DICHLOROMETHANE (CH_2Cl_2)

also known as Methylene Chloride
Chemical Abstracts Service (CAS) Number: 75-09-2

General Information

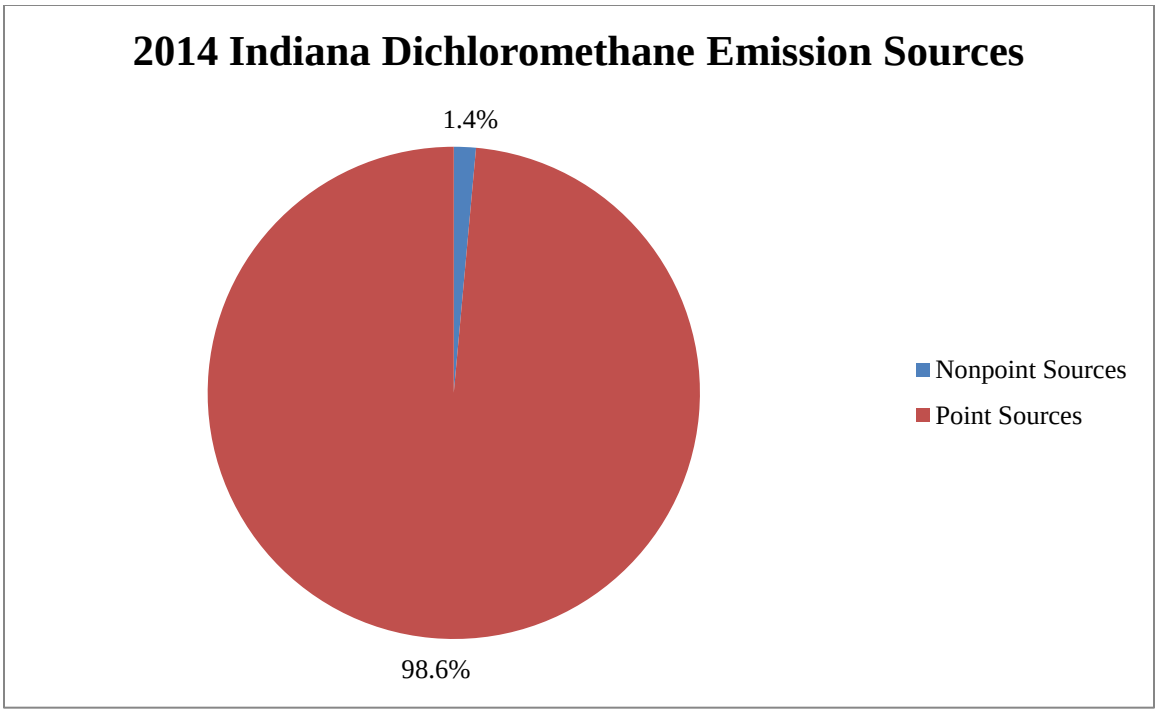
Dichloromethane is a colorless liquid with a sweetish odor. The acute (short-term) effects of dichloromethane inhalation in humans consist mainly of nervous system effects including decreased visual, auditory, and motor functions, but these effects are reversible once exposure ceases. The effects of chronic (long-term) exposure to dichloromethane suggest that the central nervous system (CNS) is a potential target in humans and animals. Human data are inconclusive regarding dichloromethane and cancer. Animal studies have shown increases in liver and lung cancer and benign mammary gland tumors following the inhalation of dichloromethane. U.S. EPA has classified dichloromethane as a probable human carcinogen.

Sources

- Dichloromethane is predominantly used as a solvent in paint strippers and removers; as a process solvent in the manufacture of drugs, pharmaceuticals, and film coatings; as a metal cleaning and finishing solvent in electronics manufacturing; and as an agent in urethane foam blowing.
- Dichloromethane is also used as a propellant in aerosols for products such as paints, automotive products, and insect sprays.
- Dichloromethane is used as an extraction solvent for spice oleoresins, hops, and for the removal of caffeine from coffee. However, due to concern over residual solvent, most decaffeinators no longer use dichloromethane.
- Dichloromethane is also approved for use as a postharvest fumigant for grains and strawberries and as a degreening agent for citrus fruit.
- The principal route of human exposure to dichloromethane is inhalation of ambient air. Occupational and consumer exposure to dichloromethane in indoor air may be much higher, especially from spray painting or other aerosol uses.

Indiana Emissions

IDEM collects HAP emissions information for the categories of point sources (large stationary sources like power plants and factories), nonpoint sources (aka area sources - smaller stationary sources like gas stations and dry cleaners), and mobile sources (vehicles, airplanes, marine vessels, etc.).* Estimated statewide emissions of dichloromethane totaled 65.5 tons in the 2014 calendar year. Of this total, 98.6% was attributed to point sources, and 1.4% was attributed to nonpoint sources.



* For additional examples of types of emission sources, please visit IDEM's Hazardous Air Pollutants page at: http://www.in.gov/idem/toxic/pages/hap/index.html. For specific details on industrial sources of air toxics, please visit U.S. EPA's Toxics Release Inventory (TRI) page at: https://www.epa.gov/toxics-release-inventory-tri-program.

