



2011 Air Toxics Summary

New Jersey Department of Environmental Protection

INTRODUCTION

Air pollutants can be divided into two categories: the criteria pollutants (ozone, sulfur dioxide, carbon monoxide, nitrogen dioxide, particulate matter, and lead); and air toxics. The criteria pollutants have been addressed at the national level since the 1970s. The United States Environmental Protection Agency (USEPA) has set National Ambient Air Quality Standards (NAAQS) for them, and they are subject to a standard planning process that includes monitoring, reporting, and control requirements. Each of these pollutants is discussed in its own section of this New Jersey Department of Environmental Protection (NJDEP) 2011 Air Quality Report.

Air toxics are basically all the other chemicals released into the air that have the potential to cause adverse health effects in humans. These effects cover a wide range of conditions, from lung irritation to birth defects to cancer. There are no NAAQS for these pollutants, but in 1990 the U.S. Congress directed the USEPA to begin addressing a list of almost 200 air toxics by developing control technology standards for specific categories of sources that emit them. These air toxics are known as the Clean Air Act Hazardous Air Pollutants (HAPs). You can get more information about HAPs at the USEPA Air Toxics web site at www.epa.gov/ttn/atw. NJDEP also has several web pages dedicated to air toxics. They can be accessed at www.state.nj.us/dep/airtoxics.

HEALTH EFFECTS

People exposed to significant amounts of air toxics may have an increased chance of getting cancer or experiencing other serious health effects. The noncancer health effects can range from respiratory, neurological, reproductive, developmental, or immune system damage, to irritation and effects on specific organs. In addition to inhalation exposure, there can be risks from the deposition of toxic pollutants onto soil or surface water. There, they can be taken up by plants and animals which are later consumed by humans.

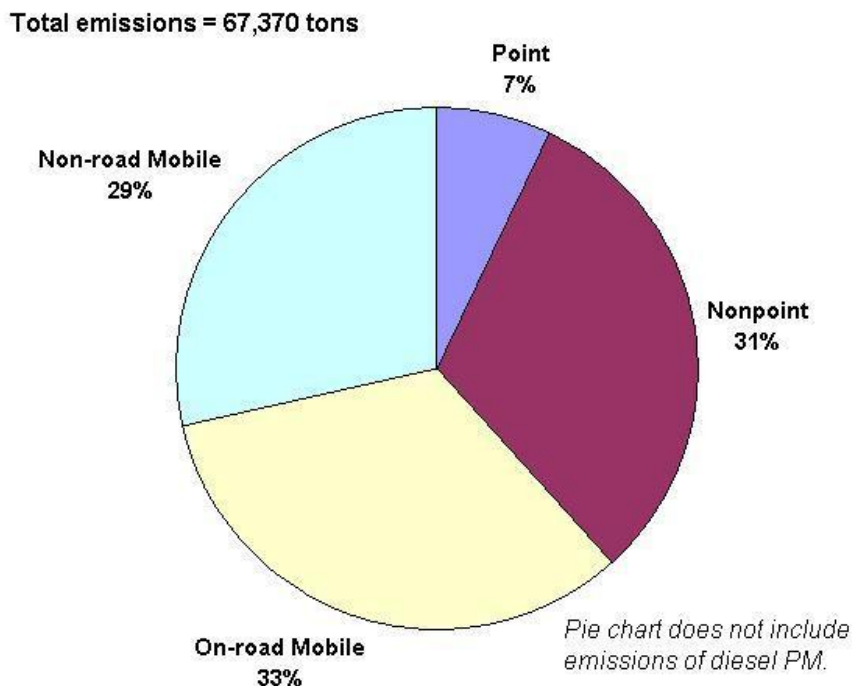
The effects on human health resulting from exposure to specific air toxics can be estimated by using chemical-specific health benchmarks. These are based on toxicity values developed by the USEPA and other agencies, using chemical-specific health studies. For carcinogens (chemicals suspected of causing cancer) the health benchmark is the concentration of the pollutant that corresponds to a one-in-a-million increase in the risk of getting cancer if a person was to breathe that concentration over his or her entire lifetime. The health benchmark for a noncarcinogen is the air concentration at which no adverse health effect is expected to occur, even if a person is exposed to that concentration on a daily basis for a lifetime (this is also known as a reference concentration). Not all air toxics have health benchmarks, because of a lack of toxicity studies. Available health benchmarks for the air toxics monitored in New Jersey are listed in Tables 6 through 8. If ambient air concentrations exceed the health benchmarks then some action, such as a reduction in emissions, should be considered.

SOURCES OF AIR TOXICS

A number of years ago, USEPA began the National-Scale Air Toxics Assessment (NATA). Starting with the year 1996, they set out on a three-year cycle to determine people's exposure to air toxics around the country. To do this, USEPA first prepares a comprehensive inventory of air toxics emissions from all man-made sources. The emissions inventory is reviewed and updated by each state. Although there are likely to be some errors in the details of such a massive undertaking, the emissions inventory still can give us a reasonable indication of the most important sources of air toxic emissions in our state. The pie chart in Figure 1, based on the most recent NATA (for 2005) emissions estimates, shows that mobile sources are the largest contributors of air toxics emissions in New Jersey.

On-road mobile sources (cars and trucks) account for 33% of the air toxics emissions, and non-road mobile sources (airplanes, trains, construction equipment, lawnmowers, boats, dirt bikes, etc.) contribute an additional 20%. Nonpoint sources (residential, commercial, and small industrial sources) represent 31% of the inventory, and point sources (such as factories and power plants) account for the remaining 7%.

Figure 1
2005 Air Toxics Emissions Source
Estimates for New Jersey

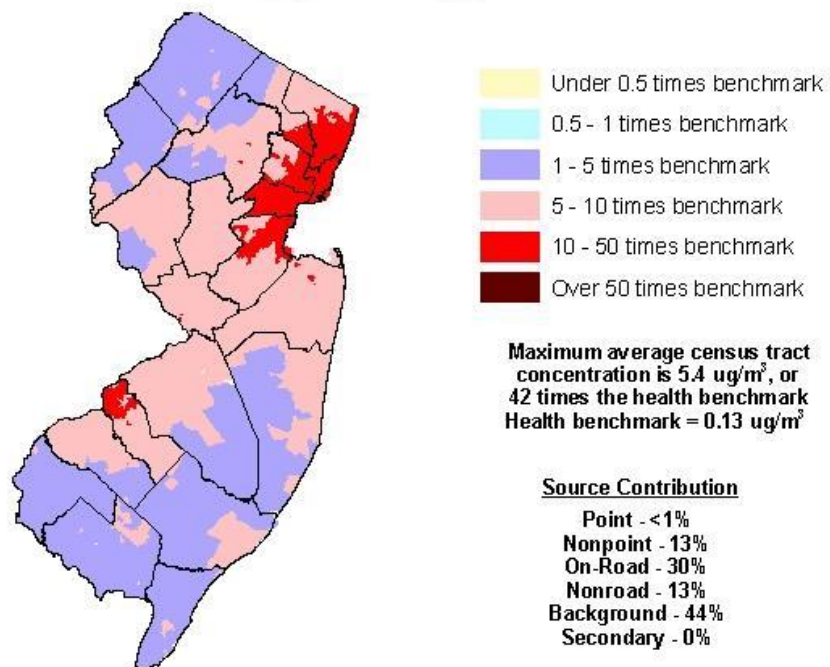


ESTIMATING AIR TOXICS EXPOSURE

There are a limited number of air toxics monitors located throughout the country, because of costs and logistics. In order to estimate air toxics concentrations in areas across the U.S., especially those areas with no monitors, USEPA's NATA project uses its emissions inventory in an air dispersion model that predicts ambient annual average concentrations. (A comparison of some the NATA results with monitoring results is presented in Figure 19).

The map in Figure 2 shows the predicted concentrations of benzene throughout New Jersey. The high concentration areas tend to overlap the more densely populated areas of the state, following the pattern of emissions. Not all air toxics follow this pattern, as some are more closely associated with individual point sources or transport, but in general, higher population densities result in greater emissions of, and exposure to, air toxics. Maps for other air toxics can be found at www.nj.gov/dep/airtoxics/nataest05.htm.

Figure 2
BENZENE - 2005 NATA Predicted
Concentrations for New Jersey



Analysis of the NATA state and county average air toxics concentrations indicates that twenty-three chemicals were predicted to exceed their health benchmarks, or level of concern, in one or more counties in 2005. Twenty-two of these are considered to be cancer-causing (carcinogenic) chemicals, and one (acrolein) is not. Estimated air concentrations of these 23 pollutants vary around the state, depending on the types of sources that emit them. This is summarized in Table 1.

Table 1
 Air Toxics of Greatest Concern in New Jersey
 Based on 2005 National-Scale Air Toxics Assessment

Pollutant of Concern	Number of Counties Above Health Benchmark	Primary Source of Emissions
Acetaldehyde	Statewide	Background, secondary
Acrolein	Statewide	Background, nonpoint
Acrylonitrile	2 (Bergen & Essex)	Point, nonpoint
Arsenic Compounds	19	Background, secondary
Benzene	Statewide	Background, mobile
1,3-Butadiene	Statewide	Background, mobile
Cadmium Compounds	1 (Warren)	Nonpoint, background
Carbon Tetrachloride	Statewide	Background
Chloroform	Statewide	Nonpoint, background
Chromium (hexavalent)	20	Background, point
Cobalt Compounds	7	Point
1,4-Dichlorobenzene	8	Nonpoint, background
1,3-Dichloropropene	1 (Hudson)	Nonpoint
Diesel Particulate Matter	Statewide	Mobile
Ethylbenzene	6	Mobile, nonpoint
Ethylene Oxide	6	Background, nonpoint
Formaldehyde	Statewide	Background, secondary
Methyl Chloride	Statewide	Background
Naphthalene	20	Nonpoint, mobile
Nickel compounds	1 (Hudson)	Nonpoint, point
PAH/POM	18	Nonpoint
Perchloroethylene	8	Nonpoint, background
1,1,2-Trichloroethane	1 (Salem)	Nonpoint

NEW JERSEY AIR TOXICS MONITORING PROGRAM RESULTS FOR 2011

NJDEP has three established air toxics monitoring sites for **volatile organic compounds (VOCs)** around the state, located in Elizabeth, New Brunswick and Chester (see Figure 3). The Camden Lab site, which had been measuring several toxics since 1989, was shut down on September 29, 2008, because NJDEP lost access to the station. (A new site in Camden is expected to become operational in 2013.) The Elizabeth Lab site began measuring VOCs in 2000, and the New Brunswick and Chester sites started in July 2001. Analysis of toxic metals at these sites also began in 2001, with Newark added in 2010. Data for some of the toxic metals will be discussed below. All samples are analyzed by a laboratory contracted through USEPA.

VOCs and carbonyls (a subset of VOCs that includes formaldehyde and acetaldehyde) are sampled every six days. 2011 air toxic monitoring results for VOCs are shown in Table 2. This table contains the annual average concentration for each air toxic measured at the three New Jersey monitoring sites. All values are in micrograms per cubic meter ($\mu\text{g}/\text{m}^3$). More detail can be found in Tables 6 through 8, including additional statistics, detection limit information, health benchmarks used by NJDEP, risk ratios, and concentrations in parts per billion by volume (ppbv). The ppbv units are more common for monitoring results, while $\mu\text{g}/\text{m}^3$ units are generally used in modeling and health studies. Many of the compounds that were analyzed were below the detection limit of the method used. These are listed separately in Table 9.

Chemicals with reported averages based on data with less than 50% of the samples above the detection limit should be viewed with extreme caution. Median values (the value of the middle sample value when the results are ranked) are reported in Tables 6 through 8 along with the mean (average) concentrations because for some compounds only a single or very few high values were recorded. These high values will tend to increase the average concentration significantly, but would have less effect on the median value. In such cases, the median value may be a better indicator of long-term exposures (the basis for the air toxics health benchmarks).

The Chester site had the lowest concentrations for the bulk of the prevalent air toxics. The highest concentrations for most compounds were split between Elizabeth and New Brunswick, with the majority occurring at Elizabeth.

USEPA has recently determined that the methods used to collect and analyze acrolein in ambient air are not producing reliable results. More information is available at www.epa.gov/schoolair/acrolein.html. Although we are including the 2011 New Jersey acrolein data in this report, the concentrations are highly uncertain and should be viewed with caution.

Included in this report for the first time are results for toxic metals from the particulate speciation monitors in Chester, Elizabeth, New Brunswick, and Newark. The data is collected every three days. Monitoring data for other speciated particulate can be found in Appendix B (Fine Particulate Speciation Summary) of this report. Table 3 presents the annual average concentrations for pollutants which have a health benchmark, along with estimated risk ratios. (For more information see the section on "Estimating Health Risk" below.) Chromium and nickel have cancer-based health benchmarks that are based on carcinogenicity of specific compounds. Since the monitoring data cannot distinguish between the types of chromium or nickel compounds, cancer risk ratios are not calculated with those benchmarks. However, risk ratios are calculated for nickel based on noncancer effects.

Table 2
2011 Summary of Toxic Volatile Organic Compounds Monitored in New Jersey

Annual Average Concentration
micrograms per cubic meter ($\mu\text{g}/\text{m}^3$)

Pollutant	Synonym	HAP	CAS No.	Chester	Elizabeth	New Brunswick
Acetaldehyde		*	75-07-0	1.61	3.24	2.49
Acetone			67-64-1	1.85	2.41	2.16
Acetonitrile		*	75-05-8	3.11	0.63	0.78
Acetylene			74-86-2	0.54	1.20	0.79
Acrolein ^a		*	107-02-8	1.19	0.96	0.76
Acrylonitrile		*	107-13-1	0.10	0.03	0.09
tert-Amyl methyl ether			994-05-8	ND	0.0003	0.001
Benzaldehyde			100-52-7	0.10	0.13	0.07
Benzene		*	71-43-2	0.52	1.02	0.71
Benzyl chloride	Chloromethylbenzene	*	100-44-7	ND	ND	ND
Bromochloromethane			74-97-5	0.001	ND	ND
Bromodichloromethane			75-27-4	0.003	0.002	ND
Bromoform		*	75-25-2	0.002	0.01	0.005
Bromomethane	Methyl bromide	*	74-83-9	0.04	0.05	0.07
1,3-Butadiene		*	106-99-0	0.02	0.13	0.05
tert-Butyl ethyl ether	Ethyl tert-Butyl Ether		637-92-3	0.001	ND	ND
Butyraldehyde & isobutyraldehyde	Butyraldehyde			0.27	0.39	0.26
Carbon disulfide		*	75-15-0	5.90	1.56	0.77
Carbon tetrachloride		*	56-23-5	0.62	0.61	0.59
Chlorobenzene		*	108-90-7	0.01	0.003	ND
Chloroethane	Ethyl chloride	*	75-00-3	0.37	0.01	0.04
Chloroform		*	67-66-3	0.10	0.14	0.12
Chloromethane	Methyl chloride	*	74-87-3	1.23	1.25	1.29
Chloroprene	2-Chloro-1,3-butadiene	*	126-99-8	ND	ND	ND
Crotonaldehyde			123-73-9	0.31	0.31	0.28
Dibromochloromethane			594-18-3	0.01	0.01	0.01
1,2-Dichlorobenzene	o-Dichlorobenzene		95-50-1	0.003	0.001	0.01
1,3-Dichlorobenzene	m-Dichlorobenzene		541-73-1	0.004	0.002	0.004
1,4-Dichlorobenzene	p-Dichlorobenzene	*	106-46-7	0.03	0.10	0.06
Dichlorodifluoromethane			75-71-8	2.73	2.72	2.73
1,1-Dichloroethane	Ethylidene dichloride	*	75-34-3	ND	ND	ND
1,1-Dichloroethylene	Vinylidene chloride	*	75-35-4	0.001	0.0004	0.0004
cis-1,2-Dichloroethylene	cis-1,2-Dichloroethene		156-59-2	ND	ND	ND
trans-1,2-Dichloroethylene	trans-1,2-Dichloroethene		156-60-5	0.001	0.0005	0.001
Dichloromethane	Methylene chloride	*	75-09-2	0.54	0.71	1.37
1,2-Dichloropropane	Propylene dichloride	*	78-87-5	ND	ND	ND

- Values in **italics** indicate averages based on less than 50% of samples above the detection limit.
- **ND** indicates that all samples were below the detection limit.
- HAP = Hazardous air pollutant as listed in the Clean Air Act.

