

Southwest Indianapolis Air Toxics Study

Final Technical Report

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Abstract

Between October 2006 and March 2010, the Indiana Department of Environmental Management (IDEM), the United States Environmental Protection Agency (U.S. EPA), the City of Indianapolis, and a diverse group of stakeholders, conducted a study of air toxics, including some listed as Hazardous Air Pollutants (HAP), in the southwestern quadrant of Indianapolis, Indiana. This area was identified by the U.S. EPA National Air Toxics Assessment (NATA) in 1996 and 1999 to be an area of potential concern for cancer risk from air toxics.

IDEM used both ambient air monitoring and community scale dispersion modeling to develop a more refined analysis of air toxic impacts in the area. IDEM solicited updated emissions information from industry in the area and used the Regional Air Impact Modeling Initiative (RAIMI) computer model to estimate emissions and their impact on the Study Area from 415 industrial sources, 15 roadways, and the Indianapolis International Airport.

The Southwest Indianapolis Air Toxics Study results indicate that inhalation cancer and non-cancer risk from potential air toxics exposure in the Southwest Indianapolis area is comparable to other cities around Indiana and the United States.

The largest contributors to air toxics in the study area are background and mobile sources (i.e., cars, trucks, etc.). Industrial source contributions to air toxics and health risks were small when compared to the risk from background and mobile sources. However, IDEM has identified a few industrial sources in the area that, while not significant sources of risk, could warrant further evaluation for potential pollution prevention opportunities and the agency has initiated communication with these entities.

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Acronym List

ACGIH	American Conference of Governmental and Industrial Hygienists
AMP	Air Modeling Pre-processor
AQS	Air Quality System
ATSDR	Agency for Toxic Substances and Disease Registry
BAMF	Bioaccumulation and Metabolism Factors
BDL	Below Detection Limits
Cal/EPA	California Environmental Protection Agency
CAP	Community Advisory Panel
CARB	California Air Resource Board
DCL	Default Closure Limits
DEM	Digital Elevation Model
DNPH	2,4-Dinitrophenyl Hydrazine
DNR	Department of Natural Resources
EF	Emission Factor
ERG	Eastern Research Group
EPC	Exposure Point Concentration
ETD	Emissions Tracking Database
ETS/CEM	Emissions Tracking System / Continuous Emissions Monitoring
g/sec	Grams per second
GC-FID	Gas Chromatograph- Flame Ionization Detector
GC/MS	Gas Chromatograph / Mass spectrometer
GINI	Greater Indianapolis Neighborhood Initiative
GIS	Global Information System
GLI	Great Lakes Initiative
HAP	Hazardous Air Pollutant
HEAST	Health Effects Assessment Summary Tables
HI	Hazard Index
HPLC	High Performance Liquid Chromatography
HQ	Hazard Quotient
IARC	International Agency for Research on Cancer

ICP-MS	Inductively Coupled Plasma Mass Spectrometry
IDEM	Indiana Department of Environmental Management
IEI	Indiana Environmental Institute
IKE	Improving Kids Environment
INDOT	Indiana Department of Transportation
IPS	Indianapolis Public School
IRIS	Integrated Risk Information System
ISCST3	Industrial Source Complex Short Term Version 3
IUPUI	Indiana University Purdue University at Indianapolis
IUR	Inhalation Unit Risk
km	Kilometer
KM	Kaplan-Meier Product Limit Estimate
LULC	Land use / Land cover
MACT	Maximum Achievable Control Technology
McANA	Marion County Alliance of Neighborhood Associations
MCHD	Marion County Health Department
MDL	Method Detection Limit
MEI	Maximum Exposed Individual
MPRM	Meteorological Processor for Regulatory Models
MRL	Minimal Risk Level
NAICS	North American Industry Classifications System
NAIT	Node Attribute Index Table
NATA	National Air Toxics Assessment
NATE	Neighborhoods and the Environment
ND	Non-Detect
NEI	National Emissions Inventory
NESHAP	National Emissions Standards for Hazardous Air Pollutants
ng/ml	Nanogram per milliliter
NIC	Neighborhood Involvement Committee
OAMTDC	Office of Air Management Toxics Data Capture
OAQPS	Office of Air Quality Planning and Standards

OES	City of Indianapolis Office of Environmental Services
OLQ	Office of Land Quality
OPPTA	Office of Pollution Prevention Technical Assistance
OSHA	Occupational Safety and Health Administration
PAG	Public Advisory Group
PAH	Polycyclic Aromatic Hydrocarbon
PCE	Pollution Control Efficiency
PE	Potential Emissions
PIT	Primary Inventory Table
PM _{2.5}	Particulate Matter less than 2.5 microns
PM ₁₀	Particulate Matter less than 10 microns
ppb	parts per billion
ppm	parts per million
PT	Potential Throughput
RAIMI	Regional Air Impact Modeling Initiative
RAPIDS	Regional Air Pollutant Inventory Development System
REL	Reference Exposure Limit
RfC	Reference Concentration
RfDi	Inhalation Reference Dose
RfDo	Oral Reference Dose
RIVM	National Institute for Public Health and the Environment (Dutch)
SE	Standard Error
SI	International System of Units (French for <i>Syste'me International</i>)
SIATS	Southwest Indianapolis Air Toxics Study
SOP	Standard Operating Procedure
TAG	Technical Advisory Group
TNMOC	Total Non Methane Organic Compound
TLV	Threshold Limit Value
tpy	tons per year
TRI	Toxics Release Inventory
TWSA	Toxicity Weighted Screening Analysis

UCL	Upper Confidence Limit of the Mean
ug/m ³	Micrograms per meter cubed
URF	Unit Risk Factor
U. S.	United States
U.S. EPA	United States Environmental Protection Agency
USGS	United States Geographic Survey
VIP	Voluntary Idling Program
VLEF	Vapor Loss Emission Factor
VMT	Vehicle Miles Traveled
VOC	Volatile Organic Compounds
WIDC	West Indianapolis Development Corporation
WINC	West Indianapolis Neighborhood Committee

1.0 Executive Summary

Between October 2006 and March 2010, the Indiana Department of Environmental Management (IDEM), the United States Environmental Protection Agency (U.S. EPA), the City of Indianapolis, and a diverse group of stakeholders, conducted a study of air toxics, including some listed as Hazardous Air Pollutants (HAP), in the southwestern quadrant of Indianapolis, Indiana. This area was identified by the U.S. EPA National Air Toxics Assessment (NATA) in 1996 and 1999 to be an area of potential concern for cancer risk from air toxics.

IDEM used both ambient air monitoring and community scale dispersion modeling to develop a more refined analysis of air toxic impacts in the area. IDEM solicited updated emissions information from industry in the area and used the Regional Air Impact Modeling Initiative (RAIMI) computer model to estimate emissions and their impact on the Study Area from 415 industrial sources, 15 roadways, and the Indianapolis International Airport.

The Southwest Indianapolis Air Toxics Study (the Study) results indicate that inhalation cancer and non-cancer risk from potential air toxics exposure in the Southwest Indianapolis area is comparable to other cities around Indiana and the United States.

The largest contributors to ambient air toxics in the study area are background and mobile sources (i.e., cars, trucks, etc.). Industrial source contributions to ambient air toxics and health risks were small when compared to the risk from background and mobile sources. However, IDEM has identified a few industrial sources in the area that, while not significant sources of risk, could warrant further evaluation for potential pollution prevention opportunities and the agency has initiated communication with these entities.

Methods

For the first component of the project, IDEM conducted ambient air monitoring in two neighborhoods for 24 months. The monitored concentrations were evaluated and compared to toxicological endpoints for each pollutant, other Indiana ToxWatch monitoring sites, other metropolitan areas, as well as U.S. EPA's National Air Toxics Assessment (NATA) modeled estimates. Volatile Organic Chemicals (VOC), carbonyls, and PM₁₀ metals were monitored in the area once every six days over a two year period at two monitoring locations. Chromium VI was monitored once every six days over a one year period at one monitoring location.

For the second component, IDEM worked with local industries in order to develop a refined emissions inventory of sources likely to be contributing to the identified air toxic concentrations.

In the third component, IDEM conducted detailed air dispersion modeling in order to estimate air toxic concentrations in the area. Modeling results were calculated for an area

bound on the north by 10th Street, the east by Bluff Road, the south by Hanna Avenue, and the west by High School Road and I-465.

IDEM used the Regional Air Impact Modeling Initiative (RAIMI) model for the study. RAIMI evaluates the risk of potential health impacts resulting from exposure to multiple pollutants emitted from multiple sources throughout a community. U. S. EPA Region 6 designed RAIMI to perform community scale multiple source risk analysis. RAIMI processes meteorological and terrain data, creates a node/receptor grid for each source. The model estimates concentrations, cancer risks and non-cancer health effects from each source and pollutant for each node.

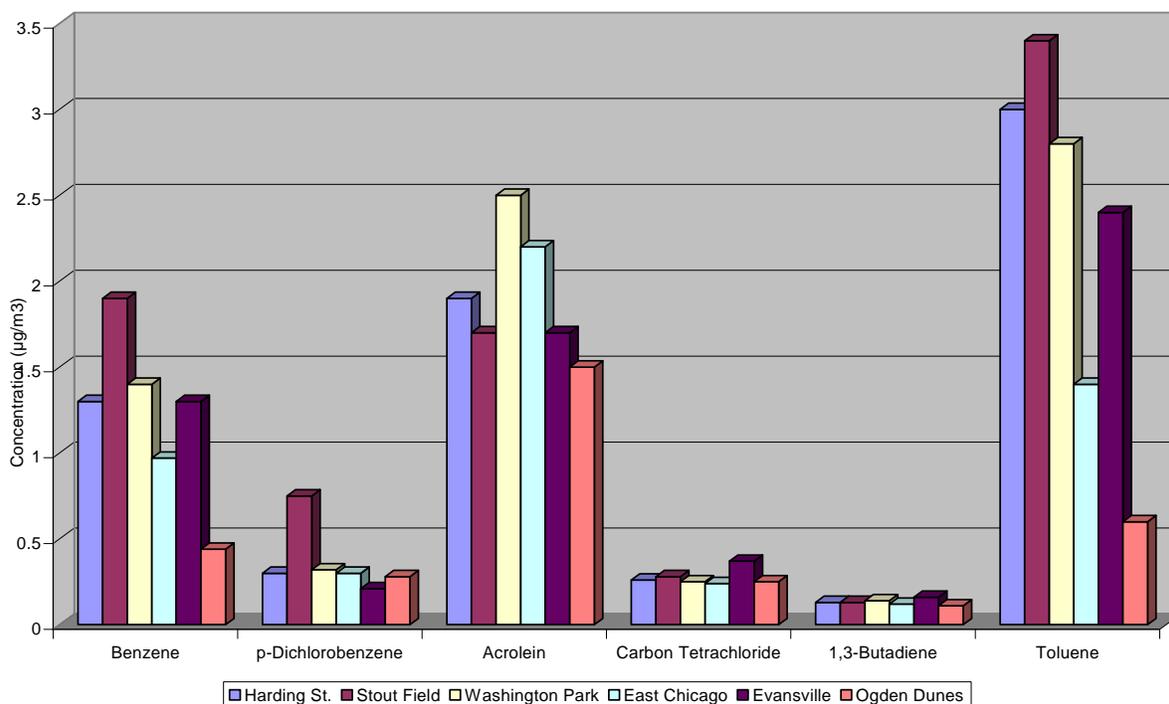
IDEM used the U.S. EPA's Air Toxics Risk Assessment Reference Library Volumes 1, 2, and 3 as a basis for its risk characterization methodology. In addition, these methods were reviewed by the Technical Advisory Group (TAG) during the course of the Study.

Particulate matter, also referred to as PM_{2.5} and PM₁₀, was not evaluated as part of this study. The goal of the Study was to gather more information regarding air toxics in an area where little information was available. The existing understanding and monitoring of particulate matter is more extensive and has clearly defined health protective concentrations and monitoring requirements by U.S. EPA. Currently, Marion County is designated as not meeting the federal health standard set by U.S. EPA for particulate matter. However, current monitoring results demonstrate that Marion County meets federal particulate matter health standards. IDEM has petitioned U.S. EPA to redesignate the area from nonattainment to attainment.

Results

IDEM monitored for a total of 85 air pollutants. A total of 78 pollutants were detected on at least one occasion by the Harding Street monitor and 73 pollutants were detected on at least one occasion at the Stout Field monitor.

Concentrations of most pollutants in Southwest Indianapolis were similar to concentrations observed in other areas of Indiana and nationally. Figure E-1 shows the concentrations of key pollutants throughout Indiana.

Figure E-1 – Average Concentrations of Key Pollutants throughout Indiana (2006-2008)

* $\mu\text{g}/\text{m}^3$ -micrograms per cubic meter

As seen in Figure E-1, p-dichlorobenzene, was observed to be higher at the Stout Field location and was higher than most other monitoring locations in the state as well. For most of the year, p-dichlorobenzene was monitored at low concentrations. However, during a two-month period p-dichlorobenzene concentrations were higher than normal at Stout Field. This episode of higher concentrations coincided with other pollutants also at levels not normally observed. Given that these readings were only observed at one monitoring location for a brief period of time, IDEM views this as a brief, localized event. IDEM investigated possible sources of p-dichlorobenzene for that episode but was unable to identify the likely source. An event like this was not observed again during the two year monitoring period and concentrations during the event were not at levels of concern to IDEM.

Benzene and toluene air monitoring concentrations were also slightly higher at the Stout Field monitor than in other areas of the state. Benzene and toluene can be emitted from a number of different industries, but are most commonly associated with mobile sources, such as cars and trucks. There is significant vehicular traffic throughout the area which would likely contribute to the higher benzene concentrations. Modeling of emissions sources in the area confirms the conclusion that benzene and toluene concentrations would be higher at the Stout Field monitor.

From the Harding St. and Stout Field monitors, IDEM evaluated the highest 24-hour air concentrations for 22 pollutants and compared that value to available toxicological values for acute (short-term) health effects. Specifically, the monitored pollutant concentrations were compared to 24-hour Minimal Risk Levels (MRLs) listed in the Agency for Toxic Substances and Disease Registry (ATSDR) and Occupational Safety and Health Administration (OSHA) 1-hour Reference Exposure Levels (RELs). No pollutant concentrations were observed over the short-term health-protective level for a 24-hour period. Table E-1 summarizes the Harding Street and Stout Field data evaluation.

Table E-1 – Short Term Exposure Comparison

Pollutant	Harding St.	Stout Field	MRL	REL
	Maximum ($\mu\text{g}/\text{m}^3$)*	Maximum ($\mu\text{g}/\text{m}^3$)*	24-hr risk ($\mu\text{g}/\text{m}^3$)*	1-hr ($\mu\text{g}/\text{m}^3$)*
Acrolein	5.6	6.3	6.9	2.5
Benzene	7.8	19	29	1300
Benzyl Chloride	-	-	-	240
Bromodichloromethane	-	-	2100	14000
Carbon Disulfide	0.44	3.3	-	6200
Carbon Tetrachloride	0.69	0.63	-	1900
Chloroform	0.88	0.3	490	150
p-Dichlorobenzene	1.5	5.4	12000	-
1,4-Dioxane	2.5	1.4	7200	3000
Methyl Tert-Butyl Ether (MTBE)	0.32	-	7200	-
Styrene	0.85	3.4	-	21000
Tetrachloroethene (PCE)	3.5	1.8	1400	20000
Toluene	25	38	3800	37000
1,1,1-Trichloroethane	-	-	11000	68000
Trichloroethene (TCE)	0.48	1.7	11000	-
Vinyl Chloride	-	-	1300	180000
o-Xylene	4.1	4.3	8700	22000
m+p-Xylenes	12	13	8700	22000
Arsenic	0.0042	0.0064	-	0.19
Mercury	0.0029	0.0017	-	1.8
Nickel	0.0026	0.025	-	6
Formaldehyde	13	8.4	49	94

* $\mu\text{g}/\text{m}^3$ -micrograms per cubic meter

Table E-2 contains the chronic (lifetime) cancer risk estimates for all the pollutants monitored during the study for both monitoring locations.

Table E-2 – Detection Rates and Lifetime Cancer Risk Estimates

Pollutant	CAS#	Harding Street			Stout Field		
		Detect Rate	95% KM(t) UCL [†]	Risk Estimate	Detect Rate	95% KM(t) UCL [†]	Risk Estimate
			µg/m ³			µg/m ³	
Benzene	71-43-2	100%	1.3	1.0x10 ⁻⁵	96%	1.9	1.5x10 ⁻⁵
1,3-Butadiene	106-99-0	22%	0.13	3.9x10 ⁻⁶	24%	0.13	3.9x10 ⁻⁶
Carbon Tetrachloride	56-23-5	35%	0.28	4.2x10 ⁻⁶	38%	0.28	4.2x10 ⁻⁶
Chloroform	67-66-3	24%	0.17	3.9x10 ⁻⁶	8%	0.15	3.4x10 ⁻⁶
p-Dichlorobenzene	106-46-7	45%	0.34	3.7x10 ⁻⁶	58%	0.75	8.2x10 ⁻⁶
Dichloromethane	75-09-2	74%	0.52	2.4x10 ⁻⁷	56%	0.24	1.1x10 ⁻⁷
1,4-Dioxane	123-91-1	13%	0.25	1.9x10 ⁻⁶	12%	0.21	1.6x10 ⁻⁶
Ethylbenzene	100-41-4	74%	0.41	1.0x10 ⁻⁶	69%	0.48	1.2x10 ⁻⁶
Tetrachloroethene (PCE)	127-18-4	40%	0.39	2.3x10 ⁻⁶	35%	0.33	1.9x10 ⁻⁶
Trichloroethene (TCE)	79-01-6	8%	0.17	3.4x10 ⁻⁷	15%	0.23	4.6x10 ⁻⁷
Acetaldehyde	75-07-0	100%	2.2	4.8x10 ⁻⁶	100%	2.3	5.0x10 ⁻⁶
Formaldehyde	50-00-0	100%	5.3	2.9x10 ⁻⁸	100%	3.6	2.0x10 ⁻⁸
Arsenic	N/A	100%	0.0011	4.8x10 ⁻⁶	100%	0.0012	5.3x10 ⁻⁶
Beryllium	N/A	8%	0.0000079	1.9x10 ⁻⁸	4%	0.0000092	2.2x10 ⁻⁸
Cadmium	N/A	100%	0.00028	5.1x10 ⁻⁷	100%	0.00026	4.6x10 ⁻⁷
Lead	N/A	100%	0.0062	7.5x10 ⁻⁸	100%	0.0094	1.1x10 ⁻⁷
Nickel	N/A	100%	0.001	2.4x10 ⁻⁷	100%	0.0020	4.7x10 ⁻⁷
Chromium VI	N/A	77%	0.000041	4.9x10 ⁻⁷			
Cumulative Cancer Risk				4.2x10⁻⁵			5.1x10⁻⁵

*µg/m³-micrograms per cubic meter

† 95% KM(t) UCL – 95% Kaplan-Meier student's-t upper confidence level of the mean

All pollutants were monitored at concentrations below the one hundred in a million (1.0×10^{-4}) risk level. Only benzene was monitored above the ten-in-a-million (1.0×10^{-5}) risk level. Risk estimates for 1,3-butadiene, acetaldehyde, arsenic, carbon tetrachloride, chloroform, p-dichlorobenzene, 1,4-dioxane, ethylbenzene, and tetrachloroethene were over one-in-a-million (1.0×10^{-6}) risk. Cancer risk refers to the likelihood that an individual will contract cancer as a result of exposure to the pollutant continuously over a 70 year lifetime. Benzene can come from many sources, most commonly cars and trucks. The benzene concentrations observed at the Southwest Indianapolis monitors are consistent with the concentrations observed at monitors in other cities around Indiana and the United States.

Table E-3 lists the detection rates and Hazard Quotients (HQs) of pollutants for which IDEM has toxicological information. A hazard quotient is a ratio of the observed concentration to the health protective concentration. Therefore, if the observed concentration is above the health protective concentration the hazard quotient will be above 1.0 and additional investigation may be necessary.

Table E-3 – Detection Rates and Hazard Quotients

Pollutant	CAS#	Harding Street			Stout Field		
		Detect Rate	95% KM(t) UCL	Hazard Quotient	Detect Rate	95% KM(t) UCL	Hazard Quotient

			$\mu\text{g}/\text{m}^3$			$\mu\text{g}/\text{m}^3$	
Acetone	67-64-1	98%	11	0.00035	97%	270	0.0087
Acrolein	107-02-8	93%	1.9	95	85%	1.7	85
Benzene	71-43-2	100%	1.3	0.043	96%	1.9	0.063
Bromomethane	74-83-9	22%	0.32	0.064	24%	0.31	0.062
1,3-Butadiene	106-99-0	22%	0.13	0.065	24%	0.13	0.065
Carbon Disulfide	75-15-0	12%	0.17	0.00024	63%	0.56	0.00080
Carbon Tetrachloride	56-23-5	35%	0.28	0.0015	38%	0.28	0.0015
Chloroform	67-66-3	24%	0.17	0.0017	8%	0.15	0.0015
Chloromethane	74-87-3	98%	1.0	0.011	96%	0.94	0.010
Cyclohexane	100-82-7	48%	0.20	0.000033	45%	0.19	0.000032
p-Dichlorobenzene	106-46-7	45%	0.34	0.00042	58%	0.75	0.00094
Dichlorodifluoromethane (F-12)	75-71-8	99%	2.8	0.0019	96%	2.6	0.0017
Dichloromethane	75-09-2	74%	0.52	0.00052	56%	0.24	0.00024
1,4-Dioxane	123-91-1	13%	0.25	0.000069	12%	0.21	0.000058
Ethanol	64-17-5	82%	51	0.00051	82%	35	0.00035
Ethyl Acetate	141-78-6	68%	0.50	0.0014	60%	0.37	0.0010
Ethylbenzene	100-41-4	74%	0.41	0.00041	70%	0.48	0.00048
Heptane	142-82-5	91%	0.57	0.0013	83%	0.64	0.0015
Hexane	110-54-3	100%	0.92	0.0013	96%	0.75	0.0011
Isopropanol	67-63-0	78%	2.0	0.00029	75%	1.6	0.00023
Methyl Ethyl Ketone (MEK)	78-93-3	99%	2.5	0.00050	95%	4.0	0.0008
Methyl Isobutyl Ketone (MIBK)	108-10-1	57%	0.34	0.00011	60%	0.43	0.00014
Methyl n-Butyl Ketone (MBK)	591-78-6	68%	1.3	0.023	70%	0.76	0.013
Propene	115-07-1	97%	1.0	0.00033	92%	1.1	0.00037
Styrene	100-42-5	14%	0.17	0.00017	60%	0.46	0.00046
Tetrachloroethene (PCE)	127-18-4	40%	0.39	0.0014	35%	0.33	0.0012
Tetrahydrofuran (THF)	109-99-9	27%	0.22	0.0063	28%	0.25	0.0071
Toluene	108-88-3	100%	2.9	0.00058	96%	3.4	0.00068
Trichloroethene (TCE)	79-01-6	8%	0.17	0.00028	15%	0.23	0.00038
Trichlorofluoromethane (F-11)	75-69-4	100%	1.4	0.0020	96%	1.4	0.0020
1,3,5-Trimethylbenzene	108-67-8	14%	0.29	0.048	22%	0.30	0.050
1,2,4-Trimethylbenzene	95-63-6	86%	0.67	0.096	84%	0.90	0.13
Vinyl Acetate	108-05-4	88%	5.3	0.026	86%	4.5	0.022
o-Xylene	95-47-6	82%	0.48	0.0048	77%	0.72	0.0072
m+p-Xylenes	106-42-3	92%	1.3	0.013	87%	1.8	0.018
Acetaldehyde	75-07-0	100%	2.19	0.24	100%	2.29	0.25
Formaldehyde	50-00-0	100%	5.28	0.54	100%	3.55	0.36
Arsenic	N/A	100%	0.00111	0.037	100%	0.00124	0.041
Beryllium	N/A	8%	0.0000079	0.00039	4%	0.0000092	0.00046
Cadmium	N/A	100%	0.000285	0.014	100%	0.000259	0.013
Chromium	N/A	99%	0.00271	0.027	100%	0.00293	0.029
Cobalt	N/A	99%	0.00068	0.0068	99%	0.0014	0.014
Lead	N/A	100%	0.00623	0.042	100%	0.00939	0.063
Manganese	N/A	100%	0.00637	0.13	100%	0.00627	0.13
Mercury	N/A	64%	0.000119	0.00040	75%	0.00019	0.00063
Nickel	N/A	100%	0.001	0.011	100%	0.00196	0.022
Selenium	N/A	100%	0.00162	0.000081	100%	0.00182	0.000091

* $\mu\text{g}/\text{m}^3$ -micrograms per cubic meter

The only pollutant with a monitored HQ over 1.0 is acrolein. Acrolein concentrations were well above the health-protective benchmark at both monitoring locations. As such, IDEM has spent considerable time investigating this pollutant.

Acrolein is a common pollutant found in many urban areas. It is most commonly associated with the burning of organic materials and from motor vehicles. It can also be formed in the air when pollutants react with one another. Animal studies have demonstrated that breathing acrolein may cause irritation to the nasal cavity and can damage the lining of the lungs.

IDEM compared concentrations of acrolein to concentrations monitored in other areas of Indianapolis and to other cities. The results indicate that acrolein concentrations in Southwest Indianapolis are comparable to concentrations monitored in other urban areas of the state. Acrolein has recently become a national concern after U.S. EPA's School Air Toxics program monitored concentrations above the health protective level around many of the schools which it monitored. Current evidence indicates that new procedures may need to be developed in order to better quantify acrolein concentrations in monitoring data. Current methods appear to bias results high so actual acrolein concentrations are likely lower than those recorded. See U.S. EPA's website for more information about issues with acrolein. (<http://www.epa.gov/schoolair/>)

Modeling results indicate that mobile sources (cars, trucks) are a large contributor to the total risk posed by air toxics in the area comprising approximately thirty-eight percent (38%) of the total risk. Approximately half of the risk in the study area comes from background. Background includes sources such as lawn mowers, emissions from homes, and transport of pollutants from outside the Study Area.

Modeling showed concentrations of certain pollutants associated with mobile sources to be very high close to major roadways. Concentrations declined rapidly farther away from the center of the roadways. While there is no monitoring data from this Study taken in close proximity to the roads, the modeling results are consistent with other studies that examined the impact roadways have on air quality. Modeling results also indicate that concentrations decline rapidly away from the road and at approximately 225 feet are ninety-eight percent (98%) lower than concentrations on the road.

Next Steps

IDEM is actively pursuing many opportunities to encourage reduced emissions in the Study Area and across the state. Current efforts include:

- Promoting the Voluntary Idling Program (VIP),
- working on diesel retrofit opportunities, and
- working with industry in the area to find ways to reduce emissions of air toxics.

In addition to the efforts undertaken by IDEM, a new mobile source air toxics rule along with new emission regulations on new cars and trucks are expected to reduce impacts from mobile sources. These new federal standards combined with the replacement of older, less efficient cars with new cleaner more efficient cars is expected to reduce air toxics emissions from mobile sources by up to forty-five percent (45%) over the next fifteen years.

2.0 Sampling and Analytical Methods

2.1 Air Toxics Monitoring

2.1.1 Overview of Air Toxics Monitoring

The Southwest Indianapolis Air Toxics Study (the Study) consisted of two monitoring stations which operated from October 2006 to October 2008 that collected 24-hour integrated canister and cartridge samples of ambient air at six-day sampling intervals. Both of the following sites were approved by the Technical Advisory Group (TAG), Indiana's Department of Environmental Management (IDEM), and the Office of Environmental Services (OES) for the City of Indianapolis. The first site was located at 1321 South Harding Street in the Eli Lilly and Company parking lot ; the second site was located at Stout Field National Guard Armory, 1802 South Holt Road. The volatile organic compounds (VOCs), which included aliphatic, aromatic, polar, and halogenated hydrocarbons, from the canisters samples were analyzed by IDEM's Ambient Air Monitoring Air Toxics laboratory (IDEM's laboratory); whereas, the carbonyl compounds from cartridge samples, hexavalent chromium from pre-treated filters, and metal compounds from filters were collected by OES personnel but analyzed by Eastern Research Group (ERG).

2.1.2 Monitoring Locations

The two monitoring sites conformed to U. S. EPA's standards for ambient air monitoring locations as described in the Quality Assurance Handbook for Air Pollution Measurement Systems-Ambient Air Quality Monitoring Program Quality System Development, EPA-454/R-98-004. Both sites were strategically located based on an evaluation of U. S. EPA's 1996 and 1999 NATA, proximity to major sources for HAP emissions and neighborhoods where the general public lives and congregates.

2.1.3 Compounds Selected for Monitoring

Urban air typically contains hundreds of components, including volatile organic VOCs, metals, inorganic acids, and particulate matter. Because monitoring for every component of air pollution is prohibitively expensive, the Study focused on measuring ambient levels of 62 VOCs, 12 carbonyls, and 11 metals. These are the constituents monitored at U.S. EPA's National Air Toxics Trends Stations (NATTS) as they are expected to contribute most significantly to health risks from air pollution. Due to budgetary constraints hexavalent chromium was only monitored for one year at the Harding Street site.

2.1.4 Sampling Equipment

The Study's monitoring locations were equipped with the following monitors:

- PM₁₀ High Volume sampler (used to collect particulate matter ten microns or less on a quartz filter) for trace metals analysis.

- A Meriter automated programmable sampler was used to collect ambient air samples in a passivated stainless steel canister (SUMMA® polished) for volatile organic compounds (VOC) monitoring.
- An Atec-2 channel sampler was used to collect carbonyl compound samples using 2,4-dinitrophenylhydrazine (DNPH) cartridges. The dual channel sampler was used to allow for duplicate sample runs to be collected for quality control purposes.
- A hexavalent chromium sampler was provided by ERG to collect particulate matter on a filter coated with sodium bicarbonate. This monitoring was conducted at the Harding Street site only, and the sampling period was only one year.
- The Harding Street site monitored meteorological parameters.

2.1.5 Analytical Methods

Five U. S. EPA-approved methods were used to analyze samples:

- Compendium Method TO-15 was used to measure ambient air concentrations of the 62 volatile organic compounds in the canister samples;
- Compendium Method TO-12 was used to measure the total non-methane organic compound (TNMOC) concentration of ambient air (canister samples);
- Compendium Method TO-11A was used to measure ambient air concentrations of the 12 carbonyl compounds (DNPH cartridge samples);
- Compendium Method IO-3.5 was used to collect and analyze the ambient concentration of 11 trace metals (filter samples);
- Modified California Air Resource Board (CARB) Method and ERG's revised method was used to analyze ambient air concentrations of hexavalent chromium (specially coated filter samples).

The following discussion presents an overview of these sampling and analytical methods. For detailed descriptions of the methods, please see U. S. EPA's original documentation of the Compendium Methods (U. S. EPA 1999a).

2.1.6 VOC Monitoring

The ambient air samples for VOC analysis were collected in evacuated stainless steel canisters. IDEM's Laboratory provided the cleaned, certified, and evacuated sampling canisters for the OES site operators. These canisters were cleaned and certified using an internal standard operating procedure (SOP) developed by the staff of IDEM's laboratory (Appendix A). The OES staff was responsible for setting up sampling and collection of

the canisters on a six- day sampling schedule. Additional sampling was also scheduled to cover for missed or invalidated samples.

Each canister sample was initially checked to ensure a valid pressure range of 15-30 PSI before being entered into the Office of Air Monitoring Toxics Data Capture (OAMTDC) Oracle-based database. A valid canister sample would then undergo two consecutive analyses for VOC determination. The first analysis, U. S. EPA method TO-12, was to determine the total non methane organic compound (TNMOC) concentration of each sample by using a gas chromatograph with a direct flame ionization detector (GC-FID) interfaced with a pressure differential system. This information was used to determine the trapping volume for the highly sensitive gas chromatograph/mass spectrometer (GC/MS) analysis. The second analysis, U. S. EPA method TO-15, was to determine the concentration of the 62 VOCs in each sample using a GC/MS system equipped with a Tekmar Autocan pre-concentrator.

IDEM's laboratory's VOC list and annual method detection limits can be found in Table 2.3.1.

2.1.7 Carbonyl Monitoring

Carbonyl compound monitoring was conducted using U. S. EPA Compendium Method TO-11A. Samples for carbonyl analysis were collected by passing ambient air over silica gel cartridges coated with 2,4-dinitrophenylhydrazine (DNPH), a compound known to react selectively and irreversibly with many compounds of the aldehyde and ketone types. Carbonyl compounds are trapped in the sampling cartridge, while other compounds pass through the cartridge without reacting with the DNPH-coated matrix. The ERG laboratory supplied the DNPH-coated silica gel cartridges for monitoring. After the 24-hour sampling period, site operators shipped the cartridges to the ERG laboratory for analysis.

To quantify concentrations of carbonyl compounds in the sampled ambient air the cartridges were eluted with acetonitrile. The extract was concentrated and analyzed using high performance liquid chromatography equipment (HPLC) with an ultraviolet detector. Because butyraldehyde and isobutyraldehyde elute from the HPLC column at the same time, the carbonyl analytical method can report only the sum of the concentrations for these compounds.

2.1.8 Trace Metals Monitoring

Ambient air samples were collected according to 40 CFR Part 50, Appendix B-Reference Method for the Determination of Suspended Particulate Matter in the Atmosphere (High-Volume Method). Twenty-four hour PM-10 quartz filter samples were collected every six days at both sites for a trace metals analysis. The filters were shipped to the ERG laboratory for trace metals analysis. The ERG laboratory analyzed samples using compendium method IO-3.5 with inductively coupled plasma mass spectrometry (ICP-MS), which is applicable for the sub-nanogram per milliliter (ng/ml) determination of

metals in a wide variety of matrices. Samples were analyzed for eleven trace metals listed in Table 2.3.1.

2.1.9 Hexavalent Chromium Monitoring

ERG provided the sampling equipment for hexavalent chromium monitoring for the Harding Street site. ERG also supplied sodium bicarbonate-impregnated filters necessary for sampling. The samples were collected for a 24-hour period every sixth day. After sampling, the filters were removed from the sampling apparatus, sealed, and returned to the ERG laboratory in the coolers in which they were received for an analysis. Disposable polyethylene gloves were used by the field operators when handling the filters to reduce contamination levels. Additional details of the hexavalent chromium sampling and analysis procedures are presented in the California Air Resources Board Method 039 (CARB, 1993) and in ERG's SOP (ERG-MOR-063). Duplicate samples and field blanks were collected and analyzed at a rate of ten percent (10%) of the number of samples.

The annual method detection limits for ERG's laboratory analysis of chromium (VI) samples can be found in Table 2.3.1.

2.1.10 Meteorological Monitoring

Hourly meteorological data were collected from instruments mounted on a tower at the height of 10 meters at the Harding Street monitoring location. Wind speed and wind direction data were collected using an RM Young Wind Unit, Model 05305-AQ and Wind Tracker, Model 06201C. The outdoor temperature and relative humidity were collected with an, RM Young OT/RH Probe, Model 41372VF. A Weathertronics BP Sensor, Model 7105-A, collected barometric pressure readings.

2.1.11 Data Storage and Availability

All data collected during the Study are available through Air Quality System (AQS), U. S. EPA's national data repository. The meteorological data are also available on line at IDEM's website, <http://leads.idem.in.gov/idem/index2.html>. The VOC data are also archived in the Agency's network database.

2.2 Modeling and Emissions Methodology

2.2.1 Pre Emissions Inventory

One of the goals of the Southwest Indianapolis Air Toxics Study (the Study) was to expand on the National Air Toxics Assessment (NATA) and compile a more detailed and accurate emissions inventory. The 1999 NATA used the 1999 National Emissions Inventory (NEI) for its nationwide assessment. The NEI was compiled using data from:

- Emissions inventories compiled by state and local environmental agencies
- Databases related to U. S. EPA's Maximum Achievable Control Technology (MACT) programs to reduce emissions of Hazardous Air Pollutants (HAPs)
- Toxic Release Inventory (TRI) data
- For electric generating units, U.S. EPA's Emission Tracking System / Continuous Emissions Monitoring data (ETS/CEM) and Department of Energy fuel use data
- For onroad sources, the Federal Highway Administration's estimate of vehicle miles traveled and emission factors from U. S. EPA's *MOBILE* computer model
- For nonroad sources, U. S. EPA's *NONROAD* computer model
- Previous emissions inventories, if states do not submit current data

One of IDEM's goals in the Study was to create a refined emission inventory database in order to conduct a localized air quality modeling analysis using the Regional Air Impact Modeling Initiative (RAIMI). The first step IDEM used to create the database was to determine which HAPs and air toxics would be of most interest to the Study Area. IDEM used available data from the Toxic Release Inventory (TRI), the Great Lakes Initiative (GLI) inventory and the NEI to estimate the total air releases for the air toxics in the Southwest Indianapolis study area. Using the most recent, quality assured inventory for all three, IDEM used the totaled pollutant emissions to perform a toxicity weighted screening analysis (TWSA). The TWSA is referred to as hazard-based approach because it is intended to be entirely emissions- and toxicity-based, without considering dispersion, fate, receptor locations, and other exposure parameters. The TWSA allowed IDEM to see what pollutants in the area might be of concern.

To conduct a TWSA, the pollutant's emissions are multiplied by a toxicity factor, either a carcinogenic inhalation unit risk (IUR) or divided by a non-cancer reference concentration (RfC) to calculate a toxicity equivalent (see Equations 2.2.1 and 2.2.2). This calculation was performed for all pollutants. All the toxicity equivalents were then summed for a total equivalency number. To rank the pollutants, each pollutant's toxicity equivalent was divided by the total equivalency to derive a toxicity percentage for each pollutant. The toxicity percentage was then sorted in descending order, highest to lowest and the percentages are added to determine which pollutants rank in the top percentile. For the TWSA for the Study, it was determined that pollutants within the top ninety-nine percent (99%) percent of the total equivalency would be considered pollutants of interest. Pollutants that fell below that percentage would not be dismissed but would be further evaluated.

The formula for calculating the pollutants toxicity equivalent is:

Equation 2.2.1 – Toxicity Equivalent for Cancer

$TEC = PE \times IUR$	
Symbol	Description
TEC	Toxicity Equivalent for Cancer
PE	Pollutant Emissions (lbs)
IUR	Inhalation Unit Risk ($\mu\text{g}/\text{m}^3\text{-}^{-1}$)

Or:

Equation 2.2.2 – Toxicity Equivalent for Non-Cancer

$TENC = \frac{PE}{RfC}$	
Symbol	Description
TENC	Toxicity Equivalent for Non-Cancer
PE	Pollutant Emissions (lbs)
RfC	Reference Concentration (mg/m^3)

Since TRI is the main inventory database used for NATA, IDEM used the 2004 TRI data for the final TWSA. Tables 2.2.1 and 2.2.2 show the cancer and non-cancer TWSA.

Table 2.2.1 – Cancer Toxicity Weighted Screening Analysis using 2004 Toxic Release Inventory

Pollutant	2004 TRI	URF	Cancer Equivalent	Percent of Total	Cumulative Percentage
	lbs	($\mu\text{g}/\text{m}^3$) ⁻¹			
Chromium	1,729	1.2×10^{-2}	$2.1 \times 10^{+1}$	51%	51%
Arsenic	4,428	4.3×10^{-3}	$1.9 \times 10^{+1}$	47%	99%
Tetrachloroethene	21,831	1.5×10^{-5}	3.3×10^{-1}	0.80%	99%
Nickel	501	2.4×10^{-4}	1.2×10^{-1}	0.30%	100%
Benzene	5,966	7.8×10^{-6}	4.6×10^{-2}	0.10%	100%
Formaldehyde	2,150	1.3×10^{-5}	2.8×10^{-2}	0.10%	100%
Trichloroethene	13,674	2.0×10^{-6}	2.7×10^{-2}	0.10%	100%
Propylene Oxide	6,422	3.7×10^{-6}	2.4×10^{-2}	0.10%	100%
Acetaldehyde	1,190	2.2×10^{-6}	2.6×10^{-3}	0.0%	100%
Methylene Chloride	3,403	4.7×10^{-7}	1.6×10^{-3}	0.0%	100%
Total			4.0×10^1	100%	100%

Table 2.2.2 – Non-Cancer Toxicity Weighted Screening Analysis using 2004 Toxic Release Inventory

Pollutant	2004 TRI	RfC	Non-Cancer Equivalent	Percent of Total	Cumulative Percentage
	lbs	$\mu\text{g}/\text{m}^3$			
Copper	3,800	0.02	190,000	42%	42%
Arsenic	4,400	0.03	150,000	33%	75%
Hydrochloric Acid	610,000	20	30,000	6.8%	82%
Chromium	1,700	0.1	17,000	3.9%	86%

Table 2.2.2 – Non-Cancer Toxicity Weighted Screening Analysis using 2004 Toxic Release Inventory

Pollutant	2004 TRI	RfC	Non-Cancer Equivalent	Percent of Total	Cumulative Percentage
	lbs	$\mu\text{g}/\text{m}^3$			
Cobalt	1,300	0.1	13,000	2.8%	88%
Manganese	500	0.05	10,000	2.3%	91%
Pyridine	33,000	3.5	9,400	2.1%	93%
Hydrogen Fluoride	140,000	20	7,200	1.6%	94%
Sulfuric Acid	460,000	70	6,600	1.5%	96%
Nickel	500	0.2	2,500	0.60%	96%
Bromomethane	11,000	5	2,100	0.50%	97%
Mercury	190	0.09	2,100	0.50%	97%
Chlorine	360	0.2	1,800	0.40%	98%
Ammonia	150,000	100	1,500	0.30%	98%
Barium Compounds	680	0.5	1,400	0.30%	98%
Antimony	270	0.2	1,400	0.30%	99%
Zinc Compounds	1,000	0.9	1,100	0.30%	99%
Lead	1,200	1.5	770	0.20%	99%
Acetonitrile	43,000	60	710	0.20%	99%
Dimethylamine	1,300	2	660	0.10%	100%
Tetrachloroethene	22,000	35	620	0.10%	100%
Cyanide	800	3	270	0.10%	100%
Formaldehyde	2,200	9.8	220	0.0%	100%
Propylene Oxide	6,400	30	210	0.0%	100%
Triethylamine	1,400	7	200	0.0%	100%
Acetaldehyde	1,200	9	130	0.0%	100%
1,2,4-Trimethylbenzene	430	6	71	0.0%	100%
Xylenes (Mixed Isomers)	5,000	100	50	0.0%	100%
Toluene	20,000	400	49	0.0%	100%
Nitric Acid	1,700	40	42	0.0%	100%
Glycol Ethers (Misc.)	610	20	30	0.0%	100%
Trichloroethene	14,000	600	23	0.0%	100%
N-Hexane	4,500	200	23	0.0%	100%
Styrene	9,800	1000	10	0.0%	100%
Dimethylformamide, N,N-	70	30	2	0.0%	100%
Propylene	5,700	3000	2	0.0%	100%
Methanol	6,700	4000	2	0.0%	100%
Ethylene Glycol	470	400	1	0.0%	100%
Methylene Chloride	3,400	3000	1	0.0%	100%
Ethylbenzene	980	1000	1	0.0%	100%
Methyl Isobutyl Ketone	740	3000	0	0.0%	100%
		Total	450,000		

The TWSA was one component that helped determine the list of pollutants of interest. Detection limits for the monitoring methods were obtained and compared to a toxicity-based screening limit for each pollutant. If the detection limit was above the screening levels, the pollutant was added to the list of pollutants of interest.

Early monitoring results were also considered. Pollutants that were detected at concentrations greater than the screening levels were also added to the list of pollutants of interest.

Table 2.2.3 shows the list of pollutants of interest with the reason or reasons why the pollutants were included.

Table 2.2.3 – Pollutants of Interest

Pollutants	Reason for Interest
1,1,2,2-Tetrachloroethane	Insufficient screening level
1,1,2-Trichloroethane	Insufficient screening level
1,2-Dibromoethane	Insufficient screening level, monitored concentration
1,2-Dichloroethane	Insufficient screening level, monitored concentration
1,3-Butadiene	Insufficient screening level, monitored concentration
1,4-Dioxane	Monitored concentration
Acetaldehyde	Monitored concentration
Acetonitrile	Toxicity Weighted Screening Analysis
Acrolein	Monitored concentration, Toxicity Weighted Screening Analysis
Ammonia	Toxicity Weighted Screening Analysis
Arsenic	Toxicity Weighted Screening Analysis, monitored concentration
Barium	Toxicity Weighted Screening Analysis
Benzene	Insufficient screening level, monitored concentration
Benzo(a)pyrene	Toxicity Weighted Screening Analysis
Benzo(g,h,i)perylene	Toxicity Weighted Screening Analysis
Benzyl Chloride	Insufficient screening level
Beryllium	Toxicity Weighted Screening Analysis
Bis(2-Ethylhexyl)Phthalate	Toxicity Weighted Screening Analysis
Bromodichloromethane	Insufficient screening level
Bromomethane	Toxicity Weighted Screening Analysis
Cadmium	Toxicity Weighted Screening Analysis
Carbon Tetrachloride	Insufficient screening level, monitored concentration
Chloroform	Insufficient screening level
Chromium (VI)	Monitored Concentration
Chromium	Toxicity Weighted Screening Analysis
Cobalt	Toxicity Weighted Screening Analysis
Crotonaldehyde	Monitored concentration above chronic value
Dibromochloromethane	Monitored concentration
Formaldehyde	Monitored concentration, Toxicity Weighted Screening Analysis
Hexachloro-1,3-butadiene	Insufficient screening level
Hexamethylene Diisocyanate	Toxicity Weighted Screening Analysis
Hydrochloric Acid	Toxicity Weighted Screening Analysis
Hydrogen Fluoride	Toxicity Weighted Screening Analysis
Lead	Toxicity Weighted Screening Analysis
Manganese	Toxicity Weighted Screening Analysis
Mercury	Toxicity Weighted Screening Analysis
Naphthalene	Toxicity Weighted Screening Analysis
Nickel	Toxicity Weighted Screening Analysis
p-dichlorobenzene	Insufficient screening level, monitored concentration

Table 2.2.3 – Pollutants of Interest

Pollutants	Reason for Interest
Pyridine	Toxicity Weighted Screening Analysis
Sulfuric Acid	Toxicity Weighted Screening Analysis
Tetrachloroethene	Monitored concentration, Toxicity Weighted Screening Analysis
Toluene	Toxicity Weighted Screening Analysis
Triethylamine	Toxicity Weighted Screening Analysis
Vinyl Chloride	Insufficient screening level
1,1-Dichloroethene (Vinylidene Chloride)	Insufficient screening level
Xylene	Toxicity Weighted Screening Analysis

The list of pollutants of interest contained pollutants that IDEM was examining in greater detail. It was not IDEM's intent that all sources verify the existence or absence of each pollutant on this list. The purpose of providing the list to the sources was to make them aware of which pollutants are of potential concern.

2.2.2 Sources

The goal of the emission inventory gathering process was to collect the best available data from sources in the Study Area. IDEM's permit database Computer Assisted Approval and Tracking System (CAATS) was searched for all sources that may affect the Study Area. Added to these permitted sources were area source categories, gas stations, dry cleaners and auto refinishing shops. Due to a heavy concentration of transportation companies in the Study Area, trucking companies were also added to the list of sources.

2.2.3 Permitted Sources

From the CAATS permit database, IDEM selected sources that reasonably could affect the Study Area for further evaluation. IDEM sought emissions information from permitted sources specifically for use in the RAIMI modeling analysis.

IDEM sent letters to all permitted sources from which emission inventory information was requested to inform them about the Study. IDEM wanted the permitted sources to be fully aware of what the intended use of the information was. IDEM stressed the importance that the permitted sources providing the best available information while also being sensitive to the resources required by the permitted sources to complete the task. The letter described the Study project and the emissions inventory gathering process.

IDEM sent emission related information requests to 319 businesses and permitted sources in the area. In addition to the request for emissions information, the letters from IDEM announced the date, time, and location of two informational sessions. The information sessions were designed to allow permitted sources to ask any questions they had before the official request for information was due to be submitted to IDEM. The information request also contained contact information for IDEM staff.

At the information sessions, IDEM gave a brief presentation about the project and went into detail about why the emissions inventory request was important, how it would be

used, and what information was needed. IDEM provided an example of the information that was sent out to the permitted sources and discussed how that information was derived. Following the walkthrough of the example emissions inventory request, IDEM answered questions and addressed concerns from representatives of the permitted sources.

For each permitted source, IDEM researched the available databases for any emissions information. The source's permit and the IDEM emissions inventory database were searched for each source's stack release information. Most of the air toxic emissions information that was compiled represented source-wide totals. IDEM sent to all the permitted sources involved in the Study a spreadsheet which contained the source's specific emissions information. The spreadsheet was designed to only display information that IDEM required to run RAIMI. The file was formatted to clearly show where IDEM obtained the emissions information (i.e., TRI, NEI, permit, etc.) and from what year the data was obtained. IDEM requested that permitted sources verify the emissions information and update the information as appropriate. IDEM also requested that, if there was missing information, the best available information be provided.

Permitted sources were given 90 days to return their verified data to IDEM. A total of 268 facilities responded, which represents an eighty-four percent (84%) response rate. It is estimated that these facilities accounted for ninety-eight percent (98%) of all estimated point and area source emissions in the area. A list of the 268 sources responding to the information request can be found in Appendix B.

2.2.4 Gas Stations

Forty-nine gas stations were identified within the study area. Emissions from gas stations occur when vapors from enclosed tanks are released into the atmosphere during the pumping of gasoline into storage tanks or into the fuel tanks of vehicles. A survey was completed to collect data on how much gasoline was sold at each station each year. In order to calculate emissions the volatile organic compound (VOC) emission factors obtained from AP-42 were used. Speciation profiles for benzene and other Hazardous Air Pollutants (HAPs) were obtained from the "Bulk Gasoline MACT Background Information Document", U. S. EPA, July, 1995. The total estimated emissions of VOCs for all stations were calculated for five different gasoline refueling processes. These processes are controlled submerge-fill, losses from transport, spillage losses, losses from vehicle refueling, and underground tank filling. The equation for each process is the same and is shown in Equation 2.2.3.

Equation 2.2.3 – Gas Station Emissions Equation

$PE_{HAP} = \frac{TP_g \times EF_{VOC}}{2000 \text{ lbs/ton}} \times EF_{HAP}$	
Symbol	Description
TP _g	Gasoline Throughput (1,000s of gallons)
EF _{VOC}	VOC Emission Factor (lbs/1,000 gallons)
PE _{HAP}	Potential HAP Emissions (tons/yr)
EF _{HAP}	HAP Emission Factor (lbs/ lbs of VOC)

For gas stations, surveys requested the amount of gasoline sold per week. Any gas station that did not return the survey was estimated based on the number of pumps and location of the station. Table 2.2.4 shows the emission factors for the calculations:

Table 2.2.4 – Gas Station Emission Factors

Pollutant	Emission Factor	Units
Volatile Organic Compounds (VOC)	12.3	Pounds per 1000 gallons
Benzene	0.009	Pounds per pound VOC
Ethylbenzene	0.001	Pounds per pound VOC
Hexane	0.016	Pounds per pound VOC
Toluene	0.013	Pounds per pound VOC
Trimethylpentane	0.008	Pounds per pound VOC
Xylenes	0.005	Pounds per pound VOC

The gas stations in the Study Area pumped an average of over 1,000,000 gallons of gasoline per week. A list of all the gas stations included in the Study can be found in Appendix B.

2.2.5 Auto Refinishing Sources

There were nineteen auto body refinishing sources identified within the Study Area. Paint and other industrial solvents which contain hazardous air pollutants are used in refinishing and repair shops. The total VOC emissions number was multiplied by the Hazardous Air Pollutant emission factors to get the speciated estimated emissions. The total emission from each auto refinishing source is based on the number of employees reported in the returned survey. The equation is shown in Equation 2.2.2.

Equation 2.2.2 Auto Refinishing Emissions Equation

$PE_{HAP} = \frac{n \times EF_{VOC} \times EF_{HAP}}{2,000 \text{ lbs/ton}}$	
Symbol	Description
PE _{HAP}	Potential HAPs Emissions (tons/yr)
n	Number of Employees
EF _{VOC}	VOC Emission Factor (lbs/employee)
EF _{HAP}	HAP Emission Factor (lbs/lbs VOCs)

The speciated emission factors for the auto refinishing sources are found in Table 2.2.5:

Table 2.2.5 – Auto Refinishing Speciated Emission Factors

Pollutant	Emission Factor	Units
Volatile Organic Compounds (VOC)	3,519	Pounds per employee
Benzene	0.0151	Pounds per pound VOC
Biphenyl	0.0002	Pounds per pound VOC
Dibutyl Phthalate	0.0001	Pounds per pound VOC
Naphthalene	0.0146	Pounds per pound VOC
Toluene	0.0865	Pounds per pound VOC
Xylene	0.2067	Pounds per pound VOC

The auto refinishing sources reported 27 employees working in the refinishing area. A list of the auto refinishing sources in the area can be found in Appendix B.

2.2.6 Dry Cleaners

For dry cleaners, the surveys requested the type and amount of chemical used. Emissions estimates were based on the response to the survey. One source used mineral spirits as the cleaning solvent, all other sources used tetrachloroethene. There were ten dry cleaning sources in the Study Area. The list of these sources can be found in Appendix B.

2.2.7 Trucking Companies

For trucking companies, surveys requested the number of trucks that go through the facility each week and if the source had an idling policy. If a source reported idling time, the number of trucks was multiplied by the amount of idling time to determine the idle hour throughput. Emissions were calculated based on emission factors taken from the Coordinating Research Council's "Diesel Exhaust Standard Phase Project", August 2003. If the source had a no idling policy, the start-up emissions were estimated based on emission factors from the same project. If the source did not respond to the survey, the emissions were estimated based on the number of trucks at a facility with a 10 minute idle time.

The "Diesel Exhaust Standard Phase Project", is the first phase of a program to develop a reproducible standard mixture that suitably captures the nature of actual diesel exhaust. An in-depth literature survey was conducted to gather information about engine-out emissions composition for a variety of diesel engine applications, fuel types, manufacturers, power outputs, and test cycles. The project researched literature published from 1999 to 2003 and combined different cycles, engines, and fuels.

The calculation for determining the emissions from truck idling is in Equation 2.2.3:

Equation 2.2.3 Truck Idling Emissions Equation

$$PE_{HAP} = \frac{\left(\frac{n_t \times IT_t \times 52 \text{ weeks/year} \times FC_h \times FE \times EF_{HAP}}{1000 \text{ mg/g}} \right)}{3600 \text{ sec/hr} \times 8760 \text{ hrs/yr} \times 34.79 \text{ tons-yr/g-sec}}$$

Symbol	Description
PE_{HAP}	Potential HAPs Emissions (tons/yr)
n_t	Number of Trucks per week
IT_t	Idling Time per Truck (hrs)
FC_h	Idling Fuel Consumption (gal/hr)
FE	Fuel Efficiency (mi/gal)
EF_{HAP}	HAP Emission Factor (mg/mi)

Table 2.2.6 contains the truck idle emission factors.

Table 2.2.6 – Truck Idle Emission Factors

Pollutant	Emission Factor	Pollutant	Emission Factor
	(mg/mi)		(mg/mi)
1,3-Butadiene	27.1	Heptane	0.33
2,3-Dimethylhexane	2.81	Hexanaldehyde	0.7
2,3-Dimethylpentane	0.95	Hexane	5.69
2-Methyl-1-Butene	5.07	m/p-Tolualdehyde	2
3-Methylpentane	2.92	Methylcyclohexane	2.36
Acetaldehyde	200.7	Methylcyclopentane	2.81
Acetone	117.6	Nonane	13.51
Acrolein	7	Pentane	2.84
Benzene	38	Pentene	11.67
Butane	3.87	Propane	7.94
Butylene	28.2	Propionaldehyde	31.1
cis-2-Butene	2.52	Propylbenzene	0.76
Crotonaldehyde	11.4	Propylene	92.1
Cyclopentane	0.69	Propyne	7.51
Cyclopentene	1.74	Styrene	8.03
Dodecane	47.72	Toluene	18.99
Ethane	13.4	trans-2-Butene	3.61
Ethyl Benzene	3.19	Trimethylbenzene	2.67
Ethylene	305.7	Undecane	504.3
Ethyne	68.4	Valeraldehyde	7.2
Formaldehyde	507.1	Xylenes	9.31

Fifty-Three (53) of the 71 trucking companies reported idling times ranging from 5 minutes to 60 minutes.

Eighteen (18) of the 71 trucking companies reported having no idling policy. Emissions for these companies were calculated based on start-up emissions. Equation 2.2.4 shows the calculation for the start-up emissions:

Equation 2.2.4 Truck Start-up Emissions Equation

$$PE_{HAP} = \frac{\left(\frac{n_t \times ST_t \times 52 \text{ weeks/year} \times HP_t \times EF_{HAP}}{1000 \text{ mg/g}} \right)}{3600 \text{ sec/hr} \times 8760 \text{ hrs/yr} \times 34.79 \text{ tons-yr/g-sec}}$$

Symbol	Description
PE _{HAP}	Potential HAPs Emissions (tons/yr)
n _t	Number of Trucks per week
ST _t	Start-up Time per Truck (hrs)
HP _t	Horsepower per truck (500hp average)
EF _{HAP}	HAP Emission Factor (mg/bhp-hr)

Table 2.2.7 contains the start-up emission factors:

Table 2.2.7 – Trucking Start-up Emission Factors

Pollutant	Emission Factor
	(mg/bhp-hr)
1,3-Butadiene	1.08
2-Methyl-1-Butene	0.3
Acetaldehyde	6.65
Acetone	2.1
Acrolein	2.55
Benzaldehyde	1.35
Benzene	1.125
Butane	0.02
Butylene	0.85
Butyraldehyde	0.75
Crotonaldehyde	0.85
Dimethyloctane	2.965
Ethyl benzene	0.37
Ethylene	7.9
Formaldehyde	17.55
Hexanaldehyde	0.55
Propane	2.2
Propionaldehyde	1.45
Toluene	0.3
Trimethylbenzene	2.22
Xylenes	3.02

A list of all of the trucking companies and their idle times are listed in Appendix B.

2.2.8 Roadway Emissions

Within the Study Area, there are two major interstates and several major city streets. As such, emissions were also estimated for mobile sources within the study area. Traffic count data was acquired for the main interstates and city streets in the Study Area. The data was estimated for each 100 meter segment of the roadway to determine the vehicle miles traveled (VMT) for each segment. Separate estimates were made for cars and

trucks. For cars the VMT was multiplied by the AP-42 emission factors. For trucks, the VMT was multiplied by the Urban Daily Driving cycle emission factors from the “Diesel Exhaust Standard Phase Project”.

For each section of roadway, eighty-five percent (85%) of the total VMT was estimated to be car or vehicle traffic. Trucks were estimated to be 15% of the total VMT. This estimate is based on a study from the Miami Valley Regional Planning Commission from Dayton, OH. The Ohio Department of Transportation estimated that 16 percent of all traffic on the interstates was truck traffic. Since the Study Area has a heavy concentration of truck traffic, fifteen-percent (15%) truck traffic was estimated throughout the Study Area.

2.2.9 Interstates

For the interstates, I-465 and I-70, traffic count data were obtained from the Indiana Department of Transportation (INDOT). The most recent year available on the INDOT website was 2002. Figure 2.2.5 contains the daily traffic count for the Indianapolis metropolitan area interstates for 2002.

Roadway emissions were calculated based on the formula in Equation 2.2.6.

Equation 2.2.6 – Roadway Emissions Calculation

$$VE = \frac{TC_d \times VR \times 365 \text{ days/yr} \times l \times EF_{HAP}}{2,000 \text{ lbs/ton}}$$

Symbol	Description
VE	Vehicle Emissions (tons/yr)
TC _d	Daily Traffic Count
VR	Vehicle Ration (0.85 – Cars; 0.15 – Trucks)
l	length of Road Segment (miles)
EF _{HAP}	HAP Emission Factor (lbs/mi.)

The emissions factors for cars are shown in Table 2.2.8:

Table 2.2.8 – Vehicle Emission Factors

Pollutant	Emission Factor
	lbs/mi
Acetaldehyde	0.00000677
Acrolein	0.0000291
Benzene	0.000344
1,3-Butadiene	0.00000653
Formaldehyde	0.000188
Xylene	0.000239
MTBE	0.00000697
Toluene	0.000846

Table 2.2.9 contains the truck emission factors based on the urban daily driving cycle:

Table 2.2.9 – Truck Urban Daily Driving Cycle Emission Factors

Pollutant	Emission Factor	Pollutant	Emission Factor
	mg/mi		mg/mi
1,3-Butadiene	6.49	Hexane	0.85
2,3-Dimethylhexane	0.08	m/p-Xylenes	1.11
2,3-Dimethylpentane	0.1	Methylcyclohexane	0.38
2-Methyl-1-Butene	1.3	Methylcyclopentane	0.37
3-Methylpentane	0.28	Nonane	1.89
Benzene	7.32	o-xylene	0.47
Butane	0.4	Pentane	0.32
Butene	4.33	Pentene	4.14
cis-2-Butene	0.73	Propane	0.74
Cyclopentene	0.76	Propene	25.7
Decane	3.53	Propylbenzene	0.12
Dodecane	7.82	Propyne	3.09
Ethane	1.68	Styrene	1.54
Ethene	60.3	Toluene	2.98
Ethylbenzene	0.51	trans-2-Butene	1.04
Ethyne	10.87	Trimethylbenzene	0.45
Heptane	0.31	Undecane	75.97

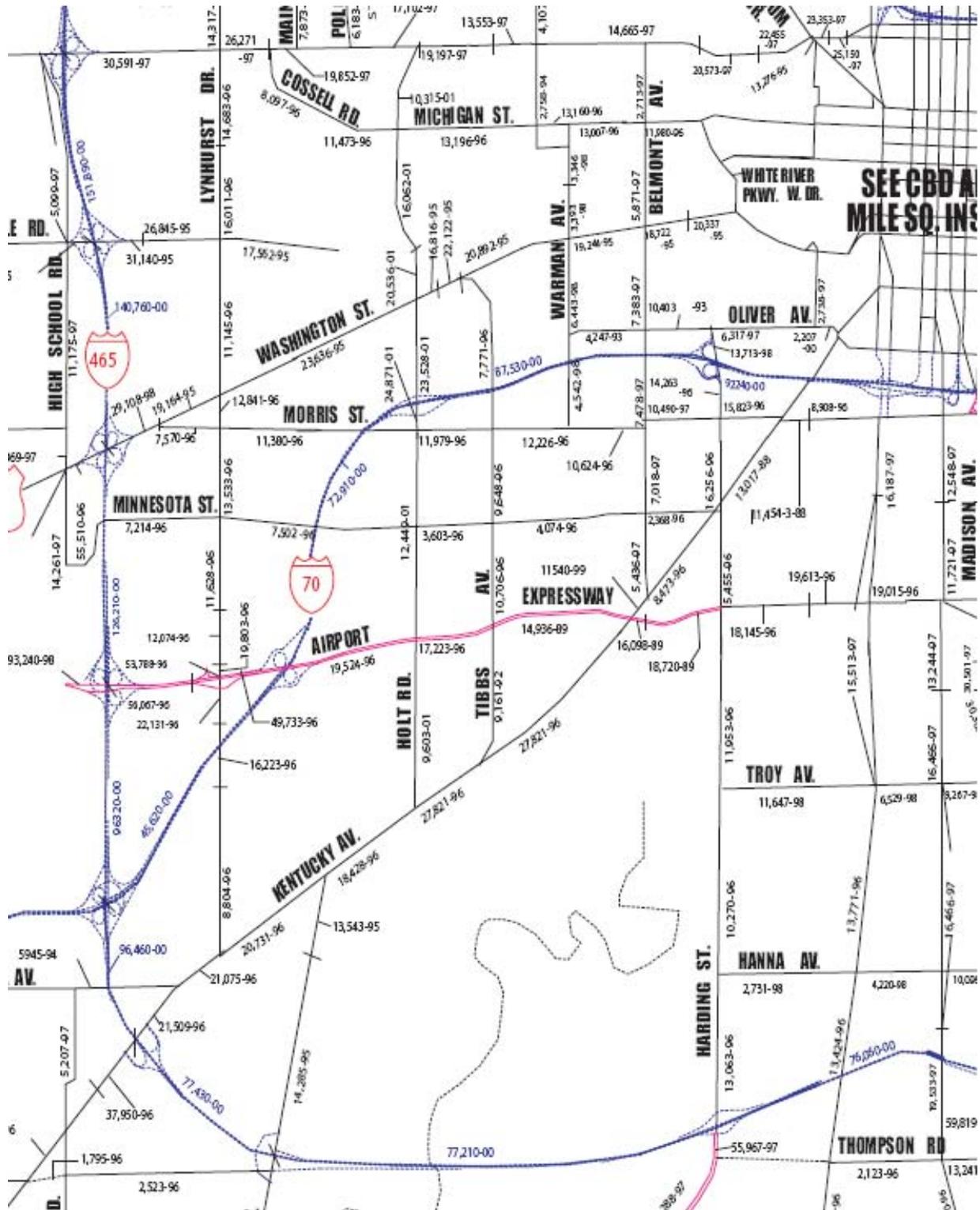
2.2.10 City Streets

Traffic count data from 13 major city streets was obtained from the Indianapolis Metropolitan Planning Organization. The 13 streets are:

- 10th Street
- Belmont Avenue
- Harding Street
- Holt Road
- Kentucky Avenue
- Lynhurst Avenue
- Michigan Street
- Minnesota Street
- Morris Street
- Raymond Street
- Rockville Road
- Tibbs Avenue
- Washington Street

Emissions were calculated using the same methods and emissions factors as used for the interstates. Figure 2.2.7 contains the daily traffic count for the Indianapolis metropolitan area city streets. The traffic count data was taken from different years for different roadway segments. The year the specific traffic count data was obtained is located next to the traffic count on Figure 2.2.7.

Figure 2.2.7 – Indianapolis City Streets Traffic Count Data



2.2.11 Indianapolis International Airport

The Indianapolis International Airport is located on the western border of the Study Area. Emissions for the airport were taken from the emission database used for the NEI. All airport emissions were combined at one emission point, at the edge of the airport property closest to the Study Area. This was considered the most health protective method for modeling the airport's emissions.

2.2.12 Quality Assurance

Emissions data were entered into input files for modeling, in addition all permitted sources were checked for accuracy and quality assured by an air toxics inventory specialist. The emissions were checked against the 2005 Regional Air Pollutant Inventory Development System (RAPIDS) inventory. Sources with a greater than 1,000 pound change from the inventory to the modeling input file were noted. The accuracy of emissions from sources that were not required to be included in the RAPIDS inventory was more difficult to determine. Four sources were assessed for having high risk pollutants at emission rates that did not seem likely for the source's permit type. Two of the sources were found to have lower emission rates and one source did not report and was therefore modeled at its potential emission rate.

Table 2.2.10 shows the emissions breakdown in number of sources and total tons per year of air toxic emissions.

Table 2.2.10 – Source Air Toxics Emissions

Source	Number	Emissions	Percent of Total Emissions
		(Tons per Year)	
Permitted sources	315	2200	74%
Trucking companies	71	1.5	0.10%
Gas stations/Truck stops	49	20	0.70%
Auto body shops	19	20	0.70%
Dry cleaning shops	10	0.58	0.0%
Interstates	600	470	16%
City Streets	1,676	220	7.5%
Airport	1	24	0.70%
Total	2,741	3,000	

Table 2.2.11 shows the emissions by pollutant from the permitted sources, trucking companies, gas stations, dry cleaners and auto refinishing sources with the three existing databases.

Table 2.2.11 – Point and Area Source Emissions Comparison

Pollutant	CAS #	2002 GLI	2002 NEI	2004 TRI	Modeling Input File
		lbs	lbs	lbs	lbs
Polychlorinated Dibenzofurans, Total	1080	0.007			
4-Nitrophenol	100-02-7		0.01		
Ethylbenzene	100-41-4	651	2456	975	6460
Styrene	100-42-5	42	15418	9800	9347
Benzyl Chloride	100-44-7	1175	1221		60
4,4'-Methylenediphenyl Diisocyanate	101-68-8		183		
p-Dichlorobenzene	106-46-7		49		
Quinone	106-51-4		34		
1,2-Dibromoethane	106-93-4	2	66		89
1,3-Butadiene	106-99-0	0.1	785		
Acrolein	107-02-8	508	6767		646
1,2-Dichloroethane	107-06-2	74	130		120
Acrylonitrile	107-13-1		1747		2722
Ethylene Glycol	107-21-1	4	1981	474	1283
Vinyl Acetate	108-05-4	20	411		15
Methyl Isobutyl Ketone	108-10-1	1284	2260	743	2522
Toluene	108-88-3	25492	75063	19683	69598
Chlorobenzene	108-90-7	41	155		187
Phenol	108-95-2	3708	22358	3430	319
2-Methylpyridine	109-06-8			12930	
N-Hexane	110-54-3	4233	28037	4501	67149
Pyridine	110-86-1			33020	742
Butyl Cellosolve	111-76-2		502		
2-Butoxyethyl Acetate	112-07-2		520		
Propylene	115-07-1			5722	14521
Bis(2-Ethylhexyl)Phthalate	117-81-7		127		826
Diocetyl Phthalate	117-84-0	123			115
Anthracene	120-12-7	0.3	68		1
2,4-Dinitrotoluene	121-14-2	0.5	0.5		7
Triethylamine	121-44-8	27841	227605	23276	1065
Hydroquinone	123-31-9		60		
Propionaldehyde	123-38-6	1192	1237	740	207
Dimethylamine	124-40-3			1320	
Tetrachloroethene	127-18-4	15058	13463	21831	34825
Pyrene	129-00-0	0.5	1.6		1
Dimethyl Phthalate	131-11-3		1.5		0.6
Cresol	1319-77-3		11		
Dibenzofuran	132-64-9		179		702
Xylenes (Mixed Isomers)	1330-20-7	2662	18541	5023	69132
Polychlorinated Biphenyls	1336-36-3		0.06		115
Methyl Tert Butyl Ether	1634-04-4	569	659		59
Polychlorinated Dibenzodioxins, Total	1746-01-6	0.004			0.0008
Chromium (VI)	18540-29-9	133	138		124
Benzo(g,h,i)Perylene	191-24-2	0.04	537		0.7

Table 2.2.11 – Point and Area Source Emissions Comparison

Pollutant	CAS #	2002 GLI	2002 NEI	2004 TRI	Modeling Input File
		lbs	lbs	lbs	lbs
Indeno(1,2,3-c,d)Pyrene	193-39-5	0.08	0.1		0.5
Benzo(b)Fluoranthene	205-99-2	0.0004	0.04		0.6
Fluoranthene	206-44-0	4	26		2
Benzo(k)Fluoranthene	207-08-9	0.0003	0.01		0.4
Acenaphthylene	208-96-8	0.4	4		0.9
Chrysene	218-01-9	0.3	96		0.7
5-Methylchrysene	3697-24-3		0.04		
Carbonyl Sulfide	463-58-1		11		149
Formaldehyde	50-00-0	3036	56108	2150	29750
Benzo(a)Pyrene	50-32-8	0.08	304		1490
2,3,7,8-Tetrachlorodibenzofuran	51207-31-9	0.0003			0.005
2,4-Dinitrophenol	51-28-5		0.02		
2-Chloroacetophenone	532-27-4	12	12		11
Dibenzo(a,h)Anthracene	53-70-3	0.0002	0.005		0.4
2,2,4-Trimethylpentane	540-84-1		3726		6257
1,3-Dichloropropene	542-75-6		36		
Carbon Tetrachloride	56-23-5		59		2623
3-Methylcholanthrene	56-49-5		0.0004		0.0006
Benz(a)Anthracene	56-55-3	4	8		0.8
Cyanide	57-12-5	4581	4745	799	4501
7,12-Dimethylbenz[a]Anthracene	57-97-6		0.004		0.03
2,4-Toluene Diisocyanate	584-84-9		0.7		9
Methyl Hydrazine	60-34-4	285	297		268
Formic Acid	64-18-6			9403	
Polycyclic Aromatic Compounds	65996-93-2			0.04	925
Methanol	67-56-1	23195	89870	6702	7397
Chloroform	67-66-3	100	282		2851
Dimethylformamide, N,N-	68-12-2	288	448	70	39
N-Butyl Alcohol	71-36-3			500	344
Benzene	71-43-2	12636	38201	5966	30223
1,1,1-Trichloroethane	71-55-6	42	12284		1395
Lead	7439-92-1	1669	13385	2082	10172
Manganese	7439-96-5	7536	11140	5215	4283
Mercury	7439-97-6	213	327	186	230
Nickel	7440-02-0	652.6	2122	501	11054
Antimony	7440-36-0	30	322	273	331
Arsenic	7440-38-2	691	5102	4428	455
Barium Compounds	7440-39-3			685	16
Beryllium	7440-41-7	35	38		31
Cadmium	7440-43-9	104	496		3593
Chromium	7440-47-3	1162	2873	2449	11702
Cobalt	7440-48-4	168	1393	1257	4618
Copper	7440-50-8	265		3774	594
Bromomethane	74-83-9	269	15279	10700	11327
Methyl Chloride	74-87-3	890	948		

Table 2.2.11 – Point and Area Source Emissions Comparison

Pollutant	CAS #	2002 GLI	2002 NEI	2004 TRI	Modeling Input File
		lbs	lbs	lbs	lbs
Hydrogen Cyanide	74-90-8	4567	4915		
Chloroethane	75-00-3	70	105		2638
Vinyl Chloride	75-01-4		594		4332
Acetonitrile	75-05-8	27241	28318	42623	10797
Acetaldehyde	75-07-0	1934	8234	1190	11355
Methylene Chloride	75-09-2	3916.78	19454	3403	8017
Carbon Disulfide	75-15-0	218	244		274
Bromoform	75-25-2	65	68		61
Ethylidene Dichloride (1,1-Dichloroethane)	75-34-3		47		9080
1,1-Dichloroethene (Vinylidene Chloride)	75-35-4		0.3		7168
Propylene Oxide	75-56-9	33	5236	6422	58
Hydrochloric Acid	7647-01-0	1612614	1819673	606900	1941587
Hydrogen Fluoride	7664-39-3	201429	219085	144046	122960
Ammonia	7664-41-7			152827	770050
Sulfuric Acid	7664-93-9			465109	1060000
Nitric Acid	7697-37-2			1664	
Phosphorous	7723-14-0		1078		1218
Dimethyl Sulfate	77-78-1	81	84		
Selenium	7782-49-2	2183	2281		5073
Chlorine	7782-50-5	340	656	360	
Isophorone	78-59-1	974	1012		912
Propylene Dichloride	78-87-5		37		60
Sec-Butyl Alcohol	78-92-2			250	274
Methyl Ethyl Ketone	78-93-3	14899	25235	0	6075
1,1,2-Trichloroethane	79-00-5		51		
Trichloroethene	79-01-6	987	21877	13674	40754
1,1,2,2-Tetrachloroethane	79-34-5		126		
Methyl Methacrylate	80-62-6	43	144		1608
Hexamethylene Diisocyanate	822-06-0		20		0.07
Acenaphthene	83-32-9	0.8	2		1
Dibutyl Phthalate	84-74-2		1		16
Phenanthrene	85-01-8	5	1040		18
Fluorene	86-73-7	2	5		2
N-Methyl-2-Pyrrolidone	872-50-4			87000	
Naphthalene	91-20-3	3276	7998	832	2988
2-Methylnaphthalene	91-57-6		0.005		0.009
Biphenyl	92-52-4	3	7		28
Benzidine	92-87-5		0.0001		
1,2,4-Trimethylbenzene	95-63-6			426	560
Cumene	98-82-8	33	325		84
Acetophenone	98-86-2	25	28		50
Dioxin And Dioxin-Like Compounds	edf-018			0.002	
Polychlorinated Alkanes	edf-045			580	
Diisocyanates	edf-067			130	
Glycol Ethers (Misc.)	edf-109	113	27126	607	

Table 2.2.11 – Point and Area Source Emissions Comparison

Pollutant	CAS #	2002 GLI	2002 NEI	2004 TRI	Modeling Input File
		lbs	lbs	lbs	lbs
Vanadium Compounds				404	4
Zinc Compounds				3645	178
Total Pounds		2017732	2877821	1732700	4437885
Total Tons		1008.9	1438.9	866.4	2218.9

Total modeled emissions for each pollutant can be found in Appendix C.

2.2.13 Emission Corrections

Since the emissions information for some sources in the Study is confidential, actual source names are not being included in this discussion. From the original quality assurance, two of the four companies that were questioned for having higher than expected emission rates were amended with further research and information. One other source had their emissions amended with more current data.

One source originally reported emissions from old data combined from three separate facilities and incorrectly converted from tons to pounds. This caused the source to total over 24 tons of air toxics. Even though this source was flagged with potential emission errors, the source was modeled at the submitted emissions. The source had the highest estimated risk in initial modeling. Through a site visit by IDEM's Office of Pollution Prevention Technical Assistance (OPPTA) and communication with the source's consultant, it was determined that the source only emitted 0.005 tons of air toxics.

Another source's emissions were decreased when a more recent permit contained updated emissions information.

A third source researched the emissions calculated from their permit's technical support document and discovered that the control equipment was not treated correctly. The scrubbers for the source were calculated with low pressure/energy configurations. The scrubbers at the source were actually high pressure/energy scrubbers and this reduced the source's particulate emission rates by a factor of approximately 10.

2.2.14 RAIMI Modeling Methods

According to the U.S. EPA Region 6 RAIMI website, "The U.S. Environmental Protection Agency (EPA), Region 6, established the Regional Air Impact Modeling Initiative (RAIMI) to evaluate the potential for health impacts as a result of exposure to multiple contaminants from multiple sources, at a community level of resolution. Often when evaluating permitting and enforcement actions, EPA needs to consider the bigger picture as opposed to the traditional source-by-source, program-by-program approach. Such an approach has blindly focused on selective units, often located among a 'forest' of others impacting the same receptor neighborhoods. As a result, goals of RAIMI focused on developing the capability to conduct localized assessments in a timely enough manner so as to actually be useful in day-to-day permitting and enforcement activities, that would

obviously support cross-program participation, and that would provide results at a level of resolution and traceability that serve as an asset to stakeholders needing to evaluate and implement solutions.”

RAIMI was established to conduct more refined and localized analysis based on results from national initiatives, including NATA.

Region 6 ran a pilot study of RAIMI in Port Neches, Texas. The assessment area for the pilot study included several large industrial facilities that were located in close proximity to several residential neighborhoods. The similarities between the Study Area with the Port Neches assessment area gave IDEM confidence that RAIMI would be effective for modeling component of this Study.

RAIMI can calculate and track risks from different sources and pollutants, as well as, use this information to prioritize and identify solutions at the community level.

In order to conduct the analysis, RAIMI contains several separate processes. These processes included, Risk-MAP, Air Modeling Preprocessor (AMP), ISCBatch and Plot Converter.

2.2.15 Risk-MAP

Risk-MAP is the main component for RAIMI. Risk-MAP is a fully integrated ArcView extension designed to work in concert with ArcMAP's expansive GIS and mapping capabilities. Risk-MAP is a risk modeling and analysis tool designed to estimate potential human health impacts associated with exposure to chemical emissions.

The first step in developing an analysis is to set up the Emissions Tracking Database (ETD). The ETD is an Access based program that consists of pre-defined tables, queries and table relationships. For Risk-MAP to function properly, the ETD must meet specific database formatting requirements. Examples of database formatting requirements include table structure, field names and table relationships.

The process of populating a RAIMI Screen Analysis ETD with project-specific emissions data involves the following ETD database tables:

- Primary Inventory Table
- Geolocation Table
- Final Geolocation Table
- Sources_to_AM Table
- AM Sources Table
- Sources Table
- Emissions Table
- Contaminant Table
- BAMF_Parameters Table
- Historical Emissions Table

RAIMI provides an Access database with multiple tables. These tables have specific structure and formatting requirements, including definition of table names, field names, and field types, that are necessary to compile the emissions information. Risk-MAP uses the ETD manager to guide the input of data into tables.

The ETD Manager is designed to guide the user through the complex process of creating and populating a project specific ETD. Specifically, the ETD Manager is designed to:

1. import the primary inventory table,
2. generate the required secondary database tables,
3. perform table import and export functions to support external tasking (e.g., geolocation, air modeling),
4. track database processing steps,
5. archive and record database tables, and
6. perform database integrity and validation steps to ensure the user has selected a database that meets the basic requirements of an ETD.

The ETD Manager significantly reduces the potential of introducing database errors or validating database integrity protocols.

Before the ETD Manager can be used to process the ETD, the user must first build and format the Primary Inventory Table (PIT). The PIT contains all study area-relevant raw model input data and source attribute information required to complete data sets that directly support modeling and supplemental analyses. The general process is to identify all relevant data from available data sources that contain desired data for emission sources within the geographic bounds of the study area, obtain all applicable data records from these fields, and assemble that data into the PIT.

All the data acquired from the emissions gathering process was input into an Excel spreadsheet using the character limitations for the ETD. This data is imported into the PIT. If any fields are outside of the requirements the ETD Manager will provide a warning message and it will not allow the import to be completed until the reason the warning messages is corrected. If any fields are left blank, the table will not be allowed to be successfully imported until all fields have data entered.

Once the import of PIT is successfully completed, the ETD manager will populate the emissions table. This table extracts all the pollutant data from the PIT and inputs the data into a specific table.

The next step is the creation of a Geolocation table. The Geolocation table involves verifying emission source locations and selecting emission sources for further processing based on consideration of source location. This table is exported and converted into a consistent geographic coordinate system (UTM83). Once the table has been corrected and formatted, it is imported back into the ETD manager.

The next step is to export the source information to the air modeler. This table is quality controlled and assured by the air modeler. Stack information is examined to determine if the inputs are out of bounds acceptable to the model. After the corrections to the table are made, it is imported back into the ETD manager.

The next step is the creation of the final Source table. The ETD manager extracts the data from the constructed data to create this table.

The next tables are the Contaminant table and the Bioaccumulation and Metabolism Factors (BAMF) parameters table. These tables are included with RAIMI and include:

- Exposure and site-specific parameters
- Chemical-specific fate and transport parameters
- Chemical-specific toxicity parameters

The contaminant table supplied by RAIMI included a formaldehyde IUR of 1.3×10^{-5} ($\mu\text{g}/\text{m}^3$)⁻¹. This data was taken from an older database. An updated formaldehyde IUR was discovered to be 5.5×10^{-9} ($\mu\text{g}/\text{m}^3$)⁻¹ and the table was changed to reflect the toxicity update and the results were reanalyzed.

The final step was to include the Historical Emissions table. This step is optional and was not required for the Study.

This completes the ETD process. The next step in setting up a Risk-MAP project is to set the source layer. A source layer depicts the various geographic source locations for those sources included in the selected ETD.

The next step in setting up a Risk-MAP project is to set the Node Attribute Index Table (NAIT) layer. The NAIT functions to organize and store air modeling data in an efficient format designed to reduce file access and data read/write times. You must process air modeling data before setting the NAIT layer in the Project Properties tool. Risk-MAP automatically sets the NAIT during NAIT processing.

The NAIT functions to organize and store air modeling data in an efficient format designed to reduce file access and data read/write times. Risk-MAP generates the NAIT by processing the source-specific AIR2GIS files into a geographically tiled binary index file. This facilitates processing and optimizes system resources.

2.2.16 Air Modeling Preprocessor (AMP)

After the completion of the NAIT, the data is analyzed by the Air Modeling Preprocessor (AMP). AMP meets the functional need of preparing data and input files for use in the air dispersion model, ISCST3.

AMP performs three key functions for air modeling within the RAIMI environment:

- Implements site parameter quantification (surface roughness, urban/rural land use) for each emission source in accordance with RAIMI methods.
- Prepares source-specific meteorological files using U.S. EPA Meteorological Processor for Regulatory Models (MPRM).
- Auto-generates air model input files for multiple sources for all four potential contaminant phases to include source-centered universal grid node array with extracted terrain elevations.

The source table from the ETD is analyzed by AMP. AMP will construct seasonal surface-roughness values for each source by analyzing land-use/land-cover (LULC) information in a 3-km circle around each source location. Provide the LULC data in the form of a GIS dataset (shapefile, coverage, or geodatabase) that must be present as one or more layers in ArcMap. The LULC for the Indianapolis metropolitan area was downloaded and inputted into the AMP.

AMP uses standard 1:250,000-scale United States Geographic Survey (USGS) Digital Elevation Model (DEM) files. These are ASCII files in a particular format described at <http://rockyweb.cr.usgs.gov/nmpstds/demstds.html>. AMP expects all the necessary DEM files for a particular analysis to be present in a single directory.

During the analysis, AMP needs to know which DEM file contains the elevation for a particular location. To find the correct DEM, AMP needs a GIS layer that contains the boundaries of the DEMs. This is the DEM Index dataset, which should be present as a layer in ArcMap. The DEM files for Indianapolis were downloaded and inputted into the AMP.

The next step is processing the meteorological data. The surface meteorological data was obtained from the Indianapolis International Airport and the upper air data from Dayton, Ohio. Data from 1986 to 1990 was used for the analysis. The meteorological data is processed using the Meteorological Processor for Regulatory Models (MPRM). MPRM is a program used to process meteorological data, both National Weather Service and on-site, for use in regulatory modeling. MPRM has 3 stages: (1) listing missing, suspect, and invalid data, (2) merging quality assured and corrected meteorological data, and (3) creating meteorological data files for input to air quality dispersion models.

The first two stages are completed outside of AMP. The merged output for the Stage 2 of MPRM is input into the AMP and the program completes the third stage of the MPRM and creates site-specific meteorological data for each source in the analysis.

After the meteorological data is processed, the surface roughness is calculated. The default settings are in RAIMI and the primary LULC is inputted into the program. High intensity residential, urban was the chosen land use for the area. RAIMI creates sectors for each source. AMP will read the source locations and calculate surface-roughness values for 12 sectors around each source.

When the sectoring is complete, AMP will create modeling input files and specific meteorological files for each source. If there is any missing data in the meteorological files, the input files will not be created. The data needs to be processed including data from the end of the previous year and the beginning of the next year. Initially this data was not processed; this caused a delay in completing this step of the process.

2.2.17 ISCBatch

When the input files are successfully created, they are imported into ISCBatch. This creates a batch file to run all of the sources in succession. Each year of meteorological data is run separately. Each vapor phase run takes approximately eight minutes per year per source. To complete the entire source modeling run containing 464 permitted sources and area sources took approximately 12 days.

RAIMI uses the Industrial Source Complex Short Term Version 3 (ISCST3) model to conduct the analysis. RAIMI was developed when ISCST3 was the approved dispersion model. During the Study, U. S. EPA changed the approved model to AERMOD. The RAIMI AMP does some of the same terrain calculations as AERMOD.

Because of the size and diversity of the area, it was not possible to input the buildings for the Study modeling analysis. For this reason, building downwash was not considered.

RAIMI runs all sources at a standardized 1 gram per second (g/sec) emission rate. This allows for the program to run the model once for each source as opposed to running each pollutant separately.

2.2.18 Plot Converter

After the modeling analysis is completed, RAIMI uses Plot Converter. Plot Converter is a utility that reads output from ISC and/or AERMOD ("plot files") and assembles those into files that can be used by the Risk-MAP Air-Import tool. Plot Converter replaces the Air2GIS utility and allows the use of multiple vapor-phase runs to accommodate the differences in air modeling of different contaminant-groups. This produces .a2g files that can be read by Risk-MAP.

2.2.19 Analysis and Results Manager

Risk-MAP's Analysis Manager converts the .a2g files. The Analysis Manager provides you with selection options for defining what criteria Risk-MAP will use to generate risk estimates for the selected Study Area. Selection criteria include exposure pathway, emissions scenario, sources, and contaminant.

The Analysis Manager allowed IDEM to take the modeling output files and analyze the results in graphical and tabular formats. With this tool IDEM was able to:

- Set the boundaries of the Study Area
- Select the exposure pathway
- Use query builder to select sources and contaminants
- Make changes to emissions data

The modeling study area for the Study was a rectangle that stretched beyond the boundaries of the Study Area. This was completed to check for potential areas of concern outside of the established grid.

The chronic inhalation exposure pathway was selected using a 70 year exposure duration.

The Analysis Manager uses a Microsoft SQL database. The SQL database has an effective limit of approximately 500,000 records. With all the sources and contaminants, some analyses contained over 2,000,000 records. This caused the Analysis Manager to crash with a Time Out Error. To keep the record counts down to prevent these errors, the modeling was broken up into four separate runs. The runs were; the 464 permitted and area sources, the two interstates, the 13 city streets and the Indianapolis International Airport. Once the modeling runs were completed, the analysis was further broken down into individual source categories and individual interstates and streets. All the data was then put together outside of the Analysis Manger using an Access database.

When the analysis was complete, RAIMI opened the Results Manager. The Results Manager provides query, analysis, and presentation functions for results generated within an individual analysis. This tool is useful for identifying hot spots, isolating results to a specific geographic area including communities and local neighborhoods or analyzing predefined geographic areas such as census tracts, blocks, or groups.

The Results Manager allowed IDEM to sort the data by nodes, concentrations, risks, sources and contaminants. Results Manager also contains query builder to make specific requests for data from any sources or contaminants.

2.3 Risk Characterization Methodology

The ultimate goal of any risk characterization is to quantify the risk or hazard posed by a pollutant or set of pollutants. This quantification can then be used in the risk management process to help determine what, if any, action needs to be taken. Many steps need to be taken before this final quantification can be reached.

Monitoring data for the Southwest Indianapolis Air Toxics Study (the Study) consisted of 24-hour samples taken every 6 days. 1-in-6-day sampling is common for this type of study because it equally represents each day of the week (Sunday-Saturday) without the unnecessary expense of daily sampling. Other common sampling regimes include 1-in-3-day sampling and 1-in-12-day sampling. 1-in-6-day sampling was chosen for the Study because it provided the most sampling information within the budget of the project.

This sampling regimen resulted in approximately 120 sample values for each monitored pollutant at each monitoring location. Since chronic risk estimates are calculated based on a long period of exposure these values need to be distilled down to single numbers that represent the average concentration of each pollutant over the entire Study period. These values are referred to as Exposure Point Concentrations (EPCs).

2.3.1 Exposure Point Concentrations (EPCs)

An EPC is a conservative (health-protective) estimate of the concentration of a pollutant to which a receptor (i.e., a person) will come in contact. Several considerations must be made before an EPC can be calculated. These considerations may include what the EPC will be used to evaluate, which statistical method will be used to calculate the EPC, and how non-detects (i.e. concentrations too low to quantify) will be handled.

Many factors can affect the choice of statistical method to use including size of dataset, statistical distribution, and method of sampling. For datasets which were randomly or systematically sampled and which have enough detected values, a 95% upper confidence limit of the mean (UCL) is the generally preferred method. A 95% UCL represents a value which one can be 95% confident that the true mean of the population is below that value. For the purposes of this analysis, this was the only type of EPC used. See section 2.3.4 for more information about the UCL calculations used in the Study.

In past risk characterizations, it has been common practice to substitute $\frac{1}{2}$ the detection limit for compounds which weren't detected in a particular sample (non-detects). Recent guidance from U.S. EPA and others has suggested that this is no longer the best method for dealing with non-detects because it introduces an unnecessary amount of bias into the results. U.S. EPA has recommended the Kaplan-Meier Product Limit Estimate (Kaplan-Meier, or KM) method for handling non-detects in environmental datasets. See Section 2.3.3 for more information about Kaplan-Meier.

2.3.2 Method Detection Limits (MDLs) and Non-Detects

Just because a compound is not detected (ND) in a sample or is below detection limits (BDL) does not mean that the compound was not present. Sampling and analysis techniques are not perfect and as such, are not able to detect very small concentrations of compounds in a sample. This is quantified in the MDL. The MDL is a number that represents the lowest concentration of a compound that can be quantitatively measured in a sample with reasonable confidence. MDLs are meant to take into account factors such as equipment precision, technician variability, etc.

Each year, IDEM's laboratory calculates MDLs for each of the sixty-two VOC compounds that were part of the Study monitoring. ERG, the laboratory which conducted the carbonyl and metals analysis, calculated, and reported MDLs for each individual sample. Table 2 shows the MDLs used for VOCs in this analysis. Appendix D contains the raw data reported by ERG, including MDLs for the metals and carbonyls.

For calculation of EPCs, any data point in the database that was reported as "ND" or "BDL" was replaced by the appropriate MDL from the year the sample was taken. However, in order to be consistent with how ProUCL handles calculation of Kaplan-Meier estimates of the mean, IDEM chose to censor the datasets at the lowest detection above the MDL rather than the MDL when calculating EPCs. This results in EPCs which are less sensitive to detection limits than they would be otherwise. For more information on how EPCs were calculated, see section 2.3.1. For more information about Kaplan-Meier, see section 2.3.3.

Another important aspect of MDLs to consider when analyzing data is whether the MDLs are low enough to measure safe concentrations of pollutants. In many cases, the MDL for a compound is above the health protective concentration for that compound. When this is the case, it is impossible to determine that a pollutant does not pose a threat to human health. On the other hand, if there were no detections of a pollutant and its MDL is below the health protective concentration, it can be said with relative certainty that the compound does not pose a risk to human health. Figures 2.3.1 through 2.3.4 graphically depict the hazard quotients and risk estimates associated with MDLs for VOCs monitored in the Study. The error bars represent the hazard or risk posed by the minimum and maximum MDLs in the dataset.

Table 2.3.1 – Method Detection Limits ($\mu\text{g}/\text{m}^3$)

Pollutant		CAS	2006	2007	2008	
VOCs	Acetone	67-64-1	0.11	0.44	0.25	
	Acrolein	107-02-8	0.11	0.54	0.18	
	Benzene	71-43-2	0.14	0.090	0.10	
	Benzyl Chloride	100-44-7	0.40	0.19	0.061	
	Bromodichloromethane	75-27-4	0.16	0.32	0.14	
	Bromoform	75-25-2	0.36	0.56	0.44	
	Bromomethane	74-83-9	0.065	0.61	0.17	
	1,3-Butadiene	106-99-0	0.18	0.18	0.074	
	Carbon Disulfide	75-15-0	0.11	0.14	0.14	
	Carbon Tetrachloride	56-23-5	0.25	0.11	0.24	
	Chlorobenzene	108-90-7	0.11	0.10	0.18	
	Chloroethane	75-00-3	0.10	0.73	0.16	
	Chloroform	67-66-3	0.30	0.12	0.12	
	Chloromethane	74-87-3	0.062	0.074	0.058	
	Cyclohexane	110-82-7	0.12	0.10	0.082	
	Dibromochloromethane	124-48-1	0.29	0.48	0.32	
	1,2-Dibromoethane	106-93-4	0.26	0.76	0.12	
	m-Dichlorobenzene	541-73-1	0.26	0.092	0.13	
	p-Dichlorobenzene	106-46-7	0.26	0.14	0.15	
	o-Dichlorobenzene	95-50-1	0.19	0.10	0.24	
	Dichlorodifluoromethane (Freon-12)	75-71-8	1.5	0.076	0.083	
	1,1-Dichloroethane	75-34-3	0.19	0.14	0.096	
	1,2-Dichloroethane	107-06-2	0.15	0.19	0.062	
	t-1,2-Dichloroethene	156-60-5	0.28	0.17	0.061	
	c-1,2-Dichloroethene	156-59-2	0.14	0.11	0.094	
	Dichloromethane	75-09-2	0.12	0.18	0.075	
	1,2-Dichloropropane	78-87-5	0.14	0.11	0.10	
	c-1,3-Dichloropropene	10061-01-5	0.22	0.26	0.19	
	t-1,3-Dichloropropene	10061-02-6	0.29	0.27	0.28	
	Dichloro-Tetrafluoroethane (Freon-114)	76-14-2	2.1	0.24	0.12	
	1,4-Dioxane	123-91-1	0.35	0.11	0.092	
	Ethanol	64-17-5	0.35	0.95	0.17	
	Ethyl Acetate	141-78-6	0.18	0.14	0.13	
	Ethylbenzene	100-41-4	0.10	0.079	0.17	
	p-Ethyltoluene	622-96-8	0.23	0.14	0.14	
	Heptane	142-82-5	0.21	0.17	0.10	
	Hexachlorobutadiene	87-68-3	0.38	0.46	0.33	
	Hexane	110-54-3	0.16	0.15	0.076	
	Isopropanol	67-63-0	0.44	0.31	0.053	
	Methyl Ethyl Ketone	78-93-3	0.26	0.35	0.35	
	Methyl Isobutyl Ketone	108-10-1	0.28	0.16	0.097	
	Methyl n-Butyl Ketone	591-78-6	0.35	0.13	0.097	
	Methyl Tert-Butyl Ether	1634-04-4	0.13	0.18	0.11	
	VOCs (cont'd)	Propene	115-07-1	2.3	0.053	0.051
		Styrene	100-42-5	0.34	0.18	0.10
1,1,2,2-Tetrachloroethane		79-34-5	0.37	0.21	0.12	
Tetrachloroethene		127-18-4	0.33	0.15	0.23	
Tetrahydrofuran		109-99-9	0.12	0.12	0.19	
Toluene		108-88-3	0.13	0.09	0.082	
Trichlorotrifluoroethane (Freon-113)		76-13-1	0.31	0.22	0.17	
1,2,4-Trichlorobenzene		120-82-1	0.30	0.42	0.37	
1,1,1-Trichloroethane		71-55-6	0.22	0.15	0.12	
1,1,2-Trichloroethane		79-00-5	0.14	0.17	0.18	
Trichloroethene		79-01-6	0.13	0.13	0.20	
Trichlorofluoromethane (Freon-11)		75-69-4	0.14	0.14	0.094	
1,3,5-Trimethylbenzene		108-67-8	0.34	0.18	0.21	
1,2,4-Trimethylbenzene		95-63-6	0.33	0.12	0.20	
Vinyl Acetate		108-05-4	0.14	0.32	0.36	
Vinyl Chloride		75-01-4	0.15	0.086	0.098	
1,1-Dichloroethene (Vinylidene Chloride)		75-35-4	0.20	0.12	0.11	
o-Xylene		95-47-6	0.16	0.066	0.10	
m+p-Xylenes		1330-20-7	0.28	0.55	0.60	
Carbonyls		2,5-Dimethylbenzaldehyde	5779-94-2	0.016	0.027	0.027
		Acetaldehyde	75-07-0	0.025	0.020	0.056
		Acetone	67-64-1	0.052	0.048	0.017
		Benzaldehyde	100-52-7	0.026	0.013	0.026
		Butyraldehyde	123-72-8	0.012	0.018	0.018
		Crotonaldehyde	123-73-9	0.011	0.017	0.032
		Formaldehyde	50-00-0	0.020	0.033	0.032
		Hexaldehyde	66-25-1	0.020	0.016	0.033
	Isovaleraldehyde	590-86-3	0.014	0.014	0.021	
	Propionaldehyde	123-38-6	0.012	0.012	0.019	
	Tolualdehydes	104-87-0	0.039	0.049	0.034	
	Valeraldehyde	110-62-3	0.014	0.021	0.025	
	Metals	Antimony		2.9×10^{-4}	1.0×10^{-5}	6.0×10^{-6}
Arsenic			2.2×10^{-5}	9.0×10^{-6}	1.0×10^{-5}	
Beryllium			2.5×10^{-5}	2.0×10^{-5}	1.2×10^{-5}	
Cadmium			1.9×10^{-5}	8.0×10^{-6}	8.0×10^{-6}	
Chromium (total)			5.1×10^{-4}	1.4×10^{-4}	1.8×10^{-4}	
Cobalt			2.2×10^{-5}	1.0×10^{-5}	9.0×10^{-6}	
Lead			6.8×10^{-5}	1.8×10^{-5}	1.1×10^{-4}	
Manganese			1.3×10^{-4}	1.6×10^{-5}	2.1×10^{-5}	
Mercury			2.1×10^{-4}	9.0×10^{-6}	2.4×10^{-5}	
Nickel			1.8×10^{-4}	8.8×10^{-5}	1.1×10^{-4}	
Selenium			2.7×10^{-5}	1.8×10^{-5}	2.4×10^{-5}	
Chromium+6			1.2×10^{-5}	8.1×10^{-6}		

Figure 2.3.1 - Hazard Quotients Associated with VOC Concentrations Equal to the Median MDL

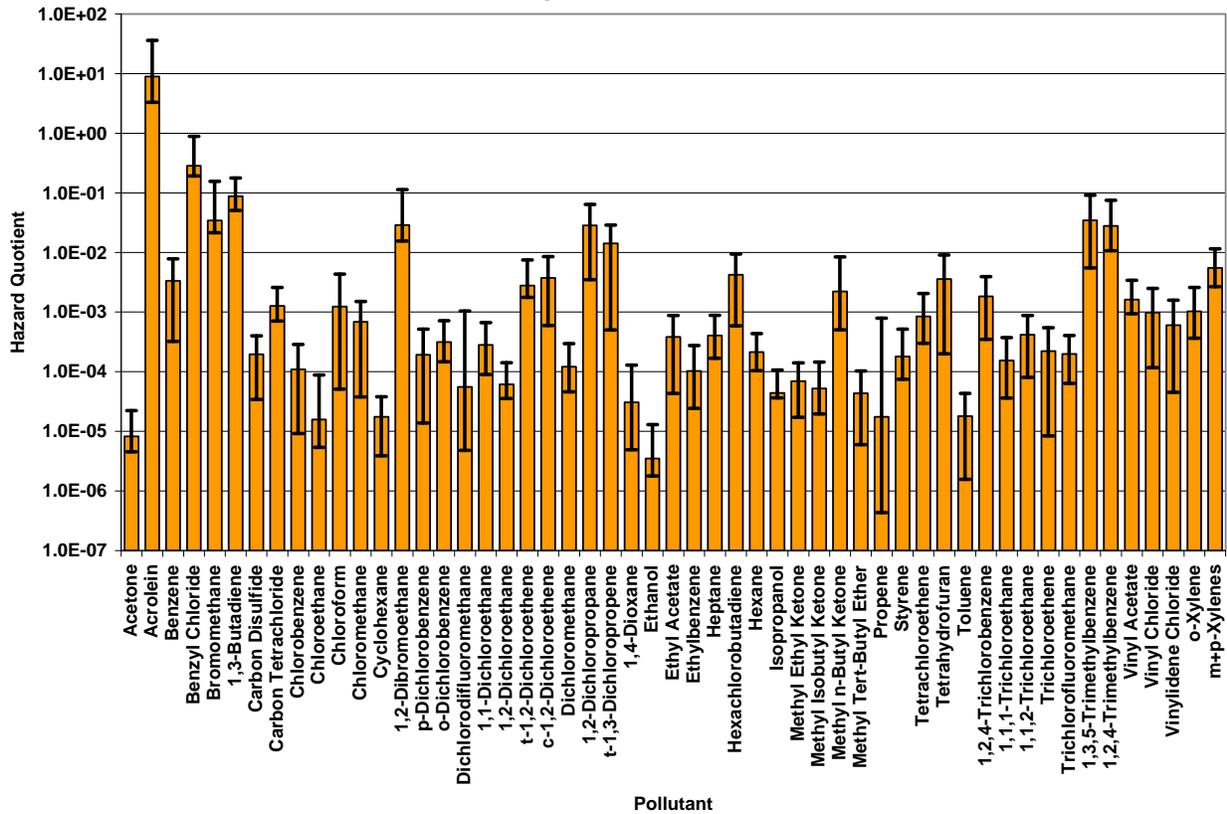


Figure 2.3.2 - Risk Estimates Associated with VOC Concentrations Equal to the Median MDL

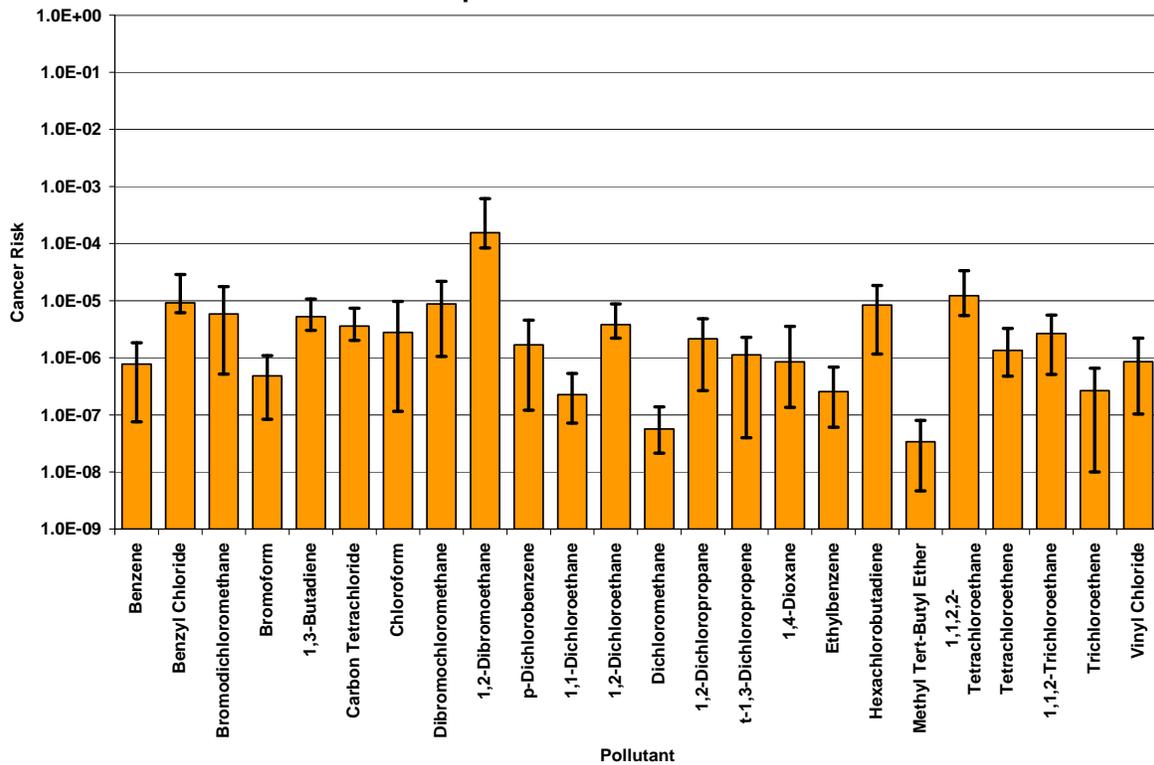


Figure 2.3.3 – Hazard Quotients Associated with Carbonyl and Metal Concentrations Equal to the Median MDL

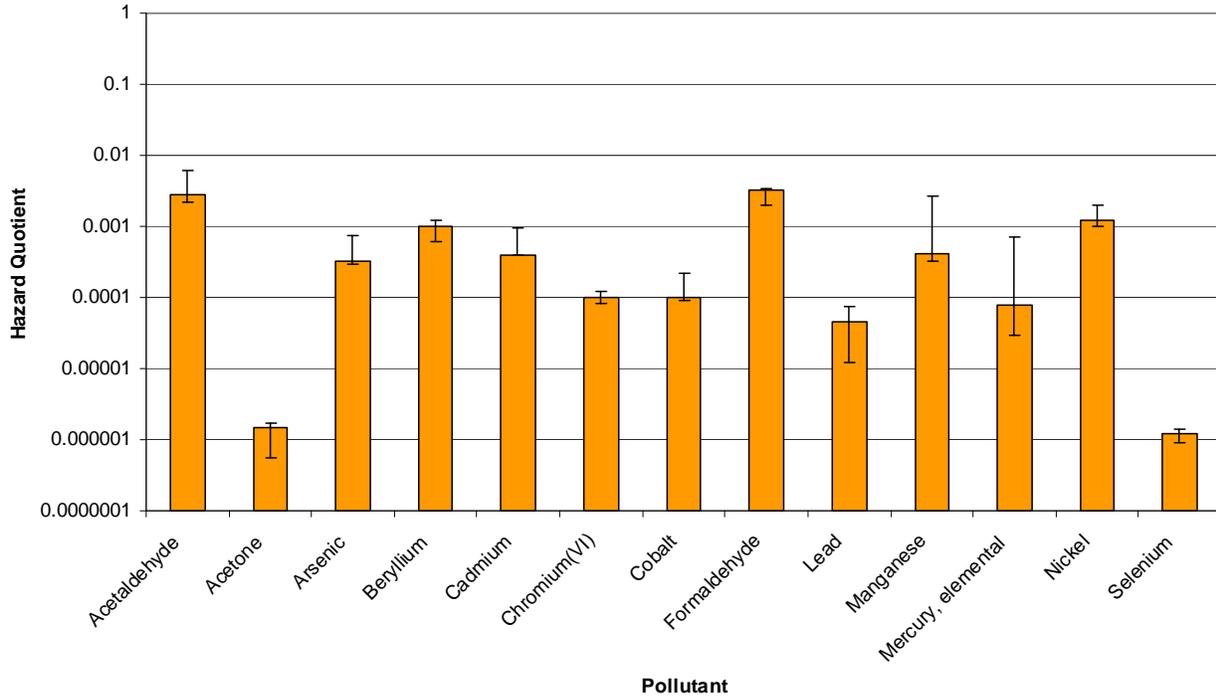
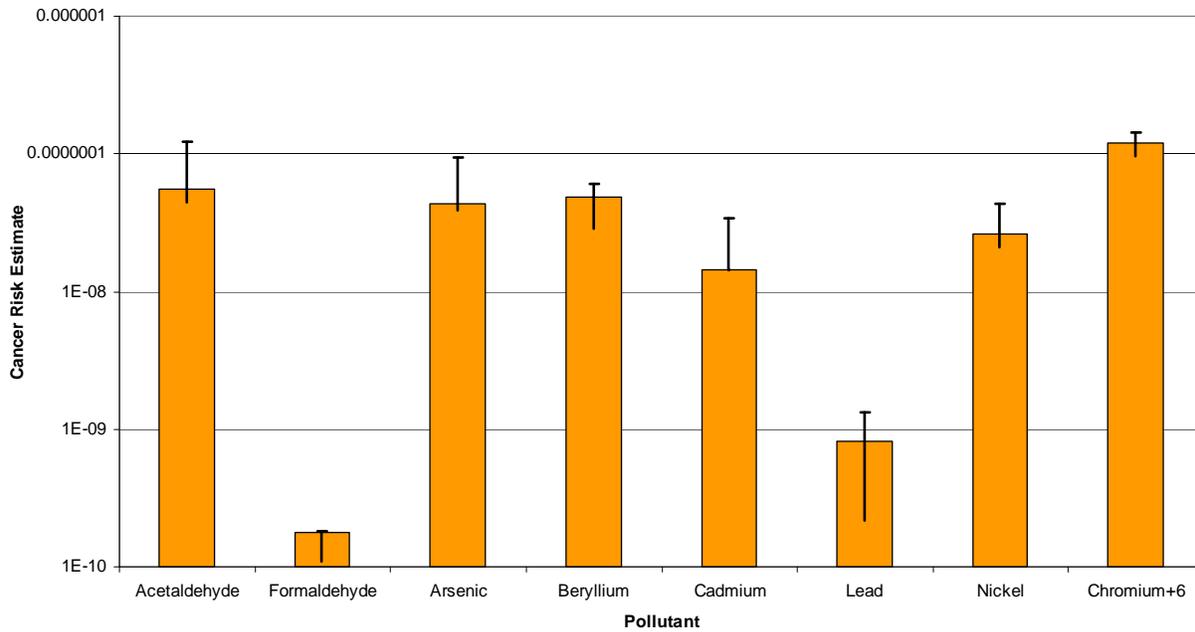


Figure 2.3.4 – Cancer Risk Estimates Associated with Carbonyl and Metal Concentrations Equal to the Median MDL



As Figure 2.3.1 shows, only acrolein has an MDL that prevents a definitive determination of hazard from being made. This is due more to acrolein's low reference concentration than to any problem with the sampling or analysis of the pollutant.

The MDLs' relations to cancer risk estimates are a different story however. U. S. EPA has set a cancer risk of 1 in 1,000,000 as a level that can be considered negligible. However, nearly all of the carcinogens in the Study have median MDLs that represent a concentration that exceeds this threshold. One compound, 1,2-dibromoethene, has an MDL that exceeds the 1 in 10,000 threshold which is the high end of the acceptable risk range set forth by U.S. EPA.

It is important to realize that it is highly unlikely that the true concentrations of samples that are reported as ND or BDL are at or near the MDL. In many cases, the true concentration may be many orders of magnitude below the MDL. Therefore, it should not be assumed that just because a compound's MDL is above the health protective level, the compound poses a threat to human health.

2.3.3 Kaplan-Meier Product Limit Estimate

Kaplan-Meier is a non-parametric method that allows the calculation of a less-biased mean and lower standard error (and by extension, many other statistical values) from a dataset that contains non-detects than simple substitution methods. Kaplan-Meier has many advantages over other methods for dealing with non-detects: it is a non-parametric method, and as such does not require that the distribution of the data be known, it can be used with datasets that contain many non-detects and multiple detection limits, and is more accurate than substitution methods such as using $\frac{1}{2}$ the detection limit.

There appear to be at least two different variations of the Kaplan-Meier method. The main difference in these methods is where censoring occurs in the dataset. The dataset can be censored either at the lowest detection in the dataset or at the lowest detection limit. Censoring at the lowest detection limit will introduce less bias into your results, where censoring at the lowest detection will provide results that are slightly more conservative. Analysis of U.S. EPA's ProUCL software indicates that it censors at the lowest detection. To be consistent with U.S. EPA's ProUCL software, this analysis chose to censor at the lowest detection, rather than the lowest detection limit.

Figure 2.3.5 is an excerpt from the ProUCL Technical Guide explaining the calculation of Kaplan-Meier.

Figure 2.3.5 – Calculation of Kaplan-Meier Product Limit Estimate

From the ProUCL Technical Guidance Document page 100-101:

Let x_1, x_2, \dots, x_n (detection limits or actual measurement) represent n data values obtained from samples collected from an area of concern (AOC), and let $x'_1 < x'_2, \dots < x'_n$ denote the n' distinct values at which detects are observed. That is, $n' (\leq n)$ represents distinct observed values in the collected data set of size n . For $j = 1, \dots, n'$, let m_j denote the number of detects at x'_j and let n_j denote the number of $x_i \leq x'_j$. Also, let $x(1)$ denote the smallest x_i . Then

$$\begin{aligned} \tilde{F}(x) &= 1, & x &\leq x'_n \\ \tilde{F}(x) &= \prod_{j \text{ such that } x'_j > x} \frac{n_j - m_j}{n_j}, & x'_1 &\leq x \leq x'_n \\ \tilde{F}(x) &= \tilde{F}(x'_1), & x(1) &\leq x \leq x'_1 \\ \tilde{F}(x) &= 0 \text{ or undefined,} & 0 &\leq x \leq x(1) \end{aligned}$$

Note that in the last equality statement of $\tilde{F}(x)$ above, $\tilde{F}(x) = 0$ when $x(1)$ is a detect, and is undefined when $x(1)$ is a nondetect. The estimation of the population mean using the KM method is described as follows.

$$\hat{\mu} = \sum_{i=1}^{n'} x'_i [\tilde{F}(x'_i) - \tilde{F}(x'_{i-1})], \text{ with } x_0 = 0$$

Using the PLE (or KM) method as described above, an estimate of the standard error (SE) of the mean can be obtained. This is given by the following equation.

$$\hat{\sigma}_{SE}^2 = \frac{n-k}{n-k-1} \sum_{i=1}^{n'-1} a_i^2 \frac{m_{i+1}}{n_{i+1}(n_{i+1} - m_{i+1})},$$

where k = number of observation below the detection limit and

$$a_i = \sum_{j=1}^i (x'_{j+1} - x'_j) \tilde{F}(x'_j), \quad i = 1, 2, \dots, n'-1.$$

2.3.4 Upper Confidence Limits of the Mean (UCLs)

UCLs are statistical calculations that provide an upper bound estimation of the true mean of a population. In the environmental arena, the population usually refers to the concentration to which a receptor is being exposed. In order to calculate any UCL there are two pieces of information that are required; an estimation of the central tendency (usually the mean), and an estimation of the spread in the values (often the standard deviation.) Different UCL calculations may have additional factors that are considered, but most, if not all, UCL calculations require these main two pieces of data.

There are literally dozens of different UCLs that can be calculated. Each has its strengths and weaknesses depending on the dataset being analyzed. For illustrative purposes one of the simplest UCL calculations, based on the student's-t-distribution will be discussed. The equation for calculating a student's-t UCL is as follows:

Eq. 2.3.1 Example– Student's-t UCL	
$UCL = \bar{x} + \frac{t \times s}{\sqrt{n}}$	
Symbol	Definition
\bar{x}	Sample Mean
t	Student's-t Statistic
s	Sample Standard Deviation
n	Sample Size

For simplicity, let us consider a set of 10 air samples for acetone (n=10) for which we want to calculate a ninety-five percent (95%) UCL. The values observed are 13, 12.7, 11.2, 11.1, 0.89, 16.6, 9.8, 7.5, 13, and 15. The mean of this dataset, \bar{x} , is 11.1, and the standard deviation, s , is 4.4. The t statistic can be found in a table available in any introductory statistics book or on many websites. In our example we wish to calculate a 95% UCL based on 10 samples so the t statistic is 1.83. Once we have these pieces of information, it is simply a matter of performing the following steps:

Figure 2.3.6 – Example UCL Calculation

$UCL = 11.1 + \frac{1.83 \times 4.4}{\sqrt{10}}$	<i>Insert the appropriate values into Eq. 1</i>
$UCL = 11.1 + \frac{1.83 \times 4.4}{3.16}$	<i>Take the square root of the sample size.</i>
$UCL = 11.1 + \frac{8.052}{3.16}$	<i>Multiply the t-statistic and the standard deviation</i>
$UCL = 11.1 + 2.55$	<i>Divide that product by the square root of the sample size</i>
$UCL = 13.6$	<i>Add this product to the mean to get the 95% UCL</i>

While the student's-t UCL is simple and does improve on a simple consideration of mean and standard deviation, it is not without its problems. The student's-t UCL is a parametric statistical test, which means that the distribution of the population from which the samples are being taken needs to be known (and in the case of student's-t, be normal) in order for the test to be statistically sound. The further from normal the population's distribution is, the less accurate a UCL based on student's-t will be. It is true of any parametric statistical test that, the further the population distribution diverges from the assumed distribution, the less accurate the results of the test will be.

That is where non-parametric tests come into play. Non-parametric tests do not require the population to be of any particular distribution or for the distribution even to be known. While a parametric test, when performed on a perfectly distributed dataset, will provide a superior result to that of a non-parametric test, this difference is usually well within any uncertainty factors found when dealing with environmental data.

Table 2.3.2 illustrates this point with data collected using EPA's ProUCL software and the dataset from the example above. The dataset from the example above was normally distributed, and thus the UCLs based on the t statistic are the most appropriate parametric values. If you examine the UCLs provided for lognormal and gamma distributions, they are considerably different than those calculated assuming a normal distribution. However, all the non-parametric UCLs are very close to those calculated assuming a normal distribution.

This example illustrates a major advantage of using non-parametric statistics, especially when the distribution is not known, or there are a great many UCLs that need to be calculated. They allow you to calculate reasonably accurate UCLs without having to determine each sample set's best fit distribution, and will almost always provide more accurate results than using a parametric method when the distribution is not known.

2.3.5 Consideration of Other EPCs

During the course of the Study questions were raised concerning whether a UCL was the most appropriate choice for use as the EPC. Some stakeholders felt that the mean or the

Table 2.3.2 - Various UCLs

Assuming Normal Distribution	
95% Student's-t UCL	13.63
95% Adjusted-CLT UCL	12.71
95% Modified-t UCL	13.53
Assuming Gamma Distribution	
95% Approximate Gamma UCL	16.61
95% Adjusted Gamma UCL	17.86
Assuming Lognormal Distribution	
95% H-UCL	29.24
95% Chebyshev (MVUE) UCL	28.02
97.5% Chebyshev (MVUE) UCL	34.68
99% Chebyshev (MVUE) UCL	47.76
Nonparametric Statistics	
95% CLT UCL	13.37
95% Jackknife UCL	13.63
95% Standard Bootstrap UCL	13.19
95% Bootstrap-t UCL	13.19
95% Hall's Bootstrap UCL	12.89
95% Percentile Bootstrap UCL	13.1
95% BCA Bootstrap UCL	12.75
Chebyshev	
95% Chebyshev(Mean, Sd) UCL	17.14
97.5% Chebyshev(Mean, Sd) UCL	19.77
99% Chebyshev(Mean, Sd) UCL	24.92

mean plus one (1) standard deviation would be a more appropriate EPC for the Study. It should be noted that the mean plus one (1) standard deviation would always be a larger EPC than the 95% UCL. There are already multiple levels of conservatism built into the calculation of risks and hazards, so it was deemed unnecessary to add this further level of conservatism to the values. On the other end of consideration, using just the mean would not be appropriate as it is descriptive only of the sample set and not the population as a whole. To illustrate the difference between the three possible EPCs discussed, Table 2.3.3 shows them side by side for the VOCs sampled in the Study.

Table 2.3.3 – Comparison of Selected UCLs, Means, and Standard Deviations

Pollutant	CAS #	Harding Street			Stout Field		
		Mean	St. Dev.	UCL	Mean	St. Dev.	UCL
Acetone	67-64-1	9.5	12	11	190	520	290
Acrolein	107-02-8	3	6.6	3.9	1.6	1.6	1.9
Benzene	71-43-2	1.1	0.93	1.3	1.6	2.3	1.9
Bromomethane	74-83-9	0.31	0.25	0.35	0.31	0.21	0.35
1,3-Butadiene	106-99-0	0.12	0.08	0.13	0.12	0.075	0.13
Carbon Disulfide	75-15-0	0.16	0.04	0.17	0.47	0.59	0.56
Carbon Tetrachloride	56-23-5	0.28	0.13	0.3	0.28	0.14	0.3
Chloroethane	75-00-3	N/A	N/A	N/A	0.19	0.069	0.2
Chloroform	67-66-3	0.16	0.083	0.17	0.15	0.011	0.15
Chloromethane	74-87-3	0.93	0.45	0.99	0.89	0.45	0.95
Cyclohexane	100-82-7	0.17	0.16	0.2	0.17	0.18	0.2
m-Dichlorobenzene	541-73-1	0.38	0.096	0.39	0.22	0.2	0.25
p-Dichlorobenzene	106-46-7	0.3	0.24	0.34	0.66	0.9	0.78
o-Dichlorobenzene	95-50-1	N/A	N/A	N/A	N/A	N/A	N/A
Dichlorodifluoromethane (F-12)	75-71-8	2.5	1.6	2.8	2.4	1.3	2.7
t-1,2-Dichloroethene	156-60-5	N/A	N/A	N/A	0.33	0.12	0.35
c-1,2-Dichloroethene	156-59-2	N/A	N/A	N/A	N/A	N/A	N/A
Dichloromethane	75-09-2	0.45	0.52	0.52	0.22	0.16	0.25
1,4-Dioxane	123-91-1	0.22	0.31	0.27	0.19	0.19	0.22
Ethanol	64-17-5	42	71	54	32	32	37
Ethyl Acetate	141-78-6	0.4	0.65	0.5	0.32	0.36	0.4
Ethylbenzene	100-41-4	0.34	0.41	0.4	0.41	0.48	0.48
p-Ethyltoluene	622-96-8	0.28	0.21	0.31	0.29	0.21	0.32
Heptane	142-82-5	0.49	0.45	0.57	0.57	0.66	0.66
Hexane	110-54-3	0.77	0.92	0.92	0.63	0.77	0.77
Isopropanol	67-63-0	1.6	2.7	2.1	1.4	1.7	1.6
Methyl Ethyl Ketone (MEK)	78-93-3	2.2	1.8	2.5	3.2	5	4.1
Methyl Isobutyl Ketone (MIBK)	108-10-1	0.29	0.29	0.34	0.38	0.38	0.45
Methyl n-Butyl Ketone (MBK)	591-78-6	0.78	3.4	1.3	0.66	0.78	0.78
Propene	115-07-1	0.93	0.58	1	1.1	0.67	1.2
Styrene	100-42-5	0.15	0.077	0.16	0.38	0.55	0.47
Tetrachloroethene (PCE)	127-18-4	0.33	0.39	0.39	0.31	0.24	0.35
Tetrahydrofuran (THF)	109-99-9	0.21	0.14	0.23	0.24	0.18	0.27
Toluene	108-88-3	2.5	2.9	2.9	2.6	4.9	3.5
Trichlorotrifluoroethane (F-113)	76-13-1	0.56	0.26	0.61	0.54	0.22	0.57
1,2,4-Trichlorobenzene	120-82-1	0.62	0.011	0.62	N/A	N/A	N/A

Table 2.3.3 – Comparison of Selected UCLs, Means, and Standard Deviations

Pollutant	CAS #	Harding Street			Stout Field		
		Mean	St. Dev.	UCL	Mean	St. Dev.	UCL
Trichloroethene (TCE)	79-01-6	0.17	0.039	0.17	0.2	0.19	0.24
Trichlorofluoromethane (F-11)	75-69-4	1.3	0.84	1.4	1.3	1	1.4
1,3,5-Trimethylbenzene	108-67-8	0.27	0.11	0.29	0.28	0.12	0.3
1,2,4-Trimethylbenzene	95-63-6	0.54	0.64	0.64	0.79	0.84	0.93
Vinyl Acetate	108-05-4	4.2	6.3	5.3	3.9	4.9	4.6
o-Xylene	95-47-6	0.4	0.52	0.48	0.61	0.69	0.69
m+p-Xylenes	106-42-3	1.1	1.4	1.3	1.5	1.9	1.8

2.3.6 Toxicity Parameters

There are several sources of published toxicity parameters available on the internet and elsewhere. None of these sources is exhaustive and they do not always agree on the risk or hazard posed by a particular compound. As such, several sources were examined when developing the toxicity parameters for the Study.

For the Study, a two-tiered approach was developed. The sources in the first tier are generally considered the most reliable sources of toxicity data in the environmental arena:

1. U.S. EPA Office of Air Quality Planning and Standards (OAQPS)

OAQPS compiles a list of available inhalation toxicity data for use in air risk assessments. It is updated on a regular basis and uses many of the other sources on this list, making it a valuable starting point.

2. Integrated Risk Information Service (IRIS)

IRIS is U.S. EPA's online database of toxicity parameters. It is maintained by the National Center for Environmental Assessment (NCEA) and is widely considered to be the definitive source of toxicity parameters within the United States.

3. Agency for Toxic Substances and Disease Registry (ATSDR)

ATSDR is a division of the U.S. Department of Health and Human Services tasked with implementing the health-related sections of laws that protect the public from hazardous wastes and environmental spills of hazardous substances. Part of this task has been fulfilled by developing a series of "Toxicological Profiles" which include acute, intermediate (sub-chronic), and chronic reference doses and reference concentrations (RfCs) for several compounds. ATSDR's primary focus is on non-carcinogenic effects and has developed few, if any, inhalation unit risks (IURs).

4. California Environmental Protection Agency (Cal/EPA)

Cal/EPA is the state-level agency responsible for the protection of human health and the environment in the State of California. Cal/EPA has done extensive independent toxicity research and has developed many of its own toxicity parameters. Many of these toxicity parameters have been cited by state and federal agencies across the nation.

Each of these sources was checked in turn for available toxicity parameters. If the above sources were unable to provide toxicity information, data from a second tier of sources that were deemed not to be as reliable or as widely accepted as their counterparts above were compiled in an attempt to fill gaps in the dataset. These sources included:

1. The National Institute for Public Health and the Environment (RIVM)

RIVM is the environmental agency of the Netherlands. They have derived many toxicological parameters that are applied in the Netherlands and the rest of Europe. However, as their values do not undergo external peer review and are not widely used within the United States, they were not included among the list of Tier 1 sources.

2. Health Canada

Health Canada is the federal department within the Canadian government responsible for the health of Canadian citizens. They fill the role of environmental regulator in Canada, as well as, administering social programs such as the national healthcare system. Health Canada maintains a database of toxicity parameters for use in the environmental field. This database was searched but was unable to provide any new toxicity parameters.

3. Health Effects Assessment Summary Tables (HEAST)

HEAST was published by U.S. EPA's National Center for Environmental Assessment (NCEA) until 1997. The HEAST tables contained non-carcinogenic toxicity parameters that U.S. EPA did not recognize as "high quality, Agency-wide consensus information". HEAST is still widely cited, but due to the lack of updates, was included in the lower tier of sources.

4. IDEM Office of Land Quality (OLQ)

OLQ maintains a table of default closure levels (DCLs) used in environmental remediation oversight by the IDEM. These DCLs are derived by using toxicity data collected from many of the sources already described in the lists above. However, when toxicity parameters are not available from a traditional source, OLQ will derive provisional toxicity values for use on a site-by-site basis.

After compiling all available data from the above sources, an analysis of American Council of Government Industrial Hygienists (ACGIH) Threshold Limit Values (TLVs) was conducted to determine whether they could be modified to serve as RfCs. TLVs are air concentrations that are meant to be protective of human health in a workplace environment. ACGIH does not, as is often thought, incorporate economic or technological considerations into their derivation of TLVs. As such, it was decided that, with proper adjustment, they could serve as RfCs.

To determine a proper adjustment factor, a list was compiled of all available RfCs from IRIS. This list was then compared against the 2008 TLV list to generate a table that

contained compounds that had both an RfC in IRIS and a TLV. These TLVs were then converted to a continuous exposure concentration using the following equation:

Equation 2.3.2 - TLV Continuous Exposure Conversion

$TLV_{CE} = TLV \times \frac{5\text{days}}{7\text{days}} \times \frac{10\text{m}^3}{20\text{m}^3}$	
Value	Description
TLV_{CE}	Continuous Exposure Threshold Limit Value
TLV	Threshold Limit Value
5days	Workdays per Week
7days	Total Days per Week
10m^3	Occupation Daily Breathing Rate
20m^3	Total Daily Breathing Rate

This basic approach was modified from one outlined in section I.A.4. of IRIS's discussion of Aluminum Phosphide's oral reference dose.

(<http://www.epa.gov/ncea/iris/subst/0005.htm>)

A scatter plot of the IRIS RfCs and the continuous exposure TLVs was generated and a best-fit line was determined. Microsoft Excel offers several trend lines and each was tested to determine which had the best correlation with the available data. Once a best-fit line was determined, a level of conservatism was added to ensure that 95% of the predicted values would be at least as conservative as the IRIS RfC. The final result was the following equation:

Equation 2.3.3 - RfC Derivation from TLV_{CE}

$RfC = 0.000328 TLV_{CE}^{1.126}$	
Value	Description
RfC	Reference Concentration
TLV_{CE}	Continuous Exposure Threshold Limit Value

Figure 2.3.7 - Predicted Iris Values vs. Actual IRIS Values

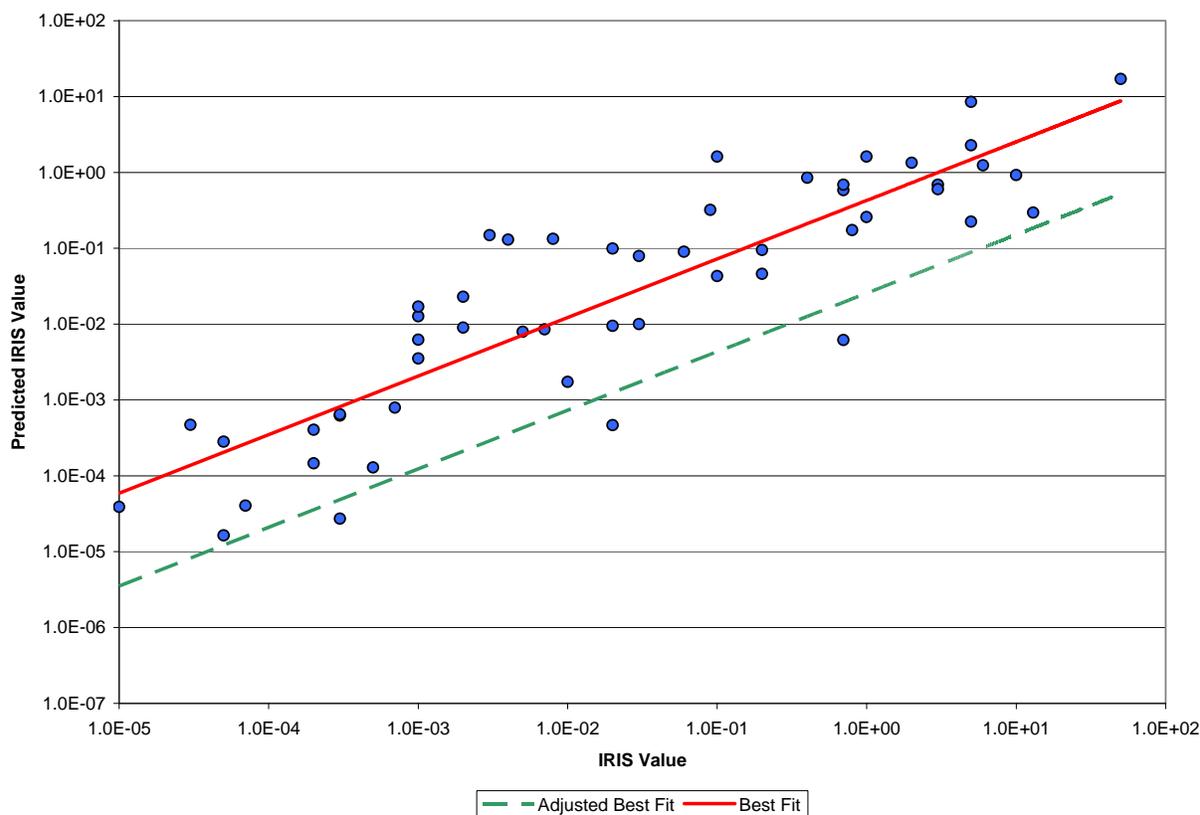


Figure 2.3.7 describes the correlation between actual IRIS values and those derived by Equation 2.3.2. Equation 2.3.3 was then used, along with information found in the 2008 TLV list, to derive RfCs for the following compounds:

- Benzyl Chloride,
- Dichlorodifluoromethane,
- Ethyl Acetate, and
- Heptane

It should be noted that while IDEM feels that the RfCs derived through this method are adequately conservative for these purposes, they do not carry the same weight as other values found in the hierarchy and should not be treated equally.

Tables 2.3.4 shows the toxicity parameters used for both the modeling and monitoring portions of the Study, along with the source of the information. These values were current as of September 2008, when the table was generated, but may not represent current toxicity parameters found in these databases.

Table 2.3.4 – Toxicity Parameters Used in the Study

Compound	CAS	IUR		RfC		
		Value	Source	Value	Source	Critical Effect
		mg/m ³		(µg/m ³) ⁻¹		
Acenaphthene	83-32-9					
Acenaphthylene	208-96-8			0.035	L(S-MI)	
Acetaldehyde	75-07-0	0.0000022	O(I)	0.009	O(I)	Resp.
Acetone	67-64-1			31	A	Neuro.
Acetophenone	98-86-2					
Acrolein	107-02-8			0.00002	O(I)	Resp.
Acrylic Acid	79-10-7			0.001	O(I)	Resp.
Ammonia	7664-41-7			0.1	I	Resp.
Anthracene	120-12-7					
Antimony	7440-36-0					
Arsenic, inorganic	7440-38-2	0.0043	O(I)	0.00003	O(C)	Repro.; Neuro.; Other
Barium and Compounds	7440-39-3			0.001	R	
Benz[a]anthracene	56-55-3	0.00011	O(C)			
Benzaldehyde	100-52-7					
Benzene	71-43-2	0.0000078	O(I)	0.03	O(I)	Other
Benzo[a]pyrene (BaP)	50-32-8	0.0011	O(C)			
Benzo[b]fluoranthene	205-99-2	0.00011	O(C)			
Benzo[g,h,i]perylene	191-24-2	0.000011				
Benzo[j]fluoranthene	205-82-3	0.00011	O(C)			
Benzyl chloride	100-44-7	0.000049	O(C)	0.00066	ACGIH	N/A
Beryllium and compounds	7440-41-7	0.0024	O(I)	0.00002	O(I)	Resp.
1,1-Biphenyl	92-52-4					
Bromodichloromethane	75-27-4	0.000037	C			
Bromoform	75-25-2	0.0000011	O(I)			
Bromomethane	74-83-9			0.005	O(I)	Resp.
1,3-Butadiene	106-99-0	0.00003	O(I)	0.002	O(I)	Repro.
Butane	106-97-8					
n-Butanol	71-36-3					
sec-Butyl alcohol	78-92-2					
Butyraldehyde	123-72-8					
3-methyl-Butyraldehyde	590-86-3					
Cadmium	7440-43-9	0.0018	O(I)	0.00002	O(C)	Resp.; Other
Carbon Disulfide	75-15-0			0.7	O(I)	Neuro.
Carbon tetrachloride	56-23-5	0.000015	O(I)	0.19	O(D-A)	Other
2-Chloroacetophenone	532-27-4			0.00003	O(I)	Resp.
Chlorobenzene	108-90-7			1	O(C)	Repro.; Other
Chloroform	67-66-3	0.000023	I	0.098	O(A)	Other
Chromium(III), insoluble salts	16065-83-1			0.06	R	Other
Chromium(VI)	18540-29-9	0.012	O(I)	0.0001	O(I)	Resp.
Chrysene	218-01-9	0.000011	O(C)			
Cobalt	7440-48-4			0.0001	O(A)	Resp.
Copper	7440-50-8			0.001	R	Resp.; Other
Crotonaldehyde	123-73-9					
Cumene	98-82-8			0.4	O(I)	Other
Cyanide, free	57-12-5			0.025	R	Other
Cyclohexane	110-82-7			6	I	Repro.
Di(2-ethylhexyl)phthalate (DEHP)	117-81-7	0.0000024	O(C)	0.01	O(P-C)	Repro.
Dibenz[a,h]anthracene	53-70-3	0.0012	O(C)			
Dibromochloromethane	124-48-1	0.000027	C			
1,2-Dibromoethane	106-93-4	0.0006	O(I)	0.009	O(I)	Resp.
1,3-Dichlorobenzene	541-73-1					
1,2-Dichlorobenzene	95-50-1			0.6	R	Other
p-Dichlorobenzene	106-46-7	0.000011	O(C)	0.8	O(I)	Repro.
Dichlorobenzene (mixed isomers)	25321-22-6					

Table 2.3.4 – Toxicity Parameters Used in the Study

		IUR		RfC		
		Value		Value		
Dichlorodifluoromethane	75-71-8			1.5	ACGIH	N/A
1,1-Dichloroethane	75-34-3	0.0000016	O(C)	0.5	O(H)	N/A
1,2-Dichloroethane	107-06-2	0.000026	O(I)	2.4	O(A)	Other
cis-1,2-Dichloroethene	156-59-2			0.03	R	Other
trans-1,2-Dichloroethene	156-60-5			0.06	R	Resp.; Other
1,1-Dichloroethene (Vinylidene Chloride)	75-35-4			0.2	O(I)	Other
Dichloromethane	75-09-2	4.7E-07	O(I)	1	O(A)	Other
1,2-Dichloropropane	78-87-5	0.000019	O(R)	0.004	O(I)	Resp.
cis-1,3-Dichloropropene	10061-01-3					
trans-1,3-Dichloropropene	10061-02-6	0.000004		0.02	L(IDEM)	
Dichlorotetrafluoroethane	76-14-2					
Dimethyl sulfate	77-78-1					
7,12-Dimethylbenz[a]anthracene	57-97-6	0.071	O(C)			
2,5-Dimethylbenzaldehyde	5779-94-2					
N,N-Dimethylformamide	68-12-2			0.03	O(I)	Other
2,4-Dinitrotoluene	121-14-2	0.000089	O(C)	0.007	O(P-C)	Repro.
1,4-Dioxane	123-91-1	0.0000077	O(C)	3.6	O(D-A)	Other
Ethane	74-84-0					
Ethanol	64-17-5			100	L(IDEM)	
Ethyl acetate	141-78-6			0.37	ACGIH	N/A
Ethyl chloride	75-00-3			10	O(I)	Repro.
1-Ethyl-4-methylbenzene	622-96-8					
Ethylbenzene	100-41-4	0.0000025	C	1	O(I)	Repro.
Ethylene glycol	107-21-1			0.4	O(C)	Repro.; Resp.; Other
Fluoranthene	206-44-0					
Fluorene	86-73-7					
Formaldehyde	50-00-0	5.5E-09	O(O)	0.0098	O(A)	Resp.
Glycol ethers	EDF-109					
n-Heptane	142-82-5			0.43	ACGIH	N/A
Hexachlorobutadiene	87-68-3	0.000022	O(I)	0.09	O(P-C)	N/A
Hexaldehyde	66-25-1					
1,6-Hexamethylene diisocyanate	822-06-0			0.00001	O(I)	Resp.
n-Hexane	110-54-3			0.7	O(I)	Neuro.
Hydrofluoric acid	7664-39-3			0.014	O(C)	Other
Hydrogen chloride	7647-01-0			0.02	O(I)	Resp.
1-Hydroxy-2-phenoxyethane	122-99-6					
Indeno[1,2,3-cd]pyrene	193-39-5	0.00011	O(C)			
Isophorone	78-59-1	2.7E-07	O(R)	2	O(C)	Repro.; Other
Isopropyl Alcohol	67-63-0			7	C	Repro.; Other
Lead and compounds (inorganic)	7439-92-1	0.000012	C	0.0015	O(O)	N/A
Manganese	7439-96-5			0.00005	O(I)	Neuro.
Mercury, elemental	7439-97-6			0.0003	O(I)	Neuro.
Methanol	67-56-1			4	O(C)	Repro.
Methyl chloride	74-87-3			0.09	O(I)	Neuro.
Methyl ethyl ketone (MEK)	78-93-3			5	I	Repro.
Methyl Hydrazine	60-34-4					
Methyl isobutyl ketone (MIBK)	108-10-1			3	O(I)	Repro.
Methyl methacrylate	80-62-6			0.7	O(I)	Resp.
Methyl n-butyl ketone	591-78-6			0.057	L(I)	
Methyl tert-butyl ether (MTBE)	1634-04-4	2.6E-07	O(C)	3	O(I)	Other
3-Methylchloranthrene	56-49-5	0.0063	O(C)			
2-Methylnaphthalene	91-57-6					
Molybdenum	7439-98-7			0.012	R	Other
Naphthalene	91-20-3	0.000034	O(C)	0.003	O(I)	Resp.
Nickel refinery dust	N/A	0.00024	I	0.00009	O(D-A)	Resp.

Table 2.3.4 – Toxicity Parameters Used in the Study

		IUR		RfC		
		Value		Value		
Pentane	109-66-0					
Phenanthrene	85-01-8					
Phenol	108-95-2			0.2	O(C)	Neuro.; Other
Polycyclic organic matter (POM)	EDF-047					
Propane	74-98-6					
Propionaldehyde	123-38-6					
Propylene	115-07-1			3	C	Resp.
Propylene oxide	75-56-9	0.0000037	O(I)	0.03	O(I)	Resp.
Pyrene	129-00-0					
Pyridine	110-86-1					Other
Selenium and compounds	7782-49-2			0.02	O(C)	Neuro.; Other
Styrene	100-42-5			1	O(I)	Neuro.
Sulfuric acid	7664-93-9			0.001	C	Resp.
1,1,2,2-Tetrachloroethane	79-34-5	0.000058	O(I)			
Tetrachloroethene	127-18-4	0.0000059	O(C)	0.27	O(A)	Neuro.
Tetrahydrofuran	109-99-9			0.035	R	Resp.; Other
Tolualdehydes	NA					
Toluene	108-88-3			5	O(I)	Neuro.
1,1,2-Trichloro-1,2,2-trifluoroethane	76-13-1					
1,2,4-Trichlorobenzene	120-82-1			0.2	O(H)	N/A
1,1,1-Trichloroethane	71-55-6			1	O(C)	Neuro.
1,1,2-Trichloroethane	79-00-5	0.000016	O(I)	0.4	O(P-C)	Resp.
Trichloroethene	79-01-6	0.000002	O(C)	0.6	O(C)	Neuro.; Other
Trichlorofluoromethane	75-69-4			0.7	L(R(H))	
Triethylamine	121-44-8			0.007	O(I)	Resp.
1,2,4-Trimethylbenzene	95-63-6			0.007	L(R(p))	
1,3,5-Trimethylbenzene	108-67-8			0.006	L(P)	
2,2,4-Trimethylpentane	540-84-1					
Valeraldehyde	110-62-3					
Vanadium	7440-62-2					
Vinyl acetate	108-05-4			0.2	O(I)	Resp.
Vinyl chloride	75-01-4	0.0000088	O(I)	0.1	O(I)	Other
Xylenes	1330-20-7			0.1	O(I)	Neuro.
Zinc and compounds	7440-66-6					

Sources:

O – U.S. EPA's Office of Air Quality Planning and Standards (OAQPS)

I – U.S. EPA's Integrated Risk Information Service (IRIS)

A – Agency for Toxic Substances and Disease Registry (ATSDR)

L – IDEM's Office of Land Quality

C – California Environmental Protection Agency (Cal/EPA)

R – The National Institute for Public Health and the Environment (RIVM)

X(Y) – X citing Y (e.g. O(I) – OAQPS citing IRIS)

3.0 Study Results

3.1 Monitoring Results

3.1.1 Calculated Exposure Point Concentrations (EPCs)

Analytical results from the Study's monitoring portion were used to calculate exposure point concentrations (EPCs). These EPCs were then used for a variety of analyses. They were used to calculate risk and hazard estimates, to test the efficacy of the modeling effort, and to perform comparisons between the Study Area and other areas of the state and nation.

Monitored concentrations at both the Harding Street and Stout Field monitors were relatively consistent. The most notable exception to this is acetone where the calculated EPC is much higher at Stout Field than Harding Street. This is the result of an apparently localized acetone release event which occurred in mid-2007. Please refer to Section 3.1.4 for more information about the acetone readings at Stout Field. It should be noted that though acetone concentrations rose to levels much higher than those normally seen, they never reached levels that would be seen as a health concern.

The following tables list the detection rates and EPCs calculated for each monitored pollutant at each of the two Study monitoring locations. For calculations of risk and hazard associated with these concentrations please refer to section 3.1.2 of this report.

Table 3.1.1 – Exposure Point Concentrations for Volatile Organic Compounds (VOCs)

Pollutant	CAS#	Harding Street		Stout Field	
		Detect Rate	95% KM(t) UCL µg/m ³	Detect Rate	95% KM(t) UCL µg/m ³
Acetone	67-64-1	98.33%	11	97.35%	270
Acrolein	107-02-8	93.33%	1.9	84.96%	1.7
Benzene	71-43-2	100.00%	1.3	95.58%	1.9
Benzyl Chloride	100-44-7	0.00%		0.00%	
Bromodichloromethane	75-27-4	0.00%		0.00%	
Bromoform	75-25-2	0.00%		0.00%	
Bromomethane	74-83-9	21.67%	0.32	23.89%	0.31
1,3-Butadiene	106-99-0	22.50%	0.13	23.89%	0.13
Carbon Disulfide	75-15-0	11.67%	0.17	62.83%	0.56
Carbon Tetrachloride	56-23-5	35.00%	0.28	38.05%	0.28
Chlorobenzene	108-90-7	1.67%		0.00%	
Chloroethane	75-00-3	0.00%		1.77%	
Chloroform	67-66-3	24.17%	0.17	7.96%	0.15
Chloromethane	74-87-3	98.33%	1	95.58%	0.94
Cyclohexane	100-82-7	47.50%	0.2	45.13%	0.19
Dibromochloromethane	124-48-1	0.00%		0.00%	
1,2-Dibromoethane	106-93-4	0.00%		0.00%	
m-Dichlorobenzene	541-73-1	5.00%		7.96%	0.25
p-Dichlorobenzene	106-46-7	45.00%	0.34	58.41%	0.75
o-Dichlorobenzene	95-50-1	0.00%		0.00%	
Dichlorodifluoromethane (F-12)	75-71-8	99.17%	2.8	96.46%	2.6
1,1-Dichloroethane	75-34-3	0.00%		0.00%	
1,2-Dichloroethane	107-06-2	0.00%		0.00%	
t-1,2-Dichloroethane	156-60-5	0.00%		1.77%	

Table 3.1.1 – Exposure Point Concentrations for Volatile Organic Compounds (VOCs)

Pollutant	CAS#	Harding Street		Stout Field	
		Detect Rate	95% KM(t) UCL	Detect Rate	95% KM(t) UCL
			$\mu\text{g}/\text{m}^3$		$\mu\text{g}/\text{m}^3$
c-1,2-Dichloroethene	156-59-2	0.00%		0.00%	
Dichloromethane	75-09-2	74.17%	0.52	55.75%	0.24
1,2-Dichloropropane	78-87-5	0.00%		0.00%	
c-1,3-Dichloropropene	10061-01-3	0.00%		0.00%	
t-1,3-Dichloropropene	10061-02-6	0.00%		0.88%	
Dichloro-Tetrafluoroethane (F-114)	76-14-2	0.83%		0.00%	
1,4-Dioxane	123-91-1	13.33%	0.25	11.50%	0.21
Ethanol	64-17-5	81.67%	51	82.30%	35
Ethyl Acetate	141-78-6	68.33%	0.5	60.18%	0.37
Ethylbenzene	100-41-4	74.17%	0.41	69.91%	0.48
p-Ethyltoluene	622-96-8	36.67%	0.31	42.48%	0.31
Heptane	142-82-5	90.83%	0.57	83.19%	0.64
Hexachlorobutadiene	87-68-3	0.83%		0.00%	
Hexane	110-54-3	100.00%	0.92	95.58%	0.75
Isopropanol	67-63-0	78.33%	2	75.22%	1.6
Methyl Ethyl Ketone (MEK)	78-93-3	99.17%	2.5	94.69%	4
Methyl Isobutyl Ketone (MIBK)	108-10-1	56.67%	0.34	60.18%	0.43
Methyl n-Butyl Ketone (MBK)	591-78-6	68.33%	1.3	69.91%	0.76
Methyl Tert-Butyl Ether (MTBE)	1634-04-4	0.83%		0.00%	
Propene	115-07-1	96.67%	1	92.04%	1.1
Styrene	100-42-5	14.17%	0.17	60.18%	0.46
1,1,2,2-Tetrachloroethane	79-34-5	0.83%		0.00%	
Tetrachloroethene (PCE)	127-18-4	40.00%	0.39	35.40%	0.33
Tetrahydrofuran (THF)	109-99-9	26.67%	0.22	28.32%	0.25
Toluene	108-88-3	100.00%	2.9	96.46%	3.4
Trichlorotrifluoroethane (F-113)	76-13-1	93.33%	0.6	85.84%	0.57
1,2,4-Trichlorobenzene	120-82-1	1.67%		0.00%	
1,1,1-Trichloroethane	71-55-6	0.00%		0.00%	
1,1,2-Trichloroethane	79-00-5	0.00%		0.00%	
Trichloroethene (TCE)	79-01-6	8.33%	0.17	15.04%	0.23
Trichlorofluoromethane (F-11)	75-69-4	100.00%	1.4	96.46%	1.4
1,3,5-Trimethylbenzene	108-67-8	14.17%	0.29	22.12%	0.3
1,2,4-Trimethylbenzene	95-63-6	85.83%	0.67	84.07%	0.9
Vinyl Acetate	108-05-4	87.50%	5.3	85.84%	4.5
Vinyl Chloride	75-01-4	0.00%		0.00%	
1,1-Dichloroethene (Vinylidene Chloride)	75-35-4	0.83%		0.00%	
o-Xylene	95-47-6	82.50%	0.48	76.99%	0.72
m+p-Xylenes	106-42-3	92.50%	1.3	86.73%	1.8

Table 3.1.2 – Exposure Point Concentrations for Carbonyls

Pollutant	CAS#	Harding Street		Stout Field	
		Detect Rate	95% KM(t) UCL	Detect Rate	95% KM(t) UCL
			$\mu\text{g}/\text{m}^3$		$\mu\text{g}/\text{m}^3$
Acetaldehyde	75-07-0	100.0%	2.19	100.0%	2.29
Benzaldehyde	100-52-7	96.7%	0.232	95.9%	0.198
Butyraldehyde	123-72-8	99.2%	0.408	99.2%	0.434
Crotonaldehyde	123-73-9	98.4%	0.422	99.2%	0.449
Formaldehyde	50-00-0	100.0%	5.28	100.0%	3.55
Hexaldehyde	66-25-1	99.2%	0.231	97.5%	0.216
Isovaleraldehyde	590-86-3	21.1%	0.0787	20.7%	0.0786
Propionaldehyde	123-38-6	97.6%	0.68	99.2%	0.43
Tolualdehydes	N/A	96.7%	0.278	98.3%	0.263
Valeraldehyde	110-62-3	95.9%	0.179	93.4%	0.167

Table 3.1.3 – Exposure Point Concentrations for Metals

Pollutant	CAS#	Harding Street		Stout Field	
		Detect Rate	95% KM(t) UCL	Detect Rate	95% KM(t) UCL
			$\mu\text{g}/\text{m}^3$		$\mu\text{g}/\text{m}^3$
Antimony	N/A	100%	0.0016	100%	0.0034
Arsenic	N/A	100%	0.00111	100%	0.00124
Beryllium	N/A	8%	7.88E-06	4%	9.19E-06
Cadmium	N/A	100%	0.000285	100%	0.000259
Chromium	N/A	99%	0.00271	100%	0.00293
Cobalt	N/A	99%	0.00068	99%	0.0014
Lead	N/A	100%	0.00623	100%	0.00939
Manganese	N/A	100%	0.00637	100%	0.00627
Mercury	N/A	64%	0.000119	75%	0.00019
Nickel	N/A	100%	0.001	100%	0.00196
Selenium	N/A	100%	0.00162	100%	0.00182
Chromium VI	N/A	77%	4.11E-05		

3.1.2 Risk Estimates and Hazard Quotients

When reliable toxicity data could be found, and monitoring results were sufficient to calculate an EPC, these data were used to calculate cancer risk estimates and non-cancer hazard quotients. Table 3.1.4 lists all risk estimates and hazard quotients associated with monitoring data in the Study.