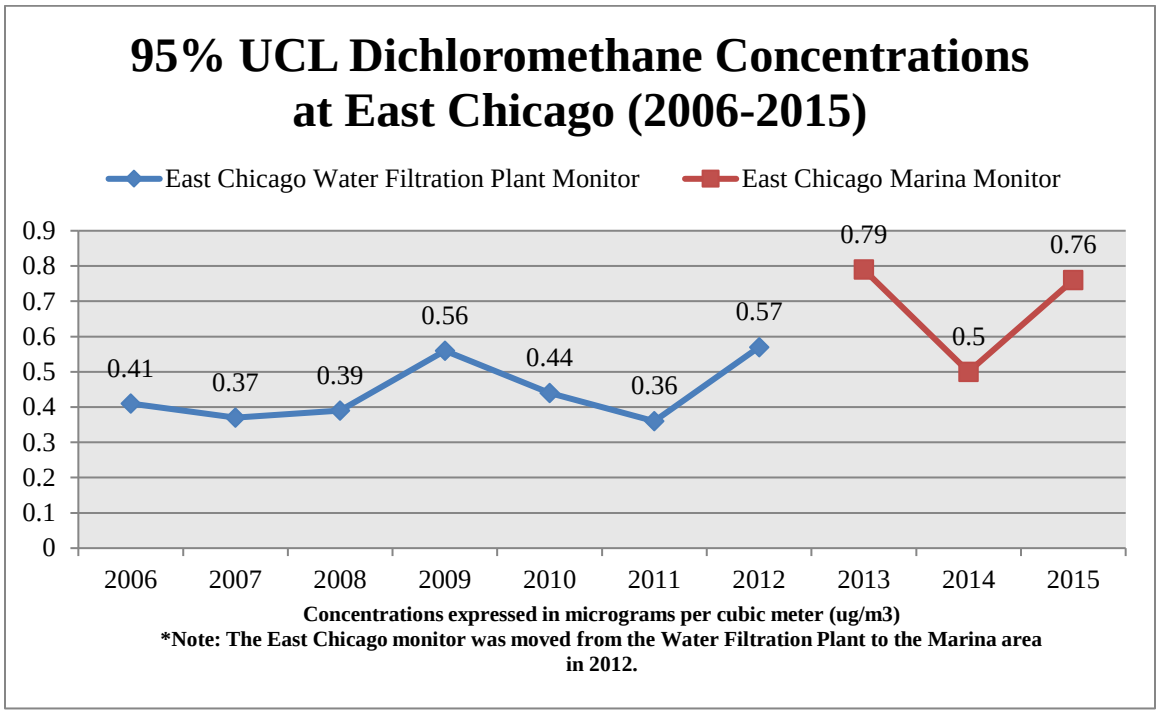
Measured Concentration Trends

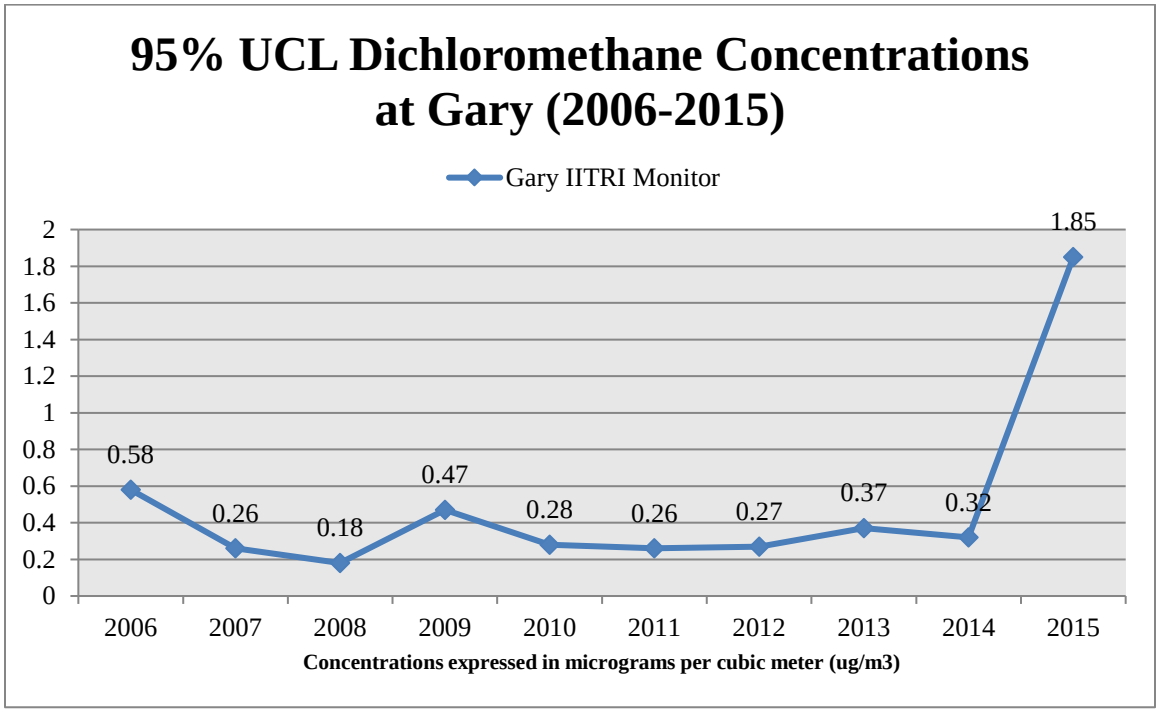
Ambient air monitoring data most accurately represents a limited area near the monitor location. All monitors for air toxics sample every sixth day. The monitoring locations by themselves are not sufficient to accurately characterize air toxic concentrations throughout the entire state, however, results from the monitors will provide exposure concentrations with a great deal of confidence at the monitoring locations.

