



Project Summary

Indoor Air Quality Data Base for Organic Compounds

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A data base for concentrations of organic compounds measured indoors has been compiled. Based on a review of the literature from 1979 through 1990, the data base contains information on over 220 compounds ranging in molecular weight from 30 to 446. The compounds are arranged in order of increasing number of carbon atoms, - from 1 to 31. The data base contains: the number of carbon atoms; the name of the compound; its empirical formula; its molecular weight; the odor threshold (when available); the minimum, maximum, median, and mean concentrations; the standard deviation; the reference number; the sampling time; and the type of building. All concentration data are given in micrograms per cubic meter. The following compounds were the most frequently reported: formaldehyde, tetrachloroethylene, 1,1,1-trichloroethane, trichloroethylene, benzene, p-dichlorobenzene, toluene, ethylbenzene, xylenes, decane, and undecane. About 50% of the reported compounds contained 9 carbon atoms or fewer, and 90% had 23 carbon atoms or fewer. Sampling times for the pollutants varied from as little as 15 minutes to as long as 2 weeks. Grab sampling, real time sampling, and integrated sampling methods were used. Odor thresholds for the pollutants reported were, in general, three to five orders of magnitude higher than the measured concentrations.

This Project Summary was developed by EPA's Air and Energy Engineering Research Laboratory, Research Triangle Park, NC, to announce key find-

ings of the research project that is fully documented in a separate report of the same title (see Project Report ordering information at back).

Introduction

Many pollutants found in ambient air are present to a larger extent in indoor air. Thus, indoor air might present problems with regard to potential health effects. Since most of the efforts directed toward ambient air analysis were with respect to the criteria pollutants, it was natural that these pollutants would be the first to be studied in indoor air. In indoor air, such pollutants as carbon dioxide, carbon monoxide, nitrogen oxides, and particulate matter have been studied extensively.

Of the organic compounds, particularly the volatile organic compounds (VOCs), only formaldehyde has been studied extensively in indoor air. Yet many sources of organic compounds in indoor air have their origins in commonly used materials. Such materials include caulking compounds, hair sprays, rug cleaners, and paints and varnishes. In addition, building materials and interior furnishings (such as furniture, floor tile, draperies, and rugs) may be sources of organic compounds.

This report provides hard copy of a data base of indoor concentrations of vapor-phase organic compounds based on a review of the literature through 1990. Disks containing the data are not available.

Data Base Description

Appendix A of the report presents the data base (see the example in Table 1). It contains approximately 220 organic compounds ranging from 1- to 31-carbon atom



Table 1. Example from IAQ Data Base

C	Compound	Formula	Mol. Wt.	Odor $\mu\text{g}/\text{m}^3$	Meas. Conc. ($\mu\text{g}/\text{m}^3$)				S.D.	Ref.	Time h	Bldg. Type
					Min.	Max.	Median	Mean				
2	Acetaldehyde	C2H4O	44	1,980 20		48		17 2.1		1 24	4-7D 8	R,A OB
2	Ethanol	C2H6O	46	93,000 2.07e + 05		767 1374 408				3 3 3	0.25-3 0.25-3 0.25-3	R R R
2	N-Nitroso-Dimethylamine	C2H6N2O	74			0.33		0.17		8		AU
3	Propane	C3H8	44	1.80e + 06		42				3	0.25 - 3	R
3	Isopropanol (Propanol-2)	C3H8O	60	90,000		140 258 80		6.9		3 3 3 24 37	0.25 - 3 0.25 - 3 0.25 - 3 8 8	R R R OB OB
3	Acetone (Propanone)	C3H6O	58	7.70e + 05 2.12e + 05 47,500		157 67		39 7.5		1 24 37	4-7D 8	R,A OB OB
3	Lactic Acid	C3H6O3	90	1.60e + 05		1.8 0.6				10 10		OB OB

compounds. These compounds range in molecular weight from 30 to 446. The compounds are arranged in order of increasing number of carbon atoms. The data are taken from the references listed in Appendix C. Reference numbers are listed in the column labeled REF in the data base.

The odor threshold values in the fifth column of the primary data base were taken from several references. In cases where several odor threshold values are given for the same compound, the values may differ by as much as an order of magnitude. This should not be surprising in view of the subjective judgement required in such tests. Also, different investigators used different test methods, and the number of subjects involved varied considerably. In some cases, impurities in the test materials may have altered the results.

