

State of Maine
Department of Environmental Protection

Ambient Air Monitoring
Revision of June 5, 2007

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The DEP has been monitoring for Air Toxics since 1997 at various areas around the state. The locations are listed in Table 1.

Table 1

CETL	Cape Elizabeth – Two Lights
CKP	Country Kitchen Parking Lot (Portland)
EMP#1	Empact Site #1 (Portland)
EMP#2	Empact Site #2 (Portland)
KPS	Kenduskeag Pump Station
PCCJ	Portland – Cumberland County Jail
PCR	Portland – Canco Road
PHC	Pumphouse Co-located sample (Rumford)
PIRS	Presque Isle River Street
RAP	Rumford Avenue Parking Lot
RAP#2	Rumford Ave. Parking Lot (#2)
RPH	Rumford Pumphouse
WPSD	West Paris – Shirley Dam’s Property
MLS	Mexico – Labonville Store

The 144 pollutants that were analyzed for are in Table 2.

Table 2

1,1,1-Trichloroethane	1,1,2,2-Tetrachloroethane	1,1,2-Trichloro-1,2,2-trifluoroethane
1,1,2-Trichloroethane	1,1-Dichloroethane	1,1-Dichloroethene
1,2,3-trimethylbenzene	1,2,4-Trichlorobenzene	1,2,4-Trimethylbenzene
1,2-Dibromomethane	1,2-Dichloro-1,1,2,2-tetrafluoroethane	1,2-Dichlorobenzene
1,2-Dichloroethane	1,2-Dichloropropane	1,3 Butadiene
1,3,5-Trimethylbenzene	1,3-Butadiene	1,3-Dichloromethylbenzene
1,3-Dichloropropene	1,4 Difluorobenzene-IS2	1,4-Dichlorobenzene
1-butene	1-pentene	2,2,4-trimethylpentane
2,2-dimethylbutane	2,3,4-trimethylpentane	2,3-dimethylbutane
2,3-dimethylpentane	2,4-dimethylpentane	2-Hexanone
2-methylheptane	2-methylhexane	2-methylpentane
3-Chloroethene	3-methylheptane	3-methylhexane
3-methylpentane	4-Ethyltoluene	Acetone
Acetonitrile	Acrolein	Acrylonitrile
BFB-SURROGATE	Benzene	Benzylchloride
Bromochloromethane-IS1	Bromodichloromethane	Bromoform
Carbon Disulfide	Carbon Tetrachloride	Chlorobenzene
Chloroethane	Chloroform	Chlorobenzene,D5-IS3
Cyclohexane	Dibromochloromethane	Chloromethane
Ethanol	Ethyl Acetate	Dichlorodifluoromethane
Ethylbenzene	Ethylene Dibromide	Ethyl Chloride
Ethylidene Dichloride	Heptane	Ethylene Dichloride
Hexane	Isopropyl Alcohol	Hexachlorobutadiene

Methyl Bromide	Methyl Chloride	MTBE
Methyl Isobutyl Ketone	Methyl-t-Butyl Ether	Methyl Ethyl Ketone
Methylmethacrylate	Propylene	Methylene Chloride
Styrene	Tetrachloroethene	Propylene Dichloride
Tetrahydrofuran	Toluene	Tetrachloroethylene
Trichloroethylene	Trichlorofluoromethane	Trichloroethane
Vinyl Bromide	Vinyl Chloride	Vinyl Acetate
a-pinene	acetaldehyde	Vinylidene Chloride
acetonitrile	acetylene	acetone
benzaldehyde	butane	acrylonitrile
chlorobenzene	cis-1,2-Dichloroethane	carbon disulfide
cis-2-pentene	cis-1,3-Dichloropropene	cis-2-butene
dodecane	cyclohexane	cyclopentane
ethylene	ethane	ethyl acetate
isopentane	ethylene oxide	isobutane
m,p Xylenes	isoprene	isopropylbenzene
methyl ethyl ketone	m-diethylbenzene	m-ethyltoluene
n-decane	methylcyclohexane	methylcyclopentane
n-nonane	n-heptane	n-hexane
n-undecane	n-octane	n-propylbenzene
o-xylene	o-Xylene	o-ethyltoluene
p-diethylbenzene	p & m xylenes	p-dichlorobenzene
propane	p-ethyltoluene	pentane
Trans-1,2-Dichloroethylene	propene	styrene
Trans-2-pentene	trans-1,3-Dichloropropene	trans-2-butene