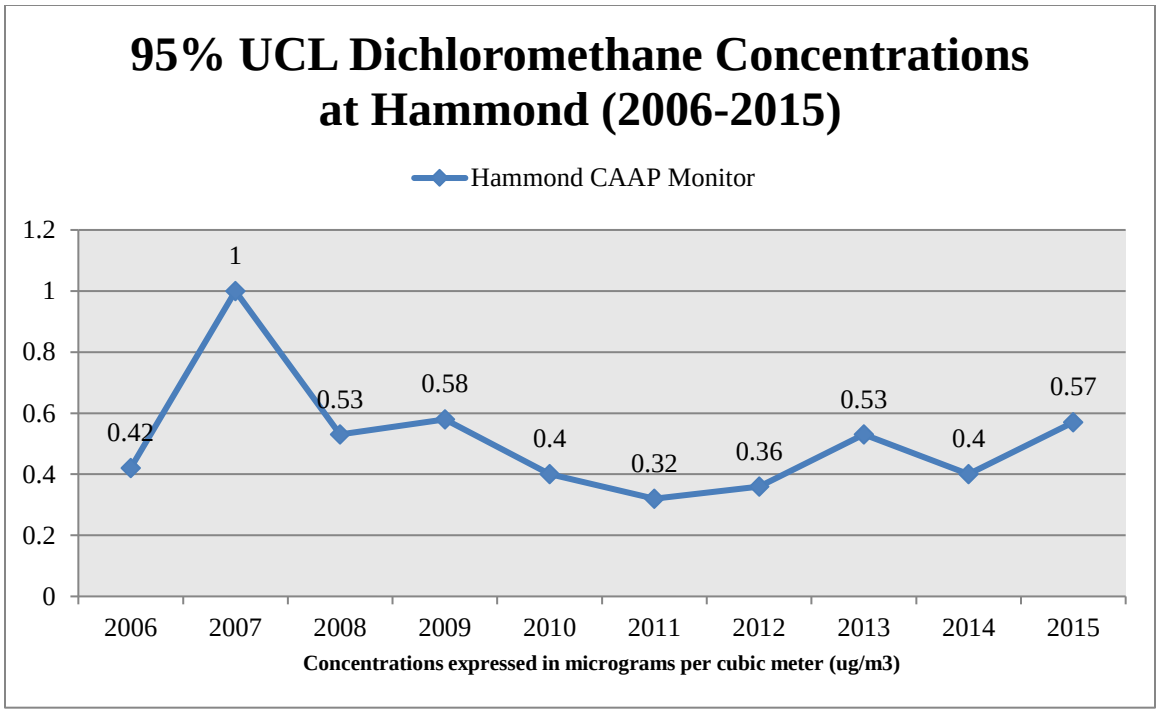
The ambient air monitoring results were analyzed using U.S. EPA recommended statistical methods. IDEM evaluated the data so that a 95% upper confidence limit of the mean (UCL) could be determined. A 95% UCL represents a value which one can be 95% confident that the true mean of the population is below that value.