^a Acrolein concentrations are highly uncertain because of problems with collection and analysis methods.

Table 2 (continued)
2011 Summary of Toxic Volatile Organic Compounds Monitored in New Jersey

**Annual Average Concentration
micrograms per cubic meter ($\mu\text{g}/\text{m}^3$)**

Pollutant	Synonym	HAP	CAS No.	Chester	Elizabeth	New Brunswick
cis-1,3-Dichloropropylene		*	542-75-6	<i>0.001</i>	ND	<i>0.002</i>
trans-1,3-Dichloropropylene		*	542-75-6	0.001	ND	ND
2,5-Dimethylbenzaldehyde			5799-94-2	ND	ND	ND
Ethyl acrylate		*	140-88-5	ND	<i>0.003</i>	ND
Ethylbenzene		*	100-41-4	0.25	0.51	0.49
Ethylene dibromide	1,2-Dibromoethane	*	106-93-4	<i>0.002</i>	<i>0.003</i>	<i>0.001</i>
Ethylene dichloride	1,2,-Dichloroethane	*	107-06-2	<i>0.03</i>	<i>0.03</i>	<i>0.03</i>
Formaldehyde		*	50-00-0	2.37	3.44	2.70
Freon 114	Dichlorotetrafluoroethane		76-14-2	0.13	0.12	0.13
Hexachlorobutadiene	Hexachloro-1,3-butadiene	*	87-68-3	<i>0.01</i>	<i>0.01</i>	<i>0.01</i>
Hexanaldehyde	Hexaldehyde		66-25-1	0.11	0.10	0.09
Isovaleraldehyde			590-86-3	ND	ND	ND
Methyl chloroform	1,1,1-Trichloroethane	*	71-55-6	0.06	0.06	0.07
Methyl ethyl ketone	MEK		78-93-3	1.32	1.38	1.32
Methyl isobutyl ketone	MIBK	*	108-10-1	0.12	0.17	0.15
Methyl methacrylate		*	80-62-6	<i>0.02</i>	<i>0.04</i>	<i>0.01</i>
Methyl tert-butyl ether	MTBE	*	1634-04-4	<i>0.02</i>	<i>0.01</i>	<i>0.02</i>
n-Octane			111-65-9	0.16	0.37	0.18
Propionaldehyde		*	123-38-6	0.26	0.45	0.29
Propylene			115-07-1	0.48	2.24	0.86
Styrene		*	100-42-5	0.34	0.27	0.21
1,1,2,2-Tetrachloroethane		*	79-34-5	<i>0.004</i>	<i>0.001</i>	<i>0.003</i>
Tetrachloroethylene	Perchloroethylene	*	127-18-4	0.09	0.20	0.12
Tolualdehydes				0.16	0.17	0.14
Toluene		*	108-88-3	1.42	2.85	2.06
1,2,4-Trichlorobenzene		*	102-82-1	<i>0.001</i>	<i>0.001</i>	<i>0.004</i>
1,1,2-Trichloroethane		*	79-00-5	<i>0.002</i>	ND	ND
Trichloroethylene		*	79-01-6	<i>0.05</i>	<i>0.09</i>	<i>0.02</i>
1,1,2-Trichloro-1,2,2-trifluoroethane	Trichlorotrifluoroethane		76-13-1	0.77	0.75	0.77
Trichlorofluoromethane			75-69-4	1.54	1.61	1.56
1,2,4-Trimethylbenzene			95-63-6	0.26	0.56	0.28
1,3,5-Trimethylbenzene			108-67-8	0.11	0.20	0.11
Valeraldehyde			110-62-3	0.09	0.11	0.07
Vinyl chloride		*	75-01-4	<i>0.001</i>	<i>0.001</i>	<i>0.003</i>
m,p-Xylene		*	1330-20-7	0.64	1.54	1.11
o-Xylene		*	95-47-6	0.26	0.60	0.37

- Values in italics indicate averages based on less than 50% of samples above the detection limit.
- ND indicates that all samples were below the detection limit.
- HAP = Hazardous air pollutant as listed in the Clean Air Act.

Table 3
2011 New Jersey Toxic Metals Summary & Risk Ratios

Pollutant	HAP ^a	Annual average concentration (µg/m ³)				Health Benchmark (µg/m ³) ^b	Risk Ratio ^c			
		Chester	Elizabeth	New Brunswick	Newark		Chester	Elizabeth	New Brunswick	Newark
Antimony	*	0.007	0.008	0.007	0.007	0.2	0.04	0.04	0.03	0.04
Arsenic	*	0.0003	0.0004	0.0004	0.0004	<i>2.3E-04</i>	1.3	1.7	1.5	1.7
Cadmium	*	0.002	0.003	0.003	0.003	<i>2.4E-04</i>	10	13	13	10
Chlorine	*	0.004	0.04	0.04	0.03	0.2	0.02	0.20	0.20	0.14
Chromium^d	*	0.004	0.002	0.005	0.006	<i>8.3E-05</i>	48	28	64	70
Cobalt	*	0.0004	0.0007	0.0007	0.0006	<i>1.1E-04</i>	4	6	6	5
Lead	*	0.001	0.002	0.002	0.002	0.15	0.01	0.01	0.01	0.01
Manganese	*	0.0007	0.002	0.003	0.001	0.05	0.01	0.04	0.05	0.02
Nickel	*	0.001	0.003	0.002	0.003	0.05	0.03	0.06	0.04	0.06
Nickel^e	*	0.001	0.003	0.002	0.003	<i>2.1E-03</i>	0.7	1.3	1.0	1.5
Phosphorus	*	0	0.0001	0.00003	0.0002	0.07	0	0.001	0.0005	0.003
Selenium	*	0.0004	0.0004	0.0003	0.0003	20	0.00002	0.00002	0.00001	0.00002
Silicon		0.03	0.06	0.09	0.04	3	0.01	0.02	0.03	0.01
Vanadium		0.0006	0.006	0.0015	0.0031	0.1	0.01	0.06	0.02	0.03

^a HAP = Hazardous air pollutant as listed in the Clean Air Act.

^b The health benchmark is defined as the chemical-specific air concentration above which there may be human health concerns. Toxicity values are not available for all chemicals. For more information, go to www.nj.gov/dep/aqpp/risk.html.

Health benchmarks in italics have a cancer endpoint.

For a carcinogen (cancer-causing chemical), the health benchmark is set at the air concentration that would cause no more than a one-in-a-million increase in the likelihood of getting cancer, even after a lifetime of exposure.

For a non-carcinogen, the health benchmark is the maximum air concentration to which exposure is likely to cause no harm, even if that exposure occurs on a daily basis for a lifetime.

^c The risk ratio for a chemical is a comparison of the annual mean air concentration to the health benchmark. A risk ratio greater than one may be of concern. If the annual mean is 0, then the risk ratio cannot be calculated.

^d Chromium - The health benchmark is based on carcinogenicity of hexavalent chromium (Cr⁺⁶). It is not known how much of the chromium measured by the monitor is hexavalent.

^e Nickel - The cancer-based health benchmark for nickel is based on specific nickel compounds. It is not known how much of the nickel measured by the monitor is in that form.

- More information on speciated fine particulate measured in New Jersey can be found in NJ's 2011 Air Quality Report, Appendix B - Fine Particulate Speciation Summary at www.njaqinow.net/Default.ltr.aspx.

ESTIMATING HEALTH RISK

A simplified way to determine whether the ambient concentration of an air toxic could pose a potential human health risk is to compare the air concentration to a health benchmark. The number that we get when we divide the concentration by the benchmark is called a **risk ratio**. If the risk ratio is less than one, the air concentration should not pose a health risk. If it is greater than one, it may be of concern. The risk ratio also indicates how much higher or lower the estimated air concentration is compared to the health benchmark.

The pollutants with risk ratios greater than one for at least one monitoring site are summarized in Table 4. In addition to the toxic VOCs and carbonyls, speciated metals were also evaluated for risk. Elizabeth had sixteen pollutants with annual average concentrations that exceeded their health benchmarks, New Brunswick had twelve and Chester had ten. The toxic VOCs with risk ratios greater than one at all sites are acetaldehyde, acrylonitrile, benzene, carbon tetrachloride, chloroform, chloromethane (methyl chloride), and formaldehyde. Toxic metals that had risk ratios greater than one at the four monitoring sites (including Newark) were arsenic, cadmium, and cobalt. The noncancer risk ratio for nickel was slightly over one at Elizabeth and Newark.

Formaldehyde contributed the highest risks, but note that the risks varied substantially from site to site. The carbon tetrachloride risk ratio is lower in 2011 than in previous years because of a change in its cancer toxicity value. Some pollutants were over the level of concern at some sites but not others. Although acrolein risk ratios at all sites were greater than one, they are not included here because of problems with the sampling method. More detail for each site, including health benchmarks used to calculate risk ratios, can be found in Tables 6-8.

Table 4 can be compared with the risk results predicted by NATA in Table 5. Chromium and nickel cancer risk cannot be estimated from monitoring data because the sampling method measures total chromium and total nickel concentrations; the amounts that are in the carcinogenic form cannot be determined. 1,3-Dichloropropene and 1,1,2-trichloroethane samples were mostly below the detection limits, so no annual average concentration could be calculated. Ethylene oxide and naphthalene are not sampled at the New Jersey sites. PAH/POM are polycyclic aromatic hydrocarbons/polycyclic organic matter, a broad class of compounds that are not measured in New Jersey because of a lack of a reliable sampling method. On the other hand, acrylonitrile is measured in New Jersey at levels higher than estimated by NATA.

NATA estimates that concentrations of diesel particulate matter (DPM) in New Jersey are at levels that potentially pose a higher cancer risk than the other air toxics combined. However, actually measuring diesel in the ambient air is problematic. It is difficult to distinguish particulate matter from diesel engines from other types of particulate matter. Diesel emissions consist of agglomerated and condensed fine particles and gases, onto which are adsorbed potentially hundreds of compounds formed by incomplete combustion, such as polycyclic aromatic hydrocarbons (PAHs) and nitrated PAHs. Some of these very specific compounds have been suggested as indicators for DPM, but sampling technologies and costs continue to be obstacles. Elemental carbon is sometimes assumed to be an indicator for diesel emissions. See Figure 3 for a comparison of DPM concentrations from NATA with monitored concentrations of elemental carbon. For more information about diesel, see www.nj.gov/dep/airtoxics/diesemis.htm.

Table 4
 Monitored Toxic Air Pollutants with Risk Ratios Greater Than One in NJ

POLLUTANT	RISK RATIO			
	Chester	Elizabeth	New Brunswick	Newark
Acetaldehyde	4	7	6	
Acrylonitrile	7	1.7 ^a	6 ^a	
Arsenic	1.3	1.7	1.5	1.7
Benzene	4	8	5	
1,3-Butadiene	0.7	4	1.6	
Cadmium	10	13	13	10
Carbon tetrachloride	4	4	3	
Chloroform	2.4	3	2.8	
Chloromethane	2.2	2.2	2.3	
Cobalt	4	6	6	5
1,4-Dichlorobenzene	0.3 ^a	1.1	0.7	
Ethylbenzene	0.6	1.3	1.2	
Ethylene dibromide	0.96 ^a	1.6 ^a	0.5 ^a	
Formaldehyde	31	45	35	
Nickel ^b	0.7	1.3	1.0	1.5
Tetrachloroethylene	0.5	1.2	0.7	

^a Based on less than 50% of samples above the detection limit.

^b The cancer-based health benchmark for nickel is based on specific nickel compounds.

Figure 3. Comparison of Elemental Carbon Monitoring Data with NATA 2005 Predicted Concentrations for Diesel PM

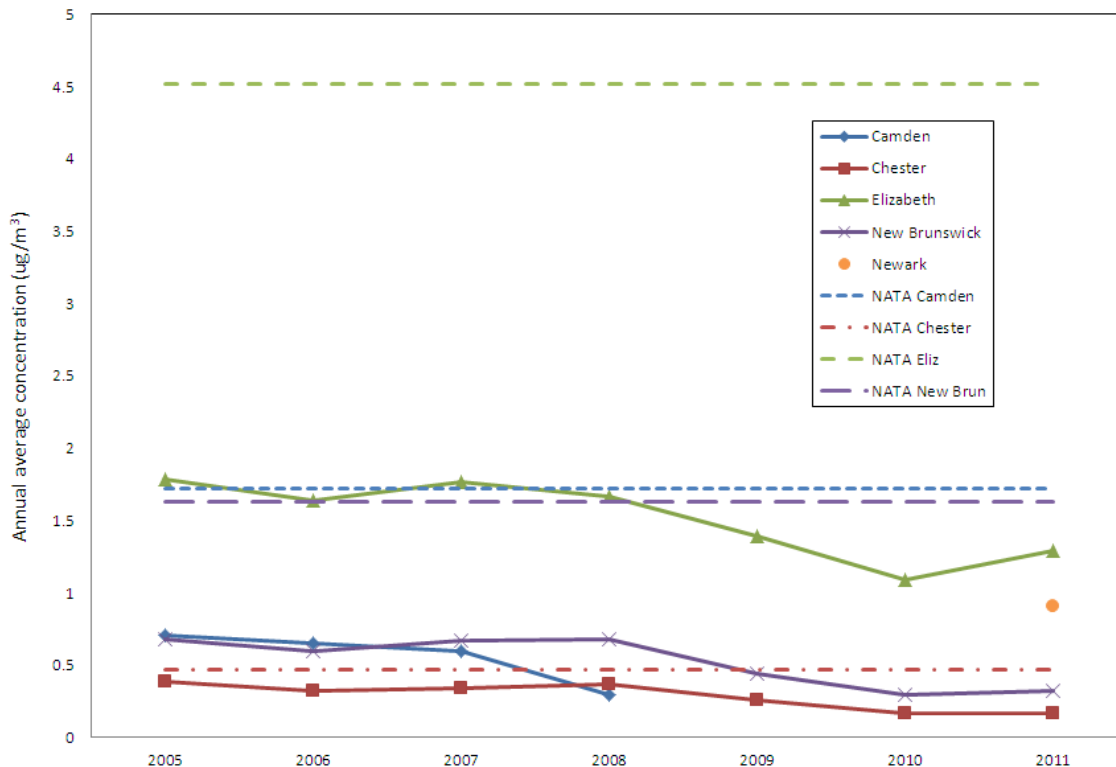


Table 5
2005 NATA Modeled Air Concentrations Compared to Health Benchmarks
New Jersey Statewide Averages

