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 PM_{10} 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.

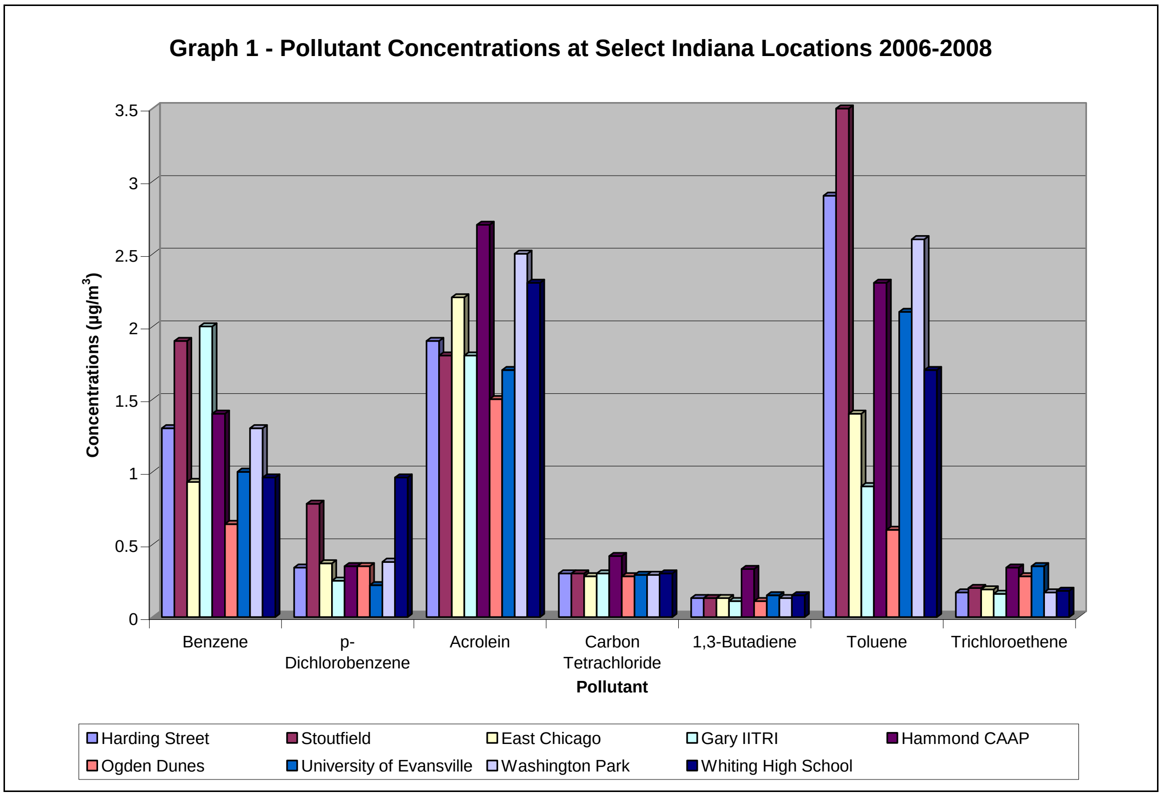
Both sites were operated consistent with procedures established for U.S. EPA’s National Air Toxics Trends Station (NATTS) network. Specifically, the selected sites used U.S. EPA recommended sampling and analytical protocols to monitor for a list of air toxics considered by U.S. EPA to pose the greatest 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. Maximum ($\mu g/m^3$)*	Stout Field Maximum ($\mu g/m^3$)*	MRL 24-hr risk ($\mu g/m^3$)*	REL 1-hr ($\mu g/m^3$)*
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

*$\mu g/m^3$-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.