Table 3.1.4 - Risk Estimates and Hazard Quotients for Monitoring Data

Pollutant	CAS#	Harding Street		Stout Field	
		Hazard Quotient	Risk Estimate	Hazard Quotient	Risk Estimate
Acetone	67-64-1	0.00035		0.0087	
Acrolein	107-02-8	95		85	
Benzene	71-43-2	0.043	1.0×10^{-5}	0.063	1.5×10^{-5}
Benzyl Chloride	100-44-7				
Bromodichloromethane	75-27-4				
Bromoform	75-25-2				

Table 3.1.4 - Risk Estimates and Hazard Quotients for Monitoring Data

		Harding Street		Stout Field	
Bromomethane	74-83-9	0.064		0.062	
1,3-Butadiene	106-99-0	0.065	3.9x10 ⁻⁶	0.065	3.9x10 ⁻⁶
Carbon Disulfide	75-15-0	0.00024		0.0008	
Carbon Tetrachloride	56-23-5	0.0015	4.2x10 ⁻⁶	0.0015	4.2x10 ⁻⁶
Chlorobenzene	108-90-7				
Chloroethane	75-00-3				
Chloroform	67-66-3	0.0017	3.9x10 ⁻⁶	0.0015	3.4x10 ⁻⁶
Chloromethane	74-87-3	0.011		0.01	
Cyclohexane	100-82-7	0.000033		0.000032	
Dibromochloromethane	124-48-1				
1,2-Dibromoethane	106-93-4				
m-Dichlorobenzene	541-73-1				
p-Dichlorobenzene	106-46-7	0.00042	3.7x10 ⁻⁶	0.00094	8.2x10 ⁻⁶
o-Dichlorobenzene	95-50-1				
Dichlorodifluoromethane (F-12)	75-71-8	0.0019		0.0017	
1,1-Dichloroethane	75-34-3				
1,2-Dichloroethane	107-06-2				
t-1,2-Dichloroethene	156-60-5				
c-1,2-Dichloroethene	156-59-2				
Dichloromethane	75-09-2	0.00052	2.4x10 ⁻⁷	0.00024	1.1x10 ⁻⁷
1,2-Dichloropropane	78-87-5				
c-1,3-Dichloropropene	10061-01-3				
t-1,3-Dichloropropene	10061-02-6				
Dichloro-Tetrafluoroethane (F-114)	76-14-2				
1,4-Dioxane	123-91-1	0.000069	1.9x10 ⁻⁶	0.000058	1.6x10 ⁻⁶
Ethanol	64-17-5	0.00051		0.00035	
Ethyl Acetate	141-78-6	0.0014		0.001	
Ethylbenzene	100-41-4	0.00041	1.0x10 ⁻⁶	0.00048	1.2x10 ⁻⁶
p-Ethyltoluene	622-96-8				
Heptane	142-82-5	0.0013		0.0015	
Hexachlorobutadiene	87-68-3				
Hexane	110-54-3	0.0013		0.0011	
Isopropanol	67-63-0	0.00029		0.00023	
Methyl Ethyl Ketone (MEK)	78-93-3	0.0005		0.0008	
Methyl Isobutyl Ketone (MIBK)	108-10-1	0.00011		0.00014	
Methyl n-Butyl Ketone (MBK)	591-78-6	0.023		0.013	
Methyl Tert-Butyl Ether (MTBE)	1634-04-4				
Propene	115-07-1	0.00033		0.00037	
Styrene	100-42-5	0.00017		0.00046	
1,1,1,2-Tetrachloroethane	79-34-5				
Tetrachloroethene (PCE)	127-18-4	0.0014	2.3x10 ⁻⁶	0.0012	1.9x10 ⁻⁶
Tetrahydrofuran (THF)	109-99-9	0.0063		0.0071	
Toluene	108-88-3	0.00058		0.00068	
Trichlorotrifluoroethane (F-113)	76-13-1				
1,2,4-Trichlorobenzene	120-82-1				
1,1,1-Trichloroethane	71-55-6				
1,1,2-Trichloroethane	79-00-5				
Trichloroethene (TCE)	79-01-6	0.00028	3.4x10 ⁻⁷	0.00038	4.6x10 ⁻⁷
Trichlorofluoromethane (F-11)	75-69-4	0.002		0.002	
1,3,5-Trimethylbenzene	108-67-8	0.048		0.05	
1,2,4-Trimethylbenzene	95-63-6	0.096		0.13	

Table 3.1.4 - Risk Estimates and Hazard Quotients for Monitoring Data

		Harding Street		Stout Field	
Vinyl Acetate	108-05-4	0.026		0.022	
Vinyl Chloride	75-01-4				
1,1-Dichloroethene (Vinylidene Chloride)	75-35-4				
o-Xylene	95-47-6	0.0048		0.0072	
m+p-Xylenes	106-42-3	0.013		0.018	
Acetaldehyde	75-07-0	0.243	4.8x10 ⁻⁶	0.254	5.0x10 ⁻⁶
Benzaldehyde	100-52-7				
Butyraldehyde	123-72-8				
Crotonaldehyde	123-73-9				
Formaldehyde	50-00-0	0.539	2.9x10 ⁻⁸	0.362	2.0x10 ⁻⁸
Hexaldehyde	66-25-1				
Isovaleraldehyde	590-86-3				
Propionaldehyde	123-38-6				
Tolualdehydes	N/A				
Valeraldehyde	110-62-3				
Antimony	N/A				
Arsenic	N/A	0.0369	4.8x10 ⁻⁶	0.0413	5.3x10 ⁻⁶
Beryllium	N/A	0.000394	1.9x10 ⁻⁸	0.00046	2.2x10 ⁻⁸
Cadmium	N/A	0.0142	5.1x10 ⁻⁷	0.013	4.6x10 ⁻⁷
Chromium	N/A	0.0271		0.0293	
Cobalt	N/A	0.0068		0.014	
Lead	N/A	0.00415	7.5x10 ⁻⁸	0.00626	1.1x10 ⁻⁷
Manganese	N/A	0.127		0.125	
Mercury	N/A	0.000397		0.000633	
Nickel	N/A	0.0112	2.4x10 ⁻⁷	0.0218	4.7x10 ⁻⁷
Selenium	N/A	0.0000812		0.0000908	
Chromium VI	N/A	0.000411	4.9x10 ⁻⁷		

None of the monitored pollutants for which data existed had a hazard quotient above 1.0 except for acrolein. Acrolein has recently become a national concern after U.S. EPA's School Air Toxics monitoring program measured concentrations above the health protective level around many of the schools which it monitored. Current evidence indicates that new procedures may need to be developed in order to better quantify acrolein concentrations in monitoring data. Current methods appear to bias results high so actual acrolein concentrations are likely lower than those recorded. See U.S. EPA's website for more information on acrolein. (<http://www.epa.gov/schoolair/>)

The only monitored pollutant with a cancer risk above 10-in-a-million was benzene. Benzene cancer risk was 10-in-a-million at the Harding Street monitor and 15-in-a-million at the Stout Field monitor. The most likely source of benzene pollution in the Study Area is mobile sources, though background sources, such as lawnmowers, and industry likely also contributed.

3.1.3 City Comparisons

One of the biggest concerns expressed by the public in the Study Area was how the air in the Study Area compared to other areas of the state and nation. It was important to them

that their air was “safe” but they also wanted to know whether it was worse than the air in other similar cities in the nation. To that end, a list of cities in the U. S., sorted by population, was compiled. Indianapolis was found to be the 14th largest city in the U. S. (see Table 3.1.5) It was decided, based on this, to include cities ranked 10th through 19th in the analysis. However, this did not result in the Midwest being well represented, so Chicago, IL, Cincinnati, OH, Minneapolis, MN, Columbus, OH, and Milwaukee, WI were added to the list. U.S. EPA’s Air Quality System (AQS) database was then examined to find any available monitoring data for those cities. If a monitor was found in the city, its location was examined in aerial photographs in order to determine if it was sited in an area comparable to the Study Area. All monitors used, with the exception of the Chicago monitor, appear to be sited similarly to those used in the Study. EPCs were calculated based on monitoring data from the same two year period as the monitoring for the Study. Monitors from Indiana’s ToxWatch monitoring network were also compared to the results of the Study monitors. All EPCs were calculated using the same algorithms used for the Study monitors. The results of this analysis can be seen in Table 3.1.6 and 3.1.7. Additional information about monitors selected for this analysis can be found in Appendix E. A graphical representation of this data is available in Figure 3.1.1.

Table 3.1.5 – Similarly Sized U.S. Cities

Rank	City	State	Population
10	San Jose	California	948,279
11	Detroit	Michigan	912,062
12	San Francisco	California	808,976
13	Jacksonville	Florida	807,815
14	<u>Indianapolis</u>	<u>Indiana</u>	<u>798,382</u>
15	Austin	Texas	757,688
16	Columbus	Ohio	754,885
17	Fort Worth	Texas	703,073
18	Charlotte	North Carolina	687,456
19	Memphis	Tennessee	669,651

Table 3.1.6 – Comparison of Study Monitor EPCs to Other Monitor EPCs across the Nation ($\mu\text{g}/\text{m}^3$)

Pollutant	CAS	Harding Street	Stout Field	St Louis	San Francisco	Milwaukee	Fort Worth	San Jose	Chicago	Detroit	Columbus	Cincinnati	Charlotte	Austin
Acetaldehyde	75-07-0	2.2	2.3	3.3	1.0	2.2	3.0	1.7	1.6	1.9	2.9			
Acetone	67-64-1	11	270	2.6	11	3.3		12	3.5	3.1	11		6.8	
Acrolein	107-02-8	1.9	1.7	0.84	1.3	0.89	0.34	1.3					2.0	
Antimony	7440-36-0	1.6×10^{-3}	3.4×10^{-3}	1.7×10^{-3}				1.7×10^{-3}						
Arsenic, inorganic	7440-38-2	1.1×10^{-3}	1.2×10^{-3}	1.6×10^{-3}		1.4×10^{-3}		5.0×10^{-4}						
Benzaldehyde	100-52-7	0.23	0.20	0.20		0.17	0.81		0.43	0.97	0.18			
Benzene	71-43-2	1.3	1.9	0.99	0.83	1.2	0.90	1.2	4.4	1.6	0.92	3.8	2.7	1.4
Benzyl chloride	100-44-7												0.47	
Beryllium and compounds	7440-41-7	7.9×10^{-6}	9.2×10^{-6}	7.4×10^{-6}		1.4×10^{-5}		2.1×10^{-6}						
Bromodichloromethane	75-27-4					0.26							0.34	
Bromoform	75-25-2					0.74							0.57	
Bromomethane	74-83-9	0.32	0.31	0.15	0.066	0.13	0.046	0.11					0.24	0.036
1,3-Butadiene	106-99-0	0.13	0.13	0.11	0.10	0.15	0.063	0.19	0.21	0.30	0.36	0.32	0.26	0.18
Butyraldehyde	123-72-8	0.41	0.43			0.24	0.53			0.47				
3-methyl-Butyraldehyde	590-86-3	0.079	0.079	0.038		0.10	0.25			0.63	0.042			
Cadmium	7440-43-9	2.8×10^{-4}	2.6×10^{-4}	8.4×10^{-4}		1.0×10^{-3}		1.1×10^{-4}						
Carbon Disulfide	75-15-0	0.17	0.56											
Carbon tetrachloride	56-23-5	0.28	0.28	0.67	0.63	0.60	0.62	0.62		0.56	0.66	0.53	0.69	0.60
Chlorobenzene	108-90-7			0.073			0.033					0.48	0.26	20
Chloroform	67-66-3	0.17	0.15	0.25	0.086	0.16	0.066	0.094		2.0		0.34	0.25	0.090
Cobalt	7440-48-4	6.8×10^{-4}	1.4×10^{-3}	1.9×10^{-4}				1.2×10^{-4}						
Crotonaldehyde	123-73-9	0.42	0.45				0.32							
Cyclohexane	110-82-7													
Dibromochloromethane	124-48-1					0.42							0.48	
1,2-Dibromoethane	106-93-4					0.18							0.50	
1,3-Dichlorobenzene	541-73-1		0.25	0.026		0.15							0.40	
1,2-Dichlorobenzene	95-50-1			0.043		0.35							0.45	

Table 3.1.6 – Comparison of Study Monitor EPCs to Other Monitor EPCs across the Nation ($\mu\text{g}/\text{m}^3$)

Pollutant	CAS	Harding Street	Stout Field	St Louis	San Francisco	Milwaukee	Fort Worth	San Jose	Chicago	Detroit	Columbus	Cincinnati	Charlotte	Austin
p-Dichlorobenzene	106-46-7	0.34	0.75	0.34	23	26		23				0.44	0.42	
Dichlorodifluoromethane	75-71-8	2.8	2.6	2.8			2.7			2.7	2.6	2.7	2.7	2.6
1,1-Dichloroethane	75-34-3					0.28								
1,2-Dichloroethane	107-06-2			0.23		0.11	0.041			1.4			0.20	0.038
cis-1,2-Dichloroethene	156-59-2													
trans-1,2-Dichloroethene	156-60-5												0.24	
1,1-Dichloroethene (Vinylidene Chloride) (1,1-DCE)	75-35-4						0.034						0.23	0.036
Dichloromethane	75-09-2	0.52	0.24	0.63	0.72	0.92	0.23	0.61		0.94	0.51	1.9	0.90	0.24
1,2-Dichloropropane	78-87-5						0.054							0.085
cis-1,3-Dichloropropene	10061-01-3													
trans-1,3-Dichloropropene	10061-02-6												0.27	
Dichlorotetrafluoroethane	76-14-2			0.12									0.38	
2,5-Dimethylbenzaldehyde	5779-94-2						0.056							
1,4-Dioxane	123-91-1	0.25	0.21										21	
Ethanol	64-17-5	51	35											
Ethyl acetate	141-78-6	0.50	0.37											
Ethyl chloride	75-00-3			0.041						0.26				
1-Ethyl-4-methylbenzene	622-96-8	0.31	0.31											
Ethylbenzene	100-41-4	0.41	0.48	0.40	0.55	0.99	0.33	0.80	2.6	0.47	0.53	1.2	0.60	0.54
Formaldehyde	50-00-0	5.3	3.6	10	1.6	4.1	2.9	2.6	7.9	2.4	3.2			
n-Heptane	142-82-5	0.57	0.64											
Hexachlorobutadiene	87-68-3			0.22									0.88	
Hexaldehyde	66-25-1	0.23	0.22	0.23		0.26	0.85		0.21	1.0	0.21			
n-Hexane	110-54-3	0.92	0.75											
Isopropyl Alcohol	67-63-0	2.0	1.6											
Lead and compounds (inorganic)	7439-92-1	6.2×10^{-3}	9.4×10^{-3}	1.6×10^{-2}		1.0×10^{-2}		3.9×10^{-3}						
Manganese	7439-96-5	6.4×10^{-3}	6.3×10^{-3}	2.2×10^{-2}		1.6×10^{-2}		5.2×10^{-3}						
Mercury, elemental	7439-97-6	1.2×10^{-4}	1.9×10^{-4}	6.0×10^{-5}				8.6×10^{-5}						

Table 3.1.6 – Comparison of Study Monitor EPCs to Other Monitor EPCs across the Nation ($\mu\text{g}/\text{m}^3$)

Pollutant	CAS	Harding Street	Stout Field	St Louis	San Francisco	Milwaukee	Fort Worth	San Jose	Chicago	Detroit	Columbus	Cincinnati	Charlotte	Austin
Methyl chloride	74-87-3	1.0	0.94	1.2		1.2	1.3			1.3	1.1	1.3	1.4	1.3
Methyl ethyl ketone (MEK)	78-93-3	2.5	4.0	1.6	0.65	0.76	0.20	0.85		3.8	3.6	3.8	0.39	0.11
Methyl isobutyl ketone (MIBK)	108-10-1	0.34	0.43	0.27			0.045			3.2	0.42		0.22	
Methyl n-butyl ketone	591-78-6	1.3	0.76											
Methyl tert-butyl ether (MTBE)	1634-04-4			0.033			0.14							0.023
Nickel	7440-02-0	1.0×10^{-3}	2.0×10^{-3}	1.3×10^{-3}		3.7×10^{-3}		1.3×10^{-3}						
Propionaldehyde	123-38-6	0.68	0.43	0.30		0.46	0.80		0.11	0.48	0.42			
Propylene	115-07-1	1.0	1.1	0.80		0.95	0.83		2.1	1.5	1.7		3.5	1.3
Selenium and compounds	7782-49-2			1.1×10^{-3}				7.3×10^{-4}						
Styrene	100-42-5	0.17	0.46	0.17	0.23	1.0	0.063	0.41	0.39	0.72		0.78	0.66	0.089
1,1,2,2-Tetrachloroethane	79-34-5												0.36	
Tetrachloroethene	127-18-4	0.39	0.33	0.20	0.22	0.13	0.092	0.33		0.49		0.57	0.55	0.14
Tetrahydrofuran	109-99-9	0.22	0.25											
Tolualdehydes	NA	0.28	0.26											
Toluene	108-88-3	2.9	3.4	2.1	2.9	2.7	2.0	4.6	13	2.6	2.1	7.3	3.2	2.2
1,1,2-Trichloro-1,2,2-trifluoroethane	76-13-1	0.60	0.57		0.48			0.52		0.67				
1,2,4-Trichlorobenzene	120-82-1			26						26		26	0.74	
1,1,1-Trichloroethane	71-55-6			0.11	0.075	0.17	0.074	0.14		0.12			0.29	0.089
1,1,2-Trichloroethane	79-00-5												0.28	
Trichloroethene	79-01-6	0.17	0.23	0.12	0.064	0.34	0.038	0.079		1.8		0.37	0.59	0.032
Trichlorofluoromethane	75-69-4	1.4	1.4	1.9	1.5		1.6	1.5		1.5	1.5	1.5	3.1	1.5
1,2,4-Trimethylbenzene	95-63-6	0.67	0.90	0.31			0.32		3.5	0.56	0.65	1.6	1.6	0.84
1,3,5-Trimethylbenzene	108-67-8	0.29	0.30	0.10			0.087		1.6	0.18		0.53	0.41	0.23
Valeraldehyde	110-62-3	0.18	0.17	0.15		0.069	0.42		0.15	0.65	0.16			
Vinyl acetate	108-05-4	5.3	4.5											
Vinyl chloride	75-01-4			0.53	1.2	1.3	0.47	1.8		1.7	0.82	2.4	0.82	0.75
o-Xylene	95-47-6	0.48	0.72	0.32	0.66	0.97	0.27	1.0	2.7	0.56	0.57	1.6	0.73	0.47

Figure 3.1.1 – Comparison of Study Monitors to Other Monitors State and Nationwide

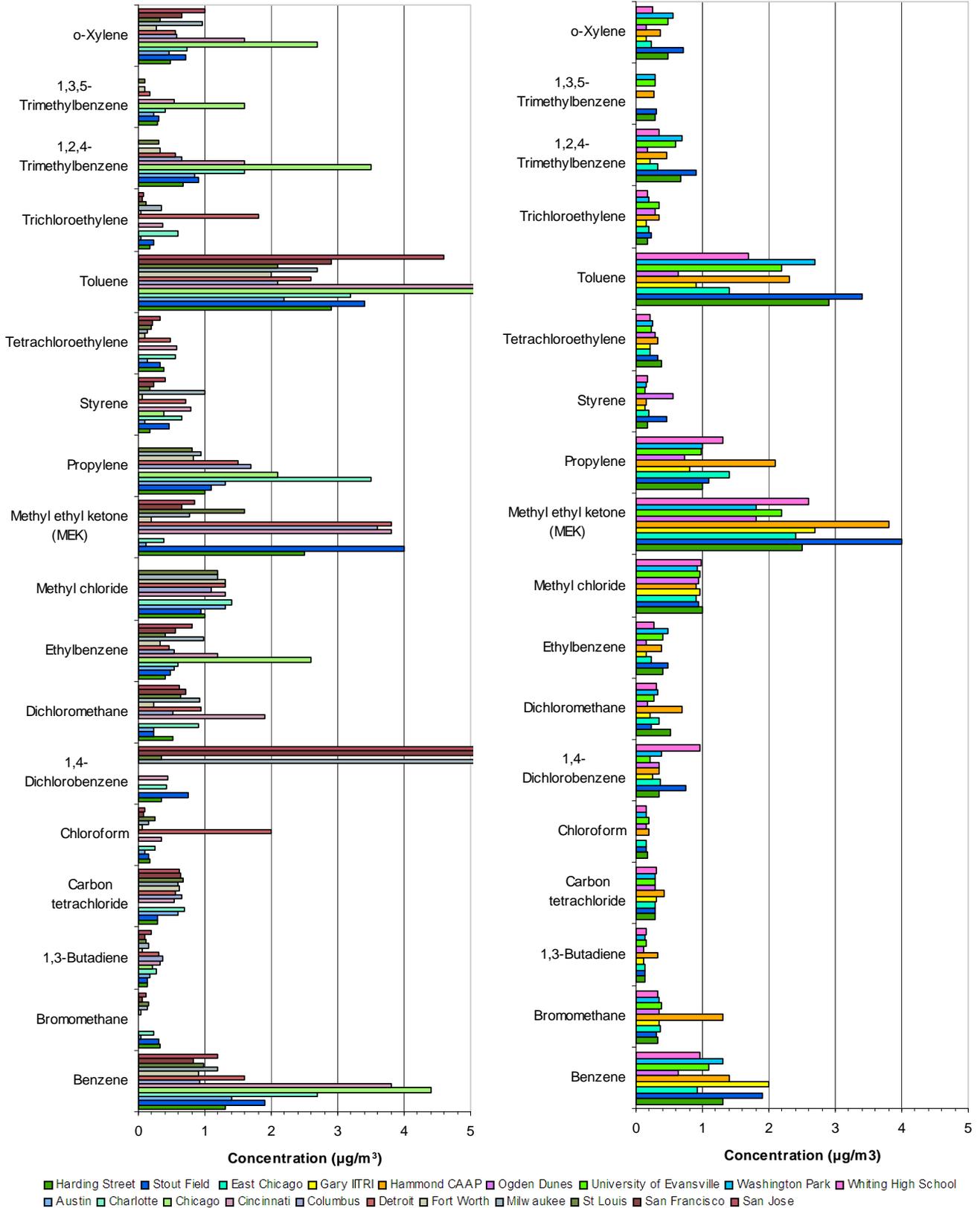


Table 3.1.7 – Comparison of Study Monitor EPCs to ToxWatch Monitor EPCs ($\mu\text{g}/\text{m}^3$)

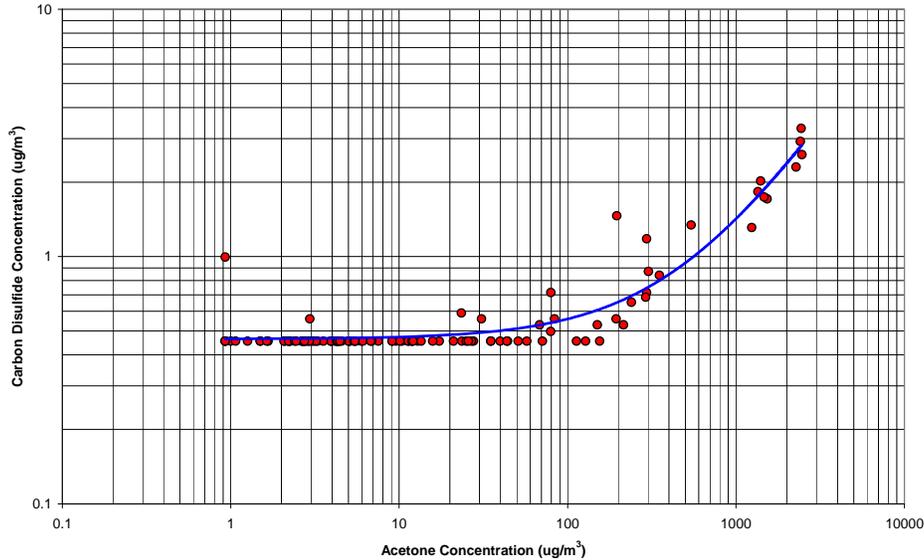
Pollutant	Harding Street	Stout Field	East Chicago	Gary IITRI	Hammond CAAP	Ogden Dunes	University of Evansville	Washington Park	Whiting High School
Benzene	1.3	1.9	0.93	2.0	1.4	0.64	1.1	1.3	0.96
Bromomethane	0.32	0.31	0.37	0.35	1.3	0.35	0.38	0.34	0.33
1,3-Butadiene	0.13	0.13	0.13	0.11	0.33	0.11	0.15	0.14	0.15
Carbon tetrachloride	0.28	0.28	0.28	0.30	0.42	0.28	0.29	0.29	0.30
Chloroform	0.17	0.15	0.15		0.20	0.16	0.19	0.15	0.16
p-Dichlorobenzene	0.34	0.75	0.36	0.25	0.35	0.35	0.22	0.39	0.96
Dichloromethane	0.52	0.24	0.35	0.21	0.69	0.18	0.27	0.32	0.31
Ethylbenzene	0.41	0.48	0.24	0.16	0.39	0.16	0.40	0.48	0.27
Methyl chloride	1.0	0.94	0.91	0.97	0.91	0.95	0.97	0.93	0.99
Methyl ethyl ketone (MEK)	2.5	4.0	2.4	2.7	3.8	1.8	2.2	1.8	2.6
Propylene	1.0	1.1	1.4	0.81	2.1	0.74	0.98	1.0	1.3
Styrene	0.17	0.46	0.19	0.13	0.16	0.55	0.14	0.16	0.18
Tetrachloroethene	0.39	0.33	0.22	0.21	0.32	0.28	0.23	0.25	0.22
Toluene	2.9	3.4	1.4	0.90	2.3	0.64	2.2	2.7	1.7
Trichloroethene	0.17	0.23	0.19	0.16	0.34	0.28	0.35	0.20	0.18
1,2,4-Trimethylbenzene	0.67	0.90	0.32	0.22	0.46	0.18	0.59	0.69	0.35
1,3,5-Trimethylbenzene	0.29	0.30			0.26		0.28	0.29	
o-Xylene	0.48	0.72	0.23	0.16	0.37	0.15	0.48	0.56	0.25

3.1.4 Acetone Readings at Stout Field

During mid-2007, acetone readings at the Stout Field monitor increased by approximately 2 orders of magnitude, to over $2400 \mu\text{g}/\text{m}^3$ according to IDEM's air monitoring lab's VOC analysis. This spike was not reflected in the carbonyl analysis conducted by U.S. EPA's contract lab, ERG. Because of this discrepancy, IDEM looked more closely at the data for this time period.

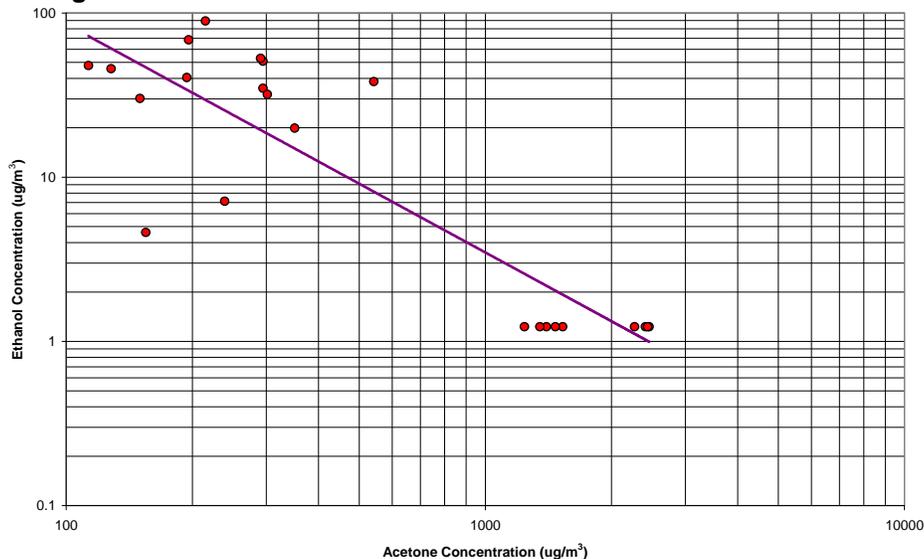
First, the data for the Stout Field monitor were examined independently. This involved producing scatter plots comparing each pollutant to acetone. This was done for the entire study period and for just the period of time that corresponded to the increased acetone readings. The scatter plots for the entire study period revealed a strong correlation ($r^2 = 0.9277$) between acetone and carbon disulfide. In fact, virtually all detections of carbon disulfide corresponded with elevated acetone readings. The following chart illustrates this relationship:

Figure 3.1.2 – Acetone Concentrations vs. Carbon Disulfide Concentrations



Additionally, it was discovered that ethanol, which generally has a very high detection rate, had readings below the detection rate when acetone was experiencing its highest readings, as illustrated by the following chart:

Figure 3.1.3 – Acetone Concentrations vs. Ethanol Concentrations



It was hypothesized that the high acetone readings were “washing out” the ethanol readings. For this to be true, the GC/MS peaks that correspond to acetone and ethanol would have to be close together. IDEM’s lab confirmed that this was likely the cause of the inverse relationship between acetone and ethanol.

Other pollutants also correlated relatively well with the acetone spike at Stout Field. Most notable was p-dichlorobenzene. P-Dichlorobenzene had a fairly low detection rate

overall, but had a much higher detection rate during the spike in acetone at Stout Field. This correlation was noticed by both TAG members and IDEM. IDEM attempted to use this correlation in conjunction with permitting information to determine a possible source for the spike. Unfortunately, IDEM was unable to definitively discern the source of the acetone or the p-dichlorobenzene.

Next, Stout Field's monitoring results for acetone were compared to those of other monitors to see if similar spikes occurred at other monitoring locations during the same period. Performing a simple linear correlation analysis revealed several relatively strong correlations. As would be expected, Harding Street showed the strongest correlation ($r^2 = 0.75$). Of additional interest was a relatively strong correlation with Ogden Dunes ($r^2 = 0.64$), and slightly weaker correlations with East Chicago ($r^2 = 0.50$) and Fort Wayne ($r^2 = 0.51$). It was also noted that the March 13, 2007 readings for acetone were the highest (or nearly highest) recorded at 9 of the 11 monitoring locations in Indiana's ToxWatch monitoring network, including Stout Field. While acetone concentrations at other ToxWatch monitors do appear to be slightly elevated at the same time Stout Field was experiencing its spike, no other monitor comes close to the concentrations observed at Stout Field.

Table 3.1.8 – Acetone Concentrations at Various Indiana Monitors During Stout Field Event

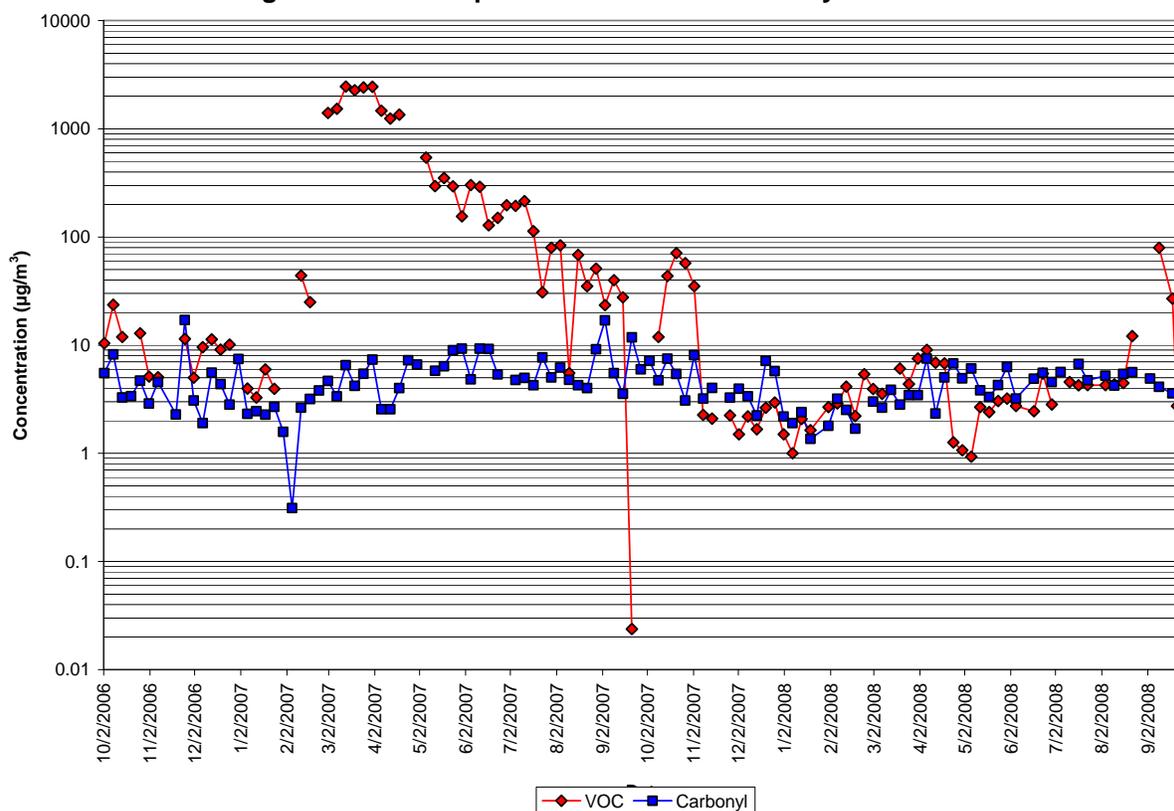
	Stout Field	Evansville	Ogden Dunes	Washington Park	Harding Street	Hammond	Whiting	East Chicago	Gary	Elkhart	Fort Wayne
3/13/2007	2460	13	34	35	60	45	41	28	14	15	29
3/19/2007	2300	11	11	36	47	12	12	19	11	4.6	12
3/25/2007	2410	18	26	8.4	43	20	17	21	8.5	27	21
3/31/2007	2440	18			61	11	41	18	3.5	22	28
4/1/2007			24								
4/6/2007	1500	13	16	11	9.9	7.9	2.9	12	3.1	7.7	7.6
4/12/2007	1200	5.3	14		8		6	9.6	7.8	2.2	20
4/18/2007	1300	13	14	7.7	16	27	11	5.2	6.1	5	23
4/24/2007		2.7	14	13	21	44	ND	8.1	16	8.3	17
4/30/2007		ND	9	13			14	11	5.9	11	15
5/6/2007	540	2.7	17	13	21	17	9.6	8.4	9.3	11	8.7
5/10/2007	240				26						
5/12/2007	290	1.4	12	12	10	8	7.1	9.1	9.5	6.2	9
5/18/2007	350	8.3		12	15	28	15	23	10	14	15
5/24/2007	290		8.5	15	6.2	3.3	9.1	4.2	3.6	4.8	6.4
5/30/2007	150	3.6	ND	8	4	ND	3.3	3.5	ND	0.048	
6/5/2007	300	12	6.4	3.4	3.9	25	7	7.5	9	3.9	
6/11/2007	290	7.3	5.6	9.1	9.4	22	14	5.3			3.5
6/17/2007	130	21	12	12	15	21	14	9.9	27	ND	15
6/23/2007	150	ND		2.1	5	7	8.4	13	ND	7.5	13
6/29/2007	200	10	6.4		6.2	32	3.6	8.6	ND	5.7	9.9
7/5/2007	190	7.3	ND	8.3	4.4	32	8.6	9.8	0.19	8	10
7/11/2007	210	8.2	5.1	8.9	5.1	21	7.2	7.6	4.1	6.4	4.4
7/17/2007	110	5.8	ND	12	10	9.8	9.8	0.024	ND	ND	11
7/23/2007	31	7.7	5.8	10	0.12	19	7.8	0.9		13	8.1

The final analysis involved comparing the acetone concentrations derived from the VOC analysis to those derived from the carbonyl analysis. As noted by Technical Advisory Group members, the data from the VOC analysis and the carbonyl analysis do not appear to correlate well. The data were examined on scatter plots in several different ways including:

- The entire dataset
- The dataset minus the apparent acetone event
- The dataset with only the apparent acetone event
- The dataset with all outliers removed

None of these treatments showed any correlation between the data from the VOC analysis and data from the carbonyl analysis. If the datasets are compared side by side in a line graph, they do appear to follow somewhat similar trends for at least part of the study period. This apparent relationship is illustrated in the graph below.

Figure 3.1.4 – Comparison of VOC and Carbonyl Data for Acetone



Overall, laboratory error was ruled out as being the source of the high acetone concentrations at the Stout field monitoring location. Due to the fact that the higher concentrations were observed over an extended period of time (months) indicates that this was not a one time error by the lab. Additionally, since the extremely high concentrations were only observed at one monitoring location yet the laboratory

evaluates 11 other toxic monitor's samples it is unlikely that a systematic error would have taken place that only affected one monitoring location and resulted in elevated acetone readings.

While IDEM was unable to identify the source of the acetone release, IDEM hypothesizes that there was a temporary activity that was taking place that resulted in the elevated concentrations of acetone. While the readings were elevated compared to "normal" readings, the concentrations observed were still orders of magnitude below both acute and chronic health protective concentration. As such, IDEM does not consider this observed instance to be a threat to human health in the area.

Acetone is a common industrial and household chemical. The most well-known household use of acetone is as a "fingernail polish remover" though many of these products are now acetone-free. In industrial applications, acetone is often used in the formation of other pollutants and as a cleaner or solvent. It is possible a source near the Stout Field monitor was doing some sort of extensive painting or cleaning, resulting in elevated acetone levels, though this cannot be confirmed. Emissions inventories were examined to try and locate a possible source of the acetone. The inventories were reported as an annual estimate and would not be able to determine short term elevated usage at sources near the monitor.

3.2 RAIMI Modeling Results

3.2.1 Major Sources

For the Southwest Indianapolis Air Toxics Study (the Study), the data for all sources were analyzed and combined to obtain concentration and risk estimates for cancer and non-cancer effects. From the emissions inventory, IDEM had data for 168 pollutants from 180 stationary sources. Table 3.2.1 shows the breakdown of the number of sources.

Table 3.2.1 Modeled Sources

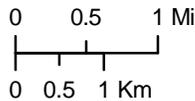
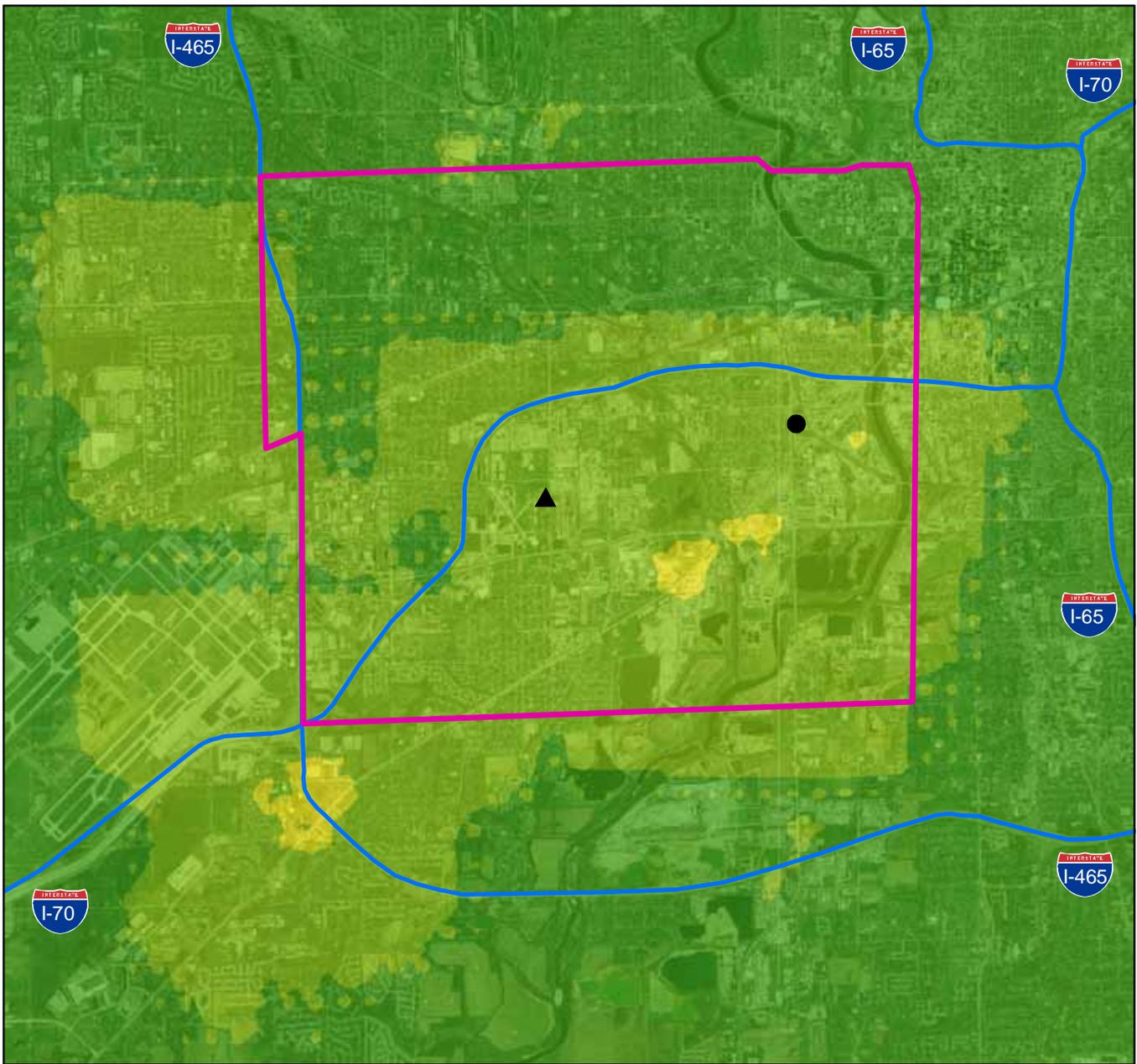
Source	Number
Permitted sources	315
Trucking companies	71
Gas stations/Truck stops	49
Auto refinishers	19
Dry cleaning shops	10
Interstates	600
City Streets	1,676
Airport	1
Total	2,741

RAIMI automatically places nodes or receptors throughout the Study Area. Some of these nodes may be located close to actual sources and on property that is not accessible to the general public. All of the nodes that had concentrations were analyzed for this Study regardless of location. RAIMI placed 54,195 nodes for the Study analysis.

The results were originally analyzed based on four separate modeling analysis. The first analysis, the major sources, included the permitted sources, trucking companies, gas stations, truck stops, auto refinishers and dry cleaners. For this analysis, the highest estimated cumulative cancer risk was 59-in-a-million. There were 282 nodes with an estimated cumulative cancer risk of greater than 10 in a million. For all of these nodes, the permitted sources contributed at least ninety-four percent (94%) of the total estimated risk.

Figure 3.2.1 shows the estimated cancer risk for major sources over the Study Area. Figure 3.2.2 shows the estimated cancer risk for mobile sources over the Study Area, and Figure 3.2.3 shows the cumulative risk of all sources in the Study Area. These maps include receptor nodes that fall outside the Study Area. Cumulative risk estimates outside the Study Area should be viewed as incomplete because they are more likely to have unaccounted sources affecting them. These extra receptor nodes were included in this report for illustrative purposes only. For the versions of these maps used for public outreach, please see Appendix F.

Figure 3.2.1 Major Sources Estimated Cancer Risk



Legend

- Harding Street Monitor
- ▲ Stout Field Monitor
- SW Indianapolis Study Area

Cancer Risk

- Cancer Risk < 1 in 1,000,000
- 1 in 1,000,000 < Cancer Risk < 1 in 100,000
- 1 in 100,000 < Cancer Risk < 1 in 10,000
- 1 in 10,000 < Cancer Risk < 1 in 1,000
- 1 in 1,000 < Cancer Risk



This map is intended to serve as an aid in graphic representation only. This information is not warranted for accuracy or other purposes.

Mapped By: B. Callahan, Office of Air Quality
Date: 11/10/2009

Sources:
Non Orthophotography Data - Obtained from the State of Indiana Geographical Information Office Library and OAQ
Orthophotography - Obtained from Indiana Map Framework Data (www.indianamap.org)
Map Projection: UTM Zone 16 N **Map Datum:** NAD83

There were 24 sources that contributed an estimated cancer risk of greater than one in a million at any at least one node throughout the Study Area. None of these sources exceeded an estimated cancer risk of greater than 100 in a million. All of these sources were given to IDEM's Office of Pollution Prevention and Technical Assistance (OPPTA) to explore pollution prevention opportunities.

No node had a non-cancer hazard quotient of greater than 1.0.

3.2.2 Mobile Sources

In the second and third analyses, the interstates and city streets were combined into a mobile source analysis. To conduct the mobile source modeling, IDEM used methodology established by the Wisconsin Department of Natural Resources Air Toxics Division. This methodology has specific inputs for cars and trucks. These inputs are in Table 3.2.2:

Table 3.2.2 Mobile Source Modeling Inputs

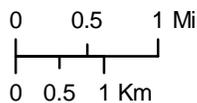
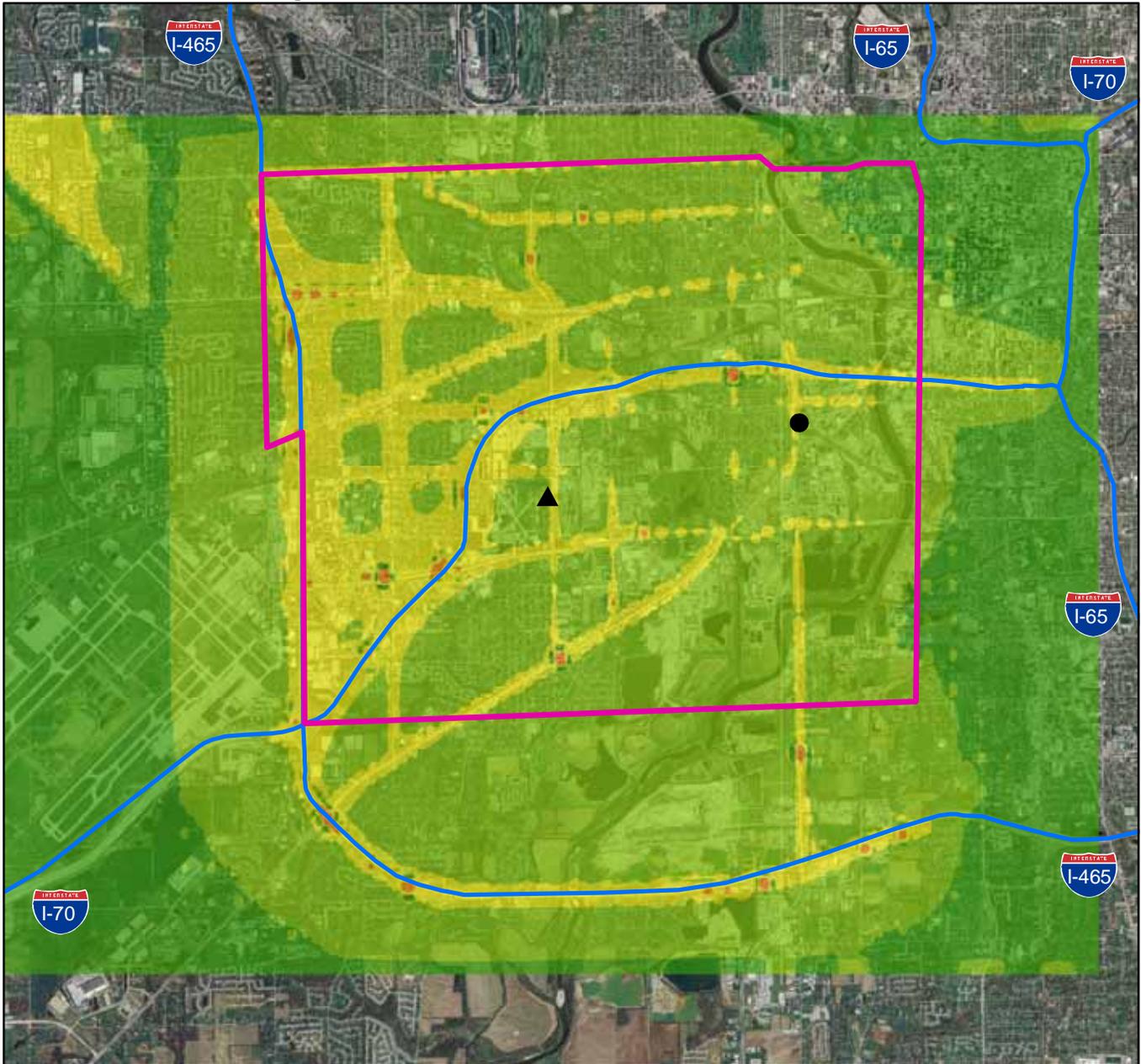
Input	Cars	Trucks
Stack Height (meters)	0.3	3.66
Stack Diameter (meters)	0.076	0.1
Exit Velocity (m/sec)	0.01	15
Exit Temperature (F)	175	225

A source was placed every 100 meters along the roadway with the emissions calculated from traffic count data.

Mobile source modeling estimated the highest cumulative cancer risk at 1,307 in a million. There were 4 nodes with a greater than 1000 in a million cancer risk. All of the high nodes were within 4 meters of a roadway source. Since the sources are set in the middle of the road, all of these high risk nodes would be located on the roadway. Another 70 nodes had a cancer risk of greater than 100 in a million. All of these nodes are also very close to a roadway source. An analysis based on the maximum impact node indicated that the estimated risk dissipates very quickly away from the source. The next closest node to the maximum impact node had an estimated cancer risk that was ninety-eight and a half percent (98.5%) lower at 70 meters away. At 500 meters away from the maximum impact node, the estimated cancer risk had decreased by over ninety-nine percent (99%).

Through some of the Study Area, the interstates are located above ground level. There was concern that the concentrations would increase at the areas below the roadway. A screening modeling run was completed with nodes 5 meters below the surface of the roadway and with horizontal release to simulate emissions from a car's tailpipe. The results indicated estimated concentrations were greater on the elevated roadway than the concentrations estimated at the lower elevation below the interstate.

Figure 3.2.2 Estimated Cancer Risk from Mobile Sources



This map is intended to serve as an aid in graphic representation only. This information is not warranted for accuracy or other purposes.

Mapped By: B. Callahan, Office of Air Quality
Date: 11/10/2009

Sources:
Non Orthophotography Data - Obtained from the State of Indiana Geographical Information Office Library and OAQ
Orthophotography - Obtained from Indiana Map Framework Data (www.indianamap.org)
Map Projection: UTM Zone 16 N **Map Datum:** NAD83

Legend

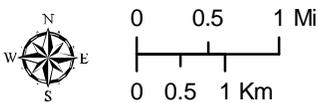
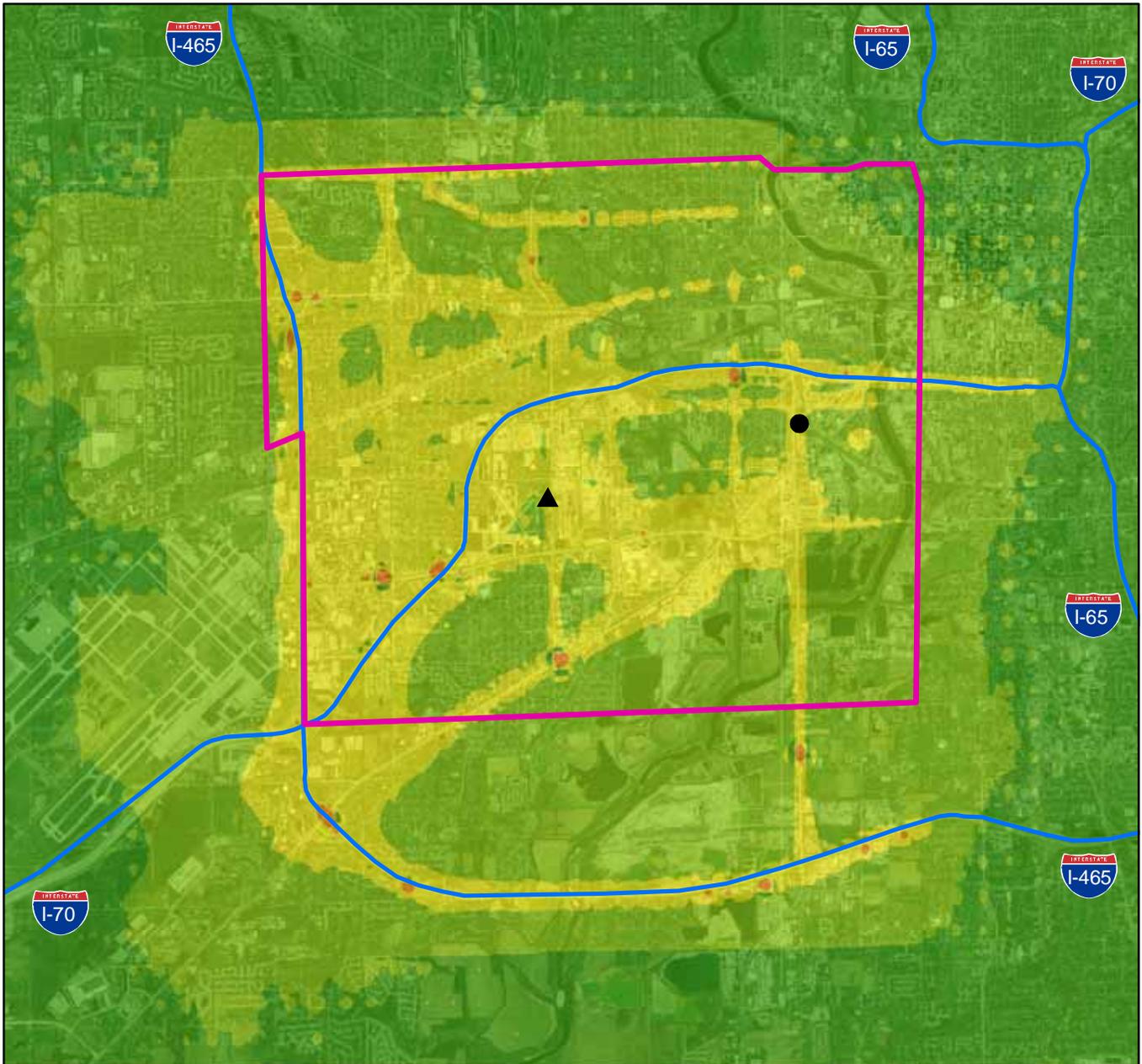
- Harding Street Monitor
- ▲ Stout Field Monitor
- SW Indianapolis Study Area

Cancer Risk

- Cancer Risk < 1 in 1,000,000
- 1 in 1,000,000 < Cancer Risk < 1 in 100,000
- 1 in 100,000 < Cancer Risk < 1 in 10,000
- 1 in 10,000 < Cancer Risk < 1 in 1,000
- 1 in 1,000 < Cancer Risk



**Figure 3.2.3 Combined Estimated Cancer Risk
All Sources (including Airport)**



This map is intended to serve as an aid in graphic representation only. This information is not warranted for accuracy or other purposes.

Mapped By: B. Callahan, Office of Air Quality
Date: 11/10/2009

Sources:
Non Orthophotography Data - Obtained from the State of Indiana Geographical Information Office Library and OAQ
Orthophotography - Obtained from Indiana Map Framework Data (www.indianamap.org)
Map Projection: UTM Zone 16 N **Map Datum:** NAD83



Legend

- Harding Street Monitor
- ▲ Stout Field Monitor
- SW Indianapolis Study Area

Cancer Risk

- Cancer Risk < 1 in 1,000,000
- 1 in 1,000,000 < Cancer Risk < 1 in 100,000
- 1 in 100,000 < Cancer Risk < 1 in 10,000
- 1 in 10,000 < Cancer Risk < 1 in 1,000
- 1 in 1,000 < Cancer Risk



3.2.3 Indianapolis International Airport

During the course of this Study, a new terminal was opened at the Indianapolis International Airport. The new terminal moved approximately 2 kilometers further to the southwest away from the Study Area. In order to insure that there would not be any impact from the airport, all emissions were modeled at the corner of the runway closest to the boundary of the Study Area, Runway 23L. The stack height was modeled at 3 meters based on a 2009 airport study that indicated that approximately eighty-seven to ninety-seven percent (87%-97%) of all airport emissions occur at this height. Other input parameters were taken from the velocity and exit temperature of jet engine test cells. The highest estimated cancer risk for the airport was 0.08 in a million.

3.2.4 Air Dispersion Modeling Uncertainties

Any modeling analysis attempts to recreate actual conditions. However, there are limitations to what a model can accomplish, and RAIMI's modeling analysis does contain some limitations.

All emissions are modeled at the annual emission rate. The model does not allow for daily or seasonal variations. Since the annual average concentration is used to determine the risk characterization, this limitation should not create any change in the final estimated concentrations. For short term averages, this may cause the model to under predict the estimated concentration.

The input will only accept vapor phase modeling. The model will treat every pollutant as a gaseous phase and will not take into account any deposition. This would mean that any metal or particulate air toxics may be over predicted. This is particularly important since metals were monitored in the areas using PM10 monitoring filters.

RAIMI does not allow for fugitive sources. Any fugitive emissions would have to be assigned a theoretical stack and attributed to only one point. This could create an over prediction at the single spot compared to the actual emissions which are dispersed over a larger area.

The model will not predict any secondary formation of pollutants within the atmosphere. The model does not assume any pollutants will breakdown or that other pollutants may be formed. The evaluation of secondary formation of certain pollutants plays an important role in the evaluation of air quality in the Study Area. Acrolein is an example of a pollutant that forms from the breakdown of other pollutants. With the modeling based on just the emitted sources of acrolein, this would lead to an under prediction. In U.S. EPA's NATA, it was estimated that up to sixty percent (60%) of the predicted concentration of acrolein was due to secondary atmospheric formation. Some U.S. EPA estimates have concentrations of certain pollutants such as formaldehyde and acetaldehyde attributed to secondary formation by as much as ninety-percent (90%) of the total concentration.

Chromium (VI) is an example of a pollutant that has been shown to chemically reduce in the atmosphere to the less toxic Chromium (III). This would cause an over prediction in the Chromium (VI) concentration.

Due to the scale of the Study Area, it was not possible to input building data to calculate the downwash effect for the analysis. Any building may change the dispersion affect of the wind. Using the AMP and high intensity residential/urban setting, the model calculates the surface roughness. It is not possible to determine if this will cause an under or over prediction in the concentrations.

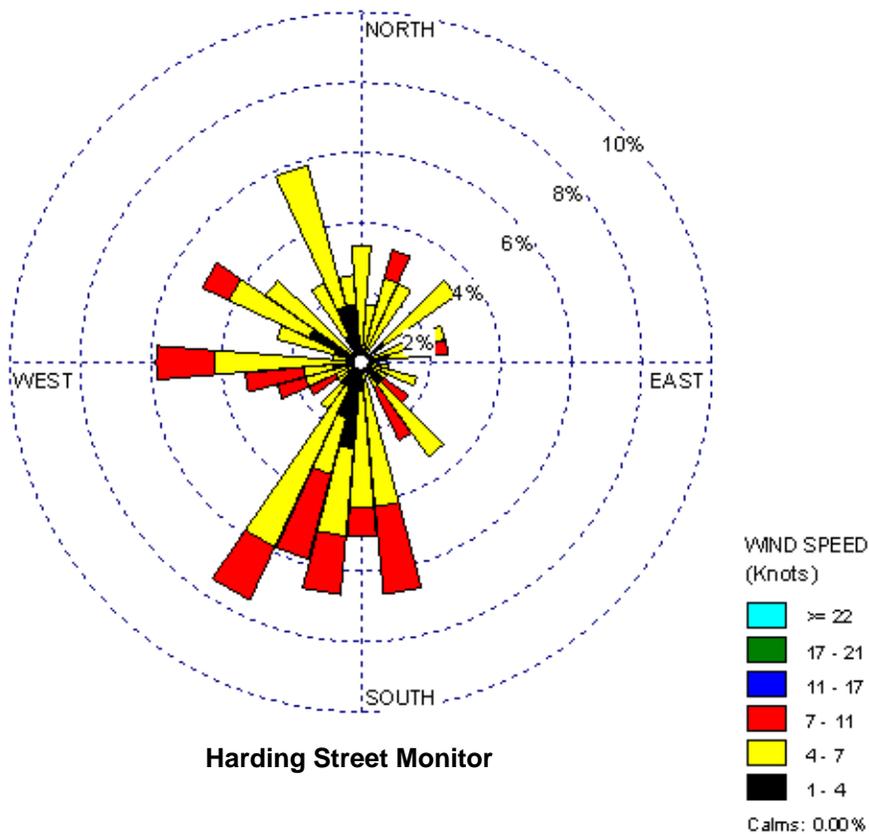
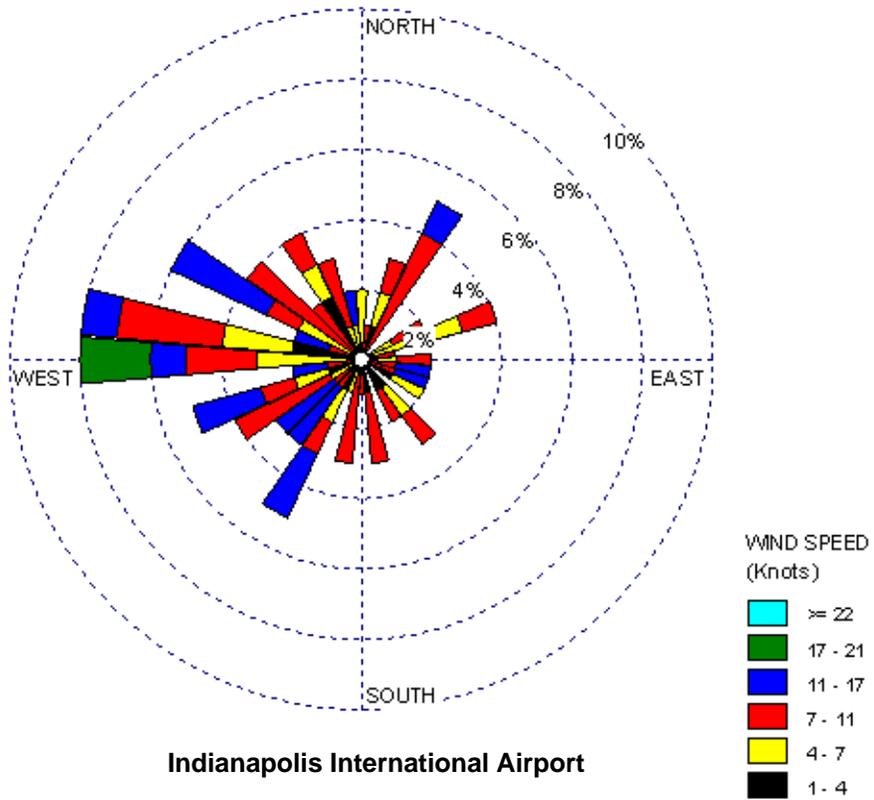
Another limitation is the actual meteorological data. Using five years worth of data is an accepted modeling practice. It assumes that during those five years, the average meteorological conditions are the same as any other five years. However, it does not lead to a direct comparison with the data collected from the monitors. The monitors sample for approximately 120 days over a two year period. The available meteorological data is an average for each day that the monitor samples.

A wind rose is a graphic tool used by meteorologists to give a succinct view of wind speed and direction at a particular location. The wind roses for both meteorological datasets indicate that the prevailing winds are from the south to westerly directions. Wind roses from the modeling data have the same prevailing winds with the primary direction coming from the southwest. Wind roses for the Harding Street monitor and the Indianapolis International Airport are available in Figure 3.2.4.

RAIMI's AMP processes the meteorological data to be specific for each source based on the source's location and the surface roughness. It is not possible to determine what affect this would have on the estimated concentrations.

Figure 3.2.4 shows wind rose patterns from the Indianapolis International Airport compared to the meteorological data from the Harding Street monitor, for the same sampling dates.

Figure 3.2.4 Wind Rose Comparison 2006-2008



Another limitation is that the model only runs steady state emission rates. The model runs the same emission rate for the entire modeling analysis. It does not take into account seasonal, daily or hourly rate changes. Major source and mobile source emissions would likely be less on weekend days than on a weekday. Some sources only emit during daytime hours. IDEM focused on the chronic, long-term health effects and used health protective assumptions to try to counteract any possible under prediction this may cause.

Even though the emission inventory attempted to include as many sources as possible, it was not possible to account for all emissions in the Study Area. Sources far outside of the boundaries of the Study Area may still have an impact on the Study Area. Residential sources, i.e., lawnmowers, weed-eaters, home furnaces, still emit air toxics and are not included in the inventory. Natural sources like fires were not included. Also not included in the inventory were non-road emissions and smaller streets. All of these sources can create enough emissions to have an impact on the Study Area. To account for these unavoidable omissions when comparing monitoring results to modeling results, IDEM used the 2002 NATA background concentrations.

3.2.5 Background Concentration

Background concentrations are typically included in source assessments to represent sources of emissions of chemicals that are not accounted for during the normal scope of source identification. IDEM needed background concentrations to get a more comprehensive understanding of air toxics in the study area.

According to the U.S. EPA's residual risk program, background concentrations are defined as:

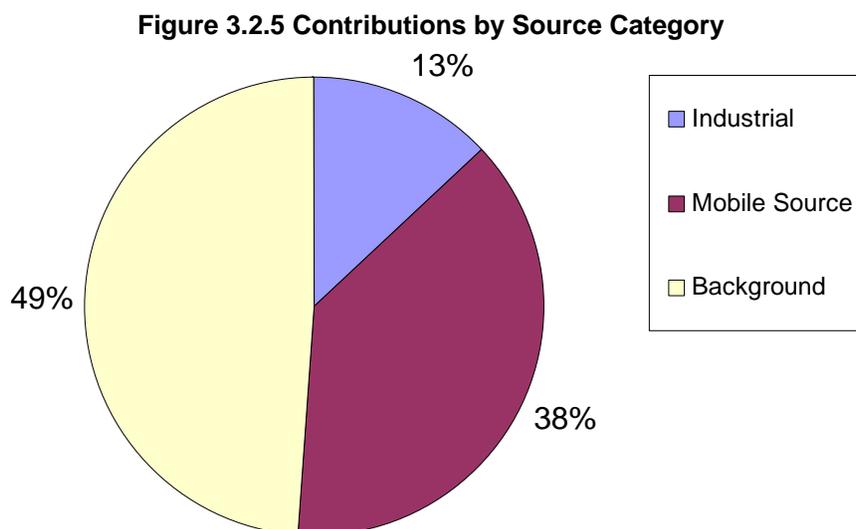
“the levels of contaminants that would be present in the absence of source-related contaminant releases. Background concentrations come from either contaminants that may occur naturally in the environment or contaminants that are emitted by other (i.e., not the sources being assessed) anthropogenic sources. Narrowly defined for HAPs and the residual risk program, background concentrations are the levels of HAPs in environmental media that are attributable to natural and anthropogenic sources other than the source(s) under evaluation.” (EPA-453/R-99-001)

Background concentrations were added to the concentrations calculated from the model to allow IDEM to conduct a more realistic comparison of modeling results to monitoring results. This comparison is a simple way to evaluate the overall accuracy of the model. This also gives a more complete picture of air toxics in the Study Area.

IDEM used background concentrations that came from the 2002 NATA. This was the most recently released NATA at the time the Study was conducted. Background concentrations are uniform throughout the Study Area and are consistent throughout the

Indianapolis metro area. The 2002 NATA background concentrations for pollutants located in the Study Area can be found in Appendix G.

Background concentrations account for approximately fifty percent (50%) of the total estimated concentration throughout the Study Area. Figure 3.2.5 breaks down the contributions for the Study.



3.2.6 RAIMI Comparisons

The 1996 and 1999 NATA were two screening tools that indicated the Southwest Indianapolis area may have higher concentrations and risk from air toxics. The NATA is a national level air toxic assessment that reports an estimated exposure concentration and risk based on a census tract centroid location. The RAIMI analysis estimated the same factors at many more points throughout each census tract.

3.2.7 RAIMI Comparison to NATA

The RAIMI results were compared to the concentrations from both the 1999 and 2002 NATAs. Originally, and for public outreach purposes, only the 1999 NATA was used despite the more recent 2002 NATA being available because the 1999 NATA was the impetus for the Study. However for this final technical report comparisons have also been made to 2002 NATA results. The results were compared based on the census tracts where the Stout Field and Harding Street monitors were located. (Stout Field – 342300, Harding Street – 358100)

Tables 3.2.3 and 3.2.5 compare the results for Stout Field and Table 3.2.4 and 3.2.6 compare the results for Harding Street:

Table 3.2.3 RAIMI Results compared to 1999 NATA at Stout Field

Pollutant	Modeled Concentration	2002 NATA Background	Total Concentration	1999 NATA
	ug/m ³	ug/m ³	ug/m ³	ug/m ³
Acetaldehyde	0.03	1.76	1.8	1.4
Benzene	0.97	0.202	1.2	1.9
Formaldehyde	0.56	2.27	2.8	1.9
Toluene	2.38	0.29	2.7	3.4
Nickel	0.0072	0.00032	0.007	0.0002
Arsenic	0.000064	0.0007	0.0008	0.001
Chromium	0.003	0.00075	0.004	0.0003

Table 3.2.4 RAIMI Results compared to 1999 NATA at Harding Street

Pollutant	Modeled Concentration	2002 NATA Background	Total Concentration	1999 NATA
	ug/m ³	ug/m ³	ug/m ³	ug/m ³
Acetaldehyde	0.023	1.76	1.8	1.7
Benzene	0.67	0.202	0.9	1.9
Formaldehyde	0.4	2.27	2.7	2.1
Toluene	1.66	0.29	2	4.1
Nickel	0.0063	0.00032	0.006	0.0002
Arsenic	0.000062	0.0007	0.0007	0.13
Chromium	0.0021	0.00075	0.003	0.0006

Table 3.2.5 RAIMI Results compared to 2002 NATA at Stout Field

Pollutant	Modeled Concentration	2002 NATA Background	Total Concentration	2002 NATA
	ug/m ³	ug/m ³	ug/m ³	ug/m ³
Acetaldehyde	0.03	1.76	1.8	2.4
Benzene	0.97	0.202	1.2	1.4
Formaldehyde	0.56	2.27	2.8	2.8
Toluene	2.38	0.29	2.7	3.3
Nickel	0.0072	0.00032	0.007	5.7x10 ⁻⁴
Arsenic	0.000064	0.0007	0.0008	8.6x10 ⁻⁴
Chromium	0.003	0.00075	0.004	1.7x10 ⁻³

Table 3.2.6 RAIMI Results compared to 2002 NATA at Harding Street

Pollutant	Modeled Concentration	2002 NATA Background	Total Concentration	2002 NATA
	ug/m ³	ug/m ³	ug/m ³	ug/m ³
Acetaldehyde	0.023	1.76	1.8	2.7
Benzene	0.67	0.202	0.9	1.6
Formaldehyde	0.4	2.27	2.7	2.9
Toluene	1.66	0.29	2	3.8
Nickel	0.0063	0.00032	0.006	7.7x10 ⁻⁴
Arsenic	0.000062	0.0007	0.0007	9.4x10 ⁻⁴
Chromium	0.0021	0.00075	0.003	3.2x10 ⁻³

The biggest difference is the arsenic concentration at Harding Street. The arsenic concentration in the 1999 NATA was the main reason for considering the air quality from air toxics in the Study Area to be worse than other areas. The RAIMI results estimate the arsenic concentration to be much lower.

Since the 2002 NATA was released during the Study, IDEM compared the data from RAIMI to determine how it compared with the more recent NATA. The results were compared at the same monitoring sites. First we compared the source category contribution to total cancer risk at the two monitoring sites. Table 3.2.7 compares the contributions to the 2002 NATA.

Table 3.2.7 2002 NATA Contribution compared to RAIMI Results

	Background	Major Sources	Mobile Source
2002 NATA	55%	25%	20%
Harding Street	54%	12%	34%
Stout Field	62%	10%	28%

The contributions from RAIMI were attributed to each source category in Figures 3.2.6 and 3.2.7

Figure 3.2.6 RAIMI Harding Street Contributions

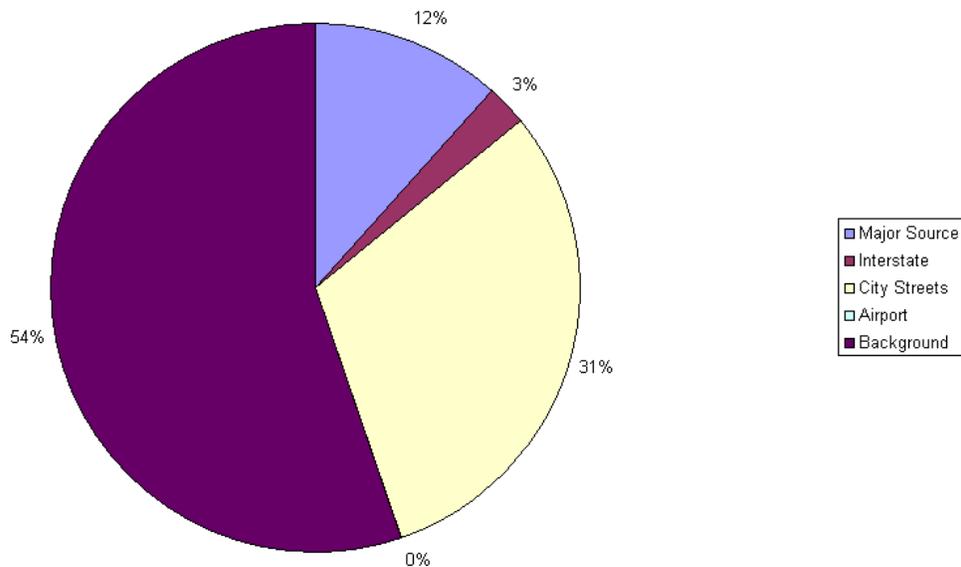
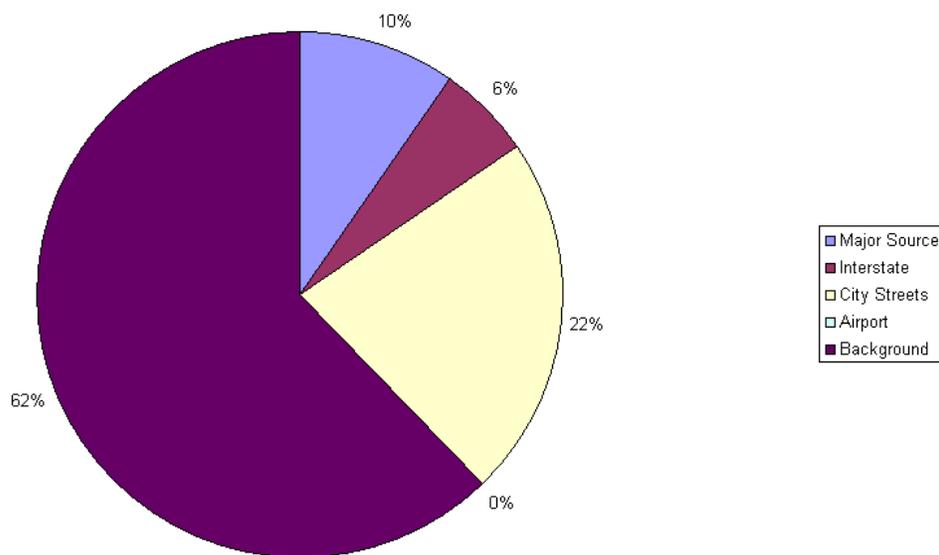


Figure 3.2.7 RAIMI Stout Field Contributions



3.2.8 RAIMI Comparison to Monitoring

To determine how effective the RAIMI analysis was, the concentrations from different pollutants were compared to the monitoring results at Harding Street and Stout Field. Model to monitoring agreement within a factor of two is generally considered good agreement. Tables 3.2.8 and 3.2.9 show the comparison:

Table 3.2.8 RAIMI Result Compared to Harding Street Monitoring Results

Pollutant	Modeled Concentration	2002 NATA Background	Total Modeled Concentration	Monitored Concentration	Total Modeled vs. Monitored Difference
	$\mu\text{g}/\text{m}^3$	$\mu\text{g}/\text{m}^3$	$\mu\text{g}/\text{m}^3$	$\mu\text{g}/\text{m}^3$	
Acetaldehyde	0.023	1.76	1.8	2.2	-1.2
Benzene	0.67	0.202	0.9	1.3	-1.4
Formaldehyde	0.4	2.27	2.7	5.3	-2
Toluene	1.66	0.29	2	2.9	-1.5
Nickel	0.0063	0.00032	0.006	0.001	6
Arsenic	0.000062	0.0007	0.0007	0.001	-1.4
Chromium	0.0021	0.00075	0.003	0.003	1

Table 3.2.9 RAIMI Results Compared to Stout Field Monitoring Results

Pollutant	Modeled Concentration	2002 NATA Background	Total Modeled Concentration	Monitored Concentration	Total Modeled vs. Monitored Difference
	$\mu\text{g}/\text{m}^3$	$\mu\text{g}/\text{m}^3$	$\mu\text{g}/\text{m}^3$	$\mu\text{g}/\text{m}^3$	
Acetaldehyde	0.03	1.76	1.8	2.3	-1.3
Benzene	0.97	0.202	1.2	1.9	-1.6
Formaldehyde	0.56	2.27	2.8	3.6	-1.3
Toluene	2.38	0.29	2.7	3.4	-1.3
Nickel	0.0072	0.00032	0.007	0.002	3.5
Arsenic	0.000064	0.0007	0.0008	0.001	-1.3
Chromium	0.003	0.00075	0.004	0.003	1.3

With the exception of nickel, all of the concentrations are within a factor of two. Nickel concentrations were expected to be higher in the modeling due to the vapor phase treatment of that particulate pollutant.

Cumulative cancer risks from modeled data were compared to cumulative cancer risks from monitored results. This comparison has some caveats. Not all of the same pollutants were considered for both the monitored and modeled estimated risk. The location of the node of the modeled estimated risk is not at exactly the same location as the monitored location. The comparison shows the estimated cancer risk for each source category, including the added background compared to the monitored estimated risk. Table 3.2.10 shows the comparison. All numbers in the table indicated the number of excess lifetime cancer cases per million people.

Table 3.2.10 RAIMI Estimated Cancer Risk (per million) Compared to Monitored Estimated Cancer Risk

Cancer Risk	Monitor	
	Harding Street	Stout Field
RAIMI Major Source	4	3
RAIMI Interstate	1	2
RAIMI City Streets	12	8
RAIMI Airport	0.02	0.02
RAIMI Total	17	13
2002 NATA Background	21	21
Sum of Modeled Risks	38	34
Monitored Risk	42	51

The cumulative cancer risk estimate for RAIMI and air monitoring were reasonably close at both Harding Street and Stout Field.

4.0 Public Outreach

4.1 Introduction

Community involvement and participation were considered essential to the successful completion of the Southwest Indianapolis Air Toxics Study (Study). It is important that the public's concerns and issues be addressed to the greatest extent possible and that the progress and results of the Study (monitoring, modeling, risk characterization) are clearly and accurately communicated throughout the Study. IDEM worked with residents, local industry, local technical experts and the news media to address the many issues associated with communication of a complex technical Study such as this.

IDEM identified four major stakeholder groups with unique interests that had different needs for interaction, planning, and feedback.

- Local industries in the Study Area that may have interest in the Study and/or subject to IDEM's emission information request.
- Technical experts from a variety of areas to discuss specific technical issues and advise IDEM.
- The local and regional news media.
- The general public, especially those people who live and work in the Study Area.

4.2 Industry

IDEM considered industry involvement and cooperation to be essential to the successful completion of the Study. Some of the issues identified by U.S. EPA in the NATA revolved around emissions inventory problems. IDEM decided to attempt to avoid some of the issues observed in NATA and developed a detailed emission inventory for use in the modeling aspects of the Study. In order to obtain the level of detail and accuracy needed IDEM solicited input and assistance from the industries evaluated as part of the Study.

IDEM mailed out informational memos to industries in and around the Study Area on November 20, 2007. This memo contained introductory information about the Study. The memo also served to give advance warning to the industries about the emission information request that would be sent to them in the next few months. In the memo, IDEM explained the emissions information gathering process and gave the date of a follow up information session. The memo can be found in Appendix H.

December 13, 2007 IDEM hosted an industry information session for the industries in the area. The meeting was held at an industry located within the Study Area. At the meeting IDEM gave a short presentation explaining why IDEM was performing the Study and what all was expected to be involved as part of the emissions information gathering process. IDEM took questions from industry and made contact information of IDEM staff available in order to provide industry a chance to ask questions in a less formal setting.

Additionally IDEM had small group meetings at industry's request. At these meetings, industry representatives felt more comfortable asking candid questions regarding issues associated with confidentiality and de minimus reporting limits.

IDEM initiated the formal emissions-related information validation request January 18th, 2008. Stakeholders were provided ninety (90) days to prepare and submit a response. The request contained the emissions information that IDEM currently had on file for the industry both in paper and electronic format on a CD. It also highlighted areas where IDEM did not have the required information on file and asked the industry to fill in these data "gaps." If an industry felt that all the information was correct and complete then the form would just be signed and returned to IDEM.

IDEM facilitated two workshops to assist businesses with the Study's emissions-related information request. During these workshops, the State and City of Indianapolis staff were available to answer questions and aid in the verification and/or accurate completion of the emission-related information request.

IDEM received an eighty-three percent(83%) response rate from the industry in the area. This accounted for ninety-nine percent (99%) of the total industrial source emissions in the area. The increased response rate adds confidence that the inputs used for the model were more accurate.

4.3 Technical Advisory Group

Any project as complex as the Southwest Indianapolis Air Toxics Study can benefit from external input and review. To that end, IDEM formed the Technical Advisory Group (TAG) to evaluate technical aspects of the Study.

The TAG was a group of external technical experts from not-for-profit organizations, local industries, and federal, state and local government agencies. The TAG was involved throughout the Study; from the initial scoping of the project to the final review of this results report.

Input from the TAG provided a practical review of the assumptions and calculations used to support the Study. The TAG served as a source of new ideas and different perspectives and helped to verify the Study's conclusions. Consensus from the group on specific methodology or technical ideas was not necessary. The TAG was not a steering committee; however, IDEM used the input and technical expertise of the group to help in its decision-making process.

The TAG met with IDEM eleven (11) times over the course of the Study. All TAG meetings were open to the public, as well as, broadcasted in real-time over the Internet and posted on the Study's Web site for later viewing. Laura Steadham of IDEM's Office of Land Quality served as facilitator of the meetings and helped ensure that each meeting followed the pre-determined agenda. During the meetings, members of the TAG discussed technical issues associated with the Study and made recommendations to

IDEM on the issues discussed. See Appendix I for notes from the TAG meetings. IDEM appreciates the hard work and dedication of all members of the TAG.

All the TAG meetings were open to the public to attend but were not considered public meetings. The meetings were broadcast over the internet using Webinar technology. This allowed viewers of the web broadcast to see copies of handout, Power Point presentations, as well as, write in questions for the TAG. Comments and questions from the public were not addressed until the end of each meeting in order to maintain the flow and dialog between TAG members. Recordings of past meetings are available on the Studies web site.

TAG Members:

- Dr. Jim Klaunig - Professor of Toxicology - Indiana University School of Medicine/IUPUI
- Rad Scott - Chemical Engineer – Air Emissions - Eli Lilly
- Dr. Bill Beranek - Indiana Environmental Institute - chemist and community facilitator
- Dr. Phil Stevens - Professor of Chemistry, Indiana University, General Public Representative-Air Pollution Control Board
- Dr. Dick Van Frank - Improving Kids' Environment
- Rod Thompson - SESCO Group
- Dr. George Bollweg - U.S. Environmental Protection Agency, Region 5
- Motria Caudill - U.S. Environmental Protection Agency, Region 5
- LaNetta Alexander - Environmental Epidemiologist - Indiana State Department of Health
- Pam Thevenow and Jason Ravenscroft – Marion County Health Department
- Dr. Syed Ghiassudin – IDEM Office of Water Quality

4.4 Press

IDEM and the City of Indianapolis wanted to assist the media in providing timely and accurate information about the Study to the public. The IDEM media team provided information about the Study to media outlets (Indy Star, other papers, radio, and television). IDEM provided press releases, media advisories, and periodic meetings/interviews throughout the Study.

As IDEM was preparing for the release of information to the public, IDEM composed articles containing information about the Study and released them to local newspapers. The timing of the release of the articles was so that they could be run for three consecutive Wednesdays prior to the release of the Study results at the public availability session hosted by IDEM. Only one local newspaper decided to run the IDEM written stories in the papers leading up to the presentation of the results.

4.5 Public Advisory Group (PAG)

Residents in the southwest side of town have an active interest in the quality of the air in the area. In a survey conducted by the Great Indianapolis Neighborhood Initiative (GINI), air quality was listed as the third most important area of concern for residents. The residents in the area were very interested in the Study and its results. Because of the intense interest, IDEM listed communication of results in the grant application and scope as essential to the success of the Study. To aid IDEM with the task of clearly communicating the results to the public, IDEM formed a Public Advisory Group (PAG).

The PAG was comprised of southwest Indianapolis residents and community leaders who work toward increasing the quality of life for area residents through community improvements. The PAG met regularly at the Mary Rigg Neighborhood Center from June 2008 through March 2010.

Purpose of the PAG:

- To ensure Study results reached Southwest Indianapolis residents first;
- To ensure Study results were communicated in a clear and understandable manner to the general public in the area;
- To give residents of Southwest Indianapolis a forum for voicing questions and concerns regarding the Study; and,
- To provide community input concerning any necessary follow-up actions once the Study is complete.

The PAG achieved these goals by helping IDEM create a community involvement plan for the Study. The community involvement plan was used to help IDEM understand which information would be most useful to residents and to identify which organizations and individuals should be involved with the release of the Study results.

The PAG also spent a great deal of time reviewing outreach materials prior to the release of the information. The Study had many complex technical aspects and communicating the technical aspects of the Study in way that is understandable to the neighbors was a challenge. Through active dialog and discussion with the PAG, the PAG and IDEM were able to go through the different pieces of the Study to determine which piece were important for residence to hear and understand. The process involved IDEM preparing many documents and then going through them in detail at PAG meetings. For each document IDEM received frank and honest feedback from the PAG members both at the meeting but also outside of the meeting times. This feedback could be as detailed as specific word choices used in describing results and the colors used in graphics or as broad as what topics should be included or excluded in the informational material.

The strategy that the PAG and IDEM used for outreach was to layer and segment the outreach materials. The PAG and IDEM understood that there was a large amount of material and information generated by the Study and that it should all be made available

to the public to view. However, the interest level will differ from person to person so not all the material will be of interest to everyone.

IDEM generated a results brochure that was very basic in the communication of the results. The amount of information in the brochure was sufficient to explain the basics of the Study and share the results of the analyses but there was not much in the way of details. The second layer of informational material generated was a summary report. The summary report contained more background information on the methods and limitations of the Study, as well as more secondary analysis and results. The summary report was much more technical than the results brochure, however, the summary report was still intended to be understandable by the public. IDEM generated multiple fact sheets about various topics of the Study. The fact sheets were intended to go along with and enhance the information contained in the summary report. These subjects were touched upon in the summary report but were not explained in detail. For example, IDEM developed a paper explaining how and why an Upper Confidence Limit of the mean (UCL) was calculated using language that the public would be comfortable with. Based on public interaction this information would not be of interest to most in the public, however a small part of the public would be interested so the material was made available. A complete list of all the material developed can be found in section 4.7. Copies of the material can be found in Appendix E.

PAG Members:

- Beth Gibson - West Indianapolis Development Corporation (WIDC)
- Joanne Hamilton - Marion County Alliance of Neighborhood Associations (McANA)
- Elizabeth McMillin - Southern Wayne Neighborhood Organization
- Dennis Papenmeier - Mayor's Neighborhood Liaison, City of Indianapolis
- Robyn Schuller - Director of Health Operations, Occupational Health and Hygiene Corporation of America
- Martha Wedemeyer - Southwest Health Clinic
- Kathy Dee - Parent Liaison, Daniel Webster School, IPS # 46
- Janet McCabe - Improving Kids' Environment
- Pastor John Hay, Jr. - West Morris Street Free Methodist Church
- Richard Myers - Environmental Health and Safety, Indianapolis Public Schools

4.6 Pre-existing Community Meetings

IDEM attended a number of public meetings around the Study Area during the course of the Study. These meetings are pre-existing meetings and were not specifically scheduled to present information about the Study to the community. IDEM gave each organization an option to have IDEM staff attend meetings on a regular schedule, or to just attend meetings when major and important information about the Study was available.

Attending many different meetings and attending on a regular basis had many benefits. IDEM staff were able to have one on one conversations with residents which allowed IDEM to gain a better understanding as to what the primary concerns in the area were. Having an understanding about the concerns allowed IDEM to develop a message that best answered the questions and concerns the public had. Also, the frequent contact with IDEM staff made the community members more at ease with staff. IDEM staff became more than just representatives of the government. This familiarity with staff created a situation where the public would listen to IDEM's message with an open mind that was less prejudiced by views of negative governmental stereotypes. Most importantly, by being more open to IDEM's communications, the public was also more willing to provide feedback on what they did and did not understand. The constant feed back and communication with the public allowed IDEM to constantly adjust the message to best communicate the results and answer the questions of the public.

Below is a list of the meetings attended by IDEM during the course of the Study:

- August 8, 2006 - Neighborhood Involvement Committee (NIC)
- August 14, 2006 - Environmental Managers Meeting
- August 28, 2006 - Neighborhoods and the Environment (NATE)
- September 11, 2006 - Environmental Managers Meeting
- September 21, 2006 - Community Advisory Panel (CAP)
- October 10, 2006 - Neighborhood Involvement Committee (NIC)
- October 19, 2006 - Community Advisory Panel (CAP)
- October 23, 2006 - West Indianapolis Neighborhood Committee (WINC)
- Nov. 16, 2006 - Community Advisory Panel (CAP)
- November 27, 2006 - Neighborhoods And The Environment (NATE)
- December 12, 2006 - Neighborhood Involvement Committee (NIC)
- February 12, 2007 - Environmental Managers Meeting
- March 15, 2007 – Community Advisory Panel (CAP)
- March 19, 2007 - Environmental Managers Meeting
- April 10, 2007 - Neighborhood Involvement Committee (NIC)
- April 16, 2007 - Environmental Managers Meeting
- April 19, 2007 - Community Advisory Panel (CAP)
- April 23, 2007 - Neighborhoods and the Environment (NATE)
- May 14, 2007 - Environmental Managers Meeting
- August 13, 2007 - Environmental Managers Meeting
- August 16, 2007 - Community Advisory Panel (CAP)
- August 27, 2007 - West Indianapolis Neighborhood Congress (WINC)
- September 20, 2007 - Community Advisory Panel (CAP)
- September 24, 2007 - Public Sound-Off organized by the West Indianapolis Neighborhood Congress (WINC)
- December 11, 2007 - Neighborhood Involvement Committee (NIC)
- December 13, 2007 - IDEM Emissions Inventory Information Session for Industry
- February 25, 2008 - West Indianapolis Neighborhood Congress (WINC)
- March 10, 2008 - Environmental Managers Meeting
- March 10, 2008 - IDEM Emissions Inventory Information Session for Industry

- March 20, 2008 - Community Advisory Panel (CAP)
- April 7, 2008 - IPS
- April 8, 2008 - Neighborhood Involvement Committee (NIC)
- May 27, 2008 - Neighborhoods and the Environment (NATE)
- June 10, 2008 - Neighborhood Involvement Committee (NIC)
- June 26, 2008 - Public Advisory Group (PAG)
- September 18, 2008 - Community Advisory Panel (CAP)
- September 22, 2008 - Town Hall Meeting organized by West Indianapolis Neighborhood Congress (WINC)
- September 25, 2008 - Public Advisory Group (PAG)
- October 5, 2008 - Thatcher Park Community Day
- October 16, 2008 - Community Advisory Panel (CAP)
- October 21, 2008 - Technical Advisory Group (TAG)
- October 29, 2008 - Public Advisory Group (PAG)
- November 20, 2008 - Community Advisory Panel (CAP)
- December, 9, 2008 - Neighborhood Involvement Committee (NIC)
- February 19, 2009 - Community Advisory Panel (CAP)
- February 23, 2009 - West Indianapolis Neighborhood Congress (WINC)
- March 4, 2009 - Public Advisory Group (PAG)
- April 14, 2009 - Neighborhood Involvement Committee (NIC)
- April 16, 2009 - Community Advisory Panel (CAP)
- April 29, 2009 - Technical Advisory Group (TAG)
- May 12, 2009 - Technical Advisory Group (TAG)
- June 2, 2009 - Public Advisory Group (PAG)
- June 9, 2009 - Neighborhood Involvement Committee (NIC)
- June 11, 2009 - Technical Advisory Group (TAG)
- June 18, 2009 - Community Advisory Panel (CAP)
- July 27, 2009 - Neighborhoods and the Environment (NATE)
- August 20, 2009 - Community Advisory Panel (CAP)
- September 17, 2009 - Community Advisory Panel (CAP)
- November 12, 2009 - Technical Advisory Group (TAG)
- November 19, 2009 - Community Advisory Panel (CAP)
- November 23, 2009 - West Indianapolis Neighborhood Congress (WINC)
- December 8, 2009 - Neighborhood Involvement Committee (NIC)
- January 14, 2010 - Joint Public and Technical Advisory Group Meeting
- January 21, 2010 - Community Advisory Panel (CAP)
- January 25, 2010 - Neighborhoods and the Environment (NATE)
- January 25, 2010 - West Indianapolis Neighborhood Congress (WINC)
- February 18, 2010 - Community Advisory Panel (CAP)

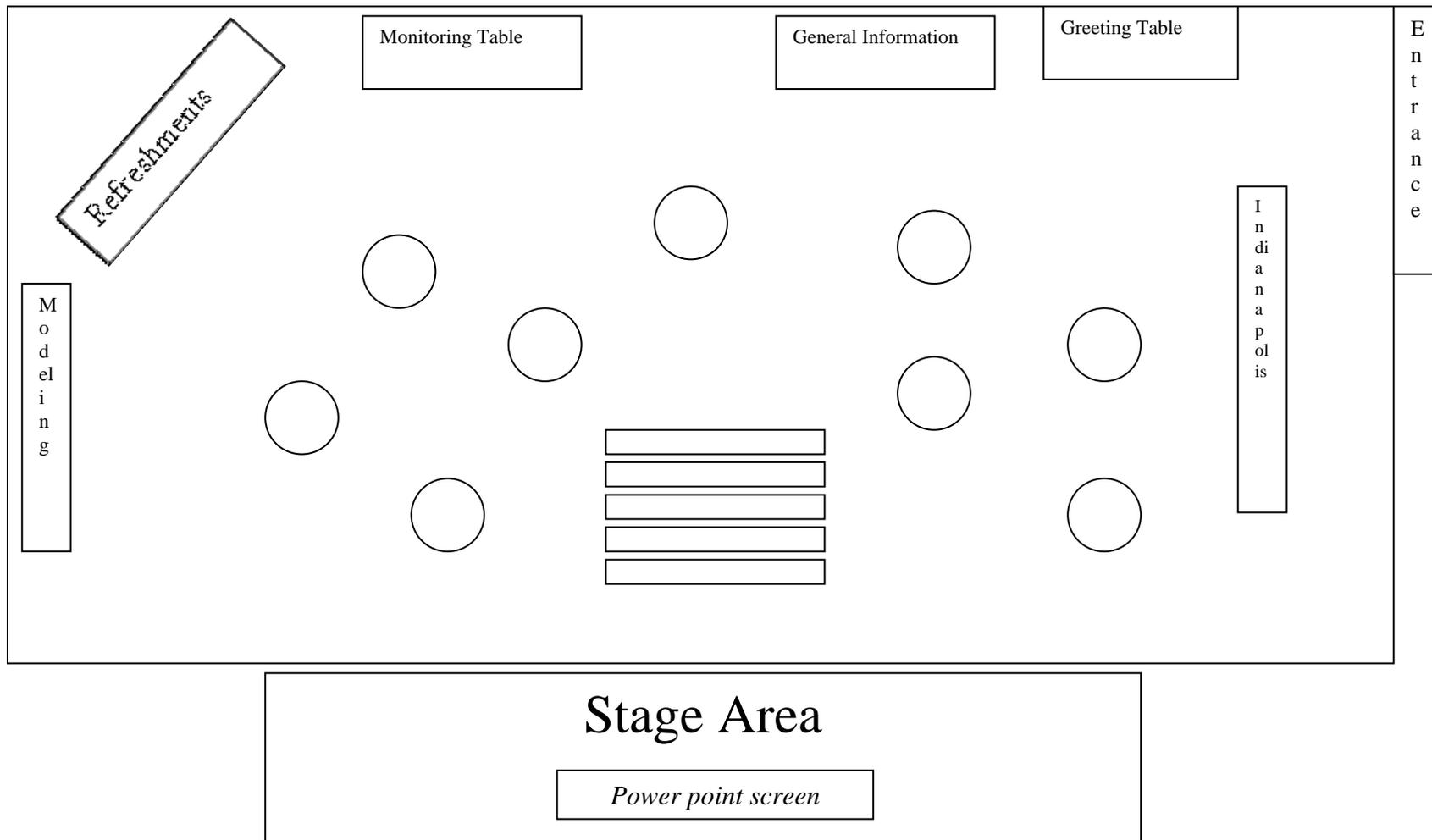
4.7 IDEM Hosted Community meeting

IDEM hosted a community meeting in the Mary Rigg Neighborhood Center gymnasium to release the results of the Study. All residents, media, and industry were invited to attend the meeting. PAG and TAG members were also invited to attend the meeting as

participants and be available to answer the public's questions. IDEM staff were accessible to the public throughout the gymnasium at various information tables (see diagram below) to answer questions.

Staff at the greeting table, met people as they entered and briefly explained the setup. The public were able to walk from station to station and ask IDEM and City of Indianapolis staff questions in a one-on-one setting. For example, if a person is more interested in monitoring information, they were able to go to the monitoring table and get handouts specific to the monitoring and ask monitoring staff questions. IDEM set up tables for monitoring, modeling, risk assessment, and a general information table in addition to the greeting table. The City of Indianapolis also had a table with city experts to answer questions. The goal of this layout was to create a casual atmosphere where residents could gather information at their own pace.

Figure 4.1 – Public Information Session Room Layout



Material available at each Station**Modeling Table:**

- Large Scale Items
 - Industrial source modeling map
 - Mobile source modeling map
 - Total risk modeling map
 - Map of modeled sources
- Handouts
 - Source pie chart
 - RAIMI fact sheet
 - Background fact sheet
 - Odor fact sheet
 - Results brochures

Monitoring Table:

- Large Scale Items
 - Chart compilation
 - Monitoring equipment
- Handouts
 - Monitoring results tables
 - Carcinogen
 - Non-carcinogen
 - Non-detect fact sheet
 - UCL fact sheet
 - PM fact sheet
 - Ozone fact sheet
 - Results brochures

Greeting Table

- Handouts
 - Agenda
 - Community sign in sheet
 - Informational brochure
 - Results brochure

General Information Table:

- Large Scale Items
 - Total modeled cancer map
- Handouts
 - Odor fact sheet
 - Indoor air guide
 - TAG fact sheet
 - PAG fact sheet
 - VIP handouts
 - Asthma guide
 - ATSDR chemical fact sheets
 - Acetaldehyde
 - Acetone
 - Acrolein
 - Benzene
 - Chromium
 - Dichlorobenzenes
 - Formaldehyde
 - Nickel
 - Tetrachloroethene
 - Toluene
 - Results brochures

The meeting was held on a Thursday, March 11, 2010 and was split into three parts. The first 45 minutes were dedicated to the open house format. Following the open house, IDEM gave a formal Power Point presentation using a projector. The presentation lasted approximately 30 minutes and IDEM took questions from the audience at the end of the presentation. Following the presentation, IDEM staff were then available for one-on-one dialog with the public in the open house format.

Media and communications staff from IDEM were stationed at the greeting table to meet and accompany any media that arrived at the meeting. Two local TV stations were present and performed on camera interviews with media and communications staff.

Following the IDEM hosted meeting at the Mary Rigg Center, IDEM staff attended the various community meetings around the area to present the results of the Study to the public.

5.0 Conclusions

5.1 Air Quality in the Study Area

While previous National Air Toxics Assessments (NATAs) had identified the Study Area as a concern in regards to pollutants like chromium VI and arsenic, the more detailed modeling and monitoring that made up this Study showed these pollutants to be at concentrations well within the range deemed safe by U.S. EPA. In fact, no air pollutants monitored or modeled in the study area were observed at levels that warranted immediate action to protect human health.

Air toxics concentrations in the study area are largely in line with levels observed at other monitors within Indiana and the United States. This is not to say that air quality cannot be improved in the area, only that, when detailed modeling and monitoring is conducted, southwest Indianapolis does not stand out as having unusually high concentrations of air toxics or risk. IDEM recognizes that there is always room for improvement when it comes to air quality and is making effort here and across the state to make the air Hoosiers breathe cleaner and healthier.

Benzene was the primary carcinogen of concern in the Study Area. The concentrations recorded at the Stout Field monitor equated to a cancer risk of 15-in-a-million; the highest cancer risk seen in monitoring data. Benzene also made up 44% of the cancer risk seen in the modeling. Benzene is a well known mobile source pollutant, with the most common source being gasoline. As such, much of this risk can be attributed to car traffic in the area. Modeling results support this conclusion.

Acrolein accounted for over 99% of the total hazard in the Study Area. Several issues surround the monitoring and analysis of acrolein, including:

- Acrolein's very low reference concentration, which makes it impossible to measure "safe" levels of the pollutant
- Recent research which indicates that current methods of sampling and analysis for acrolein can result in inconsistent data due, in part to secondary formation of acrolein in the summa canisters

Acrolein has been identified as a national issue and IDEM, along with U.S. EPA and other states are attempting to find a way to get more reliable sampling results for acrolein.

The Study indicates that the bulk of the risks and hazards posed by air toxics in the study area are the result of mobile source pollutants. Mobile sources are a primary cause of both acrolein and benzene pollution. Most higher-risk areas appear to fall along roadways. Modeling did not indicate any industry-caused hotspots in residential areas. .

As with any study, there were limitations to what the Southwest Indianapolis Neighborhood Air Toxics Study could, and did do. While there are thousands of pollutants emitted into the atmosphere across the world, only 168 pollutants were modeled, and only 85 pollutants were monitored. However, the pollutants that were chosen for modeling and monitoring were those pollutants which were either:

- Identified as a potential problem in the Study Area (e.g., chromium VI, arsenic),
- Identified as a national issue (e.g., benzene, acrolein),
- Or were shown to be particularly toxic and emitted in or around the study area.

The study also did not focus on Criteria Pollutants such as ozone and particulate matter. While IDEM recognized these pollutants as serious issues, the grant which largely funded the Study was awarded specifically for the study of air toxics. In addition to this limitation, it should also be noted that there are strict federal guidelines that regulate how Criteria Pollutants are monitored and handled and has resulted in a large amounts of information already being available on these pollutants.

5.2 Lessons Learned

The Southwest Indianapolis Neighborhood Air Toxics Study was a very complex project with many moving parts. It was a learning experience for IDEM and many lessons were learned that will help improve the outcome of similar projects in the future.

- Better methods for determining background concentrations are needed. While the Study's use of 2002 NATA background concentrations appears to be an acceptable approach to this issue, there are potentially better ways to understand and account for background. An upwind monitor to measure pollutant concentration in the air before it reaches the study area would have been useful. A more detailed analysis of household emissions would also help provide more reliable background concentration data.
- Acrolein will continue to cause problems for any study until a better method of collection and analysis is found. Measured acrolein concentrations resulted in hazard quotients hundreds of times higher than any other pollutant, making graphical representation of the data more difficult.
- PM₁₀ total chromium readings and the Chromium VI data do not allow for a direct comparison. A speciation profile of chromium emissions in the Study Area could not be created simply by comparing the two readings.
- Accurately locating sources is very important. For the Study, each source was geolocated based on the source's physical address. In some cases, the actual emission points were hundreds of meters away from the modeled point. In some cases, this discrepancy resulted in the estimated exposure concentrations being displayed on maps in locations far from where they actual occurred. While more time consuming, the sources can be placed closer to their actual release point by using available online aerial photographs.
- RAIMI proved to be a valuable tool for conducting an air quality assessment of this size. Advantages of RAIMI include:
 - The ability to take a labor intensive calculation process and automate it creating a substantial time savings. While actual performing the modeling using a unitized 1 gram per second emission rate, RAIMI eliminates modeling runs that would be needed for each pollutant. For the Study, RAIMI conducted one modeling run for each of the 2,741 sources. If each pollutant was run separately for each source, it

would have been necessary to perform 42,187 separate modeling runs. At approximately eight minutes per run for each year of the five-year modeling analysis, RAIMI saved over three years of modeling run time.

- The ability to automate the calculations and convert the estimated concentrations from the unitized rate back to the inputted emission rates for each source. Trying to calculate the estimate concentration for each of the 54,195 nodes would result in over two billion potential concentrations. This would create a time and resource issue. RAIMI also calculates the exposure concentration for cancer risk and non-cancer health effects for each source, pollutant and node and provides the data in a format that can be sorted to determine maximum exposures based on any of the different inputs.
- The ability to graphically display the results using ARCVIEW. This allowed IDEM to instantly view results on a map and locate the potential areas of concern. Again RAIMI automates this feature using Plot Converter saving more time.
- Despite all the positives of RAIMI there were a few drawbacks, including:
 - A steep learning curve. The input files needed to be exact in format to match the required inputs for the RAIMI program. Any error in the input files would prevent the program from successfully importing the data. Determining which inputs were incorrect was a matter of trial and error and caused delays in the modeling analysis. Once the data were imported, RAIMI did not allow the user to go back and correct any errors; instead the multi-step process had to be restarted from the beginning.
 - RAIMI uses a SQL backing database that has an effective limit of about 500,000 data points. This was discovered with help from Wisconsin's DNR staff that had more experience using the program. This problem is easily correctable by understanding the limitation and keeping the number of source analyzed at a time below that limit.
- Public Advisory Group (PAG) members had varying levels of technical prowess. Standard methods of document review for IDEM often proved ineffective for the PAG. Throughout the course of the study, IDEM asked the PAG to review outreach pieces. IDEM emailed the materials to PAG members and requested feedback electronically. This method resulted in low response rates. However, when IDEM brought outreach pieces needing review to the PAG meetings, PAG members would review, and make suggestions to the materials during the meeting. This proved to be very effective and valuable feedback was gathered.
- PAG members proved to be a very valuable resource. The PAG members were willing to be involved beyond their time spent at the meetings. They actively distributed brochures for IDEM to personal contacts throughout the study area and were available to speak to residents at the study results rollout meeting.
- Future PAGs should be included in the initial scoping of their role. IDEM initially attempted to clearly define the role of the PAG based on what IDEM thought would be the level of commitment from PAG members. It was thought this would provide clear direction and expectations for the members on the PAG. However, it was soon discovered that PAG members came with their own ideas for their roles and some were willing to spend much more time and energy on the study than IDEM originally anticipated. By incorporating their feedback into a document outlining the specific

- responsibilities and goals of the PAG, the group had a better understanding of their role.
- Delays should be minimized to maintain PAG interest. IDEM set an initial timeline for the course of the PAG when it was formed. As the study progressed, several delays occurred and the PAG membership and interest fell off somewhat.
 - Choose an appropriate, centralized location for PAG meetings. Many PAG members rode buses or walked to PAG meetings. IDEM held all of the PAG meetings in a central location within the study area. This proved to be a success and resulted in good attendance for most PAG meetings.
 - Light snacks are helpful at meetings involving community members.
 - Have a trained facilitator for TAG meetings. A trained facilitator can help keep the meetings on task and not allow one party to dominate a discussion. A facilitator was used for TAG meetings, and they helped ensure that useful feedback was received from multiple members.
 - Webinars of technical meetings can help broaden audiences and increase participation. Webinars of the TAG meetings increased TAG participation because members that lived or worked far away from the meeting location did not have to drive for every meeting. The meetings were also able to be recorded and allowed the public and other stakeholders to view meetings on their own schedule.
 - Make use of technology to ensure effective communication. IDEM established a forum for the submission of comments and discussion from TAG members, however, IDEM did not promote the use of the forum sufficiently. As a result, IDEM staff became the mediators for communication from TAG members that occurred outside of the meetings. That is, IDEM would have to ensure that comments submitted by TAG members to IDEM were properly distributed to the rest of the TAG for feedback. This also put IDEM in the difficult position of having to determine if communication from a TAG member was intended as a direct communication outside of the role of the TAG or if it was information that should be shared with all TAG members.
 - Be sure to set achievable timelines:
 - Incorporating more external parties (i.e. PAG, TAG, industry) results in more feedback and more groups that are required to review the work and results. As such, more time is required than a standard project to allow for the proper amount of review time for the various pieces of the study.
 - IDEM received the grant for a two year period but was also expected to perform two years worth of sampling. The grant period did not take into account time to buy equipment, site the monitors, get it set up and calibrated, run the sample analyses in the lab, QA the data, then analyze the monitoring results to establish EPC, trends, patterns, risks, etc. IDEM had to file for extensions to the grant period to account for these issues. In the future it would be better to include these time issues in the original grant agreement time line.

Glossary

This list of glossary terms was compiled from existing EPA definitions and supplemented, where necessary, by additional terms and definitions. The wording of selected items may have been modified from the EPA definition in order to assist readers who are new to risk assessment to more easily comprehend the underlying concept of the glossary entry. As such, these glossary definitions constitute neither official EPA or IDEM policy nor preempt or in any way replace any existing legal definition required by statute or regulation.

A

Absorption - The process of taking in, as when a sponge takes up water. Chemicals can be absorbed through the skin into the bloodstream and then transported to other organs. Chemicals can also be absorbed into the bloodstream after inhaling or swallowing.

Acceptable Risk - The likelihood of suffering disease or injury that will be tolerated by an individual, group, or society. The level of risk that is determined to be acceptable may depend on a variety of issues, including scientific data, social, economic, legal, and political factors, and on the perceived benefits arising from a chemical or process.

Accuracy - The measure of the correctness of data, as given by the difference between the measured value and the true or standard value.

Active Monitor - A type of personal exposure monitoring device that uses a small air pump to draw air through a filter, packed tube, or similar device.

Acute Effect - Any toxic effect produced within a short period of time following an exposure, for example, minutes to a few days

Acute Exposure Limits - A variety of short-term exposure limits to hazardous substances, designed to be protective of human health. Published by different organizations, each limit has a different purpose and definition.

Acute Exposure - One dose (or exposure) or multiple doses (or exposures) occurring within a short time relative to the life of a person or other organism (e.g., approximately 24 hours or less for humans).

Actual Risk - The damage to life, health, property, and/or the environment that may occur as a result of exposure to a given hazard. Risk assessment attempts to estimate the likelihood of actual risk.

Additive Effect - The overall result of exposure to two or more chemicals, in which the resulting effect is equal to the sum of the independent effects of the chemicals. “Effects” or “Response Addition” is a method employed in EPA risk assessments of mixtures in which the components act or are presumed to act independently (without interaction).

Additive Dose - The overall result of exposure to two or more chemicals, when each chemical behaves as a concentration or dilution of the other chemicals in the mixture.

The response of the combination is the response expected from the equivalent dose of an index chemical. The equivalent dose is the sum of component doses scaled by their toxic potency relative to the index chemical.

Adjusted Exposure Concentration - Also called a refined exposure concentration, an estimate of exposure concentration that has been refined, usually by application of an exposure model, to better understand how people in a particular location interact with contaminated media.

Administered Dose - The amount of a substance received by a test subject (human or animal) in determining dose-response relationships, especially through ingestion or inhalation.

Advection - In meteorology, the transfer of a property, such as heat or humidity, by motion within the atmosphere, usually in a predominantly horizontal direction. Thermal advection, for example, is the transport of heat by the wind. Advection is most often used to signify horizontal transport but can also apply to vertical movement. Large-scale horizontal advection of air is a characteristic of middle-latitude zones and leads to marked changes in temperature and humidity across boundaries separating air masses of differing origins.

Adverse Health Effect - A health effect from exposure to air contaminants that may range from relatively mild and temporary (e.g., eye or throat irritation, shortness of breath, or headaches) to permanent and serious conditions (e.g., birth defects, cancer and/or damage to lungs, nerves, liver, heart, or other organs), and which negatively affects an individual's health or well-being, or reduces an individual's ability to respond to an additional environmental challenge.

Affected (or Interested) Parties - Individuals and organizations potentially acted upon or affected by chemicals, radiation, or microbes in the environment or influenced favorably or adversely by proposed risk management actions and decisions.

Agent - A chemical, physical, or biological entity that may cause deleterious, beneficial, or no effects to an organism after the organism is exposed to it.

Aggregate exposure - The combined exposure of an individual (or defined population) to a specific agent or stressor via relevant routes, pathways, and sources.

Aggregate risk - The risk resulting from aggregate exposure to a single agent or stressor.

Air Emissions - The release or discharge of a pollutant(s) into the air.

Air Pressure (Atmospheric Pressure, Barometric Pressure) - The pressure experienced above the Earth's surface at a specific point as a result of the weight of the air column, extending to the outer limit or top of the atmosphere. Consequently, pressure declines exponentially with height, the rate of decrease being a function of the temperature of the atmosphere. Atmospheric pressure is generally measured, in

meteorology, either in the SI unit hectopascals (hPa) or in the c.g.s. unit of the same size, the millibar (mb) using a mercury or aneroid barometer, or a barograph. In the U.S., surface atmosphere pressure is measured in inches of mercury (Hg).

Air Mass - A large volume of air with certain meteorological or polluted characteristics (e.g., a heat inversion or smogginess) while in one location. The characteristics can change as the air mass moves away.

Air Toxic - Any air pollutant that causes or may cause cancer, respiratory, cardiovascular, or developmental effects, reproductive dysfunctions, neurological disorders, heritable gene mutations, or other serious or irreversible chronic or acute health effects in humans. See hazardous air pollutant.

Ambient Medium (e.g., Ambient Air) - Material surrounding or contacting an organism (e.g., outdoor air, indoor air, water, or soil), through which chemicals can reach an organism.

Analysis - The systematic application of specific theories and methods, including those from natural science, social science, engineering, decision science, logic, mathematics, and law, for the purpose of collecting and interpreting data and drawing conclusions about phenomena. It may be qualitative or quantitative. Its competence is typically judged by criteria developed within the fields of expertise from which the theories and methods come.

Analysis Plan - A plan that provides all the details of exactly how each part of the risk assessment will be performed. It usually describes in detail what analyses will be performed, how they will be performed, who will perform the work, schedules, resources, quality assurance/quality control requirements, and documentation requirements.

Antagonistic Effect - The situation where exposure to two chemicals together has less effect than the sum of their independent effects.

AP-42 - A compilation of air pollutant emission factors. Volume I of the fifth edition addresses stationary point and area source emission factors. AP-42 is accessible on the Air CHIEF website (<http://www.epa.gov/ttn/chief/ap42/>) and is also included on the Air CHIEF CD-ROM.

Applied Dose - The amount of a substance in contact with an absorption boundary of an organism (e.g., skin, lung, gastrointestinal tract) and is available for absorption.

Area of Impact - The geographic area affected by a facility's emissions (also known as the zone of impact).

Area Source (legal sense) - A stationary source that emits less than 10 tons per year of a single hazardous air pollutant (HAP) or 25 tons per year of all HAPs combined. (i.e. gasoline stations, drycleaners etc.)

Area Source (modeling sense) - An emission source in which releases are modeled as coming from a 2-dimensional surface. Emissions from the surface of a wastewater pond are, for example, often modeled as an area source.

Assessment Questions - The questions asked during the planning/scoping phase of the risk assessment process to determine what the risk assessment will evaluate.

Atmospheric Stability (Stability) - the degree of resistance of a layer of air to vertical motion.

ATSDR (Agency for Toxic Substances and Disease Registry) - An Agency of the U.S. Department of Health and Human Services, whose goal is to serve the public by using the best science, taking responsive public health actions, and providing health information to prevent harmful exposures and diseases to toxic substances. Its website (www.atsdr.cdc.gov) includes information on hazardous substances [e.g., toxicological profiles, minimal risk levels (MRLs)], emergency response, measuring health effects, hazardous waste sites, education and training, publications, and special issues (e.g., Children Health).

Averaging Time - The time period over which something is averaged (e.g., exposure, measured concentration).

B

Background Levels - The concentration of a chemical already present in an environmental medium due to sources other than those under study. Two types of background levels may exist for chemical substances: (a) Naturally occurring levels of substances present in the environment, and (b) Anthropogenic concentrations of substances present in the environment due to human associated activities (e.g., automobiles, industries).

Background Source - Any source from which pollutants are released and contribute to the background level of a pollutant, such as volcano eruptions, windblown dust, or manmade source with impact on the study area.

Best Available Control Technology (BACT) - An emission limitation based on the maximum degree of emission reduction (considering energy, environmental, and economic impacts) achievable through application of production processes and available methods, systems, and techniques. BACT does not permit emissions in excess of those allowed under any applicable Clean Air Act provisions. Use of the BACT concept is allowable on a case by case basis for major new or modified stationary emissions sources in attainment areas and applies to each regulated pollutant.

Bias - systematic error introduced into sampling or analysis by selecting or encouraging one outcome or answer over others.

Bioaccumulation - The net accumulation of a substance by an organism as a result of uptake from and or all routes of exposure (e.g., ingestion of food, intake of drinking water, direct contact, or inhalation).

Bioavailability - The ability to be absorbed and available to interact with the metabolic processes of an organism.

Blue Book - The 1994 National Research Council (NRC) report entitled *Science and Judgement in Risk Assessment*.

Body Weight (Mass) - The weight or mass of an individual's body. It can apply to a human or an ecological receptor.

Breathing Zone - Air in the vicinity of an organism from which respired air is drawn. Personal monitors are often used to measure pollutants in the breathing zone.

Bright Line - Specific levels of risk or of exposure that are meant to provide a practical distinction between what is considered "safe" and what is not.

Building Downwash (Plume Downwash) - The interaction of a plume with a structure, such as a building, which causes the plume to fall to ground.

C

CalEPA (California Environmental Protection Agency) - An Agency within the California State government whose goal is to protect human health and the environment and to assure the coordinated deployment of State resources against the most serious environmental risks. There are six boards that address environmental issues, including air quality, pesticides, toxic substances, waste management, water control, and the Office of Environmental Health Hazard Assessment (OEHHA). Note that OEHHA is responsible for developing and providing state and local government agencies with toxicological and medical information relevant to decisions involving public health and is a good resource for such information.

Cancer - A group of related diseases characterized by the uncontrolled growth of abnormal cells.

Cancer Incidence - The number of new cases of a disease diagnosed each year.

Cancer Risk Estimates - The probability of developing cancer from exposure to a chemical agent or a mixture of chemicals over a specified period of time. In quantitative terms, risk is expressed in values ranging from zero (representing an estimate that harm certainly will not occur) to one (representing an estimate that harm certainly will occur). The following are examples of how risk is commonly expressed: 1.E-04 or 1×10^{-4} = a risk

of 1 additional cancer in an exposed population of 10,000 people (i.e., 1/10,000); $1.E-5$ or $1 \times 10^{-5} = 1/100,000$; $1.E-6$ or $1 \times 10^{-6} = 1/1,000,000$.

Cancer Slope Factor (CSF) - An upper bound (approximating a 95% confidence limit) on the increased cancer risk from a lifetime exposure to an agent. This estimate, usually expressed in units of proportion (of a population) affected per mg/kg/day, is generally reserved for use in the low-dose region of the dose-response relationship; that is, for exposures corresponding to risks less than 1 in 100. This term is usually used to refer to oral slope factors (i.e., slope factors used for assessing ingestion exposure).

Carcinogen(ic) - An agent capable of inducing cancer.

Carcinogenesis - The origin or production of a benign or malignant tumor. The carcinogenic event modifies the genome and/or other molecular control mechanisms of the target cells, giving rise to a population of altered cells.

Census Bureau (Bureau of the Census) - A Bureau within the Department of Commerce, this is the country's preeminent statistical collection and dissemination agency of national demographic information. It publishes a wide variety of statistical data about people, housing, and the economy of the nation. The Census Bureau conducts approximately 200 annual surveys and conducts the decennial census of the United States population and housing and the quinquennial economic census and census of governments.

Census Block - An area bounded by visible and/or invisible features shown on Census Bureau maps. A block is the smallest geographic entity for which the Census Bureau collects and tabulates 100-percent decennial census data.

Census Tract - A small, relatively permanent statistical subdivision of a county or statistically equivalent entity, delineated for data presentation purposes by a local group of census data users or the geographic staff of a regional census center in accordance with Census Bureau guidelines. Designed to be relatively homogeneous units with respect to population characteristics, economic status, and living conditions at the time they are established, census tracts generally contain between 1,000 and 8,000 people, with an optimum size of 4,000 people. Census tract boundaries are delineated with the intention of being stable over many decades, so they generally follow relatively permanent visible features. However, they may follow governmental unit boundaries and other invisible features in some instances; the boundary of a state or county (or statistically equivalent entity) is always a census tract boundary.

Chemical Abstracts Service Registry Number (CASRN) - A unique, chemical-specific number used in identifying a substance. The registry numbers are assigned by the Chemical Abstract Service, a division of the American Chemical Society. (Note that some mixtures of substances, such as mixtures of various forms of xylene, are also given CAS numbers.)

Chemicals of Potential Concern - Chemicals that may pose a threat to the populations within the study area. These are the chemicals that are studied throughout the risk assessment process.

Chemical Speciation - Detailed identification of the specific identities and forms of chemicals in a mixture.

Chemical Transformation - The change of one chemical into another.

Chronic Exposure - Continuous exposure, or multiple exposures, occurring over an extended period of time, or a significant fraction of the animal's or the individual's lifetime.

Chronic Health Effects - An effect which occurs as a result of repeated or long term (chronic) exposures.

Coefficient of Variation (CV) - A dimensionless measure of dispersion, equal to the standard deviation divided by the mean, often expressed as a percentage.

Cohort - A group of people within a population that can be aggregated because the variation in a characteristic of interest (e.g., exposure, age, education level) within the group is much less than the group-to-group variation across the population.

Community - The persons associated with an area who may be directly affected by area pollution because they currently live in or near the area, or have lived in or near the area in the past (i.e., current or past residents), members of local action groups, local officials, tribal governments, health professionals, and local media. Other entities, such as local industry, may also consider themselves part of the community.

Comparative Risk Assessment - The process of comparing and ranking various types of risks to identify priorities and influence resource allocations.

Conceptual Model - A written description and/or a visual representation of actual or predicted relationships between humans or ecological entities and the chemicals or other stressors to which they may be exposed.

Confidence Interval - A range of values that has a specified probability (e.g., 95 percent) of containing the statistical parameter (i.e., a quantity such as a mean or variance that describes a statistical population) in question. The confidence limit refers to the upper or lower value of the range.

Coning - In pollution studies, emissions from a chimney stack under atmospheric conditions of near neutral stability such that concentrations of a pollutant at a given distance downwind from the stack may be described by a normal or Gaussian distribution, being the same for both vertical and horizontal cross-sections perpendicular to the flow.

Consumption Rate - The average quantity of an item consumed or expended during a given time interval, expressed in quantities by the most appropriate unit of measurement per applicable stated basis.

Continuous Monitoring - The measurement of the air or water concentration of a specific contaminant on an uninterrupted, real-time basis by instrumental methods.

Control Technology/Measures - Equipment, processes or actions used to reduce air pollution at the source.

Convection - The transfer and mixing of heat by mass movement through a fluid (e.g., air or water). It is one of the major mechanisms for the transfer of heat within the atmosphere, together with conduction and radiation. The convection process is of major importance in the troposphere, transferring sensible heat and latent heat from the Earth's surface into the boundary layer, and by promoting the vertical exchange of air-mass properties (e.g., heat, water vapor, and momentum) throughout the depth of the troposphere. Convection is generally accepted to be vertical circulation, whereas advection is usually horizontal.

Cost-Benefit Analysis - An evaluation of the costs which would be incurred versus the overall benefits of a proposed action, such as the establishment of an acceptable exposure level of a pollutant.

Criteria Air Pollutant - One of six common air pollutants determined to be hazardous to human health and regulated under EPA's National Ambient Air Quality Standards (NAAQS). The six criteria air pollutants are carbon monoxide, lead, nitrogen dioxide, ozone, sulfur dioxide, and particulate matter. The term "criteria pollutants" derives from the requirement that EPA must describe the characteristics and potential health and welfare effects of these pollutants. It is on the basis of these criteria that standards are set or revised.

Critical Effect - The first adverse effect, or its known precursor, that occurs to the most sensitive species as the dose rate of an agent increases.

Cumulative Risk - The combined risk from aggregate exposures to multiple agents or stressors.

Cumulative Risk Assessment - An analysis, characterization, and possible quantification of the combined risks to health or the environment from multiple agents or stressors.

D

Data Integrity - Refers to security (i.e., the protection of information from unauthorized access or revision) to ensure that the information is not compromised through corruption or falsification. Data integrity is one of the constituents of data quality.

Data Objectivity - A characteristic indicating whether information is being presented in an accurate, clear, complete, and unbiased manner, and as a matter of substance, is accurate, reliable, and unbiased. Data objectivity is one of the constituents of data quality.

Data Quality - The encompassing term regarding the quality of information used for analysis and/or dissemination. Utility, objectivity, and integrity are constituents of data quality.

Data Quality Objectives (DQOs) - Qualitative and quantitative statements derived from the DQO process that clarify study objectives, define the appropriate type of data, and specify tolerable levels of potential decision errors that will be used as the basis for establishing the quality and quantity of data needed to support the decisions.

Data Quality Objectives Process - A systematic planning tool to facilitate the planning of environmental data collection activities. Data quality objectives are the qualitative and quantitative outputs from the DQO Process.

Data Utility - Refers to the usefulness of the information to the intended users. Data utility is one of the constituents of data quality.

Delivered Dose - The amount of the chemical available for interaction by any particular organ or cell.

Deposition (Wet and Dry) - The removal of airborne substances to available surfaces that occurs as a result of gravitational settling and diffusion, as well as electrophoresis and thermophoresis in the absence of active precipitation (Dry) or in the presence of active precipitation (Wet).

Dermal - Referring to the skin. Dermal absorption means absorption through the skin.

Dermal Exposure - Contact between a chemical and the skin. [EPA, 1997: Terms of Environment, <http://www.epa.gov/OCEPAterms/>.]

Detection Limit - The lowest concentration of a chemical that can reliably within analytical methods be distinguished from a zero concentration.

Deterministic - A methodology relying on point (i.e., exact) values as inputs to estimate risk; this obviates quantitative estimates of uncertainty and variability. Results are also presented as point values. Uncertainty and variability may be discussed qualitatively, or semi-quantitatively by multiple deterministic risk estimates.

Developmental Toxicity - The potential of an agent to cause abnormal development. Developmental toxicity generally occurs in a dose-related manner, may result from short-term exposure (including single exposure situations) or from longer term low-level exposure, may be produced by various routes of exposure, and the types of effects may vary depending on the timing of exposure because of a number of critical periods of development for various organs and functional systems. The four major manifestations of

developmental toxicity are death, structural abnormality, altered growth, and functional deficit.

Direct Exposure - Contact between a receptor and a chemical where the chemical is still in the medium to which it was originally released. For example, direct exposure occurs when a pollutant is released to the air and a person breathes that air.

Dispersion - Pollutant or concentration mixing due to turbulent physical processes.

Dose - The amount of substance available for interaction with metabolic processes or biologically significant receptors after crossing the outer boundary of an organism. The potential dose is the amount ingested, inhaled, or applied to the skin. The applied dose is the amount of a substance presented to an absorption barrier and available for absorption (although not necessarily having yet crossed the outer boundary of the organism). The absorbed dose is the amount crossing a specific absorption barrier (e.g., the exchange boundaries of skin, lung, and digestive tract) through uptake processes. Internal dose is a more general term denoting the amount absorbed without respect to specific absorption barriers or exchange boundaries. The amount of the chemical available for interaction by any particular organ or cell is termed the delivered dose for that organ or cell.

Dose-Response Assessment - A determination of the relationship between the magnitude of an administered, applied, or internal dose and a specific biological response. Response can be expressed as measured or observed incidence, percent response in groups of subjects (or populations), or as the probability of occurrence within a population.

Dose-Response Curve - A graphical representation of the quantitative relationship between administered, applied, or internal dose of a chemical or agent, and a specific biological response to that chemical or agent.

E

Eddy - In the atmosphere, a distinct mass within a turbulent fluid that retains its identity and behaves differently for a short period within the general larger volume flow. An eddy thus ranges in size from microscale turbulence (1 cm for example) to many hundreds of kilometers in the form of frontal cyclones and anticyclones. The smallest scale eddies are critical in the process of, for example, heat and water vapor transfer from the Earth's surface into the air, while frontal cyclones transport heat toward the poles.

Emission Factor - The relationship between the amount of pollution produced and the amount of raw material processed or product produced. For example, an emission factor for a blast furnace making iron could be the number of pounds of particulates released per ton of raw materials used.

Emission Inventory - A listing, by source, of the amount of air pollutants discharged into the atmosphere in a particular place. Two of the more important publicly available emissions inventories for air toxics studies are the National Emissions Inventory (NEI) and the Toxics Release Inventory (TRI).

Emission Rate - The amount of a given substance discharged to the air per unit time, expressed as a fixed ratio (e.g., tons/yr).

Emissions Monitoring - The periodic or continuous physical surveillance or testing to determine the pollutant levels discharged into the atmosphere from sources such as smokestacks at industrial facilities and exhaust from motor vehicles, locomotives, or aircraft.

Environmental Data - Any measurements or information that describe environmental processes, location, or conditions; ecological or health effects and consequences; or the performance of environmental technology. Environmental data include information collected directly from measurements, produced from models, and compiled from other sources such as data bases or the literature.

Environmental Media Evaluation Guides - Environmental Media Evaluation Guides (EMEGs) are concentrations of a contaminant in water, soil, or air that are unlikely to be associated with any appreciable risk of deleterious noncancer effects over a specified duration of exposure. EMEGs are derived from ATSDR minimal risk levels by factoring in default body weights and ingestion rates. Separate EMEGS are computed for acute (14 days), intermediate (15-364 days), and chronic (365 days) exposures.

Environmental Medium - Any one of the major categories of material found in the physical environment (e.g., surface water, ground water, soil, or air), and through which chemicals or pollutants can move.

Epidemiology - The study of disease patterns in human populations.

Epidemiologic Study, Case Study - A medical or epidemiologic evaluation of one person or a small group of people to gather information about specific health conditions and past exposures.

Epidemiologic Study, Descriptive - An evaluation of the amount and distribution of a disease in a specified population by person, place, and time.

Epidemiologic Study, Analytical - An evaluation of the association between exposure to hazardous substances and disease by testing scientific hypotheses.

Exposure - Contact made between a chemical, physical, or biological agent and the outer boundary of an organism.

Exposure Assessment - An identification and evaluation of a population exposed to a toxic agent, describing its composition and size, as well as the type, magnitude, frequency, route and duration of exposure.

Exposure Concentration - The concentration of a chemical in its transport or carrier medium (i.e., an environmental medium or contaminated food) at the point of contact.

Exposure Duration - The total time an individual is exposed to the chemical being evaluated or the length of time over which contact with the contaminant lasts.

Exposure Factors - Any of a variety of factors that relate to how an organism interacts with or is otherwise exposed to environmental pollutants (e.g., ingestion rate of contaminated fish). Such factors are used in the calculation of exposure to toxic chemicals.

Exposure Frequency - The number of occurrences in a given time frame (e.g., a lifetime) of contact or co-occurrence of a stressor with a receptor.

Exposure Investigation (in Public Health Assessment) - The collection and analysis of site-specific information and biologic tests (when appropriate) to determine whether people have been exposed to hazardous substances.

Exposure Modeling - The mathematical equations simulating how people interact with chemicals in their environment.

Exposure Pathway - The course a chemical or physical agent takes from a source to an exposed organism. An exposure pathway includes a source and release from a source, an exposure point, and an exposure route. If the exposure point differs from the source, a transport/exposure medium (e.g., air) or media (in cases of intermedia transfer) also is included.

Exposure Profile - The exposure profile (ecological) identifies the receptors and describes the exposure pathways and intensity and spatial and temporal extent of exposure. It also describes the impact of variability and uncertainty on exposure estimates and reaches a conclusion about the likelihood that exposure will occur. The profile may be a written document or a module of a larger process model.

Exposure Route - The way a chemical enters an organism after contact (e.g., by ingestion, inhalation, dermal absorption).

Exposure Scenario - A set of conditions or assumptions about sources, exposure pathways, concentrations of toxic chemicals, and populations (numbers, characteristics and habits) which aid the investigator in evaluating and quantifying exposure in a given situation.

F

Fate and Transport - A description of how a chemical is carried through and changes in the environment.

Fate and Transport Analysis - The general process used to assess and predict the movement and behavior of chemicals in the environment.

Fate and Transport Modeling - The mathematical equations simulating a physical system which are used to assess and predict the movement and behavior of chemicals in the environment.

Fence Line - Delineated property boundary of a facility.

Field Study - Scientific study made in the ambient air to collect information that cannot be obtained in a laboratory.

Fugitive Release - Emission of a chemical to the air that does not occur from a stack, vent, duct, pipe or other confined air stream (e.g., leaks from joints).

Future Scenario - A scenario used in risk assessment to anticipate potential future exposures of individuals (e.g., a housing development could be built on currently vacant land).

G

Gaussian Plume: A plume within which the pollutants are distributed vertically and horizontally in a Gaussian (or normal) manner about the plume centre line.

Geographic Information Systems (GIS) - A computer program that allows layering of different types of spatial information (i.e., on a map) to provide a better understanding of the characteristics of a certain place.

Generally Available Control Technology (GACT) Standard - These standards are less stringent standards than the Maximum Available Control Technology (MACT) standards, and are allowed at the Administrator's discretion for area sources according to the 1990 Clean Air Act Amendments for area sources.

Grab Sample - A single sample collected at a particular time and place that represents the composition of the water, air, or soil only at that time and place.

Guidelines (human health and ecological risk assessment) - Official documentation stating current U.S. EPA methodology in assessing risk of harm from environmental pollutants to human populations and ecological receptors.

H

Hazard - In a general sense, "hazard" is anything that has a potential to cause harm. In risk assessment, the likelihood of experiencing a noncancer health effect is called hazard (not risk).

Hazard Identification - The process of determining whether exposure to an agent can cause a particular adverse health effect (e.g., cancer, birth defect) and whether the adverse health effect is likely to occur in humans at environmentally relevant doses.

Hazard Index (HI) -The sum of more than one hazard quotient for multiple substances and/or multiple exposure pathways. The HI is calculated separately for chronic, subchronic, and shorter-term duration exposures.

Hazardous Air Pollutants (HAP) - Defined under the Clean Air Act as pollutants that cause or may cause cancer or other serious health effects, such as reproductive effects or birth defects, or adverse environmental and ecological effects. Currently, the Clean Air Act regulates 188 chemicals and chemical categories as HAPs.

Hazard Quotient (HQ) - The ratio of a single substance exposure level over a specified time period (e.g., chronic) to a reference value (e.g., an RfC) for that substance derived from a similar exposure period.

Health Effects Assessment Tables (HEAST) - An older listing of (usually) interim toxicity values for chemicals of interest to Superfund, the Resource Conservation and Recovery Act (RCRA), and the EPA in general. HEAST values are generally placed low on the hierarchy of Agency recommended toxicity data sources and the compilation will eventually be phased out altogether.

Health Endpoint - An observable or measurable biological event used as an index to determine when a deviation in the normal function of the human body occurs.

Health Education (in Public Health Assessment) - Programs designed with a community to help it know about health risks and how to reduce these risks.

Health Consultation (in Public Health Assessment) - A review of available information or collection of new data to respond to a specific health question or request for information about a potential environmental hazard. Health consultations are focused on a specific exposure issue. Health consultations are therefore more limited than a public health assessment, which reviews the exposure potential of each pathway and chemical.

Henry's Law Constant - The ratio at equilibrium of the gas phase concentration to the liquid phase concentration of the gas.

High-End Exposure Estimate - A plausible estimate of individual exposure or dose for those persons at the upper end of an exposure or dose distribution, conceptually above the 90th percentile, but not higher than the individual in the population who has the highest exposure or dose.

Human Exposure Model (HEM) - An EPA model combining the Industrial Source Complex Short Term air dispersion model (ISCST) with a national set of meteorology files, U.S. census data, and a risk calculation component that can be used to estimate individual and population risks.

Hydrolysis - The decomposition of organic compounds by interaction with water.

I

Indirect Exposure Pathway - An indirect exposure pathway is one in which a receptor contacts a chemical in a medium that is different from the one to which the chemical was originally released (an example occurs with dioxin, which is emitted into the air, deposited on soil and accumulated in plants and animals which are then consumed by humans).

Individual Risk or Hazard - The risk or hazard to an individual in a population rather than to the population as a whole.

Indoor Source - Objects or places within buildings or other enclosed spaces that emit air pollutants.

Industrial Source Complex (ISC) Model - A steady-state Gaussian plume model which can be used to assess pollutant concentrations from a wide variety of sources associated with an industrial complex. This model can account for the following: settling and dry deposition of particles; downwash; point, area, line, and volume sources; plume rise as a function of downwind distance; separation of point sources; and limited terrain adjustment. ISC3 operates in both long-term (ISCLT) and short-term (ISCST) modes.

Influential Information - Scientific, financial, or statistical information that will have or does have a clear and substantial impact on important public policies or important private sector decisions.

Ingestion - Swallowing (such as eating or drinking).

Ingestion Exposure - Exposure to a chemical by swallowing it (such as eating or drinking).

Inhalation - Breathing.

Inhalation Exposure - Exposure to a chemical by breathing it in.

Inhalation Unit Risk (IUR) - The upper-bound excess lifetime cancer risk estimated to result from continuous exposure to an agent at a concentration of $1 \mu\text{g}/\text{m}^3$ in air. The interpretation of unit risk would be as follows: if unit risk = $2 \times 10^{-6} \mu\text{g}/\text{m}^3$, 2 excess tumors may develop per 1,000,000 people if exposed daily for a lifetime to a concentration of $1 \mu\text{g}$ of the chemical in 1 m^3 of air.

Intake - The process by which a substance crosses the outer boundary of an organism without passing an absorption barrier, e.g., through ingestion or inhalation.

Intake Rate - Rate of inhalation, ingestion, and dermal contact depending on the route of exposure.

Integrated Risk Information System (IRIS) - An EPA database which contains information on human health effects that may result from exposure to various chemicals in the environment. IRIS was initially developed for EPA staff in response to a growing demand for consistent information on chemical substances for use in risk assessments, decision-making and regulatory activities. The information in IRIS is intended for those without extensive training in toxicology, but with some knowledge of health sciences.

Internal Dose - In exposure assessment, the amount of a substance penetrating the absorption barriers (e.g., skin, lung tissue, gastrointestinal tract) of an organism through either physical or biological processes.

Inversion - Subsidence Inversion - A temperature inversion that develops aloft as a result of air gradually sinking over a wide area and being warmed by adiabatic compression, usually associated with subtropical high pressure areas.

Inversion - Advection Inversion - Associated with the horizontal flow of warm air. Warm air moves over a cold surface, and the air nearest the surface cools, causing a surface-based inversion.

Inversion - Radiation Inversion - A thermally produced, surface-based inversion formed by rapid radiational cooling of the Earth's surface at night. It does not usually extend above the lower few hundred feet. Conditions which are favorable for this type of inversion are long nights, clear skies, dry air, little or no wind, and a cold or snow covered surface. It is also called a Nocturnal Inversion.

Iterative Process - Replication of a series of actions to produce successively better results, or to accommodate new and different critical information or scientific inferences.

Isopleths - A delineated line or area on a map that represent equal values of a variable.

L

Laboratory Studies - Research carried out in a laboratory (e.g., testing chemical substances, growing tissues in cultures, or performing microbiological, biochemical, hematological, microscopical, immunological, parasitological tests).

Line Source - A theoretical one-dimensional source from which releases may occur (e.g., roadways are often modeled as a one-dimensional line).

Lofting - In pollution studies, a pattern of flow that occurs when the top of a plume from a chimney stack disperses into slightly turbulent or neutral airflow conditions, while the lower part of the plume is prevented from dispersing down toward the surface by a stable boundary layer, especially at night. [Smith, J. [ed], 2001: The Facts on File Dictionary of Weather and Climate.]

Low-dose Extrapolation - An estimation of the dose-response relationship at doses less than the lowest dose studied experimentally.

Lowest Observed Adverse Effect Level (LOAEL) - The lowest exposure level in a study or group of studies at which there are statistically or biologically significant increases in frequency or severity of adverse effects between the exposed population and its appropriate control group. Also referred to as lowest-effect level (LEL).

M

Major Source - Under the Clean Air Act, a stationary source that emits more than 10 tons or more per year of a single hazardous air pollutant (HAP) or 25 or more tons per year of all HAPs.

Mass-Balance Estimate - An estimate of release of a chemical based on, generally, a comparison of the amount of chemical in raw materials entering a process versus the amount of chemical going out in products.

Maximum Achievable Control Technology (MACT) - Under the Clean Air Act, a group of technology based standards, applicable to both major and some area sources of air toxics, that are aimed at reducing releases of air toxics to the environment. MACT standards are established on a source category by source category basis.

Maximum Exposed Individual (MEI) - The MEI represents the highest estimated risk to an exposed individual, regardless of whether people are expected to occupy that area.

Maximum Individual Risk (MIR) - An MIR represents the highest estimated risk to an exposed individual in areas that people are believed to occupy.

Metric (or Measure) of Exposure - The quantitative outcome of the exposure assessment. For air toxics risk assessments, personal air concentration (or adjusted exposure concentration) is the metric of exposure for the inhalation route of exposure and intake rate is the metric of exposure for the ingestion route of exposure.

Measurement - In air toxics assessment, a physical assessment (usually of the concentration of a pollutant) taken in an environmental or biological medium, normally with the intent of relating the measured value to the exposure of an organism.

Measurement Endpoint - A measurable ecological characteristic that is related to the valued characteristic chosen as the assessment endpoint. Also known as “measure of effect.”

Mechanical Turbulence - Random irregularities of fluid motion in air caused by buildings or other nonthermal, processes.

Media Concentrations - The amount of a given substance in a specific amount of environmental medium. For air, the concentration is usually given as micrograms (μg) of substance per cubic meter (m^3) of air; in water as μg of substance per L of water; and in soil as mg of substance per kg of soil.

Metabolism - Generally, the biochemical reactions by which energy is made available for the use of an organism. Metabolism includes all chemical transformations occurring in an organism from the time a substance enters, until it has been utilized and the waste products eliminated. In toxicology, metabolism of a toxicant consists of a series of chemical transformations that take place within an organism. A wide range of enzymes act on toxicants, that may increase water solubility, and facilitate elimination from the organism. In some cases, however, metabolites may be more toxic than their parent compound.

Meteorology - The science of the atmosphere, including weather.

Minimal Risk Levels (MRL) - Derived by ATSDR, an MRL is defined as an estimate of daily human exposure to a substance that is likely to be without an appreciable risk of adverse effects (noncancer) over a specified duration of exposure. MRLs can be derived for acute, intermediate, and chronic duration exposures by the inhalation and oral routes.

Mixed (Mixing) Layer - In the atmosphere, that part of the turbulent boundary layer that is dominated by turbulent diffusion caused by eddies generated by friction with the surface and thermals arising from surface heat sources. Surface heating during the day and the absence of temperature inversions allow components of the air within the planetary boundary layer to exhibit mainly random vertical movements. Such movements may become more organized into gusts of wind and dust devils during the afternoon. Despite being random, the turbulent movements allow the transfer of atmospheric properties, such as heat, water vapor, momentum, and air pollutants, from the near surface up through the planetary boundary layer.

Mixing Height - The depth through which atmospheric pollutants are typically mixed by dispersive processes.

Mixtures - Any set of multiple chemical substances occurring together in an environmental medium.

Mobile Source Air Toxics - Air toxics that are emitted from non-stationary objects that release pollution. Mobile sources include but are not limited to; cars, trucks, buses, motorcycles and portable generator.

Model - A mathematical representation of a natural system intended to mimic the behavior of the real system, allowing description of empirical data, and predictions about untested states of the system.

Model Uncertainty - Uncertainty due to necessary simplification of real-world processes, misspecification of the model structure, model misuse, or use of inappropriate surrogate variables or inputs.

Modeling - An investigative technique using a mathematical or physical representation of a system or theory that accounts for all or some of its known properties.

Modeling Node - In air quality modeling, the location where impacts are predicted.

Monitoring - Periodic or continuous physical surveillance or testing to determine pollutant levels in various environmental media or in humans, plants, and animals.

Monte Carlo Technique- A repeated random sampling from the distribution of values for each of the parameters in a generic exposure or risk equation to derive an estimate of the distribution of exposures or risks in the population.

Multipathway Assessment - An assessment that considers more than one exposure pathway. For example, evaluation of exposure through both inhalation and ingestion would be a multipathway assessment. Another example would be evaluation of ingestion of contaminated soil and ingestion of contaminated food.

Multipathway Exposure - When an organism is exposed to pollutants through more than one exposure pathway. One example would be exposure through both inhalation and ingestion. Another example would be ingestion of contaminated soil and ingestion of contaminated food.

Multipathway Risk - The risk resulting from exposure to pollutants through more than one pathway.

Mutagen - A chemical that causes a permanent genetic change in a cell other than that which occurs during normal growth.

Mutagenicity - The capacity of a chemical or physical agent to cause permanent genetic change in a cell other than that which occurs during normal growth.

N

National Ambient Air Quality Standards (NAAQS) - Maximum air pollutant standards that EPA has set under the Clean Air Act for attainment by each state. Standards are set for each of the criteria pollutants.

National Air Toxics Assessment (NATA) - EPA's ongoing comprehensive evaluation of air toxics in the U.S. Activities include expansion of air toxics monitoring, improving and periodically updating emission inventories, improving national- and local-scale modeling and risk characterization, continued research on health effects and exposures to both ambient and indoor air, and improvement of assessment tools.

National Emissions Inventory (NEI) - EPA's primary emissions inventory of HAPs.

National Emissions Standards for Hazardous Air Pollutants (NESHAPs) - Emissions standards set by EPA for hazardous air pollutants. Also commonly referred to as the MACT standards.

National Emissions Trends (NET) Database - The NET database is an emission inventory that contains data on stationary and mobile sources that emit criteria air pollutants and their precursors. The database also includes estimates of annual emissions of these pollutants from point, area, and mobile sources. The NET is developed every three years (e.g., 1996 and 1999) by EPA, and includes emission estimates for all 50 States, the District of Columbia, Puerto Rico, and the Virgin Islands.

Natural Source - Non-manmade emission sources, including biological (biogenic sources such as plants) and geological sources (such as volcanoes), and windblown dust.

Neighborhood Scale Assessment - An air monitoring network designed to assess concentrations within some extended area of the city that has relatively uniform land use with dimensions in the 0.5 to 4.0 kilometers range.

Neurotoxicity - Ability to damage nervous system tissue or adversely effect nervous system function.

Noncarcinogenic Effect - Any health effect other than cancer. Note that, while not all noncancer toxicants cause cancer, all carcinogens exhibit noncarcinogenic effects.

No Observable Adverse Effect Level (NOAEL) - Highest exposure level at which there are no statistically or biologically significant increases in the frequency or severity of adverse effect between the exposed population and its appropriate control; some effects may be produced at this level, but they are not considered adverse, nor precursors to adverse effects.

Nonpoint Source (NEI sense) - Diffuse pollution sources that are not assigned a single point of origin (e.g., multiple dry cleaners in a county which are only described in an inventory in the aggregate).

Nonroad Mobile Sources - Sources such as farm and construction equipment, gasoline-powered lawn and garden equipment, and power boats and outdoor motors that emit pollutants.

Non-Threshold Effect - An effect (usually an adverse health effect) for which there is no exposure level below which the effect is not expected to occur.

Non-Threshold Toxicant - A chemical for which there is no exposure level below which an adverse health outcome is not expected to occur. Such substances are considered to pose some risk of harm at any level of exposure.

Non Steady-state Model - A dynamic model; a mathematical formulation describing and simulating the physical behavior of a system or a process and its temporal variability.

North American Industry Classification System (NAICS) - NAICS replaced the Standard Industrial Classification (SIC) beginning in 1997. This industry-wide classification system has been designed as the index for statistical reporting of all economic activities of the U.S., Canada, and Mexico. NAICS industries are identified by a 6-digit code. The international NAICS agreement fixes only the first five digits of the code. The sixth digit, where used, identifies subdivisions of NAICS industries that accommodate user needs in individual countries.

O

Office of Air and Radiation (OAR) - EPA's Office responsible for providing information about air pollution, clean air, air quality and radiation. OAR develops national programs, technical policies, and regulations for controlling air pollution and radiation exposure. OAR is concerned with pollution prevention, indoor and outdoor air quality, industrial air pollution, pollution from vehicles and engines, radon, acid rain, stratospheric ozone depletion, and radiation protection.

Office of Air Quality, Planning, and Standards (OAQPS) - An EPA Office within OAR whose primary mission is to preserve and improve air quality in the United States. As part of this goal, OAQPS monitors and reports on air quality, air toxics, and emissions. They also respond to visibility issues, as they relate to the level of air pollution. In addition, OAQPS is tasked by the EPA with providing technical information for professionals involved with monitoring and controlling air pollution, creating governmental policies, rules, and guidance (especially for stationary sources), and educating the public about air pollution and what can be done to control and prevent it.

OAQPS Toxicity Table - The EPA Office of Air and Radiation recommended default chronic toxicity values for hazardous air pollutants. They are generally appropriate for screening-level risk assessments, including assessments of select contaminants, exposure routes, or emission sources of potential concern, or to help set priorities for further

research. For more complex, refined risk assessments developed to support regulatory decisions for single sources or substances, dose-response data may be evaluated in detail for each “risk driver” to incorporate appropriate new toxicological data.

(<http://www.epa.gov/ttn/atw/toxsource/summary.html>)

Onroad Mobile Source - Any mobile source of air pollution such as cars, trucks, motorcycles, and buses that travels on roads and highways.

Operating Permit Program - A program required by the Clean Air Act; requires existing industrial sources to obtain an "operating permit". The operating permit program is a national permitting system that consolidates all of the air pollution control requirements into a single, comprehensive “operating permit” that covers all aspects of a source’s year-to-year air pollution activities.

P

Particle-bound - Reversibly absorbed or condensed onto the surface of particles.

Particulates/Particulate Matter (PM) - Solid particles or liquid droplets suspended or carried in the air.

Partitioning - The separation or division of a substance into two or more compartments. Environmental partitioning refers to the distribution of a chemical into various media (soil, air, water, and biota).

Partitioning Model - Models consisting of mathematical equations that estimate how chemicals will divide (i.e., partition) among abiotic and biotic media in a given environment based on chemical- and site- specific characteristics.

Passive Monitor - A type of air toxics monitor that collects airborne pollutants by absorption onto a reactive material (for example, sorbent tube, filter) for subsequent laboratory analysis. No pump is used to draw the air across the reactive material. This type of monitor is usually used for personal exposure monitoring or work space monitoring.

Pathway Specific Risk - The risk associated with exposure to a chemical agent or a mixture of chemicals via a specific pathway (e.g., inhalation of outdoor air).

Persistent, Bioaccumulative, and Toxic (PBT) Chemicals - Highly toxic, long-lasting substances that can build up in the food chain to levels that are harmful to human and ecosystem health. They are associated with a range of adverse health effects, including effects on the nervous system, reproductive and developmental problems, cancer, and genetic impacts.

Percentile - Any one of the points dividing a distribution of values into parts each of which contain 1/100 of the values. For example, the 75th percentile is a value such that 75 percent of the values are less than or equal to it.

Persistence - Refers to the length of time a compound stays in the environment, once introduced. A compound may persist for very short amounts of time (e.g., fractions of a second) or for long periods of time (e.g., hundreds of years).

Pervious Surface - A surface that can be penetrated (usually in reference to water; e.g., crop land).

Pharmacodynamics - Process of interaction of pharmacologically active substances with target sites, and the biochemical and physiological consequences leading to therapeutic or adverse effects.

Photolysis - The breakdown of a material by sunlight; an important mechanism for the degradation of contaminants in air, surface water, and the terrestrial environment.

Physical Factors - Manmade and/or natural characteristics or features that influence the movement of pollutants in the environment (e.g., settling velocity, terrain effects).

Planning and Scoping - The process of determining the purpose, scope, players, expected outcomes, analytical approach, schedule, deliverables, QA/QC, resources, and document requirements for the risk assessment.

Plume - The visible or measurable presence of a contaminant in the atmosphere, once released from a given point of origin (e.g., a plume of smoke from a forest fire).

Plume Height - The elevation to which a plume travels (i.e., the sum of the release height and plume rise).

Plume Rise - The height to which a plume rises in the atmosphere from the point of release.

Plume Transport - The movement of a plume through the atmosphere and across land and water features.

Plume Washout - The removal of a substance from the atmosphere via a precipitation event.

PM-10/PM-2.5. PM-10 or PM₁₀ refers to particles in the atmosphere with a diameter of less than ten or equal to 10 micrometers. PM-2.5 or PM_{2.5} refers to smaller particles in the air (i.e., less than or equal to 2.5 micrometers in diameter).

Point of Departure (PoD) - The dose-response point that marks the beginning of a low-dose extrapolation. This point can be the lower bound on dose for an estimated incidence

or a change in response level from a dose-response model (BMD), or a NOAEL or LOAEL for an observed incidence, or change in level of response.

Point of Exposure - The location of potential contact between an organism and a chemical or physical agent.

Point of Release - Location of release to the environment.

Point Source (NEI sense) - A source of air pollution which can be physically located on a map.

Point Source (non-NEI sense) - A stack, vent, duct, pipe or other confined air stream from which chemicals may be released to the air.

Pollutant Release and Transfer Registries (PRTRs) - The international equivalent to the Toxics Release Inventory (TRI). PRTRs are data banks of recorded information of the releases and transfers of toxic chemicals from industries, such as manufacturers, mining facilities, processors, or government-owned and operated facilities.

Population Risk or Hazard - Population risk refers to an estimate of the extent of harm for the population or population segment being addressed. It often refers to an analysis of the number of people living at a particular risk or hazard level.

Potential Risk - Estimated likelihood, or probability, of injury, disease, or death resulting from exposure to a potential environmental hazard.

Potential Dose - The amount of a compound contained in material swallowed, breathed, or applied to the skin.

Practical Quantitation Limit - The lowest level of quantitation that can be reliably achieved within specified limits of precision and accuracy during routine laboratory operating conditions.

Precision - A measure of the reproducibility of a measured value under a given set of circumstances.

Present Scenario - Risk characterizations using present scenarios to estimate risks to individuals (or populations) that currently reside in areas where potential exposures may occur (e.g., using an existing population within some specified area).

Prevailing Wind - Direction from which the wind blows most frequently.

Prevention of Significant Deterioration (PSD) - An EPA program in which state and/or federal permits are required in order to restrict emissions from new or modified sources in places where air quality already meets or exceeds primary and secondary ambient air quality standards.

Primary Standard - A pollution limit based on health effects. Primary standards are set for criteria air pollutants on an individual pollutant basis.

Probabilistic - A type of statistical modeling approach used to assess the expected frequency and magnitude of a parameter by running repetitive simulations using statistically selected inputs for the determinants of that parameter (e.g., rainfall, pollutants, flows, temperature).

Probabilistic Risk Assessment/Analysis - Calculation and expression of health risks using multiple risk descriptors to provide the likelihood of various risk levels. Probabilistic risk results approximate a full range of possible outcomes and the likelihood of each, which often is presented as a frequency distribution graph, thus allowing uncertainty or variability to be expressed quantitatively.

Problem Statement - A statement of the perceived problem to be studied by the risk assessment. Problem statements often also include statements about how the problem is going to be studied.

Public Health Consultation (Public Health Assessment) - See health consultation.

Q

Quality Assurance Project Plan - A document describing in comprehensive detail the necessary quality assurance, quality control, and other technical activities that must be implemented to ensure that the results of the work performed will satisfy the stated performance criteria.

Quality Assurance - An integrated system of activities involving planning, quality control, quality assessment, reporting and quality improvement to ensure that a product or service meets defined standards of quality with a stated level of confidence.

Quality Control - The overall system of technical activities whose purpose is to measure and control the quality of a product or service so that it meets the needs of its users. The aim is to provide data quality that is satisfactory, adequate, and dependable.

R

Random Variable - A quantity which can take on any number of values but whose exact value cannot be known before a direct observation is made. For example, the outcome of the toss of a pair of dice is a random variable, as is the height or weight of a person selected at random from a city phone book.

Receptor (modeling sense) - In fate/transport modeling, the location where impacts are

predicted.

Receptor (non-modeling sense) - The entity which is exposed to an environmental stressor.

Red Book - 1983 NRC publication entitled *Risk Assessment in the Federal Government: Managing the Process*.

Reference Concentration (RfC) - An estimate (with uncertainty spanning perhaps an order of magnitude) of a continuous inhalation exposure to the human population (including sensitive subgroups) that is likely to be without an appreciable risk of deleterious effects during a lifetime.

Reference Dose (RfD) - An estimate (with uncertainty spanning perhaps an order of magnitude) of a daily oral exposure to the human population (including sensitive subgroups) that is likely to be without an appreciable risk of deleterious effects during a lifetime.

Reference Exposure Level - An estimate of a continuous inhalation exposure for an acute duration (24 hours or less) to the human population (including susceptible subgroups) that is likely to be without an appreciable risk of adverse health effects over a lifetime.

Reference Media Evaluation Guides (RMEG) - A type of comparison value derived by ATSDR to protect the most sensitive populations. They do not consider carcinogenic effects, chemical interactions, multiple route exposure, or other media-specific routes of exposure, and are very conservative concentration values designed to protect sensitive members of the population.

Regional/National Scale Assessment - An air monitoring network designed to assess from tens to hundreds of kilometers, up to the entire nation.

Relative Potency Factor - The ratio of the toxic potency of a given chemical to that of an index chemical.

Release Parameters - The specific physical characteristics of the release (e.g., stack diameter, stack height, release flow rate, temperature).

Representativeness - The degree to which one or a few samples are characteristic of a larger population about which the analyst is attempting to make an inference.