Pollutant	Modeled Air Concentration ($\mu\text{g}/\text{m}^3$)	Health Benchmark ($\mu\text{g}/\text{m}^3$)	Risk Ratio	% Contribution from				
				Major Sources	Area Sources	On-Road Mobile Sources	Nonroad Mobile Sources	Background & Secondary Formation
Acetaldehyde	1.9	0.45	4.3	<1%	4%	6%	3%	87%*
Acrolein	0.062	0.020	3.1	<1%	22%	14%	9%	55%*
Arsenic compounds	0.00053	0.00023	2.3	3%	13%	5%	5%	74%
Benzene	1.3	0.13	10	<1%	13%	30%	13%	44%
1,3-Butadiene	0.095	0.033	2.9	<1%	<1%	40%	17%	43%
Cadmium compounds	0.00011	0.00024	0.5	12%	44%	0%	1%	43%
Carbon tetrachloride	0.61	0.17	3.6	0%	<1%	0%	0%	100%
Chloroform	0.13	0.043	3.1	<1%	54%	0%	0%	46%
Chromium (hexavalent form)	0.00024	0.000083	2.9	29%	10%	4%	1%	56%
Cobalt Compounds	0.000093	0.00011	0.8	93%	7%	0%	0%	0%
1,4-Dichlorobenzene	0.12	0.091	1.3	<1%	58%	0%	0%	42%
1,3-Dichloropropene	0.14	0.25	0.5	0%	100%	0%	0%	0%
Diesel particulate matter	1.1	0.0033	327	0%	0%	47%	53%	0%
Ethylbenzene	0.34	0.40	0.9	1%	30%	45%	24%	0%
Ethylene oxide	0.011	0.011	1.0	12%	18%	0%	0%	70%
Formaldehyde	2.2	0.077	28	<1%	3%	9%	6%	82%*
Methyl chloride	1.2	0.56	2.2	<1%	1%	0%	0%	99%
Naphthalene	0.13	0.029	4.6	1%	48%	26%	4%	21%
Nickel Compounds	0.0012	0.0021	0.6	36%	37%	2%	10%	15%
PAH/POM**	0.012	0.0072*	1.6	1%	79%	8%	12%	0%
Perchloroethylene	0.25	0.17	1.4	<1%	61%	0%	0%	39%
1,1,2-Trichloroethane	0.0066	0.063	0.1	<1%	100%	0%	0%	0%

- For information on risk ratios see section on "Estimating Health Risk" above.
- Chemicals with risk ratios greater than or equal to 1 are in bold.
- Risk ratios based on noncarcinogenic effects are in *italics*.
- For diesel particulate matter, onroad and nonroad concentrations include a model-estimated background concentration.
- *Acetaldehyde, acrolein and formaldehyde concentration estimates include secondary formation, which is the process by which chemicals in the air are transformed into other chemicals.
- **PAH/POM is "polycyclic aromatic hydrocarbons/polycyclic organic matter." These define a broad class of compounds. The chemicals making up this class were broken up into 8 groups based on toxicity, and each group was assigned a cancer-weighted toxicity estimate. 0.0072 $\mu\text{g}/\text{m}^3$ is the health benchmark average across the 8 groups.

TRENDS AND COMPARISONS

Monitoring of air toxics in New Jersey has been going on for over a decade, although it continues to evolve, with improvements in the ability to detect chemicals and lowering the concentrations that can be measured for a given pollutant. Figures 4 through 13 show data for some of the VOCs that have been sampled over the past decade. For many of the chemicals of concern in New Jersey, we have been able to see a downward trend, although not in all cases.

According to USEPA's National Air Toxics Assessment (NATA), acetaldehyde concentrations in New Jersey (Figure 4) are primarily influenced by secondary formation, a process in which chemicals in the air are transformed by chemical reactions into other chemicals. Mobile sources also contribute to ambient levels. In 2003, no data was collected in Camden after September, which could have had an influence on the low annual average for that year. In 2004 in both Camden and New Brunswick, high levels of acetaldehyde were measured over a number of weeks. Note the similarity with the formaldehyde graph (Figure 12).

Acrylonitrile concentrations (Figure 5) are impacted by nonpoint sources and background. The high concentration in 2008 in Elizabeth is the result of a number of high sample values that year. Although there has been improvement in analysis, most of the samples are still below the minimum detection limit (MDL).

Benzene concentrations have been decreasing over the past two decades, as can be seen with the Camden site data in Figure 6. Most benzene now comes from mobile and area sources, and is also transported from other regions (background). Sources of 1,3-butadiene (Figure 7) are similar to those of benzene.

Some of the increase in chloroform concentrations shown in Figure 8 is because of improvements in the detection limit. Nonpoint sources and background are the major contributors to ambient chloroform levels.

Chloromethane (also known as methyl chloride) levels are influenced primarily by background. Figure 9 shows that concentrations have remained relatively stable from year to year, and that all sites show similar levels.

1,4-Dichlorobenzene (Figure 10) is emitted primarily from nonpoint sources. It is used in products such as pesticides, disinfectant, mothballs and toilet deodorizer blocks. There is also a significant background level. The high annual average for New Brunswick in 2005 is attributable to an exceptionally high reading on July 27th that may be an error.

Ethylbenzene is associated with mobile sources, which is probably why it is higher at the Elizabeth monitoring site and lower at Chester (Figure 11). 2001 data for Chester and New Brunswick have been omitted from the graph because of problems encountered when sampling was begun that May.

Formaldehyde (Figure 12) is a ubiquitous pollutant that is often found at higher concentrations indoors rather than outdoors because of its use in many consumer goods. It is used in the production of fertilizer, paper, plywood, urea-formaldehyde resins, and many other products. In New Jersey the primary emitters of formaldehyde are on-road mobile sources, although secondary formation and transport contribute

significantly to high outdoor concentrations. As with acetaldehyde, a number of very high samples were measured at Camden, and New Brunswick, in 2004.

Tetrachloroethylene (also known as perchloroethylene) (Figure 13) is used as an industrial solvent and in dry cleaning. It is a common contaminant of hazardous waste sites because of a tendency in the 20th century to dispose of it improperly. Production and demand for it by industry has been declining.