Not all pollutants were collected in every year (for example Ethanol was listed in the suite of chemical compounds that were analyzed in 1998, however, it was deemed not to be an ambient concern and thus dropped in 2004 while Toluene data spans all of the years). Also, not all sites were active for all years. The Rumford Area Parking Lot (RAP) site was collecting data for the entire time, but sites like West Paris Shirley Dam (WPSD) and Mexico Labonville Store (MLS) sites were only operational for part of the time. Finally, not all pollutants were gathered using the same procedure. Some were gathered as part of the PAMS network, some were analyzed using the SCAN mode of the GC/MS, and there were some (and this is the current method) analyzed using the SIM mode of the GC/MS. The 28 compounds listed in Table 3 are the current suite of compounds.

Table 3

1,1,2,2-Tetrachloroethane	1,1,2-Trichloroethane	1,2,4-Trichlorobenzene
1,3-Butadiene	1,3-Dichloropropene	Carbon Tetrachloride
1,4-Dichlorobenzene	Acrolein	Ethyl Chloride
Benzene	Chloroform	Ethylene Dichloride
Ethylbenzene	Ethylene Dibromide	Methyl Bromide
Ethylidene Dichloride	MTBE	Methyl Isobutyl Ketone
Methyl Chloride	Methyl Ethyl Ketone	Tetrachloroethylene
Methylene Chloride	Propylene Dichloride	Vinyl Chloride

Toluene	Trichloroethylene	
Vinylidene Chloride	m,p Xylenes	

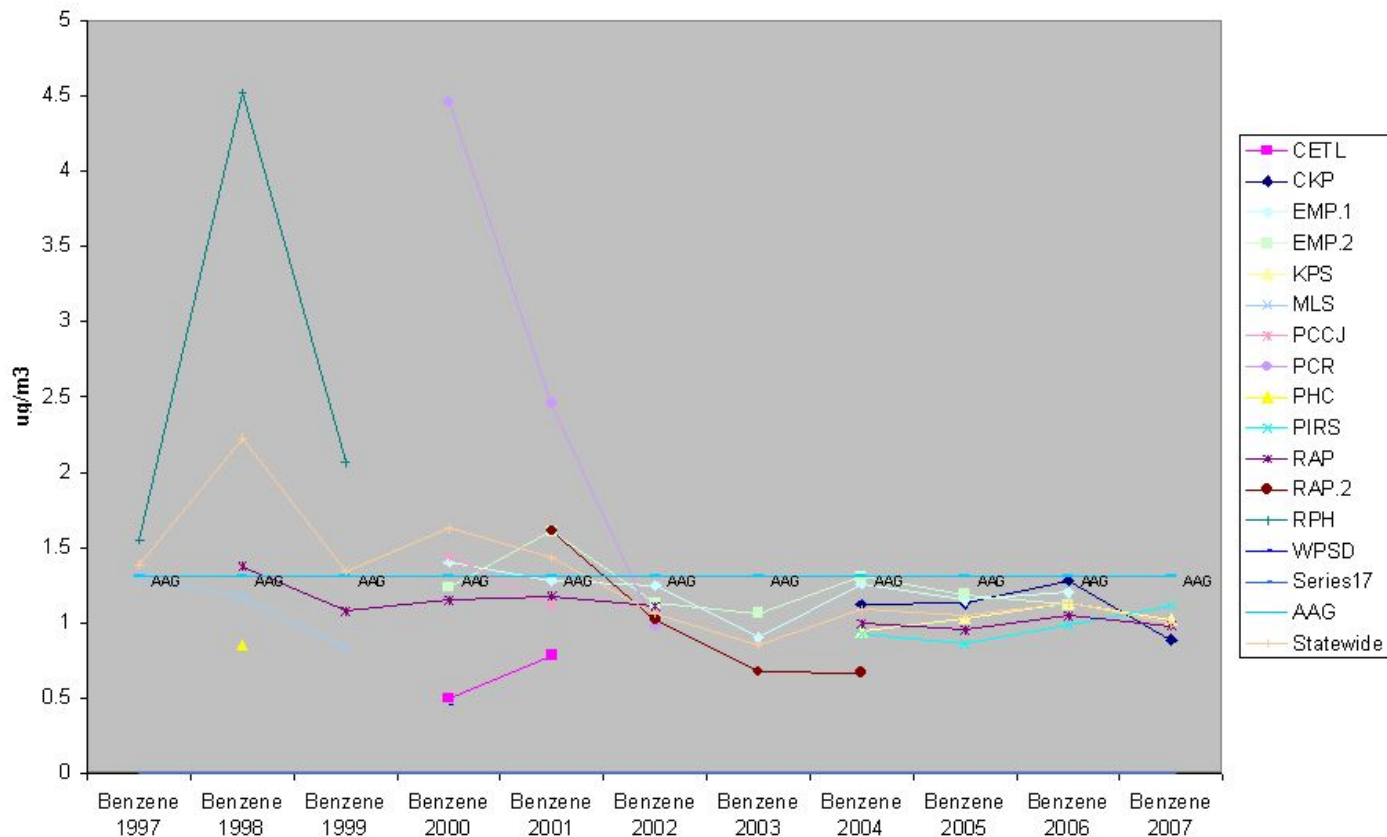
The Excel spreadsheet Ancient tabletoeportconverted to micrograms_Crosstab.xls summarizes all of the ambient air monitoring data that has been collected to date. The only pollutants to exceed ambient air quality guidelines on an annual basis are: Acetaldehyde, Acrolein, Benzene, Carbon tetrachloride, Dibromochloromethane, and Ethylene oxide. All other measured pollutant are below the Maine AAGs.