Reproductive Toxicity - The occurrence of biologically adverse effects on the reproductive systems of females or males that may result from exposure to environmental agents. The toxicity may be expressed as alterations to the female or male reproductive organs, the related endocrine system, or pregnancy outcomes. The manifestation of such toxicity may include, but not be limited to, adverse effects on onset of puberty, gamete production and transport, reproductive cycle normality, sexual behavior, fertility,

gestation, parturition, lactation, developmental toxicity, premature reproductive senescence, or modifications in other functions that are dependent on the integrity of the reproductive systems.

Residual Risk - The extent of health risk from air pollutants remaining after application of the Maximum Achievable Control Technology (MACT).

Resources - Money, time, equipment, and personnel available to perform the assessment.

Risk (in the context of human health) - The probability of injury, disease, or death from exposure to a chemical agent or a mixture of chemicals. In quantitative terms, risk is expressed in values ranging from zero (representing the certainty that harm will not occur) to one (representing the certainty that harm will occur). (Compare with hazard.)

Risk Assessor(s) - The person or group of people responsible for conducting a qualitative and quantitative evaluation of the risk posed to human health and/or the environment by environmental pollutants.

Risk Assessment - For air toxics, the scientific activity of evaluating the toxic properties of a chemical and the conditions of human or ecological exposure to it in order both to ascertain the likelihood that exposed humans or ecological receptors will be adversely affected, and to characterize the nature of the effects they may experience.

Risk Assessment Forum - A standing committee of senior EPA scientists which was established to promote Agency-wide consensus on difficult and controversial risk assessment issues and to ensure that this consensus is incorporated into appropriate Agency risk assessment guidance.

Risk Assessment Work Plan - A document that outlines the specific methods to be used to assess risk, and the protocol for presenting risk results. The risk assessment workplan may consist of one document or the compilation of several workplans that, together, constitute the overall risk assessment workplan.

Risk Characterization - The last phase of the risk assessment process in which the information from the toxicity and exposure assessment steps are integrated and an overall conclusion about risk is synthesized that is complete, informative and useful for decision-makers. In all cases, major issues and uncertainty and variability associated with determining the nature and extent of the risk should be identified and discussed. The risk characterization should be prepared in a manner that is clear, transparent, reasonable and consistent.

Risk Communication - The exchange of information about health or environmental risks among risk assessors and managers, the general public, news media, and other stakeholders.

Risk Management - The decision-making process that uses the results of risk assessment to produce a decision about environmental action. Risk management includes consideration of technical, scientific, social, economic, and political information.

Risk Manager(s) - The person or group responsible for evaluating and selecting alternative regulatory and non-regulatory responses to risk.

Route-to-Route Extrapolation - Calculations to estimate the dose-response relationship of an exposure route for which experimental data do not exist or are inadequate, and which are based on existing experimental data for other route(s) of exposure.

Runoff - That part of precipitation, snow melt, or irrigation water that runs off the land into streams or other surface water. It can carry pollutants from the air and land into receiving waters.

S

Sample - A small portion of something designed to evaluate the nature or quality of the whole (for example, one or several samples of air used to evaluate air quality generally).

Sampling and Analysis Plan - An established set of procedures specifying how a sample is to be collected, handled, analyzed, and the data validated and reported.

Sampling Frequency - The time interval between the collection of successive samples.

Science Advisory Board (SAB) - A group of recognized, non-EPA experts who advise EPA on science and science policy.

Scenario Uncertainty - Uncertainty due to descriptive errors, aggregation errors, errors in professional judgment, or incomplete analysis.

SCREEN3 - An air dispersion model developed to obtain conservative estimates of air concentration for use in screening level assessments through the use of conservative algorithms and meteorology.

Screening-level Risk Assessment - A risk assessment performed with few data and many conservative assumptions to identify exposures that should be evaluated more carefully for potential risk.

Secondary Production/Pollutant - Formation of pollutants in the atmosphere by chemical transformation of precursor compounds.

Secondary Standard - A pollution limit based on environmental effects (e.g., damage to property, plants, visibility). Secondary standards are set for criteria air pollutants.

Sensitive Subgroups - Identifiable subsets of the general population that, due to differential exposure or susceptibility, are at greater risk than the general population to the toxic effects of a specific air pollutant (e.g., depending on the pollutant and the exposure circumstances, these may be groups such as subsistence fishers, infants, asthmatics, or the elderly).

Sensitivity Analysis – The mathematical analysis of risk calculations to examine the effect in changing one or more inputs in the risk and or hazard calculation.

Settling Velocity/Rate - The maximum speed at which a particle will fall in still air. It is a function of its size, density, and shape.

Silage - Stored vegetation used as feed for cattle.

Simulation - A representation of a problem, situation in mathematical terms, especially using a computer.

Solubility - The amount of mass of a compound that will dissolve in a unit volume of solution. Aqueous solubility is the maximum concentration of a chemical that will dissolve in pure water at a reference temperature.

Source - Any place or object from which pollutants are released.

Source Category - A group of similar industrial processes or industries that are contributors to releases of hazardous air pollutants. The 1990 amendments to the Clean Air Act (CAA) requires that the EPA publish and regularly update a listing of all categories and subcategories of major and area sources that emit hazardous air pollutants.

Source Characterization - The detailed description of the source (e.g., location, source of pollutant releases, pollutants released, release parameters).

Spatial Variability - The magnitude of difference in contaminant concentrations in samples separated by a known distance.

Stable Conditions (in the Atmosphere) - Air with little or no tendency to rise, that is usually accompanied by clear dry weather. Stable air holds, instead of dispersing, pollutants. [National Weather Service, Southern Region Headquarters' Jetstream Weather School,

Stack - A chimney, smokestack, or vertical pipe that discharges used air.

Stack Release - The release of a chemical through a stack.

Stack Testing - The monitoring, by testing, of chemicals released from a stack.

Stakeholder(s) - Any organization, governmental entity, or individual that has a stake in or may be impacted by a given approach to environmental regulation, pollution prevention, energy conservation, etc.

Standard Industrial Classification (SIC) - A method of grouping industries with similar products or services and assigning codes to these groups.

Standard Operating Procedure (SOP) - A established set of written procedures adopted and used to guide the work of for a specific project. For example, an air monitoring study would include SOPs on sample collection and handling and SOPs on analytical requirements and data validation and reporting.

Stationary Source - A source of pollution that is fixed in space.

Steady-state Model - Mathematical model of fate and transport that uses constant values of input variables to predict constant values of receiving media concentrations.

Stressor - Any physical, chemical, or biological entity that can induce adverse effects on ecosystems or human health.

Support Center for Regulatory Models (SCRAM) - An EPA website that is a source of information on atmospheric dispersion models (e.g., ISCST3, SCREEN 3, and ASPEN) that support regulatory programs required by the Clean Air Act. Documentation and guidance for these computerized models are a major feature of this website. This site also contains computer code, data, and technical documents that deal with mathematical modeling for the dispersion of air pollutants.

Synergistic Effect - A situation in which the overall effect of two chemicals acting together is greater than the simple sum of their individual effects.

T

Target Organ - The biological organ(s) most adversely affected by exposure to a chemical substance (e.g., the site of the critical effect).

Target Organ Specific Hazard Index (TOSHI) - The sum of hazard quotients for individual air toxics that affect the same organ/organ system or act by similar toxicologic processes

Temporal Variability - The difference in contaminant concentrations observed in samples taken at different times.

Teratogenesis - The introduction of nonhereditary birth defects in a developing fetus by exogenous factors such as physical or chemical agents acting in the womb to interfere with normal embryonic development.

Terrain Effects - The impact on the airflow as it passes over complex land features such as mountains.

Thermal Turbulence - Turbulent vertical motions that result from surface heating and the subsequent rising and sinking of air.

Threshold Dose/Threshold - The lowest dose of a chemical at which a specified measurable effect is observed and below which it is not observed.

Threshold Effect - An effect (usually an adverse health effect) for which there is an exposure level below which the effect is not expected to occur.

Threshold Toxicant - A chemical for which there is an exposure level below which an adverse health outcome is not expected to occur.

Tiered Analysis - An analysis arranged in layers/steps. Risk assessments/analyses are often conducted in consecutive layers/steps that begin with a reliance on conservative assumptions and little data (resulting in less certain, but generally conservative answers) and move to more studyarea specific data and less reliance on assumptions (resulting in more realistic answers). The level of effort and resources also increases with the development of more realistic data.

Time-integrated Sample - Samples are collected over a period of time. Only the total pollutant collected is measured, and so only the average concentration during the sampling period can be determined.

Time-trend Study - Samples spaced in time to capture systematic temporal trends (e.g., a facility might change its production methods or products over time).

Time-weighted Sum of Exposures - Used in inhalation exposure modeling. Provides a total exposure from all different microenvironments in which a person spends time.

Toxic Air Pollutants - see hazardous air pollutant.

Toxicity - The degree to which a substance or mixture of substances can harm humans or environmental receptors.

Toxicity Assessment - Characterization of the toxicological properties and effects of a chemical, with special emphasis on establishment of dose-response characteristics.

Toxicity Test - Biological testing (usually with an cell system, invertebrate, fish, or small mammal) to determine the adverse effects of a compound.

Toxicology - The study of harmful interactions between chemicals and biological systems.

Toxic Release Inventory (TRI) - Annual database of releases to air, land, and water, and information on waste management in the United States of over 650 chemicals and chemical compounds. This data is collected under Section 313 of the Emergency Planning and Community Right to Know Act.

Trajectory - The track taken by a parcel of air as it moves within the atmosphere over a given period.

Transformation - The change of a chemical from one form to another.

Transparency - Conducting a risk assessment in such a manner that all of the scientific analyses, uncertainties, assumptions, and science policies which underlie the decisions made throughout the risk assessment are clearly stated (i.e., made readily apparent).

Turbulence - Irregular motion of the atmosphere, as indicated by gusts and lulls in the wind.

U

Uncertainty - Uncertainty represents a lack of knowledge about factors affecting exposure/toxicity assessments and risk characterization and can lead to inaccurate or biased estimates of risk and hazard. Some of the types of uncertainty include scenario uncertainty, parameter uncertainty, and model uncertainty.

Uncertainty analysis - A detailed examination of the systematic and random errors of a measurement or estimate (in this case a risk or hazard estimate); an analytical process to provide information regarding the uncertainty.

Uncertainty Factor (UF) - One of several, generally 10-fold factors, used in operationally deriving the RfD and RfC from experimental data. UFs are intended to account for (1) the variation in sensitivity among the members of the human population; (2) the uncertainty in extrapolating animal data to humans, i.e., interspecies variability; (3) the uncertainty in extrapolating from data obtained in a study with less-than-lifetime exposure to lifetime exposure, i.e., extrapolating from subchronic to chronic exposure; (4) the uncertainty in extrapolating from a LOAEL rather than from a NOAEL; and (5) the uncertainty associated with extrapolation from animal data when the data base is incomplete.

Unstable Conditions (in the Atmosphere) - An atmospheric state in which warm air is below cold air. Since warm air naturally rises above cold air (due to warm air being less dense than cold air), vertical movement and mixing of air layers can occur.

Uptake - The process by which a substance crosses an absorption barrier and is absorbed into the body.

Urban Scale Assessment - An air monitoring network designed to assess the overall, citywide conditions with dimensions on the order of 4 to 50 kilometers. This scale would usually require more than one site for definition.

V

Vapor - The gas given off by substances that are solids or liquids at ordinary atmospheric pressure and temperatures.

Variability - Refers to the observed differences attributable to true heterogeneity or diversity in a population or exposure parameter. Examples include human physiological variation (e.g., natural variation in body weight, height, breathing rate, drinking water intake rate), weather variability, variation in soil types and differences in contaminant concentrations in the environment. Variability is usually not reducible by further measurement of study, but it can be better characterized.

Volatilization/Vapor Release - The conversion of a liquid or solid into vapors.

Volume Source - In air dispersion modeling, a three dimensional volume from which a release may occur (e.g., a gas station modeled as a box from which chemicals are emitted).

W

Weight-of-Evidence (WOE) - A system for characterizing the extent to which the available data support the hypothesis that an agent causes an adverse health effect in humans. For example, under EPA's 1986 cancer risk assessment guidelines, the WOE was described by categories "A through E," Group A for known human carcinogens through Group E for agents with evidence of noncarcinogenicity. The approach outlined in EPA's proposed guidelines for carcinogen risk assessment (1996 and updates) considers all scientific information in determining whether and under what conditions an agent may cause cancer in humans, and provides a narrative approach to characterize carcinogenicity rather than categories.

Wind Rose - A graphical display showing the frequency and strength of winds from different directions over some period of time.

Appendix A

Laboratory Standards and SOPs

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ERG QAPP

IDEM Air Lab QAPP

Southwest Indianapolis Air Toxics Study QAPP



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0190.00
68-D-03-049

June 17, 2004

Vickie Presnell
U.S. Environmental Protection Agency
OAR/OAQPS/TSD (C304-02)
Research Triangle Park, North Carolina 27711

Dear Vickie:

Enclosed is a copy of the Support for NMOC/SNMOC, UATMP, and PAMS Networks Quality Assurance Project Plan (Category #1), for EPA Contract No. 68-D-03-049. This is for the year 2004. For your records, a CD is enclosed (in WordPerfect). The document can be found on ERG's web site: <http://www.ergweb2.com/uatmp/user/index.cfm>. This site will require the individual to request a user identification number and password. If approved, the user will be contacted with that information. Only EPA, state and local agencies will be approved.

If you have any questions, please call me at (919) 468-7924.

Sincerely,

Julie L. Swift
Deputy Program Manager

JLS/mhr

Enclosures

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SUPPORT FOR THE EPA NATIONAL MONITORING PROGRAMS

(NMOC, UATMP, PAMS, HAPs, and NATTS)

Contract No. 68-D-03-049 2004/2005 Quality Assurance Project Plan

Category 1

Eastern Research Group, Inc. 900 Perimeter Park Drive Morrisville, NC 27560

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Date June 2
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Approved by:

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DISCLAIMER

This Category 1 Quality Assurance Project Plan has been prepared specifically to address the operation and management of the U.S. EPA National Monitoring Programs (NMOC/SNMOC, UATMP, PAMS, HAPs, and NATTS). The contents have been prepared in accordance with Level I Specifications of the EPA Guidance for Quality Assurance Project Plans, EPA QA/G-5.

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D Subcontractor QAPPs - Research Triangle Institute

Subcontractor QAPPs - Columbia Analytical Services, Inc.

(Atmospheric Analysis and Consulting; will be added i.e. if they are initiated)

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AC AQS BFB CARB

CD CFR cm CRDL DFTPP DNPH DPC DQA DQO ECD EMPC EPA ERG FB FID GC
GC/MS GPRA HAP(s) Hg HPLC HRGC HRMS IC ICAL Air Quality Subsystem (of the
Aerometric Information and Retrieval System) 4-Bromofluorobenzene California Air
Resources Board Calibration Check Compound Compact Diskette Code of Federal
Regulations Centimeter Contract-Required Detection Limit
Decafluorotriphenylphosphine 2,4-Dinitrophenylhydrazine Daily Observed Propane
Concentration Data Quality Assessment Data Quality Objective(s) Electron Capture
Detector Estimated Maximum Possible Concentration

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SYMBOLS AND ABBREVIATIONS

Area Counts

U.S. Environmental Protection Agency Eastern Research Group, Inc. Field Blank Flame
Ionization Detector Gas Chromatograph Gas Chromatograph/Mass Spectrometer
Government Performance and Results Act Hazardous Air Pollutant(s) Mercury High
Performance Liquid Chromatography High Resolution Gas Chromatography High
Resolution Mass Spectrometry Ion Chromatography Initial Calibration

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SYMBOLS AND ABBREVIATIONS (Continued)

ICPMS Inductively Coupled Plasma/Mass Spectrometer
ID Inner Diameter
ID Identification
in. Inch

IS	Internal Standard
KI	Potassium Iodide
LCS	Laboratory Control Standard
LCSD	Laboratory Control Standard Duplicate
m	Meter
MB	Megabyte
MDL	Method Detection Limit
min	Minute
MLD	Monitoring and Laboratory Division
mL	Milliliter
mm	Millimeter
MQO	Method Quality Objective
MS	Mass Spectrometer
MS/MSD	Method Spike/Method Spike Duplicate
µg	Micrograms
µL	Microliters
n	Number of Injections
NAAQS	National Ambient Air Quality Standard
ND	Nondetect
NERL	National Exposure Research Laboratory
NIOSH	National Institute for Occupational Safety and Health
NIST	National Institute of Standards and Technology
nm	Nanometer
NO _x	Oxides of Nitrogen
OAQPS	Office of Air Quality Planning and Standards

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SYMBOLS AND ABBREVIATIONS (Continued)

OPR	Ongoing Precision and Recovery
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OSHA	Occupational Safety and Health Administration
PAMS	Photochemical Assessment Monitoring Stations
PCDD	Polychlorinated Dibenzodioxins
PCDF	Polychlorinated Dibenzofurans
PDFID	Preconcentration Direct Flame Ionization Detection
POC	Parameter Occurrence Code
ppbC	Parts per Billion as Carbon
ppbV	Parts per Billion (by volume)
ppmC	Parts per Million as Carbon
ppmv	Parts per Million (by volume)
psig	Pounds per Square Inch Gauge
PT	Proficiency Testing
QA	Quality Assurance
QAD	Quality Assurance Division
QAPP	Quality Assurance Project Plan
QC	Quality Control
RCA	Recommendation for Corrective Action
RPD	Relative Percent Difference
RSD	Relative Standard Deviation
RT	Retention Time
RTI	Research Triangle Institute
RTP	Research Triangle Park
SD	Standard Deviation
SIP	State Implementation Plan
SNMOC	Speciated Nonmethane Organic Compound
SOP	Standard Operating Procedure
SPCC	System Performance Check Compound
STI	Sonoma Technology, Inc.

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SYMBOLS AND ABBREVIATIONS (Continued)

SVOC Semivolatile Organic Compounds
TAD Technical Assistance Document. Also a NATTS TAD
TCDD Tetrachlorodibenzodioxin
TPC Theoretical Propane Concentration
UAM Urban Airshed Model
UATMP Urban Air Toxics Monitoring Program
UV Ultraviolet
VOC Volatile Organic Compound

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DISTRIBUTION LIST

Copies of this plan and all revisions will be provided to:

- . • Vickie Presnell, Work Assignment Manager, U.S. EPA, C304-02, RTP, NC
- . • Sharon Nizich, Delivery Order Manager, U.S. EPA, C339-02, RTP, NC
- . • Dennis Mikel, AT QA Coordinator, U.S. EPA, C339-02, RTP, NC

U.S. EPA Regional contacts may obtain a copy of the QAPP by contacting the Delivery Order Manager. It is the responsibility of each Regional contact to make copies of the plan for appropriate State personnel or to refer them to the ERG website: <http://www.ergweb2.com/uatmp/index.htm>.

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A—PROJECT MANAGEMENT

SECTION 1

PROJECT/TASK ORGANIZATION

1.1 Assignment of Program Personnel

Table 1-1 presents the program organization listing the program assignment and responsible person for each aspect of the EPA National Monitoring Programs. The program organizational chart is presented in Figure 1-1.

Eastern Research Group's (ERG) areas of focus on this contract include Nonmethane Organic Compounds (NMOC), Speciated Nonmethane Organic Compound(s) (SNMOC), Volatile Organic Compound(s) (VOC), Hazardous Air Pollutants (HAPs) and Semivolatile Organic Compound(s) (SVOC). Subcontracting services are extended by Chromian for onsite technical assistance for PAMS analysis, Sonoma Technology, Inc. (STI) for data validation, Research Triangle Institute (RTI) for metals analysis, Columbia Analytical Services (CAS) for metals and dioxin analysis, and Atmospheric Analysis and Consulting (AAC) for specialty HAPs analysis.

1.1.1 Program Manager

Mr. Dave Dayton, an ERG Senior Program Manager and Technical Director, will serve as the Program Manager for EPA's National Monitoring Programs. In this role, he has the primary responsibility for understanding EPA's and their clients' (i.e., State, local, and tribal agencies) needs at the program level. Mr. Dayton is ultimately accountable for providing timely, cost effective, and high quality services in support of the National Monitoring Program efforts. His primary responsibility is ensuring client satisfaction by verifying that components of effective management are in place and active at all times during the contract performance period. Mr. Dayton coordinates with the Deputy Program Manager, ERG QA Officer, and task leaders to

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provide insight and communicate technical issues and needs, and to ensure that these program staff facilitate management decisions appropriate to their roles on Contract 68-D-03-049. He reviews all budgetary and schedule information, as prepared by the Deputy Program Manager, and reviews all information for presentation to EPA at scheduled program meetings. Mr. Dayton also functions as a Technical Manager to provide direction and support, and to assist in the resolution of technical issues that may arise.

1.1.2 Deputy Program Manager

As the Deputy Program Manger, Ms. Julie Swift is responsible for the technical operation of the program on a day-to-day basis, and communicating issues that could impact the Program to the Program Manager. Ms. Swift deals with day to day correspondence with the States/local/tribal agencies, and is responsible for ensuring that the appropriate level of staffing, number of work shifts, and committed resources (analytical equipment, materials, reagents) are available to meet project deliverables and sample turnaround times.

Ms. Swift tracks approved budget performance for all tasks and reports this information to the Program Manager and all Task Leaders. She also ensures that all management systems and tools required for this program are implemented and tracked, and tracks deliverables and budget performance to present project performance information to the EPA at monthly meetings and in monthly progress reports. As a Technical Manager, Ms. Swift leads the analytical tasks and provides technical direction and support. She assists in the resolution of technical issues and serves as a resource for Task Leaders regarding any project issues. Ms. Swift assists with sample preparation and analysis, as well as data reduction, review, and reporting.

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1.1.3 Program QA Officer

The Program QA Officer, Dr. Ray Merrill, is responsible for ensuring the overall integrity and quality of the project results. He reviews the QAPP and coordinates data and laboratory audits that will provide information relative to data quality and determine whether procedures are in accordance with the QAPP. The lines of communication between management, the Program QA Officer, and the technical staff are formally established and allow for discussion of real and potential problems, preventive actions, and corrective procedures. The major QC responsibilities and QC review functions are summarized in Table 1-2.

At any time during the program, additional QA/QC measures may be initiated upon consultation between the Task Leaders, Program Managers, and Program QA Officer.

1.1.4 Deputy Program QA Officer

Ms. Donna Tedder, the Deputy Program QA Officer, is responsible for ensuring the integrity and quality of project results. Ms. Tedder will do a QA review for all sample analyses delivered for reporting to the Deputy Program Manager. The major QC responsibilities and QC review functions are summarized in Table 1-2. Ms. Tedder will work closely with Dr. Merrill to ensure the overall quality of the Program.

Table 1-1 Program Organization

Program Assignment	Program Personnel Assigned	Phone Number	em
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Program Manager	Dave Dayton	(919) 468-7883	ddayton@
Deputy Program Manager	Julie Swift	(919) 468-7924	julie.swif
Analytical Coordinators	Laura VanEnwyck Mitch Howell	(919) 468-7930 (919) 468-7915	laura.van mitch.ho
Task Leader - Network Site Coordination	Dave Dayton	(919) 468-7883	ddayton@
Task Leader - SNMOC Analysis	Scott Sholar	(919) 468-7951	scott.sho
Task Leader - Air Toxics and Hexavalent Chromium	Mitch Howell	(919) 468-7915	mitch.ho
Task Leader - Carbonyl Analysis	Laura VanEnwyck	(919) 468-7930	laura.van
Task Leader - PAMS Support *	Dave Dayton	(919) 468-7883	ddayton@
Task Leader - HAPs Support **	Julie Swift	(919) 468-7924	julie.swif
Task Leader - Final Report Preparation	Regi Oommen	(919) 468-7829	regi.oom
Task Leader - AQS Data Entry	Randy Bower	(919) 468-7916	randy.bo
Task Leader - NMOC Analysis	Mark Holland	(919) 468-7913	mark.hol
Program QA Officer	Ray Merrill	(919) 468-7887	ray.merr
Deputy Program Manager	Donna Tedder	(919) 468-7921	donna.tec
Project Administrator	Manieta Roman	(919) 468-7962	manieta.r

* Subcontracting support when requested from Chromian and Sonoma Technology, Inc.
** Subcontracting support when requested from Columbia (metals and dioxin analysis), Research Triangle Institute (metals analysis), and Atmospheric Analysis Consulting (miscellaneous HAPs).

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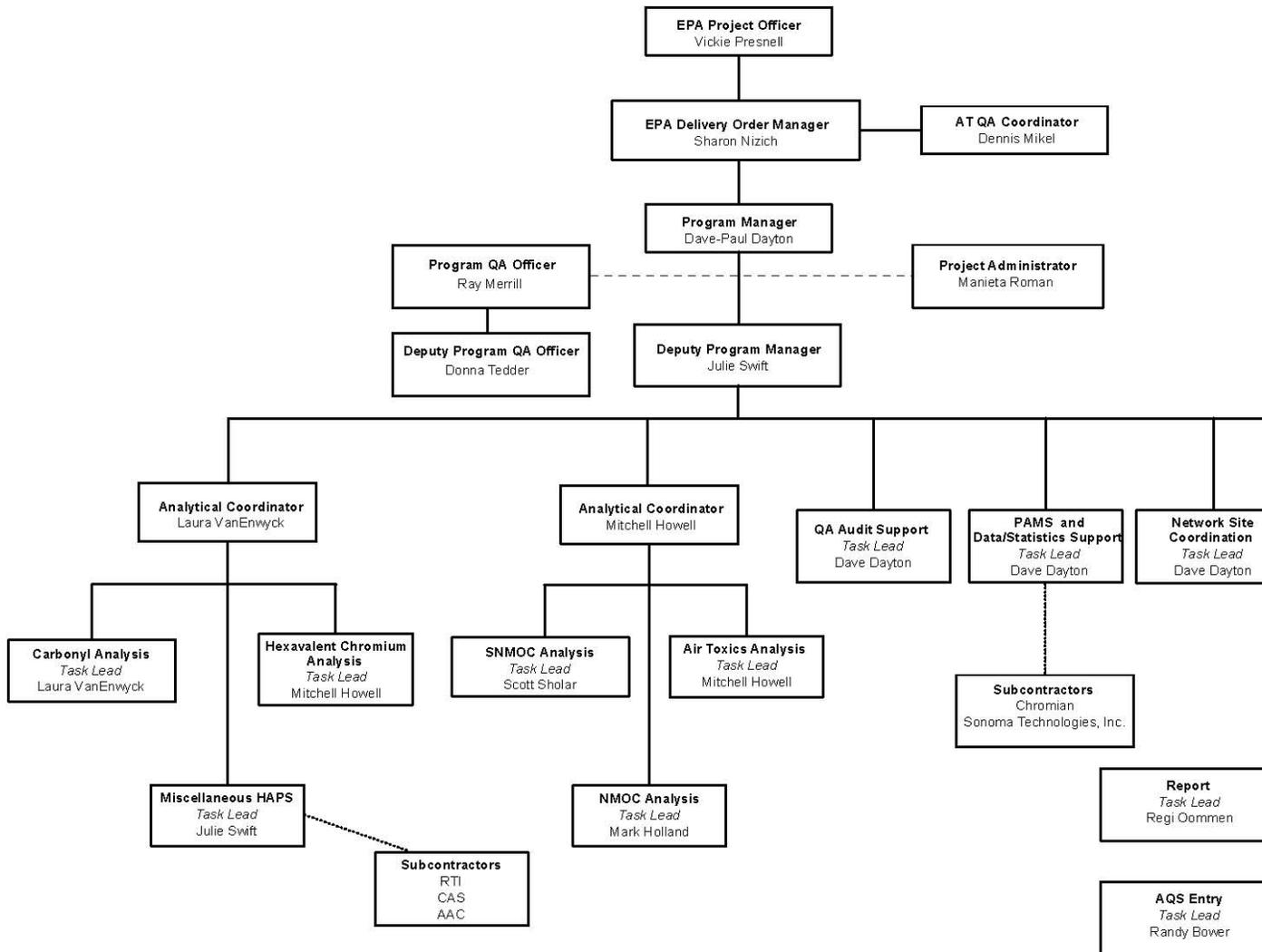


Figure 1-1. National Monitor Programs Organizational Chart

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Table 1-2

QC Responsibilities and Review Functions

Responsible Person	Major Responsibilities
Program Manager	<ul style="list-style-type: none"> • • Ensure overall timely performance of high quality technical services Communicate technical issues and needs

- • • • • Train and supervise analysts Meet task budgets and report schedules Manage day-to-day technical activities Check information completeness Review instrument and maintenance log books Review calibration factor drift
- • Perform preventive maintenance Prepare monthly/quarterly reports

1.1.4 Analytical Coordinator

The Analytical Coordinators are responsible for ensuring that schedules for analysis of samples and delivery of the resulting data to the Deputy Program Manager are met.

1.1.5 Task Leaders

ERG Task Leaders are responsible for meeting the project objectives, meeting budgets and schedules, and directing the technical staff in execution of the technical effort for their respective task(s). The Task Leaders manage the day-to-day technical activities. They assess and report on the project's progress and results (e.g., recordkeeping, data validation procedures, sample turnaround time) and ensure timely, high-quality services and adherence to the project QA plan.

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1.1.6 Peer Reviewers

The ERG peer reviewers are responsible for ensuring the quality of the final data deliverable before a report is delivered to the client. Peer Reviewers perform the final data review on the analytical reports and also assist in resolving any technical issues that arise in the laboratory or at the sites.

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SECTION 2

PROBLEM DEFINITION/BACKGROUND

The Clean Air Act Amendments of 1990 required the Environmental Protection Agency's (EPA's) Office of Air Quality Planning and Standards (OAQPS) to set National Ambient Air Quality Standard (NAAQS) for the "criteria" pollutant, ozone. In areas of the country where the NAAQS for ozone is being exceeded, additional measurements of the ambient nonmethane organic compound (NMOC)⁽¹⁾ concentration are needed to assist the affected States in developing revised ozone control strategies. Measurements of ambient NMOC are important to the control of volatile organic compounds (VOCs) that are precursors to atmospheric ozone. Because of previous difficulty in obtaining accurate NMOC concentration measurements, EPA started a monitoring and analytical program in 1984 to provide support to the States. ERG has continuously supported EPA for the NMOC programs since 1984.

Studies indicate that a potential for elevated cancer risk is associated with certain toxic compounds often found in ambient urban air.⁽²⁾ In 1987, EPA developed the Urban Air Toxics Monitoring Program (UATMP) to help State, local and tribal air monitoring agencies characterize the nature and extent of potentially toxic air pollution in urban areas. Since 1987, several State and local agencies have participated in the UATMP by implementing ambient air monitoring programs. These efforts have helped to identify the toxic compounds most prevalent in the ambient air and indicate emissions sources that are likely to be contributing to elevated concentrations. As a screening program the UATMP also provides data input for models used by EPA, State, local and risk assessment personnel to assess risks posed by the presence of toxic compounds in urban areas. The UATMP program is a year-round sampling program, collecting 24-hour integrated ambient air samples at urban sites in the contiguous United States every 12

days, and is also supported by ERG.

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The speciated NMOC (SNMOC) program was initiated in 1991 in response to requests by State agencies for more detailed speciated hydrocarbon data for use in ozone control strategies and Urban Airshed Model (UAM) input.

Title I, Section 182 of the Clean Air Act Amendments of 1990 requires States to establish Photochemical Assessment Monitoring Stations (PAMS) as part of their State implementation plan (SIP) for ozone nonattainment areas. The rule revises the ambient air quality surveillance regulations to include enhanced monitoring of ozone and its precursors. The regulations promulgated in 1993 require monitoring of ozone, oxides of nitrogen (NO_x), selected carbonyl compounds, and VOCs. The required monitoring is complex and requires considerable lead time for the agencies to acquire the equipment and expertise to implement their PAMS network. Under the PAMS program, each site may require a different level of support with respect to sampling frequency, sampling equipment, analyses, and report preparation. Presampling, sampling, and analytical activities are performed according to the guidance provided in the Technical Assistance Document (TAD)⁽³⁾, for Sampling and Analysis of Ozone Precursors, 1998 revision. The

specific methodology applicable to the PAMS program will be discussed in this Quality Assurance Project Plan (QAPP).

In 1999, the EPA expanded this program to provide for the measurement of additional Clean Air Act Hazardous Air Pollutants (HAPs) to support the Government Performance and Results Act (GPRA). As required under the GPRA, the EPA developed a Strategic Plan that includes a goal for Clean Air. Under this goal, there is an objective to improve air quality and reduce air toxics emissions to levels 75 percent below 1993 levels by 2010 in order to reduce the risk to Americans of cancer and other serious adverse health effects caused by airborne toxics.

In 2001 the United States Environmental Protection Agency (EPA) designed a national network for monitoring air toxics compounds present in ambient air entitled the “National Ambient Toxics Trend System”. The intent of this network is to develop an extensive air toxics database from actual field measurements (rather than calculated emission rates) in order to detect

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selected air toxics compounds and track the trends in the concentrations with the ultimate

goal of assessing specific related health risks.

The data obtained by following this QAPP will be used by EPA, State, local, and risk assessment personnel to determine prevalent air toxics in the urban air. The data collected from the continuous yearly sites gives data analysts consistent analytical results. Sampling and analytical uncertainties are determined through this program by performing 10% sampling duplicate and analytical replicate samples for each of the urban air sites.

This combined QAPP defines the presampling and sampling activities and laboratory analyses conducted by ERG for the EPA National Monitoring Programs and describes the quality assurance/quality control (QA/QC) procedures used to assess data quality. Many of these procedures are based on experiences obtained during previous National Program Studies.

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SECTION 3

PROJECT/TASK DESCRIPTION

This section describes the activities performed under each of the major EPA National Monitoring Programs components (NMOC, SNMOC, UATMP, PAMS, HAPs, and NATTS). The passivated canisters used by this laboratory are dedicated to use in EPA's National Monitoring Programs. Sampling and analysis schedules are prepared in the project instructions when the delivery orders are provided by EPA.

3.1 NMOC and SNMOC

The NMOC and SNMOC programs require several activities for a successful monitoring program. The monitoring program begins with activities prior to sample collection. The NMOC and SNMOC sample collection systems are designed to collect ambient air samples in SUMMA[®] treated stainless steel canisters over a 3-hour period. This sample collection period occurs from 6:00 - 9:00 a.m. local time to capture mobile source pollutants during the morning “rush hour” simultaneously with sunrise, which provides the energy necessary for many photochemical reactions. Weekday sampling will be the responsibility of the individual States involved in this program. ERG provides the sampler, training, and any technical assistance needed throughout the monitoring program.

A selected number of canisters from State- and EPA-directed sites are analyzed for additional air toxics compounds; these sites and canisters are identified at the beginning of the program to ensure sample completeness. Some sites also collect carbonyl samples for analysis. The analytical methods and procedures are discussed later in the UATMP and PAMS project descriptions (Section 10).

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The SUMMA[®] canisters dedicated to the program are checked for leaks, repaired, and cleaned using the vacuum and pressurization canister cleaning system described in the TAD⁽³⁾. The canisters are certified by ERG for cleanliness by analyzing the contents using EPA Compendium Method TO-12⁽¹¹⁾ for determining total NMOC concentration.

The State/local/or tribal agency site personnel are contacted to coordinate monitoring site installation, operator training, sample collection, and shipping. ERG provides installation of the sample collection system, supporting documentation, training of the site operator for collection of scheduled samples, and ongoing technical support and coordination for sample collection during the entire monitoring program.

Samples are collected by State or local agency personnel every weekday typically starting on the first Monday of June through the end of September at each of the designated sites. At least two days before each sample collection episode, ERG ships the necessary clean, certified canisters and carbonyl tubes to the site along with the field sample collection form and chain of custody forms. The time integrated ambient samples are then collected and shipped to ERG for analysis.

Samples are delivered to a dedicated loading dock area that is part of the laboratory space used for the programs. Samples are received and logged into ERG's Laboratory Information Management System (LIMS) database. The ERG LIMS is networked to be accessible to all appropriate program staff. After the sample identification number, date received, sample date, project name, canister pressure (if applicable), and storage location are documented, the field sample collection form is reviewed and any discrepancies or invalidated samples are reported to the Deputy Program Manager. ERG contacts the site operator for resolution of any sample issues. The samples are then taken to the laboratory for analysis.

The analytical equipment used for the NMOC program consists of a modified Preconcentration Direct Flame Ionization Detection (PDFID) Hewlett-Packard gas

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chromatograph (GC) with cryogenic sample preconcentration systems and dual-channel Flame Ionization Detectors (FIDs). EPA Compendium Method TO-12⁽¹¹⁾ is used for the analysis.

The PDFID system used for analyses is calibrated and blanked daily before sample analysis. Cleaned, humidified air from the canister cleaning system is analyzed to determine the level of organic compounds present in the analytical system. Upon achievement of acceptable system blank results (< 10 ppbC), a daily QC check sample of certified standard propane is analyzed. The QC check sample is used to check the calibration of the analytical system. Upon acceptable calibration results ($r^2 \geq 0.995$), sample analysis begins. Ten percent of the total number of samples received are collected in duplicate and analyzed twice to determine the analytical precision for the program.

The NMOC data are then processed to determine the total NMOC present in the sample. The parts per million as carbon (ppmC) concentration of the NMOC is determined using the daily propane calibration response factor. Preliminary data summaries are compiled monthly for all sites and distributed to the site contacts and the EPA Project Officer.

Speciated NMOC (SNMOC) analysis is performed to identify and quantify the ozone precursor species present in the ambient air. The analytical equipment used for the SNMOC program consists of an Entech 7100A Preconcentrator, a Hewlett-Packard Model 6890 GC system that incorporates an FID, with a data acquisition system. ERG staff analyze the samples for SNMOC compounds (listed in Table 3-1) in accordance with the methodology specified in the TAD⁽³⁾ and EPA Compendium Method TO-15.⁽¹⁷⁾ The FID is used to perform quantitative analysis of the SNMOC compounds of interest;

the MS is used for confirmation of the identification of compounds of interest. The FID provides good sensitivity and uniform response based on the number of carbon atoms per compound. Total NMOC is also reported, allowing one instrument to actually present three total analyses: SNMOC, NMOC, and TO-15⁽¹⁷⁾ air toxics.

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Table 3-1

**SNMOC Target
 Compounds**

Compound	
Ethylene	2,3-Dimethylpentane
Acetylene	3-Methylhexane
Ethane	1-Heptene
Propylene	2,2,4-Trimethylpentane
Propane	<i>n</i> -Heptane
Propyne	Methylcyclohexane
Isobutane	2,2,3-Trimethylpentane
Isobutene	2,3,4-Trimethylpentane
1-Butene	Toluene
1,3-Butadiene	2-Methylheptane
<i>n</i> -Butane	3-Methylheptane
<i>trans</i> -2-Butene	1-Octene
<i>cis</i> -2-Butene	<i>n</i> -Octane
3-Methyl-1-Butene	Ethylbenzene
Isopentane	<i>p,m</i> -Xylene
1-Pentene	Styrene
2-Methyl-1-Butene	<i>o</i> -Xylene
<i>n</i> -Pentane	1-Nonene
Isoprene	<i>n</i> -Nonane
<i>trans</i> -2-Pentene	Isopropylbenzene
<i>cis</i> -2-Pentene	<i>n</i> -Propylbenzene
2-Methyl-2-Butene	α -Pinene
2,2-Dimethylbutane (Neohexane)	<i>m</i> -Ethyltoluene
Cyclopentene	<i>p</i> -Ethyltoluene
4-Methyl-1-Pentene	1,3,5- Trimethylbenzene
2,3-Dimethylbutane	<i>o</i> -Ethyltoluene
Cyclopentane	β -Pinene
2-Methylpentane (Isohexane)	1,2,4- Trimethylbenzene
3-Methylpentane	1-Decene
2-Methyl-1-Pentene	<i>n</i> -Decane
1-Hexene	1,2,3- Trimethylbenzene
2-Ethyl-1-Butene	<i>m</i> -Diethylbenzene

n-Hexane
trans-2-Hexene
cis-2-Hexene
Methylcyclopentane
2,4-Dimethylpentane
Benzene
Cyclohexane
2-Methylhexane (Isoheptane)

p-Diethylbenzene
1-Undecene
n-Undecane
Dodecene
n-Dodecane
Tridecene
n-Tridecane
Total NMOC

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Moisture and carbon dioxide are removed from the analytical system using a microscale purge and trap dehydration device located in the Entech Preconcentrators. Personnel perform cryogenic concentration of the samples using a trap consisting of chromatographic-grade stainless steel tubing packed with commercially available 60/80 mesh Tenax[®] combined with deactivated glass beads maintained at -160°C during sample concentration. The concentrated VOCs are thermally desorbed at room temperature to revolatilize them for transfer to the secondary trap. The secondary trap is Tenax[®] at -60°C. The VOCs are then back-flushed while heating to be further focused on an open-tubular focusing trap for rapid injection onto the analytical column. The

sample is injected onto the cold column to separate C₂ through C₁₃ hydrocarbons and to obtain total SNMOC and NMOC concentrations.

The SNMOC systems are calibrated using a certified standard of propane and blanked daily prior to sample analysis. A QC standard containing certified PAMS compounds is analyzed daily prior to sample analysis to ensure the validity of the current response factor. Following the daily QC standard analysis, cleaned, dried air from the canister cleaning system that has been humidified is analyzed to determine the level of organic compounds present in the analytical system. Upon achieving acceptable system blank results, sample analysis begins. Samples are analyzed for the target compounds listed in Table 3-1. Ten percent of the total number of samples are analyzed twice to determine the precision of analysis for the program.

The SNMOC raw data from the Hewlett-Packard Chemstation[®] data acquisition system are processed and reduced to determine peak identifications for any target analytes present in the samples. The propane response factor from the calibration curve determines the parts per billion as carbon (ppbC) concentration of the target analytes.

Upon completion of the sample collection activities at each site, the postsampling activities begin. The sample collection equipment is recovered from the sites and refurbished as necessary by ERG, who collect and store the equipment in a dedicated area until the next monitoring program presampling activities begin. ERG then prepares the final program report

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describing procedures, results, discussion of results, compilation of statistics, and recommendations. Upon approval by the EPA Project Officer and Delivery Order Manager, ERG distributes the final report to designated recipients. ERG provides the

final data summaries to EPA in Excel[®] format on compact disk media, archives all project files, raw data, reports, correspondence, memos, letters, and copies of the final report, and formats the finalized data for input into the AQS database.

During the 1997 season, ERG's laboratory implemented a system using the standard UATMP instrumentation to analyze the SNMOC canisters. For the first time, all results — SNMOC, UATMP and PAMS compounds — can be obtained from one analysis. Because of this analytical achievement, effort and costs for any combination of analyses are significantly reduced.

3.2 UATMP

The UATMP requires several key activities for a successful monitoring program. The program originates with activities conducted prior to sample collection. The UATMP sample collection system is designed to collect whole-air 24-hour integrated ambient air samples in SUMMA[®]-treated stainless steel canisters, resulting in a subatmospheric final pressure. Prior to field installation, the sample collection systems are certified using a dual-manifold certification system, which verifies cleanliness and determines the background level of target organic compounds introduced by the sample collection system. The certification procedure also determines the percent recovery of selected target analytes by challenging the system with a known concentration of selected toxic organic compounds. The 2004 sampling schedule, including all current sampling sites, is presented in Appendix B and the certification procedure is presented in SOP ERG-MOR-030 in Appendix C. Because all sites are not on the sample schedule, the project schedule is revised as required.

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The SUMMA[®] canisters are checked for leaks, repaired if necessary by ERG or the canister vendor, cleaned using a vacuum and pressurization canister cleaning system, and then certified for cleanliness (SOP ERG-MOR-062, Appendix C). The cleanliness of a canister is determined by analyzing the contents using EPA Compendium Method TO-15⁽¹⁷⁾ for determining volatile compound concentration and by analyzing one canister per cleaned set by GC/FID/MS.

The analytical equipment used for the UATMP consists of a cryogenic sample concentration system and a GC/FID/MS with the FID detector used for hydrocarbon analysis. The FID is used concurrently with the MS to quantitate up to 139 target compounds present in the sample. UATMP target compounds are listed in Table 3-2. This system provides the required sensitivity with confirmation of target compound identification to determine the detection limits needed for the assessment of potential risks associated with the toxic compounds measured for this program. The EPA Compendium Method TO-15⁽¹⁷⁾ and EPA's TAD⁽³⁾ are followed to illustrate that analyses for all compounds requested can be achieved according to EPA's preference for method.

As with NMOC and SNMOC activities, the State or local agency site personnel are contacted to coordinate installation, operator training, sample collection, and shipping activities. ERG provides installation of the sample collection system, support documentation, training of the site operator for collection of scheduled samples, and ongoing technical support and coordination of sample collection. Sampling on every

sixth or twelfth day is the responsibility of the individual States involved in this program.

Samples are collected by State or local agency personnel once every 6 or 12 days for a period of 1 year at each of the designated sites. At least 2 days prior to the sample collection episode, ERG ships the necessary cleaned and certified canisters to the site along with the chain of custody form and field sample collection form. The ambient air samples are collected in canisters over a 24-hour period from midnight to midnight local standard time. Ten percent of the total number of samples are received in duplicate and analyzed in replicate to statistically determine the precision of sampling and analysis for the program.

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Table 3-2

**UATMP Target
Compounds**

UATMP Target Compounds	
Acetylene	Ethyl Acrylate
Propylene	Bromodichloromethane
Dichlorodifluoromethane	Trichloroethylene
Chloromethane	Methyl Methacrylate
Dichlorotetrafluoroethane	<i>cis</i> -1,3-Dichloropropene
Vinyl Chloride	Methyl Isobutyl Ketone
1,3-Butadiene	<i>trans</i> -1,3-Dichloropropene
Bromomethane	1,1,2-Trichloroethane
Chloroethane	Toluene
Acetonitrile	Dibromochloromethane
Trichlorofluoromethane	1,2-Dibromoethane
Acrylonitrile	<i>n</i> -Octane
1,1-Dichloroethene	Tetrachloroethylene
Methylene Chloride	Chlorobenzene
Trichlorotrifluoroethane	Ethylbenzene
<i>trans</i> -1,2-Dichloroethylene	<i>m/p</i> -Xylene

1,1-Dichloroethane	Bromoform
Methyl <i>tert</i> -Butyl Ether	Styrene
Methyl Ethyl Ketone	1,1,2,2-Tetrachloroethane
Chloroprene	<i>o</i> -Xylene
<i>cis</i> -1,2-Dichloroethene	1,3,5-Trimethylbenzene
Bromochloromethane	1,2,4-Trimethylbenzene
Chloroform	<i>m</i> -Dichlorobenzene
Ethyl <i>tert</i> -Butyl Ether	Chloromethylbenzene
1,2-Dichloroethane	<i>p</i> -Dichlorobenzene
1,1,1-Trichloroethane	<i>o</i> -Dichlorobenzene
Benzene	1,2,4-Trichlorobenzene
Carbon Tetrachloride	Hexachloro-1,3-Butadiene
<i>tert</i> -Amyl Methyl Ether	1,2-Dichloropropane

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Samples are shipped to ERG and received in a loading dock area that is part of the dedicated laboratory space used for the program. ERG then logs the samples into the sample receipt log book and documents the sample identification number, date received, sample date, project name, canister vacuum, and storage location. ERG also logs samples into the computerized login database. After comparing the above information with the field sample collection form, ERG staff bring any discrepancies or invalidated samples to the attention of the Site Coordinator. ERG contacts the site operator for resolution of any sample issues, and the samples are then taken to the laboratory for analysis.

The GC/FID/MS system is calibrated at least quarterly for the target compounds in Tables 3-1 and 3-2 and blanked daily prior to sample analysis. The validity of the tune of the MS is verified daily using 4-Bromofluorobenzene (BFB). A QC check sample containing all the compounds listed in Table 3-2 is also analyzed daily using a UATMP standard and PAMS standard to validate the response factors from the

calibration of the analytical system. Upon achieving acceptable QC results, a blank sample is analyzed daily. Clean, humidified air from the canister cleaning system is analyzed to determine the level of organic compounds present in the analytical system; upon achieving acceptable blank results, sample analysis begins.

ERG uses the Hewlett-Packard Chemstation[®] data system to acquire data. Personnel identify compounds by referring to a combination of the compound's retention time, the MS library, and the analyst's experience and judgment. All of the target UATMP compounds are quantitated using the MS; all target SNMOC compounds are quantitated using the FID. Sample concentrations are calculated using the calibration curve response factor from the MS and propane monthly calibration for the FID. Preliminary data summary reports are compiled every quarter for all sites and distributed to the site contacts and the EPA Project Officer. ERG staff also finalize and format data quarterly for input into the AQS database.

ERG oversees recertification and refurbishment of the samplers once a year to enable sampling to continue from season to season without interruption. Staff prepare the

final program

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report describing the procedures, results, discussion of results, compilation of statistics, and recommendations and, upon approval of the report by the EPA Project Officer, distribute the final report to the sites and other persons as designated by the Project Officer. ERG staff also provide the final data summaries to the EPA in Excel[®] format on magnetic floppy or compact disk media. All project files, raw data, reports, correspondence, memoranda, letters, and copies of the final report are put in short-term file storage and archived.

3.3 PAMS

The program objective of PAMS is to provide data that are consistent with the proposed rule for Ambient Air Quality Surveillance in accordance with Code of Federal Regulations Title 40, Part 58 (40 CFR Part 58). As a team, the ERG staff can offer site support to any State that needs to set up a PAMS site or maintain it with technical help.

After a PAMS program has been established by the State or local agency, ERG contacts the State site personnel to coordinate sample collection and sample shipment. ERG maintains coordination of the sample collection and sample shipments with the site contact and resolves any issues that occur during the sampling season. The PAMS samples are collected by State or local agencies from June first through the end of September at each of the designated sites.

The State or local agency typically provides the program's SUMMA[®]-treated canisters, although ERG supplies the 2,4-dinitrophenylhydrazine (DNPH) carbonyl sampling tubes and ozone scrubbers. ERG cleans the canisters using a vacuum and pressurization canister cleaning system, and then certifies them for cleanliness by analyzing the contents using EPA Compendium Method TO-12⁽¹⁾ for determining total NMOC. Canisters are recycled through the canister cleaning and verification process as needed to support the sample collection schedule for the program.

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Sep-Pak[®] chromatographic-grade silica gel cartridges impregnated with DNPH are used for carbonyl sample collection. The vendor precoats the cartridges with DNPH. Sep-Pak[®] potassium iodide (KI) coated silica gel ozone scrubbers are provided for use during sample collection to remove ozone from the sample stream on systems not configured with a denuder ozone scrubber.

Following sample collection, the site contact ships the canisters, cartridges, and documentation to the ERG laboratory. Project personnel receive samples in a loading dock area that is part of the dedicated laboratory space used for the programs, log them into the sample receipt log book and the computerized log, and document the information pertaining to the sample identification number, the date received, sample date, project name, canister vacuum (if applicable), and storage location. Project personnel review the chain of custody and field sample collection forms and any discrepancies or invalidated samples are brought to the attention of the PAMS Task Leader. If necessary, the Site Preparation Task Leader contacts the site for resolution of issues for subsequent samples. The canister samples are then taken to the laboratory for analysis and the cartridges are stored under refrigeration.

ERG staff analyze samples for PAMS VOC (listed in Table 3-3) in accordance with the methodology specified in the TAD⁽³⁾ using a GC/MS and a FID. The FID is used to perform quantitative analysis of the compounds of interest; the MS is used for confirmation of the identification of compounds of interest. The FID provides good sensitivity and uniform response based on the number of carbon atoms per compound. Moisture and carbon dioxide are removed from the analytical system using a microscale purge and trap dehydration device. Personnel perform cryogenic concentration of the samples using a trap consisting of chromatographic-grade stainless steel tubing packed

with commercially available 60/80 mesh/Tenax[®] combined with deactivated glass beads maintained at -160°C during sample concentration. The concentrated VOCs are thermally desorbed at room temperature to revolatilize them for transfer to the secondary trap. The second trap is Tenax[®] at -60°C. The VOCs are then back-flushed

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Table 3-3

PAMS Volatile Hydrocarbon Target Compounds

Compound

Acetylene	3-Methylhexane
Ethylene	2,2,4-Trimethylpentane
Ethane	<i>n</i> -Heptane
Propylene	Methylcyclohexane
Propane	2,3,4-Trimethylpentane
Isobutane	Toluene
1-Butene	2-Methylheptane
<i>n</i> -Butane	3-Methylheptane
<i>trans</i> -2-Butene	<i>n</i> -Octane
<i>cis</i> -2-Butene	Ethylbenzene
Isopentane	<i>m</i> -Xylene
1-Pentene	<i>p</i> -Xylene
<i>n</i> -Pentane	Styrene
Isoprene	<i>o</i> -Xylene
<i>trans</i> -2-Pentene	<i>n</i> -Nonane
<i>cis</i> -2-Pentene	Isopropylbenzene
2,2-Dimethylbutane	<i>n</i> -Propylbenzene
Cyclopentane	<i>m</i> -Ethyltoluene
2,3-Dimethylbutane	<i>p</i> -Ethyltoluene
2-Methylpentane	1,3,5-Trimethylbenzene
3-Methylpentane	<i>o</i> -Ethyltoluene
1-Hexene	1,2,4-Trimethylbenzene
<i>n</i> -Hexane	<i>n</i> -Decane
Methylcyclopentane	1,2,3-Trimethylbenzene
2,4-Dimethylpentane	<i>m</i> -Diethylbenzene
Benzene	<i>p</i> -Diethylbenzene
Cyclohexane	<i>n</i> -Undecane
2-Methylhexane	Total NMOC
2,3-Dimethylpentane	

while heating to be further focused on an open-tubular focusing trap for rapid injection onto the analytical column.

The carbonyl samples are analyzed for the carbonyl compounds listed in Table 3-4 using EPA Compendium Method TO-11A.⁽¹⁸⁾ The analytical instruments consist of two Waters 2487

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High Performance Liquid Chromatographs (HPLC) with a multiwavelength ultraviolet (UV) detector operated at 360 nanometers (nm). The HPLCs are configured with a 25 centimeter (cm), 4.6 millimeter (mm) ID C18 silica analytical column with a 5-micron particle size. Typically, 25 microliter (μL) aliquots are injected with an automatic sample injector.

Table 3-4

Carbonyl Target Compounds

|| **Compounds** _____

Formaldehyde	Isovaleraldehyde
Acetaldehyde	Valeraldehydes
Propionaldehyde	Tolualdehydes
Crotonaldehyde	Hexaldehyde
Butyraldehyde	2,5-Dimethylbenzaldehyde
Isobutyraldehyde	Acetone
Benzaldehyde	

A Hewlett-Packard Chemstation[®] and PE-Turbochrom[®] chromatography data acquisition systems are used to retrieve data from both the ozone precursor and carbonyl analytical instruments, respectively. The data are processed and peak identifications are made using retention times and relative retention times. After peak identifications are made, the concentration of each target analyte is determined using individual response factors for carbonyl compounds or propane response factors for ozone precursor compounds. Preliminary data summary reports are distributed to the sites and the EPA Project Officer once per month. Final data are summarized and a letter report are provided to the sites and the EPA at the program end. Quarterly data summary information is formatted for inclusion into the AQS database upon approval by the EPA

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3.4 HAPs

The program objective of HAPs is to provide data to prepare health risk determinations and to perform trend analyses to gauge whether GPRA goals are being met. As a team, and with assistance from Contractors, the ERG staff can offer site support to any State that needs HAPs analysis. The responsibility for the equipment for sample collection falls on the State or local agency. The analytical services support provided by the ERG team is shown in Table 3-5. All HAPs quarterly data summary information is formatted for inclusion into the AQS database upon approval by the EPA

Project Officer.

3.5 DNSH Sampling and Analysis

The DNSH method for sampling and analysis for acrolein has not been approved by US EPA. When studies have been completed, this section will be written in detail.

3.6 OPR and PT Sample Analysis (VOCs, Carbonyls, PAHs, Metals)

On a quarterly basis, Proficiency Testing (Ongoing Precision and Recovery) samples for VOCs, Carbonyls, PAHs, and Metals (including hexavalent chromium) will be prepared using certified and/or NIST-traceable standards and analyzed in all ERG laboratories as well as subcontractor laboratories. OPR samples will be prepared by spiking clean collection media (XAD-2[®], PUF, filters) or humidified canisters. Stock solutions of spiking standards will be considered stable for one year, and will be replaced on an annual basis. Results will be evaluated by the Program QA Officer and appropriate Corrective Action will be taken, as required. Results from the analyses of all PT samples will be maintained by the Program QA Officer and will be available to EPA upon request.

At the convenience of EPA, external PT samples may be supplied. These external PT samples may be supplied. These external PT samples will be analyzed according to standard laboratory procedures, and reviewed results will be reported to the suppliers of the samples.

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SECTION 4

DATA QUALITY OBJECTIVES AND CRITERIA FOR MEASUREMENT DATA

Because ERG performs measurement services only, data quality objectives (DQOs) for defining a toxics network program are not identified in this QAPP. A well-prepared description of the measurement quality objectives (MQOs) can be found in the Draft Technical Assistance Document for the National Ambient Air Toxics Trends and Assessment Program prepared for the EPA in June 2003⁽³¹⁾. This section will discuss the MQOs of the ERG laboratory analyses, emphasizing the levels of uncertainty the decision maker is willing to allow/accept from the analytical results. The DQOs for the four programs—NMOC, UATMP, PAMS, and HAPs—are similar but are not identical. Therefore, the programs are discussed separately.

Once a sampling DQO is established, the quality of the data must be evaluated and controlled to ensure that data quality is maintained within the established acceptance criteria. Measurement quality objectives are designed to evaluate and control various phases (sampling, preparation, analysis) of the measurement process to ensure that the total measurement uncertainty is within the range prescribed by the DQOs. MQOs can be defined in terms of the following data quality indicators:

Precision - a measure of mutual agreement among individual measurements of the same property usually under prescribed similar conditions. This is the random component of error.

Bias - the systematic or persistent distortion of a measurement process which causes error in one direction. Bias is determined by estimating the positive and negative deviation from the true value as a percentage of the true value.

Representativeness - a measure of the degree to which data accurately and precisely

represent a characteristic of population, parameter variations at a sampling point, a process condition, or an environmental condition.

Detectability - the determination of the low range critical value of a characteristic that a method-specific procedure can reliably discern.

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Completeness - a measure of the amount of valid data obtained from a measurement system compared to the amount that was expected to be obtained under correct, normal conditions. Data completeness requirements are included in the reference methods (see References, Section 21).

Comparability - a measure of the level of confidence with which one data set can be compared to another.

Accuracy has been the term frequently used to represent closeness to “truth” and includes a combination of precision and bias error components. The MQOs listed will attempt to separate measurement uncertainties into precision and bias components. Table 4-1 lists the MQOs for pollutants to be measured in all areas of the NMOC/UATMP/PAMS/HAPs program. A more detailed description of these MQOs and how they will be used to control and assess measurement uncertainty will be described in other elements as well as the SOPs (see Appendices C, D, and E) in this

QAPP.

For the NMOC program, the quality control procedures are listed in Table 4-2 and in Table 4-3 for the SNMOC monitoring program. Because the SNMOC samples are also analyzed by the UATMP system, the quality procedures presented in Table 4-4 are also applicable to hydrocarbon analyses (flagged with an [®]).

The measurement quality procedures for the Category I Analytes listed in Table 3-5 and supported under the UATMP and HAPs portions of the program ensure that ambient air samples are collected in the prescribed manner and that target compound qualitative and quantitative analyses are performed with known precision and bias. Quality procedures for the UATMP are presented in Table 4-4. The quality procedures for PAMS ambient air canister analyses are the same as those described for the SNMOC and the UATMP (flagged with a [®]) and summarized in Tables 4-3 and 4-4, respectively.

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Table 4-1 Measurement Quality Objectives for the National Program

Program	Reporting Units	Accuracy Using Replicate Samples	Precision (CV) from collection of Duplicate Samples	Representativeness	Comparability/ Method Selection	Completeness
NMOC	ppmC	10%	± 20%	Neighborhood	GC-PDFID EPA Compendium Method TO-12	>85%
SNMOC	ppbv	30%	± 30%	Neighborhood	GC-FID EPA Compendium Method TO-15	>85%
UATMP	ppbv	30%	± 30%	Neighborhood	GC-FID/MS EPA Compendium	>85%

					Method TO-15	
Carbonyls	ppbv	10%	± 20%	Neighborhood	HPLC EPA Compendium Method TO-11A	>85
Semivolatile	total µg/m ³ for XAD thimbles, ng/m ³ for PUF	30%	± 30%	Neighborhood	GC/MS EPA Compendium Method TO-13A & SW-846 Method 8270C	>85
Phosgene	ppbv	15%	± 10%	Neighborhood	HPLC EPA Compendium Method TO-6	>85

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Table 4-1 (Continued)

Program	Reporting Units	Accuracy Using Replicate Samples	Precision (CV) from collection of Duplicate Samples	Representativeness	Comparability/ Method Selection	Completeness
Hydrazine	ppbv	10%	± 10%	Neighborhood	HPLC/ OSHA Method 108	>85
Hydrocyanic Acid	total µg	10%	± 20%	Neighborhood	Ion Chromatography/ NIOSH 6010 and CTM 033	>85
Carbon Disulfide	total mg	10%	± 10%	Neighborhood	GCMS/Modified NIOSH 1600	>85
2,3,7,8-TCDD	pg/m ³	20%	± 20%	Neighborhood	GC/HRMS EPA Method 23	>85
Ethylene Oxide	total µg	10%	± 20%	Neighborhood	GC/ECD NIOSH Method 1614	>85
Metals	ng/filter	20%	± 20%	Neighborhood	ICP-MS EPA Compendium Method IO-3.5	>85

Hexavalent Chromium	ng/filter	10%	± 30%	Neighborhood	IC-UV Detector CARB Method MLD 039	>85
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Table 4-2 Summary of NMOC Quality Control Procedures

NMOC Quality Check	Frequency	Acceptance Criteria	Corrective Action
Calibration Check (midpoint of curve), Certified Standard	Daily	Relative percent difference within 20% of average calibration response (avg-daily)/avg	1) Repeat analysis of the point 2) Repeat analysis of a different level 3) Repeat calibration curve 4) Reprepare and reanalyze standard
Laboratory Control Standard (LCS), Certified Standard	Daily	Recovery Limits 20% of average calibration response	1) Repeat analysis 2) Repeat calibration curve
System blank - Wet Air <50% RH	Daily (after a calibration check)	<10.0 ppbC	1) Repeat analysis 2) Leak check system 3) Notify task leader
Multi-point Calibration; 5 point plus zero, 3 injections per point	At the beginning and end of the sampling season	Correlation criteria (r_2) ≥ 0.995 . Each point must have an RSD <3% (except zero)	1) Repeat one or two individual points 2) Repeat entire curve 3) Remake and reanalyze curve
Replicates	All duplicates	Within 100 area counts - RSD $\pm 5\%$	1) Notify analytical coordinator
Can Cleaning	One can analyzed on the Air Toxics system per batch of eight-highest total NMOC	Less than 10.0 ppbC	1) Repeat analysis once 2) Reclean canister batch

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Table 4-3 Summary of SNMOC Quality Control Procedures

QC Check	Frequency	Acceptance Criteria	Corrective Action
System Blank Analysis	Daily, following calibration check	20 ppbC total	1) Repeat analysis 2) Check system for leaks 3) Clean system with wet a
Multiple point calibration (5 points minimum); propane bracketing the expected sample concentration.	Prior to analysis and quarterly	Average Response Factor within $\pm 30\%$ of previous calibration	1) Repeat individual sample analysis 2) Repeat linearity check 3) Prepare new calibration standards and repeat
Calibration check using midpoint of calibration curve spanning the carbon range (C ₂ -C ₁₀), Certified Standard. Laboratory Control Standard (LCS), Certified Standard	Daily on the days of sample analysis	Response for selected hydrocarbons spanning the carbon range within $\pm 30\%$ difference of calibration curve slope	1) Repeat check 2) Repeat calibration curve
Canister cleaning certification	One can analyzed on the Air Toxics system per batch of eight-highest total NMOC	≤ 10 ppbC total	Reclean canisters and reanalyze

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Table 4-4 Summary of Air Toxics TO-15⁽¹⁷⁾ Quality Control Procedures

QC Check	Frequency	Acceptance Criteria	Corrective A
Bromofluorobenzene (BFB) Instrument Tune Performance Check ₁	Daily ₂ prior to sample analysis	Evaluation criteria in Table 11-1 presented in this QAPP.	1) Retune 2) Clean ion source quadrupoles
Five point calibration bracketing the expected sample concentration, Certified Standard	Following any major change, repair or maintenance or if daily QC is not acceptable. Recalibration not to exceed three months.	1) RSD of response factors $\leq 30\%$ 2) Relative Retention Times (RRTs) for target peaks ± 0.06 units from mean relative retention time	1) Repeat individual analysis 2) Repeat linearity Prepare new calibration standards and repeat
Calibration check using mid-point of calibration curve or one other point in curve ₁ , Certified Standard, LCS, Certified Standard	Daily ₂ on the days of sample analysis	Analyst verifies that the response factor $\leq 30\%$ bias from calibration curve average response factor	1) Repeat calibration 2) Repeat calibration
System Blank Analysis ₁	Daily ₂ following BFB and calibration check; prior to sample analysis	1) 0.2 ppbv per analyte or the MDL, whichever is greater 2) Internal Standard (IS) area response $\pm 40\%$ and IS Retention Time (RT) ± 0.33 min. of most recent calibration check	1) Repeat analysis blank canister 2) Check system for leaks, contamination 3) Repeat blank
Duplicate and Replicate Analysis ₁	All duplicate field samples	$< 30\%$ RPD for compounds greater than 5 times MDL	Repeat sample analysis
Canister Cleaning Certification	One can analyzed on the Air Toxics system per batch of eight-highest total NMOC	< 0.2 ppbv per VOC targeted compound or MDL, whichever is greater	Reclean canisters and reanalyze

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Table 4-4 (Continued)

QC Check	Frequency	Acceptance Criteria	Corrective A
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Sampler Certification	Annual	1) Recovery 80% to 120% of targeted compounds for certification challenge 2) <0.2 ppbv or the MDL, whichever is greater, of targeted compounds for blank certifications	Repeat certification canisters
Samples	All samples	IS area response $\pm 40\%$ and IS RT ± 0.33 min. of most recent calibration validation	Repeat analysis

¹ The same QA criteria are needed for SNMOC and PAMS analysis. ² Every 24 hours frequency.
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The major quality procedures for all of the programs ensure that ambient air samples are collected in a prescribed manner and concentrations are measured precisely and accurately. In theory, if these MQOs are met, measurement uncertainty should be controlled to the levels required by the sampling systems' DQOs.

Quality procedures determined for the carbonyl analysis and the HAPs-supported carbonyl compounds listed as Category II analytes in Table 3-5 ensure that ambient air samples are collected in the prescribed manner and that compound quantitative analyses are performed with known bias and precision. The quality procedures for carbonyl analysis are presented in Table 4-5.

Quality procedures determined for semivolatile organic compounds (Category III) and Polynuclear Aromatic Hydrocarbons (PAHs, Category IV) ensure that ambient air samples have been collected in the prescribed manner and to ensure that target

compound quantitative analyses are performed with known precision and bias. The quality procedures for these compounds are presented in Tables 4-6 and 4-7.

The quality procedures for phosgene, 2,3,7,8-tetrachlorodibenzo-*p*-dioxin (2,3,7,8-TCDD), ethylene oxide, hydrazine, hydrocyanic acid, carbon disulfide (Category III) and acrolein (Category II) listed as HAPs in Table 3-5 ensure that ambient air samples are collected in the prescribed manner and that target compound qualitative and quantitative analyses are performed with known precision and bias. The quality procedures for ethylene oxide, hydrazine, hydrocyanic acid, carbon disulfide, and acrolein will be presented, and this QAPP modified, when these analytes are requested from the contract. The quality procedures for 2,3,7,8-TCDD are presented in Table 4-8.

Quality procedures determined for the Clean Air Act metals (Inorganic HAPs, Category V from Table 3-5) ensure that ambient air samples are collected in the prescribed manner and that compound quantitative analyses are performed with known bias and precision. The quality procedures for the metals and hexavalent chromium analysis are presented in Table 4-8.

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Table 4-5 Summary of Carbonyl Quality Control Procedures

Parameter	Quality Control Check	Frequency	Acceptance Criteria	Corrective
HPLC Column Efficiency	Analyze second source QC SSQC sample	At setup and 1 per sample batch	Resolution between acetone and propionaldehyde ≥ 1.0 Column efficiency > 5,000 plate counts	1) Eliminate dead 2) Back flush 3) Replace the co repeat analysis

Linearity Check	Run a 5-point calibration curve and SSQC sample in triplicate	At setup or when calibration check is out of acceptance criteria	Correlation coefficient ≥ 0.999 , relative error for each level against calibration curve $\pm 20\%$ or less relative error	1) Check integrat 2) Reintegrate 3) Recalibrate
			Intercept acceptance should be $\leq 10,000$ area counts per compound which correlates to $0.06 \mu\text{g}/\mu\text{L}$	1) Check integrat 2) Reintegrate 3) Recalibrate
Retention Time	Analyze SSQC sample	Once per 12 hours or less	Acetaldehyde, Benzaldehyde, Hexaldehyde within retention time window established by determining 3σ or $\pm 2\%$ of the mean calibration and midpoint standards, whichever is greater	1) Check system 2) Regulate column temperature 3) C and solvents
Calibration Check	Analyze SSQC sample	Once per 12 hours or less	85-115% recovery	1) Check integrat Recalibrate or rep standard 4) Reanalyze sam bracketed by accep standard
Calibration Accuracy	Analyze SSQC sample	Once after calibration in triplicate	85-115% recovery	1) Check integrat 2) Recalibrate 3) standard 4) Reana not bracke acceptable standa
System Blank	Analyze acetonitrile	Bracket sample batch, 1 at beginning and 1 at end of batch	Measured concentration ≤ 5 times the MDL	1) Locate contam document levels contamination in

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Table 4-5 (Continued)

Parameter	Quality Control Check	Frequency	Acceptance Criteria	Corrective
Lot Blank Check	Analyze blank cartridge on new lots	Every lot received	Compounds must be less than values listed: Formaldehyde $< 0.15 \mu\text{g}/\text{cartridge}$ Acetaldehyde $< 0.10 \mu\text{g}/\text{cartridge}$ Acetone $< 0.30 \mu\text{g}/\text{cartridge}$ Others $< 0.10 \mu\text{g}/\text{cartridge}$	1) Reanalyze cart Notify vendor if l continues to fail.

Field Blank (FB) Check	Field blank samples collected in the field	≤10% of the sampling schedule	Compounds must be less than values listed: Formaldehyde <0.4 µg/mL derivatized <0.3 µg/cartridge underivatized Acetaldehyde <0.4 µg/mL derivatized <0.4 µg/cartridge underivatized Acetone <0.6 µg/mL derivatized <0.75 µg/cartridge underivatized Others <0.10 µg/mL derivatized <7.0 µg/cartridge underivatized	If FB fails, notify tor, schedule another reason for failure and corresponding high concentration subtract that sample flag data in report does not have high NOT blank subtract data. Additional FB collected until the corrected and data acceptable.
Duplicate Analyses	Duplicate and replicate samples	As collected	±20% RPD	1) Check integrat 2) Check instrum 3) Reanalyze dup samples
Replicate Analyses	Replicate injections	Duplicate samples only	≤ 10% RPD for concentrations greater than 0.1 µg/mL.	1) Check integrat 2) Check instrum 3) Reanalyze dup samples
Method Spike/Method Spike Duplicate (MS/MSD)	Analyze MS/MSD, using calibration standard	One MS/MSD per batch of 20 samples	80-120% recovery for all compounds.	1) Check calibrati 2) Check extracti procedures

Note: Crotonaldehyde tautomerizes into two chromatographically separate peaks after it is spiked onto the DNPH cartridge. The best analytical recovery for crotonaldehyde is determined when both peaks are integrated together for all samples and QC.

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Table 4-6

Summary of Quality Control Procedures for Analysis of Semivolatile Organic Samples (EPA Method 8270C⁽²¹⁾)

Quality Control Check	Frequency	Acceptance Criteria	Corrective Action
Decafluorotriphenylphosphine (DFTPP) instrument tune check	Daily prior to calibration check and sample analysis; every 12 hours if instrument is operated 24 hours/day	Evaluation criteria in Table 3 of Method 8270C, and Table 11-2 of this QAPP	1) Re-tune instrument; re-analyze 2) Clean ion source; re-tune instrument; re-analyze 3) Prepare new tune check standards; re-analyze
Five-point calibration standard	Following any major change, repair, or maintenance if daily quality control check is not acceptable. Minimum frequency every six weeks, more frequently if required	Average RSD of response factors for Calibration Check Compounds (CCCs) must be $\leq 30\%$ and System Performance Check Compounds (SPCCs) must be ≤ 0.050 from the response factor	1) Repeat individual sample analysis 2) Check calculations 3) Perform maintenance on GC, especially leak check 4) Clean ion source 5) Prepare new calibration standards and repeat analysis
SPCC standard	Daily (or every 12 hours)	Minimum response for SPCCs of 0.050	1) Repeat individual sample analysis 2) Check calculations 3) Perform maintenance on GC, especially leak check 4) Clean ion source 5) Prepare new calibration standards and repeat analysis
CCC standard	Daily (or every 12 hours)	Percent difference for each compound must be less than 20% relative to the mean of the calibration curve	1) Repeat individual sample analysis 2) Check calculations 3) Perform maintenance on GC, especially leak check 4) Clean ion source 5) Prepare new calibration standards and repeat analysis
Method Blank	With every extraction batch	All analytes $< 5 \times$ MDL	1) Repeat analysis 2) Flag data

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Table 4-6 (Continued)

Quality Control Check	Frequency	Acceptance Criteria	Corrective Action
Duplicate and Replicate Analyses	Duplicate and/or Replicate samples only	$\leq 10\%$ RPD for concentrations greater than 1.0 $\mu\text{g/mL}$.	1) Check integration 2) Check instrument function 3) Reanalyze duplicate samples

Surrogate compound recoveries nitrobenzene-d5 2-fluorobiphenyl <i>p</i> -terphenyl-d14 phenol-d6 2-fluorophenol 2,4,6-tribromophenol	Every sample/blank and laboratory control standard	±30%	1) Repeat analysis 2) Flag data
LCS	Every 20 samples	To be determined by control charting used in laboratory. Refer to Tables 6 and 7 in 8270C	1) Flag data for extraction problem
Internal Standard Response	Every sample/blank/LCS	-50 to 100% from that in the midpoint standard level of the most recent initial calibration	1) Repeat analysis 2) Flag data

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Table 4-7

Summary of Quality Control Procedures for Analysis of Semivolatile Organic Samples for PAHs (EPA Compendium Method TO-13A⁽²⁰⁾)

Quality Control Check	Frequency	Acceptance Criteria	Corrective
DFTPP instrument tune check	Daily prior to calibration check and sample analysis; every 12 hours if instrument is operated 24 hours/day	Evaluation criteria in Table 3 of EPA Compendium Method	1) Re-tune instrument 2) Clean ion source instrument; re-analyze new tune check standards
Five-point calibration standard	Following any major change, repair, or maintenance if daily quality control check is not acceptable. Minimum frequency every six weeks, more frequently if required.	Minimum Relative Response Factor, Maximum % Relative Standard Deviation, and Maximum % Difference shown in Table 7 of EPA Compendium Method TO-13A for each compound	1) Repeat individual analyses 2) Check calibration Perform maintenance especially leak check source 5) Prepare new standards and reanalyze

Method Blank	With every extraction batch	All analytes < 5 x MDL	1) Repeat analysis 2) Flag data Duplicate and Repl
Duplicate and/or Replicate Analyses	Duplicate and/or Replicate samples only	≤ 10% RPD for concentrations greater than 1.0 µg/mL	1) Check integration 2) Check instrument 3) Re-analyze dupli
Surrogate compound recoveries: Laboratory surrogates fluorene-d ₁₀ pyrene-d ₁₀ Field Surrogates fluoranthene-d ₁₀ L:\LABPROJ\0190\0190-01\QAPP 2004\SECT4.WPD benzo(a)pyrene-d ₁₂	Every sample/blank and laboratory control standard	± 30%	1) Repeat analysis 2) Check calculation 3) Flag data

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Table 4-7 Continued

Quality Control Check	Frequency	Acceptance Criteria	Corr
LCS	Every 20 samples	To be determined by control charting used in laboratory.	1) Flag da preparation
Internal Standard Response: 1,4-dichlorobenzene-d ₄ naphthalene-d ₈ acenaphthylene-d ₁₀ chrysene-d ₁₂ perylene-d ₁₂	Every sample/blank/LCS	-50 to 100% from the midpoint standard level of the most recent initial calibration	1) Repeat 2) Flag da

Table 4-8 Summary of Quality Control Procedures for Dioxin Analysis (Method 23⁽²³⁾)

Parameter	Frequency	Acceptance Criteria	Corrective Action	Document
Method blank	Every 20 samples	>CRDL	1. Analyze an instrument blank to demonstrate instrument is free of possible contamination. 2. Evaluate whether entire sample batch needs re-extraction.	Compounds associated with value in the method flagged with a "B" or "Ls".
Instrument blank	Daily	>CRDL	1. Determine cause of contamination. 2. Analyze an acceptable instrument blank prior to analyzing analytical sequence.	Resolve blank problem before proceeding.
Initial calibration standards	Monthly	* See Table 8 of CAS-Houston SOP: HRMS-M23	Reanalyze standards. If still unacceptable, remake standards and reanalyze.	Resolve ICAL standard problems before proceeding.
Continuing calibration verification standard	Every 10 samples	* See Table 8 of CAS-Houston SOP: HRMS-M23	Reanalyze standard. If still unacceptable, recalibrate and reanalyze samples from last acceptable continuing calibration standard	Comment in case of problem.
LCS	One per batch	50%>value<150%	Reanalyze LCS. If still unacceptable, reanalyze samples.	Resolve LCS problem before proceeding.
Laboratory control standard duplicate (LCSD)	One per batch	>50% RSD	Reanalyze LCSD. If still unacceptable, check instrument with continuing calibration verification standard.	Comment in case of problem.
Recovery of labeled standards - surrogate	Every sample	Outside acceptable QC limits for ion abundance ratios	Report values and flag results.	Flag associated results with "Y".
Labeled standard ions	Every sample	Outside QC limits for ion abundance ratios	Report values and flag results.	Flag associated results with "Z".
Native ions	Every sample	Outside QC limits for ion abundance ratios	Report as EMPC.	Flag associated results with "K".

Please note that re-extraction may not always be a possible corrective action solution when working with XAD traps. Resampling is the most appropriate corrective action.

* Refer to CAS QAPP in Appendix E

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Table 4-9

Summary of Quality Control Procedures for Metals Analysis (Method IO-3.5⁽²⁹⁾) and Hexavalent Chromium (CARB 039⁽³⁰⁾)

Parameter	Frequency	Acceptance Criteria	Corrective Action
Multipoint calibration standards	Daily	Correlation coefficient ≥ 0.995	1) Repeat analysis of calibration standards. 2) Reprepare calibration standards and reanalyze.
Calibration check standard	Daily	Recovery 90-110%	1) Repeat analysis of calibration standard. 2) Repeat analysis of calibration standard. 3) Reprepare calibration standards and reanalyze.
Continuing calibration verification standard	Every 10 samples	Recovery 90-110%	1) Repeat analysis of continuing verification sample. 2) Reprepare calibration standard and reanalyze. 3) Reanalyze sample until acceptable continuing calibration verification.
Duplicate and/or replicate analysis	On all duplicate samples/one every 10 samples	Relative standard deviation of $\pm 15-20\%$ for all samples above 5 times the MDL	1) Repeat analysis. 2) Flag data.
Method blanks	Every 10 samples	Analytes below MDL	1) Reanalyze. 2) Reprepare blank and reanalyze. 3) Correct contamination and reanalyze blank. 4) Repeat analysis of blank samples since last clean blank.
LCS	One sample per batch	Recovery 90-110%	1) Reprepare sample batch. 2) Reanalyze.

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SECTION 5

SPECIAL TRAINING REQUIREMENTS/CERTIFICATION

The activities of the EPA National Monitoring Programs are performed using

accepted EPA, National Institute for Occupational Safety and Health (NIOSH), and Occupational Safety and Health Administration (OSHA) sampling and analytical protocols and requiring the efforts of field sampling personnel and analytical laboratory staff.

5.1 Field Activities Training Personnel

Field activities training personnel involved in this project have from 1 to 27 years of experience in the duties they will be performing in the field. The training of ERG field activities training personnel is recorded in the ERG Training Records database. It is the responsibility of the trainee and the laboratory's System Administrator to keep the Training Records up to date. Special certification is not needed for an operator to set up the sampling systems. Each State should document and record the training of their personnel on the field testing procedures provided by ERG.

The States' field testing staff will be subject to on-site surveillance by the EPA and ERG Task Leader with appropriate corrective action enforced, if necessary. ERG personnel setting up the sampling equipment will also be subject to on-site surveillance by the ERG Task Leader with appropriate corrective action enforced, if necessary. ERG provides employee training, with specialized, in-house training classes and on-the-job training by supervisors and co-workers. The appropriate Standard Operating Procedures (SOPs) used during training are presented in Appendix C. ERG does not provide SOPs for sampling systems that we do not maintain.

The monitoring sites may be inside a sampling building or outside. There are no unusual hazards and no special safety training or equipment is required. All ERG field activities training personnel will follow the ERG Corporate Health and Safety Plan. The ERG Task Leader will

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pay special attention to potential heat or pollutant exposure on a daily basis as conditions change at the site.

5.2 Analytical Laboratory Personnel

Analytical laboratory personnel involved in this project have been trained in their tasks and have from 2 to 28 years of experience in the duties they will be performing in the analytical laboratory. Training of ERG laboratory personnel is recorded in the ERG Training Records in an Access[®] database. It is the responsibility of the trainee and the laboratory's System Administrator to keep the Training Records up to date. Special certification is not needed for the analysis of the ambient samples received from the States.

ERG maintains appropriate SOPs for each of the analytical methods. These SOPs are presented in Appendix C. Laboratory staff will be subject to on-site surveillance by the Quality Assurance staff. The samples involved in this program are being generated by monitoring of air emissions. No unusual hazards are expected and no special safety training or equipment will be required to perform the analyses. The laboratory will adhere to the ERG Corporate Health and Safety manual.

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SECTION 6

DOCUMENTATION AND RECORDS

The EPA National Monitoring Programs are a collection of individual ambient monitoring programs that generate a number of documents and records that need to be

retained/archived. In this QAPP, ERG uses the term reporting package (defined as all of the information required to support the concentration data reported to EPA and the States), including all data required to be collected as well as support data deemed important by ERG.

6.1 Information Included in the Reporting Package

6.1.1 Data Management

ERG has a structured records management retrieval system that allows for the efficient archive and retrieval of records. The ambient air toxics information that is collected in the laboratory will be included in this system. Each laboratory archives the data from the computer systems on a compact disk (CD) or removable cartridge hard drive. All data are then stored on location in a temperature-controlled environment for up to five years after the close of each contract. The laboratory paper copies of all analyses are stored on site in a secured temperature-controlled laboratory area for easy retrieval. The Program Manager has final authority for the storage, access to, and final disposal of all records kept for the EPA National Monitoring Programs.

6.1.2 Annual Summary Reports Submitted to EPA

Hard copies of the final report are presented to the EPA contacts at the end of the sampling period. State/local/tribal agencies receive electronic copies

(i.e., .pdf files).

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The report is submitted by April 1 of each year for the data collected from January 1 to

December 31 of the previous year.

The report contains the following information:

- Names of participating sites, including city name, location and the AQS codes;
- Background information on the methodology used to present and analyze the data;
- General summary of the year's results;
- Discussion of different trends for the hydrocarbons, halogenated hydrocarbons, polar compounds, and carbonyls, as well as any HAPs compounds chosen for analysis;
- Discussion of precision and accuracy and other prevalent QC concerns; and
- Yearly discussions of conclusions and recommendations.

The final copy of the annual report is stored on CD for easy access. If corrections are needed after the final report is presented to the EPA, the report is easily retrieved and corrections are sent to all relevant personnel.

6.2 Data Reporting Package Format and Document Control

All raw data required for the calculation of air toxics concentrations, the submission to the EPA/AQS database, and QA/QC data are collected electronically or on data forms that are included in the field and analytical methods sections. All hardcopy information is filled out in indelible ink. Corrections are made by inserting one line through the incorrect entry, initialing the correction (ERG maintains a signature log), and placing the correct entry alongside the incorrect entry, if this can be accomplished legibly, or by providing the information on a new line.

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6.2.1 Notebooks

ERG issues laboratory notebooks to each laboratory division upon request. This notebook is uniquely numbered and associated with the laboratory personnel. Although data entry forms are associated with all routine environmental data operations, the notebooks can be used to record additional information about these operations.

Field Notebooks -Field notebooks are the responsibility of the EPA, States, local or tribal agencies.

Laboratory Notebooks - Numerous notebooks are used throughout the laboratory for each individual analytical procedure. Other notebooks are associated with general procedures such as temperature records for the refrigerators, calibration of analytical balances, sample preparation logs, etc., used in this program.

Sample Shipping and Receipt - ERG's LIMS system is used to record samples received. Copies of chain of custody records are also maintained.

6.2.2 Electronic Data Collection

In order to reduce the potential for data entry errors, automated systems are utilized where appropriate and record the same information that is found on data entry forms. In order to provide a back-up, hardcopy data collected on an automated system will be stored for 5 years after the end of each contract term of the National Program with EPA.

6.3 Data Reporting Package Archiving and Retrieval

In general, all the information listed above will be retained for at least 5 years from the date of the end of the closed contract with EPA. However, if any litigation, claim, negotiation, audit or other action involving the records has been started before the expiration of the 5-year period, the records will be retained until completion of the action and resolution of all issues which arise from it, or until the end of the regular 5-year period, whichever is later.

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B—MEASUREMENT DATA ACQUISITION

SECTION 7

SAMPLING PROCESS DESIGN

Sampling procedures for the NMOC, UATMP and Hexavalent Chromium programs are discussed in this section. ERG provides site-specific support for the PAMS and HAPs sampling. All parameters listed in this section should be considered critical for the projects listed below.

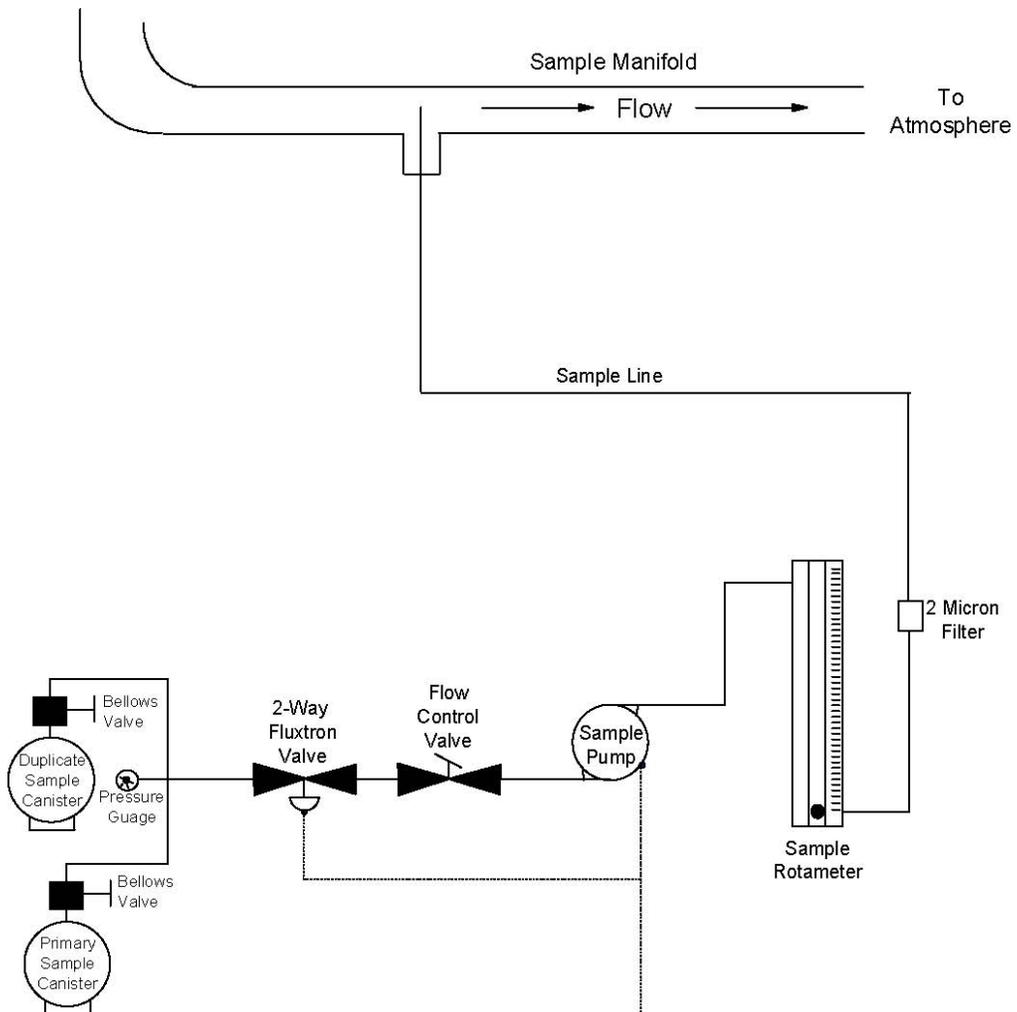
7.1 NMOC and SNMOC Sampling

Sampling for NMOC and SNMOC takes place each workday from the beginning of June to the end of September at designated NMOC and SNMOC sites from 6:00 a.m. to 9:00 a.m., standard time. Sampling procedures have been discussed in detail in other documents.^(1,30) Figure 7-1 is a diagram of the sampling system used for collecting the

ambient air samples. Evacuated stainless steel canisters are shipped daily from ERG's Research Triangle Park (RTP) Laboratory to the NMOC and SNMOC sites. Canisters are connected by local operators to the sampling system as shown. The timer will automatically activate the pump and solenoid valve to start and stop sample collection. The pump will pressurize air samples during the sampling period to about 15 psig, and the flow control valve orifice will ensure a constant sampling rate over the 3-hour period (a 2 micron stainless steel filter is installed in the sampling line and removes particulate from the ambient air that may damage or plug the critical orifice). The sample intake point ranges from 3 to 10 meters above ground level.

ERG installs the sampling systems at the local site and trains designated local operators on site. It is the responsibility of the local operators to operate the sampling apparatus and complete the field sample data form that ERG supplies with each canister. ERG staff maintain telephone contact throughout the project to provide whatever assistance is needed to resolve technical issues that arise during the course of the program.

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2 Micron Filter

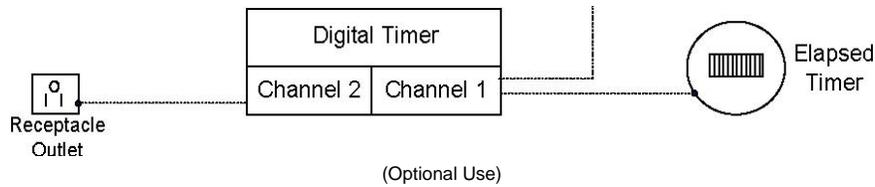


Figure 7-1. NMOC, SNMOC, and 3-Hour Air Toxics Sampling System Components

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ERG creates a sampling schedule (Appendix A), including the appropriate number of samples, when sites are specified and site requirements are established.

All NMOC and SNMOC sites are usually scheduled to begin sampling at the beginning of June and continue to the end of September. With a 3-hour ambient air sample, both PDFID, SNMOC, and air toxics measurements may be performed on the same canister if enough pressure remains in the canister. It is recommended that any aliquots for analysis be taken from the canister on successive days to allow equilibration between analyses.

7.1.1 Air Toxics Compounds Sampling

The 3-hour air toxics samples under the NMOC program are analyzed from the same canisters as the NMOC and/or SNMOC samples. Refer to Section 7.2 for sampler certification.

7.1.2 Carbonyl Compounds Sampling

Carbonyl samples are collected using DNPH impregnated sampling cartridges with an integrated sampling system (e.g., stand-alone pumps, capillary critical orifices, ozone scrubbers ahead of the DNPH cartridges), shown in Figure 7-2.

7.2 UATMP Sampling

Prior to installation of the UATMP sampler at a site, the sampler is certified at the ERG RTP laboratory for performance capability and qualified for cleanliness. To certify the sampling system, cleaned, humidified air is flushed through the sampler for at least 48 hours to remove organic contaminants in the system. The cleaned, humidified air is then analyzed following EPA Compendium Method TO-15⁽¹⁷⁾ and the results placed in a permanent file to record any contamination. The samplers are then challenged with a mixture of known concentration to qualify the sampler. These results are placed in a permanent file.

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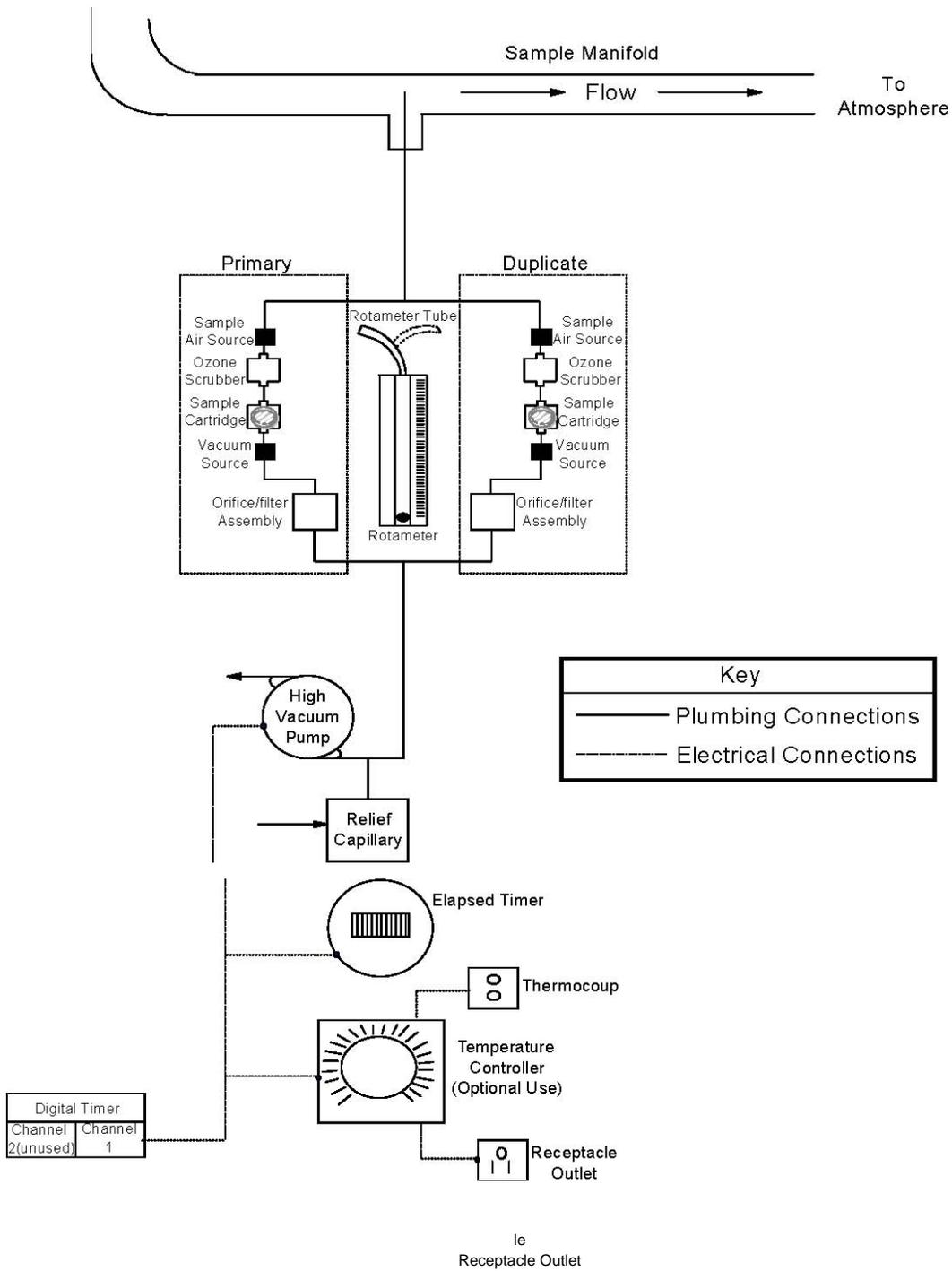


Figure 7-2. Carbonyl Sampling System

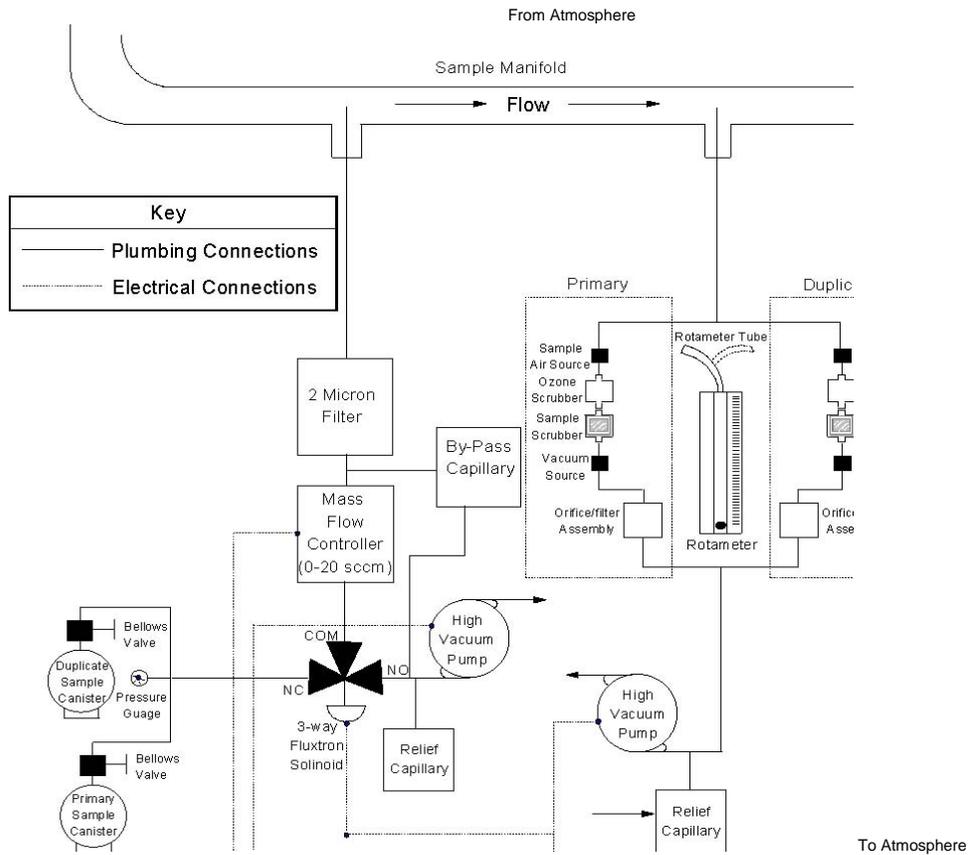
The 2004 UATMP sampling frequency is presented in Section 3. ERG establishes a sampling frequency for the UATMP sites each year when the sites are identified. A total of 30 sampling days will be scheduled per site program for a 12-day sampling schedule and 60 sampling days for the 6-day sampling schedule. Days for duplicate and field blank sampling will also be designated.

Integrated ambient air samples are collected in 6-liter stainless steel SUMMA[®]-treated canisters for a 24-hour period beginning at midnight. Cleaned quality-controlled canisters are shipped to the site under vacuum from the ERG RTP laboratory. After sampling, the final pressure in the canister should be between 2 and 7 in. Hg vacuum.

The sampling assembly for the UATMP sample collection is shown in Figure 7-3. The physical mechanism for filling the canister is vacuum displacement. The high vacuum pump shown in Figure 7-3 is used to purge the mass flow controller and the sample inlet lines. A second high vacuum pump is used to draw ambient air through the carbonyl sampling probe and cartridges.

7.2.1 Carbonyl Compounds Sampling

Carbonyl sampling occurs at UATMP sites at the same time as the canister samples are taken. A potassium iodide coated denuder ozone scrubber and DNPH sampling cartridges are connected in series to the UATMP sampler as shown in Figure 7-2 when the 6-liter canisters are connected, and ambient air is drawn through the cartridges through a separate sampling probe. A total of 30 sampling cartridges for 12-day sampling and 60 sampling cartridges for 6-day sampling will be analyzed per site, excluding ten percent duplicate samples and ten percent field blanks per season.



Sample Air Source Ozone Scrubber Sample Scrubber

Vacuum Source

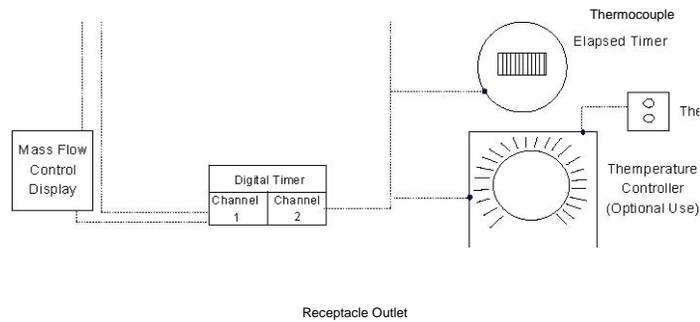


Figure 7-3. Sampling Assembly for the UATMP

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7.3 PAMS Sampling

PAMS sampling is performed completely by the PAMS sites in accordance with the TAD,⁽³⁾ with ERG supplying only such support as requested (e.g., sampling system and training, automated GC systems). ERG ships cleaned canisters and prepared carbonyl compounds sampling cartridges to the PAMS sites on the appropriate schedule to support the sampling program, and the samples are shipped to the ERG RTP laboratory for analysis. Exact provision for support of automated GC systems is site specific.

7.4 HAPs Sampling

HAPs sampling is performed completely by the sites in accordance with the methods listed in Table 3-5. ERG may supply sampling media (if requested) and receives the samples from the sites for analysis only.

7.4.1 Hexavalent Chromium

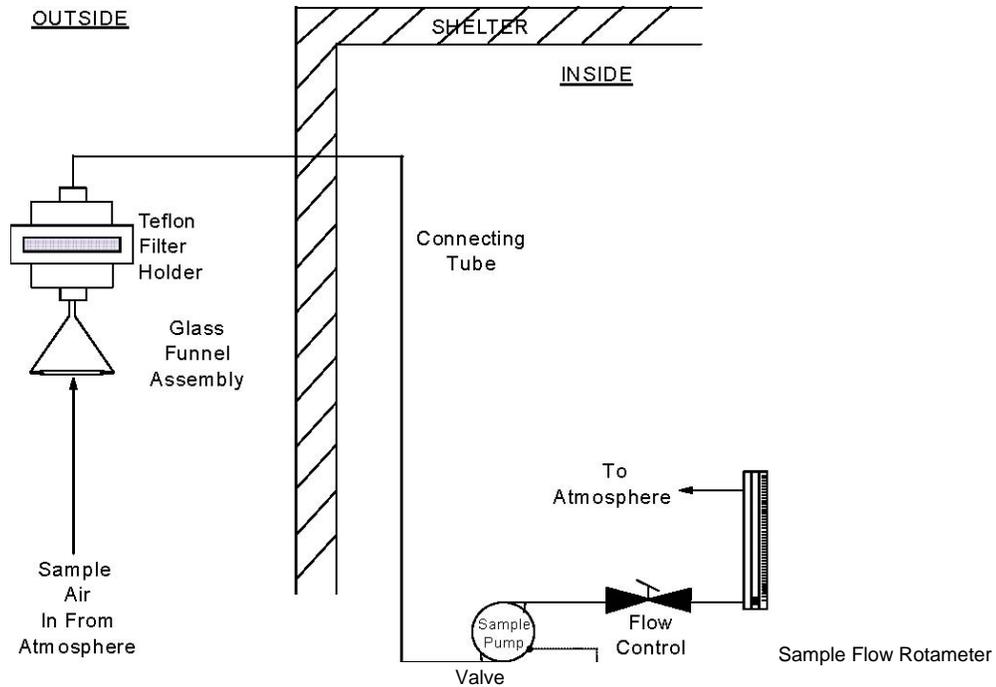
Sodium bicarbonate-impregnated filters are connected to the Hexavalent Chromium sampler as shown in Figure 7-4 and ambient air is drawn through the filters through a glass sampling probe using Teflon sampling lines at a point as close to the ambient air monitoring point as possible. Prepared filters are shipped to each site for the hexavalent chromium sampling. A total of 30 samples for the 12-day sampling schedule and 60 samples for the 6-day sampling schedule will be analyzed per site. Additionally, duplicate samples and field blanks will be collected and analyzed at a rate of 10% of the volume of samples.

ERG ships the bicarbonate-impregnated sodium filters to each site in coolers (chilled with blue ice packs). The samples are also collected for a 24-hour period. After sampling, the filters are removed from the sampling apparatus, sealed, and returned to the ERG RTP laboratory in the coolers in which they were received. Disposable polyethylene gloves are used by the field operators when

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handling the filters to reduce background contamination levels. Additional qualifying information for the hexavalent chromium sampling and analysis techniques is presented in the California Air Resources Board Method 039⁽³⁰⁾ and specific details are provided in ERG's SOP (ERG-MOR-063) presented in Appendix C.



Key Plumbing Connections Electrical Connections

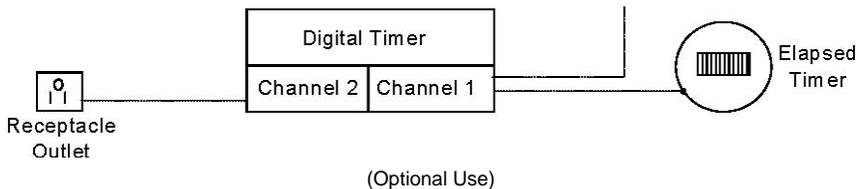


Figure 7-4. Hexavalent Chromium Sampling System

SECTION 8

SAMPLING METHOD REQUIREMENTS

The sampling methods that are used in this program are described in this Section. Since there are four separate sampling systems and subsequently four separate analytical

techniques, each of the sampling methods is different. General QC handling requirements are crucial for all sampling, so in that aspect, sample handling is similar.

Because ERG is not responsible for actual execution of the field sampling in this program, the ERG SOPs list general sampling guidelines needed for the NMOC, UATMP, Carbonyl and Hexavalent Chromium sampling. Table 8-1 identifies the different methods and SOP numbers for operation of each of the different samplers that ERG provides. Because other HAPs sampling is not addressed in the NMOC/UATMP/PAMS contract, other samplers are not discussed in this QAPP.

Table 8-1

EPA Methods and ERG SOPs for each Sampling System

Sampling System	Applicable Method	ERG SOP Number
NMOC	EPA Compendium Method TO-12 ₍₁₁₎	ERG-MOR-046
UATMP	EPA Compendium Method TO-15 ₍₁₇₎	ERG-MOR-003
Carbonyl	EPA Compendium Method TO-11A ₍₁₈₎	ERG-MOR-047
Hexavalent Chromium	Modified CARB Method 039 ₍₃₀₎	ERG-MOR-013

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SECTION 9

SAMPLE HANDLING AND CUSTODY REQUIREMENTS

Similar canister sample custody procedures are followed for all monitoring programs. However, program-specific differences exist because the canister cleanliness requirements and the analytical requirements for the three programs vary. Because these activities are conducted under one EPA program, all shipping to and from the

States will be handled by Federal Express with Overnight Delivery. Unless special procedures are listed below, the samples taken in the field should not require any extra precautions for shipping.

9.1 NMOC, SNMOC, and UATMP Sample Custody

9.1.1 NMOC Sampling Field Data Forms

A color-coded, three-copy canister sample chain of custody form (Figures 9-1 and 9-2) is shipped with each 6-liter canister to an NMOC, SNMOC or UATMP site. If duplicate samples are to be taken, two canisters and two data sheets are sent in the shipping container to the site. When a sample is taken, the site operator fills out the field data form according to the instructions in the NMOC, SNMOC or UATMP on-site notebook. The site operator detaches the pink copy, inserts it in the on-site notebook, and sends the remaining copies with the canister in the shipping container to ERG's laboratory.

Upon receipt, the sample canister vacuum/pressure is compared against the field documented vacuum/pressure to ensure the canister remained airtight during transport. If any leaks are detected, the sample is voided. The sample specific information from the chain of custody sheets is then entered into the Laboratory Information Management System (LIMS) (login information is shown in Figure 9-3), given a unique ERG identification (ID) number, and tagged (see Figure 9-4), noting the site location and the sample collection date.



EASTERN RESEARCH GROUP, INC.

ERG Lab ID #: _____

NMOC Sample Data Sheet

LAB PRE SAMPLING	Site Code: _____ City / State: _____ AIRS Code: _____ Collection Date: _____ Options NMOC (Y/N): _____ SNMOC (Y/N): _____ TOXICS (Y/N): _____	Canister Number: _____ Lab Initial Can. Press. ("Hg): _____ Duplicate Event (Y/N): _____ Duplicate Can #: _____ Date Can. Cleaned: _____ Cleaning Batch #: _____
FIELD SETUP	Operator: _____ Sys. #: _____ Setup Date: _____ Field Initial Can. Press. ("Hg): _____	Rotameter Setting: _____ Elapsed Timer Reset (Y/N): _____ Canister Valve Opened (Y/N): _____
FIELD RECOVERY	Recovery Date: _____ Field Final Can. Press. (psig): _____	Sample Duration (hours): _____ Elapsed Time: _____ Canister Valve Closed (Y/N): _____
LAB RECOVERY	Received by: _____ Date: _____ Sample Login Date: _____ If void, why: _____	Lab Final Can. Press. (psig): _____ Status (valid/void): _____
NMOC	Analyst: _____ Date: _____ NMOC Instrument: _____ Inj. 1 (AC): _____ (ppmC): _____ Inj. 2 (AC): _____ (ppmC): _____ Inj. 3 (AC): _____ (ppmC): _____ Average AC: _____ Standard Dev. (AC): _____ Average Conc. (ppmC): _____ Standard Dev. (ppmC): _____	Database entry by: _____ Date: _____ Data File Name: _____ Dup. File Name: _____ Rep. File Name: _____
SNMOC Option	Analyst: _____ Data File Name: _____ Dup. File Name: _____	Date: _____ Rep. File Name: _____
TOXICS Option	Analyst: _____ Data File Name: _____ Dup. File Name: _____	Date: _____ Rep. File Name: _____

Comments:

White: Sample File Copy Yellow: Receiving Copy Pink: Field Copy

Figure 9-1. Example NMOC Chain of Custody



ERG Lab ID #: _____

Toxics/SNMOC Sample Data Sheet

LAB PRE SAMPLING	Site Code: _____ City / State: _____ AIRS Code: _____ Collection Date: _____ Options SNMOC (Y/N): _____ TOXICS (Y/N): _____	Canister Number: _____ Lab Initial Can. Press. ("Hg): _____ Duplicate Event (Y/N): _____ Duplicate Can #: _____ Date Can. Cleaned: _____ Cleaning Batch #: _____
FIELD SETUP	Operator: _____ Sys. #: _____ Setup Date: _____ Field Initial Can. Press. ("Hg): _____	MFC Setting: _____ Elapsed Timer Reset (Y/N): _____ Canister Valve Opened (Y/N): _____
FIELD RECOVERY	Recovery Date: _____ Field Final Can. Press. ("Hg): _____	Sample Duration (3 or 24 hr): _____ Elapsed Time: _____ Canister Valve Closed (Y/N): _____
LAB RECOVERY	Received by: _____ Date: _____ Sample Login Date: _____ If void, why: _____	Lab Final Can. Press. ("Hg): _____ Status (valid/void): _____
SNMOC	Analyst: _____ Date: _____ Data File Name: _____ Dup. File Name: _____ Rep. File Name: _____	
TOXICS	Analyst: _____ Date: _____ Data File Name: _____ Dup. File Name: _____ Rep. File Name: _____	

Comments:

Figure 9-2. Example Toxics/SNMOC Chain of Custody

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Samples - 4012109 [Intertribal Council of MI - ITCMI]

Sample Name: ITCMI

Lab Matrix: Air | Sampled [Eastern]: 01/16/04 00:00

Report Matrix: Air | Sampled Begin: 01/16/04 00:00

Sample Type: Field Sample | Sampled By: []

Sample Comments: []

Container	Location
A 6L Summa Canister	Room 177
*	

Work Order Analyses: TO-13

Modify Analyses included for this sample

Analysis	Subanalysis	Comments	TAT	Due	Hold
TO-15			45	03/06/04 12:00	30

Buttons: Add, Edit, Copy, Delete, << Work Orders, Done

Analysis: _____
Sample ID: _____
Laboratory ID: _____
Date Sampled: _____
Canister #: _____ Press/Vac: _____
Site: _____ Dup/Rep: _____
Comment: _____

Analysis: _____ Sample ID: _____
Laboratory ID: _____ Date
Sampled: _____ Canister #: _____ Press/Vac: _____
Site: _____ Dup/Rep: _____ Comment: _____

Figure 9-4. Canister Tag

The remaining copies of the canister sample data sheet are separated; the white copy is stored with the canister until analysis is complete and the yellow copy is stored chronologically in the receiving notebook. The sample ID number is presented on the canister tag and on all ERG copies of the data sheet.

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9.1.2 NMOC Invalid Sample

The canister sample chain of custody form may indicate that the sample sent from a site is invalid. When a sample is designated as invalid, the assigned ERG ID number is voided and is invalidated on the individual respective chain of custody form. The sites will be notified in the analytical reports of any invalid samples. If the site seems to have problems taking a valid sample, normally two voids in a row, the ERG site task leader will work with the site personnel to eliminate the problem.

9.1.3 NMOC Sample Analysis Forms

The ERG NMOC analyst completes the canister sample data sheet-NMOC section and NMOC Calibration Form (Figure 9-5), which must include the following items:

- Critical instrument parameters (checklist format)
- Sample canister number
- Analysis date
- Sequential ERG ID
- The analyst's name
- Calibration cylinder used
- Analysis start time

- Results of the NMOC analysis (individual replicates and NMOC average).

The information from the daily calibration form is added to the computer data file. NMOC Calibration Forms are filed consecutively by ERG Sample ID number in a three-ring analysis notebook for permanent record.

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NMOC Calibration Form

Date:

FID Instrument (A-D): Analyst

Hydrogen Pressure:

Air Pressure:

Propane Calibration Cylinder No.: Label Concentration: ppmv Actual Concentration:
ppmv

ppmC Propane Initial Daily

Calibration: Time: (DST) Zero Air AC Propane AC

$\bar{X} =$

$\bar{X} =$

ppmC Propane

Calibration Factor =

(Propane AC - Zero Air AC)

=()

[() - ()] Final Calibration: Time: (DST) Zero

Air AC Propane AC

$\bar{X} =$

X =

ppmC Propane

Calibration Factor =

(Propane AC - Zero Air AC)

= () / [() - ()]

Figure 9-5. NMOC Calibration Form

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9.1.4 NMOC Canister Log

All canisters are cleaned prior to reuse using SOP ERG-MOR-062 (*Standard Operating Procedure for UATMP and NMOC Canister Cleaning*). All canisters, whether used for NMOC, UATMP, or PAMS, are cleaned by the same procedure and are entered into the canister cleanup log, shown in Figure 9-6.

9.1.5 Canister Analytical Routing Schedule

The canisters received from the monitoring sites are placed in the laboratory by ERG staff. The canister analysis hold time is 30 days from the sampling date.

For the sites for which 3-hour air toxics will be analyzed, ten 3-hour air toxics samples per site are selected from the NMOC samples at random. After NMOC analyses (PDFID), the samples are sent to the ERG Air Toxics Laboratory for UATMP and speciated NMOC/PAMS (GC/FID/MS) analysis.

9.1.6 SNMOC/UATMP/PAMS Analysis Log

Figure 9-7. SNMOC/UATMP/PAMS Analysis Log

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SAMPLE DATE Date the sample was taken.

ANALYSIS DATE Date the analysis was performed.

STANDARD REF. No. Standard reference number. For samples and system blanks the column is left blank or indicated by "NA."

MS METHOD Method used to acquire MS data in HP Chemstation.

FID METHOD Method used to acquire FID data in HP Chemstation.

LOAD VOLUME The load volume is recorded in milliliters according to the autosampling system.

CAN NO. Canister reference number

ANALYST Analyst initials

COMMENTS Any appropriate comments relative to the analysis.

9.2 Carbonyl Sample Custody

Figure 9-8 shows the multipage chain of custody form used for all carbonyl sampling documentation. A chain of custody is shipped to the site with blank carbonyl tubes if the tubes are provided by ERG, or blank data sheets are provided to sites supplying their own tubes for sampling. After sampling, the field data sheet is completed by the site operator and a copy retained for site records. The carbonyl sample tubes and

field data sheet are shipped to ERG's analytical laboratory.



ERG Lab ID #: _____

Carbonyl Compounds Data Sheet

LAB PRE-SAMP.	Site Code: _____ City / State: _____ AIRS Code: _____	Collection Date: _____ Cartridge Lot #: _____ Duplicate Event (Y/N): _____
FIELD SETUP	Setup Date: _____ Operator: _____ Sys. #: _____ Pre-Sampling Rotameter Reading (cc/min): _____ Elapsed Timer Reset (Y/N): _____	
FIELD RECOVERY	Recovery Date: _____ Sample Duration (3 or 24 hr): _____ Post Sampling Rotameter Reading (cc/min): _____ Elapsed Time: _____ Cartridges Capped (Y/N): _____	
LAB RECOVERY	Received by: _____ Date: _____ Refrigerator No.: _____ Status (valid/void): _____ Sample Login Date: _____ If void, why: _____ Sample volume (total Liters): _____	

	Sample Date	Sample Time	Sample Duration	Sample Volume	Cartridge Lot #	Sample ID	Lab ID
PAMS							

Comments:

White: Sample File Copy Yellow: Receiving Copy Pink: Field Copy

Figure 9-8. Example Carbonyl Compounds Chain of Custody

When samples are received, they are given an ERG sample ID number and logged into the LIMS (see figure 9-3). The database records each carbonyl sample; the carbonyl tubes and the field data sheet are put into a bag labeled with the ERG ID number, site code, sampling date, individual tube designations, and date of receipt and initials of receiving personnel. This sample bag is stored in a refrigerator designated for carbonyl samples. The carbonyl tubes are extracted within 14 days of the sampling day and analyzed within 30 days after extractions.

9.3 HAPs Sample Custody

Prepared sample media (i.e., XAD, PUF, filters, etc.) and documentation during the sample collection phase of the program will use pre-formatted forms supplied by ERG or the subcontractor (Columbia Analytical Services (CAS)) for dioxin analysis. Field testing personnel will record data on the appropriate chain of custody forms (Figures 9-9 and 9-10). The chain of custody forms provided by CAS are presented in their QAPP, which is Appendix E. The chain of custody forms provide for documentation of time, date, location, meteorological parameters and possibly some laboratory parameters. Other documentation that will be used in the field is the identification label shown in Figure 9-11. If Corrective Action is required during the field monitoring activities, the reason for the correction and action taken will be documented on the "Corrective Action Report" (Figure 9-12). All forms will be written in indelible ink. If correction is required on the form, a single line will be drawn through the erroneous entry and the correction will be dated and initialed. Any blank spaces will have a line drawn through to ensure that the space is not filled in later. All corrections will be authorized by the Site Coordination Task Leader.

All analytical laboratories will provide sample tracking forms, narratives describing any anomalies and any modifications to analytical procedures, data and sample handling records, and laboratory notes for inclusion in the final report. All laboratory electronic records will be recorded for archive on magnetic media, and all hardcopies of raw data will be included in the project archive file.

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	<div style="border: 1px solid black; padding: 5px; display: inline-block;"> ERG Lab ID #: _____ </div>
<h3>SVOC Sample Data Sheet</h3>	

Sampler I.D. No.:	Operator:
Lab XAD Sample No.:	Other:
Date Sampled:	
Sample Location:	

XAD Cartridge Certification Date:
Date/Time XAD Cartridge Installed:

Collection System Information:

	Elapsed Time	Temp (°C)	Barometric ("Hg)	Magnehelic ("H ₂ O)	Flowrate (std. m ³ /min)
Start					
End					
Average					

Total Collection Time (Minutes)	Total Collection Volume (std. m ³)
---------------------------------	---

Interim Flow Check Information:

Time	Temp	Barometric Pressure	Magnehelic Reading	Calculated Flow Rate (std. m ³)	Operator

Average					

Comments:

White: Sample File Copy Yellow: Receiving Copy Pink: Field Copy

Figure 9-9. Example SVOC Sample Chain of Custody

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LAB ID # _____

Post-Collection Pre-Collection

**Site Info.
 AMBIENT HEXAVALENT CHROMIUM DATA SHEET**

City/Location:
 AIRS No.
 Site Operator:

Set-Up Date:
 Collection Date:
 Filter I.D. No.:
 Initial Rotameter Setting (C.O.B.): (After 5 minutes warm-up)
 Programmed Start Time: Programmed End Time:
 Elapsed Timer Reset (Y/N):
 Comments:

Recovery Date:
 Final Rotameter Reading (C.O.B.): (After 5 minutes warm-up)
 Elapsed Time:
 Comments:

FOR LAB USE ONLY

Site Code:
 Date Received: Refrigerator No.:
 Collection Time (Minutes):
 -
 x Flowrate (cc/min):
 Total Volume of Air Sampled:

White: Sample File Copy Yellow: Receiving Copy Pink: Field Copy

Figure 9-10. Example Ambient Hexavalent Chromium Chain of Custody

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Site Name Site Address

Sampler Identification Sample Type Sampling Period Date Collected Signature

Figure 9-11. Label for Sample Identification

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**Corrective Action
 Report**

Originator:	Date:
Project Number:	Corrective Action Number:
Description of Problem:	State Cause of Problem:

(Give Date and Time Identified)	
State Corrective Action Planned: (Include Persons Involved in Action)	QA Officer Comments:
Signatures:	Project Manager Comments:
QA Officer:	
Project Manager:	
Originator:	

Figure 9-12. Corrective Action Report

All records generated by measurement activities are signed or initialed by the person performing the work and reviewed by an appropriate supervisor. Measurement results become part of a project report which is reviewed by a technical reviewer. All notebooks are kept in black ink, dated and signed by the person making the entries, and routinely inspected by the appropriate supervisor, as evidenced by his/her initials and date of inspection. Laboratory notebook maintenance procedures are regulated by Standard Operating Procedure, ERG-MOR-039, which is presented in Appendix C.

9.4 Sampling Monitoring Data

All data sheets from the monitoring sites will be collected at the end of each monitoring episode by the Task Leader and maintained in his custody throughout the monitoring program. The data sheets will be released to the report writer after a thorough debriefing. The original field data will remain in ERG custody and is eventually stored on file with the final report until 5 years after the end of the contract with EPA.

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SECTION 10

ANALYTICAL METHODS REQUIREMENTS

Analytical procedures are program-specific because the instrumentation and the target compounds of the four programs differ. The primary analytical instrument is PDFID for NMOC; GC/FID/MS for SNMOC, UATMP, VOCs and PAMS hydrocarbons; HPLC for carbonyls for UATMP and PAMS; GC/MS for Semivolatiles; Inductively Coupled Plasma Mass Spectrometer (ICPMS) for Metals; high resolution GC/high resolution MS (HRGC/HRMS) for dioxin; and ion chromatograph (IC) for Hexavalent Chromium. All samples taken for SNMOC, UATMP, or PAMS hydrocarbons can be

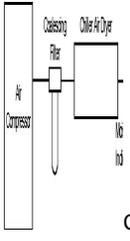
evaluated by GC/FID/MS because the instrumentation is collecting all of the data at the same time. All analytical method Standard Operating Procedures are provided in Appendix C (ERG), Appendix D (RTI), and Appendix E (CAS). The methods used for individual HAPs analysis will be added to this QAPP when the individual States request the analyses. Samples will not be analyzed until ERG receives approval from the EPA.

10.1 Canister Cleanup System

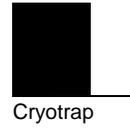
A canister cleanup system (Figure 10-1) has been developed and is used to prepare sample canisters for use and reuse after analysis (SOP ERG-MOR-062, *Standard Operating Procedure for UATMP and NMOC Canister Cleaning*). (see Appendix C). An oil-free compressor with an 80-gallon reservoir provides source air for the system. The compressor was chosen to minimize hydrocarbon contamination. A coalescing filter removes water mist and particulate matter down to a particle size of 10 microns and permeation dryers remove water vapor from the compressor source air. The permeation dryers are used with a moisture indicator to show detectable moisture in the air leaving the dryer.

Next, air is passed through a catalytic oxidizer to destroy residual hydrocarbons. The oxidizer is followed by an in-line filter for secondary particulate matter removal.

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Catalytic Pressure Oxidizer



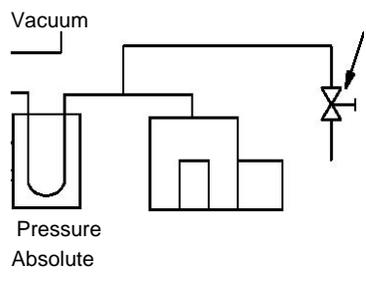
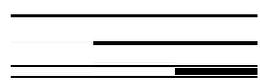
Cryotrap

Flow Regulator



Purge Valve Air Flow Rotameter

Wet Rotameter



Cryotrap



Turbomolecular Pump

Dry Rotameter

Vacuum Source



Roughing



Selector Valve

Air

Pump

Humidifi

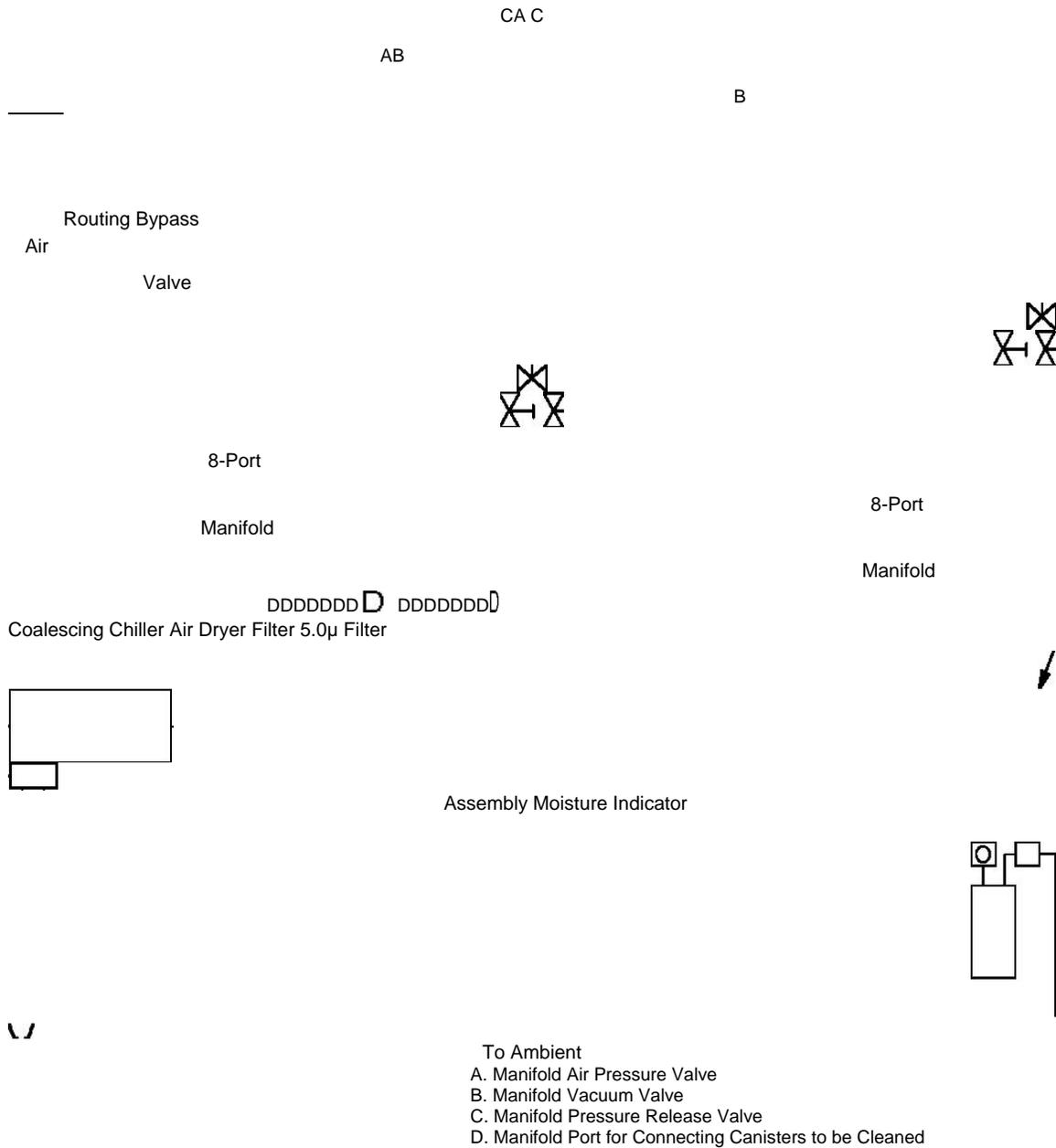


Figure 10-1. Canister Cleanup System Schematic

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A single-stage regulator controls the final air pressure in the canisters and a metering valve is used to control the flow rate at which the canisters are filled during a cleanup cycle. The flow direction is controlled by a separate rotameter, installed in the clean, dried air line. A shutoff valve exists between the clean dried air line and the humidifier system (which is a modified SUMMA[®]-treated 6-liter canister partially filled with HPLC-grade water). One flowmeter and flow-control valve direct the cleaned, dried air into the 6-liter canisters, where it is bubbled through the HPLC-grade water; a second flow-control valve and flowmeter allow air to bypass the canister/bubbler. By setting the flow-control valves separately, the downstream relative humidity can be regulated. A setting of 100% relative humidity is used for canister cleaning with the wet rotameter on and the dry rotameter off. Another shutoff valve is located between the humidifier and each 8-port manifold where the canisters are connected for cleanup.

The vacuum system consists of a Precision Model DD-310 turbomolecular vacuum pump, a cryogenic trap, an absolute pressure gauge, and a manifold vacuum valve connected as shown in Figure 10-1. The cryogenic trap prevents the sample canisters from being contaminated by back-diffusion of hydrocarbons from the vacuum pump into the cleanup system. The manifold vacuum valves enable isolation of the vacuum pump from the system without shutting off the vacuum pump.

After sample analyses are completed, a bank of eight canisters is connected to each manifold as shown in Figure 10-1, with each canister valve open and the air pressure, vacuum, and bellows valves closed. The vacuum pump is started and one of the bellows valves is opened, drawing a vacuum on the canisters connected to the corresponding manifold. After reaching 10 mm Hg absolute pressure, as indicated by the absolute pressure gauge, the vacuum is maintained for 30 minutes. The bellows valves are then closed and the cleaned, dried air that has been humidified is introduced into the evacuated canisters at a rate of 4.0 liters per minute until the pressures reach approximately 20 psig. This flow rate has been recommended by the manufacturer as the highest flow rate at which the catalytic oxidizers can handle elimination of

hydrocarbons with a minimum of 99.7% efficiency. The evacuation and pressurization of the canisters constitutes one cleanup cycle.

The cleanup cycle is repeated twice more during the canister cleanup procedure. Following the third pressurization, the canister valves are closed and the canister that had the highest pre-cleanup concentration is selected for cleanliness verification. The cleanliness of the canister is qualified by GC/MS analysis (one canister per bank of cleaned canisters - one canister per eight cleaned). The cleanliness criterion for each bank of eight canisters is 0.2 ppbv per analyte or the Method Detection Limit (MDL), whichever is greater. Upon meeting this criterion, the canister is reconnected to the cleanup manifold. All canister valves are opened and the canisters are evacuated to approximately 0.5 mm Hg absolute pressure for a fourth time, in preparation for shipment to the site.

10.2 NMOC Analytical Systems

A modified Hewlett-Packard dual-channel FID gas chromatograph is used to determine the NMOC concentrations in the ambient air samples shipped daily to the ERG RTP laboratory. Figure 10-2 presents a schematic of the NMOC system. The two analytical channels are designated as ERG Channels A and B. A specific volume (273 mL) of sample is drawn from the canister into a cryogenic trap and cooled with liquid argon. The NMOC fraction is condensed in the sample trap. The 6-port valve is changed to the "Inject" position, the liquid argon is removed, and the oven door of the chromatograph is closed. The oven is heated to 90°C at 30°C/min, and the NMOC is carried into the FID by the helium carrier gas. The results are reported on the data system of the instrument. The analytical procedure described is the PDFID method and is described in detail elsewhere, and in ERG SOP, *Standard Operating Procedure for PDFID Sample Analysis* (ERG-MOR-060).^(1-2, 4-10) (see Appendix C).

Sites requesting 3-hour toxic analysis will have selected samples analyzed by GC/FID/MS. The analytical procedures for the GC/FID/MS are described in

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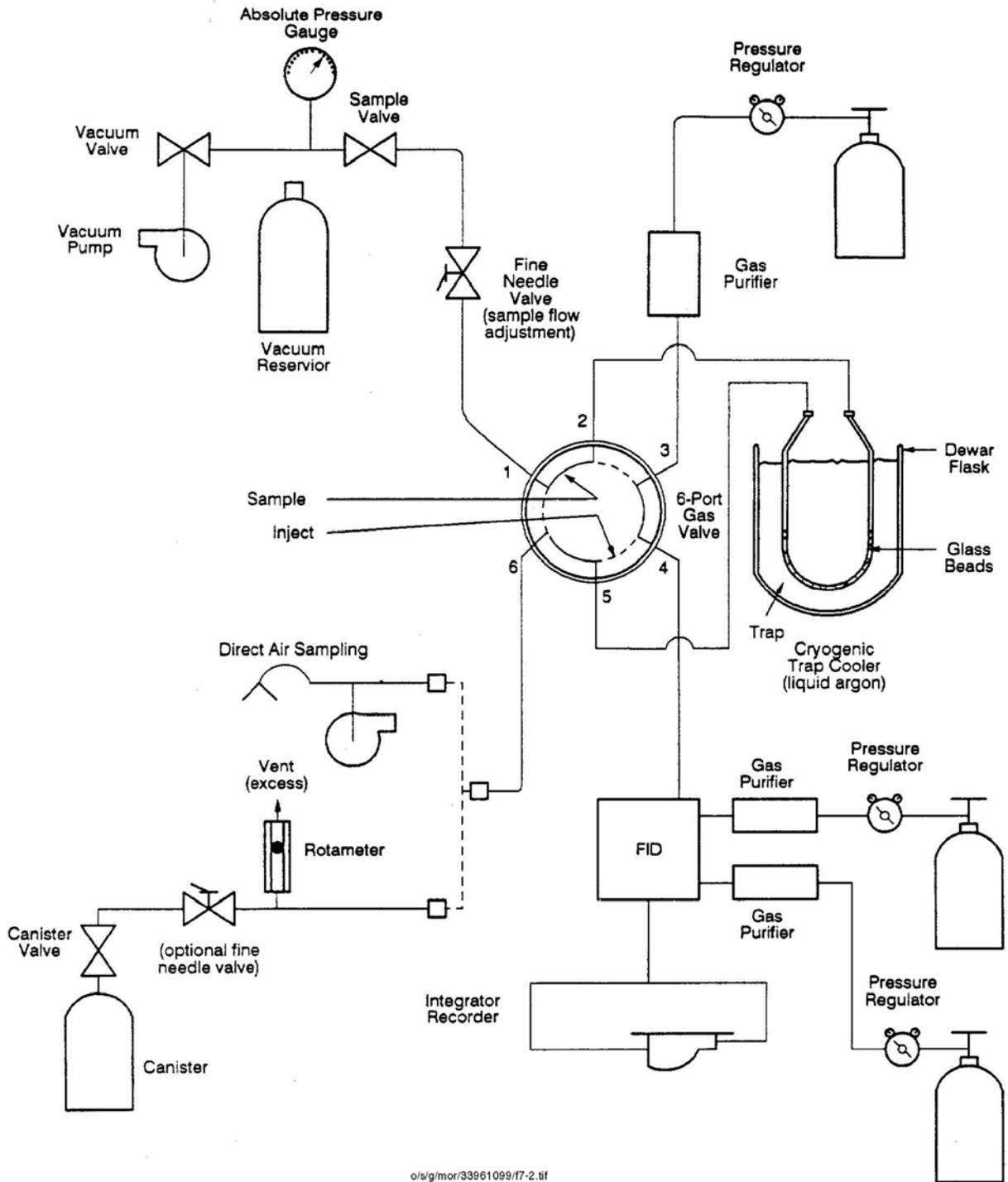


Figure 10-2. Schematic of Analytical Systems for NMOc

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Sites requesting carbonyl analysis will have samples analyzed by the HPLC. The

analytical procedures for the HPLC are described in Section 10.5.

10.3 SNMOC Analytical Systems

The SNMOC and 3-hour toxic analysis samples are analyzed by the same procedures described for UATMP GC/FID/MS in Section 10.4. The list of SNMOC target compounds is shown in Table 3-1.

Sites requesting carbonyl analysis will have samples analyzed by the HPLC. The analytical procedures for the HPLC are described in Section 10.5.

10.4 UATMP and Concurrent Analytical System

The UATMP GC/FID/MS analyses are performed on a 400 mL sample from the canister with a Hewlett Packard 5890 Series II GC and a Hewlett Packard 5971 Mass Selective (MS) Detector (System I) or an Agilent 6890 GC and an Agilent 5973 MS (System IV) using a 60 m by 0.32 mm ID and a 1 μ m film thickness J&W DB-1 capillary column followed by a 2:1 splitter that sends the larger portion of the column effluent to the MS and the smaller fraction to the FID. Table 10-1 shows the GC/FID/MS operating conditions. Figure 10-3 shows the GC/FID/MS system arrangement. The list of UATMP target compounds is shown in Table 3-2. The analytical SOP, *Standard Operating Procedure for the Concurrent GC/FID/MS Analysis of Canister Air Toxic Samples* (ERG-MOR-005) used for this analysis is presented in Appendix C.

The chromatograph oven, which contains the DB-1 capillary column, is cooled to -50°C with liquid nitrogen at the beginning of the sample injection. This temperature is held for five minutes and then increased at the rate of 15°C per minute to 0°C. The temperature is then ramped at 6°C per minute to 150°C, then ramped at 20°C per minute to 225°C and held for 8 minutes.

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Table 10-1

UATMP GC/FID/MS Operating Conditions

Parameter	Operating Value
Sample Volume	400 mL
J&W DB-1 Capillary Column: Length Inside diameter Film thickness Oven temperature	60 m 0.32 mm 1 μ m -50°C for five minutes, 15°C/min to 0°C then 6°C/min to 150°C, then 20°C/min to 225°C for 8 minutes
Temperatures: FID Injector Oven Temperature Auxiliary Temperature	300°C 210°C 278°C
Gas Flow Rates: He Carrier Gas He Make-up H ₂ to FID Air to FID	1.5 mL/min 30 mL/min 30 mL/min 300 mL/min
Entech Sample Interface Conditions Module 1 - Glass Bead Trap Initial Temperature Module 2 - Tenax® Trap Initial Temperature Module 3 - Cryofocuser Temperature	-160°C -55°C -195°C

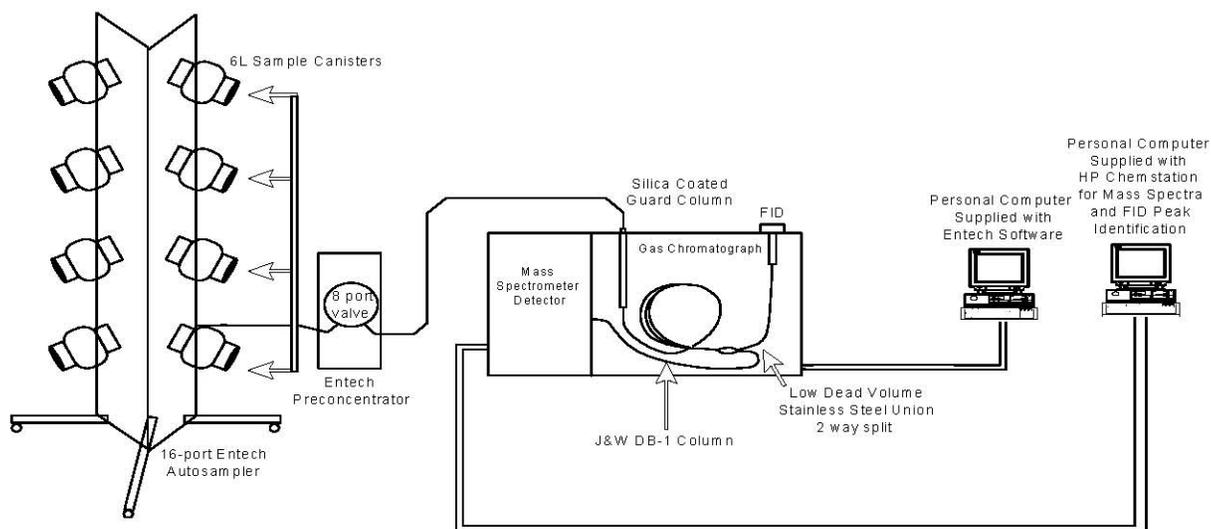


Figure 10-3. Gas Chromatograph/Mass Spectrometer/FID System

The gas eluting from the DB-1 capillary column goes through the 2:1 fixed splitter, which divides the flow between the MS and FID.

The analytical procedure for UATMP carbonyl analysis performed by HPLC is described in Section 10.5 for PAMS carbonyl analysis.

10.5 PAMS Analytical Systems

The following analyses are included in the PAMS program.

PAMS hydrocarbon samples are analyzed by the same procedures described for the Concurrent GC/FID/MS in Section 10.4, with the target list shown in Table 3-3.

PAMS and UATMP carbonyl samples are stored in the refrigerator after they are received from the field prior to analysis. The carbonyl tubes are extracted within 14 days of the sampling day and analyzed within 30 days after extractions. Sample preparation is performed by removing the DNPH sampling cartridge from its shipping vial and attaching it to the end of a 5-mL Micro-Mate[®] glass syringe. Five mL of acetonitrile is added to the syringe and allowed to drain through the cartridge into a 5-mL Class A volumetric flask. This solution is then transferred to a 2-mL autosampler vial fitted with a Teflon-lined, self-sealing septum and a 4-mL vial Teflon-lined cap and stored in a refrigerator at 4 °C until analysis is performed.

The analytical separation of carbonyls is performed using a Waters HPLC configured with a 25 cm by 4.6 mm C-18 silica analytical column with a 5 micron particle size. A typical HPLC system is shown in Figure 10-4. ERG's system uses a Nelson Analytical A/D interface as the data system. Typically, 15- μ L samples are injected with an automatic sample injector. A mobile phase gradient of water, acetonitrile, and methanol is used to perform the analytical separation at a flow rate of 1.0 mL/min. A multiwavelength UV detector is used at 360 nm. The complete SOP for carbonyl extraction and analysis (ERG-MOR-024) is presented in Appendix C.

10.6 Semivolatile Analytical Systems

Sampling modules containing XAD-2[®], petri dishes containing filters, and chain of custody forms and all associated documentation will be shipped to the ERG laboratory from the field. Upon receipt at the laboratory, samples will be logged into the laboratory sample tracking system and sent to the sample preparation laboratory. Sample preparation and analysis procedures are based on SW-846 Method 3540C⁽³³⁾ for sample preparation and SW-846 Method 8270C⁽²¹⁾ for sample analysis. The hold time is two weeks for extraction and 45 days after extraction for analysis. A complete

description of XAD-2[®] extraction procedures (ERG-MOR-044) is presented in

Appendix C.

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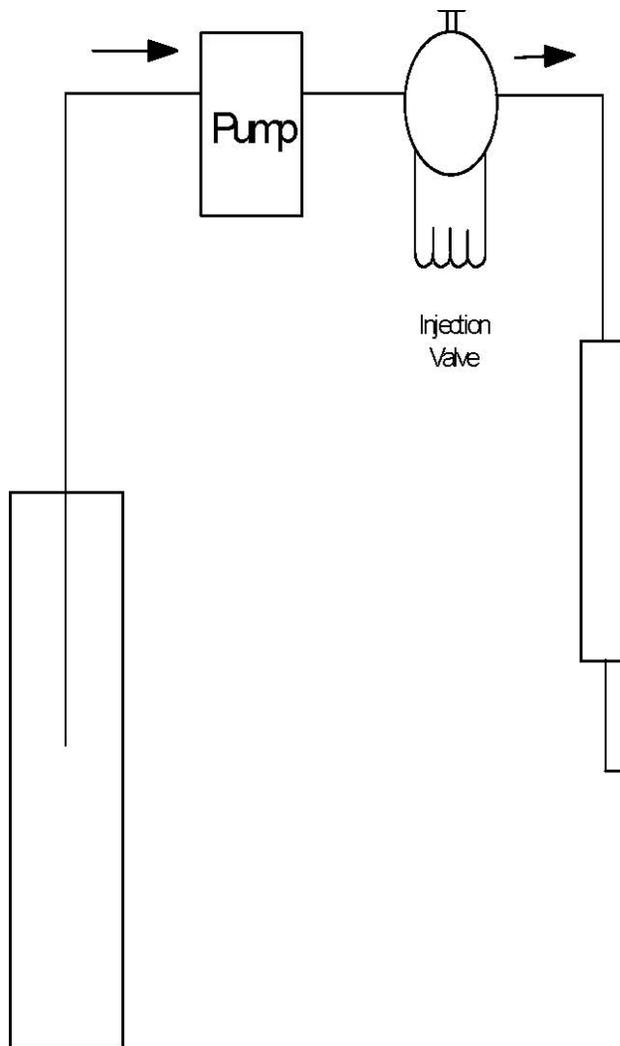
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Column

Variable Wavelength UV Detector



Mobile



Phase

Data

Reservoir

Output

Figure 10-4. HPLC System

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Sample extracts will be analyzed for semivolatile organic compounds using the analytical procedures outlined in SW-846 Method 8270C. Instrument operating conditions are shown in Method 8270C⁽²¹⁾ and the laboratory standard operating procedure (ERG-MOR-044, Appendix C). The mass spectrometer will be tuned and mass calibrated as required using perfluorotributylamine (FC-43), per the manufacturer's instructions. The tune of the instrument is verified by injecting 50 ng of DFTPP and checking the ion abundance criteria against the ion abundance criteria listed in Method 8270C.⁽²¹⁾ If the DFTPP mass spectrum does not meet method specifications, the DFTPP is re-analyzed or the mass spectrometer is re-tuned so that the instrument will meet the tuning criteria. The DFTPP tuning criteria must be met before analysis of samples can begin. The

acceptability of the instrument tune will be verified by analysis of the DFTPP solution daily or every 12 hours. Analytical procedures are presented in ERG-MOR-044 for analysis by Method 8270C (see Appendix C).

10.6.1 Analysis of PAH using EPA Compendium Method TO-13A

Sampling modules containing polyurethane foam (PUF), petri dishes containing filters, and chain of custody forms and all associated documentation will be shipped to the ERG laboratory from the field. Upon receipt at the laboratory, samples will be logged into the laboratory sample tracking system and sent to the sample preparation laboratory. Sample preparation and analysis procedures are based on SW-846 Method 3540C⁽³³⁾ for sample preparation and EPA Compendium Method TO-13A⁽²⁰⁾ for analysis using Selected Ion Monitoring techniques. The hold time is one week (seven days) after sampling for extraction and 45 days after extraction for analysis. A complete description of PUF extraction procedures (ERG-MOR-044) is presented in Appendix C.

Sample extracts will be analyzed for PAHs using the analytical procedures outlined in EPA Compendium Method TO-13A⁽²⁰⁾, using Selected Ion Monitoring. Instrument operating conditions are shown in Table 2 of EPA Compendium Method TO-13A⁽²⁰⁾ and the laboratory Standard Operating Procedure (ERG-MOR-044, Appendix C). The mass spectrometer will be tuned and mass-calibrated as required using perfluorotributylamine (FC-43), per the manufacturer's instructions. The tune of the instrument is verified by injecting 50ng of DFTPP and checking the ion abundance criteria against the ion abundance criteria listed in Table 3 of EPA Compendium Method TO-13A⁽²⁰⁾. If the DFTPP mass spectrum does not meet method specifications, the DFTPP is re-analyzed or the mass spectrometer is re-turned so that the instrument will meet the tuning criteria. The DFTPP tuning criteria must be met before analysis of samples can begin. The acceptability of the instrument tune will be verified by analysis of the DFTPP solution daily, or every twelve hours if the instrument is operated for 24 hours a day. Analytical procedures for performance of the Selected Ion Monitoring analysis are presented in ERG-MOR-049 for analysis by EPA Compendium Method TO-13A (see Appendix C).

10.7 Metals Using an Inductively Coupled Argon Plasma Mass Spectrometry Analytical System

After receipt of the sample shipment, the samples are checked against the chain of custody forms and then assigned an analytical laboratory sample number. Each sample component is examined to determine if damage occurred during travel. Color, appearance, and other particulars of the samples are noted. Samples are prepared according to standard procedures listed in the QAPP from RTI (see Appendix D).

The analytical procedure used to obtain the metal concentrations uses inductively coupled argon plasma mass spectrometry (ICP/MS). The metals are to be analyzed by Research Triangle Institute, using approved methods presented in Method IO-3.5⁽²⁹⁾.

10.8 2,3,7,8-Tetrachlorodibenzo-*p*-dioxin Using a High Resolution Gas Chromatograph/High Resolution Mass Spectrometer Analytical System

All sampling media and receipt of samples will be handled by CAS. Each sample should be examined to determine whether damage occurred during travel to CAS. Samples are to be handled, extracted, and analyzed according to EPA Compendium Method TO-9A⁽²²⁾, CAS's QAPP (see Appendix E), and SOPs.

The analytical procedure used to obtain the dioxin concentration uses HRGC/HRMS. The dioxin is to be analyzed by CAS using the approved method

presented in EPA Compendium Method TO-9A⁽²²⁾.

10.9 Hexavalent Chromium Analytical System

Hexavalent chromium filter samples are stored in the freezer after they are received from the field prior to analysis. Internal studies have shown that the hexavalent chromium does not degrade for up to 21 days before extracting the filters. Due to oxidation/reduction and conversion problems between the Cr^{3+} and Cr^{6+} , the extraction is performed immediately prior to analysis. Therefore, it is important that the ion chromatograph (IC) be equilibrated, calibrated and ready for analysis before filters are extracted. Sample preparation is performed by removing the filter from its shipping petri dish and placing it into a 30-mL glass tube and adding 15-mL of deionized water. The extraction is done in a glove box purged with dry nitrogen. The tubes are sonicated for three hours before a 5-mL aliquot is removed for analysis on the IC. Extracts are stored in a freezer until they are analyzed, but all analysis is completed the day the filters are extracted.

The analytical separation for the hexavalent chromium is performed using a Dionex[®] DX-300 configured with an IonPac AS7 and an IonPac CG5 guard column. ERG's system uses a Nelson Analytical A/D interface as the data system. Samples are injected in duplicate using a Dionex A540 autosampler. A mobile phase is used to perform the analytical separation at a flow rate of 1.5mL/min, and a post-column reagent flow rate of 0.5mL/min. A multiwavelength UV detector is used at 540 nm. A modified CARB Method 039 is used and the ERG SOP, *Standard Operating Procedure for the Analysis of Ambient Air for Hexavalent Chromium by IC* (ERG-MOR-063) is presented in Appendix C.

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SECTION 11

QUALITY CONTROL REQUIREMENTS

This section describes the quality control requirements for each of the major program components (NMOC, SNMOC, UATMP, Carbonyls, PAMS, and HAPs - SVOC, Metals and Hexavalent Chromium). As additional analytical work from the HAPs section of the contract is requested by the States, the QA requirements will be updated in the QAPP.

11.1 Sample Canister Cleanup Studies

Before any samples are collected for a program, all stainless steel sample canisters are checked for leaks. The canisters are filled to about 15 psig pressure with zero-grade air from a cylinder and the valve and fittings are checked for leaks. The canisters are then cleaned using the procedure described in Section 10.

After cleanup, each canister is analyzed for quality control and the results are noted on the custody form for the permanent record. In order for the canister to be used without further cleanup, the analysis must show that it meets the quality objective for cleanliness, as shown in Table 4-4.

11.2 Standard Traceability

The standards used for the NMOC/SNMOC and PAMS are vendor-supplied National Institute of Standards and Technology (NIST) standards or referenced to a vendor-supplied NIST standard. The standards used for UATMP are certified by comparison to external audit samples when supplied by individual States or the EPA. ERG supplies only second source standards and Ongoing Precision and Recovery (OPR) for their own laboratory. The SOP used to prepare standards is the SOP for Standard

Preparation Using Dynamic Flow Dilution, ERG-MOR-061 (Appendix C).

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11.3 Accuracy and Acceptance

Because ambient air measurements encompass a range of mixtures of organic compounds whose individual concentrations are unknown, defining absolute accuracy is not possible. Instead, accuracy is determined by comparison of analysis of duplicate samples and comparison of analysis of standards of known concentration.

11.3.1 NMOC Instrument Calibration

Accuracy is monitored throughout the program using internally generated QC samples. On days when ambient air samples are analyzed for NMOC content, an in-house certified QC sample of propane (calibration check) is also analyzed. The QC samples are from propane cylinders obtained from a gas supplier.

11.3.2 SNMOC Instrument Calibration

Because all samples analyzed for volatile organic compounds utilize the same instrument and have the potential to report all target analytes, the hydrocarbon and TO-15⁽¹⁷⁾ parameters must conform to the standard quality control procedures listed in Tables 4-2 and 4-3.

Prior to sample analysis for SNMOC, a calibration check standard of

hydrocarbons, prepared using either a Scott Specialty Gas or Spectra certified high pressure gas, is analyzed daily to ensure the validity of the current response factors. This standard will have an approximate concentration range from 15 ppbC to 40 ppbC.

For both the MS and FID detectors, load volumes and the standard response area counts are entered into a computer spreadsheet and the current monthly response factors are used to calculate selected hydrocarbon concentrations. The concentrations are compared to the calculated theoretical concentrations of the QC standard. A percent bias less than or equal to 30 percent for each compound is considered acceptable.

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If the QC standard does not meet the 30 percent criterion, a second QC standard is analyzed. If the second QC standard meets the criterion, the analytical system is considered in control. If the second QC check does not meet acceptance criteria, a leak test and system maintenance are performed. Following these maintenance procedures, a third QC standard analysis can be performed. If the criterion is met by the third analysis, the analytical system is considered in control. If maintenance causes a change in system response, a new calibration curve is required.

A system blank of cleaned, humidified air is analyzed after the daily QC standard analysis and before the sample analysis. The system is considered in control if the total NMOC concentration for the system blank is less than or equal to 20 ppbC as previously outlined in Table 4-3.

11.3.3 UATMP Instrument Calibration

The tune of the MS is verified using a BFB instrument performance check on a daily basis. The tune is usually verified during the analysis of the QC sample. The acceptance criteria for the BFB are presented in Table 11-1. Before sample analyses, a standard prepared at approximately 5 ppbv from a certified cylinder is used for a daily calibration check. The resulting response factor for each compound will be compared to the calibration curve response factors generated from the GC/MS using the HP Chemstation® Software. Correspondence within an absolute value of less than or equal to 30 relative percent difference (RPD) is considered acceptable for the quantitated compounds. If the first QC check does not meet this criterion, a second standard may be analyzed. If the second QC standard is acceptable, sample analysis can continue. If the second check does not meet acceptance criteria, a leak check and system maintenance are performed. If the system maintenance is completed and a third QC analysis meets the criterion, then analysis may continue. If the maintenance causes a change in the system response, a new calibration curve must be analyzed before sample analyses can continue.

