ranging from 5.66 percent for cobalt to 31.48 percent for mercury, with an overall average at 11.92 percent.

Table 9-21. PM₁₀ Metal Sampling and Analytical Precision: 228 Collocated Samples

Compound	Number of Observations	Average RPD for Collocate Analyses (%)	Average Concentration Difference for Collocate Analyses (ng/m ³)	Coefficient of Variation (%)
Antimony	192	16.56	0.001	11.71
Arsenic	173	12.70	< 0.001	8.98
Beryllium	159	8.46	< 0.001	5.98
Cadmium	214	8.18	< 0.001	5.79
Chromium	230	25.26	< 0.001	17.86
Cobalt	133	8.01	< 0.001	5.66
Lead	226	11.86	< 0.001	8.39
Manganese	228	12.61	< 0.001	8.92
Mercury	207	44.52	< 0.001	31.48
Nickel	203	22.07	< 0.001	15.61
Potassium	228	14.61	0.015	10.33

Table 9-21. PM₁₀ Metal Sampling and Analytical Precision: 228 Collocated Samples (continued)

Compound	Number of Observations	Average RPD for Collocate Analyses (%)	Average Concentration Difference for Collocate Analyses (ng/m ³)	Coefficient of Variation (%)
Selenium	173	17.74	0.001	12.54
Sodium	226	16.49	0.104	11.66

Tables 9-22 through 9-25 present the results from collocated PM₁₀ metals at the SAMS, FSMS, MFLA, and WALA sites, respectively. The variability ranges from 0.42 percent (beryllium at WALA) to 44.26 percent (mercury at MFLA). Interestingly, mercury had the highest average CV at each of the four sites.

Table 9-22. PM₁₀ Metal Sampling and Analytical Precision: 92 Collocated Samples at SAMS

Compound	Number of Observations	Average RPD for Collocate Analyses (%)	Average Concentration Difference for Collocate Analyses (ng/m ³)	Coefficient of Variation (%)
Antimony	80	20.71	< 0.001	14.65
Arsenic	70	12.52	< 0.001	8.86
Beryllium	56	11.44	< 0.001	8.09
Cadmium	84	10.19	< 0.001	7.20
Chromium	90	37.22	0.001	26.32
Cobalt	54	13.34	< 0.001	9.43
Lead	90	10.73	< 0.001	7.59
Manganese	92	12.88	< 0.001	9.11
Mercury	86	46.95	< 0.001	33.20
Nickel	80	44.61	0.001	31.55
Potassium	92	10.99	0.011	7.77
Selenium	68	20.64	< 0.001	14.60
Sodium	92	19.55	0.053	13.83

**Table 9-23. PM₁₀ Metal Sampling and Analytical Precision:
74 Collocated Samples at FSMS**

Compound	Number of Observations	Average RPD for Collocate Analyses (%)	Average Concentration Difference for Collocate Analyses (ng/m ³)	Coefficient of Variation (%)
Antimony	49	33.42	0.003	23.63
Arsenic	48	20.10	< 0.001	14.21
Beryllium	57	3.90	< 0.001	2.76
Cadmium	66	9.83	< 0.001	6.95
Chromium	76	24.91	0.001	17.62
Cobalt	29	9.23	< 0.001	6.52
Lead	72	17.68	0.001	12.50
Manganese	72	21.93	0.001	15.51
Mercury	60	48.68	< 0.001	34.43
Nickel	66	26.43	0.001	18.69
Potassium	74	15.98	0.02	11.30
Selenium	45	39.23	0.002	27.74
Sodium	72	15.87	0.13	11.22

**Table 9-24. PM₁₀ Metal Sampling and Analytical Precision:
58 Collocated Samples at MFLA**

Compound	Number of Observations	Average RPD for Collocate Analyses (%)	Average Concentration Difference for Collocate Analyses (ng/m ³)	Coefficient of Variation (%)
Antimony	58	6.37	< 0.001	4.50
Arsenic	53	11.35	< 0.001	8.03
Beryllium	41	17.91	< 0.001	12.67
Cadmium	58	9.35	< 0.001	6.61
Chromium	58	32.81	< 0.001	23.20
Cobalt	46	3.24	< 0.001	2.29
Lead	58	11.16	< 0.001	7.89
Manganese	58	8.76	< 0.001	6.19
Mercury	56	62.59	< 0.001	44.26
Nickel	54	12.84	< 0.001	9.08
Potassium	56	27.23	0.02	19.25
Selenium	57	8.18	< 0.001	5.79
Sodium	57	26.37	0.14	18.65

**Table 9-25. PM₁₀ Metal Sampling and Analytical Precision:
6 Collocated Samples at WALA**

Compound	Number of Observations	Average RPD for Collocate Analyses (%)	Average Concentration Difference for Collocate Analyses (ng/m ³)	Coefficient of Variation (%)
Antimony	6	5.73	< 0.001	4.05
Arsenic	4	6.81	< 0.001	4.81
Beryllium	6	0.60	< 0.001	0.42
Cadmium	6	3.37	< 0.001	2.39
Chromium	6	6.12	< 0.001	4.33
Cobalt	4	6.22	< 0.001	4.40
Lead	6	7.87	< 0.001	5.56
Manganese	6	6.88	< 0.001	4.87
Mercury	6	19.87	< 0.001	14.05
Nickel	6	4.41	< 0.001	3.12
Potassium	6	4.24	0.01	3.00
Selenium	6	2.88	< 0.001	2.04
Sodium	6	4.17	0.10	2.95

Table 9-26 shows the collocated PM_{2.5} metals for SAMS. The range of variation is 7.31 percent (lead) to 29.70 percent (mercury), with an average of 14.91 percent. This is within the 15 percent CV control limit.

**Table 9-26. PM_{2.5} Metal Sampling and Analytical Precision:
54 Collocated Samples at SAMS**

Compound	Number of Observations	Average RPD for Collocate Analyses (%)	Average Concentration Difference for Collocate Analyses (ng/m ³)	Coefficient of Variation (%)
Antimony	44	28.31	< 0.001	20.02
Arsenic	44	12.27	< 0.001	8.67
Beryllium	34	14.43	< 0.001	10.20
Cadmium	48	12.70	< 0.001	8.98
Chromium	54	24.83	< 0.001	17.56
Cobalt	22	27.90	< 0.001	19.73
Lead	52	10.34	< 0.001	7.31
Manganese	54	28.85	< 0.001	20.40
Mercury	50	42.00	< 0.001	29.70
Nickel	46	27.57	0.031	19.50

**Table 9-26. PM_{2.5} Metal Sampling and Analytical Precision:
54 Collocated Samples at SAMS (continued)**

Compound	Number of Observations	Average RPD for Collocate Analyses (%)	Average Concentration Difference for Collocate Analyses (ng/m ³)	Coefficient of Variation (%)
Potassium	54	10.39	0.008	7.35
Selenium	40	17.95	< 0.001	12.69
Sodium	52	16.61	0.033	11.74

Table 9-27 presents the average CV per pollutant, per pollutant per site, the average CV per site (for PM₁₀ for FSMS, MFLA, WALA and SAMS and PM_{2.5} for SAMS), and the overall CV. The results from collocated samples show low to high level variability among sites, ranging from 4.31 percent at WALA to 15.62 percent FSMS, with an overall average of 11.92 percent.

**Table 9-27. Metals Sampling and Analytical Precision:
Coefficient of Variation for all Collocated Samples, All Sites**

Compound	Average	PM ₁₀ , Long Beach, MS (FSMS)	PM ₁₀ , Fire Training Academy, New Orleans, LA (MFLA)	PM ₁₀ , Water Purification Plant, New Orleans, LA (WALA)	PM ₁₀ , Stennis Airbase, MS (SAMS)	PM _{2.5} , Stennis Airbase, MS (SAMS)
Antimony	11.71	23.63	4.50	4.05	14.65	20.02
Arsenic	8.98	14.21	8.03	4.81	8.86	8.67
Beryllium	5.98	2.76	12.67	0.42	8.09	10.20
Cadmium	5.79	6.95	6.61	2.39	7.20	8.98
Chromium	17.86	17.62	23.20	4.33	26.32	17.56
Cobalt	5.66	6.52	2.29	4.40	9.43	19.73
Lead	8.39	12.50	7.89	5.56	7.59	7.31
Manganese	8.92	15.51	6.19	4.87	9.11	20.40
Mercury	31.48	34.43	44.26	14.05	33.20	29.70
Nickel	15.61	18.69	9.08	3.12	31.55	19.50
Potassium	10.33	11.30	19.25	3.00	7.77	7.35
Selenium	12.54	27.74	5.79	2.04	14.60	12.69
Sodium	11.66	11.22	18.65	2.95	13.83	11.74
Average	11.92	15.62	12.95	4.31	14.78	14.91

9.1.5 Hexavalent Chromium Sampling and Analytical Precision

The average concentration differences observed for collocated analyses of hexavalent chromium ranged from 0.0040 ng/m³ at SAMS to 0.0088 ng/m³ at GPMS. The average RPD was lower than the required 25 percent, calculated at an overall 21.4 percent. The RPD ranged from 17.7 percent at KELA to 27.4 percent at GPMS. The CV ranged from 12.5 percent at KELA to 19.3 percent at GPMS, with an overall average of 15.1 percent, which is slightly higher than the 15 percent required limit.

Table 9-28. Hexavalent Chromium Sampling and Analytical Precision: 66 Collocated Samples

Post-Katrina Site Code	Number of Collocated samples	Frequency of Detection	Average RPD for Collocate Analyses (%)	Average Concentration Difference for Collocate Analyses (ng/m ³)	Coefficient of Variation (%)
GPMS	18	83%	27.4	0.0088	19.30
KELA	32	100%	17.7	0.0045	12.50
SAMS	16	25%	19.2	0.0040	13.60
Average	66	69.33%	21.43	0.0058	15.13

9.2 Analytical Precision

Analytical precision is a measurement of random errors associated with the process of analyzing 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. The number of observations from Tables 9-29 through 9-47, in comparison to the respective tables listed for duplicate analyses in Tables 9-2 through 9-19, is approximately twice as high because each sample produces a replicate for each duplicate (or collocated) sample.

Collocated samples were collected for metals and hexavalent chromium, which provide sampling and analytical precision. However, replicate analyses were not performed for metals and hexavalent chromium. Therefore, metals and hexavalent chromium analytical precision will not be discussed in this section.

9.2.1 VOC Analytical Precision

In Table 9-29, the replicate analyses of all duplicate samples show that for most of the pollutants, the VOC analysis precision was within the control limits of 15 percent for CV. The precision of the VOC analytical method, in terms of average concentration difference, ranges from 0.001 ppbv for chloroethane and dichlorotetrafluoroethane to 3.31 ppbv for acetonitrile. In terms of CV, the overall average variability is 20.71 percent and the median CV is 7.55 percent. The low median CV shows that most of the pollutant variabilities are generally low. The relatively high average variability is likely due to the substitution of non-detects with half the MDL.