Pollutant	Year	AAG	Total Of AMBIENT	CETL	CKP	EMP.1	EMP.2	KPS	MLS	PCCJ	PCR	PHC	PIRS	RAP	RAP.2	RPH	WPSD
Acetaldehyde	2006	4.54	9.326923077		8.170	13.711	7.135							7.507			
Acrolein	1998	0.02	1.096864407						2.513			0.724		0.275		0.070	
Acrolein	2006	0.02	0.0434		0.011	0.124	0.079	0.000					0.000	0.076			
Benzene	1997	1.31	1.386666667						1.305							1.550	
Benzene	1998	1.31	2.227372881						1.166			0.854		1.375		4.518	
Benzene	1999	1.31	1.342460317						0.831					1.080		2.063	
Benzene	2000	1.31	1.629357798	0.499		1.409	1.238			1.443	4.455			1.149			0.455
Benzene	2001	1.31	1.432811502	0.786		1.282	1.607			1.118	2.456			1.180	1.611		
Carbon Tetrachloride	1998	0.69	0.728474576						0.712			0.776		0.832		0.674	
Carbon Tetrachloride	1999	0.69	0.709365079						0.693					0.745		0.692	
Dibromochloromethane	1999	0.0004	0.019206349						0.021					0.038		0.000	
Dibromochloromethane	2000	0.0004	0.006972477	0.000		0.000	0.000			0.000	0.000			0.036			0.000
Dibromochloromethane	2001	0.0004	0.000990415	0.006		0.000	0.000			0.000	0.000			0.000	0.000		
Dibromochloromethane	2002	0.0004	0.006428571			0.000	0.000				0.030			0.000	0.000		
Ethylene Oxide	2006	0.11	0.166153846		0.170	0.231	0.134							0.137			