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Table 11-1

BFB Key Ion Abundance Criteria

Mass	Ion Abundance Criteria
50	8 to 40% of mass 95
75	30 to 66% of mass 95
95	base peak, 100% relative abundance
96	5 to 9% of mass 95
173	less than 2% of mass 174
174	50 to 120% of mass 95
175	4 to 9% of mass 174
176	93 to 101% of mass 174
177	5 to 9% of mass 176

After acceptable analysis of the daily standard has been demonstrated, a system blank consisting of cleaned, humidified air is analyzed. A total concentration per compound of less than 0.2 ppbv (or the method detection limit, whichever is greater as outlined in Table 4-4) indicates that the system is in control. If a concentration greater than the acceptance criterion is detected, a second system blank is analyzed. If the second system blank fails, system maintenance is performed. Another system blank can be analyzed and if it is in control, ambient air samples are analyzed.

11.3.4 PAMS VOC Analysis

Daily QC checks for PAMS VOC analysis are the same as those described for SNMOC in Section 11.3.2.

11.3.5 Carbonyl Compounds Analysis

Daily calibration checks are performed to ensure that the analytical procedures are in control. Daily QC checks are performed after every 12 hours or less when samples are analyzed.

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Compound responses in the daily QC check must be within 15% of the mean responses from the current calibration curve. Compound retention time drifts are also measured from this analysis and tracked to ensure that the HPLC instruments are operating within

acceptable parameters.

If this daily QC check does not meet the criterion, a second injection of the QC standard is performed. If the second QC check does not pass or if more than one daily QC check does not meet the criterion, a new calibration curve (5 concentration levels) is analyzed. All samples analyzed with the unacceptable QC check will be reanalyzed.

Crotonaldehyde tautomerizes into two chromatographically separate peaks after it is spiked onto the DNPH cartridge. The best analytical recovery for crotonaldehyde is determined when both peaks are integrated together for all samples and QC.

An acetonitrile system blank is analyzed after the daily calibration check and before sample analysis. The system is considered in control if target compound concentrations are less than or equal to five times the current detection limits.

11.3.6 Analysis of Semivolatile Organic Compounds Using EPA Method 8270C

Prior to analysis of samples using Method 8270C⁽²¹⁾, the filter/sorbent samples are prepared for analysis using the procedures of EPA Method 3540C.⁽³³⁾ The extracts are analyzed by GC/MS, using a DB-5 fused silica capillary column and a mass spectrometer capable of scanning from 35 to 500 mass units every 1 sec or less, using a nominal electron energy of 70 eV in the electron ionization mode. The mass spectrometer must be capable of producing a mass spectrum for decafluorotriphenylphosphine (DFTPP) that meets all of the acceptance criteria in

Table 11-2 when 1 µL of the GC/MS tuning standard is injected through the GC (50 ng on-column).

Table 11-2

**Decafluorotriphenylphosphine (DFTPP) Key Ions and Ion Abundance Criteria
(EPA Method 8270C⁽²¹⁾)**

Mass	Ion Abundance Criteria
51	30 to 80% of mass 198
68	<2% of mass 69
70	<2% of mass 69
127	25 to 75% of mass 198
197	<1% of mass 198
198	Base peak, 100% relative abundance
199	5 to 9% of mass 198
275	10 to 31% of mass 198
365	>1% of mass 198
441	Present but less than mass 443
442	40 to 110% of mass 198
443	15 to 23% of mass 442

The Method 8270C⁽²¹⁾ surrogate compounds will be used to spike the sorbent immediately before extraction. These surrogate compounds are phenol-d₆, 2-fluorophenol, 2,4,6-tribromophenol, nitrobenzene-d₅, 2-fluorobiphenyl, and *p*-terphenyl-d₁₄. Surrogate recovery ranges will be established for XAD-2[®] by control charting the surrogate recoveries. Ranges from Method 8270C⁽²¹⁾ will be used as a guideline.

A GC/MS system performance check must be performed to ensure that minimum average response factors are met before the multipoint calibration is used. For 8270C organic compounds, the System Performance Check Compounds are N-nitroso-di-

n-propylamine, hexachlorocyclopentadiene, 2,4-dinitrophenol, and 4-nitrophenol. These System Performance Check Compounds typically have very low response factors (0.1 - 0.2) and the response factors tend to decrease as the chromatographic system begins to deteriorate or as the standard begins to deteriorate. These compounds are usually the first to show poor performance, and these compounds must, therefore, meet the minimum requirement when the system is calibrated.

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After the analytical system performance check is met, the calibration check compounds (8270C) are used to check the validity of the initial multipoint calibration. These calibration check compounds are acenaphthene, 1,4-dichlorobenzene, hexachlorobutadiene, N-nitroso-di-phenylamine, di-*n*-octyl phthalate, fluoranthene, benzo(a)pyrene, 4-chloro-3-methylphenol, 2,4-dichlorophenol, 2-nitrophenol, phenol, pentachlorophenol, and 2,4,6-trichlorophenol. The response factor for the calibration check compounds must be within $\pm 20\%$ of the mean response factor from the initial calibration.

Internal standard responses and retention times must also be evaluated for stability. EPA Method 8270C⁽²¹⁾ also presents detailed guidelines for qualitative analysis of mass spectra, as well as a detailed analytical scheme to determine that all target analytes are quantitated relative to the nearest-eluting internal standard.

11.3.7 Analysis of Semivolatile Organic Compounds (PAHs) Using EPA Compendium Method TO-13A

Prior to analysis of samples using EPA Compendium Method TO-13A,⁽²⁰⁾ the filter/PUF samples are prepared for analysis using the procedures of EPA Method 3540C.⁽³³⁾ The extracts are analyzed by GC/MS, using a DB-5 fused silica capillary column and a mass spectrometer capable of performing Selected ion Monitoring for up to 16 ions on a cycle of 100 milliseconds or less, using a nominal electron energy of 70 eV

in the electron ionization mode. The mass spectrometer must be capable of producing a mass spectrum for DFTPP that meets all of the acceptance criteria in Table 11-3 when 1 μ L of the GC/MS tuning standard is injected through the GC (50 ng on column).

Table 11-3 DFTPP Key Ions and Ion Abundance Criteria (EPA Compendium Method TO-13A)⁽²⁰⁾

Mass	Ion Abundance Criteria
51	30 to 60% of mass 198
68	< 2% of mass 69
70	< 2% of mass 69
127	40 to 60% of mass 198
197	< 2% of mass 198
198	Base peak, 100% relative abundance
199	5 to 9% of mass 198
275	10 to 30% of mass 198
365	> 1.0% of mass 198
441	Present but < mass 443
442	40% of mass 198
443	17 to 23% of mass 442

EPA Compendium Method TO-13A employs two different types of surrogates. The Field Surrogates, fluoranthene-d₁₀ and benzo(a)pyrene-d₁₂, are spiked onto the PUF

media prior to shipment to the field; acceptable recoveries for these Field Surrogates are in the range of 70 to 130%. The Laboratory Surrogates, fluorene-d₁₀ and pyrene-d₁₀, are spiked into the PUF immediately before extraction; acceptable recoveries for these Laboratory Surrogates are in the range of 70 to 130%.

A GC/MS system performance check must be performed to ensure that minimum average response factors are achieved before the multipoint calibration is used. Relative Response Factor criteria for initial and continuing calibration of PAHs are applicable to all of the PAHs determined by EPA Compendium Method TO-13A are shown in Table 7 of EPA Compendium Method TO-13A and Table 11-4 of this QAPP.

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Table 11-4 Relative Response Factor Criteria for Initial and Continuing Calibration of Common Semivolatile Compounds

Semivolatile Compounds	Minimum RRF	Maximum %RSD	Maximum % Difference
Naphthalene	0.700	30	30
Acenaphthylene	1.300	30	30
Acenaphthene	0.800	30	30
Fluorene	0.900	30	30
Phenanthrene	0.700	30	30
Anthracene	0.700	30	30
Fluoranthene	0.600	30	30

Pyrene	0.600	30	30
Benz(a)anthracene	0.800	30	30
Chrysene	0.700	30	30
Benzo(b)fluoranthene	0.700	30	30
Benzo(k)fluoranthene	0.700	30	30
Benzo(a)pyrene	0.700	30	30
Indeno(1,2,3-cd)pyrene	0.500	30	30
Dibenz(a,h)anthracene	0.400	30	30
Benzo(g,h,i)perylene	0.500	30	30
Perylene	0.500	30	30
Coronene	0.700	30	30

In performing the calibration check, all PAHs must meet the performance criterion of 30% maximum difference.

Internal standard responses and retention times must also be evaluated for stability. The Selected Ion Monitoring procedures of EPA Compendium Method TO-13A preclude the use

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of guidelines for qualitative analysis of mass spectra, since complete mass spectra are not acquired when Selected Ion Monitoring procedures are used. Quantitative analysis for each compound is performed relative to the nearest-eluting internal standard.

11.3.8 Quality Control Measures for Analysis of Airborne Metals Collected on a Filter Using EPA Method IO-3.5⁽²⁹⁾

Analysis of the metals will be performed by inductively coupled argon plasma mass spectrometry for antimony, arsenic, beryllium, cadmium, total chromium, lead,

manganese, selenium, cobalt, and nickel, and by cold vapor atomic absorption spectrophotometry for mercury. Analysis of arsenic requires the use of a collision cell to avoid isobaric interferences. Quality control measures for the metals analysis are shown in Table 4-8.

11.3.9 Quality Control Measures for Dioxins Collected on XAD Using EPA Method

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Analysis of dioxin will be performed by high resolution gas chromatography/high resolution mass spectrometry for 2,3,7,8-tetrachlorodibenzo-*p*-dioxin. Quality control measures are presented in Table 4-7.

11.4 Precision

Analytical precision is estimated by repeated analysis of samples. For all samples, the second analysis is performed at least 24 hours after the first analysis. Duplicate samples are reanalyzed once each to determine overall precision, including sampling and analysis variability.

Precision estimates are calculated in terms of absolute percent difference. Because the true concentration of the ambient air sample is unknown, these calculations are relative to the average sample concentration. The precision criteria for all parameters were listed previously in Table 4-1.

Precision is determined as the relative percent difference (RPD) using the following calculation:

$$-\frac{X_1 - X_2}{\bar{X}} \text{RPD} = \times 100^{(1)}$$

Where:

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

X_2 is the concentration of the same compound measured during replicate analysis;

and

\bar{X} is the arithmetic mean of X_1 and X_2 .

11.5 Completeness

Completeness, a quality measure, is calculated at the end of the program. Percent completeness is calculated as the ratio of the number of valid samples received to the number of scheduled samples (beginning with the first valid sample received through the last sample received). This quality measure is presented in the final report. The completeness criteria for all parameters were previously presented in Table 4-1.

Completeness is determined using the following calculation:

$$\frac{\text{Number of valid samples}}{\text{Total expected number of samples}} \text{Completeness} = \times 100$$

11.6 Representativeness

Representativeness measures how well the reported results reflect the actual ambient air concentrations. This measure of quality can be enhanced by ensuring that a representative sampling design is employed. This design includes proper integration over the desired sampling period and following siting criteria established for each task. The

experimental design for sample collection should ensure samples are collected at proper times and intervals for their

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designated purpose according to the data quality objectives. For example, NMOC/SNMOC samples are collected to gain information about PAMS volatile hydrocarbons. Therefore, collection of 3-hour samples from 6:00 a.m. to 9:00 a.m. each weekday is appropriate. Quality measures for duplicate sample collection and replicate analyses are included. ERG is not responsible for the sampling design; therefore, representativeness is beyond the scope of this QAPP. The state and local areas should designate the representativeness following EPA guidelines.

11.7 Method Detection Limits

For SNMOC, UATMP and carbonyls, the method detection limits of the target compounds are determined by performing at least seven replicate analyses of a standard spiked on the appropriate collection media that is at a concentration within five times the expected detection limits. This procedure follows the method listed in the Federal Register, Title 40, Chapter 1, Part 136, Appendix B.⁽³⁴⁾ The detection limits determined are verified by analyzing multiple injections of standards at the obtained limits to confirm the reported lowest level concentration.

The method detection limit for NMOC is 0.23 ppbC. The method detection limits for the SNMOC are listed in Table 11-5, for UATMP compounds in Table 11-6, and for the carbonyl compounds in Table 11-7. All laboratories at ERG's Morrisville location verify the method detection limits once a year by preparing and analyzing the seven replicate standards. The semivolatile method detection limits, based on an average sampling volume of 200 m³, are presented in Table 11-8. The detection limits for semivolatile compounds are determined by analyzing spiked and extracted XAD. Metals detection limits are summarized in the subcontractor quality assurance plan provided by

RTI (Appendix D). Metals MDLs determined by RTI using a spiked filter matrix and the procedures of 40 CFR Part 136, Appendix B, are shown in Table 11-9. The 2,3,7,8-TCDD method detection limit is 10 pg/trap. The hexavalent chromium method detection limit is 0.434 ng/filter.

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Target Compound	ppbC	Target Compound	ppbC
Ethylene	0.07	2,3-Dimethylpentane	0.43
Acetylene	0.06	3-Methylhexane	0.23
Ethane	0.20	1-Heptene	0.43
Propylene	0.12	2,2,4-Trimethylpentane	0.43
Propane	0.18	<i>n</i> -Heptane	0.26
Propyne	0.18	Methylcyclohexane	0.13
Isobutane	0.07	2,2,3-Trimethylpentane	0.81
Isobutene/1-Butene	0.30	2,3,4-Trimethylpentane	0.36
1,3-Butadiene	0.52	Toluene	0.35
<i>n</i> -Butane	0.52	2-Methylheptane	0.39
<i>trans</i> -2-Butene	0.08	3-Methylheptane	0.28
<i>cis</i> -2-Butene	0.13	1-Octene	0.81
3-Methyl-1-Butene	0.32	<i>n</i> -Octane	0.25
Isopentane	0.32	Ethylbenzene	0.19
1-Pentene	0.21	<i>m/p</i> -Xylene	0.22
2-Methyl-1-Butene	0.32	Styrene	0.81
<i>n</i> -Pentane	0.09	<i>o</i> -Xylene	0.19
Isoprene	0.17	1-Nonene	0.36
<i>trans</i> -2-Pentene	0.20	<i>n</i> -Nonane	0.15
<i>cis</i> -2-Pentene	0.12	Isopropylbenzene	0.36
2-Methyl-2-Butene	0.32	<i>alpha</i> -Pinene	0.26
2,2-Dimethylbutane	0.29	<i>n</i> -Propylbenzene	0.17
Cyclopentene	0.32	<i>m</i> -Ethyltoluene	0.14
4-Methyl-1-Pentene	0.29	<i>p</i> -Ethyltoluene	0.21
Cyclopentane	0.12	1,3,5-Trimethylbenzene	0.15
2,3,-Dimethylbutane	0.27	<i>o</i> -Ethyltoluene	0.15
2-Methylpentane	0.28	<i>beta</i> -Pinene	0.26
3-Methylpentane	0.23	1,2,4-Trimethylbenzene	0.21

2-Methyl-1-Pentene	0.29	1-Decene	0.26
1-Hexene	0.26	<i>n</i> -Decane	0.20
2-Ethyl-1-butene	0.29	1,2,3-Trimethylbenzene	0.13
<i>n</i> -Hexane	0.09	<i>m</i> -Diethylbenzene	0.26
<i>trans</i> -2-Hexene	0.29	<i>p</i> -Diethylbenzene	0.16
<i>cis</i> -2-Hexene	0.29	1-Undecene	0.59
Methylcyclopentane	0.12	<i>n</i> -Undecane	0.59
2,4-Dimethylpentane	0.28	1-Dodecene	0.77
Benzene	0.26	<i>n</i> -Dodecane	0.77
Cyclohexane	0.29	1-Tridecene	0.77
2-Methylhexane	0.18	<i>n</i> -Tridecane	0.77

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Table 11-5. 2004 SNMOC Method Detection Limits

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Table 11-6. 2004 UATMP Method Detection Limits

Target Compounds	ppbv	µg/m ³	Target Compounds	ppbv	µg/m ³
Acetylene	0.05	0.05	1,2-Dichloropropane	0.07	0.33
Propylene	0.07	0.11	Ethyl Acrylate	0.06	0.23
Dichlorodifluoromethane	0.03	0.17	Bromodichloromethane	0.04	0.25
Chloromethane	0.05	0.09	Trichloroethylene	0.05	0.25
Dichlorotetrafluoroethane	0.03	0.21	Methyl Methacrylate	0.11	0.43
Vinyl Chloride	0.04	0.11	<i>cis</i> -1,3-Dichloropropene	0.05	0.22
1,3-Butadiene	0.06	0.13	Methyl Isobutyl Ketone	0.08	0.31
Bromomethane	0.05	0.19	<i>trans</i> -1,3-Dichloropropene	0.05	0.23
Chloroethane	0.10	0.27	1,1,2-Trichloroethane	0.08	0.42
Acetonitrile	0.13	0.22	Toluene	0.05	0.17
Trichlorofluoromethane	0.04	0.20	Dibromochloromethane	0.07	0.57
Acrylonitrile	0.08	0.18	1,2-Dibromoethane	0.05	0.40
1,1-Dichloroethene	0.05	0.20	<i>n</i> -Octane	0.06	0.29
Methylene Chloride	0.08	0.26	Tetrachloroethylene	0.05	0.34

Trichlorotrifluoroethane	0.04	0.32	Chlorobenzene	0.04	0.20
<i>trans</i> -1,2-Dichloroethylene	0.05	0.21	Ethylbenzene	0.04	0.18
1,1-Dichloroethane	0.05	0.21	<i>m,p</i> -Xylene	0.05	0.39
Methyl <i>tert</i> -Butyl Ether	0.07	0.24	Bromoform	0.06	0.63
Methyl Ethyl Ketone	0.15	0.45	Styrene	0.04	0.18
Chloroprene	0.05	0.18	1,1,2,2-Tetrachloroethane	0.05	0.36
<i>cis</i> -1,2-Dichloroethylene	0.06	0.22	<i>o</i> -Xylene	0.04	0.19
Bromochloromethane	0.09	0.45	1,3,5-Trimethylbenzene	0.04	0.21
Chloroform	0.04	0.21	1,2,4-Trimethylbenzene	0.06	0.28
Ethyl <i>tert</i> -Butyl Ether	0.05	0.22	<i>m</i> -Dichlorobenzene	0.07	0.39
1,2-Dichloroethane	0.06	0.26	Chloromethylbenzene	0.05	0.28
1,1,1-Trichloroethane	0.05	0.28	<i>p</i> -Dichlorobenzene	0.06	0.39
Benzene	0.05	0.16	<i>o</i> -Dichlorobenzene	0.04	0.27
Carbon Tetrachloride	0.06	0.39	1,2,4-Trichlorobenzene	0.18	1.37
<i>tert</i> -Amyl Methyl Ether	0.07	0.28	Hexachloro-1,3-butadiene	0.16	1.73

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Table 11-7. 2004 Carbonyl Method Detection Limits (Underivatized Concentration (ppbv)) SAMPLE VOLUME (L)

COMPOUND	100	200	300	400	500	600	700	800	900
Formaldehyde	0.157	0.078	0.052	0.039	0.031	0.026	0.022	0.020	0.018
Acetaldehyde	0.135	0.068	0.045	0.034	0.027	0.023	0.019	0.017	0.015
Acetone	0.079	0.040	0.026	0.020	0.016	0.013	0.011	0.010	0.009
Propionaldehyde	0.051	0.025	0.017	0.013	0.010	0.008	0.007	0.006	0.005
Crotonaldehyde	0.040	0.020	0.013	0.010	0.008	0.007	0.006	0.005	0.004
Butyr/Isobutyraldehyde	0.049	0.024	0.016	0.012	0.010	0.008	0.007	0.006	0.005
Benzaldehyde	0.031	0.015	0.010	0.008	0.006	0.005	0.004	0.004	0.003
Isovaleraldehyde	0.035	0.017	0.012	0.009	0.007	0.006	0.005	0.004	0.003
Valeraldehyde	0.035	0.017	0.012	0.009	0.007	0.006	0.005	0.004	0.003
Tolualdehydes	0.043	0.022	0.014	0.011	0.009	0.007	0.006	0.005	0.004
Hexaldehyde	0.024	0.012	0.008	0.006	0.005	0.004	0.003	0.003	0.002
2,5-dimethylbenzaldehyde	0.027	0.014	0.009	0.007	0.005	0.005	0.004	0.003	0.002

SAMPLE VOLUME(L)

COMPOUND	1100	1200	1300	1400	1500	1600	1700	1800	1900
Formaldehyde	0.0143	0.0131	0.0121	0.0112	0.0105	0.0098	0.0092	0.0087	0.0082
Acetaldehyde	0.0123	0.0113	0.0104	0.0097	0.0090	0.0085	0.0080	0.0075	0.0071
Acetone	0.0072	0.0066	0.0061	0.0057	0.0053	0.0049	0.0047	0.0044	0.0042

Propionaldehyde	0.0046	0.0042	0.0039	0.0036	0.0034	0.0032	0.0030	0.0028	0.0026
Crotonaldehyde	0.0036	0.0033	0.0031	0.0029	0.0027	0.0025	0.0024	0.0022	0.0021
Butyr/Isobutyraldehyde	0.0044	0.0041	0.0038	0.0035	0.0033	0.0030	0.0029	0.0027	0.0026
Benzaldehyde	0.0028	0.0026	0.0024	0.0022	0.0020	0.0019	0.0018	0.0017	0.0016
Isovaleraldehyde	0.0032	0.0029	0.0027	0.0025	0.0023	0.0022	0.0021	0.0019	0.0018
Valeraldehyde	0.0032	0.0029	0.0027	0.0025	0.0023	0.0022	0.0020	0.0019	0.0018
Tolualdehydes	0.0039	0.0036	0.0033	0.0031	0.0029	0.0027	0.0025	0.0024	0.0023
Hexaldehyde	0.0022	0.0020	0.0018	0.0017	0.0016	0.0015	0.0014	0.0013	0.0012
2,5-dimethylbenzaldehyde	0.0025	0.0023	0.0021	0.0019	0.0018	0.0017	0.0016	0.0015	0.0014

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Table 11-8

2004 Semivolatile Organic Compounds Analyzed by the Analytical Procedures of Method 8270C,⁽²⁾ with Method Detection Limits

XAD®-2 MDLs					
Target Compounds	µg	µg/m ³	Target Compounds	µg	µg/m ³
N-Nitrosodimethylamine	6.62	0.033	Acenaphthylene	4.31	0.022
Pyridine	11.73	0.059	2,4-Dinitrophenol	8.06	0.040
Ethyl methanesulfonate	7.07	0.035	4-Nitrophenol	6.81	0.034
2-Picoline	32.25	0.161	Acenaphthene	4.67	0.023
N-Nitrosomethylethylamine	7.05	0.035	2,4-Dinitrotoluene	6.53	0.033
Methyl methanesulfonate	8.07	0.040	2-Naphthylamine	24.10	0.121
N-Nitrosodiethylamine	7.24	0.036	Dibenzofuran	3.29	0.016
Phenol	8.04	0.040	Pentachlorobenzene	5.14	0.026
Pentachloroethane	8.88	0.044	1-Naphthylamine	24.46	0.122
bis (2-Chloroethyl)ether	7.03	0.035	Diethyl phthalate	4.52	0.023
Aniline	13.16	0.066	2,3,4,6-Tetrachlorophenol	6.93	0.035
2-Chlorophenol	7.64	0.038	4-Nitroaniline	6.04	0.030
1,3-Dichlorobenzene	5.08	0.025	4-Chlorophenylphenyl ether	4.82	0.024
1,4-Dichlorobenzene	5.72	0.029	Fluorene	4.21	0.021
Benzyl alcohol	8.33	0.042	5-Nitro- <i>o</i> -toluidine	5.28	0.026
<i>o</i> -Cresol (2-Methylphenol)	9.14	0.046	4,6-Dinitro-2-methylphenol	6.48	0.032
1,2-Dichlorobenzene	6.16	0.031	Diphenylamine	26.38	0.132
bis(2-Chloroisopropyl)ether	5.55	0.028	Azobenzene	6.06	0.030
<i>m,p</i> -Cresol (3&4-Methylphenol)	8.43	0.042	Phenacetin	4.75	0.024
N-Nitrosopyrrolidine	7.31	0.037	Diallate	4.70	0.023
N-Nitrosodipropylamine	5.52	0.028	4-Bromophenyl phenyl ether	6.09	0.030

<i>o</i> -Toluidine	7.51	0.038	4-Aminobiphenyl	26.38	0.132
Hexachloroethane	5.09	0.025	Hexachlorobenzene	4.63	0.023
Acetophenone	6.86	0.034	Pronamide	5.87	0.029
Nitrobenzene	5.73	0.029	Pentachlorophenol	7.54	0.038
N-Nitrosopiperidine	4.84	0.024	Pentachloronitrobenzene	7.20	0.036
Isophorone	5.56	0.028	Phenanthrene	5.62	0.028
2-Nitrophenol	9.25	0.046	Dinoseb	6.23	0.031
2,4-Dimethylphenol	32.77	0.164	Anthracene	6.16	0.031
bis(2-Chloroethoxy)methane	6.93	0.035	Carbazole	5.74	0.029
2,4-Dichlorophenol	5.66	0.028	Di- <i>n</i> -butyl phthalate	4.71	0.024
4-Chloroaniline	9.44	0.047	Benzidine	50.00	0.250
1,2,4-Trichlorobenzene	5.47	0.027	Isodrin	4.55	0.023
Naphthalene	6.86	0.034	Fluoranthene	3.85	0.019
2,6-Dichlorophenol	5.66	0.028	Pyrene	5.38	0.027
Hexachloropropene	6.49	0.032	4-Dimethylaminoazobenzene	4.35	0.022
Hexachlorobutadiene	7.20	0.036	Chlorobenzilate	3.26	0.016

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Table 11-8. (Continued)

Target Compounds	μg	$\mu\text{g}/\text{m}^3$	Target Compounds	μg	$\mu\text{g}/\text{m}^3$
N-Nitrosodibutylamine	4.97	0.025	3,3'-Dimethylbenzidine	50.00	0.250
4-Chloro-3-methylphenol	6.83	0.034	Butyl benzyl phthalate	5.59	0.028
Safrole	5.89	0.029	2-Acetylaminofluorene	3.39	0.017
2-Methylnaphthalene	5.88	0.029	3-Methylcholanthrene	6.42	0.032
1,2,4,5-Tetrachlorobenzene	5.99	0.030	3,3'-Dichlorobenzidine	7.16	0.036
2,4,6-Trichlorophenol	4.86	0.024	bis(2-Ethylhexyl)phthalate	4.86	0.024
Hexachlorocyclopentadiene	10.27	0.051	Benzo(a)anthracene	3.87	0.019
2,4,5-Trichlorophenol	6.53	0.033	Chrysene	5.84	0.029
2-Nitroaniline	6.40	0.032	Di- <i>n</i> -octyl phthalate	4.34	0.022
Isosafrole	5.82	0.029	7,12-Dimethylbenz(a)anthracene	5.56	0.028
2-Chloronaphthalene	4.09	0.020	Benzo(b)fluoranthene	6.95	0.035
1,4-Naphthoquinone	5.81	0.029	Benzo(k)fluoranthene	5.62	0.028
Dimethyl phthalate	4.37	0.022	Benzo(a)pyrene	3.57	0.018
1,3-Dinitrobenzene	7.54	0.038	Indeno(1,2,3- <i>cd</i>)pyrene	8.09	0.040
2,6-Dinitrotoluene	6.63	0.033	Dibenz(a,h)anthracene	5.13	0.026
3-Nitroaniline	4.83	0.024	Benzo(g,h,i)perylene	5.64	0.028
PUF MDLs					
Target Compounds	ng	ng/m³	pg	pg/m³	

bis(2-Chloroethyl)ether	0.031	0.000155	31.1	0.155
N-Nitrosodipropylamine	0.032	0.000162	32.3	0.162
Acetophenone	0.028	0.000141	28.1	0.141
Naphthalene	0.021	0.000103	20.6	0.103
Hexachlorobutadiene	0.026	0.000128	25.6	0.128
N-Nitrosodibutylamine	0.051	0.000255	51.0	0.255
Acenaphthylene	0.125	0.000627	125.5	0.627
Acenaphthene	0.021	0.000103	20.6	0.103
Fluorene	0.029	0.000143	28.5	0.143
Azobenzene	0.114	0.000570	114.1	0.570
Hexachlorobenzene	0.026	0.000128	25.6	0.128
Phenanthrene	0.023	0.000117	23.3	0.117
Anthracene	0.075	0.000374	74.8	0.374
Fluoranthene	0.033	0.000163	32.7	0.163
Pyrene	0.033	0.000163	32.7	0.163
4-Dimethylaminoazobenzene	0.105	0.000523	104.6	0.523
Benz(a)anthracene	0.039	0.000197	39.5	0.197
Chrysene	0.021	0.000104	20.7	0.104
7,12-Dimethylbenz(a)anthracene	0.031	0.000157	31.3	0.157

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Table 11-8. (Continued)

Target Compounds	ng	ng/m ³	pg	pg/m ³
Benzo(b)fluoranthene	0.041	0.000206	41.3	0.206
Benzo(k)fluoranthene	0.029	0.000143	28.5	0.143
Benzo(e)pyrene	0.035	0.000174	34.7	0.174
Benzo(a)pyrene	0.073	0.000363	72.5	0.363
Perylene	0.046	0.000228	45.7	0.228
Indeno(1,2,3-cd)pyrene	0.034	0.000172	34.3	0.172
Dibenz(a,h)anthracene	0.030	0.000152	30.5	0.152
Dibenzo(g,h,i)perylene	0.027	0.000136	27.2	0.136
Coronene	0.033	0.000166	33.3	0.166

Table 11-9. 2004 Metals Method Detection Limit for Spiked Filter Strips

Element	ng/filter strip	ng/filter
---------	-----------------	-----------

Arsenic (As)	11	86
Beryllium (Be)	6	47
Cadmium (Cd)	1	6
Cobalt (Co)	10	80
Chromium (Cr) ²	77	603
Manganese (Mn)	16	130
Nickel (Ni)	63	499
Lead (Pb)	11	87
Antimony (Sb)	1	5
Selenium (Se)	3	23

¹ICP/MS analysis only; mercury (Hg) not determined. ²Total chromium.

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SECTION 12

INSTRUMENT/EQUIPMENT TESTING, INSPECTION, AND MAINTENANCE REQUIREMENTS

To ensure the quality of the sampling and analytical equipment, ERG conducts performance checks for all equipment used in the programs. ERG personnel check, and, if needed, repair the sampling systems before the season begins each year. ERG tracks the performance of the GCs to ensure proper operation. ERG also maintains a spare parts inventory to prevent equipment downtime. Table 12-1 details the maintenance

items, how frequently they will be performed, and who is responsible for performing the maintenance.

12.1 NMOC

The Hewlett-Packard GC used for NMOC measurements is maintained on an as-needed basis. Before the beginning of the analytical season, March and April preventive maintenance is performed. Throughout the analytical season, maintenance is performed as needed.

The SNMOC analytical system is maintained as described in Section 12.2.

12.2 SNMOC, UATMP, and PAMS

The GC/FID/MS system is maintained under a service agreement. Twice a year, preventive maintenance is performed by a technical representative. ERG personnel perform minor maintenance, such as ferrule changes, carrier gas filter replacements, column maintenance, and source cleaning.

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Table 12-1

Preventive Maintenance in ERG Laboratories

Item	Maintenance Frequency	Responsible Party
Air Toxics Laboratory		
Multipoint Maintenance Calibration	Quarterly, or as needed	Analyst
Comparison to Continuing Calibration Standard	Daily	Analyst

Replace GC/LC/IC Column	As necessary	Analyst
Replace Flame Ion Detector Tip	As necessary	Analyst
Computer Backup	Daily	Analyst
Liquid Chromatography Laboratory		
Inspect Delivery System Motor	Annually	Analyst
Replace Teflon Delivery Tubing	Annually	Analyst
For Sampling Systems (UATMP, Carbonyl, NMOC/SNMOC, and Hexavalent Chromium)		
Inspect/Replace Motor Brush	Annually, replace as needed	Field Specialist
Inspect/Replace Cartridge Connectors	Annually, replace as needed	Field Specialist
Inspect/Replace Fan Motors	Annually, replace as needed	Field Specialist
Inspect Sampler	Annually, replace as needed	Field Specialist

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12.3 PAMS

The VOC PAMS analytical system is maintained as described in Section 12.2.

The PAMS carbonyl HPLC analytical system receives preventive maintenance by a technical service representative before the beginning of the analytical season. ERG personnel perform other minor maintenance, such as column and detector maintenance, on an as-needed basis.

12.4 HAPs

The GC/MS system is maintained under a service agreement. Twice a year,

preventive maintenance is performed by a technical representative. ERG personnel perform minor maintenance, such as ferrule changes, carrier gas filter replacements, column maintenance, and source cleaning.

For the other HAPs sample analyses performed on the IC, gas chromatography/electron capture detector (GC/ECD), high resolution mass spectrometry (HRMS), and ICP/MS analytical systems, preventive maintenance is performed by competent technical service representatives as needed. ERG and subcontractor personnel perform minor maintenance, such as column and detector maintenance, on an as-needed basis.

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SECTION 13

INSTRUMENT CALIBRATION AND FREQUENCY

Because the requirements of the programs for analytical system calibrations differ, the programs are discussed separately in this section. Each calibration is stored, electronically and hardcopy, with the samples analyzed using that calibration. All programs store the calibration information separately with all pertinent information (raw data, control charts, and/or any summary statistics) together with the analyzed samples. Each of the analytical systems is calibrated for all of the reported target analytes, with the exception of the NMOC and SNMOC calibration. These calibrations, based on propane only, are outlined in Sections 13.1 and 13.2, respectively.

13.1 NMOC Calibration

At least every six months an NMOC calibration curve is generated at the beginning and the end of the sampling season using three certified propane standards and

zero air. Propane standards for the calibration curve are prepared at a concentration range from zero to 10 ppmC using dynamic flow dilution (SOP Number ERG-MOR-061, Appendix C). Zero concentration air is made from clean humidified air. These individual certified standards are analyzed by the NMOC instruments directly from the cylinder.

Calibration curves are calculated by linear regression, assuming a linear relationship between area counts and concentration. If the regression coefficient for any channel is less than 0.995, the entire curve is regenerated. If the relative standard deviation is not $\leq 3\%$ for each point, the point is repeated.

Response factors for the NMOC calibration are verified every morning samples are analyzed by making two injections of the mid-range QC calibration standard, an independently

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prepared calibration standard with a concentration of approximately 3.0 ppmC. The percent relative standard deviation (%RSD) is computed and a third injection is analyzed if the %RSD is greater than 3%. After the third injection, the RSD is computed again.

SD

%RSD =

$$\frac{SD}{\text{Sample Average}} \times 100 \quad (\text{Eq. 13-1})$$

Sample Average

where: SD = Sample Standard Deviation calculated with the denominator of N-1. N =

Number of injections.

The relative error from the pair of QC injections should be within 20% of the theoretical concentration.

$$\frac{\text{TPC} - \text{DPC}}{\text{TPC}}$$

Relative Error =

$$\frac{\text{TPC} - \text{DPC}}{\text{TPC}} \quad (\text{Eq. 13-2})$$

where:

TPC = Theoretical Propane Concentration.

DPC = Daily Observed Propane Concentration.

If the QC value does not meet the 20% requirement, the QC check analysis is repeated.

If the 20% requirement is again not met, the analysis is repeated using a lower level standard

(0.5 ppmC). If, after trying a second concentration level, the QC still does not meet acceptance criteria, the Task Leader is contacted and the Analyst and Task Leader discuss rerunning the calibration curve.

After running and checking the QC, two zero air samples at 50% relative humidity are injected to determine system cleanliness. The average of the two sets of area counts should be less than

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1. 10.0 ppbC. If the concentration is greater than 10.0 ppbC, an additional injection is analyzed and the analyst averages all three. If the concentration is still greater than 10.0 ppbC, a leak check of the analytical system is performed and the Task Leader is contacted.

2. **13.2 SNMOC Calibration**

For the SNMOC instrument, a carbon response factor is obtained quarterly based on the analysis of humidified propane calibration standard. These standards are prepared by using the Dynamic Flow Dilution System (SOP Number ERG-MOR-061, Appendix C) to dilute Scott Specialty or Spectra Gas NIST certified standards into clean, evacuated stainless steel canisters. HPLC grade water is injected to humidify the standard to approximately 75%. The standard is diluted with nitrogen to achieve the desired concentrations for the calibration. The response factors generated from the calibration are used to determine concentrations of detected compounds, on the assumption that FID response is linear with respect to the number of carbon atoms present in the compound.

Calibration standards are prepared in ranges from 5 to 90 ppbC concentrations. The calibration standards are analyzed in order of increasing concentration, followed by the system blank analysis to ensure no carryover after analysis of the high level standard. The propane area count recorded by the FID is correlated to propane concentration by an average response factor and is used to quantitate the C₂ through C₁₃ compounds. The calibration is considered representative if the average response factor for the points from the curve and the blank is within ±30% of the previous calibration for propane. The slopes of the regression lines are then used to calculate monthly response factors.

Daily, before sample analysis, a QC standard consisting of a verified PAMS standard prepared using a gas standard obtained from a qualified vendor is analyzed to ensure the validity of the current monthly response factors. This standard has a midpoint concentration from the calibration for compounds that span the carbon range. This level is considered representative of

the majority of concentrations expected in ambient air samples. The concentrations computed from the QC standard are compared to the calculated theoretical concentrations. A concentration percent bias of less than or equal to 30% is considered acceptable and the analytical system is in control.

If the daily QC standard does not meet the 30% criterion, a second QC standard is prepared and analyzed. If the second QC standard meets the criterion, the analytical system is considered in control. If the second QC check does not pass, a leak test and system maintenance are performed, and a third QC standard analysis is performed. If the criterion is met by the third analysis, the analytical system is considered in control. If the maintenance causes a change in system response, a new calibration curve is required.

A system blank of cleaned, humidified air is analyzed after the daily QC standard analysis and before sample analyses. The system is considered in control if the total NMOC concentration for the system blank is less than or equal to 20 ppbC.

Retention time standards are used to gather information and set up a reference database using relative retention times referenced to toluene. These relative retention times are used to identify the target compounds in the ambient air samples.

For simplicity, each instrument is calibrated for all of the SNMOC, PAMS, and UATMP compounds daily. All QC check standards have to pass each of the calibration procedures listed in Sections 13.2, 13.3, and 13.4.

13.3 UATMP Calibration

Calibration of the GC/FID/MS is accomplished quarterly by analyzing humidified

calibration standards generated from certified standards supplied by a qualified vendor. The certified standards contain the UATMP target compounds at approximately 500 ppbv - polar compounds

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at 1 ppm. Although the MS is the primary quantitation tool, responses on the FID are recorded and quantitated to detect and quantify hydrocarbon peaks and can be used for SNMOC or PAMS results. The calibration for these hydrocarbon peaks should be accomplished as explained in Sections 13.2 and 13.4, respectively.

Calibration curves for the UATMP samples should include at least a five-point calibration and daily calibration checks at a mid-level concentration for the target compounds (see Standard Operating Procedure ERG-MOR-061, Appendix C).

Calibration standards are generated with a dynamic flow dilution apparatus (Figure 13-1). The gases are mixed in a SUMMA[®]-treated mixing sphere and bled into evacuated canisters. One dilution air stream is routed through a SUMMA[®]-treated bubbler containing HPLC-grade water to humidify; the other stream is not humidified. The dilution air streams are then brought together for mixing with the streams from the

certified cylinders. Flow rates from all streams are gauged and controlled by mass flow controllers. The split air dilution streams are metered by “wet” and “dry” rotameters from the humidified and unhumidified dilution air streams, respectively. Air is controlled from channel 4 where the mass flow controller ranges from 0-5 L/min, whereas all other channels range from 0-20 mL/min.

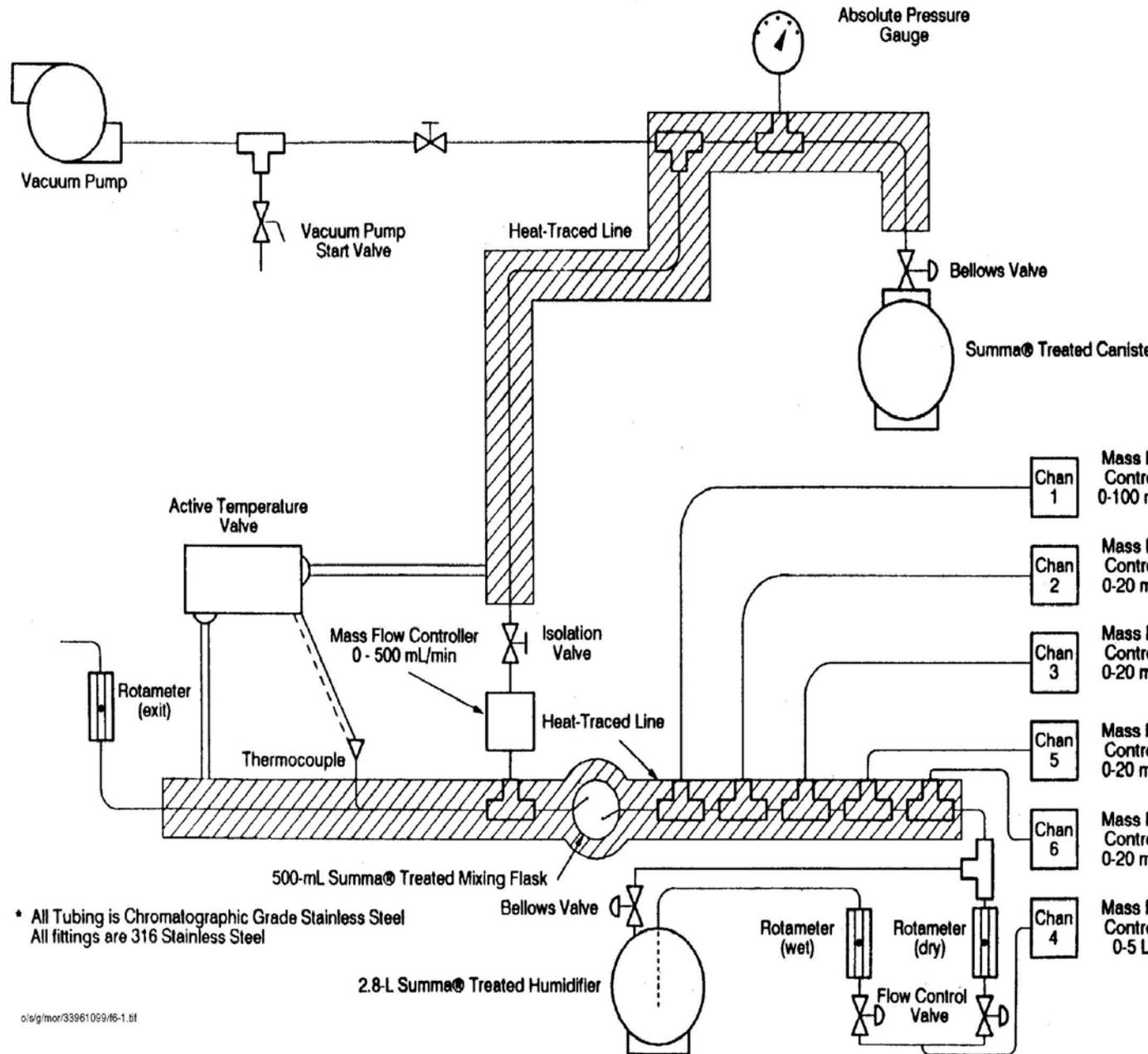
The system is evacuated with a vacuum pump while the closed canister is connected. The lines leading to the canister and to the mixing sphere are flushed for at least 15 minutes with standard gas before being connected to the canister for filling. A precision absolute pressure gauge measures the canister pressure before and after filling.

Initial calibration standards are prepared at an average of 0.5, 1, 5, 10, and 15 ppbv for each of the target compounds. All standards and samples are analyzed with the following internal standards: *n*-hexane-d₁₄, 1,4-difluorobenzene, and chlorobenzene-d₃. Bromofluorobenzene is also injected with the internal standards to verify mass spectrometer tune. The calibration requires an average response factor, based on the internal standard, of

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±30% relative standard deviation. The zero air used for canister cleaning and for standard dilution is analyzed at the time of calibration, but the results are not included in

the calibration curve. Daily quality control verification is done with standards made from Scott certified gases at an average concentration of 5 ppbv.

For simplicity, each instrument is calibrated for all of the SNMOC, PAMS, and UATMP compounds daily. All QC check standards have to pass each of the calibration procedures listed in Sections 13.2, 13.3 and 13.4.

PAMS Calibration

The PAMS hydrocarbon analysis system is calibrated using the same procedure described for SNMOC in Section 13.2 on the GC/FID/MS system.

For the PAMS carbonyl analyses, the HPLC instrument is calibrated using 0.01 to 3.0 micrograms per milliliter ($\mu\text{g/mL}$) nominal concentrations of the derivatized targeted compounds contained in a solution of acetonitrile. The calibration curve consists of six concentration levels between 0.01 and 3.0 $\mu\text{g/mL}$, and each is analyzed in replicate. The standard linear regression analysis performed on the data for each analyte must have a correlation coefficient greater than or equal to 0.995.

As a QC procedure to check HPLC column efficiency, a SSQC sample solution containing 15 target carbonyl compounds at a known concentration is analyzed after every calibration curve. A calibration accuracy check (a midpoint calibration standard) is analyzed after every 12 hours or less when samples are analyzed (meeting the $\pm 15\%$ criteria), and a system blank brackets the analytical batch, by analyzing one blank at the beginning and one at the end.

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HAPs Calibration

Analytical instruments and equipment are calibrated prior to each use or on a scheduled periodic basis. Analytical methods requiring calibration standards are governed by SOPs for laboratory standards and are included in Appendix C, D, or E. Appropriate standards are prepared by serial dilutions of pure substances or accurately prepared concentrated solutions. Many analytical instruments have high sensitivity, so calibration standards must be extremely dilute solutions. In preparing stock solutions of calibration standards, great care is exercised in measuring weights and volumes, since analyses following the calibration are based on the accuracy of the calibration. Calibration requirements for the HAPs analytical methods are shown in Table 13-1. Calibration requirements for metal analysis performed by RTI and CAS are provided in their respective QAPPs, which are presented in Appendix D. Calibration requirements for dioxin analysis performed by CAS are provided in CAS's QAPP and SOP in Appendix E.

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Table 13-1

HAP Analytical Equipment Calibration Requirements

Analytical Parameter	Quality Parameter	Method of Determination	Frequency	Acceptance Criteria
Semivolatiles GC/MS (8270C)	Calibration Quantitative	Initial analysis of standards at 5 levels bracketing sample concentrations	Prior to sample analysis	Variability of average Relative Response Factor < 30%
	Calibration Calibration Check Compounds	With calibration standards	Prior to sample analysis	Percent Difference with curve MUST be <30%
	Calibration System Performance Check Compounds	With calibration standards	Prior to sample analysis	Minimum Relative Response Factor for Check Compounds ≥ 0.050

	Calibration - Daily calibration check	Every 12 hours	Prior to sample analysis	Relative percent difference compared to mean of calibration curve <20%
	Calibration - Blanks	20% of samples	Concurrent with sample analysis	Analytes < Method Detection Limit
Hexavalent Chromium	Calibration Quantitative	Initial analysis of 4 levels of standards bracketing sample concentrations	Daily	Linear correlation coefficient > 0.995
	Filter Blanks	After calibration standards	Every batch	Less than method detection limit of 0.434 ng/filter
	Continuing Calibration Check	Analysis of mid-range calibration standard	Every 10 samples	90-110% of expected value

Note: Refer to RTI's QAPP in Appendix D for Analytical Equipment Calibration Requirements for the ICP/MS and other instrumentation used in the analysis of metals.

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SECTION 14

INSPECTION/ACCEPTANCE FOR SUPPLIES AND CONSUMABLES

14.1 Purpose

The purpose of this element is to establish and document a system for inspecting and accepting all supplies and consumables that may directly or indirectly affect the quality of the Program. By having documented inspection and acceptance criteria, consistency of the supplies can be assured. This section details the supplies/consumables, their acceptance criteria, and the required documentation for tracing this process.

14.2 Critical Supplies and Consumables

Table 14-1 details the various components for the field and laboratory operations.

14.3 Acceptance Criteria

Acceptance criteria must be consistent with overall project technical and quality criteria. It is the laboratory analyst's responsibility to update the criteria for acceptance of consumables. As requirements change, so do the acceptance criteria. Knowledge of laboratory equipment and experience are the best guides to acceptance criteria. Other acceptance criteria such as observation of damage due to shipping can only be performed once the equipment has arrived on site.

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Table 14-1

Critical Field and Laboratory Supplies and Consumables

Area	Item	Description	Vendor	Model Number
Field Supplies and Consumables				
All Samplers	Various Swagelok® fittings	All Samplers	Raleigh Valve and Fitting	
NMOC Sampler	Pump	Metal Bellows	KNF Newberger	UN 05-SV.91
VOC Sampler	Vacuum Pump	UATMP System		
	Canisters	UATMP Canisters	Meriter	AeroSphere 6-liter Canisters
Carbonyl Sampler	DNPH Cartridges	DNPH coated plastic cartridges	Waters	WAT 037500
Hexavalent Chromium Sampler	Pump	High Vacuum	Thomas	VA-2110
Laboratory Supplies and Consumables				
All	Powder Free Gloves	Polyethylene	VWR	32915-246
All	Gloves	Nitrile	Safeskin	52002

Liquid Chromatography	Guard column	Zorbax ODS	MacMod	820950-902
Liquid Chromatography	Chromatographic Column	Zorbax ODS	MacMod	880952-702
Liquid Chromatography	UV Lamp	For 2487 detector	Waters	WA 5081142
GC/MS	Chromatographic Column	0.32 x 1 μ - 60 m column	J&W	DB-1
GC/MS & Liquid Chromatography	Helium	Carrier Gas	National Welders	UHP
GC/MS	Hydrogen Gas	FID Gas	National Welders	UHP
GC/MS	Liquid Nitrogen	Coolant Gas	National Welders	XL-65, Low

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Table 14-1

(Continued)

Area	Item	Description	Vendor	Model Number
Laboratory Supplies and Consumables (Continued)				
GC/MS	Argon	Coolant Gas	National Welders	LARS-65
GC/MS	Air	FID Gas	National Welders	Zero
GC/MS	Traps	Glass bead/Tenax Trap	Entech	01-04-11340
Prep	Acetonitrile	Solvent	VWR	B&J 018-4
Prep	Methanol	Solvent	Krackeler	MS-0488-1 EMSci
Prep	Methylene Chloride	Solvent	Krackeler	DX-0831-1 EMSci
Prep	4 mL sample vials	Sample containers	Krackeler	B7999-2A
Prep	4 mL sample caps	Sample containers	Krackeler	B7815-13
Prep	Autosampler snap-it vials	Sample containers	Krackeler	B4011-6
Prep	Autosampler snap-it caps	Sample containers	Krackeler	B4011-54
Prep	Carbonyl Standards	Standards	Cerilliant	ERA-030

Prep	HAPS Standards	Standards	Cerilliant	ERG-026 & ERG-024
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14.4 Tracking and Quality Verification of Supplies and Consumables

Tracking and quality verification of supplies and consumables have two main components. The first is the need of the end user of the supply or consumable to have an item of the required quality. The second need is for the purchasing department to accurately track goods received so that payment or credit of invoices can be approved. In order to address these two issues, the following procedures outline the proper tracking and documentation procedures to follow:

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- Receiving personnel will perform a rudimentary inspection of the packages as they are received from the courier or shipping company. Note any obvious problems with a receiving shipment such as crushed box or wet cardboard.
- The package will be opened, inspected, and contents compared against the packing slip.
- If there is a problem with the equipment/supply, note it on the packing list and notify the Purchasing Agent who will immediately call the vendor.
- If the equipment/supplies appear to be complete and in good condition, sign and date the packing list and sent to the Purchasing Agent so that payment can be made in a timely manner.
- Notify appropriate personnel that equipment/supplies are available. For items such as the filters, it is critical to notify the laboratory manager of the weigh room so sufficient time for processing of the filters can be allowed.
- Stock equipment/supplies in appropriate pre-determined area.

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SECTION 15

DATA MANAGEMENT

15.1 Purpose

This section describes the data management operations pertaining to measurements for the field monitoring stations supported by ERG, with an overview of the mathematical operations and analyses performed on raw (“as-collected”) data. These operations include data recording, validation, transformation, transmittal, reduction, analysis, management, storage, and retrieval.

Data processing for analysis data is summarized in Figure 15-1. Data processing steps are integrated, to the extent possible, into the existing data processing system used for the network.

The sample tracking and chain of custody information are entered into the ERG LIMS as shown in Figure 15-1. All users must be authorized by the Deputy Program Manager. The following privilege levels are defined:

- Data Entry Privilege – The individual may see and modify only data within the LIMS that he or she has personally entered.
- Reporting Privilege – Without additional privileges.
- Data Administration Privilege – Data Administrators for the database are allowed to change data as a result of QA screening and related reasons. The Data Administrator is responsible for performing the following tasks on a regular basis:
 - .– Merging/correcting the duplicate data entry files;
 - .– Running verification/validation routines, correcting data as necessary; and
 - .– Generating summary data reports for management.

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Figure 15-1. Data Management and Sample Flow Diagram

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15.2 Data Recording

Data entry, validation, and verification functions are all integrated in the ERG LIMS. Procedures for providing all laboratory notebook information and subsequent data entry are provided in SOP #ERG-MOR-039, (see Appendix C) for Maintaining Laboratory Notebooks.

15.3 Data Validation

Data validation is a combination of checking that data processing operations have been carried out correctly and of monitoring the quality of the field operations. Data validation can identify problems in either of these areas. Once problems are identified, the data can be corrected or invalidated, and corrective actions can be taken for field or laboratory operations.

The following validation functions are incorporated to ensure quality of data entry and data processing operations:

- **Completeness Checks** – When the data are processed certain completeness criteria must be met. For example, each sample must have a start time, an end time, an average flow rate, dates analyzed, and operator and technician names.
- **Data Retention** – Raw data sheets are retained on file at ERG for a minimum of five years after the close of the contract, and are readily available for audits and data verification activities. After five years, hardcopy records and computer backup media are disposed.
- **Statistical Data Checks** – Errors found during statistical screening will be traced back to original data entry files and to the raw data sheets, if necessary. These

checks shall be run on an annual schedule and prior to any data submission to AQS. Data validation is the process by which raw data are screened and assessed before they can be included in the main data base.

The objective will be to optimize the performance of all monitoring equipment.

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15.4 Data Transformation

Calculations for transforming raw data from measured units to final concentrations use standardized procedures listed in the individual SOPs or subcontractor's QAPP. All data are double checked to ensure there are no incorrect transformations. All new spreadsheets go through peer review as well, to ensure that all data submitted are accurate. The peer reviewer uses hand calculations and visual verification to review all data reported to the EPA and State/ local/tribal agencies are valid following guidelines outlined in SOP #ERG-MOR-057 (see Appendix C). Separate SOPs for Developing, Documenting, and Evaluating the Accuracy of Spreadsheet Data are presented in SOP #ERG-MOR-017 (see Appendix C).

15.5 Data Transmittal

Data transmittal occurs when data are transferred from one person or location to another or when data are copied from one form to another. Some examples of data transmittal are copying raw data from a notebook onto a data entry form for keying into a computer file and electronic transfer of data over a computer network. Each individual SOP listed in Appendix C discusses the procedures for determining the calculations of concentrations as well as data entry.

ERG will report all ambient air quality data and information specified by the AQS User's Guide (Volume II, Air Quality Data Coding, and Volume III, Air Quality Data

Storage), coded in the AQS format. Such air quality data and information will be fully screened and validated and will be submitted directly to the AQS via electronic transmission, in the format of the AQS, and in accordance with the annual schedule.

15.6 Data Reduction

Data reduction processes involve aggregating and summarizing results so that they can be understood and interpreted in different ways. Examples of data summaries include:

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- Average concentration for a station or set of stations for a specific time period;
- Accuracy, bias, and precision statistics; and
- Data completeness reports based on numbers of valid samples collected during a specified period.

15.7 Data Summary

ERG is currently implementing the data summary and analysis program. It is anticipated that as the Monitoring Program develops, additional data analysis procedures will be developed. The following specific summary statistics will be tracked and reported for the network:

- Single sampler bias or accuracy (based on laboratory audits if available);
- Sampler precision (based on collocated data);
- Network-wide bias and precision; and
- Data completeness.

Equations used for these reports are given in Table 15-1.

Table 15-1. Report Equations

Criterion	Equation
Percent Difference for a Single Check (di) X_i and Y_i are concentrations from the primary and duplicate samplers, respectively.	$\frac{ Y - X }{\frac{Y + X}{2}} \times 100$
Upper 95% Confidence Limit, S_i is the standard error.	Limit $d \leq 1.96 * S_i$
Lower 95% Confidence Limit	Limit $d \geq 1.96 * S_i$
Percent Completeness	$\frac{\text{Completeness } N}{N_{\text{valid theoretical}}} * 100$

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15.8 Data Tracking

The ERG LIMS database contains the necessary input functions and reports appropriate to track and account for the whereabouts of specific samples during processing operations. The following input locations are used to track sample location and status:

- Laboratory (initial receipt)
 - S Sample receipt (by Work Order);
 - S Canister number (VOC only);
 - S Filter package for the laboratory (filter numbers in each package are recorded);
- Laboratory (receipt from field)

- S Package receipt (package is opened and contents are logged in);
- S Samples are stored in correct locations (i.e., carbonyl tubes, XAD resin, and PUF are stored in separate refrigerators and canisters are stored in the Air Toxics laboratory);

- Refrigerator, by refrigerator number.

15.9 Data Storage and Retrieval

Data archival policies are shown in Table 15-2. All data are stored on the ERG

LIMS server. This system has the following specifications:

- Storage: 438G (RAID 5 array);

-

Security of the data in the database is ensured by the following controls:

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Table 15-2. Data Archive Policies

Data Type	Medium	Location	Retention Time	Final Disposition
Laboratory notebooks	Hardcopy	Laboratory	5 years after close of contract	N/A
Database	Electronic (on-line)	Laboratory	Backup media after 5 years	Backup tapes retained indefinitely
Semivolatile organics	XAD PUF	Laboratory	XAD reused after cleaning. PUF not reused.	Discarded
VOC canisters	Metal canister	Laboratory	Reused after cleaning	Recycled
DNPH cartridge	Plastic cartridge	Laboratory	6 months	Discarded
Hexavalent chromium filter	Filter	Laboratory	1 month	Discarded

- Network: Novell Netware 5.0, Windows NT, Linux RedHat, 10/100 Mbps

Ethernet network (Windows 95/98 on workstations); and

- Security: Network login password protection on all workstations and dial-in-lines; Additional password protection applied by application software.
- Password protection on the data base that defines three levels of access to the data;
- Regular password changes (quarterly for continuing personnel);
- Logging of all incoming communication sessions, including the originating telephone number, the user's ID, and connect times; and
- Storage of media including backup tapes in locked, restricted access areas.

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C—ASSESSMENT/OVERSIGHT

SECTION 16

ASSESSMENTS AND RESPONSE ACTIONS

An assessment is defined as an evaluation process used to measure the performance or effectiveness of the quality system or the establishment of the monitoring network and sites and various measurement phases of the data operation.

The results of quality assurance assessments indicate whether the control efforts are adequate or need to be improved. Documentation of all quality assurance and quality control efforts implemented during the data collection, analysis, and reporting phases are important to data users, who can then consider the impact of these control efforts on the data quality. Both qualitative and quantitative assessments of the effectiveness of these control efforts will identify those areas most likely to impact the data quality and to what extent. In order to ensure the adequate performance of the

quality system, ERG will perform the following assessments.

16.1 Assessment Activities and Project Planning

16.1.1 Management Systems Review

A management systems review (MSR) is a qualitative assessment of a data collection operation or organization to establish whether the prevailing quality management structure, policies, practices, and procedures are adequate. MSRs are conducted every year when the laboratory internal audit is conducted (see Section 20.1.4). The MSR will use appropriate regulations and the QAPP to determine the adequate operation of the air program and its related quality system. A Laboratory Quality Manual for the ERG laboratory is also available for reference. The quality assurance activities for all criteria pollutants including air toxics will be part of the MSR.

The Project QA Officer will report findings to the Program Manager, Deputy

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Program Manager, and the Program QA Officer within 30 days of completion of the MSR. The report will be appropriately filed. Follow-up and progress on corrective

action(s) will be determined during regularly scheduled meetings.

16.1.2 Technical System Audits

A Technical System Audit (TSA) is a thorough and systematic on-site qualitative audit, where facilities, equipment, personnel, training, procedures, and record keeping are examined for conformance to the QAPP. The TSAs will be performed by the EPA or its designee at the ERG Morrisville Laboratory. The TSAs of the contract should be conducted every year. The EPA QA Office will implement the TSA either as a team or as an individual auditor. The EPA QA Office will perform two TSA activities that can be accomplished separately or combined :

- Laboratory - Pre-sampling, shipping, receiving, post-sampling weighing, analysis, archiving, and associated QA/QC; and
- Data management - Information collection, flagging, data editing, security, upload.

Key personnel to be interviewed during the audit are those individuals with responsibilities for: planning, laboratory operations, QA/QC, data management, and reporting. To increase uniformity of the TSA, an EPA audit checklist will be developed and used. This checklist is based on the EPA R-5 guidance.

The EPA audit team will prepare a brief written summary of findings, organized into the following areas: planning, laboratory operations, quality assurance/quality control, data management, and reporting. Problems with specific areas will be discussed and an attempt made to rank them in order of their potential impact on data quality.

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The EPA audit finding form has been designed such that one is filled out for each major deficiency that requires formal corrective action. The finding could include the following items: systems impacted, estimated time period of deficiency, site(s) affected, and reason of action. The finding form will inform the Division about serious problems that may compromise the quality of the data and therefore require specific corrective actions. They are initiated by the Audit Team, and discussed at the debriefing. During the debriefing, if the ERG is in agreement with the finding, the form is signed by the ERG's Program QA Officer during the exit interview. If a disagreement occurs, the EPA Audit Team will record the opinions of the group audited and set a time at some later date to address the finding at issue.

Follow-up and Corrective Action Requirements — ERG will work with the EPA to solve required corrective actions. As part of corrective action and follow-up, an audit finding response letter will be generated by the ERG organization . The audit finding response letter will address what actions are being implemented to correct the finding of the TSA. The audit response letter will be completed by ERG within 30 days of acceptance of the audit report.

16.1.3 Performance Audit

Quality assurance performance audit samples are provided by the EPA (or an EPA contractor) as available. Percent accuracy (or bias) is calculated using the EPA-

reported audit sample concentration as the true value. For the NMOC program, audit samples of propane or multicomponents in air are analyzed as received. Multi-component audit samples will be analyzed for the 12-month UATMP by the GC/FID/MS. For the SNMOC and PAMS programs, multicomponent audit samples are also analyzed as received by the GC/FID/MS analytical system.

Currently, the only audit program supported by this contract is the PAMS carbonyl audit, providing three separate audits throughout the summer months. The acceptable limits are provided on the annual reports presented to the participating States and EPA.

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16.1.4 Data Quality Assessments

A data quality assessment (DQA) is the statistical analysis of environmental data to determine whether the quality of data is adequate to support the decisions which are based on the DQOs. Data are appropriate if the level of uncertainty in a decision based on the data is acceptable. The DQA is processed before the final report is presented to the EPA and State agencies and is summarized below.

1. 1. Review the data quality objectives (DQOs) and sampling design of the program: Review the DQO. Define statistical hypothesis, tolerance limits, and/or confidence intervals.
2. 2. Conduct preliminary data review. Review Precision & Accuracy (P&A) and other available QA reports, calculate summary statistics, plots and graphs. Look for patterns, relationships, or anomalies.
3. 3. Select the statistical test: Select the best test for analysis based on the preliminary review, and identify underlying assumptions about the data for that test.
4. 4. Verify test assumptions: Decide whether the underlying assumptions made by the selected test hold true for the data and the consequences.
5. 5. Perform the statistical test: Perform test and document inferences. Evaluate the performance for future use.

Terminology associated with measurement uncertainty includes: (a) Precision - a

measurement of mutual agreement among individual measurements of the same property usually under prescribed similar conditions, expressed generally in terms of the standard deviation;

(b) Accuracy - the degree of agreement between an observed value and an accepted reference value. Accuracy includes a combination of random error (precision) and systematic error (bias) components which are due to sampling and analytical operations;

(c) Bias - the systematic or persistent distortion of a measurement process which causes errors in one direction. The

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individual results of these tests for each method or analyzer shall be reported to the EPA and States.

16.1.5 Proficiency Testing and System Audits

ERG supports several State/local agencies that participate in the National Air Toxics Trends Station (NATTS) network. Starting in the Summer 2004, EPA's designated laboratory will begin providing quarterly Proficiency Testing (PT) samples to all laboratories that support the NATTS. ERG and its support laboratories will analyze all PT samples provided by EPA's designated laboratory and participate in any "round robin" program sponsored by EPA's designated laboratory. All PT and round robin samples will be analyzed in accordance of this QAPP, ERG's and ERG's support laboratories' SOPs. Results will be returned to EPA's designated laboratory in a manner described in the paperwork that accompanies the PT or round robin samples.

The proficiency testing (PT) is an assessment tool for the laboratory operations. 'Blind' samples are sent to the laboratory, where they are logged in following the normal handling routines that any other sample follows. The results are sent to the Deputy

Program Manager for final review. The results are then reported to the auditing agency. The auditing agency writes up a PT report and sends a copy of the results to the Program/Deputy Program Manager and the EPA QA Office. Any results outside the acceptance criteria are noted in the PT report.

16.2. Documentation of Assessments

The Program QA Officer provides written QA reports to the Task Leader, Deputy Program Manager, and Program Manager as needed. These reports are provided whenever a QC problem occurs that requires a change in the operating procedure. These reports address QC problems arising in the application of the work plan, an assessment of the probable

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significance of the problems, and recommended corrective actions. QC problems to be addressed may arise from:

- Poor compliance with sampling procedures reported by the project personnel;
- Invalid samples;
- In-process procedure changes required by the nature of the program; and
- Quality control waivers dictated by operating conditions.

The final report also addresses QA considerations of the whole project.

The assessment of the significance of the problems is based, in part, on the probable effect on program completeness and validity of inferences made from the data.

Recommended actions include, as applicable:

- Tests that may clarify the problem;
- Corrective actions to alleviate the problem;
- Further documentation of the problem; and
- Acceptance of the anomalous condition with associated risk.

These reports will also include:

- Periodic assessment of measurement accuracy, precision, and completeness;
- and • Results of performance and laboratory system audits.

In the final project report, a QA summary discusses all the QA activities and results for the entire project.

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SECTION 17

REPORTS TO MANAGEMENT

This section describes the quality-related reports and communications to management necessary to support monitoring network operations and the associated data acquisition, validation, assessment, and reporting. Important benefits of regular monthly reports to the EPA provide the opportunity to alert the EPA to data quality problems, to propose viable solutions to problems, and to procure necessary additional resources.

Effective communication among all personnel is an integral part of a quality system. Regular, planned quality reporting provides a means for tracking the following:

- Adherence to scheduled delivery of data and reports;
- Documentation of deviations from approved QA and test plans, and the impact of these deviations on data quality; and
- Analysis of the potential uncertainties in decisions based on the data.

17.1 Frequency, Content, and Distribution of Reports

Frequency, content and distribution of reports for monitoring in general are shown below.

17.1.1 Annual Report

Yearly assessment of the air toxics data is reported to the EPA and State agencies involved in that year's monitoring. This report documents the statistical analysis and quality for the measurement data and how the objectives for the program were met.

The annual report includes the quality information for each toxic monitoring network in each state. Each report includes:

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- Program overview and update;
- Quality objectives for measurement data;
- Data quality assessment;

- Collocated and duplicate sampling estimates for precision and bias; and
- Audits that were performed during the study, if applicable.

17.1.2 Internal Technical System Audit Reports

ERG performs a technical system audit once a year for the monitoring network for this EPA and State contracts. These reports are filed and available to the EPA personnel during their technical system audit.

17.1.3 Response/Corrective Action Reports

The Response/Corrective Action Report procedure will be filed whenever a problem is found such as a safety defect, an operational problem, or a failure to comply with procedures. A Response/Corrective Action Report is one of the most important ongoing reports to management because it documents primary QA activities and provides valuable records of QA activities. A copy of the ERG Response/Corrective Action Form is shown in Figure 17-1.

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Corrective Action Report

Originator:	Date:
Project Number:	Corrective Action Number:
Description of Problem:	State Cause of Problem:

(Give Date and Time Identified)	
State Corrective Action Planned: (Include Persons Involved in Action and Date Action is to be Completed)	QA Officer Comments:
Signatures:	Project Manager Comments:
QA Officer:	
Project Manager:	
Originator:	

Figure 17-1. ERG Response/Corrective Action Form

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SECTION 18

DATA REVIEW, VALIDATION, AND VERIFICATION REQUIREMENTS

ERG's LIMS is used to facilitate data storage, retrieval, analysis, and reporting. Data summaries, QC charts, and other graphs, generated in a cost-effective manner, aid in maintaining consistent data quality. All data reported by ERG will use a flagging system (designated as "U") to notify the observer of compounds detected at a level less than the detection limit.

18.1 Data Review Design

Each sample received at the ERG Laboratory is logged into the ERG LIMS. The accompanying field data forms are reviewed to verify that all data entry is complete and correct. The personnel performing the data review are:

- familiar with typical diurnal concentration variations (for example, benzene, toluene, and xylene concentrations usually increase and decrease together, since the occurrence of these compounds is attributed to mobile sources);
- familiar with the type of instrument malfunctions which cause characteristic trace irregularities;
- recognize that cyclical or repetitive variations (at the same time each day or at periodic intervals during the day) may be caused by excessive line voltage or temperature variations. Nearby source activity can also cause erroneous or non representative measurements; and
- recognize that flow rates showing little or no activity often indicate flow problems, or sample line leaks.

Information used to validate air toxics data, includes:

- Multi-point calibrations - the multipoint calibrations are used to establish proper initial calibration and can be used to show changes in calibration.

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- Instrument logs - all activities and samples analyzed are entered into the log books to track the samples throughout the measurement procedures.

- Blanks, replicate and spike results - these QC indicators can be used to ascertain whether sample handling or analysis is causing bias in the data set.
- Summary Reports - Quarterly summary reports present the preliminary data to the EPA and respective State representatives. Final data reports are completed at the end of the year including all data collected throughout the year's measurements. These data will include:
 - .- summaries for the monitoring locations in the respective cities;
 - .- analysis and interpretation of data trends for that year's group of prevalent compounds;
 - .- illustration of changes in ambient air concentrations of the most prevalent components of urban air pollution from year to year;
 - .- completeness report;
 - .- collocated and duplicate results from the field and replicate results from the laboratory.

The reliability and acceptability of environmental analytical information depends on the rigorous completion of all the requirements outlined in the QA/QC protocol. During data analysis and validation, data are filtered and accepted or rejected based on the set of QC criteria listed in the individual SOPs included in Appendix C. The data are critically reviewed to locate and isolate spurious values. A spurious value, when located, is not immediately rejected. All questionable data, whether rejected or not, are maintained along with rejection criteria and any possible explanation. Such a detailed approach can be time-consuming but can also be helpful in identifying sources of error and, in the long run, save time by reducing the number of outliers.

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18.2 Data Review

Prior to performing any statistical calculations, the reported data from the chain of custody forms are checked to ensure accurate transcription. The value is double-checked and a comparison to previously recorded data is made. Using conveniently formatted and bound prepared data recording forms is essential; hardcopies of data can also be obtained

directly from measuring devices equipped with the necessary digital recording peripherals. Usually, this method of recording data is sufficient if the hardcopies are properly labeled and filed, although a periodic check will be performed to ensure the proper operation of such a device.

The collected data are reviewed by the Analyst and the Task Leader. The data are scrutinized daily to eliminate the collection of invalid data. The analyst records any unusual circumstances (no matter how minor) during analysis (e.g., power loss or fluctuations, temporary leaks or adjustments, operator error) on the chain of custody form and notifies the analytical Task Leader. A copy of the chain of custody form can be found in Section 9.

18.3 Data Verification

Data verification consists of confirmation by examination and provision of objective evidence that specified requirements have been fulfilled. The specific requirements are QC checks, acceptable data entry limits, etc. Data validation is confirmation by examination and provision of objective evidence that the particular requirements for a specific intended use are fulfilled. Intended use deals with data of acceptable quality to permit making decisions at the correct level of confidence. The following sections outline ERG's data validation and usability requirements. All of the data management guidelines followed for this contract are presented in Section 15.

At least 10 percent of the database is checked to verify its validity. Items checked include original data sheets, checks of all calculations (from calibration to sample analysis), and

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data transfers. As the data are checked, corrections are made to the database as errors or omissions are encountered. If errors are located, all of the data is checked to verify data quality. The analytical reviewer examines all data for overall data quality and completeness. The Deputy Program Manager reviews all data before data are reported to the EPA or the State/local/tribal agencies.

18.4 NMOC, SNMOC, UATMP, and NATTS Data Reduction, Validation, and Reporting

A sample analysis logbook is maintained to detail pertinent sample information at the time of analysis. Entries include site code, sample date, analysis date, and electronic file names. A chromatograph and area count report from each detector are printed for each analysis and the analytical database for each analysis acquires, integrates, and stores the analytical data.

The NMOC data are processed manually by a Hewlett-Packard Integrator. The data are entered into an Excel[®] spreadsheet for review. The SNMOC and UATMP data are processed using Hewlett Packard Chemstation[®] Software on a PC system containing the software. The MS and FID data are reported with the chromatogram and detailed information. Electronic copies of the data are stored on the ERG LIMS server.

Monthly site-specific data update summaries for NMOC, SNMOC, and PAMS programs are developed for the purpose of distribution to the participating EPA technical staff, administrators, and to the administrators of the State/local/tribal agencies involved in the study. Quarterly data summaries are developed for the distribution of UATMP data to the participating EPA technical staff, administrators, and administrators of the State/local/tribal agencies involved in the study. UATMP data consists of any toxics VOC, SNMOC, carbonyl, semivolatile (or other HAPs) requested by the program participants. Each summary updates prior data listings. Cumulative listings are periodically generated upon request. Even though these data summaries have not passed

through the final data validation steps, this timely turnaround of data assists in planning, preliminary modeling, and program development for the participating State/local/tribal

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agencies. Any changes made in the preliminary data as a result of subsequent data validation processes are noted in the cumulative project data summaries for each specific sampling site. The data summaries include:

- Site code;
- Sample identifications;
- Sample dates;
- Target compound list;
- Concentrations (ppbv, ppbC, and $\mu\text{g}/\text{m}^3$); and
- Method detection limits.

Preliminary data summaries are mailed to the program participants. These data summaries are considered preliminary until the final report is prepared, at which time the data are validated.

The Analytical Peer Reviewer examines all data for overall data quality and completeness. The Deputy Program Manager reviews all data before they are reported to the EPA and/or the State/local/tribal agencies. ERG prepares a final report containing all aspects of the individual programs including data summaries, QA, QC, and data analysis results for EPA, and distributes site-specific summaries of the final data to designated State and local personnel. ERG will submit the final UATMP data to the AQS, as detailed in Section 18.7.

18.5 PAMS Data Reduction, Validation, and Reporting

18.5.1 VOC Data

Data from PAMS volatile hydrocarbon analyses performed at ERG are processed using the same procedures as described in Section 18.4. The final data are submitted to the AQS as

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detailed in Section 18.7. For the PAMS sites, there is an option of statistically validating the data generated using software developed by Sonoma Technology, Inc. (VOCDat).

18.5.2 Carbonyl Compounds Data

All carbonyl samples received are given an ID number that corresponds to the VOC canister sample. An extraction log is maintained to record pertinent information at the time of extraction. A sample analysis log is also maintained to record pertinent information at the time of analysis.

A PE Turbochrom[®] Data System is used to acquire, integrate, and quantitate the analytical data. Preliminary peak identifications are determined based on elution times. A data reviewer compares the chromatogram and the QC chromatogram to determine proper peak identifications and determine if reintegration is needed on any peak. Quantitations are based on raw amounts of analyte in $\mu\text{g/mL}$ calculated by the Turbochrom[®] Data System from a 6-point, least-squares regression of the calibration curve. Results in ppbv are then calculated as described in EPA Compendium Method TO-11A.⁽¹⁸⁾ The analytical reviewer examines all data for overall data quality and

completeness. The Deputy Program Manager reviews all data before they are reported to the EPA and/or the States/local/tribal agencies. Final report versions containing information on all quantitated peaks are printed using spreadsheet software, and the final data are submitted to the AQS as detailed in Section 18.7.

18.6 HAPs Data Reduction, Validation, and Reporting

The HAPs analytical procedures performed during the monitoring program will be checked against those described in the QAPP and the two SOPs for SVOC and hexavalent chromium included in Appendix C. Deviations from the QAPP will be classified as acceptable or unacceptable, and critical or noncritical. Acceptance criteria are stated in each method and in

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Section 8 of this document. The critical or noncritical nature of a deviation will be determined in the daily quality assessment (DQA) process.

Quality control samples and procedures performed during the monitoring program will be checked against those described in Section 4 of the QAPP. Omissions will be

discussed in the final report. Quality control results (matrix/method spike recoveries, blank analysis, duplicate analysis, etc.) will be reviewed. All results outside specified parameters will be discussed with the EPA Delivery Order Manager for corrective action. In some cases, reference methods have guidance on corrective action. Where available, the guidance in the reference methods will be followed. Otherwise, the data will be flagged and reported to the EPA and/or State/local/tribal agencies.

Documentation of equipment and instrument calibration (e.g., monitoring equipment and analytical instruments) will be checked against the values used in data collection. Errors and omissions will be discussed in the final report. The documentation will be checked to ensure that the calibration:

- Was performed within an acceptable time prior to the sampling dates;
 - Includes the proper number of calibration points;
 - Was performed using appropriate standards for the reported measurements; and
 - Had acceptable checks to ensure that the measurement system or analytical system was stable when the calibration was performed.

The data processing systems will be checked by using raw data for which calculated values are already known. The example data will be put into the system and the calculated results compared to the known values. Hand calculations will be used to check the data processing system. Findings from these audits will be included in the final report.

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18.7 Air Quality System

ERG submits all data collected for the NMOC, UATMP, and PAMS programs to the AQS database.

Prior to ERG's submittal of data to AQS, the State/local/tribal agency submits Basic Site Information transactions (Type AA) for each sampling site, plus Site Street Information (Type AB) if necessary. ERG then submits monitor transactions to prepare the AQS database for the raw data transactions (RD and RP).

The submittal process involves the following steps:

- The raw data are formatted into the pipe-delimited (|) coding that is accepted by the AQS. Raw data, data generated by single sample episodes or by the primary sample (D1) of a duplicate episode are submitted using the RD transaction. Precision data, data generated by duplicate and replicate samples (R1, D2, and R2) are submitted using the RP transaction.
- The RD and RP coding is reviewed to ensure that proper monitor ID (including state, county, site, parameter, and parameter occurrence code [POC] codes), sampling interval, units, method, sample date, start hour, and sample values are correct. The transactions are stored as text files for upload into the AQS database.
- The transaction files are loaded into the Monitoring and Quality Assurance screening file.
- The transactions are edited to remove any monitor errors found by AQS and then are resubmitted. This step is repeated until the transactions are free of monitor errors.
- AQS performs a statistical check on the data submitted to validate the data and determine if there are any outliers based on past data.
- The data transactions are then posted into the database.

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SECTION 19

DATA VALIDATION, VERIFICATION AND ANALYSIS

Many of the processes for verifying and validating the measurement phases of the data collection operation have been discussed in Section 15. If these processes as written in the QAPP are followed, and the sites are representative of the boundary conditions for which they were selected, one would expect to achieve the DQOs. However, exceptional field events may occur, and field and laboratory activities may negatively affect the integrity of samples. In addition, it is expected that some of the QC checks will fail to meet the acceptance criteria. This section will outline how ERG will take the data to a higher level of quality analysis by performing software tests, plotting, and other methods of analysis.

19.1 Process for Validating and Verifying Data

19.1.1 Verification of Data

After a reporting batch is completed, a thorough review of the data will be conducted for completeness and manual and electronic data entry accuracy. For the chromatographic data, the entries are reviewed to reduce the possibility of entry and transcription errors. Once the data are transferred to the ERG LIMS database, the data will be reviewed for routine data outliers and data outside acceptance criteria. These data will be flagged appropriately. All flagged data will be “re-verified” to ensure that the values are entered correctly. Appropriate data qualifiers or flags can be found in the SOPs.

19.1.2 Validation

Records of all invalid samples will be retained on file for 5 years. Information will include a brief summary of why the sample was invalidated along with the associated flags. This record will be available on stored electronic media.

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19.1.3 Validation of Measurement Values

Certain criteria based upon the laboratory analyst's judgment have been developed that will be used to invalidate a sample or measurement (i.e., water in cartridges, vacuum on canister too low, etc.). In all cases the sample will be returned to the laboratory for further examination. When the laboratory analyst reviews the chain of custody forms he/she will look for possible problems. Filters that have flags related to obvious contamination, filter damage, or field accidents will be examined immediately. Upon concurrence of the associated laboratory analyst, the Analytical Coordinator, and the Field Task Leader, these samples will be invalidated.

19.2 Data Analysis

Data analysis refers to the process of interpreting the data that are collected. Although there are a large number of parameters to analyze, many of these parameters present similar characteristics, (i.e., VOC, SVOC, and particulate metals, grouped according to their physical and chemical properties). This section will describe how ERG will begin to analyze the data to ascertain what the data illustrate and how the data should be applied.

19.2.1 Analytical Tests

ERG will employ software programs, described below, to help analyze the data.

Spreadsheet – ERG will perform a rudimentary analysis on the data sets using Excel[®] spreadsheets. Spreadsheets allow the user to input data and statistically analyze, plot and graph linear data. This type of analysis will allow the user to see if there are any

variations in the data sets. In addition, various statistical tests such as tests for linearity, slope, intercept or correlation coefficient can be generated between two strings of data.

Time series plots can help identify the following trends:

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- Large jumps or dips in concentrations;
- Periodicity of peaks within a month or quarter; and
- Expected or unexpected relationships among species.

VOCDat – Recently, the EPA has made software available that can analyze data. One such program is VOCDat, developed by Sonoma Technology, Inc., under contract to EPA. ERG has a subcontract with Sonoma Technology, Inc., who provide VOCDat to State/local/tribal agencies. This software program was originally written for input of PAMS data. VOCDat is a Windows®-based program that provides a graphical platform from which to display collected VOC data; to evaluate data according to specified quality control procedures; and for exploratory data analysis. This program will enable the States to rapidly validate and release their air toxics VOC data to AQS. VOCDat displays the observed VOC concentrations using scatter, fingerprint, and time series plots.

Customizable screening criteria may be applied to the data and the quality control codes may be changed for individual data points as well as for the entire sample on all plots.

VOCDat allows a user to find out the percentage a particular compound is of the total.

This test allows the user the ability to see if the data exceed the 3 sigma rule for outliers.

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SECTION 20

RECONCILIATION WITH DATA QUALITY OBJECTIVES

The project management team, QA Officer, and sampling and analytical team members are responsible for ensuring that all measurement procedures are followed as specified and that measurement data meet the prescribed acceptance criteria. Prompt action is taken to correct any problem that may arise.

QC problems requiring major corrective action are documented. The Program QA Officer or other project members initiate corrective action if QC results exceed control limits, or if another problem or potential problem is identified. Corrective action is immediately reported in a corrective action report to appropriate project management and the Program QA Officer. Corrective action is also initiated by the Program QA Officer based on QC data or audit results.

In addition to the corrective action reporting system for addressing problems identified through the internal QC system, a system for issuing recommendations for corrective action exists for addressing problems identified through QA review. Each recommendation addresses a specific problem or deficiency.

Each of these written recommendations requires a written response from the responsible party. Each also requires the Program QA Officer to verify that the corrective action has been implemented.

ERG and its subcontractors are responsible for implementing the analytical phase of this program and are not responsible for the overall DQOs. Therefore, this QAPP tries to ensure that analytical results are of known and adequate quality to ensure the achievement of the various program DQOs.

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20.1 Conduct Preliminary Data Review

A preliminary data review will be performed to uncover potential limitations to using the data, to reveal outliers, and generally to explore the basic structure of the data. The first step is to review the quality assurance reports. The second step is to calculate basic summary statistics, generate graphical presentations of the data, and review these summary statistics and graphs.

Review Quality Assurance Reports – ERG will review all relevant quality assurance reports, internal and external, that describe the data collection and reporting process. Particular attention will be directed to looking for anomalies in recorded data, missing values, and any deviations from standard operating procedures in a qualitative review.

20.2 Draw Conclusions from the Data

If the sampling design and statistical tests conducted during the final reporting process show results that meet acceptance criteria, it can be assumed that the network design and the uncertainty of the data are acceptable. This conclusion can then be reported to EPA and the States, who then decide whether to perform risk assessments and analyze the data to determine whether these data can be used to address health effects.

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SECTION 21

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Appendix A

Glossary

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APPENDIX A

GLOSSARY OF QUALITY ASSURANCE AND RELATED TERMS

Acceptance criteria — Specified limits placed on characteristics of an item, process, or service defined in requirements documents.

Accuracy — A measure of the closeness of an individual measurement or the average of a number of measurements to the true value. Accuracy includes a combination of random error (precision) and systematic error (bias) components that are due to sampling and analytical operations; the EPA recommends using the terms “*precision*” and “*bias*”, rather than “accuracy,” to convey the information usually associated with accuracy.

Assessment — The evaluation process used to measure the performance or effectiveness of a system and its elements. As used here, assessment is an all-inclusive term used to denote any of the following: audit, performance evaluation (PE), management systems review (MSR), peer review, inspection, or surveillance.

Audit (quality) — A systematic and independent examination to determine whether quality activities and related results comply with planned arrangements and whether these arrangements are implemented effectively and are suitable to achieve objectives.

Bias — The systematic or persistent distortion of a measurement process, which causes

errors in one direction (i.e., the expected sample measurement is different from the sample's true value).

Blank — A sample subjected to the usual analytical or measurement process to establish a zero baseline or background value. Sometimes used to adjust or correct routine analytical results; a sample that is intended to contain none of the analytes of interest. A blank is used to detect contamination during sample handling, preparation and/or analysis.

Calibration — A comparison of a measurement standard, instrument, or item with a standard or instrument of higher accuracy to detect and quantify inaccuracies and to report or eliminate those inaccuracies by adjustments.

Certification — The process of testing and evaluation against specifications designed to document, verify, and recognize the competence of a person, organization, or other entity to perform a function or service, usually for a specified time.

Chain of custody — An unbroken trail of accountability that ensures the physical security of samples, data, and records.

Collocated samples — Two or more samples collected at the same point in time and space to be considered identical. These samples are also known as field replicates and should be identified as such.

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Comparability — A measure of the confidence with which one data set or method can be compared to another.

Completeness — A measure of the amount of valid data obtained from a measurement system compared to the amount that was expected to be obtained under correct, normal conditions.

Computer program — A sequence of instructions suitable for processing by a computer. Processing may include the use of an assembler, a compiler, an interpreter, or a translator to prepare the program for execution. A computer program may be stored on magnetic media and referred to as “software,” or it may be stored permanently on computer chips, referred to as “firmware.” Computer programs covered in a QAPP are those used for design analysis, data acquisition, data reduction, data storage (databases), operation or control, and database or document control registers when used as the controlled source of quality information.

Configuration — The functional, physical, and procedural characteristics of an item, experiment, or document.

Contractor — Any organization or individual contracting to furnish services or items or to perform work.

Corrective action — Any measures taken to rectify conditions adverse to quality and, where possible, to preclude their recurrence.

Correlation coefficient — A number between -1 and +1 that indicates the degree of linearity between two variables or sets of numbers. The closer to -1 or +1, the stronger the linear relationship between the two (i.e., the better the correlation). Values close to zero suggest no correlation between the two variables. The most common correlation coefficient is the product-moment, a measure of the degree of linear relationship between two variables.

Data Quality Indicators (DQIs) — The quantitative statistics and qualitative descriptors that are used to interpret the degree of acceptability or utility of data to the user. The principal data quality indicators are bias, precision, accuracy (bias is preferred), comparability, completeness, representativeness.

Data Quality Objectives (DQOs) — The qualitative and quantitative statements derived from the DQO Process that clarify a study's technical and quality objectives, define the appropriate type of data, and specify tolerable levels of potential decision errors that will be used as the basis for establishing the quality and quantity of data needed to support decisions.

Data Quality Objectives (DQO) Process — A systematic strategic planning tool based on the scientific method that identifies and defines the type, quality, and quantity of data needed to satisfy a specified use. The key elements of the DQO process include:

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- state the problem,
- identify the decision,
- identify the inputs to the decision,
- define the boundaries of the study,
- develop a decision rule,
- specify tolerable limits on decision errors, and
- optimize the design for obtaining data.

DQOs are the qualitative and quantitative outputs from the DQO Process.

Data reduction — The process of transforming the number of data items by arithmetic or statistical calculations, standard curves, and concentration factors, and collating them into a more useful form. Data reduction is irreversible and generally results in a reduced data set and an associated loss of detail.

Deficiency — An unauthorized deviation from acceptable procedures or practices, or a defect in an item.

Duplicate samples — Two samples taken from and representative of the same population and carried through all steps of the sampling and analytical procedures in an identical manner. Duplicate samples are used to assess variance of the total method, including sampling and analysis. See also *collocated sample*.

Estimate — A characteristic of the sample from which inferences on parameters can be made.

Evidentiary records — Any records identified as part of litigation and subject to restricted access, custody, use, and disposal.

Field blank — A blank used to provide information about contaminants that may be introduced during sample collection, storage, and transport. A clean sample, carried to the sampling site, exposed to sampling conditions, returned to the laboratory, and treated as an environmental sample.

Hazardous waste — Any waste material that satisfies the definition of hazardous waste given in 40 CFR 261, “Identification and Listing of Hazardous Waste.”

Holding time — The period of time a sample may be stored prior to its required analysis. While exceeding the holding time does not necessarily negate the veracity of analytical results, it causes the qualifying or “flagging” of any data not meeting all of the specified acceptance criteria.

Internal standard — A standard added to a test portion of a sample in a known amount and carried through the entire determination procedure as a reference for calibrating and controlling the precision and bias of the applied analytical method.

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Item — An all-inclusive term used in place of the following: appurtenance, facility, sample, assembly, component, equipment, material, module, part, product, structure, subassembly, subsystem, system, unit, documented concepts, or data.

Management — Those individuals directly responsible and accountable for

planning, implementing, and assessing work.

Matrix spike — A sample prepared by adding a known mass of a target analyte to a specified amount of matrix sample for which an independent estimate of the target analyte concentration is available. Spiked samples are used, for example, to determine the effect of the matrix on a method's recovery efficiency.

May — When used in a sentence, a term denoting permission but not a necessity.

Mean (arithmetic) — The sum of all the values of a set of measurements divided by the number of values in the set; a measure of central tendency.

Method — A body of procedures and techniques for performing an activity (e.g., sampling, chemical analysis, quantification), systematically presented in the order in which they are to be executed.

Method blank — A blank prepared to represent the sample matrix as closely as possible and analyzed exactly like the calibration standards, samples, and quality control (QC) samples. Results of method blanks provide an estimate of the within-batch variability of the blank response and an indication of bias introduced by the analytical procedure.

Method Detection Limit (MDL) — A measure of the capability of an analytical method to distinguish samples that do not contain a specific analyte from samples that contain low concentrations of the analyte; the lowest concentration or amount of the target analyte that can be determined to be different from zero by a single measurement at a stated level of probability. MDLs are analyte- and matrix-specific and may be laboratory-dependent.

Mid-range check — A standard used to establish whether the middle of a measurement method's calibrated range is still within specifications.

Must — When used in a sentence, a term denoting a requirement that has to be met.

Nonconformance — A deficiency in a characteristic, documentation, or procedure that renders the quality of an item or activity unacceptable or indeterminate; nonfulfillment of a specified requirement.

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Observation — An assessment conclusion that identifies a condition (either positive or negative) that does not represent a significant impact on an item or activity. An observation may identify a condition that has not yet caused a degradation of quality.

Organization — A company, corporation, firm, enterprise, or institution, or part thereof, whether incorporated or not, public or private, that has its own functions and administration.

Outlier — An extreme observation that is shown to have a low probability of belonging to a specified data population.

Parameter — A quantity, usually unknown, such as a mean or a standard deviation characterizing a population. Commonly misused for "variable," "characteristic," or "property."

Peer review — A documented critical review of work generally beyond the state of the art or characterized by the existence of potential uncertainty. Conducted by qualified individuals (or an organization) who are independent of those who performed the work but collectively equivalent in technical expertise (i.e., peers) to those who performed the original work. Peer reviews are conducted to ensure that activities are technically adequate, competently performed, properly documented, and satisfy established technical and quality requirements. An in-depth assessment of the assumptions, calculations, extrapolations, alternate interpretations, methodology, acceptance criteria, and conclusions pertaining to specific work and of the documentation that supports them. Peer reviews provide an evaluation of a subject where quantitative methods of analysis or measures of success are unavailable or undefined, such as in research and development.

Performance Evaluation (PE) — A type of audit in which the quantitative data generated in a measurement system are obtained independently and compared with routinely obtained data to evaluate the proficiency of an analyst or laboratory.

Precision — A measure of mutual agreement among individual measurements of the same property, usually under prescribed similar conditions expressed generally in terms of the standard deviation.

Procedure — A specified way to perform an activity.

Project — An organized set of activities within a program.

Quality — The totality of features and characteristics of a product or service that bears on its ability to meet the stated or implied needs and expectations of the user.

Quality Assurance (QA) — An integrated system of management activities involving planning, implementation, assessment, reporting, and quality improvement to ensure that a process, item, or service is of the type and quality needed and expected by the client.

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Quality Assurance Project Plan (QAPP) — A formal document describing in comprehensive detail the necessary quality assurance (QA), quality control (QC), and other technical activities that must be implemented to ensure that the results of the work performed will satisfy the stated performance criteria. The QAPP components are divided into four classes: 1) Project Management, 2) Measurement/Data Acquisition, 3) Assessment/Oversight, and 4) Data Validation and Usability. Guidance and requirements on preparation of QAPPs can be found in EPA QA/R-5 and QA/G-5.

Quality Control (QC) — The overall system of technical activities that measures the attributes and performance of a process, item, or service against defined standards to verify that they meet the stated requirements established by the customer; operational techniques and activities that are used to fulfill requirements for quality. The system of activities and checks used to ensure that measurement systems are maintained within prescribed limits, providing protection against “out of control” conditions and ensuring the results are of acceptable quality.

Quality control (QC) sample — An uncontaminated sample matrix spiked with known amounts of analytes from a source independent of the calibration standards. Generally used to establish intralaboratory or analyst-specific precision and bias or to assess the performance of all or a portion of the measurement system.

Recovery — The act of determining whether or not the methodology measures all of the analyte contained in a sample.

Repeatability — The degree of agreement between independent test results produced by the same analyst, using the same test method and equipment on random aliquots of the same sample within a short time period.

Representativeness — A measure of the degree to which data accurately and precisely represent a characteristic of a population, a parameter variation at a sampling point, a process condition, or an environmental condition.

Reproducibility — The precision, usually expressed as variance, that measures the variability among the results of measurements of the same sample at different laboratories.

Round-robin study — A method validation study involving a predetermined number of laboratories or analysts, all analyzing the same sample(s) by the same method. In a round-robin study, all results are compared and used to develop summary statistics such as interlaboratory precision and method bias or recovery efficiency.

Sensitivity — the capability of a method or instrument to discriminate between measurement responses representing different levels of a variable of interest.

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Shall — A term denoting a requirement that is mandatory whenever the criterion for conformance with the specification permits no deviation. This term does not prohibit the use of alternative approaches or methods for implementing the specification so long as the requirement is fulfilled.

Should — A term denoting a guideline or recommendation whenever noncompliance with the specification is permissible.

Spike — A substance that is added to an environmental sample to increase the concentration of target analytes by known amounts; used to assess measurement accuracy (spike recovery). Spike duplicates are used to assess measurement precision.

Standard deviation — A measure of the dispersion or imprecision of a sample or population distribution expressed as the positive square root of the variance and has the same unit of measurement as the mean.

Standard Operating Procedure (SOP) — A written document that details the method for an operation, analysis, or action with thoroughly prescribed techniques and steps and that is officially approved as the method for performing certain routine or repetitive tasks.

Supplier — Any individual or organization furnishing items or services or performing work according to a procurement document or a financial assistance agreement. An all-inclusive term used in place of any of the following: vendor, seller, contractor, subcontractor, fabricator, or consultant.

Surrogate spike or analyte — A pure substance with properties that mimic the analyte of interest. It is unlikely to be found in environmental samples and is added to them to establish that the analytical method has been performed properly.

Technical review — A documented critical review of work that has been performed within the

state of the art. The review is accomplished by one or more qualified reviewers who are independent of those who performed the work but are collectively equivalent in technical expertise to those who performed the original work. The review is an in-depth analysis and evaluation of documents, activities, material, data, or items that require technical verification or validation for applicability, correctness, adequacy, completeness, and assurance that established requirements have been satisfied.

Trip blank — A clean sample of a matrix that is taken to the sampling site and transported to the laboratory for analysis without having been exposed to sampling procedures.

Validation — Confirmation by examination and provision of objective evidence that the particular requirements for a specific intended use have been fulfilled. In design and development, validation concerns the process of examining a product or result to determine conformance to user needs. See also *Appendix G, Data Management*.

Appendix B

2004 Sampling Schedule

UATMP Sampling Calendar for 2004

January						
S	M	T	W	T	F	S
				1	2	3
FB	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	FB	23	24
25	26	27	D	29	30	31

February						
S	M	T	W	T	F	S
1	2	FB	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	FB
22	23	24	25	26	D	28



29						

March						
S	M	T	W	T	F	S
	1	2	3	FB	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	FB	23	24	25	26	27
M	29	30	31			

Sioux Falls, SD	Azalea - Pinellas Co., F
Bountiful, UT	Lewis - Hillsboro Co., F
Camden, NJ	Clearwater, FL - Pinella
Chester, NJ	Gandy, Hillsboro Co., F
New Brunswick, NJ	Kingsport, TN
Elizabeth, NJ	Dickson, TN
Rutgers, NJ	Loudon, TN
Custer Park, SD	Elizabeth, NJ
Mara Copa County, AZ	St. Louis, MO -S4MO
South Phoenix, AZ	Spirit Lake, ND
Phoenix, AZ	Providence, RI
St. John, AZ	Chicago, IL (Schiller Pa

Chicago, IL (Northbrook) Sault Ste. Marie, MI (

April						
S	M	T	W	T	F	S
				1	2	FB
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	FB	22	23	24
25	26	M	28	29	30	

May						
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2	3	4	5	6	7	8
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July						
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25	FB	27	28	29	30	31

August						
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15	16	17	18	19	20	21
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29	30	FB				

September						
S	M	T	W	T	F	S
			1	2	3	4
5	6	7	8	9	10	11
FB	13	14	15	16	17	FB
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26	27	28	29	30		



Azalea - Pinellas Co., FL Brattleboro, VT Lewis - Hillsboro Co., FL Bountiful, UT Clearwater, FL - Pinellas CoSioux Falls, SD

Gandy, Hillsboro Co., Houghton Lake,
 FL MI
 Orlando, FL Dearborn, MI
 Camden, NJ Grenada, MS
 Chester, NJ Jackson, MS
 Elizabeth, NJ Gulf Port, MS

New Brunswick, NJ Tupelo, MS Nashville, TN - EATN Pascagoula, MS Nashville, TN -
 LOTN St. Louis, MO -S4MO Custer Park, SD Providence, RI Chicago, IL (Northbrook)

St. John, AZ Chicago, IL (Schiller Park) Sault Ste. Marie, MI (

October						
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31						

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21	22	FB	24	25	26	27
28	29	30				

December						
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UATMP Sampling Calendar for 2005



January						
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30	31					

February						
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13	14	15	16	17	18	19
20	D	22	23	24	25	26
F	28					

March						
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		1	2	3	4	5
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13	14	15	16	17	18	19
20	21	22	M	24	25	26
27	28	FB	30	31		

Sioux Falls, SD Bountiful, UT Camden, NJ Chester, NJ New Brunswick, NJ Elizabeth, NJ Rutgers, NJ Custer Park, SD Azalea - Pinellas Co., F Lewis - Hillsboro Co., F Gandy, Hillsboro Co., F Kingsport, TN Dickson, TN Loudon, TN Elizabeth, NJ St. Louis, MO - S4MO

April						
S	M	T	W	T	FB	S
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3	FB	5	6	7	8	9
FB	11	12	13	14	15	16
17	18	19	20	21	M	23
24	25	26	27	28	29	30

May						
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S	M	T	W	T	FB	S
1	2	3	FB	5	6	7
8	9	D	11	12	13	14
15	16	17	18	19	20	21
FB	23	24	25	26	27	28
29	30	31				

June						
S	M	T	W	T	FB	S
			1	2	FB	4
5	6	7	8	FB	10	11
12	13	14	15	16	17	18
19	20	D	22	23	24	25
26	27	28	29	30		

St. John, AZ Spirit Lake, ND Chicago, IL (Northbrook) Providence, RI Chicago, IL (Schiller Park) Candor, NC Sault Ste. Marie, MI (ITC Grand Junction, CO

Gary, IN

Azalea - Pinellas Co.,
 FL Brattleboro, VT
 Lewis - Hillsboro Co.,
 FL Bountiful, UT
 Gandy, Hillsboro Co.,
 FL Sioux Falls, SD
 Orlando, FL Houghton Lake,
 MI
 Camden, NJ Dearborn, MI
 Chester, NJ Grenada, MS
 Elizabeth, NJ Jackson, MS
 New Brunswick, NJ Gulf Port, MS
 Nashville, TN - EATN Tupelo, MS

July						
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FB	4	5	6	7	8	FB
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17	18	19	20	M	22	23
24	25	26	27	28	29	30
31						

August						
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	1	FB	3	4	5	6

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28	29	30	31			

September						
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11	12	FB	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	



Nashville, TN - LOTN Pascagoula, MS

October						
S	M	T	W	T	FB	S
						FB
2	3	4	5	6	7	8
9	10	11	12	D	14	15
16	17	18	FB	20	21	22
23	24	25	26	27	28	29
30	31					

November						
S	M	T	W	T	FB	S
		1	2	3	4	5
M	7	8	9	10	11	FB
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20	21	22	23	D	25	26
27	28	29	FB			

December						
S	M	T	W	T	FB	S
				1	2	3
4	5	M	7	8	9	10
11	FB	13	14	15	16	17

FB	19	20	21	22	23	24
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Custer Park, SD St. Louis, MO -S4MO Chicago, IL (Northbrook) Providence, RI
 Chicago, IL (Schiller Park) St. John, AZ Sault Ste. Marie, MI (ITC Candor, NC Grand
 Junction, CO Gary, IN



Make-up Duplicate day



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Canister Cleaning And Certification
S-001-OAQ-M-AT-08-T-R0

Technical Standard Operating Procedure

Office: Office of Air Quality

Branch: Air Monitoring

Section: Air Toxic Monitoring

Revised: N/A. **Revision Cycle:** 2 years

Effective date: March 31, 2008

Scope of operations

The canister cleaning and certification SOP is used for cleaning and certifying stainless steel canisters used for collecting ambient air samples from eleven Urban Air Toxic monitoring sites located throughout the State. Canisters are cleaned and certified prior to sampling to ensure the data quality.

Scope of applicability

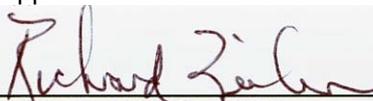
This SOP applies to all Air Toxic Monitoring Section's Staff. This SOP will be used for cleaning and certifying canisters for sampling at all Urban Air Toxic monitoring sites.

Method summary

This SOP is mainly used for canister cleaning and certifying for ambient air monitoring after the canister analysis. Canisters are put in circulation once they are cleaned and certified for future sampling. Canisters are used for collecting twenty four hour ambient air samples for the hazardous air pollutants monitoring at all urban air toxic monitoring sites every six days throughout the year.

Authorized Signatures

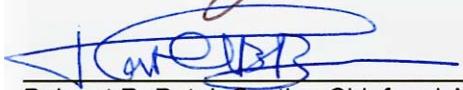
I approve and authorize this Standard Operating Procedure:



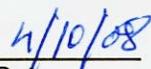
Dick Zeiler, Branch Chief



Date

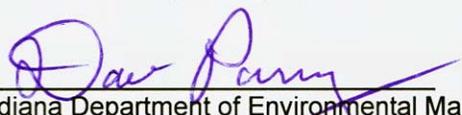


Balvant R. Patel, Section Chief and Author

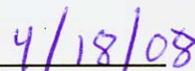


Date

This Standard Operating Procedure is consistent with agency requirements.



Indiana Department of Environmental Management
Quality Assurance Program
Planning and Assessment

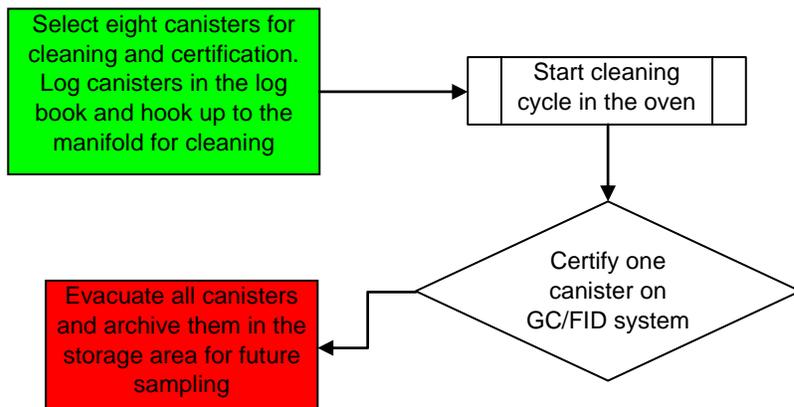


Date

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1. Overview work flowchart



2. Definitions

Agency: The Indiana Department of Environmental Management (IDEM)

Air Quality System (AQS): This is the Environmental Protection Agency's data base for ambient air monitoring data

Attainment: Ambient concentrations that meet National Ambient Air Quality Standards

Branch Chief (BC): An Agency Supervisor in one of the Program Area branches responsible for managing Section Chiefs and non-Supervisory Agency staff.

CFR: Code of Federal Regulations

Data: A collection of facts from which conclusions may be drawn

Data Quality - a measure of the degree of acceptability or utility of data for a particular purpose

Data Sheet: Compilation of the monthly data that has been reviewed by AMS for a particular parameter

Environmental Chemist (EC): Staff level position within the chemistry section

Environmental Chemist Supervisor (ECS): A first-level Agency supervisor responsible for managing

Environmental Protection Agency (EPA): The term EPA refers to the Environmental Protection Agency Region V

Exceedence: A measurement during the monitoring period that exceeds the maximum permit requirement for a parameter.

Excel Software: A computer software spreadsheet.

Flowchart: A graphic illustration of the steps in a process using flow shapes and flow connectors that shows step-by-step progression through a procedure, process or system.

Gas Chromatograph/Flame Ionization Detector_(GC/FID system): Gas chromatograph equipped with a flame ionization detector analyzer used for analyzing volatile organic compounds.

Guidance: A quality system document that provides staff with direction or advice as to a decision or course of action

HAPs: Hazardous Air Pollutants

IDEM (Agency): The Indiana Department of Environmental Management

IDEM Quality Manager: a staff member of IDEM's Quality Assurance Program in the Planning and Assessment Branch

Immediate Supervisor: A Section Chief, Branch Chief, Regional Office Director, Program Director or Assistant Commissioner to whom Agency Staff directly report

Invalid Data: Any data that fails to meet minimum Quality Assurance (QA) standards

OAQ: IDEM Office of Air Quality

Parameter: The subcategory of a Protocol which identifies the compound or compounds for which the environmental sample will be analyzed (e.g., Metals, Volatile Organics, etc.).

Procedure: (1) A specified set of guidelines detailing how to perform an activity

Protocol: A broad category of analytical methods for which the source is one or more USEPA methods manuals developed for a specific regulatory program

PSD: Programmable Sample Dispenser

Quality Assurance (QA): An integrated system of management activities involving planning, implementation, documentation, assessment, reporting, and quality improvement to ensure that a process, item, or service is of the type and quality needed.

QA/QC: (1) Quality Assurance/Quality Control

Standard Operating Procedure (SOP): The method for an operation, analysis, or action with thoroughly prescribed techniques and steps. An SOP is the officially approved method for performing a specific routine or repetitive task. SOPs are developed in consultation with the staff performing the work.

A total Non-Methane Organic Carbon (TNMOC): *Total non methane organic compound is a type of analytical method established by EPA to analyze air sample as a whole to determine the combine concentration of all organic compounds without the methane.*

3. Roles

Role Title

Air Toxic Monitoring Section's staff performs this task collaboratively.

Responsibilities

Staff ensures the cleanliness and certification of the canisters. Staff also makes sure that all canisters are under vacuums to ensure the proper sampling. The analytical system (GC/FID) system is calibrated properly using propane standard to certify batch of clean canisters.

Experience requirements

This SOP does require the experience in gas chromatograph equipped with a Flame Ionization detector (FID) and the pressure differential system. The SOP requires knowledge and experience in handling cryogenic liquids and Familiarity with EPA's TO-12 methodology.

Qualifications and Training requirements

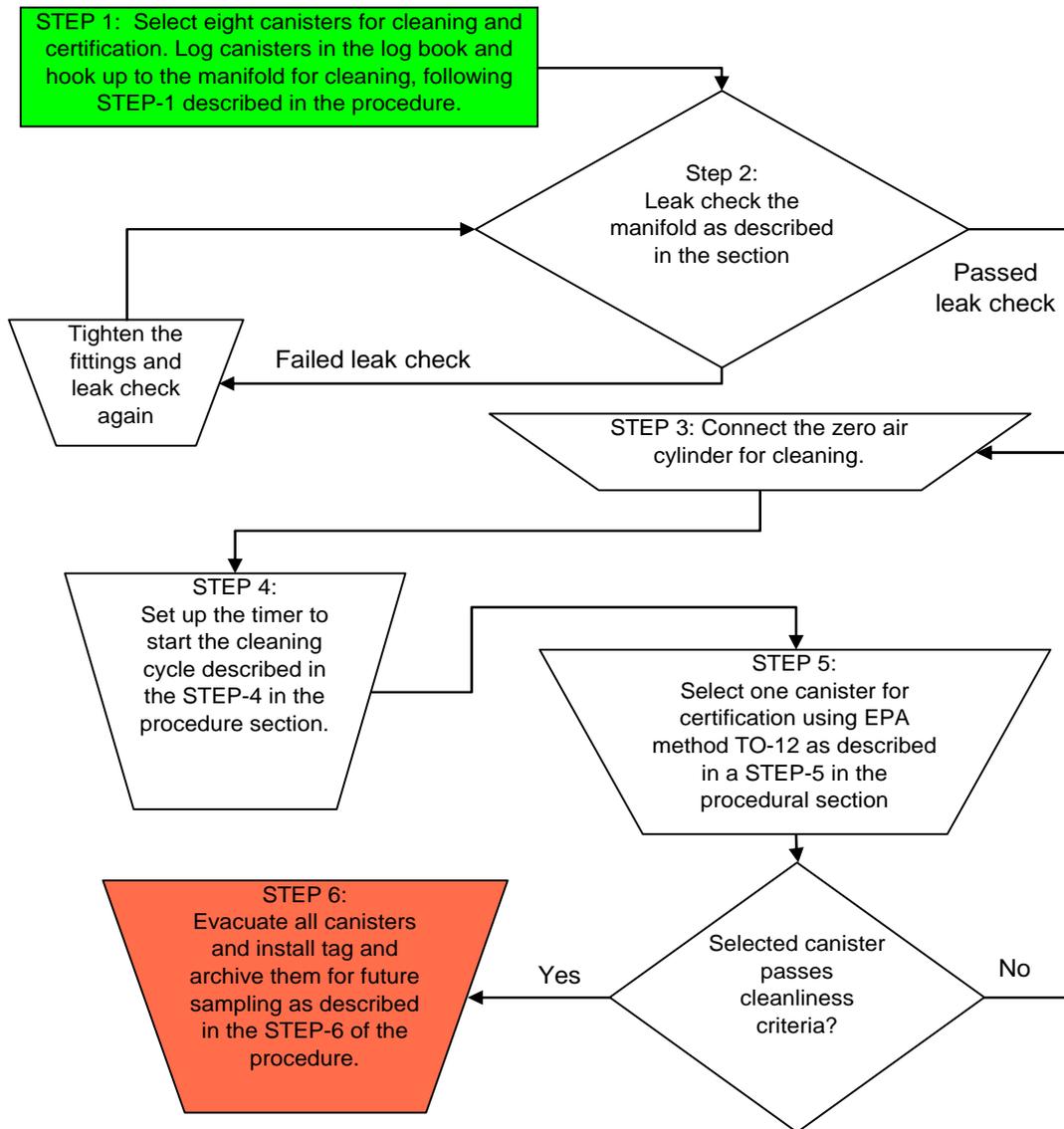
Familiarity with Agilent gas chromatograph equipped with a Flame Ionization detector (GC/FID) operation as well as EPA's method TO-12.

4. Description of equipment, forms, and/or software to be used

Equipment Used	User	Location
Absolute Pressure Gauge; Model 61A-1A-0100	Air Toxic Staff	Air Toxic Laboratory
Gaust Vacuum pump	Air Toxic Staff	Air Toxic Laboratory
GRASSUN seven day timer	Air Toxic Staff	Air Toxic Laboratory
NUPRO two way valves	Air Toxic Staff	Air Toxic Laboratory
Allenair two way electronic valve	Air Toxic Staff	Air Toxic Laboratory
Precision Scientific convection oven, Model 645	Air Toxic Staff	Air Toxic Laboratory
Zero Air Cylinder	Air Toxic Staff	Air Toxic Laboratory
Canister cleaning manifold	Air Toxic Staff	Air Toxic Laboratory
Precision Vacuum pump	Air Toxic Staff	Air Toxic Laboratory
Agilent GC/FID system interfaced with a pressure differential system	Air Toxic Staff	Air Toxic Laboratory
Canisters, 6.0 Litter	Air Toxic Staff	Air Toxic Laboratory
Reference	Air Toxic Staff	EPA Compendium Method TO-12

5. Procedure

Procedural Flowchart



Procedural Steps

After the analysis all canisters are cleaned and certified prior to re-use of the canisters in the field. Canister cleaning and certification is critical to ensure the highest possible quality of data from canister sampling and analysis. The following procedure has been developed in order to ensure efficient cleaning and certification of air sampling canisters:

STEP-1.

- 1) Enter the information about the canisters to be cleaned in the canister cleaning and certification logbook.
- 2) Remove the 1/4" caps from the canisters to be cleaned using a 9/16" open-ended wrench and remove all old sampling tags from the canisters.
- 3) File the sampling tags in the appropriate file boxes.

- 4) Connect the canisters to the cleaning assembly in the Precision Scientific oven.
- 5) Tighten the connecting nuts to finger tight and then tighten 1/4 turn past finger-tight using the 9/16" open-ended wrench.
The cleaning assembly holds up to eight canisters. In the event that fewer than eight canisters require cleaning, place a 1/4" plug in any unused cleaning assembly ports and tighten to 1/4 turn past finger-tight using the 9/16" open end wrench.
- 6) Open the canister valves by turning counter-clockwise until slight resistance is felt

STEP-2.

- 1) Leak checks the manifold by turning the two way green valve on the bench to 90 degrees.
- 2) Open the ON/OFF valve of the absolute pressure gauge to read the canister pressure.
- 3) Hold the pressure for ten minutes to check for leaks.
 - If it fails then tighten the fittings and try again for leak checks (See STEP 1. 5), above).
 - If it passes then continue to the next step.
- 4) Open the ballast on the Fisher Maxima vacuum pump, located in the fume hood.
- 5) Allow the pump to warm up with the ballast open for ten to fifteen minutes and then close the ballast on the pump.

STEP-3.

- 1) Make sure that the zero air cylinder connected to the canister cleaning assembly has a primary pressure above 500 psi. .
- 2) If the cylinder pressure falls below 500 psi, the canisters may become contaminated.
- 3) Set the delivery pressure on the two-stage regulator for the zero air tank to about 15 psi.
- 4) Make sure that the ON/OFF valve on the external cleaning assembly on the lab bench is in the on position and that the unused ports on the external cleaning assembly are closed with 1/4" plugs.
- 5) Make sure that the arrow of the three-way valve (Allenair) located beneath the first port of the external cleaning assembly points downward which will allow flow to the cleaning assembly in the oven.

STEP-4.

- 1) Close the oven doors and turn the oven on. It should be set to 90 degrees C.
- 2) The programmable timer controls the solenoid valve and roughing pump of the cleaning assembly.
- 3) It is programmed to run EVERY DAY from 9:25 AM through 12:25 PM. Ten pressurization/evacuation cycles are performed in this time period. **DO NOT CHANGE THE PROGRAM!** Adjust the time on the clock to start the cleaning cycle.
- 4) The solenoid valve starts in the OFF position.
In this position, the pump is OFF, and the valve is in a position which allows zero air to flow into the canisters. The timer should be displaying a symbol like this:[O]. This is the "always off" position. The cleaning cycle program is ignored in this position.

- 5) Press and hold the button which looks like a small clock face, and use the hour and minute buttons to re-set the time to about 9:23 AM on the timer. Use the button shaped like a hand until the timer shows a symbol like a small clock with an open circle next to it. The program is now active.
- 6) The timer will automatically run 10 cleaning cycles (evacuate 5 minutes, pressurize 15 minutes).
- 7) It is necessary to program a second set of cleaning cycles to ensure that the canisters will certify as clean.
- 8) After the second set of cleaning cycles, turn the oven off, open the doors, and allow the canisters to pressurize to about 20psi on the absolute pressure gauge.

STEP-5.

- 1) Close the canister valves and allow the canisters to cool to room temperature.
- 2) Select one canister from the batch and test the canister for total non-methane organic carbon (NMOC) using the procedure outlined in the standard operating procedure for NMOC determination.
Ideally, the cleaned canister will have no peaks when analyzed for total NMOC. In some cases, there will be a small peak.
- 3) Analyze the canister twice and record the average area count from the two analyses in the canister cleaning log book.
The average of the two total NMOC values in the canister should be 10 ppbC (parts per billion of carbon) or less.
- 4) If the canister fails this certification procedure, run one more set of cleaning cycles and re-test the same canister.
- 5) Repeat as necessary until the canister meets the certification requirement.
Generally, the canister will pass on the first certification attempt.
- 6) If the canister repeatedly fails attempts at certification, change the in-line hydrocarbon trap which helps to purify the air from the zero air cylinder, and check the moisturizer to verify that it has sufficient water.

STEP-6.

- 1) After the canister has been certified as clean, hook up the canister to the cleaning assembly again and re-open all of the canister valves.
- 2) Use the large vacuum control valve to open the flow path to the large Fisher Maxima pump in the hood.
- 3) Evacuate all canisters to 0 psi absolute and hold for five minutes.
- 4) Close the canister valves and the vacuum control valve.
- 5) Remove the canisters from the cleaning assembly.
- 6) Place a new sampling tag on each canister and place the canisters in one of the designated locations in the Air Toxic Monitoring laboratories for storage of clean canisters which are ready to be used for sampling.

Related Technical Issues

Health and Safety Warnings

Be careful handling canisters when they are inside the oven and heated at 90 degree centigrade. Turn off the oven heat and open the door to cool the canisters. Be careful with replacing a zero air cylinder. Follow safety guidelines mentioned in the GC/FID system for TNMOC analysis for canister certification.

Cautions

None

Interferences

None

Calibration

The GC/FID system is calibrated using propane standard as mentioned in the SOP for TNMOC analysis.

Troubleshooting

Make sure all connections are leaks free. Zero air cylinder has primary pressure above 500 psi. TNMOC system is properly calibrated.

6. Standards and checklists

Check the canister tags to make sure all analysis are done before they are cleaned. All analysis data are properly archived. Canister tag has staff initials and date of certification or cleaning.

7. Records Management

All canister certification are recoded in the cleaning record book. Hard copies of the analysis report is filed in the three ring binder and placed them on the self near the other binders.

8. Quality Assurance / Quality Control

Make sure certifying can has total concentration of total non methane organic compounds less then 10 ppbv (parts per billion). If the average of two analysis exceed that then the whole batch is rejected and another cleaning cycle is repeated. The batch has to be recertified.

9. Continuous Improvement Cycle

This procedure is well defined and no continuous improvement cycle has been defined.

9.1 Triggers / Performance measures & standards

Tighten all fittings and connections if the initial leak check of the manifold fails. If the leaks persist then individual canister has to be tested for leaks to make sure valves are ok and not leaking.

No additional performance measures and standards are established.

9.2 Trigger Response

If canister certification is failed will trigger response to repeat the cleaning cycle and make sure the contamination is not contributed by zero air cylinder. All connections are leak tight.

9.3 Modification procedures

Corrective actions are taken by the staff member depending on the cause of not passing the canister certification.

9.4 Assessment

The changes are assessed in terms of certification of clean canisters and what TNMOC concentration was observed. The whole batch of canisters are considered cleaned if the certifying canister has TNMOC concentration less than 10 ppbv

10. References

EPA compendium method TO-12.

11. History of Revisions

N/A

12. Appendices

N/A

Quality Assurance Project Plan

Southwest Indianapolis Neighborhood Air Toxics Study



Office: Air Quality

Branch: Air Programs Branch

Section: Program Planning and Policy

Creation date: October 2, 2006

Revision #: 0

Revised:

Review/ Revision cycle: Two years

Effective date: October 2, 2006

Project summary: This is a two-year study of air toxics in southwestern Indianapolis. Working with the City of Indianapolis, community groups, local businesses, environmental organizations, other public institutions, and the U.S. Environmental Protection Agency, IDEM will study 80 pollutants to determine whether any of them may be present in the air in concentrations that would warrant further attention to reduce potential health risks.

1.0 QA Project Plan Identification and Approval

Title: Southwest Indianapolis Neighborhood Air Toxics Study

The attached QAPP for the Air Toxics Monitoring Program is hereby recommended for approval and commits the Department to the following elements described within.

Indiana Department of Environmental Management

1) Signature: _____ Date: _____
Brian Wolff – Project Manager OAQ, Programs

2) Signature: _____ Date: _____
Steve Blaser – Air Monitoring QA Coordinator

3) Signature: _____ Date: _____
Kathryn Watson – Branch Chief OAQ, Programs

4) Signature: _____ Date: _____
Dick Zeiler – Branch Chief OAQ, Ambient Air Monitoring

5) Signature: _____ Date: _____
Christine Pedersen – OAQ Quality Assurance Manager

6) Signature: _____ Date: _____
David Parry – IDEM Quality Assurance Manager

7) Signature: _____ Date: _____
Balvant Patel – Air Monitoring Section Chief

8) Signature: _____ Date: _____
Neil Deardorff – Air monitoring

EPA Region 5

1) Signature: _____ Date: _____
Motria Caudill - Air Monitoring Branch

2) Signature: _____ Date: _____
Gordon Jones - QA Coordinator

ERG Laboratories

1) Signature: _____ Date: _____
Julie Swift – Project Manager

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3.0 Distribution

A hardcopy of this QAPP has been distributed to the individuals in Table 3-1. The document is also available upon request.

Table 3.1 Distribution List

Name	Position	Affiliation
Indiana Department of Environmental Management		
Balvant Patel	Monitoring Section Chief	Monitoring
Jeffery Stoaks	Environmental Scientist	Modeling
Debra Cole	Environmental Scientist	Technical Support
Scott Deloney	Planning and policy Section Chief	Management
Brian Wolff	Environmental Scientist	Project Manager
Richard Zeiler	Monitoring Branch Chief	Management
Bowden Quinn	Environmental Liaison	Environmental Liaison
Rob Elstro	Media Liaison	Media Liaison
Kenneth Ritter	Modeling Section Chief	Management
Kathryn Watson	Programs Branch Chief	Management
Steve Blaser	Air Monitoring QA officer	Management
Neil Deardorff	Data Manager	Data Management
Steven Lengerich	Section Chief	Management
Christine Pedersen	Air Division QA Manager	Environmental Manager
EPA Region 5		
Motria Caudill	Project Manager	Project Manager
Sharleen Getzman	Grant Coordinator	Grant Coordinator
George Bollweg	Toxicologist	Toxicologist
Gordon Jones	QA Coordinator	QA Branch
City of Indianapolis OES		
Aaron Childs		Monitoring
Felicia Robinson	Director of Operations	Management
Matt Mosier		Technical Support

4.0 Project

4.1 Roles and Responsibilities

The Southwest Indianapolis Monitoring Project will involve the Indiana Department of Environmental Management (IDEM), City of Indianapolis Office of Environmental Services (OES), Environmental Protection Agency (EPA) Region V, and the Eastern Research Group (ERG). The breakdown of the roles and responsibilities of each group are listed below.

4.1.1 Indiana Department of Environmental Management (IDEM)

The Indiana Department of Environmental Management is responsible for the overall management of the project. IDEM will coordinate all the sampling and analysis activities with OES and ERG. IDEM will also be responsible for the data management, modeling, and risk assessment. Along with those responsibilities, the IDEM laboratory will analyze the 6-L stainless steel canisters for VOC analysis using U.S. EPA method TO-15.

IDEM will be working with the Technical Advisory Group (TAG) to guide the project and to advise on any technical issues that may arise.

4.1.2 City of Indianapolis Office of Environmental Services (OES)

OES will coordinate monitoring activities with IDEM and ERG at both project locations, including sample set-up, shipment to the appropriate analysis laboratory, and maintenance and certification of the equipment. They will also be responsible for conducting emission inventories for the surrounding area sources.

OES shall conduct these activities such that data collected and instrument operation meets Valid Data Return requirements as described in Chapter 11 of the IDEM/OAQ "Quality Assurance Manual" (1/1/06 revision). This manual is available to the public on IDEM's web site at <http://www.state.in.us/idem/>.

4.1.3 U.S. Environmental Protection Agency Region 5 (U.S. EPA)

U.S.EPA will provide oversight of the project to ensure that all aspects are performed up to standard and of good quality. EPA will also provide members to be a part of the Technical Advisory Group (TAG) which will aid IDEM in answering technical questions that arise during the course of the project.

4.1.4 Eastern Research Group (ERG)

Part of the Southwest Indianapolis Monitoring project grant money is allocated to ERG, EPA's main contract laboratory, to provide analytical support for this project. ERG will be installing the Chromium (VI) sampler and train OES staff on its operation. ERG will also provide the monitoring supplies and analysis for Cr(VI) and carbonyl monitoring. ERG will also be analyzing the PM-10 hi-volume filters for the seven metals listed in this project. ERG will submit all the analytical results from the Cr(VI), carbonyl and PM-10 metals to the IDEM data manager.

5.0 Problem Definition/Background

5.1 Problem Statement and Background

5.1.1 Background

On December 31, 2002, the Indiana Department of Environmental Management published a report summarizing key hazardous air pollutant (HAP) risk issues in Indiana, based on a comprehensive review of existing emissions, monitoring and modeling data. This report addressed the requirements of Senate Enrolled Act (SEA) 259, which was passed by the Indiana General Assembly in 2002. In addition to summarizing HAP risk issues, the report also contained a five-year strategy, with priorities, for further assessing and addressing these issues.

One finding of the assessment was that, based on US EPA's 1996 National Air Toxics Assessment (NATA), some areas of the state (e.g., Marion, Allen and Lake Counties) have significantly higher estimated risk from HAPs. These three counties, which account for 27% of the state population, have a population-adjusted estimated cancer risk of 94 in a million – almost 60% greater than the statewide average. The risk in these counties is driven primarily by point source emissions.

Further, certain census tracts may be subject to even greater risk associated with exposure to air toxics. Two census tracts located in southwest Marion County (#342600 and #358100) are of particular concern. Based on the 1996 NATA, these two census tracts, which are adjacent, rank #17 and #21 nationally (out of over 60,000 census tracts assessed). The risk in these census tracts appears to be driven by point source emissions, primarily Chromium. Furthermore, preliminary information associated with the 1999 NATA indicates that cancer risk within certain portions of the proposed study area may even be greater and driven by arsenic (primarily from a single industrial source).

5.1.2 Role of Ambient Monitoring

IDEM will conduct HAP monitoring in two residential neighborhoods in the primary study area. The monitored concentrations of HAPs will be evaluated and compared to a U.S. EPA based pre-determined threshold (see Table 4) for each pollutant, other Indiana ToxWatch sites, and the National Air Toxics Assessment. In addition, IDEM will collect speciated Chromium data and a ratio of Chromium VI to total Chromium will be established.

Uses of monitoring data:

- Evaluate ambient levels of air toxics for use in exposure assessment.

- Aid in the development of a refined emissions inventory of sources and categories of sources likely to be contributing to HAP concentrations in the study area.
- A tool to compare results of the 1999 and future National Air Toxics Assessment (NATA) modeling projects.
- Compare HAP concentrations to those measured in other parts of Indiana.

5.2 List of Pollutants

There were a number of pollutants identified by the 1996 and 1999 National Air Toxics Assessment (NATA) as being pollutants that could be of concern. These pollutants were also highlighted in a number of newspaper articles as being of concern to the residents in the community. Three analytical methods were chosen for sampling in order to ensure that the pollutants identified as posing the highest potential risk in the 1996 and 1999 NATA were monitored.

Table 5.1
Method IO-3.2 Compounds
Antimony Compounds
Arsenic Compounds
Beryllium Compounds
Cadmium Compounds
Cobalt Compounds
Chromium Compounds
Lead Compounds
Manganese Compounds
Mercury Compounds
Nickel Compounds
Selenium Compounds

Table 5.2
Method TO-11A Compounds
2,5-dimethylbenzaldehyde
Acetaldehyde
Acetone
Benzaldehyde
Butyr/Isobutyraldehyde
Crotonaldehyde
Formaldehyde
Hexaldehyde
Isovaleraldehyde
Propionaldehyde

Tolualdehydes
Valeraldehyde

Compounds monitored using method TO-15		
1,1,1-Trichloroethane	Carbon Disulfide	MBK
1,1,2,2-Tetrachloroethane	Carbon Tetrachloride	m-Dichlorobenzene
1,1,2-Trichloroethane	Chlorobenzene	MEK
1,1-Dichloroethane	Chloroethane	MIBK
1,2,4-Trichlorobenzene	Chloroform	MTBE
1,2,4-Trimethylbenzene	Chloromethane	o-Dichlorobenzene
1,2-Dibromoethane	Cyclohexane	o-Xylene
1,2-Dichloroethane	Dibromochloromethane	p-Dichlorobenzene
1,2-Dichloropropane	Dichloromethane	p-Ethyltoluene
1,3,5-Trimethylbenzene	Ethanol	Propylene
1,3-Butadiene	Ethyl Acetate	Styrene
1,4-dioxane	Ethylbenzene	t-1,2-Dichloroethene
Acetone	Freon-11	t-1,3-Dichloropropene
Acrolein	Freon-113	Tetrachloroethene
Benzene	Freon-114	THF
Benzyl Chloride	Freon-12	Toluene
bromodichloromethane	Heptane	Trichloroethene
Bromoform	Hexachloro-1,3-butadiene	Vinyl Acetate
Bromomethane	Hexane	Vinyl Chloride
c-1,2-Dichloroethene	Isopropanol	Vinylidene Chloride
c-1,3-Dichloropropene	m+p-Xylenes	

In addition, IDEM will also analyze in order to speciate the different valence levels of Chromium in the ambient air. Monitoring will use a RMESI Model 924-Cr+6 Sampler or equivalent to obtain the total amount of Chromium VI. Results will then be compared to the total volume of Chromium collected using the PM-10 samplers to obtain a Chromium ratio for the monitoring location.

5.3 Locations of Interest for Air Toxics

Information on air toxics is needed for this area of the State. There is very little ambient air data available for this area. Southwest Marion County (Indianapolis) is heavily industrialized with a number of large stationary sources. Sources in this area emit over 1000 Tons annually. The Indianapolis International Airport is located within a few miles of the assessment area, and two urban interstates (I-70 and I-465) interconnect near the

assessment area. Both of these urban interstates are among the most heavily traveled transportation arteries in Indiana. There are also a number of communities located between and around the industrial sources in the area. The area has a dense population and a number of schools. All of these elements add up to an assessment area with significantly impacted air quality.

5.3.1 Spatial and Temporal Consideration

The monitoring will primarily emphasize long-term measurements of air quality. The major part of the effort to develop air quality and emissions data will focus on year round information. To provide maximum flexibility in data use, the data collected will be based on intermittent (every six days) collection of 24-hr samples for two years. Chromium VI sampling differs in that sampling will take place every six days and will only take place over one year.

6.0 Project Description

6.1 Description of work to be performed

The goal of the monitoring is to identify if a number of air toxics are present in the area and to estimate ambient concentrations for those air toxic compounds. This will be accomplished by four separate collection media.

EPA approved PM-10 samplers will be used to collect samples that will be analyzed for trace metals. The seven metals will be analyzed using ICP-MS analysis. The method code for analysis is EPA compendium method IO-3.2.

Carbonyl samples will be collected using Atec 2-channel DNPH tube samplers, which allow for duplicate sample runs for quality assurance/quality control purposes. Carbonyl compounds are analyzed using EPA method TO-11A using DNPH (2,4-dinitrophenylhydrazine) cartridges. The cartridges are extracted and analyzed using HPLC (high performance liquid chromatography) equipment.

Volatile Organic Compounds (VOC) will be collected in 6-liter stainless steel Summa-polished canisters using Meriter air toxic samplers, also capable of duplicate runs for QA/QC. All canister VOC samples will be analyzed by IDEM using EPA method TO-15

Chromium speciation monitoring will take place using a specialized monitor (RMESI Model 924-Cr+6 Sampler or equivalent) to collect hexavalent Chromium data. Data will be collected at the site for one year. This activity will include sixty samples (1 every 6 days), ten-percent duplicates (additional 6), and twelve field blanks, for a total of seventy-eight samples. Data collected will enable IDEM and the U.S. EPA to determine what portion (fraction) of the total measured Chromium is hexavalent (Cr+6).

6.2 Field Activities

Table 6.1, 6.2, 6.3 and 6.4 summarizes some of the more critical performance requirements.

Table 6.1 Particulate Matter 10 micron or less – Toxics Metals

Equipment	Frequency	Acceptance Criteria	Reference
Filter Design Specs.			
Size	1 in 6 days	See Reference 1 203 x 254 mm.	See Reference 1 “ IO1 Sec 2.1.1
Medium		Quartz Glass Fiber Filter	“ Sec 1.1
Pore size		0.3µm	“ Sec 5.6
Filter thickness		0.50 mm	“ Sec 6.1.3.2
Max. pressure drop		600 mm Hg @ 1.13 m ³ /min	“ Sec 7.3.1
Collection efficiency		99.95%	“ Sec 5.6

Alkalinity		6.5<pH<7.5	“ Sec 6.1.3
Sampler performance Specs.	1 in 6 days		
Sample flow rate		1.13 m ³ /min	“ Sec 2.1
Flow regulation		0.1 m ³ /min	“
Flow rate precision		± 10%	“
Flow rate accuracy		± 10%	“
External Leakage		Vendor Specs	NA
Internal Leakage		Vendor Specs	NA
Clock/Timer		24 hour ± 2 minute accuracy	“ Sec2.1.8

Table 6.2 Design/Performance Specifications – Air Canister Sampler – Volatile Organic Compounds

Equipment	Frequency	Acceptance Criteria	Reference
Canister Design Specs.	1 in 6 days	See Reference 2	See Reference 2
Size		6 liter spherical	“Vendor Spec.
Medium		Passivated SUMMA electro-polished Stainless Steel Canister	“Vendor Spec.
Max Pressure		30 psig	“Vendor Spec.
Max pressure drop		14 psig	“Vendor Spec.
Collection efficiency		99%	“Vendor Spec.
Lower Detection limit		Compound specific, usually >0.1 ppbv	See TO-15
Sampler Performance Specs.	1 in 6 days		
Sample flow rate		6.5 cc/min	“Vendor Spec.
Flow regulation		1.0 cc/min	See Reference 2
Flow Rate precision		± 10%	TO-15
Flow rate accuracy		± 10%	TO-15
External Leakage		Vendor specs	NA
Internal Leakage		Vendor specs	NA
Clock/Timer		24 hour ± 2 min accuracy	“Sec 6.1.8

Table 6.3 Design/Performance Specifications – Carbonyl Sampler – Aldehyde and Ketone Compounds

Equipment	Frequency	Acceptance Criteria	Reference
Filter Design Specs.	1 in 6 days	See Reference 4	See Reference 3
Size		100 mm Cylindrical Silica Gel cartridge coated with	“TO-11A Sec 7.1
Medium		2,4-Dinitro-phenyl hydrazine	“TO-11A Sec 7.1
Sampler Performance Specs.	1 in 6 days		
Sample flow rate		250 cc/min	“Vendor specs
Flow regulation		1.0 cc/min	“Vendor specs
Flow rate precision		± 10%	“Vendor specs
Flow rate accuracy		± 10%	“Vendor specs
External leakage		Vendor specs	NA
Internal leakage		Vendor specs	NA
Clock/Timer		24 hour ± 2 min accuracy	“Vendor specs

6.3 Laboratory Activities

Laboratory activities for the air toxics program include preparing the filters, canisters and cartridges for the routine field operator, which includes three general phases:

Pre-Sampling

- Receiving filters, canisters or cartridges from the vendors;
- Checking sample integrity;
- Conditioning filters, storing canisters and cartridges;
- Weighing filters;
- Storing prior to field use;
- Packaging filters, canisters and cartridges for field use;
- Associated QA/QC activities;
- Maintaining microbalance and analytical equipment at specified environmental conditions
- Equipment maintenance and calibrations.

Shipping/Receiving

- Receiving filters, canisters and cartridges from the field and logging into database;
- Storing filters, canisters and cartridges;
- Associated QA/QC activities.

Post-Sampling

- Checking filter, cartridge and canister integrity;
- Stabilizing/weighing filters;
- Extraction of metals from quartz filter using hot acid/microwave extraction;
- Extraction of DNPH compounds;
- Analysis of samples extracted;
- Analysis of VOCs in canisters;
- Data downloads from field samplers;
- Data entry/upload to AQS and the public website
- Data archiving;
- Storing filters/archiving;
- Cleaning/certifying canisters;
- Associated QA/QC activities.

6.4 Project Assessment Techniques

Table 6.4 Project Assessment Techniques

Assessment Type	Assessment Agency	Frequency
Performance Evaluation	State's QA Office	Submit "blind" samples to laboratory annually
Data Quality Assessment	State's QA Office	1 every 3 years
	District's QA Office	Annually
Performance Audits (field)	District's QA Office	Annually

Parameter	Performance Assessment	Frequency
Volatile Organic Compounds (VOC)	Mass flow stability verification	Initial – 1 year
	ET Meter	Every 6 months
	QC Precision – Duplicate Analysis	10% - Every 2 months
	Inter-comparison (States)	Every six months
	Blanks	Blank is run with each batch of canister analysis
Metals	Mass Flow audits	Monthly
Hexavalent Chromium	QC Precision – Duplicate Analysis	10% - Every 2 months
	Blanks	Monthly
Carbonyl	Sampler Flow Audits	Initial - 6 months
	Duplicates	10% - Every 2 months
	Blanks	1 per month

6.5 Schedule of Activities

Table 6.5 Schedule of Activities

Activity	Due Date	Comments
Order Monitoring Equipment	February 2006	Requisition submitted for equipment purchase.
Set-up Field Sites	September 2006	Use field site footprints already in use.
Move Harding Street Trailer	September 2006	Due to construction near the original site, the Harding Street trailer will move approximately 300 yards away.

Begin Sampling	October 2006	All 1-in-6 day sampling will begin.
Return Harding Street Trailer	November 2006	Return trailer to original location after construction is completed.
End Sampling	September 2008	End sampling at conclusion of two-year study.

6.6 Project Records

IDEM will maintain procedures for the timely preparation, review, approval, issuance, control, revision, and maintenance of documents which are applicable to document control for air toxics information. IDEM will adhere to the Records Retention and Disposition Schedule as found on the Public Records website http://www.in.gov/apps/icpr/retention/icpr_retention.

Reference:

1. Compendium Method for the Determination of Inorganic Compounds in Air, U.S. EPA, June 1999, Section IO-2.1 and 3.5
2. Compendium Method for the Determination of Toxics Organic Compounds in Air, U.S. EPA, January 1999, Section TO-15
3. Compendium Method for the Determination of Toxics Organic Compounds in Air, U.S. EPA, January 1999, Section TO-11A

7.0 Quality Objectives and Criteria for Measurement Data

7.1 Data Quality Objectives (DQOs)

7.1.1 DQO Process

The DQO Process consists of seven steps. The output from each step influences the choices that will be made later in the Process. During the first six steps of the DQO Process, the planning team developed the decision performance criteria that were used to develop the data collection design. The final step of the process involves developing the data collection design based on the DQOs. Every step should be completed before data collection begins.

The seven steps of the DQO process are:

1. State the Problem
2. Identify the Decision
3. Identify the Inputs to the Decision
4. Define the Study Boundaries
5. Develop a Decision Rule
6. Specify Tolerable Limits on Decision Errors
7. Optimize the design

Each of these steps will be examined in the following section. Each of these steps has been performed to ensure a maximized project.

1. State the Problem

Currently IDEM does not have a sufficient amount of monitoring data of known quality or quantity to understand the hazards residents in the area of Southwestern Indianapolis face due to air toxics. There is evidence through national modeling exercises that a number of air toxics are emitted in the area and may be at concentrations in the ambient air that could be detrimental to the health of the citizens living in that area of Indianapolis. Funding provided by U.S. EPA will help IDEM by allowing the set up of two monitoring locations in that area of the city.

The goals of the monitoring data are to:

- Determine measured concentrations of air toxics in the ambient air
- Use monitoring results to identify “gaps” in the emissions inventory for the area
- Establish a Chromium VI to total Chromium ratio for air quality in the area
- Calculate inhalation risk for air toxics in the neighborhood

The current problem is:

IDEM will characterize air toxics concentrations in the southwest area of Indianapolis Indiana. How much monitoring is needed and where should monitors be placed for the study to characterize risk to citizens of this area. Is the emissions inventory for this area complete enough to model ambient concentrations of air toxic? Are detection limits for monitoring low enough for the intended uses of the data?

To address this problem IDEM will use monitoring and modeling data. IDEM was awarded a grant from U.S. EPA for \$244,262 for the project for 2 years worth of modeling and monitoring work.

2. Identify the Decision:

The decision that must be made once the data is evaluated is whether or not IDEM feels it can provide a meaningful annual air toxics concentration estimates for the monitoring area at an every 6-day sampling frequency. The decision also must be made as to if the monitoring data is sensitive enough to allow for an accurate determination of an exposure concentration for all pollutants. Possible actions could be that the data from the study appears to adequately represent the study area and that we continue our plans to implement an ambient air monitoring program; or our results indicate that the estimate are not sufficient which could be corrected by implementing one or a number of the following options: increasing the number on monitors, increasing the sampling frequency, stratifying the monitoring boundaries, changing monitoring methods, or correcting sampling or analytical errors.

3. Identify the Input to the Decision:

For this study the important inputs are:

- The 24-hour concentration estimates of air toxics
- The measured average concentration of air toxics
- The Minimum Detection Limits (MDL) for methods used to monitor the pollutants
- Screening values for the pollutants

4. Define Study Boundaries

The boundary for this study is described in section 10. The boundary represents the area in which modeling results will derive exposure concentrations. Temporal conditions for this study are 2 years.

5. Develop a Decision Rule

Given that there are screening levels developed for the compounds, a comparison of the MDLs to the screening levels will work as a comparison to determine if detection limits are low enough for all pollutants (see table 7.1).

Monitoring data should have below a 10% coefficient of variation in order for the data to be considered precise when estimating exposure concentrations in the area

6. Specific Tolerable Limits on Decision Errors

It is important that each sampling site provides a true estimate of pollutant concentrations at that location. IDEM must feel comfortable that the results will provide reasonable estimates of air toxics. Since screening levels have been established for air toxics in this project, it is important to have an established and adequate level of confidence in the concentrations that are reported. Since there are many pollutants being examined in this study, benzene will be used as an example.

The baseline condition is:

The average concentration for benzene is greater than the screening level value of 0.13 $\mu\text{g}/\text{m}^3$.

From this statement, two types of potential decision error could be established.

1. Falsely accepting the baseline condition that the average concentration for benzene is greater than the screening value thus this pollutant fails screening and warrants further evaluation.
2. Falsely rejecting the baseline condition by stating that the annual average concentration for benzene is less than the screening level when in truth it is greater than the screening level. Thus the pollutant could be potentially dropped from future consideration for inventory and risk evaluations.

Since the baseline condition will be used for screening purposes, it is important that IDEM error on the side of being health protective. As such, decision error number one would simply result in the pollutant being evaluated further by IDEM. While this is an added burden to the State's resources, an error of this nature does not potentially threaten human health and the environment. Error in decision number two could represent that IDEM has overlooked a potential threat to human health and the environment. Because of this, health protective assumptions were used in the derivation of the screening values. This helps limit the possibility that an error of this nature will result in a threat to human health and the environment. Generally, a 10% Coefficient of Variability (CV) calculated for the monitoring data will result in the acceptance of the data.

Since one of the primary purposes of the monitoring data is to use in the derivation of an exposure concentration, it is necessary that the Minimal Detection Limits (MDL) for the

various monitoring methods are lower than the screening values. If an MDL is higher than the screening value that pollutant will fail screening and be subject to further evaluation.

Table 7.1 Monitored pollutant screening levels and MDLs

Compound	CAS #	MDL (ug/m3)	Screening value	Sufficient/ Not Sufficient
Antimony		0.0000293	*	
Arsenic		0.0000221	0.00023	Sufficient
Beryllium		0.000248	0.00042	Sufficient
Cadmium		0.000019	0.00056	Sufficient
Chromium		0.0005093	8.30E-05	Not Sufficient
Cobalt		0.0000221	0.1	Sufficient
Lead		0.0000683	1.5	Sufficient
Manganese		0.0001253	0.05	Sufficient
Mercury		0.0002123	0.3	Sufficient
Nickel		0.0001835	0.0042	Sufficient
Selenium		0.0000273	20	Sufficient
Carbonyls				
2,5-dimethylbenzaldehyde	97-51-8	0.005	*	
Acetaldehyde	75-07-0	0.009	0.45	Sufficient
Acetone	67-64-1	0.019	31000	Sufficient
Benzaldehyde	100-52-7	0.01	35	Sufficient
Butyr/Isobutyraldehyde	78-84-2	0.005	35	Sufficient
Crotonaldehyde	4170-30-3	0.004	0.0018	Not Sufficient
Formaldehyde	50-00-0	0.007	0.077	Sufficient
Hexaldehyde	123-05-7	0.007	*	
Isovaleraldehyde	590-86-3	0.005	*	
Propionaldehyde	123-38-6	0.004	*	
Tolualdehydes		0.014	*	
Valeraldehyde	110-62-3	0.005	*	
VOC				
1,1,1-Trichloroethane	71-55-6	0.218	1000	Sufficient
1,1,2,2-Tetrachloroethane	79-34-5	0.367	0.017	Not Sufficient
1,1,2-Trichloroethane	79-00-5	0.135	0.063	Not Sufficient
1,1-Dichloroethane	75-34-3	0.178	0.63	Sufficient
1,2,4-Trichlorobenzene	120-82-1	0.259	1	Sufficient
1,2,4-Trimethylbenzene	95-63-6	0.188	6	Sufficient
1,2-Dibromoethane	106-93-4	0.258	0.0045	Not Sufficient
1,2-Dichloroethane	107-06-2	0.114	0.038	Not Sufficient
1,2-Dichloropropane	78-87-5	0.138	0.052	Not Sufficient
1,3,5-Trimethylbenzene	108-67-8	0.307	6	Sufficient
1,3-Butadiene	106-99-0	0.175	0.033	Not Sufficient
1,4-dioxane	123-91-1	0.194	0.32	Sufficient
Acetone	67-64-1	0.125	31000	Sufficient

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Acrolein	107-02-8	0.355	0.02	Not Sufficient
Benzene	71-43-2	0.135	0.13	Not Sufficient
Benzyl Chloride	100-44-7	0.321	0.02	Not Sufficient
Bromodichloromethane	75-27-4	0.159	0.056	Not Sufficient
Bromoform	75-25-2	0.361	0.91	Sufficient
Bromomethane	74-83-9	0.065	5	Sufficient
c-1,2-Dichloroethene	156-59-2	0.182	0.357	Sufficient
c-1,3-Dichloropropene	10061-01-5	0.159	0.02	Not Sufficient
Carbon Disulfide	75-15-0	0.095	700	Sufficient
Carbon Tetrachloride	56-23-5	0.251	0.067	Not Sufficient
Chlorobenzene	108-90-7	0.109	1000	Sufficient
Chloroethane	75-00-3	0.104	7.52	Sufficient
Chloroform	67-66-3	0.150	0.043	Not Sufficient
Chloromethane	74-87-3	0.062	0.56	Sufficient
Cyclohexane	110-82-7	0.123	6000	Sufficient
Dibromochloromethane	124-48-1	0.286	0.042	Not Sufficient
Dichloromethane	75-09-2	0.106	2.13	Sufficient
Ethanol	64-17-5	0.441	2200	Sufficient
Ethyl Acetate	141-78-6	0.214	315	Sufficient
Ethylbenzene	100-41-4	0.103	1000	Sufficient
Freon-11	75-69-4	0.159	700	Sufficient
Freon-113	76-13-1	0.306	30000	Sufficient
Freon-114	76-14-2	2.127	*	
Freon-12	75-71-8	0.606	200	Sufficient
Heptane	142-82-5	0.208	1900	Sufficient
Hexachloro-1,3-butadiene	87-68-3	0.380	0.045	Not Sufficient
Hexane	110-54-3	0.157	200	Sufficient
Isopropanol	67-63-0	0.189	7000	Sufficient
m+p-Xylenes	1330-20-7	0.219	200	Sufficient
MBK	591-78-6	0.354	*	
m-Dichlorobenzene	541-73-1	0.229	200	Sufficient
MEK	78-93-3	0.125	5000	Sufficient
MIBK	108-10-1	0.122	3000	Sufficient
MTBE	1634-04-4	0.126	3000	Sufficient
o-Dichlorobenzene	95-50-1	0.143	200	Sufficient
o-Xylene	95-47-6	0.094	200	Sufficient
p-Dichlorobenzene	106-46-7	0.229	0.15	Not Sufficient
p-Ethyltoluene	622-96-8	0.175	*	
Propylene	115-07-1	2.239	3000	Sufficient
Styrene	100-42-5	0.254	1000	Sufficient
t-1,2-Dichloroethene	156-60-5	0.268	0.7	Sufficient
t-1,3-Dichloropropene	10061-02-6	0.231	0.027	Not Sufficient
Tetrachloroethene	127-18-4	0.168	0.067	Not Sufficient
Tetrahydrofuran	109-99-9	0.118	0.238	Sufficient
Toluene	108-88-3	0.126	400	Sufficient

Trichloroethene	79-01-6	0.133	0.32	Sufficient
Vinyl Acetate	108-05-4	0.354	200	Sufficient
Vinyl Chloride	75-01-4	0.153	0.11	Not Sufficient
Vinylidene Chloride	75-35-4	0.196	0.0029	Not Sufficient

7. Optimize the Design

Ideally, the IDEM would be able to use monitoring methods that detect pollutants at levels low enough to be below all screening values. Since this is not feasible for this study, those pollutants that do not have MDLs below the screening values will be evaluated further through modeling and emission inventory methods to ensure that they do not pose a threat to human health and the environment.

Based upon U.S. EPA documents (reference 1,2,3) on the statistical analyses of ambient monitoring data, generally a 1 in 6 day sampling frequency will produce data that meets the 10% Coefficient of Variation requirements as detailed in this QAPP. However, since this is dependent on the actual variability of the data collected, this cannot be determined until all the data has been collected. If the data for a particular pollutant does not meet these criteria, appropriate assumptions and statistical evaluations will be used for that pollutant.

7.2 Measurement Quality Objectives

Once a DQO is established, the quality of the data must be evaluated and controlled to ensure that it is maintained within the established acceptance criteria. Measurement Quality Objectives (MQOs) are designed to evaluate and control various phases (samplings, preparation, analysis) of the measurement process to ensure that total measurement uncertainty is within the range prescribed by the DQOs. This is covered in more detail in section 14 of this QAPP.

References

1. www.ladco.org/toxics/reports/Battelle/Phase2%20final%20report/Final%20Technical%20Report/sections%2013-18.pdf
2. Model QAPP for local scale monitoring projects – www.epa.gov/ttn/amtic/files/ambient/airtox/pilotqapp.pdf
3. NATTS Quality Management plan – www.epa.gov/ttn/amtic/files/ambient/airtox/nattsqmp.pdf

8.0 Special Training Requirements/Certification

8.1 Training

IDEM will follow the training and certifications procedures as covered in Section 3 in the Office of Air Quality Air Monitoring Quality Management Plan version 3. OAQ AMB uses Senior personal to train employees in addition to using vendor provided training for equipment used.

Training needs OAQ AMB personnel are determined by supervisors based on the skills and abilities of the staff and identified during annual performance appraisals. OAQ AMB does not employ staff members that require formal training and licensing. OAQ AMB supervisors determine when staff should be retrained or be provided with training updates based on employee performance and when significant technical changes have occurred.

8.2 Certification

IDEM office of air quality does not require or issue official certification for the collection of monitoring employees.

9.0 Documentation and Records

9.1 Identification of Q/A-related Records

OAQ Ambient Monitoring Branch identifies various documents and records that require chain-of-custody and secure filing in the OAQ Quality Assurance Manual and AMB SOPs. AMB retains all records concerning data validity, including calibration records, data audits, and sighting process records. AMB also retains records of contractual arrangements with landowners and external monitoring entities. In addition, the Air Compliance Branch retains any document and all records bearing an original signature used as the basis for decision-making. Staff work with the file room to adhere to the Records Retention and Disposition Schedule as found on the Public Records website http://www.in.gov/apps/icpr/retention/icpr_retention.

IDEM has a structured records management system that allows for the efficient archive and retrieval of records. The air toxics information will be included in this system. Table 9.1 includes the documents and records that will be filed according to the statute of limitations discussed in Section 19.

IDEM will have responsibility to maintain and update the QAPP throughout the project. Steve Blaser of IDEM's Office of Air Quality Air Monitoring Branch will maintain the most up to date copy of the QAPP and will ensure that updated copies are distributed to the appropriate people as changes are made.