**Table 9-29. VOC Analytical Precision:
210 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 (%)
Acetonitrile	164	15.76	3.31	11.14
Acetylene	208	10.27	0.09	7.26
Acrolein	133	19.71	0.08	13.94
Acrylonitrile	NA	NA	NA	NA
<i>tert</i> -Amyl Methyl Ether	NA	NA	NA	NA
Benzene	210	6.82	0.02	4.82
Bromochloromethane	NA	NA	NA	NA
Bromodichloromethane	1	NA	NA	NA
Bromoform	NA	NA	NA	NA
Bromomethane	196	10.49	0.002	7.42
1,3-Butadiene	168	10.17	0.005	7.19
Carbon Tetrachloride	210	6.19	0.01	4.38
Chlorobenzene	1	NA	NA	NA
Chloroethane	132	5.94	0.001	4.20
Chloroform	142	12.16	0.003	8.60
Chloromethane	210	6.07	0.04	4.29
Chloromethylbenzene	NA	NA	NA	NA
Chloroprene	NA	NA	NA	NA
Dibromochloromethane	NA	NA	NA	NA
1,2-Dibromoethane	NA	NA	NA	NA
<i>m</i> -Dichlorobenzene	3	66.67	0.01	47.14
<i>o</i> -Dichlorobenzene	5	50.00	0.01	35.36
<i>p</i> -Dichlorobenzene	120	23.80	0.01	16.83
Dichlorodifluoromethane	210	5.04	0.03	3.56
1,1-Dichloroethane	NA	NA	NA	NA
1,2-Dichloroethane	8	50.00	0.01	35.36
1,1-Dichloroethene	2	7.41	0.01	5.24
<i>cis</i> -1,2-Dichloroethylene	1	192.86	0.54	136.37

**Table 9-29. VOC Analytical Precision:
210 Replicate Analyses for all Duplicate Samples (continued)**

Compound	Number of Observations	Average RPD for Replicate Analyses (%)	Average Concentration Difference for Replicate Analyses (ppbv)	Coefficient of Variation (%)
<i>trans</i> -1,2-Dichloroethylene	NA	NA	NA	NA
Dichloromethane	199	15.28	0.20	10.81
1,2-Dichloropropane	NA	NA	NA	NA
<i>cis</i> -1,3-Dichloropropene	NA	NA	NA	NA
<i>trans</i> -1,3-Dichloropropene	NA	NA	NA	NA
Dichlorotetrafluoroethane	205	9.06	0.001	6.41
Ethyl Acrylate	NA	NA	NA	NA
Ethyl <i>tert</i> -Butyl Ether	1	163.64	0.04	115.71
Ethylbenzene	210	7.99	0.01	5.65
Hexachloro-1,3-butadiene	88	20.27	0.003	14.33
Methyl Ethyl Ketone	91	10.86	0.03	7.68
Methyl Isobutyl Ketone	54	41.07	0.01	29.04
Methyl Methacrylate	1	66.67	0.01	47.14
Methyl <i>tert</i> -Butyl Ether	5	95.93	0.02	67.83
<i>n</i> -Octane	191	17.91	0.01	12.66
Propylene	210	6.57	0.03	4.65
Styrene	191	9.42	0.01	6.66
1,1,2,2-Tetrachloroethane	2	66.67	0.01	47.14
Tetrachloroethylene	133	7.29	0.002	5.15
Toluene	210	7.29	0.04	5.15
1,2,4-Trichlorobenzene	31	64.93	0.03	45.91
1,1,1-Trichloroethane	202	10.29	0.003	7.28
1,1,2-Trichloroethane	NA	NA	NA	NA
Trichloroethylene	46	32.51	0.005	22.99
Trichlorofluoromethane	210	4.57	0.01	3.23
Trichlorotrifluoroethane	210	5.38	0.01	3.80
1,2,4-Trimethylbenzene	197	15.54	0.01	10.99
1,3,5-Trimethylbenzene	193	8.14	0.003	5.75
Vinyl chloride	28	25.99	0.004	18.38
<i>m,p</i> -Xylene	210	9.68	0.02	6.84
<i>o</i> -Xylene	208	7.56	0.01	5.34

Table 9-30 shows the results from replicate analyses of duplicate VOC samples taken at GPMS. The replicate results from duplicate samples show variation for the pollutants ranging from <0.001 percent (chloroethane) to 11.96 percent (acetonitrile), as indicated by average concentration differences. The overall average variability is 9.35 percent, which is within the program's objectives.

**Table 9-30. VOC Analytical Precision:
56 Replicate Analyses for Duplicate Samples for GPMS**

Compound	Number of Observations	Average RPD for Replicate Analyses (%)	Average Concentration Difference for Replicate Analyses (ppbv)	Coefficient of Variation (%)
Acetonitrile	45	16.40	11.96	11.60
Acetylene	56	7.46	0.09	5.28
Acrolein	39	17.77	0.09	12.57
Acrylonitrile	NA	NA	NA	NA
<i>tert</i> -Amyl Methyl Ether	NA	NA	NA	NA
Benzene	56	8.83	0.04	6.24
Bromochloromethane	NA	NA	NA	NA
Bromodichloromethane	NA	NA	NA	NA
Bromoform	NA	NA	NA	NA
Bromomethane	52	5.98	0.001	4.23
1,3-Butadiene	52	11.10	0.01	7.85
Carbon Tetrachloride	56	8.57	0.01	6.06
Chlorobenzene	NA	NA	NA	NA
Chloroethane	46	2.67	<0.001	1.89
Chloroform	47	10.76	0.003	7.61
Chloromethane	56	5.55	0.05	3.93
Chloromethylbenzene	NA	NA	NA	NA
Chloroprene	NA	NA	NA	NA
Dibromochloromethane	NA	NA	NA	NA
1,2-Dibromoethane	NA	NA	NA	NA
<i>m</i> -Dichlorobenzene	NA	NA	NA	NA
<i>o</i> -Dichlorobenzene	NA	NA	NA	NA
<i>p</i> -Dichlorobenzene	42	22.23	0.005	15.72
Dichlorodifluoromethane	56	4.81	0.03	3.40
1,1-Dichloroethane	NA	NA	NA	NA
1,2-Dichloroethane	2	66.67	0.01	47.14
1,1-Dichloroethene	NA	NA	NA	NA
<i>cis</i> -1,2-Dichloroethylene	NA	NA	NA	NA
<i>trans</i> -1,2-Dichloroethylene	NA	NA	NA	NA
Dichloromethane	56	12.06	0.01	8.53
1,2-Dichloropropane	NA	NA	NA	NA
<i>cis</i> -1,3-Dichloropropene	NA	NA	NA	NA
<i>trans</i> -1,3-Dichloropropene	NA	NA	NA	NA
Dichlorotetrafluoroethane	56	7.14	0.001	5.05
Ethyl Acrylate	NA	NA	NA	NA
Ethyl <i>tert</i> -Butyl Ether	NA	NA	NA	NA
Ethylbenzene	56	7.90	0.01	5.59
Hexachloro-1,3-butadiene	24	16.67	0.003	11.79
Methyl Ethyl Ketone	24	8.51	0.04	6.01
Methyl Isobutyl Ketone	18	16.52	0.01	11.68
Methyl Methacrylate	NA	NA	NA	NA
Methyl <i>tert</i> -Butyl Ether	NA	NA	NA	NA
<i>n</i> -Octane	56	12.82	0.005	9.07
Propylene	56	5.56	0.04	3.93

**Table 9-30. VOC Analytical Precision:
56 Replicate Analyses for Duplicate Samples for GPMS (continued)**

Compound	Number of Observations	Average RPD for Replicate Analyses (%)	Average Concentration Difference for Replicate Analyses (ppbv)	Coefficient of Variation (%)
Styrene	56	9.79	0.01	6.92
1,1,2,2-Tetrachloroethane	NA	NA	NA	NA
Tetrachloroethylene	43	9.53	0.002	6.74
Toluene	56	8.55	0.09	6.05
1,2,4-Trichlorobenzene	12	18.10	0.01	12.80
1,1,1-Trichloroethane	54	11.57	0.004	8.18
1,1,2-Trichloroethane	NA	NA	NA	NA
Trichloroethylene	11	28.57	0.004	20.20
Trichlorofluoromethane	56	5.08	0.02	3.59
Trichlorotrifluoroethane	56	5.60	0.01	3.96
1,2,4-Trimethylbenzene	54	19.48	0.02	13.78
1,3,5-Trimethylbenzene	56	8.15	0.004	5.77
Vinyl chloride	11	31.29	0.004	22.13
<i>m,p</i> -Xylene	56	10.14	0.03	7.17
<i>o</i> -Xylene	56	7.75	0.01	5.48

Table 9-31 shows the results from replicate analyses of duplicate VOC samples taken at SAMS. The variation of the replicate results from the duplicate samples ranges from 1.40 percent (*o*-xylene) to 136.37 percent (*cis*-1,2-dichloroethylene), as represented by the coefficient of variation. The overall average variability is 16.89 percent, and the median CV is 5.88 percent.

**Table 9-31. VOC Analytical Precision:
40 Replicate Analyses for Duplicate Samples for SAMS**

Compound	Number of Observations	Average RPD for Replicate Analyses (%)	Average Concentration Difference for Replicate Analyses (ppbv)	Coefficient of Variation (%)
Acetonitrile	28	9.23	0.38	6.53
Acetylene	38	12.22	0.06	8.64
Acrolein	22	10.36	0.05	7.33
Acrylonitrile	NA	NA	NA	NA
<i>tert</i> -Amyl Methyl Ether	NA	NA	NA	NA
Benzene	40	3.20	0.01	2.26
Bromochloromethane	NA	NA	NA	NA
Bromodichloromethane	NA	NA	NA	NA
Bromoform	NA	NA	NA	NA
Bromomethane	36	14.81	0.002	10.48

**Table 9-31. VOC Analytical Precision:
40 Replicate Analyses for Duplicate Samples for SAMS (continued)**

Compound	Number of Observations	Average RPD for Replicate Analyses (%)	Average Concentration Difference for Replicate Analyses (ppbv)	Coefficient of Variation (%)
1,3-Butadiene	22	21.79	0.01	15.41
Carbon Tetrachloride	40	4.38	0.005	3.10
Chlorobenzene	1	NA	NA	NA
Chloroethane	17	NA	NA	NA
Chloroform	24	5.22	0.003	3.69
Chloromethane	40	5.67	0.05	4.01
Chloromethylbenzene	NA	NA	NA	NA
Chloroprene	NA	NA	NA	NA
Dibromochloromethane	NA	NA	NA	NA
1,2-Dibromoethane	NA	NA	NA	NA
<i>m</i> -Dichlorobenzene	1	66.67	0.01	47.14
<i>o</i> -Dichlorobenzene	2	NA	NA	NA
<i>p</i> -Dichlorobenzene	7	25.00	0.01	17.68
Dichlorodifluoromethane	40	3.81	0.02	2.69
1,1-Dichloroethane	NA	NA	NA	NA
1,2-Dichloroethane	1	NA	NA	NA
1,1-Dichloroethene	NA	NA	NA	NA
<i>cis</i> -1,2-Dichloroethylene	1	192.86	0.54	136.37
<i>trans</i> -1,2-Dichloroethylene	NA	NA	NA	NA
Dichloromethane	36	3.17	0.001	2.24
1,2-Dichloropropane	NA	NA	NA	NA
<i>cis</i> -1,3-Dichloropropene	NA	NA	NA	NA
<i>trans</i> -1,3-Dichloropropene	NA	NA	NA	NA
Dichlorotetrafluoroethane	36	NA	NA	NA
Ethyl Acrylate	NA	NA	NA	NA
Ethyl <i>tert</i> -Butyl Ether	NA	NA	NA	NA
Ethylbenzene	40	5.97	0.002	4.22
Hexachloro-1,3-butadiene	20	21.33	0.004	15.08
Methyl Ethyl Ketone	15	26.40	0.04	18.66
Methyl Isobutyl Ketone	3	73.91	0.01	52.26
Methyl Methacrylate	NA	NA	NA	NA
Methyl <i>tert</i> -Butyl Ether	NA	NA	NA	NA
<i>n</i> -Octane	35	7.41	0.001	5.24
Propylene	40	5.54	0.01	3.92
Styrene	36	3.54	0.02	2.50
1,1,2,2-Tetrachloroethane	1	66.67	0.01	47.14
Tetrachloroethylene	16	NA	NA	NA
Toluene	40	4.56	0.01	3.22
1,2,4-Trichlorobenzene	7	61.07	0.03	43.18
1,1,1-Trichloroethane	40	NA	NA	NA
1,1,2-Trichloroethane	NA	NA	NA	NA
Trichloroethylene	4	44.44	0.01	31.43
Trichlorofluoromethane	40	3.80	0.01	2.68
Trichlorotrifluoroethane	40	3.50	0.01	2.48

**Table 9-31. VOC Analytical Precision:
40 Replicate Analyses for Duplicate Samples for SAMS (continued)**

Compound	Number of Observations	Average RPD for Replicate Analyses (%)	Average Concentration Difference for Replicate Analyses (ppbv)	Coefficient of Variation (%)
1,2,4-Trimethylbenzene	31	33.70	0.01	23.83
1,3,5-Trimethylbenzene	31	3.70	0.001	2.62
Vinyl chloride	9	13.33	0.002	9.43
<i>m,p</i> -Xylene	40	5.19	0.004	3.67
<i>o</i> -Xylene	38	1.98	0.001	1.40

Tables 9-32 shows results from VOC replicate analyses of duplicate samples at PGMS. The replicate results from duplicate samples show low to high level variability as represented by CV, ranging from 4.05 percent (trichlorofluoromethane) to 132.30 percent (methyl *tert* butyl ether), with an average of 19.87 percent, and a median CV of 8.47 percent.