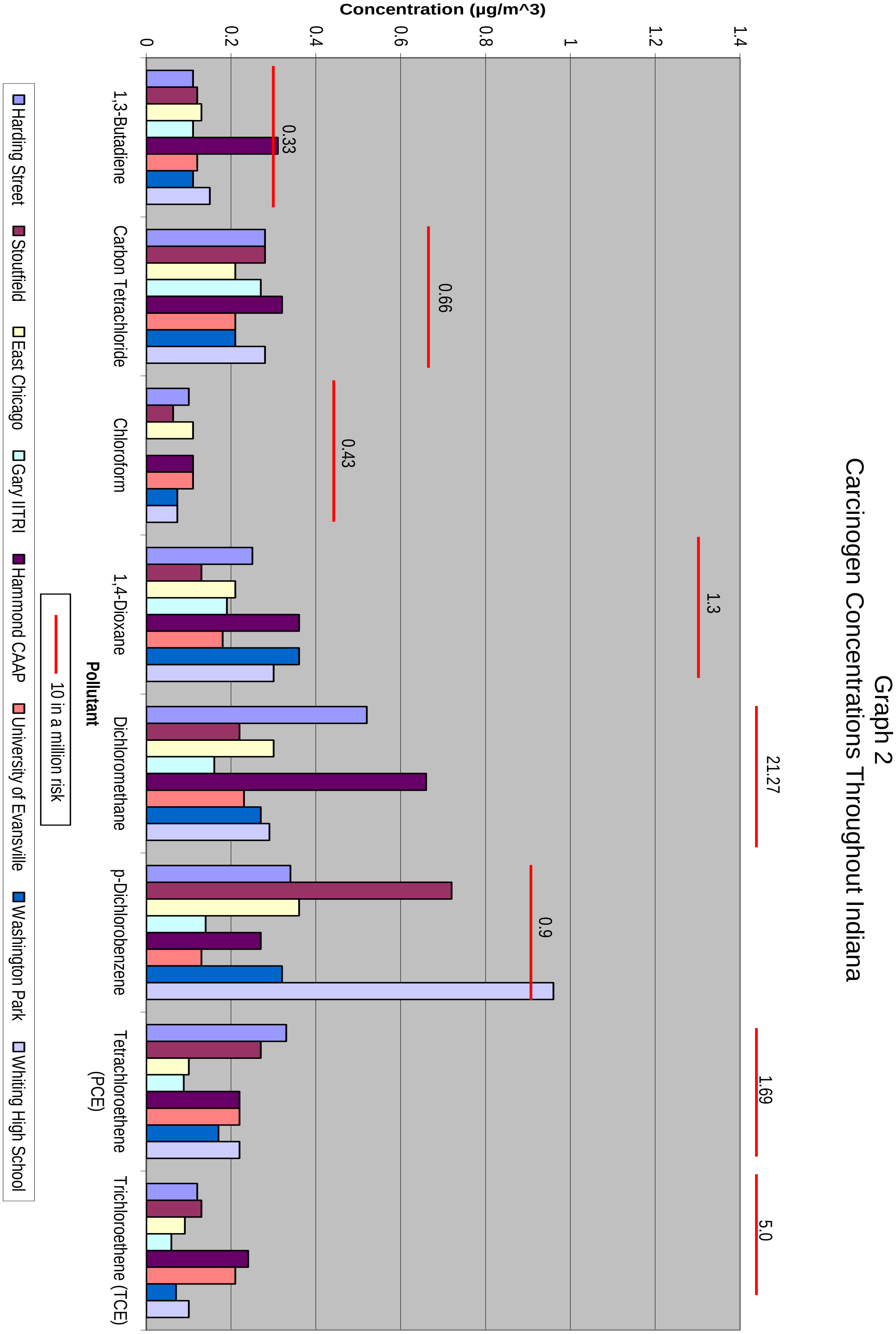
Table 3 – Pollutant Detection Rates and Lifetime Cancer Risk Estimates