Table 9.1 Record Handling Processes

Series #	Document Name	Preparation	Review	Approval
Series # from file-room listing (if applicable)	Name of document type.	Information related to file preparation, including the following: <ul style="list-style-type: none"> The policy on what goes to the file room. Do you have written policy? If yes, please summarize and reference. If not, please provide a summary of your oral policy in your response. Documents are coded by the programs before they are sent to the file room. Reference any guidance containing the coding system currently used by your program. What staff position does the file coding and preparation? Do you have confidential records, and/or exceptions to confidentiality associated with this record series? If yes, please explain. 	Describe processes associated with Q/A document review. <ul style="list-style-type: none"> Who (by name and position) reviews materials to be sent to the file room? What do they look for, and how do they determine if the records are complete? Are there written processes (SOPs), or checklists? 	Describe processes associated with Q/A document approval. <ul style="list-style-type: none"> Are there particular levels of approval for a document before it is sent to the file room? What positions participate in the approval? If, in your area, the level of approval needed depends upon document type, please provide the alternate review scenarios in your response.
	All documents below except as noted.	<ul style="list-style-type: none"> AMB has no written policy regarding filing. The item drives the file location through job responsibilities. Files are sent to secretary for filing in central files or filed by the staff member in an appropriate area. Files are not coded. They are filed by subject or by county-facility-date. There are no confidential files other than personnel files. 	<ul style="list-style-type: none"> Group Leaders (Environmental Manager 2Ws) or Senior Environmental Manager 1s review documents initially and Section Chiefs or Branch Chief provide final review if necessary. Documents are reviewed for completeness and correctness. Completeness is has no missing information in areas that require response. If a response is missing it must be documented in comments. Correctness is evaluated by checking to make sure the entries are in the correct range and that calculations produce correct values. There are no written SOPs for the review although there is guidance for acceptable completion of the documents. 	<ul style="list-style-type: none"> Very few QA documents require sign-off approval other than the originator and for communications the Section Chief or Branch Chief. Documents that do require approval generally follow the review path described to the left whit sign-off. When signature approval is needed it will be noted below.
79-2748	Correspondence - Industry/ External Customers	As indicated above	Section Chiefs or Branch Chief provide final review for correspondence	Section Chiefs and Branch Chief approve/sign correspondence
80-479	Annual Reports - AT Data Summaries	As indicated above	As indicated above	As indicated above
80-1234	Documentation - Motor Pool	As indicated above	As indicated above	As indicated above
80-1255	Reference documents- Quarterly Reports - Reports to Section Chief - Requisition Justifications - Justifications for Equipment, Site Files	As indicated above	As indicated above	As indicated above
80-1284	Excel files - purchase requisitions, siting images	As indicated above	As indicated above	As indicated above

80-1285	QA Reference Files - Certification Stickers, QAPPs, Methods, General Information	As indicated above	Section Chiefs and Branch Chief provide final review for QAPPs	Section Chiefs and Branch Chief approve
80-1286	Chap 17 Manual - Monitoring Analysis QA	As indicated above	As indicated above	As indicated above
80-1287	Miscellaneous Files - Areas of Responsibility, Site inspections, procedure references, forms	As indicated above	As indicated above	As indicated above
80-1300	Requisitions - Siting Information, Local Agency reference files	As indicated above	Section Chiefs and Branch Chief provide final review for Requisitions	Section Chiefs and Branch Chief approve Requisitions
80-1304	Particulate Sampler - Performance Records	As indicated above	As indicated above	As indicated above
80-1327	Reference documentation - site monitoring lists	As indicated above	As indicated above	As indicated above
80-1345	Industry Monitoring Plans - Discontinued Monitoring Plans, NADP Reports	As indicated above	As indicated above	As indicated above
80-1368	Background Information - Subject Reference Files, Site Safety Evaluations	As indicated above	As indicated above	As indicated above
80-1370	Audits/Cals/Invalidations, Branch Activities, certifications	As indicated above	As indicated above	As indicated above
80-1389	Instrument Manuals	As indicated above	As indicated above	As indicated above
80-1390	Quality Assurance Manual - All Chapters, AMB SOPs	As indicated above	Section Chiefs and Branch Chief provide final review	Section Chiefs and Branch Chief approve
80-1411	Reference documents - speciation procedures	As indicated above	As indicated above	As indicated above
80-1412	Forms - Filter Weight Check, Equipment Photos, reference files	As indicated above	As indicated above	As indicated above
80-1414	OAMD Manual - OAMD Reference Guide	As indicated above	As indicated above	As indicated above
80-1430	Speciation Audits - Procedures-Forms-	As indicated above	As indicated above	As indicated above
80-1435	EPA Reference Procedures - Quality Assurance Methods	As indicated above	As indicated above	As indicated above
80-1440	Invalid Memos - Office Memos	As indicated above	As indicated above	As indicated above
80-1446	QA Laboratory - Certification Reports	As indicated above	As indicated above	As indicated above
80-1455	Summary documents - Network Review site summary docs, PARS Program Files	As indicated above	As indicated above	As indicated above
80-1462	Monitoring Site Maps - Site Addresses, Site Summaries, Data Checks, Data Summaries	As indicated above	As indicated above	As indicated above
80-6813	Equipment Maintenance - General Program	As indicated above	As indicated above	As indicated above
83-483	Lab SOPs - QA Cert Facility-Lab SOPs, field operational	As indicated above	As indicated above	As indicated above
83-485	Local Agency Evaluations - Performance Records	As indicated above	As indicated above	As indicated above
83-540	Inter-QA Lab Audits - Local and Industrial	As indicated above	As indicated above	As indicated above

Series #	Document Name	Issuance	Use	Authentication	Revisions
Series # from file-room listing (if applicable)	Name of document type.	Describe processes associated with Q/A document issuance. With respect to permits and other decisions, what are the processes for the following: <ul style="list-style-type: none"> Who is notified of the issuances? Where to store the documents bearing the decision filed? Where the underlying, or working, documents associated with the issuance are filed or stored? 	Describe processes associated with Q/A document use (i.e. when to use, who uses). <ul style="list-style-type: none"> Are there protocols (SOPs) for using existing records (current permits, DMRs, inspection reports) in decision-making and/or the development of new documents (renewed permits, future inspection lists, etc)? 	Describe processes associated with Q/A document authentication (for documents that need to be managed in print form). Please provide: <ul style="list-style-type: none"> Process to ensure that the current versions of Q/A documents are signed and dated. Reference any associated routing sheets. 	Describe processes associated with Q/A document revisions, including revision timelines and roles). <ul style="list-style-type: none"> Describe triggers (regulatory changes, judicial decisions, EPA policy changes, changes to SIPs, etc) that initiate revisions to this document type, and associated work tools and daily forms? SOPs are discussed separately under QMP Element #8
		<ul style="list-style-type: none"> Not applicable 	<ul style="list-style-type: none"> Document use is described in the OAQ QA Manual and in some SOPs. 	<ul style="list-style-type: none"> There is a tracking spreadsheet for tracking SOPs and QAPPs that have routing through signature and a distribution database. Other QA documents are not tracked or routed, but updated as needed. Distribution to applicable parties upon update. 	<ul style="list-style-type: none"> Revisions are made to documents based changes in Federal or State law, technical guidance, new methods, Agency policy, QA policy changes, physical site, and for convenience of use.
79-2748	Correspondence - Industry/ External Customers	Not applicable	As indicated above	As indicated above	No Revisions
80-479	Annual Reports - AT Data Summaries	Not applicable	As indicated above	As indicated above	No Revisions
80-1234	Documentation - Motor Pool	Not applicable	As indicated above	As indicated above	No Revisions
80-1255	Reference documents- Quarterly Reports - Reports to Section Chief - Requisition Justifications - Justifications for Equipment, Site Files	Not applicable	As indicated above	As indicated above	No Revisions except site files are updated as physical changes occur or about annually.
80-1284	Excel files - purchase requisitions, siting images	Not applicable	As indicated above	As indicated above	No Revisions
80-1285	QA Reference Files - Certification Stickers, QAPPs, Methods, General Information	Not applicable	As indicated above	As indicated above	As indicated above
80-1286	Chap 17 Manual - Monitoring Analysis QA	Not applicable	As indicated above	As indicated above	As indicated above, but on 2 year revision schedule
80-1287	Miscellaneous Files - Areas of Responsibility, Site inspections, procedure references, forms	Not applicable	As indicated above	As indicated above	As indicated above
80-1300	Requisitions - Siting Information, Local Agency reference files	Not applicable	As indicated above	As indicated above	No Revisions except site files are updated as physical changes occur or about annually.
80-1304	Particulate Sampler - Performance Records	Not applicable	As indicated above	As indicated above	As indicated above
80-1327	Reference documentation - site monitoring lists	Not applicable	As indicated above	As indicated above	As indicated above
80-1345	Industry Monitoring Plans - Discontinued Monitoring Plans, NADP Reports	Not applicable	As indicated above	As indicated above	As indicated above
80-1368	Background Information - Subject Reference Files, Site Safety Evaluations	Not applicable	As indicated above	As indicated above	No Revisions

80-1370	Audits/Cals/Invalidations, Branch Activities, certifications	Not applicable	As indicated above	As indicated above	No Revisions
80-1389	Instrument Manuals	Not applicable	As indicated above	As indicated above	No Revisions
80-1390	Quality Assurance Manual - All Chapters, AMB SOPs	Not applicable	As indicated above	As indicated above	As indicated above, but on 2 year revision schedule
80-1411	Reference documents - speciation procedures	Not applicable	As indicated above	As indicated above	As indicated above
80-1412	Forms - Filter Weight Check, Equipment Photos, reference files	Not applicable	As indicated above	As indicated above	No Revisions – photos updated when change occurs.
80-1414	OAMD Manual - OAMD Reference Guide	Not applicable	As indicated above	As indicated above	No Revisions
80-1430	Speciation Audits - Procedures-Forms-	Not applicable	As indicated above	As indicated above	No Revisions
80-1435	EPA Reference Procedures - Quality Assurance Methods	Not applicable	As indicated above	As indicated above	As indicated above
80-1440	Invalid Memos - Office Memos	Not applicable	As indicated above	As indicated above	No Revisions
80-1446	QA Laboratory - Certification Reports	Not applicable	As indicated above	As indicated above	No Revisions
80-1455	Summary documents - Network Review site summary docs, PARS Program Files	Not applicable	As indicated above	As indicated above	No Revisions
80-1462	Monitoring Site Maps - Site Addresses, Site Summaries, Data Checks, Data Summaries	Not applicable	As indicated above	As indicated above	No Revisions
80-6813	Equipment Maintenance - General Program	Not applicable	As indicated above	As indicated above	No Revisions
83-483	Lab SOPs - QA Cert Facility-Lab SOPs, field operational	Not applicable	As indicated above	As indicated above	As indicated above
83-485	Local Agency Evaluations - Performance Records	Not applicable	As indicated above	As indicated above	No Revisions
83-540	Inter-QA Lab Audits - Local and Industrial	Not applicable	As indicated above	As indicated above	No Revisions

Table 9.2 Document Maintenance

Series #	Document Name	Transmittal	Distribution	Retention	Access
		Processes associated with transmittal of Q/A related documents. <ul style="list-style-type: none"> When, how, and to where are completed work documents transmitted? 	Processes associated with distribution of Q/A related documents. <ul style="list-style-type: none"> Who gets what? What is the protocol for what work product goes to the public (including via the Internet), to the file room, or to non-file room, but internal program files? 	Processes associated with retention of Q/A related documents. <ul style="list-style-type: none"> What are your record retention policies? 	Processes / network locations associated with access of Q/A related documents. <ul style="list-style-type: none"> What are the access points (both internal and external) for this document type?
		A comprehensive document management system is under development.	A comprehensive document management system is under development.	Agency Document Retention Schedule – A comprehensive document management system is under development.	A comprehensive document management system is under development.
79-2748	Correspondence - Industry/ External Customers	As indicated above	As indicated above	As indicated above	As indicated above
80-479	Annual Reports - AT Data Summaries	As indicated above	As indicated above	As indicated above	As indicated above
80-1234	Documentation - Motor Pool	As indicated above	As indicated above	As indicated above	As indicated above
80-1255	Reference documents- Quarterly Reports - Reports to Section Chief - Requisition Justifications - Justifications for Equipment, Site Files	As indicated above	As indicated above	As indicated above	As indicated above
80-1284	Excel files - purchase requisitions, siting images	As indicated above	As indicated above	As indicated above	As indicated above
80-1285	QA Reference Files - Certification Stickers, QAPPs, Methods, General Information	As indicated above	As indicated above	As indicated above	As indicated above
80-1286	Chap 17 Manual - Monitoring Analysis QA	As indicated above	As indicated above	As indicated above	As indicated above
80-1287	Miscellaneous Files - Areas of Responsibility, Site inspections, procedure references, forms	As indicated above	As indicated above	As indicated above	As indicated above
80-1300	Requisitions - Siting Information, Local Agency reference files	As indicated above	As indicated above	As indicated above	As indicated above
80-1304	Particulate Sampler - Performance Records	As indicated above	As indicated above	As indicated above	As indicated above
80-1327	Reference documentation - site monitoring lists	As indicated above	As indicated above	As indicated above	As indicated above
80-1345	Industry Monitoring Plans - Discontinued Monitoring Plans, NADP Reports	As indicated above	As indicated above	As indicated above	As indicated above
80-1368	Background Information - Subject Reference Files, Site Safety Evaluations	As indicated above	As indicated above	As indicated above	As indicated above
80-1370	Audits/Cals/Invalidations, Branch Activities, certifications	As indicated above	As indicated above	As indicated above	As indicated above
80-1389	Instrument Manuals	As indicated above	As indicated above	As indicated above	As indicated above
80-1390	Quality Assurance Manual - All Chapters, AMB SOPs	As indicated above	As indicated above	As indicated above	As indicated above
80-1411	Reference documents - speciation procedures	As indicated above	As indicated above	As indicated above	As indicated above
80-1412	Forms - Filter Weight Check, Equipment Photos, reference files	As indicated above	As indicated above	As indicated above	As indicated above

80-1414	OAMD Manual - OAMD Reference Guide	As indicated above	As indicated above	As indicated above	As indicated above
80-1430	Speciation Audits - Procedures-Forms-	As indicated above	As indicated above	As indicated above	As indicated above
80-1435	EPA Reference Procedures - Quality Assurance Methods	As indicated above	As indicated above	As indicated above	As indicated above
80-1440	Invalid Memos - Office Memos	As indicated above	As indicated above	As indicated above	As indicated above
80-1446	QA Laboratory - Certification Reports	As indicated above	As indicated above	As indicated above	As indicated above
80-1455	Summary documents - Network Review site summary docs, PARS Program Files	As indicated above	As indicated above	As indicated above	As indicated above
80-1462	Monitoring Site Maps - Site Addresses, Site Summaries, Data Checks, Data Summaries	As indicated above	As indicated above	As indicated above	As indicated above
80-6813	Equipment Maintenance - General Program	As indicated above	As indicated above	As indicated above	As indicated above
83-483	Lab SOPs - QA Cert Facility-Lab SOPs, field operational	As indicated above	As indicated above	As indicated above	As indicated above
83-485	Local Agency Evaluations - Performance Records	As indicated above	As indicated above	As indicated above	As indicated above
83-540	Inter-QA Lab Audits - Local and Industrial	As indicated above	As indicated above	As indicated above	As indicated above

Series #	Document Name	Traceability	Retrieval	Removal of Obsolete Documentation	Archiving and/or Disposal
		Processes associated with tracking of Q/A related documents. <ul style="list-style-type: none"> List tracking tools (forms, routing sheets, software, etc) List any written SOPs or policies that address the use or maintenance and/or use of these tracking tools. 	Processes associated with retrieval of Q/A related documents. <ul style="list-style-type: none"> What are the protocol/SOPs for retrieving non-file room documents? (That is, documents that must be maintained, but are not sent to the file room and which may be public or confidential?) 	Processes associated with removing obsolete Q/A related documents. <ul style="list-style-type: none"> Describe process for purging records that have exceeded scheduled retention timetables? 	Processes associated with archiving and/or disposing of Q/A related documents. [What we want is: what is your process for addressing disposal of documents that may have special disposal requirements due to confidentiality? Regarding archiving, that might overlap somewhat with 5.4.5. above, on document preservation?]
		Agency Document Retention Schedule – A comprehensive document management system is under development.	Agency Document Retention Schedule – A comprehensive document management system is under development.	Agency Document Retention Schedule – A comprehensive document management system is under development.	Agency Document Retention Schedule – A comprehensive document management system is under development.
79-2748	Correspondence - Industry/ External Customers	As indicated above	As indicated above	As indicated above	As indicated above
80-479	Annual Reports - AT Data Summaries	As indicated above	As indicated above	As indicated above	As indicated above
80-1234	Documentation - Motor Pool	As indicated above	As indicated above	As indicated above	As indicated above
80-1255	Reference documents- Quarterly Reports - Reports to Section Chief - Requisition Justifications - Justifications for Equipment, Site Files	As indicated above	As indicated above	As indicated above	As indicated above
80-1284	Excel files - purchase requisitions, siting images	As indicated above	As indicated above	As indicated above	As indicated above
80-1285	QA Reference Files - Certification Stickers, QAPPs, Methods, General Information	As indicated above	As indicated above	As indicated above	As indicated above
80-1286	Chap 17 Manual - Monitoring Analysis QA	As indicated above	As indicated above	As indicated above	As indicated above
80-1287	Miscellaneous Files - Areas of Responsibility, Site inspections, procedure references, forms	As indicated above	As indicated above	As indicated above	As indicated above
80-1300	Requisitions - Siting Information, Local Agency reference files	As indicated above	As indicated above	As indicated above	As indicated above
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80-1368	Background Information - Subject Reference Files, Site Safety Evaluations	As indicated above	As indicated above	As indicated above	As indicated above
80-1370	Audits/Cals/Invalidations, Branch Activities, certifications	As indicated above	As indicated above	As indicated above	As indicated above
80-1389	Instrument Manuals	As indicated above	As indicated above	As indicated above	As indicated above
80-1390	Quality Assurance Manual - All Chapters, AMB SOPs	As indicated above	As indicated above	As indicated above	As indicated above
80-1411	Reference documents - speciation procedures	As indicated above	As indicated above	As indicated above	As indicated above
80-1412	Forms - Filter Weight Check, Equipment Photos, reference files	As indicated above	As indicated above	As indicated above	As indicated above
80-1414	OAMD Manual - OAMD Reference Guide	As indicated above	As indicated above	As indicated above	As indicated above

80-1430	Speciation Audits - Procedures-Forms-	As indicated above	As indicated above	As indicated above	As indicated above
80-1435	EPA Reference Procedures - Quality Assurance Methods	As indicated above	As indicated above	As indicated above	As indicated above
80-1440	Invalid Memos - Office Memos	As indicated above	As indicated above	As indicated above	As indicated above
80-1446	QA Laboratory - Certification Reports	As indicated above	As indicated above	As indicated above	As indicated above
80-1455	Summary documents - Network Review site summary docs, PARS Program Files	As indicated above	As indicated above	As indicated above	As indicated above
80-1462	Monitoring Site Maps - Site Addresses, Site Summaries, Data Checks, Data Summaries	As indicated above	As indicated above	As indicated above	As indicated above
80-6813	Equipment Maintenance - General Program	As indicated above	As indicated above	As indicated above	As indicated above
83-483	Lab SOPs - QA Cert Facility-Lab SOPs, field operational	As indicated above	As indicated above	As indicated above	As indicated above
83-485	Local Agency Evaluations - Performance Records	As indicated above	As indicated above	As indicated above	As indicated above
83-540	Inter-QA Lab Audits - Local and Industrial	As indicated above	As indicated above	As indicated above	As indicated above

9.2 Ensuring that Documents Accurately Reflect Completed Work

The primary role of AMB is to perform monitoring. Documents created are reviewed by senior AMB personnel, as well as supervisors. In addition, the OAQ Ambient Monitoring Branch employs a wide range of QC/QA reviews to ensure documents produced and monitoring work performed is complete and accurate. Documentation produced as a result of monitoring includes field reports and data – these documents are not reflective of a completed work product but integrate with various work activities that are documented. Monitoring data is subject to rigorous QA/QC as described in element 6.4.

9.3 Compliance with Statutory/EPA Recordkeeping Requirements

Upon promulgation of new legislation that has potential to alter or present new monitoring and recordkeeping requirements, Air Monitoring Branch forms a workgroup of program staff to analyze regulatory requirements. Monitoring Branch then identifies documents used to establish data validity and as the basis for decision-making under such legislation and works with OLC to develop or use an existing retention schedule for such documents.

10.0 Sampling Design

The purpose of this section is to describe the relevant components of the monitors to be operated during the course of the study. This includes describing the key parameters to be estimated, the rationale for the location of the monitors, the frequency of sampling, and the type of samplers used.

10.1 Schedule of monitoring activities

Table 10.1 Schedule of activities

Activity	Due Date	Comments
Order Monitoring Equipment	February 2006	Requisition submitted for equipment purchase.
Set-up Field Sites	September 2006	Use field site footprints already in use.
Move Harding Street Trailer	September 2006	Due to construction near the original site, the Harding Street trailer will move approximately 300 yards away.
Begin Sampling	October 2006	All 1-in-6 day sampling will begin.
Return Harding Street Trailer	November 2006	Return trailer to original location after construction is completed.
End Sampling	September 2008	End sampling at conclusion of two-year study.

10.2 Design Assumptions

10.2.1 Primary Samplers

The purpose of the samplers in this study is to ascertain the spatial/temporal variability of the urban area. To determine whether these characteristics are quantified with sufficient confidence, IDEM must address sampler type, sampling frequency, and sampler siting. By employing samplers that are described in the appropriate compendia, the data collected will be comparable to standard EPA methods. By complying with the sampling frequency requirements of *Network Design and Site Exposure Criteria for Selected Noncriteria Air Pollutants*, IDEM assumes that the sampling frequency is sufficient to attain the desired confidence in the annual 95th percentile and annual mean of concentrations in the vicinity of each monitor. By selecting sampler locations using the rules in *Network Design and Site Exposure Criteria for Selected Noncriteria Air Pollutants*, IDEM can be confident that the concentrations within its jurisdiction are adequately characterized. Sampler type, frequency, and siting are further described in section 10.3.

10.2.2 QA Samplers

Field accuracy will be estimated using flow, temperature sensor and barometric checks. Laboratory accuracy will be determined by the analysis of known reference analytes prepared by independent laboratories submitted to IDEM's laboratory. If samplers and laboratory equipment are operating within the required bias, precision and accuracy levels, then the decision maker can proceed knowing that the decisions will be supported by unambiguous data. Thus the key characteristics being measured with the QA samplers are bias and precision.

10.3 Procedure for Locating and Selecting Monitor Locations and Rationale for Design

Monitoring location selection conforms to EPA standards for ambient air monitoring locations as detailed in the Quality Assurance Handbook for Air Pollution Measurement Systems - Ambient Air Quality Monitoring Program Quality System Development EPA-454/R-98-004. Each will be strategically located based on an evaluation of the EPA's 1996 and 1999 NATA, proximity to major sources for HAP emissions, and in locations where the general public lives and congregates.

Monitors will be located at 1321 South Harding Street and at Stout Field National Guard Armory at 1802 South Holt Road in Indianapolis Indiana.

Two monitoring locations were selected for this project. A number of criteria were used in the selection of monitoring locations. As stated above, the monitoring will have three primary uses; evaluated exposure concentrations to air toxics at a location, evaluated modeling needs, and rough comparison to the 1999 NATA results.

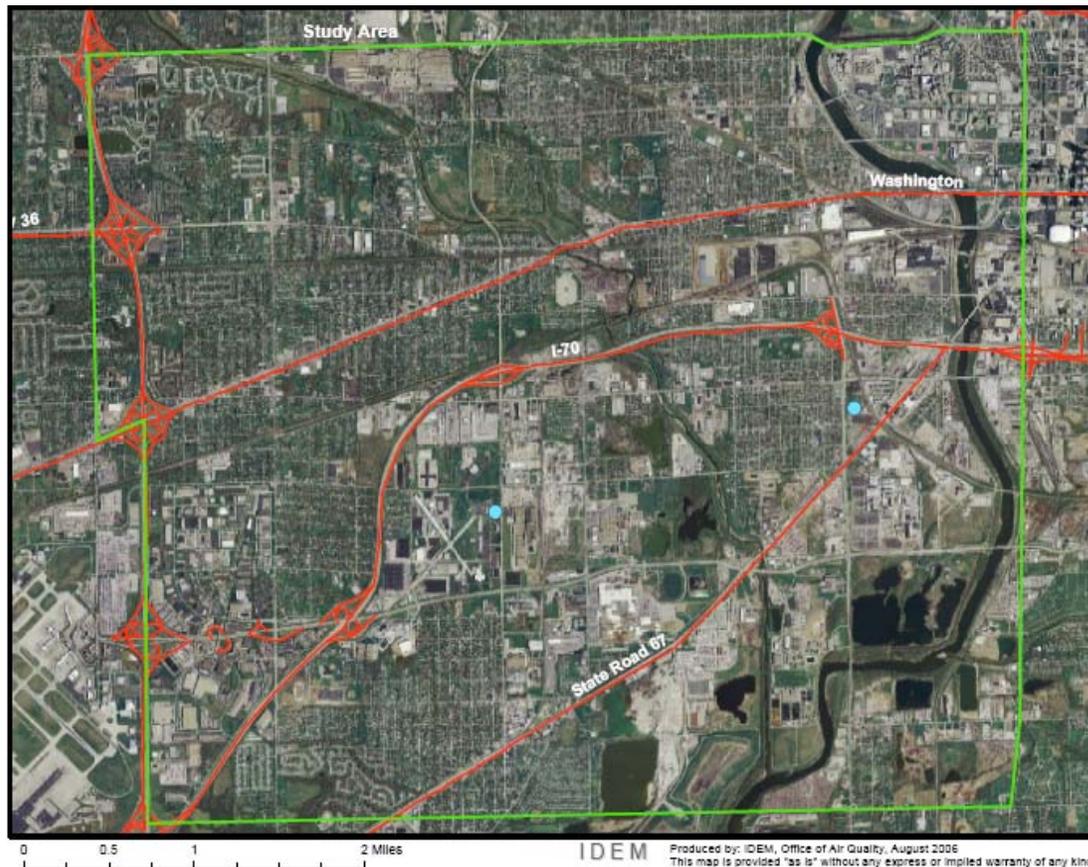
From a risk perspective it is important that the monitor be placed in an area that is representative of where the public would be exposed. That is, the monitor should be located in an area where people live or congregate. It would be appropriate to attempt to locate the monitor in a location where it is expected that the public would be exposed to the greatest levels of pollutants and/or in an area where the risk is predicted to be the greatest. This would add an extra measure of health protective assumptions when formulating the risk characterization. However, since the risk characterization will take into account the placement of the monitors when risk is characterized this is not necessary, but having monitoring data from locations predicted to pose the greatest risk has benefits. It gives confidence to the risk managers when making decisions that they are considering the upper end of exposure.

In general, placement of the monitors from a risk prospective should be in locations where it is reasonable for the public to be exposed. Consideration should be made using other tools available to attempt to locate the monitors in an area where the risk is

perceived to be the greatest. In this study area there are a number of locations that meet these criteria.

1999 NATA results were considered when selecting where to place the monitors but NATA was not the only tool used when selecting sites. In this study area arsenic is predicted to be the risk driver in a number of census tracts in the northeast sections of the study area. It is also believed that the 1999 NATA underestimates the levels of metals that the public is exposed to. As such, it may be beneficial to place a monitor in a location where the 1999 NATA predicted arsenic risk to be relatively high to evaluate the levels of metals. The monitors were placed in areas that were predicted to have high risk values for the census tracts in and around the study area.

General siting requirements were used when considering the location of the monitors. Those requirements are detailed in Appendix A of the IDEM's Quality Assurance of Ambient Air Toxics Compounds Monitoring Manual.



● Monitoring Locations

Sampling Frequency

IDEM has set the frequency for samples to once every six days for VOC, Carbonyl, and PM-10 and Chromium speciation monitoring.

Collocated Sampling

IDEM OAQ will not have collocated samples during this project.

Classification of Measurements as Critical/Noncritical

All of the measurements are considered critical because they form the basis for estimating bias and precision.

Validation of Any Non-Standard Measurements

IDEM is deploying and operating instruments according to descriptions in the applicable EPA guidance documents.

11.0 Sampling Methods Requirements

11.1 Purpose/Background

The methods described herein provide for measurement of the relative concentration of a number of hazardous air pollutants in ambient air for a 24-hour sampling period. Since there are 4 separate instruments and subsequently four separate analytical techniques, each of the sampling methods are different. General QA handling requirements are crucial for all sampling, so in that aspect, sample handling is similar. Below is a list of SOPs that will be used by IDEM during the course of the project. ERG's QAPP contains a list of SOPs that they will follow.

- Preparation of Aqua Regia Extracting Solution SOP
- GC/MS SOP
- PM10 sampling SOP
- Clean room SOP
- Canister Cleaning SOP
- Canister Handling SOP
- OAQ AMB Management Plan
- ERG QAPP

11.2 Sample Collection and Preparation

Sample preparation is an essential portion of the AMTP. The following functions are required for sample preparation:

- PM10 - filter receipt and inspection, filter numbering, conditioning and storage;
- VOC - cleaning, testing, verification and storage of canisters;
- Aldehydes - receipt and storage of DNPH cartridges in the laboratory refrigerator.
- Chromium VI

Sample set-up of the air toxics samplers in the IDEM network takes place any day after the previous sample has been recovered. For instance, on a Sunday - Thursday sample day set-up when 1 in 6 day sampling is required, the pickup occurs the day after the run. However, on Friday and Saturday run dates, the pickup is on the following Monday. It is important to recognize that the only holding time that affects sample set-up is the 30 day window from the time samples are pre-weighed/processed to the time they are installed in the monitor. Detailed sample set-up procedures are available from the IDEM OAQ AMB sample methods standard operating procedure.

Table 11.1 SW INDIANAPOLIS CR+6 Sampling Calendar for 2006

January						
S	M	T	W	T	F	S
1	2	3	4	FB	6	7
8	9	10	FB	12	13	14
15	16	17	18	19	20	21
22	D	24	25	26	27	28
29	30	31				

February						
S	M	T	W	T	F	S
			1	2	3	4
5	6	7	8	9	FB	11
12	13	14	15	16	17	18
19	20	21	M	23	24	25
26	27	FB				

March						
S	M	T	W	T	F	S
			1	2	3	4
5	6	7	8	9	10	11
FB	13	14	15	16	17	D
19	20	21	22	23	24	25
26	27	28	29	FB	31	

April						
S	M	T	W	T	F	S
						1
2	3	4	FB	6	7	8
9	10	FB	12	13	14	15
16	17	18	19	20	21	22
M	24	25	26	27	28	29
30						

May						
S	M	T	W	T	F	S
	1	2	3	4	FB	6
7	8	9	10	D	12	13
14	15	16	17	18	19	20
21	22	FB	24	25	26	27
28	29	30	31			

June						
S	M	T	W	T	F	S
				1	2	3
FB	5	6	7	8	9	FB
11	12	13	14	15	M	17
18	19	20	21	22	23	24
25	26	27	28	29	30	

July						
S	M	T	W	T	F	S
						1
2	3	FB	5	6	7	8
9	FB	11	12	13	14	15
D	17	18	19	20	21	22
23	24	25	26	27	28	29
30	31					

August						
S	M	T	W	T	F	S
		1	2	FB	4	5
6	7	8	FB	10	11	12
13	14	15	16	17	18	19
20	M	22	23	24	25	26
27	28	29	30	31		

September						
S	M	T	W	T	F	S
					1	2
3	4	5	6	7	FB	9
10	11	12	13	FB	15	16
17	18	19	D	21	22	23
24	25	26	27	28	29	30

October						
S	M	T	W	T	F	S
1	FB	3	4	5	6	7
8	9	10	11	12	13	M
15	16	17	18	19	FB	21
22	23	24	25	26	27	28
29	30	31				

November						
S	M	T	W	T	F	S
			1	2	3	4
5	6	FB	8	9	10	11
12	D	14	15	16	17	18
19	20	21	22	23	24	FB
26	27	28	29	30		

December						
S	M	T	W	T	F	S
					1	2
3	4	5	6	FB	8	9
10	11	12	FB	14	15	16
17	18	M	20	21	22	23
24	25	26	27	28	29	30
31						

M ----- Make-up Duplicate day or normal sample

FB ----- Field Blank + Normal Sample

D ----- Duplicate sample

11.3 Support Facilities for Sampling Methods

The main support facility for sampling is the sample trailer or shelter. At each sample location there is a climate controlled sample trailer. The trailer has limited storage space for items used in support of air toxic sampling. Since there are other items that the field operator may need during a site visit that are not expected to be at each site, the operator is expected to bring these items with him/her.

11.4 Sampling/Measurement System Corrective Action

Corrective action measures in the ATMP will be taken to ensure the data quality objectives are attained. There is the potential for many types of sampling and measurement system corrective actions. Table 11.3 is an attempt to detail the expected problems and corrective actions needed for the project.

Table 11.2 Corrective Action Table

Field Corrective Action Item	Problem	Action	Notification
Filter Inspection (Pre-sample)	Pinhole(s) or torn	1.) If additional filters have been brought, use one of them. Void filter with pinhole or tear. 2.) Use new field blank filter as sample filter. 3.) Obtain a new filter from lab.	1.) Document on field data sheet. 2.) Document on field data sheet. 3.) Notify Field Manager
Filter Inspection (Post-sample)	Torn or otherwise suspect particulate bypassing 46.2 mm filter.	1.) Inspect area downstream of where filter rests in sampler and determine if particulate has been bypassing filter. 2.) Inspect in-line filter before sample pump and determine if excessive loading has occurred. Replace as necessary.	1.) Document on field data sheet. 2.) Document in logbook.
Flow rate erratic	Heavy loading or motor/motor brushes are worn.	Replace brushes or motor. Re-calibrate flow rate.	Document in log book
Sample Flow Rate Verification	Out of Specification (+ 10% of transfer standard)	1.) Completely remove mass flow controller and perform flow rate check. 2.) Perform leak test. 3.) Check flow rate at 3 points to determine if flow rate problem is with zero bias or slope. 4.) Re-calibrate flow rate	1.) Document on datasheet. 2.) Document on datasheet. 3.) Document on datasheet. Notify Field Manager 4.) Document on datasheet. Notify Field Manager.
Leak Test	VOC canisters will not hold pressure.	1.) Replace fitting on nut on sampler line. 2.) Inspect connections to the mass flow controller and re-perform leak test.	1.) Document in logbook. 2.) Document in logbook, notify Field Manager, and flag data since last successful leak test.
Sample Flow Rate	Consistently low flows documented during sample run	1.) Check programming of sampler flow rate of VOC/Carbonyl Sampler. 2.) Check flow with a flow rate verification filter and determine if actual flow is low. 3.) Inspect in-line filter and PUF	1.) Document in logbook. 2.) Document in logbook. 3.) Document in logbook.

Field Corrective Action Item	Problem	Action	Notification
		cartridge downstream of filter location, replace as necessary.	
Ambient Temperature Verification and Filter Temperature Verification.	Out of Specification (+ 1°C of standard)	1.) Make certain thermocouples are immersed in same liquid at same point without touching sides or bottom of container. 2.) Use ice bath or warm water bath to check a different temperature. If acceptable, re-perform ambient temperature verification. 3.) Connect new thermocouple. 4.) Check ambient temperature with another NIST traceable thermometer.	1.) Document on datasheet. 2.) Document on datasheet. 3.) Document on datasheet. Notify Field Manager. 4.) Document on datasheet. Notify Field Manager.
Ambient Pressure Verification	Out of Specification (± 10 mm Hg)	1.) Make certain pressure sensors are each exposed to the ambient air and are not in direct sunlight. 2.) Compare certified pressure device measurement to pressure data from monitor's sensor. Pressure correction maybe required 3.) Connect new pressure sensor	1.) Document on datasheet. 2.) Document on datasheet. 3.) Document on datasheet. Notify Field Manager
Elapsed Sample Time	Out of Specification (10 min/day)	Check Programming, Verify Power Outages	Notify Field Manager
Elapsed Sample Time	Sample did not run	1.) Check Programming 2.) Try programming sample run to start while operator is at site. Use a flow verification filter.	1.) Document on datasheet. Notify Field Manager 2.) Document in logbook. Notify Field Manager.
Power	Power Interruptions	Check Line Voltage	Notify Field Manager
Power	LCD panel on, but sample not working.	Check circuit breaker, some VOC and Carbonyl samplers have battery back-up for data but will not work without AC power.	Document in log book
Data Downloading	Data will not transfer to laptop computer or there is no printout from the Carbonyl/VOC samplers	Document key information on sample data sheet. Make certain problem is resolved before data is written over in sampler microprocessor.	Notify Field Manager.

In addition to these corrective actions, the samplers will also be calibrated: when installed, after any major repairs, or when an audit flow rate shows that the sampler is outside of the +/- 10% (+/- 7% for PM10) relative to the audit flow value.

11.5 Sampling Equipment, Preservation, and Holding Time Requirements

This sections details the requirements needed to prevent sample contamination, the volume of air to be sampled, how to protect the sample from contamination, temperature preservation requirements, and the permissible holding times to ensure against degradation of sample integrity.

11.5.1 Sample Contamination Prevention

The quality system has rigid requirements for preventing sample contamination. Powder free gloves are worn while handling filter cassettes, and DNPH cartridges. Filter and

cartridges are to be held in storage containers (static resistant zip lock bags) as provided by the sampler manufacturer during transport to and from the laboratory. Once samples have been analyzed they, are stored in static resistant zip lock bags.

11.5.2 Sample Volume

The volume of air to be sampled is specified in manufacturer's method specifications. The different methods specify that certain minimum volumes must be collected. Samples are expected to be collected for 24 hours, therefore the site operators must set the flow rates to collect sufficient sample to obtain the minimum sample volume. In some cases a shorter sample period may occur due to power outages. A valid sample run should not to be less than 23 hours. If the sample period is less than 23 hours or greater than 25 hours, the sample will be flagged and the Branch Manager notified.

11.5.3 Temperature Preservation Requirements

The temperature requirements of the samples vary between methods. During transport from the laboratory to the sample location there are no specific requirements for temperature control with the exception of DNPH cartridges. Filters will be located in their protective container and in the transport container. Excessive heat must be avoided (e.g., do not leave in direct sunlight or a closed-up car during summer). DNPH cartridges need to be stored at 4° C until they are loaded into the sampler. The filter temperature requirements are detailed in Table 11.4.

Table 11.3 Temperature Requirements

Item	Temperature Requirement	Reference
PM10 filter temperature control during sampling and until recovery.	No requirements	
DNPH Cartridge Filter temperature control pre- and post-sampling.	4° C or less	TO-11A Compendium Section 9.4.3
VOC canister Pre and post sampling	No Requirements	

11.4 Permissible Holding Times

Item	Holding Time	From:	To:	Reference
PM10 filter temperature	No limits			
VOC canister	<30 days	Completion of sample period	Time of analysis	TO-15 Compendium Section 9.4.2.1
DNPH Cartridge Filter	<30 days	Sample end date/time	Date of Post Weigh	TO-11A Compendium Section 11.1.1

12.0 Sampling Custody

An essential part of any sampling or analytical process is ensuring the integrity of the sample from collection through data reporting. A Chain-of-Custody is necessary if there is any possibility that litigants will use analytical data or conclusions based upon that data in litigation. "Chain-of-Custody" is defined as the documentation of the history of samples through all possession and handling from the time of collection through analysis and final disposition. For more information on Chain of Custody procedures used by IDEM please refer to Chapter 8 and 10 of the Office of Air Quality's Quality Assurance Manual and Chapter 5 of Office of Air Quality Air Monitoring Quality Management Plan.

Consider all ambient sampling data collected in the State of Indiana as having potential use in court; therefore, all sampling data must follow a Chain-of-Custody procedure. In cases involving no litigation, many Chain-of-Custody procedures are still useful for routine control of validity of sample data.

When samples collected at one location are mailed or hand carried to another agency (IDEM lab for example) for analysis, the Chain-of-Custody procedures must be followed. All samples or sample lots must be accompanied by a Chain-of-Custody form (see Forms 1, 2, 3, and 4 for examples of forms). These forms must include who relinquishes the sample and the signature of the person(s) who receives the sample(s). All samples must be hand carried or sent by a reputable courier service such as the U.S. mail. The shipping envelopes must be sealed.

Once the samples have been delivered to the laboratory, the addressee or a designated substitute should make sure the package has not been tampered with. The addressee should then open the package and verify the contents. He should sign on the accompanying form that the packages were or were not received in the original package and that all appropriate information has been addressed. The samples should be logged in at the laboratory facility and be placed in limited access area until and during analysis. When dealing with multiple parameters in the same package container, each technician or analyst handling the samples or portions of the sample indicates handling by signing the Chain-of-Custody form.

Procedure for Chain-of-Custody and Sample Logging (Canister System Only): The air samples brought into the laboratory for analysis generally originate from ambient air monitoring or individual complaint. The person bringing in the sample completes a request for analysis form to register the samples for analysis. The custody of the sample is relinquished, the form is signed, and the transfer of the sample chain of custody (chain of custody form is on the back of the request for analysis form) is acknowledged.

These are usually grab samples and are pressurized to one atmosphere. For analysis, the samples are diluted by pressurizing with zero air to 1.5 times the pressure of the sample when received.

Procedure:

1. Sign the chain of custody form. Make and keep a copy of the form.
2. In the sample logbook, assign a sample number and record the source, date of sampling, canister number, and any other pertinent information about the sample.
3. Measure the canister pressure and record in the logbook along with other sample information. If the pressure is at or below 14.3 psi absolute, dilute the sample with zero air to 1.5 times the sample canister pressure. Record the dilution factor (x1.5), final dilution pressure and sample volume.
4. Record the pressures, before and after dilution, on the tag on the sample canister and initial the tag.
5. Repeat procedure 1 through 4 for the next sample.
6. When all samples have been logged in, place the canisters in their proper place.

Form 1
Continuous Monitoring Data Chain-of-Custody Record

Sample Site Identification:

Parameter/Inclusive Dates:

Parameter/Inclusive Dates:

Parameter/Inclusive Dates:

Collector's Name and Organization:

Shipped Via:

Sample/Data Receiver:

1. _____

(Organization/Section Receiving Data/Sample)

2. _____

(Organization/Section Receiving Data/Sample)

3. _____

(Organization/Section Receiving Data/Sample)

Chain of Custody:

1. _____

(Signature, Title, Date Deposition)

2. _____

(Signature, Title, Date Deposition)

3. _____

(Signature, Title, Date Deposition)

Remarks: _____

Form 2

Intermittent Sampling Chain-of-Custody Record

Reporting Organization: _____ **Operator:** _____

Sample Identification:

Site	Filter #	Run Date	Site	Filter #	Run Date

Sample Receiver:

1. _____

(Organization/Section Receiving Data/Sample)

2. _____

(Organization/Section Receiving Data/Sample)

3. _____

(Organization/Section Receiving Data/Sample)

Chain of Custody:

1. _____

(Signature, Title, Date Deposition)

2. _____

(Signature, Title, Date Deposition)

3. _____

(Signature, Title, Date Deposition)

Form 3

Request for Laboratory Analysis

Collected By:

Section, Branch, or Agency:

Test Approved By:

Date and Time Collected:

Site:

Address:

Method of Collection:

Purpose of Analysis:

Samples

<u>I.D. Number</u>	<u>Location</u>	<u>Lab I.D. Number</u>

Remarks/Comments

Chain-of-Custody

Relinquished By: _____ **Date/Time:** _____ **Was Seal Intact?**

Yes / No

Received By: _____ **Reason:** _____

Relinquished By: _____ **Date/Time:** _____ **Was Seal Intact?**

Yes / No

Received By: _____ **Reason:** _____

Relinquished By: _____ **Date/Time:** _____ **Was Seal Intact?**

Yes / No

Received By: _____ **Reason:** _____

Form 4

Filter Holder & Data Card (actual size 9 1/2 x 11)

Volumetric Flow Controlled PM ₁₀ Information	PM ₁₀ / HI-VOL DATA RECORD
Initial Stagnation Press.: _____	Site: _____
Initial Barometric Press.: _____	AIRS No.: _____
Initial Temperature: _____	Flow Controller Serial No.: _____
Initial Flow Rate: _____	Hi-Vol Serial No.: _____
Final Stagnation Press.: _____	Filter No.: _____
Final Barometric Press.: _____	Time Start: _____ 00:00
Final Temperature: _____	mo. day yr.
Final Flow Rate: _____	Flow Meter Reading: _____
Average Flow Rate: _____	Time Stop: _____ 24:00
	mo. day yr.
	Flow Meter Reading: _____
	Pickup Day: _____
	Sample Day: _____
	Final: _____
	Initial: _____
	Elapsed Time: _____
	Average VFC Flow Rate: _____
	This filter was invalidated
	by: _____ on: _____
	Remarks: _____
	Sample was collected in accordance with the guidelines as set forth in the Indiana Department of Environmental Management, Office of Air Management, Quality Assurance Manual.
	_____ Signature

13.0 Analytical Methods Requirements

13.1 Background

The methods used during this study are approved by U.S. EPA for the detection of the air toxics. Methodologies were selected to allow the agency to detect pollutants identified by the 1996 and 1999 National Air Toxics Assessment as being those that contribute the greatest amount of risk to the public in the ambient air in the area. All analytical methods used for this project are approved USEPA Compendium Methods.

13.2 Analysis Method

Instruments used in analysis are listed below.

Table 13.1 Instrument List

Instrument	Analysis	Reference
Hewlett Packard Gaschromatograph,(HPGC) Model 6890 with a 5973 Mass Selective Detector (GC/MS) interfaced to Tekmar Autocan preconcentrator	VOC for 63 HAP's collected in a SUMA canister	EPA Compendium method TO-15
HP GC Model 6890 interfaced with a six port valve and pressure differential system	Total Non Methane Organic Compounds (TNMOC) analysis of all VOC canister samples	EPA Compendium Method TO-12
Sartorius Balance, Model: AC211S	Gravimetric Analysis for PM-10 filters	40 CFR Part 50; Appendix-J
Inductively Coupled Plasma with Mass Spectrometer (ICP-MS)	Trace metals analysis by ERG	EPA Reference Method IO.3
High Pressure Liquid Chromatography (HPLC)	Carbonyl Analysis by ERG Laboratory	EPA Compendium Method TO-11A
Ion Chromatography (IC)	Hexavalent Chromium analysis by ERG	Modified CARB Method 039

14.0 QC Requirements

To assure the quality of data from air monitoring measurements, two distinct and important interrelated functions must be performed. One function is the control of the measurement process through broad quality assurance activities, such as establishing policies and procedures, developing data quality objectives, assigning roles and responsibilities, procedures, such as audits, calibrations, checks, replicates, routine self-assessments, etc. In general, the greater the control of a given monitoring system, the better will be the resulting quality of the monitoring data.

14.1 Sampling

Quality Control (QC) is the overall system of technical activities that measures the attributes and performance of a process. In the case of the ATMP, QC activities are used to ensure that measurement uncertainty, as discussed in Section 7, is maintained within acceptance criteria for the attainment of the DQO. Figure 14.1 represents a number of QC activities that help to evaluate and control data quality for the program. Many of the activities in this figure are implemented by the Air Division and are discussed in the appropriate sections of this QAPP.

14.1.1 Air Canister Sampling Quality Control/Quality Assurance

General Site Check: This involves sampler and instrument checks at the site. On a monthly basis the site check will be performed by Air Toxics Monitoring Section's personnel. See Appendix G for details involving a site check.

1. **Sampler Assembly Cleanliness Check:** This is required every 6 months. The entire sampler assembly will be flushed with hot, hydrocarbon free zero-grade air for two hours at approximately 40-50 cc/min. A certified canister will then be attached and the sampler will be allowed to sample the zero grade air until the canister is pressurized to approximately 20 psia. The canister will then be analyzed by the Air Toxics Section according to the procedure found in Appendix F using a GC/FID system. Cleanliness is defined as <10 ppbv TNMOC.

If a sampler fails the certification then the cleaning process is continued until it passes the certification.

2. **Flow Controller Stability Verification:** Mass flow controllers for canister systems will be verified for stability every 6 months by the Quality Assurance Section. Flow rate can't fluctuate more than $\pm 20\%$ in a 24 hour period. An approved NIST traceable bubble meter and stopwatch, or NIST traceable flow meter will be used as the primary standard. For *verification*, two flows are to be taken; one at the beginning of
-

the 24 hour period, and one at the end. The two flows must correlate to the above stated tolerance.

3. Sample Integrity Logbook Audit: All canisters must have a final pressure of 15 - 30 psia (21.0 psia is ideal) or the canister sample is invalid. An elapsed time meter reading of 1440 ± 60 minutes is required or the canister sample data is flagged.
4. Canister Integrity: Before the sample is taken, the evacuated pressure of the canister will be verified by field personnel to determine canister integrity. After sampling, the sample canister pressure will be verified by laboratory personnel, and it must meet the specifications above to ensure sample integrity.
5. Elapsed Time Meter Certifications: These are required every 6 months. Some of these time meters are built-in to the samplers. Elapsed time meters (ETM's), or other built-in timing device will be certified every 6 months by the Quality Assurance Section at ± 1.0 minute tolerance per 24 hour certification test period.
6. Condensation Control: This is part of the monthly site check performed by the Ambient Monitoring and Toxics Sections. Water droplets in the manifold will indicate that condensation has occurred. If condensation has occurred, the canister data will be deemed invalid for the appropriate period.
7. Replacement of or physical trauma to components in any system warrants recertification.

14.1.2 Analysis Quality Control/Quality Assurance

Precision: Analysis precision audits will be performed by duplicate independent analysis of a single canister with each batch of canisters analyzed. Ten percent of all samples are projected to undergo duplicate analysis. The Air Toxic Section also participates in an EPA sponsored Performance Testing Audit program (PT Audit) which is available to all States participates in a National Air Toxic Trend Sites (NATTS) to track analysis precision. PT audits will be done twice a r year. Analytical results are expected to be within 30%. The Quality Assurance Section will review the audit results. If any discrepancies in data between the states are found, appropriate corrective action will be coordinated by both sections to remedy the situation.

Accuracy: Air Toxics personnel will perform analysis accuracy audits by direct analysis of humidified NIST gas standards. Accuracy standards will be analyzed every other analytical run.

Quality Control Standards: Three quality control standards have been provided by the EPA for the calibration of the VOC analysis equipment. After initial calibration, all systems are checked weekly with at least one of the quality control standards to ensure that the continuing calibration of each instrument meets the EPA QA/QC guidelines.

Blanks:

VOC blanks are run for each analytical run to determine system contamination. In this case, zero is defined as less than 0.2 ppbC per target compound. If it is not “zero”, final data can still be submitted to the AQS database, however, the Air Toxics Section will need to identify the source of contamination.

Table 14.1 Blanks Process

Parameter	Blank Process	Baseline	Frequency
PM10 Metals	Analyze a strip of a blank filter from the same lot with each batch of sample analysis	Blank concentration is reported to AQS	With each batch of filters analyzed
VOC	Humidified zero air blank is run with each batch of canisters analyzed	<0.2 ppbC per target compound	With each run
Aldehydes	Duplicate DNPH cartridges setup but not run	Blank concentration is reported to AQS	With each batch analysis
Chromium VI	Field blanks are run twice a month	Blanks results are submitted to AQS	2 /month

14.2 Data Precision and Accuracy

Procedures currently used to report precision and accuracy of criteria pollutants are also used to assess precision and accuracy of selected toxic air pollutant species (see Attachments 2 and 3). These procedures conform to 40 CFR Part 58, Appendix A, and “U.S. EPA Quality Assurance Handbook for Air Pollution Measurement Systems Volume 1, Principles” (see Reference 10). Detailed procedures are described in Chapter 13 of the IDEM/OAQ/QA Manual (see Reference 9).

Since no precision and accuracy limits are initially defined, outliers will not be included when audit data is assessed. Testing for outliers will be performed using procedures found in the U.S. EPA Quality Assurance Handbook for Air Pollution Measurement Systems Volume 1, Appendix F. A separate listing of outliers will be maintained and available on request. Outliers will be dealt with according to corrective action procedures (see Section 3.11).

14.2.1 Entire System Precision

The quantitative difference between data duplicate samples will determine the entire system's precision.

14.2.2 Entire System Accuracy

The entire VOC measurement system's accuracy will be determined by the quantitative difference between (1) data obtained by analysis of a canister filled with challenge compounds (NIST standards) drawn through the entire sampling apparatus, and (2) the known values of the NIST gas standards. The quantitative difference between two independent measurements of a single canister sample will determine analysis accuracy. Recoveries of each challenge compound should be 80-120%. Overall system specific recovery (the average of the individual compound recoveries) should be 85-115%. The challenge sample percent recoveries are used to gauge potential additive/subtractive bias characteristics for each specific sampling system.

14.2.3 VOC Analysis Accuracy

The quantitative difference between data obtained using direct analysis of humidified NIST standards and known values of the standards will determine analysis accuracy.

14.2.4 VOC Canister Sampling Precision

Sampling precision will be calculated from the difference in the overall system precision and the analysis precision.

14.2.5 VOC Canister Sampling Accuracy

Sampling accuracy will be calculated from the difference in the overall system accuracy and the analysis accuracy.

14.2.6 Reporting Agency Accuracy and Precision

The precision and accuracy of the reporting agency will be calculated using results from all reporting sites.

15.0 Testing and Maintenance

IDEM OAQ Air Monitoring Lab will follow the procedures as detailed in the Standard Operating Procedures (SOP) for the Air monitoring Lab for testing of the equipment. SOPs for the lab are attached in appendix B through G.

IDEM will follow procedures as detailed in the instrumentation manuals as provided by the manufacturers of the machines for maintenance of equipment.

16.0 Calibration

Because the requirements of the programs for analytical system calibrations differ, the programs are discussed separately in this section. Each calibration is stored, electronically and hardcopy, with the samples analyzed using that calibration. All programs store the calibration information separately with all pertinent information (raw data, control charts, and/or any summary statistics) together with the analyzed samples. Each of the analytical systems is calibrated for all of the reported target analytes. For more information on the calibration of equipment please see appendix H.

Analytical instruments and equipment are calibrated prior to each use or on a scheduled periodic basis. Analytical methods requiring calibration standards are governed by SOPs for laboratory standards. Appropriate standards are prepared by serial dilutions of pure substances or accurately prepared concentrated solutions. Many analytical instruments have high sensitivity, so calibration standards must be extremely dilute solutions. In preparing stock solutions of calibration standards, great care is exercised in measuring weights and volumes, since analyses following the calibration are based on the accuracy of the calibration. Calibration requirements for the HAPs analytical methods are shown in Table 16.1.

Table 16.1 HAP Analytical Equipment Calibrations

Analytical Parameter	Quality Parameter	Method of Determination	Frequency	Acceptance Criteria
GC/MS (8270C)	Calibration Quantitative	Initial analysis of standards at 5 levels bracketing sample concentrations	Prior to sample analysis	Variability of average Relative Response Factor < 30%
	Calibration Calibration Check Compounds	With calibration standards	Prior to sample analysis	Percent Difference with curve MUST be <30%
	Calibration System	With calibration standards	Prior to sample analysis	Minimum Relative Response Factor for
	Performance Check Compounds			Check Compounds ≥ 0.050

	Calibration - Daily calibration check	Every 12 hours	Prior to sample analysis	Relative percent difference compared to mean of calibration curve <20%
	Calibration - Blanks	20% of samples	Concurrent with sample analysis	Analytes < Method Detection Limit
Hexavalent Chromium	Calibration Quantitative	Initial analysis of 4 levels of standards bracketing sample concentrations	Daily	Linear correlation coefficient > 0.995
	Filter Blanks	After calibration standards	Every batch	Less than method detection limit of 0.434 ng/filter
	Continuing Calibration Check	Analysis of mid-range calibration standard	Every 10 samples	90-110% of expected value

17.0 Inspection of Supplies

17.1 Purpose

The purpose of this element is to establish and document a system for inspecting and accepting all supplies and consumables that may directly or indirectly affect the quality of the Program. By having documented inspection and acceptance criteria, consistency of the supplies can be assured. This section details the supplies/consumables, their acceptance criteria, and the required documentation for tracing this process.

17.2 Acceptance Criteria

Acceptance criteria must be consistent with overall project technical and quality criteria. It is the laboratory analyst's responsibility to update the criteria for acceptance of consumables. As requirements change, so do the acceptance criteria. Knowledge of laboratory equipment and experience are the best guides to acceptance criteria. Other acceptance criteria such as observation of damage due to shipping can only be performed once the equipment has arrived on site.

17.3 Tracking and Quality Verification of Supplies and Consumables

Tracking and quality verification of supplies and consumables have two main components. The first is the need of the end user of the supply or consumable to have an item of the required quality. The second need is for the purchasing department to accurately track goods received so that payment or credit of invoices can be approved. In order to address these two issues, the following procedures outline the proper tracking and documentation procedures to follow:

Receiving personnel will perform an initial inspection of the packages as they are received from the courier or shipping company. Note any obvious problems with a receiving shipment such as crushed box or wet cardboard.

The package will be opened, inspected, and contents compared against the packing slip.

If there is a problem with the equipment/supply, note it on the packing list and notify the Purchasing Agent who will immediately call the vendor. If the equipment/supplies appear to be complete and in good condition, sign and date the packing list and sent to the Purchasing Agent so that payment can be made in a timely manner.

Notify appropriate personnel that equipment/supplies are available. For items such as the filters, it is critical to notify the laboratory manager of the weigh room so sufficient time for processing of the filters can be allowed.

Equipment/supplies are stocked in an appropriate pre-determined area.

18.0 Data Acquisition Requirements

This section addresses data not obtained by direct measurement from air toxics monitoring during this project.

Air toxics monitoring relies on data that are generated through field and laboratory operations; however, other significant data are obtained from sources outside IDEM or from historical records. This section lists this data and addresses quality issues related to the monitoring.

18.1 Chemical and Physical Properties Data

Physical and chemical properties data and conversion constants are often required in the processing of raw data into reporting units. This type of information that has not already been specified in the monitoring regulations will be obtained from nationally and internationally recognized sources. Other data sources may be used with approval of the Air Division QA Officer.

- National Institute of Standards and Technology (NIST);
- ISO, IUPAC, ANSI, and other widely-recognized national and international standards organizations;
- U.S. EPA;
- The current edition of certain standard handbooks may be used without prior approval of the IDEM QA Officer.

18.2 Sampler Operation and Manufacturers' Literature

Another important source of information needed for sampler operation is manufacturers' literature. Operations manuals and users' manuals frequently provide numerical information and equations pertaining to specific equipment. IDEM personnel are cautioned that such information is sometimes in error, and appropriate cross-checks will be made to verify the reasonableness of information contained in manuals. Whenever possible, the field operators will compare physical and chemical constants in the operators manuals to those given in the sources listed above. If discrepancies are found, determine the correct value by contacting the manufacturer. The following types of errors are commonly found in such manuals:

- insufficient precision;
- outdated values for physical constants;
- typographical errors;
- incorrectly specified units;
- inconsistent values within a manual, and
- use of different reference conditions than those called for in EPA regulations.

18.3 Geographic Location

Another type of data that will commonly be used in conjunction with the Monitoring Program is geographic information. The IDEM located sites using global positioning systems (GPS) that meet EPA Locational Data Policy of 25 meters accuracy. USGS maps were used for locating and siting stations for the project.

18.4 External Monitoring Data Bases

Data from the EPA -AQS database may be used in published reports with appropriate caution. Care must be taken in reviewing/using any data that contain flags or data qualifiers. If data is flagged, such data shall not be utilized unless it is clear that the data still meets critical QA/QC requirements. It is impossible to assure that a data base such as AQS is completely free from errors including outliers and biases, so caution and skepticism is called for in comparing Southwest Indianapolis data from other reporting agencies as reported in AQS. Users should review available QA/QC information to assure that the external data are comparable with IDEM measurements and that the original data generator had an acceptable QA program in place.

18.5 Lead and Speciated Particulate Data

IDEM has been routinely monitoring airborne lead since the 1981. Early data is likely to be problematic because of significantly higher detection limits. Caution is needed in directly comparing this data because of the difference in size fractions.

18.6 U.S. Weather Service Data

Meteorological information is gathered from the U.S. Weather Service station at the Indianapolis International Airport. Parameters include: temperature, relative humidity, barometric pressure, rainfall, wind speed, wind direction, cloud type/layers, percentage cloud cover and visibility range. No changes to the way in which these data are collected are anticipated due to the addition of the air toxics data.

19.0 Data Management

19.1 Background and Overview

This section describes the data management operations pertaining to this project. This includes an overview of the mathematical operations and analyses performed on raw (“as-collected”) data. These operations include data recording, validation, transformation, transmittal, reduction, analysis, management, storage, and retrieval. Data processing for air toxics data are summarized in Figure 19.1. Data processing steps are integrated, to the extent possible, into the existing data system used for the IDEM air toxics network.

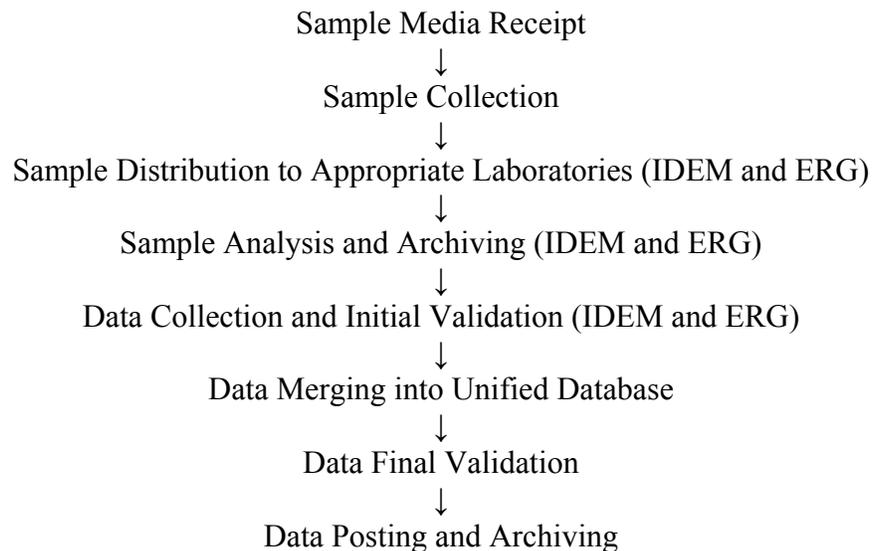


Figure 19.1: Data processing steps for the project

19.2 Data Recording

Data entry, validation, and verification functions are all integrated in the database. Bench sheets shown in Figure 19.1 are entered by laboratory personnel. Procedures for filling out the laboratory sheets and subsequent data entry are provided in SOPs listed in Appendix B-G

19.3 Data Validation

Data validation is a combination of checking that data processing operations have been carried out correctly and of monitoring the quality of the field operations. Data validation can identify problems in either of these areas. Once problems are identified, the data can be corrected or invalidated, and corrective actions can be taken for field or

laboratory operations. Numerical data stored in the database are never internally overwritten by condition flags. Flags denoting error conditions or QA status are saved as separate fields in the data base, so that it is possible to recover the original data.

The following validation functions are incorporated into the data processing procedure to ensure quality of data entry and data processing operations:

- **Range Checks** - almost all monitored parameters have simple range checks programmed in. For example, valid times must be between 00:00 and 23:59, summer temperatures must be between 10 and 50 degrees Celsius, etc. The data entry operator is notified when an entry is out of range. The operator has the option of correcting the entry or overriding the range limit. The specific values used for range checks may vary depending on season and other factors. Since these range limits for data input are not regulatory requirements, the Air Division QA Officer may adjust them from time to time to better meet quality goals.
- **Completeness Checks** - When the data are processed certain completeness criteria must be met. For example, each sample must have a start time, an end time, an average flow rate, dates weighed or analyzed and operator and technician names. The data entry operator will be notified if an incomplete record has been entered before the record can be closed.
- **Internal Consistency and Other Reasonableness Checks** -Several other internal consistency checks are built into the database. For example, the end time of a sample must be greater than the start time. Computed filter volume (integrated flow) must be approximately equal to the exposure time multiplied by the nominal flow. Additional consistency and other checks will be implemented as the result of problems encountered during data screening..
- **Data Retention** - Raw data sheets are retained on file for a minimum of two years, and are readily available for audits and data verification activities. After two years, hardcopy records and computer backup media are cataloged and boxed for storage at the warehouse. Physical samples such as filters shall be discarded with appropriate attention to proper disposal of potentially hazardous materials.
- **Statistical Data Checks** - Errors found during statistical screening will be traced back to original data entry files and to the raw data sheets, if necessary. These checks shall be run on a monthly schedule and prior to any data submission to AQS. Data validation is the process by which raw data are screened and assessed before it can be included in the main data base.

Table 19.1 summarizes the validation checks applicable to the data.

Table 19.1 Validation Check Summaries

	Electronic Transmission and Storage	Manual Checks	Automated Checks
Data Parity and Transmission Protocol Checks	X		
Date and Time Consistency		X	X
Completeness of Required Fields		X	X
Range Checking		X	X
Statistical Outlier Checking		X	X
Manual Inspection of Charts and Reports		X	
Field and Lab Blank Checks		X	

19.4 Data Transformation

Calculations for transforming raw data from measured units to final concentrations are relatively straightforward.

19.5 Data Transmittal

Data transmittal occurs when data are transferred from one person or location to another or when data are copied from one form to another. Some examples of data transmittal are copying raw data from a notebook onto a data entry form for keying into a computer file and electronic transfer of data over a telephone or computer network.

Table 19.2 summarizes the data transfer operations.

Table 19.2 Data Transfer Operations

Description of Data Transfer	Originator	Recipient	QA Measures Applied
Keying Data into The Database	Laboratory Technician (hand-written data form)	Data Processing Personnel	
Electronic data transfer	(between computers or over network)		Parity Checking; transmission protocols
Filter Receiving and Chain-of-Custody	Filter Technician	The database computer (technician enters data at a local terminal)	Sample numbers are verified automatically; reports indicate missing filters and/or incorrect data entries
Calibration and Audit Data	Auditor or field supervisor	Air Quality Field Supervisor	Entries are checked by Air Quality Supervisor and QA Officer
AQS data summaries	Air Quality Supervisor	AQS (U.S. EPA)	Entries are checked by Air Quality Supervisor and QA Officer

IDEM will report all ambient air quality data and information specified by the AQS Users Guide (Volume II, Air Quality Data Coding, and Volume III, Air Quality Data Storage), coded in the AIRS-AQS format. Such air quality data and information will be fully screened and validated and will be submitted directly to the AIRS-AQS via electronic transmission, in the format of the AIRS-AQS, and in accordance with the monthly schedule.

19.6 Data Reduction

Data reduction processes involve aggregating and summarizing results so that they can be understood and interpreted in different ways. Examples of data summaries include:

- average concentration for a station or set of stations for a specific time period;
- accuracy, bias, and precision statistics;
- data completeness reports based on numbers of valid samples collected during a specified period.

The Audit Trail is another important concept associated with data transformations and reductions. An audit trail is a data structure that provides documentation for changes

made to a data set during processing. Typical reasons for data changes that would be recorded include the following:

- corrections of data input due to human error;
- application of revised calibration factors;
- addition of new or supplementary data;
- flagging of data as invalid or suspect;

The audit trail is implemented as a separate worksheet in the database. Audit trail records will include the following fields:

- operator's identity;
- date and time of the change;
- location of the changed data item;
- reason for the change;
- information for the item changed (date, time, site location, parameter, etc.);
- value of the item before and after the change.

19.7 Data Summary

IDEM is currently developing the data summary and analysis protocol. It is anticipated that as the project develops, the data analysis procedures will evolve.

19.8 Data Tracking

The database contains the necessary input functions and reports necessary to track and account for the whereabouts of filters and the status of data processing operations for specific data. Information about filter location is updated at the data entry terminal at the points of significant operations. In most cases the tracking data base and the monitoring data base are updated simultaneously. For example, when the filter is pre-weighed, the weight is entered into the monitoring data base and the filter number and status are entered into the tracking data base. For the VOC system, the sample handling is different. The VOC canisters are reused many times before they are retired from field use. Each canister has its own unique code that designates the can number. When the canister is sent into the field, a canister number becomes a portion of the tracking code. This allows the sample that was in the canister to be tracked.

19.9 Data Storage and Retrieval

IDEM data archival policies for the data are shown in Table 19.3.

Table 19.3 Data Archive Policies

Data Type	Medium	Location	Retention Time	Final Disposition
Weighing records; chain of custody forms	Hardcopy	Laboratory	10 years	Discarded
Laboratory Notebooks	Hardcopy	Laboratory	10 years	Discarded
Field Notebooks	Hardcopy	Air Monitoring Branch	10 years	Discarded
Data Base and Audit Trail records	Electronic (on-line)	Air Monitoring Branch	indefinite (may be moved to backup media after 2 years)	Backup media retained indefinitely
PM10 Quartz filters	Filters	Warehouse	10 years	Discarded
VOC canisters	metal can	Laboratory	reused after cleaning	Recycled

ERG data archival policies can be found in the referenced QAPP document for that laboratory.

20.0 Assessments and Response Actions

An assessment is defined as an evaluation process used to measure the performance or effectiveness of the quality system or the establishment of the monitoring network and sites and various measurement phases of the data operation.

The results of quality assurance assessments indicate whether the control efforts are adequate or need to be improved. Documentation of all quality assurance and quality control efforts implemented during the data collection, analysis, and reporting phases is important to data users, who can then consider the impact of these control efforts on the data quality (see Section 21). Both qualitative and quantitative assessments of the effectiveness of these control efforts will identify those areas most likely to impact the data quality and to what extent. In order to ensure the adequate performance of the quality system, IDEM will perform the following assessments:

20.1 Assessment Activities and Project Planning

20.1.1 Network Reviews

Network reviews determine conformance with network requirements of the monitoring network through annual review. The network review is used to determine how well a particular air monitoring network is achieving its required air monitoring objective, and how it should be modified to continue to meet its objective. The Air Monitoring Branch will be responsible for conducting the network review.

Prior to the implementation of the network review, significant data and information pertaining to the review will be compiled and evaluated. Such information might include the following:

- network files (including updated site information and site photographs);
- AQS reports (AMP220, 225, 380, 390, 450);
- air quality summaries;
- air toxics emissions trends reports for major metropolitan area;
- emission information, such as emission density maps for the region in which the monitor is located and emission maps showing the major sources of emissions;
- National Weather Service summaries for monitoring area.

Upon receiving the information it will be checked to ensure it is the most current. Discrepancies will be noted on the checklist and resolved during the review. Files and/or

photographs that need to be updated will also be identified. The following categories will be emphasized during network reviews:

Adequacy of the network will be determined by using the following information:

- maps of historical monitoring data;
- maps of emission densities
- dispersion modeling
- special studies/saturation sampling;
- best professional judgment
- GIS updates.

Location of Monitors

Adequacy of the location of monitors can only be determined on the basis of stated objectives. Maps, graphical overlays, and GIS-based information will be helpful in visualizing or assessing the adequacy of monitor locations. Plots of potential emissions and/or historical monitoring data versus monitor locations will also be used.

During the network review, the stated objective for each monitoring location or site (see section 10) will be “reconfirmed” and the spatial scale “reverified” and then compared to each location to determine whether these objectives can still be attained at the present location.

Other Discussion Topics

In addition to the items included in the checklists, other subjects for discussion as part of the network review and overall adequacy of the monitoring program will include:

- relocation of existing monitors;
- siting criteria problems and suggested solutions;
- problems with data submittals and data completeness;
- maintenance and replacement of existing monitors and related equipment;
- quality assurance problems;
- air quality studies and special monitoring programs;
- other issues;
 - proposed regulations;
 - funding.

20.1.2 Technical Systems Audits

A TSA is a thorough and systematic on-site qualitative audit, where facilities, equipment, personnel, training, procedures, and record keeping are examined for conformance to the QAPP. TSAs of the project will be conducted by IDEM every year. The QA Section will implement the TSA either as a team or as an individual auditor.

Key personnel to be interviewed during the audit are those individuals with responsibilities for: planning, field operations, laboratory operations, QA/QC, data management, and reporting.

The audit finding form has been designed such that one is filled out for each major deficiency that requires formal corrective action. The finding should include items like: systems impacted, estimated time period of deficiency, site(s) affected, and reason of action. The finding form will inform the AMB Chief about serious problems that may compromise the quality of the data and therefore require specific corrective actions. These are discussed and a course of resolution is determined.

Within thirty (30) calendar days of the completion of the audit, the audit report will be prepared and submitted. The systems audit report will be submitted to the applicable branch managers and appropriately filed. The report will include an agreed-upon schedule for corrective action implementation.

Follow-up and Corrective Action Requirements

The QA Office and the audited Branch Sections will work together to implement required corrective actions. As part of corrective action and follow-up, an audit finding response memo will be generated by the AMB within 30 days of acceptance of the audit report.

20.1.3 Performance Audit

A Performance Audit is a field operations audit that ascertains whether the samplers are operating within the specified limits as stated in the SOPs and QAPP. The Performance Audit is performed is normally done in conjunction with the field TSA. Independent Performance audits are not deemed necessary since challenging sampler operation using independent NIST-traceable orifices or other flow devices is ongoing throughout the project. If US EPA Region V conducts a performance audit during project operation the results will be included in the TSA report.

20.1.4 Data Quality Assessments

A data quality assessment (DQA) is the statistical analysis of environmental data to determine whether the quality of data is adequate to support the decision which are

based on the DQOs. Data are appropriate if the level of uncertainty in a decision based on the data is acceptable. The DQA process is described in detail in *Guidance for the Data Quality Assessment Process*, EPA QA/G-9 and is summarized below.

1. Review the data quality objectives (DQOs) and sampling design of the program: review the DQO. Define statistical hypothesis, tolerance limits, and/or confidence intervals.
2. Conduct preliminary data review. Review Precision & Accuracy (P&A) and other available QA reports; calculate summary statistics, plots and graphs. Look for patterns, relationships, or anomalies.
3. Select the statistical test: select the best test for analysis based on the preliminary review, and identify underlying assumptions about the data for that test.
4. Verify test assumptions: decide whether the underlying assumptions made by the selected test hold true for the data and the consequences.
5. Perform the statistical test: perform test and document inferences. Evaluate the performance for future use.

Data quality assessment will be included in the Quality Assurance Assessment Reports. Details of these reports are discussed in Section 21.

Measurement uncertainty will be estimated for both automated and manual methods. Terminology associated with measurement uncertainty are found within 40 CFR Part 58 Appendix A and includes: (a) Precision - a measurement of mutual agreement among individual measurements of the same property usually under prescribed similar conditions, expressed generally in terms of the standard deviation; (b) Accuracy- the degree of agreement between an observed value and an accepted reference value, accuracy includes a combination of random error (precision) and systematic error (bias) components which are due to sampling and analytical operations; (c) Bias-the systematic or persistent distortion of a measurement process which causes errors in one direction. The individual results of these tests for each method or analyzer shall be reported to EPA.

Estimates of the data quality will be calculated on the basis of single monitors and aggregated to all monitors.

20.1.5 Performance Evaluations

The PE is an assessment tool for the laboratory operations. The State's Laboratory Division creates "blind" samples and sends them periodically to the District's laboratory. Upon receipt, the laboratory logs in the samples and performs the normal handling routines as any other sample. The PE is analyzed in accordance with the SOPs and QAPP. The results are then sent to the Laboratory Branch Manager for final review. Then the results are reported to the State's Laboratory Director. The State's

laboratory writes up a PE report and sends a copy of the results to the Laboratory Branch Manager and the EPA QA Office. Any results outside of the State's acceptance criteria are then noted in the PE report. IDEM has 120 days to address any deficiencies noted in the PE Report

Table 20.1 Interlaboratory/Independent Sample Assessment

Parameter	Assessment	Frequency
PM10	EPA Flow Transfer Standard	Annually
VOC	EPA's PT Audits	Every six months
Aldehydes - DNPH cartridges	EPA's Inter lab Audit	Every six months
Chromium VI	Duplicate sampling and analysis	10% of the samples

21.0 Reports to Managers

IDEM and City managers are involved in the day to day activities and are constantly being informed of any problems associated with the quality of the monitoring being performed. Staff provide periodic updates to managers through verbal report, e-mail, and notes alerting management of any quality concerns. In addition, management oversees the daily operations of the monitoring and is able to identify any quality issues that may be overlooked by staff.

IDEM will report monitoring results to the Technical Advisory Group (TAG) on a quarterly basis. These reports will also contain any quality problems encountered and the remedies applied to correct any problems.

Table 21.1 Reporting Schedule

Report	Contents	Frequency
Site Inspections	Details current site operations and safety issues	Quarterly Annually
PARS/AQS	Audit summary results and statistics	Quarterly Annually
VDR	Quantity of data collected	Quarterly Annually
Quality Assurance Assessment Report	Network Review TSA DQA	Annual Project Completion
Annual Report		Annual

22.0 Data Review

22.1 Data Review Design

The primary purpose of this section is to describe the data validation procedures which may be used by IDEM to process ambient air toxics data. Data validation refers to those activities that may be performed after the fact, that is, after the data have been collected. The difference between data validation and quality control techniques is that the quality control techniques attempt to minimize the amount of bad data being collected, while data validation seeks to prevent any bad data from getting through the data collection and storage systems.

It is preferable that data review be performed as soon as possible after the data collection, so that the questionable data can be checked by recalling information on unusual events and on meteorological conditions which can aid in the validation. Also, timely corrective actions should be taken when indicated to minimize further generation of questionable data.

Personnel performing data review should:

- Be familiar with typical diurnal concentration variations (e.g., the time daily maximum concentrations occur and the interrelationship of pollutants.) For example, benzene, toluene and xylene concentrations usually increase and decrease together, due to these being attributed to mobile sources, whereas, metals are usually attributable to manufacturing process, and may have a longer temporal cycle.
- Be familiar with the type of instrument malfunctions which cause characteristic trace irregularities.
- Recognize that cyclical or repetitive variations (at the same time each day or at periodic intervals during the day) may be caused by excessive line voltage or temperature variations. Nearby source activity can also cause erroneous or non-representative measurements.
- Recognize that flow traces showing little or no activity often indicate flow problems, or sample line leaks.

There is a wide variety of information with which to validate air toxics data. Among them are the following, along with their uses:

- Multi-point Calibration Forms - the multipoint forms should be used to establish proper
- initial calibration and can be used to show changes in the calibration;
- Span Control Charts - these charts will be the most valuable tool in spotting data that is out of control limits;
- Site and Instrument Logs - because all station activities are noted in one or both of these logs, one can obtain a good picture of station operations by reading these logs
- Data From Other Air Quality Stations - data from other air quality stations nearby can be compared between two stations to help the identification of invalid data.
- Blanks, Replicates and Spikes - these QC indicators can be used to ascertain whether sample handling or analysis is causing bias in the data set.
- Monthly Summary Reports - The Monthly Summary Reports are outputs from the
- Analytical Laboratory OAMTDC database. These reports are “canned” reports provided by the computer vendor who writes the interface software. These reports provide the following information:
 - Completeness report;
 - Initial Calibration Report from the Analytical Instruments;

22.1.1 Data Identification Checks

Data with improper identification codes are useless. Three equally important identification fields which must be correct are time, location, parameter and sampler ID.

22.1.2 Unusual Event Review

Extrinsic events (e.g., construction activity, dust storms, unusual traffic volume, and traffic jams) can explain unusual data. This information could also be used to explain why no data are reported for a specified time interval, or it could be the basis for deleting data from a file for specific analytical purposes.

22.1.3 Relationship Checks

Toxics data sets contain many physically or chemically related parameters. These relations can be routinely checked to ensure that the measured values on an individual parameter do not exceed the corresponding measured values of an aggregate parameter

which includes the individual parameter. For example, benzene, toluene and xylene are mobile source driven. The relative concentrations are within +/- 10 ppbv, if these values are recorded at the same time and location. Data sets in which individual parameter values exceed the corresponding aggregate values are flagged for further investigation. Minor exceptions to allow for measurement system noise may be permitted in cases where the individual value is a large percentage of the aggregate value.

22.1.4 Review of Spikes, Blanks and Replicates

An additional check of the data set is to verify that the spikes, blanks and replicate samples have been reviewed. Generally, recovery of spikes in samples should be greater than 80%. Blanks should not be more than 3 times the MDL for any compound. The difference in concentration of replicates should be within +/- 10%. If any of these are outside of this boundary, then the reviewer should notify the air monitoring branch supervisor for direction. The air branch supervisor will discuss these results with the lab branch supervisor and the QA officer. The three will decide whether any of these results can or will invalidate a single run or batch.

22.2 Procedures

These tests check values in a data set which appear atypical when compared to the whole data set. Common anomalies of this type include unusually high or low values (outliers) and large differences in adjacent values. These tests will not detect errors which alter all values of the data set by either an additive or multiplicative factor (e.g., an error in the use of the scale). The following tests for internal consistency are used:

- Data Plots
- Ratio Test
- Students "t-test"

22.2.1. Tests for Historical and Temporal Consistency

These tests check the consistency of the data set with respect to similar data recorded in the past. In particular these procedures will detect changes where each item is increased by a constant or by a multiplicative factor. Gross limit checks are useful in detecting data values that are either highly unlikely or considered impossible. The use of upper and lower 95% confidence limits is very useful in identifying outliers.

22.2.2 Pattern and Successive Difference Tests

These tests check data for pollutant behavior which has never or very rarely occurred in the past. Values representing pollutant behavior outside of these predetermined limits are then flagged for further investigation. Pattern tests place upper limits on:

- The individual concentration value (maximum-hour test),
- The difference in adjacent concentration values (adjacent hour test),
- The difference or percentage difference between a value and both of its adjacent values (spike test), and
- The average of three or more consecutive values (consecutive value test)

22.2.3 Parameter Relationship Tests

Parameter relationship tests can be divided into deterministic tests involving the theoretical relationships between parameters (e.g., ratios between benzene and toluene) or empirical tests which determine whether or not a parameter is behaving normally in relation to the observed behavior of one or more other parameters. Determining the “normal” behavior of related parameters requires the detailed review of historical data.

23.0 Data Validation

Many of the processes for verifying and validating the measurement phases of the data collection operation have been discussed in Section 22. If these processes, as written in the QAPP, are followed, and the sites are representative of the boundary conditions for which they were selected, one would expect to achieve the DQOs. However, exceptional field events may occur, and field and laboratory activities may negatively affect the integrity of samples. In addition, it is expected that some of the QC checks will fail to meet the acceptance criteria. This section will outline how IDEM will take the data to a higher level of analysis. This will be accomplished by performing software tests, plotting and other methods of analysis.

23.1 Process for Validating and Verifying Data

23.1.1 Verification of Samples

After a sample batch is completed, a thorough review of the data will be conducted for completeness and data entry accuracy. For the chromatographic data, the data will be reviewed by another staff member for routine data outliers and data outside of acceptance criteria. These data will be flagged appropriately. All flagged data will be “reverified” that the values are entered correctly. The entries are compared to reduce the possibility of entry and transcription errors. Once the data is entered into the Office of Air Management Air Toxic Database (OAMTDC) database the system will review the data for routine data outliers and data outside of acceptance criteria.. The data qualifiers or flags can be found in the SOPs.

23.1.2 Validation

Validation of measurement data will be archived for 10 years. Information will include a brief summary of why the sample was invalidated along with the associated flags. This record will be available on the OAMTDC since all samples that were analyzed will be recorded. At least one flag will be associated with an invalid sample, that being the “INV” flag signifying invalid, or the “NAR” flag when no analysis result is reported, or “BDL” which means below the detection limit..

Validation of Measurement Values

Certain criteria based upon field operator and laboratory technician judgment have been developed that will be used to invalidate a sample or measurement. The flags listed in

table 23.1 will be used to determine if individual samples, or samples from a particular instrument will be invalidated. In all cases the sample will be returned to the laboratory for further examination. When the laboratory technician reviews the field sheet and chain-of-custody forms he/she will look for flag values.

Filters that have flags related to obvious contamination (CON), filter damage (DAM), field accidents (FAC) will be immediately examined. Upon concurrence of the laboratory technician and laboratory branch manager, these samples will be invalidated. The flag "NAR" for no analysis result will be placed in the flag area associated with this sample, along with the other associated flags. Other flags listed may be used alone or in combination to invalidate samples. Since the possible flag combinations are overwhelming and can not be anticipated, the air division will review these flags and determine if single values or values from a site for a particular time period will be invalidated. The division will keep a record of the combination of flags that resulted in invalidating a sample or set of samples. As mentioned above, all data invalidation will be documented. Table 23.1 contains criteria that can be used to invalidate single samples based on single flags.

Table 23.1 Single Flag Invalidation Criteria for Single Samples

Requirement	Flag	Comment
Contamination	CON	Concurrence with lab technician and branch manager
Filter Damage	DAM	Concurrence with lab technician and branch manager
Event	EVT	Exceptional, known field event expected to have affected sample. Concurrence with lab technician and branch manager
Laboratory Accident	LAC	Concurrence with lab technician and branch manager
Below Detection Limits	BDL	Value is below the Minimum Detection Limit of the analytical system
Field Accident	FAC	Concurrence with lab technician and branch manager

23.2 Data Analysis

Data analysis refers to the process of attempting to make sense of the data that are collected. By examining the list in Table 5-1, there are a large number of parameters to analyze. However, many of these have similar characteristics.

This section will state how IDEM will begin to analyze the data to ascertain what the data illustrates and how it should be applied.

23.2.1 Analytical tests

IDEM will employ several software programs towards analyzing the data. These are listed below with a short explanation of each.

Spreadsheet - IDEM will perform a rudimentary analysis on the data sets using EXCEL spreadsheets. Spreadsheets allow the user to input data and statistically analyze, plot and graph linear data. This type of analysis will allow the user to see if there are any variations in the data sets. In addition, various statistical tests such as tests for linearity, slope, intercept or correlation coefficient can be generated between two strings of data. Box and Whisker, Scatter and other plots can be employed. Time series plots can help identify the following trends:

- Large jumps or dips in concentrations
- periodicity of peaks within a month or quarter
- Expected or un-expected relationships among species

VOCDat- As stated in Section 22, the EPA has placed resources into creating software that can analyze data. One such program is VOCDat. This software program was originally written for input of PAMS data.. VOCDat is a Windows-based program that provides a graphical platform from which to display collected VOC data; to perform quality control tasks on the data; and for exploratory data analysis. This program will enable IDEM to rapidly validate and release their air toxics VOC data to AIRS. VOCDat displays the concentrations of the VOC data using scatter, fingerprint, and time series plots. Customizable screening criteria may be applied to the data and the quality control codes may be changed for individual data points as well as for the entire sample on all plots. VOCDat can allow a user to find out what percentage a particular compound is of the total. This test allows the user the ability to see if the data exceeds the 3 sigma rule for outliers. For more details, please see Section 22.2.

Wind Rose and Pollution Rose Plots - The wind direction, wind speed and pollutant data will be input into the program and wind and rose which show the relative direction and speed of pollutants (transport) will be graphically displayed.

GIS - GIS program that allows the user the ability to overlay concentration data on geographic data. By creating “views”, the user can overlay temporally changing data into a spatial analysis too. Plots of concentrations of data can be temporal/spatially displaced.

24.0 Reconciliation with DQOs

This section of the QAPP will outline the assessment procedures that IDEM will follow to determine whether the monitors and laboratory analyses are producing data that comply with the stated goals. This section will then state what action will be taken as a result of the assessment process. Such an assessment is termed a Data Quality Assessment (DQA) and is thoroughly described in *EPA QA/G-9: Guidance for Data Quality Assessment*. For the stated DQO, the assessment process must follow statistical routines. The following five steps will discuss how this will be achieved.

24.1 Review DQOs and Sampling Design.

Section 7 of this QAPP contains the details for the development of the DQOs, including defining the objectives of the air toxics monitoring network and developing limits on the decision errors. Section 10 of this QAPP contains the details for the sampling design, including the rationale for the design, the design assumptions, and the sampling locations and frequency. If any deviations from the sampling design have occurred, these will be indicated and their potential effect carefully considered throughout the entire DQA. Since this project is in the formative stages no assessments have been performed.

24.2 Conduct Preliminary Data Review

A preliminary data review will be performed to uncover potential limitations to using the data, to reveal outliers, and generally to explore the basic structure of the data. The first step is to review the quality assurance reports. The second step is to calculate basic summary statistics, generate graphical presentations of the data, and review these summary statistics and graphs.

24.2.1 Review Quality Assurance Reports- IDEM will review all relevant quality assurance reports, internal and external, that describe the data collection and reporting process. Particular attention will be directed to looking for anomalies in recorded data, missing values, and any deviations from standard operating procedures. This is a qualitative review. However, any concerns will be further investigated in the next two steps.

24.2.2 Select the Statistical Test

IDEM will generate summary statistics for each of its samplers. The summary statistics will be calculated at the quarterly, annual, and 2 year mark and will include only valid samples. These following statistical tests will be performed as well as others that are deemed to be appropriate:

- Test to examine distribution of the data
- Simple averages of all pollutants
- 95% Upper confidence limit of the mean
- Examination of bias and precision of the data
- Seasonal averages to determine any seasonal variability
- Standard deviation
- Applicable trend analysis
- More tests as deemed applicable

Particular attention will be given to the impact on the statistics caused by the observations noted in the quality assurance review. In fact, IDEM may evaluate the influence of a potential outlier by evaluating the change in the summary statistics resulting from exclusion of the outlier.

24.2.3 Verify Assumptions of Statistical Test

There are no NAAQS to compare with air toxics. Therefore, verification of the data must be done against estimated values, such as models. However, before this can occur, the distribution, tests for trends, tests for outliers must be examined.

Normal distribution for measurement error- Assuming that measurement errors are normally distributed is common in environmental monitoring. IDEM has not investigated the sensitivity of the statistical test to violation of this assumption; although, small departures from normality generally do not create serious problems. IDEM will evaluate the reasonableness of the normality assumption by reviewing a normal probability plot and employing the Coefficient of Variance Test. If the plot or statistics indicate possible violations of normality, IDEM may need to determine the sensitivity of the DQOs to departures in normality.

*Trends Analysis-*The study will not generate data for a long enough period of time to statistically evaluate for trends in pollutant concentrations. However, a simple linear regression test may be performed to observe the temporal variations in the data sets.

24.2.4 Draw Conclusions from the Data

If the sampling design and the statistical test bear out, it can be assumed that the network design and the uncertainty of the data are acceptable. This conclusion can then be written in the Annual Report to management. Management may then decide whether to perform risk assessments, allow the State and EPA to analyze the data or work closely with the nearby university to determine whether this data can be used to assess conclusion from health effects studies.

24.2.5 Exposure concentration derivation

Sampling results will be used to derive an exposure concentration for the purposes of risk assessment analysis. Only data that has passed the DQO process will be used for the derivation of the exposure concentration. Concentration outliers may be used in the derivation depending on the analysis of the outliers.

Appendix A

Glossary

The following glossary is taken from the document EPA Guidance for Quality Assurance Project Plans EPA QA/G-5.

GLOSSARY OF QUALITY ASSURANCE AND RELATED TERMS

Acceptance criteria — Specified limits placed on characteristics of an item, process, or service defined in requirements documents. (ASQC Definitions)

Accuracy — A measure of the closeness of an individual measurement or the average of a number of measurements to the true value. Accuracy includes a combination of random error (precision) and systematic error (bias) components that are due to sampling and analytical operations; the EPA recommends using the terms “*precision*” and “*bias*”, rather than “accuracy,” to convey the information usually associated with accuracy. Refer to *Appendix D, Data Quality Indicators* for a more detailed definition.

Activity — An all-inclusive term describing a specific set of operations of related tasks to be performed, either serially or in parallel (e.g., research and development, field sampling, analytical operations, equipment fabrication), that, in total, result in a product or service.

Assessment — The evaluation process used to measure the performance or effectiveness of a system and its elements. As used here, assessment is an all-inclusive term used to denote any of the following: audit, performance evaluation (PE), management systems review (MSR), peer review, inspection, or surveillance.

Audit (quality) — A systematic and independent examination to determine whether quality activities and related results comply with planned arrangements and whether these arrangements are implemented effectively and are suitable to achieve objectives.

Audit of Data Quality (ADQ) — A qualitative and quantitative evaluation of the documentation and procedures associated with environmental measurements to verify that the resulting data are of acceptable quality.

Authenticate — The act of establishing an item as genuine, valid, or authoritative.

Bias — The systematic or persistent distortion of a measurement process, which causes errors in one direction (i.e., the expected sample measurement is different from the sample’s true value). Refer to *Appendix D, Data Quality Indicators*, for a more detailed definition.

Blank — A sample subjected to the usual analytical or measurement process to establish a zero baseline or background value. Sometimes used to adjust or correct routine analytical results. A sample that is intended to contain none of the analytes of interest. A blank is used to detect contamination during sample handling preparation and/or analysis.

Calibration — A comparison of a measurement standard, instrument, or item with a standard or instrument of higher accuracy to detect and quantify inaccuracies and to report or eliminate those inaccuracies by adjustments.

Calibration drift — The deviation in instrument response from a reference value over a period of time before recalibration.

Certification — The process of testing and evaluation against specifications designed to document, verify, and recognize the competence of a person, organization, or other entity to perform a function or service, usually for a specified time.

Chain of custody — An unbroken trail of accountability that ensures the physical security of samples, data, and records.

Characteristic — Any property or attribute of a datum, item, process, or service that is distinct, describable, and/or measurable.

Check standard — A standard prepared independently of the calibration standards and analyzed exactly like the samples. Check standard results are used to estimate analytical precision and to indicate the presence of bias due to the calibration of the analytical system.

Collocated samples — Two or more portions collected at the same point in time and space so as to be considered identical. These samples are also known as field replicates and should be identified as such.

Comparability — A measure of the confidence with which one data set or method can be compared to another.

Completeness — A measure of the amount of valid data obtained from a measurement system compared to the amount that was expected to be obtained under correct, normal conditions. Refer to *Appendix D, Data Quality Indicators*, for a more detailed definition.

Computer program — A sequence of instructions suitable for processing by a computer. Processing may include the use of an assembler, a compiler, an interpreter, or a translator to prepare the program for execution. A computer program may be stored on magnetic media and referred to as “software,” or it may be stored permanently on computer chips, referred to as “firmware.” Computer programs covered in a QAPP are those used for design analysis, data

acquisition, data reduction, data storage (databases), operation or control, and database or document control registers when used as the controlled source of quality information.

Confidence Interval — The numerical interval constructed around a point estimate of a population parameter, combined with a probability statement (the confidence coefficient) linking it to the population's true parameter value. If the same confidence interval construction technique and assumptions are used to calculate future intervals, they will include the unknown population parameter with the same specified probability.

Confidentiality procedure — A procedure used to protect confidential business information (including proprietary data and personnel records) from unauthorized access.

Configuration — The functional, physical, and procedural characteristics of an item, experiment, or document.

Conformance — An affirmative indication or judgment that a product or service has met the requirements of the relevant specification, contract, or regulation; also, the state of meeting the requirements.

Consensus standard — A standard established by a group representing a cross section of a particular industry or trade, or a part thereof.

Contractor — Any organization or individual contracting to furnish services or items or to perform work.

Corrective action — Any measures taken to rectify conditions adverse to quality and, where possible, to preclude their recurrence.

Correlation coefficient — A number between -1 and 1 that indicates the degree of linearity between two variables or sets of numbers. The closer to -1 or +1, the stronger the linear relationship between the two (i.e., the better the correlation). Values close to zero suggest no correlation between the two variables. The most common correlation coefficient is the product-moment, a measure of the degree of linear relationship between two variables.

Data of known quality — Data that have the qualitative and quantitative components associated with their derivation documented appropriately for their intended use, and when such documentation is verifiable and defensible.

Data Quality Assessment (DQA) — The scientific and statistical evaluation of data to determine if data obtained from environmental operations are of the right type, quality, and quantity to support their intended use. The five steps of the DQA Process include: 1) reviewing the DQOs and sampling design, 2) conducting a preliminary data review, 3) selecting the statistical test, 4) verifying the assumptions of the statistical test, and 5) drawing conclusions from the data.

Data Quality Indicators (DQIs) — The quantitative statistics and qualitative descriptors that are used to interpret the degree of acceptability or utility of data to the user. The principal data quality indicators are bias, precision, accuracy (bias is preferred), comparability, completeness, representativeness.

Data Quality Objectives (DQOs) — The qualitative and quantitative statements derived from the DQO Process that clarify study's technical and quality objectives, define the appropriate type of data, and specify tolerable levels of potential decision errors that will be used as the basis for establishing the quality and quantity of data needed to support decisions.

Data Quality Objectives (DQO) Process — A systematic strategic planning tool based on the scientific method that identifies and defines the type, quality, and quantity of data needed to satisfy a specified use. The key elements of the DQO process include:

- state the problem,
- identify the decision,
- identify the inputs to the decision,
- define the boundaries of the study,
- develop a decision rule,
- specify tolerable limits on decision errors, and
- optimize the design for obtaining data. DQOs are the qualitative and quantitative outputs from the DQO Process.

Data reduction — The process of transforming the number of data items by arithmetic or statistical calculations, standard curves, and concentration factors, and collating them into a more useful form. Data reduction is irreversible and generally results in a reduced data set and an associated loss of detail.

Data usability — The process of ensuring or determining whether the quality of the data produced meets the intended use of the data.

Deficiency — An unauthorized deviation from acceptable procedures or practices, or a defect in an item.

Demonstrated capability — The capability to meet a procurement's technical and quality specifications through evidence presented by the supplier to substantiate its claims and in a manner defined by the customer.

Design — The specifications, drawings, design criteria, and performance requirements. Also, the result of deliberate planning, analysis, mathematical manipulations, and design processes.

Design change — Any revision or alteration of the technical requirements defined by approved and issued design output documents and approved and issued changes thereto.

Design review — A documented evaluation by a team, including personnel such as the responsible designers, the client for whom the work or product is being designed, and a quality assurance (QA) representative but excluding the original designers, to determine if a proposed design will meet the established design criteria and perform as expected when implemented.

Detection Limit (DL) — A measure of the capability of an analytical method to distinguish samples that do not contain a specific analyte from samples that contain low concentrations of the analyte; the lowest concentration or amount of the target analyte that can be determined to be different from zero by a single measurement at a stated level of probability. DLs are analyte- and matrix-specific and may be laboratory-dependent.

Distribution — 1) The appointment of an environmental contaminant at a point over time, over an area, or within a volume; 2) a probability function (density function, mass function, or distribution function) used to describe a set of observations (statistical sample) or a population from which the observations are generated.

Document — Any written or pictorial information describing, defining, specifying, reporting, or certifying activities, requirements, procedures, or results.

Document control — The policies and procedures used by an organization to ensure that its documents and their revisions are proposed, reviewed, approved for release, inventoried, distributed, archived, stored, and retrieved in accordance with the organization's requirements.

Duplicate samples — Two samples taken from and representative of the same population and carried through all steps of the sampling and analytical procedures in an identical manner. Duplicate samples are used to assess variance of the total method, including sampling and analysis. See also *collocated sample*.

Environmental conditions — The description of a physical medium (e.g., air, water, soil, sediment) or a biological system expressed in terms of its physical, chemical, radiological, or biological characteristics.

Environmental data — Any parameters or pieces of information collected or produced from measurements, analyses, or models of environmental processes, conditions, and effects of pollutants on human health and the ecology, including results from laboratory analyses or from experimental systems representing such processes and conditions.

Environmental data operations — Any work performed to obtain, use, or report information pertaining to environmental processes and conditions.

Environmental monitoring — The process of measuring or collecting environmental data.

Environmental processes — Any manufactured or natural processes that produce discharges to, or that impact, the ambient environment.

Environmental programs — An all-inclusive term pertaining to any work or activities involving the environment, including but not limited to: characterization of environmental processes and conditions; environmental monitoring; environmental research and development; the design, construction, and operation of environmental technologies; and laboratory operations on environmental samples.

Environmental technology — An all-inclusive term used to describe pollution control devices and systems, waste treatment processes and storage facilities, and site remediation technologies and their components that may be utilized to remove pollutants or contaminants from, or to prevent them from entering, the environment. Examples include wet scrubbers (air), soil washing (soil), granulated activated carbon unit (water), and filtration (air, water). Usually, this term applies to hardware-based systems; however, it can also apply to methods or techniques used for pollution prevention, pollutant reduction, or containment of contamination to prevent further movement of the contaminants, such as capping, solidification or vitrification, and biological treatment.

Estimate — A characteristic from the sample from which inferences on parameters can be made.

Evidentiary records — Any records identified as part of litigation and subject to restricted access, custody, use, and disposal.

Expedited change — An abbreviated method of revising a document at the work location where the document is used when the normal change process would cause unnecessary or intolerable delay in the work.

Field blank — A blank used to provide information about contaminants that may be introduced during sample collection, storage, and transport. A clean sample, carried to the sampling site, exposed to sampling conditions, returned to the laboratory, and treated as an environmental sample.

Field (matrix) spike — A sample prepared at the sampling point (i.e., in the field) by adding a known mass of the target analyte to a specified amount of the sample. Field matrix spikes are used, for example, to determine the effect of the sample preservation, shipment, storage, and preparation on analyte recovery efficiency (the analytical bias).

Field split samples — Two or more representative portions taken from the same sample and submitted for analysis to different laboratories to estimate interlaboratory precision.

Financial assistance — The process by which funds are provided by one organization (usually governmental) to another organization for the purpose of performing work or furnishing services or items. Financial assistance mechanisms include grants, cooperative agreements, and governmental interagency agreements.

Finding — An assessment conclusion that identifies a condition having a significant effect on an item or activity. An assessment finding may be positive or negative, and is normally

accompanied by specific examples of the observed condition.

Goodness-of-fit test — The application of the chi square distribution in comparing the frequency distribution of a statistic observed in a sample with the expected frequency distribution based on some theoretical model.

Grade — The category or rank given to entities having the same functional use but different requirements for quality.

Graded approach — The process of basing the level of application of managerial controls applied to an item or work according to the intended use of the results and the degree of confidence needed in the quality of the results. (See also *Data Quality Objectives (DQO) Process*.)

Guidance — A suggested practice that is not mandatory, intended as an aid or example in complying with a standard or requirement.

Guideline — A suggested practice that is not mandatory in programs intended to comply with a standard.

Hazardous waste — Any waste material that satisfies the definition of hazardous waste given in 40 CFR261, “Identification and Listing of Hazardous Waste.”

Holding time — The period of time a sample may be stored prior to its required analysis. While exceeding the holding time does not necessarily negate the veracity of analytical results, it causes the qualifying or “flagging” of any data not meeting all of the specified acceptance criteria.

Identification error — The misidentification of an analyte. In this error type, the contaminant of concern is unidentified and the measured concentration is incorrectly assigned to another contaminant.

Independent assessment — An assessment performed by a qualified individual, group, or organization that is not a part of the organization directly performing and accountable for the work being assessed.

Inspection — The examination or measurement of an item or activity to verify conformance to specific requirements.

Internal standard — A standard added to a test portion of a sample in a known amount and carried through the entire determination procedure as a reference for calibrating and controlling the precision and bias of the applied analytical method.

Item — An all-inclusive term used in place of the following: appurtenance, facility, sample, assembly, component, equipment, material, module, part, product, structure, subassembly,

subsystem, system, unit, documented concepts, or data.

Laboratory split samples — Two or more representative portions taken from the same sample and analyzed by different laboratories to estimate the interlaboratory precision or variability and the data comparability.

Limit of quantitation — The minimum concentration of an analyte or category of analytes in a specific matrix that can be identified and quantified above the method detection limit and within specified limits of precision and bias during routine analytical operating conditions.

Management — Those individuals directly responsible and accountable for planning, implementing, and assessing work.

Management system — A structured, nontechnical system describing the policies, objectives, principles, organizational authority, responsibilities, accountability, and implementation plan of an organization for conducting work and producing items and services.

Management Systems Review (MSR) — The qualitative assessment of a data collection operation and/or organization(s) to establish whether the prevailing quality management structure, policies, practices, and procedures are adequate for ensuring that the type and quality of data needed are obtained.

Matrix spike — A sample prepared by adding a known mass of a target analyte to a specified amount of matrix sample for which an independent estimate of the target analyte concentration is available. Spiked samples are used, for example, to determine the effect of the matrix on a method's recovery efficiency.

May — When used in a sentence, a term denoting permission but not a necessity.

Mean (arithmetic) — The sum of all the values of a set of measurements divided by the number of values in the set; a measure of central tendency.

Mean squared error — A statistical term for variance added to the square of the bias.

Measurement and Testing Equipment (M&TE) — Tools, gauges, instruments, sampling devices, or systems used to calibrate, measure, test, or inspect in order to control or acquire data to verify conformance to specified requirements.

Memory effects error — The effect that a relatively high concentration sample has on the measurement of a lower concentration sample of the same analyte when the higher concentration sample precedes the lower concentration sample in the same analytical instrument.

Method — A body of procedures and techniques for performing an activity (e.g., sampling, chemical analysis, quantification), systematically presented in the order in which they are to be executed.

Method blank — A blank prepared to represent the sample matrix as closely as possible and analyzed exactly like the calibration standards, samples, and quality control (QC) samples. Results of method blanks provide an estimate of the within-batch variability of the blank response and an indication of bias introduced by the analytical procedure.

Mid-range check- A standard used to establish whether the middle of a measurement method's calibrated range is still within specifications.

Mixed waste — A hazardous waste material as defined by 40 CFR 261 Resource Conservation and Recovery Act (RCRA) and mixed with radioactive waste subject to the requirements of the Atomic Energy Act.

Must — When used in a sentence, a term denoting a requirement that has to be met.

Nonconformance — A deficiency in a characteristic, documentation, or procedure that renders the quality of an item or activity unacceptable or indeterminate; nonfulfillment of a specified requirement.

Objective evidence — Any documented statement of fact, other information, or record, either quantitative or qualitative, pertaining to the quality of an item or activity, based on observations, measurements, or tests that can be verified.

Observation — An assessment conclusion that identifies a condition (either positive or negative) that does not represent a significant impact on an item or activity. An observation may identify a condition that has not yet caused a degradation of quality.

Organization — A company, corporation, firm, enterprise, or institution, or part thereof, whether incorporated or not, public or private, that has its own functions and administration.

Organization structure — The responsibilities, authorities, and relationships, arranged in a pattern, through which an organization performs its functions.

Outlier — An extreme observation that is shown to have a low probability of belonging to a specified data population.

Parameter — A quantity, usually unknown, such as a mean or a standard deviation characterizing a population. Commonly misused for "variable," "characteristic," or "property."

Peer review — A documented critical review of work generally beyond the state of the art or characterized by the existence of potential uncertainty. Conducted by qualified individuals (or an organization) who are independent of those who performed the work but collectively equivalent in technical expertise (i.e., peers) to those who performed the original work. Peer reviews are

conducted to ensure that activities are technically adequate, competently performed, properly documented, and satisfy established technical and quality requirements. An in-depth assessment of the assumptions, calculations, extrapolations, alternate interpretations, methodology, acceptance criteria, and conclusions pertaining to specific work and of the documentation that supports them. Peer reviews provide an evaluation of a subject where quantitative methods of analysis or measures of success are unavailable or undefined, such as in research and development.

Performance Evaluation (PE) — A type of audit in which the quantitative data generated in a measurement system are obtained independently and compared with routinely obtained data to evaluate the proficiency of an analyst or laboratory.

Pollution prevention — An organized, comprehensive effort to systematically reduce or eliminate pollutants or contaminants prior to their generation or their release or discharge into the environment.

Population – The totality of items or units of material under consideration or study.

Precision — A measure of mutual agreement among individual measurements of the same property, usually under prescribed similar conditions expressed generally in terms of the standard deviation. Refer to *Appendix D, Data Quality Indicators*, for a more detailed definition.

Procedure — A specified way to perform an activity.

Process — A set of interrelated resources and activities that transforms inputs into outputs. Examples of processes include analysis, design, data collection, operation, fabrication, and calculation.

Project — An organized set of activities within a program.

Qualified data — Any data that have been modified or adjusted as part of statistical or mathematical evaluation, data validation, or data verification operations.

Qualified services — An indication that suppliers providing services have been evaluated and determined to meet the technical and quality requirements of the client as provided by approved procurement documents and demonstrated by the supplier to the client's satisfaction.

Quality — The totality of features and characteristics of a product or service that bears on its ability to meet the stated or implied needs and expectations of the user.

Quality Assurance (QA) — An integrated system of management activities involving planning, implementation, assessment, reporting, and quality improvement to ensure that a process, item, or service is of the type and quality needed and expected by the client.

Quality Assurance Program Description/Plan — See *quality management plan*.

Quality Assurance Project Plan (QAPP) — A formal document describing in comprehensive detail the necessary quality assurance (QA), quality control (QC), and other technical activities that must be implemented to ensure that the results of the work performed will satisfy the stated performance criteria. The QAPP components are divided into four classes: 1) Project Management, 2) Measurement/Data Acquisition, 3) Assessment/Oversight, and 4) Data Validation and Usability. Guidance and requirements on preparation of QAPPs can be found in EPA QA/R-5 and QA/G-5.

Quality Control (QC) — The overall system of technical activities that measures the attributes and performance of a process, item, or service against defined standards to verify that they meet the stated requirements established by the customer; operational techniques and activities that are used to fulfill requirements for quality. The system of activities and checks used to ensure that measurement systems are maintained within prescribed limits, providing protection against “out of control” conditions and ensuring the results are of acceptable quality.

Quality control (QC) sample — An uncontaminated sample matrix spiked with known amounts of analytes from a source independent of the calibration standards. Generally used to establish intra-laboratory or analyst-specific precision and bias or to assess the performance of all or a portion of the measurement system.

Quality improvement - A management program for improving the quality of operations. Such management programs generally entail a formal mechanism for encouraging worker recommendations with timely management evaluation and feedback or implementation.

Quality management — That aspect of the overall management system of the organization that determines and implements the quality policy. Quality management includes strategic planning, allocation of resources, and other systematic activities (e.g., planning, implementation, and assessment) pertaining to the quality system.

Quality Management Plan (QMP) — A formal document that describes the quality system in terms of the organization’s structure, the functional responsibilities of management and staff, the lines of authority, and the required interfaces for those planning, implementing, and assessing all activities conducted.

Quality system — A structured and documented management system describing the policies, objectives, principles, organizational authority, responsibilities, accountability, and implementation plan of an organization for ensuring quality in its work processes, products (items), and services. The quality system provides the framework for planning, implementing, and assessing work performed by the organization and for carrying out required quality assurance (QA) and quality control (QC).

Radioactive waste — Waste material containing, or contaminated by, radio nuclides, subject to the requirements of the Atomic Energy Act.

Readiness review — A systematic, documented review of the readiness for the start-up or continued use of a facility, process, or activity. Readiness reviews are typically conducted before proceeding beyond project milestones and prior to initiation of a major phase of work.

Record (quality) — A document that furnishes objective evidence of the quality of items or activities and that has been verified and authenticated as technically complete and correct. Records may include photographs, drawings, magnetic tape, and other data recording media.

Recovery — The act of determining whether or not the methodology measures all of the analyte contained in a sample. Refer to *Appendix D, Data Quality Indicators*, for a more detailed definition.

Remediation — The process of reducing the concentration of a contaminant (or contaminants) in air, water, or soil media to a level that poses an acceptable risk to human health.

Repeatability — The degree of agreement between independent test results produced by the same analyst, using the same test method and equipment on random aliquots of the same sample within a short time period.

Reporting limit — The lowest concentration or amount of the target analyte required to be reported from a data collection project. Reporting limits are generally greater than detection limits and are usually not associated with a probability level.

Representativeness — A measure of the degree to which data accurately and precisely represent a characteristic of a population, a parameter variation at a sampling point, a process condition, or an environmental condition. See also *Appendix D, Data Quality Indicators*.

Reproducibility -The precision, usually expressed as variance, that measures the variability among the results of measurements of the same sample at different laboratories.

Requirement — A formal statement of a need and the expected manner in which it is to be met.

Research (applied) — A process, the objective of which is to gain the knowledge or understanding necessary for determining the means by which a recognized and specific need may be met.

Research (basic) — A process, the objective of which is to gain fuller knowledge or understanding of the fundamental aspects of phenomena and of observable facts without specific applications toward processes or products in mind.

Research development/demonstration — The systematic use of the knowledge and understanding gained from research and directed toward the production of useful materials, devices, systems, or methods, including prototypes and processes.

Round-robin study — A method validation study involving a predetermined number of laboratories or analysts, all analyzing the same sample(s) by the same method. In a round-robin study, all results are compared and used to develop summary statistics such as interlaboratory precision and method bias or recovery efficiency.

Ruggedness study — The carefully ordered testing of an analytical method while making slight variations in test conditions (as might be expected in routine use) to determine how such variations affect test results. If a variation affects the results significantly, the method restrictions are tightened to minimize this variability.

Scientific method — The principles and processes regarded as necessary for scientific investigation, including rules for concept or hypothesis formulation, conduct of experiments, and validation of hypotheses by analysis of observations.

Self-assessment — The assessments of work conducted by individuals, groups, or organizations directly responsible for overseeing and/or performing the work.

Sensitivity — the capability of a method or instrument to discriminate between measurement responses representing different levels of a variable of interest. Refer to *Appendix D, Data Quality Indicators*, for a more detailed definition.

Service — The result generated by activities at the interface between the supplier and the customer, and the supplier internal activities to meet customer needs. Such activities in environmental programs include design, inspection, laboratory and/or field analysis, repair, and installation.

Shall — A term denoting a requirement that is mandatory whenever the criterion for conformance with the specification permits no deviation. This term does not prohibit the use of alternative approaches or methods for implementing the specification so long as the requirement is fulfilled.

Should — A term denoting a guideline or recommendation whenever noncompliance with the specification is permissible.

Significant Condition - Any state, status, incident, or situation of an environmental process or condition, or environmental technology in which the work being performed will be adversely affected sufficiently to require corrective action to satisfy quality objectives or specifications and safety requirements.

Software life cycle — The period of time that starts when a software product is conceived and ends when the software product is no longer available for routine use. The software life cycle typically includes a requirement phase, a design phase, an implementation phase, a test phase, an installation and check-out phase, an operation and maintenance phase, and sometimes a retirement phase.

Source reduction — Any practice that reduces the quantity of hazardous substances,

contaminants, or pollutants.

Span check — A standard used to establish that a measurement method is not deviating from its calibrated range.

Specification — A document stating requirements and referring to or including drawings or other relevant documents. Specifications should indicate the means and criteria for determining conformance.

Spike — A substance that is added to an environmental sample to increase the concentration of target analytes by known amounts; used to assess measurement accuracy (spike recovery). Spike duplicates are used to assess measurement precision.

Split samples — Two or more representative portions taken from one sample in the field or in the laboratory and analyzed by different analysts or laboratories. Split samples are quality control (QC) samples that are used to assess analytical variability and comparability.

Standard deviation — A measure of the dispersion or imprecision of a sample or population distribution expressed as the positive square root of the variance and has the same unit of measurement as the mean.

Standard Operating Procedure (SOP) — A written document that details the method for an operation, analysis, or action with thoroughly prescribed techniques and steps and that is officially approved as the method for performing certain routine or repetitive tasks.

Supplier — Any individual or organization furnishing items or services or performing work according to a procurement document or a financial assistance agreement. An all-inclusive term used in place of any of the following: vendor, seller, contractor, subcontractor, fabricator, or consultant.

Surrogate spike or analyte — A pure substance with properties that mimic the analyte of interest. It is unlikely to be found in environmental samples and is added to them to establish that the analytical method has been performed properly.

Surveillance (quality) — Continual or frequent monitoring and verification of the status of an entity and the analysis of records to ensure that specified requirements are being fulfilled.

Technical review — A documented critical review of work that has been performed within the state of the art. The review is accomplished by one or more qualified reviewers who are independent of those who performed the work but are collectively equivalent in technical expertise to those who performed the original work. The review is an in-depth analysis and evaluation of documents, activities, material, data, or items that require technical verification or validation for applicability, correctness, adequacy, completeness, and assurance that established requirements have been satisfied.

Technical Systems Audit (TSA) — A thorough, systematic, on-site qualitative audit of facilities, equipment, personnel, training, procedures, record keeping, data validation, data management, and reporting aspects of a system.

Traceability — The ability to trace the history, application, or location of an entity by means of recorded identifications. In a calibration sense, traceability relates measuring equipment to national or international standards, primary standards, basic physical constants or properties, or reference materials. In a data collection sense, it relates calculations and data generated throughout the project back to the requirements for the quality of the project.

Trip blank — A clean sample of a matrix that is taken to the sampling site and transported to the laboratory for analysis without having been exposed to sampling procedures.

Validation — Confirmation by examination and provision of objective evidence that the particular requirements for a specific intended use have been fulfilled. In design and development, validation concerns the process of examining a product or result to determine conformance to user needs. See also *Appendix G, Data Management*.

Variance (statistical) — A measure or dispersion of a sample or population distribution. Population variance is the sum of squares of deviation from the mean divided by the population size (number of elements). Sample variance is the sum of squares of deviations from the mean divided by the degrees of freedom (number of observations minus one).

Verification — Confirmation by examination and provision of objective evidence that specified requirements have been fulfilled. In design and development, verification concerns the process of examining a result of a given activity to determine conformance to the stated requirements for that activity.

Appendix B

PREPARATION OF AQUA REGIA EXTRACTING SOLUTION SOP

1. Place approximately 300 ml. D. I. water into a 1 lit. volumetric flask.
2. Add 77 ml. of concentrated HCL and 167 ml. of concentrated HNO₃.
3. Allow the mixture to cool.
4. Add D. I. water to the flask.
5. Place a stirring rod in the flask.
6. Stir for 4 to 6 hours.
7. Add D. I. water to the flask in order to bring the flask to volume, i. e. 1 liter.
8. This solution is 2.6 M HNO₃ and 0.9 M HCL.

SAMPLE PREPARATION ULTRA SONIC EXTRACTION PROCEDURE

1. Cut a 1" x 8" strip from the exposed filter.
2. Fold the strip in half twice and place in a 30 ml beaker. Add 15 ml of the Aqua Regia solution. The parafilm should be placed over the beaker such that none of the parafilm is in contact with water in the ultrasonic bath.
3. Place the beaker in the ultrasonic bath and operate for 30 minutes and quantitatively transfer the sample by rinsing parafilm and sides of beaker with D. I. water.
4. Decant extract and rinsing into a 100 ml volumetric flask and add 20 ml of D. I. water to cover the filter strip, cover with parafilm and set aside for a minimum of 30 minutes. This is a critical step can not be omitted.

5. Decant the water from the filter into the volumetric flask. Rinse filter and beaker twice with D. I. water and add rinsing to volumetric flask until total volume is 80 to 85 ml.
6. Put the Stopper on flask and shake vigorously. Set aside for approximately 5 minutes and bring solution to volume with D. I. water. Allow solution to settle for one hour before proceeding with analysis.

CLEANING SOLUTION FOR GLASSWARE
USED WITH METALS

The metals analysis program requires all glassware to be cleaned very thoroughly with nitric acid solution according to EPA reference method 40 CFR CH.1 (7-1-86 Edition). A 20% (w/w) nitric acid cleaning solution is prepared as follows:

Check bottle of nitric acid (HNO₃) for actual HNO₃ percentage contained in the bottle.
e.g. 70.4%

Therefore, 100ml of 70.4% HNO₃ would contain 70.4 ml HNO₃

70.4 ml * Density of HNO₃ (check specific gravity on bottle)
70.4 * 1.41g/ml = 99.264 g HNO₃

Thus, 100 ml of 70.4% HNO₃ contains 99.264 g HNO₃

$99.264 \text{ g} = 0.2 * X$ (X = total weight, i. e. HNO₃ + HCL)

$99.264/0.2 = X$

$X = 496.32$

For every 99.264 g HNO₃, there are

$496.32 - 99.264 = 397.056 \text{ g H}_2\text{O}$

Every 100 ml of 70.4% HNO₃ solution contains approximately 29.6 ml H₂O (1 g H₂O = 1 ml H₂O), so

$397.056 \text{ g H}_2\text{O} - 29.6 \text{ g H}_2\text{O} = 367.456 \text{ g H}_2\text{O}$

**** For every 100 ml of 70.4% HNO₃ solution, add 367.456 ml H₂O ****

GENERAL NOTES

For H₂O --- 1 ml = 1 g

I. Density = g/ml

J. ppm = ug/ml or ppm = ug/g of sample (for a solid sample)

K. 1 g = 1000 mg 1 mg/L = 1 ppm
1 mg = 1000 ug 1 ug/L = 1 ppb

A. Examples of how to prepare standards manually
** ppm=ug/ml **

1ml of 1000ppm = 1000ug Add the 1ml to 100ml D.I. water.
1000ug/100ml = 10ug/ml or 10ppm

2ml of 10ppm = 20ug Add the 2ml to 100ml D.I. water.
20ug/100ml = 0.2ug/ml or 0.2ppm

0.3ml of 1000ppm = 300ug Add the 0.3ml to 100ml D.I. water.
300ug/100ml = 3ug/ml or 3ppm

Preparation of standards can be done with autosampler.

F. Dilutions:
e.g. Dilution = 10 if take 1ml of the original sample volume and add it to 9ml D.I. water.

H. Calculation of Results (for a filter):
Mean of Sample X 9 X ?ml
Mean of Sample = Result obtained from AA

9 = Each filter strip is 1" x 8" which is 1/9th of the total filter, so to include the entire filter - take (x9)
?ml = Total amount of extraction volume prepared.

I. In general, Air Volume = $1.3\text{m}^3/\text{min}$ x minutes
However, the m^3/min value can be different.

K. All values should be carried out to 3 significant figures.

TURNING ON THE AA

1. Turn on the instrument (Spectrometer, the computer and printer).
2. Select **spectra AA** icon on the windows 95 desktop.

TURNING OFF AA

1. Turn off the instrument (Spectrometer, the computer and printer).air and fuel off on the AA.
2. Turn fuel tank off.

DISPOSAL OF CLEANING SOLUTION

1. Fill the basin of the sink with water.
2. Pour cleaning solution into the water. Do this in intervals so that not all cleaning solution is going into the drain pipes at once, therefore the pipes will not be destroyed.

**EXTRACTION PROCEDURE FOR SOLID MATERIALS:
(After 30 Minutes in Ultrasonication Bath)**

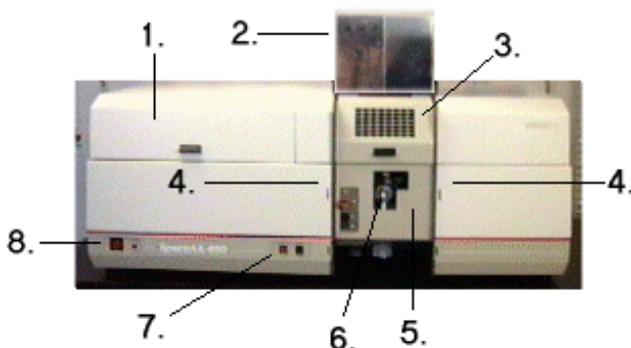
1. Put dry filter into funnel (placed in volumetric flask).
2. Rinse dry filter with:
 - A. D.I. water
 - B. Matrix (1/2 of a 15ml volume)
 - C. D.I. water
 - D. Matrix (1/2 of a 15ml volume)
 - E. D.I. water
3. Discard in sink the liquid which has flowed into volumetric flask.
4. ****Do not have to wait an extra 30 minutes.****
5. Rinse material in beaker several times with D.I. water. Put rinsings into flask.
6. Fill to volume with D.I. water.

CLEANING PIPETTES

- A. Clean the pipettes with a detergent solution.
 1. Put container with pipettes into the outer tub marked Nalgene.
 2. Fill with a detergent solution.
 3. Raise and slowly lower the pipettes.
 4. Allow the pipettes to sit in the detergent for 2 to 3 hours.
- B. Remove the basket containing the pipettes and place it in the larger tub marked Nalgene which has a hose attachment for water.
 1. Connect the hose from the Nalgene tub to the distilled water.
 2. Turn on the distilled water.
 3. The tub will automatically fill with water, rinse the pipettes, and drain.
 4. Allow the pipettes to be rinsed 4 to 5 times.
- C. Clean the pipettes in a dilute HNO₃ solution. Fill a large graduated cylinder with the cleaning solution used for glassware (this cylinder will probably be prepared and located under the hood), and dip the pipettes in this solution.
- D. Rinse the pipettes with distilled water as in B.

Standard operating procedure for metals analysis using Varian Spectra 880 Atomic Absorption Spectrometer.

Front view - Flame (880)



The diagram shows the front of a SpectrAA-880 Flame instrument.

The numbered items are:

1. Lamp compartment
2. Chimney
3. Flame shield
4. Slots for accessories and tray
5. Sample compartment front panel
6. Atomizer adjuster position controls
7. Flame off and ignition buttons
8. Power (off/on) switch and power indicator

Spectra 880 also comes with the Sample Introduction Pump System (SIPS 20) is an integrated, efficient sampling system and Auto sampler SPS 5 or PSD (for Graphite Furnace)

Burners

Your Spectra AA Flame instrument is designed to use either a **nitrous oxide-acetylene burner** or an **air-acetylene burner**. Both burners include an interlock spigot designed to inhibit ignition if either a burner is not fitted to the spray chamber, or a burner is fitted which is not suitable for the flame gas mixture selected. A lever allows you to rotate the burner over a 90° range.

Nitrous oxide-acetylene burner

This flame allows the determination of many refractory elements which cannot be determined in the cooler air-acetylene flame. It also provides better sensitivity and greater freedom from interference than air-acetylene for a number of elements, notably barium, calcium, chromium, molybdenum, and strontium. However, a nitrous oxide-acetylene flame is not as simple to use as an air-acetylene flame. Flame stoichiometry and burner position are more critical, and small departures from optimum may cause a severe loss in sensitivity.

Generally, a slightly fuel-rich flame is required with a red zone approximately 2 cm high. A number of metals are appreciably ionized in the nitrous oxide-acetylene flame but this interference can be countered by adding excess of potassium or cesium to the analytical solution (1000–2000 mg/L K or Cs).

Air acetylene burner

For most elements the flame should be oxidizing (non-luminous with a hazy blue inner cone). For some metals, particularly chromium, and molybdenum, a reducing flame (white, luminous) is required.

Installing a burner

1. Check the O-ring on the burner. It must be supple, free from nicks or cracks and make a gas-tight seal. If you are using the Universal spray chamber, make sure the O-ring on the base of the burner is the white fluoro-elastomer O-ring.
2. Align the hole in the rotation handle with the burner hole in the spray chamber.
3. Position the burner in the sample compartment, with the slot along the optical path and the plate with the warning toward the front of the instrument.

4. Hold the lower ratchet handle lever closed. Lower the burner so that the interlock key enters the interlock socket on the atomizer adjuster and the burner neck enters the hole for the burner in the handle and spray chamber.
5. Push the burner down as far as it will go. Release the lower ratchet handle and move the upper handle slightly to the left and right. The ratchet will engage and you should be able to rotate the burner using the rotation lever.

SETTING UP AN INSTRUMENT

The general preparation procedure is as follows:

1. Check that all required hardware (including sampler and printer if necessary) is correctly installed.
2. Turn on any required accessories or peripheral equipment.
3. Turn on your instrument.
4. If you have not already done so, turn on the computer, start the SpectrAA system, go to the Instrument window, and select the sequence or method you require.
5. Check the lamps. Align them if necessary (refer to Aligning lamps for more detail). Make sure the exhaust system is working. You can do this by using the **smoke from an extinguished match, or holding a thin single-ply tissue up to the mouth of the extraction hood. The smoke or tissue should be drawn toward the hood.**

If you are using a sampler, make sure all solutions are in their correct positions. You can select Loading guide on the SPS Racks or PSD Carousels dialog to help you do this

Aligning lamps

You should align a lamp if:

- You need the best possible signal to noise ratio
- You are using a non-Varian lamp
- You are using a position previously used for a non-Varian lamp
- You only need to align each lamp position once.

You should need only align the D2 lamp after it has been installed (Flame and Furnace only).

Use the following procedure for hollow cathode lamps and the D2 lamp.

1. On the Instrument page press Optimize, select an appropriate method, press OK then give the lamp time to warm up.
2. Make sure nothing is in the optical path, and while watching the lamp signal bar, slowly turn one of the adjustment knobs. If the signal decreases, turn the knob in the other direction, until you find the maximum signal. If the HC lamp signal is too small, first check that you have the correct lamp for the current method, and that it is glowing, then select Rescale. If the signal becomes too large, select Rescale.
3. Repeat the previous step with the other adjustment knob.

Lighting the flame

1. Ensure that the working area is completely clear of all hazardous materials including corrosive liquids and flammable solvents.
2. Check that the liquid trap is filled with the same solvent as will be used in the matrix.
3. Make sure the waste container is empty.
4. Check that the drain tube is positioned correctly in the waste vessel, with the end of the tube as high as possible in the vessel above the expected liquid level.
5. Ensure that the correct burner is in place.
6. Make sure the flame shield and front panel are in position. When operating your SpectrAA in Flame mode, ensure that the flame shield is closed and the front panel is in place.
7. Make sure the chimney is correctly in place.
8. Press the 'Ignite' button, and keep it pressed until the flame ignites. If the ignition sequence times out before the flame ignites, release the button, wait about five seconds, and restart the sequence.
9. Check the gas regulator settings and readjust if necessary.
10. When the flame has stabilized, adjust the flame conditions.
11. Aspirate 50 mL of the appropriate solvent. When you are not aspirating a solution, you should be aspirating the appropriate solvent.

Nebulizer setup

For correct operation of SIPS it is essential that the nebulizer uptake rate is correctly adjusted. The following procedure must be performed each time new tubing is installed on the SIPS and checked on a regular basis (e.g. daily).

Note: This procedure assumes the spectrometer is fully operational (lamp optimized, flame on etc.).

1. On the Instrument page press the “Optimize” button and select the required method.
2. Press the “OK” button to display the Flame Optimization dialog.
3. Press the “Optimize Signal” button to display the Optimize Signal dialog then press the “Start Pumps” button to optimize with the SIPS pump running.
4. Set the nebulizer to the high solids position (wound all the way in).
5. Using your finger, block the air vent (the small hole in the lid) on the diluent Mariott vessel. Very quickly disconnect and then reconnect the diluent tubing from the Mariott vessel. This will create a small air bubble in the diluent tubing.
6. Observe the movement of the bubble in the diluent line. If it is not travelling towards the nebulizer, then slowly wind out the nebulizer thimble until the bubble travels towards the nebulizer. It should take approximately 25-30 seconds for the bubble to travel 100 mm in the diluent tubing with the pump running at 100%.

Note: Make sure that you do not let too much air into the diluent tubing when you remove it from the Mariott vessel. If this is the case, when you reconnect the tubing, ensure that you run the SIPS until the tubing is air-free. Repeat step 5 again to create a small air bubble.

Note: Should a blockage occur in the nebulizer, the diluent in the Mariott vessel will need to be replaced since this causes the flow of diluent to be reversed, towards the Mariott vessel, leading to contamination of the diluent and hence erroneous results.

Optimizing the flame signal (880)

* Steps 1, 2, 3, and 4 are done with the **Flame Off** on the Optimization Page under the Optimize Lamps Heading... (Green Peaking Bar)

1. **Lamp** turn the two knobs at the base of the HCL while watching the green peaking bar, if the bar peaks out, hit the rescale button. When the lamp is optimized fully, record the % **Gain** number.

2. **Burner Vertical** using the burner alignment card in the center of the burner placing the line on the slot of the burner, align the burner using the inner knob on the front of the instrument to move vertically until the light is in the center of the circle of the card.
3. **Burner Horizontal** using the burner alignment card in the center of the burner placing the line on the slot of the burner, align the burner using the outer knob on the front of the instrument to move horizontally until the light is in the center of the circle of the card.
4. **Burner Rotational**... using the burner alignment card on both ends of the burner, squeeze the burner handle and slightly rotate the burner until the light is in the center of the circle of the card at both ends.

** Steps 5, 6, and 7 are done with the **Flame On** the Optimization Page under the Optimize Signal Heading... (Blue Peaking Bar)

Nebulizer Uptake Rate... using a graduated cylinder with water, measure the uptake rate for 1 minute. The value should be 6 ml/min (+/- 0.5 ml/min). if not, adjust the barrel of the nebulizer counterclockwise to speed up and clockwise to slow down the rate.

5. **Glass Bead Adjustment**... on the optimize signal page, instrument zero on water, then aspirate a mid to high level std of the element observing the blue signal bar rising. Begin by turning the glass bead knob (the one under the nebulizer barrel) completely clockwise. Watch for the signal to decrease then turn the knob counterclockwise finding the peak in signal. The glass bead is now fully optimized.
6. **Fuel Adjustment**... on the optimize signal page, instrument zero on water, then aspirate a mid to high level std of the element observing the blue signal bar rising as in step 6. Begin by adjusting the red arrow up or down on right side of the page or turning the acetylene knob on the front of the instrument. Maximize the blue bar signal by adjusting this fuel flow to the best setting.
7. **Fuel Adjustment**... on the optimize signal page, instrument zero on water, then aspirate a mid to high level std of the element observing the blue signal bar rising as in step 6. Begin by adjusting the red arrow up or down on right side of the page or turning the acetylene knob on the front of the instrument. Maximize the blue bar signal by adjusting this fuel flow to the best setting.

Optimization is now complete, if using the sips, start the pump tube conditioning program and complete the bubble test to confirm an air bubble moving towards the instrument. This verifies no clogs and that the nebulizer uptake is 6 ml/min

Analysis

How to create a Worksheet

To create a new worksheet:

1. Go to the Main Index window (first close the current worksheet if one is loaded).
2. Press the "Worksheet" buttons (the Load Worksheet dialog box will appear).
3. Press "New".
4. Enter the required name for this worksheet (this can be changed later).
5. Enter your name as the analyst (optional).
6. Enter any appropriate comments (optional).
7. Enter the required number of samples (this can be changed later).
8. Press "OK".

How to create Flame method

Click on worksheet icon and follow the steps "To create a new work sheet".

- A. Click on the ADD METHODS icon.
 1. Highlight the LOAD From Cookbook radio button
 2. Select FLAME as the method type
 3. Enter the symbol Pb (for Lead) in the search Element field.
 4. Click on the matrix field then enter 1% HNO₃
 5. Highlight Pb in the Select an Element Window, then click on OK.
- B. Click on the EDIT METHOD icon.
 - 1 On the METHOD TYPE and MODE screen click on the empty Matrix box.
 - 2 At the flashing cursor type in 1% HNO₃
 - 3 Select the options:

SAMPLING MODE:	Auto Normal
INSTUMENT MODE:	Absorbance

FLAME TYPE	Air/acetylene
USE SIPS	select or click

- C. Access the measurement parameters page by clicking on NEXT (or by clicking on MEASUREMENT in the PAGE INDEX tabs)
On the MEASUREMENT PARAMETERS page select the following.

MEASUREMENT MODE:	Integration
CALIBRATION	Concentration
SMOOTHING:	5 point
MEASUREMENT TIME:	5 s
READ DELAY:	10 s
REPLICATES:	3 (standard and sample)

- D. Access the OPTICAL PARAMETERS page and check the default values:

ULTRA AA LAMP	Select (if you are using Ultra AA Lamp)
LAMP POSITION:	1 or 2(if you are using Ultra AA Lamp)
LAMP CURRENT:	10mA
WAVELENGTH:	217 nm
SLIT WIDTH	1.0 nm
BACKGROUND CORR.	BC On

- E. Access the SIPS PARAMETER page and check the following

NEBULIZER UPTAKE RATE:	5 ml/min
RIGHT PUMP	none

- F. Access the STANDARDS page and check the following.

Inst. Zero Rate	0
Recalibration Rate	100
Reslope rate	10
Reslope Std. No.	2
Expansion Factor	1.0
Conc. Decimal Places	3
Calib. Algorithm	New Rational

SLOPE TESTS

	Lower	Upper
Calibration	20 %	150 %

Optical
SIPS
QC Tests
PSD Sampler (Furnace/Zeeman)
SPS Sampler (Flame/Vapor)
Notes
Cookbook
QCP

How to modify existing methods

To modify existing methods:

1. Select the Develop page.
2. Press "Edit Method" (the Methods window will appear).
3. Select the Method page tab corresponding to the Worksheet method you wish to edit (bottom page tabs).
4. Modify the required parameters on this page.
5. Press Ctrl+Tab to go to the next page in this method (top page tabs).
6. Repeat steps 4-5 for all the pages in this method.
7. Press "OK"

How to enter sample labels

Sample labels may be entered into the Worksheet in a number of ways

To enter sample labels:

1. Double click on the sample label cell where you wish to enter a label (or press F2).
2. Type in the name of the sample.
3. Press Enter to accept the entry or Esc to discard it.
4. Repeat steps 1-3 until all sample labels have been entered.

ANALYSIS

There are two types of flame operation, (1) Air/Acetylene flame operation, (2) Nitrous Oxide/Acetylene flame operation. Following are the list of various metals to be analysis by either one of the above flame operation.

As-	Arsenic	Fe-	Iron
Ba-	Barium	Mn-	Manganese
Be-	Beryllium*	Mo-	Molybdenum*
Cd-	Cadmium	Ni-	Nickel
Co-	Cobalt	Pb-	Lead
Cu-	Copper	V -	Vanadium*
Cr-	Chromium*	Z -	Zinc

(* - Nitrous Oxide/ Acetylene flame operation)

Air/Acetylene flame operation:

1. Insert the long path air/acetylene burner head
2. At the air cylinder, set pressure to 50 psig.
3. At the acetylene Cylinder, set pressure to 15 psig.
4. Turn the gas control to the AIR position.
5. Place the aspirator tube in a graduated cylinder containing deionized water.
6. Set the aspiration rate 4 to 6 ml/min. (Clockwise rotation increases aspiration rate; counter-clockwise rotation decreases it.)
7. Place the gas flow selector switch to the AIR/FUEL position, and set upto 3 to 5 SCFH with the fuel flow control.

DISPOSAL OF EXTRACTS

The method used for this analysis (40 CFR, Part 50, App. G, 7-1-95 edition) does not address the disposal of the extracts generated.

After filling the sink with water, we take the extracts and dump them into the sink while more water is running into the sink. We continue to run water for approximately twenty minutes. The concentrations of acids before they are disposed of are approximately 1N. After these procedures, we estimate that only a very low concentration of acid actually makes it to the pipes.

Acid strength is not the only factor in the safety of the disposal of these solutions into the sink. These extracts also contain various hazardous metals. We generally find metals concentrations

in the range of a few micrograms per cubic meter (ug/m³). However, the permissible exposure limits for these metals (see PEL table) are well above the levels which we find in our samples. The only exception to this is for beryllium. This metal has a PEL of 2 ug/m³, but we rarely find any of this metal.

OFFICE OF AIR MANAGEMENT METALS ANALYSIS OF HI-VOLUME FILTERS BY ATOMIC ABSORPTION

This program, in existence since the 1970's, analyzes metals from hi-volume filters. Small strips of the filters are immersed in 15 ml of aqua regia reagent to extract their metals content. Then, these extracts are placed in 100 ml flasks and water is added to them. Finally, they are analyzed using atomic absorption spectrophotometry. This program began with lead as the metal of interest but has now expanded. The metals currently analyzed are:

As-	Arsenic	Fe-	Iron
Ba-	Barium	Mn-	Manganese
Be-	Beryllium*	Mo-	Molybdenum*
Cd-	Cadmium	Ni-	Nickel
Co-	Cobalt	Pb-	Lead
Cu-	Copper	V -	Vanadium*
Cr-	Chromium*	Z -	Zinc

DISPOSAL OF EXTRACTS

The method used for this analysis (40 CFR, Part 50, App. G, 7-1-95 edition) does not address the disposal of the extracts generated.

After filling the sink with water, we take the flasks two at a time and dump them into the sink while more water is running into the sink. We continue until all the flasks are dumped and then run water for an additional twenty minutes. The concentrations of acids before they are disposed of are approximately 1N. After these procedures, we estimate that only a very low concentration of acid actually makes it to the pipes.

Acid strength is not the only factor in the safety of the disposal of these solutions into the sink. These extracts also contain various hazardous metals. We generally find metals concentrations in the range of a few micrograms per cubic meter (ug/m³). However, the permissible exposure limits for these metals (see attached PEL table) are well above the levels which we find in our samples. The only exception to this is for beryllium. This metal has a PEL of 2 ug/m³, but we rarely find any of it.

Graphite furnace operation of Varian GTA 100

Furnace setup and Alignment:

1. **Lamp...** Goto optimization page and turn the two knobs at the base of the HCL while watching the green peaking bar, if the bar peaks out, hit the rescale button. When the lamp is optimized fully, record the lowest % **Gain** number
2. **Furnace Workhead...** Place furnace in sample compartment, locating pins in holes in adjustment assembly and locking down thumbscrew on side. Adjust height to set position for best light through put. Use handle to open door and place a new graphite tube into workhead with hole of tube centered in hole of workhead shroud. (Clean all graphite components with 10% methanol in water using Q-tips)
 - a. Turn on Water and Argon.
3. **Autosampler...** Hang PSD (Programmable Sample Dispenser / Autosampler) on front of AA on the two hooks in sample compartment. Alignment block on right of psd should have sample wall in slot. From the Instrument Page go to menu bar under **Instrument to Furnace Facilities**.
 - a. Capillary (white tubing) should go through black sleeve and length should be one inch from bottom tip to bottom of black sleeve.
 - b. Black sleeve should be parallel to depth adjustment screw on probe arm and bottom of sleeve should be approximately 2-5 mm above rinse station.
 - c. Click on Align in Furnace Facilities, Probe goes to cup one. Check alignment and repeat a & b if necessary.
 - d. Click OK and Probe goes to Graphite Tube. UNLOCK Adjustment screw on bottom of PSD. Use the 2 knobs of front and side of PSD to move Probe and capillary for alignment of capillary into Tube. Once aligned, LOCK screw.
 - e. With Capillary in Tube, Set depth using screw on probe so the capillary is about $\frac{3}{4}$ ths down in tube using dental mirror to view this alignment. Click on OK and return probe to Rinse Station... Capillary is SET...
 - f. Remove Syringe from front of PSD, Take Plunger out of end and Click on Rinse. Air Bubbles should be forced out of end of Syringe. If not replace Plunger and slowly work bubbles to end and then try Rinsing again.
 - g. Fill Autosampler with solutions... Standard, Blank, Modifier, & Samples.

4. Graphite Tubes... Tubes should last for at least 300 firings... (Reset Firing Counter in Instrument on Menu Bar for new Tubes) New Tube Should receive at least 5 Tube Cleans on Furnace Facilities page. Old but good Tube should receive at least 2 Tube Cleans. (Tube Conditioning is even a better way to prepare a new Graphite Tube)

5. Analysis... Select the samples to run and Click on Start. View injection of Cal Zero to verify alignment. Cal Zero Abs should be less than 0.01 Abs. If not, do more Tube Cleans. Calibrate Standards and run samples.

Note: Cal Zero Abs. < 0.02 is good
< 0.01 is Great
< 0.005 excellent

% of RSD OF at least .05 abs .	< 10 is good		
	< 5 is Great		
	<	1	excellent

Appendix C

GC/MS SOP 2/16/03

The GC/MS instrument (Agilent Model 6890 GC/5971N MS) is used for the analysis of 62 toxic organic compounds as specified in EPA Method TO-15. The instrument is equipped with a Tekmar Autocan canister autosampler which allows for the analysis of up to 16 samples per batch in addition to up to 3 standards, spikes, blanks, or tuning checks. The instrument uses liquid nitrogen as a coolant for the trap, the cryofocusing unit, and the GC oven to ensure the best possible separation and resolution of all 62 organic compounds using a 60m 0.32mm i.d. 1 micron film thickness BP-1 capillary column. A detailed flow chart of all necessary steps in data acquisition and analysis is provided in the document "GCMS Flow Chart 2001".

Tuning the Mass Spectrometer

The MS must be tuned prior to running any samples. Tuning sets the voltages on the various lenses in the ion source, as well as setting the electron multiplier voltage needed to generate adequate signal from the tuning compound. The MS uses PFTBA (perfluorotributylamine) as the tuning compound. PFTBA contains no hydrogen atoms, so it does not have the hydrogen "mass defect" (atomic mass of hydrogen is 1.008 amu). Tuning also verifies that the system is reasonably clean, free of leaks, and behaving normally. The tune which is used daily to ensure proper system performance is the Autotune. The steps used to perform the Autotune are found in the flow chart.

After the Autotune report has been generated, the following parameters should be verified in order to ensure proper system performance:

1. EMVoltage < 2500
2. Number of Peaks <250
3. Isotope Ratio approximately 1:4:9
4. Mass 28 (nitrogen peak) < 10% of mass 69 peak
5. Mass 18 (water peak) <5% of mass 69 peak

If any or all of parameters 1-3 fail, the ion source should be cleaned. There is a CDROM, which came with the instrument, which details this procedure and includes video, which can be paused when necessary. If parameter 4 and/or 5 fail, there is a leak somewhere in the system which must be fixed. The best method of troubleshooting the leak is to isolate the parts of the system (autosampler, GC, and MS) and check each one for leaks individually. Once the leak has been

found and repaired, allow the system to pump down for at least 4 hours (preferably overnight), and perform the Autotune again. The instrument is NOT performing properly unless all 5 parameters pass this check. Daily Autotune reports should be filed in the GC/MS QA/QC binder. Reviewing tune reports allows the analyst to track instrumentation performance over time and also allows the analyst to catch sudden changes in instrumentation performance, which may indicate the need for maintenance or a service call.

Method Generation

Before acquiring any GC/MS run data, it is necessary to create a data acquisition method. The data acquisition method sets all of the parameters for the GC/MS to optimize the instrument conditions for the analysis of the specific sample types being analyzed in the laboratory. The method which is used for TO-15 analysis has been adapted from the technical assistance document for TO-15 analysis by Tekmar-Dohrmann. Complete data acquisition method generation parameters can be found in the GC/MS flowchart.

BFB Environmental Tune Check

The EPA requires that a sample containing 50ng of 4-Bromofluorobenzene (BFB) must be run each time a set of samples is analyzed on the GC/MS instrumentation. A canister is prepared quarterly by injecting 2.4ul of a solution containing 2000ug/ml of BFB in methanol into the canister and pressurizing the 6-liter canister to 2 atm with zero grade air. Each 125ml sample taken from the canister contains 50ng of BFB.

The instrument must be tuned properly to ensure that the BFB passes the EPA mandated tuning requirements. This is accomplished by manually tuning the instrument or by performing a BFB target tune from the instrument tune menu and saving the instrument tuning parameters in a file called BFB.U. Manually tuning the instrument for BFB can be accomplished using the procedure which is found in the Environmental GC-MS DOS Operation course manual, volume 1, Section 2, pages 2-24 through 2-26. Manually tuning the instrument for BFB generally yields better results than using the BFB target tune provided in the Enviroquant software. Any time maintenance is performed on the system (new column installed, source cleaned, etc.) it is necessary to re-tune the instrument to pass the BFB tuning requirements. After running the Autotune, load the tune parameters from the BFB.U file and execute 3 to 4 spectrum scans. After the 3rd or 4th spectrum scan, the abundance of the base peak at 69 amu should stabilize, as well as the abundance of the other peaks. The 131 and 219 amu peaks should have approximately equal abundance and be between 35 and 40% of the base peak at 69 amu. Small adjustments to the repeller voltage may be necessary if the criteria are not met. In order to assure good continuing calibration results, check the abundance of the 69 amu base peak- it should be

380,000 +/- 5%. If this is not the case, adjust the electron multiplier (EM) voltage to bring the 69 amu abundance to 380,000 +/- 5%.

After the sample containing the 50ng of BFB has been analyzed, it is necessary to evaluate the tune in order to verify that it passes the EPA environmental tuning requirements. Passing the tune requirements ensures that the instrument is set up properly to analyze samples containing volatile organic compounds (VOCs) and will be in at least rough equivalence with any other laboratory's instrumentation so that equivalent analytical results can be obtained.

Initial Calibration of the GC/MS

The GC/MS must be properly calibrated in order to ensure quality analytical results. Calibration is performed using a 62 compound standard from Spectra Gases. This standard is the TO-15 subset standard, which contains both polar and non-polar volatile organic compounds. The standard contains each of the 62 compounds at a concentration of 100 parts per billion (ppb) in nitrogen and is contained in a lecture-bottle-sized cylinder. The stability of standard concentration in the cylinder is guaranteed for 6 months only, so the standard must be replaced twice per year.

The range of most volatile organic compounds in ambient air samples generally ranges from around 10 parts per trillion up to 5 parts per billion approximately. In order to calibrate in this range, the standard is diluted by using 1 part standard to 10 parts zero air, which yields a concentration of 10 parts per billion in the canister. Restek Silco cans seem to work better than the usual SUMMA canisters provided by other vendors. Silco cans have a more inert inner surface inside of the canister, which allows for better recovery and reproducibility of standard analysis.

The standard is analyzed at six levels (1ppb, 2ppb, 2.5ppb, 3ppb, 4ppb and 5ppb) with the analysis of a zero air blank providing a "zero" level. The mid-point of the calibration curve (2.5ppb) is given a duplicate entry in the calibration table and labeled as "cc". This level of standard is used to evaluate the continuing calibration response of the instrument any time samples are analyzed. Rather than further dilution of the standard to provide the necessary concentration levels, the Tekmar Autocan is programmed to trap appropriate amounts of the standard in order to provide the correct concentration levels (50cc, 100cc, 125cc, 150cc, 200cc, and 250cc). Each analysis is run twice, and the resulting data files are evaluated for proper peak identification and proper quantitation. The analyst must choose a target ion for the identification and quantitation of each compound, as well as up to 3 qualifier ions to aid in the proper identification of each compound. The target ion chosen is generally one of the most abundant ions in the mass spectrum of the given compound, while the qualifier(s) chosen should be as specific to the given compound as possible, or at least unique for any compound which may elute within the expected retention window. The EPA includes a list of suggested target and qualifier

ions for each compound in the TO-15 method. The calibration curves are generated using the average responses for the two sets of runs. Each compound should have a calibration curve ideally within 10% of being linear. Some of the more polar compounds may have curves that are only within 20 to 30% of linear. Once the initial calibration has been performed and the calibration curves have been evaluated, the method should be saved using a file name with eight characters starting with the letters "TO" followed by the current 6-digit date. Any time the initial calibration is changed due to re-tuning or maintenance, the new method should be saved with the current date. This file-naming procedure will enable the analyst to reevaluate old data using the proper method if necessary.

Continuing Calibration Check

The mid-level standard (2.5ppb concentration) has been designated as the level for performing the GC/MS continuing calibration check each time samples are run on the instrumentation. After the BFB tune evaluation standard has been run in each sequence, the following run should be the 2.5ppb level 62 compound calibration standard. The resulting chromatogram from this run should be evaluated using the Qedit quant results option of the Enviroquant data analysis software. All peaks should be properly identified and integrated. The analyst may manually identify and integrate any peaks, which are not properly handled by the initial quantitation by the data analysis software. The modified result file should be saved to ensure that any changes by the analyst are properly recorded. The modified result file is then evaluated as a continuing calibration file to the printer and the response factors calculated for the specific file are compared to the initial calibration response factors. All compounds should ideally be within +/- 20% of the initial response factors. For some of the more difficult or polar compounds, +/- 30% is acceptable. If the continuing calibration report does not meet these requirements, troubleshooting and maintenance may be needed. If maintenance is performed, it may also be necessary to retune and recalibrate the instrument prior to proceeding with sample analysis.

Data Acquisition

Ambient air samples (and complaint monitoring samples) can be analyzed in batches of up to 16 samples using the Autocan autosampler. The Autocan uses Teklink software to control the sequencing of the autosampler. Samples are loaded on the autocan in positions 1 to 16. Samples are generally arranged from the least concentration of total non-methane organic compounds (NMOC) to the highest. This helps to eliminate carry-over from one sample to the next. The BFB tuning standard and the calibration standard are connected to the ports at the bottom of the autosampler (ports A, B, & C are available for BFB, standards, spikes, etc.)

Teklink is used to create schedules for analyzing the sample batches. The schedule is created with one entry for each blank, standard, BFB tune check, and sample. Each entry is created using the appropriate 2-letter code (TO for TO-15 standard, BF for BFB, BL for blank, or the appropriate 2-letter site code for samples) followed by the six-digit code for the sample date. Each entry must specify the location of the sample (ports 1-16 or A-C) and the desired sample volume to be taken from the can. Save the Autocan sequence using the current date as the file name.

In order to synchronize the Autocan with the GC/MS, a sequence for the GC/MS must be written using the Chemstation software. To ensure proper functioning of the equipment, it is necessary to use the same file names in the same order as they appear in the Teklink schedule controlling the Autocan. The GC/MS sequence is also saved using the current date as the file name.

The first run of the sequence must be started on the Autocan prior to starting the GC/MS sequence to ensure that the instruments are synchronized. Allow the Autocan to proceed through the sample pressure, special bake, and sample trapping stages. Once the Autocan begins the dry-purge step of the cycle, the Run Sequence button can be clicked in the GC/MS Chemstation software. After the initial run, the autosampler and the GC/MS will remain synchronized throughout the rest of the batch. Refer to the GC/MS flow chart for detailed steps in creating these sequences.

Data Analysis of GC/MS Results

The actual sample analysis data collected on the GC/MS must also be evaluated by the analyst to ensure that all compounds are properly identified and integrated. The analyst can make use of several tools within the Enviroquant software as aids in determining the proper identification and integration of the components in the sample. Extracted Ion Chromatograms can be used to look for trace amounts of a target compound by searching for selected target ions and looking for maximization of those ions in the proper retention time range. In addition, the mass spectral library database contains spectra of more than 250,000 organic compounds. Spectra of unknown peaks in the sample matrix can be compared to the library database which will show the best matching compounds from the library. The experience of the analyst must be the final determining factor in the decision to manually integrate or re-identify a peak in the sample chromatogram. Once the data have been verified, the changes to the result file must be saved. A hard copy of the result file can then be generated using the Quant→Generate Report option. DO NOT USE Quant→Calculate/Generate report! This will undo any changes made to the result file by the analyst! The hard copy of the result file should be filed in the appropriate folder along with the corresponding NMOC data (and Perkin Elmer system data in the case of the Gary IITRI site). The electronic data must be converted to the proper format for entry into the Oracle Toxics database. This is accomplished using the procedure outlined in the flowchart for creating a custom report and saving the results in .csv (comma separated variable) format

using Microsoft Excel. Electronic data are transferred to the Oracle database in addition to being archived on CDROM for a five-year period.

Appendix D

Standard Operating Procedure

PM-10, TSP Filter Weighing

Part 1: Preparation

Exposed filters should arrive from the field in individual envelopes from the mail or from loop runners. Take them into the Clean Room. Remove the first filter and look inside for any particulate that may remain. If any is found, shake it onto the filter and discard the envelope. If the envelope is clean, place it the drawer near Atul's desk in the main lab. It can be used in the field again. Repeat this procedure for the remaining filters.

Weighing of exposed filters begins with alphabetizing them according to the order of the sites in the Particulate/Log Book. Please note that the sites are in the logbook alphabetically by city and then site name.

It is very important to look at the whole name of the site listed on the card to ensure proper order. This is because there are colocated sites that may appear to be the same site but are different. PM-10 sites are in the book first, then TSP. If you have any questions, the AQS code for each site is listed on the filter card as well as on the log sheets. Remember that a reporting site and its colocated partner will have the same AQS code.

Part 2: Logging in the filters

With your filters in proper order, you are ready to begin the log-in procedure. You will need a calculator, the particulate logbook and two filter weight books. There is a quartz fiber weight book (for PM-10 filters) and a glass fiber weight book (for TSP). These are usually in the cabinet.

Find the appropriate page for the first filter in your stack and log in the first five items (sample date through and including initial filter weight):

Make sure the **sample date** given on the card follows sampling schedule (posted on all four walls of the room). All sites follow this six-day sampling schedule listed. If you have a filter that seems to be out of place chronologically, leave a space for it. In other words, if a 4/15 filter

has already been logged in at a 6-day site and the next one you have is a 4/27, leave a line open in the log book for the 4/21 filter. It is probably delayed in the mail.

Be sure the **filter number** listed matches the actual number of the filter in the card. If wrong, put a strike through the number and put your initials by your changes. A PM-10 filter will have a number that begins with a Q. TSP filters may begin with G or just have numbers without letters.

Item 3, **true flow corrected to SRC**, is a two decimal place value for PM-10 sites. This value will be the same as the date before as long as no recalibration has occurred. The **true flow** is always 1.3 for TSP sites. Do not record any value in this column if the current calibration is more than 3 months old. Notify Steve to get the motor redone.

Item 4 is the **time in minutes**. These readings come from subtracting the initial elapsed time (ET) from the final. Any such calculations already done by the operator should be checked. These ET readings may need to be adjusted due to audits by QA. In the clean room are a number of sheets telling which sites have had audits performed, the date of the audit, the amount of time the audit took and what filter is affected. Subtract any time listed on these sheets from the ET on the filter. Be sure to note this subtraction on the filter card. We have a stamp on the Clean Room desk that is convenient to use for this. If an ET clock reading hours is being used at the site, convert the reading to minutes before entering in the book. Also, write this converted result on the card.

The final item that can be filled in is the **initial weight**. PM-10 filters are found in the quartz fiber filter weight book. The TSP filters are in the glass fiber weight book.

Repeat these steps for each of the filters received. Place them in the slots in the wooden blocks in the desiccator by the balance. They should be spread out as much as is practical. Try to put no more than two per slot. Also, the folded edge of the filter should be in the crease of your filter card. This helps them open up. They must sit in the room for 24 hours (bet you wish you read this before you started).