Figure 4
ACETALDEHYDE – New Jersey Monitored Concentrations

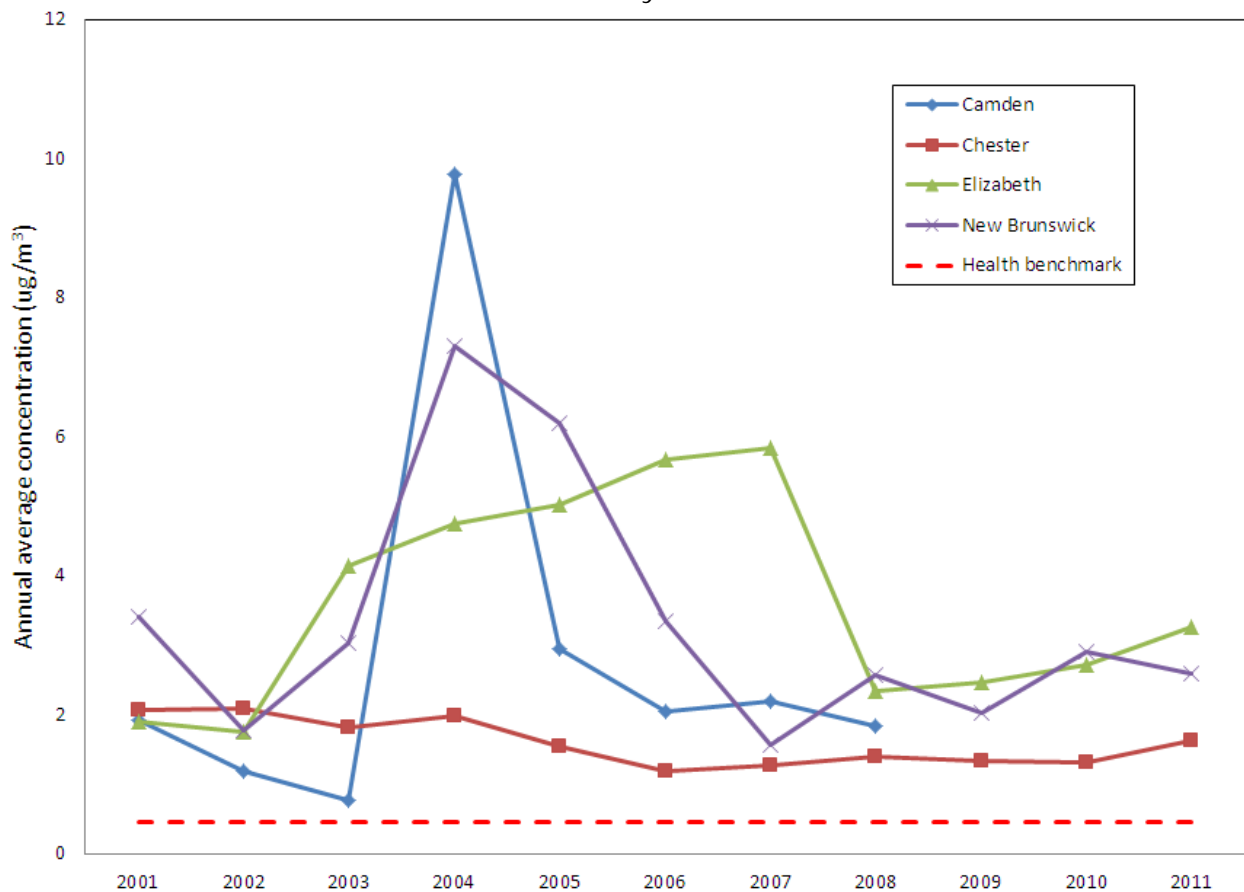


Figure 5
ACRYLONITRILE – New Jersey Monitored Concentrations

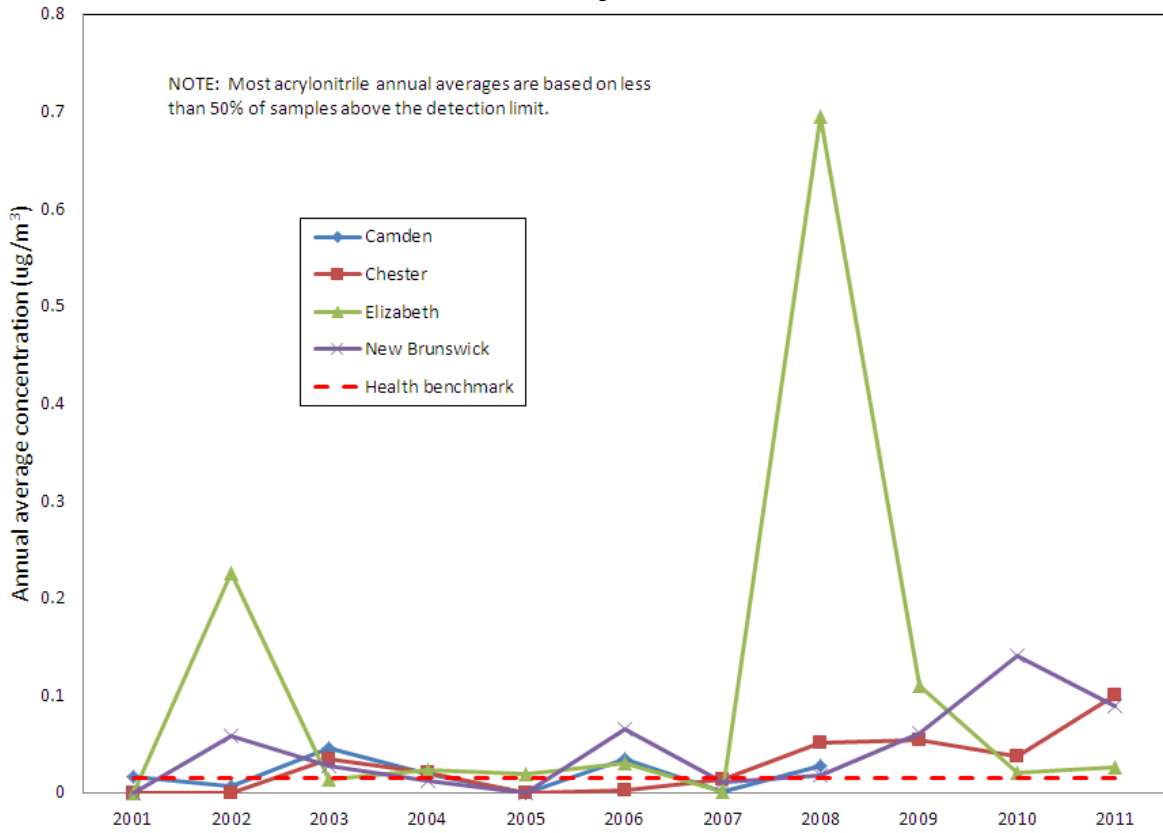


Figure 6
BENZENE – New Jersey Monitored Concentrations

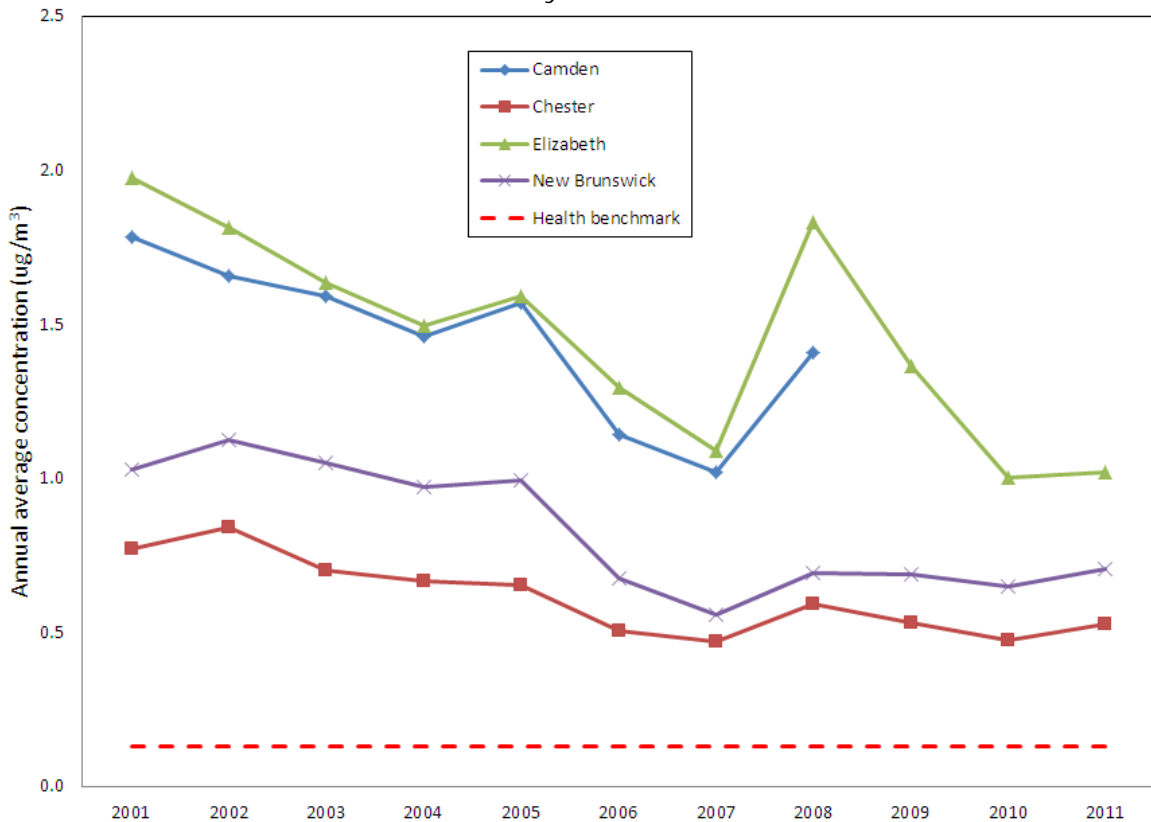


Figure 7
1,3-BUTADIENE – New Jersey Monitored Concentrations

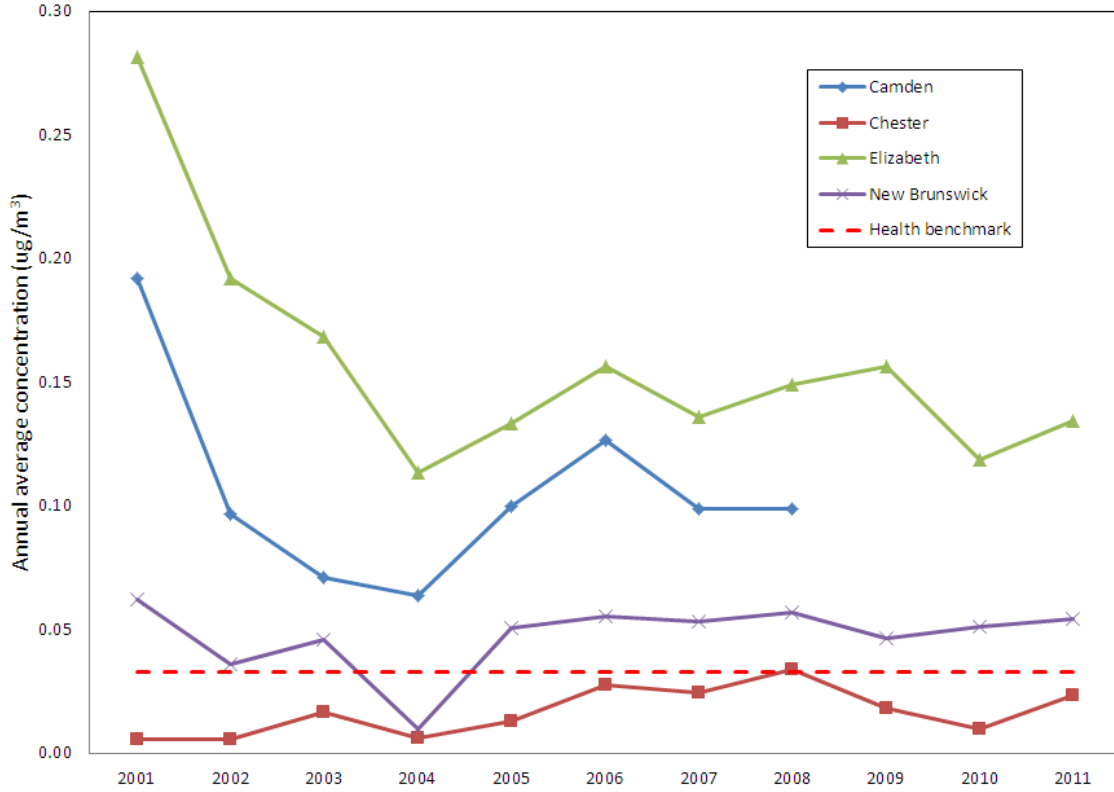


Figure 8
CHLOROFORM – New Jersey Monitored Concentrations

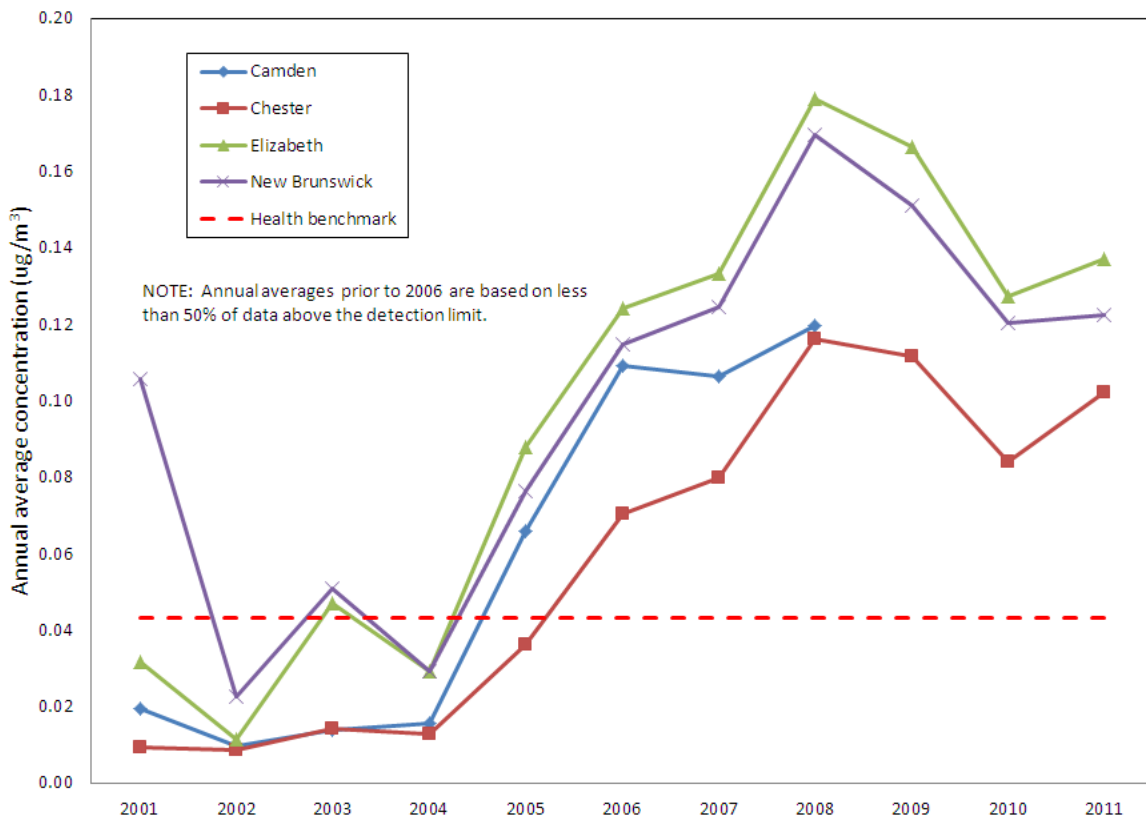


Figure 9
 CHLOROMETHANE (Methyl chloride) - New Jersey Monitored Concentrations

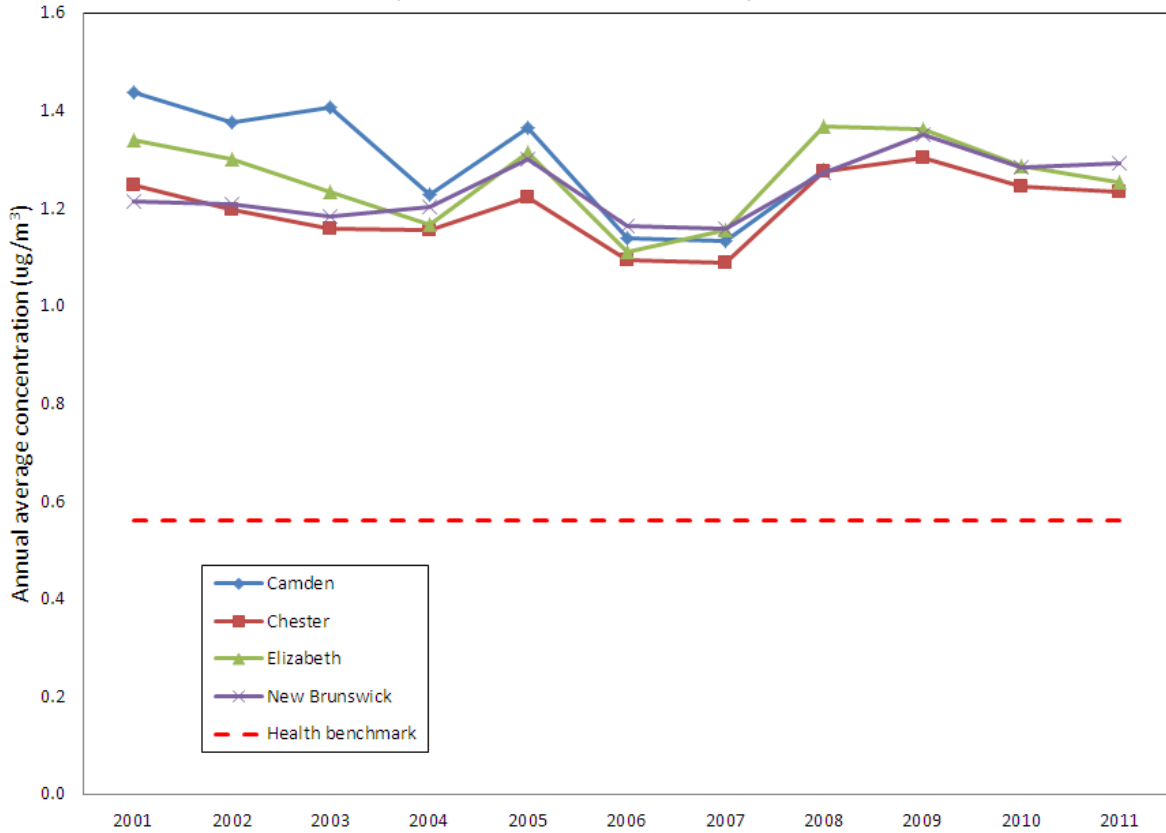


Figure 10
 1,4-DICHLOROBENZENE - New Jersey Monitored Concentrations

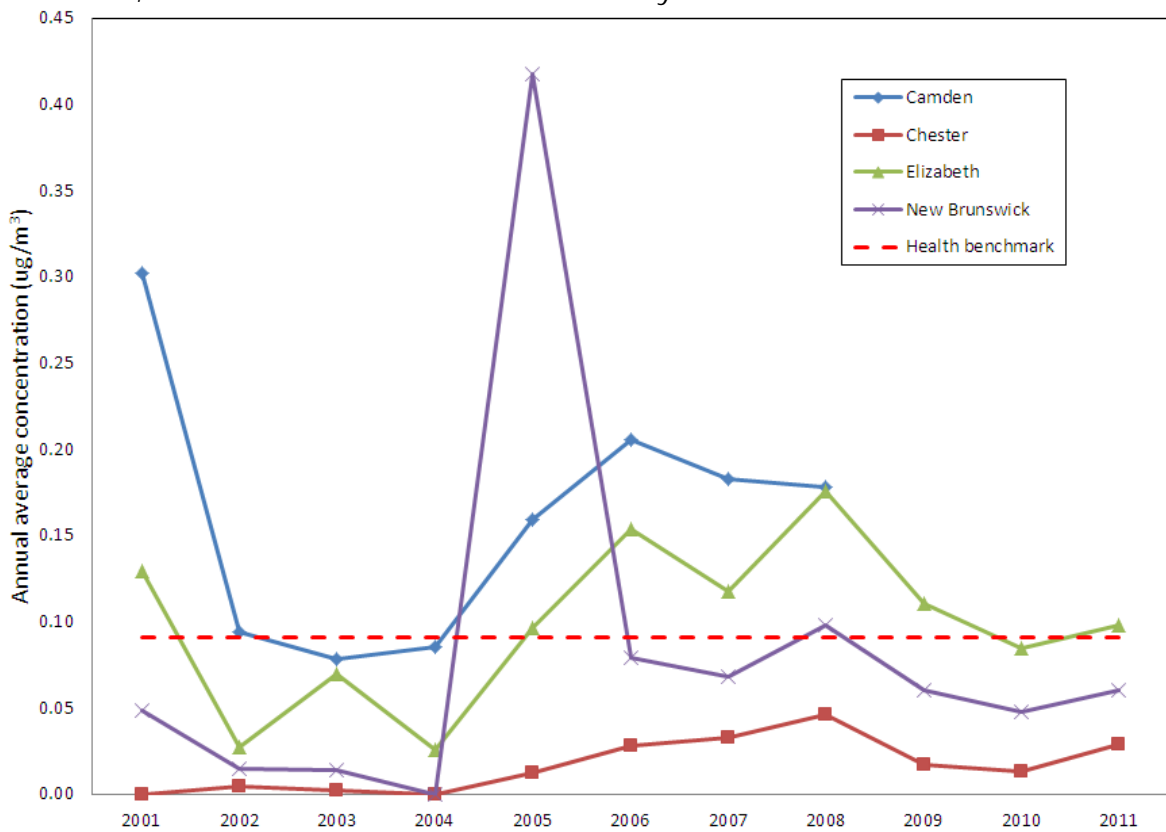


Figure 11
ETHYLBENZENE - New Jersey Monitored Concentrations

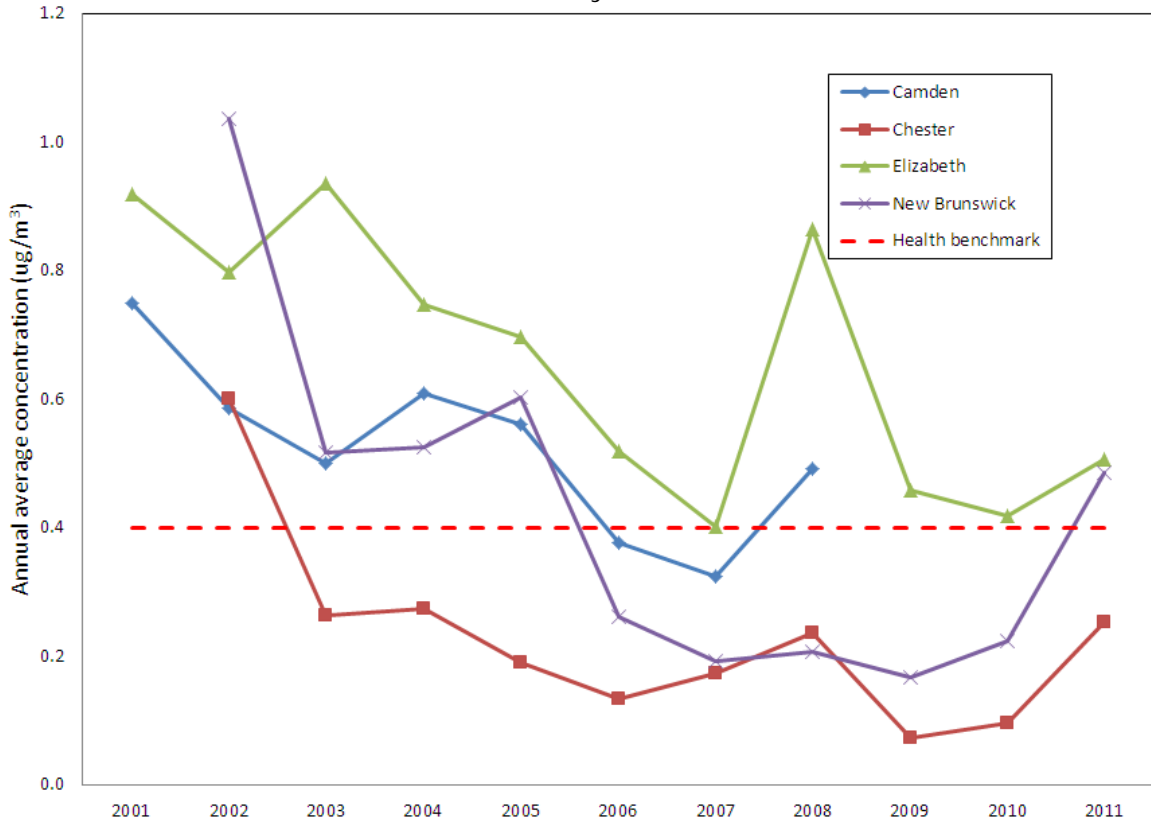


Figure 12
FORMALDEHYDE - New Jersey Monitored Concentrations

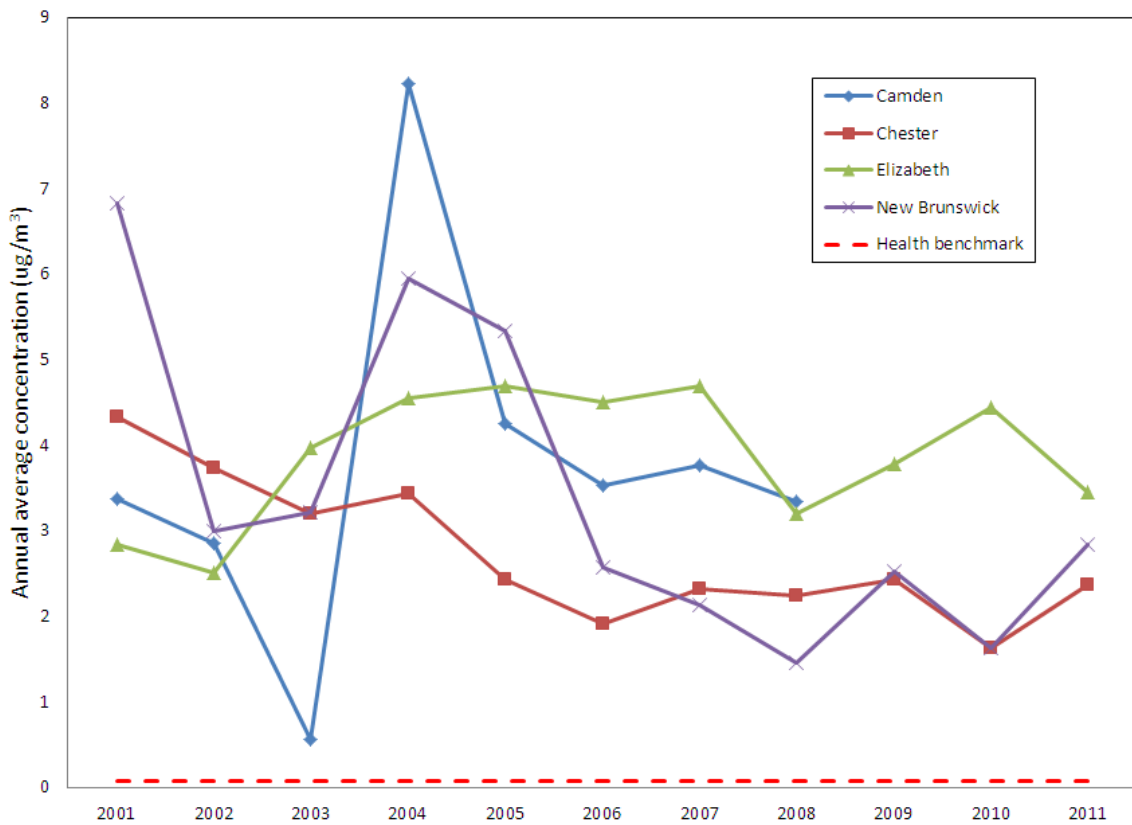