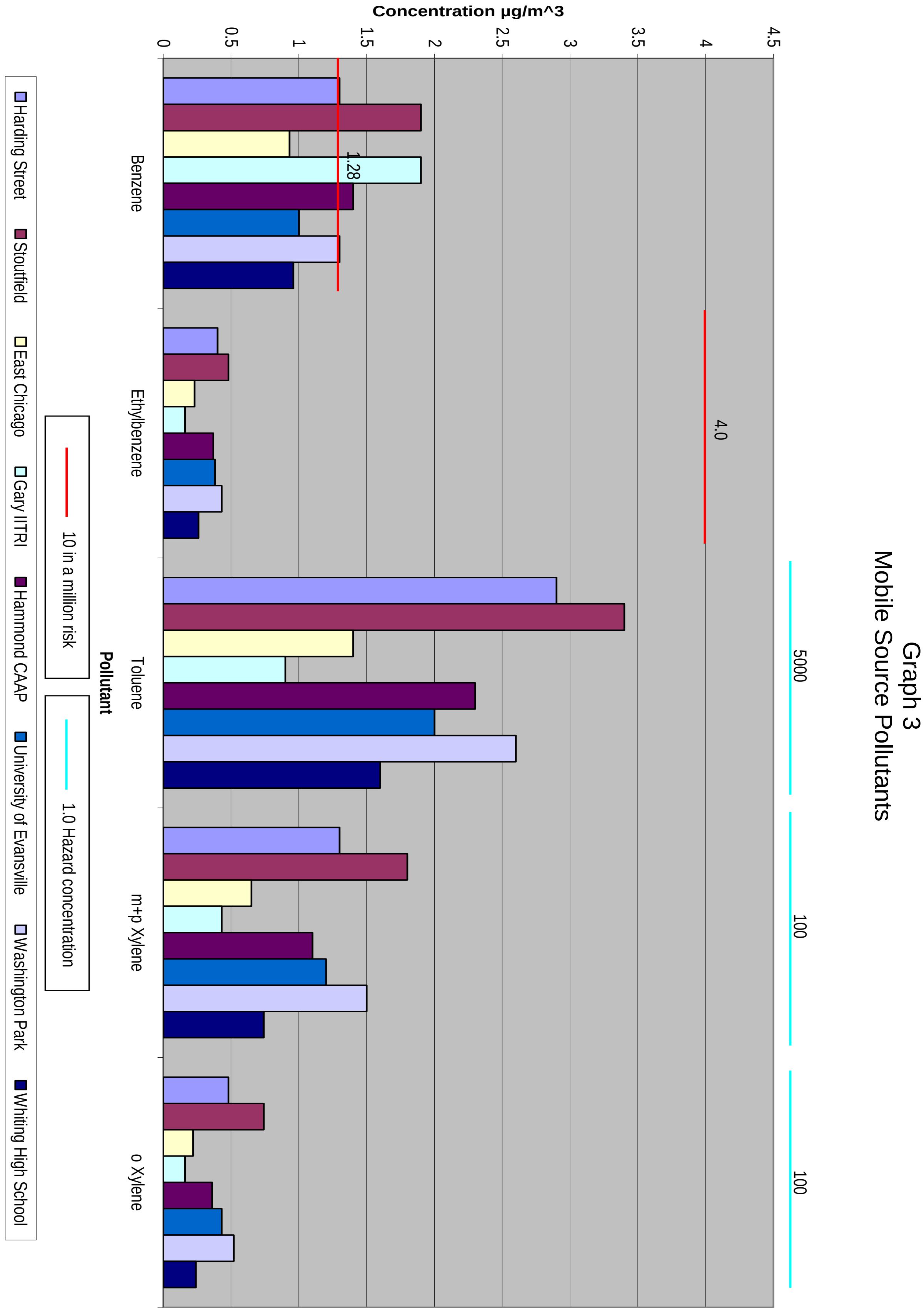
Pollutant	CAS #	Harding Street			Stout Field		
		Detection Rate percentage	Exposure Concentration ($\mu g/m^3$)*	Lifetime Risk Estimate (per million)	Detection Rate percentage	Exposure Concentration ($\mu g/m^3$)*	Lifetime Risk Estimate (per million)
Acetaldehyde	75-07-0	87.0%	0.67	1.5	86.8%	0.70	1.5
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	-	-	-