Part 3: Filter Weighing

The weighings are performed on the Sartorius AC211S balance. It is the one with the stainless steel lid. You must check the balance before beginning. Turn the balance on by pressing down on the top left button that says "I/0." When zeros show up, you are ready. Checking the balance is done using the Troemner set of Class I weights on the desk. When the "g" designation at the right side of the readout comes on, the balance has stabilized enough for the reading to be

recorded. In a drawer you will see the balance calibration logbook used for recording this check. You will see a paper clip near the page of interest. Follow the example of the previous entries to do the check. The digital readout on the wall mounted Liebert unit may be used for the humidity and temperature readings.

Once a week the internal weight should be used to do an internal calibration on the Sartorius. The weight is in a plastic bag kept on the table near the balance. Instructions for doing this calibration are on a piece of yellow paper taped to the wall near the balance. Document this calibration in the balance calibration logbook.

You are now ready to weigh the filters. Take your first filter, remove the lid and place the filter on the weighing pan of the balance. Wait a few seconds until the "g" light goes on before you record a weight (we record the weight out to 3 places) in the final weight column. Also, record the date and put your initials in the date weighed column. I usually check the zero between each filter. When you are done weighing the filter, the folded side of the filter should be on the folded edge of the card.

Part 4: Quality Assurance

After all the filters are done, find one of the QA people and tell them you need exposed filter QA. They will weigh at least 3 of the filters over again. Their weights and yours must agree within 0.005 g (5 mg). After this, you can give the filters to the QA section for inspection.

Part 5: Filter reconciliation, calculations and filing

QA will take your filters and check them to make sure they are valid. They will return the pile to you. Now you will go through them all to make sure the filters are turned over in the cards. In other words, the open end of the filter goes into the crease of the card. You also have to make sure that your filter invalidations match QA's. Filters deemed invalid will have a comment in the remarks section and the initials of the person who invalidated it. Record these invalidations in the logbook (somewhere to the right of the **final weight** column), strike a line through the area reserved for the **concentration**, strike a line through the **valid initials** column and write the reason given for the **invalidation**.

The filters can now be filed in the cabinet in the organic prep room. Follow the pattern of the ones in there already.

Calculations of the concentrations of the filters are done using the computer. You will need to go to the Excel

database to find the G:\Everyone\Particulatedata\PM10\xxpm10calc.xls file (xx indicates the year) to do this calculation. This is now the logbook for the final concentrations on all particulate data.

These calculations are currently being done using SRC flows (a flow corrected to Standard Reference Conditions). Results are rounded to the nearest ug/m³. The formula for the concentration is:

$$\text{ug/m}^3 = \frac{\text{weight gain} \times 10^6}{\text{true flow} \times \text{time}}$$

Enter the data from the logbook into the computer. Be sure you have selected the tab for the proper site. The columns called weight gain, SRC, concentration and corrected act. flow are calculated fields and should be left alone. All the other fields through Date Weighed must be entered manually. For a valid sample, there should be a number to put in all the columns through Date Weighed.

Weather data for the sample runs is available from Oliver. We keep it in a folder called state weather data in Mark's cubicle. The sheet Oliver puts out has weather data for Gary and Indy on it. This is generally available shortly after the end of a month. Gary data should be used for any of the sites in the Northwest. This data goes into the Sample Temp and Sample Pressure columns.

After all of the data for a particular run is entered, the computer will calculate the SRC concentration. This database is also set up to automatically kick out data outside our acceptable limits and print "inv" for the concentrations. These triggers are in the columns U through Z. They work by testing values in certain columns. If the value is within our acceptable range, nothing happens. If not, the computer puts a 1 into the cell.

Column U has the weight gain flag. If the initial weight of the filter exceeds the final, the computer puts a 1 in this column. Column V has the ET flag. A sample time outside the range of 1380 to 1500 minutes will trigger this to read "False". Column W is the flag for the corrected actual flow (CAF). This flow must be within the range of 1.02 to 1.24. **Our database is the only source of this CAF information. If you see an invalid resulting from the CAF flag, be sure to notify Jan and Steve Lenz.** Column X is the miscellaneous invalidation flag. This looks for an "x" in Column S. If you have any other type of invalidation that has not been covered in the flags listed previously, put an x in Column S. You will be prompted to enter a reason for the invalidation in Column R. Columns Y (called Flag for any Inv) and Z are the summations of the other flag columns. If column Z says true, the sample is valid.

In 1999, EPA required us to submit concentrations calculated two ways. The first was what we are still doing now, the SRC flow calculation. They also had us submit the concentration resulting from using the actual flow. Remnants from this actual flow calculation are still in the database in hidden columns. Do not delete these columns because these flows are used to calculate our corrected actual flow.

Appendix E

Clean Room SOP

Entry/Exit:

The most important thing to remember about the clean room (Shadeland Room 153, also known formerly as the microscopy room) is that the two doors should **never** be open at the same time. To enter the room, open the outer door and step into the ante-room. Pull the outer door almost shut and then give it a good pull, making sure the click of the latch was heard. Next, step on the flooring and then onto the sticky mat. This flooring is grounded and this step will eliminate static electricity. Walk across the sticky mat to eliminate debris from your shoes. Now open the inner door to the room and shut it the same way as the outer door.

Room Condition Monitoring Devices:

The room has four devices to measure humidity and temperature. The first is the Liebert unit located on the east wall above the Mettler microbalance. This unit toggles between a temperature and RH reading once every five seconds or so. The sensor for the unit is located on the south wall near the return air ducts. The second is a hand-held Mannix brand Thermo-hygrometer. This currently is on the north wall near the Sartorius PM-10 balance. Device number three, on the east wall, is the HOBO Pro Temperature/RH data logger. This is a recording device which will archive the room conditions every five minutes. The fourth device, located on the west bench, is our dual pen hygrothermograph.

Room and Monitor Maintenance:

OAM personnel handle maintenance of this room. There is no need for any of the Western Select staff to enter. The floor of the room should be swept at least monthly and damp-mopped at least once every three months. Countertops should be wiped down as well. The HOBO Pro Temperature/RH data logger will need to have its data downloaded every two to three days. See the SOP at G:/analyt/SOPs/PM25hobodatalogger.doc for this procedure. The hygrothermograph needs to have its chart replaced every month.

Operation:

The room was designed to have only 2 people in at a time. Please do not enter the room when PM 2.5 filters are being weighed. If you need to discuss something with the room operator, the phone number in the room is 308-3245.

Do not try to slam the door from more than a distance of about three inches. This creates pressure in the ante-room which can blow the ceiling panels out of place. Even though this is a Class 10000 clean room, some settling of dust particles does occur. For this reason, always condition filters in the desiccators (notice, the doors are gone) or in the shelves of the wall cabinets.

Appendix F

STANDARD OPERATING PROCEDURE CANISTER CLEANING AND CERTIFICATION

After the analysis all canisters are cleaned and certified prior to re-use of the canisters in the field. Canister cleaning and certification is critical to ensure the highest possible quality of data from canister sampling and analysis. The following procedure has been developed in order to ensure efficient cleaning and certification of air sampling canisters:

1. Enter the information about the canisters to be cleaned in the canister cleaning and certification logbook.
2. Turn on the Fisher Maxima vacuum pump located in the fume hood and open the ballast on the pump. Allow the pump to warm up with the ballast open for ten to fifteen minutes and then close the ballast on the pump.
3. Remove the 1/4" caps from the canisters to be cleaned using a 9/16" open-ended wrench and remove all old sampling tags from the canisters. File the sampling tags in the appropriate file boxes.
4. Connect the canisters to the cleaning assembly in the Precision Scientific oven. Tighten the connecting nuts to finger tight and then tighten 1/4 turn past finger-tight using the 9/16" open-ended wrench. The cleaning assembly holds up to eight canisters. In the event that fewer than eight canisters require cleaning, place a 1/4" plug in any unused cleaning assembly ports and tighten to 1/4 turn past finger-tight using the 9/16" open end wrench.
5. Make sure that both valves on the moisturizer connected to the external canister cleaning assembly on the lab bench are open and that there is sufficient HPLC grade water in the moisturizer to ensure humidification of the zero air used to clean the canisters. Add water to the moisturizer if necessary. Humid zero air is more efficient than dry zero air for canister cleaning.
6. Make sure that the zero air cylinder connected to the canister cleaning assembly has a primary pressure above 500 psi. If the cylinder pressure falls below 500 psi, the canisters may become contaminated.

7. Set the delivery pressure on the two-stage regulator for the zero air tank to about 25 psi.
8. Make sure that the on/off valve on the external cleaning assembly on the lab bench is in the on position and that the unused ports on the external cleaning assembly are closed with 1/4" plugs.
9. Make sure that the arrow of the three-way valve located beneath the first port of the external cleaning assembly points toward the cleaning assembly, which will allow flow to the cleaning assembly in the oven.
10. Open the canister valves by turning counter-clockwise until slight resistance is felt.
11. Close the oven doors and turn the oven on. It should be set to 90 degrees C.
12. The zero air flow control valve is located above the solenoid switch. Turn this valve slowly so that the arrow points straight down. The flow of zero air to the canisters is at a maximum in this position.
13. The programmable timer controls the solenoid valve and roughing pump of the cleaning assembly. It is programmed to run EVERY DAY from 9:25 AM through 12:25 PM. Ten pressurization/evacuation cycles are performed in this time period. **DO NOT CHANGE THE PROGRAM! ADJUST THE TIME ON THE CLOCK TO START THE CLEANING CYCLE.**
14. The solenoid valve starts in the OFF position. In this position, the pump is OFF, and the valve is in a position which allows zero air to flow into the canisters. The timer should be displaying a symbol like this: [O]. This is the "always off" position. The cleaning cycle program is ignored in this position. Press and hold the button which looks like a small clock face, and use the hour and minute buttons to re-set the time to about 9:23 AM on the timer. Use the button shaped like a hand until the timer shows a symbol like a small clock with an open circle next to it. The program is now active.
15. The timer will automatically run 10 cleaning cycles (evacuate 5 minutes, pressurize 15 minutes). It is necessary to program a second set of cleaning cycles to ensure that the canisters will certify as clean.
16. After the second set of cleaning cycles, turn the oven off, open the doors, and allow the canisters to pressurize to about 20psi on the absolute pressure gauge.
17. Close the canister valves and allow the canisters to cool to room temperature.

18. Select one canister from the batch and test the canister for total non-methane organic carbon (NMOC) using the procedure outlined in the standard operating procedure for NMOC determination.
19. Ideally, the cleaned canister will have no peaks when analyzed for total NMOC. In some cases, there will be a small peak. Analyze the canister twice and record the average area count from the two analyses in the canister cleaning log book. The average of the two total NMOC values in the canister should be 10 ppbC (parts per billion of carbon) or less.
20. If the canister fails this certification procedure, run one more set of cleaning cycles and re-test the same canister. Repeat as necessary until the canister meets the certification requirement. Generally, the canister will pass on the first certification attempt. If the canister repeatedly fails attempts at certification, change the in-line hydrocarbon trap which helps to purify the air from the zero air cylinder, and check the moisturizer to verify that it has sufficient water.
21. After the canister has been certified as clean, hook up the canister to the cleaning assembly again and re-open all of the canister valves. Use the large vacuum control valve to open the flow path to the large Fisher Maxima pump in the hood. Evacuate all canisters to 0 psi absolute and hold for five minutes.
22. Close the canister valves and the vacuum control valve. Remove the canisters from the cleaning assembly. Place a new sampling tag on each canister and place the canisters in one of the designated locations in the Air Toxic Monitoring laboratories for storage of clean canisters which are ready to be used for sampling.

Appendix G

Canister Handling SOP

1. All clean canisters used for network or complaint sampling must be signed out by the person transporting the canisters to the monitoring location.
2. There will be a specific location chosen in the Air Toxic Monitoring lab for the submission of canister samples. Canisters must be submitted **DIRECTLY** to a staff member of the Air Toxic Monitoring Section for immediate sample log-in. A sample request form must be completed by the person submitting complaint samples for analysis. The sample request form will be filed in an appropriately labeled binder as part of the complaint sample log-in procedure. A copy of the sample request form will be stored in the 3-ring binder used for complaint sample analysis.
3. All non-complaint samples must be logged in to the Oracle Toxics Data Capture database. Filing of the sample request form for complaint samples constitutes sample log-in for complaints. If a network sample is invalid, the Oracle database provides a drop-down menu of invalid reasons which translate into the proper AIRS invalid code in the database.
4. The database also includes entries for the canister number, sample date, sample location, sampling time elapsed, site operator, person who received the sample in the lab, sample pressure in the canister, absolute pressure measured in the canister, and dilution factor. The Oracle database **REQUIRES** entry of the dilution factor for **ALL** samples! If no dilution is done, a "1" must be entered in this field. NMOC value must be entered in the sample log form in Oracle after the NMOC analysis has been done. All fields in the database must be completed for valid samples.

All samples must be logged in immediately when they arrive in the lab. Failure to log in a sample will result in the inability to automatically transfer Perkin Elmer and GC/MS data into the Oracle database for that sample until the log entry has been completed.

Each site now has its own 3-ring binder for filing of raw data generated by each instrument. The NMOC analysis for a sample is filed in front, followed by the Perkin Elmer data, and finally the GC/MS data. The most recent data are filed in the front.

When analysis has been completed for a given sample and the analysis has been verified by the Section Chief, the canister should be placed in an area of the lab which has been designated for canisters which are ready for cleaning. Canisters should be cleaned as soon as a sufficient number of canisters are available to load the canister cleaning assembly.

This SOP should be followed in order to ensure timely updates of the Toxwatch web page and availability of the data for trend analysis by the Air Programs Branch.

Appendix H

Office of Air Quality Air Monitoring Quality Management Plan



Revision: 3

7/11/2006

Indiana Department of Environmental Management

Indiana Government Center-North

100 N. Senate Ave.

Indianapolis, IN 46204

Office of Air Quality Air Monitoring Quality Management Plan Approvals

Name/Title	Name (Signed)	Date
Paul Dubenetzky Acting Assistant Commissioner IDEM Office of Air Quality		
Dick Zeiler Branch Chief Air Monitoring Branch		
Steve Blaser Branch QA Coordinator		
David Parry IDEM Quality Assurance Manager		

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Management and Organization

Q/A Policy

Importance of Q/A System

The major functions of the Monitoring Branch are to collect, analyze, and report air quality data. Every aspect of these functions contains QA/QC activities.

Q/A System Goals

To ensure that the air quality data meets data quality objectives as determined for the monitoring projects by regulation or data need.

1. Criteria Pollutants

Priority: Maintain Indiana's ambient air monitoring networks for criteria pollutants

Process: Enhance the fine particulate networks

- a) Continuous speciation monitors
- b) Nephelometer & aethalometer applications
- c) Visibility monitoring/cameras

Measure: Annual VDR, Milestones met, Percent complete

2. Air Toxics

Priority: Monitor for air toxics

Process: School #21 continuous gas chromatograph

SW Indianapolis Special Project

NW Indiana Photo-chemical Assessment Monitoring Site

Measure: Annual VDR, Milestones met, Percent complete

3. Regional Monitoring Strategy

Priority: Participate in the Regional Monitoring Strategy Development

Process: Coordination of State, Regional, & Federal Monitoring Strategy

Measure: Milestones met, Percent complete

4. LEADS

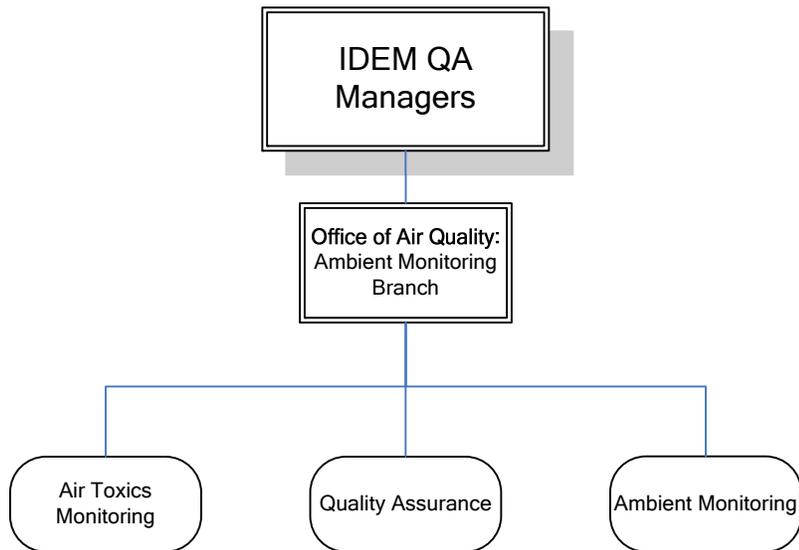
Priority: Provide timely & high quality information on Air Quality to the Public
Process: Implement LEADS (Leading Environmental Analysis & Display System)
Measure: Milestones met, Percent complete

Q/A Resources

Activity	Section	QA Staff Resources	QA Role & Tools or Standards Used
Monitoring plan development Safety Training & Implementation	Air Monitoring Branch	Chief 1 – Environmental Branch Chief 6	Oversight of QAPPs/Monitoring Plans and Training as well as program implementation. Tools: Employee Work Profile(s) IDEM OAQ QA Manual Standard Operating Procedures EPA Guidance
Administrative operations Equipment Tracking	AMB Support	Shipping/Receiving 1 – Administrative Assistant 4 1 – Secretary 3	QA/QC Documentation routing Tools: Employee Work Profile Requisition Program Procedures U.S. EPA Directive 2160 - Records Management Manual
Monitoring plan development Safety Training & Implementation	Air Toxics	Chief 1 – Senior Environmental Manager Supervisor 3	QC oversight of sample preparation & analysis Tools: Employee Work Profile(s) IDEM OAQ QA Manual Standard Operating Procedures EPA Guidance
Sample Preparation Sample Analysis	Air Toxics	Laboratory Personnel Several Chemist 1 & Chemist 2s	QC of sample preparation, analysis, and data tracking Tools: Employee Work Profile(s) IDEM OAQ QA Manual Standard Operating Procedures – TO Compendium of Methods EPA Guidance
Monitoring plan development Safety Training & Implementation	Ambient Monitoring	Chief 1 – Senior Environmental Manager Supervisor 3	QC oversight of monitoring operations including data transmission Tools: Employee Work Profile(s) IDEM OAQ QA Manual Standard Operating Procedures EPA Guidance
Sampler/Analyzer/Equipment Setup Maintenance and cleaning of monitoring and analysis equipment Sample Acquisition Sample Transport	Ambient Monitoring	Field Personnel 2 – Senior Environmental Manager 1s Several Environmental Manager 2s	QC of field operations - document sampling, analysis and transport of samples through maintenance checks and check sheets. Tools: Employee Work Profile(s) IDEM OAQ QA Manual Standard Operating Procedures EPA Guidance
Data Analysis Data Transmission	Ambient Monitoring	Information Manager 1 – Senior Environmental Manage 1	QC of sample data. Ensures data transmission is secure and correct. Tools: Employee Work Profile IDEM OAQ QA Manual Standard Operating Procedures EPA Guidance
Sample Transport	Ambient Monitoring	Shipping/Receiving 1 – Administrative Assistant 4	QC of sample transport – documentation. Tools: Employee Work Profile IDEM OAQ QA Manual Standard Operating Procedures EPA Guidance
Monitoring plan development Safety Training & Implementation	Quality Assurance	Chief 1 – Senior Environmental Manager Supervisor 3	Oversight of QAPPs/Monitoring Plan development and entire QA program implementation. Tools: Employee Work Profile(s) IDEM OAQ QA Manual Standard Operating Procedures EPA Guidance
QA Documentation Sampler/Analyzer/Equipment Setup Sampler/Analyzer/Equipment performance evaluation	Quality Assurance	QA Laboratory Personnel 1 – Senior Environmental Manager	QA/QC of QA Standards Laboratory including maintaining standard and equipment certification documentation. Tools: Employee Work Profile(s)

		1 Several Environmental Manage 2s	IDEM OAQ QA Manual Standard Operating Procedures EPA Guidance
QA Documentation Sampler/Analyzer/Equipment performance evaluation	Quality Assurance	Field Personnel Several Environmental Manage 2s	QA evaluation of field monitoring instruments, monitoring plans, and monitoring data. Tools: Employee Work Profile(s) IDEM OAQ QA Manual Standard Operating Procedures EPA Guidance

Q/A Org Chart



Q/A Staff Contacts and Roles

Name/Title	Section	Role
Steve Blaser		Branch QA Coordinator
Steve Blaser	Quality Assurance	Section QA Contact
Balvant Patel	Air Toxics Monitoring	Section QA Contact
Cole Remsburg	Ambient Monitoring	Section QA Contact

Programs Covered by Q/A System

Technical Programs Subject to QA/QC Processes

Technical Program	Environmental Activity
Field Monitoring	<ul style="list-style-type: none"> • Sample Acquisition • Sample Transport • Site information • Sampler/Analyzer/Equipment Setup • Monitoring plan development
Laboratory analytical analysis of samples	<ul style="list-style-type: none"> • Sample Preparation • Sample Analysis
Data Processing	<ul style="list-style-type: none"> • Data Analysis • QA Documentation • Data Transmission
Standards laboratory – comparisons	<ul style="list-style-type: none"> • Sampler/Analyzer/Equipment performance evaluation
Laboratory and office operations	<ul style="list-style-type: none"> • Maintenance and cleaning of monitoring and analysis equipment • Safety Training & Implementation • QA Personnel Documentation • QA Operations Policy • Equipment Tracking • Training Equipment Operations • Administrative operations

Field Monitoring – site selection, site setup, ongoing operations

Laboratory analytical analysis of samples

Data Processing – Collection, evaluation, corrections, submittal, etc.

Standards laboratory –comparisons

Internal Coordination

When monitoring is required Monitoring activities are coordinated. Since oversight of the monitoring is done by AMB and data reports are submitted to the AMB, significant monitoring interruptions or concentrations above the standards require notification of QA/QC compliance personnel.

1.4.2 Internal Coordination: The IDEM QA Managers asked AMB staff to provide the names of other IDEM units (offices, branches, sections) with which the AMB program should be coordinating QA/QC activities. AMB stated in the response to the element that the Branch coordinates with OAQ compliance – but it seems likely that AMB coordinates with other agency branches and workgroups. Does AMB coordinate with OAQ permits? Local air agencies? Coordination takes place with many groups including EPA, IT, Macs, etc. however QA/QC activities are dealt with by the entity or the AMB.

Oversight of Contractors and Extramural Organizations

Some laboratory analysis is done by contract laboratories. Local Agencies perform some environmental monitoring under agreement with IDEM. Some industries are required to monitor for various reasons. While this monitoring is not delegated to them they are subject to QA/QC requirements and oversight by the AMB

Contract/Extramural entity name	Data or Service provided	Means of oversight
Insert name of contract and/or extramural entity	Example: Fish tissue sampling data in support of the Fish Consumption Advisory	Examples of some lab quality control checks: Quarterly reproducibility testing of lab (in terms of RPD) based on equivalency of laboratory results for a known concentration sample. 1 in 20 samples split, sent to two different labs to check for parity (Within RPD limits specified in a QAPP).

Eastern Research Group (ERG)	Analysis – Carbonyls, PAMS SW Indy – Metals, Carbonyls, Chrome 6 PM2.5 Speciation	EPA contract Lab – EPA provides QA/QC
Local Agencies		
Indianapolis Office of Environmental Services (IOES)	Monitoring, QA and QC of SO ₂ , O ₃ , NO _x , PM ₁₀ , CO, TSP(Pb), AQI	Local Agency Agreement Monitoring/QA plan – OAQ QA Manual Systems Evaluation by OAQ QA (Annually) Quarterly QA data submittal review
Evansville EPA	Monitoring, QA and QC of PM ₁₀ & AQI plus monitoring assistance – site visits and checks	Same as above
Vigo Co APC	Monitoring, QA and QC of PM ₁₀ & AQI plus monitoring assistance – site visits and checks	Same as above
Industries		
American Electric Power (AEP)	Monitoring, QA and QC of SO ₂	Monitoring/QA plan – OAQ QA Manual Systems Evaluation by OAQ QA (Annually) Quarterly QA data submittal review
Aluminum Company of America (ALCOA)	Monitoring, QA and QC of SO ₂	Same as above
CINERGY - (PSI)		Same as above

Naval Air Warfare Center - Crane Division	Monitoring, QA and QC of Pb	Same as above
Exide	Monitoring, QA and QC of Pb	Same as above
Hoosier Energy	Monitoring, QA and QC of SO2	Same as above
IPL (AES)	Monitoring, QA and QC of SO2	Same as above
Northern Indiana Power & Service Company (NIPSCO)	Monitoring, QA and QC of SO2	Same as above
Richmond Power & Light (RPL)	Monitoring, QA and QC of SO2	Same as above
Southern Indiana Gas & Electric Company (SIGECO)	Monitoring, QA and QC of SO2	Same as above
SDI-Bar (Steel Dynamics)	Monitoring, QA and QC of SO2, NOx, PM10, CO	Same as above
SMD-SDI (Steel Dynamics)	Monitoring, QA and QC of PM10	Same as above
Waupauca	Monitoring, QA and QC of PM10	Same as above

Communication

Hands-on training is continuous for all employees. The IDEM OAQ Quality Assurance Manual is update as necessary and SOPs are developed and distributed to affected parties. The QA Manual contains description of the monitoring that is done by the AMB and provides guidance regarding the most common monitoring activities.

Quality System Components

Quality System Description

Documentation

Provide a listing of documentation used as part of your quality system.

Name of QA Document	Description	Type	Effective Date	Name of Section to which it applies	Name of Environmental Activity to which it applies
IDEM OAQ QA Manual	General monitoring and analysis guide	SOPs/QAPP		Ambient Monitoring	All Monitoring Activities
Grab Sample Collection	To collect air toxic samples in canisters	SOP	ongoing	Air Toxics	Sample Acquisition
Chain of Custody and logging	for canister system only	SOP	ongoing	Air Toxics	Sample Transport
Canister cleaning and certif.	to clean dirty canisters, prepare for reuse	SOP	ongoing	Air Toxics	Sample Preparation
NMOC analysis	Analysis for non-methane organic carbon	SOP	ongoing	Air Toxics	Sample Analysis
GC/MS Analysis	Method TO-15 Analysis		11/15/01 rev.	Air Toxics	Sample Analysis
Perkin Elmer GC	Auto GC for PAMS	SOP	pending	Air Toxics	Sample Analysis
Metals Analysis	Analysis of filters on Atomic Absorption	SOP	1/23/2002	Air Toxics	Sample Analysis
PM 10, TSP Filter Weighing	Particulate Analysis, 8 x 10 filters	SOP	1/5/2004	Air Toxics	Sample Analysis
PM 2.5 using GLIMS	Gravimetric Analysis of 2.5 using GLIMS	SOP	12/28/2005	Air Toxics	Sample Analysis
Manipulating HOBO Data	Downloading Clean Room data into Excel	SOP	3/1/2001	Air Toxics	Data Analysis
Clarus SOP	GC at School 21	SOP	pending	Air Toxics	Sample Acquisition
Clean Room SOP	maintenance and cleaning of Clean Room	SOP	pending	Air Toxics	Maintenance and cleaning of monitoring and analysis equipment
Chemical Spill Kits	inspection and maintenance	SOP		Air Toxics	Safety Training & Implementation
Handling Compressed Gases	safety for gas cylinders	SOP		Air Toxics	Safety Training & Implementation
Spill Kit, Flammables	clean up of flammable solvent spills	SOP		Air Toxics	Safety Training & Implementation
Spill Kit, Acids	clean up of acid spills	SOP		Air Toxics	Safety Training & Implementation
Spill Kit, Caustics	clean up of caustic spills	SOP		Air Toxics	Safety Training & Implementation
Spill Kit, Mercury	clean up of mercury spills	SOP		Air Toxics	Safety Training & Implementation
How to Format SOPs	Standard Operating Procedures				

Preparation & Distribution of Invalid Data Memos		SOP	6/30/06 rev.	Quality Assurance	QA Documentation
Formatting of the QA Correspondence Letters and Memos		SOP	6/30/06 rev.	Quality Assurance	QA Documentation
Printing and Distribution of QA Manual		SOP	6/30/06 rev.	Quality Assurance	QA Documentation
Evaluation Process	Systems Evaluation Procedures	SOP	8/15/1997	Quality Assurance	QA Personnel Documentation
Acting Supervisor Designation		Policy	6/30/06 rev.	Quality Assurance	QA Operations Policy
Performance Appraisal Preparation		SOP	10/25/2000	Quality Assurance	QA Personnel Documentation
Loaning Out Quality Assurance Equipment		SOP	4/11/2006 rev.	Quality Assurance	Equipment Tracking
Satellite/TV/AVCR Operations		SOP	6/30/06 rev.	Quality Assurance	Training Equipment Operations
QA Section Vehicles		SOP	7/8/1999	Quality Assurance	Equipment Tracking
Cylinder Inventory		SOP	6/6/1993	Quality Assurance	Equipment Tracking
Evaluating Ambient/QA Monitoring Plan		SOP	10/25/1996	Quality Assurance	Data Analysis
Site Description Book		SOP	5/11/2004	Quality Assurance	Site information
Review of Precision & Accuracy Data		SOP	5/11/2004	Quality Assurance	Data Analysis
Meteorological Audit Procedure		SOP	2/22/1995	Quality Assurance	Sampler/Analyzer/Equipment performance evaluation
Certification Facility Program Procedures		SOP	6/1/1995	Quality Assurance	Sampler/Analyzer/Equipment performance evaluation
Interlab Audit Program		SOP	10/4/1996	Quality Assurance	Sampler/Analyzer/Equipment performance evaluation
Quarterly PARS Data Transfer		SOP	6/5/1995	Quality Assurance	Data Transmission
Seasonal Monitoring Calibration Requirement		SOP	10/27/1995	Quality Assurance	QA Documentation
Exceedance Review Reporting System		SOP	9/27/1995	Quality Assurance	Data Analysis
Procedures for Querying PARS		SOP	4/27/1996	Quality Assurance	Data Analysis
Submitting P&A Reporting		SOP	8/15/1997	Quality Assurance	Data Transmission
Data Checks	Review Process	SOP	3/8/2001	Quality Assurance	QA Documentation
Molbox Certification Procedures		SOP	8/17/1999	Quality Assurance	Sampler/Analyzer/Equipment performance evaluation
Vacuum Checks on Manifolds		SOP	6/29/06 rev.	Quality Assurance	Sampler/Analyzer/Equipment performance evaluation
Barometer Certification/Calibration Procedures		SOP	10/1/1998	Quality Assurance	Sampler/Analyzer/Equipment performance evaluation
CO Calibration		SOP	8/2/1999	Quality Assurance	Sampler/Analyzer/Equipment performance evaluation
Calibration of Ozone Analyzer		SOP	5/19/1999	Quality Assurance	Sampler/Analyzer/Equipment Setup
Thermometer/Temperature Probe Certification		SOP	7/14/1999	Quality Assurance	Sampler/Analyzer/Equipment performance evaluation
Orifice Calibrations		SOP	7/29/1999	Quality Assurance	Sampler/Analyzer/Equipment performance evaluation
Verification of SO2 Calibrations		SOP	7/22/1999	Quality Assurance	Sampler/Analyzer/Equipment performance evaluation
Multimeter Certification/Calibration		SOP	9/1/1999	Quality Assurance	Sampler/Analyzer/Equipment performance evaluation
Audit Method for Analysis of Lead Strips		SOP	10/11/2001	Quality Assurance	Sample Analysis
GMIS Designation		SOP	10/11/2001	Quality Assurance	Sampler/Analyzer/Equipment performance evaluation
CO Certification		SOP	8/20/1999	Quality Assurance	Sampler/Analyzer/Equipment performance evaluation
Elapsed Time Meter Certification		SOP	10/12/2001	Quality Assurance	Sampler/Analyzer/Equipment performance evaluation
SO2 Analyzer Calibration		SOP	10/12/2001	Quality Assurance	Sampler/Analyzer/Equipment Setup
Anemometer Certification		SOP	1/11/2000	Quality Assurance	Sampler/Analyzer/Equipment performance evaluation
Bios Verification		SOP	9/9/1999	Quality Assurance	Sampler/Analyzer/Equipment performance evaluation
NO Calibration		SOP	9/16/1999	Quality Assurance	Sampler/Analyzer/Equipment Setup
SO2 Certification		SOP	1/20/1999	Quality Assurance	Sampler/Analyzer/Equipment performance evaluation
NO Certification		SOP	1/11/2000	Quality Assurance	Sampler/Analyzer/Equipment

					performance evaluation
Particulate Filter Quality Assurance		SOP	1/20/1999	Quality Assurance	Data Analysis
Ozone Certification and Calibration		SOP	5/14/2001	Quality Assurance	Sampler/Analyzer/Equipment Setup
Ozone Loss Test		SOP	1/11/2000	Quality Assurance	Sampler/Analyzer/Equipment Setup
"S" Weights		SOP	6/30/06 rev.	Quality Assurance	Sampler/Analyzer/Equipment performance evaluation
Stop Watch Certification		SOP	6/30/06 rev.	Quality Assurance	Sampler/Analyzer/Equipment performance evaluation
Factory Cert/Cal for Photo Tachometer		SOP	6/30/06 rev.	Quality Assurance	Sampler/Analyzer/Equipment performance evaluation
Factory Cert/Cal for Radiation Sensors		SOP	1/11/2000	Quality Assurance	Sampler/Analyzer/Equipment performance evaluation
Factory Cert/Cal for Voltage Calibrators		SOP	6/30/06 rev.	Quality Assurance	Sampler/Analyzer/Equipment performance evaluation
Retrieval of PM2.5 Field Blank Data		SOP	1/12/2000	Quality Assurance	Data Transmission
Operating Epson PhotoPC 750z Digital Camera		SOP	4/22/2002	Quality Assurance	Sampler/Analyzer/Equipment Setup
Epson PowerLite 7250 A/V Projector Setup		SOP	1/23/2004	Quality Assurance	Sampler/Analyzer/Equipment Setup
Requisition Program Procedures		SOP	1/23/2004	Quality Assurance	Administrative operations
Procedures for Disposal of Hazardous Waste		SOP	10/9/1998	Quality Assurance	Safety Training & Implementation
Safety Program Procedures		SOP	6/5/1995	Quality Assurance	Safety Training & Implementation
<i>U.S. EPA Directive 2160 - Records Management Manual (July 13, 1984)</i>		EPA Guidance	7/13/1984	Air Monitoring Branch Quality Assurance Air Toxics Ambient Monitoring	Administrative Operations
<i>EPA Requirements for Quality Assurance Project Plans (QA/R-5)</i>		EPA Guidance	5/2006	Air Monitoring Branch	Monitoring Plan Development
<i>Guidance for Quality Assurance Project Plans (G-5)</i>		EPA Guidance	2/1998	Air Monitoring Branch	Monitoring Plan Development
Data Quality Assessment: Statistical Tools for Practitioners (QA/G-9S)		EPA Guidance	2/2006	Air Monitoring Branch	Data Analysis
Data Quality Assessment: A Reviewer's Guide (QA/G-9R)		EPA Guidance	2/2006	Air Monitoring Branch	Data Analysis
Guidance on Environmental Data Verification and Data Validation (QA/G-8)		EPA Guidance	11/2002	Air Monitoring Branch	Data Analysis
Guidance for Preparing Standard Operating Procedures (QA/G-6)		EPA Guidance	3/2001	Air Monitoring Branch	Administrative Operations
"Data Quality Objectives (DQOs) for Relating Federal Reference Method (FRM) and Continuous PM _{2.5} Measurements to Report an Air Quality Index (AQI)" EPA-454/B-02-002, November 2002		EPA Guidance	11/2002	Air Monitoring Branch	Monitoring Plan Development
PM2.5 "Data Flagging Guidance"		EPA Guidance	6/27/2000	Air Monitoring Branch	Data Analysis
Guideline for Reporting of Daily Air Quality - "Air Quality Index (AQI)"		EPA Guidance	5/2006	Ambient Monitoring	Data Transmission
40 CFR parts 50, 53 and 58		Federal Regulations	Thru 1/1/2006	Air Monitoring Branch	All Monitoring Activities
"Guidance for Network Design and Optimum Site Exposure for PM2.5 and PM10", EPA-454R-99-022, December 1997		EPA Guidance	12/1997	Air Monitoring Branch	Monitoring Plan Development
<u>Guideline on Data Handling Conventions for the PM NAAQS</u>		EPA Guidance	4/1999	Air Monitoring Branch	Data Analysis
EPA's "Visibility Monitoring Guidance" document, EPA-454/R-99-003		EPA Guidance	6/1999	Ambient Monitoring	Monitoring Plan Development
Technical Assistance Document (TAD) for Sampling and Analysis of Ozone Precursors; EPA/600-R-98/161		EPA Guidance	9/1998	Ambient Monitoring	Sample Acquisition
QA Handbook for Air Pollution Measurement Systems: Volume I & II		EPA Guidance	Updated to current versions	Ambient Monitoring	All Monitoring Activities
TO Compendium of Methods		EPA	Updated to	Air Toxics	Sample Preparation

		Guidance	current versions		Sample Analysis
"Ambient Monitoring Guidelines for Prevention of Significant Deterioration (PSD)"		EPA Guidance	5/1987	Quality Assurance Ambient Monitoring	Data Analysis
"Guideline on the Identification and use of Air Quality Data Affected by Exceptional Events", EPA-450/4-86-007		EPA Guidance	7/1986	Air Monitoring Branch	Data Analysis
"Office of Air Quality Planning and Standards Air Monitoring Strategy For Criteria Pollutants"		EPA Guidance	1987	Quality Assurance Ambient Monitoring	Monitoring Plan Development
AQS Data Coding Manual		EPA Guidance	6/30/2005	Air Monitoring Branch	Data Transmission
AQS Data Dictionary		EPA Guidance	6/20/2006	Air Monitoring Branch	Data Transmission
AQS User Guide		EPA Guidance	1/23/06	Air Monitoring Branch	Data Transmission
AQS Data Retrieval Guide		EPA Guidance	10/21/05	Air Monitoring Branch	Data Transmission

Planning and Annual Review

The Office of Air Quality (OAQ) Ambient Monitoring Branch (AMB) does not perform annual quality system reviews or assessments that lead to any planning activities to improve the quality system.

Management Assessments

OAQ AMB does not perform management assessments.

Training

OAQ AMB does not perform quality system trainings.

Systematic Planning of Projects

For major monitoring projects a QAPP is developed using the standard QAPP preparation approach. For small projects no systematic approach is currently being implemented. A streamlined systematic approach for small projects needs to be defined and implemented. Projects are identified in the AMB Strategic plan and the EnPPA.

Project-specific Quality Documentation

AMB develops QAPPs for EPA-driven projects that require a QAPP. When such a project is proposed, usually an EPA contractor develops a "skeleton" QAPP and distributes it to state air monitoring bodies for review. The contractor receives comments and then releases a "skeleton" or "template" QAPP. OAQ AMB modifies the QAPP, as needed, to reflect AMB operations and QA procedures. AMB submits these to EPA.

Project and Data Assessments

Does your program area assess the project activities and the data collected during, or upon completion of the project? Yes, however most of the projects are ongoing. Monitoring activities are adjusted base on results of the data. Most of the data that is acquired is used to assess environmental conditions at a moment in time (e.g. hourly or daily). Data is also used to evaluate compliance with long term objectives such as area reduction of concentrations or maintaining standards which have limits based on data (highest values) from several years.

Data is assessed using data acquisition software and via manual QA/QC as in Chapter 12 “Data Reduction & Audit Procedures” and Chapter 13 “Quality Assessment and Statistical Analysis of Air Monitoring Data” of the OAQ QA Manual. Flagging of data for various reasons (low flow, power failure, etc.) is explained in Chapter 7 parts 1 and 5. The flags allow data availability in the AQS (AIRS) database, but qualify data with a descriptive flag (number) to allow users to include or exclude the data for their specific use.

Quality System Tools

Q/A Tools include the following:

- Quality Management Plans
- QA Project Plan
- Data Verification and Validation (data assessments);

Quality Assurance Project Plans (QAPPs)

Environmental Programs that Use QAPPs

- List programs that use Quality Assurance Project Plans

Review and Approval Procedures

Provide explanation of review and approval procedures for QAPPs. Alternatively, you may use an external reference.

Personnel Qualification and Training

Description of Training Policy

OAQ AMB does not use a written training policy or plan for training of management and staff.

Training Q/A Procedures

Ensuring Appropriate Training

OAQ AMB does not have a formal process for identifying, ensuring, and documenting that personnel have and maintain the appropriate knowledge and skills. Training needs are sometimes identified during annual performance appraisals.

Meeting Requirements for Formal Training

OAQ AMB does not employ staff that require formal training and licensing.

Identifying Need for Retraining

OAQ AMB does not have a systematic means of determining when staff should be retrained or be provided with training updates. Retraining is initiated based on employee performance and when significant technical changes have occurred.

Procurement of Items and Services

Reviewing and Approving Q/A Documents

Equipment, contracts, and other procurement costs are estimated in the annual Ambient Monitoring Branch (AMB) budget. Purchase of these items is proposed based on program needs. Items include ambient analyzers, calibration equipment, data acquisition systems, vehicles, property rent, service contracts, analytical equipment, computer programming, software, etc.

AMB technical staff develop specifications for requisitions of technical equipment. The specifications must meet program technical and quality requirements contained in the Quality Assurance Manual and in EPA guidance. The specifications are incorporated into the requisition by assigned staff. Next, the requisition is reviewed by the respective OAQ AMB Section Chief. The AMB Branch Chief provides final branch approval for requisitions below 100,000. After AMB Branch Chief approval, requisitions are sent to OAQ Procurement for processing. Requisitions above 10,000 need approval from the OAQ Assistant Commissioner. Requisitions with remunerated values of above 100,000 also need approval from the Office of External Affairs AC. To ensure that data are of the necessary quality, all external sources producing air quality monitoring data must prepare a Monitoring/QA Plan. The plan contains all the elements of a QAPP and is submitted prior to commencement of monitoring or analysis. The plans are reviewed for applicability and completeness based on monitoring and QA requirements of the IDEM OAQ Quality Assurance Manual, the CFR, and Federal guidance documents, and approved by the OAQ Air Monitoring Branch Quality Assurance Section Chief.

Post-procurement Product/Service Q/A Procedures

Upon delivery specifications are checked by initiator of the procurement. Quantity, material and performance are tested. Testing varies based on product or service. Section Chiefs and the Branch Chief review procurement documents and approve prior to submittal to the Purchasing Department. EPA approved equipment is verified against grant applications (tied to EnPPA priorities).

OAQ AMB evaluates technical equipment "on the bench" before use. If the equipment is defective, AMB can withhold payment and/or send the instrument back for repair under warranty.

Documents and Records

Identification of Q/A-related Records

OAQ Ambient Monitoring Branch does not use a systematic process for identifying QA-related records subject to control. In general, Air Compliance Branch retains any document bearing an original signature and all records used as the basis for decision-making. AMB retains all records concerning data validity, including calibration records, data audits, and siting process records.

AMB also retains records of contractual arrangements with landowners and external monitoring entities.

[Staff name and position] works with the file room and [other program staff names and positions] to maintain document retention policy. [Staff name/position] identifies Q/A related records in consultation with [other program staff names and positions], OLC, and [applicable rules/statutes and associated program]."

The answer above the generic statement is correct. AMB has identified QA/QC documents and their retention schedule in a spreadsheet but the development and application of this document retention process in conjunction with the agency document retention schedule was put on hold pending the electronic document control system being initiated by IDEM upper management. Files are not stored in a central file system (File Room) therefore completing the Record Handling Process table below is not applicable. There is a general file area and many individual file areas kept by staff members.

The Document/Record Handling Process would be better defined through an electronic spreadsheet or database rather than a hard copy listing such as below in 5.2 and 5.3.

Record Handling Processes

Series #	Document Name	Preparation	Review	Approval
Series # from file-room listing (if applicable)	Name of document type.	Information related to file preparation, including the following: <ul style="list-style-type: none"> The policy on what goes to the file room. Do you have written policy? If yes, please summarize and reference. If not, please provide a summary of your oral policy in your response. Documents are coded by the programs before they are sent to the file room. Reference any guidance containing the coding system currently used by your program. What staff position does the file coding and preparation? Do you have confidential records, and/or exceptions to confidentiality associated with this record series? If yes, please explain. 	Describe processes associated with Q/A document review. <ul style="list-style-type: none"> Who (by name and position) reviews materials to be sent to the file room? What do they look for, and how do they determine if the records are complete? Are there written processes (SOPs), or checklists? 	Describe processes associated with Q/A document approval. <ul style="list-style-type: none"> Are there particular levels of approval for a document before it is sent to the file room? What positions participate in the approval? If, in your area, the level of approval needed depends upon document type, please provide the alternate review scenarios in your response.
	All documents below except as noted.	<ul style="list-style-type: none"> AMB has no written policy regarding filing. The item drives the file location through job responsibilities. Files are sent to secretary for filing in central files or filed by the staff member in an appropriate area. Files are not coded. They are filed by subject or by county-facility-date. There are no confidential files other than personnel files. 	<ul style="list-style-type: none"> Group Leaders (Environmental Manager 2Ws) or Senior Environmental Manager 1s review documents initially and Section Chiefs or Branch Chief provide final review if necessary. Documents are reviewed for completeness and correctness. Completeness is has no missing information in areas that require response. If a response is missing it must be documented in comments. Correctness is evaluated by checking to make sure the entries are in the correct range and that calculations produce correct values. There are no written SOPs for the review although there is guidance for acceptable completion of the documents. 	<ul style="list-style-type: none"> Very few QA documents require sign-off approval other than the originator and for communications the Section Chief or Branch Chief. Documents that do require approval generally follow the review path described to the left whit sign-off. When signature approval is needed it will be noted below.
79-2748	Correspondence - Industry/ External Customers	As indicated above	Section Chiefs or Branch Chief provide final review for correspondence	Section Chiefs and Branch Chief approve/sign correspondence
80-479	Annual Reports - AT Data Summaries	As indicated above	As indicated above	As indicated above
80-1234	Documentation - Motor Pool	As indicated above	As indicated above	As indicated above
80-1255	Reference documents- Quarterly Reports - Reports to Section Chief - Requisition Justifications - Justifications for Equipment,	As indicated above	As indicated above	As indicated above

	Site Files			
80-1284	Excel files - purchase requisitions, siting images	As indicated above	As indicated above	As indicated above
80-1285	QA Reference Files - Certification Stickers, QAPPs, Methods, General Information	As indicated above	Section Chiefs and Branch Chief provide final review for QAPPs	Section Chiefs and Branch Chief approve
80-1286	Chap 17 Manual - Monitoring Analysis QA	As indicated above	As indicated above	As indicated above
80-1287	Miscellaneous Files - Areas of Responsibility, Site inspections, procedure references, forms	As indicated above	As indicated above	As indicated above
80-1300	Requisitions - Siting Information, Local Agency reference files	As indicated above	Section Chiefs and Branch Chief provide final review for Requisitions	Section Chiefs and Branch Chief approve Requisitions
80-1304	Particulate Sampler - Performance Records	As indicated above	As indicated above	As indicated above
80-1327	Reference documentation - site monitoring lists	As indicated above	As indicated above	As indicated above
80-1345	Industry Monitoring Plans - Discontinued Monitoring Plans, NADP Reports	As indicated above	As indicated above	As indicated above
80-1368	Background Information - Subject Reference Files, Site Safety Evaluations	As indicated above	As indicated above	As indicated above
80-1370	Audits/Cals/Invalidations, Branch Activities, certifications	As indicated above	As indicated above	As indicated above
80-1389	Instrument Manuals	As indicated above	As indicated above	As indicated above
80-1390	Quality Assurance Manual - All Chapters, AMB SOPs	As indicated above	Section Chiefs and Branch Chief provide final review	Section Chiefs and Branch Chief approve
80-1411	Reference documents - speciation procedures	As indicated above	As indicated above	As indicated above
80-1412	Forms - Filter Weight Check, Equipment Photos, reference files	As indicated above	As indicated above	As indicated above
80-1414	OAMD Manual - OAMD Reference Guide	As indicated above	As indicated above	As indicated above
80-1430	Speciation Audits - Procedures-Forms-	As indicated above	As indicated above	As indicated above
80-1435	EPA Reference Procedures - Quality Assurance Methods	As indicated above	As indicated above	As indicated above
80-1440	Invalid Memos - Office Memos	As indicated above	As indicated above	As indicated above
80-1446	QA Laboratory - Certification Reports	As indicated above	As indicated above	As indicated above
80-1455	Summary documents - Network Review site summary docs, PARS Program Files	As indicated above	As indicated above	As indicated above
80-1462	Monitoring Site Maps - Site Addresses, Site Summaries, Data Checks, Data Summaries	As indicated above	As indicated above	As indicated above
80-6813	Equipment Maintenance - General Program	As indicated above	As indicated above	As indicated above
83-483	Lab SOPs - QA Cert Facility-Lab SOPs, field operational	As indicated above	As indicated above	As indicated above
83-485	Local Agency Evaluations - Performance Records	As indicated above	As indicated above	As indicated above
83-540	Inter-QA Lab Audits - Local and Industrial	As indicated above	As indicated above	As indicated above

Series #	Document Name	Issuance	Use	Authentication	Revisions
Series # from file-room listing (if applicable)	Name of document type.	Describe processes associated with Q/A document issuance. With respect to permits and other decisions, what are the processes for the following: <ul style="list-style-type: none"> Whom is notified of the issuances? Where to store the documents bearing the decision filed? Where the underlying, or working, documents associated with the issuance are filed or stored? 	Describe processes associated with Q/A document use (i.e. when to use, who uses). <ul style="list-style-type: none"> Are there protocols (SOPs) for using existing records (current permits, DMRs, inspection reports) in decision-making and/or the development of new documents (renewed permits, future inspection lists, etc)? 	Describe processes associated with Q/A document authentication (for documents that need to be managed in print form). Please provide: <ul style="list-style-type: none"> Process to ensure that the current versions of Q/A documents are signed and dated. Reference any associated routing sheets. 	Describe processes associated with Q/A document revisions, including revision timelines and roles). <ul style="list-style-type: none"> Describe triggers (regulatory changes, judicial decisions, EPA policy changes, changes to SIPs, etc) that initiate revisions to this document type, and associated work tools and daily forms? SOPs are discussed separately under QMP Element #8
		<ul style="list-style-type: none"> Not applicable 	<ul style="list-style-type: none"> Document use is described in the OAQ QA Manual and in some SOPs.. 	<ul style="list-style-type: none"> There is a tracking spreadsheet for tracking SOPs and QAPPs that have routing through signature and a distribution database. Other QA documents are not tracked or routed, but updated as needed. Distribution to applicable parties upon update. 	<ul style="list-style-type: none"> Revisions are made to documents based changes in Federal or State law, technical guidance, new methods, Agency policy, QA policy changes, physical site, and for convenience of use.
79-2748	Correspondence - Industry/ External Customers	Not applicable	As indicated above	As indicated above	No Revisions
80-479	Annual Reports - AT Data Summaries	Not applicable	As indicated above	As indicated above	No Revisions
80-1234	Documentation - Motor Pool	Not applicable	As indicated above	As indicated above	No Revisions
80-1255	Reference documents- Quarterly Reports - Reports to Section Chief - Requisition Justifications - Justifications for Equipment, Site Files	Not applicable	As indicated above	As indicated above	No Revisions except site files are updated as physical changes occur or about annually.
80-1284	Excel files - purchase requisitions, siting images	Not applicable	As indicated above	As indicated above	No Revisions
80-1285	QA Reference Files - Certification Stickers, QAPPs, Methods, General Information	Not applicable	As indicated above	As indicated above	As indicated above
80-1286	Chap 17 Manual - Monitoring Analysis QA	Not applicable	As indicated above	As indicated above	As indicated above, but on 2 year revision schedule
80-1287	Miscellaneous Files - Areas of Responsibility, Site inspections, procedure references, forms	Not applicable	As indicated above	As indicated above	As indicated above
80-1300	Requisitions - Siting Information, Local Agency reference files	Not applicable	As indicated above	As indicated above	No Revisions except site files are updated as physical changes occur or about annually.
80-1304	Particulate Sampler - Performance Records	Not applicable	As indicated above	As indicated above	As indicated above
80-1327	Reference documentation - site monitoring lists	Not applicable	As indicated above	As indicated above	As indicated above
80-1345	Industry Monitoring Plans - Discontinued	Not applicable	As indicated above	As indicated above	As indicated above

	Monitoring Plans, NADP Reports				
80-1368	Background Information - Subject Reference Files, Site Safety Evaluations	Not applicable	As indicated above	As indicated above	No Revisions
80-1370	Audits/Cals/Invalidations, Branch Activities, certifications	Not applicable	As indicated above	As indicated above	No Revisions
80-1389	Instrument Manuals	Not applicable	As indicated above	As indicated above	No Revisions
80-1390	Quality Assurance Manual - All Chapters, AMB SOPs	Not applicable	As indicated above	As indicated above	As indicated above, but on 2 year revision schedule
80-1411	Reference documents - speciation procedures	Not applicable	As indicated above	As indicated above	As indicated above
80-1412	Forms - Filter Weight Check, Equipment Photos, reference files	Not applicable	As indicated above	As indicated above	No Revisions – photos updated when change occurs.
80-1414	OAMD Manual - OAMD Reference Guide	Not applicable	As indicated above	As indicated above	No Revisions
80-1430	Speciation Audits - Procedures-Forms-	Not applicable	As indicated above	As indicated above	No Revisions
80-1435	EPA Reference Procedures - Quality Assurance Methods	Not applicable	As indicated above	As indicated above	As indicated above
80-1440	Invalid Memos - Office Memos	Not applicable	As indicated above	As indicated above	No Revisions
80-1446	QA Laboratory - Certification Reports	Not applicable	As indicated above	As indicated above	No Revisions
80-1455	Summary documents - Network Review site summary docs, PARS Program Files	Not applicable	As indicated above	As indicated above	No Revisions
80-1462	Monitoring Site Maps - Site Addresses, Site Summaries, Data Checks, Data Summaries	Not applicable	As indicated above	As indicated above	No Revisions
80-6813	Equipment Maintenance - General Program	Not applicable	As indicated above	As indicated above	No Revisions
83-483	Lab SOPs - QA Cert Facility-Lab SOPs, field operational	Not applicable	As indicated above	As indicated above	As indicated above
83-485	Local Agency Evaluations - Performance Records	Not applicable	As indicated above	As indicated above	No Revisions
83-540	Inter-QA Lab Audits - Local and Industrial	Not applicable	As indicated above	As indicated above	No Revisions

Document Maintenance

Series #	Document Name	Transmittal	Distribution	Retention	Access
		Processes associated with transmittal of Q/A related documents. <ul style="list-style-type: none"> When, how, and to where are completed work documents transmitted? 	Processes associated with distribution of Q/A related documents. <ul style="list-style-type: none"> Who gets what? What is the protocol for what work product goes to the public (including via the Internet), to the file room, or to non-file room, but internal program files? 	Processes associated with retention of Q/A related documents. <ul style="list-style-type: none"> What are your record retention policies? 	Processes / network locations associated with access of Q/A related documents. <ul style="list-style-type: none"> What are the access points (both internal and external) for this document type?
		A comprehensive document management system is under development.	A comprehensive document management system is under development.	Agency Document Retention Schedule – A comprehensive document management system is under development.	A comprehensive document management system is under development.
79-2748	Correspondence - Industry/ External Customers	As indicated above	As indicated above	As indicated above	As indicated above
80-479	Annual Reports - AT Data Summaries	As indicated above	As indicated above	As indicated above	As indicated above
80-1234	Documentation - Motor Pool	As indicated above	As indicated above	As indicated above	As indicated above
80-1255	Reference documents- Quarterly Reports - Reports to Section Chief - Requisition Justifications - Justifications for Equipment, Site Files	As indicated above	As indicated above	As indicated above	As indicated above
80-1284	Excel files - purchase requisitions, siting images	As indicated above	As indicated above	As indicated above	As indicated above
80-1285	QA Reference Files - Certification Stickers, QAPPs, Methods, General Information	As indicated above	As indicated above	As indicated above	As indicated above
80-1286	Chap 17 Manual - Monitoring Analysis QA	As indicated above	As indicated above	As indicated above	As indicated above
80-1287	Miscellaneous Files - Areas of Responsibility, Site inspections, procedure references, forms	As indicated above	As indicated above	As indicated above	As indicated above
80-1300	Requisitions - Siting Information, Local Agency reference files	As indicated above	As indicated above	As indicated above	As indicated above
80-1304	Particulate Sampler - Performance Records	As indicated above	As indicated above	As indicated above	As indicated above
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80-1370	Audits/Cals/Invalidations, Branch Activities, certifications	As indicated above	As indicated above	As indicated above	As indicated above
80-1389	Instrument Manuals	As indicated above	As indicated above	As indicated above	As indicated above
80-1390	Quality Assurance Manual - All Chapters, AMB SOPs	As indicated above	As indicated above	As indicated above	As indicated above

80-1411	Reference documents - speciation procedures	As indicated above	As indicated above	As indicated above	As indicated above
80-1412	Forms - Filter Weight Check, Equipment Photos, reference files	As indicated above	As indicated above	As indicated above	As indicated above
80-1414	OAMD Manual - OAMD Reference Guide	As indicated above	As indicated above	As indicated above	As indicated above
80-1430	Speciation Audits - Procedures-Forms-	As indicated above	As indicated above	As indicated above	As indicated above
80-1435	EPA Reference Procedures - Quality Assurance Methods	As indicated above	As indicated above	As indicated above	As indicated above
80-1440	Invalid Memos - Office Memos	As indicated above	As indicated above	As indicated above	As indicated above
80-1446	QA Laboratory - Certification Reports	As indicated above	As indicated above	As indicated above	As indicated above
80-1455	Summary documents - Network Review site summary docs, PARS Program Files	As indicated above	As indicated above	As indicated above	As indicated above
80-1462	Monitoring Site Maps - Site Addresses, Site Summaries, Data Checks, Data Summaries	As indicated above	As indicated above	As indicated above	As indicated above
80-6813	Equipment Maintenance - General Program	As indicated above	As indicated above	As indicated above	As indicated above
83-483	Lab SOPs - QA Cert Facility-Lab SOPs, field operational	As indicated above	As indicated above	As indicated above	As indicated above
83-485	Local Agency Evaluations - Performance Records	As indicated above	As indicated above	As indicated above	As indicated above
83-540	Inter-QA Lab Audits - Local and Industrial	As indicated above	As indicated above	As indicated above	As indicated above

Series #	Document Name	Tracability	Retrieval	Removal of Obsolete Documentation	Archiving and/or Disposal
		Processes associated with tracking of Q/A related documents. <ul style="list-style-type: none"> List tracking tools (forms, routing sheets, software, etc) List any written SOPs or policies that address the use or maintenance and/or use of these tracking tools. 	Processes associated with retrieval of Q/A related documents. <ul style="list-style-type: none"> What is the protocol/SOPs for retrieving non-file room documents? (That is, documents that must be maintained, but are not sent to the file room and which may be public or confidential?) 	Processes associated with removing obsolete Q/A related documents. <ul style="list-style-type: none"> Describe process for purging records that have exceeded scheduled retention timetables? 	Processes associated with archiving and/or disposing of Q/A related documents. [What we want is: what is your process for addressing disposal of documents that may have special disposal requirements due to confidentiality? Regarding archiving, that might overlap somewhat with 5.4.5. above, on document preservation?]
		Agency Document Retention Schedule – A comprehensive document management system is under development.	Agency Document Retention Schedule – A comprehensive document management system is under development.	Agency Document Retention Schedule – A comprehensive document management system is under development.	Agency Document Retention Schedule – A comprehensive document management system is under development.
79-2748	Correspondence - Industry/ External Customers	As indicated above	As indicated above	As indicated above	As indicated above
80-479	Annual Reports - AT Data Summaries	As indicated above	As indicated above	As indicated above	As indicated above
80-1234	Documentation - Motor Pool	As indicated above	As indicated above	As indicated above	As indicated above
80-1255	Reference documents- Quarterly Reports - Reports to Section Chief - Requisition Justifications - Justifications for Equipment, Site Files	As indicated above	As indicated above	As indicated above	As indicated above
80-1284	Excel files - purchase requisitions, siting images	As indicated above	As indicated above	As indicated above	As indicated above
80-1285	QA Reference Files - Certification Stickers, QAPPs, Methods, General Information	As indicated above	As indicated above	As indicated above	As indicated above
80-1286	Chap 17 Manual - Monitoring Analysis QA	As indicated above	As indicated above	As indicated above	As indicated above
80-1287	Miscellaneous Files - Areas of Responsibility, Site inspections, procedure references, forms	As indicated above	As indicated above	As indicated above	As indicated above
80-1300	Requisitions - Siting Information, Local Agency reference files	As indicated above	As indicated above	As indicated above	As indicated above
80-1304	Particulate Sampler - Performance Records	As indicated above	As indicated above	As indicated above	As indicated above
80-1327	Reference documentation - site monitoring lists	As indicated above	As indicated above	As indicated above	As indicated above
80-1345	Industry Monitoring Plans - Discontinued Monitoring Plans, NADP Reports	As indicated above	As indicated above	As indicated above	As indicated above
80-1368	Background Information - Subject Reference Files, Site Safety Evaluations	As indicated above	As indicated above	As indicated above	As indicated above
80-1370	Audits/Cals/Invalidations, Branch Activities, certifications	As indicated above	As indicated above	As indicated above	As indicated above
80-1389	Instrument Manuals	As indicated above	As indicated above	As indicated above	As indicated above
80-1390	Quality Assurance Manual - All Chapters, AMB SOPs	As indicated above	As indicated above	As indicated above	As indicated above
80-1411	Reference documents - speciation	As indicated above	As indicated above	As indicated above	As indicated above

	procedures				
80-1412	Forms - Filter Weight Check, Equipment Photos, reference files	As indicated above	As indicated above	As indicated above	As indicated above
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80-1462	Monitoring Site Maps - Site Addresses, Site Summaries, Data Checks, Data Summaries	As indicated above	As indicated above	As indicated above	As indicated above
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83-483	Lab SOPs - QA Cert Facility-Lab SOPs, field operational	As indicated above	As indicated above	As indicated above	As indicated above
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83-540	Inter-QA Lab Audits - Local and Industrial	As indicated above	As indicated above	As indicated above	As indicated above

Ensuring that Documents Accurately Reflect Completed Work

OAQ Ambient Monitoring Branch does not perform operations for which documents are produced to report on completed work. The primary role of AMB is to perform monitoring - there is no opportunity to check monitoring work performed against documentation. Documentation produced as a result of monitoring includes field reports and data – these documents are not reflective of a completed work product. Monitoring data is subject to rigorous QA/QC as described in element 6.4.

Compliance with Statutory/EPA Recordkeeping Requirements

Upon promulgation of new legislation that has potential to alter or present new monitoring and recordkeeping requirements, Air Monitoring Branch forms a workgroup of program staff to analyze regulatory requirements. Monitoring Branch then identifies documents used to establish data validity and as the basis for decision-making under such legislation and works with OLC to develop or use an existing retention schedule for such documents.

Procedures for Implementing Chain of Custody for Evidentiary Records

OAQ Ambient Monitoring Branch Chain of Custody requirements are addressed in detail in the AMB Quality Assurance Manual, Chapter 10. The manual also contains Chain of Custody forms that are routed with samples, including:

- Continuous Monitoring Chain of Custody Record
- Intermittent Sampling Chain of Custody Record
- Request for Laboratory Analysis
- Single Filter PM_{2.5} Data Sheet

* An unbroken trail of accountability that ensures the physical security of samples, data, and records.

Computer Hardware and Software

Hardware/Software Q/A Processes

Name	Type (Hardware or Software)	Testing requirements	Usage requirements	Maintenance requirements	Control	Documentation
Provide a list of hardware/software subject to Q/A processes Unique software/hardware requirements and management practices may apply to the following: Software <ul style="list-style-type: none"> • Computer modeling applications and simulations • Program-specific database applications (documentation, details on usage, and 		Processes associated with software/hardware testing.	Processes associated with software/hardware use.	Processes associated with software/hardware maintenance.	Processes associated with software/hardware control (i.e. access control; security).	List documentation associated with hardware/software.

<p>your program's role in development and maintenance)</p> <p>Hardware</p> <ul style="list-style-type: none"> • Lab instrumentation • GPS devices • Automated data acquisition devices 						
<p>There are large number of software applications and special database and spreadsheet programs used to acquire, track, or store monitoring data. Testing of software or software applicability is done on case by case basis. There are too many to list. Listing the hardware is also problematic. There are hundreds of pieces of equipment that is used to acquire, transmit, or check monitoring data. Equipment meets design specifications but again there are too many items to realistically list them.</p>						

Hardware/Software Usage Assessment and Documentation

AMB does not have a formal process for hardware or software usage assessment and documentation. AMB addresses usage assessment and documentation on a case-by-case basis.

Hardware/Software Evaluation

AMB does not have a formal process for hardware or software evaluation. The Branch evaluates specialized database software (and upgrades to such software) during the design stages. AMB relies on the Office of External Affairs Business Services division to coordinate software testing.

Data QA/QC

Data Stream	QA/QC methods and acceptance criteria	% of total data undergoing QA/QC
Not sure how to answer this question. All of the Quality Assurance Section functions are related to QA/QC 10% or the rest of the Branch personnel are involved in QA/QC. The entire Quality Assurance Manual defines and sets the criteria for QA/QC. I will just try to list some things in general. Examples below:		
Continuous Data Checks	Hourly average comparisons within 2% if recording device.	About 8.5%
Continuous SO ₂ , O ₃ , NO _x , CO Monitoring Data	Field Audits - 15% of standard.	100%
Intermittent Particulate PM ₁₀ , TSP data	Field Audits - 7% of standard.	100%
Sequential particulate PM ₁₀ , PM _{2.5} flow audits		7% of batch
Intermittent particulate PM ₁₀ , TSP filter weights	Weight comparison within	7% of batch
Sequential particulate PM ₁₀ , PM _{2.5} filter weights	PM _{2.5} reweigh within 30 ug, PM ₁₀ exposed 5 mg, PM ₁₀ unexposed 2.8 mg	7% of batch
Intermittent particulate data card checks	Run time = 1380 -1500, Signature, missing filter < 9mm sq, <10 bugs	100%
There are so many that listing is impractical. They are defined throughout the QA Manual		

Planning

Systematic Planning Process Description

Air Monitoring Branch develops QAPPs for EPA-driven projects that require them. When such a project is proposed, usually an EPA contractor develops a “skeleton” QAPP and distributes it to state air monitoring bodies for review. The contractor receives comments and then releases a “skeleton” or “template” QAPP. OAQ AMB modifies the QAPP, as needed, to reflect AMB operations and QA procedures described in the OAQ AMB Quality Manual. AMB approves modifications to “skeleton” project QAPPs internally. Because AMB develops QAPPs only when provided a template from EPA (presumably prepared by the contractor using DQO), AMB does not directly employ the DQO process in the preparation of QAPPs.

QAPP Development Process

QAPPs are assigned to a QA staff member for development (writing).

The QA Section Chief reviews the QAPP as does the AMB Chief. The Assistant Commissioner reviews the QAPP if it is a grant require QAPP. The Agency Quality Manager will review the QAPP and it then goes to EPA for review.

Each of the reviewers provide sign-off approval.

Describe your branch QAPP development process, from the planning stages (using a Systematic Planning Process) to final approval.

EPA recommends the use of the Data Quality Objectives process for planning Environmental Data Operations. If your area uses a different process, it must include the following:

- the identification and involvement of the project manager, sponsoring organization and responsible official, project personnel, stakeholders, scientific experts, etc. (e.g., all customers and suppliers);
- a description of the project goal, objectives, and questions and issues to be addressed;
- the identification of project schedule, resources (including budget), milestones, and any applicable requirements (e.g., regulatory and contractual requirements);
- the identification of the type and quantity of data needed and how the data will be used to support the project's objectives;
- the specification of performance criteria for measuring quality;

Processes Associated with Using External Data

AMB receives external data through consulting companies that operate monitoring stations on behalf of power plants and other sources. AMB must approve siting/instrumentation/methods before data transfer. Review processes and operating requirements for external monitoring networks are contained in Chapter 15 of the AMB Quality Assurance Manual.

Once received at OAQ AMB, external data undergoes the same QA/QC processes as specified in 6.4. Data QA/QC.

Implementation of Work Processes

Processes for Ensuring Work Follows Planning and Technical Documents

Duties are assigned and AMB uses Performance Appraisals as a means of oversight. The AMB QA section also evaluates work product with QA checks; poor work or poor monitoring results prompt investigation which leads to operational correction or systematic corrections (repair or replacement of equipment – training and/or correction regarding policies or procedures).

Identification of Operations Needing SOPs/Technical Documents

OAQ AMB identifies the needs for new SOPs and technical documents when undertaking any new project or activity. The Branch considers the following questions before deciding to write an SOP or technical guidance for an activity:

1. Is the process of sufficient complexity to warrant the use of an SOP? Does the process require some degree of expertise or training? If yes, the process may need an SOP.
2. Is the process repetitive? Non-repetitive processes are difficult to document with SOPs
3. Does the process have a high potential impact to a work product and/or customer? For example, are there potentially environmental or litigious repercussions for performing the task incorrectly?
4. Will the office benefit from standardizing the activity?

Handling of SOPs/Technical Documents

AMB uses the following agency-wide policies for the management of SOPs and technical documentation:

A-006-OEA-05-P-R0 Project and Process Documentation Policy (AKA: SOP and QAPP Policy)

A-004-OEA-05-P-R0 Administrative Documentation Policy (AKA: Policy on Policies)

Assessment and Response

Assessment

Assessment Tools

List the assessment tools in use by your area. Available assessment tools include quality systems audits, management systems reviews, peer reviews, technical reviews, performance evaluations, data quality assessments, readiness reviews, technical systems audits, and surveillance.

Tool	Frequency	Personnel and Processes
Peer reviews	Ongoing review	Oversight by QA personnel and supervisors of AMB activities. Calibration - review Data - review
Technical reviews	Ongoing review % of every batch All filters process varies % of data monthly	Oversight by QA personnel and supervisors of AMB activities. Filter weighing & calculation Filter invalidation verification Data Checks & calculations
Performance evaluations	Ongoing review Bi-weekly, monthly or quarterly as applicable Quarterly	Oversight by QA personnel and supervisors of AMB activities. Instruments are audited for Precision and Accuracy Site safety and operational evaluations.
Data quality assessments	Prior to project start	Adjustments made in initial

	Annually for ongoing projects.	stages of project by Ambient Section or Toxic Section personnel. Network adjustments (number of monitoring sites and location are the resultant output).
Readiness reviews	Before site start-up and weekly Instrument performance tests	Site checks - Oversight by QA personnel and supervisors These documented tests verify operational parameters.
Technical systems audits		
Surveillance	Ongoing review	Every aspect of equipment and site operation along with data obtained are verified against criteria in the Quality Assurance Manual. Oversight by QA personnel and supervisors

Frequency of Assessments

What is your program area's process for assessing the adequacy of the quality system at least annually?

This is an ongoing process as described in the above table, but all the review and assessment information is used to prepare the network description and future network change proposals. This is usually tied to grant proposals.

Selection of Assessment Personnel

What is your program area's process for determining the level of competence, experience, and training necessary for the personnel conducting quality system assessments to ensure that they are:

- 1) technically knowledgeable,

Hands on training provided along with any applicable external training combined with QA staff performance evaluations.

- 2) have no real or perceived conflict of interest, and

QA personnel are isolated by section functions under a QA Section Chief supervisor. While QA Section Chief is in the review chain of the Air Monitoring Branch Chief, the QA Section Chief is the Quality Assurance Officer for air monitoring in the State of Indiana and has final data quality authority for monitoring.

- 3) have no direct involvement or responsibility for the work being assessed?

Responsibility for site setup and operation is not the responsibility of QA personnel although they may assist with some duties. The assessment work assigned and done by all QA staff members is independently assessed by the QA Section Chief.

Assessment Planning

What is your program area's process for planning, implementing, and documenting assessments and reporting assessment results to management including:

- 1) how to select an assessment tool,
- 2) the expected frequency of their application to environmental programs, and
- 3) the roles and responsibilities of assessors?

For QA personnel 1-3 above are defined by the Quality Assurance Section Chief based on QA requirements defined in the QA Manual and as necessary. Other assessments are conducted as described in the table above.

Implementation

See "Assessment Planning" above.

Documentation

See "Assessment Planning" above.

Assessment Personnel Authority and Organizational Independence

What is your program area's process for ensuring that personnel conducting quality system assessments have sufficient authority, access (to programs, managers, documents, and records), and organizational freedom to;

- 1) identify both quality problems and noteworthy practices,

- 2) propose recommendations for resolving quality problems, and
- 3) independently confirm implementation and effectiveness of solutions?

Staff are trained and encouraged to provide direct feedback regarding quality problems and provide potential solutions (with notification of supervisors). If they are uncomfortable providing direct feedback the information is transmitted by the QA Section Chief through his position as Quality Assurance Officer for air monitoring in the State of Indiana. Responsibility for effective solutions falls on the Branch managers.

Reporting Results to Management

What is your program area's process for ensuring that management will review and respond to quality assessment findings?

Safety and significant site operational problems require a written memo to a defined distribution list. Invalid data problems also require a written memo to a defined distribution list. The consequences for not addressing serious issues is normally invalidation of the data collected. Since the primary objective of the Air Monitoring Branch is collection of as much quality valid data as possible, any significant impediment to meeting this objective is addressed as soon as possible.

Response

Corrective Actions

What is your program area's process for identifying how and when corrective actions are to be taken in response to the findings of the assessment?

The type data involved, amount of data in jeopardy, availability of equipment and personnel all weigh on supervisory decisions regarding corrective actions. We are currently updating to automated calibration/audit systems at all sites. This automation will change the approach we take for analysis of problems and the corrective actions taken.

Dispute Resolution

What is your program area's process for addressing any disputes encountered as a result of assessments?

If there is any doubt about the assessment another assessment is conducted with different personnel and/or equipment. Branch supervisors then discuss disputes over the assessment information and a conclusion is reached that satisfies all parties. If a mutually satisfactory resolution cannot be reached then the QA Section Chief, as the Quality Assurance Officer makes the final decision.

Quality Improvement

Point of Contact

Who (within your program area) is responsible for identifying, planning, implementing, and evaluating the effectiveness of quality improvement activities?

Steven Blaser, Chief Quality Assurance Section

Process(es) for Continuous Quality Improvement

What is your program area's process for ensuring continuous quality improvement (including the roles and responsibilities of management and staff)?

Standard Operating Procedures including the Quality Assurance Manual are continually updated as new or improved techniques develop. Training and retraining of all branch staff members is ongoing based on program and personnel needs.

Process(es) for Preventing or Ameliorating Conditions Averse to Quality

Prevention

What is your program area's the process for ensuring that conditions adverse to quality are prevented?

To the extent possible most operations and site setups are standardized and meet predefined parameters. Techniques for analysis are also modified as little as possible and technicians specialize in a particular area of monitoring or analysis.

Identification

Process for ensuring conditions averse to quality are identified promptly including a determination of the nature and extent of the problem.

There are a wide variety of checks of site parameters, equipment functions, and data integrity to ensure issues are identified by both QA personnel and Ambient personnel (QC). To the best extent possible these checks are being set up to be automated.

Correction

Implementation

Processes for implementing corrective actions from start to finish. Include actions to prevent reoccurrence.

1. Issue is identified
 2. A verbal or written report is presented to the parameter site operator (from the site if possible – cell phone). If parameter site operator can't be contacted one of the Monitoring Branch supervisors is notified.
 3. Site operator or supervisor determines the immediate action to be taken by onsite individual (diagnostics, part replacement, calibration or other effort).
 4. If resolution is not possible the repair/replacement task is assigned to the ambient monitoring staff person responsible for the particular area of work.
 5. The next site visitor will evaluate operations to determine if any serious issues are pending.
 6. Issues are entered into the site logbook and/or the electronic log.
 7. On occasion problems are identified via the data being gathered by telemetry or lack there of. For these issues a Branch wide email is sent regarding the assistance needed so that the next onsite visitor can perform minor repairs of
-

maintenance. This type process will become more prevalent as sites become more automated.

Documentation

Processes for documenting corrective actions from start to finish.

In most cases documentation is done via email or memo and in the site logbook.

Tracking to Closure

Processes for tracking corrective actions to closure.

Closure tracking is not actually necessary since each site visit verifies operations. Any significant problem starts the corrective action process in motion

Appendix B

Modeled Sources

Contents

Permitted Sources

Gas Stations

Auto Body Refinishers

Trucking Companies

Dry Cleaners

Source Name	Address	UTM Easting	UTM Northing
AAR AIRCRAFT	2825 W PERIMETER	559899	4397801
ADMIRAL PETROLEUM	8755 CRAWFORDSVILLE RD	560299	4398200
ALLISON TRANSMISSION	4700 W 10TH ST	565099	4403800
ATD OF GM	2840 FORTUNE CIRCLE W , STE A	563299	4397801
BELL MORTUARY	2230 W WASHINGTON	568499	4402201
BELMONT WWTP	2700 S BELMONT AVE.	569099	4398601
BHMM ENERGY	2825 W PERIMETER	559899	4397801
BIOSTORAGE TECHNOLOGIES	2655 FORTUNE CIRCLE W	563299	4397801
CARGILL	1730 WEST MICHIGAN STREET	569099	4403201
CELLCO PARTNERSHIP	1645 MIDWEST BLVD	559899	4404401
CENTRAL INDIANA TIRE	1051 LA CLEDE ST	564899	4400801
CITIZENS THERMAL ENERGY	366 KENTUCKY AVE	571299	4401601
CLARIAN LAB	360 W 11TH ST	571499	4404001
COVANTA	2320 SOUTH HARDING STREET	569699	4398601
CUMMINS CROSSPOINT	3621 W MORRIS	566699	4400401
D.E. BAUGH COMPANY	1661 W 16TH ST	569299	4404801
DARLING INTERNATIONAL	700 W. SOUTHERN AVE.	570899	4398201
DORSEY PAVING INC	2102 SOUTH HARDING STREET	569699	4399201
E & B PAVING INC.	4350 S. HARDING ST.	569699	4395001
ELI LILLY	307 E MCCARTY	572299	4401201
ELI LILLY	1555 SOUTH HARDING ST	569699	4399801
ELI LILLY	2800 S HIGH SCHOOL	562899	4397601
FED EX CORP	6648 S PERIMETER RD	559399	4394402
FOUNTAIN TRUCK	2770 BLUFF RD	571299	4398000
GENERAL CABLE	7950 ROCKVILLE RD.	559700	4402001
HANGAR, LLC	7739 CROSSWIND	560299	4398200
HAWKER BEECHCRAFT	6821 PIERSON DR	561699	4398801
HEBREW NATIONAL	602 W. RAY ST.	571099	4401001
HENRY CO	4351 W MORRIS ST	565699	4400400
HERITAGE ENVIRONMENTAL	7901 WEST MORRIS STREET	559899	4400201
HH SUMCO INC	1351 S GIRLS SCHOOL RD	560899	4400001
IAT LLC	4760 KENTUCKY AVE	563099	4394801
IDM	2825 W PERIMETER	559899	4397801
IMAGEMARK	1400 S SENATE	571499	4400201
INDIANA MEMORIAL	3562 W 10TH ST	566699	4403801
INDPLS ARTCC	2500 S HIGH SCHOOL RD	562499	4398201
INDPLS METAL CENTER	340 WHITE RIVER PKWY W DR S	570699	4401601
INDUSTRIAL ANODIZING	1610 WEST WASHINGTON STREET	569299	4402401
INDUSTRIAL COATINGS	1102 W 16TH ST	570099	4404801
INDY RAILWAY SERVICE	6111 W. HANNA AVE.	562899	4395401
INDY TELCOM CENTER	733 W HENRY	570899	4401601
INSITUFORM TECHNOLOGOIES	2130 STOUT FIELD W DR	565699	4399001
IPALCO - STOUT	3700 SOUTH HARDING STREET	569699	4396201
JACKSON OIL	1970 KENTUCKY AVE	569099	4399201
KOCOLONE	9042 W WASHINGTON	558300	4398200
LEVEL 3 COMMUNICATIONS	1902 S EAST ST	572899	4399601
LONESTAR INDUSTRIES, INC	1112 W THOMPSON RD	570299	4394001

Source Name	Address	UTM Easting	UTM Northing
MAACO	511 E WERGES AVE	572898	4396801
MAGNODE CORP	4151 W WASHINGTON ST	565699	4401200
MAPLEHURST REMEDIATION	2929 S HOLT RD	566499	4397202
MARATHON PETROLEUM	255 N BELMONT	568699	4402601
MARATHON SPEEDWAY TERMINAL	1304 OLIN AVE	566299	4404201
MAR-ZANE PT. 16	2605 KENTUCKY AVENUE	567899	4398001
MCI TELECOMMUNICATIONS	720 W HENRY ST	570899	4401601
METAL DYNAMICS	1800 S HOLT RD	566300	4399401
METALWORKING LUBRICANTS	1509 S. SENATE AVE.	571499	4400201
METHODIST HOSPITAL	1701 NORTH SENATE AVENUE	571699	4404601
MICRONUTRIENTS	1550 RESEARCH WAY	560299	4399601
MILESTONE CONTRACTORS	4202 S HARDING ST	569699	4395201
NATIONAL STARCH	1515 S DROVER ST	570499	4400001
NWS FORECASTING	6900 W HANNA	561699	4395401
PARTS CLEANING TECHNOLOGY	2263 DISTRIBUTORS DRIVE	563499	4398601
PEERLESS PUMP CO.	2005 DR. MARTIN LUTHER KING JR	571099	4405201
PET HEAVEN	5901 CRAWFORDSVILLE	563100	4405601
PRAXAIR SURFACE TECHNOLOGY	1500 POLCO STREET	565499	4404401
PREMCOR REFINING	3200 KENTUCKY	565699	4396601
QUEMETCO, INC.	7870 W. MORRIS STREET	559899	4400201
QWEST HENRY	731 WEST HENRY STREET	570899	4401601
QWEST KENTUCKY	550 KENTUCKY AVENUE	570899	4401601
REPUBLIC SERVICES	832 LANGSDALE AVE	570900	4405601
REXNORD LINK BELT	7601 ROCKVILLE RD	560299	4402001
RIETH-RILEY PLANT #325	2605 SOUTH KENTUCKY AVENUE	567899	4398001
ROLLS-ROYCE	5601 FORTUNE CIRCLE S SUITE I	563699	4397201
ROLLS-ROYCE CORP	2355 S TIBBS AVE.	567099	4398601
RYDER TRUCK RENTAL	1340 S MADISON	572499	4400400
SENSIENT FLAVORS	5600 WEST RAYMOND STREET	563899	4398801
SHOREWOOD PACKAGING	620 S BELMONT AVE	568899	4401600
SIMS CABINET COMPANY	431 N HOLMES	568099	4403001
SOUTHSIDE LANDFILL	2561 KENTUCKY AVENUE	568099	4398201
SPEEDWAY WWTP	4251 W VERMONT ST	565699	4402801
STEWART WARNER	1514 S DROVER ST	570499	4400001
SUPERIOR OIL COMPANY	400 WEST REGENT ST.	571499	4399001
TARGET DISTRIBUTION	7551 W MORRIS	560499	4400401
TIN-INLAND PAPERBOARD	7536 MILES DR.	560499	4399600
TIN-INLAND STOUT FD	2135 STOUT FIELD DRIVE EAST	568700	4401801
USPS AIR HUB	2475 S HOFFMAN RD	559499	4398201
UTC	7310 W MORRIS	560899	4400401
VA HOSPITAL	1481 W 10TH ST	569499	4403800
VALSPAR INDUSTRIES	546 W ABBOTT STREET	571299	4401400
VERTELLUS	1500 SOUTH TIBBS AVENUE	567099	4399801
WILLIAN HERMANN AND SONS	1135 S PENNSYLVANIA	572299	4400600
WILLOUGHBY INDUSTRIES	1610 S GIRLS SCHOOL RD	560899	4399600
WOOD MIZER	8180 W 10TH ST	559500	4403601

Source Name	Address	UTM Easting	UTM Northing
Amoco	4906 Kentucky	562700	4394201
Badesha Bros	3759 W Washington	566499	4401600
Century Marathon	7350 W Washington	560699	4399200
Circle K	6302 W Washington	562500	4400001
Circle K	6402 W 10th	562299	4403601
Circle K	2610 N High School	562499	4406201
Citgo	14 Beachway Dr	562499	4402001
Clark Oil	1405 S Holt	566300	4400001
Convenient Food Mart	9100 W 10th	558099	4403601
Flying J	1720 W Thompson	569299	4394001
G & G Citgo	2801 Holt	566499	4397601
Gas America	6470 W 10th	562099	4403601
Joe's Junction	2210 Kentucky	568699	4398801
KPS Food Mart	1541 W Thompson	558099	4403601
Mr. Fuel	4610 S Harding	569700	4394800
Par Petroleum	5208 W 10th	564300	4403800
Phillips 66	2411 W 16th	568300	4404601
Pilot Travel Center	4607 S Harding	569700	4394600
Shell	1201 S Holt	562700	4394201
Shell	4887 Kentucky	567499	4404600
Shell	3060 W 16th	566300	4400401
Silver Express	8328 W 10th St	559299	4403600
Speedway	2954 S Holt	563500	4395200
Speedway	3250 W Morris	562499	4402001
Speedway	2601 S Lyndhurst	564299	4402201
Speedway	1205 S Lyndhurst	565300	4396401
Speedway	4610 Kentucky	561099	4402000
Speedway	6302 Rockville Rd	565699	4403801
Speedway	75 N Lyndhurst	560900	4403601
Speedway	3535 Kentucky	565299	4404601
Speedway	7169 Rockville Rd	567699	4403001
Speedway	4155 W 10th	569699	4402401
Speedway	7270 W 10th	571299	4401601
Speedway	4743 W 16th	566499	4397202
Speedway	10908 E US 36	567299	4400401
Speedway	1404 W Washington	564299	4398001
Speedway	401 Kentucky	564299	4400401
Sunoco	9042 W Washington	558300	4398200
Super Seven	8310 Rockville	559300	4402001
Super Stop Indiana	982 N Tibbs	567099	4403801
Swiftly	7073 W Washington	561299	4399400
Swiftly	4725 Kentucky	563099	4394801
Thorton's	5310 W 10th St	564099	4403801
Thorton's	5760 Crawfordsville	563299	4405601
Village Pantry	3139 Kentucky	565900	4396801
Village Pantry	2030 W Washington	568899	4402201

Source Name	Address	UTM Easting	UTM Northing
B & M Body Shop	4839 W Morris	564899	4400401
Church Brothers	135 W McCarthy	571899	4401201
Collision solutions	3855 Rockville Rd	566099	4401801
Crash Doctor	7105 Girls School Rd	561299	4400001
DJ's Auto Body	5811 W Morris	563299	4400401
Duke Gold Collision	1935 W 16th	568899	4404800
El Catracho Body	2640 W 10th	568099	4403801
Golden Chassis Auto Body	1100 Main St	564899	4404001
Howellco Paint and Body	1755 Country Club	559299	4404601
Indy Body Werks	5244 Crawfordsville	564099	4405001
K & C Collision Center	9012 W Washington	558300	4398200
National Car Rental	7111 W Washington	561099	4399401
PMT Auto Service	2323 W 10th	568499	4403801
Recycled Auto parts	7524 W Washington	560699	4399200
Reynolds Body Shop	4325 W Washington	565299	4401200
Ron & Sons Collision	4002 Bluff	571099	4395601
Shafer's Collision	10690 E US 36	567498	4402802
Speedway Body Shop	2534 W 16th	568099	4404601
Team Enterprise	2996 Bluff	571298	4397401

Source Name	Address	UTM Easting	UTM Northing
Carriage Cleaners	8336 W 10th St	559299	4403600
Deering Cleaners	6137 Crawfordsville	562699	4406000
Fabric Care Center	5760 W Morris	563499	4400401
Family Cleaners	8204 Rockville Rd	559499	4402001
Milto Cleaners	4897 Kentucky	562899	4394401
Neff Cleaners	3904 Rockville Rd	566099	4401801
P & J Cleaners	1340 Main St	564899	4404201
Q Cleaners	5945 Crawfordsville	563100	4405601
Sparkle Cleaners	3358 W 16th St	567099	4404601
Tuchman Cleaners	7335 W 10th St	560900	4403601

Source Name	Idle Time (minutes)	Address	UTM Easting	UTM Northing
ABF FREIGHT SYSTEM	NO IDLE	1260 TERMINAL RD	570099	4395000
ACTIVAIR, INC	5	2910 FORTUNE CIRCLE W #B	563299	4397201
AFC WORLDWIDE	5	5717 W MINNESOTA	563499	4399601
AIR ROAD EXPRESS	5	3150 CHIEF LN	563499	4396801
ALLSTATES WORLDCARGO	5	2346 S LYNHURST DR # 603	564299	4398600
ALVAN MOTOR FREIGHT	5	1235 TERMINAL RD	570300	4395001
AREA TRANSPORTATION	5	2515 S HOLT RD	566299	4398001
B & B LOGISTICS	5	2346 S LYNHURST DR #201F	564299	4398600
BAX GLOBAL	5	6425 AIRWAY DR	562299	4395601
BDP INTERNATIONAL, INC	5	5601 FORTUNE CIRCLE S #N	563699	4397201
BERRY , INC	5	1231 W TROY	569899	4397402
BRIDGE TERMINAL	5	3274 S HARDING	569699	4396801
C & A EXPRESS	5	1002 W HANNA	570500	4395801
CAL TRANS	5	1428 W HENRY ST	569700	4401601
CARGO SERVICES	NO IDLE	7640 MILES DR	560299	4399400
CARTER TRUCK LINES	5	2462 S WEST ST.	571299	4398401
CENTRAL TRANSPORT	NO IDLE	4409 W MORRIS ST	565299	4400400
CERTIFIED TRANSPORT	5	2415 W THOMPSON RD	568499	4394001
COVENANT TRANSPORT	5	2350 S BELMONT	569099	4398601
DHL GLOBAL FORWARDING	5	3902 HANNA CIRCLE	563499	4395601
EF TRANSIT	5	4515 STOUT FIELD SOUTH DRIVE	565300	4398601
EH HAMILTON TRUCKING	15	2612 W MORRIS ST	568100	4400401
ESTES EXPRESS LINES	10	4209 W MORRIS ST	565699	4400200
FED EX FREIGHT	5	4750 DECATUR BLVD	561699	4394201
FIRST STUDENT BUS	60	1702 S BELMONT	568899	4399601
FORWARD AIR, INC	5	4711 W MORRIS ST	565099	4400401
FOUR STAR TRANSPORTATION	5	5723 DIVIDENDS ROAD	563499	4399201
FRONTIER TEMPERATURE	NO IDLE	1560 W RAYMOND	569499	4399001
FRONTIER TRANSPORT	NO IDLE	1560 W RAYMOND	569499	4399001
HARVEY'S MACHINERY	5	6302 S BELMONT	568899	4392001
HINER TRANSPORT	5	4401 S HARDING	569699	4395001
HOGAN TRANSPORT	NO IDLE	4501 W BRADBURY	565299	4398201
IFS OF INDIANA	NO IDLE	1840 EXECUTIVE	563900	4399402
INTERSTATE CARRIER	5	811 W TROY	571099	4397401
JET LOGISITICS	5	2503 LAMBERT ST	568298	4400401
KNIGHT TRANSPORTATION	NO IDLE	3702 W MINNESOTA	566699	4399601
KUEHNE & NAGEL	NO IDLE	1810 S LYNHURST DR #A	564299	4399400
L D LEASING	5	1414 S WEST ST	571299	4400200
LANDSTAR SYSTEMS	5	1644 W EDGEWOOD	569499	4392401
LINKS, INC	NO IDLE	3902 HANNA CIRCLE #E	563499	4395601
MCKNIGHT TRUCKING	5	939 W TROY	570699	4397401
MCS TRUCKING	NO IDLE	1414 W HANNA	569899	4395801
MEL TAR LEASING	5	3830 HANNA CIRCLE	563499	4395801
MID STATES EXPRESS	5	5751 DIVIDENDS ROAD	563499	4399201
MILAN EXPRESS	7	3103 W MORRIS ST	567499	4400401
MORGAN SOUTHERN	5	1045 W SUMNER	570300	4396600

Source Name	Idle Time (minutes)	Address	UTM Easting	UTM Northing
NIPPON EXPRESS	NO IDLE	3830 HANNA CIRCLE #D	563499	4395801
OLD DOMINION	5	3915 W MORRIS ST	566099	4400400
PANALPINA	5	2431 DIRECTORS ROW	563100	4398201
PHEONIX INTERNATIONAL	5	2655 FORTUNE CIRCLE W #D	563299	4397801
PUTNAM TRUCK	NO IDLE	1401 W RAY ST	569699	4401000
R & S TRANSPORT	5	7350 W WASHINGTON	560699	4399200
ROADRUNNER DAWES	30	2506 S CALIFORNIA	571099	4398402
ROADWAY EXPRESS	5	2530 S TIBBS	567299	4398001
SHAMROCK TRANSPORTATION	5	1151 W THOMPSON	570100	4394001
SODREL TRUCKING	NO IDLE	1254 S WEST ST	571299	4400401
SOUTHWESTERN TRANSPORT	5	2501 W MORRIS ST	568299	4400600
SPEARS ENTERPRISE	NO IDLE	610 W TROY	570899	4397401
STOOPS FREIGHTLINER	5	1631 W THOMPSON RD	569499	4394000
TENNESSEE TRUCKING	NO IDLE	350 KANSAS ST	571499	4400601
TOM JOY & SONS	5	2715 S HOLT ROAD	566499	4397801
TOM THOMPSON TRUCKING	5	3745 FARNSWORTH	566499	4397601
TOWNE AIR FREIGHT	5	6430 AIRWAY DR	562299	4395801
UNDERWOOD TRANSPORT	15	940 W TROY	570699	4397401
UNIVERSAL TRANSPORTATION	5	2346 S LYNHURST #100	564299	4398600
UNIVERSAL TRANSPORTATION	5	2162 W EPLER AVE	568899	4393201
UPS FREIGHT	5	3747 W MORRIS ST	566499	4400400
VENTURE LOGISITCS	5	1101 HARDING CT	570299	4394600
VITRAN EXPRESS	NO IDLE	1600 OLIVER	569299	4401401
WERNER ENTERPRISES	5	2444 S WEST ST	571298	4398601
YELLOW TRANSPORTATION	10	1818 S HIGH SCHOOL ROAD	562499	4399200

Appendix C

Total Modeled Emissions

CAS	Modeled Pollutant	Total Modeled Emissions (TPY)
7647010	Hydrogen chloride (Hydrochloric acid)	970.8
7664939	Sulfuric Acid	530
7664417	Ammonia	385
108883	Toluene	366.6
71432	Benzene	150.9
1330207	Xylene (Total)	128.4
50000	Formaldehyde	95.8
7664393	Hydrogen Fluoride	61.5
110543	Hexane	33.7
79016	Trichloroethene	20.4
127184	Tetrachloroethene	17.4
1120214	Undecane	12.4
107028	Acrolein	11.8
110805	Cellosolve Solvent	11.3
115071	Propylene	11.2
75070	Acetaldehyde	10.7
74851	Ethylene	9.7
7440473	Chromium compounds	5.9
74839	Methyl bromide (Bromomethane)	5.7
7440020	Nickel	5.5
75058	Acetonitrile	5.4
7439921	Lead compounds	5.1
100425	Styrene	4.9
75343	Dichloroethane 1,1-	4.5
75092	Methylene chloride	4
67561	Methanol	3.7
75354	Dichloroethene 1,1- (Vinylidene Chloride)	3.6
156592	Dichloroethene, cis-1,2-	3.6
106990	Butadiene	3.5
100414	Ethylbenzene	3.3
540841	Trimethyl pentane, 2-2-4	3.1
78933	Methyl ethyl ketone (2-Butanone)	3
7782492	Selenium	2.5
75183	Dimethyl Sulfide	2.4
7440484	Cobalt Compounds	2.3
57125	Cyanide Compounds	2.3
75014	Vinyl chloride	2.2
7439965	Manganese Compounds	2.1
95501	Dichlorobenzene, 1,2-	1.8
7440439	Cadmium compounds	1.8
91203	Naphthalene	1.5
67663	Chloroform (Trichloromethane)	1.4
107131	Acrylonitrile	1.4
75003	Chloroethane	1.3
56235	Carbon tetrachloride	1.3
112403	Dodecane	1.3
108101	Methyl isobutyl ketone	1.3
67641	Acetone	0.92

CAS	Modeled Pollutant	Total Modeled Emissions (TPY)
110827	Cyclohexane	0.83
80626	Methyl Methacrylate	0.8
50328	Benzo(a)pyrene	0.75
71556	Trichloroethane, 1,1,1-	0.7
107211	Ethylene Glycol	0.64
7723140	Phosphorous-P	0.61
123864	Butyl Acetate	0.58
124185	Decane	0.54
121448	Triethylamina	0.53
78591	Isophorone	0.46
117817	Ethylhexyl phthalate, bis-2-	0.4
110861	Pyridine	0.37
132649	Dibenzofuran	0.35
95636	Trimethyl benzene, 1-2-4	0.35
13463677	Titanium Dioxide	0.32
7440508	Copper Compounds	0.3
64741668	Naphtha	0.29
25167673	Butene	0.27
7440382	Arsenic Compounds	0.23
123739	Crotonaldehyde	0.19
109660	Pentane	0.18
71363	N-butyl Alcohol	0.17
7440360	Antimony compounds	0.17
108952	Phenol	0.16
75150	Carbon disulfide	0.14
78922	Sec-butyl alcohol	0.14
142290	Cyclopentene	0.12
123386	Propionaldehyde	0.12
7439976	Mercury (elemental)	0.11
74862	Acetylene	0.11
108907	Chlorobenzene	0.09
7440666	Zinc	0.09
142825	Heptane	0.07
8052413	Stoddard Solvent	0.06
18540299	Chromium, hexavalent	0.06
108872	Methylcyclohexane	0.06
107062	Dichloroethane, 1,2- (Ethylene Dichloride)	0.06
117840	Di-n-octylphthalate	0.06
7783064	Hydrogen Sulfide	0.05
98828	Cumene (Isopropylbenzene)	0.04
67630	Isopropanol	0.04
75252	Bromoform (Tribromomethane)	0.03
78875	Dichloropropane, 1,2-	0.03
100447	Benzyl chloride	0.03
1634044	Methyl tert-butyl ether	0.03
79107	Acrylic Acid	0.03
75569	Propylene Oxide	0.03
98862	Acetophenone	0.02

CAS	Modeled Pollutant	Total Modeled Emissions (TPY)
68122	Dimethyl Formamide	0.02
62533	Aniline	0.02
103231	Bis (2-ethylhexyl) Adipate	0.02
7440417	Beryllium compounds	0.02
92524	Biphenyl	0.01
74997	Methyl Acetylene	0.01
85018	Phenanthrene	0.009
7440393	Barium	0.008
111422	Diethanolamine	0.008
84742	Di-n-butyl phthalate	0.008
108054	Vinyl acetate	0.007
121142	Dinitrotoluene, 2,4-	0.004
87683	Hexachloro-1,3-butadiene (Perchlorobutadiene)	0.003
96128	Dibromo-3-chloropropane, 1,2-	0.003
7440622	Vanadium	0.002
206440	Fluoranthene	0.001
287923	Cyclopentane	0.001
86737	Fluorene	0.001
100527	Benzaldehyde	0.0009
111466	Diethylene Glycol	0.0008
95534	Toluidine, o-	0.0006
83329	Acenaphthene	0.0006
120127	Anthracene	0.0005
129000	Pyrene	0.0005
123728	Butyraldehyde	0.0005
56553	Benzo(a)anthracene	0.0004
218019	Chrysene	0.0003
98884	Benzoyl Chloride	0.0003
205992	Benzo(b)fluoranthene	0.0003
131113	Dimethyl phthalate	0.0003
193395	Indeno(1,2,3-cd) pyrene	0.0002
40321764	PentaCDD, 1,2,3,7,8-	0.0002
123911	Dioxane, 1,4-	0.0002
207089	Benzo(k)fluoranthene	0.0002
53703	Dibenz(a,h)anthracene	0.0002
95487	Cresol, o-	0.00008
7439987	Molybdenum	0.00006
120821	Trichlorobenzene, 1,2,4-	0.00005
822060	Hexamethylene-1,6-diisocyanate	0.00003
51207319	TetraCDF, 2,3,7,8-	0.0000026
57117416	PentaCDF, 1,2,3,7,8-	0.00000062
1746016	TetraCDD, 2,3,7,8-	0.0000004
	Total	2932.2

Appendix D

Raw Monitoring Data

Contents

VOC Monitoring Results
Carbonyl Monitoring Results
Metals Monitoring Results

Harding Street Carbonyl Raw Data (ppbv)

Pollutant	2,5-Dimethylbenzaldehyde		Acetaldehyde		Acetone		Benzaldehyde		Butyraldehyde		Crotonaldehyde		Formaldehyde		Hexaldehyde		Isovaleraldehyde		Propionaldehyde		Tolualdehydes		Valeraldehyde	
CAS	5779-94-2		75-07-0		67-64-1		100-52-7		123-72-8		123-73-9		50-00-0		66-25-1		590-86-3		123-38-6		NA		110-62-3	
MW	134.1774		44.053		58.0798		106.1238		72.1066		70.0908		30.0262		100.16		86.13		58.08		120.15		86.13	
Date	Reading	Detection Limit	Reading	Detection Limit	Reading	Detection Limit	Reading	Detection Limit	Reading	Detection Limit	Reading	Detection Limit	Reading	Detection Limit	Reading	Detection Limit	Reading	Detection Limit	Reading	Detection Limit	Reading	Detection Limit	Reading	Detection Limit
10/2/2006	ND	0.003	1.300	0.014	1.800	0.022	0.052	0.006	0.181	0.004	0.203	0.004	3.130	0.016	0.119	0.005	ND	0.004	0.141	0.005	0.082	0.008	0.078	0.004
10/8/2006	ND	0.003	2.330	0.014	5.060	0.022	0.102	0.006	0.350	0.004	0.141	0.004	3.530	0.016	0.108	0.005	0.145	0.004	0.325	0.005	0.099	0.008	0.100	0.004
10/14/2006	ND	0.003	0.840	0.014	1.590	0.022	0.048	0.006	0.091	0.004	0.053	0.004	1.780	0.016	0.047	0.005	ND	0.004	0.110	0.005	0.055	0.008	0.051	0.004
10/20/2006	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID
10/26/2006	ND	0.004	1.270	0.021	6.280	0.033	0.044	0.009	0.148	0.007	0.065	0.006	1.950	0.024	0.112	0.008	ND	0.006	0.169	0.008	0.119	0.012	0.062	0.005
11/1/2006	ND	0.003	0.883	0.014	1.230	0.022	0.036	0.006	0.096	0.004	0.044	0.004	1.490	0.016	0.041	0.005	ND	0.004	0.101	0.005	0.045	0.008	0.037	0.004
11/7/2006	ND	0.003	0.860	0.014	5.700	0.022	0.038	0.006	0.122	0.004	0.052	0.004	1.340	0.016	0.041	0.005	ND	0.004	0.123	0.005	0.045	0.008	0.044	0.004
11/13/2006	ND	0.003	0.703	0.014	3.050	0.022	0.039	0.006	0.090	0.004	0.050	0.004	1.080	0.016	0.031	0.005	ND	0.004	0.088	0.005	0.068	0.008	0.033	0.004
11/19/2006	ND	0.003	0.579	0.014	0.089	0.022	0.033	0.006	0.091	0.004	0.044	0.004	1.200	0.016	0.031	0.005	ND	0.004	0.885	0.005	0.037	0.008	0.039	0.004
11/25/2006	ND	0.003	1.750	0.014	3.530	0.022	0.084	0.006	0.227	0.004	0.105	0.004	3.290	0.016	0.085	0.005	0.027	0.004	0.223	0.005	0.070	0.008	0.085	0.004
12/1/2006	ND	0.003	0.718	0.014	0.985	0.022	0.036	0.006	0.072	0.004	0.040	0.004	1.390	0.016	0.035	0.005	ND	0.004	0.086	0.005	0.059	0.008	0.033	0.004
12/7/2006	ND	0.003	0.610	0.014	0.845	0.022	0.033	0.006	0.088	0.004	0.039	0.004	0.879	0.016	0.035	0.005	ND	0.004	0.093	0.005	0.033	0.008	0.048	0.004
12/13/2006	ND	0.003	0.899	0.014	2.120	0.022	0.037	0.006	0.137	0.004	0.052	0.004	1.420	0.016	0.043	0.005	ND	0.004	0.137	0.005	0.092	0.008	0.035	0.004
12/19/2006	ND	0.003	1.140	0.014	1.710	0.022	0.067	0.006	0.134	0.004	0.074	0.004	2.130	0.016	0.039	0.005	ND	0.004	0.131	0.005	0.074	0.008	0.043	0.004
12/25/2006	ND	0.003	0.570	0.014	1.050	0.022	0.047	0.006	0.090	0.004	0.037	0.004	0.892	0.016	0.034	0.005	ND	0.004	0.082	0.005	0.040	0.008	0.029	0.004
12/31/2006	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID
1/6/2007	ND	0.003	0.680	0.014	0.960	0.022	0.035	0.006	0.094	0.004	0.043	0.004	1.120	0.016	0.028	0.005	ND	0.004	0.083	0.005	0.042	0.008	0.031	0.004
1/12/2007	ND	0.005	0.595	0.011	1.040	0.020	0.034	0.003	0.078	0.006	0.050	0.006	1.300	0.027	0.039	0.004	ND	0.004	0.091	0.005	0.055	0.010	0.035	0.006
1/18/2007	ND	0.005	0.600	0.011	1.450	0.020	0.041	0.003	0.080	0.006	0.041	0.006	1.010	0.027	0.024	0.004	ND	0.004	0.067	0.005	0.033	0.010	0.024	0.006
1/24/2007	ND	0.005	0.799	0.011	1.190	0.020	0.037	0.003	0.089	0.006	0.046	0.006	1.160	0.027	0.021	0.004	ND	0.004	0.092	0.005	0.041	0.010	0.028	0.006
1/30/2007	ND	0.005	0.631	0.011	0.667	0.020	0.034	0.003	0.072	0.006	0.043	0.006	0.895	0.027	0.024	0.004	ND	0.004	0.080	0.005	0.088	0.010	0.026	0.006
2/5/2007	ND	0.005	0.677	0.011	0.640	0.020	0.030	0.003	0.082	0.006	0.048	0.006	1.160	0.027	0.023	0.004	ND	0.004	0.091	0.005	0.028	0.010	0.034	0.006
2/11/2007	ND	0.006	1.030	0.006	1.880	0.027	0.043	0.004	0.138	0.004	0.067	0.005	1.830	0.011	0.032	0.020	ND	0.003	0.133	0.005	0.039	0.010	0.049	0.006
2/17/2007	ND	0.005	0.851	0.011	4.280	0.020	0.034	0.003	0.104	0.006	0.046	0.006	1.570	0.027	0.033	0.004	ND	0.004	ND	0.005	0.036	0.010	0.047	0.006
2/23/2007	ND	0.005	0.971	0.011	1.270	0.020	0.041	0.003	0.097	0.006	0.050	0.006	1.620	0.027	0.052	0.004	ND	0.004	0.107	0.005	0.040	0.010	0.040	0.006
3/1/2007	ND	0.005	0.901	0.011	4.520	0.020	0.030	0.003	0.143	0.006	0.050	0.006	1.680	0.027	0.044	0.004	0.035	0.004	ND	0.005	0.026	0.010	0.047	0.006
3/7/2007	ND	0.005	0.744	0.011	1.420	0.020	0.040	0.003	0.127	0.006	0.048	0.006	1.220	0.027	0.028	0.004	0.022	0.004	0.113	0.005	0.048	0.010	0.040	0.006
3/13/2007	ND	0.005	1.290	0.011	2.580	0.020	0.050	0.003	0.148	0.006	0.085	0.006	3.280	0.027	0.062	0.004	0.033	0.004	0.205	0.005	0.054	0.010	0.060	0.006
3/19/2007	ND	0.005	0.846	0.011	2.660	0.020	0.043	0.003	0.105	0.006	0.051	0.006	1.550	0.027	0.037	0.004	ND	0.004	0.121	0.005	0.040	0.010	0.037	0.006
3/25/2007	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID
3/31/2007	ND	0.005	1.100	0.011	0.159	0.020	0.032	0.003	0.142	0.006	0.063	0.006	2.120	0.027	0.055	0.004	ND	0.004	5.540	0.005	0.028	0.010	0.060	0.006
4/6/2007	ND	0.005	0.727	0.011	1.130	0.020	0.024	0.003	0.080	0.006	0.034	0.006	1.370	0.027	0.027	0.004	ND	0.004	0.099	0.005	0.047	0.010	0.031	0.006
4/12/2007	ND	0.005	0.547	0.011	1.050	0.020	0.022	0.003	0.074	0.006	0.037	0.006	1.300	0.027	0.027	0.004	ND	0.004	0.109	0.005	0.026	0.010	0.027	0.006
4/18/2007	ND	0.005	0.862	0.011	1.930	0.020	0.035	0.003	0.152	0.006	0.040	0.006	1.880	0.027	0.042	0.004	ND	0.004	0.138	0.005	0.059	0.010	0.069	0.006
4/24/2007	ND	0.005	1.230	0.011	2.890	0.020	0.044	0.003	0.160	0.006	0.061	0.006	2.670	0.027	0.080	0.004	0.042	0.004	0.198	0.005	0.030	0.010	0.047	0.006
4/30/2007	ND	0.005	1.290	0.011	2.560	0.020	0.047	0.003	0.127	0.006	0.124	0.006	3.340	0.027	0.047	0.004	ND	0.004	0.200	0.005	0.091	0.010	0.077	0.006
5/6/2007	ND	0.005	0.859	0.011	1.550	0.020	0.021	0.003	0.092	0.006	0.035	0.006	1.830	0.027	0.031	0.004	ND	0.004	0.127	0.005	0.027	0.010	0.037	0.006
5/12/2007	ND	0.005	1.280	0.011	2.390	0.020	0.052	0.003	0.140	0.006	0.092	0.006	2.900	0.027	0.071	0.004	ND	0.004	0.217	0.005	0.068	0.010	0.054	0.006
5/18/2007	ND	0.005	1.110	0.011	2.540	0.020	0.053	0.003	0.123	0.006	0.069	0.006	2.540	0.027	0.058	0.004	0.026	0.004	0.191	0.005	0.043	0.010	0.043	0.006
5/24/2007	ND	0.005	1.360	0.011	5.880	0.020	0.044	0.003	0.147	0.006	0.420	0.006	5.510	0.027	0.062	0.004	0.033	0.004	0.204	0.005	0.044	0.010	0.092	0.006
5/30/2007	ND	0.005	2.460	0.011	5.530	0.020	0.096	0.003	0.255	0.006	0.646	0.006	7.300	0.027	0.152	0.004	0.056	0.004	0.384	0.005	0.135	0.010	0.131	0.006
6/5/2007	ND	0.005	0.710	0.011	1.900	0.020	0.028	0.003	0.066	0.006	0.074	0.006	2.110	0.027	0.037	0.004	ND	0.004	0.095	0.005	0.059	0.010	0.033	0.006
6/11/2007	ND	0.005	1.360	0.011	3.140	0.020	0.033	0.003	0.158	0.006	0.101	0.006	3.480	0.027	0.044	0.004	0.022	0.004	0.189	0.005	0.049	0.010	0.058	0.006
6/17/2007	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID
6/23/2007	ND	0.005	1.570	0.011	2.500	0.020	0.039	0.003	0.158	0.006	0.137	0.006	3.080	0.027	0.057	0.004	0.054	0.004	0.130	0.005	0.042	0.010	0.039	0.006
6/29/2007	ND	0.005	0.956	0.011	1.810	0.020	0.039	0.003	0.122	0.006	0.134	0.006	2.710	0.027	0.033	0.004	ND	0.004	0.121	0.005	0.021	0.010	0.025	0.006
7/2/2007	ND	0.005	0.884	0.011	2.080	0.020	0.030	0.003	0.102	0.006	0.079	0.006	2.350	0.027	0.034	0.004	ND	0.004	0.141	0.005	0.025	0.010	0.040	0.006
7/5/2007	ND	0.005	1.000																					

Harding Street Carbonyl Raw Data (ppbv)

Pollutant	2,5-Dimethylbenzaldehyde		Acetaldehyde		Acetone		Benzaldehyde		Butyraldehyde		Crotonaldehyde		Formaldehyde		Hexaldehyde		Isovaleraldehyde		Propionaldehyde		Tolualdehydes		Valeraldehyde	
CAS	5779-94-2		75-07-0		67-64-1		100-52-7		123-72-8		123-73-9		50-00-0		66-25-1		590-86-3		123-38-6		NA		110-62-3	
MW	134.1774		44.053		58.0798		106.1238		72.1066		70.0908		30.0262		100.16		86.13		58.08		120.15		86.13	
Date	Reading	Detection Limit	Reading	Detection Limit	Reading	Detection Limit	Reading	Detection Limit	Reading	Detection Limit	Reading	Detection Limit	Reading	Detection Limit	Reading	Detection Limit	Reading	Detection Limit	Reading	Detection Limit	Reading	Detection Limit	Reading	Detection Limit
8/10/2007	ND	0.005	1.330	0.011	1.840	0.020	0.093	0.003	0.192	0.006	0.167	0.006	6.770	0.027	0.097	0.004	ND	0.004	0.173	0.005	0.067	0.010	0.055	0.006
8/16/2007	ND	0.005	1.970	0.011	1.790	0.020	0.096	0.003	0.214	0.006	0.755	0.006	10.400	0.027	0.096	0.004	ND	0.004	0.357	0.005	0.062	0.010	0.105	0.006
8/22/2007	ND	0.005	1.740	0.011	1.880	0.020	0.100	0.003	0.220	0.006	0.575	0.006	9.410	0.027	0.081	0.004	0.068	0.004	0.248	0.005	0.047	0.010	0.093	0.006
8/28/2007	ND	0.005	2.200	0.011	4.930	0.020	0.113	0.003	0.248	0.006	0.311	0.006	8.830	0.027	0.085	0.004	0.049	0.004	0.341	0.005	0.038	0.010	0.093	0.006
9/3/2007	ND	0.005	3.200	0.011	5.400	0.020	0.118	0.003	0.414	0.006	0.278	0.006	8.040	0.027	0.172	0.004	0.058	0.004	0.497	0.005	0.083	0.010	0.143	0.006
9/9/2007	ND	0.005	1.070	0.011	1.970	0.020	0.086	0.003	0.146	0.006	0.137	0.006	6.110	0.027	0.059	0.004	ND	0.004	0.129	0.005	0.162	0.010	0.054	0.006
9/15/2007	ND	0.005	0.752	0.011	1.480	0.020	0.034	0.003	0.107	0.006	0.060	0.006	2.900	0.027	0.041	0.004	ND	0.004	0.105	0.005	0.043	0.010	0.036	0.006
9/21/2007	ND	0.005	0.038	0.011	0.143	0.020	ND	0.003	ND	0.006	ND	0.006	0.067	0.027	ND	0.004	ND	0.004	ND	0.005	ND	0.010	ND	0.006
9/27/2007	ND	0.005	1.440	0.011	2.730	0.020	0.066	0.003	0.196	0.006	0.102	0.006	6.410	0.027	0.050	0.004	ND	0.004	0.146	0.005	0.068	0.010	0.049	0.006
10/3/2007	ND	0.005	1.590	0.011	3.090	0.020	0.071	0.003	0.257	0.006	0.237	0.006	8.520	0.027	0.103	0.004	0.021	0.004	0.194	0.005	0.068	0.010	0.062	0.006
10/9/2007	ND	0.005	0.903	0.012	2.010	0.021	0.030	0.003	0.086	0.006	0.100	0.007	2.590	0.028	0.038	0.004	ND	0.004	0.109	0.006	0.018	0.011	0.029	0.007
10/15/2007	ND	0.005	1.640	0.011	3.770	0.020	0.039	0.003	0.214	0.006	0.229	0.006	6.640	0.027	0.059	0.004	0.051	0.004	0.185	0.005	0.032	0.010	0.069	0.006
10/21/2007	ND	0.005	1.090	0.011	4.860	0.020	0.038	0.003	0.153	0.006	0.188	0.006	5.610	0.027	0.047	0.004	ND	0.004	0.122	0.005	0.026	0.010	0.048	0.006
10/27/2007	ND	0.005	0.684	0.011	1.350	0.020	0.030	0.003	0.062	0.006	0.038	0.006	2.940	0.027	0.028	0.004	ND	0.004	0.074	0.005	ND	0.010	0.023	0.006
11/2/2007	ND	0.005	2.270	0.011	3.590	0.020	0.115	0.003	0.242	0.006	0.108	0.006	4.090	0.027	0.068	0.004	ND	0.004	0.220	0.005	0.119	0.010	0.078	0.006
11/8/2007	ND	0.005	1.080	0.011	2.420	0.020	0.034	0.003	0.144	0.006	0.048	0.006	2.320	0.027	0.038	0.004	ND	0.004	0.101	0.005	ND	0.010	0.029	0.006
11/14/2007	ND	0.005	0.890	0.011	1.740	0.020	0.032	0.003	0.085	0.006	0.039	0.006	3.560	0.027	0.038	0.004	ND	0.004	0.106	0.005	0.034	0.010	0.026	0.006
11/20/2007	ND	0.005	1.070	0.011	2.140	0.020	0.038	0.003	0.124	0.006	0.056	0.006	4.770	0.027	0.033	0.004	ND	0.004	0.123	0.005	ND	0.010	0.052	0.006
11/26/2007	ND	0.005	0.662	0.011	1.340	0.020	0.019	0.003	0.039	0.006	0.036	0.006	2.050	0.027	0.026	0.004	ND	0.004	0.067	0.005	0.049	0.010	0.022	0.006
12/2/2007	ND	0.005	0.832	0.011	2.100	0.020	0.033	0.003	0.125	0.006	0.061	0.006	2.840	0.027	0.030	0.004	ND	0.004	0.096	0.005	0.029	0.010	0.025	0.006
12/5/2007	ND	0.005	0.910	0.011	1.310	0.020	0.040	0.003	0.074	0.006	0.064	0.006	2.260	0.027	0.033	0.004	ND	0.004	0.125	0.005	0.048	0.010	0.025	0.006
12/8/2007	ND	0.005	0.898	0.011	1.230	0.020	0.032	0.003	0.064	0.006	0.041	0.006	2.070	0.027	0.029	0.004	ND	0.004	0.146	0.005	0.051	0.010	0.029	0.006
12/14/2007	ND	0.005	0.710	0.011	1.010	0.020	0.026	0.003	0.057	0.006	0.038	0.006	2.210	0.027	0.025	0.004	ND	0.004	0.134	0.005	0.031	0.010	0.027	0.006
12/20/2007	ND	0.005	1.320	0.011	2.290	0.020	0.033	0.003	0.146	0.006	0.044	0.006	2.620	0.027	0.025	0.004	0.044	0.004	0.144	0.005	0.032	0.010	0.049	0.006
12/26/2007	ND	0.005	1.490	0.011	2.460	0.020	0.054	0.003	0.147	0.006	0.114	0.006	2.710	0.027	0.065	0.004	ND	0.004	0.249	0.005	0.072	0.010	0.038	0.006
1/1/2008	ND	0.005	0.707	0.011	0.898	0.020	ND	0.003	0.069	0.006	0.036	0.006	1.060	0.027	0.023	0.004	ND	0.004	0.149	0.005	0.035	0.010	0.037	0.006
1/7/2008	ND	0.005	0.675	0.011	1.270	0.020	0.028	0.003	0.061	0.006	0.039	0.006	3.750	0.027	0.026	0.004	ND	0.004	0.089	0.005	0.025	0.010	0.027	0.006
1/13/2008	ND	0.005	0.717	0.032	1.600	0.007	0.019	0.006	0.064	0.006	0.034	0.011	1.580	0.026	0.029	0.008	ND	0.006	0.089	0.008	0.018	0.007	0.062	0.007
1/19/2008	ND	0.005	0.606	0.011	0.688	0.020	ND	0.003	0.052	0.006	0.028	0.006	1.250	0.027	0.029	0.004	ND	0.004	0.093	0.005	0.039	0.010	ND	0.006
1/25/2008	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID
1/31/2008	ND	0.005	0.533	0.032	0.699	0.007	ND	0.006	0.052	0.006	0.031	0.011	1.060	0.027	0.021	0.008	ND	0.006	0.054	0.008	0.019	0.007	ND	0.007
2/6/2008	ND	0.005	0.891	0.032	1.450	0.007	0.027	0.006	0.055	0.006	0.035	0.011	2.220	0.027	0.033	0.008	ND	0.006	0.227	0.008	0.027	0.007	ND	0.007
2/12/2008	ND	0.005	0.904	0.032	1.150	0.007	0.037	0.006	0.069	0.006	0.048	0.011	1.760	0.027	0.042	0.008	ND	0.006	0.168	0.008	0.040	0.007	ND	0.007
2/18/2008	ND	0.005	0.896	0.032	0.812	0.007	0.021	0.006	0.056	0.006	0.030	0.011	2.070	0.027	0.028	0.008	ND	0.006	0.131	0.008	0.041	0.007	0.025	0.007
2/24/2008	ND	0.005	1.200	0.032	1.870	0.007	0.027	0.006	0.124	0.006	0.043	0.011	2.660	0.027	0.026	0.008	0.028	0.006	0.151	0.008	0.043	0.007	0.031	0.007
3/1/2008	ND	0.005	1.360	0.032	1.100	0.007	0.024	0.006	0.060	0.006	0.034	0.011	2.780	0.027	0.044	0.008	ND	0.006	0.161	0.008	0.036	0.007	0.025	0.007
3/4/2008	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID
3/7/2008	ND	0.005	0.819	0.031	1.220	0.007	0.025	0.006	0.091	0.006	0.031	0.011	2.630	0.026	0.020	0.008	ND	0.006	0.102	0.008	0.029	0.007	0.021	0.007
3/13/2008	ND	0.005	1.120	0.032	4.810	0.007	0.026	0.006	0.099	0.006	0.042	0.011	3.720	0.026	0.036	0.008	ND	0.006	0.125	0.008	0.036	0.007	0.057	0.007
3/19/2008	ND	0.005	0.663	0.032	1.350	0.007	0.032	0.006	0.045	0.006	0.032	0.011	2.200	0.026	0.053	0.008	ND	0.006	0.136	0.008	0.033	0.007	0.025	0.007
3/25/2008	ND	0.005	0.797	0.032	1.700	0.007	0.017	0.006	0.081	0.006	0.031	0.011	3.470	0.027	0.022	0.008	ND	0.006	0.110	0.008	0.042	0.007	0.023	0.007
3/31/2008	ND	0.005	0.717	0.032	4.130	0.007	0.035	0.006	0.072	0.006	0.040	0.011	3.180	0.027	0.043	0.008	ND	0.006	0.116	0.008	0.038	0.007	0.036	0.007
4/3/2008	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID
4/6/2008	ND	0.005	1.390	0.032	3.270	0.007	0.041	0.006	0.114	0.006	0.053	0.011	4.350	0.027	0.050	0.008	ND	0.006	0.196	0.008	0.034	0.007	0.041	0.007
4/16/2008	ND	0.005	0.903	0.031	3.130	0.007	0.034	0.006	0.072	0.006	0.043	0.011	3.670	0.026	0.034	0.008	ND	0.006	0.161	0.008	0.031	0.007	0.029	0.007
4/18/2008	ND	0.005	1.070	0.032	4.640	0.007	0.035	0.006	0.087	0.006	0.047	0.011	4.070	0.026	0.051	0.008	0.021	0.006	0.170	0.008	0.039	0.007	0.025	0.007
4/24/2008	ND	0.005	0.733	0.032	2.230	0.007	0.026	0.006	0.099	0.006	ND	0.011	2.420	0.027	0.032	0.008	ND	0.006	0.090	0.008	0.023	0.007	0.029	0.007
4/27/2008	ND	0.00																						

Harding Street Carbonyl Raw Data (ppbv)

Pollutant	2,5-Dimethylbenzaldehyde		Acetaldehyde		Acetone		Benzaldehyde		Butyraldehyde		Crotonaldehyde		Formaldehyde		Hexaldehyde		Isovaleraldehyde		Propionaldehyde		Tolualdehydes		Valeraldehyde	
CAS	5779-94-2		75-07-0		67-64-1		100-52-7		123-72-8		123-73-9		50-00-0		66-25-1		590-86-3		123-38-6		NA		110-62-3	
MW	134.1774		44.053		58.0798		106.1238		72.1066		70.0908		30.0262		100.16		86.13		58.08		120.15		86.13	
Date	Reading	Detection Limit	Reading	Detection Limit	Reading	Detection Limit	Reading	Detection Limit	Reading	Detection Limit	Reading	Detection Limit	Reading	Detection Limit	Reading	Detection Limit	Reading	Detection Limit	Reading	Detection Limit	Reading	Detection Limit	Reading	Detection Limit
5/30/2008	ND	0.005	1.670	0.032	4.720	0.007	0.055	0.006	0.200	0.006	0.235	0.011	5.320	0.027	0.080	0.008	ND	0.006	0.248	0.008	0.040	0.007	0.067	0.007
6/5/2008	ND	0.005	1.270	0.032	1.280	0.007	0.082	0.006	0.164	0.006	0.523	0.011	7.230	0.027	0.064	0.008	ND	0.006	0.221	0.008	0.166	0.007	0.038	0.007
6/11/2008	ND	0.005	1.790	0.032	4.160	0.007	0.065	0.006	0.179	0.006	0.223	0.011	6.160	0.027	0.068	0.008	ND	0.006	0.197	0.008	0.103	0.007	0.074	0.007
6/17/2008	ND	0.005	1.130	0.032	2.230	0.007	0.054	0.006	0.124	0.006	0.073	0.011	4.540	0.027	0.054	0.008	ND	0.006	0.147	0.008	0.047	0.007	0.051	0.007
6/23/2008	ND	0.005	0.994	0.032	2.080	0.007	0.042	0.006	0.066	0.006	0.069	0.011	4.280	0.027	0.046	0.008	ND	0.006	0.166	0.008	0.037	0.007	0.031	0.007
6/29/2008	ND	0.005	1.050	0.032	2.090	0.007	0.047	0.006	0.138	0.006	0.145	0.011	4.830	0.027	0.050	0.008	ND	0.006	0.131	0.008	0.028	0.007	0.049	0.007
7/5/2008	ND	0.005	1.210	0.032	2.390	0.007	0.050	0.006	0.072	0.006	0.103	0.011	5.200	0.027	0.052	0.008	ND	0.006	0.153	0.008	0.037	0.007	0.030	0.007
7/11/2008	ND	0.005	1.260	0.032	1.930	0.007	0.052	0.006	0.175	0.006	0.336	0.011	5.770	0.027	0.065	0.008	ND	0.006	0.167	0.008	0.040	0.007	0.083	0.007
7/17/2008	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID
7/23/2008	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID
7/24/2008	ND	0.005	1.460	0.032	2.530	0.007	0.077	0.006	0.161	0.006	0.200	0.011	7.340	0.027	0.088	0.008	ND	0.006	0.185	0.008	0.039	0.007	0.076	0.007
7/29/2008	0.091	0.005	2.020	0.032	2.850	0.007	0.123	0.006	0.185	0.006	0.590	0.011	10.200	0.027	0.113	0.008	ND	0.006	0.316	0.008	0.121	0.007	0.057	0.007
7/31/2008	ND	0.005	1.520	0.032	1.670	0.007	0.116	0.006	0.163	0.006	0.273	0.011	8.640	0.027	0.074	0.008	ND	0.006	0.226	0.008	0.116	0.007	0.063	0.007
8/4/2008	ND	0.005	1.710	0.032	2.900	0.007	0.143	0.006	0.186	0.006	0.703	0.011	10.600	0.027	0.075	0.008	0.077	0.006	0.314	0.008	0.127	0.007	0.086	0.007
8/7/2008	ND	0.005	1.190	0.032	2.700	0.007	0.086	0.006	0.099	0.006	0.124	0.011	8.030	0.027	0.061	0.008	0.024	0.006	0.166	0.008	0.038	0.007	0.040	0.007
8/10/2008	ND	0.005	0.918	0.032	1.960	0.007	0.071	0.006	0.081	0.006	0.102	0.011	6.090	0.027	0.055	0.008	0.018	0.006	0.147	0.008	0.047	0.007	0.032	0.007
8/16/2008	ND	0.005	1.240	0.032	2.380	0.007	0.064	0.006	0.151	0.006	0.180	0.011	7.070	0.027	0.063	0.008	ND	0.006	0.164	0.008	0.032	0.007	0.065	0.007
8/19/2008	ND	0.005	1.640	0.032	3.230	0.007	0.078	0.006	0.223	0.006	0.150	0.011	7.900	0.027	0.088	0.008	0.021	0.006	0.232	0.008	0.036	0.007	0.082	0.007
8/22/2008	ND	0.005	1.880	0.032	5.170	0.007	0.111	0.006	0.193	0.006	0.367	0.011	10.700	0.027	0.078	0.008	ND	0.006	0.296	0.008	0.182	0.007	0.054	0.007
8/28/2008	ND	0.005	1.880	0.032	3.770	0.007	0.111	0.006	0.164	0.006	0.261	0.011	9.660	0.027	0.096	0.008	ND	0.006	0.294	0.008	0.201	0.007	0.051	0.007
9/3/2008	ND	0.005	2.050	0.032	1.580	0.007	0.110	0.006	0.192	0.006	0.194	0.011	9.820	0.027	0.108	0.008	ND	0.006	0.282	0.008	0.046	0.007	0.059	0.007
9/9/2008	ND	0.005	0.805	0.032	1.890	0.007	0.052	0.006	0.091	0.006	0.070	0.011	5.840	0.027	0.038	0.008	0.030	0.006	0.130	0.008	0.117	0.007	0.035	0.007
9/15/2008	ND	0.005	0.881	0.032	1.730	0.007	0.056	0.006	0.058	0.006	0.056	0.011	6.030	0.027	0.038	0.008	0.014	0.006	0.119	0.008	0.038	0.007	0.029	0.007
9/18/2008	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID
9/21/2008	ND	0.005	1.900	0.032	3.130	0.007	0.071	0.006	0.212	0.006	0.145	0.011	8.720	0.027	0.078	0.008	ND	0.006	0.270	0.008	0.045	0.007	0.089	0.007
9/24/2008	ND	0.005	2.420	0.032	4.920	0.007	0.083	0.006	0.280	0.006	0.233	0.011	9.090	0.027	0.088	0.008	ND	0.006	0.352	0.008	0.047	0.007	0.091	0.007
9/27/2008	ND	0.005	1.360	0.031	2.040	0.007	0.053	0.006	0.105	0.006	0.092	0.011	7.210	0.026	0.075	0.008	0.051	0.006	0.216	0.008	0.005	0.007	0.045	0.007

Stout Field Carbonyl Raw Data (ppbv)

Pollutant	2,5-Dimethylbenzaldehyde		Acetaldehyde		Acetone		Benzaldehyde		Butyraldehyde		Crotonaldehyde		Formaldehyde		Hexaldehyde		Isovaleraldehyde		Propionaldehyde		Tolualdehydes		Valeraldehyde	
CAS	5779-94-2		75-07-0		67-64-1		100-52-7		123-72-8		123-73-9		50-00-0		66-25-1		590-86-3		123-38-6		NA		110-62-3	
MW	134.1774		44.053		58.0798		106.1238		72.1066		70.0908		30.0262		100.16		86.13		58.08		120.15		86.13	
Date	Reading	Detection Limit	Reading	Detection Limit	Reading	Detection Limit	Reading	Detection Limit	Reading	Detection Limit	Reading	Detection Limit	Reading	Detection Limit	Reading	Detection Limit	Reading	Detection Limit	Reading	Detection Limit	Reading	Detection Limit	Reading	Detection Limit
10/2/2006	ND	0.003	1.170	0.014	2.310	0.022	0.050	0.006	0.206	0.004	0.196	0.004	3.810	0.016	0.112	0.005	ND	0.004	0.204	0.005	0.096	0.008	0.096	0.004
10/8/2006	ND	0.003	2.480	0.014	3.450	0.022	0.102	0.006	0.294	0.004	0.133	0.004	3.980	0.016	0.120	0.005	0.032	0.004	0.267	0.005	0.075	0.008	0.100	0.004
10/14/2006	ND	0.003	0.858	0.014	1.380	0.022	0.062	0.006	0.104	0.004	0.057	0.004	1.710	0.016	0.051	0.005	ND	0.004	0.125	0.005	0.071	0.008	0.052	0.004
10/20/2006	ND	0.003	0.756	0.014	1.420	0.022	0.052	0.006	0.088	0.004	0.046	0.004	1.330	0.016	0.033	0.005	ND	0.004	0.101	0.005	0.066	0.008	0.039	0.004
10/26/2006	ND	0.003	1.050	0.014	1.970	0.022	0.043	0.006	0.143	0.004	0.056	0.004	1.870	0.016	0.051	0.005	ND	0.004	0.094	0.005	0.035	0.008	0.042	0.004
11/1/2006	ND	0.003	0.877	0.014	1.210	0.022	0.036	0.006	0.112	0.004	0.047	0.004	1.730	0.016	0.042	0.005	ND	0.004	0.102	0.005	0.039	0.008	0.038	0.004
11/7/2006	ND	0.003	1.070	0.014	1.910	0.022	0.052	0.006	0.148	0.004	0.066	0.004	1.960	0.016	0.065	0.005	ND	0.004	0.127	0.005	0.052	0.008	0.057	0.004
11/13/2006	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID
11/19/2006	ND	0.003	0.547	0.014	0.964	0.022	0.031	0.006	0.100	0.004	0.038	0.004	0.995	0.016	0.033	0.005	ND	0.004	0.078	0.005	0.030	0.008	0.034	0.004
11/25/2006	ND	0.003	1.390	0.014	7.200	0.022	0.059	0.006	0.177	0.004	0.079	0.004	2.630	0.016	0.052	0.005	0.022	0.004	0.177	0.005	0.062	0.008	0.060	0.004
12/1/2006	ND	0.003	0.524	0.014	1.290	0.022	0.033	0.006	0.096	0.004	0.032	0.004	0.802	0.016	0.031	0.005	ND	0.004	0.078	0.005	0.043	0.008	0.033	0.004
12/7/2006	ND	0.003	0.498	0.014	0.799	0.022	0.025	0.006	0.066	0.004	0.034	0.004	0.809	0.016	0.024	0.005	ND	0.004	0.079	0.005	0.026	0.008	0.031	0.004
12/13/2006	ND	0.003	0.863	0.014	2.340	0.022	0.035	0.006	0.128	0.004	0.049	0.004	1.450	0.016	0.033	0.005	ND	0.004	0.143	0.005	0.047	0.008	0.032	0.004
12/19/2006	ND	0.003	1.080	0.014	1.830	0.022	0.069	0.006	0.145	0.004	0.077	0.004	2.300	0.016	0.044	0.005	ND	0.004	0.128	0.005	0.075	0.008	0.048	0.004
12/25/2006	ND	0.003	1.380	0.014	1.180	0.022	0.041	0.006	0.119	0.004	0.071	0.004	1.360	0.016	0.033	0.005	ND	0.004	0.173	0.005	0.048	0.008	0.039	0.004
12/31/2006	ND	0.003	0.670	0.014	3.130	0.022	0.025	0.006	0.094	0.004	0.039	0.004	1.010	0.016	0.038	0.005	ND	0.004	0.083	0.005	0.028	0.008	0.032	0.004
1/6/2007	ND	0.003	0.580	0.014	0.974	0.022	0.048	0.006	0.094	0.004	0.049	0.004	1.210	0.016	0.033	0.005	ND	0.004	0.084	0.005	0.039	0.008	0.032	0.004
1/12/2007	ND	0.005	0.587	0.011	1.030	0.020	0.031	0.003	0.083	0.006	0.048	0.006	1.260	0.027	0.033	0.004	ND	0.004	0.093	0.005	0.037	0.010	0.027	0.006
1/18/2007	ND	0.005	0.629	0.011	0.952	0.020	0.036	0.003	0.084	0.006	0.044	0.006	1.100	0.027	0.026	0.004	ND	0.004	0.089	0.005	0.050	0.010	0.028	0.006
1/24/2007	ND	0.005	0.715	0.011	1.130	0.020	0.032	0.003	0.087	0.006	0.038	0.006	1.110	0.027	0.031	0.004	ND	0.004	0.079	0.005	0.040	0.010	0.027	0.006
1/30/2007	ND	0.005	0.529	0.011	0.665	0.020	0.056	0.003	0.065	0.006	0.041	0.006	0.989	0.027	0.022	0.004	ND	0.004	0.085	0.005	0.033	0.010	0.025	0.006
2/5/2007	ND	0.005	0.117	0.011	0.131	0.020	ND	0.003	ND	0.006	ND	0.006	0.127	0.027	ND	0.004	ND	0.004	ND	0.005	ND	0.010	ND	0.006
2/11/2007	ND	0.006	1.140	0.006	1.110	0.027	0.043	0.004	0.167	0.004	0.073	0.005	2.060	0.011	0.036	0.020	ND	0.003	0.153	0.005	0.038	0.010	0.060	0.006
2/17/2007	ND	0.005	0.910	0.011	1.330	0.020	0.036	0.003	0.119	0.006	0.058	0.006	1.610	0.027	0.037	0.004	ND	0.004	0.111	0.005	0.034	0.010	0.040	0.006
2/23/2007	ND	0.005	1.300	0.011	1.600	0.020	0.040	0.003	0.119	0.006	0.067	0.006	1.920	0.027	0.044	0.004	ND	0.004	0.143	0.005	0.050	0.010	0.039	0.006
3/1/2007	ND	0.005	0.868	0.011	1.960	0.020	0.034	0.003	0.113	0.006	0.064	0.006	1.910	0.027	0.044	0.004	ND	0.004	0.126	0.005	0.026	0.010	0.042	0.006
3/7/2007	ND	0.005	2.140	0.011	1.410	0.020	0.053	0.003	0.176	0.006	0.114	0.006	2.030	0.027	0.037	0.004	ND	0.004	0.216	0.005	0.055	0.010	0.042	0.006
3/13/2007	ND	0.005	1.340	0.011	2.730	0.020	0.064	0.003	0.170	0.006	0.091	0.006	3.390	0.027	0.063	0.004	0.032	0.004	0.240	0.005	0.050	0.010	0.045	0.006
3/19/2007	ND	0.005	0.770	0.011	1.760	0.020	0.038	0.003	0.124	0.006	0.052	0.006	1.660	0.027	0.036	0.004	ND	0.004	0.124	0.005	0.029	0.010	0.038	0.006
3/25/2007	ND	0.005	1.280	0.011	2.280	0.020	0.053	0.003	0.172	0.006	0.078	0.006	3.070	0.027	0.069	0.004	ND	0.004	0.156	0.005	0.056	0.010	0.058	0.006
3/31/2007	ND	0.005	1.210	0.011	3.090	0.020	0.053	0.003	0.160	0.006	0.080	0.006	2.790	0.027	0.070	0.004	ND	0.004	0.172	0.005	0.049	0.010	0.042	0.006
4/6/2007	ND	0.005	0.764	0.011	1.070	0.020	0.025	0.003	0.083	0.006	0.036	0.006	2.130	0.027	0.027	0.004	ND	0.004	0.107	0.005	0.023	0.010	0.029	0.006
4/12/2007	ND	0.005	0.618	0.011	1.070	0.020	0.022	0.003	0.077	0.006	0.042	0.006	1.270	0.027	0.029	0.004	ND	0.004	0.101	0.005	0.026	0.010	0.032	0.006
4/18/2007	ND	0.005	1.090	0.011	1.680	0.020	0.046	0.003	0.133	0.006	0.054	0.006	2.110	0.027	0.054	0.004	ND	0.004	0.176	0.005	0.043	0.010	0.049	0.006
4/24/2007	ND	0.020	1.630	0.003	3.040	0.006	0.068	0.006	0.201	0.027	0.090	0.005	3.240	0.011	0.103	0.004	0.054	0.004	0.271	0.005	0.055	0.010	0.071	0.006
4/30/2007	ND	0.005	1.360	0.011	2.770	0.020	0.043	0.003	0.162	0.006	0.096	0.010	3.650	0.006	0.068	0.006	0.025	0.027	0.237	0.004	0.031	0.004	0.082	0.005
5/6/2007	ND	0.005	1.290	0.011	2.440	0.020	0.040	0.003	0.167	0.006	0.100	0.006	3.230	0.027	0.078	0.004	ND	0.004	0.207	0.005	0.115	0.010	0.051	0.006
5/12/2007	ND	0.005	0.860	0.011	1.910	0.020	0.046	0.003	0.128	0.006	0.073	0.006	2.120	0.027	0.052	0.004	ND	0.004	0.119	0.005	0.053	0.010	0.042	0.006
5/18/2007	ND	0.005	1.400	0.011	2.670	0.020	0.057	0.003	0.166	0.006	0.100	0.006	2.920	0.027	0.070	0.004	0.028	0.004	0.214	0.005	0.046	0.010	0.086	0.006
5/24/2007	ND	0.005	1.550	0.011	3.760	0.020	0.047	0.003	0.177	0.006	0.465	0.006	5.710	0.027	0.092	0.004	0.038	0.004	0.250	0.005	0.048	0.010	0.081	0.006
5/30/2007	ND	0.005	1.780	0.011	3.890	0.020	0.083	0.003	0.177	0.006	0.737	0.006	6.520	0.027	0.091	0.004	ND	0.004	0.284	0.005	0.086	0.010	0.085	0.006
6/5/2007	ND	0.005	0.744	0.011	2.020	0.020	0.031	0.003	0.094	0.006	0.085	0.006	2.360	0.027	0.037	0.004	ND	0.004	0.109	0.005	0.117	0.010	0.049	0.006
6/11/2007	ND	0.005	3.580	0.011	3.890	0.020	0.073	0.003	0.275	0.006	0.309	0.006	4.320	0.027	0.069	0.004	0.047	0.004	0.352	0.005	0.072	0.010	0.068	0.006
6/17/2007	ND	0.005	1.620	0.011	3.880	0.020	0.043	0.003	0.201	0.006	0.511	0.006	6.830	0.027	0.074	0.004	0.047	0.004	0.253	0.005	0.056	0.010	0.064	0.006
6/23/2007	ND	0.005	1.350	0.011	2.250	0.020	0.060	0.003	0.174	0.006	0.155	0.006	3.340	0.027	0.058	0.004	0.037	0.004	0.174	0.005	0.056	0.010	0.047	0.006
6/29/2007	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID
7/2/2007	ND	0.005	1.210	0.011	2.930	0.020	0.049	0.003	0.176	0.006	0.112	0.006	3.1											

Stout Field Carbonyl Raw Data (ppbv)

Pollutant	2,5-Dimethylbenzaldehyde		Acetaldehyde		Acetone		Benzaldehyde		Butyraldehyde		Crotonaldehyde		Formaldehyde		Hexaldehyde		Isovaleraldehyde		Propionaldehyde		Tolualdehydes		Valeraldehyde	
CAS	5779-94-2		75-07-0		67-64-1		100-52-7		123-72-8		123-73-9		50-00-0		66-25-1		590-86-3		123-38-6		NA		110-62-3	
MW	134.1774		44.053		58.0798		106.1238		72.1066		70.0908		30.0262		100.16		86.13		58.08		120.15		86.13	
Date	Reading	Detection Limit	Reading	Detection Limit	Reading	Detection Limit	Reading	Detection Limit	Reading	Detection Limit	Reading	Detection Limit	Reading	Detection Limit	Reading	Detection Limit	Reading	Detection Limit	Reading	Detection Limit	Reading	Detection Limit	Reading	Detection Limit
8/10/2007	ND	0.005	1.110	0.011	2.010	0.020	0.062	0.003	0.129	0.006	0.155	0.006	4.010	0.027	0.045	0.004	ND	0.004	0.149	0.005	0.064	0.010	0.040	0.006
8/16/2007	ND	0.005	1.530	0.011	1.790	0.020	0.041	0.003	0.143	0.006	0.652	0.006	5.820	0.027	0.060	0.004	ND	0.004	0.280	0.005	0.074	0.010	0.078	0.006
8/22/2007	ND	0.005	1.350	0.011	1.680	0.020	0.042	0.003	0.129	0.006	0.540	0.006	6.020	0.027	0.051	0.004	0.058	0.004	0.194	0.005	0.062	0.010	0.068	0.006
8/28/2007	ND	0.005	1.740	0.011	3.830	0.020	0.090	0.003	0.182	0.006	0.328	0.006	5.700	0.027	0.051	0.004	0.079	0.004	0.279	0.005	0.053	0.010	0.092	0.006
9/3/2007	ND	0.005	2.390	0.011	7.100	0.020	0.120	0.003	0.307	0.006	0.260	0.006	4.800	0.027	0.134	0.004	0.035	0.004	0.290	0.005	0.093	0.010	0.106	0.006
9/9/2007	ND	0.005	1.120	0.011	2.310	0.020	0.083	0.003	0.142	0.006	0.147	0.006	3.180	0.027	0.119	0.004	ND	0.004	0.142	0.005	0.257	0.010	0.073	0.006
9/15/2007	ND	0.005	1.050	0.011	1.490	0.020	0.035	0.003	0.101	0.006	0.073	0.006	1.680	0.027	0.041	0.004	ND	0.004	0.102	0.005	0.043	0.010	0.032	0.006
9/21/2007	ND	0.005	1.910	0.011	4.950	0.020	0.075	0.003	0.220	0.006	0.441	0.006	5.960	0.027	0.073	0.004	ND	0.004	0.241	0.005	0.062	0.010	0.058	0.006
9/27/2007	ND	0.005	1.130	0.011	2.510	0.020	0.065	0.003	0.128	0.006	0.101	0.006	3.030	0.027	0.040	0.004	ND	0.004	0.108	0.005	0.059	0.010	0.035	0.006
10/3/2007	ND	0.005	1.210	0.011	3.000	0.020	0.043	0.003	0.190	0.006	0.218	0.006	4.030	0.027	0.062	0.004	ND	0.004	0.139	0.005	0.030	0.010	0.047	0.006
10/9/2007	ND	0.005	1.060	0.011	1.990	0.020	0.043	0.003	0.121	0.006	0.086	0.006	5.510	0.027	0.045	0.004	ND	0.004	0.115	0.005	0.031	0.010	0.050	0.006
10/15/2007	ND	0.005	1.170	0.011	3.150	0.020	0.044	0.003	0.177	0.006	0.245	0.006	4.150	0.027	0.047	0.004	0.043	0.004	0.172	0.005	0.039	0.010	0.048	0.006
10/21/2007	ND	0.005	1.010	0.011	2.270	0.020	0.044	0.003	0.150	0.006	0.210	0.006	3.250	0.027	0.055	0.004	ND	0.004	0.137	0.005	0.038	0.010	0.037	0.006
10/27/2007	ND	0.005	0.622	0.011	1.290	0.020	0.022	0.003	0.057	0.006	0.038	0.006	1.570	0.027	0.023	0.004	ND	0.004	0.078	0.005	ND	0.010	ND	0.006
11/2/2007	ND	0.005	1.990	0.011	3.390	0.020	0.095	0.003	0.243	0.006	0.122	0.006	3.020	0.027	0.071	0.004	ND	0.004	0.202	0.005	0.071	0.010	0.109	0.006
11/8/2007	ND	0.005	1.020	0.011	1.350	0.020	0.041	0.003	0.156	0.006	0.048	0.006	2.050	0.027	0.120	0.004	0.051	0.004	0.142	0.005	0.071	0.010	0.067	0.006
11/14/2007	ND	0.005	0.850	0.011	1.690	0.020	0.022	0.003	0.115	0.006	0.033	0.006	1.610	0.027	0.049	0.004	ND	0.004	0.112	0.005	0.031	0.010	0.050	0.006
11/20/2007	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID
11/26/2007	ND	0.005	0.828	0.011	1.370	0.020	0.030	0.003	0.091	0.006	0.047	0.006	1.010	0.027	0.034	0.004	ND	0.004	0.093	0.005	0.024	0.010	0.043	0.006
12/2/2007	ND	0.005	0.780	0.011	1.660	0.020	0.024	0.003	0.088	0.006	0.046	0.006	1.610	0.027	0.045	0.004	0.023	0.004	0.135	0.005	0.040	0.010	0.040	0.006
12/5/2007	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID
12/8/2007	ND	0.005	1.870	0.011	1.410	0.020	0.031	0.003	0.094	0.006	0.056	0.006	1.500	0.027	0.036	0.004	ND	0.004	0.161	0.005	0.040	0.010	0.025	0.006
12/14/2007	ND	0.005	0.657	0.011	0.935	0.020	0.021	0.003	0.068	0.006	0.042	0.006	1.120	0.027	0.031	0.004	ND	0.004	0.165	0.005	0.045	0.010	0.033	0.006
12/20/2007	ND	0.005	1.110	0.011	3.010	0.020	0.038	0.003	0.143	0.006	0.053	0.006	1.670	0.027	0.025	0.004	ND	0.004	0.148	0.005	0.045	0.010	0.054	0.006
12/26/2007	ND	0.005	1.660	0.011	2.420	0.020	0.051	0.003	0.093	0.006	0.070	0.006	2.990	0.027	0.048	0.004	0.036	0.004	0.200	0.005	0.062	0.010	0.039	0.006
1/1/2008	ND	0.005	0.742	0.011	0.915	0.020	0.022	0.003	0.062	0.006	0.035	0.006	1.560	0.027	0.026	0.004	ND	0.004	0.139	0.005	0.037	0.010	0.028	0.006
1/7/2008	ND	0.005	0.671	0.011	0.799	0.020	0.019	0.003	0.098	0.006	0.031	0.006	1.320	0.027	0.034	0.004	ND	0.004	0.104	0.005	0.019	0.010	0.035	0.006
1/13/2008	ND	0.005	0.700	0.031	1.010	0.007	0.019	0.006	0.084	0.006	0.049	0.011	0.993	0.026	0.027	0.008	ND	0.006	0.120	0.008	0.032	0.007	0.026	0.007
1/19/2008	ND	0.005	0.426	0.011	0.570	0.020	ND	0.003	0.047	0.006	0.027	0.006	0.601	0.027	0.023	0.004	ND	0.004	0.083	0.005	0.044	0.010	0.028	0.006
1/25/2008	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID
1/31/2008	ND	0.005	0.942	0.031	0.757	0.007	0.019	0.006	0.091	0.006	0.053	0.011	1.090	0.026	0.032	0.008	0.022	0.006	0.188	0.008	0.046	0.007	0.039	0.007
2/6/2008	ND	0.005	0.807	0.031	1.340	0.007	0.024	0.006	0.059	0.006	0.039	0.011	1.360	0.026	0.028	0.008	ND	0.006	0.235	0.008	0.032	0.007	ND	0.007
2/12/2008	ND	0.005	2.070	0.031	1.060	0.007	0.029	0.006	0.103	0.006	0.081	0.011	1.460	0.026	0.023	0.008	ND	0.006	0.266	0.008	0.047	0.007	ND	0.007
2/18/2008	ND	0.005	0.630	0.031	0.708	0.007	ND	0.006	0.061	0.006	0.032	0.011	1.220	0.026	ND	0.008	ND	0.006	0.138	0.008	0.040	0.007	0.030	0.007
2/24/2008	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID
3/1/2008	ND	0.005	1.320	0.031	1.260	0.007	0.025	0.006	0.081	0.006	0.057	0.011	1.630	0.026	0.029	0.008	ND	0.006	0.179	0.008	0.033	0.007	0.028	0.007
3/4/2008	ND	0.013	2.100	0.079	2.010	0.018	0.048	0.014	0.149	0.016	0.095	0.027	3.140	0.066	0.058	0.020	ND	0.014	0.489	0.020	0.103	0.017	ND	0.018
3/7/2008	ND	0.005	0.787	0.031	1.110	0.007	0.022	0.006	0.072	0.006	0.042	0.011	1.460	0.026	0.032	0.008	ND	0.006	0.111	0.008	0.036	0.007	0.029	0.007
3/13/2008	ND	0.005	0.952	0.031	1.620	0.007	0.025	0.006	0.120	0.006	0.051	0.011	2.080	0.026	0.032	0.008	ND	0.006	0.212	0.008	0.041	0.007	0.077	0.007
3/19/2008	ND	0.005	0.529	0.031	1.180	0.007	0.029	0.006	0.042	0.006	0.034	0.011	0.992	0.026	0.026	0.008	ND	0.006	0.127	0.008	0.038	0.007	0.026	0.007
3/25/2008	ND	0.005	0.716	0.031	1.450	0.007	ND	0.006	0.077	0.006	0.041	0.011	1.760	0.026	0.022	0.008	ND	0.006	0.221	0.008	0.036	0.007	0.028	0.007
3/31/2008	ND	0.005	0.712	0.031	1.450	0.007	0.032	0.006	0.076	0.006	0.045	0.011	1.710	0.026	0.043	0.008	ND	0.006	0.129	0.008	0.046	0.007	0.035	0.007
4/3/2008	ND	0.005	0.930	0.031	2.400	0.007	0.036	0.006	0.092	0.006	0.058	0.011	1.670	0.026	0.031	0.008	ND	0.006	0.174	0.008	0.047	0.007	0.025	0.007
4/6/2008	ND	0.005	1.260	0.031	3.160	0.007	0.040	0.006	0.122	0.006	0.073	0.011	2.450	0.026	0.052	0.008	ND	0.006	0.202	0.008	0.036	0.007	0.039	0.007
4/16/2008	ND	0.005	0.505	0.031	0.977	0.007	ND	0.006	0.052	0.006	0.028	0.011	1.010	0.026	ND	0.008	ND	0.006	0.126	0.008	0.026	0.007	ND	0.007
4/18/2008	ND	0.005	0.941	0.031	2.110	0.007	0.037	0.006	0.088	0.006	0.061	0.011	2.130	0.026	0.053	0.008	0.022	0.006	0.163	0.008	0.032	0.007	0.031	0.007
4/24/2008	ND	0.005	1.280	0.031	2.840	0.007	0.060	0.006	0.195	0.006	0.042	0.011	2.820	0.026	0.055	0.008	ND	0.006	0.187	0.008	0.041	0.007	0.059	0.007
4/27/2008	ND	0.005	1.210	0.031	1.720	0.007	0.046	0.006																

Stout Field Carbonyl Raw Data (ppbv)