**Table 9-32. VOC Analytical Precision:
44 Replicate Analyses for Duplicate Samples for PGMS**

Compound	Number of Observations	Average RPD for Replicate Analyses (%)	Average Concentration Difference for Replicate Analyses (ppbv)	Coefficient of Variation (%)
Acetonitrile	42	15.01	1.04	10.61
Acetylene	44	13.60	0.16	9.62
Acrolein	30	31.02	0.13	21.93
Acrylonitrile	NA	NA	NA	NA
<i>tert</i> -Amyl Methyl Ether	NA	NA	NA	NA
Benzene	44	7.80	0.03	5.51
Bromochloromethane	NA	NA	NA	NA
Bromodichloromethane	NA	NA	NA	NA
Bromoform	NA	NA	NA	NA
Bromomethane	43	6.06	0.001	4.29
1,3-Butadiene	44	7.95	0.01	5.62
Carbon Tetrachloride	44	7.32	0.01	5.17
Chlorobenzene	NA	NA	NA	NA
Chloroethane	33	9.32	0.001	6.59
Chloroform	31	11.98	0.002	8.47
Chloromethane	44	8.16	0.06	5.77
Chloromethylbenzene	NA	NA	NA	NA
Chloroprene	NA	NA	NA	NA
Dibromochloromethane	NA	NA	NA	NA
1,2-Dibromoethane	NA	NA	NA	NA
<i>m</i> -Dichlorobenzene	2	66.67	0.01	47.14

**Table 9-32. VOC Analytical Precision:
44 Replicate Analyses for Duplicate Samples for PGMS (continued)**

Compound	Number of Observations	Average RPD for Replicate Analyses (%)	Average Concentration Difference for Replicate Analyses (ppbv)	Coefficient of Variation (%)
<i>o</i> -Dichlorobenzene	3	50.00	0.01	35.36
<i>p</i> -Dichlorobenzene	24	33.42	0.01	23.63
Dichlorodifluoromethane	44	6.38	0.04	4.51
1,1-Dichloroethane	NA	NA	NA	NA
1,2-Dichloroethane	1	NA	NA	NA
1,1-Dichloroethene	NA	NA	NA	NA
<i>cis</i> -1,2-Dichloroethylene	NA	NA	NA	NA
<i>trans</i> -1,2-Dichloroethylene	NA	NA	NA	NA
Dichloromethane	40	24.53	0.03	17.34
1,2-Dichloropropane	NA	NA	NA	NA
<i>cis</i> -1,3-Dichloropropene	NA	NA	NA	NA
<i>trans</i> -1,3-Dichloropropene	NA	NA	NA	NA
Dichlorotetrafluoroethane	43	16.53	0.002	11.69
Ethyl Acrylate	NA	NA	NA	NA
Ethyl <i>tert</i> -Butyl Ether	1	163.64	0.04	115.71
Ethylbenzene	44	9.45	0.01	6.68
Hexachloro-1,3-butadiene	24	23.33	0.004	16.50
Methyl Ethyl Ketone	12	8.34	0.03	5.90
Methyl Isobutyl Ketone	6	83.31	0.02	58.91
Methyl Methacrylate	NA	NA	NA	NA
Methyl <i>tert</i> -Butyl Ether	1	187.10	0.03	132.30
<i>n</i> -Octane	42	26.54	0.01	18.77
Propylene	44	7.80	0.06	5.52
Styrene	44	8.68	0.004	6.14
1,1,2,2-Tetrachloroethane	1	66.67	0.01	47.14
Tetrachloroethylene	31	12.96	0.002	9.17
Toluene	44	8.41	0.06	5.95
1,2,4-Trichlorobenzene	11	30.56	0.01	21.61
1,1,1-Trichloroethane	40	11.33	0.003	8.01
1,1,2-Trichloroethane	NA	NA	NA	NA
Trichloroethylene	17	20.00	0.003	14.14
Trichlorofluoromethane	44	5.73	0.02	4.05
Trichlorotrifluoroethane	44	7.07	0.01	5.00
1,2,4-Trimethylbenzene	44	11.87	0.01	8.39
1,3,5-Trimethylbenzene	44	12.25	0.004	8.66
Vinyl chloride	NA	NA	NA	NA
<i>m,p</i> -Xylene	44	8.88	0.02	6.28
<i>o</i> -Xylene	44	9.82	0.01	6.94

Table 9-33 shows the results from replicate analyses of duplicate VOC samples at TUMS. The variation of the replicate results from the duplicate samples ranges from 0.42 percent (tetrachloroethylene) to 106.07 percent (1,2,4-trichlorobenzene), as represented by the

coefficient of variation. The overall average variability is 11.66 percent, which is within the program's objective.

**Table 9-33. VOC Analytical Precision:
32 Replicate Analyses for Duplicate Samples for TUMS**

Compound	Number of Observations	Average RPD for Replicate Analyses (%)	Average Concentration Difference for Replicate Analyses (ppbv)	Coefficient of Variation (%)
Acetonitrile	20	6.82	0.24	4.82
Acetylene	32	7.00	0.04	4.95
Acrolein	14	7.27	0.03	5.14
Acrylonitrile	NA	NA	NA	NA
<i>tert</i> -Amyl Methyl Ether	NA	NA	NA	NA
Benzene	32	4.35	0.01	3.08
Bromochloromethane	NA	NA	NA	NA
Bromodichloromethane	1	NA	NA	NA
Bromoform	NA	NA	NA	NA
Bromomethane	28	NA	NA	NA
1,3-Butadiene	22	2.60	0.001	1.84
Carbon Tetrachloride	32	6.59	0.01	4.66
Chlorobenzene	NA	NA	NA	NA
Chloroethane	19	NA	NA	NA
Chloroform	16	16.67	0.003	11.79
Chloromethane	32	4.74	0.03	3.35
Chloromethylbenzene	NA	NA	NA	NA
Chloroprene	NA	NA	NA	NA
Dibromochloromethane	NA	NA	NA	NA
1,2-Dibromoethane	NA	NA	NA	NA
<i>m</i> -Dichlorobenzene	NA	NA	NA	NA
<i>o</i> -Dichlorobenzene	NA	NA	NA	NA
<i>p</i> -Dichlorobenzene	16	NA	NA	NA
Dichlorodifluoromethane	32	4.24	0.03	3.00
1,1-Dichloroethane	NA	NA	NA	NA
1,2-Dichloroethane	NA	NA	NA	NA
1,1-Dichloroethene	2	7.41	0.01	5.24
<i>cis</i> -1,2-Dichloroethylene	NA	NA	NA	NA
<i>trans</i> -1,2-Dichloroethylene	NA	NA	NA	NA
Dichloromethane	29	21.59	0.01	15.27
1,2-Dichloropropane	NA	NA	NA	NA
<i>cis</i> -1,3-Dichloropropene	NA	NA	NA	NA
<i>trans</i> -1,3-Dichloropropene	NA	NA	NA	NA
Dichlorotetrafluoroethane	32	NA	NA	NA
Ethyl Acrylate	NA	NA	NA	NA
Ethyl <i>tert</i> -Butyl Ether	NA	NA	NA	NA
Ethylbenzene	32	7.56	0.004	5.34
Hexachloro-1,3-butadiene	10	26.67	0.004	18.86
Methyl Ethyl Ketone	16	7.26	0.03	5.14
Methyl Isobutyl Ketone	12	6.72	0.003	4.75

**Table 9-33. VOC Analytical Precision:
32 Replicate Analyses for Duplicate Samples for TUMS (continued)**

Compound	Number of Observations	Average RPD for Replicate Analyses (%)	Average Concentration Difference for Replicate Analyses (ppbv)	Coefficient of Variation (%)
Methyl Methacrylate	1	66.67	0.01	47.14
Methyl <i>tert</i> -Butyl Ether	NA	NA	NA	NA
<i>n</i> -Octane	24	17.81	0.004	12.59
Propylene	32	4.74	0.01	3.35
Styrene	25	12.12	0.003	8.57
1,1,2,2-Tetrachloroethane	NA	NA	NA	NA
Tetrachloroethylene	24	0.60	0.002	0.42
Toluene	32	4.18	0.02	2.95
1,2,4-Trichlorobenzene	1	150.00	0.06	106.07
1,1,1-Trichloroethane	32	1.79	0.001	1.26
1,1,2-Trichloroethane	NA	NA	NA	NA
Trichloroethylene	3	33.33	0.01	23.57
Trichlorofluoromethane	32	3.75	0.01	2.65
Trichlorotrifluoroethane	32	5.20	0.01	3.68
1,2,4-Trimethylbenzene	30	5.66	0.001	4.00
1,3,5-Trimethylbenzene	24	NA	NA	NA
Vinyl chloride	4	33.33	0.01	23.57
<i>m,p</i> -Xylene	32	10.73	0.01	7.59
<i>o</i> -Xylene	32	7.50	0.003	5.30

Table 9-34 shows the VOC results for the replicates for duplicate samples at KELA. The replicate results from duplicate samples show variation for the pollutants ranging from 2.48 percent (dichlorotetrafluoroethane) to 25.59 percent (trichloroethylene). The overall average variability is 9.30 percent, which is within the program objective of 15 percent CV.