*$\mu g/m^3$-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
Concentration (µg/m^3)
0
0.2
0.4
0.6
0.8
1
1.2
1.4
Pollutant
1,3-Butadiene
Carbon Tetrachloride
Chloroform
1,4-Dioxane
Dichloromethane
p-Dichlorobenzene
Tetrachloroethene (PCE)
Trichloroethene (TCE)
0.33
0.66
0.43
1.3
21.27
0.9
1.69
5.0
10 in a million risk
Harding Street
Stoutfield
East Chicago
Gary IITRI
Hammond CAAP
University of Evansville
Washington Park
Whiting High School


Graph 3
Mobile Source Pollutants
Concentration µg/m^3
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
Pollutant
Benzene
Ethylbenzene
Toluene
m+p Xylene
o Xylene
1.28
4.0
5000
100
100
10 in a million risk
1.0 Hazard concentration
Harding Street
Stoutfield
East Chicago
Gary IITRI
Hammond CAAP
University of Evansville
Washington Park
Whiting High School

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

	Harding Street			Stout Field		
Pollutant	**Detection Rate Percentage**	**Exposure Concentration (µg/m^3)***	**Hazard Quotient**	**Detection Rate Percentage**	**Exposure Concentration (µg/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

	Harding Street			Stout Field		
Pollutant	**Detection Rate Percentage**	**Exposure Concentration ($\mu g/m^3$)***	**Hazard Quotient**	**Detection Rate Percentage**	**Exposure Concentration ($\mu g/m^3$)***	**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

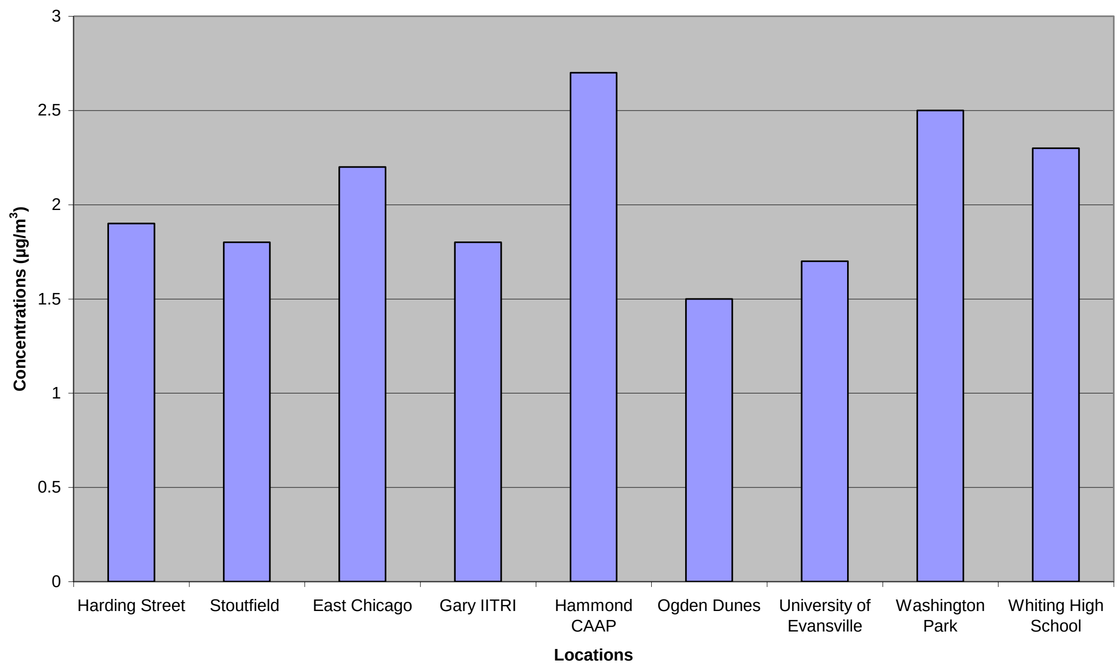
***$\mu g/m^3$**-micrograms per cubic meter

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.

Graph 4 - Acrolein Concentrations at Select Locations in Indiana



IDEM has determined that acrolein concentrations are not unusually high in Southwest Indianapolis compared to other metropolitan areas in the state.