Pollutant	2,5-Dimethylbenzaldehyde		Acetaldehyde		Acetone		Benzaldehyde		Butyraldehyde		Crotonaldehyde		Formaldehyde		Hexaldehyde		Isovaleraldehyde		Propionaldehyde		Tolualdehydes		Valeraldehyde	
CAS	5779-94-2		75-07-0		67-64-1		100-52-7		123-72-8		123-73-9		50-00-0		66-25-1		590-86-3		123-38-6		NA		110-62-3	
MW	134.1774		44.053		58.0798		106.1238		72.1066		70.0908		30.0262		100.16		86.13		58.08		120.15		86.13	
Date	Reading	Detection Limit	Reading	Detection Limit	Reading	Detection Limit	Reading	Detection Limit	Reading	Detection Limit	Reading	Detection Limit	Reading	Detection Limit	Reading	Detection Limit	Reading	Detection Limit	Reading	Detection Limit	Reading	Detection Limit	Reading	Detection Limit
5/30/2008	ND	0.005	1.260	0.031	2.640	0.007	0.045	0.006	0.156	0.006	0.229	0.011	3.200	0.026	0.077	0.008	ND	0.006	0.187	0.008	0.039	0.007	0.044	0.007
6/5/2008	ND	0.005	1.100	0.031	1.350	0.007	0.029	0.006	0.080	0.006	0.556	0.011	3.970	0.026	0.044	0.008	ND	0.006	0.202	0.008	0.061	0.007	0.019	0.007
6/11/2008	ND	0.005	1.600	0.031	2.940	0.007	0.057	0.006	0.195	0.006	0.232	0.011	3.610	0.026	0.073	0.008	ND	0.006	0.198	0.008	0.050	0.007	0.079	0.007
6/17/2008	ND	0.005	1.080	0.031	2.050	0.007	0.053	0.006	0.123	0.006	0.082	0.011	2.350	0.026	0.045	0.008	ND	0.006	0.157	0.008	0.040	0.007	0.037	0.007
6/23/2008	ND	0.005	1.300	0.031	2.330	0.007	0.030	0.006	0.081	0.006	0.086	0.011	2.450	0.026	0.064	0.008	ND	0.006	0.158	0.008	0.024	0.007	0.042	0.007
6/29/2008	ND	0.005	0.925	0.031	1.910	0.007	0.021	0.006	0.084	0.006	0.133	0.011	2.160	0.026	0.027	0.008	ND	0.006	0.123	0.008	0.032	0.007	0.033	0.007
7/5/2008	ND	0.005	3.660	0.031	2.370	0.007	0.037	0.006	0.195	0.006	0.159	0.011	3.040	0.026	0.046	0.008	ND	0.006	0.260	0.008	0.046	0.007	0.030	0.007
7/11/2008	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID
7/17/2008	ND	0.005	1.650	0.031	2.810	0.007	0.051	0.006	0.124	0.006	0.382	0.011	5.060	0.026	0.061	0.008	0.024	0.006	0.273	0.008	0.060	0.007	0.029	0.007
7/23/2008	ND	0.005	0.917	0.031	1.990	0.007	0.038	0.006	0.131	0.006	0.166	0.011	2.880	0.026	0.057	0.008	ND	0.006	0.119	0.008	0.036	0.007	0.044	0.007
7/24/2008	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID
7/29/2008	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID
7/31/2008	ND	0.005	1.250	0.031	1.850	0.007	0.036	0.006	0.117	0.006	0.281	0.011	3.630	0.026	0.042	0.008	0.022	0.006	0.160	0.008	0.043	0.007	0.021	0.007
8/4/2008	ND	0.005	1.490	0.031	2.190	0.007	0.050	0.006	0.115	0.006	0.727	0.011	5.760	0.026	0.047	0.008	0.028	0.006	0.279	0.008	0.096	0.007	0.028	0.007
8/7/2008	ND	0.005	1.150	0.031	2.480	0.007	0.026	0.006	0.136	0.006	0.127	0.011	3.340	0.026	0.030	0.008	0.017	0.006	0.166	0.008	0.035	0.007	0.020	0.007
8/10/2008	ND	0.005	0.995	0.031	1.780	0.007	0.027	0.006	0.112	0.006	0.111	0.011	2.760	0.026	0.037	0.008	ND	0.006	0.158	0.008	0.055	0.007	0.016	0.007
8/16/2008	ND	0.005	1.340	0.031	2.270	0.007	0.039	0.006	0.111	0.006	0.173	0.011	3.330	0.026	0.040	0.008	ND	0.006	0.210	0.008	0.079	0.007	0.035	0.007
8/19/2008	ND	0.005	0.866	0.031	1.470	0.007	0.030	0.006	0.089	0.006	0.087	0.011	2.110	0.026	0.037	0.008	ND	0.006	0.124	0.008	0.035	0.007	ND	0.007
8/22/2008	ND	0.005	1.570	0.031	2.360	0.007	0.070	0.006	0.153	0.006	0.368	0.011	5.210	0.026	0.061	0.008	0.027	0.006	0.251	0.008	0.066	0.007	0.040	0.007
8/28/2008	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID
9/3/2008	ND	0.005	2.090	0.031	2.060	0.007	0.068	0.006	0.164	0.006	0.212	0.011	4.500	0.026	0.087	0.008	ND	0.006	0.321	0.008	0.037	0.007	0.054	0.007
9/9/2008	ND	0.005	0.879	0.031	1.730	0.007	0.021	0.006	0.092	0.006	0.083	0.011	2.500	0.026	0.027	0.008	ND	0.006	0.141	0.008	0.056	0.007	0.013	0.007
9/15/2008	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID
9/18/2008	ND	0.005	0.828	0.031	1.510	0.007	0.015	0.006	0.052	0.006	0.053	0.011	1.550	0.026	0.018	0.008	ND	0.006	0.119	0.008	0.030	0.007	ND	0.007
9/21/2008	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID
9/24/2008	ND	0.005	2.450	0.031	5.260	0.007	0.073	0.006	0.302	0.006	0.242	0.011	5.600	0.026	0.091	0.008	ND	0.006	0.375	0.008	0.065	0.007	0.092	0.007
9/27/2008	ND	0.005	1.440	0.031	2.080	0.007	0.032	0.006	0.124	0.006	0.115	0.011	3.100	0.026	0.053	0.008	0.029	0.006	0.232	0.008	0.010	0.007	0.039	0.007

Harding Street Metals Raw Data (ng/m³)

Name	Antimony		Arsenic		Beryllium		Cadmium		Chromium		Cobalt		Lead		Manganese		Mercury		Nickel		Selenium	
Date	Reading	Detection Limit	Reading	Detection Limit	Reading	Detection Limit	Reading	Detection Limit	Reading	Detection Limit	Reading	Detection Limit	Reading	Detection Limit	Reading	Detection Limit	Reading	Detection Limit	Reading	Detection Limit	Reading	Detection Limit
10/2/2006	1.160	0.029	1.110	0.022	0.017	0.025	0.668	0.019	2.000	0.509	0.152	0.022	4.890	0.068	11.900	0.125	ND	0.212	1.150	0.184	1.590	0.027
10/8/2006	2.260	0.029	3.270	0.022	0.007	0.025	0.527	0.019	2.170	0.509	0.121	0.022	14.400	0.068	9.080	0.125	0.004	0.212	1.020	0.184	2.180	0.027
10/14/2006	0.454	0.029	0.588	0.022	0.005	0.025	0.132	0.019	1.770	0.509	0.081	0.022	3.530	0.068	8.870	0.125	ND	0.212	0.844	0.184	0.820	0.027
10/20/2006	0.779	0.029	0.617	0.022	0.005	0.025	0.322	0.019	2.520	0.509	4.200	0.022	3.260	0.068	5.580	0.125	0.292	0.212	1.030	0.184	0.695	0.027
10/26/2006	0.582	0.029	0.752	0.022	0.007	0.025	0.138	0.019	1.900	0.509	0.054	0.022	2.960	0.068	2.780	0.125	0.003	0.212	0.932	0.184	2.010	0.027
11/1/2006	0.691	0.029	0.732	0.022	0.008	0.025	0.304	0.019	1.920	0.509	0.972	0.022	12.500	0.068	9.400	0.125	0.081	0.212	0.798	0.184	0.646	0.027
11/7/2006	1.070	0.029	0.914	0.022	0.004	0.025	0.208	0.019	1.560	0.509	0.190	0.022	6.190	0.068	1.830	0.125	0.027	0.212	0.674	0.184	1.730	0.027
11/13/2006	1.130	0.029	1.770	0.022	0.012	0.025	0.200	0.019	1.420	0.509	0.090	0.022	4.620	0.068	4.660	0.125	0.010	0.212	0.730	0.184	2.660	0.027
11/19/2006	0.663	0.029	0.720	0.022	0.005	0.025	0.153	0.019	1.440	0.509	0.048	0.022	4.800	0.068	2.320	0.125	0.022	0.212	0.791	0.184	0.386	0.027
11/25/2006	2.120	0.029	2.210	0.022	0.018	0.025	0.678	0.019	1.830	0.509	0.132	0.022	7.740	0.068	7.710	0.125	0.012	0.212	1.200	0.184	2.700	0.027
12/1/2006	0.141	0.029	0.224	0.022	0.003	0.025	0.099	0.019	1.760	0.509	0.038	0.022	1.090	0.068	1.450	0.125	0.017	0.212	0.943	0.184	0.565	0.027
12/7/2006	0.193	0.029	0.285	0.022	0.005	0.025	0.079	0.019	1.610	0.509	0.053	0.022	2.040	0.068	3.770	0.125	0.021	0.212	0.770	0.184	0.314	0.027
12/13/2006	0.532	0.029	0.668	0.022	0.010	0.025	0.184	0.019	1.890	0.509	0.082	0.022	3.840	0.068	3.560	0.125	0.020	0.212	0.971	0.184	1.300	0.027
12/19/2006	1.410	0.029	0.669	0.022	0.006	0.025	0.177	0.019	3.490	0.509	29.200	0.022	6.730	0.068	8.890	0.125	2.940	0.212	1.550	0.184	0.573	0.027
12/25/2006	0.530	0.029	0.631	0.022	0.004	0.025	0.121	0.019	1.700	0.509	0.046	0.022	3.380	0.068	2.750	0.125	0.016	0.212	0.690	0.184	1.820	0.027
12/31/2006	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID
1/6/2007	0.539	0.010	0.755	0.009	0.002	0.020	0.116	0.008	1.520	0.142	0.045	0.010	3.350	0.018	2.560	0.016	0.002	0.009	0.550	0.088	0.835	0.018
1/12/2007	0.538	0.010	0.685	0.009	0.004	0.020	0.533	0.008	1.780	0.142	0.082	0.010	1.670	0.018	4.980	0.016	0.003	0.009	0.843	0.088	1.680	0.018
1/18/2007	0.582	0.010	0.598	0.009	0.009	0.020	0.284	0.008	2.340	0.142	0.071	0.010	3.610	0.018	6.080	0.016	0.003	0.009	0.859	0.088	2.120	0.018
1/24/2007	0.545	0.010	0.386	0.009	0.004	0.020	0.136	0.008	1.950	0.142	0.954	0.010	4.600	0.018	3.430	0.016	0.198	0.009	0.573	0.088	0.753	0.018
1/30/2007	0.275	0.010	0.665	0.009	0.008	0.020	0.190	0.008	1.930	0.142	0.123	0.010	2.620	0.018	4.110	0.016	0.026	0.009	1.020	0.088	0.818	0.018
2/5/2007	0.262	0.010	0.339	0.009	0.007	0.020	0.079	0.008	1.790	0.142	0.051	0.010	2.880	0.018	3.660	0.016	0.032	0.009	0.711	0.088	0.932	0.018
2/11/2007	0.577	0.010	0.569	0.009	0.012	0.020	0.195	0.008	1.730	0.142	0.076	0.010	3.350	0.018	4.680	0.016	0.027	0.009	0.782	0.088	1.150	0.018
2/17/2007	0.310	0.010	0.518	0.009	0.014	0.020	0.153	0.008	1.850	0.142	0.051	0.010	3.730	0.018	2.820	0.016	0.116	0.009	0.918	0.088	1.470	0.018
2/23/2007	0.800	0.010	0.584	0.009	0.006	0.020	0.218	0.008	1.950	0.142	0.083	0.010	4.540	0.018	5.340	0.016	0.018	0.009	0.700	0.088	0.538	0.018
3/1/2007	0.546	0.010	0.540	0.009	0.005	0.020	0.147	0.008	1.610	0.142	0.055	0.010	2.500	0.018	3.670	0.016	0.005	0.009	0.862	0.088	2.290	0.018
3/7/2007	0.067	0.010	0.080	0.009	0.001	0.020	0.029	0.008	1.540	0.142	0.022	0.010	0.572	0.018	0.734	0.016	0.003	0.009	0.479	0.088	0.284	0.018
3/13/2007	3.900	0.010	1.160	0.009	0.017	0.020	0.808	0.008	2.590	0.142	0.210	0.010	9.670	0.018	15.600	0.016	0.016	0.009	1.330	0.088	2.720	0.018
3/19/2007	1.160	0.010	0.948	0.009	0.007	0.020	0.370	0.008	2.090	0.142	0.082	0.010	5.020	0.018	4.780	0.016	0.006	0.009	0.829	0.088	1.900	0.018
3/25/2007	0.683	0.010	1.290	0.009	0.009	0.020	0.535	0.008	2.450	0.142	0.063	0.010	3.920	0.018	3.380	0.016	0.015	0.009	0.969	0.088	1.820	0.018
3/31/2007	0.955	0.010	1.120	0.009	0.005	0.020	0.234	0.008	1.580	0.142	0.065	0.010	3.680	0.018	3.830	0.016	0.004	0.009	1.010	0.088	1.700	0.018
4/6/2007	3.170	0.010	0.359	0.009	0.004	0.020	0.162	0.008	1.900	0.142	0.079	0.010	5.180	0.018	5.570	0.016	0.022	0.009	0.730	0.088	0.572	0.018
4/12/2007	0.302	0.010	0.285	0.009	0.002	0.020	0.072	0.008	1.580	0.142	0.033	0.010	3.030	0.018	1.490	0.016	0.009	0.009	0.936	0.088	1.060	0.018
4/18/2007	1.200	0.010	0.898	0.009	0.012	0.020	0.205	0.008	1.960	0.142	0.521	0.010	6.770	0.018	6.110	0.016	0.038	0.009	1.200	0.088	1.300	0.018
4/24/2007	0.715	0.010	0.627	0.009	0.007	0.020	0.178	0.008	1.690	0.142	1.280	0.010	5.730	0.018	7.290	0.016	0.348	0.009	0.872	0.088	1.130	0.018
4/30/2007	1.400	0.010	1.030	0.009	0.012	0.020	0.681	0.008	2.360	0.142	0.177	0.010	5.300	0.018	17.900	0.016	0.005	0.009	1.200	0.088	1.880	0.018
5/6/2007	0.447	0.010	0.852	0.009	0.005	0.020	0.191	0.008	1.750	0.142	0.061	0.010	4.610	0.018	4.040	0.016	0.033	0.009	0.725	0.088	0.481	0.018
5/12/2007	1.080	0.010	1.070	0.009	0.005	0.020	0.180	0.008	1.680	0.142	0.096	0.010	5.180	0.018	7.370	0.016	0.029	0.009	0.895	0.088	1.430	0.018
5/18/2007	1.450	0.010	4.150	0.009	0.008	0.020	0.146	0.008	2.010	0.142	0.114	0.010	4.700	0.018	7.680	0.016	0.036	0.009	0.841	0.088	0.406	0.018
5/24/2007	1.500	0.010	1.360	0.009	0.022	0.020	0.606	0.008	3.430	0.142	0.181	0.010	6.410	0.018	13.200	0.016	0.030	0.009	1.150	0.088	2.160	0.018
5/30/2007	1.710	0.010	1.960	0.009	0.015	0.020	0.443	0.008	2.160	0.142	0.135	0.010	5.440	0.018	9.590	0.016	0.033	0.009	1.410	0.088	2.270	0.018
6/5/2007	0.592	0.010	0.452	0.009	0.003	0.020	0.115	0.008	2.530	0.142	2.190	0.010	3.790	0.018	4.360	0.016	0.228	0.009	1.510	0.088	0.458	0.018
6/11/2007	0.878	0.010	1.610	0.009	0.005	0.020	0.192	0.008	1.920	0.142	0.092	0.010	9.070	0.018	8.140	0.016	0.006	0.009	1.090	0.088	0.969	0.018
6/17/2007	1.090	0.010	1.090	0.009	0.008	0.020	0.478	0.008	1.990	0.142	0.122	0.010	7.800	0.018	8.810	0.016	0.001	0.009	1.210	0.088	3.010	0.018
6/23/2007	0.926	0.010	2.070	0.009	0.003	0.020	0.227	0.008	1.940	0.142	0.064	0.010	6.450	0.018	3.410	0.016	0.011	0.009	0.967	0.088	2.830	0.018
6/29/2007	2.470	0.010	0.713	0.009	0.005	0.020	0.242	0.008	1.910	0.142	0.090	0.010	4.530	0.018	5.050	0.016	0.006	0.009	1.070	0.088	1.440	0.018
7/5/2007	1.210	0.010	0.711	0.009	0.006	0.020	0.273	0.008	2.490	0.142	0.250	0.010	3.970	0.018	5.020	0.016	0.010	0.009	0.922	0.088	1.380	0.018
7/11/2007	0.646	0.010	0.226	0.009	0.004	0.020	0.088	0.008	2.200	0.142	1.250	0.010	3.820	0.018	5.600	0.016	0.121	0.009	0.845	0.088	0.428	0.018
7/17/2007	1.040	0.010	0.888	0.009	0.006	0.020	0.220	0.008	2.060	0.142	0.129	0.010	3.530	0.018	5.130	0.016	0.033	0.009	2.580	0.088	1.510	0.018
7/23/2007	1.530	0.010	1.150	0.009	0.006	0.020	0.452	0.008	2.270	0.142	0.097	0.010	7.120	0.018	6.300	0.016	0.032	0.009	2.020	0.088	1.010	0.018

Harding Street Metals Raw Data (ng/m³)

Name	Antimony		Arsenic		Beryllium		Cadmium		Chromium		Cobalt		Lead		Manganese		Mercury		Nickel		Selenium		
Date	Reading	Detection Limit	Reading	Detection Limit	Reading	Detection Limit	Reading	Detection Limit	Reading	Detection Limit	Reading	Detection Limit	Reading	Detection Limit	Reading	Detection Limit	Reading	Detection Limit	Reading	Detection Limit	Reading	Detection Limit	
7/29/2007	1.120	0.010	1.170	0.009	0.007	0.020	0.183	0.008	4.130	0.142	0.048	0.010	5.330	0.018	2.690	0.016	0.015	0.009	1.820	0.088	2.820	0.018	
8/4/2007	0.699	0.010	1.110	0.009	0.009	0.020	0.143	0.008	1.540	0.142	0.100	0.010	5.010	0.018	7.020	0.016	0.004	0.009	1.330	0.088	1.190	0.018	
8/10/2007	0.825	0.010	0.483	0.009	0.003	0.020	0.113	0.008	1.980	0.142	0.420	0.010	4.060	0.018	4.140	0.016	0.475	0.009	1.380	0.088	0.686	0.018	
8/16/2007	0.933	0.010	0.786	0.009	0.006	0.020	0.207	0.008	1.490	0.142	0.149	0.010	8.110	0.018	8.940	0.016	0.072	0.009	1.050	0.088	2.470	0.018	
8/22/2007	1.700	0.010	0.862	0.009	0.010	0.020	0.723	0.008	1.610	0.142	0.183	0.010	6.860	0.018	8.980	0.016	0.070	0.009	2.060	0.088	2.320	0.018	
8/28/2007	1.440	0.010	1.240	0.009	0.012	0.020	0.279	0.008	1.790	0.142	0.146	0.010	11.700	0.018	7.590	0.016	0.025	0.009	0.858	0.088	2.280	0.018	
9/3/2007	2.360	0.010	3.140	0.009	0.003	0.020	0.315	0.008	1.880	0.142	0.448	0.010	14.900	0.018	6.470	0.016	0.062	0.009	0.612	0.088	2.450	0.018	
9/9/2007	0.356	0.010	0.514	0.009	0.003	0.020	0.067	0.008	1.650	0.142	0.106	0.010	1.800	0.018	1.480	0.016	0.025	0.009	0.503	0.088	0.703	0.018	
9/15/2007	0.572	0.010	1.050	0.009	0.002	0.020	0.093	0.008	2.040	0.142	1.690	0.010	6.700	0.018	3.330	0.016	0.136	0.009	0.497	0.088	0.193	0.018	
9/21/2007	2.230	0.010	1.540	0.009	0.024	0.020	0.337	0.008	3.430	0.142	0.347	0.010	12.300	0.018	23.600	0.016	0.031	0.009	1.970	0.088	3.400	0.018	
9/27/2007	0.599	0.010	0.870	0.009	0.002	0.020	0.119	0.008	1.700	0.142	0.662	0.010	4.300	0.018	4.620	0.016	0.074	0.009	0.452	0.088	0.670	0.018	
10/3/2007	0.868	0.010	1.430	0.009	0.010	0.020	0.360	0.008	1.670	0.142	0.291	0.010	7.860	0.018	7.000	0.016	0.050	0.009	0.625	0.088	2.240	0.018	
10/9/2007	0.552	0.010	0.355	0.009	0.004	0.020	0.146	0.008	1.880	0.142	0.867	0.010	4.300	0.018	7.180	0.016	0.287	0.009	0.527	0.088	0.692	0.018	
10/15/2007	2.010	0.010	0.683	0.009	0.008	0.020	0.114	0.008	2.870	0.142	0.082	0.010	3.480	0.018	5.120	0.016	0.198	0.009	0.814	0.088	2.470	0.018	
10/21/2007	1.630	0.010	1.070	0.009	0.010	0.020	0.421	0.008	2.750	0.142	0.046	0.010	6.250	0.018	2.870	0.016	0.006	0.009	0.506	0.088	1.620	0.018	
10/27/2007	0.554	0.010	1.050	0.009	0.001	0.020	0.294	0.008	2.930	0.142	0.041	0.010	3.390	0.018	3.000	0.016	0.005	0.009	0.610	0.088	0.511	0.018	
11/2/2007	7.100	0.010	1.140	0.009	0.012	0.020	0.319	0.008	3.950	0.142	0.469	0.010	11.900	0.018	16.500	0.016	0.039	0.009	1.190	0.088	0.790	0.018	
11/8/2007	0.547	0.010	0.754	0.009	0.018	0.020	0.431	0.008	3.270	0.142	0.130	0.010	5.330	0.018	9.540	0.016	0.012	0.009	0.678	0.088	1.760	0.018	
11/14/2007	0.561	0.010	0.610	0.009	0.006	0.020	0.246	0.008	3.180	0.142	0.323	0.010	4.960	0.018	9.800	0.016	0.039	0.009	0.936	0.088	0.967	0.018	
11/20/2007	0.656	0.010	0.683	0.009	ND	0.020	0.349	0.008	2.910	0.142	0.068	0.010	4.050	0.018	5.180	0.016	0.026	0.009	0.750	0.088	1.570	0.018	
11/26/2007	0.743	0.010	0.915	0.009	ND	0.020	0.305	0.008	2.900	0.142	0.245	0.010	5.340	0.018	2.930	0.016	0.137	0.009	0.471	0.088	1.840	0.018	
12/2/2007	0.608	0.010	0.910	0.009	0.006	0.020	0.351	0.008	3.390	0.142	0.041	0.010	3.100	0.018	1.950	0.016	0.021	0.009	0.823	0.088	1.740	0.018	
12/8/2007	0.765	0.010	0.828	0.009	0.004	0.020	0.228	0.008	3.230	0.142	0.046	0.010	6.200	0.018	2.240	0.016	0.008	0.009	0.602	0.088	1.510	0.018	
12/14/2007	0.577	0.010	0.439	0.009	0.002	0.020	0.153	0.008	3.120	0.142	0.105	0.010	5.430	0.018	3.940	0.016	0.014	0.009	0.494	0.088	0.829	0.018	
12/20/2007	0.925	0.010	1.240	0.009	0.007	0.020	0.308	0.008	ND	0.142	0.235	0.010	7.080	0.018	5.890	0.016	0.033	0.009	1.230	0.088	4.570	0.018	
12/26/2007	1.930	0.010	1.890	0.009	0.005	0.020	0.485	0.008	4.470	0.142	0.117	0.010	14.400	0.018	8.240	0.016	0.028	0.009	1.510	0.088	2.360	0.018	
1/1/2008	0.336	0.006	0.564	0.010	0.003	0.012	0.310	0.008	3.010	0.178	0.051	0.009	4.930	0.107	1.770	0.021	0.007	0.024	0.392	0.110	0.615	0.024	
1/7/2008	0.750	0.006	0.681	0.010	0.011	0.012	0.306	0.008	3.210	0.178	0.078	0.009	2.780	0.107	2.450	0.021	0.045	0.024	0.985	0.110	3.710	0.024	
1/13/2008	0.684	0.006	0.670	0.010	0.004	0.012	0.239	0.008	3.240	0.178	0.060	0.009	4.210	0.107	2.280	0.021	0.032	0.024	0.682	0.110	1.500	0.024	
1/19/2008	0.275	0.006	0.357	0.010	0.002	0.012	0.198	0.008	3.200	0.178	0.101	0.009	2.980	0.107	6.380	0.021	0.032	0.024	0.601	0.110	0.293	0.024	
1/25/2008	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID
1/31/2008	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID
2/6/2008	0.353	0.006	0.434	0.010	0.001	0.012	0.123	0.008	3.250	0.178	0.069	0.009	3.310	0.107	2.740	0.021	0.072	0.024	0.753	0.110	0.601	0.024	
2/12/2008	0.409	0.006	0.804	0.010	0.007	0.012	0.196	0.008	3.400	0.178	0.180	0.009	4.870	0.107	4.910	0.021	0.106	0.024	0.997	0.110	2.240	0.024	
2/18/2008	0.260	0.006	0.379	0.010	0.002	0.012	0.168	0.008	3.000	0.178	0.040	0.009	2.780	0.107	2.220	0.021	0.034	0.024	0.561	0.110	0.448	0.024	
2/24/2008	0.839	0.006	0.857	0.010	0.009	0.012	0.242	0.008	3.170	0.178	0.057	0.009	4.250	0.107	2.520	0.021	0.065	0.024	0.583	0.110	2.080	0.024	
3/1/2008	1.090	0.006	0.486	0.010	0.005	0.012	0.106	0.008	3.120	0.178	0.078	0.009	4.110	0.107	3.300	0.021	0.013	0.024	0.700	0.110	0.791	0.024	
3/7/2008	0.561	0.006	0.664	0.010	0.007	0.012	0.098	0.008	3.000	0.178	0.059	0.009	3.150	0.107	3.590	0.021	0.014	0.024	0.551	0.110	0.439	0.024	
3/13/2008	1.240	0.006	0.806	0.010	0.008	0.012	0.283	0.008	3.500	0.178	0.571	0.009	5.680	0.107	5.210	0.021	0.098	0.024	0.748	0.110	1.160	0.024	
3/19/2008	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID
3/25/2008	0.728	0.006	0.896	0.010	0.022	0.012	0.403	0.008	3.550	0.178	0.154	0.009	6.740	0.107	12.000	0.021	0.011	0.024	1.260	0.110	3.040	0.024	
3/31/2008	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID
4/6/2008	1.990	0.006	2.950	0.010	0.007	0.012	0.328	0.008	3.330	0.178	0.086	0.009	8.980	0.107	5.370	0.021	0.037	0.024	0.857	0.110	1.780	0.024	
4/12/2008	0.199	0.006	0.147	0.010	0.003	0.012	0.031	0.008	2.630	0.178	ND	0.009	0.847	0.107	0.903	0.021	0.018	0.024	0.464	0.110	0.143	0.024	
4/18/2008	0.800	0.006	0.932	0.010	0.012	0.012	0.182	0.008	2.900	0.178	0.080	0.009	4.570	0.107	6.750	0.021	0.023	0.024	0.676	0.110	2.330	0.024	
4/24/2008	1.100	0.006	1.010	0.010	0.006	0.012	0.202	0.008	2.910	0.178	0.093	0.009	7.210	0.107	6.970	0.021	0.186	0.024	0.819	0.110	1.480	0.024	
4/30/2008	0.793	0.006	0.825	0.010	0.003	0.012	0.157	0.008	2.910	0.178	0.061	0.009	5.370	0.107	5.230	0.021	0.131	0.024	0.775	0.110	1.320	0.024	
5/6/2008	1.380	0.006	1.260	0.010	0.009	0.012	0.334	0.008	3.470	0.178	0.184	0.009	7.110	0.107	13.900	0.021	0.013	0.024	1.180	0.110	1.770	0.024	
5/12/2008	5.300	0.006	0.670	0.010	ND	0.012	0.106	0.008	4.050	0.178	1.890	0.009	4.870	0.107	4.670	0.021	0.848	0.024	0.816	0.110	0.635	0.024	
5/18/2008	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID

Harding Street Metals Raw Data (ng/m³)

Name	Antimony		Arsenic		Beryllium		Cadmium		Chromium		Cobalt		Lead		Manganese		Mercury		Nickel		Selenium		
	Date	Reading	Detection Limit																				
5/24/2008	0.878	0.006	1.770	0.010	0.004	0.012	0.163	0.008	2.800	0.178	0.051	0.009	6.720	0.107	3.260	0.021	0.034	0.024	0.577	0.110	1.020	0.024	
5/30/2008	1.040	0.006	1.280	0.010	0.015	0.012	0.390	0.008	3.310	0.178	0.158	0.009	5.580	0.107	10.500	0.021	0.029	0.024	0.924	0.110	2.980	0.024	
6/5/2008	0.658	0.006	0.617	0.010	0.015	0.012	0.310	0.008	3.060	0.178	0.103	0.009	3.870	0.107	7.670	0.021	0.073	0.024	1.280	0.110	2.060	0.024	
6/11/2008	1.030	0.006	1.520	0.010	0.005	0.012	0.531	0.008	3.190	0.178	0.080	0.009	3.310	0.107	4.770	0.021	0.089	0.024	0.685	0.110	2.400	0.024	
6/17/2008	2.710	0.006	0.625	0.010	0.004	0.012	0.120	0.008	4.310	0.178	1.540	0.009	15.900	0.533	8.620	0.021	0.079	0.024	1.200	0.110	1.330	0.024	
6/23/2008	1.560	0.006	0.926	0.010	0.003	0.012	0.234	0.008	3.190	0.178	0.231	0.009	5.140	0.107	6.040	0.021	0.063	0.024	0.698	0.110	0.569	0.024	
6/29/2008	0.460	0.006	0.409	0.010	0.002	0.012	0.075	0.008	2.910	0.178	0.034	0.009	2.480	0.107	2.150	0.021	0.033	0.024	0.448	0.110	0.666	0.024	
7/5/2008	3.070	0.006	2.580	0.010	0.005	0.012	0.288	0.008	3.930	0.178	0.072	0.009	15.200	0.107	3.370	0.021	ND	0.024	0.802	0.110	1.760	0.024	
7/11/2008	1.010	0.006	1.270	0.010	0.015	0.012	0.612	0.008	2.850	0.178	0.115	0.009	6.380	0.107	7.280	0.021	ND	0.024	1.030	0.110	2.060	0.024	
7/17/2008	1.640	0.006	1.910	0.010	0.012	0.012	0.555	0.008	3.100	0.178	0.140	0.009	8.630	0.107	10.400	0.021	ND	0.024	0.994	0.110	3.090	0.024	
7/23/2008	2.580	0.006	0.482	0.010	0.001	0.012	0.121	0.008	3.430	0.178	0.432	0.009	3.070	0.107	2.420	0.021	ND	0.024	0.642	0.110	0.323	0.024	
7/29/2008	3.670	0.006	2.070	0.010	0.008	0.012	0.292	0.008	3.590	0.178	0.199	0.009	11.500	0.107	8.440	0.021	ND	0.024	1.680	0.110	1.460	0.024	
8/4/2008	4.510	0.006	1.820	0.010	0.018	0.012	0.441	0.008	3.310	0.178	0.123	0.009	8.570	0.107	6.350	0.021	0.270	0.024	0.798	0.110	3.170	0.024	
8/10/2008	0.668	0.006	0.536	0.010	0.001	0.012	0.084	0.008	2.540	0.178	0.030	0.009	1.920	0.107	1.790	0.021	0.113	0.024	0.603	0.110	0.204	0.024	
8/16/2008	1.440	0.006	1.330	0.010	0.001	0.012	0.148	0.008	3.340	0.178	0.077	0.009	4.850	0.107	4.120	0.021	0.107	0.024	1.030	0.110	0.245	0.024	
8/22/2008	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID
8/28/2008	1.470	0.006	1.670	0.010	0.006	0.012	0.290	0.008	3.670	0.178	0.475	0.009	7.350	0.107	8.900	0.021	0.114	0.024	2.250	0.110	1.950	0.024	
9/3/2008	1.650	0.006	1.530	0.010	0.007	0.012	0.139	0.008	3.410	0.178	0.305	0.009	4.760	0.107	7.090	0.021	0.025	0.024	1.250	0.110	1.390	0.024	
9/9/2008	0.876	0.006	0.398	0.010	0.003	0.012	0.124	0.008	2.860	0.178	0.046	0.009	2.490	0.107	2.380	0.021	0.012	0.024	0.429	0.110	0.417	0.024	
9/15/2008	0.579	0.006	0.451	0.010	0.001	0.012	0.149	0.008	3.370	0.178	0.692	0.009	3.030	0.107	2.950	0.021	0.039	0.024	0.562	0.110	0.500	0.024	
9/21/2008	1.810	0.006	2.550	0.010	0.005	0.012	0.275	0.008	3.620	0.178	0.082	0.009	15.300	0.107	4.710	0.021	0.378	0.024	0.895	0.110	2.060	0.024	
9/27/2008	0.874	0.006	0.912	0.010	0.002	0.012	0.145	0.008	2.860	0.178	0.053	0.009	4.010	0.107	3.870	0.021	0.129	0.024	2.060	0.110	0.958	0.024	

Stout Field Metals Raw Data (ng/m³)

Name	Antimony		Arsenic		Beryllium		Cadmium		Chromium		Cobalt		Lead		Manganese		Mercury		Nickel		Selenium	
Date	Reading	Detection Limit	Reading	Detection Limit	Reading	Detection Limit	Reading	Detection Limit	Reading	Detection Limit	Reading	Detection Limit	Reading	Detection Limit	Reading	Detection Limit	Reading	Detection Limit	Reading	Detection Limit	Reading	Detection Limit
10/2/2006	0.837	0.029	1.160	0.022	0.017	0.025	0.190	0.019	2.150	0.509	0.127	0.022	4.620	0.068	8.610	0.125	0.178	0.212	2.400	0.184	2.590	0.027
10/8/2006	2.680	0.029	4.100	0.022	0.010	0.025	0.567	0.019	2.700	0.509	0.447	0.022	17.500	0.068	9.000	0.125	0.117	0.212	1.180	0.184	3.410	0.027
10/14/2006	0.401	0.029	0.451	0.022	0.005	0.025	0.122	0.019	1.640	0.509	0.069	0.022	3.230	0.068	8.980	0.125	0.000	0.212	0.682	0.184	0.366	0.027
10/20/2006	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID
10/26/2006	2.150	0.029	2.020	0.022	0.018	0.025	0.361	0.019	3.470	0.509	2.810	0.022	12.200	0.068	17.300	0.125	0.375	0.212	2.280	0.184	1.330	0.027
11/1/2006	1.170	0.029	0.650	0.022	0.026	0.025	0.176	0.019	2.830	0.509	0.487	0.022	6.160	0.068	9.980	0.125	0.034	0.212	0.830	0.184	0.259	0.027
11/7/2006	1.080	0.029	0.990	0.022	0.004	0.025	0.247	0.019	1.590	0.509	0.050	0.022	6.660	0.068	2.240	0.125	0.010	0.212	0.889	0.184	2.100	0.027
11/13/2006	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID
11/19/2006	0.515	0.029	0.881	0.022	0.004	0.025	0.132	0.019	1.630	0.509	0.046	0.022	4.440	0.068	2.160	0.125	0.014	0.212	0.531	0.184	0.395	0.027
11/25/2006	2.140	0.029	5.870	0.022	0.009	0.025	0.353	0.019	1.680	0.509	0.096	0.022	6.210	0.068	5.770	0.125	0.028	0.212	0.818	0.184	2.480	0.027
12/1/2006	0.219	0.029	0.250	0.022	0.002	0.025	0.086	0.019	1.520	0.509	0.059	0.022	1.820	0.068	2.360	0.125	0.009	0.212	0.855	0.184	0.503	0.027
12/7/2006	0.365	0.029	0.309	0.022	0.006	0.025	0.166	0.019	2.110	0.509	0.363	0.022	4.080	0.068	6.280	0.125	0.027	0.212	0.944	0.184	0.380	0.027
12/13/2006	0.877	0.029	0.754	0.022	0.012	0.025	0.764	0.019	2.160	0.509	0.110	0.022	5.580	0.068	7.140	0.125	0.001	0.212	1.080	0.184	1.990	0.027
12/19/2006	1.670	0.029	0.960	0.022	0.009	0.025	0.363	0.019	2.550	0.509	16.300	0.022	14.100	0.068	11.300	0.125	1.660	0.212	1.310	0.184	0.533	0.027
12/25/2006	0.438	0.029	0.609	0.022	0.004	0.025	0.133	0.019	1.570	0.509	0.060	0.022	3.450	0.068	2.720	0.125	0.013	0.212	0.632	0.184	1.820	0.027
12/31/2006	0.676	0.029	0.887	0.022	0.005	0.025	0.243	0.019	1.580	0.509	0.046	0.022	2.910	0.068	3.360	0.125	0.003	0.212	0.686	0.184	3.660	0.027
1/6/2007	0.371	0.010	0.787	0.009	0.002	0.020	0.104	0.008	1.560	0.142	0.031	0.010	2.910	0.018	1.320	0.016	0.007	0.009	0.515	0.088	0.758	0.018
1/12/2007	0.369	0.010	0.553	0.009	0.003	0.020	0.083	0.008	1.410	0.142	0.050	0.010	1.460	0.018	1.640	0.016	0.006	0.009	0.657	0.088	1.190	0.018
1/18/2007	0.510	0.010	0.486	0.009	0.006	0.020	0.123	0.008	1.760	0.142	0.052	0.010	2.920	0.018	2.880	0.016	0.020	0.009	0.694	0.088	1.950	0.018
1/24/2007	0.382	0.010	0.522	0.009	0.004	0.020	0.168	0.008	1.790	0.142	0.054	0.010	4.370	0.018	2.850	0.016	0.012	0.009	0.864	0.088	1.010	0.018
1/30/2007	0.201	0.010	0.399	0.009	0.005	0.020	0.175	0.008	1.660	0.142	0.053	0.010	2.350	0.018	3.840	0.016	0.006	0.009	0.586	0.088	0.842	0.018
2/5/2007	0.442	0.010	0.397	0.009	0.009	0.020	0.088	0.008	1.910	0.142	0.087	0.010	3.220	0.018	4.900	0.016	0.090	0.009	1.020	0.088	0.588	0.018
2/11/2007	0.715	0.010	0.750	0.009	0.013	0.020	0.720	0.008	1.940	0.142	0.077	0.010	4.450	0.018	4.530	0.016	0.041	0.009	1.220	0.088	2.140	0.018
2/17/2007	0.317	0.010	0.429	0.009	0.007	0.020	0.170	0.008	1.620	0.142	0.048	0.010	3.150	0.018	2.970	0.016	0.015	0.009	0.956	0.088	1.330	0.018
2/23/2007	0.529	0.010	0.468	0.009	0.005	0.020	0.100	0.008	1.630	0.142	0.045	0.010	3.560	0.018	2.880	0.016	0.010	0.009	1.030	0.088	1.300	0.018
3/1/2007	0.645	0.010	0.744	0.009	0.012	0.020	0.209	0.008	2.720	0.142	0.122	0.010	3.720	0.018	5.170	0.016	0.009	0.009	2.530	0.088	3.130	0.018
3/7/2007	6.050	0.010	0.837	0.009	0.006	0.020	0.246	0.008	2.000	0.142	0.108	0.010	17.300	0.018	6.130	0.016	0.011	0.009	1.020	0.088	2.080	0.018
3/13/2007	1.390	0.010	1.270	0.009	0.014	0.020	0.361	0.008	4.010	0.142	0.170	0.010	6.320	0.018	12.100	0.016	0.010	0.009	1.160	0.088	2.260	0.018
3/19/2007	0.896	0.010	0.880	0.009	0.005	0.020	0.203	0.008	1.950	0.142	0.066	0.010	4.870	0.018	3.450	0.016	0.006	0.009	0.977	0.088	2.130	0.018
3/25/2007	1.180	0.010	1.440	0.009	0.008	0.020	0.343	0.008	1.790	0.142	0.067	0.010	4.810	0.018	3.780	0.016	0.058	0.009	1.330	0.088	1.530	0.018
3/31/2007	1.060	0.010	1.510	0.009	0.007	0.020	0.289	0.008	1.830	0.142	0.065	0.010	6.430	0.018	3.570	0.016	0.004	0.009	1.140	0.088	1.680	0.018
4/6/2007	0.478	0.010	0.503	0.009	0.003	0.020	0.100	0.008	1.590	0.142	0.054	0.010	6.710	0.018	4.790	0.016	0.034	0.009	0.681	0.088	1.920	0.018
4/12/2007	0.356	0.010	0.376	0.009	0.005	0.020	0.085	0.008	1.660	0.142	0.038	0.010	2.860	0.018	1.740	0.016	0.016	0.009	0.946	0.088	0.621	0.018
4/18/2007	2.100	0.010	0.850	0.009	0.008	0.020	0.267	0.008	1.930	0.142	0.446	0.010	57.300	0.018	6.620	0.016	0.025	0.009	1.220	0.088	1.260	0.018
4/24/2007	0.815	0.010	0.535	0.009	0.009	0.020	0.459	0.008	2.150	0.142	6.530	0.010	6.250	0.018	9.040	0.016	1.380	0.009	0.806	0.088	5.060	0.018
4/30/2007	0.966	0.010	0.895	0.009	0.009	0.020	0.218	0.008	1.810	0.142	0.098	0.010	5.040	0.018	8.000	0.016	0.069	0.009	0.952	0.088	0.944	0.018
5/6/2007	0.445	0.010	0.963	0.009	0.006	0.020	0.196	0.008	1.640	0.142	0.063	0.010	4.070	0.018	4.180	0.016	0.033	0.009	0.681	0.088	0.573	0.018
5/12/2007	1.410	0.010	1.070	0.009	0.008	0.020	0.204	0.008	2.160	0.142	0.758	0.010	6.870	0.018	7.470	0.016	0.091	0.009	0.855	0.088	1.400	0.018
5/18/2007	2.330	0.010	0.980	0.009	0.008	0.020	0.186	0.008	2.370	0.142	0.491	0.010	6.280	0.018	7.630	0.016	0.141	0.009	0.780	0.088	0.421	0.018
5/24/2007	1.050	0.010	1.010	0.009	0.016	0.020	0.250	0.008	2.200	0.142	0.154	0.010	6.880	0.018	11.500	0.016	0.022	0.009	1.090	0.088	2.200	0.018
5/30/2007	1.670	0.010	1.360	0.009	0.012	0.020	0.420	0.008	3.250	0.142	0.155	0.010	4.940	0.018	10.600	0.016	0.015	0.009	1.500	0.088	4.120	0.018
6/5/2007	0.411	0.010	0.704	0.009	0.004	0.020	0.085	0.008	1.970	0.142	0.305	0.010	3.240	0.018	2.970	0.016	0.059	0.009	0.951	0.088	0.890	0.018
6/11/2007	1.050	0.010	1.940	0.009	0.009	0.020	0.324	0.008	2.190	0.142	0.118	0.010	10.300	0.018	10.600	0.016	0.024	0.009	1.230	0.088	1.120	0.018
6/17/2007	1.040	0.010	0.934	0.009	0.009	0.020	0.311	0.008	1.950	0.142	0.110	0.010	7.100	0.018	7.540	0.016	0.014	0.009	1.060	0.088	2.050	0.018
6/23/2007	0.954	0.010	1.550	0.009	0.004	0.020	0.473	0.008	2.060	0.142	0.074	0.010	6.470	0.018	3.490	0.016	0.023	0.009	1.070	0.088	3.350	0.018
6/29/2007	0.921	0.010	0.740	0.009	0.004	0.020	0.134	0.008	2.320	0.142	1.320	0.010	4.060	0.018	5.100	0.016	0.188	0.009	1.130	0.088	1.530	0.018
7/5/2007	2.390	0.010	0.708	0.009	0.005	0.020	0.117	0.008	2.130	0.142	0.118	0.010	5.120	0.018	3.850	0.016	0.048	0.009	1.810	0.088	1.410	0.018
7/11/2007	0.408	0.010	0.326	0.009	0.007	0.020	0.103	0.008	1.840	0.142	0.105	0.010	2.960	0.018	6.730	0.016	0.028	0.009	1.160	0.088	0.572	0.018
7/17/2007	0.562	0.010	1.080	0.009	0.005	0.020	0.093	0.008	1.800	0.142	0.055	0.010	2.630	0.018	2.500	0.016	0.030	0.009	0.705	0.088	0.883	0.018
7/23/2007	2.560	0.010	1.270	0.009	0.006	0.020	0.461	0.008	2.270	0.142	1.430	0.010	7.930	0.018	6.300	0.016	0.322	0.009	0.943	0.088	0.946	0.018

Stout Field Metals Raw Data (ng/m³)

Name	Antimony		Arsenic		Beryllium		Cadmium		Chromium		Cobalt		Lead		Manganese		Mercury		Nickel		Selenium	
Date	Reading	Detection Limit	Reading	Detection Limit	Reading	Detection Limit	Reading	Detection Limit	Reading	Detection Limit	Reading	Detection Limit	Reading	Detection Limit	Reading	Detection Limit	Reading	Detection Limit	Reading	Detection Limit	Reading	Detection Limit
7/29/2007	9.110	0.067	6.400	0.060	0.027	0.133	0.925	0.057	12.200	0.948	0.493	0.067	38.600	0.121	14.000	0.104	0.135	0.062	24.700	0.587	11.900	0.120
8/4/2007	1.120	0.010	1.020	0.009	0.009	0.020	0.186	0.008	1.870	0.142	0.113	0.010	6.370	0.018	7.500	0.016	0.005	0.009	1.270	0.088	1.620	0.018
8/10/2007	0.615	0.010	0.438	0.009	0.003	0.020	0.086	0.008	1.660	0.142	0.319	0.010	3.080	0.018	3.680	0.016	0.338	0.009	1.100	0.088	0.603	0.018
8/16/2007	0.822	0.010	1.060	0.009	0.009	0.020	0.176	0.008	2.130	0.142	0.469	0.010	5.840	0.018	7.880	0.016	0.684	0.009	1.490	0.088	2.880	0.018
8/22/2007	1.090	0.010	0.853	0.009	0.004	0.020	0.153	0.008	1.430	0.142	0.082	0.010	4.600	0.018	5.700	0.016	0.131	0.009	1.120	0.088	2.010	0.018
8/28/2007	1.360	0.010	1.190	0.009	0.009	0.020	0.374	0.008	2.210	0.142	2.420	0.010	12.400	0.018	8.190	0.016	0.250	0.009	1.260	0.088	2.340	0.018
9/3/2007	1.800	0.010	3.310	0.009	0.011	0.020	0.446	0.008	2.160	0.142	0.439	0.010	14.100	0.018	12.000	0.016	0.044	0.009	0.842	0.088	2.380	0.018
9/9/2007	0.345	0.010	0.586	0.009	0.003	0.020	0.166	0.008	1.620	0.142	0.082	0.010	1.750	0.018	1.400	0.016	0.026	0.009	0.478	0.088	0.688	0.018
9/15/2007	0.450	0.010	1.470	0.009	0.005	0.020	0.085	0.008	1.300	0.142	0.047	0.010	4.540	0.018	3.410	0.016	0.020	0.009	0.395	0.088	0.191	0.018
9/21/2007	1.720	0.010	1.130	0.009	0.014	0.020	0.253	0.008	2.030	0.142	0.174	0.010	8.290	0.018	12.500	0.016	0.012	0.009	1.130	0.088	4.030	0.018
9/27/2007	1.030	0.010	1.030	0.009	0.005	0.020	0.165	0.008	1.820	0.142	0.774	0.010	6.840	0.018	6.640	0.016	0.082	0.009	0.580	0.088	0.787	0.018
10/3/2007	0.823	0.010	1.350	0.009	0.008	0.020	0.180	0.008	1.690	0.142	0.087	0.010	4.530	0.018	5.290	0.016	0.031	0.009	0.671	0.088	2.040	0.018
10/9/2007	0.407	0.010	0.287	0.009	0.010	0.020	0.067	0.008	1.900	0.142	0.155	0.010	2.920	0.018	4.750	0.016	0.046	0.009	0.581	0.088	0.662	0.018
10/15/2007	0.961	0.010	0.972	0.009	0.009	0.020	0.257	0.008	3.090	0.142	0.149	0.010	5.150	0.018	8.140	0.016	0.032	0.009	0.834	0.088	3.190	0.018
10/21/2007	0.726	0.010	0.837	0.009	0.009	0.020	0.111	0.008	2.630	0.142	0.054	0.010	2.440	0.018	2.920	0.016	0.031	0.009	0.331	0.088	0.759	0.018
10/27/2007	0.414	0.010	1.270	0.009	0.000	0.020	0.149	0.008	2.850	0.142	0.061	0.010	4.260	0.018	2.450	0.016	0.016	0.009	0.297	0.088	0.813	0.018
11/2/2007	3.580	0.010	1.200	0.009	0.012	0.020	0.554	0.008	4.540	0.142	1.380	0.010	19.600	0.090	15.200	0.016	0.096	0.009	1.570	0.088	1.680	0.018
11/8/2007	0.639	0.010	0.650	0.009	0.018	0.020	0.148	0.008	2.870	0.142	0.108	0.010	3.680	0.018	7.930	0.016	0.014	0.009	0.637	0.088	1.320	0.018
11/14/2007	0.393	0.010	0.482	0.009	0.006	0.020	0.217	0.008	3.040	0.142	0.081	0.010	5.650	0.018	7.460	0.016	0.012	0.009	0.644	0.088	0.875	0.018
11/20/2007	0.898	0.010	1.040	0.009	ND	0.020	0.139	0.008	2.940	0.142	0.059	0.010	3.910	0.018	3.740	0.016	0.035	0.009	0.629	0.088	1.620	0.018
11/26/2007	0.751	0.010	2.420	0.009	ND	0.020	0.194	0.008	2.870	0.142	0.204	0.010	5.930	0.018	2.890	0.016	0.105	0.009	0.484	0.088	2.190	0.018
12/2/2007	0.596	0.010	1.020	0.009	0.003	0.020	0.159	0.008	3.420	0.142	0.043	0.010	3.170	0.018	2.130	0.016	ND	0.009	0.668	0.088	1.300	0.018
12/8/2007	1.110	0.010	1.080	0.009	0.004	0.020	0.248	0.008	3.920	0.142	0.100	0.010	7.460	0.018	2.630	0.016	0.007	0.009	0.661	0.088	1.460	0.018
12/14/2007	0.637	0.010	0.401	0.009	0.002	0.020	0.123	0.008	3.310	0.142	0.080	0.010	3.790	0.018	3.350	0.016	0.045	0.009	0.521	0.088	1.030	0.018
12/20/2007	1.130	0.010	1.130	0.009	0.006	0.020	0.546	0.008	3.910	0.142	0.263	0.010	6.690	0.018	8.140	0.016	0.061	0.009	0.960	0.088	5.910	0.018
12/26/2007	2.220	0.010	3.050	0.009	0.006	0.020	0.471	0.008	4.260	0.142	0.184	0.010	7.540	0.018	8.370	0.016	0.038	0.009	1.320	0.088	2.290	0.018
1/1/2008	0.308	0.006	0.543	0.010	0.003	0.012	0.359	0.008	3.120	0.178	0.064	0.009	4.570	0.107	2.200	0.021	0.006	0.024	0.442	0.110	0.552	0.024
1/7/2008	0.324	0.010	0.398	0.009	0.004	0.020	0.079	0.008	3.210	0.142	0.039	0.010	1.770	0.018	1.180	0.016	0.047	0.009	0.615	0.088	0.921	0.018
1/13/2008	0.639	0.010	0.666	0.009	0.004	0.020	0.182	0.008	3.110	0.142	0.060	0.010	3.930	0.018	2.130	0.016	0.045	0.009	0.889	0.088	1.210	0.018
1/19/2008	0.215	0.010	0.369	0.009	0.002	0.020	0.205	0.008	3.130	0.142	0.034	0.010	2.830	0.018	4.770	0.016	0.031	0.009	0.430	0.088	0.245	0.018
1/25/2008	0.886	0.010	0.568	0.009	0.008	0.020	0.233	0.008	3.820	0.142	0.121	0.010	5.090	0.018	8.180	0.016	0.136	0.009	0.822	0.088	0.945	0.018
1/31/2008	0.850	0.010	1.070	0.009	0.014	0.020	0.216	0.008	3.500	0.142	0.137	0.010	6.930	0.018	7.690	0.016	0.064	0.009	1.460	0.088	2.460	0.018
2/6/2008	0.620	0.006	0.288	0.010	0.001	0.012	0.115	0.008	3.470	0.178	0.196	0.009	16.700	0.107	2.460	0.021	0.293	0.024	0.663	0.110	0.644	0.024
2/12/2008	0.582	0.006	0.866	0.010	0.006	0.012	0.152	0.008	3.260	0.178	0.076	0.009	5.010	0.107	5.110	0.021	0.237	0.024	0.688	0.110	2.390	0.024
2/18/2008	0.171	0.006	0.375	0.010	0.000	0.012	0.146	0.008	3.120	0.178	0.031	0.009	2.030	0.107	2.020	0.021	0.091	0.024	0.511	0.110	0.422	0.024
2/24/2008	0.896	0.006	1.070	0.010	0.007	0.012	0.355	0.008	3.320	0.178	0.067	0.009	4.980	0.107	3.180	0.021	0.212	0.024	0.700	0.110	2.630	0.024
3/1/2008	0.631	0.006	0.689	0.010	0.005	0.012	0.181	0.008	3.040	0.178	0.041	0.009	4.690	0.107	3.030	0.021	0.011	0.024	0.496	0.110	0.984	0.024
3/7/2008	0.451	0.006	0.486	0.010	0.004	0.012	0.120	0.008	3.920	0.178	0.701	0.009	3.270	0.107	4.000	0.021	0.331	0.024	0.657	0.110	0.338	0.024
3/13/2008	1.190	0.006	0.784	0.010	0.007	0.012	0.133	0.008	3.450	0.178	1.520	0.009	3.500	0.107	5.100	0.021	0.442	0.024	0.566	0.110	1.190	0.024
3/19/2008	0.340	0.006	0.456	0.010	0.003	0.012	0.087	0.008	3.470	0.178	2.630	0.009	2.500	0.107	2.130	0.021	0.838	0.024	0.621	0.110	0.469	0.024
3/25/2008	0.446	0.006	0.770	0.010	0.015	0.012	0.200	0.008	3.830	0.178	0.120	0.009	4.550	0.107	8.640	0.021	0.027	0.024	0.616	0.110	1.210	0.024
3/31/2008	0.682	0.006	1.200	0.010	0.008	0.012	0.189	0.008	3.520	0.178	0.057	0.009	4.120	0.107	2.660	0.021	0.012	0.024	0.742	0.110	1.530	0.024
4/6/2008	1.720	0.006	2.820	0.010	0.008	0.012	0.351	0.008	3.630	0.178	0.210	0.009	8.440	0.107	5.640	0.021	0.137	0.024	1.010	0.110	2.600	0.024
4/12/2008	0.131	0.006	0.137	0.010	0.001	0.012	0.030	0.008	2.920	0.178	0.001	0.009	0.819	0.107	0.852	0.021	0.041	0.024	0.371	0.110	0.152	0.024
4/18/2008	1.110	0.012	1.100	0.020	0.016	0.025	0.235	0.015	3.490	0.357	0.159	0.018	7.080	0.213	10.400	0.043	0.042	0.048	1.330	0.221	1.320	0.048
4/24/2008	1.010	0.006	1.300	0.010	0.021	0.012	0.253	0.008	3.970	0.178	0.263	0.009	7.210	0.107	22.500	0.021	0.044	0.024	1.700	0.110	2.040	0.024
4/30/2008	0.651	0.006	1.070	0.010	0.013	0.012	0.195	0.008	3.230	0.178	0.104	0.009	5.470	0.107	8.050	0.021	0.032	0.024	0.950	0.110	2.430	0.024
5/6/2008	1.220	0.006	1.310	0.010	0.013	0.012	0.250	0.008	3.470	0.178	0.192	0.009	6.810	0.107	12.200	0.021	0.029	0.024	0.945	0.110	2.520	0.024
5/12/2008	2.840	0.006	0.641	0.010	0.002	0.012	0.150	0.008	3.350	0.178	0.112	0.009	5.180	0.107	4.720	0.021	0.028	0.024	0.531	0.110	0.616	0.024
5/18/2008	0.441	0.006	1.250	0.010	0.003	0.012	0.072	0.008	2.880	0.178	1.020	0.009	2.570	0.107	3.770	0.021	0.233	0.024	0.437	0.110	0.379	0.024

Stout Field Metals Raw Data (ng/m³)

Name	Antimony		Arsenic		Beryllium		Cadmium		Chromium		Cobalt		Lead		Manganese		Mercury		Nickel		Selenium		
	Date	Reading	Detection Limit																				
5/24/2008	0.966	0.006	2.790	0.010	0.003	0.012	0.191	0.008	2.940	0.178	0.065	0.009	7.170	0.107	3.210	0.021	0.023	0.024	0.600	0.110	1.100	0.024	
5/30/2008	0.993	0.006	1.370	0.010	0.010	0.012	0.195	0.008	3.330	0.178	0.125	0.009	4.720	0.107	8.860	0.021	0.048	0.024	1.020	0.110	1.980	0.024	
6/5/2008	0.313	0.006	0.431	0.010	0.009	0.012	0.082	0.008	2.540	0.178	0.064	0.009	1.390	0.107	3.320	0.021	0.049	0.024	0.749	0.110	0.824	0.024	
6/11/2008	0.943	0.006	0.963	0.010	0.006	0.012	0.152	0.008	3.000	0.178	0.112	0.009	4.300	0.107	9.930	0.021	0.044	0.024	0.901	0.110	1.790	0.024	
6/17/2008	0.726	0.006	0.814	0.010	0.002	0.012	0.129	0.008	3.760	0.178	0.288	0.009	4.250	0.107	5.120	0.021	0.052	0.024	0.523	0.110	0.960	0.024	
6/23/2008	5.600	0.006	0.417	0.010	0.002	0.012	0.069	0.008	3.140	0.178	0.217	0.009	5.570	0.107	4.500	0.021	0.049	0.024	0.478	0.110	0.541	0.024	
6/29/2008	0.378	0.006	0.443	0.010	0.001	0.012	0.060	0.008	2.550	0.178	0.023	0.009	1.790	0.107	1.800	0.021	0.027	0.024	0.394	0.110	0.668	0.024	
7/5/2008	4.640	0.006	2.650	0.010	0.005	0.012	0.550	0.008	4.480	0.178	0.082	0.009	18.200	0.107	4.300	0.021	ND	0.024	0.738	0.110	1.680	0.024	
7/11/2008	1.040	0.006	0.682	0.010	0.009	0.012	0.123	0.008	2.940	0.178	0.162	0.009	3.610	0.107	3.710	0.021	ND	0.024	0.602	0.110	1.490	0.024	
7/17/2008	1.790	0.006	2.090	0.010	0.008	0.012	0.460	0.008	3.000	0.178	0.109	0.009	6.440	0.107	6.740	0.021	ND	0.024	0.778	0.110	3.500	0.024	
7/23/2008	0.456	0.006	0.464	0.010	0.001	0.012	0.163	0.008	2.850	0.178	0.059	0.009	3.470	0.107	3.060	0.021	ND	0.024	0.648	0.110	0.340	0.024	
7/29/2008	47.600	0.006	1.890	0.010	0.011	0.012	0.304	0.008	3.320	0.178	0.844	0.009	35.300	0.107	8.690	0.021	ND	0.024	1.110	0.110	1.550	0.024	
8/4/2008	1.750	0.006	1.830	0.010	0.011	0.012	0.205	0.008	3.300	0.178	0.093	0.009	4.790	0.107	5.030	0.021	0.083	0.024	0.809	0.110	3.030	0.024	
8/10/2008	1.230	0.006	0.699	0.010	ND	0.012	0.093	0.008	3.160	0.178	0.030	0.009	1.960	0.107	1.710	0.021	0.040	0.024	0.496	0.110	0.224	0.024	
8/16/2008	1.150	0.006	1.560	0.010	0.001	0.012	0.167	0.008	3.790	0.178	0.086	0.009	5.560	0.107	3.240	0.021	0.060	0.024	0.613	0.110	0.260	0.024	
8/22/2008	1.440	0.006	1.290	0.010	0.008	0.012	0.389	0.008	3.610	0.178	0.114	0.009	6.140	0.107	6.530	0.021	0.050	0.024	1.070	0.110	2.840	0.024	
8/28/2008	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID	INVALID
9/3/2008	1.410	0.006	1.220	0.010	0.007	0.012	0.133	0.008	3.880	0.178	0.997	0.009	3.870	0.107	6.660	0.021	0.135	0.024	0.935	0.110	1.430	0.024	
9/9/2008	0.491	0.006	0.328	0.010	0.002	0.012	0.114	0.008	2.980	0.178	0.052	0.009	1.950	0.107	2.160	0.021	0.066	0.024	0.406	0.110	0.346	0.024	
9/15/2008	1.980	0.006	0.393	0.010	0.001	0.012	0.187	0.008	2.600	0.178	0.031	0.009	6.130	0.107	2.140	0.021	0.050	0.024	0.411	0.110	0.935	0.024	
9/21/2008	1.460	0.006	2.380	0.010	0.004	0.012	0.252	0.008	4.400	0.178	0.135	0.009	10.400	0.107	4.310	0.021	0.072	0.024	0.574	0.110	2.090	0.024	
9/27/2008	9.400	0.006	3.700	0.010	0.002	0.012	0.999	0.008	3.590	0.178	0.263	0.009	6.210	0.107	3.910	0.021	0.050	0.024	0.605	0.110	1.460	0.024	

Appendix E

AQS Monitoring Locations Data

Contents

Southwest Indianapolis Monitoring Locations

ToxWatch Monitoring Locations

National Comparison Monitoring Locations

Appendix E

Southwest Indianapolis Air Monitoring Locations

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
 AIR QUALITY SYSTEM
 SITE DESCRIPTION REPORT

Aug. 3, 2009

Site ID: 18-097-0057	Site Name:	Local ID:
Street Address: 1321 SOUTH HARDING		City: Indianapolis (Remainder)
State: Indiana	Zip Code: 46221	County: Marion
Location Description: Monitoring Point		Location Setting: Urban And Center City
Coll. Method: GPS - Unspecified		Land Use: Residential
Date Established: 19820101	Date Terminated:	Last Updated: 20070823
Regional Eval. Date:	HQ Eval. Date:	AQCR : Metropolitan Indianapolis
CBSA: Indianapolis-Carmel, IN	CSA: Indianapolis-Anderson-Columbus, IN	Direct Met Site: Met. Site ID:
Type Met Site: On-Site Met Equip	Dist to Met. Site(m):	Local Region:
Urban Area: Indianapolis, IN		EPA Region: Chicago
City Population: 781870	Dir. to CBD: SW	Dist. to City(km):
Census Block: 6002	Block Group: 6	Census Tract: 35810
Congressional District: 7		Class 1 Area:
Site Latitude: +39.749019	Site Longitude: - 86.186314	Time Zone: Eastern
UTM Zone:	UTM Northing:	UTM Easting:
Accuracy: 3	Datum: WGS84	Scale: 1 Point/Line/Area: Point
Vertical Measure(m): 208.0		Vert Accuracy: 0
Vert Datum Unknown		Vert Method: Unknown

ACTIVE MONITOR TYPES		AGENCY ROLES			
Monitor Type	# of Monitors	Role	Agency Desc	Begin Date	End Date
NON-REGULATORY	41	SUPPORTING	Indianapolis Office of Environmental Services	19820101	
OTHER	5				
SLAMS	2				

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
AIR QUALITY SYSTEM
SITE DESCRIPTION REPORT

Aug. 3, 2009

Site ID: 18-097-0085	Site Name:	Local ID:
Street Address: 2002 S. HOLT RD/ STOUT FIELD 2		City: Indianapolis (Remainder)
State: Indiana	Zip Code: 46241	County: Marion
Location Description: Monitoring Point		Location Setting: Urban And Center City
Coll. Method: GPS - Unspecified		Land Use: Military Reservation
Date Established: 20061001	Date Terminated:	Last Updated: 20070823
Regional Eval. Date:	HQ Eval. Date:	AQCR : Metropolitan Indianapolis
CBSA: Indianapolis-Carmel, IN	CSA: Indianapolis-Anderson-Columbus, IN	Direct Met Site: Met. Site ID:
Type Met Site:	Dist to Met. Site(m):	Local Region:
Urban Area: Indianapolis, IN		EPA Region: Chicago
City Population: 781870	Dir. to CBD:	Dist. to City(km):
Census Block: 2000	Block Group: 2	Census Tract: 34230
Congressional District: 7		Class 1 Area:
Site Latitude: +39.740383	Site Longitude: - 86.225950	Time Zone: Eastern
UTM Zone:	UTM Northing:	UTM Easting:
Accuracy: 15	Datum: WGS84	Scale: 15 Point/Line/Area: Point
Vertical Measure(m): 188.0		Vert Accuracy: 15
Vert Datum NAVD88		Vert Method: Other

SITE COMMENTS

SITE REPLACES OLD STOUT FIELD SITE. SITE RAN BY INDIANAPOLIS LOCAL AGENCY
OLD STOUT FIELD SITE: 18-097-0028

ACTIVE MONITOR TYPES		AGENCY ROLES			
Monitor Type	# of Monitors	Role	Agency Desc	Begin Date	End Date
NON-REGULATORY	37	SUPPORTING	Indiana Depart Of Environ Management/Office Of Air Management	20061001	

Road		TANGENT ROADS				Compass	
Road Number	Road Name	Traffic Count	Traffic Year	Traffic Volume Source	Road Type	Sector	
1	HOLT RD	11628	1996	DOT	THRU ST OR HY	E	
2	W. MINNESOTA ST	7214	1996		THRU ST OR HY	N	
3	AIRPORT EXPRESSWAY	12074	1996		THRU ST OR HY	S	

Appendix E

ToxWatch Comparison Monitoring Locations

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
 AIR QUALITY SYSTEM
 SITE DESCRIPTION REPORT

Apr. 15, 2010

Site ID: 18-089-0022	Site Name: LOCATED ON AT AN OLD AMMUNITION BUNKER	Local ID:
Street Address: 201 MISSISSIPPI ST., IITRI BUNKER	City: Gary	
State: Indiana	Zip Code: 46402	County: Lake
Location Description: Monitoring Point	Location Setting: Urban And Center City	
Coll. Method: Interpolation-Map	Land Use: Industrial	
Date Established: 19930326	Date Terminated:	Last Updated: 20100302
Regional Eval. Date:	HQ Eval. Date:	AQCR : Metropolitan Chicago
CBSA: Chicago-Naperville-Joliet, IL-IN-WI	CSA: Chicago-Naperville-Michigan City, IL-IN-WI	Direct Met Site: Met. Site ID:
Type Met Site: On-Site Met Equip	Dist to Met. Site(m):	Local Region:
Urban Area: Chicago, IL-NORTHWESTERN INDIANA	EPA Region: Chicago	
City Population: 102746	Dir. to CBD: NE	Dist. to City(km): 3
Census Block: 1019	Block Group: 1	Census Tract: 01020
Congressional District: 1		Class 1 Area:
Site Latitude: +41.606680	Site Longitude: - 87.304729	Time Zone: Central
UTM Zone: 16	UTM Northing: 4605938	UTM Easting: 474608
Accuracy: 30.36	Datum: WGS84	Scale: 24000
Vertical Measure(m): 183.0		Point/Line/Area: Point
Vert Datum Unknown		Vert Accuracy: 0
		Vert Method: Unknown

SITE COMMENTS

SITE MOVED FROM THE GATE CITY STEEL DUE TO SALE OF PROPERTY PAMS TYPE II SITE FOR CHICAGO NONATTAINMENT

ACTIVE MONITOR TYPES		AGENCY ROLES			
Monitor Type	# of Monitors	Role	Agency Desc	Begin Date	End Date
SLAMS	14	SUPPORTING	Indiana Depart Of Environ Management/Office Of Air Management	19930326	
UNOFFICIAL PAMS	121				
SPECIAL PURPOSE	3				
NON-REGULATORY	20				
OTHER	98				
SUPLMNTL SPECIATI	76				

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
 AIR QUALITY SYSTEM
 SITE DESCRIPTION REPORT

Apr. 15, 2010

Site ID: 18-089-0022	Site Name: LOCATED ON AT AN OLD AMMUNITION BUNKER	Local ID:
Street Address: 201 MISSISSIPPI ST., IITRI BUNKER	City: Gary	
State: Indiana	Zip Code: 46402	County: Lake
Location Description: Monitoring Point	Location Setting: Urban And Center City	
Coll. Method: Interpolation-Map	Land Use: Industrial	
Date Established: 19930326	Date Terminated:	Last Updated: 20100302
Regional Eval. Date:	HQ Eval. Date:	AQCR : Metropolitan Chicago
CBSA: Chicago-Naperville-Joliet, IL-IN-WI	CSA: Chicago-Naperville-Michigan City, IL-IN-WI	Direct Met Site: Met. Site ID:
Type Met Site: On-Site Met Equip	Dist to Met. Site(m):	Local Region:
Urban Area: Chicago, IL-NORTHWESTERN INDIANA	EPA Region: Chicago	
City Population: 102746	Dir. to CBD: NE	Dist. to City(km): 3
Census Block: 1019	Block Group: 1	Census Tract: 01020
Congressional District: 1		Class 1 Area:
Site Latitude: +41.606680	Site Longitude: - 87.304729	Time Zone: Central
UTM Zone: 16	UTM Northing: 4605938	UTM Easting: 474608
Accuracy: 30.36	Datum: WGS84	Scale: 24000
Vertical Measure(m): 183.0		Vert Accuracy: 0
Vert Datum Unknown		Vert Method: Unknown
		Point/Line/Area: Point

Road Number	Road Name	TANGENT ROADS		Traffic Volume Source	Road Type	Compass Sector
		Traffic Count	Traffic Year			
1	I-90 TOLL ROAD	15520	1990		FREEWAY	SW
2	US 12-20	27430	1989		MAJ ST OR HY	SW

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
 AIR QUALITY SYSTEM
 SITE DESCRIPTION REPORT

Apr. 15, 2010

Site ID: 18-089-0023	Site Name: SITE MOVED FROM EAST CHICAGO FIELD SCHOOL	Local ID:
Street Address: WATER FILTRATION PLANT		City: East Chicago
State: Indiana	Zip Code: 46312	County: Lake
Location Description: Monitoring Point		Location Setting: Urban And Center City
Coll. Method: Interpolation-Map		Land Use: Industrial
Date Established: 19970101	Date Terminated:	Last Updated: 20090604
Regional Eval. Date:	HQ Eval. Date:	AQCR : Metropolitan Chicago
CBSA: Chicago-Naperville-Joliet, IL-IN-WI	CSA: Chicago-Naperville-Michigan City, IL-IN-WI	Direct Met Site: S Met. Site ID: 18-089-0006
Type Met Site: Other AQS Site		Local Region:
Urban Area: Chicago, IL-NORTHWESTERN INDIANA	Dist to Met. Site(m): 1810.512	EPA Region: Chicago
City Population: 32414	Dir. to CBD:	Dist. to City(km):
Census Block: 3000	Block Group: 3	Census Tract: 03030
Congressional District: 1		Class 1 Area:
Site Latitude: +41.652740	Site Longitude: - 87.439551	Time Zone: Central
UTM Zone: 16	UTM Northing: 4611100	UTM Easting: 463400
Accuracy: 30.36	Datum: WGS84	Scale: 24000 Point/Line/Area: Point
Vertical Measure(m): 0.0		Vert Accuracy: 0
Vert Datum Unknown		Vert Method: Unknown

ACTIVE MONITOR TYPES		AGENCY ROLES			
Monitor Type	# of Monitors	Role	Agency Desc	Begin Date	End Date
SLAMS	2	SUPPORTING	Indiana Depart Of Environ Management/Office Of Air Management	19970101	
OTHER	61				
SPECIAL PURPOSE	2				

		TANGENT ROADS					
Road Number	Road Name	Traffic Count	Traffic Year	Traffic Volume Source	Road Type	Compass Sector	
1	ALDIS	500	1997		LOCAL ST OR HY	N	
2	CLINE AVE.	37350	1992		EXPRESSWAY	E	
3	INLAND STEEL OVERPAS	5000	1997		THRU ST OR HY	E	

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
 AIR QUALITY SYSTEM
 SITE DESCRIPTION REPORT

Apr. 15, 2010

Site ID: 18-089-0030	Site Name:	Local ID:
Street Address: 1751 OLIVER ST/ WHITING HIGH SCHOOL	City: Whiting	
State: Indiana	County: Lake	
Location Description: Monitoring Point	Location Setting: Urban And Center City	
Coll. Method: Address Matching-Digitized	Land Use: Residential	
Date Established: 20040330	Date Terminated:	Last Updated: 20060307
Regional Eval. Date:	HQ Eval. Date:	AQCR : Metropolitan Chicago
CBSA: Chicago-Naperville-Joliet, IL-IN-WI	CSA: Chicago-Naperville-Michigan City, IL-IN-WI	Direct Met Site: Met. Site ID:
Type Met Site:	Dist to Met. Site(m):	Local Region:
Urban Area: Chicago, IL-NORTHWESTERN INDIANA		EPA Region: Chicago
City Population: 5137	Dir. to CBD:	Dist. to City(km):
Census Block:	Block Group:	Census Tract:
Congressional District:		Class 1 Area:
Site Latitude: +41.681384	Site Longitude: - 87.494722	Time Zone: Central
UTM Zone: 16	UTM Northing: 4614307.26	UTM Easting: 458823.37
Accuracy: 10	Datum: NAD27	Scale: 10 Point/Line/Area: Point
Vertical Measure(m): 180.0		Vert Accuracy: 10
Vert Datum Unknown		Vert Method: Unknown

ACTIVE MONITOR TYPES		AGENCY ROLES			
Monitor Type	# of Monitors	Role	Agency Desc	Begin Date	End Date
SPECIAL PURPOSE	2	SUPPORTING	Indiana Depart Of Environ Management/Office Of Air Management	20040330	
OTHER	62				

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
AIR QUALITY SYSTEM
SITE DESCRIPTION REPORT

Apr. 15, 2010

Site ID: 18-089-2008	Site Name: HAMMOND CAAP	Local ID:
Street Address: 1300 141 ST STREET		City: Hammond
State: Indiana	Zip Code: 46327	County: Lake
Location Description: Monitoring Point		Location Setting: Suburban
Coll. Method: Unknown		Land Use: Commercial
Date Established: 19740701	Date Terminated:	Last Updated: 20090721
Regional Eval. Date:	HQ Eval. Date: 19800312	AQCR : Metropolitan Chicago
CBSA: Chicago-Naperville-Joliet, IL-IN-WI	CSA: Chicago-Naperville-Michigan City, IL-IN-WI	Direct Met Site: Met. Site ID:
Type Met Site: On-Site Met Equip		Local Region:
Urban Area: Chicago, IL-NORTHWESTERN INDIANA	Dist to Met. Site(m):	EPA Region: Chicago
City Population: 83048	Dir. to CBD: NE	Dist. to City(km): 2
Census Block: 3019	Block Group: 3	Census Tract: 02030
Congressional District: 1		Class 1 Area:
Site Latitude: +41.639460	Site Longitude: - 87.493623	Time Zone: Central
UTM Zone:	UTM Northing:	UTM Easting:
Accuracy: 0	Datum: WGS84	Scale: 0 Point/Line/Area: Point
Vertical Measure(m): 183.0		Vert Accuracy: 0
Vert Datum Unknown		Vert Method: Unknown

SITE COMMENTS

CAAP STATION CONTAINING 1-HOUR SO2 CO NO NOX O3 COH MET DATA HC W/WO METHANE
for lead, please use other airs site 18-089-2010 distance: 4425.696m direction to site: NNW

ACTIVE MONITOR TYPES		AGENCY ROLES			
Monitor Type	# of Monitors	Role	Agency Desc	Begin Date	End Date
OTHER	64	SUPPORTING	Indiana Depart Of Environ Management/Office Of Air Management	19740701	
SLAMS	4				
SPECIAL PURPOSE	2				
NON-REGULATORY	4				

TANGENT ROADS						
Road Number	Road Name	Traffic Count	Traffic Year	Traffic Volume	Source	Compass Sector

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
 AIR QUALITY SYSTEM
 SITE DESCRIPTION REPORT

Apr. 15, 2010

Site ID: 18-089-2008	Site Name: HAMMOND CAAP	Local ID:
Street Address: 1300 141 ST STREET		City: Hammond
State: Indiana	Zip Code: 46327	County: Lake
Location Description: Monitoring Point		Location Setting: Suburban
Coll. Method: Unknown		Land Use: Commercial
Date Established: 19740701	Date Terminated:	Last Updated: 20090721
Regional Eval. Date:	HQ Eval. Date: 19800312	AQCR : Metropolitan Chicago
CBSA: Chicago-Naperville-Joliet, IL-IN-WI	CSA: Chicago-Naperville-Michigan City, IL-IN-WI	Direct Met Site: Met. Site ID:
Type Met Site: On-Site Met Equip	Dist to Met. Site(m):	Local Region:
Urban Area: Chicago, IL-NORTHWESTERN INDIANA		EPA Region: Chicago
City Population: 83048	Dir. to CBD: NE	Dist. to City(km): 2
Census Block: 3019	Block Group: 3	Census Tract: 02030
Congressional District: 1		Class 1 Area:
Site Latitude: +41.639460	Site Longitude: - 87.493623	Time Zone: Central
UTM Zone:	UTM Northing:	UTM Easting:
Accuracy: 0	Datum: WGS84	Scale: 0 Point/Line/Area: Point
Vertical Measure(m): 183.0		Vert Accuracy: 0
Vert Datum Unknown		Vert Method: Unknown

		TANGENT ROADS				
Road Number	Road Name	Traffic Count	Traffic Year	Traffic Volume Source	Road Type	Compass Sector
1	UNKNOWN	1000			LOCAL ST OR HY	UNK

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
 AIR QUALITY SYSTEM
 SITE DESCRIPTION REPORT

Apr. 15, 2010

Site ID: 18-097-0078	Site Name: Washington Park- IN PARKING LOT NEXT TO POLICE STATION	Local ID: SITE 41
Street Address: 3120 E. 30TH ST., WASHINGTON PARK	City: Indianapolis (Remainder)	
State: Indiana	Zip Code: 46218	County: Marion
Location Description: Monitoring Point	Location Setting: Suburban	
Coll. Method: GPS Code (Pseudo Range) Precise Position	Land Use: Residential	
Date Established: 19990307	Date Terminated:	Last Updated: 20100304
Regional Eval. Date:	HQ Eval. Date:	AQCR : Metropolitan Indianapolis
CBSA: Indianapolis-Carmel, IN	CSA: Indianapolis-Anderson-Columbus, IN	Direct Met Site: Met. Site ID:
Type Met Site:	Dist to Met. Site(m):	Local Region:
Urban Area: Indianapolis, IN	EPA Region: Chicago	
City Population: 781870	Dir. to CBD: NE	Dist. to City(km):
Census Block: 2002	Block Group: 2	Census Tract: 35070
Congressional District: 7	Class 1 Area:	
Site Latitude: +39.811097	Site Longitude: - 86.114469	Time Zone: Eastern
UTM Zone:	UTM Northing:	UTM Easting:
Accuracy: 20	Datum: WGS84	Scale: 0 Point/Line/Area: Point
Vertical Measure(m): 230.0	Vert Accuracy: 0	
Vert Datum Unknown	Vert Method: Unknown	

ACTIVE MONITOR TYPES		AGENCY ROLES			
Monitor Type	# of Monitors	Role	Agency Desc	Begin Date	End Date
SLAMS	11	SUPPORTING	Indianapolis Office of Environmental Services	19990307	
SPECIAL PURPOSE	17				
PROPOSED NCORE	7				
NON-REGULATORY	35				
OTHER	62				
TRENDS SPECIATION	76				

		TANGENT ROADS				Road Type	Compass Sector
		Traffic Count	Traffic Year	Traffic Volume	Source		
Road Number	Road Name						
1	E. 30TH ST.	11514	1984			THRU ST OR HY	S

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
 AIR QUALITY SYSTEM
 SITE DESCRIPTION REPORT

Apr. 15, 2010

Site ID: 18-127-0024	Site Name:	Local ID:
Street Address: 84 DIANA RD/ WATER TREATMENT PLANT		City: Ogden Dunes (Wickliffe)
State: Indiana	Zip Code: 46368	County: Porter
Location Description: Monitoring Point		Location Setting: Suburban
Coll. Method: Unknown		Land Use: Residential
Date Established: 19831101	Date Terminated:	Last Updated: 20100302
Regional Eval. Date:	HQ Eval. Date:	AQCR : Metropolitan Chicago
CBSA: Chicago-Naperville-Joliet, IL-IN-WI	CSA: Chicago-Naperville-Michigan City, IL-IN-WI	Direct Met Site: Met. Site ID:
Type Met Site:	Dist to Met. Site(m):	Local Region:
Urban Area: Chicago, IL-NORTHWESTERN INDIANA		EPA Region: Chicago
City Population: 1313	Dir. to CBD:	Dist. to City(km):
Census Block: 1014	Block Group: 1	Census Tract: 05040
Congressional District: 1		Class 1 Area:
Site Latitude: +41.617558	Site Longitude: - 87.199248	Time Zone: Central
UTM Zone: 16	UTM Northing: 4607120	UTM Easting: 483400
Accuracy: 0	Datum: WGS84	Scale: 0 Point/Line/Area: Point
Vertical Measure(m): 183.0		Vert Accuracy: 0
Vert Datum Unknown		Vert Method: Unknown

ACTIVE MONITOR TYPES		AGENCY ROLES			
Monitor Type	# of Monitors	Role	Agency Desc	Begin Date	End Date
OTHER	61	SUPPORTING	Indiana Depart Of Environ Management/Office Of Air Management	19831101	
SPECIAL PURPOSE	3				
SLAMS	12				

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
AIR QUALITY SYSTEM
SITE DESCRIPTION REPORT

Apr. 15, 2010

Site ID: 18-163-0016	Site Name: SITE IS LOCATED ON TOP OF CARSON CENTER ON WESTERN SII	Local ID:
Street Address: UNIVERSITY OF EVANSVILLE - CARSON CENTER	City: Evansville	
State: Indiana	Zip Code: 47714	County: Vanderburgh
Location Description: Monitoring Point	Location Setting: Urban And Center City	
Coll. Method: Interpolation-Map	Land Use: Commercial	
Date Established: 19990605	Date Terminated:	Last Updated: 20080827
Regional Eval. Date:	HQ Eval. Date:	AQCR : Evansville-Owensboro-Henderson
CBSA: Evansville, IN-KY	CSA:	Direct Met Site: NW Met. Site ID: 18-129-0003
Type Met Site: Other AQS Site	Dist to Met. Site(m): 17	Local Region:
Urban Area: Evansville, IN-KY		EPA Region: Chicago
City Population: 121582	Dir. to CBD: E	Dist. to City(km): 3
Census Block: 3001	Block Group: 3	Census Tract: 00030
Congressional District: 8		Class 1 Area:
Site Latitude: +37.974436	Site Longitude: - 87.532289	Time Zone: Central
UTM Zone: 16	UTM Northing: 4202900	UTM Easting: 453250
Accuracy: 30.36	Datum: WGS84	Scale: 24000 Point/Line/Area: Point
Vertical Measure(m): 118.0		Vert Accuracy: 0
Vert Datum Unknown		Vert Method: Unknown

SITE COMMENTS

PM2.5 SITE - 3 DAY SAMPLING TOXICS MONITORING PROJECT - PERMANENT SITE

ACTIVE MONITOR TYPES		AGENCY ROLES			
Monitor Type	# of Monitors	Role	Agency Desc	Begin Date	End Date
OTHER	61	SUPPORTING	Indiana Depart Of Environ Management/Office Of Air Management	19990605	
SPECIAL PURPOSE	2				
SLAMS	10				

		TANGENT ROADS					
Road Number	Road Name	Traffic Count	Traffic Year	Traffic Volume Source	Road Type	Compass Sector	
1	WALNUT ST	4856	1996		THRU ST OR HY	S	
2	LLOYD EXPRESSWAY	59359	1996		EXPRESSWAY	N	
3	WEINBACH AVE.	22347	1996		MAJ ST OR HY	E	

Appendix E

Nation-Wide Comparison Monitoring Locations

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
AIR QUALITY SYSTEM
SITE DESCRIPTION REPORT

Aug. 3, 2009

Site ID: 06-075-0005	Site Name:	Local ID:
Street Address: 10 ARKANSAS ST., SAN FRANCISCO		City: San Francisco
State: California	Zip Code:	County: San Francisco
Location Description: Monitoring Point		Location Setting: Urban And Center City
Coll. Method: Unknown		Land Use: Industrial
Date Established: 19800101	Date Terminated:	Last Updated: 20070813
Regional Eval. Date:	HQ Eval. Date: 19880928	AQCR : San Francisco Bay Area
CBSA: San Francisco-Oakland-Fremont, CA	CSA: San Jose-San Francisco-Oakland, CA	Direct Met Site: Met. Site ID:
Type Met Site:	Dist to Met. Site(m):	Local Region: San Francisco Bay Area
Urban Area: San Francisco-Oakland, CA		EPA Region: San Francisco
City Population: 776733	Dir. to CBD:	Dist. to City(km):
Census Block:	Block Group:	Census Tract:
Congressional District:		Class 1 Area:
Site Latitude: +37.766000	Site Longitude: -122.399100	Time Zone: Pacific
UTM Zone: 10	UTM Northing: 4179817.62	UTM Easting: 552926.17
Accuracy: 0	Datum: NAD27	Scale: 0 Point/Line/Area: Point
Vertical Measure(m): 5.0		Vert Accuracy: 0
Vert Datum Unknown		Vert Method: Unknown

SITE COMMENTS

ARB # 9000306. SITE REPLACES 056860004A01 3/87 EMSL/NASN STARTED 12/85, REPLACED SAN FRANCISCO-23RD ST

ACTIVE MONITOR TYPES		AGENCY ROLES			
Monitor Type	# of Monitors	Role	Agency Desc	Begin Date	End Date
QA COLLOCATED	14	SUPPORTING	Bay Area Air Quality Management District	19800101	
NON-REGULATORY	20				
SLAMS	38				
OTHER	35				

		TANGENT ROADS					
Road Number	Road Name	Traffic Count	Traffic Year	Traffic Volume Source	Road Type	Compass Sector	
1	ROUTE 101	240700	1991		FREEWAY	W	
2	ROUTE 280	60180	1991		FREEWAY	E	

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
 AIR QUALITY SYSTEM
 SITE DESCRIPTION REPORT

Aug. 3, 2009

Site ID: 06-075-0005	Site Name:	Local ID:
Street Address: 10 ARKANSAS ST., SAN FRANCISCO		City: San Francisco
State: California	Zip Code:	County: San Francisco
Location Description: Monitoring Point		Location Setting: Urban And Center City
Coll. Method: Unknown		Land Use: Industrial
Date Established: 19800101	Date Terminated:	Last Updated: 20070813
Regional Eval. Date:	HQ Eval. Date: 19880928	AQCR : San Francisco Bay Area
CBSA: San Francisco-Oakland-Fremont, CA	CSA: San Jose-San Francisco-Oakland, CA	Direct Met Site: Met. Site ID:
Type Met Site:	Dist to Met. Site(m):	Local Region: San Francisco Bay Area
Urban Area: San Francisco-Oakland, CA		EPA Region: San Francisco
City Population: 776733	Dir. to CBD:	Dist. to City(km):
Census Block:	Block Group:	Census Tract:
Congressional District:		Class 1 Area:
Site Latitude: +37.766000	Site Longitude: -122.399100	Time Zone: Pacific
UTM Zone: 10	UTM Northing: 4179817.62	UTM Easting: 552926.17
Accuracy: 0	Datum: NAD27	Scale: 0 Point/Line/Area: Point
Vertical Measure(m): 5.0		Vert Accuracy: 0
Vert Datum Unknown		Vert Method: Unknown

		TANGENT ROADS				
Road Number	Road Name	Traffic Count	Traffic Year	Traffic Volume Source	Road Type	Compass Sector
3	16TH STREET	4160	1991		LOCAL ST OR HY	S

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
 AIR QUALITY SYSTEM
 SITE DESCRIPTION REPORT

Aug. 3, 2009

Site ID: 06-085-0005	Site Name: SAN JOSE JACKSON ST	Local ID:
Street Address: 158B JACKSON ST, SAN JOSE, CA		City: San Jose
State: California	Zip Code: 95112	County: Santa Clara
Location Description: Monitoring Point		Location Setting: Urban And Center City
Coll. Method: GPS - Unspecified		Land Use: Commercial
Date Established: 20021001	Date Terminated:	Last Updated: 20060807
Regional Eval. Date:	HQ Eval. Date:	AQCR : San Francisco Bay Area
CBSA: San Jose-Sunnyvale-Santa Clara, CA	CSA: San Jose-San Francisco-Oakland, CA	Direct Met Site: Met. Site ID:
Type Met Site:	Dist to Met. Site(m):	Local Region: San Francisco Bay Area
Urban Area: San Jose, CA		EPA Region: San Francisco
City Population: 894943	Dir. to CBD:	Dist. to City(km):
Census Block:	Block Group:	Census Tract:
Congressional District:		Class 1 Area:
Site Latitude: +37.348500	Site Longitude: -121.895000	Time Zone: Pacific
UTM Zone: 10	UTM Northing: 4133902.27	UTM Easting: 597872.04
Accuracy: 20	Datum: NAD83	Scale: 0 Point/Line/Area: Point
Vertical Measure(m): 31.0		Vert Accuracy: 5
Vert Datum Mean Sea-Level		Vert Method: Topographic Map Interpolation

ACTIVE MONITOR TYPES		AGENCY ROLES			
Monitor Type	# of Monitors	Role	Agency Desc	Begin Date	End Date
OTHER	47	SUPPORTING	Bay Area Air Quality Management District	20021001	
SLAMS	20				
NATTS	6				
NON-REGULATORY	53				
TRENDS SPECIATION	81				
PROPOSED NCORE	16				

		TANGENT ROADS				Road Type	Compass Sector
		Road Number	Road Name	Traffic Count	Traffic Year		
	1	JACKSON ST				LOCAL ST OR HY	NNW
	2	4TH ST				THRU ST OR HY	ESE

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
AIR QUALITY SYSTEM
SITE DESCRIPTION REPORT

Aug. 3, 2009

Site ID: 17-031-0072	Site Name: JARDINE WATER PLANT	Local ID:
Street Address: 1000 E. OHIO		City: Chicago
State: Illinois	Zip Code: 60611	County: Cook
Location Description: Monitoring Point		Location Setting: Urban And Center City
Coll. Method: GPS Code (Pseudo Range) Standard Position (SA Off)		Land Use: Commercial
Date Established: 19950414	Date Terminated:	Last Updated: 20071114
Regional Eval. Date:	HQ Eval. Date:	AQCR : Metropolitan Chicago
CBSA: Chicago-Naperville-Joliet, IL-IN-WI	CSA: Chicago-Naperville-Michigan City, IL-IN-WI	Direct Met Site: Met. Site ID:
Type Met Site: On-Site Met Equip	Dist to Met. Site(m):	Local Region:
Urban Area: Not in an urban area		EPA Region: Chicago
City Population: 2896016	Dir. to CBD: NE	Dist. to City(km): 1
Census Block: 2000	Block Group: 2	Census Tract: 08140
Congressional District:		Class 1 Area:
Site Latitude: +41.895812	Site Longitude: - 87.607683	Time Zone: Central
UTM Zone: 16	UTM Northing: 4638387	UTM Easting: 449591
Accuracy: 10	Datum: WGS84	Scale: 24000 Point/Line/Area: Point
Vertical Measure(m): 181.0		Vert Accuracy: 3
Vert Datum Mean Sea-Level		Vert Method: Topographic Map Interpolation

ACTIVE MONITOR TYPES		AGENCY ROLES			
Monitor Type	# of Monitors	Role	Agency Desc	Begin Date	End Date
UNOFFICIAL PAMS	179	SUPPORTING	Illinois Environmental Protection Agency	19950414	
NON-REGULATORY	191				

		TANGENT ROADS					
		Traffic Count	Traffic Year	Traffic Volume Source	Road Type		
1	LAKE SHORE DRIVE	138200	1991		ARTERIAL	W	

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
AIR QUALITY SYSTEM
SITE DESCRIPTION REPORT

Aug. 3, 2009

Site ID: 26-163-0015	Site Name:	Local ID:
Street Address: 6921 WEST FORT		City: Detroit
State: Michigan	Zip Code: 48209	County: Wayne
Location Description: Monitoring Point		Location Setting: Urban And Center City
Coll. Method: Unknown		Land Use: Commercial
Date Established: 19710101	Date Terminated:	Last Updated: 20070828
Regional Eval. Date:	HQ Eval. Date: 19800515	AQCR : Metropolitan Detroit-Port Huron
CBSA: Detroit-Warren-Livonia, MI	CSA: Detroit-Warren-Flint, MI	Direct Met Site: Met. Site ID:
Type Met Site:	Dist to Met. Site(m):	Local Region:
Urban Area: Detroit, MI		EPA Region: Chicago
City Population: 951270	Dir. to CBD: SW	Dist. to City(km): 6
Census Block: 1020	Block Group: 1	Census Tract: 52360
Congressional District: 13		Class 1 Area:
Site Latitude: +42.302786	Site Longitude: - 83.106530	Time Zone: Eastern
UTM Zone:	UTM Northing:	UTM Easting:
Accuracy: 0	Datum: WGS84	Scale: 0 Point/Line/Area: Point
Vertical Measure(m): 180.0		Vert Accuracy: 0
Vert Datum Unknown		Vert Method: Unknown

SITE COMMENTS

NAMS/SLAMS/NFAN ACTIVE 10/70

ACTIVE MONITOR TYPES		AGENCY ROLES			
Monitor Type	# of Monitors	Role	Agency Desc	Begin Date	End Date
SPECIAL PURPOSE	16	SUPPORTING	Wayne County Air Pollution Control Division	19710101	20040430
SUPLMNTL SPECIATI	80	SUPPORTING	Michigan Dept Of Environmental Quality-Air Quality Division	20040501	
UNKNOWN	1				
SLAMS	5				
OTHER	79				

Road		TANGENT ROADS				Compass	
Number	Road Name	Traffic Count	Traffic Year	Traffic Volume Source	Road Type	Sector	
1	UNKNOWN	1000			LOCAL ST OR HY	UNK	

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
 AIR QUALITY SYSTEM
 SITE DESCRIPTION REPORT

Aug. 3, 2009

Site ID: 26-163-0015	Site Name:	Local ID:
Street Address: 6921 WEST FORT		City: Detroit
State: Michigan	Zip Code: 48209	County: Wayne
Location Description: Monitoring Point		Location Setting: Urban And Center City
Coll. Method: Unknown		Land Use: Commercial
Date Established: 19710101	Date Terminated:	Last Updated: 20070828
Regional Eval. Date:	HQ Eval. Date: 19800515	AQCR : Metropolitan Detroit-Port Huron
CBSA: Detroit-Warren-Livonia, MI	CSA: Detroit-Warren-Flint, MI	Direct Met Site: Met. Site ID:
Type Met Site:	Dist to Met. Site(m):	Local Region:
Urban Area: Detroit, MI		EPA Region: Chicago
City Population: 951270	Dir. to CBD: SW	Dist. to City(km): 6
Census Block: 1020	Block Group: 1	Census Tract: 52360
Congressional District: 13		Class 1 Area:
Site Latitude: +42.302786	Site Longitude: - 83.106530	Time Zone: Eastern
UTM Zone:	UTM Northing:	UTM Easting:
Accuracy: 0	Datum: WGS84	Scale: 0 Point/Line/Area: Point
Vertical Measure(m): 180.0		Vert Accuracy: 0
Vert Datum Unknown		Vert Method: Unknown

		TANGENT ROADS				
Road Number	Road Name	Traffic Count	Traffic Year	Traffic Volume Source	Road Type	Compass Sector
2	UNKNOWN	17437			MAJ ST OR HY	UNK

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
AIR QUALITY SYSTEM
SITE DESCRIPTION REPORT

Aug. 3, 2009

Site ID: 29-510-0085	Site Name: BLAIR STREET CATEGORY A CORE SLAM PM2.5.	Local ID:
Street Address: BLAIR ST		City: St. Louis
State: Missouri	Zip Code: 63107	County: St. Louis City
Location Description: Monitoring Point		Location Setting: Urban And Center City
Coll. Method: Address Matching-Other		Land Use: Residential
Date Established: 19990301	Date Terminated:	Last Updated: 20080825
Regional Eval. Date:	HQ Eval. Date:	AQCR : Metropolitan St. Louis
CBSA: St. Louis, MO-IL	CSA: St. Louis-St. Charles-Farmington, MO-IL	Direct Met Site: Met. Site ID:
Type Met Site:	Dist to Met. Site(m):	Local Region:
Urban Area: St. Louis, MO-IL		EPA Region: Kansas City
City Population: 348189	Dir. to CBD:	Dist. to City(km):
Census Block: 1061	Block Group: 1	Census Tract: 12670
Congressional District: 1		Class 1 Area:
Site Latitude: +38.656349	Site Longitude: - 90.198198	Time Zone: Central
UTM Zone:	UTM Northing:	UTM Easting:
Accuracy: 303.63	Datum: WGS84	Scale: 24000 Point/Line/Area: Point
Vertical Measure(m): 300.0		Vert Accuracy: 0
Vert Datum Unknown		Vert Method: Unknown

ACTIVE MONITOR TYPES		AGENCY ROLES			
Monitor Type	# of Monitors	Role	Agency Desc	Begin Date	End Date
TRENDS SPECIATION	83	SUPPORTING	St Louis City Division Of Air Pollution Control	19990301	
NON-REGULATORY	213				
PROPOSED NCORE	1				
SLAMS	7				
QA COLLOCATED	3				
SPECIAL PURPOSE	8				

		TANGENT ROADS				Road Type	Compass Sector
		Traffic Count	Traffic Year	Traffic Volume Source			
1	BLAIR STREET	22840	1995			LOCAL ST OR HY	W

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
 AIR QUALITY SYSTEM
 SITE DESCRIPTION REPORT

Aug. 3, 2009

Site ID: 37-119-0041	Site Name: Garinger High School	Local ID:
Street Address: 1130 EASTWAY DRIVE		City: Charlotte
State: North Carolina	Zip Code: 28205	County: Mecklenburg
Location Description: Monitoring Point		Location Setting: Urban And Center City
Coll. Method: GPS Code (Pseudo Range) Precise Position		Land Use: Residential
Date Established: 19990730	Date Terminated:	Last Updated: 20080129
Regional Eval. Date:	HQ Eval. Date:	AQCR : Metropolitan Charlotte
CBSA: Charlotte-Gastonia-Concord, NC-SC	CSA: Charlotte-Gastonia-Salisbury, NC-SC	Direct Met Site: Met. Site ID:
Type Met Site:	Dist to Met. Site(m):	Local Region:
Urban Area: Charlotte, NC		EPA Region: Atlanta
City Population: 540828	Dir. to CBD:	Dist. to City(km):
Census Block: 1013	Block Group: 1	Census Tract: 00130
Congressional District: 12		Class 1 Area:
Site Latitude: +35.240100	Site Longitude: - 80.785683	Time Zone: Eastern
UTM Zone:	UTM Northing:	UTM Easting:
Accuracy: 60.73	Datum: WGS84	Scale: 24000 Point/Line/Area: Point
Vertical Measure(m): 232.0		Vert Accuracy: 0
Vert Datum Unknown		Vert Method: Unknown

SITE COMMENTS

1/1 PM2.5 Sampling on roof of monitoring shelter. MOVED SHELTER 230 M SW OF ORIGINAL LOCATION ON 5/11/01.

ACTIVE MONITOR TYPES		AGENCY ROLES			
Monitor Type	# of Monitors	Role	Agency Desc	Begin Date	End Date
PROPOSED NCORE	4	SUPPORTING	Mecklenburg County Air Quality	19990730	
TRENDS SPECIATION	80				
NON-REGULATORY	376				
SLAMS	32				
SPECIAL PURPOSE	2				

Road		TANGENT ROADS				Compass
Number	Road Name	Traffic Count	Traffic Year	Traffic Volume Source	Road Type	Sector

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
 AIR QUALITY SYSTEM
 SITE DESCRIPTION REPORT

Aug. 3, 2009

Site ID: 37-119-0041	Site Name: Garinger High School	Local ID:
Street Address: 1130 EASTWAY DRIVE		City: Charlotte
State: North Carolina	Zip Code: 28205	County: Mecklenburg
Location Description: Monitoring Point		Location Setting: Urban And Center City
Coll. Method: GPS Code (Pseudo Range) Precise Position		Land Use: Residential
Date Established: 19990730	Date Terminated:	Last Updated: 20080129
Regional Eval. Date:	HQ Eval. Date:	AQCR : Metropolitan Charlotte
CBSA: Charlotte-Gastonia-Concord, NC-SC	CSA: Charlotte-Gastonia-Salisbury, NC-SC	Direct Met Site: Met. Site ID:
Type Met Site:	Dist to Met. Site(m):	Local Region:
Urban Area: Charlotte, NC		EPA Region: Atlanta
City Population: 540828	Dir. to CBD:	Dist. to City(km):
Census Block: 1013	Block Group: 1	Census Tract: 00130
Congressional District: 12		Class 1 Area:
Site Latitude: +35.240100	Site Longitude: - 80.785683	Time Zone: Eastern
UTM Zone:	UTM Northing:	UTM Easting:
Accuracy: 60.73	Datum: WGS84	Scale: 24000 Point/Line/Area: Point
Vertical Measure(m): 232.0		Vert Accuracy: 0
Vert Datum Unknown		Vert Method: Unknown

Road Number	Road Name	TANGENT ROADS		Traffic Volume Source	Road Type	Compass Sector
		Traffic Count	Traffic Year			
1	SUGAR CREEK ROAD	16400	1997		MAJ ST OR HY	N
2	EASTWAY DRIVE	17200	1997		MAJ ST OR HY	NE
3	SHAMROCK DRIVE	12400	1997		MAJ ST OR HY	SE

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
AIR QUALITY SYSTEM
SITE DESCRIPTION REPORT

Aug. 3, 2009

Site ID: 39-049-0034	Site Name: STATE FAIRGROUNDS	Local ID:
Street Address: KORBEL AVE.		City: Columbus
State: Ohio	Zip Code: 43215	County: Franklin
Location Description: Monitoring Point		Location Setting: Urban And Center City
Coll. Method: Interpolation-Map		Land Use: Commercial
Date Established: 19920713	Date Terminated:	Last Updated: 20080707
Regional Eval. Date:	HQ Eval. Date:	AQCR : Metropolitan Columbus
CBSA: Columbus, OH	CSA: Columbus-Marion-Chillicothe, OH	Direct Met Site: Met. Site ID:
Type Met Site:	Dist to Met. Site(m):	Local Region:
Urban Area: Columbus, OH		EPA Region: Chicago
City Population: 711470	Dir. to CBD: N	Dist. to City(km):
Census Block:	Block Group:	Census Tract:
Congressional District:		Class 1 Area:
Site Latitude: +40.002500	Site Longitude: - 82.994444	Time Zone: Eastern
UTM Zone: 17	UTM Northing: 4429750	UTM Easting: 329750
Accuracy: 12	Datum: NAD27	Scale: 24000 Point/Line/Area: Point
Vertical Measure(m): 252.0		Vert Accuracy: 1
Vert Datum NGVD29		Vert Method: Topographic Map Interpolation

SITE COMMENTS

MONITORING TRAILOR ON STATE FAIRGROUNDS

ACTIVE MONITOR TYPES		AGENCY ROLES			
Monitor Type	# of Monitors	Role	Agency Desc	Begin Date	End Date
OTHER	48	SUPPORTING	Ohio EPA, Central District Office	19920713	
SLAMS	2				
SPECIAL PURPOSE	26				
NON-REGULATORY	12				

		TANGENT ROADS					
Road Number	Road Name	Traffic Count	Traffic Year	Traffic Volume Source	Road Type	Compass Sector	
1	17TH AVE.	14800	2003		LOCAL ST OR HY	S	
2	KOEBEL AVENUE	50	2000		LOCAL ST OR HY	E	

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
AIR QUALITY SYSTEM
SITE DESCRIPTION REPORT

Aug. 3, 2009

Site ID: 39-061-0014	Site Name: CARTHAGE	Local ID:
Street Address: SEYMOUR & VINE ST.		City: Cincinnati
State: Ohio	Zip Code: 45216	County: Hamilton
Location Description: Monitoring Point		Location Setting: Suburban
Coll. Method: Interpolation-Map		Land Use: Industrial
Date Established: 19691101	Date Terminated:	Last Updated: 20080709
Regional Eval. Date:	HQ Eval. Date: 19910426	AQCR : Metropolitan Cincinnati
CBSA: Cincinnati-Middletown, OH-KY-IN	CSA: Cincinnati-Middletown-Wilmington, OH-KY-IN	Direct Met Site: Met. Site ID:
Type Met Site:	Dist to Met. Site(m):	Local Region:
Urban Area: Cincinnati, OH-KY		EPA Region: Chicago
City Population: 331285	Dir. to CBD: N	Dist. to City(km):
Census Block:	Block Group:	Census Tract:
Congressional District:		Class 1 Area:
Site Latitude: +39.194167	Site Longitude: - 84.478889	Time Zone: Eastern
UTM Zone: 16	UTM Northing: 4341145	UTM Easting: 717720
Accuracy: 12	Datum: NAD27	Scale: 24000 Point/Line/Area: Point
Vertical Measure(m): 163.0		Vert Accuracy: 1
Vert Datum NGVD29		Vert Method: Topographic Map Interpolation

SITE COMMENTS

CARTHAGE FIRE HOUSE

ACTIVE MONITOR TYPES		AGENCY ROLES			
Monitor Type	# of Monitors	Role	Agency Desc	Begin Date	End Date
OTHER	1	SUPPORTING	Southwestern Ohio Air Pollution Control Agency	19691101	19920816
QA COLLOCATED	1	SUPPORTING	Hamilton County Department Of Environmental Services	19920817	
SLAMS	76				

TANGENT ROADS						
Road Number	Road Name	Traffic Count	Traffic Year	Traffic Volume Source	Road Type	Compass Sector
1	VINE ST.	11800	1998		THRU ST OR HY	E
2	SEYMOUR	7950	1998		THRU ST OR HY	S

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
 AIR QUALITY SYSTEM
 SITE DESCRIPTION REPORT

Aug. 3, 2009

Site ID: 39-061-0014	Site Name: CARTHAGE	Local ID:
Street Address: SEYMOUR & VINE ST.		City: Cincinnati
State: Ohio	Zip Code: 45216	County: Hamilton
Location Description: Monitoring Point		Location Setting: Suburban
Coll. Method: Interpolation-Map		Land Use: Industrial
Date Established: 19691101	Date Terminated:	Last Updated: 20080709
Regional Eval. Date:	HQ Eval. Date: 19910426	AQCR : Metropolitan Cincinnati
CBSA: Cincinnati-Middletown, OH-KY-IN	CSA: Cincinnati-Middletown-Wilmington, OH-KY-IN	Direct Met Site: Met. Site ID:
Type Met Site:	Dist to Met. Site(m):	Local Region:
Urban Area: Cincinnati, OH-KY		EPA Region: Chicago
City Population: 331285	Dir. to CBD: N	Dist. to City(km):
Census Block:	Block Group:	Census Tract:
Congressional District:		Class 1 Area:
Site Latitude: +39.194167	Site Longitude: - 84.478889	Time Zone: Eastern
UTM Zone: 16	UTM Northing: 4341145	UTM Easting: 717720
Accuracy: 12	Datum: NAD27	Scale: 24000 Point/Line/Area: Point
Vertical Measure(m): 163.0		Vert Accuracy: 1
Vert Datum NGVD29		Vert Method: Topographic Map Interpolation

Road Number	Road Name	TANGENT ROADS		Traffic Volume Source	Road Type	Compass Sector
		Traffic Count	Traffic Year			
3	I-75	161250	2002		EXPRESSWAY	W

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
 AIR QUALITY SYSTEM
 SITE DESCRIPTION REPORT

Aug. 3, 2009

Site ID: 48-439-1002	Site Name: FORT WORTH NORTHWEST	Local ID:
Street Address: 3317 ROSS AVE.		City: Fort Worth
State: Texas	Zip Code: 76106	County: Tarrant
Location Description: Monitoring Point		Location Setting: Urban And Center City
Coll. Method: GPS		Land Use: Commercial
Date Established: 19750101	Date Terminated:	Last Updated: 20080312
Regional Eval. Date: 19800801	HQ Eval. Date: 19801028	AQCR : Metropolitan Dallas-Fort Worth
CBSA: Dallas-Fort Worth-Arlington, TX	CSA: Dallas-Fort Worth, TX	Direct Met Site: Met. Site ID:
Type Met Site: On-Site Met Equip	Dist to Met. Site(m):	Local Region:
Urban Area: Dallas-Fort Worth, TX		EPA Region: Dallas
City Population: 534694	Dir. to CBD: N	Dist. to City(km): 6
Census Block: 1006	Block Group: 1	Census Tract: 10030
Congressional District: 12		Class 1 Area:
Site Latitude: +32.805820	Site Longitude: - 97.356570	Time Zone: Central
UTM Zone:	UTM Northing:	UTM Easting:
Accuracy: 5.01	Datum: WGS84	Scale: 24000 Point/Line/Area: Point
Vertical Measure(m): 204.0		Vert Accuracy: 0
Vert Datum Unknown		Vert Method: Unknown

SITE COMMENTS

CONTINUOUS MONITRING STATION

ACTIVE MONITOR TYPES		AGENCY ROLES			
Monitor Type	# of Monitors	Role	Agency Desc	Begin Date	End Date
SLAMS	4	SUPPORTING	Texas Commission On Environmental Quality	19750101	
SPECIAL PURPOSE	1				
OTHER	106				
UNOFFICIAL PAMS	114				

		TANGENT ROADS					
Road Number	Road Name	Traffic Count	Traffic Year	Traffic Volume Source	Road Type	Compass Sector	
1	ROSS AVENUE	100	1992		LOCAL ST OR HY	W	
2	LONG AVENUE	11550	1992		THRU ST OR HY	N	

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
 AIR QUALITY SYSTEM
 SITE DESCRIPTION REPORT

Aug. 3, 2009

Site ID: 48-453-0021	Site Name: AUSTIN WEBBERVILLE RD	Local ID:
Street Address: 2600 B WEBBERVILLE RD.		City: Austin
State: Texas	Zip Code: 78702	County: Travis
Location Description: Monitoring Point		Location Setting: Urban And Center City
Coll. Method: GPS		Land Use: Industrial
Date Established: 19990929	Date Terminated:	Last Updated: 20080312
Regional Eval. Date:	HQ Eval. Date:	AQCR : Austin-Waco
CBSA: Austin-Round Rock, TX	CSA:	Direct Met Site: Met. Site ID:
Type Met Site: On-Site Met Equip	Dist to Met. Site(m):	Local Region:
Urban Area: Austin, TX		EPA Region: Dallas
City Population: 656562	Dir. to CBD:	Dist. to City(km):
Census Block: 4004	Block Group: 4	Census Tract: 00080
Congressional District: 25		Class 1 Area:
Site Latitude: +30.263233	Site Longitude: - 97.712883	Time Zone: Central
UTM Zone:	UTM Northing:	UTM Easting:
Accuracy: 5.01	Datum: WGS84	Scale: 24000 Point/Line/Area: Point
Vertical Measure(m): 152.0		Vert Accuracy: .1
Vert Datum Mean Sea-Level		Vert Method: Other

SITE COMMENTS

NEW LAT / LONG COORDINATES WERE TAKEN ON JULY 26, 2005---J. SAULS

ACTIVE MONITOR TYPES		AGENCY ROLES			
Monitor Type	# of Monitors	Role	Agency Desc	Begin Date	End Date
SLAMS	92	SUPPORTING	Texas Commission On Environmental Quality	19990929	
OTHER	113				

Road		TANGENT ROADS			Road Type	Compass Sector
Road Number	Road Name	Traffic Count	Traffic Year	Traffic Volume Source		
1	WEBBERVILLE RD.	5780	1992		LOCAL ST OR HY	N

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
AIR QUALITY SYSTEM
SITE DESCRIPTION REPORT

Aug. 3, 2009

Site ID: 55-079-0010	Site Name: HEALTH CENTER	Local ID:
Street Address: HEALTH CENTER, 1337 SO 16TH ST		City: Milwaukee
State: Wisconsin	Zip Code:	County: Milwaukee
Location Description: Monitoring Point		Location Setting: Urban And Center City
Coll. Method: Unknown		Land Use: Commercial
Date Established: 19970404	Date Terminated:	Last Updated: 20030514
Regional Eval. Date:	HQ Eval. Date:	AQCR : Southeastern Wisconsin
CBSA: Milwaukee-Waukesha-West Allis, WI	CSA: Milwaukee-Racine-Waukesha, WI	Direct Met Site: Met. Site ID:
Type Met Site:	Dist to Met. Site(m):	Local Region:
Urban Area: Milwaukee, WI		EPA Region: Chicago
City Population: 596974	Dir. to CBD: SW	Dist. to City(km): 2
Census Block:	Block Group:	Census Tract:
Congressional District:		Class 1 Area:
Site Latitude: +43.016667	Site Longitude: - 87.933333	Time Zone: Central
UTM Zone: 16	UTM Northing: 4762873	UTM Easting: 423944
Accuracy: 30.36	Datum: NAD83	Scale: 0 Point/Line/Area: Point
Vertical Measure(m): 200.0		Vert Accuracy: 0
Vert Datum Unknown		Vert Method: Unknown

SITE COMMENTS

ON ROOF OF BUILDING

ACTIVE MONITOR TYPES		AGENCY ROLES			
Monitor Type	# of Monitors	Role	Agency Desc	Begin Date	End Date
SLAMS	107	SUPPORTING	Wisconsin Dept Of Natural Resources, Air Monitoring Section	19970404	
QA COLLOCATED	52				
NATTS	8				
SPECIAL PURPOSE	63				

		TANGENT ROADS					
Road Number	Road Name	Traffic Count	Traffic Year	Traffic Volume Source	Road Type	Compass Sector	
1	GREENFIELD AVE	10000	1996		MAJ ST OR HY	S	
2	BB	10000	1996		MAJ ST OR HY	E	

Appendix F

Public Outreach Materials

Contents

Factsheets

Outreach Maps

Informational Brochure

Results Brochure

Public Report

Community Presentation



INDIANA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT

Ambient Air Background

www.idem.IN.gov

Mitchell E. Daniels, Jr.
Governor

Thomas W. Easterly
Commissioner

100 North Senate Avenue, Mail Code 61-50, Indianapolis, IN 46204

Phone: (317) 233-0178

Toll Free: (800) 451-6027

Description:

While conducting the Southwest Indianapolis Air Toxics Study, the Indiana Department of Environmental Management (IDEM) attempted to be as thorough as possible when identifying sources of air toxics. However, there are many sources of air toxics that IDEM cannot account for directly. These include natural sources (e.g., fires), long range transport (i.e., pollutants coming into Southwest Indianapolis from outside the study area), and very small residential sources (e.g., lawnmowers, weed-eaters, household chemicals, etc.). When the pollutants produced from all these sources are combined, this is referred to as "background." In other words, background is all the pollution that could not be directly counted by IDEM.

Why it was needed:

IDEM needed background concentrations to get a more complete picture of air toxics in the study area. IDEM conducted a detailed modeling analysis that looked at emissions from local industries, the interstates, major roads, and the Indianapolis International Airport. This was only part of the picture though. Background concentrations combined with the modeling results help to give the most complete picture possible of air toxics in the study area.

How it was used:

Background concentrations were added to the concentrations calculated from the model to allow IDEM to conduct a more realistic comparison of modeling results to monitoring results. This comparison is a simple way to judge the overall accuracy of the model. This also gives a more complete picture of air toxics in the study area.

Where it comes from:

IDEM used background concentrations that came from the 2002 National Air Toxics Assessment (NATA). NATA is a national modeling study U.S. EPA conducts every three years to assess overall air quality around the country. It was the 1996 and 1999 NATAs that first brought the southwest Indianapolis area to IDEM's attention. The 2002 NATA is the most recent NATA that has been released by U.S. EPA. The 2005 NATA is due for release in mid-2010 and is expected to use the same, or similar, background concentrations as the 2002 NATA.

Things to keep in mind:

Even the cleanest air has small amounts of pollutants in it. The term "background" can sometimes be used to describe "clean" air coming into an area before it is impacted by local sources of pollution. This type of background is most useful when trying to determine the impact that an area has on air quality, rather than the other way around. This type of background should not be confused with the type of background used by IDEM for the study.

More Information:

- For more information on Ambient Air Background, visit IDEM's Web site at www.idem.IN.gov.
- For more information on the Southwest Indianapolis Air Toxics Study, visit the study's Web site at www.idem.IN.gov/programs/air/workgroups/swindyairtox.
- For questions and concerns, feel free to call IDEM's Office of Air Quality Project Management Section at (317) 234-3499.



INDIANA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT

The Effects of Non-detects

www.idem.IN.gov

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Commissioner

100 North Senate Avenue, Mail Code 61-50, Indianapolis, IN 46204

Phone: (317) 233-0178

Toll Free: (800) 451-6027

Description:

A constant problem with any environmental sampling project is non-detects. “Non-detect” is the common term for the result of any sample where there is not enough of the pollutant in the sample for us to see it. Sampling equipment is not perfect, so we can never say that the concentration is zero. Any sampling procedure has a detection limit associated with it. In reality any sampling procedure has many detection limits associated with it; each with a different name and a slightly different meaning. For the purposes of this paper the generic term, “detection limit,” means the lowest concentration of a pollutant in a sample at which we can assign a number.

Importance:

Any concentration represented as a non-detect effectively represents a range of possible values. If the detection limit of a pollutant is 1 ppbv (parts per billion by volume) and a sample is reported as ND (non-detect) that mean the true concentration could be anything below 1 ppbv. It could be 0 ppbv or it could be 0.999 ppbv, we have no way of knowing for sure. Ignoring non-detects is not an acceptable thing to do so environmental scientists have to figure out what to do with non-detects.

Substitution:

Historically, the most common thing done with non-detects is called “substitution.” All this means it that you would replace any non-detect with a numeric value, usually $\frac{1}{2}$ of the detection limit. So in the previous example with the detection limit of 1 ppbv, a non-detect would get replaced with 0.5 ppbv ($\frac{1}{2}$ of 1 ppbv). You could replace non-detects with any value you wanted (e.g., 0, $\frac{1}{4}$ of the detection limit, $\frac{1}{2}$ the detection limit, the whole detection limit) so long as you were consistent. Half the detection limit was by far the most common and accepted value.

This worked reasonably well, but as computers became more common and more powerful people began to realize the there might be better ways of doing things. One of these better ways of doing things is called the “Kaplan-Meier Product Limit Estimate” or simply, Kaplan-Meier.

Kaplan-Meier:

Kaplan-Meier is a method that compares the number of non-detects you have to the number of detects you have, and uses that comparison, along with the detection limit and some other aspects of the data to estimate what the average of the data would be if you had known the true values of all the non-detects. Through extensive studies, it has been shown to introduce less bias and provide more accurate results than any of the substitution methods used in the past. Because of this, IDEM chose the Kaplan-Meier method to handle non-detects in the Southwest Indianapolis Air Toxics Study.

More Information:

- For more information on Non-detects, visit IDEM's Web site at www.idem.IN.gov.
- For more information on the Southwest Indianapolis Air Toxics Study, visit the study's Web site at www.idem.IN.gov/programs/air/workgroups/swindyairtox.
- For questions and concerns, feel free to call IDEM's Office of Air Quality Project Management Section at (317) 234-3499.



INDIANA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT

Odor and Air Toxics

www.idem.IN.gov

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Governor

Thomas W. Easterly
Commissioner

100 North Senate Avenue, Mail Code 61-50, Indianapolis, IN 46204

Phone: (317) 233-0178

Toll Free: (800) 451-6027

Introduction:

Many chemicals used today have the potential to be smelled by humans. The human nose has an amazing ability to detect odors that, in many cases, still cannot be matched by scientific equipment. Because the nose is so good at its job, it is important to realize that just because an odor is present does not mean that a danger exists. For example most people can smell acetone, a common industrial and household chemical, at concentrations well below 1 part per million (ppm), however acetone concentrations would need to be more than 10 times above that constantly for many years before adverse health effects would be expected. On the other hand, just because you cannot smell a pollutant does not mean that it is not present, or that it does not pose a risk.

Description:

Some pollutants have odor thresholds well above concentrations that have the potential for adverse health effects. In some cases, the smell of a mixture of pollutants, such as those being emitted from an industrial facility, can be very different from how each chemical would smell independently. Two pollutants could work together to smell worse than either pollutant by itself, they could cancel each other out completely, or anywhere in-between. These interactions make tracking down odors difficult at best.

That is why the Indiana Department of Environmental Management (IDEM) conducts studies like the Southwest Indianapolis Air Toxics Study and performs ambient air monitoring at sites around the state. These activities allow IDEM to evaluate Indiana's air quality without relying on subjective criteria like smell.

The table below lists common pollutants, along with their odor thresholds and health protective levels. If the odor threshold is lower than the health protective level that means you can smell the pollutant before it is a health concern.

Odor Thresholds and Health Protective Concentrations of Common Pollutants

Name	Odor Threshold (ppm)	Health Protective Level (ppm)	Odor
Acetone	< 1	13	sweet, fruity
Ammonia	< 1	0.14	sharp, pungent
Pyridine*	0.0037	0.037	disagreeable, unpleasant
Benzene	> 1	0.0094	aromatic, sweet
Toluene	> 1	1.3	sour, burnt
Methyl Mercaptan	0.0011	†	decayed cabbage

Grey shading indicates that pollutant can be smelled at concentrations below its health protective level.

*Pyridine is one of the most likely odor causing pollutants in the SIATS study area. The table shows that its odor threshold is well below its health protective level.

† no health protective level was available for methyl mercaptan.

More Information:

- For more information on Odor and Air Toxics, visit IDEM's Web site at www.idem.IN.gov.
- For more information on the Southwest Indianapolis Air Toxics Study, visit the study's Web site at www.idem.IN.gov/programs/air/workgroups/swindyairtox.
- For questions and concerns, feel free to call IDEM's Office of Air Quality Project Management Section at (317) 234-3499.



INDIANA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT

Public Advisory Group (PAG)

www.idem.IN.gov

Mitchell E. Daniels, Jr.
Governor

Thomas W. Easterly
Commissioner

100 North Senate Avenue, Mail Code 61-50, Indianapolis, IN 46204
Phone: (317) 233-0178 Toll Free: (800) 451-6027

Description:

The Public Advisory Group (PAG) was comprised of Southwest Indianapolis residents and community leaders who work toward increasing the quality of life for area residents through community improvements. The PAG met regularly at the Mary Rigg Neighborhood Center from June 2008 through March 2010.

Purpose of the PAG:

- to ensure study results reached Southwest Indianapolis residents first;
- to ensure study results were communicated in a clear and understandable manner to the general public in the area;
- to give residents of Southwest Indianapolis a forum for voicing questions and concerns regarding the study; and,
- to provide community input concerning any necessary follow-up actions once the study is complete.

The PAG achieved these goals by helping IDEM to create a community involvement plan for the study. The community involvement plan was used to help IDEM understand which information would be most useful to residents and to identify which organizations and individuals should be involved with the release of the study results.

PAG Members:

- Beth Gibson - West Indianapolis Development Corporation (WIDC)
- Joanne Hamilton - Marion County Alliance of Neighborhood Associations (McANA)
- Elizabeth McMillin - Southern Wayne Neighborhood Organization
- Dennis Papenmeier - Mayor's Neighborhood Liaison, City of Indianapolis
- Robyn Schuller - Director of Health Operations, Occupational Health and Hygiene Corporation of America
- Martha Wedemeyer - Southwest Health Clinic
- Kathy Dee - Parent Liaison, Daniel Webster School, IPS #46
- Janet McCabe - Improving Kids' Environment
- Pastor John Hay, Jr. - West Morris Street Free Methodist Church
- Richard Myers - Environmental Health and Safety, Indianapolis Public Schools

More Information:

- For more information on the PAG, visit IDEM's Web site at www.idem.IN.gov.
- For more information on the Southwest Indianapolis Air Toxics Study, visit the study's Web site at www.idem.IN.gov/programs/air/workgroups/swindyairtox.
- For questions and concerns, feel free to call IDEM's Office of Air Quality Project Management Section at (317) 234-3499.



INDIANA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT

Regional Air Impact Modeling Initiative (RAIMI)

www.idem.IN.gov

Mitchell E. Daniels, Jr.

Governor

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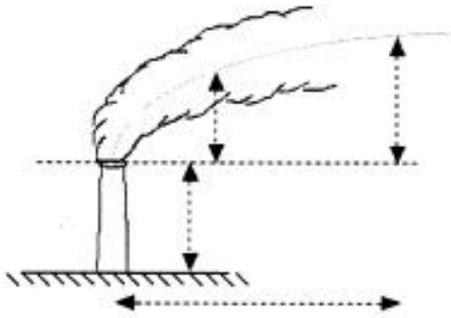
100 North Senate Avenue, Mail Code 61-50, Indianapolis, IN 46204

Phone: (317) 233-0178

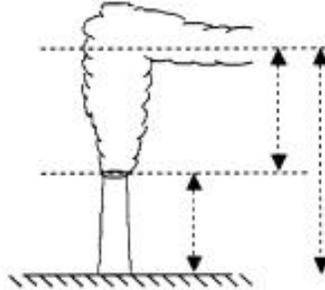
Toll Free: (800) 451-6027

Description:

- Computer model developed by U.S. Environmental Protection Agency Region 6 to evaluate region-wide estimation of potential health risks, on a community level of resolution, as a result to multiple contaminants and sources.
- Use Industrial Source Complex-3 (ISC3) model.
- RAIMI calculates concentrations at 54,195 different receptors (locations).
- Emissions inventory developed using information from sources, permit data, and approved calculations.
- 465 industrial and area sources modeled including:
 - Permitted (Industrial Sources)
 - Gas Stations
 - Dry Cleaners
 - Trucking Companies
 - Automotive Refinishing Shops
 - Indianapolis International Airport
- 600 points modeled along I-465 and I-70.
- 1676 points modeled along 13 main city streets.
 - Traffic count data obtained from Indiana Department of Transportation and City of Indianapolis for each roadway.
 - Modeled for cars and trucks.
- RAIMI imports multiple sources into a single batch modeling analysis and exports results into a graphical format.
- Modeling inputs for each source include:
 - Stack Dimensions(Height and Diameter)
 - Stack Exhaust Characteristics(Temperature and Velocity)
 - Source Location
 - Pollutant Emission Rate per source(amount of each air toxic released for a set time period)
- Five years (43,680 Hours) of weather data used for modeling:
 - Temperature
 - Wind Speed and Direction
 - Data from Indianapolis National Weather Service



High Wind Speed



Low Wind Speed

- Model considers geographic features:
 - Urban Setting
 - Terrain and Elevation
 - Land Use

More Information:

- For more information on RAIMI, visit IDEM's Web site at www.idem.IN.gov.
- For more information on the Southwest Indianapolis Air Toxics Study, visit the study's Web site at www.idem.IN.gov/programs/air/workgroups/swindyairtox
- For questions and concerns, feel free to call IDEM's Office of Air Quality Project Management Section at (317) 234-3499.



INDIANA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT

Technical Advisory Group (TAG)

www.idem.IN.gov

Mitchell E. Daniels, Jr.
Governor

Thomas W. Easterly
Commissioner

100 North Senate Avenue, Mail Code 61-50, Indianapolis, IN 46204
Phone: (317) 233-0178 Toll Free: (800) 451-6027

Description:

Any project as complex as the Southwest Indianapolis Air Toxics Study (the Study) can benefit from external input and review. To that end, the Indiana Department of Environmental Management (IDEM) formed the Technical Advisory Group (TAG). The TAG was a group of external technical experts from not-for-profit organizations, local industries, and state and local government agencies. The TAG was involved throughout the Study; from the initial scoping of the project to the final review of the results report.

Purpose of the TAG:

Input from the TAG provided a practical review of the assumptions and calculations used to support the Study. The TAG also served as a source of new ideas and different perspectives and helped to verify the Study's conclusions. Consensus from the group on specific methodology or technical ideas was not necessary. The TAG was not a steering committee, however, IDEM used the input and technical expertise of the group to help in its decision-making process.

The TAG met with IDEM 11 times over the course of the Study. All TAG meetings were open to the public, as well as broadcast in real-time over the Internet and posted on the Study's Web site for later viewing. Laura Steadham of IDEM's Office of Land Quality served as facilitator of the meetings and helped ensure that each meeting followed the pre-determined agenda. During the meetings, members of the TAG discussed technical issues associated with the Study and made recommendations to IDEM on the issues discussed. IDEM appreciates the hard work and dedication of all members of the TAG.

TAG Members:

- Dr. Jim Klaunig - Professor of Toxicology - Indiana University School of Medicine/IUPUI
- Rad Scott - Chemical Engineer - Eli Lilly
- Dr. Bill Beranek - Indiana Environmental Institute - chemist and community facilitator
- Dr. Phil Stevens - Professor of Chemistry, Indiana University General Public Representative-Air Pollution Control Board
- Dick Van Frank - Improving Kids' Environment
- Rod Thompson, - SESCO Group
- Dr. George Bollweg - U.S. Environmental Protection Agency - Region 5
- Motria Caudill - U.S. Environmental Protection Agency - Region 5
- LaNetta Alexander - Environmental Epidemiologist - Indiana State Department of Health
- Pam Thevenow and Jason Ravenscroft – Marion County Health Department
- Dr. Syed Ghiassudin – IDEM Office of Water Quality

More Information:

- For more information on the TAG, visit IDEM's Web site at www.idem.IN.gov.
- For more information on the Southwest Indianapolis Air Toxics Study, visit the study's Web site at www.idem.IN.gov/programs/air/workgroups/swindyairtox.
- For questions and concerns, feel free to call IDEM's Office of Air Quality Project Management Section at (317) 234-3499.



INDIANA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT

95% Upper Confidence Limits

www.idem.IN.gov

Mitchell E. Daniels, Jr.
Governor

Thomas W. Easterly
Commissioner

100 North Senate Avenue, Mail Code 61-50, Indianapolis, IN 46204

Phone: (317) 233-0178

Toll Free: (800) 451-6027

Introduction:

The 95% Upper Confidence Limit of the Mean (95% UCL) was used to represent the exposure concentrations associated with pollutants in the Southwest Indianapolis Air Toxics Study. 95% UCLs are the standard way of representing exposure concentrations in the environmental field. However, it may not be immediately clear what a 95% UCL is, or how it is used.

Description:

The technical definition of a 95% UCL is “a number that one can be 95% confident that the true mean (average) concentration of the population is below that value.” A slightly simpler definition is that it is a level that we are confident is health protective when we use it to calculate risks and hazards.

Why IDEM uses them:

Some people may argue that the average calculated from all the samples taken would be the best scientific estimate of the exposure concentration of a pollutant. If we were only concerned with the average concentration of every 6th day that may be true, but IDEM is interested in the average concentration of all days over the two-year period of the study. Since samples are collected every 6th day, we have no direct information about the concentrations of pollutants the other 5 out of 6 days.

Imagine two monitors set up at the exact same location. Both monitors sample the air every 6th day for two years. However, Monitor #1 starts sampling on a Monday, but Monitor #2 does not start until the next day, so they never sample the same day's air. At the end of the two years of sampling you would have two different sets of numbers. Is one set of numbers better than the other? Probably not, they are just two different sample sets from the same “population” of possible sampling days. What a 95% UCL does is takes into account that we do not have all the information about all the possible sampling days and makes a conservative (i.e., health protective) estimate of what the true concentration over all possible sampling days would be.

How they are calculated:

There are many different ways to calculate UCLs, but they all require two main pieces of information about the data: a value that represents the “middle” of the data, and a number that represents how “spread out” the data is. A UCL starts with the middle number and then looks at how spread out the data is to determine how much needs to be added to be adequately conservative. For example, consider the two sets of numbers below:

Table 1 – Sample Data Sets

Set #1	1	2	2	4	6	8	12	14	16	18	18	19
Set #2	7	7	8	9	9	10	10	11	11	12	13	13

Both sets of numbers have an average of 10, but Set #1 is much more spread out than Set #2. Because of this, we couldn't be as sure about any missing numbers in the dataset so a UCL

calculated from Set #1 would be larger (we would have to add more to the average) than a UCL calculated from Set #2.

What they mean:

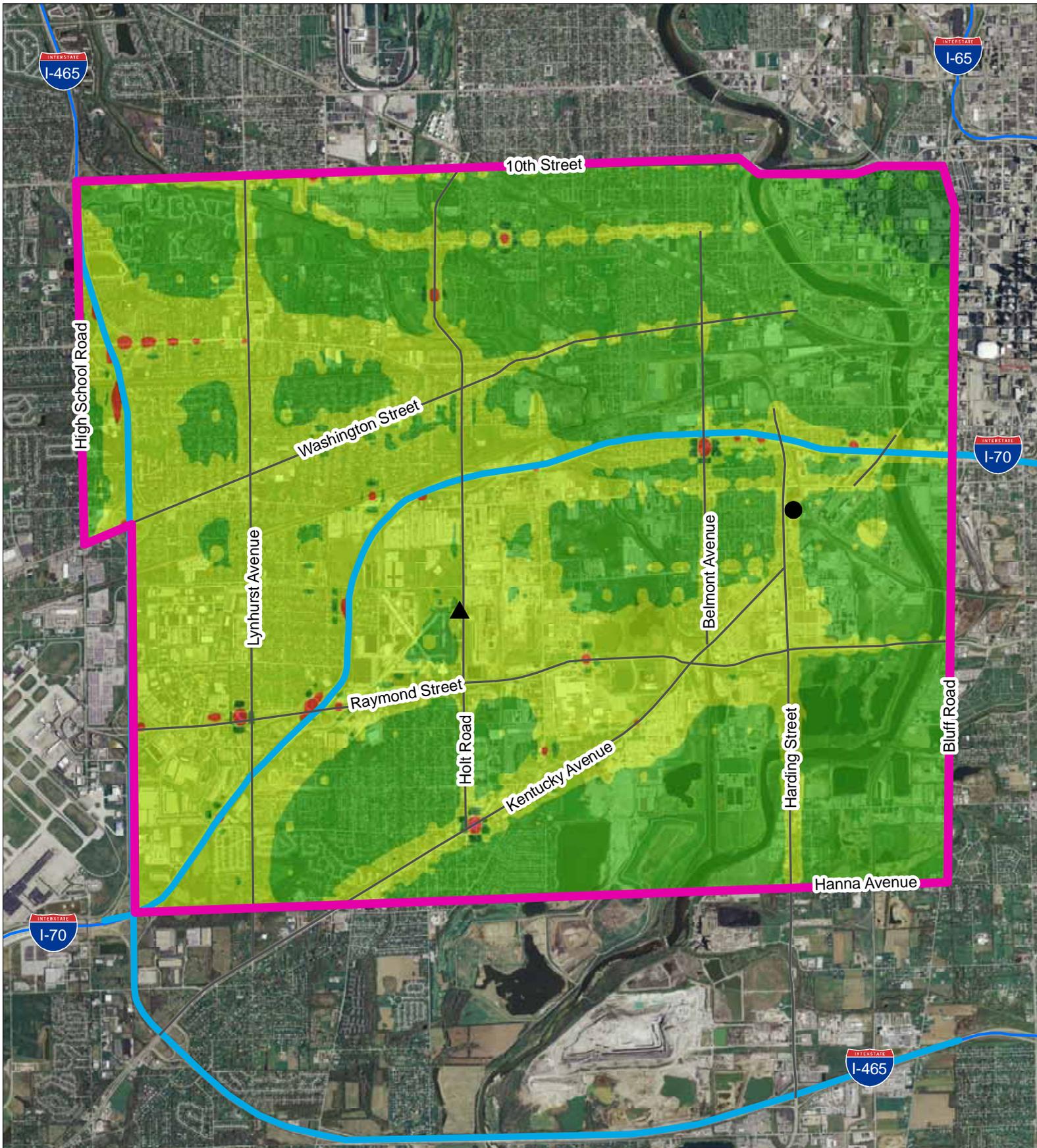
This is perhaps the most misunderstood aspect of UCLs. Some people think that a UCL is meant to account for an expected increase in emissions over time or the overall uncertainty of emission rates over time. This is incorrect. The purpose of a UCL is to take an average calculated from a sample of possible sampling days and convert it to a number that represents a health protective estimate of the average concentration on all possible sampling days.

This does add some uncertainty to the values we use in risk assessments. Risk estimates assume that emissions will remain the same over the entire life of a person exposed to them when we know that that is unlikely. It is impossible to guess what emissions rates will be in the future and any attempt to do so would be wild speculation at best. By using current emission rates and extending them into the future we create a “baseline” which tells us what risks are associated with current emissions. Stakeholders can use this data to make informed decisions about the effects that new industries or technologies may have on the area’s air quality.

More Information:

- For more information on 95% UCLs, visit IDEM’s Web site at www.idem.IN.gov.
- For more information on the Southwest Indianapolis Air Toxics Study, visit the study’s Web site at www.idem.IN.gov/programs/air/workgroups/swindyairtox.
- For questions and concerns, feel free to call IDEM’s Office of Air Quality Project Management Section at (317) 234-3499.

Southwest Indianapolis Air Toxics Study Total Modeled Estimated Cancer Risk



This map is intended to serve as an aid in graphic representation only. This information is not warranted for accuracy or other purposes.

Mapped By: B. Callahan, Office of Air Quality
Date: 2/18/2010

Sources:
Non-Orthophotography Data - Obtained from the State of Indiana Geographical Information Office Library and OAQ
Orthophotography Data - Obtained from Indiana Map Framework Data (www.indianamap.org)

Map Projection: UTM Zone 16 N Map Datum: NAD83

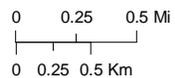


Legend

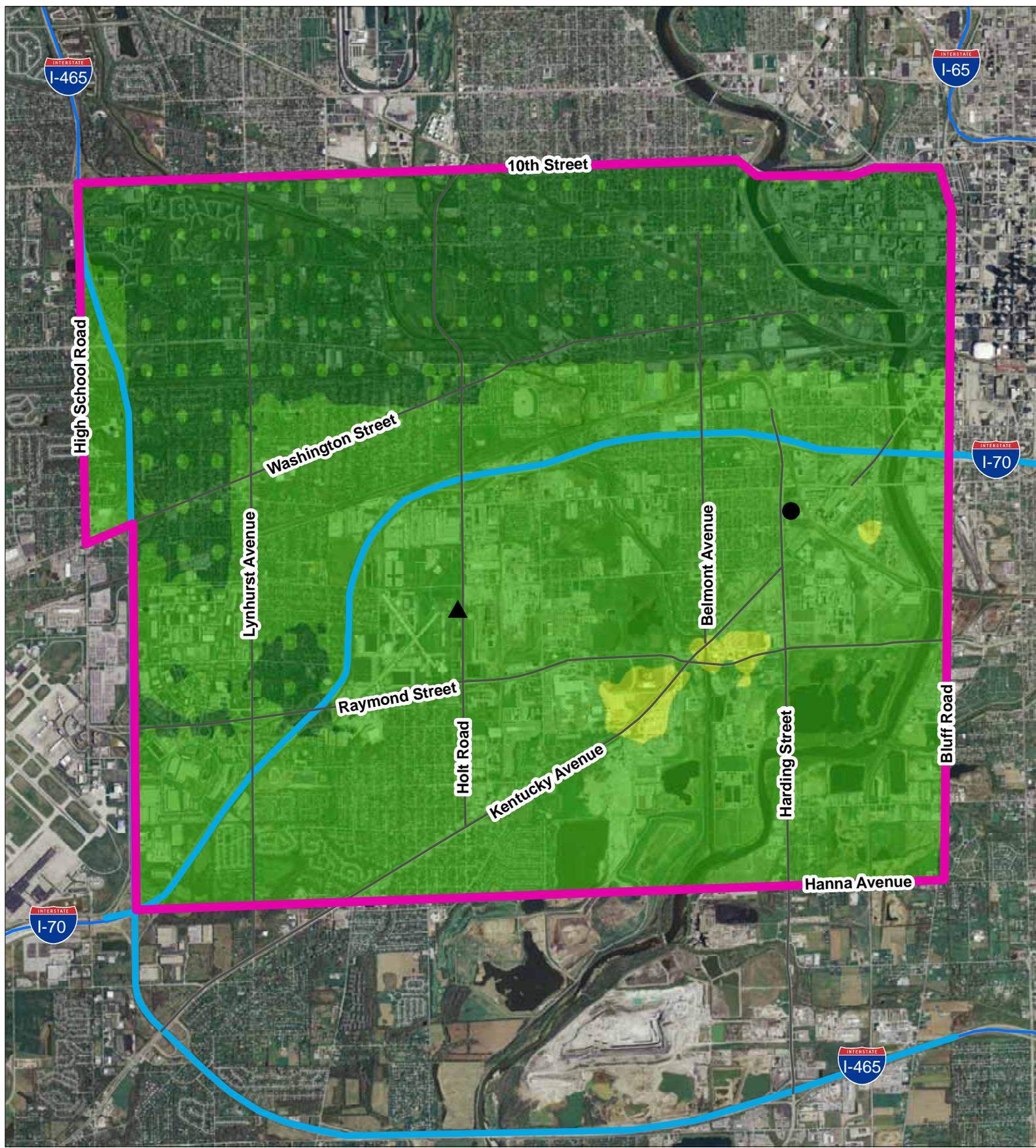
- Harding St. Monitor
- Stout Field Monitor
- SW Indianapolis Study Area

Cancer Risk

- Cancer Risk < 1 in 1,000,000
- 1 in 1,000,000 < Cancer Risk < 10 in 1,000,000
- 10 in 1,000,000 < Cancer Risk < 100 in 1,000,000
- 100 in 1,000,000 < Cancer Risk < 1,000 in 1,000,000



Southwest Indianapolis Air Toxics Study Total Modeled Estimated Major Source Cancer Risk



This map is intended to serve as an aid in graphic representation only. This information is not warranted for accuracy or other purposes.

Mapped By: B. Callahan, Office of Air Quality
Date: 2/18/2010

Sources:
Non-Orthophotography Data - Obtained from the State of Indiana Geographical Information Office Library and OAQ
Orthophotography Data - Obtained from Indiana Map Framework Data (www.ecdmmap.org)

Map Projection: UTM Zone 16 N Map Datum: NAD83

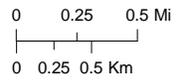


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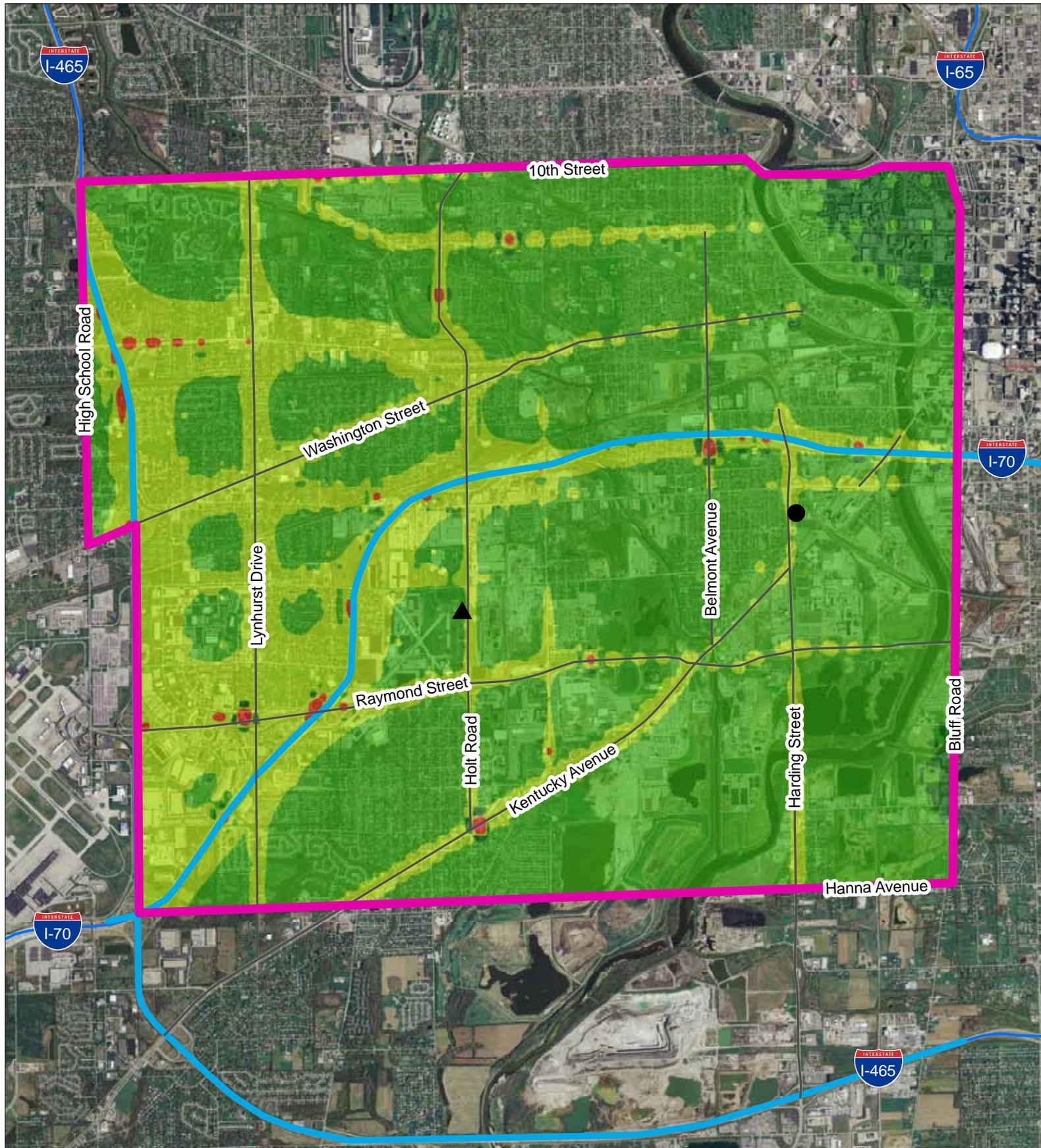
- Harding St. Monitor
- Stout Field Monitor
- SW Indianapolis Study Area

Cancer Risk

- Cancer Risk < 1 in 1,000,000
- 1 in 1,000,000 < Cancer Risk < 10 in 1,000,000
- 10 in 1,000,000 < Cancer Risk < 100 in 1,000,000
- 100 in 1,000,000 < Cancer Risk < 1,000 in 1,000,000



Southwest Indianapolis Air Toxics Study Total Modeled Estimated Mobile Source Cancer Risk



This map is intended to serve as an aid in graphic representation only. This information is not warranted for accuracy or other purposes.

Mapped By: B. Callahan, Office of Air Quality
Date: 2/18/2010

Sources:
Non-Orthophotography Data - Obtained from the State of Indiana Geographical Information Office Library and OAQ
Orthophotography - Obtained from Indiana Map Framework Data (www.indianamap.org)

Map Projection: UTM Zone 16 N Map Datum: NAD83

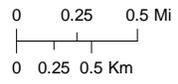


Legend

- Harding St. Monitor
- ▲ Stout Field Monitor
- SW Indianapolis Study Area

Cancer Risk

- Cancer Risk < 1 in 1,000,000
- 1 in 1,000,000 < Cancer Risk < 10 in 1,000,000
- 10 in 1,000,000 < Cancer Risk < 100 in 1,000,000
- 100 in 1,000,000 < Cancer Risk < 1,000 in 1,000,000

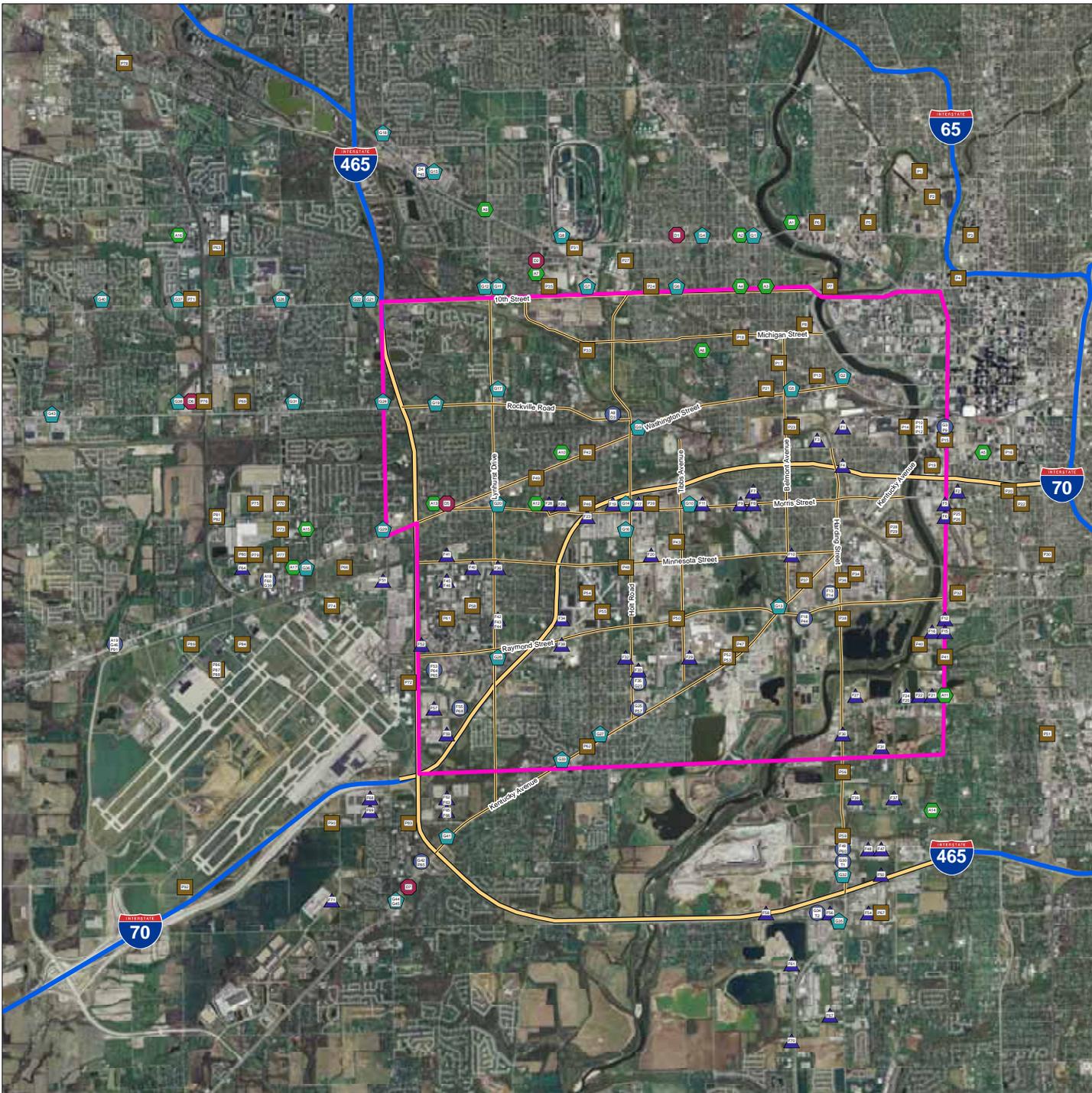


Southwest Indianapolis Air Toxics Study

Locations of Modeled Sources

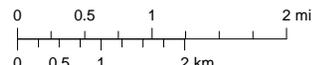
Source Key

Permitted Sources	Freight Companies	Gas Stations
P1 Republic Services Of Indiana	F1 Call Trans	G1 Phillips 66
P2 Peerless Pump Co	F2 Tennessee Trucking	G2 Speedway
P3 Clarion Health Partners	F3 Verizon Express	G3 Speedway
P4 Clarion Lab Consolidation	F4 Putnam Truck Load Direct	G4 Shell
P5 Industrial Coatings Services	F5 Scales Truck Lines	G5 Village Partry
P6 D.E. Baugh Company	F6 L D Leasing Ins	G6 Super Stop Indiana
P7 VA Hospital	F7 Southwestern Motor Transport	G7 Speedway
P8 Cargill	F8 Jet Logistics	G8 Speedway
P9 Colburn Thermal Energy	F9 EH Hamilton Trucking	G9 Badelsha Bros
P10 MCI Telecommunications	F10 First Student Bus, Inc.	G10 Speedway
P11 Ovest	F11 Milan Express	G11 Par Petroleum
P12 Indy Telecom Center, LLC	F12 Warner Enterprises Inc	G12 Thornton's
P13 Industrial Anodizing Co.	F13 Frontier Transport Corp.	G13 Joe's Junction
P14 Indianapolis Metal Center	F14 Frontier Temperature Control	G14 Shell
P15 Engineered Polymer Solutions	F15 Carter Truck Lines	G15 Thornton's
P16 El Lilly and Company - Corporate Center	F16 Roadrunner Daves	G16 Clark Oil
P17 Marathon Petroleum Company	F17 UPS Freight	G17 Speedway
P18 Sims Cabinet Company	F18 Covariant Transport	G18 Circle K
P19 Hebrew National	F19 Old Dominion Freight Lines	G19 QTGO
P20 William Hermann and Son, Inc.	F20 Knight Transportation	G20 Speedway
P21 Bell Professional Mortuary	F21 Interstate Carrier Express	G21 Circle K
P22 Ryder Truck Rental	F22 Spears Enterprise Trucking	G22 Gas America
P23 Showroom Packaging Corporation of Indiana	F23 Estes Express Lines	G23 G & G QTGO
P24 Indiana Memorial and Cremation Service	F24 Underwood Transport Co., LLC	G24 Speedway
P25 Manufacturing Lubricants Company	F25 McKnight Trucking	G25 Speedway
P26 ImageMark	F26 Central Transport	G26 Speedway
P27 Marathon Ashland Petroleum - Speedway Terminal	F27 Berry, Inc.	G27 Village Partry
P28 National Starch & Chemical Corporation	F28 Forward Air, Inc.	G28 Speedway
P29 Stevan Warner	F29 Roadway Express	G29 Circle K
P30 Indy 3 Communications	F30 Bridge Terminal Transport	G30 M. Fuel
P31 Prazer Surface Technologies, Inc.	F31 Morgan Southern	G31 Speedway
P32 Superior Oil Company	F32 Aes Transportation Co.	G32 Rib Transit Center
P33 Speedway WWTP	F33 Tom's & Sons	G33 Speedway
P34 El Lilly and Company - Technology Center	F34 EF Transit	G34 Fyring J
P35 Allison Transmission	F35 Tom Thompson Trucking	G35 WFS Food Mart
P36 Dorsey Paving, Inc.	F36 Kuehne & Nagel	G36 Swifty
P37 Jackson Oil	F37 C & A Express, Inc.	G37 Silver Express
P38 Covanta Indianapolis, Inc.	F38 Hogan Transport and Motor Leasing	G38 Super Center
P39 Cummins Crosspoint, LLC	F39 MCS Trucking	G39 Century Marathon
P40 Dating International, LLC	F40 IFS of Indiana	G40 Convent Food Mart
P41 Fontaine Truck Equipment Co.	F41 AFC Worldwide Express	G41 Speedway
P42 Magdore Corp Indianapolis Division	F42 Allstates Worldcargo	G42 Swifty
P43 Verheul Agricultural & Nutrition Specialties, LLC	F43 B & B Logistics	G43 Speedway
P44 Indianapolis Belmont WWTP	F44 Universal Transportation Services	G44 Shell
P45 Pet Heaven	F45 Four Star Transportation	G45 Amoco
P46 Henry Co.	F46 Mid States Express	G46 Sunoco
P47 South Side Landfill, Inc.	F47 Alan Motor Freight	
P48 Metal Dynamics	F48 ABF Freight Systems, Inc	
P49 Central Indiana Tire & Retread	F49 Hiner Transport	
P50 Rula-Royce Corporation - Plants S & B	F50 Ventura Logistics	
P51 MAACO	F51 Yellow Transportation	
P52 Raeth-Riley Asphalt Plant #325	F52 Parapalpa	
P53 May-Zinc, Inc. P. 16	F53 Phoenix International Freight	
P54 Intraform Technologies, Inc.	F54 Shamrock Transportation	
P55 Trichland Paperboard and Packaging Stout Field	F55 BDP International, Inc.	
P56 IPALCO	F56 Sloop's Freightliner Quality	
P57 Maplehurst Remediation	F57 Activair, Inc.	
P58 Sensient Flavors, Inc.	F58 Certified Transport	
P59 Milestone Contractors, L.P.	F59 Air Road Express	
P60 E & B Paving, Inc.	F60 R & S Transport	
P61 Parts Cleaning Technologies, LLC	F61 Universal Transportation Services	
P62 Premcor Refining	F62 Mel Tar Leasing	
P63 CalCo Partnership	F63 Nippon Express	
P64 Allison Transmission-Plant 15	F64 Cargo Services	
P65 BioStorage Technologies	F65 DHL Global Forwarding	
P66 Indianapolis Air Route Traffic Control Center	F66 Links, Inc.	
P67 Lone Star Industries, Inc.	F67 Landstar Systems, Inc.	
P68 Rula-Royce Corp Single Crystal Operation	F68 Toomey Air Freight	
P69 Reynold Industries, Inc. - Link Belt Bearing Division	F69 BAX Global	
P70 United Technologies Carrier Corp.	F70 Harvey's Machinery Movers	
P71 Wood-Mozor	F71 FedEx Freight	
P72 El Lilly and Company - Aviation Facility		
P73 Hill Sumco, Inc.		
P74 Hawker Beechcraft Services, Inc.		
P75 Target Distribution		
P76 Indianapolis Air Route Traffic Control Center		
P77 Willoughby Industries		
P78 Admiral Petroleum		
P79 TIN-Temple Island		
P80 Micronutrients		
P81 Quwestco, Inc.		
P82 Heritage Environmental Services, LLC		
P83 Indy Railway Service Corp.		
P84 Hanger, LLC		
P85 International Aerospace Tubes, LLC		
P86 AAR Aircraft Services		
P87 Indianapolis Diversified Machine		
P88 BIRAM Energy Services		
P89 US Postal Service Eagle Air Hub		
P90 NWS Forecasting Office		
P91 Kocourek		
P92 Fed Ex Corp.		