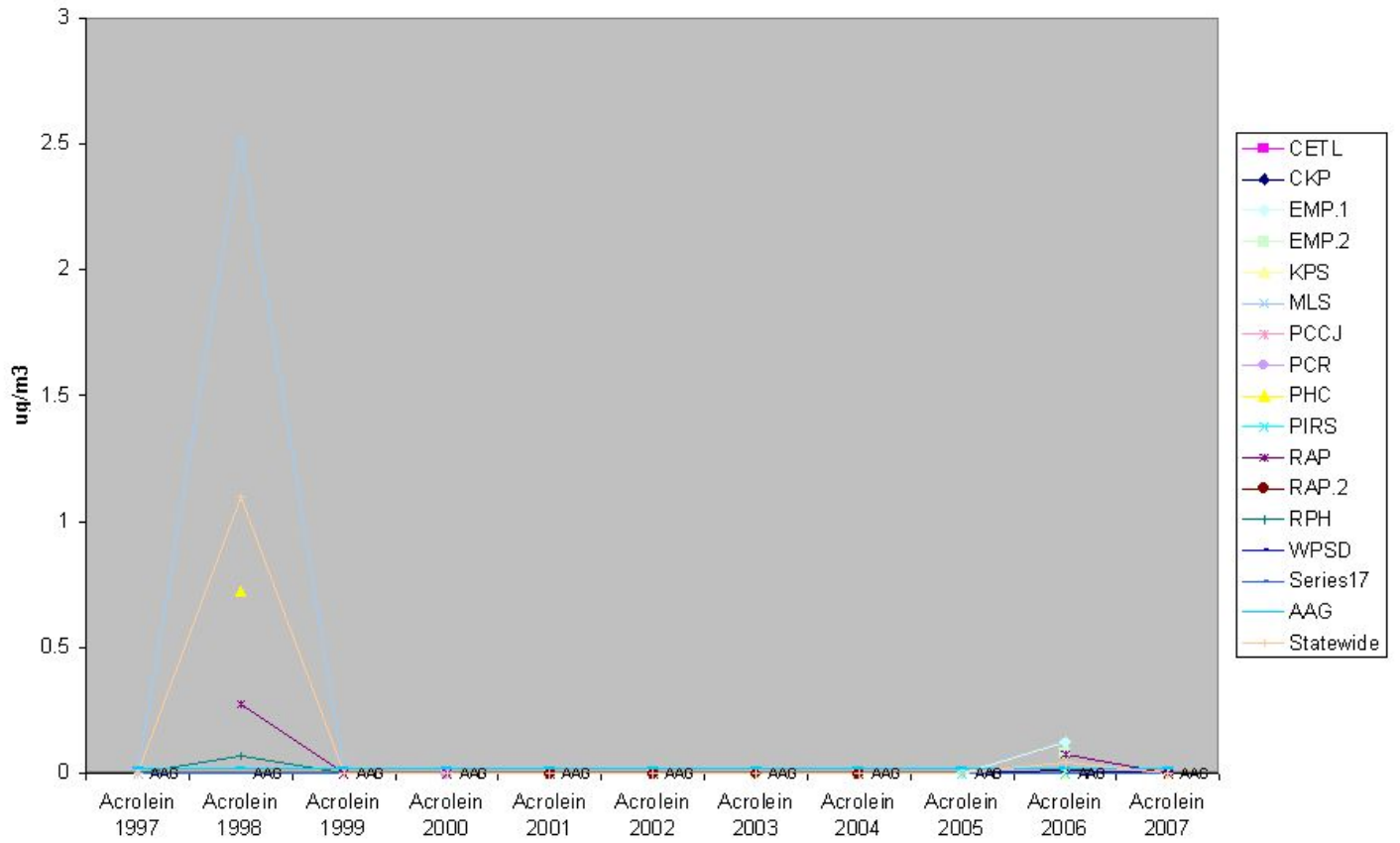
Pollutant		acetaldehyde	Acrolein	Benzene	Carbon Tetrachloride	Dibromochloromethane	ethylene oxide	
Ambient Guideline		4.54	0.02	1.31	0.69	0.0004	0.11	
Location	year							
CETL	2000	Sampled Value Average Detected Not Found	0.00 0 45	0.50 43 2	0.38 26 19	0.00 0 45		
	2001	Sampled Value Average Detected Not Found	0.00 0 52	0.79 45 7	0.61 25 27	0.01 1 51		
CKP	2004	Sampled Value Average Detected Not Found	0.00 0 1	1.12 26 0	0.66 26 0			
	2005	Sampled Value Average Detected Not Found	0.00 0 2	1.12 53 1	0.60 53 1	0.00 0 1		
	2006	Sampled Value Average Detected Not Found	8.17 1 0	0.01 1 40	1.24 47 4	0.56 47 4	0.00 0 3	0.17 1 0
	2007	Sampled Value Average Detected Not Found	0.00 0 18	0.87 18 0	0.49 18 0			
EMP#1	2000	Sampled Value Average Detected Not Found	0.00 0 32	1.48 32 0	0.46 22 10	0.00 0 32		
	2001	Sampled Value Average Detected Not Found	0.00 0 35	1.28 34 1	0.45 21 14	0.00 0 35		
	2002	Sampled Value Average Detected Not Found	0.00 0 1	1.25 1 0	0.62 1 0	0.00 0 1		
	2003	Sampled Value Average Detected Not Found	0.00 0 1	0.90 1 0	0.57 1 0	0.00 0 1		
	2004	Sampled Value Average Detected Not Found	0.00 0 6	1.27 43 3	0.68 43 3	0.00 0 3		
	2005	Sampled Value Average Detected Not Found	0.00 0 1	1.15 54 0	0.59 54 0			