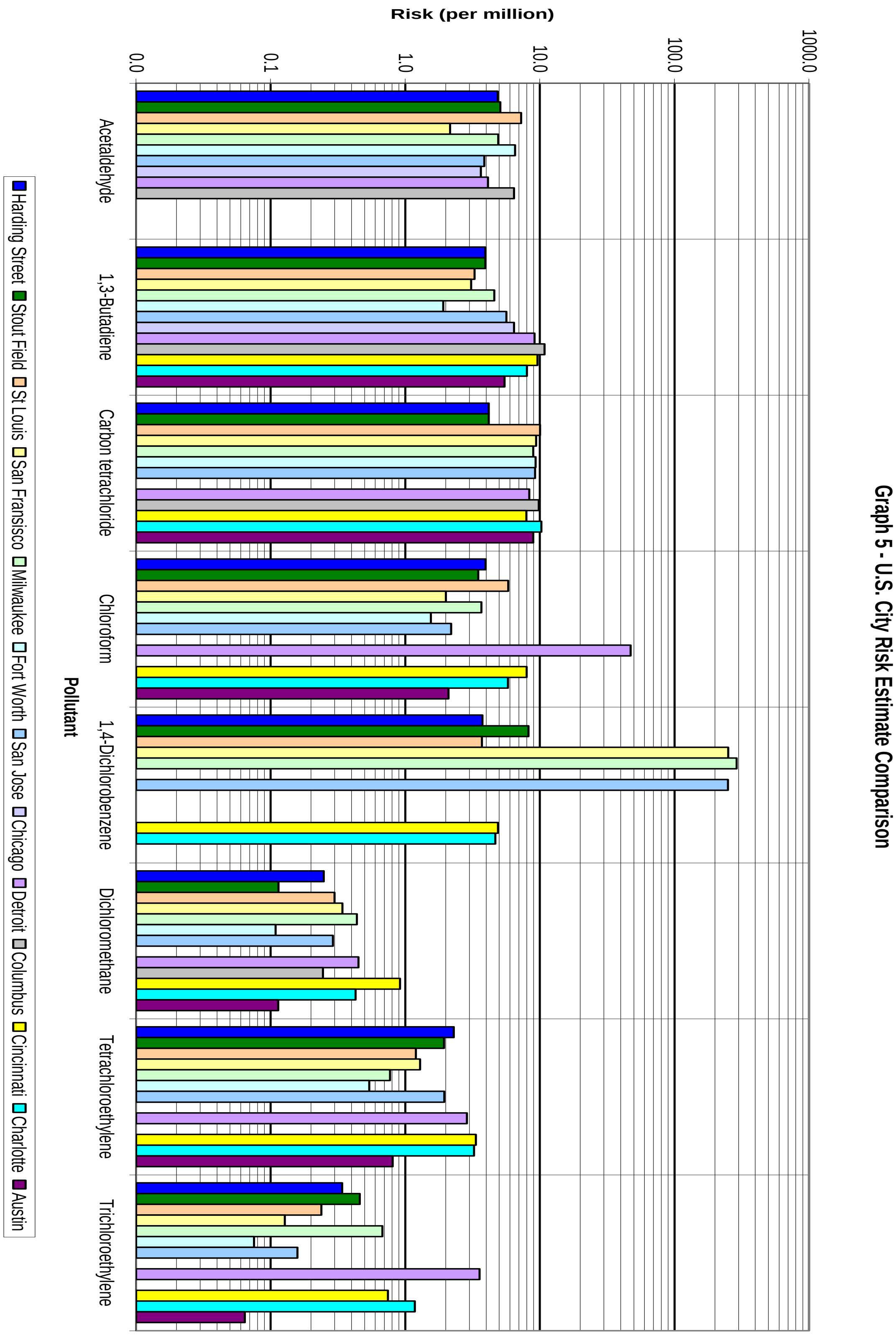
Air Monitoring Comparison

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.