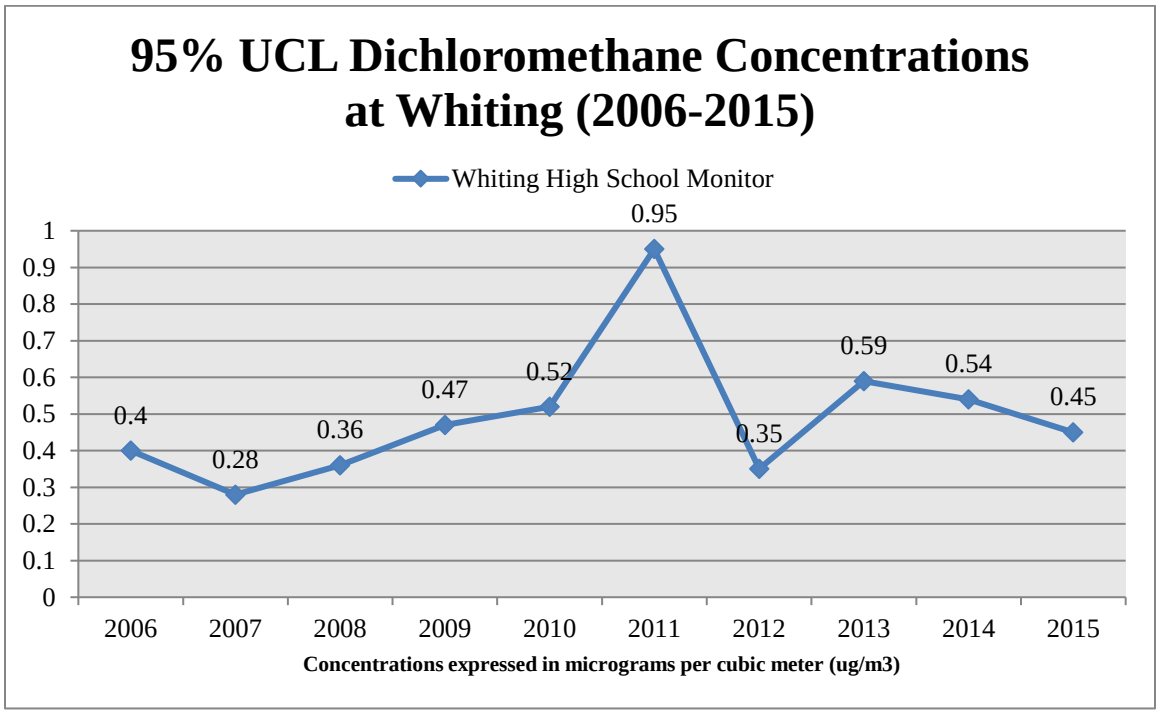
To learn more about the current monitoring locations, please visit IDEM's Air Toxics Monitor Siting webpage at: http://www.in.gov/idem/toxic/2337.htm

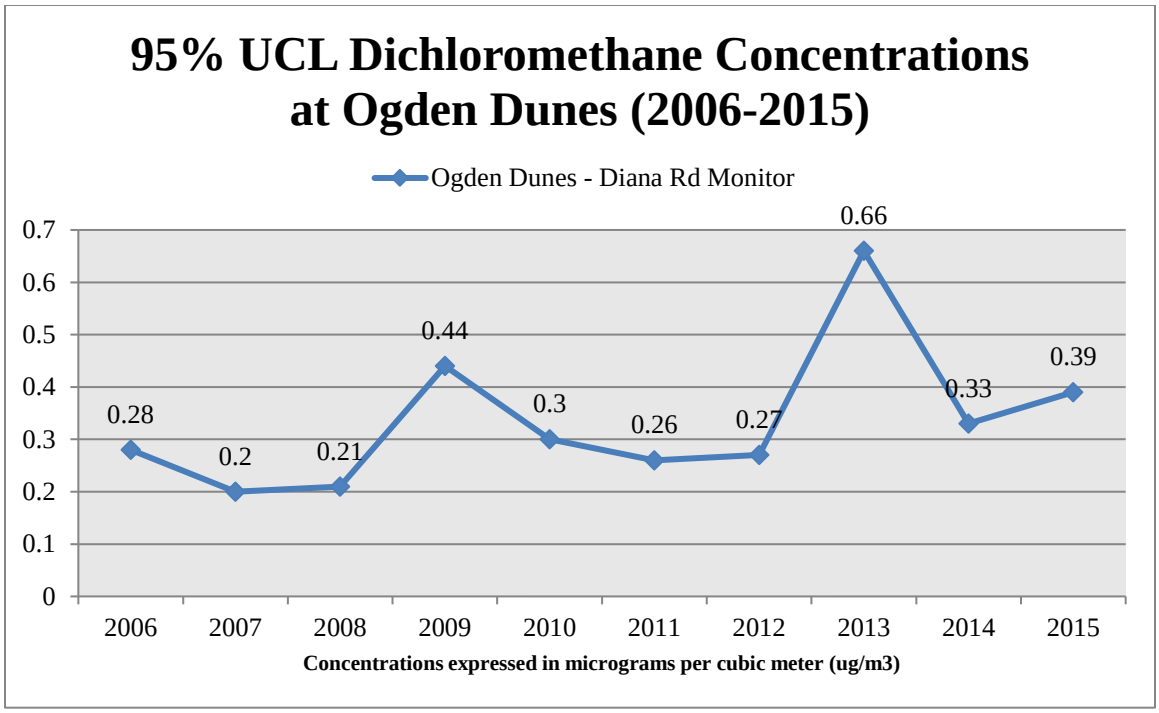
Data analysis was performed for each monitor that operated for a significant portion of the analysis period. This analysis determined the detection rate, which is defined as the percentage of valid samples taken statewide that had a quantifiable concentration of the pollutant. The statewide detection rate of dichloromethane for the monitors analyzed from 2006-2015 was 82.3%. Trend graphs for each of these monitors are provided below.