	2006	Sampled Value Average Detected Not Found	13.71 8 0	0.10 8 29	1.16 46 1	0.57 46 1		0.23 8 0
EMP#2	2000	Sampled Value Average Detected Not Found	0.00 0 31	1.24 30 1	0.49 24 7	0.00 0 31		
	2001	Sampled Value Average Detected Not Found	0.00 0 54	1.61 54 0	0.30 21 33	0.00 0 54		
	2002	Sampled Value Average Detected Not Found	0.00 0 25	1.13 25 0	0.54 24 1	0.00 0 25		
	2003	Sampled Value Average Detected Not Found	0.00 0 32	1.06 32 0	0.56 32 0	0.00 0 32		
	2004	Sampled Value Average Detected Not Found	0.00 0 7	1.32 37 3	0.69 37 3	0.00 0 4		
	2005	Sampled Value Average Detected Not Found	0.00 0 0	1.19 54 0	0.59 54 0			
	2006	Sampled Value Average Detected Not Found	7.13 8 0	0.06 8 21	1.18 30 0	0.55 30 0		0.13 8 0
KPS	2004	Sampled Value Average Detected Not Found	0.00 0 1	0.95 35 2	0.65 35 2	0.00 0 2		
	2005	Sampled Value Average Detected Not Found	0.00 0 1	1.04 57 1	0.60 57 1	0.00 0 1		
	2006	Sampled Value Average Detected Not Found	0.00 0 37	1.14 45 1	0.59 45 1	0.00 0 1		
	2007	Sampled Value Average Detected Not Found	0.00 0 17	1.00 16 1	0.40 15 2	0.00 0 1		
MLS	1997	Sampled Value Average Detected Not Found	0.00 0 4	1.30 4 0	0.63 4 0	0.00 0 4		
	1998	Sampled Value Average Detected Not Found	2.51 7 36	1.17 43 0	0.71 42 1	0.00 0 43		
	1999	Sampled Value Average Detected Not Found	0.00 0 41	0.83 41 0	0.69 41 0	0.02 3 38		