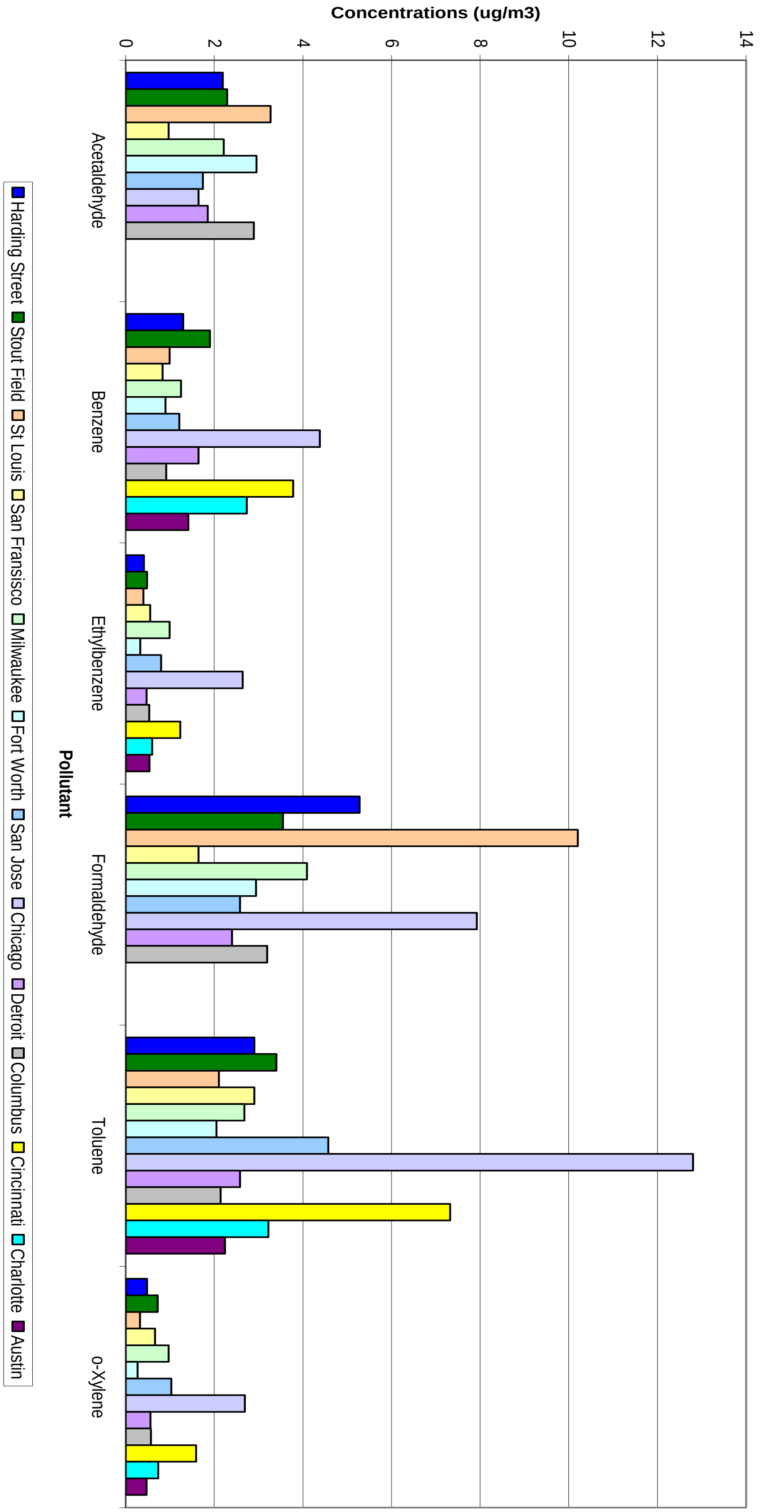
Graph 5 compares the cancer risk estimates from pollutants classified as carcinogens monitored in several urban locations. The chart shows that concentrations observed in Southwest Indianapolis are comparable to concentrations monitored in other cities for pollutants classified as carcinogens.