**Table 9-34. VOC Analytical Precision:
38 Replicate Analyses for Duplicate Samples for KELA**

Compound	Number of Observations	Average RPD for Replicate Analyses (%)	Average Concentration Difference for Replicate Analyses (ppbv)	Coefficient of Variation (%)
Acetonitrile	29	31.34	2.94	22.16
Acetylene	38	11.06	0.08	7.82
Acrolein	28	32.13	0.09	22.72
Acrylonitrile	NA	NA	NA	NA
<i>tert</i> -Amyl Methyl Ether	NA	NA	NA	NA
Benzene	38	9.92	0.02	7.01
Bromochloromethane	NA	NA	NA	NA

**Table 9-34. VOC Analytical Precision:
38 Replicate Analyses for Duplicate Samples for KELA (continued)**

Compound	Number of Observations	Average RPD for Replicate Analyses (%)	Average Concentration Difference for Replicate Analyses (ppbv)	Coefficient of Variation (%)
Bromodichloromethane	NA	NA	NA	NA
Bromoform	NA	NA	NA	NA
Bromomethane	37	15.09	0.003	10.67
1,3-Butadiene	28	7.39	0.004	5.22
Carbon Tetrachloride	38	4.09	0.004	2.89
Chlorobenzene	NA	NA	NA	NA
Chloroethane	17	5.82	0.002	4.11
Chloroform	24	16.20	0.005	11.46
Chloromethane	38	6.23	0.04	4.41
Chloromethylbenzene	NA	NA	NA	NA
Chloroprene	NA	NA	NA	NA
Dibromochloromethane	NA	NA	NA	NA
1,2-Dibromoethane	NA	NA	NA	NA
<i>m</i> -Dichlorobenzene	NA	NA	NA	NA
<i>o</i> -Dichlorobenzene	NA	NA	NA	NA
<i>p</i> -Dichlorobenzene	31	14.53	0.004	10.27
Dichlorodifluoromethane	38	5.95	0.04	4.21
1,1-Dichloroethane	NA	NA	NA	NA
1,2-Dichloroethane	4	33.33	0.01	23.57
1,1-Dichloroethene	NA	NA	NA	NA
<i>cis</i> -1,2-Dichloroethylene	NA	NA	NA	NA
<i>trans</i> -1,2-Dichloroethylene	NA	NA	NA	NA
Dichloromethane	38	15.07	0.93	10.66
1,2-Dichloropropane	NA	NA	NA	NA
<i>cis</i> -1,3-Dichloropropene	NA	NA	NA	NA
<i>trans</i> -1,3-Dichloropropene	NA	NA	NA	NA
Dichlorotetrafluoroethane	38	3.51	0.001	2.48
Ethyl Acrylate	NA	NA	NA	NA
Ethyl <i>tert</i> -Butyl Ether	NA	NA	NA	NA
Ethylbenzene	38	9.07	0.01	6.42
Hexachloro-1,3-butadiene	10	13.33	0.002	9.43
Methyl Ethyl Ketone	24	3.80	0.02	2.69
Methyl Isobutyl Ketone	15	24.88	0.01	17.59
Methyl Methacrylate	NA	NA	NA	NA
Methyl <i>tert</i> -Butyl Ether	4	4.76	0.01	3.37
<i>n</i> -Octane	34	24.96	0.01	17.65
Propylene	38	9.21	0.04	6.52
Styrene	30	12.98	0.01	9.18
1,1,2,2-Tetrachloroethane	NA	NA	NA	NA
Tetrachloroethylene	19	6.06	0.001	4.29
Toluene	38	10.75	0.04	7.60
1,2,4-Trichlorobenzene	NA	NA	NA	NA
1,1,1-Trichloroethane	36	16.49	0.003	11.66
1,1,2-Trichloroethane	NA	NA	NA	NA

**Table 9-34. VOC Analytical Precision:
38 Replicate Analyses for Duplicate Samples for KELA (continued)**

Compound	Number of Observations	Average RPD for Replicate Analyses (%)	Average Concentration Difference for Replicate Analyses (ppbv)	Coefficient of Variation (%)
Trichloroethylene	11	36.19	0.004	25.59
Trichlorofluoromethane	38	4.51	0.01	3.19
Trichlorotrifluoroethane	38	5.52	0.01	3.90
1,2,4-Trimethylbenzene	38	6.98	0.01	4.94
1,3,5-Trimethylbenzene	38	8.43	0.003	5.96
Vinyl chloride	4	NA	NA	NA
<i>m,p</i> -Xylene	38	13.45	0.02	9.51
<i>o</i> -Xylene	38	10.74	0.01	7.60

Table 9-35 shows the average CV per pollutant, per pollutant per site, the average CV per site, and the overall average CV. The average site CV ranged from 9.30 percent at KELA to 19.87 percent at PGMS, with an overall program average CV of 13.41 percent. This meets the 15 percent CV criteria.

**Table 9-35. VOC Analytical Precision:
Coefficient of Variation for all Replicate Analyses, All Sites**

Compound	Average	Gulfport, MS (GPMS)	Stennis Airbase, MS (SAMS)	Pascagoula, MS (PGMS)	Tupelo, MS (TUMS)	Kenner, LA (KELA)
Acetonitrile	11.14	11.60	6.53	10.61	4.82	22.16
Acetylene	7.26	5.28	8.64	9.62	4.95	7.82
Acrolein	13.94	12.57	7.33	21.93	5.14	22.72
Acrylonitrile	NA	NA	NA	NA	NA	NA
<i>tert</i> -Amyl Methyl Ether	NA	NA	NA	NA	NA	NA
Benzene	4.82	6.24	2.26	5.51	3.08	7.01
Bromochloromethane	NA	NA	NA	NA	NA	NA
Bromodichloromethane	NA	NA	NA	NA	NA	NA
Bromoform	NA	NA	NA	NA	NA	NA
Bromomethane	7.42	4.23	10.48	4.29	NA	10.67
1,3-Butadiene	7.19	7.85	15.41	5.62	1.84	5.22
Carbon Tetrachloride	4.38	6.06	3.10	5.17	4.66	2.89
Chlorobenzene	NA	NA	NA	NA	NA	AN
Chloroethane	4.20	1.89	NA	6.59	NA	4.11
Chloroform	8.60	7.61	3.69	8.47	11.79	11.46
Chloromethane	4.29	3.93	4.01	5.77	3.35	4.41

**Table 9-35. VOC Analytical Precision:
Coefficient of Variation for all Replicate Analyses, All Sites (continued)**

Compound	Average	Gulfport, MS (GPMS)	Stennis Airbase, MS (SAMS)	Pascagoula, MS (PGMS)	Tupelo, MS (TUMS)	Kenner, LA (KELA)
Chloromethylbenzene	NA	NA	NA	NA	NA	NA
Chloroprene	NA	NA	NA	NA	NA	NA
Dibromochloromethane	NA	NA	NA	NA	NA	NA
1,2-Dibromoethane	NA	NA	NA	NA	NA	NA
<i>m</i> -Dichlorobenzene	47.14	NA	47.14	47.14	NA	NA
<i>o</i> -Dichlorobenzene	35.36	NA	NA	35.36	NA	NA
<i>p</i> -Dichlorobenzene	16.83	15.72	17.68	23.63	NA	10.27
Dichlorodifluoromethane	3.56	3.40	2.69	4.51	3.00	4.21
1,1-Dichloroethane	NA	NA	NA	NA	NA	NA
1,2-Dichloroethane	35.36	47.14	NA	NA	NA	23.57
1,1-Dichloroethene	5.24	NA	NA	NA	5.24	NA
<i>cis</i> -1,2-Dichloroethylene	136.37	NA	136.37	NA	NA	NA
<i>trans</i> -1,2-Dichloroethylene	NA	NA	NA	NA	NA	NA
Dichloromethane	10.81	8.53	2.24	17.34	15.27	10.66
1,2-Dichloropropane	NA	NA	NA	NA	NA	NA
<i>cis</i> -1,3-Dichloropropene	NA	NA	NA	NA	NA	NA
<i>trans</i> -1,3-Dichloropropene	NA	NA	NA	NA	NA	NA
Dichlorotetrafluoroethane	6.41	5.05	NA	11.69	NA	2.48
Ethyl Acrylate	NA	NA	NA	NA	NA	NA
Ethyl <i>tert</i> -Butyl Ether	115.71	NA	NA	115.71	NA	NA
Ethylbenzene	5.65	5.59	4.22	6.68	5.34	6.42
Hexachloro-1,3-butadiene	14.33	11.79	15.08	16.50	18.86	9.43
Methyl Ethyl Ketone	7.68	6.01	18.66	5.90	5.14	2.69
Methyl Isobutyl Ketone	29.04	11.68	52.26	58.91	4.75	17.59
Methyl Methacrylate	47.14	NA	NA	NA	47.14	NA
Methyl <i>tert</i> -Butyl Ether	67.83	NA	NA	132.30	NA	3.37
<i>n</i> -Octane	12.66	9.07	5.24	18.77	12.59	17.65
Propylene	4.65	3.93	3.92	5.52	3.35	6.52
Styrene	6.66	6.92	2.50	6.14	8.57	9.18
1,1,2,2-Tetrachloroethane	47.14	NA	47.14	47.14	NA	NA
Tetrachloroethylene	5.15	6.74	NA	9.17	0.42	4.29
Toluene	5.15	6.05	3.22	5.95	2.95	7.60
1,2,4-Trichlorobenzene	45.91	12.80	43.18	21.61	106.07	NA
1,1,1-Trichloroethane	7.28	8.18	NA	8.01	1.26	11.66
1,1,2-Trichloroethane	NA	NA	NA	NA	NA	NA
Trichloroethylene	22.99	20.20	31.43	14.14	23.57	25.59
Trichlorofluoromethane	3.23	3.59	2.68	4.05	2.65	3.19
Trichlorotrifluoroethane	3.80	3.96	2.48	5.00	3.68	3.90
1,2,4-Trimethylbenzene	10.99	13.78	23.83	8.39	4.00	4.94
1,3,5-Trimethylbenzene	5.75	5.77	2.62	8.66	NA	5.96
Vinyl chloride	18.38	22.13	9.43	NA	23.57	NA
<i>m,p</i> -Xylene	6.84	7.17	3.67	6.28	7.59	9.51

**Table 9-35. VOC Analytical Precision:
Coefficient of Variation for all Replicate Analyses, All Sites (continued)**

Compound	Average	Gulfport, MS (GPMS)	Stennis Airbase, MS (SAMS)	Pascagoula, MS (PGMS)	Tupelo, MS (TUMS)	Kenner, LA (KELA)
<i>o</i> -Xylene	5.34	5.48	1.40	6.94	5.30	7.60
Average	13.41	9.35	16.89	19.87	11.66	9.30

9.2.2 SNMOC Analytical Precision

Table 9-36 presents replicate analytical data for all duplicate SNMOC samples. The average concentration differences observed for replicate analyses of SNMOC ranged from 0.02 (*n*-nonane and *n*-octane) to 9.14 (TNMOC) ppbC. For most of the pollutants, the SNMOC precision was within the control limits of 15 percent. The overall average variability is 11.49 percent. The PGMS and TUMS sites did not collect any SNMOC samples.

