

Volatile organic compounds (VOCs) in Office Air and Outdoor Air
Data from Indoor Air Technologies Inc. building IAQ investigations
conducted between 2002 and 2004

Office air was sampled with Perkin Elmer Air Toxic Tubes containing Carbopack B plus Carboxen 1000 separated by glass/quartz wools sorbent tubes. Volatile organic compounds were obtained via thermal desorption and analyzed using gas chromatography/mass spectrometry (GC/MS), the NIST Mass spectral database, reference calibration compounds (acetone, toluene and 35 VOCs commonly found in indoor environments) to provide semi-quantitative concentrations to the ppb level. Area sources are identified through air movement and diffusion analyses, and potential source and area VOC fingerprint comparisons. AM = arithmetic mean. SD = standard deviation. TVOC = total volatile organic compounds.

Office work day rank	VOC	Office workday AM 7 bldgs ($\mu\text{g}/\text{m}^3$)	Office workday SD ($\mu\text{g}/\text{m}^3$)	Office night/ Weekend AM 3 bldgs ($\mu\text{g}/\text{m}^3$)	Office night/ weekend SD ($\mu\text{g}/\text{m}^3$)	Outdoor air AM 3 bldgs ($\mu\text{g}/\text{m}^3$)	Outdoor air SD ($\mu\text{g}/\text{m}^3$)
	TVOC	606.0	52.2	250.2	32.5	64.2	65.4
	Sum of individual VOCs not quantified	94.4	16.7	35.9	10.7	18.7	23.6
1	Cyclopentasiloxane, decamethyl-	95.3	21.0	38.9	2.3	0.3	0.5
2	Ethanol	75.1	15.5	27.6	10.6	0.0	0.0
3	Limonene	24.9	4.0	5.6	5.9	0.0	0.0
4	Acetone	24.9	3.2	15.2	4.2	3.2	2.9
5	Benzene, 1,4-dichloro-	23.8	2.0	0.3	0.4	0.0	0.0
6	Cyclohexane, methyl-	19.2	1.8	3.9	2.3	0.0	0.0
7	Pentane, 2,3,3-trimethyl-	16.1	11.3	0.0	0.0	0.0	0.0
8	Cyclohexane	14.1	2.3	2.4	2.6	1.3	1.9
9	Propylene glycol	13.2	31.6	0.0	0.0	0.3	0.5
10	Isobutane	12.1	6.2	3.2	4.5	0.3	0.5
11	Toluene	10.6	2.4	2.9	1.3	4.8	6.5
12	Pentane, 2,3,4-trimethyl-	10.1	7.1	0.0	0.0	0.0	0.0

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13	Butane	9.9	0.9	2.9	0.9	0.7	0.9
14	Acetaldehyde	9.5	2.5	11.3	3.4	1.2	1.3
15	Butane, 2-methyl-	9.2	0.7	9.0	3.9	2.0	2.2
16	Hexane, 3-methyl-	8.1	3.8	2.3	0.9	1.7	2.4
17	Trichloromonofluoromethane	7.7	5.5	21.1	23.0	1.8	1.3
18	Cyclotrisiloxane, hexamethyl-	7.6	1.0	3.5	0.7	2.2	2.7
19	1,3-Butadiene, 2-methyl-	6.7	2.3	2.7	3.1	0.3	0.5
20	Hexane, 2,2,5-trimethyl-	6.5	4.5	0.0	0.0	0.0	0.0
21	Isopropyl alcohol	6.5	6.8	2.3	1.2	0.0	0.0
22	Pentane	6.0	0.5	4.8	2.3	1.8	1.0
23	Cyclotetrasiloxane, octamethyl-	5.2	1.2	3.6	0.9	0.7	0.9
24	Propanal (Propionaldehyde)	5.1	5.6	1.2	1.3	1.0	1.4
25	Hexane, 2-methyl-	4.9	1.1	2.2	0.5	1.2	1.3
26	Heptane	4.5	0.7	1.3	0.5	1.0	1.4

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27	Carbon tetrachloride	4.2	0.4	3.4	2.0	2.3	1.2
28	Hexane	3.9	1.2	2.0	2.2	0.5	0.4
29	Benzene	3.9	0.2	2.2	1.0	1.0	0.8
30	Cyclohexasiloxane, dodecamethyl-	3.8	0.6	0.9	0.8	0.0	0.0
31	Pentane, 2-methyl-	3.3	0.8	1.3	1.0	1.0	0.8
32	Hexanal (Carproaldehyde)	3.0	0.9	3.2	0.2	0.0	0.0
33	m/p-Xylene	2.4	2.3	1.8	1.4	0.5	0.4
34	Pentane, 3-methyl-	2.2	0.5	0.9	1.1	1.2	0.8
35	Propane	2.2	0.7	1.2	1.6	0.0	0.0
36	Undecane	2.2	0.6	1.1	0.7	0.2	0.2
37	Propene	2.1	1.3	1.0	1.4	0.0	0.0
38	Tetradecane	2.0	3.7	0.2	0.2	0.0	0.0
39	Pentane, 2,3-dimethyl-	1.9	1.3	0.1	0.2	1.0	1.4
40	Acetic acid	1.8	1.4	1.0	1.4	1.0	0.8