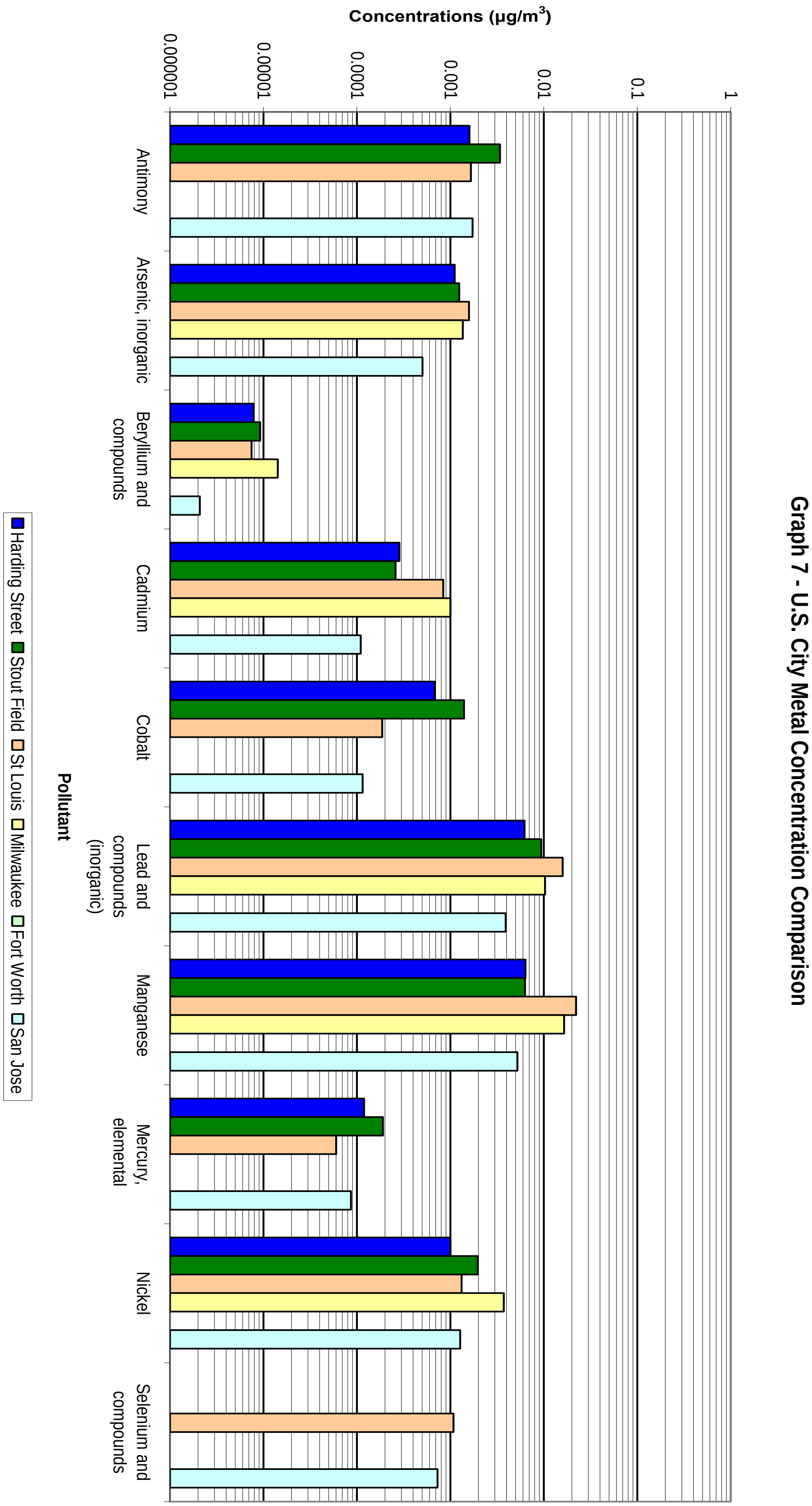
Graph 6 compares concentrations of pollutants monitored in several urban locations which are most commonly associated with mobile sources. Concentrations of mobile source pollutants in some urban locations appear to be slightly higher than in Southwest Indianapolis and they appear to be lower in others. 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
Risk (per million)
0.0
0.1
1.0
10.0
100.0
1000.0
Pollutant
Acetaldehyde
1,3-Butadiene
Carbon tetrachloride
Chloroform
1,4-Dichlorobenzene
Dichloromethane
Tetrachloroethylene
Trichloroethylene
Harding Street
Stout Field
St Louis
San Fransisco
Milwaukee
Fort Worth
San Jose
Chicago
Detroit
Columbus
Cincinnati
Charlotte
Austin