**Table 9-36. SNMOC Analytical Precision:
146 Replicate Analyses for all Duplicate Samples**

Compound	Number of Observations	Average RPD for Replicate Analyses (%)	Average Concentration Difference for Replicate Analyses (ppbC)	Coefficient of Variation (%)
Acetylene	143	12.72	0.26	8.99
Benzene	129	10.24	0.12	7.24
1,3-Butadiene	58	21.30	0.04	15.06
<i>n</i> -Butane	146	3.36	0.18	2.37
<i>cis</i> -2-Butene	75	15.44	0.03	10.92
<i>trans</i> -2-Butene	63	21.07	0.04	14.90
Cyclohexane	130	13.08	0.04	9.25
Cyclopentane	129	11.23	0.05	7.94
Cyclopentene	11	21.04	0.04	14.88
<i>n</i> -Decane	90	25.85	0.07	18.28
1-Decene	NA	NA	NA	NA
<i>m</i> -Diethylbenzene	57	25.13	0.06	17.77
<i>p</i> -Diethylbenzene	102	15.76	0.09	11.14
2,2-Dimethylbutane	119	13.70	0.04	9.69
2,3-Dimethylbutane	126	8.95	0.03	6.33
2,3-Dimethylpentane	111	16.28	0.05	11.51
2,4-Dimethylpentane	101	15.51	0.03	10.97
<i>n</i> -Dodecane	39	34.28	0.10	24.24
1-Dodecene	14	29.77	0.10	21.05

**Table 9-36. SNMOC Analytical Precision:
146 Replicate Analyses for all Duplicate Samples (continued)**

Compound	Number of Observations	Average RPD for Replicate Analyses (%)	Average Concentration Difference for Replicate Analyses (ppbC)	Coefficient of Variation (%)
Ethane	139	24.54	1.00	17.36
Ethylbenzene	142	10.48	0.04	7.41
2-Ethyl-1-butene	NA	NA	NA	NA
Ethylene	122	30.83	0.42	21.80
<i>m</i> -Ethyltoluene	140	8.50	0.04	6.01
<i>o</i> -Ethyltoluene	85	21.90	0.05	15.49
<i>p</i> -Ethyltoluene	115	11.93	0.03	8.44
<i>n</i> -Heptane	145	7.71	0.03	5.45
1-Heptene	90	21.88	0.04	15.47
<i>n</i> -Hexane	146	6.63	0.40	4.68
1-Hexene	93	19.32	0.04	13.66
<i>cis</i> -2-Hexene	NA	NA	NA	NA
<i>trans</i> -2-Hexene	14	27.07	0.04	19.14
Isobutane	146	3.44	0.09	2.43
Isobutene/1-Butene	143	6.45	0.04	4.56
Isopentane	138	3.76	0.18	2.66
Isoprene	123	11.17	0.06	7.90
Isopropylbenzene	37	35.01	0.05	24.75
2-Methyl-1-butene	78	21.89	0.05	15.48
2-Methyl-2-butene	78	14.82	0.04	10.48
3-Methyl-1-butene	15	21.17	0.03	14.97
Methylcyclohexane	131	11.28	0.04	7.97
Methylcyclopentane	142	6.06	0.04	4.29
2-Methylheptane	90	17.73	0.04	12.54
3-Methylheptane	75	17.94	0.03	12.68
2-Methylhexane	107	13.05	0.04	9.23
3-Methylhexane	138	10.94	0.08	7.74
3-Methylpentane	144	11.55	0.09	8.17
2-Methylpentane	146	8.22	0.12	5.81
4-Methyl-1-pentene	2	40.39	0.14	28.56
2-Methyl-1-pentene	25	23.47	0.04	16.60
<i>n</i> -Nonane	121	10.09	0.02	7.13
1-Nonene	74	22.52	0.04	15.93
<i>n</i> -Octane	142	8.45	0.02	5.97
1-Octene	44	20.82	0.04	14.72
<i>n</i> -Pentane	146	5.93	0.16	4.19
1-Pentene	101	14.96	0.04	10.58
<i>cis</i> -2-Pentene	64	25.97	0.04	18.36
<i>trans</i> -2-Pentene	95	15.60	0.04	11.03
<i>a</i> -Pinene	146	7.21	0.13	5.10
<i>b</i> -Pinene	24	5.87	0.06	4.15
Propane	146	3.02	0.21	2.14
<i>n</i> -Propylbenzene	73	25.05	0.05	17.71
Propylene	146	5.53	0.06	3.91

**Table 9-36. SNMOC Analytical Precision:
146 Replicate Analyses for all Duplicate Samples (continued)**

Compound	Number of Observations	Average RPD for Replicate Analyses (%)	Average Concentration Difference for Replicate Analyses (ppbC)	Coefficient of Variation (%)
Propyne	NA	NA	NA	NA
Styrene	138	12.48	0.06	8.82
TNMOC (Speciated)	146	5.64	4.01	3.99
TNMOC (w/unknowns)	146	7.23	9.14	5.11
Toluene	146	5.39	0.15	3.81
<i>n</i> -Tridecane	8	8.85	0.03	6.26
1-Tridecene	NA	NA	NA	NA
1,2,3-Trimethylbenzene	69	33.22	0.11	23.49
1,2,4-Trimethylbenzene	123	18.43	0.09	13.03
1,3,5-Trimethylbenzene	93	19.35	0.04	13.68
2,2,3-Trimethylpentane	40	42.11	0.11	29.77
2,2,4-Trimethylpentane	136	8.65	0.05	6.12
2,3,4-Trimethylpentane	102	17.83	0.04	12.61
<i>n</i> -Undecane	55	14.30	0.05	10.11
1-Undecene	11	49.03	0.10	34.67
<i>m</i> -Xylene/ <i>p</i> -Xylene	146	7.91	0.07	5.59
<i>o</i> -Xylene	142	13.63	0.06	9.64

Table 9-37 presents results from SNMOC replicate analyses for all of the duplicate GPMS samples. These results show low to high level variability, ranging from 1.68 percent (propane) to 35.16 percent (1-dodecene). The overall average variability is 11.00 percent. Table 9-38 shows the SNMOC results for the replicate analyses of duplicate samples at SAMS. The range of variability is 1.35 percent (propane) to 68.64 percent (1-undecene), with an average variability of 13.22 percent. Table 9-39 presents results from SNMOC replicate analyses for all of the duplicate KELA samples. The replicate results from duplicate samples show variation ranging from 2.83 percent (*n*-butane) to 34.79 percent (*n*-dodecane). The overall variability is 9.66 percent. Each site's analytical precision is within the 15 percent control limit.

**Table 9-37. SNMOC Analytical Precision:
56 Replicate Analyses for Duplicate Samples for GPMS**

Compound	Number of Observations	Average RPD for Replicate Analyses (%)	Average Concentration Difference for Replicate Analyses (ppbC)	Coefficient of Variation (%)
Acetylene	55	16.44	0.47	11.62
Benzene	39	15.37	0.21	10.87
1,3-Butadiene	35	17.45	0.04	12.34
<i>n</i> -Butane	56	3.63	0.33	2.57
<i>cis</i> -2-Butene	42	11.62	0.04	8.22
<i>trans</i> -2-Butene	37	10.92	0.05	7.72
Cyclohexane	56	14.59	0.05	10.32
Cyclopentane	51	14.20	0.05	10.04
Cyclopentene	4	26.02	0.06	18.40
<i>n</i> -Decane	44	15.97	0.07	11.29
1-Decene	NA	NA	NA	NA
<i>m</i> -Diethylbenzene	23	26.85	0.05	18.98
<i>p</i> -Diethylbenzene	35	22.07	0.09	15.61
2,2-Dimethylbutane	54	13.38	0.05	9.46
2,3-Dimethylbutane	56	8.52	0.04	6.03
2,3-Dimethylpentane	52	11.03	0.04	7.80
2,4-Dimethylpentane	50	15.36	0.04	10.86
<i>n</i> -Dodecane	17	40.87	0.12	28.90
1-Dodecene	4	49.73	0.13	35.16
Ethane	55	22.15	1.31	15.66
Ethylbenzene	56	9.44	0.06	6.67
2-Ethyl-1-butene	NA	NA	NA	NA
Ethylene	48	33.89	0.84	23.96
<i>m</i> -Ethyltoluene	56	8.73	0.06	6.17
<i>o</i> -Ethyltoluene	43	12.49	0.04	8.83
<i>p</i> -Ethyltoluene	55	11.78	0.04	8.33
<i>n</i> -Heptane	56	7.26	0.04	5.13
1-Heptene	40	22.92	0.04	16.21
<i>n</i> -Hexane	56	5.56	0.07	3.93
1-Hexene	44	21.20	0.04	14.99
<i>cis</i> -2-Hexene	NA	NA	NA	NA
<i>trans</i> -2-Hexene	6	48.53	0.07	34.32
Isobutane	56	3.16	0.15	2.23
Isobutene/1-Butene	56	4.44	0.05	3.14
Isopentane	52	3.31	0.25	2.34
Isoprene	51	7.71	0.07	5.45
Isopropylbenzene	26	34.79	0.05	24.60
2-Methyl-1-butene	48	15.07	0.07	10.66
2-Methyl-2-butene	46	16.20	0.05	11.45
3-Methyl-1-butene	7	31.94	0.05	22.58
Methylcyclohexane	56	8.46	0.04	5.98
Methylcyclopentane	56	5.38	0.05	3.80
2-Methylheptane	49	11.05	0.03	7.82
3-Methylheptane	46	14.82	0.03	10.48

**Table 9-37. SNMOC Analytical Precision:
56 Replicate Analyses for Duplicate Samples for GPMS (continued)**

Compound	Number of Observations	Average RPD for Replicate Analyses (%)	Average Concentration Difference for Replicate Analyses (ppbC)	Coefficient of Variation (%)
2-Methylhexane	52	10.88	0.05	7.69
3-Methylhexane	55	12.65	0.13	8.95
3-Methylpentane	56	10.25	0.10	7.25
2-Methylpentane	56	7.25	0.16	5.12
4-Methyl-1-pentene	2	40.39	0.14	28.56
2-Methyl-1-pentene	20	17.89	0.02	12.65
<i>n</i> -Nonane	55	8.36	0.02	5.91
1-Nonene	35	28.71	0.05	20.30
<i>n</i> -Octane	56	8.20	0.03	5.80
1-Octene	23	18.65	0.04	13.19
<i>n</i> -Pentane	56	5.38	0.21	3.80
1-Pentene	51	13.54	0.04	9.58
<i>cis</i> -2-Pentene	36	23.89	0.05	16.89
<i>trans</i> -2-Pentene	51	8.63	0.03	6.11
<i>a</i> -Pinene	56	4.71	0.10	3.33
<i>b</i> -Pinene	24	5.87	0.06	4.15
Propane	56	2.38	0.21	1.68
<i>n</i> -Propylbenzene	41	25.29	0.05	17.89
Propylene	56	4.18	0.07	2.96
Propyne	NA	NA	NA	NA
Styrene	52	13.15	0.07	9.30
TNMOC (Speciated)	56	6.62	6.58	4.68
TNMOC (w/unknowns)	56	7.61	10.91	5.38
Toluene	56	4.80	0.24	3.39
<i>n</i> -Tridecane	NA	NA	NA	NA
1-Tridecene	NA	NA	NA	NA
1,2,3-Trimethylbenzene	41	27.74	0.10	19.62
1,2,4-Trimethylbenzene	52	14.67	0.10	10.37
1,3,5-Trimethylbenzene	50	12.30	0.04	8.70
2,2,3-Trimethylpentane	29	36.77	0.09	26.00
2,2,4-Trimethylpentane	56	9.73	0.08	6.88
2,3,4-Trimethylpentane	48	10.95	0.04	7.75
<i>n</i> -Undecane	27	16.70	0.07	11.81
1-Undecene	4	15.68	0.02	11.09
<i>m</i> -Xylene/ <i>p</i> -Xylene	56	8.37	0.10	5.92
<i>o</i> -Xylene	56	14.88	0.09	10.52