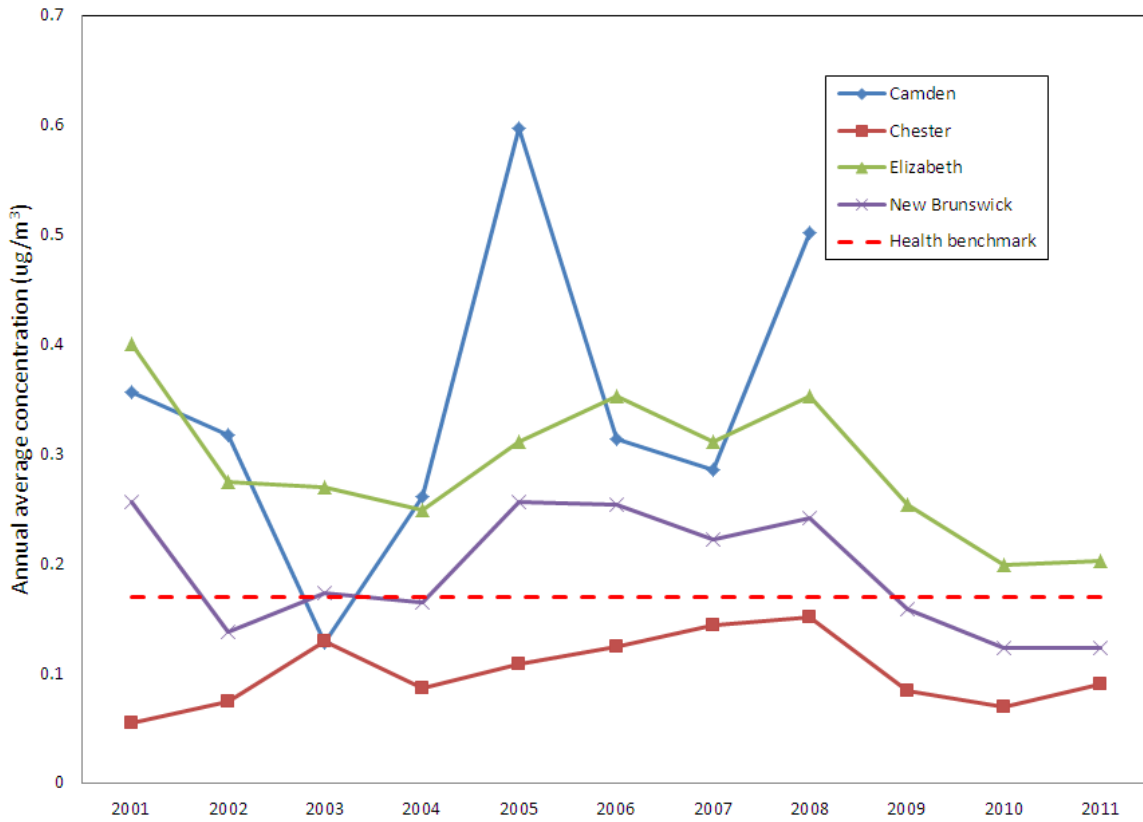


Figure 13

TETRACHLOROETHYLENE - New Jersey Monitored Concentrations



TOXIC METALS data are presented in Figures 14 through 18, taken from the PM_{2.5} speciation monitors around the state. The Newark site became operational in 2010.

Chromium and nickel are shown here because NATA 2005 indicated that there are levels of their carcinogenic forms in the air above the one-in-a-million cancer risk level. The data in Figures 16 and 18 are for total chromium and nickel. The specific carcinogenic compounds cannot be measured with available monitoring methods.

Arsenic, cadmium, and cobalt concentrations are all influenced by combustion, industrial processes, and transport. Arsenic levels in New Jersey are decreasing.

Note that in a few of the graphs some of the years are marked with an asterisk, indicating that less than 50% of the samples used to calculate the annual average were above the detection limit.