		Pollutant	acetaldehyde	Acrolein	Benzene	Carbon Tetrachloride	Dibromochloromethane	ethylene oxide
		Ambient Guideline	4.54	0.02	1.31	0.69	0.0004	0.11
Location	year							
PCCJ	2000	Sampled Value Average Detected Not Found		0.00 0 4	1.44 4 0	0.36 2 2	0.00 0 4	
	2001	Sampled Value Average Detected Not Found		0.00 0 52	1.12 50 2	0.32 21 31	0.00 0 52	
PCR	2000	Sampled Value Average Detected Not Found		0.00 0 43	4.38 42 1	0.44 29 14	0.00 0 43	
	2001	Sampled Value Average Detected Not Found		0.00 0 53	2.46 51 2	0.36 18 35	0.00 0 53	
	2002	Sampled Value Average Detected Not Found		0.00 0 21	0.98 21 0	0.57 21 0	0.03 1 20	
PHC	1998	Sampled Value Average Detected Not Found		0.72 2 17	0.85 19 0	0.78 19 0	0.00 0 19	
PIRS	2004	Sampled Value Average Detected Not Found		0.00 0 5	0.94 42 2	0.67 42 2	0.00 0 2	
	2005	Sampled Value Average Detected Not Found		0.00 0 2	0.86 54 1	0.61 54 1	0.00 0 1	
	2006	Sampled Value Average Detected Not Found		0.00 0 39	0.98 44 3	0.54 44 3	0.00 0 1	
	2007	Sampled Value Average Detected Not Found		0.00 0 15	1.07 15 0	0.46 15 0		
RAP	1998	Sampled Value Average Detected Not Found		0.27 4 14	1.37 18 0	0.83 18 0	0.00 0 18	
	1999	Sampled Value Average Detected Not Found		0.00 0 41	1.08 41 0	0.75 41 0	0.04 3 38	
	2000	Sampled Value Average Detected Not Found		0.00 0 43	1.16 42 1	0.44 27 16	0.04 1 42	
	2001	Sampled Value Average Detected Not Found		0.00 0 47	1.18 45 2	0.35 21 26	0.00 0 47	
	2002	Sampled Value Average Detected Not Found		0.00 0 20	1.11 20 0	0.45 16 4	0.00 0 20	
	2004	Sampled Value Average Detected Not Found		0.00 0 6	1.02 43 4	0.69 43 4	0.00 0 4	
	2005	Sampled Value Average Detected Not Found			0.95 55 0	0.61 55 0		
	2006	Sampled Value Average Detected Not Found	7.51 9 0	0.06 9 37	1.06 53 3	0.55 53 3	0.00 0 2	0.14 9 0
2007	Sampled Value Average Detected Not Found		0.00 0 16	0.98 16 0	0.46 16 0			
RAP#2	2001	Sampled Value Average Detected Not Found		0.00 0 20	1.61 20 0	0.13 3 17	0.00 0 20	
	2002	Sampled Value Average Detected Not Found		0.00 0 31	1.02 30 1	0.55 28 3	0.00 0 31	
	2003	Sampled Value Average Detected Not Found		0.00 0 38	0.68 38 0	0.57 38 0	0.00 0 38	
	2004	Sampled Value Average Detected Not Found		0.00 0 1	0.67 1 0	0.44 1 0	0.00 0 1	
RPH	1997	Sampled Value Average Detected Not Found		0.00 0 2	1.55 2 0	0.68 2 0	0.00 0 2	
	1998	Sampled Value Average Detected Not Found		0.07 2 36	4.52 37 1	0.67 36 2	0.00 0 38	
	1999	Sampled Value Average Detected Not Found		0.00 0 44	2.06 44 0	0.69 43 1	0.00 0 44	
WPSD	2000	Sampled Value Average Detected Not Found		0.00 0 39	0.45 38 1	0.56 35 4	0.01 1 38	