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41	Pentadecane	1.8	2.7	0.1	0.1	0.3	0.5
42	Dichlorodifluoromethane	1.7	2.0	1.3	1.9	1.3	1.9
43	Ethane, 1,1,1-trichloro-	1.7	1.0	1.9	0.8	1.0	1.4
44	Pentane, 2,4-dimethyl-	1.5	0.0	0.0	0.0	0.0	0.0
45	Ethane, 1-chloro-1,1-difluoro-	1.4	1.2	6.3	9.0	0.0	0.0
46	.alpha.-Pinene	1.3	1.6	0.4	0.3	0.0	0.0
47	Hexane, 2,3,5-trimethyl-	1.3	0.7	0.0	0.0	0.0	0.0
48	Decane	1.2	1.0	0.3	0.5	0.0	0.0
49	Ethanol, 2-butoxy-	1.2	4.5	0.9	1.3	0.0	0.0
50	Methane, chlorodifluoro-	1.1	1.3	0.0	0.0	0.0	0.0
51	Dibenzofuran	1.0	4.6	0.0	0.0	0.3	0.5
52	Dodecane	0.9	0.5	0.3	0.5	0.0	0.0
53	Hexane, 2,2,5,5-tetramethyl-	0.9	0.2	0.0	0.0	0.0	0.0
54	Hexane, 3,4-dimethyl-	0.9	0.2	0.0	0.0	0.0	0.0
55	Octane, 2,2-dimethyl-	0.9	0.2	0.0	0.0	0.0	0.0
56	Biphenyl	0.9	4.2	0.0	0.0	0.0	0.0
57	Pentane, 2,2-dimethyl-	0.8	0.0	0.0	0.0	0.0	0.0
58	Cyclopentane, methyl-	0.8	0.4	0.1	0.1	1.0	0.0
59	2-Butanone (methyl ethyl ketone)	0.7	0.4	0.7	0.9	0.3	0.5

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60	2-Propenal (Acrolein)	0.7	1.5	0.7	0.9	0.0	0.0
61	Octane, 3,3-dimethyl-	0.7	0.0	0.0	0.0	0.0	0.0
62	1-Propanol	0.7	1.1	0.7	0.9	0.0	0.0
63	Ethyl acetate	0.7	0.5	0.1	0.1	0.0	0.0
64	Nonanal	0.7	0.5	1.8	0.2	0.0	0.0
65	Hexane, 2,4-dimethyl-	0.6	1.6	0.0	0.0	0.0	0.0
66	Pentane, 2,2,3-trimethyl-	0.5	1.4	0.0	0.0	0.0	0.0
67	Pentane, 3,3-dimethyl-	0.5	0.0	0.0	0.0	0.0	0.0
68	2-Propenol	0.4	0.8	0.0	0.0	0.0	0.0
69	Decane, 4-methyl-	0.4	1.3	0.0	0.0	0.0	0.0
70	Diethylene glycol butyl ether	0.4	1.2	0.0	0.0	0.0	0.0
71	Cyclohexane, butyl-	0.4	1.1	0.0	0.0	0.0	0.0
72	Decane, 5-methyl-	0.4	1.1	0.0	0.0	0.0	0.0
73	Nonane, 3,7-dimethyl-	0.4	0.0	0.0	0.0	0.0	0.0
74	Tetrasiloxane, decamethyl-	0.4	0.0	0.0	0.0	0.0	0.0
75	Methylene chloride	0.4	1.0	0.4	0.5	2.2	2.7
76	Cyclopentane, pentane	0.3	0.9	0.0	0.0	0.0	0.0
77	Formic acid	0.3	1.2	0.0	0.0	0.0	0.0
78	Benzoic acid	0.3	1.7	0.0	0.0	0.0	0.0
79	Norflurane	0.3	3.3	0.1	0.2	0.0	0.0
80	1-Hexanol, 2-ethyl-	0.3	0.8	0.0	0.0	0.0	0.0
81	Cyclopentane, 1,2-dimethyl-	0.3	0.0	0.0	0.0	0.0	0.0
82	Decane, 2,2-dimethyl-	0.3	0.0	0.0	0.0	0.0	0.0