Figure 14
ARSENIC - New Jersey Monitored Concentrations

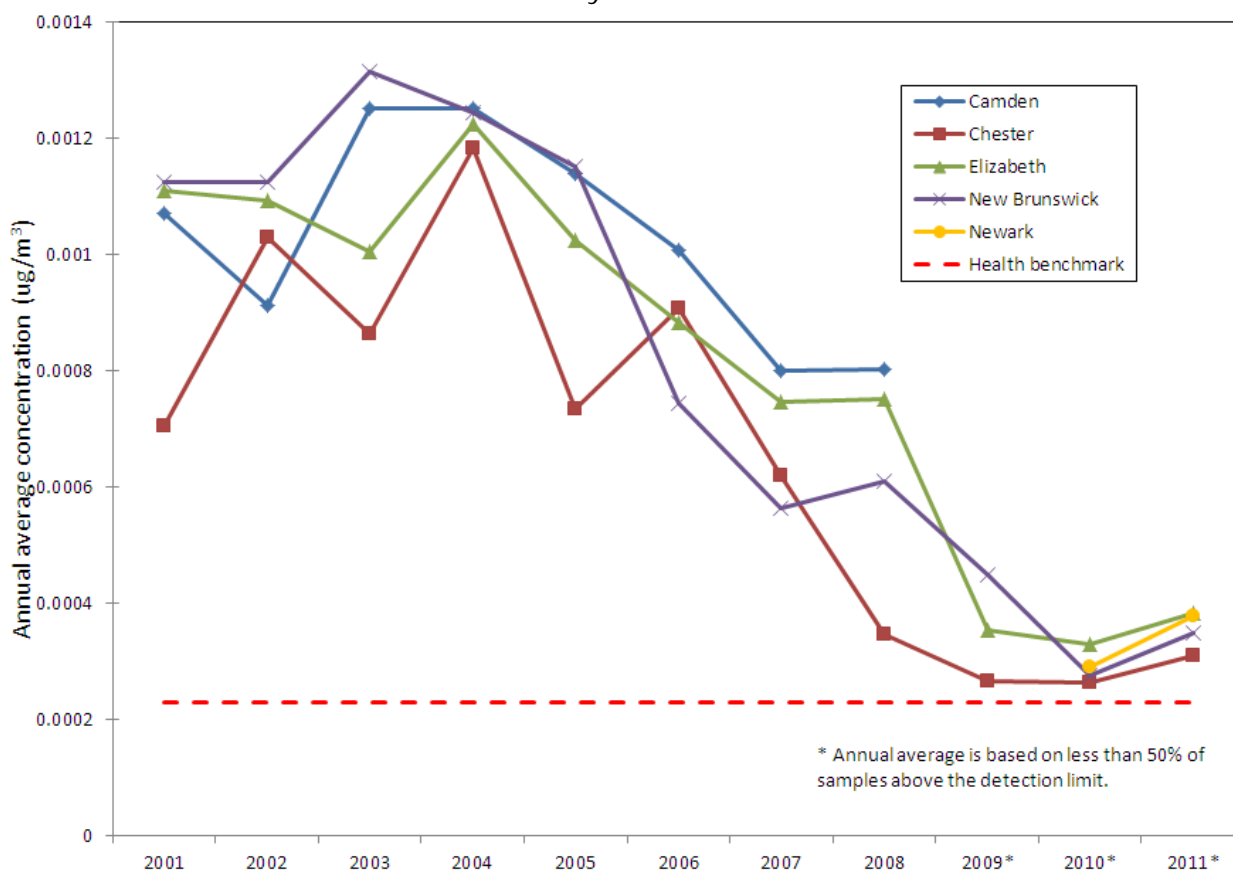


Figure 15
 CADMIUM – New Jersey Monitored Concentrations

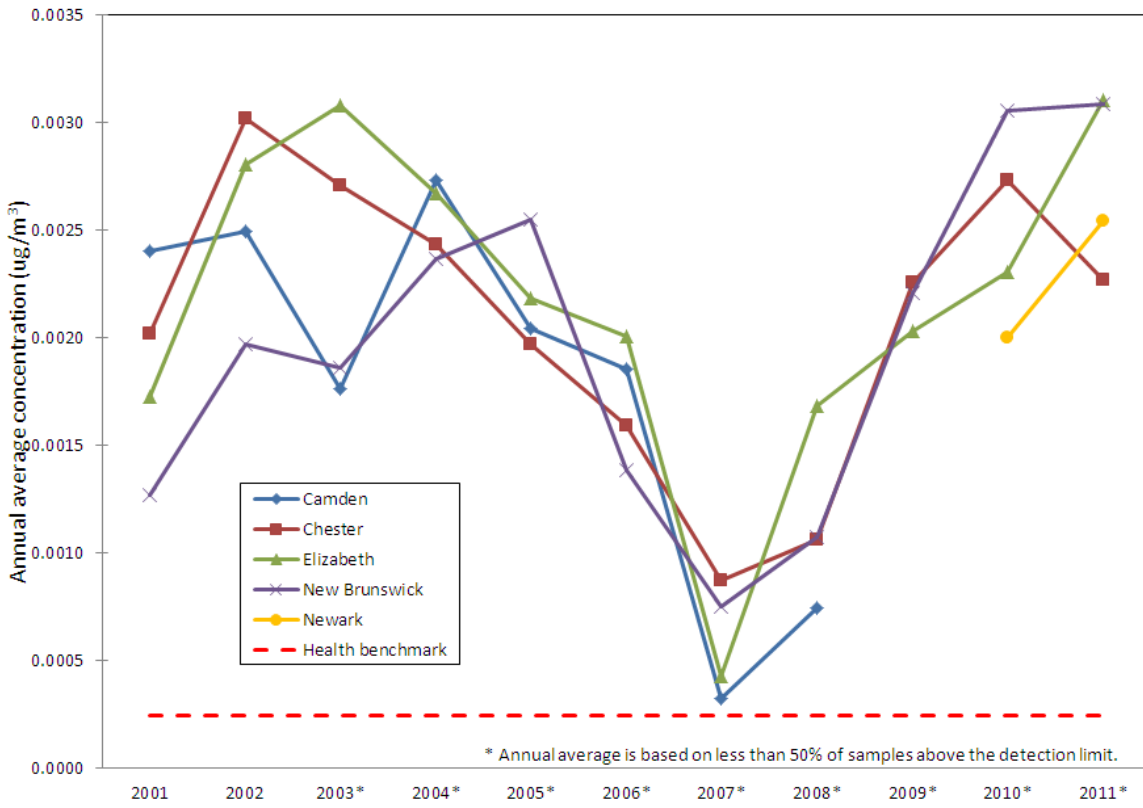


Figure 16
 CHROMIUM – New Jersey Monitored Concentrations

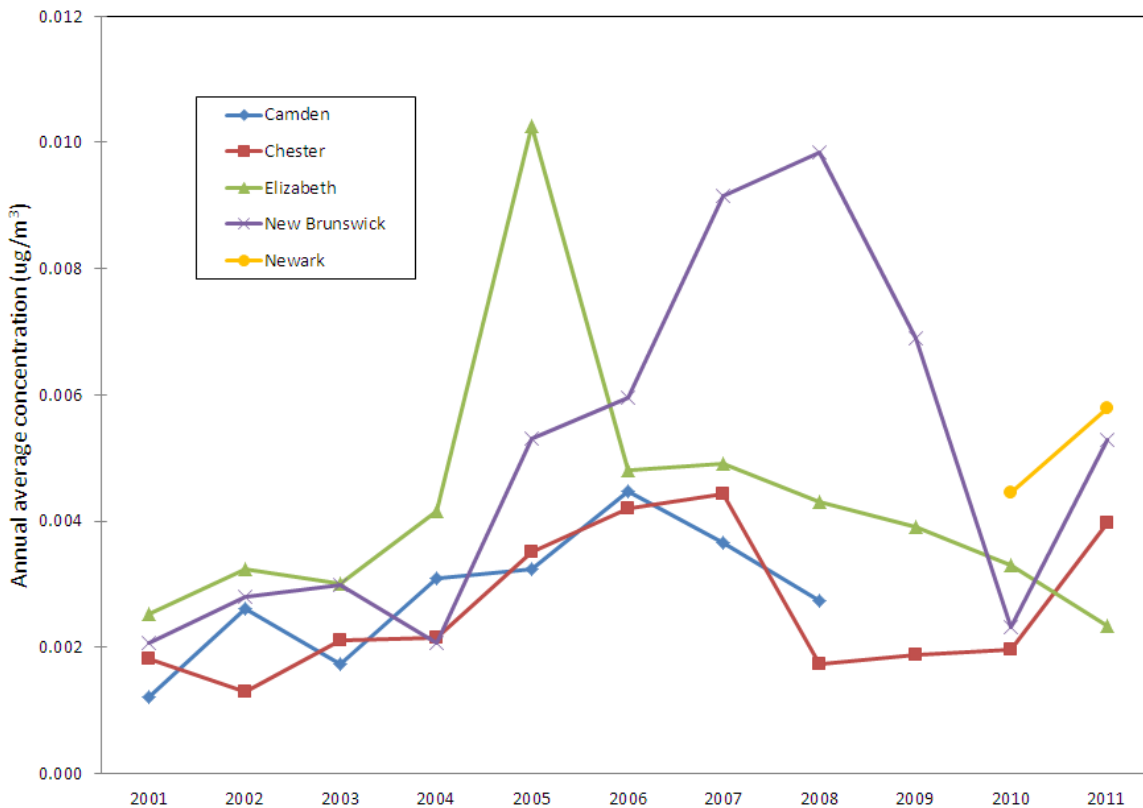


Figure 17
COBALT - New Jersey Monitored Concentrations

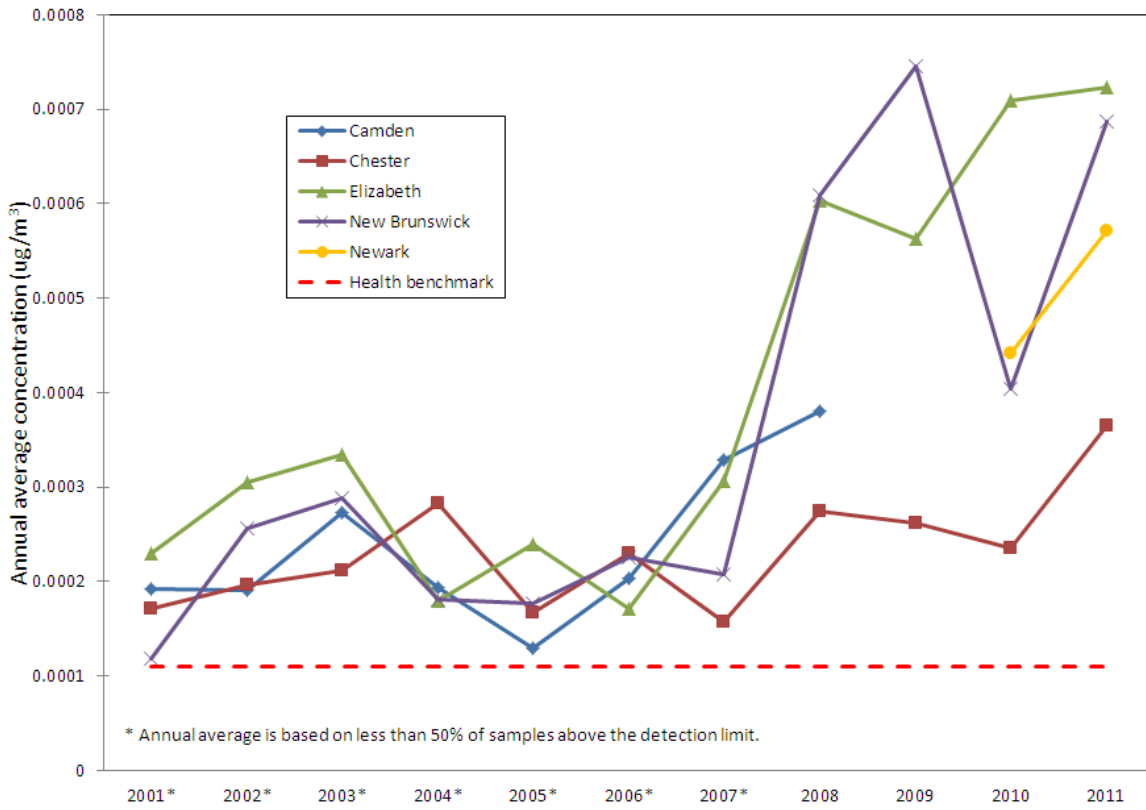


Figure 18
NICKEL - New Jersey Monitored Concentrations

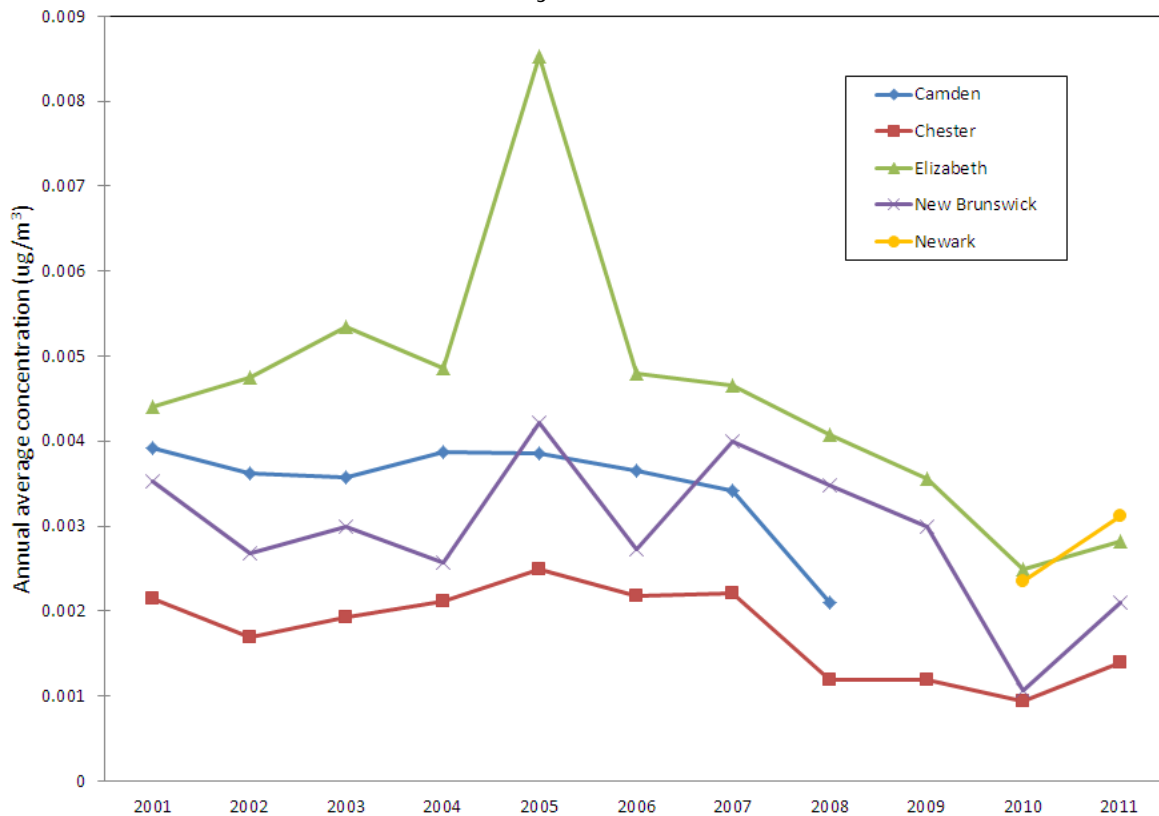
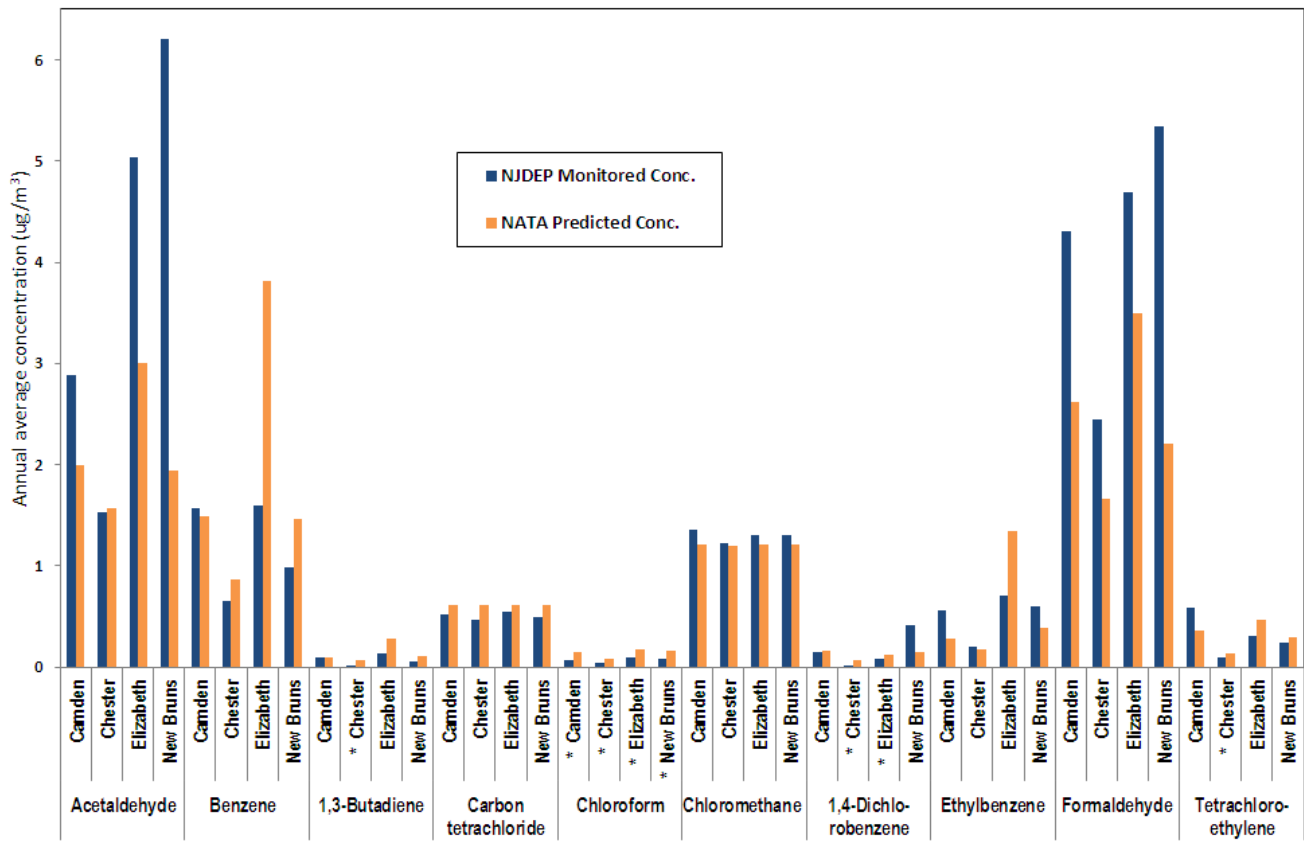


Figure 19 below shows a comparison of annual average concentrations measured at New Jersey's four air toxics monitoring sites in 2005 with annual average concentrations predicted by USEPA's 2005 NATA (at the monitoring site census tract). Most of the pollutants show agreement within a factor of 2 or less, although acetaldehyde and formaldehyde appear to be underestimated by NATA.

Figure 19
2005 New Jersey Monitored Concentrations Compared to 2005 NATA Predicted Concentrations



* Monitoring data average is based on less than 50% of samples above the detection limit.

Table 6

CHESTER NJ 2011 Toxic VOCs Monitoring Data^a

Analyte ^b	CAS No.	Annual Mean (ppbv) ^{c,d}	Annual Median (ppbv) ^{c,d}	24-Hour Min. (ppbv)	24-Hour Max. (ppbv)	Annual Mean (ug/m ³) ^{c,d}	Annual Median (ug/m ³) ^{c,d}	24-Hour Min. (ug/m ³)	24-Hour Max. (ug/m ³)	Health Benchmark (ug/m ³) ^e	Annual Mean Risk Ratio ^f	Detection Limit (ug/m ³)	% Above Minimum Detection Limit
Acetaldehyde	75-07-0	0.89	0.78	0.322	2.44	1.61	1.41	0.58	4.40	0.45	4	0.011	100
Acetone	67-64-1	0.78	0.74	0.308	1.63	1.85	1.75	0.73	3.87	31000	0.0001	0.014	100
Acetonitrile	75-05-8	1.85	0.40	0.132	42.2	3.11	0.67	0.22	70.85	60	0.05	0.040	100
Acetylene	74-86-2	0.51	0.45	0.15	1.12	0.54	0.48	0.16	1.19			0.017	100
Acrolein^g	107-02-8	0.52	0.27	0.078	2.36	1.19	0.63	0.18	5.41	0.02	59	0.115	100
Acrylonitrile	107-13-1	0.046	0.04	0	0.63	0.10	0.087	0	1.37	0.015	7	0.026	54
tert-Amyl methyl ether	994-05-8	0	0	0	0	0	0	0	0			0.067	0
Benzaldehyde	100-52-7	0.023	0.016	0	0.18	0.098	0.069	0	0.77			0.009	92
Benzene	71-43-2	0.16	0.15	0.064	0.65	0.52	0.49	0.20	2.07	0.13	4	0.093	100
Benzyl chloride	100-44-7	0	0	0	0	0	0	0	0	0.02		0.202	0
Bromochloromethane	74-97-5	0.0002	0	0	0.011	0.001	0	0	0.058			0.042	2
Bromodichloromethane	75-27-4	0.0005	0	0	0.017	0.003	0	0	0.11			0.168	3
Bromoform	75-25-2	0.0002	0	0	0.014	0.002	0	0	0.14	0.91	0.003	0.258	2
Bromomethane	74-83-9	0.009	0.01	0	0.05	0.036	0.039	0	0.19	5	0.007	0.035	64
1,3-Butadiene	106-99-0	0.010	0.008	0	0.12	0.023	0.018	0	0.26	0.033	0.7	0.015	51
tert-Butyl ethyl ether	637-92-3	0.0002	0	0	0.015	0.001	0	0	0.063			0.033	2
Butyraldehyde & isobutyraldehyde		0.092	0.07	0.038	0.50	0.27	0.21	0.11	1.47			0.009	100
Carbon disulfide	75-15-0	1.89	0.25	0.053	7.05	5.90	0.78	0.17	21.95	700	0.008	0.103	100
Carbon tetrachloride	56-23-5	0.099	0.097	0.058	0.17	0.62	0.61	0.36	1.06	0.17	4	0.151	100
Chlorobenzene	108-90-7	0.002	0	0	0.084	0.008	0	0	0.39	1000	0.00001	0.097	3
Chloroethane	75-00-3	0.14	0	0	8.18	0.37	0	0	21.59	10000	0.00004	0.024	16
Chloroform	67-66-3	0.021	0.019	0	0.19	0.10	0.093	0	0.91	0.043	2	0.044	82
Chloromethane	74-87-3	0.60	0.58	0.417	0.92	1.23	1.20	0.86	1.90	0.56	2	0.025	100
Chloroprene	126-99-8	0	0	0	0	0	0	0	0	0.0033		0.029	0
Crotonaldehyde	123-73-9	0.11	0.029	0	0.68	0.31	0.08	0	1.96			0.009	95
Dibromochloromethane	594-18-3	0.001	0	0	0.015	0.01	0	0	0.15			0.208	15
1,2-Dichlorobenzene	95-50-1	0.0006	0	0	0.011	0.003	0	0	0.066	200	0.00002	0.222	7
1,3-Dichlorobenzene	541-73-1	0.0006	0	0	0.012	0.004	0	0	0.072			0.204	7
1,4-Dichlorobenzene	106-46-7	0.005	0	0	0.026	0.03	0	0	0.16	0.091	0.3	0.210	39
Dichlorodifluoromethane	75-71-8	0.55	0.54	0.41	0.81	2.73	2.68	2.03	4.00	200	0.01	0.054	100
1,1-Dichloroethane	75-34-3	0	0	0	0	0	0	0	0	0.63		0.032	0
1,1-Dichloroethylene	75-35-4	0.0002	0	0	0.01	0.001	0	0	0.040	200	0.000003	0.036	2
cis-1,2-Dichloroethylene	156-59-2	0	0	0	0	0	0	0	0			0.036	0
trans-1,2-Dichloroethylene	156-60-5	0.0002	0	0	0.01	0.001	0	0	0.040			0.032	2
Dichloromethane	75-09-2	0.16	0.096	0.062	2.53	0.54	0.33	0.22	8.79	2.1	0.3	0.035	100
1,2-Dichloropropane	78-87-5	0	0	0	0	0	0	0	0	0.1		0.106	0
cis-1,3-Dichloropropylene	542-75-6	0.0002	0	0	0.012	0.001	0	0	0.054	0.25	0.004	0.100	2
trans-1,3-Dichloropropylene	542-75-6	0.0002	0	0	0.011	0.001	0	0	0.050	0.25	0.003	0.113	2