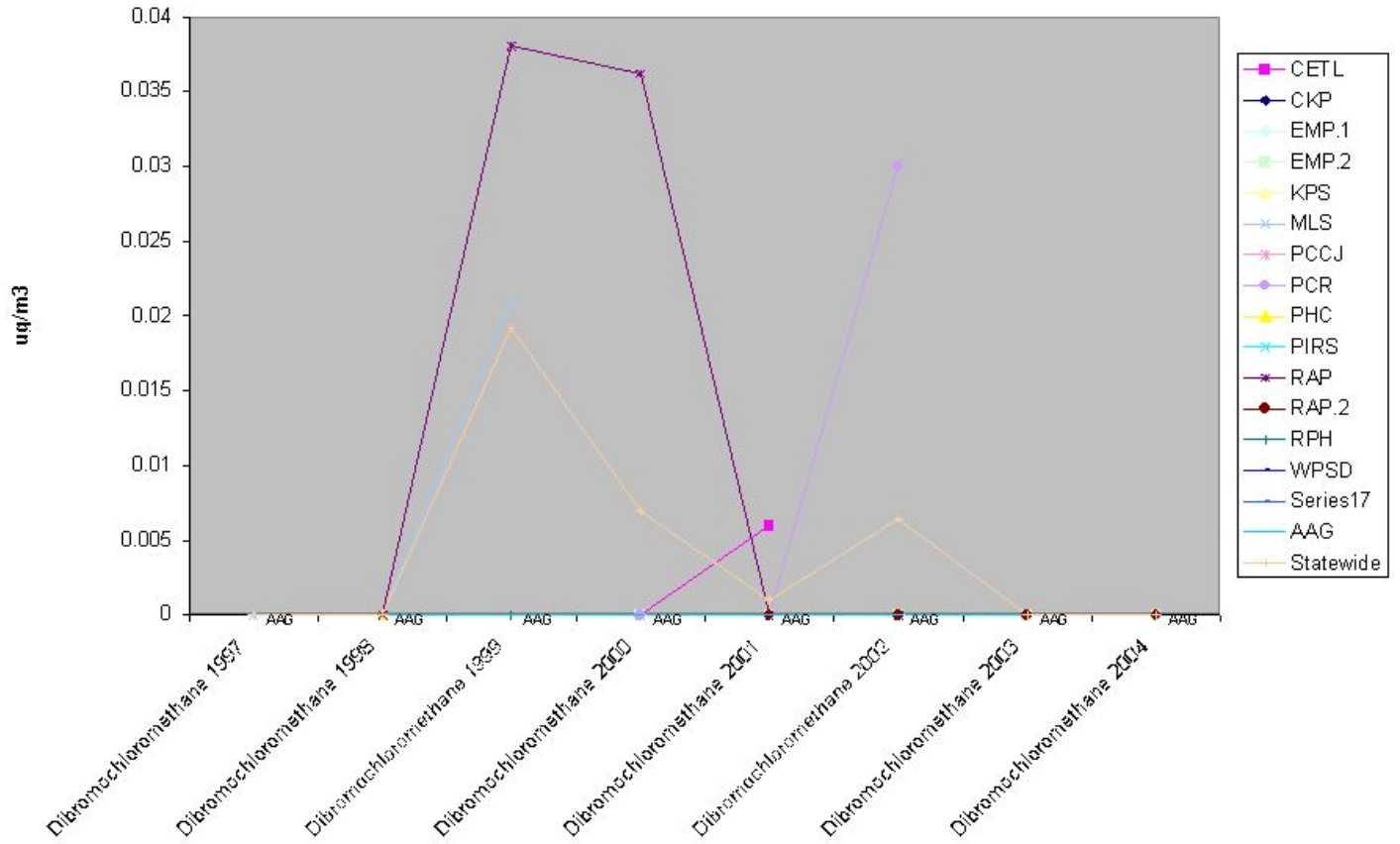
Ambient Air Pollution in Maine



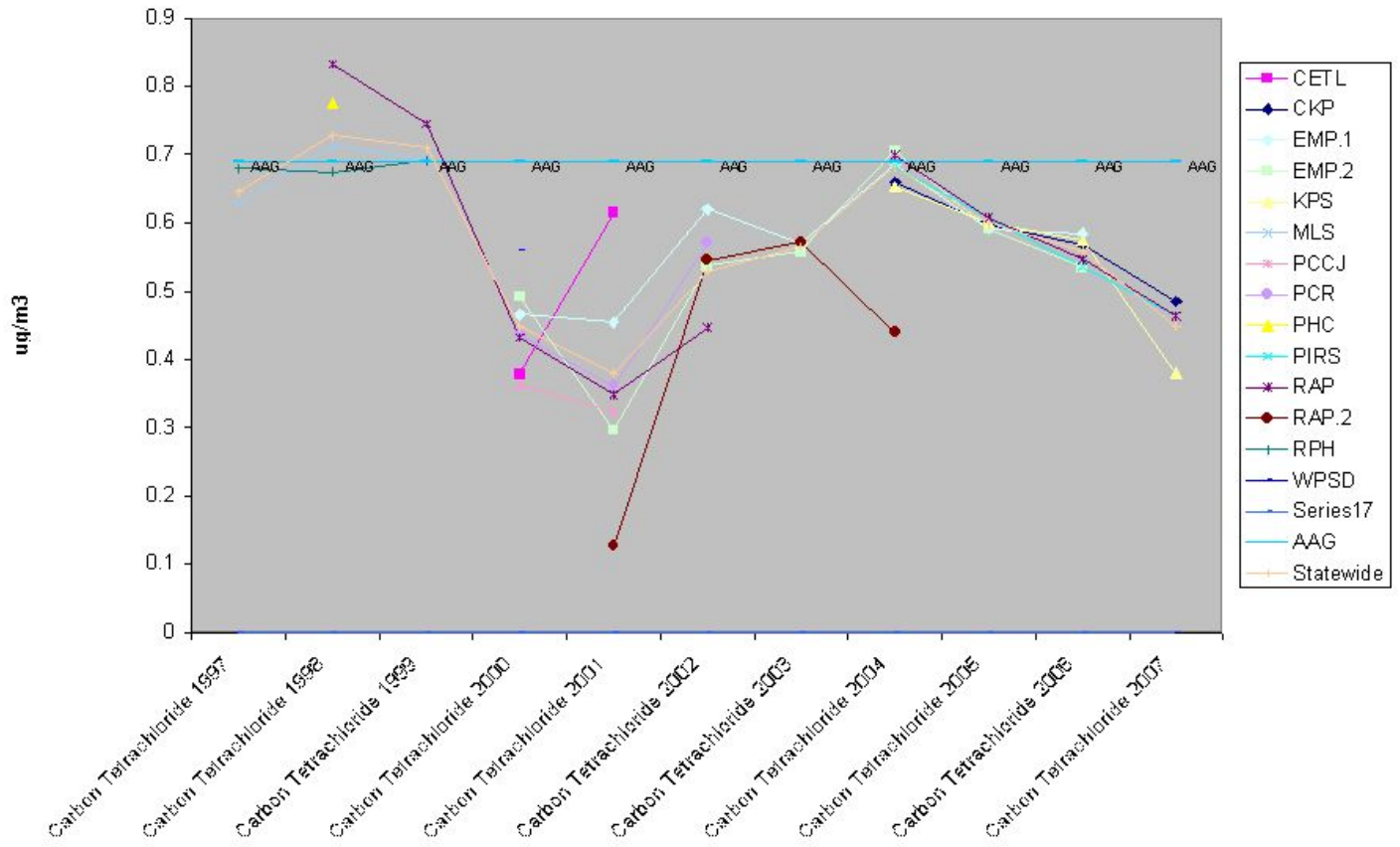
Ambient Air Pollution in Maine



Ambient Air Pollution in Maine



Ambient Air Pollution in Maine



What do these charts and tables mean?

Benzene

Benzene is found at every site around the state. The ambient levels hover (in most cases) right around the AAG. The lowest annual averages were found at CETL in 2000 (0.5 ug/m³) and 2001 (0.79 ug/m³), and RAP#2 in 2003 (0.68 ug/m³) and 2004 (0.672 ug/m³). Unfortunately, only 1 sample was collected at RAP#2 in 2004, so the annual average is not statistically valid. The other years all had a higher number of collected samples, so the confidence in the annual average is much better. The highest values were found at RPH in 1998 (4.51 ug/m³) and 1999 (2.06 ug/m³), and PCR in 2000 (4.38 ug/m³) and 2001 (2.46 ug/m³). The number of samples collected at each one of these high sites is adequate to give us great confidence in the values, however, an explanation for these higher values still eludes us. We have not exceeded the AAG for benzene since 2001.

Acrolein

Acrolein is a very difficult chemical to measure. This has been documented in another document. The highest value (2.51 ug/m³) was found at the Labonville store in Mexico (MLS). This, as well as all of the ambient data were confounded by the fact that there were always more “non-detects” than “detects”. In this report all of the “non-detects” were counted as zeroes. At MLS in 1998, there were 36 “non-detects” and only 7 “detects”. That means there were 36 zeroes factored into the average. The detected samples were: 85.1 ug/m³, 13.8 ug/m³, 2.3 ug/m³, 5.29 ug/m³, 0.437 ug/m³, 0.299 ug/m³ and 0.851 ug/m³. These samples were collected in the winter, summer and fall. Although there are too few samples to say for sure that there is not a seasonal effect, it doesn't