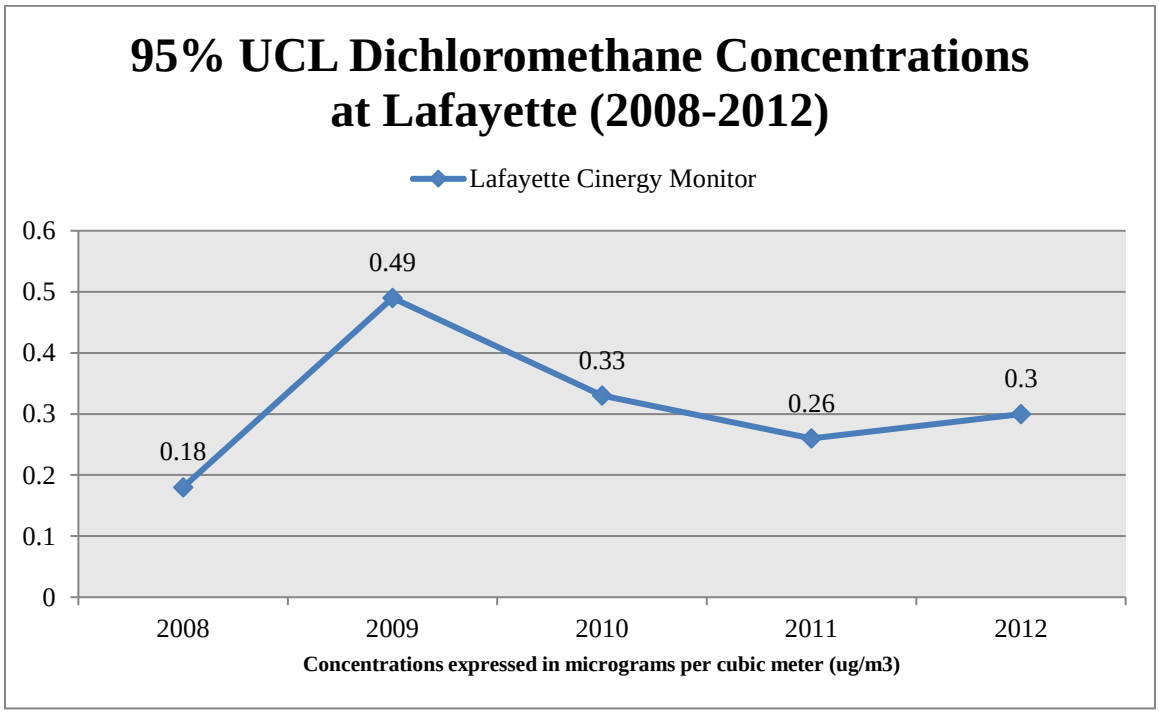

95% UCL Dichloromethane Concentrations at East Chicago (2006-2015)
East Chicago Water Filtration Plant Monitor
East Chicago Marina Monitor
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0.41
0.37
0.39
0.56
0.44
0.36
0.57
0.79
0.5
0.76
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
Concentrations expressed in micrograms per cubic meter (ug/m3)
*Note: The East Chicago monitor was moved from the Water Filtration Plant to the Marina area in 2012.