Minimum, maximum, median, and/or mean concentrations (in micrograms per cubic meter) are presented in the appropriate columns. Where compounds were identified but not quantified, all the columns are blank. In most cases, decimal notation is used; for very large and very small numbers, scientific notation is used. The standard deviations of the data are also given, when available.

The column labeled TIME (second from last column) is the sampling time in hours, except where otherwise indicated. In this column, a "D" indicates the time in days and a "W" indicates weeks.

In the column labeled BLDG. TYPE, the type of building investigated is given as follows: A = Apartment, AU = Automobile, CB = Commercial Building, H = Hospital, MH = Mobile Home, NH = Nursing Home, OB = Office Building, R = Residence, S = School, and V = Various types of buildings.

Appendix B of the report contains information on "Sources of Indoor Organic Compounds" (see the example in Table 2). It lists substantiated and possible sources for most of the indoor pollutants contained in the data base. The information in Appendix B should be used with some caution, because the composition of materials and products changes over time as manufacturers alter their manufacturing processes and products.

Observations

A review of the data shows concentrations of pollutants ranging from below the quantification level to more than 80,000 $\mu\text{g}/\text{m}^3$. There is a paucity of data on the standard deviation of concentration val-

ues reported in the literature. It is important for users of the data to know the standard deviation in order to know how much confidence to place in the reported values. Other than listing the standard deviation, when reported, this report makes no effort to judge the quality of the data. To do this, the reader should obtain a copy of the reference and use his or her own judgement.

About 50% of the compounds listed contained 9 carbon atoms or fewer; about 90% had 23 carbon atoms or fewer.

The following compounds were the most frequently reported: formaldehyde, tetrachloroethylene, 1,1,1-trichloroethane, trichloroethylene, benzene, p-dichlorobenzene, toluene, ethylbenzene, xylenes, decane, and undecane.

Sampling times for the pollutants varied widely, from as little as 15 minutes to as long as 2 weeks. Grab sampling, real time sampling, and integrated sampling were used.

Odor thresholds for the pollutants were, in general, three to five orders of magnitude higher than the concentrations actually measured. One cannot, therefore, expect to detect the presence of a pollutant through odor alone.

Table 2. Example from Source Data Base

C	Compound	Formula	Substantiated Sources	Possible Sources
2	Ethanol	C2H6O	fiberboard	solvent, antifreeze, tobacco smoke
2	N-Nitroso-Dimethylamine	C2H6N2O	auto interior furnishings	gasoline
3	Propane	C3H8	auto exhaust	fuel gas, refrigerant, tobacco smoke
3	Isopropanol	C3H8O	particle board	antifreeze, solvent for gums, shellac, essential oils, cosmetics
3	Acetone (Propanone)	C3H6O	lacquer solvent, auto exhaust	tobacco smoke, pharmaceuticals
3	Lactic Acid	C3H6O3		
3	Pyruvic Acid	C3H4O3		medicinal ointments
3	1, 2 - Dichloropropane	C3H6Cl2		
3	Dibromochloropropane	C3H5Br2Cl		
4	Ethylacetate	C4H8O2	linoleum floor covering	artificial fruit essences, solvent for varnishes and lacquers, perfume, artificial leather
4	Butane	C4H10	fuel, tobacco smoke	
4	Isobutane	C4H10	fuel	
4	Diethylamine	C4H11N		resins, dyes, pharmaceuticals, synthetic rubber
4	Dimethylacetamide	C4H10O2N		solvent for many organic reactions
4	N-Butylacetate	C4H10O2	floor lacquer	
4	I-Butylacetate	C4H10O2	floor lacquer	
4	1,4-Dioxane	C4H8O2		solvent for many oils, waxes, dyes, cellulose acetate
4	N-Butanol	C4H10O	edge sealing molding tape, jointing compound, cement flagstone, linoleum	flavors, perfumes, industrial cleaners, paint removers
4	I-Butanol	C4H10O	floor covering, floor lacquer, architectural coating	tobacco smoke, plasticizers
4	Butanal	C4H8O		

M. Samfield is a consultant.

Bruce A. Tichenor is the EPA Project Officer (see below).

The complete report, entitled "Indoor Air Quality Data Base for Organic compounds," (Order No. PB92-158 468/AS; Cost: \$19.00; subject to change) will be available only from:

National Technical Information Service

5285 Port Royal Road

Springfield, VA 22161

Telephone: 703-487-4650

The EPA Project Officer can be contacted at:

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