seem like there is one. Another way of looking at this data is to ignore the “non-detects” so that they do not factor into the average. This yields a mean value of 15.44 ug/m³. Factoring the “non-detect” at half the detection limit is another way. This was not done, but empirically, one could tell that the mean would be closer to the 2.51 value than the 15.44 value.

Carbon tetrachloride

Carbon tetrachloride is a background pollutant with no known manmade “active” sources. The highest values were found at RAP in 1998 (0.83 ug/m³) and 1999 (0.75 ug/m³). These two annual averages would be the same if you ignored the “non-detect”, because there weren't any. The lowest value (0.126 ug/m³) was found at the RAP2 site in 2001. It, however had just 3 “detects” and 17 “non-detects”, and therefore is greatly influenced by the “zero effect”. Ignoring the “non-detects” gives us a mean of 0.840 ug/m³. For the most part, most of the annual averages that hover right around the AAG (0.69 ug/m³) have very few “non-detects” while those with lower annual averages seem to have many “non-detects”. The trend seems to be going down.

Dibromochloromethane

This compound has never appeared on our radar screen in the past. It is used on a very small scale in research laboratories, however, it can be formed when chlorine reacts with other naturally occurring substances in water, such as decomposing plant material. Plants in the ocean also produce small amounts of this chemical. As seen in the table, dibromochloromethane is hardly ever found in the ambient air, and the reason that it is included in this analysis is because the AAG is microscopically small.

Ethylene oxide and Acetaldehyde

A graph for ethylene oxide and acetaldehyde were not included because the annual averages for both chemicals are based on very few samples. They are included in the table however, since they do both exceed the AAG.