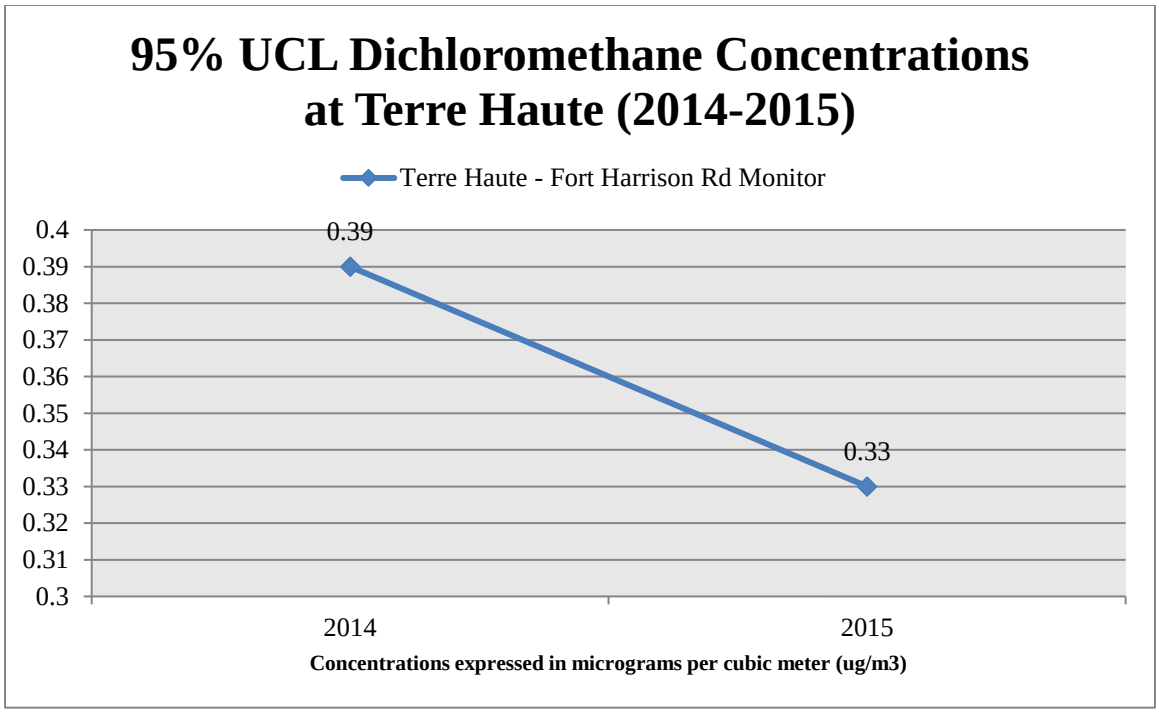

95% UCL Dichloromethane Concentrations at Gary (2006-2015)
Gary IITRI Monitor
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
0.58
0.26
0.18
0.47
0.28
0.26
0.27
0.37
0.32
1.85
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
Concentrations expressed in micrograms per cubic meter (ug/m3)

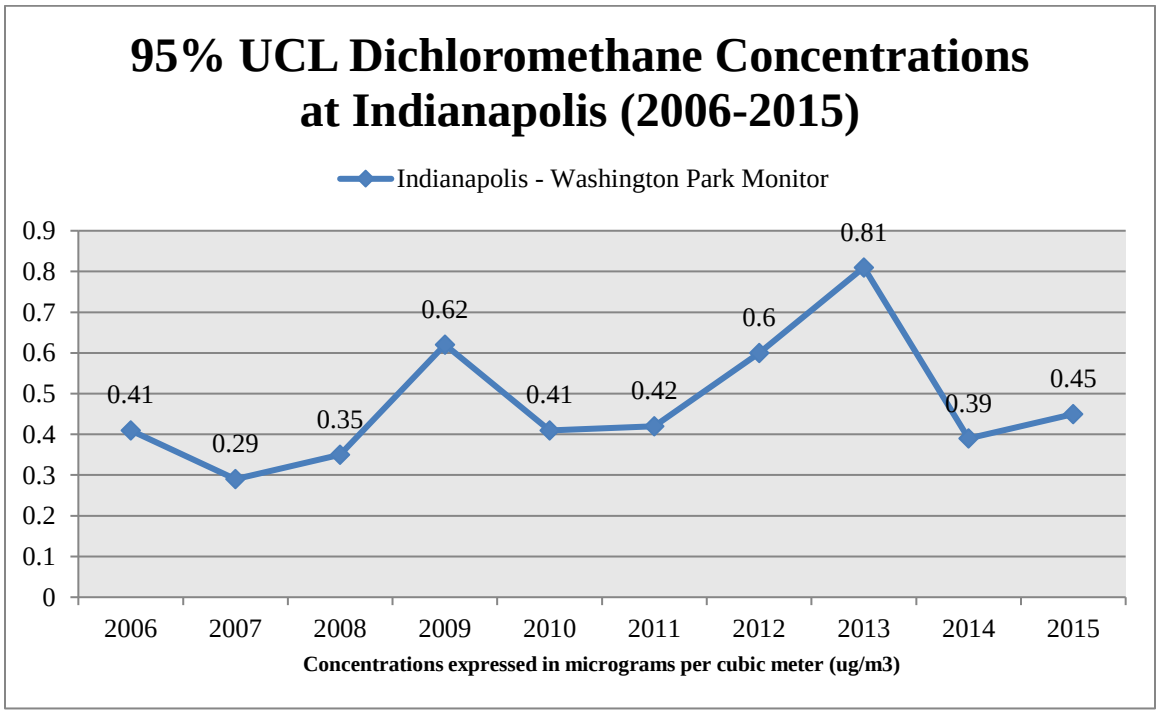

95% UCL Dichloromethane Concentrations at Hammond (2006-2015)
Hammond CAAP Monitor
1.2
1
0.8
0.6
0.4
0.2
0
0.42
1
0.53
0.58
0.4
0.32
0.36
0.53
0.4
0.57
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
Concentrations expressed in micrograms per cubic meter (ug/m3)