Legend

- Permitted Sources
- Freight Companies
- Gas Stations
- Auto Body Shops
- Dry Cleaners
- Multiple Source Types
- Study Area
- Modeled Surface Roads
- Modeled Interstates
- Other Interstates



Mapped By:
E. Bailey, Office of Air Quality
Date: 1/11/2010

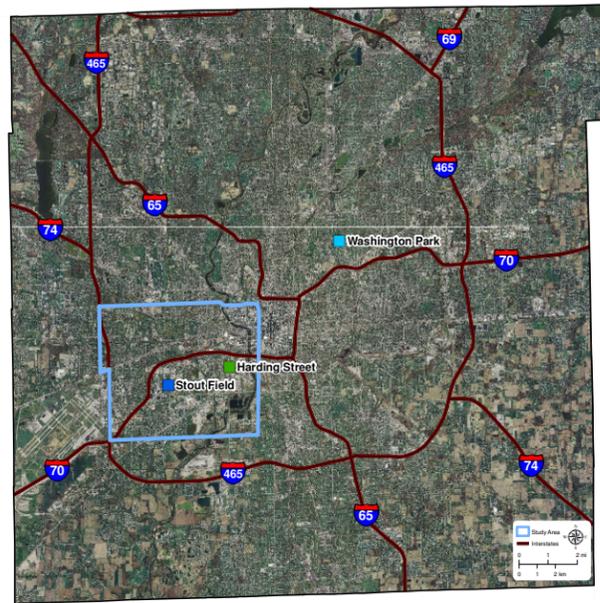
Sources:
Non Orthophotography Data -
Obtained from the State of Indiana Geographical
Information Office Library and IDEM Office of Air Quality
Orthophotography
Obtained from Indiana Map Framework Data
(www.indianamap.org)
Map Projection: UTM Zone 16 N Map Datum: NAD83

This map is intended to serve as an aid in graphic representation only. This information is not warranted for accuracy or other purposes.

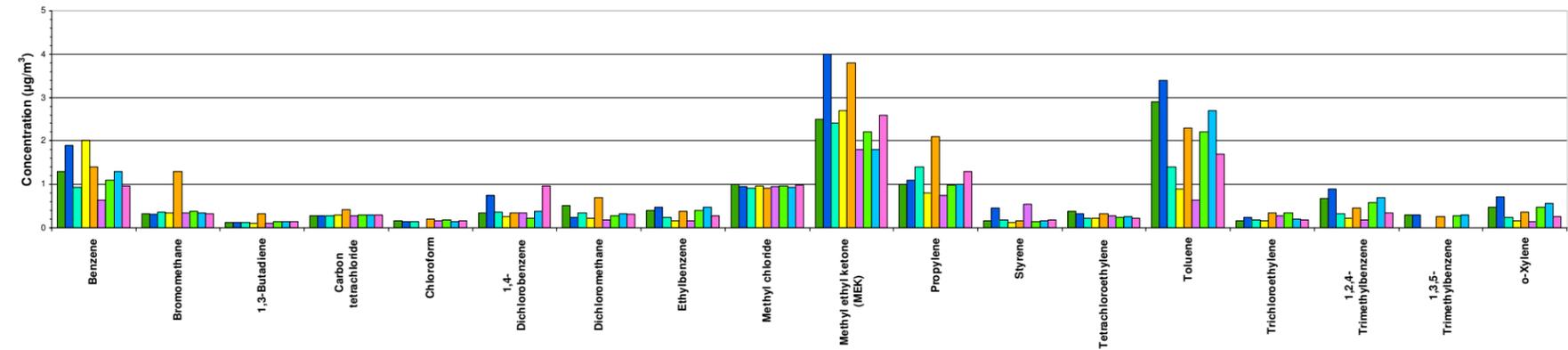
Southwest Indianapolis Neighborhood Air Toxics Study

City Comparisons

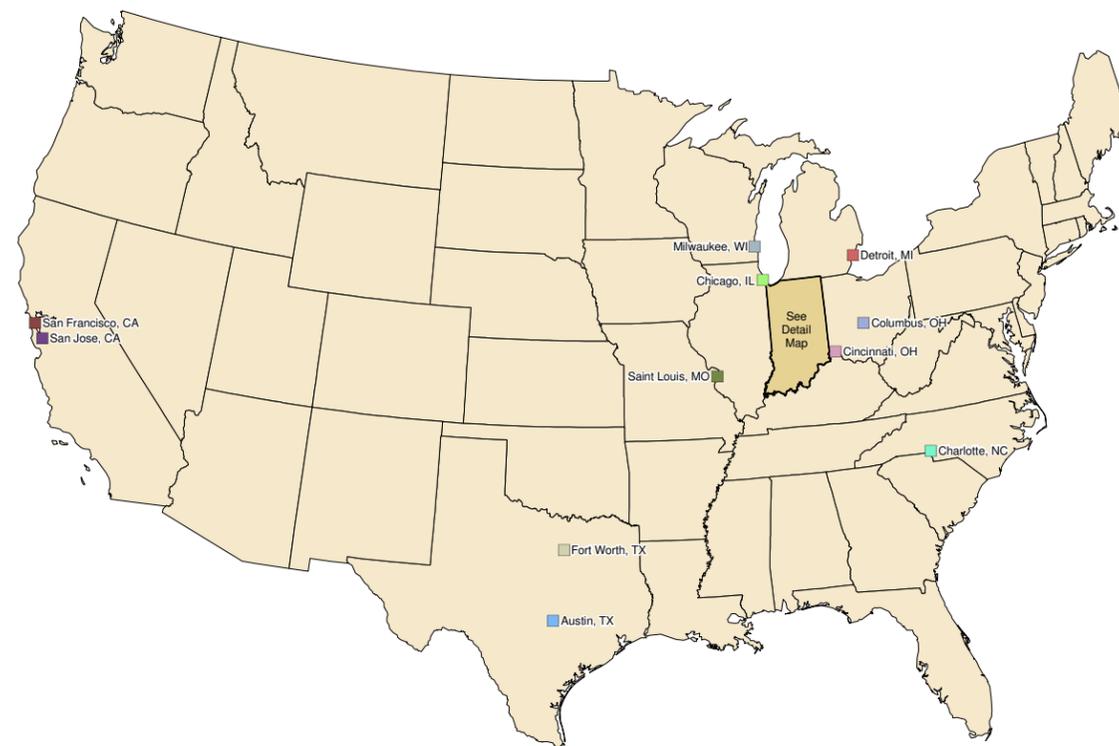
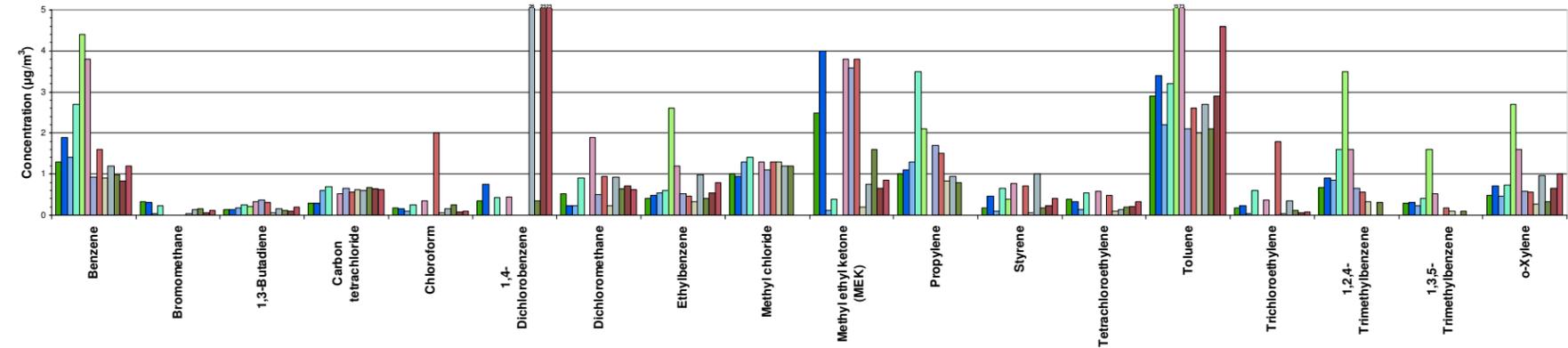
Marion County



Indiana ToxWatch Monitors



Selected National Air Toxics Monitors



Legend

- | | |
|--|--|
| Southwest Indianapolis Monitors | National Air Toxics Monitors |
| ■ Harding Street | ■ Austin, TX |
| ■ Stout Field | ■ Charlotte, NC |
| ■ East Chicago | ■ Chicago, IL |
| ■ Gary IITRI | ■ Cincinnati, OH |
| ■ Hammond CAAP | ■ Columbus, OH |
| ■ Ogden Dunes | ■ Detroit, MI |
| ■ University of Evansville | ■ Fort Worth, TX |
| ■ Washington Park | ■ Milwaukee, WI |
| ■ Whiting High School | ■ Saint Louis, MO |
| | ■ San Francisco, CA |
| | ■ San Jose, CA |

This map is intended to serve as an aid in graphic representation only. This information is not warranted for accuracy or other purposes.

Mapped By:
E. Bailey, Office of Air Quality
Date: 3/2/2010

Sources:
Non Orthophotography
Data - Obtained from the State of Indiana Geographical Information Office Library and IDEM Office of Air Quality
Orthophotography - Obtained from Indiana Map Framework Data (www.indianamap.org)
Map Projection: UTM Zone 16 N **Map Datum:** NAD83



Where is the study being conducted?

Boundaries of study area: 

- | | |
|---|---------------------------------|
| North
10 th Street | East
Bluff Road |
| South
Hanna Avenue | West
High School Road |

Monitoring locations:

-  1321 S. Harding Street
-  Stout Field National Guard Armory, 1802 S. Holt Road



Who can I contact if I have questions about the study?

Indiana Department of Environmental Management

- Brian Wolff _____
(317) 234-3499 or bwolff@idem.IN.gov

Indiana Department of Environmental Management

Office of Air Quality
www.idem.IN.gov



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LA 541- BE 02/09 i H

Southwest Indianapolis



Indiana Department of Environmental Management



Neighborhood Air Toxics Study

Project Summary
March 2009

www.idem.IN.gov/programs/air/workgroups/swindyairtox

What is the Southwest Indianapolis Air Toxics Study?

It is a two-year study of air quality in the southwestern Indianapolis area. The study is being done to evaluate air quality within the area and determine what steps, if any, are necessary to adequately protect public health.

Who is Participating in the Study?

- Indiana Department of Environmental Management (IDEM)
- Area residents and community leaders
- Community groups and local businesses
- City of Indianapolis
- U.S. Environmental Protection Agency (U.S. EPA)

Why is this study being done?

U.S. EPA studies have shown that this area may experience concentrations of air toxics above average levels. It is important to note that all areas of the country are exposed to air toxics concentrations. It is the level of concentration and the length of exposure that determines how public health is affected. This study is designed to answer two questions:

- Is the air quality within the study area adequately protective of public health?
- What can be done to enhance air quality within the study area?

What is the schedule for this study?

The study started in the fall of 2006. Air quality samples were collected from October 2006 through September 2008 and the results of the study are due to be released in mid-2009.

How is the Study being Implemented?

IDEM is evaluating the air quality in three ways:

- **Monitoring:** IDEM collected samples of the air at two monitor site locations once every six days from October 2006 to October 2008. In all, IDEM recorded the levels of 80 different pollutants in the area over a two year period.

Air toxics monitor



- **Emissions Inventory Evaluation:** IDEM contacted 319 area businesses and collected information about what toxics they released into the air, where the release occurred, and what processes resulted in the release.

- **Modeling:** The information gathered from local business and industry will be put into a computerized tool referred to as a "model". The model will then estimate what the anticipated concentrations of air toxics would be at unmonitored locations within the study area.

Once these three steps are complete, IDEM will evaluate the information and determine whether the air quality is adequately protective of public health and what steps, in any, are needed to enhance air quality. The diagram below shows how the different components of the study work together to produce the results.

Basic Process for Air Toxics Study



Technical Experts for This Study

Technical Advisory Group

This 11-member panel is comprised of outside technical experts who review the technical aspects of the study and provide recommendations to IDEM. The Technical Advisory Group was formed when the study began in the fall of 2006 and meets several times a year. All meeting information is available on the IDEM Web site at www.idem.IN.gov.

Community Assistance with the Study

Public Advisory Group

This eight-member panel is comprised of community leaders and residents. This group advises IDEM about the best way to communicate important study information to the community.

Neighborhood Meetings

IDEM has been regularly attending neighborhood meetings since the beginning of the study. This is one way IDEM keeps the community informed about the study's progress. For a list of neighborhood meetings IDEM attends or if you are interested in having an IDEM staff member come to your neighborhood or organization meeting, please contact:

- Amy Bukarica _____
(317) 233-1179 or abukarica@idem.IN.gov.

How can I learn about the study results once they are released?

The study results are due to be released in mid-2009 and an official study report will be available at that time. In addition, IDEM will be taking information to the community by:

- giving presentations at neighborhood meetings;
- hosting an information session;
- distributing information summaries through community organizations; and,
- publishing information to local newsletters and the IDEM Web site: www.idem.IN.gov.

Frequently Asked Questions

1. What are air toxics?

Toxic air pollutants, also known as hazardous air pollutants, are those pollutants that are known or suspected to cause cancer or other serious health effects, such as reproductive effects, birth defects, or adverse environmental effects.

2. Sometimes the air smells bad. Are these smells dangerous?

The chemicals commonly smelled in Southwest Indianapolis can be smelled well below levels of concern. Pyridine is one of the most likely odor causing pollutants within the study area. IDEM has created a fact sheet about pyridine and other odors in the Southwest Indianapolis area. To view the fact sheet, please visit www.idem.IN.gov/programs/air/workgroups/swindyairtox.

3. What prompted the study?

IDEM received grant money from the U.S. EPA to conduct the study following the release of the U.S. EPA 1999 National Air Toxics Assessment (NATA), which identified the area of southwestern Indianapolis as being "of potential concern" due to higher than average levels of air toxics. Area residents were also concerned, as documented by the *Indianapolis Star* (Feb. 22-23, 2004).

4. Are IDEM and the City of Indianapolis currently taking any actions to protect air quality in the area?

IDEM issues permits to regulate the amount of emissions released into the air by industry and other businesses. In addition to permitting sources, IDEM worked to initiate some pollution prevention measures in the area in consultation with the study's Public Advisory Group. This included contacting area schools to promote the use of the Green Steps environmental management program and contacting area trucking companies to encourage them to join IDEM's Voluntary Idling Program. The City of Indianapolis is working with industry, schools, and trucking companies to improve air quality throughout the city.

5. What are the sources of benzene in the area?

The primary source of benzene within the study area is motor vehicle exhaust. Industrial activity, tobacco smoke, and automobile service stations are also common sources of benzene and likely contributed to the monitored levels.

6. What are the health effects of benzene?

Long-term exposure to benzene can be harmful to bone marrow and can cause anemia and leukemia. Breathing high levels of benzene over a short period of time can cause drowsiness, dizziness, and unconsciousness. Benzene concentrations in the area were not monitored at these high levels.

7. What are the sources of acrolein in the area?

The primary source of acrolein within the study area is motor vehicle exhaust. Acrolein can also come from overheated cooking oil, tobacco smoke, and industrial activity.

8. What are the health effects of acrolein?

There is little information about how exposure to acrolein affects people's health. Research indicates acrolein may cause burning of the nose and throat, watery eyes, and can damage the lungs at very high levels. Breathing low levels of acrolein over time may also cause a decreased breathing rate. At this time, acrolein cannot be determined a carcinogen, based on inadequate information.

9. What is IDEM going to do about the study results?

To the extent possible, IDEM will assist community groups and residents in taking steps to improve air quality. Some examples of assistance could include assisting with grant applications and providing technical expertise. In the few isolated areas where industry was identified as a significant contributor to air toxics, IDEM is in contact with these industries to identify potential ways to reduce emissions.

Protecting Air Quality is Everyone's Responsibility. Here Are Ten Things You Can Do Now

Use the following tips to reduce air pollution from vehicle exhaust in the area:

- Combine errands, carpool or use public transit.
- For short trips, walk or ride a bike.
- Limit engine idling time to less than 30 seconds. Idling for just 30 seconds uses more fuel than stopping and starting your engine.
- Fill gas tank during the cool evening hours to reduce evaporation; avoid refueling your vehicle on air quality action days.
- Park and go inside at restaurants; avoid drive-thru windows to save fuel and time.
- Delay using gas-powered recreational vehicles until the evening hours on hot, sunny days. Small engines are a significant source of air pollution.
- Get regular engine tune-ups and keep the right amount of air in the tires. Well-maintained vehicles create less pollution.
- Pack a lunch or walk to lunch; organize group deliveries from local restaurants with co-workers.
- If possible, work a flexible schedule and commute during non-peak driving times.
- Mow your lawn after 7 p.m.

For more information about the Southwest Indianapolis Air Toxics Study, visit the IDEM Web site, at : www.idem.IN.gov/programs/air/workgroups/swindyairtox.

Indiana Department of
Environmental Management
Office of Air Quality
www.idem.IN.gov



Southwest Indianapolis



Indiana Department of Environmental Management



Neighborhood Air Toxics Study Results

Results Summary
February 2010

www.idem.IN.gov/programs/air/workgroups/swindyairtox



Background

Between October 2006 and December 2009, the Indiana Department of Environmental Management (IDEM), the United States Environmental Protection Agency (U.S. EPA), the city of Indianapolis, and a diverse group of stakeholders conducted a study of hazardous air pollutants and other air toxics in southwestern Indianapolis, Indiana. The goal of the study was to evaluate air quality within the area and determine if additional steps were needed to protect public health.

The study involved three steps:

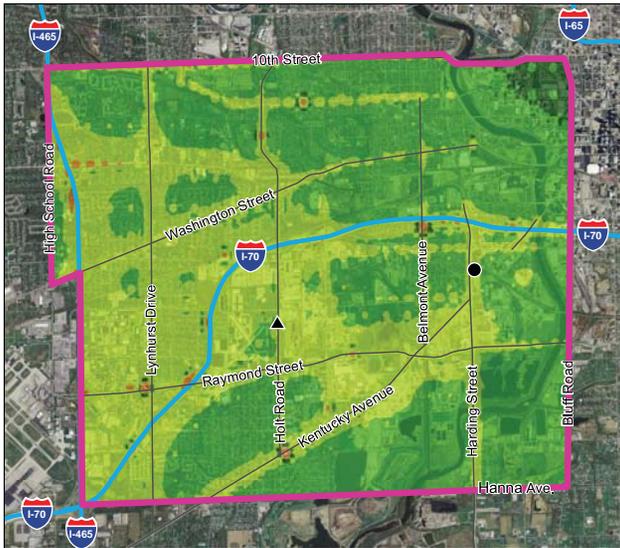
- **Monitoring:** IDEM sampled the air for a total of 95 pollutants at two monitors in Southwest Indianapolis.
- **Emissions Inventory:** IDEM worked with local industries to develop a detailed inventory of air emissions from 319 sources of air toxics.
- **Modeling:** IDEM conducted air dispersion modeling of 464 sources to estimate air toxics levels and get a comprehensive picture of air quality in the area. This included major industry sources, trucking companies, gas stations/truck stops, auto body shops, and dry cleaning facilities.

Technical and Community Assistance

IDEM assembled two independent groups to provide guidance and expertise throughout the study.

- The Technical Advisory Group, made up of external technical experts, reviewed technical aspects of the study and provided recommendations to IDEM.
- The Public Advisory Group, made up of community leaders and residents, provided community perspective and advised IDEM about the most effective ways to communicate study information to residents of Southwest Indianapolis.

Southwest Indianapolis Air Toxics Study Total Modeled Estimated Cancer Risk



This map is intended to serve as an aid in graphic representation only. This information is not warranted for accuracy or other purposes.

Legend

- Harding St. Monitor
- ▲ Stout Field Monitor
- SW Indianapolis Study Area

Cancer Risk

- Green: Cancer Risk < 1 in 1,000,000
- Yellow: 1 in 1,000,000 < Cancer Risk < 10 in 1,000,000
- Orange: 10 in 1,000,000 < Cancer Risk < 100 in 1,000,000
- Red: 100 in 1,000,000 < Cancer Risk < 1,000 in 1,000,000

Scale: 0, 0.25, 0.5 M (Miles); 0, 0.5 Km (Kilometers)

Results Summary

IDEM found the air toxics concentrations measured in the area to be similar to those found throughout Indiana and other Midwestern cities. No pollutants were found to be at concentrations which required immediate or emergency action. IDEM's analyses shows that air toxics concentrations, and therefore potential health risks, are lower than predicted by the U.S. EPA in the 1999 and 2002 National Air Toxics Assessment (NATA) reports.

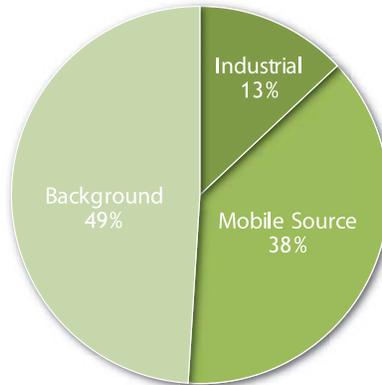
During the course of the study, IDEM looked at all potential sources of air toxics in the area and found the largest contributor to be mobile sources (i.e., cars and trucks). Industrial sources were evaluated closely. The risks contributed by industry in the area were small when compared to the risk from mobile sources. Many of the major industrial sources within the study area are active partners of the State Partners for Pollution Prevention program. For those sources that are not, IDEM will be exploring partnership opportunities.

Among the chemicals assessed as part of this study, benzene contributes the most cancer risk in the area. Levels of benzene were found to be 15 in-a-million. For the approximately 60,000 people who live within the study area, that means there is potential for no more than one additional cancer case over a period of 70 years from exposure to air toxics. **This estimate is based on a series of health protective assumptions which results in an estimate that is most likely higher than the actual risk.**

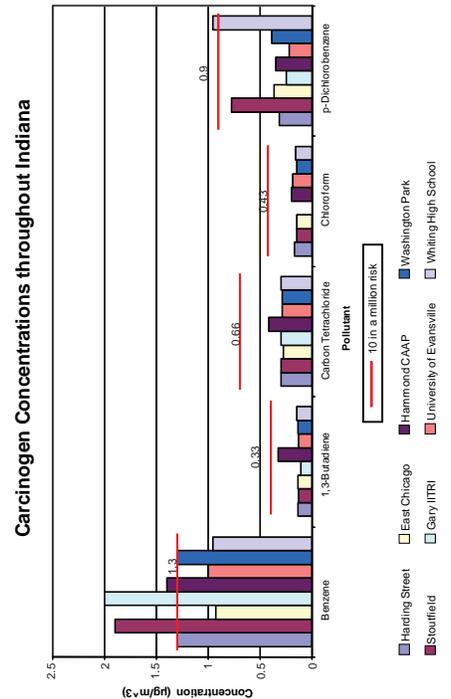
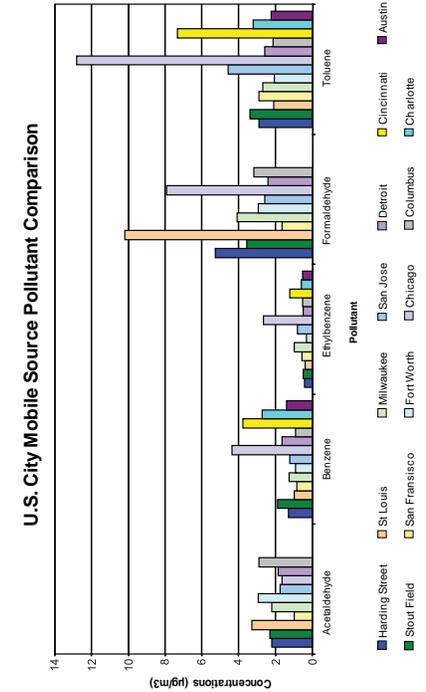
Acrolein is the only non-carcinogenic pollutant of concern in the study area. Acrolein levels were well above health protective benchmarks at both monitoring locations. However, acrolein is not a localized pollutant. Levels within the study area do not vary significantly from levels monitored around the country. IDEM is working with the U.S. EPA and other states to better understand acrolein and its origin.

The study results, while useful, are not a statement of "actual risk" that people face, but an estimate. The actual risk individuals face is a complex combination of many factors, including genetic predisposition, diet, lifestyle choices, and environmental contribution.

Breakdown of Risk within the Study Area



Note: Background represents pollutants which occur in the air naturally, unidentified sources (e.g., lawn mowers) and long-range pollutant transport (e.g., pollutants from other states or countries).



SOUTHWEST INDIANAPOLIS AIR TOXICS STUDY



**SUMMARY REPORT
MARCH 11, 2010**

Southwest Indianapolis Community-Scale Air Toxics Study

Overview

Between October 2006 and October 2008 the Indiana Department of Environmental Management (IDEM), the United States Environmental Protection Agency (U.S. EPA), the city of Indianapolis, and a diverse group of stakeholders conducted a study of air toxics including some listed as Hazardous Air Pollutants in the southwestern quadrant of Indianapolis, Indiana.

IDEM's refined analyses shows that air toxics concentrations and cancer or non-cancer risks to citizens in the study area are significantly lower than predicted by the U.S. EPA's 1999 and 2002 National Air Toxics Assessment (NATA) for the area. The air toxics concentrations measured in the area are similar to concentrations observed throughout Indiana and in other Midwestern cities. No pollutants were observed at concentrations that warrant immediate or emergency action.

The largest contributor to air toxics concentrations and estimated risks from within the study area are mobile sources (cars, trucks, etc.). IDEM is actively promoting the Voluntary Idling Program (VIP) as well as working on diesel retrofit opportunities to reduce mobile source impacts in the area. Industrial sources were evaluated in detail concerning their contribution to air toxics and risk to human beings. The health risks contributed by industry in the area were small when compared to the risk from mobile sources. However, IDEM has identified a few industrial sources in the area that, while not significant sources of risk, could warrant further evaluation for potential pollution prevention opportunities and has initiated communication with these entities. The risks in this section of Indianapolis are comparable to the risks observed in other metropolitan areas and Indiana.

Goals and Objectives

The goal of the Southwest Indianapolis Community-Scale Air Toxics Study was to conduct a community-scale analysis of air toxics in a 10 square mile area of southwestern Indianapolis, Indiana. In the 1999 NATA, U.S. EPA identified census tracts in this area as being of potential concern for exposure to air toxics. In addition, there was considerable concern by residents in this part of the city, as documented by articles in the *Indianapolis Star* (February 22-23, 2004). The study was comprised of three interconnected components:

- For the first component of the project, IDEM conducted ambient air monitoring in two neighborhoods for 24 months. The monitored concentrations were evaluated and compared to toxicological information for each pollutant, other Indiana ToxWatch sites, other metropolitan areas, and the NATA.
- For the second component, IDEM worked with the local industries to develop a refined emissions inventory of sources and categories of sources likely to be contributing to the identified air toxic concentrations.

- For the third component, IDEM conducted detailed air dispersion modeling of sources over a large area in order to estimate air toxic concentrations in the area. Modeling results were calculated for an area bound on the north by 10th Street, east by Bluff Road, south by Hanna Avenue, and west by High School Road.

The results of the above analyses were used to characterize the potential (not actual) excess cancer risk and non-cancer hazard posed by air toxics in the study area. The resulting risk characterization can be used to inform citizens and other interested parties of the potential health risks from air toxic emissions and to identify areas where, in the future, IDEM can work with local sources and the community to reduce emissions and their potential health risks.

Particulate matter, also referred to as PM_{2.5} and PM₁₀ was not evaluated as part of this study. The goal of the study was to gather more information about air toxics in an area where little information was available. The existing understanding and monitoring of particulate matter is more extensive and has clearly defined health protective concentrations and monitoring requirements by U.S. EPA. Currently, Marion County is designated as not meeting the federal health standard set by U.S. EPA for particulate matter. However, current monitoring results demonstrate that Marion County meets federal particulate matter health standards. IDEM has petitioned U.S. EPA to redesignate the area from nonattainment to attainment.

Ambient Air Monitoring

IDEM operated two monitoring sites in neighborhoods within Southwest Indianapolis with one site having an additional chromium speciation monitor. One monitoring location was at 1321 South Harding Street. The other monitoring location was at 1802 South Holt Road. Monitoring location selection conforms to U.S. EPA standards as detailed in the Quality Assurance Handbook for Air Pollution Measurement Systems - Ambient Air Quality Monitoring Program Quality System Development EPA-454/R-98-004. The ambient air monitoring sites were strategically located based on an evaluation of the U.S. EPA's 1996 and 1999 NATA reports, proximity to major sources for emissions, and in locations where the general public lives and congregates.

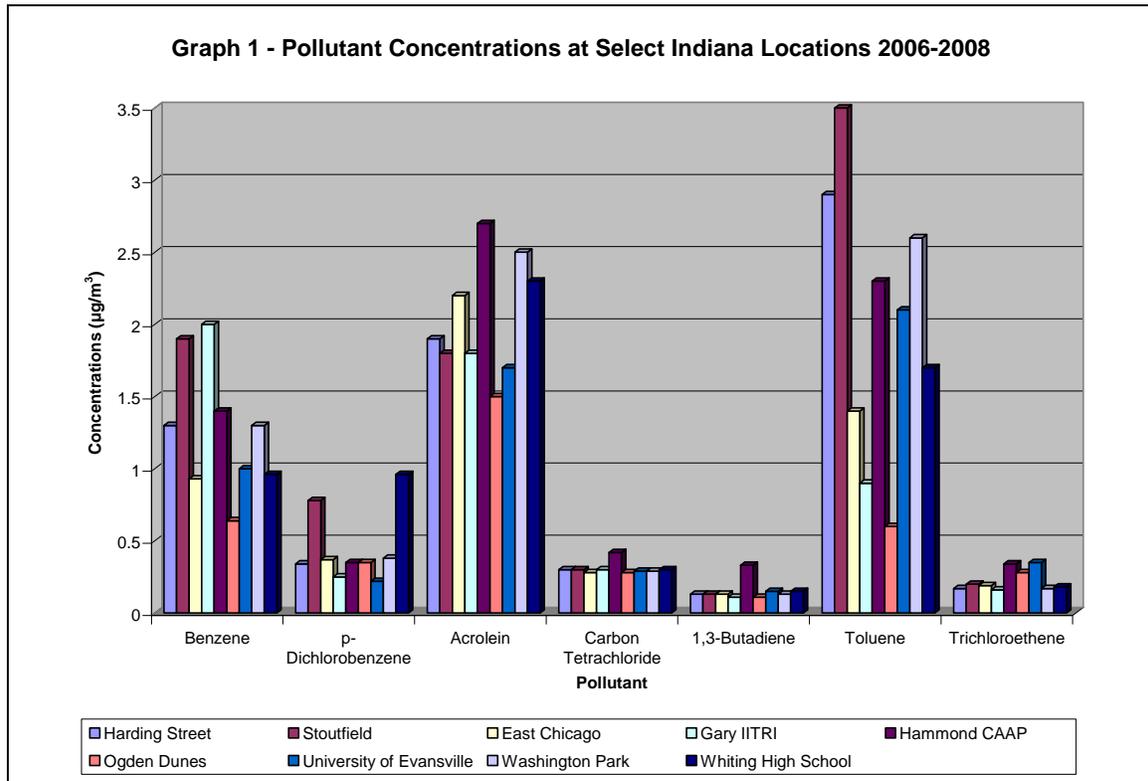
Both sites were operated consistent with procedures established for U.S. EPA's National Air Toxics Trends Station (NATTS) network. Specifically, the selected sites used U.S. EPA recommended sampling and analytical protocols to monitor for a list of air toxics considered by U.S. EPA to pose the greatest potential health risk. IDEM monitored volatile organic compounds (VOCs), carbonyls, and metals. The Harding Street site has a chromium speciation monitor. The sites followed U.S. EPA's standard one-in-six-day monitoring schedule and each air sample was collected for a 24-hour period. All monitoring followed the project's Quality Assurance Project Plan (QAPP) approved by U.S. EPA. VOCs samples were analyzed by IDEM's air monitoring laboratory following all U.S. EPA recommended analytical methods. Carbonyl, metals, and chromium speciation samples were analyzed by U.S. EPA contract lab ERG using U.S. EPA methods and quality assurance measures. All monitoring results were uploaded to U.S.

EPA's Air Quality System for public availability purposes as well as posted on the study's web page.

The air monitoring results were analyzed using U.S. EPA recommended statistical methods. IDEM used a statistical analysis tool called Kaplan-Meier to evaluate the data. During sampling, it is not uncommon to have pollutant concentrations below the detection limits, even with the low detection limits that IDEM was able to achieve (parts per billion). IDEM used Kaplan-Meier rather than ignoring readings that were below the detection limit, assuming that the concentration was always zero, or assuming that the concentration is always at the detection limit for that chemical. Kaplan-Meier was used to evaluate the data so that a 95% upper confidence limit of the mean (UCL) could be determined. This is the standard methodology recommended by U.S. EPA for estimating the inhalation exposure concentration.

IDEM monitored for a total of 95 air pollutants. A total of 78 pollutants were detected at least one time at the Harding Street location and 73 pollutants were detected at least one time at Stout Field.

Concentrations of most pollutants in Southwest Indianapolis were similar to concentrations observed in other areas of Indiana and other metropolitan areas. Graph 1 shows the concentrations of some key pollutants throughout Indiana.



One pollutant, p-dichlorobenzene, was observed to be higher at the Stout Field location than most other monitoring locations in the state. A majority of the time p-dichlorobenzene was monitored at low concentrations at both monitors. However, during a two-month period p-dichlorobenzene concentrations were higher than normal at Stout Field. This episode of higher p-dichlorobenzene concentrations coincided with other pollutants also at levels not normally observed. Given that these readings were only observed at one monitoring location for a brief period of time, IDEM views this as a brief, localized event. IDEM investigated possible sources of the p-dichlorobenzene but was unable to identify the likely source. An event like this was not observed again during the two year monitoring period and concentrations during the event were not at levels of concern to IDEM.

Benzene and toluene air monitoring concentrations were slightly higher at the Stout Field monitor than in some areas of the state. Benzene and toluene can be emitted from a number of different industries, but are most commonly associated with coming from mobile sources. There is significant car and truck traffic through the area which may contribute to the slightly higher benzene concentrations observed in the monitoring. Modeling of emissions in the area supports that mobile source impacts would be higher at the Stout Field monitor.

Inventory and Air Dispersion Modeling

IDEM used the Regional Air Impact Modeling Initiative (RAIMI) model for the Southwest Indianapolis study. RAIMI evaluates the potential for health impacts resulting from exposure to multiple pollutants emitted from multiple sources throughout a community. RAIMI uses different tools to focus on the risk characterization process. The Data Miner tool allows data from different sources to be combined to run the model. The Air Modeling Preprocessor can process meteorological and terrain data and automatically input them into the model. The processor also creates a receptor grid node for each source, which allows IDEM to estimate concentrations out to 10 kilometers (about 6 miles) from each source. The model prepared output files based on chronic (long term) and acute (short term) averaging periods.

To get the most up-to-date information for the model, IDEM sent emission related information requests to 319 businesses and industries in the area. IDEM held workshops and meetings with businesses and industry to build the most accurate emissions inventory possible with the information available. A total of 84% of facilities that received requests responded with updates or confirmation of their emissions.

IDEM modeled a total of 464 sources of emissions within the study area. This included industrial sources, trucking companies, gas stations/truck stops, auto body shops, and dry cleaning facilities. Some industries had more than one source located on their property so those sources were modeled separately. Table 1 provides a breakdown of the different sources modeled. A total of 168 pollutants were modeled throughout the study area.

Table 1 – Modeled Sources

Source	Number
Industrial sources	315
Trucking companies	71
Gas stations/Truck stops	49
Auto body shops	19
Dry cleaning shops	10
Total	464

IDEM also modeled major and secondary roadways for emissions and impacts from cars and trucks. Interstates I-465 and I-70 were modeled along with thirteen major roadways within the study area. IDEM split the roads into segments and used traffic count data from the Indiana Department of Transportation to aid in the determination of the volume of emissions deriving from each segment.

Risk Characterization

The term “risk characterization” has many different meanings and can include projects of wide variability in depth and scope. The tools and resources available to IDEM limit the scale and scope of the risk characterization that IDEM can produce. This risk characterization is designed to answer questions about the types, amounts, and potential health risks posed by air toxics in the study area. This risk characterization focuses on two toxic endpoints for each pollutant, cancer and non-cancer health effects from inhalation exposure over a lifetime (70 years) and uses health protective assumptions and inputs. The primary function of the risk characterization is to put into context the concentration of each of the pollutants to which the public is exposed by taking into account the toxicity of the different pollutants.

The risk characterization, while a useful tool, is not a statement of “actual risk” that people face but rather a reasonable estimate of upper-bound potential risk. It is not IDEM’s goal to identify the cause of any observed health effects in the area through this study. This characterization can be used to make decisions about whether additional resources should be dedicated to reduce emissions and risk. The “actual risk” that individuals face is a complex combination of many factors, including genetic predisposition, diet, lifestyle choices, and environmental contribution. It is outside the scope of this study to determine what this complex combination of factors is for every person who lives in the study area. IDEM has made certain health protective assumptions that result in an estimate of upper-bound potential risk posed by the pollutants in the ambient air (i.e., the air in and around the study area). Risk values shown should not be considered to represent actual predicted cases of cancer.

IDEM used risk characterization methodology based on U.S. EPA-approved guidance. Specifically, U.S. EPA’s Air Toxics Risk Assessment Reference Library Volumes 1, 2, and 3, were used. Methods were reviewed by the study’s Technical Advisory Group during the course of the study.

IDEM evaluated the highest 24-hour air monitoring concentrations and compared that value to available toxicological values for acute (short-term) health effects. Table 2 summarizes the Harding Street and Stout Field data evaluation. Twenty-four hour (24-hour) air monitored pollutant concentrations were compared to 24-hour Minimal Risk Levels (MRLs) list in the Agency for Toxic Substances and Disease Registry (ATSDR) and Occupational Safety and Health Administration (OSHA) 1-hour Reference Exposure Levels (RELs). No pollutants were observed over the short-term health-protective level for a 24-hour period.

Table 2 – Short Term Exposure Comparison

Pollutant	Harding St.	Stout Field	MRL	REL
	Maximum (µg/m ³)*	Maximum (µg/m ³)*	24-hr risk (µg/m ³)*	1-hr (µg/m ³)*
Acrolein	5.6	6.3	6.9	2.5
Benzene	7.8	19	29	1300
Benzyl Chloride	-	-		240
Bromodichloromethane	-	-	2100	14000
Carbon Disulfide	0.44	3.3		6200
Carbon Tetrachloride	0.69	0.63		1900
Chloroform	0.88	0.3	490	150
p-Dichlorobenzene	1.5	5.4	12000	
1,4-Dioxane	2.5	1.4	7200	3000
Methyl Tert-Butyl Ether (MTBE)	0.32	-	7200	
Styrene	0.85	3.4		21000
Tetrachloroethene (PCE)	3.5	1.8	1400	20000
Toluene	25	38	3800	37000
1,1,1-Trichloroethane	-	-	11000	68000
Trichloroethene (TCE)	0.48	1.7	11000	
Vinyl Chloride	-	-	1300	180000
o-Xylene	4.1	4.3	8700	22000
m+p-Xylenes	12	13	8700	22000
Arsenic	0.0042	0.0064		0.19
Mercury	0.0029	0.0017		1.8
Nickel	0.0026	0.025		6
Formaldehyde	13	8.4	49	94

*µg/m³-micrograms per cubic meter

For chronic exposure, IDEM evaluated pollutants for the reasonable upper-bound probability of causing harm for non-cancer health effects when exposed to pollutants over a lifetime. IDEM assumes that individuals are exposed to the pollutant continuously for 70 years. IDEM also considers sensitive population (i.e., those with conditions making them more susceptible to the effects of pollution, like children or the elderly) when evaluating the observed concentrations.

IDEM used U.S. EPA methods and toxicological information from reliable sources when calculating potential cancer risk estimates. Potential lifetime cancer risk estimates are obtained by multiplying upper-bound exposure concentrations by cancer slope factors. The resulting calculations give a number that is expressed using the term “cancer cases per number of people.” For example, a number could be four excess (additional) cancer cases per million people over 70 years. U.S. EPA uses a range between one in a million to one hundred in a million (1.0×10^{-6} to 1.0×10^{-4}) when evaluating whether the estimated risk is at a level where action should be taken. Generally, U.S. EPA considers risk estimates over one hundred in a million (1.0×10^{-4}) to be at levels where action or more investigation is required. Risks that fall between one in a million and 100 in a million (1.0×10^{-6} to 1.0×10^{-4}) level generate decisions and actions taking into account the assumptions used to determine the estimate. Risk estimates below one in a million (1.0×10^{-6}) are usually considered as not requiring further action.

Table 3 contains the chronic (lifetime) cancer risk estimates for all the pollutants monitored during the study for both monitoring locations.

Table 3 – Pollutant Detection Rates and Lifetime Cancer Risk Estimates

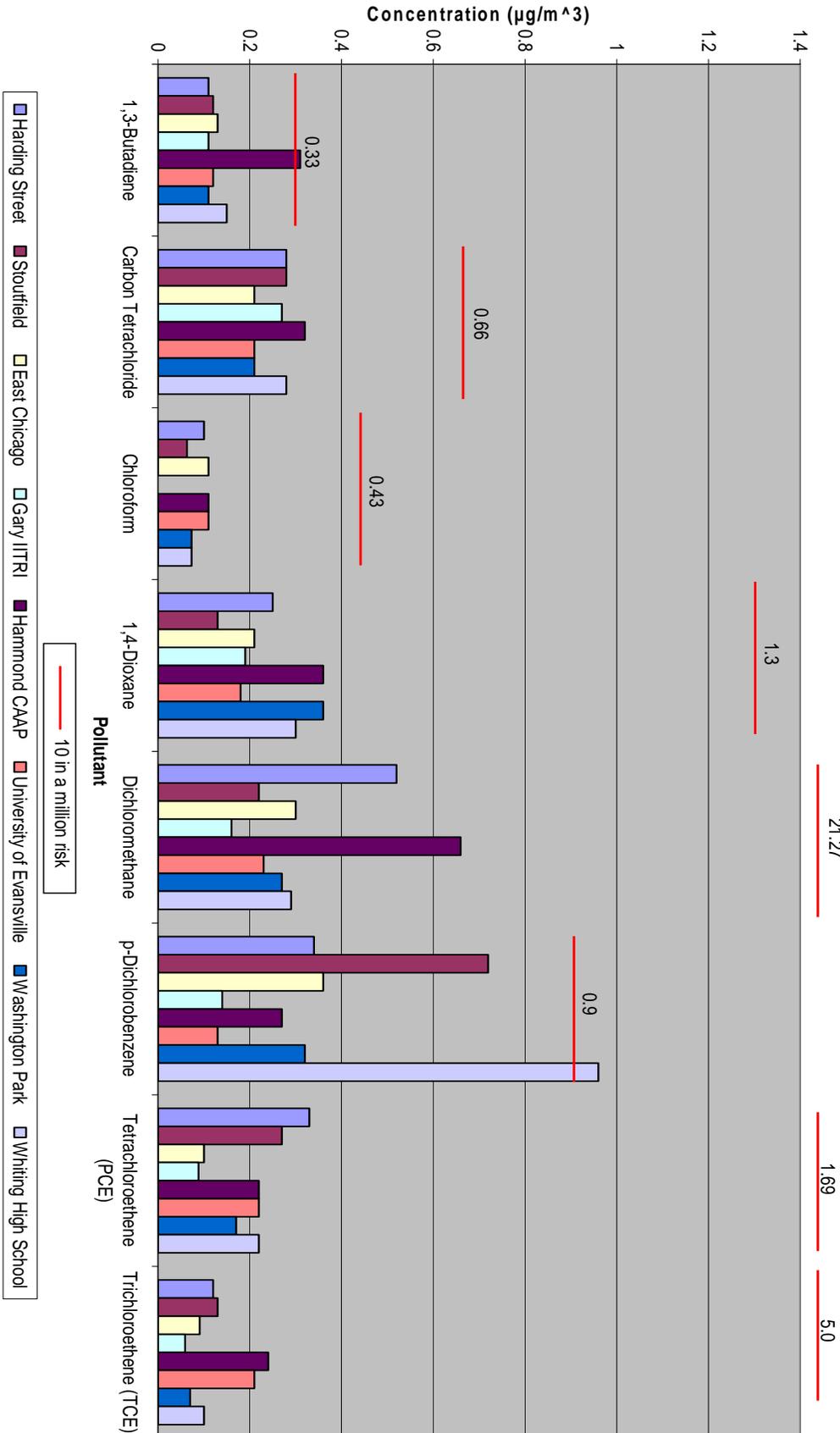
Pollutant	CAS #	Harding Street			Stout Field		
		Detection Rate percentage	Exposure Concentration ($\mu\text{g}/\text{m}^3$)*	Lifetime Risk Estimate (per million)	Detection Rate percentage	Exposure Concentration ($\mu\text{g}/\text{m}^3$)*	Lifetime Risk Estimate (per million)
Acetaldehyde	75-07-0	87.0%	0.67	1.5	86.8%	0.70	1.5
Arsenic	N/A	91.3%	0.0011	4.8	89.1%	0.0012	5.3
Benzene	71-43-2	100.0%	1.3	10	95.5%	1.9	15
Beryllium	N/A	97.4%	0.0000080	0.020	97.5%	0.0000090	0.020
1,3-Butadiene	106-99-0	22.9%	0.11	3.2	25.2%	0.12	3.5
Cadmium	N/A	92.2%	0.00030	0.50	84.9%	0.00030	0.50
Carbon Tetrachloride	56-23-5	35.6%	0.28	4.2	38.7%	0.28	4.2
Chloroform	67-66-3	24.6%	0.10	2.4	9.9%	0.063	1.5
p-Dichlorobenzene	106-46-7	45.8%	0.34	3.8	60.4%	0.72	8.0
Dichloromethane	75-09-2	73.7%	0.52	0.20	56.8%	0.22	0.10
1,4-Dioxane	123-91-1	13.6%	0.25	1.9	15.3%	0.13	1.0
Ethylbenzene	100-41-4	74.6%	0.40	1.0	70.3%	0.48	1.2
Formaldehyde	50-00-0	93.5%	3.5	0.020	89.3%	2.4	0.010
Lead	N/A	91.3%	0.0060	0.070	96.6%	0.0090	0.10
Nickel	N/A	87.0%	0.0010	0.20	88.2%	0.0020	0.40
Tetrachloroethene (PCE)	127-18-4	41.5%	0.33	1.9	37.8%	0.27	1.6
Trichloroethene (TCE)	79-01-6	8.5%	0.12	0.20	18.0%	0.13	0.30
Chromium VI	1854-02-99	77.0%	0.000041	0.50	-	-	-

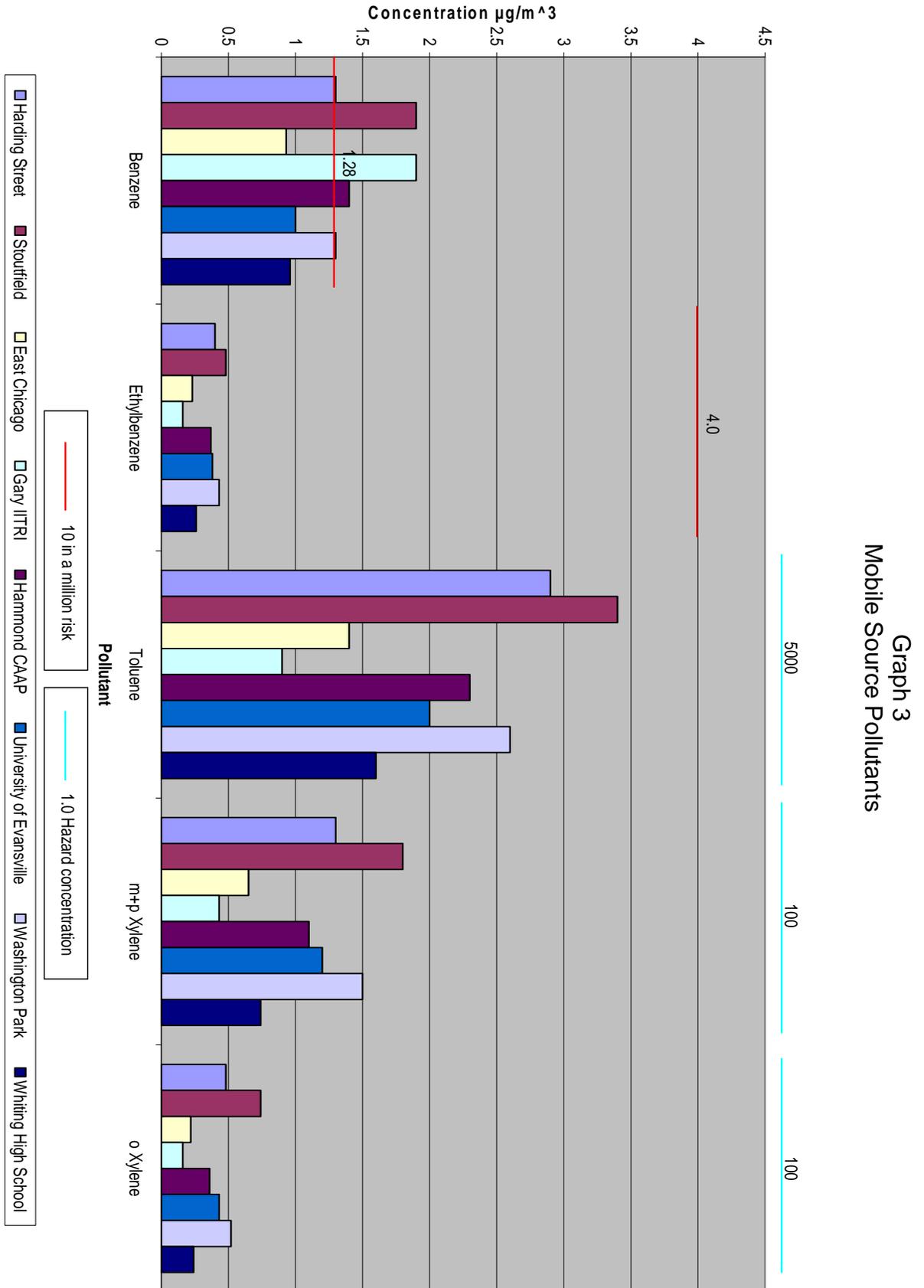
* $\mu\text{g}/\text{m}^3$ -micrograms per cubic meter

All pollutants were monitored at concentrations below the one hundred in a million (1.0×10^{-4}) risk level. Only benzene was monitored above the ten in a million (1.0×10^{-5}) risk level. Risk estimates for 1,3-butadiene, acetaldehyde, arsenic, carbon tetrachloride, chloroform, p-dichlorobenzene, 1,4-dioxane, ethylbenzene, and tetrachloroethene were over one in a million (1.0×10^{-6}) risk. Benzene can come from many sources, most commonly cars and trucks. The benzene concentrations observed at the Southwest Indianapolis monitors are consistent with the concentrations observed at monitors in other cities around Indiana and the United States.

Graph 2 shows how the pollutants' monitored values in the study area compare to pollutants' monitored values around Indiana. Graph 3 shows the monitored concentrations of pollutants that are commonly attributed to mobile sources, like cars and trucks. Both graphs contain reference bars that mark the concentration that represents ten in a million risk or a non-cancer hazard index of one (1.0) for each pollutant.

Graph 2
 Carcinogen Concentrations Throughout Indiana





IDEM evaluates chronic (lifetime) non-cancer hazard assuming a threshold for each pollutant at which a health effect can be observed. That is, it assumes safe exposure to the pollutant up to a certain level before it is possible to experience a health effect from breathing the pollutant. IDEM uses health protective assumptions by taking into account people who might be more sensitive to the pollutants. A Hazard Quotient (HQ) is a ratio that divides an exposure concentration by a reference concentration value. A HQ under 1.0 is commonly recognized to be below the health-protective level. HQs over 1.0 indicate that further investigation may be necessary and does not necessarily mean that health effects are expected. Given the many health-protective assumptions used in the evaluation, most HQs over 1.0 are still unlikely to be associated with observable adverse health effects. However, for the purposes of this study, IDEM evaluated all pollutants where the HQ was over 1.0. Table 4 lists the detection rates and HQ of pollutants for which IDEM has toxicological information.

Table 4 – Pollutant Detection Rates and Non-cancer Hazard Estimate

Pollutant	Harding Street			Stout Field		
	Detection Rate Percentage	Exposure Concentration ($\mu\text{g}/\text{m}^3$)*	Hazard Quotient	Detection Rate Percentage	Exposure Concentration ($\mu\text{g}/\text{m}^3$)*	Hazard Quotient
Acetaldehyde	87.0%	0.67	0.075	86.8%	0.70	0.078
Acetone	98.3%	11	0.00037	98.2%	290	0.0092
Acrolein	85.4%	1.9	96	82.2%	1.7	84
Arsenic	91.3%	0.0010	0.037	89.1%	0.0010	0.041
Benzene	100.0%	1.3	0.043	95.5%	1.9	0.064
Beryllium	97.4%	0.0000080	0.00040	97.5%	0.0000090	0.00040
Bromomethane	22.0%	0.32	0.064	27.0%	0.23	0.047
1,3-Butadiene	22.9%	0.11	0.053	25.2%	0.12	0.059
Cadmium	92.2%	0.00029	0.014	84.9%	0.00026	0.013
Carbon Disulfide	11.9%	0.17	0.00024	64.9%	0.53	0.00076
Carbon Tetrachloride	35.6%	0.28	0.0015	38.7%	0.28	0.0015
Chloroform	24.6%	0.10	0.0010	9.9%	0.063	0.00065
Chloromethane	98.3%	1.0	0.011	96.4%	0.93	0.010
Cobalt	99.1%	0.0016	0.016	80.7%	0.0014	0.014
Cyclohexane	49.2%	0.18	0.000029	46.8%	0.17	0.000029
p-Dichlorobenzene	45.8%	0.34	0.00043	60.4%	0.72	0.0009
Dichlorodifluoromethane (F-12)	99.2%	2.8	0.0018	96.4%	2.6	0.0017
Dichloromethane	73.7%	0.52	0.00052	56.8%	0.22	0.00022
1,4-Dioxane	13.6%	0.25	0.000069	15.3%	0.13	0.000036
Ethanol	82.2%	51.0	0.00051	83.8%	34	0.00034
Ethyl Acetate	69.5%	0.50	0.0014	63.1%	0.34	0.00091
Ethylbenzene	74.6%	0.40	0.00040	70.3%	0.48	0.00048
Formaldehyde	93.5%	3.52	0.36	89.3%	2.36	0.24
Heptane	91.5%	0.57	0.0013	87.4%	0.61	0.0014
Hexane	100.0%	0.92	0.0013	95.5%	0.74	0.0011
Isopropanol	78.8%	2.0	0.00029	76.6%	1.6	0.00023
Lead	91.3%	0.0062	0.0042	96.6%	0.0094	0.0063
Manganese	100.0%	0.0064	0.13	93.3%	0.0063	0.13
Mercury	93.9%	0.00021	0.00070	95.0%	0.00019	0.00060
Methyl Ethyl Ketone (MEK)	99.2%	2.5	0.0005	96.4%	3.8	0.00077
Methyl Isobutyl Ketone (MIBK)	57.6%	0.34	0.00011	62.2%	0.41	0.00014
Methyl n-Butyl Ketone (MBK)	68.6%	1.3	0.023	73.0%	0.74	0.013
Nickel	87.0%	0.0010	0.011	88.2%	0.0020	0.022
Propene	97.5%	1.0	0.00034	94.6%	1.1	0.00038

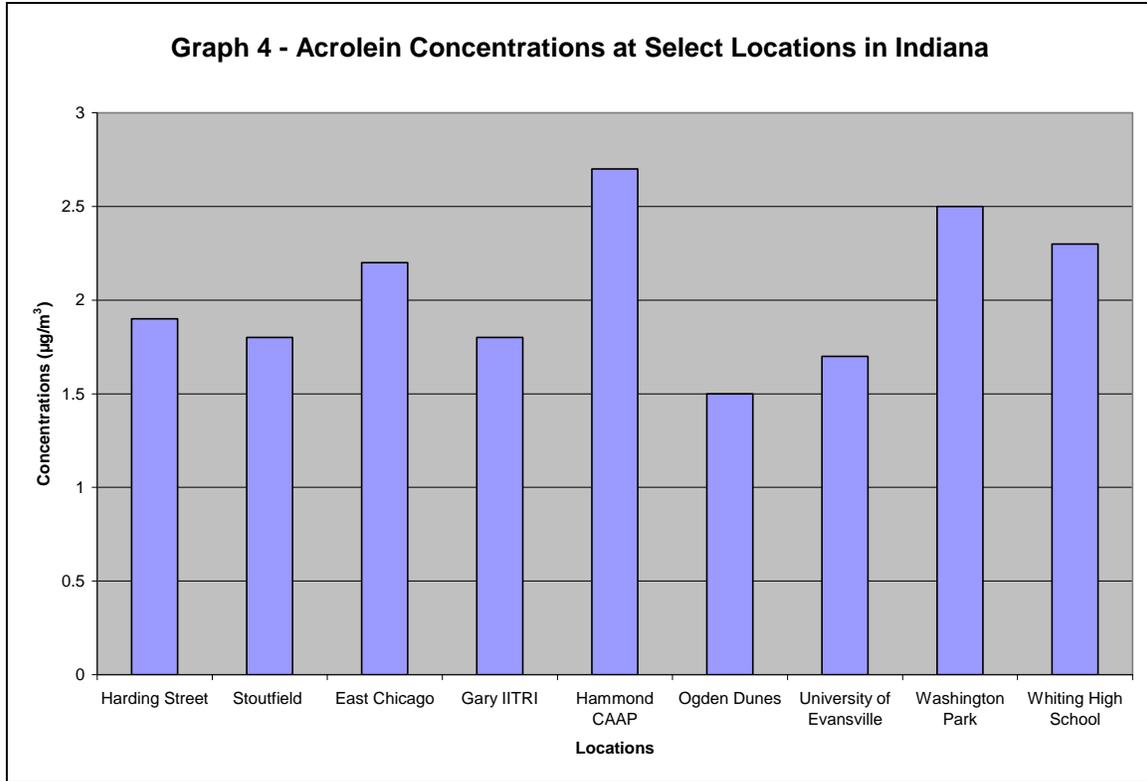
Pollutant	Harding Street			Stout Field		
	Detection Rate Percentage	Exposure Concentration ($\mu\text{g}/\text{m}^3$)*	Hazard Quotient	Detection Rate Percentage	Exposure Concentration ($\mu\text{g}/\text{m}^3$)*	Hazard Quotient
Propionaldehyde	78.9%	0.17	0.021	99.2%	0.077	0.0096
Selenium	93.0%	0.0016	0.000080	89.9%	0.0018	0.000090
Styrene	14.4%	0.17	0.00017	60.4%	0.47	0.00047
Tetrachloroethene (PCE)	41.5%	0.33	0.0012	37.8%	0.27	0.0010
Tetrahydrofuran (THF)	28.8%	0.18	0.0051	30.6%	0.19	0.0054
Toluene	100.0%	2.9	0.00058	96.4%	3.4	0.00069
Trichloroethene (TCE)	8.5%	0.12	0.00020	18.0%	0.13	0.00022
Trichlorofluoromethane (F-11)	100.0%	1.4	0.0020	97.3%	1.4	0.0020
1,3,5-Trimethylbenzene	13.6%	0.29	0.048	24.3%	0.16	0.026
1,2,4-Trimethylbenzene	86.4%	0.69	0.098	85.6%	0.89	0.13
Valeraldehyde	49.6%	0.016	0.00045	93.4%	0.014	0.00039
Vinyl Acetate	89.8%	5.3	0.026	88.3%	4.6	0.023
o-Xylene	82.2%	0.48	0.0048	76.6%	0.74	0.0074
m+p-Xylenes	93.2%	1.3	0.013	86.5%	1.8	0.018

* $\mu\text{g}/\text{m}^3$ -micrograms per cubic meter

The only pollutant with a monitored HQ over 1.0 is acrolein. Acrolein concentrations were well above the health-protective benchmark at both monitoring locations. As such, IDEM has spent considerable time investigating this pollutant.

Acrolein is a common pollutant found in many urban areas. It is most commonly associated with the burning of organic materials and from motor vehicles. It can also be formed in the air when pollutants react with the sunlight and other chemicals. Animal studies have shown that breathing acrolein may cause irritation to the nasal cavity and can damage the lining of the lungs.

IDEM compared concentrations of acrolein to concentrations monitored in other areas of Indianapolis and to other cities. The results indicate that acrolein concentrations in Southwest Indianapolis are comparable to concentrations monitored in other urban areas of the state. Graph 4 shows how acrolein concentrations compare for the time period of the study.



IDEM has determined that acrolein concentrations are not unusually high in Southwest Indianapolis compared to other metropolitan areas in the state.

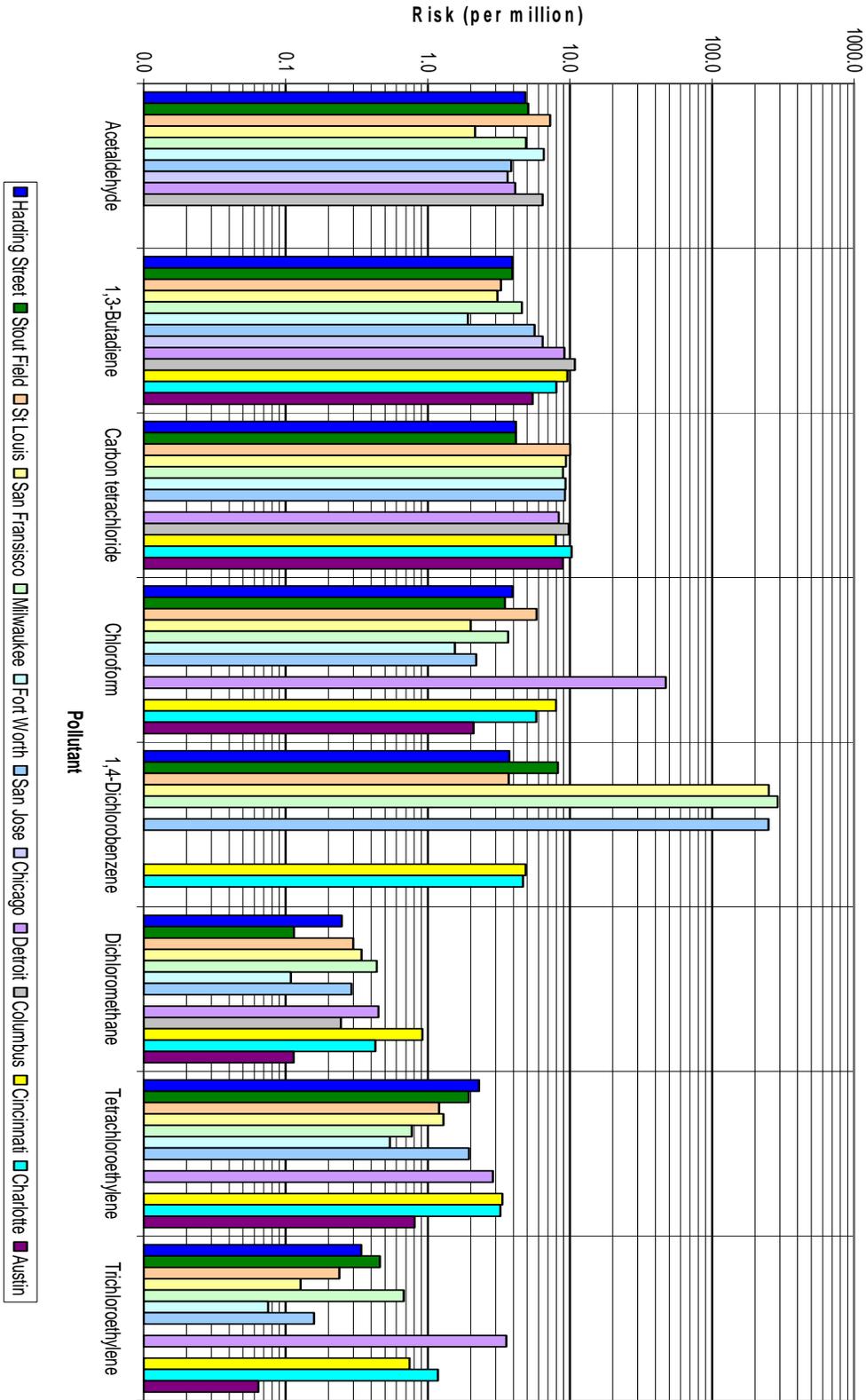
Air Monitoring Comparison

While risk evaluations are useful tools, comparing the air pollutants' monitoring results from the study area to air pollutants' monitoring results for the same pollutants from other metropolitan areas around the United States is also helpful at putting the monitoring results into perspective. The graphs 5 through 7 compare readings from various monitors which were placed using similar criteria and site descriptions as those used for the Southwest Indianapolis Air Toxics Study. It is important to note that while siting descriptions are similar, it does not mean that they were sited exactly the same. As such, the results should be used for general comparisons only.

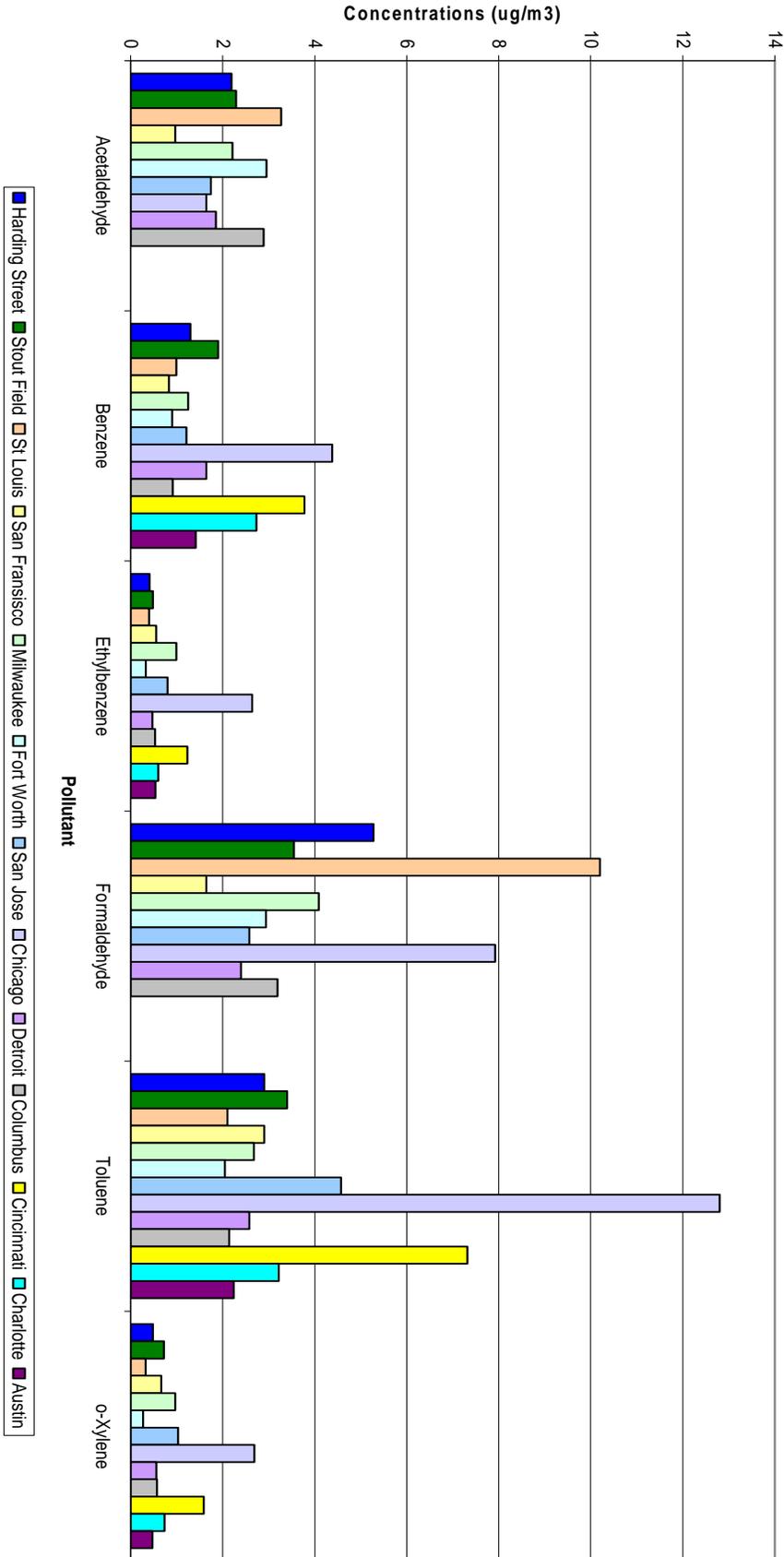
Graph 5 compares the cancer risk estimates from pollutants classified as carcinogens monitored in several urban locations. The chart shows that concentrations observed in Southwest Indianapolis are comparable to concentrations monitored in other cities for pollutants classified as carcinogens.

Graph 6 compares concentrations of pollutants monitored in several urban locations which are most commonly associated with mobile sources. Concentrations of mobile source pollutants in some urban locations appear to be slightly higher than in Southwest Indianapolis and they appear to be lower in others. Based on monitored and modeled values, mobile source pollutants are some of the biggest contributors to potential non-cancer risk in the area.

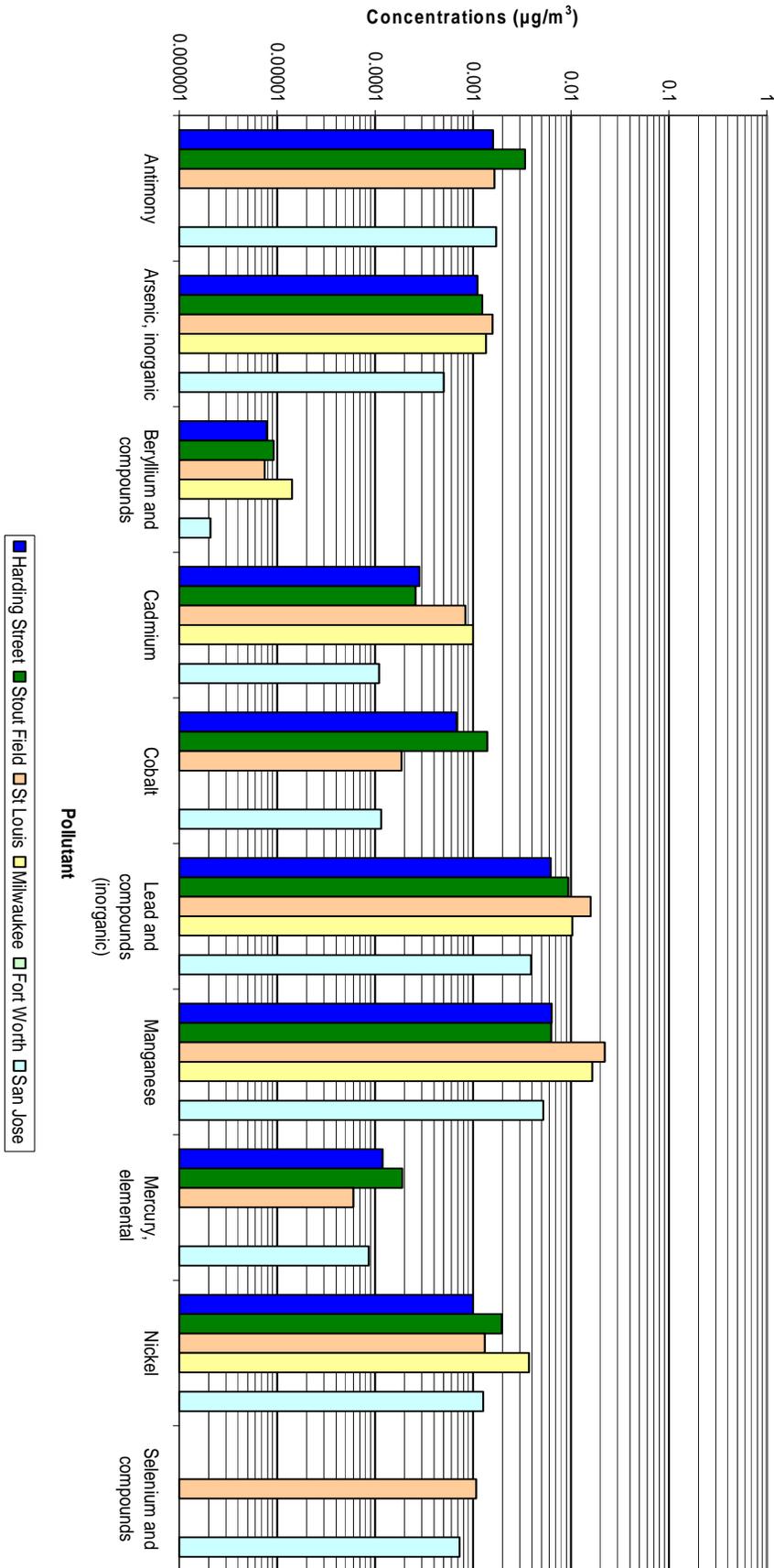
Metals were identified in past large scale modeling analyses (NATA) as being one of the primary concerns in Southwest Indianapolis. Based on monitoring results however it does not appear that metals pose a significant risk in Southwest Indianapolis. Metal concentrations in other cities are displayed in graph 7. Metal concentrations in Southwest Indianapolis do not significantly vary from concentrations observed in other cities.



Graph 5 - U.S. City Risk Estimate Comparison



Graph 6 - U.S. City Mobile Source Pollutant Comparison

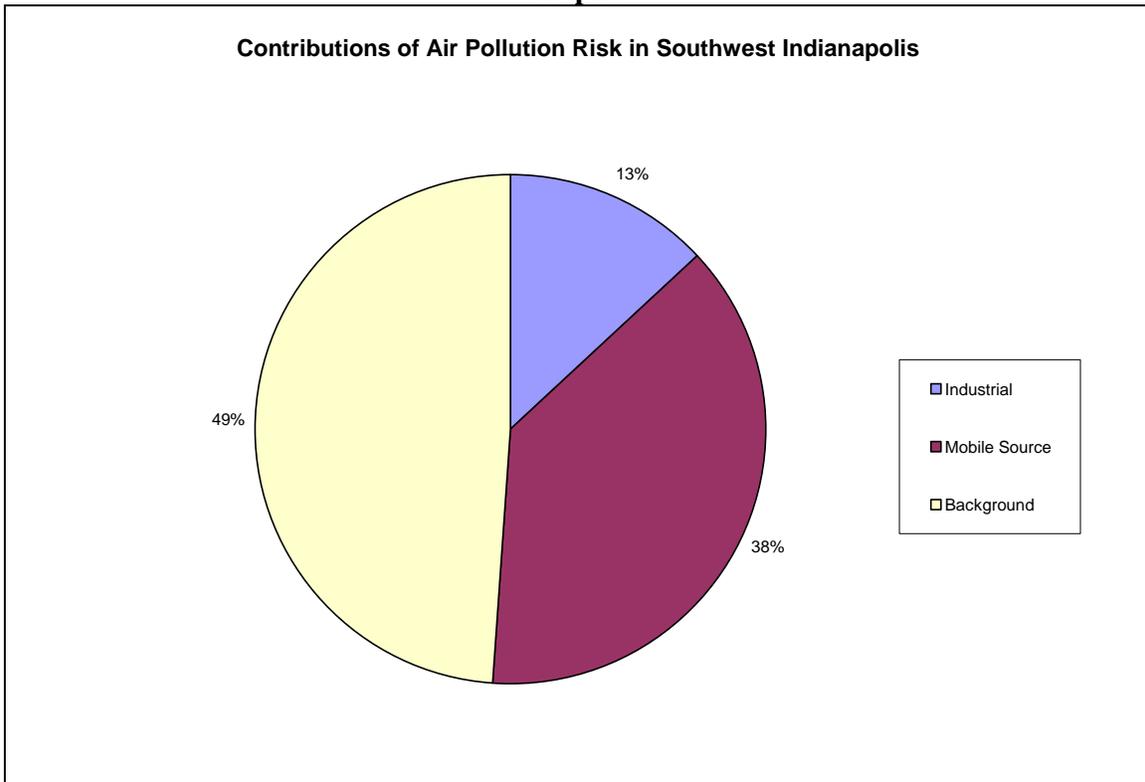


Graph 7 - U.S. City Metal Concentration Comparison

Estimates Based on Air Dispersion Modeling

Modeling results indicate that mobile sources (cars, trucks) are a large contributor to the total risk posed by air toxics in the area comprising approximately 38% of the total. Approximately half of the risk in the study area comes from background. The percent contribution from each source is based on averages throughout the study area and could vary from one location to another. Background includes sources such as lawn mowers, emissions from homes, and transport of pollutants from outside the study area. Background concentrations are uniform throughout the study area and are consistent throughout the Indianapolis metro area.

Graph 8



Modeling showed concentrations of certain pollutants associated with mobile sources to be very high close to major roadways. Concentrations declined rapidly farther away from the center of the roadways. While there is no monitoring data from this study taken in close proximity to the roads, the modeling results are consistent with other studies that examined the impact roadways have on air quality. Modeling results also indicate that concentrations decline rapidly away from the road and are 98% lower about 225 feet from the road than concentrations on the road. Other monitoring studies have shown that concentrations decline dramatically 30 feet from the roadway.

Modeling did identify a few isolated locations, or nodes, where an industrial source was the most significant contributor to air toxics concentrations. Many of these locations were actually still on the property of the industry, implying that the general public would be exposed to lower concentrations. While none of the concentrations predicted by the

modeling are cause for alarm, IDEM is in contact with the industries to attempt to identify potential ways to reduce emissions.

Model to Monitor Comparison

IDEM compared the concentrations of air pollutants predicted by the RAIMI computer model to air pollutants measured concentrations at the two monitoring locations. While a direct comparison relies on a variety of assumptions, a comparison of specific pollutants does provide a general sense as to whether the model results are realistic. The results of the comparison are in Table 5 and Table 6.

Table 5 - Harding Street Model to Monitor Comparison

Pollutant	Modeled Concentration Harding Street Monitor	Background 2002 NATA	Total Modeled Concentration Harding Street	Monitored Concentration Harding Street
	µg/m ³	µg/m ³	µg/m ³	µg/m ³
Acetaldehyde	0.023	1.76	1.783	0.67
Benzene	0.67	0.202	0.872	1.3
Formaldehyde	0.4	2.27	2.67	3.5
Toluene	1.66	0.29	1.95	2.9
Nickel	0.0063	0.00032	0.00662	0.001

Table 6 – Stout Field Model to Monitor Comparison

Pollutant	Modeled Concentration Stout Field	Background 2002 NATA	Total Modeled Concentration Stout Field	Monitored Concentration Stout Field
	ug/m ³	ug/m ³	ug/m ³	ug/m ³
Acetaldehyde	0.03	1.76	1.79	0.7
Benzene	0.97	0.202	1.172	1.9
Formaldehyde	0.56	2.27	2.83	2.4
Toluene	2.38	0.29	2.67	3.4
Nickel	0.0072	0.00032	0.00752	0.002

When comparing the modeling results to the air monitoring concentrations, there is reasonably good agreement between the two methods. The model over predicts concentrations of some pollutants and under predicts for others. The modeling in general seems to under predict slightly the concentrations of pollutants typically attributed to mobile sources. While the model and the air monitoring data are not exactly the same, they are close enough to give confidence that the modeling results provide a realistic estimate of concentrations around the study area.

The modeled locations are not at the exact locations of the monitor but represent a location in close proximity. The background used in this comparison was taken from the 2002 NATA conducted by U.S. EPA, and is specific to the census tract where the monitor is located.

Summary

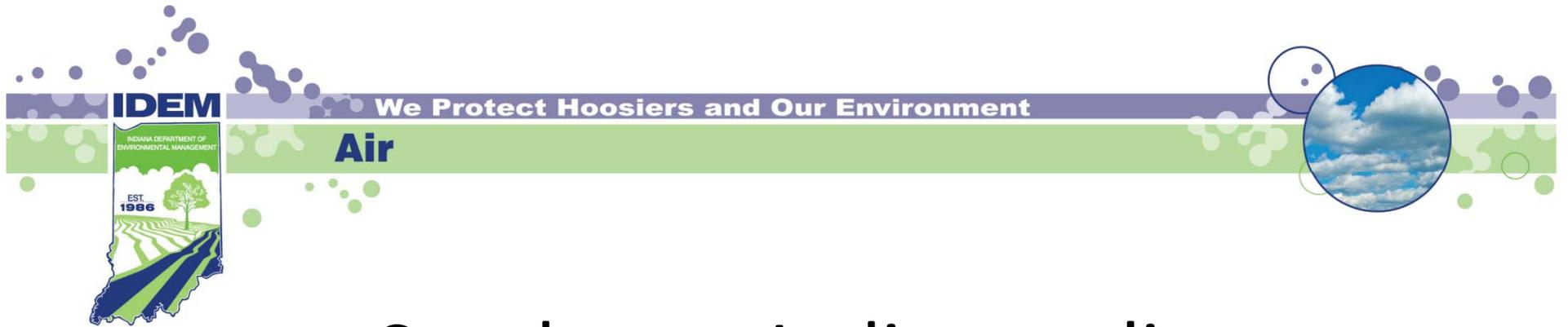
The study results indicate that inhalation cancer and non-cancer risk from potential air toxics exposure in the Southwest Indianapolis area is comparable to other cities around Indiana and the United States.

The largest contributors to air toxics in the study area are background and mobile sources (i.e., cars, trucks, etc.). Industrial source contributions to air toxics and health risks were small when compared to the risk from background and mobile sources. However, IDEM has identified a few industrial sources in the area that, while not significant sources of risk, could warrant further evaluation for potential pollution prevention opportunities and has initiated communication with these entities.

IDEM is actively promoting the Voluntary Idling Program (VIP) as well as working on diesel retrofit opportunities to reduce mobile source impacts in the area and working with industry in the area to find ways to reduce emissions of air toxics. A new mobile source air toxics rule along with new emission regulations on new cars and trucks are expected to reduce mobile source impacts. These new federal standards combined with the replacement of older, less efficient cars with new cleaner, more efficient cars is expected to reduce mobile source air toxics emissions by up to 45% over the next fifteen years.

Acronyms

ATSDR	Agency for Toxic Substances and Disease Registry
HQ	Hazard Quotient
IDEM	Indiana Department of Environmental Management
MRLs	Minimal Risk Levels
NATA	National Air Toxics Assessment
NATTS	National Air Toxics Trends Station
OSHA	Occupational Safety and Health Administration
PM	Particulate Matter
QAPP	Quality Assurance Project Plan
RAIMI	Regional Air Impact Modeling Initiative
RELs	Reference Exposure Levels
UCL	Upper Confidence Limit of the mean
U.S. EPA	United States Environmental Protection Agency
VIP	Voluntary Idling Reduction Program
VOCs	Volatile Organic Compounds



Southwest Indianapolis Community Scale Air Toxics Study

March 11, 2010

Indiana Department of
Environmental Management



Background of Study

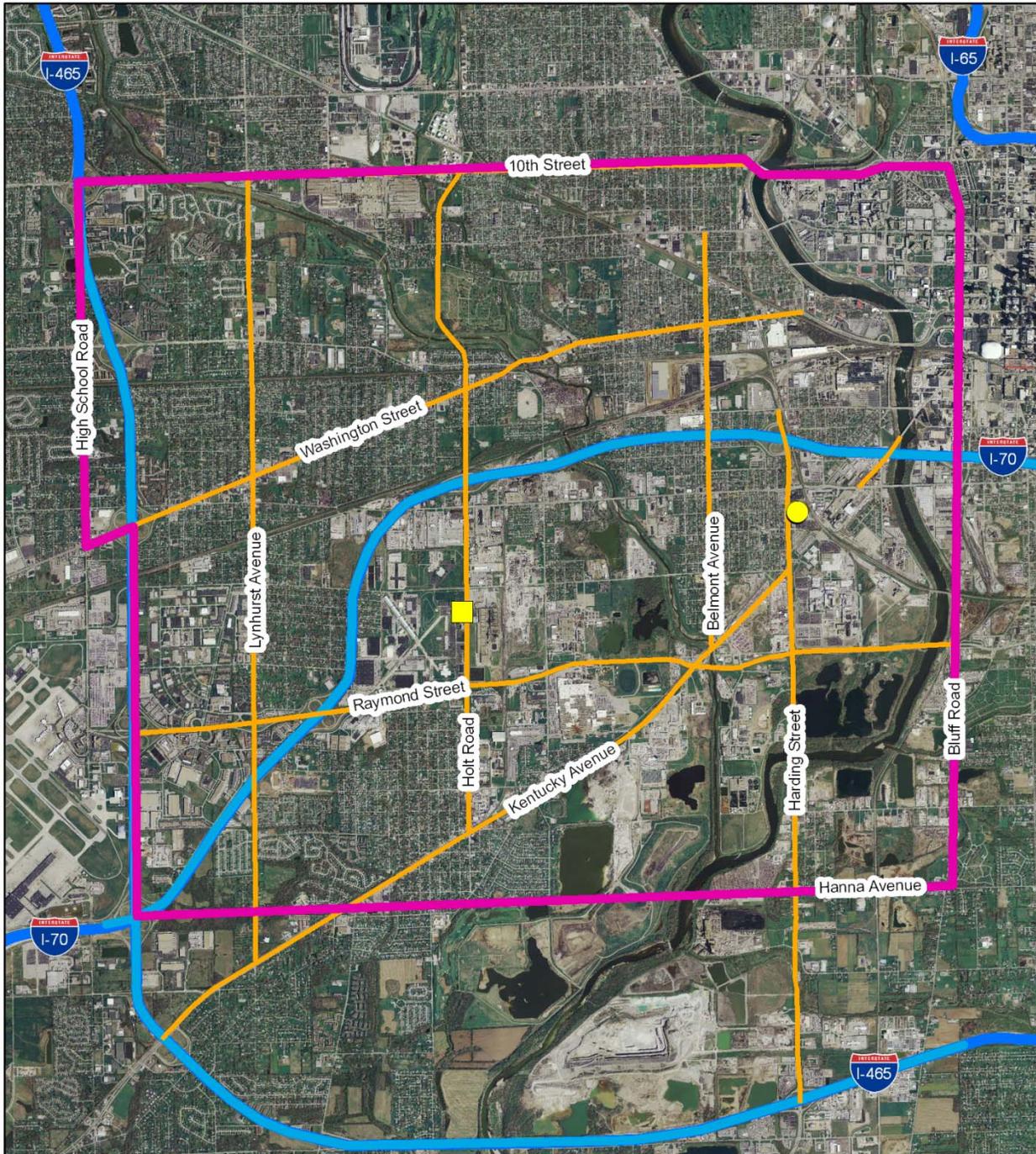
- Area highlighted in 1996 National Air Toxics Assessment (NATA) as high risk (released 2002)
 - National computer model that screens air toxics for the entire United States
 - Chromium VI main chemical of interest
- Identified through results of SEA 259 as being an area of interest for further study (released 2003)
- Highlighted again in 1999 NATA as area of high risk (released 2006)
 - Arsenic and acrolein main chemicals of interest
- Area featured in 2004 by local news as having poor air quality



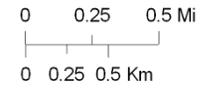
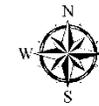
Background of Area

- Area has a large number of industries mixed within residential neighborhoods
- Indianapolis International Airport located next to study area
- Two major interstate highways run through the study area
- IDEM applied for and received a \$244,262 grant from U.S. EPA to study air toxics levels and health risk in cooperation with City of Indianapolis (third application accepted)
- Monitoring ran from October 2006 through October 2008

Southwest Indianapolis Air Toxics Study



- Harding St. Monitor
- Stout Field Monitor
- SW Indianapolis Study Area



This map is intended to serve as an aid in graphic representation only. This information is not warranted for accuracy or other purposes.

Mapped By: B. Callahan, Office of Air Quality
Date: 2/18/2010

Sources:
Non-Orthophotography Data - Obtained from the State of Indiana Geographical Information Office Library and CAC
Orthophotography Data - Obtained from Indiana Map Framework Data (www.indianamap.org)

Map Projection: UTM Zone 16 N Map Datum: NAD83



Goals of the Study

- Collect air toxics monitoring data within the study area
- Develop a detailed emissions inventory of all industrial and business sources in the area
- Conduct community scale detailed air toxics modeling
- Assess and characterize potential health risks from air toxics to the community
- Look for opportunities to reduce risk from pollution sources
- Communicate results of the study



Study Outline

- Air Monitoring
 - Two monitoring locations (Harding Street, Stout Field)
 - Metals (arsenic, manganese, nickel, etc.)
 - Carbonyls (formaldehyde, acetaldehyde, valeraldehyde, etc.)
 - Volatile Organic Compounds (VOC) (acrolein, benzene, toluene, etc.)
 - Chromium VI sampling for one year (Harding Street)
- Air Modeling component
 - Regional Air Impact Modeling Initiative (RAIMI)
- Community involvement
 - Public Advisory Group
 - Technical Advisory Group



Study Limitations

- Thousands of pollutants are emitted
 - Modeled 168 pollutants, monitored 85 pollutants
 - Selected pollutants based on what industry emits and chemicals identified as the most toxic by NATA
- Ozone (O₃) and Particulate Matter (PM) not evaluated as part of the study
 - IDEM evaluates O₃ and PM as part of its core network for Indianapolis
 - Current monitoring levels are below health protective levels
- Uncertainty in toxicity data
 - Individual people react differently, have different exposure, genetic make up, etc.
 - IDEM uses reasonable “*worst case*” assumptions in evaluations



Overall Conclusions

- IDEM's more detailed analysis and measured data shows that air toxics concentrations are lower than predicted by U.S. EPA's NATA screening tool
 - Monitored concentrations of chromium VI and arsenic were lower than predicted by NATA and below health protective levels
- No pollutants were observed at concentrations that warrant immediate or drastic action to protect human health
- Air toxics concentrations in Southwest Indianapolis are similar to concentrations observed throughout other Indiana and Midwestern cities
- Motor vehicles (cars, trucks, etc.) are the largest contributor of air toxics in the area, which is common in large urban areas



Secondary Conclusions

- Both monitors measured similar results
- Acrolein is a pollutant of interest based on monitoring data collected
 - We believe that motor vehicles are primary contributor to air concentrations
 - Other pollutants “break down” into acrolein in air
 - Challenges with monitoring methodology and origin of pollutant
- Benzene is the carcinogen of greatest concern
 - Motor vehicles are primary contributor
 - Consistent with concentrations observed in other metropolitan areas
- No industry-caused hotspots were observed in residential areas of the study
- Air toxics concentrations in the area are as safe to breathe as other urban areas in Indiana and the Midwest



Air Monitoring

- Monitoring Locations
 - Followed U.S. EPA guidance
 - Near residential areas but secure from tampering
- Monitoring Frequency
 - 24-hour samples
 - Sampled every 6 days
- Quality Assurance
 - U.S. EPA-approved Quality Assurance Project Plan (QAPP)



Risk Estimates

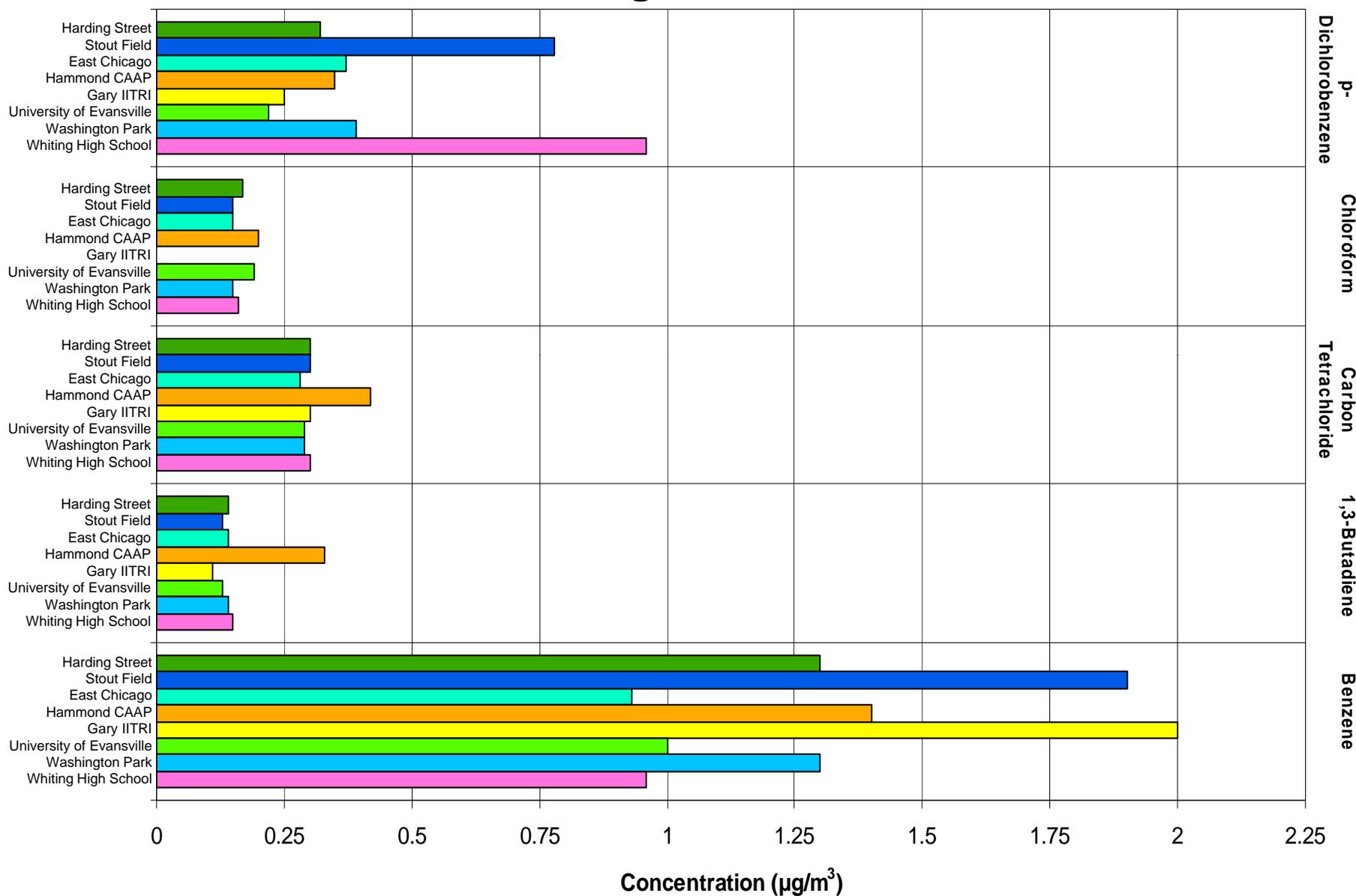
- Examined both cancer and non-cancer health effects
- Exposure assumptions
 - Erred on the side of being health-protective
 - Continuous exposure (24 hours a day for 70 years)
- Toxicity information
 - Used toxics data from U.S. EPA and other health agencies (i.e., IRIS, ATSDR, CALEPA)



Cancer Risk

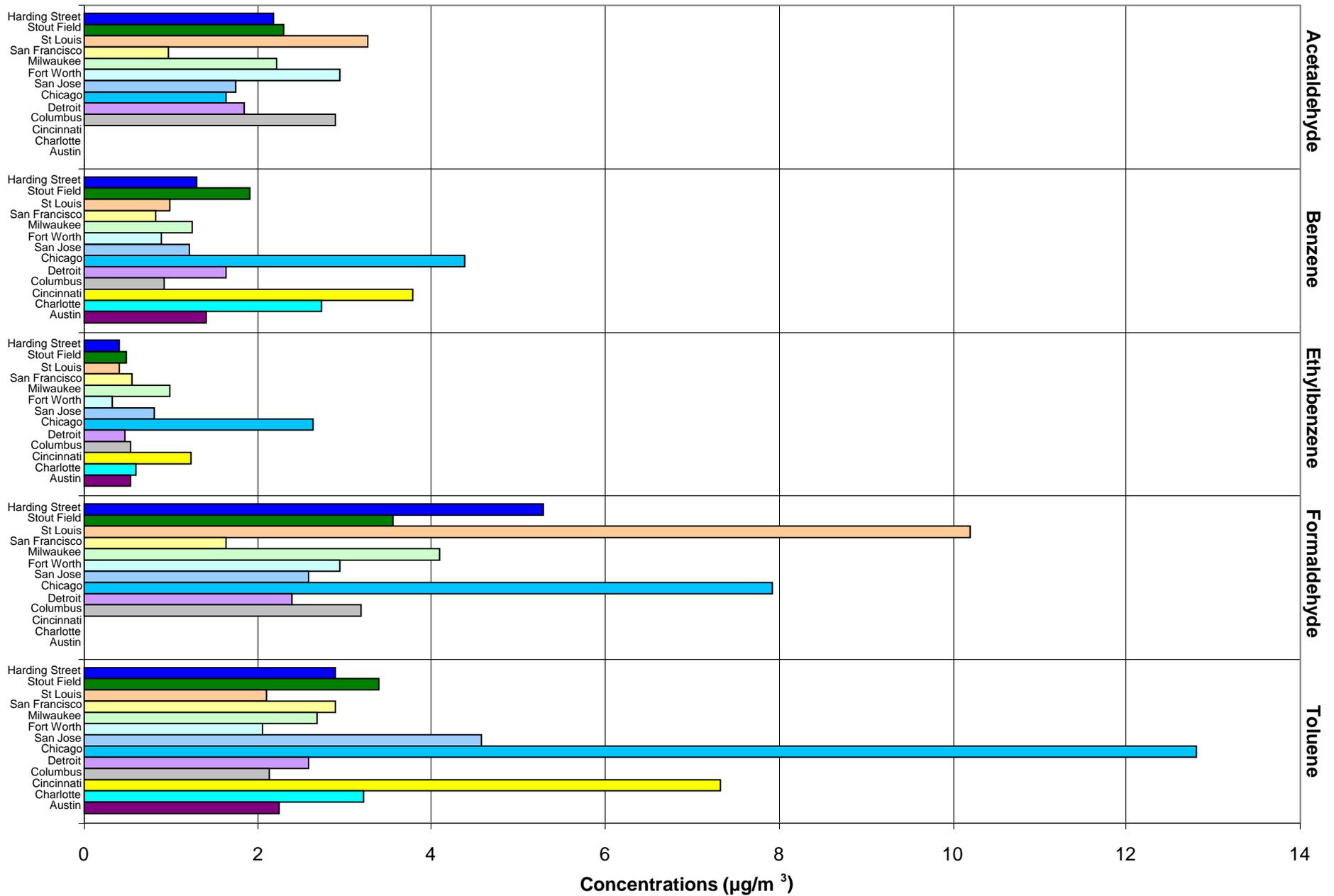
- Highest monitored cancer risk pollutant was benzene
 - Highest risk estimate was at Stout Field at 15 in a million
 - With population of 60,000, we would expect to see less than one additional cancer case in the study area over 70 years

Carcinogenic Compound Concentrations Throughout Indiana



■ Harding Street
 ■ Stoutfield
 ■ East Chicago
 ■ Hammond CAAP
 ■ Gary IITRI
 ■ University of Evansville
 ■ Washington Park
 ■ Whiting High School

U.S. City Mobile Source Pollutant Concentration Comparison





Non-Cancer Hazard

- Acrolein main contributor - 99% of total hazard in both locations
 - Many unknowns concerning monitoring of acrolein
 - No standard method nationally for monitoring
 - How much acrolein forms from breakdown of other pollutants
 - Acrolein identified as being of interest nationally
 - IDEM actively involved in addressing acrolein monitoring challenges with other agencies



Computer-Based Modeling

- Used Regional Air Impact Modeling Initiative (RAIMI) to evaluate emissions from:
 - Industries
 - Gas stations, small businesses, etc.
 - Cars and trucks (mobile sources)
- Designed by U.S. EPA specifically to evaluate communities with the size and complexity of Southwest Indianapolis
- Much more localized and detailed than U.S. EPA NATA



Modeling

- 465 total sources
 - 315 Industrial sources
 - 71 Trucking sources
 - 49 Gas stations/truck stop sources
 - 19 Auto body sources
 - 10 Dry cleaning sources
 - Indianapolis International Airport
- 2 Interstates (I-70 and I-465)
- 13 major roadways (Holt Rd., Raymond St., Belmont Ave., etc.)
- 168 total pollutants
- Data from 54,195 nodes (locations/receptors)
- Sources included from areas outside of the study area to evaluate impact on area

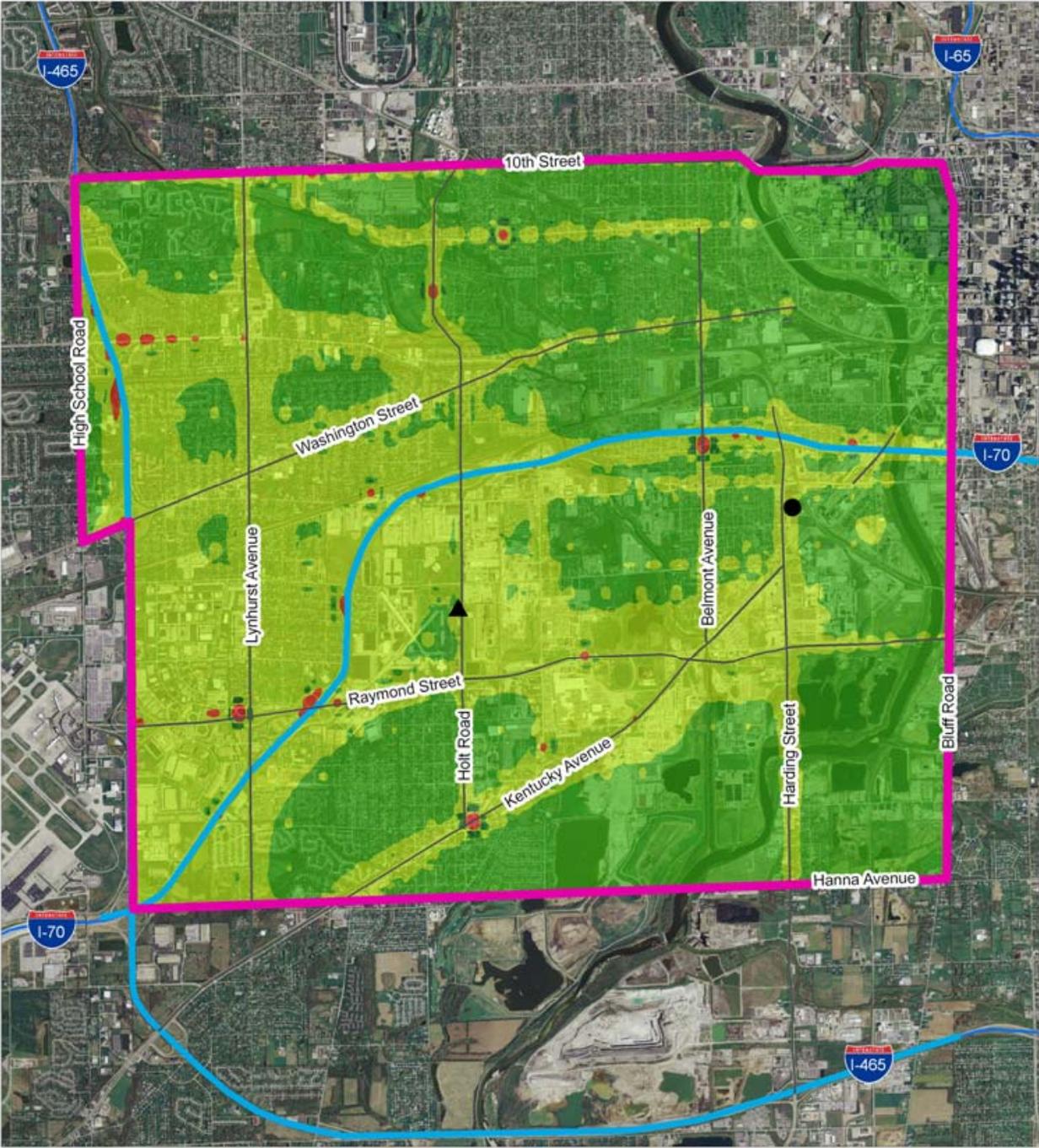
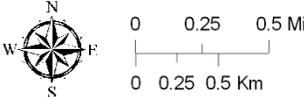
Total Modeled Estimated Cancer Risk

Cancer Risk

- Cancer Risk < 1 in 1,000,000
- 1 in 1,000,000 < Cancer Risk < 10 in 1,000,000
- 10 in 1,000,000 < Cancer Risk < 100 in 1,000,000
- 100 in 1,000,000 < Cancer Risk < 1,000 in 1,000,000

Legend

- Harding St. Monitor
- Stout Field Monitor
- SW Indianapolis Study Area



This map is intended to serve as an aid in graphic representation only. This information is not warranted for accuracy or other purposes.

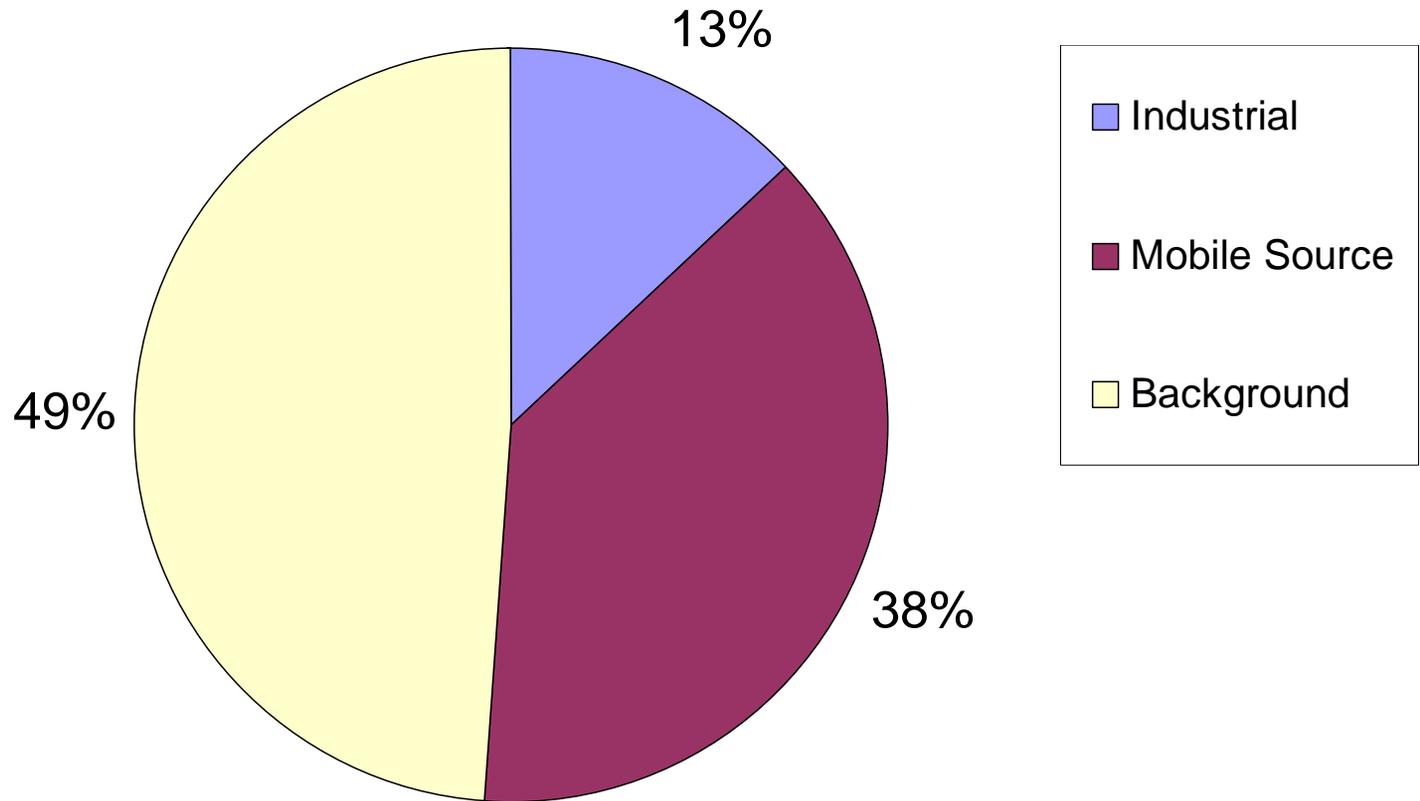
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Map Projection: UTM Zone 16 N Map Datum: NAD83



Contributions of Air Pollutant Risk for Southwest Indianapolis by Source Category





Model to Monitor Comparison*

Harding Street Monitor

Pollutants	Modeling Concentration (including background)	Monitoring Concentration	Comparison (under 3 considered good agreement)
	$\mu\text{g}/\text{m}^3$	$\mu\text{g}/\text{m}^3$	
Acetaldehyde	1.8	0.67	2.7
Benzene	0.87	1.3	-1.5
Formaldehyde	2.7	3.5	-1.3
Toluene	1.9	2.9	-1.5
Nickel	0.0066	0.001	6.6

* Necessary to put model performance into perspective.



Model to Monitor Comparison*

Stout Field Monitor

Pollutants	Modeling Concentration (including background)	Monitoring Concentration	Comparison (under 3 considered good agreement)
	$\mu\text{g}/\text{m}^3$	$\mu\text{g}/\text{m}^3$	
Acetaldehyde	1.8	0.70	2.6
Benzene	1.2	1.9	-1.6
Formaldehyde	2.8	2.4	1.2
Toluene	2.7	3.4	-1.3
Nickel	0.0075	0.002	3.8

- Necessary to put model performance into perspective.



NATA vs. Harding Street Monitoring

Pollutant	1999 NATA Concentration	2002 NATA Concentration	Harding Street Monitor
	$\mu\text{g}/\text{m}^3$	$\mu\text{g}/\text{m}^3$	$\mu\text{g}/\text{m}^3$
Acetaldehyde	1.7	2.7	0.67
Arsenic	0.13	0.001	0.001
Benzene	1.9	1.6	1.3
Chromium VI	0.00064	N/A	0.00004
Formaldehyde	2.1	2.9	3.5
Toluene	4.1	3.8	2.9



NATA vs. Stout Field Monitoring

Pollutant	1999 NATA Concentration	2002 NATA Concentration	Stout Field Monitor
	$\mu\text{g}/\text{m}^3$	$\mu\text{g}/\text{m}^3$	$\mu\text{g}/\text{m}^3$
Acetaldehyde	1.4	2.4	0.70
Arsenic	0.0011	0.001	0.001
Benzene	1.9	1.4	1.9
Chromium VI	0.00031	N/A	N/A
Formaldehyde	1.9	2.8	2.4
Toluene	3.4	3.4	3.4



Outreach

- Technical Advisory Group
 - Served as forum to evaluate methods and make recommendations concerning specific technical matters
- Public Advisory Group
 - Helped IDEM understand community concerns
 - Helped develop communication plan to present results as clearly as possible
 - Provided community perspective
- Industry Cooperation
 - Helped with collection of emissions inventory information
 - 83% response rate to emission information request
 - Kept employees in area informed
- Web Page
 - www.idem.IN.gov/programs/air/workgroups/swindyairtox



City of Indianapolis

- Project Partner
 - Helped maintain monitoring locations
 - Collected samples
 - Provided local industry information
 - Assisted with public outreach



Overall Conclusions

- IDEM's more detailed analysis and measured data shows that air toxics concentrations are lower than predicted by U.S. EPA's NATA screening tool
 - Monitored concentrations of chromium VI and arsenic were well below levels assumed in NATA
- No pollutants were observed at concentrations that warrant immediate or drastic action to protect human health
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- Air toxics concentrations in the area are as safe to breathe as other urban areas in Indiana and the Midwest



Next Steps

- U.S. EPA and IDEM Initiatives
 - Mobile Source Air Toxics rule implementation
 - Work to promote reduced car, truck, and bus idling
 - Diesel exhaust retrofits (DieselWise, retrofits, grants)
 - Continue to work with industry on creative pollution prevention opportunities
- City of Indianapolis
 - Central Indiana Clean Air Partnership (CICAP)
 - Knozone program
- Community
 - Reduce mobile emissions



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 - relstro@idem.IN.gov



Comments & Questions?

Appendix G

2002 NATA Background Concentrations

Pollutant	2002 NATA Background Concentration (ug/m ³)
FORMALDEHYDE	2.273736501
ACETALDEHYDE	1.764882544
METHYL CHLORIDE (CHLOROMETHANE)	1.2
CARBON TETRACHLORIDE	0.61
TOLUENE	0.290360765
BENZENE (INCLUDING BENZENE FROM GASOLINE)	0.201655966
1,1,1-TRICHLOROETHANE	0.17
TRICHLOROETHENE	0.128054758
METHYLENE CHLORIDE (DICHLOROMETHANE)	0.11
CHLOROFORM	0.059
METHYL BROMIDE (BROMOMETHANE)	0.035
TETRACHLOROETHENE	0.033898222
1,3-BUTADIENE	0.025054896
1,4-DICHLOROBENZENE	0.021
NAPHTHALENE	0.014586481
ACRYLONITRILE	0.009301871
ETHYLENE OXIDE	0.006290081
BIS(2-ETHYLHEXYL)PHTHALATE (DEHP)	0.005777398
ETHYLENE DICHLORIDE (1,2-DICHLOROETHANE)	0.003292819
1,1,2,2-TETRACHLOROETHANE	0.003196444
LEAD COMPOUNDS	0.002190012
MANGANESE COMPOUNDS	0.001108364
CHROMIUM COMPOUNDS	0.000751365
ETHYLENE DIBROMIDE (DIBROMOETHANE)	0.000750411
ARSENIC COMPOUNDS(INORGANIC INCLUDING ARSINE)	0.000702415
PROPYLENE DICHLORIDE (1,2-DICHLOROPROPANE)	0.000658123
NICKEL COMPOUNDS	0.000314388
QUINOLINE	0.000181193
CADMIUM COMPOUNDS	4.23573E-05
BERYLLIUM COMPOUNDS	2.04046E-05
1,2-DIBROMO-3-CHLOROPROPANE	0.0000013
HYDRAZINE	0.00000013
BENZIDINE	9.9E-09

Appendix H

Industry Outreach Materials

Contents

Industry Information Letter
Industry Emissions Request Letter



INDIANA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT

We make Indiana a cleaner, healthier place to live.

Mitchell E. Daniels, Jr.
Governor

Thomas W. Easterly
Commissioner

100 North Senate Avenue
Indianapolis, Indiana 46204
(317) 232-8603
(800) 451-6027
www.idem.IN.gov

TO: Southwest Indianapolis Business and Industry Stakeholders

FROM: Daniel Murray, Assistant Commissioner
Office of Air Quality

DATE: November 20, 2007

SUBJECT: Southwest Indianapolis Air Toxics Study

The Indiana Department of Environmental Management's (IDEM) Office of Air Quality is in the process of conducting an air quality study in the southwest area of Indianapolis. This area has been identified by the U.S. Environmental Protection Agency as a potential area of concern for air toxics. Included with this letter is a brochure that provides an overview of this study. As part of the study, IDEM is performing ambient air monitoring and dispersion modeling for a select group of air toxics. IDEM will soon be initiating a data gathering and validation exercise and will respectfully request your assistance to help ensure that the data and assumptions that are used for dispersion modeling represent the best available for this study. IDEM views industry stakeholder involvement to be essential to the accurate and successful completion of the project.

IDEM has been conducting ambient air monitoring in the southwest Indianapolis area since October 2, 2006 to help identify pollutants of interest. Attached is a list of the pollutants that IDEM currently believes warrant further evaluation. This list was derived from preliminary monitoring information, current emissions inventories, and information from previous U.S. EPA national scale air toxics assessments. It will not be necessary for you to verify the presence or absence of all the pollutants on this list from your facility. However, if your facility has additional information available concerning these pollutants, we encourage that it be provided.

In order to prepare you for the data gathering and validation exercise, IDEM will conduct an information session at the Rolls-Royce Training center located at 2355 Tibbs Avenue Indianapolis, IN 46225 on December 13, 2007 at 1:00 p.m. During this session, IDEM will provide an overview of the Southwest Indianapolis Air Toxics Study and present an illustrative example of an emissions-related information validation request. IDEM and City of Indianapolis technical staff will also be on hand to answer any questions that you may have about the project or the forthcoming information validation request.

IDEM intends to initiate the formal emissions-related information validation request by mid-December 2007. Once the formal request is received, stakeholders will be provided ninety (90) days to prepare and submit a response. IDEM will host two (2) workshop events within the study area during the ninety-day response period. IDEM and the City of Indianapolis will have technical staff available during the workshops to share information concerning the project, respond to questions and concerns, and to provide technical assistance in the verification and completion of the emission-related information request form.

If you have any questions about the project or the emissions inventory request, please feel free to contact Brian Wolff at bwolff@idem.in.gov or (317) 234-3499), or Jeff Stoakes at jstoakes@idem.in.gov or (317) 233-2725.

If you would like to learn more about the project or how else you can be involved, please feel free to contact the project manager, Brian Wolff (contact information above), or visit the project web page at www.IN.gov/idem/programs/air/workgroups/swindyairtox/index.html. Thank you in advance for your assistance with this project. Your participation will help facilitate accurate and timely results from the study; information that will be useful to you and your community.



INDIANA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT

We make Indiana a cleaner, healthier place to live.

Mitchell E. Daniels, Jr.
Governor

Thomas W. Easterly
Commissioner

100 North Senate Avenue
Indianapolis, Indiana 46204
(317) 232-8603
(800) 451-6027
www.idem.IN.gov

August 2, 2010

Company Name
Company Address
City, IN Zip+4

Re: 326 IAC 2-6-5
Emissions Information Request

Dear:

The Indiana Department of Environmental Management's (IDEM) Office of Air Quality is in the process of conducting an air quality study in the southwest area of Indianapolis. This area has been identified by U.S. Environmental Protection Agency as a potential area of concern for the concentration of air toxics. As part of the study, IDEM is performing ambient air monitoring and air toxics modeling. IDEM is collecting information concerning emissions to the ambient air in the southwest area of Indianapolis and is respectfully requesting your assistance to make the inventory as accurate and complete as possible.

The information being requested by IDEM includes emissions and emissions-related data. IDEM will use this information for air quality dispersion modeling and a human health risk characterization of the air quality in the southwest area of Indianapolis. Therefore, it is important to gather as much accurate information as possible concerning the emission of air toxics for this study.

Entities should provide information based on measured emissions, testing, reasonable estimates and best data available to the preparers. All submissions should be verified by an authorized representative of your company. In an attempt to make the emissions inventory gathering process easier for all involved, IDEM is supplying a sheet and CD with the current information specifically for your facility with this letter. Please commit some time to verify that the information IDEM currently has for your facility is the most up-to-date and accurate information you have available. In addition, please fill in any data gaps that there may be in your information if possible. Verifying the accuracy of the inventory information for your facility and filling in any information gaps will meet IDEM's needs in the inventory requests. IDEM is seeking information specifically to meet the needs of the modeling phase of the study.

IDEM has been conducting ambient air monitoring in the southwest Indianapolis area since October 2, 2006 to help identify pollutants of interest. Attached is a list of the pollutants that IDEM currently believes warrant further evaluation. This list was derived from preliminary monitoring information, current emissions inventories, and information from previous U.S. EPA national scale air toxics

assessments. It will not be necessary for you to verify the presence or absence of all the pollutants on this list from your facility. However, if your facility has additional information available concerning these pollutants, we encourage that it be provided.

IDEM is requesting this information pursuant to the Emission Reporting Rule, 326 IAC 2-6-5 (Additional Information Requests), which allows IDEM to request emissions and emissions-related information from all sources permitted by IDEM.

Though entities are allowed ninety (90) days from the mailing of this request to respond, IDEM would appreciate a response as soon as possible in order to support the timely implementation of the Southwest Indianapolis Air Toxics Study. If you feel that any of the information provided to IDEM may be considered confidential, please specify what information and the grounds for that determination in accordance with 326 IAC 17.1. The information submitted to IDEM is not intended to be used for compliance purposes.

IDEM will host two (2) workshop events within the study area during the ninety-day response period. IDEM and the City of Indianapolis will have technical staff available during the workshops to share information concerning the study, respond to questions and concerns, and to provide technical assistance in the verification and completion of the emission-related information request form.

All information and data requested should be sent to the following address:

Jeff Stoakes
Office of Air Quality
Indiana Department of Environmental Management
100 North Senate Avenue, Room N1001
P.O. Box 6015
Indianapolis, IN 46206-6015

If you would like to submit the information electronically please submit information to Jeff Stoakes at jstoakes@idem.IN.gov. Information will be accepted in electronic format as formatted on the enclosed CD or in paper format as included on the enclosed form. If you have the information in another format that contains all the information requested as detailed on the CD or paper form, feel free to submit the information in your own format. For technical questions please contact, Jeff Stoakes (317-233-2725), Jon Bates (317-233-4226), or Jay Koch (317-233-0178). Thank you in advance for your cooperation.

If you would like to find out more about the study or how else you can be involved, please feel free to contact the project manager, Brian Wolff at bwolff@idem.IN.gov or visit the study Web page at www.IN.gov/idem/programs/air/workgroups/swindyairtox/index.html. Thank you again for your assistance with this study. Your participation will help facilitate accurate and timely results from the study that will be useful to your community.

Sincerely,

Daniel Murray
Assistant Commissioner
Office of Air Quality

Appendix I

TAG Meeting Materials

Contents

TAG Meeting Agendas and Notes

Southwest Indianapolis Air Toxics Study

Technical Advisory Group (TAG) Meeting Agenda (Revised)

August 21, 2006 1:00-3:00 PM

Indiana Government Center-North

Room 1319

Welcome – Paul Dubenetzky, Assistant Commissioner, Office of Air Quality, IDEM

Introductions- Laura Steadham, facilitator

Members will introduce themselves and discuss briefly their background and areas of expertise. This will also be an opportunity to discuss the role and functioning of the TAG.

Preliminary Feedback from Community

Bowden Quinn, IDEM environmental and community liaison, will provide any feedback from his presentations to the community groups.

Review the Proposed Scope of Work for the Study

Scope review

Members have an opportunity to provide comments on technical aspects of the proposed scope and provide recommendations for enhancements.

Monitor Site Locations

IDEM will present the rationale for the placement of the monitors, and will request feedback from the TAG.

Compounds with unidentified screening levels

The scope identifies a number of pollutants that IDEM intends to monitor that currently do not have a screening level for more refined analysis. IDEM is seeking input on acceptable screening levels for these pollutants.

TAG Meetings:

IDEM is seeking input from the TAG members as to the day, time, and location of the next meeting.

Public Comment period

Members of the general public in attendance will have an opportunity to have an opportunity to ask questions of or provide comments to the TAG on the issues discussed during the meeting.

Reminders/Adjournment

Next Meeting: TBA

Meeting Notes

August 21, 2006 Technical Advisory Group Meeting

1-3 PM IGC-N Room 1319

Facilitator – Laura Steadham

Welcome

Paul Dubenetzky, IDEM's Assistance Commissioner of the Office of Air Quality, gave a brief introduction and overview of the Southwest Indianapolis Air Toxics Study. Mr. Dubenetzky thanked all IDEM staff who have had a part in this study so far, and highlighted three key staff for this project: Brian Wolff, Bowden Quinn and Dick Zeiler.

Introductions

Mr. Dubenetzky introduced Laura Steadham of IDEM who will serve as the facilitator of the Technical Advisory Group meetings. Laura shared her background with the group.

Members of the Technical Advisory Group introduced themselves; identified the entity they represent; and gave a brief explanation of their backgrounds and areas of expertise.

Members of the TAG present for the meeting:

- Rad Scott - Eli Lilly – chemical engineer - dispersion monitoring and internal inhalation risk assessments (air toxics) for Lilly sites
- Dr. George Bollweg - U.S. EPA Region 5 – Air Division - toxicology, air quality and risk assessment
- Brian Wolff – IDEM; project manager
- Motria Caudill – U.S. EPA Region 5 – Air Division – ambient air monitoring with specialty in air toxics monitoring
- Dr. Syed Ghias – IDEM – environmental toxicologist and chemist in the Office of Water Quality
- Dr. Bill Beranek – Indiana Environmental Institute – chemist and community facilitator
- Dr. Phil Stevens – School of Public and Environmental Affairs and Chemistry Department – Indiana University - Bloomington – atmospheric chemist -ground level ozone
- Janet McCabe – Improving Kids' Environment – many years service in air regulation and air quality
- Dr. Jim Klaunig – Center for Environmental Health – Indiana University Medical School-environmental toxicologist –effects of toxic substances on humans
- Balvant Patel – IDEM-air toxics monitoring
- Jeff Stoakes – IDEM/OAQ – air toxics modeler

Preliminary Feedback from Community

Bowden Quinn, environmental liaison for IDEM, gave a brief summary of his goals in outreach to the general public, especially people who live in the study area, and to legislators who represent the study area. Bowden has attended two recent meetings, one with a neighborhood group and the other with environmental managers of various entities. Bowden indicated that both groups were very receptive to the news of an air toxics study.

Review of the Scope of Work

Brian Wolff of IDEM and project manager for the study reviewed the study area, goals, project outputs and outcomes and the risk characterization aspect of the project. Bowden Quinn, IDEM, took questions from the group pertaining to the community involvement aspect of the project. Balvant Patel, IDEM toxics monitoring, summarized the air monitoring activities. Jeff Stoakes began a discussion of emissions inventory and modeling but time did not permit a complete discussion of those sections. Discussion will continue on the emissions inventory and modeling at the next meeting. There will also be discussion of the project schedule (Table 5) for the study.

The advisory group suggested some changes in wording to the scope as well as some clarification and expansion of topics:

- Eliminate the orange line indicating the “primary focus zone” from the map, leaving just the green line delineating the study area.
- Replace the terms “hazardous air pollutants or HAPs with “air toxics”.
- Agree to incorporate the 2002 NATA, should it become available, in the Indianapolis study
- Chlorinates, jet fuel and diesel can be picked up in the modeling.
- Accept that hierarchy of toxics information may be used as “best available information” and does not have to be followed rigidly
- Identify the U.S. EPA cancer risk to each chemical listed in Table 4
- U.S. EPA Region 5 has offered to send an asthma expert to speak to the group

These changes will be incorporated into a revised Scope of Work and distributed to the TAG members.

Wrap Up

Others attendees at the August 21, 2006 meeting:

Richard Zeiler (IDEM), Rob Elstro (IDEM), Kathy Watson (IDEM), Scott Deloney (IDEM), Felicia Robinson (City of Indianapolis OES)

The next meeting is scheduled for January 22, 2007 from 1:30 to 3:30 PM.
Location TBA.

Southwest Indianapolis Air Toxics Study

**Technical Advisory Group (TAG) Meeting - Revised Agenda
November 14, 2006 1:30-3:30 PM
Indiana Government Center-South
Media Center**

1. Complete the Review of the Scope of Work
 - Toxicity Weighted Analysis Of Emission Information
2. HAP Vs Non-HAP And Cancer Vs Non-Cancer Pollutant Evaluation
 - Review tables of pollutants classified as HAPs or Non-HAPs and Cancer and Non-cancer
3. Acute Risk Levels
 - Review table of available acute risk concentrations
4. Method Detection Limits For Monitoring Compared To Risk Screening Levels
5. Quality Assurance Project Plan (QAPP)
6. Analysis of Metals

Meeting Notes of November 14, 2006

Technical Advisory Group Meeting

1:30 -3:30 PM Media Conference Center – IGC-S

Facilitator – Laura Steadham

TAG members present:

Dr. Bill Beranek, Dick Van Frank, Pam Thevenow, LaNetta Alexander, Dr. Phil Stevens, Rad Scott, Rod Thompson, Dr. Giassuddin, Brian Wolff

TAG members participating via Webinar:

Motria Caudill, Dr. George Bollweg

IDEM staff:

Kathy Watson, Balvant Patel, Scott Deloney, Jeff Stoakes, Rob Elstro, Dick Zeiler, Bowden Quinn, Deborah Cole

Others present:

Felicia Robinson, Janet McCabe,

Others participating via Webinar:

Dona Bergman, Merri Anderson, Winter Bottum, Sarah Raymond

Community Outreach

Bowden Quinn of IDEM informed the group that he has been attending community meetings on a regular basis sometimes accompanied by Brian Wolff, also of IDEM. Since the August 21, 2006, meeting Bowden has attended meetings with the following groups.

Continuation from the last meeting of the Review of the Scope of Work

Jeff Stoakes of IDEM continued the review of the Scope of Work with an explanation of the Emissions Inventory that IDEM is developing in cooperation with the City of Indianapolis. The available inventories that will be used are: Indiana's i-Steps database; National Toxics Inventory; Toxics Release Inventory; and information from permit applications.

Jeff continued the review with a discussion of the modeling that will be done and the modeling package that will be used.

The modeling discussion concluded the discussion of the Scope of Work. Jeff also presented and explained the Toxic Weighted Screening Analysis (see doc on website) IDEM has completed.

HAP vs. Non-HAP and Cancer vs. Non-cancer Pollutant Evaluation

Brian Wolff presented to the group the set of tables created by IDEM identifying Monitored HAPs, non-monitored HAPs, other monitored air toxics and their carcinogenic category. These tables were in response to a request from the group at the August meeting. (Document is on website)

Acute Risk Levels

Brian Wolff reviewed these tables for the group and asked for the group's assistance in finalizing the information contained in the tables. (Document is on website.)

Method Detection Limits for Monitoring compared to Risk Screening Levels

Brian Wolff explained the purpose of the document and asked the group for their review and input.

Quality Assurance Project Plan (QAPP)

The Quality Assurance Project Plan is a document specific to the project and is required by the U.S. EPA. As of the November meeting, it had not been signed off by EPA yet but is expected soon. Brian Wolff explained to the group that the QAPP is a dynamic document that can change as need if the project changes.

Analysis of Metals

Brian Wolff informed the group that the contractor being used to do monitoring analysis, ERG, could actually do more analysis that was originally thought. With that in mind, Brian asked the group for their input on adding the following metals to the current list to be analyzed: selenium, cobalt, mercury (particulate), and antimony. The group was unanimous in agreement that these metals should be included.

Meeting Wrap-up

The next meeting of the Technical Advisory Group is scheduled for Monday, January 22, 2007. Meeting location TBA.

Web participants offered comments and suggestions regarding the success of the web broadcast. It is the intent of IDEM that all future TAG meetings will be broadcast via the web.

Southwest Indianapolis Air Toxics Study

Technical Advisory Group (TAG) Meeting - Revised Agenda
January 22, 2007 1:30-3:30 PM
Indiana Government Center-South
Media Center

Conference Line Call-in Number: 317-233-9100

Webinar Login: <https://www.webinar.in.gov/swindy0122/>

(NOTE: Link does not become live until the scheduled meeting time.)

Introductions

Correction to the *Toxicity Weighted Screening Analysis* document

Review of Preliminary Monitoring Results

- October and November VOC Monitoring Results
- October Carbonyl Monitoring Results
- October Chromium VI results

Acute exposure evaluation of monitoring results

Review of risk assessment dose-response values tables

Formaldehyde

- Evaluation of toxic endpoints and dose-response values

Questions from non-TAG members

Wrap up/next meeting date

Meeting Notes
SW Indianapolis Air Toxics Study TAG
January 22, 2007
1:30-3:30 PM
IGCS – Media Conference Room

Attendees:

TAG Members

Laura Steadham - moderator
Rod Thompson - IDEM
Dick Van Frank – Improving Kids’ Environment
Dr. George Bollweg – U.S. EPA-Region 5
Dr. Phil Stevens – Indiana University
Dr. Bill Beranek – Indiana Environmental Institute
Rad Scott – Eli Lilly
Dr. Syed Ghiassuddin – IDEM
LaNetta Alexander – Indiana State Dept of Health
Balvant Patel - IDEM
Motria Caudill –U.S. EPA-Region 5 (via conference line)

Other attendees:

Brian Wolff - IDEM
Jeff Stoakes -IDEM
Scott Deloney - IDEM
Dick Zeiler -IDEM
Rob Elstro -IDEM
Bowden Quinn - IDEM
Deborah Cole - IDEM
Kevin Bump – IDEM web host
Monica Dick – City of Indianapolis
Mary Pat Tyson – U.S. EPA Region 5
Carl Nash – U.S. EPA – Region 5
Fayette Bright – U.S. EPA – Region 5
Pat Ellis – Rolls Royce (via conference line)
John Jones – Vertellus (via conference line)

Laura Steadham, moderator, brought the meeting to order with a group introduction.

Jeff Stoakes gave an update to a question raised at the November 14, 2006 meeting concerning copper in the *Toxicity Weighted Screening Analysis* presented. After further research, IDEM discovered that the information included in the document was erroneous. The original document was corrected.

Brian Wolff presented information on preliminary monitoring results. Results have been gathered for October and November 2006. Brian stressed that the results represent only a very small number of samples and there is no metals data as yet. The group held a discussion on how to treat the data.

Brian Wolff presented the Acute Exposure Evaluation table for discussion. Group discussion suggested that the table is incomplete and that IDEM should develop sub-chronic numbers. IDEM is uncertain at this point if that project should be undertaken.

Brian Wolff presented the Risk Assessment Dose-Response Value tables. The TAG suggested that all information (HAPs and Air Toxics) be combined into one table. For the group's purpose as all chemicals are at issue, regardless of whether they are truly a HAP or just an air toxin. There was discussion regarding some additional information to be included in these tables.

Brian Wolff presented an informational document on formaldehyde. Discussion ensued regarding the challenges associated with formaldehyde.

After discussion of data issues that arose with each agenda topic at today's meeting, IDEM proposed that a meeting be convened specifically for discussion of data handling procedures. The group agreed to a meeting on March 12, 2007 at 1:30-3:30PM for this purpose.

The next Technical Advisory Group meeting for the Southwest Indianapolis Air Toxics Study is scheduled for Tuesday April 10 at 1:30 PM in the Indiana Government Center North - Room 1319. (NOTE: This is a different location than the last meeting.)

Meeting Agenda

1. Project Update
2. Toxicity Table Update
3. Statistical Method Discussion
 - How to handle monitoring non-detects

Despite the short agenda, it is important that we discuss these topics prior to calculating a summary monitoring data statistics. The group felt that statistics are too complex to discuss via email; therefore, a meeting would be the most effective way to discuss the topics and gather input from the TAG.

Should you have any questions, need directions to the meeting room, or parking information, please contact me.

Thank you again for your time and input on this project. We look forward to seeing you on Tuesday.

Southwest Indianapolis Air Toxics TAG Meeting
April 10, 2007
1:30 – 3:30 PM
IGCN Room 1319

Meeting Attendees

TAG

LaNetta Alexander
Dr. Bill Beranek
Dr. Syed Ghias
Laura Steadham
Rod Thompson

IDEM

Kathy Watson
Scott Deloney
Jeff Stoakes
Brian Wolff
Balvant Patel
Rob Elstro
Kevin Bump
Megan Tretter
Deborah Cole

Web/Phone

George Bollweg
Motria Caudill
Monica Dick
Dona Bergman
Rad Scott
Phil Stevens

Laura Steadham, meeting facilitator, welcomed the group, initiated introductions and reviewed the day's agenda. Brian Wolff gave the group an overall progress report of the study.

Toxicity Table Update

Jeff Stoakes presented a document entitled "Compounds of Interest for the Southwest Indianapolis Project with Toxicological Values and Reason for Interest". This document was compiled for review by the TAG as a step to help determine what chemicals to ask businesses for.

Jeff explained to the group the methodologies used to select compounds for inclusion in the table:

Three screening methods were used to develop the "Compounds of Interest" table. The first method looked at the preliminary monitoring results. Any compound that measured a concentration over the preset screening concentration for an acute or chronic concentration is included. The second method is based on the monitor's ability to detect compounds at the preset screening concentration. If the Method Detection Limit (MDL) for the compound is above the screening level set for the monitor, the compound was included based on the insufficient screening level. The third method is based on the Toxicity Weighted Screening Analysis (TWSA). The TWSA was conducted using 2004 TRI data, 2002 NEI data and 2002 GLI data. The reported emissions were multiplied by either the URF or RfC to produce a Toxicity Weighted Equivalent. The top 99% of the cumulative equivalent are included in the compounds of interest.

The group had questions and comments regarding this document.

-
Comments on table

1. Model all compounds?
2. Modeling not connected to the monitoring?
3. Ask every source for their data?
4. Time between the monitoring and the modeling?
5. The list of chemicals to analyze will be a "big job"
6. Aren't we looking for the "big stuff"?

Statistical Method Discussion

Brian Wolff presented a document entitled "Monitoring Data Statistical Evaluation". The group discussed the procedures used in the document in an effort to establish a constant and parallel definition of each procedure for the purpose of the air toxics study. Dr. Ghias shared two U.S. EPA guidance documents with the group. The consensus was to suspend further discussion of the procedures and methods of analysis until everyone has reviewed the EPA documents. After review, the group will resume discussion of the statistical evaluation method(s) via email.

Southwest Indianapolis Air Toxics Study

Technical Advisory Group (TAG) Meeting - Agenda

August 9, 2007 1:30-3:30 PM

Indiana Government Center North

Meeting Room 1319

Call in number 1-866-299-3188 (pass code 3123534418)

Introductions

Review of Preliminary Monitoring data

- Summary of results
- Explanation of Statistical methods used
 - Questions for TAG
 - "Are statistical methods appropriate?"
 - Pro UCL calculations
 - Regression Order Statistics
 - MDL

Presentation of Emissions reporting request

- Present and explain form for emissions request
- Pollutant of interest list
 - Questions for TAG
 - "Does this list look complete?"
 - "Atmospheric reactions: Do we need to take them into account?"

Questions from TAG members on other issues

Questions from non-TAG members

Wrap up/next meeting date

Southwest Indianapolis Air Toxics Study

Technical Advisory Group (TAG)

Meeting Notes

August 9, 2007

IDEM members present:

Dan Murray
Brian Wolff
Jeff Stoakes
Balvant Patel
Kevin Bump
Megan Tretter
Amy Bukarica
Laura Steadham (facilitator)
Scott Deloney
Rob Elstro

City of Indianapolis OES

Felicia Robinson
Monica Dick
Matt Mosier (via telephone)

TAG members present:

Dr. Jim Klaunig
Rad Scott
Dr. Bill Beranek
Rod Thompson
Dr. Syed Ghiassudin
Janet McCabe (proxy for Dick Van Frank)

TAG members via telephone:

Motria Caudill (TAG)
Dr. George Bollweg (TAG)
Matt Mosier (City of Indianapolis)

TAG members via Webinar:

Dr. Phil Stevens (Indiana University)

Meeting

Daniel Murray provided opening remarks, stressing the importance of the Southwest Indy Air Toxics Study and the value of having such a diverse group of specialists as acting members of the TAG.

Method Detection Limit (MDL)

Brian Wolff explained the use of Regression Order Statistics (ROS) has more defensibility. This brought some questions and comments from the TAG.

- What happens if no data points?
- Development of exposure concentration?
 - IDEM answered questions about the use of ROS

Support documentation for methodologies from two U.S. Environmental Protection Agency documents. Brian Wolff explained ROS statistics will be used in the final report.

TAG comments:

- Can we use the info as an intermediate step and at the end?
- Should be robust with our uncertainties.

Preliminary Data

Questions and Comments from TAG:

- What way can we look at other cities doing same or similar studies?
- Can we use data from other geographical areas to put our data into context?
- Need some info of how this is relative to other places to show significance.
- How will this study compare to a rural environment and another urban one?
- What number will be used to calculate risk?
- Numbers may change based on ProUCL tests from current values.
- Most carbonyls will be higher in the summer.
- Acrolein: compare both monitoring sites and see if they are both high.
 - IPL is the only source of acrolein being reported.
- What are the health effects of these pollutants?
- Need to look at the compounds altogether (cumulative effects).

IDEM responded to questions from the TAG on these topics. IDEM commented that they are still considering options for putting the results into context with other areas of the city/state/country. IDEM addressed the issues concerning the risk evaluation and explained that some of that work is still in the process of being completed.

Emissions Reporting

Jeff Stoakes lead the group in the emissions reporting portion of the meeting. IDEM has compiled a list of 160 businesses located in southwest Indy. IDEM will send a letter to these businesses, both large and small, requesting emissions information, along with a list of pollutants of interest. Jeff Stoakes said he would like to get all stack info to have a better modeling run.

TAG members provided input:

- Pollutants of interest – lower than MDL?
- Cancer risk low using ½ MDL. Can additional compounds be reduced?
- Concern about high level of detail at such an early stage.
- What are the effects we are looking for? One hour exposure?

IDEM provided feedback on these topics and stated that the pollutant of interest list will be re-evaluated based on TAG input.

IDEM requested that TAG members review the list and provide input on which pollutants should remain on the list and which should be removed, as well as suggestions of any additional pollutants to be included.

- Should chlorine be on the list? Is this an acute effect?
- Are the pollutants of interest a health concern?
- How will IDEM get hard numbers? What dose?
- Can use 2002, 2004 TR1 emissions data or NAI database instead?

The TAG had the following suggestions and comments concerning the efforts of emission inventory gathering available at the meeting:

- Make more explicit IDEM's availability to help the businesses. Do not want to alarm small businesses.
- IDEM could hold instructional workshops for small businesses.
- Balance information with cost of obtaining it.
- Need to be focused on useful information.
- What is normal background and what is from mobile sources?

IDEM informed the TAG that the suggestions would be taken into consideration when performing the emission inventory request.

Daniel Murray addressed the group, announcing that IDEM is meeting with businesses from southwest Indy on Monday. This meeting will help IDEM better understand what information they can provide.

What's Next

It was suggested that the TAG will likely meet again in three months.

- Items which may be emailed: statistics, timeline.
- Detailed toxicity info for compounds.
- How is IDEM communicating with the community?

Southwest Indianapolis Air Toxics Study

**Technical Advisory Group (TAG) Meeting - Agenda
May 13, 2008 1:30-3:30 PM
Indiana Government Center-South
Media Center**

Introductions

Monitoring data update

- Review of monitoring data

Emissions relates emissions information request

- Information request results
- Inventory data gaps & solutions

Public Advisory Group (PAG)

- Members and objective

Background Ambient Air Concentrations

- Review of document and approach
- Input on possible gaps

Questions from non-TAG members

Wrap up/next meeting date

Southwest Indianapolis Air Toxics Study
Technical Advisory Group
Meeting Notes prepared by Amy Bukarica

5/13/2008

- I. Monitoring Data
 - a. To be used: ProUCL, substitution method for non-detects, regression order statistics.
 - b. TAG commented about spike in acetone for two months.
 - i. IDEM responded that the source was concluded to be a temporary source that was near the monitor, but which is no longer present.
 - ii. IDEM will write a document outlining the difference between VOC and carbonyl methods for detecting acetone.
- II. Emissions Inventory
 - a. 90-day reporting period ended April 30, 2008.
 - b. TAG questioned how IDEM is handling major sources who did not submit an emissions inventory.
 - i. Possibly look at enforcement record?
 - ii. Possibly look at gas stations' tax record for throughput.
 - c. TAG questioned if sources have asked IDEM for assistance in completing the emissions inventory request.
 - i. IDEM responded that yes, several companies have called; IDEM hosted two emissions inventory assistance workshops; IDEM has had additional meetings with large industry.
 - d. TAG questioned how IDEM will handle railroads and airport.
 - i. Switching road located just north of Harding St.
 - e. Diesel emissions? Idling?
 - f. TAG questioned how IDEM will gather traffic count data.
 - i. INDOT
 - g. TAG questioned the use of MET data.
 - i. IDEM said the most recent MET data is from 1988-1992. This is what IDEM will use, assuming weather conditions will repeat in the future.
 - ii. IDEM will review MET data to be sure no exceptional events took place.
 - iii. U.S. EPA approves of this method.
- III. Public Advisory Group
 - a. Three members so far. First meeting in June, SW Indy location.
 - b. TAG commented to follow up with local politicians.
- IV. Background
 - a. Monitored background and modeling background.
 - b. TAG strongly recommends Washington Park data be used to demonstrate background air quality.
 - c. TAG commented about the need to determine the increased risk from air toxics entering the study area from that within the study area.

- d. Look at 2002 NATA data when is released.
- e. Discussion about different types of background.
 - i. IDEM will produce separate documents for each scenario mentioned.

V. Upcoming

- a. Look at the big picture/long range planning.
- b. TAG will e-mail IDEM with topic suggestions for next meeting.
- c. TAG will meet every three months.

Southwest Indianapolis Air Toxics Study

Technical Advisory Group (TAG) Meeting - Agenda

October 21, 2008 1:30-3:30 PM

Indiana Government Center-South

Media Center

Conference call number (317) 233-9088

Introductions

- Monitoring update
- Modeling update
- Public Advisory Group update
- Toxics information
 - Review of dose-response tables
 - Critical effects and target organ lists
 - Proposal of methods to fill data gaps
 - Route to route extrapolation
 - Using ACGIH
 - Other ideas
 - Mode of action concerning carcinogen-relating to additivity of carcinogenic effects and possible age adjusted mutagenic issues
- Background documents (time permitting)

Questions from non-TAG members

Wrap up/next meeting date

Southwest Indianapolis Air Toxics Study
Technical Advisory Group
Meeting Notes
Oct. 21, 2008

*Monitoring Seasoning ended end of Sept. 2008, currently compiling data

I. Modeling Update

- a. Where data is not available use permit's potential to emit -When will results be available?
- b. Data needs to be QA'd
- c. Will take a while to run (WI took 100 hrs) -Modeling sources
- d. Background: how estimate?
- e. Open ended request for chemicals-did you get other information

II. Public Advisory Group Update

- a. 2 meetings
- b. Concerns noted - not interested in what EPA is interested in
- c. Try to meet 1/month
- d. Reps: school 46, SW Wayne Twp., resident, nurse, West Indy Dev. Corp.
- e. What has group done for direction? how compare to others, how handle news media

III. Toxics Information

- a. Hierarchy - 1st Tier: IRIS, CAL-EPA; 2nd Tier: HEAST, Health Canada, OLQ -Got 50% tox information -Need Tier 2 info: route extrapolation or ACGIH
- b. Recommendation: see how much mass emissions gap -How much of 50% are for chemicals not detected -Looked at recent NADA?
- c. Find out what chemicals we need tox info for how feasible for structure comparison - New EPA program "Compu-Tox"
- d. Can EPA run chemicals through a Quasar
- e. Screening vs. "drilling down"
- f. 30% info on carcinogens-of those you know?
- g. Are there specific routes that the compounds are carcinogenic for?
- h. Can't do all those carcinogens - what about those that are most toxic?
- i. Additivity might make it more complex
- j. Keep track of uncertainties
- k. Table suggests a single number - IRIS says not to use it - Go back and look at supporting studies - Bring along the range -IDEM defaults to IRIS -Put the range in as the numbers are used for a wide variety of purposes -Slope factors & IUR given as single numbers in IRIS but some compounds have ranges -IUR are intended to be high end estimates -Used for community risk -Suggestion - give public more than a single number m. Provide assumptions -Rfdi only -Will come out as risk 0 to 10^{-x} -
Do this for those compounds with the most toxicity & concentrations -Why did HEAST stop in 1997? Replaced with NCEA & provisionals -Methyline chloride dropped off? Name change?

- l. No acute tox data? Only OAQPS has limited info on this -Acute assessment w/modifying yearly data
- m. Acetone: peak to mean ratio?
- n. Acute values available from OSHA?
- o. Hourly concentration in the model?
- p. Modeling looks area-wide
- q. Odor problems
- r. Not doing asthma? MCHD?
- s. PM2.5 not part of this study
- t. Suggestion for public - mention PM as monitoring data available -from other sources

IV. Critical Effects & Target Organs

- a. 100% additivity=total hazard index
- b. 1st cut by Rfc
- c. Dependent on concentrations in air - independent of mass?
- d. Add together, then break it down
- e. Abbreviation explanation in the table (footnotes) -Critical effects from different sources - good -Additivity complicated when trying to define critical effects -Tox information may provide info especially if compound is highly toxic -Do not have to go to Mode of Action -Modeling data expressed as hourly average not close to exposure limits -What about continuous data?
- f. Continuous data more for other types of compounds (O3) -Acute info will be hard - Addressed cumulative risk? No only inhalation effects - smoking is a confounding factor
- g. Compare data from the 2 monitors - hesitated to do acute assessment from model

V. Methods to Fill Gaps - ACGIH

- a. Convert ACGIH TLVs to RfCs
- b. Back calculation from TLV is difficult and conservative -Good for basic screening - Tell public about conservatism/uncertainties -Proposed ACGIH conversion take into account children?
- c. Do what School 21 study did for children (age adjusted mutagen) -This is different: This is conservative enough for children -Increased sensitivity for children -IRIS takes children into account -Include caveats on using TLV values -Are there other human health studies that could resolve TLV substitution issue?
- d. In TLV process, equivalents MCL-G
- e. Don't know yet how this method will play w/modeling data -Caution in mixing health-based standards w/numbers derived for some other purpose -Communicate the limitations
- g. Any have pesticide characteristics? (FIFRA) -Units? ug/m3

VI. Mode of Action

- a. How to add carcinogens?
- b. EPA's approach is add carcinogens no matter the route -Consider tissue response -Dr. Klaunig agrees it is worth looking at this approach -Concern about focusing on inhalation causing cancer -Cheaper than exposure reduction -Keep uncertainties in forefront -WOE for carcinogenic? Class A, B, C...?

- c. Wait for "heavy-hitter" list
- d. Ds are unclassified - potency information -Save for screening -Tell public what is the risk -What is a "heavy-hitter"? Based on concentration and/or toxicity
- e. Ex: sulfuric acid - not carcinogenic
- f. Recommendation: concern about A, B, C only to determine IUR

VII. Background Ambient Air Concentrations

- a. use all Washington Park data - do not limit it to study time -Washington Park is not considered upgradient monitor to the study area -Add another area to the model -Add background to model -Washington Park model compared with School 21 model - Comparison vs. absolute risk

VIII. Miscellaneous

- a. Next meeting - Jan. 2009
- b. post 2-year data
- c. need met data for every sample

Southwest Indianapolis Air Toxics Study

Technical Advisory Group (TAG) Meeting - Agenda

April 29, 2009 2:00-4:00 PM

Indiana Government Center-South

Media Center

Conference call number (317) 233-0451

Introductions

- Modeling update (Jeff Stoakes)
- Public Advisory Group update (Amy Bukarica)
- Monitoring (Brian Wolff, Balvant Patel, & Eric Bailey)
 - Statistical evaluation
 - Summary results
 - Questions from TAG
 - Further analyses input
- Toxics information
 - Table of toxics

Questions from non-TAG members

Wrap up/next meeting date

4/29/1009 Meeting Notes Unavailable

Southwest Indianapolis Air Toxics Study

Technical Advisory Group (TAG) Meeting - Agenda

June 11, 2009 1:00-3:00 PM

Indiana Government Center-South

Conference Room C

Conference call number (317) 233-3677

Introductions

- Modeling (Jeff Stoakes)
- IDEM Conclusions (Brian Wolff)
- Monitoring (Brian Wolff, Balvant Patel, & Eric Bailey)
 - Updated spreadsheet
 - Site comparisons
 - VOC PT Study
 - Carbon Tetrachloride
 - Acrolein
 - Next Steps
- PAG update (Amy Bukarica)

Questions from non-TAG members

Wrap up/next meeting date

6/11/1009 Meeting Notes Unavailable

Southwest Indianapolis Air Toxics Study

Technical Advisory Group (TAG) Meeting - Agenda

November 12, 2009 1:00-3:00 PM

Indiana Government Center-South

Media Center

Conference call number (866) 299-3188

Pass code: 3123534418

Introductions

- Modeling update
 - Mobile Source modeling
 - Airport modeling
 - Updated emissions information
- TAG questions
 - Background
 - Toxics monitoring (acetone)
 - Other topics as suggested
- Timeline

Questions from non-TAG members

Wrap up/next meeting date

11/12/1009 Meeting Notes Unavailable

Southwest Indianapolis Air Toxics Study

Public Advisory Group (PAG) and Technical Advisory Group (TAG)
Meeting Agenda

January 14, 2010 1:00-3:00 PM

Mary Rigg Neighborhood Center – 2nd floor Large Conference Room
Conference call number (317) 233-4990

Introductions

Outreach meeting plan overview

Outreach material overview and examples

- Chemical fact sheets
- Results Brochure
- Criteria pollutant information
- Odor handout
- Tables with monitoring results
- VIP information
- FAQ
- Statistics information
- Indoor air information
- Modeling results maps
- City comparison graphs and maps

Public Advisory Group comments on report

- Public understanding
- Unanswered questions

Technical Advisory Group comments on report

- Revisions based on technical merit

Additional PAG/TAG feedback

Questions from non-TAG members

Wrap up

Joint Technical and Public Advisory Group Meeting
Meeting Notes: 1/14/10

Outreach Materials

- Outreach meeting – open to the public, but IDEM staff available for other meetings too.
- How did IDEM select the chemicals for Fact Sheets?
- Will IDEM note that criteria pollutants are not addressed in the study?
- What will IDEM say about mercapton?
- Can smell pyridine in SW Indy.
- Note that people can get sick from [acute exposure to] smells
- Note that a chemical can have two types of toxicity: Non-carcinogenic and Carcinogenic.
- Can IDEM do VIP program with the resources they have? Community can get behind this program.
- 95% UCL = Central tendency represents the mean.
- Consider an uncertainty analysis.
- Toxicity of factors change since beginning of study?
- What is the total cancer risk?
- Characterize the conservatism. Use the term “health-protective.”
- MAP: Delineate different risk ranges. Add EPA acceptable levels.
 - Add data from other cities.
 - Let public know what is going to be done w/ large map.
 - Compare Washington Park data.

PAG Comments on Report

- What industries is IDEM contacting? OPPTA/CTAP confidential.
- Industry could contact neighborhood groups.
- OPPTA will partner w/ industries to explore mitigation opportunities.
- Acronym glossary

TAG Comments on Report

- Compare actions w/ those of other cities.
- Strengthen 10 to the -4, 10 to the -6, discussion.
- Discuss conservatism to not underestimate the risk.
- Common regulatory procedures.
- Risk in terms of population.
- Regard the study as a planning tool, not as a prediction.
- End of report has a summary. Add “next steps” by itself.
- What did we learn? What was the benefit of the study?
- Compound specific model to monitor comparison.
- Looked at enforcement record of industries in the study area?
- Common risk perspective.
- Explain how some assumptions were derived.

- PM10 not as conservative as PM2.5.
- Risks with smoking and other risks [i.e., car accidents, lightening...].
- Indoor air exposure.
- Clarify “acceptable” to IDEM