**Table 9-38. SNMOC Analytical Precision:
52 Replicate Analyses for Duplicate Samples for SAMS**

Compound	Number of Observations	Average RPD for Replicate Analyses (%)	Average Concentration Difference for Replicate Analyses (ppbC)	Coefficient of Variation (%)
Acetylene	50	10.35	0.13	7.32
Benzene	52	7.30	0.06	5.16
1,3-Butadiene	13	37.24	0.06	26.33
<i>n</i> -Butane	52	2.44	0.06	1.72
<i>cis</i> -2-Butene	7	17.72	0.02	12.53
<i>trans</i> -2-Butene	4	20.10	0.04	14.21
Cyclohexane	36	14.24	0.03	10.07
Cyclopentane	40	9.98	0.02	7.06
Cyclopentene	NA	NA	NA	NA
<i>n</i> -Decane	13	33.40	0.08	23.62
1-Decene	NA	NA	NA	NA
<i>m</i> -Diethylbenzene	12	36.34	0.07	25.70
<i>p</i> -Diethylbenzene	45	16.40	0.08	11.60
2,2-Dimethylbutane	30	15.87	0.03	11.22
2,3-Dimethylbutane	32	9.34	0.02	6.61
2,3-Dimethylpentane	21	24.07	0.04	17.02
2,4-Dimethylpentane	15	16.58	0.02	11.73
<i>n</i> -Dodecane	2	12.75	0.03	9.01
1-Dodecene	NA	NA	NA	NA
Ethane	47	36.10	0.95	25.53
Ethylbenzene	48	13.45	0.03	9.51
2-Ethyl-1-butene	NA	NA	NA	NA
Ethylene	38	34.40	0.21	24.32
<i>m</i> -Ethyltoluene	46	9.27	0.03	6.55
<i>o</i> -Ethyltoluene	17	37.45	0.07	26.48
<i>p</i> -Ethyltoluene	22	14.46	0.02	10.23
<i>n</i> -Heptane	51	9.99	0.02	7.06
1-Heptene	22	30.57	0.05	21.62
<i>n</i> -Hexane	52	6.36	0.03	4.50
1-Hexene	17	21.83	0.04	15.43
<i>cis</i> -2-Hexene	NA	NA	NA	NA
<i>trans</i> -2-Hexene	NA	NA	NA	NA
Isobutane	52	2.50	0.03	1.77
Isobutene/1-Butene	51	10.10	0.04	7.14
Isopentane	48	2.34	0.05	1.65
Isoprene	39	14.39	0.04	10.17
Isopropylbenzene	5	27.76	0.04	19.63
2-Methyl-1-butene	2	34.35	0.05	24.29
2-Methyl-2-butene	5	16.47	0.03	11.65
3-Methyl-1-butene	NA	NA	NA	NA
Methylcyclohexane	37	10.47	0.02	7.40
Methylcyclopentane	48	7.01	0.01	4.95
2-Methylheptane	11	22.41	0.05	15.84
3-Methylheptane	4	25.85	0.03	18.28

**Table 9-38. SNMOC Analytical Precision:
52 Replicate Analyses for Duplicate Samples for SAMS (continued)**

Compound	Number of Observations	Average RPD for Replicate Analyses (%)	Average Concentration Difference for Replicate Analyses (ppbC)	Coefficient of Variation (%)
2-Methylhexane	17	18.73	0.03	13.24
3-Methylhexane	45	14.63	0.04	10.34
3-Methylpentane	50	14.54	0.04	10.28
2-Methylpentane	52	8.26	0.05	5.84
4-Methyl-1-pentene	NA	NA	NA	NA
2-Methyl-1-pentene	NA	NA	NA	NA
<i>n</i> -Nonane	28	15.69	0.02	11.10
1-Nonene	18	21.11	0.04	14.93
<i>n</i> -Octane	48	10.22	0.01	7.23
1-Octene	14	28.13	0.06	19.89
<i>n</i> -Pentane	52	6.07	0.09	4.29
1-Pentene	20	22.23	0.04	15.72
<i>cis</i> -2-Pentene	5	33.16	0.04	23.45
<i>trans</i> -2-Pentene	12	17.69	0.02	12.51
<i>a</i> -Pinene	52	5.37	0.18	3.80
<i>b</i> -Pinene	NA	NA	NA	NA
Propane	52	1.91	0.11	1.35
<i>n</i> -Propylbenzene	6	30.36	0.05	21.47
Propylene	52	6.59	0.04	4.66
Propyne	NA	NA	NA	NA
Styrene	50	6.29	0.07	4.45
TNMOC (Speciated)	52	5.45	1.78	3.85
TNMOC (w/unknowns)	52	7.55	5.02	5.34
Toluene	52	5.70	0.05	4.03
<i>n</i> -Tridecane	NA	NA	NA	NA
1-Tridecene	NA	NA	NA	NA
1,2,3-Trimethylbenzene	7	51.28	0.16	36.26
1,2,4-Trimethylbenzene	33	27.21	0.05	19.24
1,3,5-Trimethylbenzene	5	31.40	0.04	22.20
2,2,3-Trimethylpentane	NA	NA	NA	NA
2,2,4-Trimethylpentane	42	9.24	0.02	6.53
2,3,4-Trimethylpentane	20	29.96	0.04	21.19
<i>n</i> -Undecane	3	10.13	0.03	7.16
1-Undecene	2	97.08	0.20	68.64
<i>m</i> -Xylene/ <i>p</i> -Xylene	52	8.95	0.04	6.33
<i>o</i> -Xylene	48	16.94	0.05	11.98

**Table 9-39. SNMOC Analytical Precision:
38 Replicate Analyses for Duplicate Samples for KELA**

Compound	Number of Observations	Average RPD for Replicate Analyses (%)	Average Concentration Difference for Replicate Analyses (ppbC)	Coefficient of Variation (%)
Acetylene	38	11.37	0.18	8.04
Benzene	38	8.06	0.09	5.70
1,3-Butadiene	10	9.21	0.02	6.51
<i>n</i> -Butane	38	4.01	0.16	2.83
<i>cis</i> -2-Butene	26	16.97	0.03	12.00
<i>trans</i> -2-Butene	22	32.20	0.04	22.77
Cyclohexane	38	10.40	0.04	7.36
Cyclopentane	38	9.52	0.09	6.73
Cyclopentene	7	16.06	0.03	11.36
<i>n</i> -Decane	33	28.18	0.07	19.93
1-Decene	NA	NA	NA	NA
<i>m</i> -Diethylbenzene	22	12.21	0.05	8.63
<i>p</i> -Diethylbenzene	22	8.80	0.11	6.22
2,2-Dimethylbutane	35	11.85	0.03	8.38
2,3-Dimethylbutane	38	8.99	0.04	6.36
2,3-Dimethylpentane	38	13.73	0.05	9.71
2,4-Dimethylpentane	36	14.58	0.04	10.31
<i>n</i> -Dodecane	20	49.21	0.13	34.79
1-Dodecene	10	9.82	0.06	6.95
Ethane	37	15.38	0.75	10.88
Ethylbenzene	38	8.57	0.04	6.06
2-Ethyl-1-butene	NA	NA	NA	NA
Ethylene	36	24.21	0.22	17.12
<i>m</i> -Ethyltoluene	38	7.50	0.03	5.30
<i>o</i> -Ethyltoluene	25	15.76	0.04	11.14
<i>p</i> -Ethyltoluene	38	9.56	0.02	6.76
<i>n</i> -Heptane	38	5.89	0.04	4.16
1-Heptene	28	12.15	0.03	8.59
<i>n</i> -Hexane	38	7.95	1.09	5.62
1-Hexene	32	14.92	0.03	10.55
<i>cis</i> -2-Hexene	NA	NA	NA	NA
<i>trans</i> -2-Hexene	8	5.61	0.01	3.97
Isobutane	38	4.67	0.09	3.30
Isobutene/1-Butene	36	4.81	0.03	3.40
Isopentane	38	5.62	0.23	3.98
Isoprene	33	11.42	0.08	8.07
Isopropylbenzene	6	42.46	0.05	30.03
2-Methyl-1-butene	28	16.25	0.04	11.49
2-Methyl-2-butene	27	11.78	0.04	8.33
3-Methyl-1-butene	8	10.40	0.02	7.35
Methylcyclohexane	38	14.91	0.06	10.54
Methylcyclopentane	38	5.79	0.05	4.10
2-Methylheptane	30	19.73	0.05	13.95
3-Methylheptane	25	13.15	0.03	9.30

**Table 9-39. SNMOC Analytical Precision:
38 Replicate Analyses for Duplicate Samples for KELA (continued)**

Compound	Number of Observations	Average RPD for Replicate Analyses (%)	Average Concentration Difference for Replicate Analyses (ppbC)	Coefficient of Variation (%)
2-Methylhexane	38	9.53	0.03	6.74
3-Methylhexane	38	5.55	0.06	3.92
3-Methylpentane	38	9.86	0.14	6.97
2-Methylpentane	38	9.15	0.17	6.47
4-Methyl-1-pentene	NA	NA	NA	NA
2-Methyl-1-pentene	5	29.05	0.05	20.54
<i>n</i> -Nonane	38	6.21	0.02	4.39
1-Nonene	21	17.74	0.03	12.55
<i>n</i> -Octane	38	6.93	0.02	4.90
1-Octene	7	15.68	0.03	11.09
<i>n</i> -Pentane	38	6.34	0.19	4.48
1-Pentene	30	9.12	0.03	6.45
<i>cis</i> -2-Pentene	23	20.86	0.04	14.75
<i>trans</i> -2-Pentene	32	20.48	0.06	14.48
<i>a</i> -Pinene	38	11.55	0.11	8.17
<i>b</i> -Pinene	NA	NA	NA	NA
Propane	38	4.79	0.30	3.38
<i>n</i> -Propylbenzene	26	19.49	0.04	13.78
Propylene	38	5.82	0.07	4.11
Propyne	NA	NA	NA	NA
Styrene	36	17.99	0.05	12.72
TNMOC (Speciated)	38	4.87	3.67	3.44
TNMOC (w/unknowns)	38	6.53	11.47	4.62
Toluene	38	5.68	0.15	4.01
<i>n</i> -Tridecane	8	8.85	0.03	6.26
1-Tridecene	NA	NA	NA	NA
1,2,3-Trimethylbenzene	21	20.62	0.06	14.58
1,2,4-Trimethylbenzene	38	13.40	0.11	9.48
1,3,5-Trimethylbenzene	38	14.35	0.03	10.14
2,2,3-Trimethylpentane	11	47.45	0.13	33.55
2,2,4-Trimethylpentane	38	6.98	0.06	4.94
2,3,4-Trimethylpentane	34	12.57	0.04	8.88
<i>n</i> -Undecane	25	16.08	0.04	11.37
1-Undecene	5	34.33	0.07	24.28
<i>m</i> -Xylene/ <i>p</i> -Xylene	38	6.39	0.08	4.52
<i>o</i> -Xylene	38	9.08	0.04	6.42

Table 9-40 presents the average CV per pollutant, per pollutant per site, the average CV per site, and the overall average CV. The average site CV ranged from 9.66 percent at KELA to 13.22 percent at SAMS, with an overall program average CV of 11.29 percent. This overall average variability of 11.29 percent is within the 15 percent CV control limit.