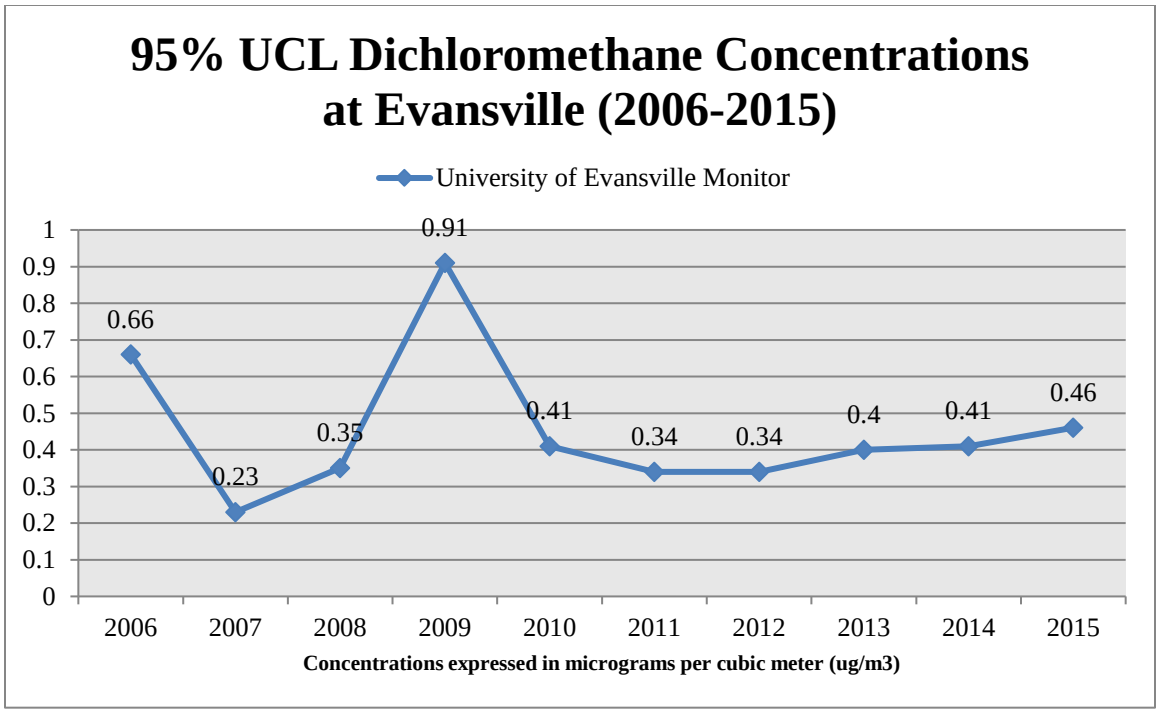

95% UCL Dichloromethane Concentrations at Whiting (2006-2015)
Whiting High School Monitor
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0.4
0.28
0.36
0.47
0.52
0.95
0.35
0.59
0.54
0.45
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
Concentrations expressed in micrograms per cubic meter (ug/m3)

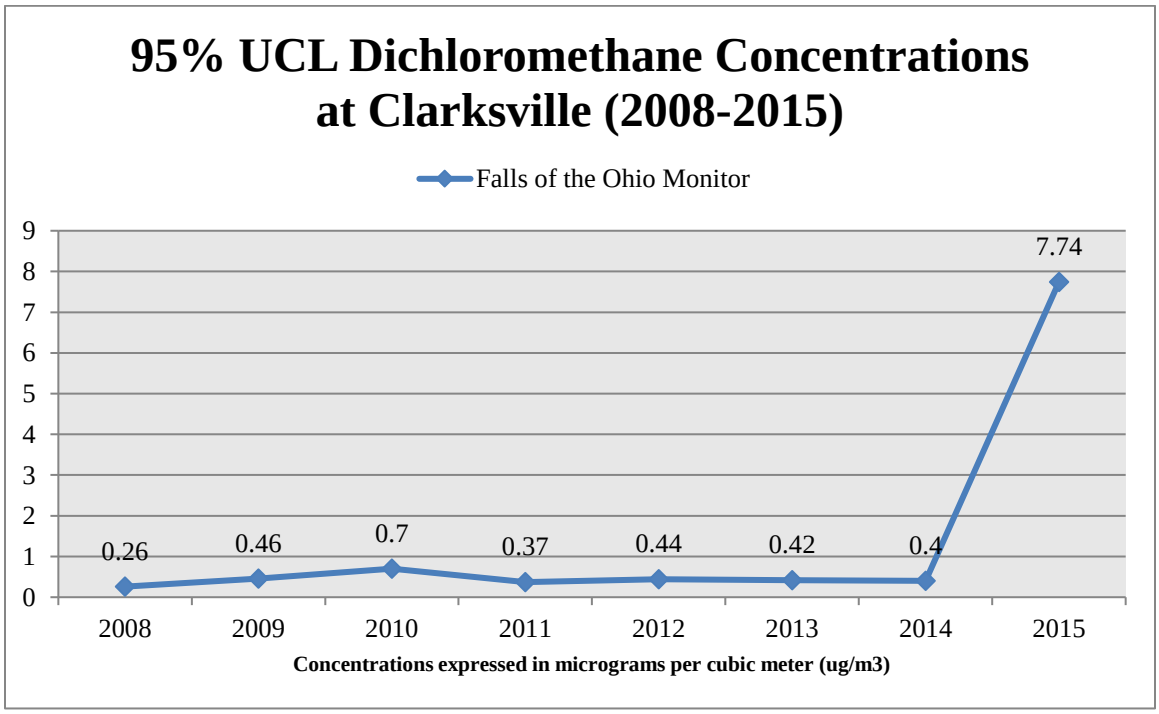

95% UCL Dichloromethane Concentrations at Ogden Dunes (2006-2015)
Ogden Dunes - Diana Rd Monitor
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0.28
0.2
0.21
0.44
0.3
0.26
0.27
0.66
0.33
0.39
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
Concentrations expressed in micrograms per cubic meter (ug/m3)


95% UCL Dichloromethane Concentrations at Lafayette (2008-2012)
Lafayette Cinergy Monitor
0.6
0.5
0.4
0.3
0.2
0.1
0
0.18
0.49
0.33
0.26
0.3
2008
2009
2010
2011
2012
Concentrations expressed in micrograms per cubic meter (ug/m3)