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83	Naphthalene	0.3	0.0	0.0	0.0	0.0	0.0
84	o-Xylene	0.3	0.5	0.1	0.2	0.0	0.0
85	Ethylbenzene	0.3	0.8	0.2	0.2	0.0	0.0
86	Propanal, 2-methyl- (Isobutyraldehyde)	0.3	0.7	0.0	0.0	0.0	0.0
87	Benzene, 1,2,4-trimethyl-	0.3	0.3	0.0	0.0	0.0	0.0
88	Cyclohexane, propyl-	0.3	0.8	0.0	0.0	0.0	0.0
89	Heptane, 3-ethyl-2-methyl-	0.3	0.8	0.0	0.0	0.0	0.0
90	Benzaldehyde	0.2	0.4	0.7	0.2	0.0	0.0
91	Phenol	0.2	1.1	0.1	0.1	0.0	0.0
92	Hexadecane	0.2	1.1	0.0	0.0	0.0	0.0
93	Methyl isobutyl ketone	0.2	1.9	0.0	0.0	0.0	0.0
94	Octane	0.2	0.6	0.0	0.0	0.0	0.0
95	Butanal (Butyraldehyde)	0.2	0.6	0.2	0.2	0.8	0.8
96	Tridecane	0.1	0.7	0.0	0.0	0.0	0.0
97	2-Propen-1-ol	0.1	0.8	0.0	0.0	0.0	0.0
98	Butyl acetate	0.1	1.6	0.0	0.0	0.0	0.0
99	Dodecane, 2,6,10-trimethyl-	0.1	0.6	0.0	0.0	0.0	0.0
100	Ethanol, 2-(2-butoxyethoxy)- (Butyl diglycol)	0.1	0.6	0.0	0.0	0.0	0.0
101	1,1-Dichloro-1-fluoroethane	0.1	0.7	4.2	5.5	0.0	0.0
102	Ethane, 1,1,2-trichloro-1,2,2-trifluoro-	0.1	0.4	0.2	0.2	1.5	0.4

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103	Vinyl acetate	0.1	0.4	0.0	0.0	0.0	0.0
104	Tridecane, 2-methyl-	0.1	0.4	0.0	0.0	0.0	0.0
105	Tridecane, 3-methyl-	0.1	0.4	0.0	0.0	0.0	0.0
106	Acetophenone	0.1	0.3	0.0	0.0	0.0	0.0
107	Decanal	0.1	0.2	0.2	0.2	0.0	0.0
108	Caprolactam	0.1	0.4	0.0	0.0	0.0	0.0
109	1-Propene, 2-methyl-	4.5E-02	3.8E-01	1.7E-01	2.4E-01	0.0E+00	0.0E+00
110	1-Butanol	4.2E-02	3.3E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00
111	Isopropyl adipate	3.6E-02	1.9E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00
112	Acetonitrile	2.8E-02	5.3E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00
113	Tetrachloroethylene	2.8E-02	3.1E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00
114	Octanal	2.6E-02	1.6E-01	5.6E-02	7.9E-02	0.0E+00	0.0E+00
115	2-Propanol, 1-methoxy-	2.4E-02	4.7E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00
116	1,2-Butadiene, 3-methyl-	2.1E-02	4.0E-01	0.0E+00	0.0E+00	1.7E-01	2.4E-01
117	Silanol, trimethyl-	2.1E-02	2.8E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00
118	2,4-Di-tert-butylphenol	1.4E-02	1.9E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00
119	2-Propanol, 2-methyl-	1.4E-02	2.1E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00
120	Ethanol, 2-phenoxy-	1.4E-02	2.1E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00
121	Menthol	1.0E-02	1.1E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00
122	1-Propanol, 2,2-dimethyl-	7.0E-03	1.3E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00
123	Carbon disulfide	7.0E-03	1.3E-01	1.1E-01	1.6E-01	0.0E+00	0.0E+00

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124	Ethanol, 2-(2-ethoxyethoxy)- (Diethylene glycol ethyl ether)	7.0E-03	1.3E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00
125	Isopropyl Myristate	7.0E-03	1.3E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00
126	Nonane, 2,2,4,4,6,8,8-heptamethyl-	7.0E-03	1.3E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00
127	Octane, 1,1'-oxybis-	7.0E-03	1.3E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00
128	p-Isopropyltoluene	7.0E-03	1.3E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00
129	Styrene	7.0E-03	9.3E-02	5.6E-02	7.9E-02	0.0E+00	0.0E+00
130	3-Buten-2-one	3.5E-03	6.7E-02	0.0E+00	0.0E+00	0.0E+00	0.0E+00
131	Benzene, 1,2,3-trimethyl-	3.5E-03	6.7E-02	0.0E+00	0.0E+00	0.0E+00	0.0E+00
132	Cyclohexane, isothiocyanato-	3.5E-03	6.7E-02	0.0E+00	0.0E+00	0.0E+00	0.0E+00
133	Decane, 2,2,8-trimethyl-	3.5E-03	6.7E-02	0.0E+00	0.0E+00	0.0E+00	0.0E+00
134	Decane, 2,6,8-trimethyl-	3.5E-03	6.7E-02	0.0E+00	0.0E+00	0.0E+00	0.0E+00
135	Geranylacetate	3.5E-03	6.7E-02	0.0E+00	0.0E+00	0.0E+00	0.0E+00
136	Heptane, 2,2,4,6,6-pentamethyl-	3.5E-03	6.7E-02	0.0E+00	0.0E+00	0.0E+00	0.0E+00
137	Decane, 2,6,6-trimethyl-	1.1E-03	2.2E-02	0.0E+00	0.0E+00	0.0E+00	0.0E+00
138	Heptanoic acid	1.1E-03	2.2E-02	0.0E+00	0.0E+00	0.0E+00	0.0E+00