**Table 9-40. SNMOC Analytical Precision:
Coefficient of Variation for all Replicate Analyses, All Sites**

Compound	Average	Gulfport, MS (GPMS)	Stennis Airbase, MS (SAMS)	Kenner, LA (KELA)
Acetylene	8.99	11.62	7.32	8.04
Benzene	7.24	10.87	5.16	5.70
1,3-Butadiene	15.06	12.34	26.33	6.51
<i>n</i> -Butane	2.37	2.57	1.72	2.83
<i>cis</i> -2-Butene	10.92	8.22	12.53	12.00
<i>trans</i> -2-Butene	14.90	7.72	14.21	22.77
Cyclohexane	9.25	10.32	10.07	7.36
Cyclopentane	7.94	10.04	7.06	6.73
Cyclopentene	14.88	18.40	NA	11.36
<i>n</i> -Decane	18.28	11.29	23.62	19.93
1-Decene	NA	NA	NA	NA
<i>m</i> -Diethylbenzene	17.77	18.98	25.70	8.63
<i>p</i> -Diethylbenzene	11.14	15.61	11.60	6.22
2,2-Dimethylbutane	9.69	9.46	11.22	8.38
2,3-Dimethylbutane	6.33	6.03	6.61	6.36
2,3-Dimethylpentane	11.51	7.80	17.02	9.71
2,4-Dimethylpentane	10.97	10.86	11.73	10.31
<i>n</i> -Dodecane	24.24	28.90	9.01	34.79
1-Dodecene	21.05	35.16	NA	6.95
Ethane	17.36	15.66	25.53	10.88
Ethylbenzene	7.41	6.67	9.51	6.06
2-Ethyl-1-butene	NA	NA	NA	NA
Ethylene	21.80	23.96	24.32	17.12
<i>m</i> -Ethyltoluene	6.01	6.17	6.55	5.30
<i>o</i> -Ethyltoluene	15.49	8.83	26.48	11.14
<i>p</i> -Ethyltoluene	8.44	8.33	10.23	6.76
<i>n</i> -Heptane	5.45	5.13	7.06	4.16
1-Heptene	15.47	16.21	21.62	8.59
<i>n</i> -Hexane	4.68	3.93	4.50	5.62
1-Hexene	13.66	14.99	15.43	10.55
<i>cis</i> -2-Hexene	NA	NA	NA	NA
<i>trans</i> -2-Hexene	19.14	34.32	NA	3.97
Isobutane	2.43	2.23	1.77	3.30
Isobutene/1-Butene	4.56	3.14	7.14	3.40
Isopentane	2.66	2.34	1.65	3.98
Isoprene	7.90	5.45	10.17	8.07
Isopropylbenzene	24.75	24.60	19.63	30.03
2-Methylheptane	12.54	7.82	15.84	13.95
3-Methylheptane	12.68	10.48	18.28	9.30
2-Methylhexane	9.23	7.69	13.24	6.74
3-Methylhexane	7.74	8.95	10.34	3.92
3-Methylpentane	8.17	7.25	10.28	6.97

**Table 9-40. SNMOC Analytical Precision:
Coefficient of Variation for all Replicate Analyses, All Sites (continued)**

Compound	Average	Gulfport, MS (GPMS)	Stennis Airbase, MS (SAMS)	Kenner, LA (KELA)
2-Methylpentane	5.81	5.12	5.84	6.47
4-Methyl-1-pentene	28.56	28.56	NA	NA
2-Methyl-1-pentene	16.60	12.65	NA	20.54
<i>n</i> -Nonane	7.13	5.91	11.10	4.39
1-Nonene	15.93	20.30	14.93	12.55
<i>n</i> -Octane	5.97	5.80	7.23	4.90
1-Octene	14.72	13.19	19.89	11.09
<i>n</i> -Pentane	4.19	3.80	4.29	4.48
1-Pentene	10.58	9.58	15.72	6.45
<i>cis</i> -2-Pentene	18.36	16.89	23.45	14.75
<i>trans</i> -2-Pentene	11.03	6.11	12.51	14.48
<i>a</i> -Pinene	5.10	3.33	3.80	8.17
<i>b</i> -Pinene	4.15	4.15	NA	NA
Propane	2.14	1.68	1.35	3.38
<i>n</i> -Propylbenzene	17.71	17.89	21.47	13.78
Propylene	3.91	2.96	4.66	4.11
Propyne	NA	NA	NA	NA
Styrene	8.82	9.30	4.45	12.72
TNMOC (Speciated)	3.99	4.68	3.85	3.44
TNMOC (w/unknowns)	5.11	5.38	5.34	4.62
Toluene	3.81	3.39	4.03	4.01
<i>n</i> -Tridecane	6.26	NA	NA	6.26
1-Tridecene	NA	NA	NA	NA
1,2,3-Trimethylbenzene	23.49	19.62	36.26	14.58
1,2,4-Trimethylbenzene	13.03	10.37	19.24	9.48
1,3,5-Trimethylbenzene	13.68	8.70	22.20	10.14
2,2,3-Trimethylpentane	29.77	26.00	NA	33.55
2,2,4-Trimethylpentane	6.12	6.88	6.53	4.94
2,3,4-Trimethylpentane	12.61	7.75	21.19	8.88
<i>n</i> -Undecane	10.11	11.81	7.16	11.37
1-Undecene	34.67	11.09	68.64	24.28
<i>m</i> -Xylene/ <i>p</i> -Xylene	5.59	5.92	6.33	4.52
<i>o</i> -Xylene	9.64	10.52	11.98	6.42
Average	<i>11.29</i>	<i>11.00</i>	<i>13.22</i>	<i>9.66</i>

9.2.3 Carbonyl Compound Analytical Precision

In Table 9-41, the replicate analyses for duplicate samples show that laboratory carbonyl analysis precision is within the control limits of 15 percent CV. The overall average variability is 2.05 percent. In terms of average concentration difference, the carbonyl precision ranges from

0.001 ppbv for benzaldehyde, crotonaldehyde, isovaleraldehyde, valeraldehyde, and hexaldehyde to 0.02 ppbv for formaldehyde.

**Table 9-41. Carbonyl Analytical Precision:
242 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 (%)
Acetaldehyde	242	0.69	0.01	0.49
Acetone	242	0.72	0.01	0.51
Benzaldehyde	242	3.60	0.001	2.54
Butyraldehyde	242	2.90	0.002	2.05
Crotonaldehyde	238	2.80	0.001	1.98
2,5-Dimethylbenzaldehyde	2	6.45	0.002	4.56
Formaldehyde	242	0.74	0.02	0.52
Hexaldehyde	242	3.51	0.001	2.48
Isovaleraldehyde	108	2.83	0.001	2.00
Propionaldehyde	242	2.12	0.002	1.50
Tolualdehydes	234	5.23	0.003	3.70
Valeraldehyde	242	3.22	0.001	2.28

Table 9-42 shows the results from replicate analyses of duplicate carbonyl samples taken at GPMS. The replicate results from duplicate samples show variation for the pollutants ranging from 0.59 percent (acetone) to 3.12 percent (isovaleraldehyde). The overall average variability is 1.66 percent.

**Table 9-42. Carbonyl Analytical Precision:
56 Replicate Analyses for Duplicate Samples for GPMS**

Compound	Number of Observations	Average RPD for Replicate Analyses (%)	Average Concentration Difference for Replicate Analyses (ppbv)	Coefficient of Variation (%)
Acetaldehyde	56	0.85	0.01	0.60
Acetone	56	0.84	0.01	0.59
Benzaldehyde	56	2.67	0.001	1.88
Butyraldehyde	56	2.45	0.003	1.73
Crotonaldehyde	56	2.57	0.002	1.82

**Table 9-42. Carbonyl Analytical Precision:
56 Replicate Analyses for Duplicate Samples for GPMS (continued)**

Compound	Number of Observations	Average RPD for Replicate Analyses (%)	Average Concentration Difference for Replicate Analyses (ppbv)	Coefficient of Variation (%)
2,5-Dimethylbenzaldehyde	NA	NA	NA	NA
Formaldehyde	56	1.04	0.03	0.73
Hexaldehyde	56	3.14	0.001	2.22
Isovaleraldehyde	26	4.42	0.001	3.12
Propionaldehyde	56	1.53	0.002	1.08
Tolualdehydes	56	2.78	0.001	1.96
Valeraldehyde	56	3.57	0.001	2.52

Table 9-43 shows the results from replicate analyses of duplicate carbonyl samples taken at SAMS. The replicate results from duplicate samples show variation for the pollutants ranging from 0.45 percent (formaldehyde) to 10.33 percent (tolualdehydes). The overall average variability is 2.87 percent.

**Table 9-43. Carbonyl Analytical Precision:
50 Replicate Analyses for Duplicate Samples for SAMS**

Compound	Number of Observations	Average RPD for Replicate Analyses (%)	Average Concentration Difference for Replicate Analyses (ppbv)	Coefficient of Variation (%)
Acetaldehyde	50	1.10	0.01	0.78
Acetone	50	1.09	0.01	0.77
Benzaldehyde	50	5.26	0.001	3.72
Butyraldehyde	50	2.66	0.002	1.88
Crotonaldehyde	50	2.85	0.001	2.02
2,5-Dimethylbenzaldehyde	2	6.45	0.002	4.56
Formaldehyde	50	0.64	0.01	0.45
Hexaldehyde	50	6.19	0.003	4.38
Isovaleraldehyde	22	1.34	0.000	0.95
Propionaldehyde	50	2.43	0.002	1.72
Tolualdehydes	50	14.61	0.01	10.33
Valeraldehyde	50	4.18	0.001	2.95

Table 9-44 shows the results from replicate analyses of duplicate carbonyl samples taken at PGMS. The replicate results from duplicate samples show variation for the pollutants ranging from 0.36 percent (acetaldehyde and acetone) to 2.87 percent (valeraldehyde). The overall average variability is 1.69 percent.

**Table 9-44. Carbonyl Analytical Precision:
44 Replicate Analyses for Duplicate Samples for PGMS**

Compound	Number of Observations	Average RPD for Replicate Analyses (%)	Average Concentration Difference for Replicate Analyses (ppbv)	Coefficient of Variation (%)
Acetaldehyde	44	0.51	0.01	0.36
Acetone	44	0.51	0.004	0.36
Benzaldehyde	44	3.53	0.002	2.50
Butyraldehyde	44	2.69	0.004	1.90
Crotonaldehyde	44	3.73	0.001	2.64
2,5-Dimethylbenzaldehyde	NA	NA	NA	NA
Formaldehyde	44	0.63	0.03	0.44
Hexaldehyde	44	2.22	0.002	1.57
Isovaleraldehyde	20	3.64	0.001	2.57
Propionaldehyde	44	1.49	0.002	1.05
Tolualdehydes	44	3.36	0.002	2.38
Valeraldehyde	44	4.06	0.003	2.87

Table 9-45 shows the results from replicate analyses of duplicate carbonyl samples at TUMS. The precision from replicate results from duplicate samples ranges from 0.21 percent (acetaldehyde) to 3.33 percent (butyraldehyde). The overall average variability was 1.49 percent.

**Table 9-45. Carbonyl Analytical Precision:
32 Replicate Analyses for Duplicate Samples for TUMS**

Compound	Number of Observations	Average RPD for Replicate Analyses (%)	Average Concentration Difference for Replicate Analyses (ppbv)	Coefficient of Variation (%)
Acetaldehyde	32	0.29	0.003	0.21
Acetone	32	0.35	0.003	0.25

**Table 9-45. Carbonyl Analytical Precision:
32 Replicate Analyses for Duplicate Samples for TUMS (continued)**

Compound	Number of Observations	Average RPD for Replicate Analyses (%)	Average Concentration Difference for Replicate Analyses (ppbv)	Coefficient of Variation (%)
Benzaldehyde	32	3.61	0.001	2.55
Butyraldehyde	32	4.71	0.002	3.33
Crotonaldehyde	28	1.84	0.001	1.30
2,5-Dimethylbenzaldehyde	NA	NA	NA	NA
Formaldehyde	32	0.56	0.01	0.40
Hexaldehyde	32	3.39	0.000	2.40
Isovaleraldehyde	NA	NA	NA	NA
Propionaldehyde	32	3.51	0.001	2.48
Tolualdehydes	28	1.76	0.001	1.25
Valeraldehyde	32	1.04	0.000	0.74

Table 9-46 presents results from carbonyl replicate analyses for the duplicate samples at KELA. Variability ranges from 0.48 percent (acetaldehyde) to 2.56 percent (tolualdehydes), with an average variability of 1.50 percent.