95% UCL Dichloromethane Concentrations at Terre Haute (2014-2015)
Terre Haute - Fort Harrison Rd Monitor
0.4
0.39
0.38
0.37
0.36
0.35
0.34
0.33
0.32
0.31
0.3
0.39
0.33
2014
2015
Concentrations expressed in micrograms per cubic meter (ug/m3)


95% UCL Dichloromethane Concentrations at Indianapolis (2006-2015)
Indianapolis - Washington Park Monitor
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0.41
0.29
0.35
0.62
0.41
0.42
0.6
0.81
0.39
0.45
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
Concentrations expressed in micrograms per cubic meter (ug/m3)





The analysis of monitoring data from 2006 to 2015 indicates that concentrations of dichloromethane have increased at many air monitors over that time. Spikes of concentrations at Gary and Clarksville are particularly noteworthy. The 2015 spike at Gary can be largely attributed to an exceptionally high reading of 27.20 ug/m3 recorded on 3/6/2015 . The 2015 spike at Clarksville can be largely attributed to exceptionally high readings recorded over three samples in July. This included readings of 82.10 ug/m3 on 7/17/2015, 47.54 ug/m3 on

7/23/2015, and 39.97 ug/m3 on 7/29/2015. The exceptionally high readings noted at these monitors were not repeated at any other time during 2015.

Hazard Quotient

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. The hazard quotient is a ratio that divides the measured concentration of a pollutant by the reference concentration (RfC). A hazard quotient under 1.0 is commonly recognized to be below the health-protective level. Hazard quotients 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 non-cancer hazards over 1.0 are still unlikely to be associated with observable adverse health effects.

The average concentration of dichloromethane was evaluated for each air pollutant monitor over the span of this study. The results for each monitor are displayed in the table below. The calculated hazard quotient is well below 1.0 at all monitors, which indicates that the measured concentrations of dichloromethane do not present a risk for non-cancer health effects.

Table 1. Dichloromethane Hazard Quotients (concentrations expressed in micrograms per cubic meter)

Monitor	Years	Average Concentration	Reference Concentration (RfC)*	Hazard Quotient
East Chicago Water Filtration Plant	2006-2012	0.39	600.0	0.0007
East Chicago Marina	2013-2015	0.63	600.0	0.0011
Gary IITRI	2006-2015	0.45	600.0	0.0008
Hammond CAAP	2006-2015	0.46	600.0	0.0008
Whiting High School	2006-2015	0.45	600.0	0.0008
Ogden Dunes – Diana Rd	2006-2015	0.32	600.0	0.0005
Lafayette Cinergy	2008-2012	0.30	600.0	0.0005
Terre Haute – Fort Harrison Rd	2014-2015	0.35	600.0	0.0006
Indianapolis – Washington Park	2006-2015	0.44	600.0	0.0007
University of Evansville	2006-2015	0.40	600.0	0.0007
Clarksville – Falls of the Ohio	2008-2015	1.20	600.0	0.0020

* Reference Concentration Source: Integrated Risk Information Service (IRIS).

Cancer Risk

IDEM uses 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 ambient air concentrations by cancer slope factors. The resulting calculations give a number that is expressed using the term "lifetime cancer cases per number of people." U.S. EPA uses a range between one in a million and one hundred in a million (1 to 100) when evaluating whether the estimated risk is at a level where action should be taken. Generally, U.S. EPA considers lifetime cancer risk estimates over one hundred in a million to be at levels where action or more investigation is required. Lifetime cancer risks that fall between the one in a million and 100 in a million range generate decisions and actions taking into account the assumptions used to determine the estimate. Lifetime cancer risk estimates below one in a million are usually considered not to require further action.

Dichloromethane has been classified as a probable human carcinogen. The estimated risk of contracting cancer from dichloromethane consistently runs far below one in a million at monitors across the state. Based on the calculated risk levels, dichloromethane is not considered to be a significant cancer risk driver related to Indiana air quality.

Table 2. Dichloromethane Additional Lifetime Cancer Risk (concentrations expressed in micrograms per cubic meter)

Monitor	Years	Average Concentration	Cancer Risk (in one million)*
East Chicago Water Filtration Plant	2006-2012	0.39	0.004
East Chicago Marina	2013-2015	0.63	0.006
Gary IITRI	2006-2015	0.45	0.005
Hammond CAAP	2006-2015	0.46	0.005
Whiting High School	2006-2015	0.45	0.005
Ogden Dunes – Diana Rd	2006-2015	0.32	0.003
Lafayette Cinergy	2008-2012	0.30	0.003
Terre Haute – Fort Harrison Rd	2014-2015	0.35	0.004
Indianapolis – Washington Park	2006-2015	0.44	0.004
University of Evansville	2006-2015	0.40	0.004
Clarksville – Falls of the Ohio	2008-2015	1.20	0.012

* Additional Cancer Risk Factor Source: Integrated Risk Information Service (IRIS).