Graph 6 - U.S. City Mobile Source Pollutant Comparison



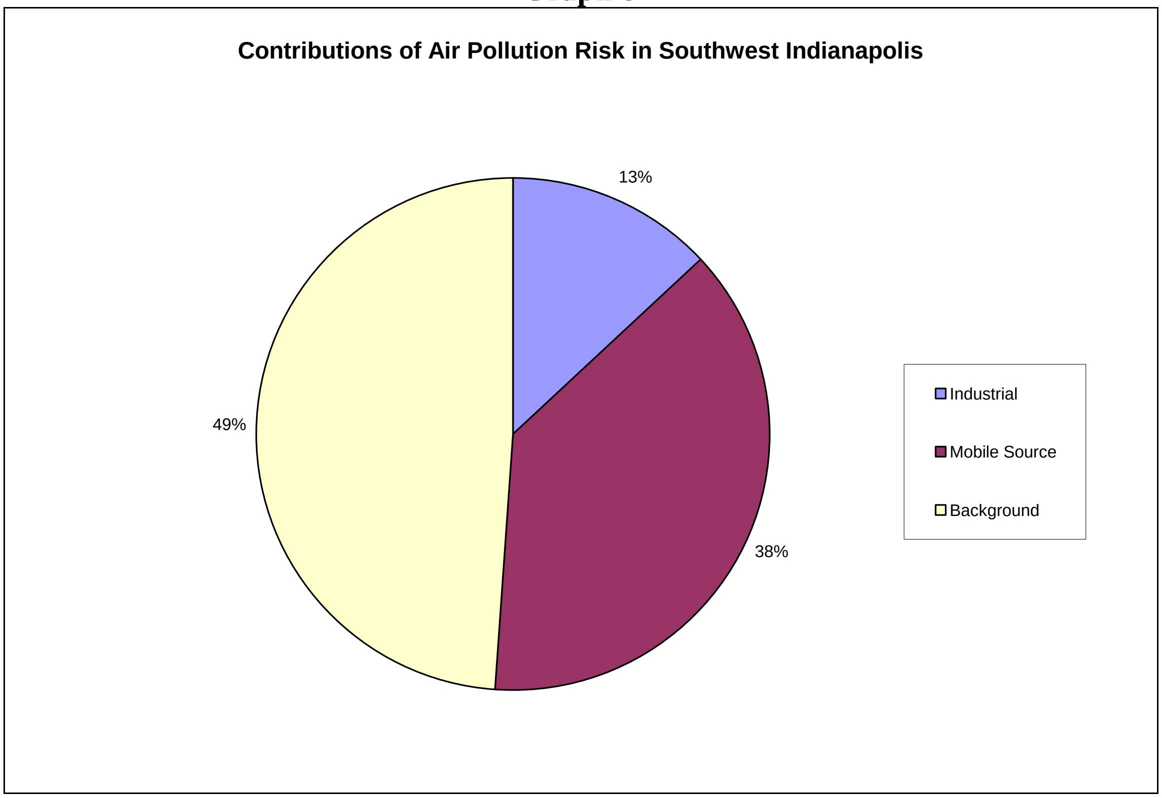

Graph 7 - U.S. City Metal Concentration Comparison
Concentrations (µg/m3)
0.000001
0.00001
0.0001
0.001
0.01
0.1
1
Antimony
Arsenic, inorganic
Beryllium and compounds
Cadmium
Cobalt
Lead and compounds (inorganic)
Manganese
Mercury, elemental
Nickel
Selenium and compounds
Pollutant
Harding Street
Stout Field
St Louis
Milwaukee
Fort Worth
San Jose

Risk

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/m3	ug/m3	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