**Table 9-46. Carbonyl Analytical Precision:
60 Replicate Analyses for Duplicate Samples for KELA**

Compound	Number of Observations	Average RPD for Replicate Analyses (%)	Average Concentration Difference for Replicate Analyses (ppbv)	Coefficient of Variation (%)
Acetaldehyde	60	0.68	0.01	0.48
Acetone	60	0.80	0.005	0.56
Benzaldehyde	60	2.94	0.001	2.08
Butyraldehyde	60	2.02	0.002	1.43
Crotonaldehyde	60	3.00	0.001	2.12
2,5-Dimethylbenzaldehyde	NA	NA	NA	NA
Formaldehyde	60	0.84	0.02	0.59
Hexaldehyde	60	2.60	0.001	1.84
Isovaleraldehyde	40	1.93	0.000	1.36
Propionaldehyde	60	1.66	0.002	1.17
Tolualdehydes	56	3.62	0.001	2.56
Valeraldehyde	60	3.27	0.001	2.31

Table 9-47 presents the average CV per pollutant, per pollutant per site, the average CV per site, and the overall CV. The replicate results from duplicate samples show low-level variability among the sites, ranging from 1.49 percent at TUMS to 2.87 percent at SAMS. The average CV is 1.84 percent, which is well with in the requested 15 percent overall CV per site.

**Table 9-47. Carbonyl Analytical Precision:
Coefficient of Variation for all Replicate Analyses, All Sites**

Compound	Average	Gulfport, MS (GPMIS)	(SAMS)	(PGMS)	(TUMS)	(KELA)
Acetaldehyde	0.49	0.60	0.78	0.36	0.21	0.48
Acetone	0.51	0.59	0.77	0.36	0.25	0.56
Benzaldehyde	2.54	1.88	3.72	2.50	2.55	2.08
Butyraldehyde	2.05	1.73	1.88	1.90	3.33	1.43
Crotonaldehyde	1.98	1.82	2.02	2.64	1.30	2.12
2,5-Dimethylbenzaldehyde	4.56	NA	4.56	NA	NA	NA
Formaldehyde	0.52	0.73	0.45	0.44	0.40	0.59
Hexaldehyde	2.48	2.22	4.38	1.57	2.40	1.84
Isovaleraldehyde	2.00	3.12	0.95	2.57	NA	1.36
Propionaldehyde	1.50	1.08	1.72	1.05	2.48	1.17
Tolualdehydes	3.70	1.96	10.33	2.38	1.25	2.56
Valeraldehyde	2.28	2.52	2.95	2.87	0.74	2.31
Average	<i>1.84</i>	<i>1.66</i>	<i>2.87</i>	<i>1.69</i>	<i>1.49</i>	<i>1.50</i>

Overall, the replicate analyses of both duplicate and collocated samples of VOC, SNMOC, and carbonyl compounds suggest the analytical precision level is within the data quality objectives and guidelines in the Compendium Methods.

9.3 Bias

Laboratories typically evaluate their bias (or accuracy) by analyzing external audit samples and comparing the measured concentrations obtained to the known concentrations of the audit samples. Bias, or accuracy, indicates the extent to which experimental measurements represent their corresponding “true” or “actual” values.

The accuracy of the post-Katrina 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 post-Katrina monitoring effort have been approved by EPA for accurately measuring ambient levels of various compounds—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 post-Katrina monitoring data accurately represent ambient air quality.

9.3.1 Proficiency Test Studies

Laboratories participating in NATTS are provided with proficiency test (PT) audit samples on a quarterly basis for VOC, carbonyls, and metals. These PT samples can be used as a measure of analytical accuracy.

Tables 9-48 through 9-50 present results from the 2005-2006 NATTS PT audit samples for carbonyls, metals, and VOC, respectively. The acceptable percent difference from the true values is ± 25 percent, and the values exceeding this criteria are bolded in the tables. While there are a few values outside the limits, there are no compounds that are consistently over for multiple audits. Percent differences exceeding 25 percent are bolded.

Table 9-48. Carbonyl NATTS Audit Samples – Percent Difference from True Value

Pollutant	Oct., 2005	Nov., 2005	June, 2006
Formaldehyde	-5.3	2.5	-9.7
Acetaldehyde	3.7	9.2	0.8
Acetone	2.6	3.7	Not included
Crotonaldehyde	Not included	Not included	-31.0

Table 9-49. Metals NATTS Audit Samples – Percent Difference from True Value

Pollutant	Sept., 2005	Nov., 2005	April, 2006	July, 2006	Sept., 2006
Arsenic	9.5	15.5	17.3	10.8	2.3
Beryllium	22.8	13.6	15.5	16.0	1.4
Cadmium	12.2	5.1	19.9	3.8	-1.9
Chromium	4.4	10.2	Not included	Not included	Not included
Lead	13.0	5.1	13.0	5.5	-6.6
Manganese	0.6	2.3	20.8	-10.0	-9.5
Nickel	2.0	21.8	14.8	-3.0	-8.2

Table 9-50. VOC NATTS Audit Samples – Percent Difference from True Value

Pollutant	Nov., 2005 (1)	Nov., 2005 (2)	May, 2006	Aug., 2006
Acrolein	Not included	22.3	Not included	Not included
Benzene	Not included	Not included	-14.1	-1.4
1,3-Butadiene	Not included	27.8	8.5	3.9
Carbon Tetrachloride	37.7	Not included	-4.0	-18.8
Chloroform	23.7	Not included	14.6	0.0
1,2-Dibromoethane	Not included	Not included	7.6	22.5
1,2-Dichloroethane	25.6	Not included	27.1	9.8
Dichloromethane	Not included	Not included	14.1	10.5
1,2-Dichloropropane	Not included	Not included	-12.8	-1.4
<i>cis</i> -1,3-Dichloropropene	9.1	Not included	3.5	13.3
<i>trans</i> -1,3-Dichloropropene	16.4	Not included	1.4	17.9
1,1,2,2-Tetrachloroethane	Not included	Not included	-5.6	11.4
Tetrachloroethylene	10.4	Not included	-13.3	-9.7
Trichloroethylene	14.0	Not included	13.9	50.6
Vinyl Chloride	12.0	Not included	-5.1	-11.4

10.0 Conclusions

As indicated throughout this report, post-Katrina monitoring data offer a wealth of information for evaluating trends and patterns in air quality. The post-Katrina monitoring network consisted of 30 monitoring sites sampling across Mississippi and Louisiana during three distinct phases: Phase 1 sampling occurred every day; Phase 2 sampling occurred every three days; and Phase 3 sampling occurred every six days. The following discussion summarizes the primary conclusions of this report.

10.1 Method-Specific Conclusions

- *VOC*. Measurements of VOC pollutants were made at five comprehensive sites: KELA, GPMS, PGMS, SAMS, and TUMS. By mass concentration, the top five daily averages, with at least a 75 percent detection rate were: acetonitrile (18.31 ppbv); acetylene (0.72 ppbv); chloromethane (0.72 ppbv); dichlorodifluoromethane (0.62 ppbv); and toluene (0.62 ppbv).
- *SNMOC*. Measurements of SNMOC pollutants were made at three comprehensive sites: KELA, GPMS, and SAMS. By mass concentration, the top five daily averages, with at least a 75 percent detection rate were: propane (8.62 ppbC); ethane (6.94 ppbC); isopentane (6.41 ppbC); *n*-butane (5.99 ppbC); and *n*-pentane (5.78 ppbC).
- *Carbonyl Compounds*. Measurements of carbonyl pollutants were made at five comprehensive sites: KELA, GPMS, PGMS, SAMS, and TUMS. By mass concentration, the top three daily averages, with at least a 75 percent detection rate were: formaldehyde (6.04 ppbv); acetaldehyde (1.23 ppbv); and acetone (0.75 ppbv).
- *Metals (PM₁₀)*. Measurements of PM₁₀ metals were made at all monitoring sites, with the exception of TUMS. By mass concentration, the top five daily averages, with at least a 75 percent detection rate were: sodium (812.21 ng/m³); potassium (155.53 ng/m³); manganese (5.88 ng/m³); lead (5.26 ng/m³); and chromium (2.43 ng/m³).
- *Metals (PM_{2.5})*. Measurements of PM_{2.5} metals were made at most monitoring sites, with the exception of TUMS, PCMS, BYMS, and WAMS. By mass concentration, the top five daily averages, with at least a 75 percent detection rate were: sodium (144.93 ng/m³); potassium (99.59 ng/m³); lead (4.32 ng/m³); nickel (1.89 ng/m³); and manganese (1.54 ng/m³).

- *SVOC (TO-13A PUF)*. Measurements of SVOC pollutants using TO-13A PUF were made at two comprehensive sites: GPMS, and SAMS. By mass concentration, the top five daily averages, with at least a 75 percent detection rate were: naphthalene (29.89 ng/m³); phenanthrene (5.60 ng/m³); fluorene (3.36 ng/m³); acenaphthene (3.20 ng/m³); and fluoranthene (1.38 ng/m³).
- *SVOC (TO-13A XAD-2[®])*. Measurements of SVOC pollutants using TO-13A XAD-2[®] were made at three comprehensive sites: KELA, GPMS, and SAMS. By mass concentration, the top five daily averages, with at least a 75 percent detection rate were: naphthalene (54.63 ng/m³); 2-methylnaphthalene (31.17 ng/m³); 1,4-dichlorobenzene (19.70 ng/m³); acetophenone (15.13 ng/m³); and phenanthrene (11.97 ng/m³).
- *Hexavalent Chromium*. Measurements of hexavalent chromium were made at three comprehensive sites: KELA, GPMS, and SAMS. Of the 167 total detects, the concentrations ranged from 0.0014 ng/m³ to 0.367 ng/m³. The overall daily average across the three sites was 0.027 ng/m³.

10.2 Post-Katrina Network Conclusions

- *Ambient air concentration data sets met data quality objectives for completeness*. Completeness, or the number of valid samples collected compared to the number expected from a 1-, 3-, or 6-day sampling schedule, measures the reliability of the sampling and analytical equipment as well as the efficiency of the program. Typically, a completeness of 85-100 percent is desired for a complete data set. All 48 datasets (by site and method) were greater than the data quality objective of 85 percent completeness. Six data sets achieved 100 percent completeness.
- *Total number of samples for Post-Katrina pollutants*. Over 155,000 measurements of air toxics were made. Phase 1 sampling accounted for over 88,700 measurements, while Phase 2 and 3 sampling accounted for over 66,300 measurements.
- *Ambient air concentrations of air toxics*. Approximately 50 percent of the measured concentrations were less than 1 µg/m³. Less than 1 percent of the concentrations were greater than 5 µg/m³.
- *Detects*. Detection of a post-Katrina pollutant is subject to the analytical methods used and the limitations of the instruments. Method detection limits are the lowest concentration an instrument can reliably quantify with a certain level of confidence. For the post-Katrina monitoring sites, 92 pollutants (VOC = 11 pollutants; SNMOC = 4 pollutants; SVOC = 77 pollutants) were not detected at any of the participating sites.

10.3 Data Quality

The precision of the sampling methods and concentration measurements was analyzed for the post-Katrina monitoring network using RPD, CV, and average concentration difference calculations based on duplicate and collocated samples. The overall precision was well within data quality objectives and Monitoring Method guidelines. Sampling and analytical method accuracy is assured by using proven methods and following strict quality control and quality assurance guidelines.

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Environmental Protection
Agency

Office of Air Quality Planning and Standards
Air Quality Strategies and Standards Division
Research Triangle Park, NC

Publication No. EPA-454/R-08-004
March 2008