Table 6
CHESTER NJ 2011 Toxic VOCs Monitoring Data^a

Analyte ^b	CAS No.	Annual Mean (ppbv) ^{c,d}	Annual Median (ppbv) ^{c,d}	24-Hour Min. (ppbv)	24-Hour Max. (ppbv)	Annual Mean (ug/m ³) ^{c,d}	Annual Median (ug/m ³) ^{c,d}	24-Hour Min. (ug/m ³)	24-Hour Max. (ug/m ³)	Health Benchmark (ug/m ³) ^e	Annual Mean Risk Ratio ^f	Detection Limit (ug/m ³)	% Above Minimum Detection Limit
2,5-Dimethylbenzaldehyde	5799-94-2	0	0	0	0	0	0	0	0			0.011	0
Ethyl acrylate	140-88-5	0	0	0	0	0	0	0	0	2		0.082	0
Ethylbenzene	100-41-4	0.058	0.038	0.009	1.21	0.25	0.16	0.039	5.25	0.4	0.6	0.074	100
Ethylene dibromide	106-93-4	0.0002	0	0	0.013	0.002	0	0	0.100	0.0017	0.96	0.138	2
Ethylene dichloride	107-06-2	0.008	0	0	0.13	0.03	0	0	0.52	0.038	0.9	0.036	30
Formaldehyde	50-00-0	1.93	1.34	0.425	12.5	2.37	1.65	0.52	15.35	0.077	31	0.010	100
Freon 114	76-14-2	0.018	0.017	0	0.033	0.13	0.12	0	0.23			0.063	97
Hexachlorobutadiene	87-68-3	0.0007	0	0	0.013	0.008	0	0	0.14	0.045	0.2	0.395	7
Hexanaldehyde	66-25-1	0.026	0.019	0	0.24	0.11	0.078	0	0.97			0.008	92
Isovaleraldehyde	590-86-3	0	0	0	0	0	0	0	0			0.004	0
Methyl chloroform	71-55-6	0.011	0.01	0	0.03	0.058	0.055	0	0.16	1000	0.0001	0.120	87
Methyl ethyl ketone	78-93-3	0.45	0.28	0.115	4.73	1.32	0.81	0.34	13.93	5000	0.0003	0.462	100
Methyl isobutyl ketone	108-10-1	0.028	0.018	0	0.43	0.12	0.074	0	1.75	3000	0.00004	0.090	89
Methyl methacrylate	80-62-6	0.006	0	0	0.34	0.02	0	0	1.20	700	0.00003	0.077	3
Methyl tert-butyl ether	1634-04-4	0.005	0	0	0.274	0.02	0	0	0.99	3.8	0.004	0.029	3
n-Octane	111-65-9	0.035	0.03	0	0.35	0.16	0.14	0	1.64			0.070	95
Propionaldehyde	123-38-6	0.11	0.09	0.035	0.33	0.26	0.21	0.083	0.79	8	0.03	0.005	100
Propylene	115-07-1	0.28	0.26	0.132	0.77	0.48	0.44	0.23	1.33	3000	0.0002	0.067	100
Styrene	100-42-5	0.081	0.031	0	3.06	0.34	0.13	0	13.03	1.8	0.2	0.094	93
1,1,2,2-Tetrachloroethane	79-34-5	0.0006	0	0	0.017	0.004	0	0	0.12	0.017	0.2	0.165	5
Tetrachloroethylene	127-18-4	0.013	0.011	0	0.15	0.091	0.075	0	1.02	0.17	0.5	0.122	66
Tolualdehydes		0.033	0.029	0	0.092	0.16	0.14	0	0.45			0.015	93
Toluene	108-88-3	0.38	0.16	0.047	12.7	1.42	0.60	0.18	47.85	5000	0.0003	0.060	100
1,2,4-Trichlorobenzene	102-82-1	0.0002	0	0	0.011	0.001	0	0	0.082	4	0.0003	0.267	2
1,1,2-Trichloroethane	79-00-5	0.0003	0	0	0.017	0.002	0	0	0.093	0.063	0.02	0.136	2
Trichloroethylene	79-01-6	0.008	0	0	0.49	0.05	0	0	2.63	0.5	0.09	0.134	5
1,1,2-Trichloro-1,2,2-trifluoroethane	76-131	0.10	0.099	0.074	0.18	0.77	0.76	0.57	1.38	30000	0.00003	0.084	100
Trichlorofluoromethane	75-69-4	0.27	0.27	0.194	0.45	1.54	1.51	1.09	2.52	700	0.002	0.056	100
1,2,4-Trimethylbenzene	95-63-6	0.054	0.037	0.006	1.05	0.26	0.18	0.029	5.16			0.138	100
1,3,5-Trimethylbenzene	108-67-8	0.023	0.018	0	0.39	0.11	0.088	0	1.90			0.128	92
Valeraldehyde	110-62-3	0.024	0.016	0	0.18	0.086	0.056	0	0.62			0.007	93
Vinyl chloride	75-01-4	0.0005	0	0	0.012	0.001	0	0	0.031	0.11	0.01	0.020	5
m/p- Xylene	1330-20-7	0.15	0.067	0.012	4.74	0.64	0.29	0.052	20.58	100	0.006	0.148	100
o-Xylene	95-47-6	0.061	0.032	0	1.69	0.26	0.14	0	7.34	100	0.003	0.078	98

a See page 29 for footnotes.

Table 7

ELIZABETH NJ 2011 Toxic VOCs Monitoring Data^a

Analyte ^b	CAS No.	Annual Mean (ppbv) ^{c,d}	Annual Median (ppbv) ^{c,d}	24-Hour Min. (ppbv)	24-Hour Max. (ppbv)	Annual Mean (ug/m ³) ^{c,d}	Annual Median (ug/m ³) ^{c,d}	24-Hour Min. (ug/m ³)	24-Hour Max. (ug/m ³)	Health Benchmark (ug/m ³) ^e	Annual Mean Risk Ratio ^f	Detection Limit (ug/m ³)	% Above Minimum Detection Limit
Acetaldehyde	75-07-0	1.80	1.54	0.547	4.48	3.24	2.77	0.99	8.07	0.45	7	0.011	100
Acetone	67-64-1	1.01	0.88	0.238	2.18	2.41	2.09	0.57	5.18	31000	0.0001	0.014	100
Acetonitrile	75-05-8	0.37	0.18	0.071	5.80	0.63	0.30	0.12	9.74	60	0.01	0.040	100
Acetylene	74-86-2	1.12	0.93	0.261	2.71	1.20	0.99	0.28	2.88			0.017	100
Acrolein^g	107-02-8	0.42	0.32	0.106	2.48	0.96	0.73	0.24	5.69	0.02	48	0.115	100
Acrylonitrile	107-13-1	0.012	0	0	0.15	0.03	0	0	0.33	0.015	1.7	0.026	15
tert-Amyl methyl ether	994-05-8	0.0001	0	0	0.005	0.0003	0	0	0.021			0.067	2
Benzaldehyde	100-52-7	0.031	0.026	0.006	0.079	0.13	0.11	0.026	0.34			0.009	100
Benzene	71-43-2	0.32	0.30	0.13	1.17	1.02	0.95	0.42	3.74	0.13	8	0.093	100
Benzyl chloride	100-44-7	0	0	0	0	0	0	0	0	0.02		0.202	0
Bromochloromethane	74-97-5	0	0	0	0	0	0	0	0			0.042	0
Bromodichloromethane	75-27-4	0.0002	0	0	0.015	0.002	0	0	0.10			0.168	2
Bromoform	75-25-2	0.0005	0	0	0.013	0.005	0	0	0.13	0.91	0.006	0.258	5
Bromomethane	74-83-9	0.012	0.011	0	0.12	0.048	0.043	0	0.48	5	0.01	0.035	62
1,3-Butadiene	106-99-0	0.061	0.059	0	0.15	0.13	0.13	0	0.33	0.033	4	0.015	97
tert-Butyl ethyl ether	637-92-3	0	0	0	0	0	0	0	0			0.033	0
Butyraldehyde & isobutyraldehyde		0.13	0.13	0.051	0.37	0.39	0.37	0.15	1.08			0.009	100
Carbon disulfide	75-15-0	0.50	0.48	0.225	1.33	1.56	1.49	0.70	4.14	700	0.002	0.103	100
Carbon tetrachloride	56-23-5	0.097	0.098	0.019	0.15	0.61	0.62	0.12	0.94	0.17	4	0.151	100
Chlorobenzene	108-90-7	0.0008	0	0	0.039	0.003	0	0	0.18	1000	0.000003	0.097	3
Chloroethane	75-00-3	0.004	0	0	0.058	0.009	0	0	0.15	10000	0.000001	0.024	13
Chloroform	67-66-3	0.028	0.024	0	0.12	0.14	0.12	0	0.61	0.043	3	0.044	79
Chloromethane	74-87-3	0.61	0.59	0.35	1.09	1.25	1.23	0.72	2.25	0.56	2	0.025	100
Chloroprene	126-99-8	0	0	0	0	0	0	0	0	0.0033		0.029	0
Crotonaldehyde	123-73-9	0.11	0.042	0.012	0.58	0.31	0.12	0.034	1.65			0.009	100
Dibromochloromethane	594-18-3	0.0007	0	0	0.01	0.007	0	0	0.099			0.208	11
1,2-Dichlorobenzene	95-50-1	0.0002	0	0	0.008	0.001	0	0	0.048	200	0.00001	0.222	3
1,3-Dichlorobenzene	541-73-1	0.0003	0	0	0.007	0.002	0	0	0.042			0.204	5
1,4-Dichlorobenzene	106-46-7	0.016	0.015	0	0.083	0.098	0.09	0	0.50	0.091	1.1	0.210	79
Dichlorodifluoromethane	75-71-8	0.55	0.55	0.375	0.74	2.72	2.70	1.85	3.64	200	0.01	0.054	100
1,1-Dichloroethane	75-34-3	0	0	0	0	0	0	0	0	0.63		0.032	0
1,1-Dichloroethylene	75-35-4	0.0001	0	0	0.006	0.0004	0	0	0.024	200	0.000002	0.036	2
cis-1,2-Dichloroethylene	156-59-2	0	0	0	0	0	0	0	0			0.036	0
trans-1,2-Dichloroethylene	156-60-5	0.0001	0	0	0.007	0.0005	0	0	0.028			0.032	2
Dichloromethane	75-09-2	0.20	0.13	0.07	3.29	0.71	0.45	0.24	11.43	2.1	0.3	0.035	100
1,2-Dichloropropane	78-87-5	0	0	0	0	0	0	0	0	0.1		0.106	0
cis-1,3-Dichloropropylene	542-75-6	0	0	0	0	0	0	0	0	0.25		0.100	0
trans-1,3-Dichloropropylene	542-75-6	0	0	0	0	0	0	0	0	0.25		0.113	0

Table 7

ELIZABETH NJ 2011 Toxic VOCs Monitoring Data^a

Analyte ^b	CAS No.	Annual Mean (ppbv) ^{c,d}	Annual Median (ppbv) ^{c,d}	24-Hour Min. (ppbv)	24-Hour Max. (ppbv)	Annual Mean (ug/m ³) ^{c,d}	Annual Median (ug/m ³) ^{c,d}	24-Hour Min. (ug/m ³)	24-Hour Max. (ug/m ³)	Health Benchmark (ug/m ³) ^e	Annual Mean Risk Ratio ^f	Detection Limit (ug/m ³)	% Above Minimum Detection Limit
2,5-Dimethylbenzaldehyde	5799-94-2	0	0	0	0	0	0	0	0			0.011	0
Ethyl acrylate	140-88-5	0.0007	0	0	0.041	0.003	0	0	0.17	2	0.001	0.082	2
Ethylbenzene	100-41-4	0.12	0.09	0.028	1.15	0.51	0.40	0.12	4.99	0.4	1.3	0.074	100
Ethylene dibromide	106-93-4	0.0003	0	0	0.009	0.003	0	0	0.069	0.0017	1.6	0.138	5
Ethylene dichloride	107-06-2	0.007	0	0	0.073	0.03	0	0	0.30	0.038	0.7	0.036	26
Formaldehyde	50-00-0	2.80	2.32	0.808	7.70	3.44	2.85	0.99	9.46	0.077	45	0.010	100
Freon 114	76-14-2	0.017	0.017	0	0.026	0.12	0.12	0	0.18			0.063	97
Hexachlorobutadiene	87-68-3	0.0005	0	0	0.009	0.005	0	0	0.096	0.045	0.1	0.395	8
Hexanaldehyde	66-25-1	0.023	0.019	0	0.098	0.096	0.078	0	0.40			0.008	98
Isovaleraldehyde	590-86-3	0	0	0	0	0	0	0	0			0.004	0
Methyl chloroform	71-55-6	0.012	0.011	0	0.03	0.064	0.06	0	0.16	1000	0.0001	0.120	92
Methyl ethyl ketone	78-93-3	0.47	0.37	0.131	2.02	1.38	1.08	0.39	5.95	5000	0.0003	0.462	100
Methyl isobutyl ketone	108-10-1	0.041	0.031	0	0.28	0.17	0.13	0	1.14	3000	0.0001	0.090	98
Methyl methacrylate	80-62-6	0.012	0	0	0.16	0.04	0	0	0.55	700	0.0001	0.077	25
Methyl tert-butyl ether	1634-04-4	0.004	0	0	0.18	0.01	0	0	0.63	3.8	0.004	0.029	8
n-Octane	111-65-9	0.080	0.061	0.018	0.37	0.37	0.28	0.084	1.74			0.070	100
Propionaldehyde	123-38-6	0.19	0.17	0.051	0.50	0.45	0.40	0.12	1.18	8	0.06	0.005	100
Propylene	115-07-1	1.30	0.85	0.247	6.03	2.24	1.46	0.43	10.38	3000	0.0007	0.067	100
Styrene	100-42-5	0.065	0.041	0	1.37	0.27	0.17	0	5.84	1.8	0.2	0.094	98
1,1,2,2-Tetrachloroethane	79-34-5	0.0002	0	0	0.01	0.001	0	0	0.069	0.017	0.07	0.165	2
Tetrachloroethylene	127-18-4	0.030	0.026	0	0.18	0.20	0.18	0	1.22	0.17	1.2	0.122	92
Tolualdehydes		0.034	0.024	0.006	0.13	0.17	0.12	0.029	0.64			0.015	100
Toluene	108-88-3	0.76	0.51	0.14	11.30	2.85	1.93	0.53	42.58	5000	0.001	0.060	100
1,2,4-Trichlorobenzene	102-82-1	0.0001	0	0	0.008	0.001	0	0	0.059	4	0.0002	0.267	2
1,1,2-Trichloroethane	79-00-5	0	0	0	0	0	0	0	0	0.063	0	0.136	0
Trichloroethylene	79-01-6	0.017	0	0	0.52	0.093	0	0	2.81	0.5	0.2	0.134	38
1,1,2-Trichloro-1,2,2-trifluoroethane	76-131	0.098	0.098	0.057	0.13	0.75	0.75	0.44	0.98	30000	0.00003	0.084	100
Trichlorofluoromethane	75-69-4	0.29	0.28	0.194	0.48	1.61	1.56	1.09	2.67	700	0.002	0.056	100
1,2,4-Trimethylbenzene	95-63-6	0.11	0.09	0.022	1.01	0.56	0.44	0.11	4.96			0.138	100
1,3,5-Trimethylbenzene	108-67-8	0.042	0.035	0.008	0.38	0.20	0.17	0.039	1.89			0.128	100
Valeraldehyde	110-62-3	0.031	0.028	0.009	0.11	0.11	0.10	0.032	0.39			0.007	100
Vinyl chloride	75-01-4	0.0005	0	0	0.008	0.001	0	0	0.020	0.11	0.01	0.020	7
m/p- Xylene	1330-20-7	0.35	0.24	0.075	6.00	1.54	1.02	0.33	26.05	100	0.02	0.148	100
o-Xylene	95-47-6	0.14	0.095	0.031	1.99	0.60	0.41	0.13	8.64	100	0.006	0.078	100

a See page 29 for footnotes.

Table 8

NEW BRUNSWICK NJ 2011 Toxic VOCs Monitoring Data^a

Analyte ^b	CAS No.	Annual Mean (ppbv) ^{c,d}	Annual Median (ppbv) ^{c,d}	24-Hour Min. (ppbv)	24-Hour Max. (ppbv)	Annual Mean (ug/m ³) ^{c,d}	Annual Median (ug/m ³) ^{c,d}	24-Hour Min. (ug/m ³)	24-Hour Max. (ug/m ³)	Health Benchmark (ug/m ³) ^e	Annual Mean Risk Ratio ^f	Detection Limit (ug/m ³)	% Above Minimum Detection Limit
Acetaldehyde	75-07-0	1.38	1.33	0.46	3.62	2.49	2.39	0.82	6.52	0.45	6	0.011	100
Acetone	67-64-1	0.91	0.81	0.22	2.29	2.16	1.92	0.52	5.44	31000	0.0001	0.014	100
Acetonitrile	75-05-8	0.46	0.34	0.12	3.24	0.78	0.57	0.20	5.44	60	0.01	0.040	100
Acetylene	74-86-2	0.74	0.58	0.21	3.52	0.79	0.62	0.22	3.75			0.017	100
Acrolein^g	107-02-8	0.33	0.27	0.12	0.86	0.76	0.63	0.28	1.97	0.02	38	0.115	100
Acrylonitrile	107-13-1	0.041	0	0	0.62	0.089	0	0	1.34	0.015	6	0.026	41
tert-Amyl methyl ether	994-05-8	0.0001	0	0	0.008	0.0006	0	0	0.033			0.067	2
Benzaldehyde	100-52-7	0.017	0.013	0	0.081	0.073	0.056	0	0.35			0.009	90
Benzene	71-43-2	0.22	0.19	0.073	0.86	0.71	0.62	0.23	2.74	0.13	5	0.093	100
Benzyl chloride	100-44-7	0	0	0	0	0	0	0	0	0.02		0.202	0
Bromochloromethane	74-97-5	0	0	0	0	0	0	0	0			0.042	0
Bromodichloromethane	75-27-4	0	0	0	0	0	0	0	0			0.168	0
Bromoform	75-25-2	0.0004	0	0	0.011	0.005	0	0	0.11	0.91	0.005	0.258	5
Bromomethane	74-83-9	0.018	0.011	0	0.44	0.071	0.043	0	1.70	5	0.01	0.035	62
1,3-Butadiene	106-99-0	0.025	0.025	0	0.091	0.054	0.055	0	0.20	0.033	1.6	0.015	71
tert-Butyl ethyl ether	637-92-3	0	0	0	0	0	0	0	0			0.033	0
Butyraldehyde & isobutyraldehyde		0.087	0.080	0.023	0.20	0.26	0.23	0.068	0.58			0.009	100
Carbon disulfide	75-15-0	0.25	0.076	0.013	0.96	0.77	0.24	0.040	3.00	700	0.001	0.103	100
Carbon tetrachloride	56-23-5	0.093	0.098	0.021	0.14	0.59	0.62	0.13	0.87	0.17	3	0.151	100
Chlorobenzene	108-90-7	0	0	0	0	0	0	0	0	1000		0.097	0
Chloroethane	75-00-3	0.015	0	0	0.16	0.04	0	0	0.42	10000	0.000004	0.024	19
Chloroform	67-66-3	0.025	0.025	0	0.07	0.12	0.120	0	0.34	0.043	3	0.044	79
Chloromethane	74-87-3	0.63	0.59	0.4	2.53	1.29	1.22	0.83	5.22	0.56	2	0.025	100
Chloroprene	126-99-8	0	0	0	0	0	0	0	0	0.0033		0.029	0
Crotonaldehyde	123-73-9	0.097	0.028	0	0.66	0.28	0.080	0	1.88			0.009	98
Dibromochloromethane	594-18-3	0.001	0	0	0.011	0.01	0	0	0.11			0.208	19
1,2-Dichlorobenzene	95-50-1	0.0008	0	0	0.01	0.005	0	0	0.060	200	0.000003	0.222	12
1,3-Dichlorobenzene	541-73-1	0.0007	0	0	0.01	0.004	0	0	0.060			0.204	9
1,4-Dichlorobenzene	106-46-7	0.01	0.009	0	0.048	0.060	0.054	0	0.29	0.091	0.7	0.210	67
Dichlorodifluoromethane	75-71-8	0.55	0.54	0.42	0.68	2.73	2.69	2.08	3.35	200	0.014	0.054	100
1,1-Dichloroethane	75-34-3	0	0	0	0	0	0	0	0	0.63		0.032	0
1,1-Dichloroethylene	75-35-4	0.0001	0	0	0.006	0.0004	0	0	0.024	200	0.000002	0.036	2
cis-1,2-Dichloroethylene	156-59-2	0	0	0	0	0	0	0	0			0.036	0
trans-1,2-Dichloroethylene	156-60-5	0.0001	0	0	0.008	0.0005	0	0	0.032			0.032	2
Dichloromethane	75-09-2	0.39	0.14	0.071	14.2	1.37	0.48	0.25	49.33	2.1	0.7	0.035	100
1,2-Dichloropropane	78-87-5	0	0	0	0	0	0	0	0	0.1		0.106	0
cis-1,3-Dichloropropylene	542-75-6	0.0003	0	0	0.02	0.002	0	0	0.091	0.25	0.006	0.100	2
trans-1,3-Dichloropropylene	542-75-6	0	0	0	0	0	0	0	0	0.25		0.113	0

Table 8

NEW BRUNSWICK NJ 2011 Toxic VOCs Monitoring Data^a

Analyte ^b	CAS No.	Annual Mean (ppbv) ^{c,d}	Annual Median (ppbv) ^{c,d}	24-Hour Min. (ppbv)	24-Hour Max. (ppbv)	Annual Mean (ug/m ³) ^{c,d}	Annual Median (ug/m ³) ^{c,d}	24-Hour Min. (ug/m ³)	24-Hour Max. (ug/m ³)	Health Benchmark (ug/m ³) ^e	Annual Mean Risk Ratio ^f	Detection Limit (ug/m ³)	% Above Minimum Detection Limit
2,5-Dimethylbenzaldehyde	5799-94-2	0	0	0	0	0	0	0	0			0.011	0
Ethyl acrylate	140-88-5	0	0	0	0	0	0	0	0	2		0.082	0
Ethylbenzene	100-41-4	0.11	0.062	0.024	2.65	0.49	0.27	0.10	11.51	0.4	1.2	0.074	100
Ethylene dibromide	106-93-4	0.0001	0	0	0.007	0.0009	0	0	0.054	0.0017	0.5	0.138	2
Ethylene dichloride	107-06-2	0.007	0	0	0.053	0.03	0	0	0.21	0.038	0.7	0.036	31
Formaldehyde	50-00-0	2.20	1.27	0.66	22.5	2.70	1.56	0.81	27.63	0.077	35	0.010	100
Freon 114	76-14-2	0.018	0.018	0	0.025	0.13	0.13	0	0.17			0.063	98
Hexachlorobutadiene	87-68-3	0.001	0	0	0.012	0.01	0	0	0.13	0.045	0.3	0.395	14
Hexanaldehyde	66-25-1	0.023	0.014	0	0.17	0.094	0.057	0	0.70			0.008	89
Isovaleraldehyde	590-86-3	0	0	0	0	0	0	0	0			0.004	0
Methyl chloroform	71-55-6	0.013	0.012	0	0.054	0.069	0.063	0	0.29	1000	0.0001	0.120	93
Methyl ethyl ketone	78-93-3	0.45	0.36	0.13	1.4	1.32	1.06	0.38	4.12	5000	0.0003	0.462	100
Methyl isobutyl ketone	108-10-1	0.037	0.029	0	0.20	0.15	0.12	0	0.83	3000	0.00005	0.090	97
Methyl methacrylate	80-62-6	0.002	0	0	0.089	0.008	0	0	0.31	700	0.00001	0.077	7
Methyl tert-butyl ether	1634-04-4	0.006	0	0	0.26	0.02	0	0	0.94	3.8	0.005	0.029	7
n-Octane	111-65-9	0.039	0.036	0	0.14	0.18	0.17	0	0.64			0.070	98
Propionaldehyde	123-38-6	0.12	0.10	0.03	0.37	0.29	0.25	0.071	0.87	8	0.04	0.005	100
Propylene	115-07-1	0.50	0.43	0.17	1.88	0.86	0.75	0.29	3.24	3000	0.0003	0.067	100
Styrene	100-42-5	0.049	0.033	0	0.91	0.21	0.14	0	3.88	1.8	0.1	0.094	95
1,1,2,2-Tetrachloroethane	79-34-5	0.0005	0	0	0.012	0.003	0	0	0.082	0.017	0.2	0.165	5
Tetrachloroethylene	127-18-4	0.018	0.018	0	0.057	0.12	0.12	0	0.39	0.17	0.7	0.122	84
Tolualdehydes		0.028	0.021	0	0.13	0.14	0.10	0	0.64			0.015	96
Toluene	108-88-3	0.55	0.28	0.097	14.9	2.06	1.04	0.37	56.14	5000	0.0004	0.060	100
1,2,4-Trichlorobenzene	102-82-1	0.0005	0	0	0.011	0.004	0	0	0.082	4	0.001	0.267	5
1,1,2-Trichloroethane	79-00-5	0	0	0	0	0	0	0	0	0.063		0.136	0
Trichloroethylene	79-01-6	0.004	0	0	0.034	0.02	0	0	0.18	0.5	0.04	0.134	22
1,1,2-Trichloro-1,2,2-trifluoroethane	76-131	0.10	0.099	0.07	0.16	0.77	0.76	0.54	1.20	30000	0.00003	0.084	100
Trichlorofluoromethane	75-69-4	0.28	0.27	0.21	0.43	1.56	1.53	1.17	2.40	700	0.002	0.056	100
1,2,4-Trimethylbenzene	95-63-6	0.057	0.053	0.014	0.26	0.28	0.26	0.069	1.29			0.138	100
1,3,5-Trimethylbenzene	108-67-8	0.023	0.022	0	0.081	0.11	0.11	0	0.40			0.128	98
Valeraldehyde	110-62-3	0.021	0.018	0	0.086	0.073	0.062	0	0.30			0.007	90
Vinyl chloride	75-01-4	0.001	0	0	0.016	0.003	0	0	0.041	0.11	0.02	0.020	10
m/p- Xylene	1330-20-7	0.26	0.14	0.052	6.08	1.11	0.62	0.23	26.40	100	0.01	0.148	100
o-Xylene	95-47-6	0.085	0.062	0.021	1.35	0.37	0.27	0.091	5.86	100	0.004	0.078	100

a See page 29 for footnotes.

Footnotes for Tables 6 through 8

^b Analytes in bold text had annual means above the long-term health benchmark.

^c Numbers in italics are arithmetic means (or averages) based on less than 50% of the samples above the detection limit.

^d For a valid 24-hour sampling event, when the analyzing laboratory reports the term “Not Detected” for a particular pollutant, the concentration of 0.0 ppbv is assigned to that pollutant. These zero concentrations were included in the calculation of annual averages and medians for each pollutant regardless of percent detection.

^e The health benchmark is defined as the chemical-specific air concentration above which there may be human health concerns. For a carcinogen (cancer-causing chemical), the health benchmark is set at the air concentration that would cause no more than a one-in-a-million increase in the likelihood of getting cancer, even after a lifetime of exposure. For a non-carcinogen, the health benchmark is the maximum air concentration to which exposure is likely to cause no harm, even if that exposure occurs on a daily basis for a lifetime. These toxicity values are not available for all chemicals. For more information, go to www.nj.gov/dep/aqpp/risk.html.

^f The risk ratio for a chemical is a comparison of the annual mean air concentration to the long-term health benchmark. If the annual mean is 0, then the annual mean risk ratio is not calculated.

^g Acrolein concentrations are highly uncertain because of problems with collection and analysis methods.

Table 9
Analytes with 100% Non-Detects in 2011

Analyte	CAS No.	Chester	Elizabeth	New Brunswick
tert-Amyl methyl ether	994-05-8	X		
Benzyl Chloride	100-44-7	X	X	X
Bromochloromethane	74-97-5		X	X
Bromodichloromethane	75-27-4			X
tert-Butyl ethyl ether	637-92-3		X	X
Chlorobenzene	108-90-7			X
Chloroprene	126-99-8	X	X	X
1,1-Dichloroethane	75-34-3	X	X	X
cis-1,2-Dichloroethene	156-59-2	X	X	X
1,2-Dichloropropane	78-87-5	X	X	X
cis-1,3-Dichloropropylene	542-75-6		X	
trans-1,3-Dichloropropylene	542-75-6		X	X
2,5-Dimethylbenzaldehyde	5799-94-2	X	X	X
Ethyl Acrylate	140-88-5	X		X
Isovaleraldehyde	590-86-3	X	X	X

- In 2011, collected samples of these chemicals were never above the detection limits at the specific monitoring locations. However, they may be present in the air below the detection limit level. Chemical-specific detection limits can be found in Tables 6 through 8.

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