Levels and Prevalence of Selected Volatile Organic Compounds and Pesticides in the General U.S. Population

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The relationship between human exposure to environmental toxicants and health effects is of utmost interest to public health scientists. Accurate and precise methods for assessing exposure and health effects are needed to define this relationship. One of the most accurate and precise means of assessing exposure is to measure the internal dose, the level of the toxicant or its primary metabolite in a human specimen.

The Analytical Toxicology Branch, Division of Environmental Health Laboratory Sciences of the National Center for Environmental Health has measured the internal dose of organic toxicants in human specimens for many years. Two of its most recent projects have involved establishing reference ranges in the general population of the United States for 32 volatile organic compounds (VOCs) and 12 pesticides (or their metabolites); many of these are halogenated. The VOCs are listed in Table 1; the pesticides are listed in Table 2. The VOCs are measured at the low parts-per-trillion levels in 10 mL of whole blood by using purge and trap/GC/MRMS and isotope dilution techniques for quantification (1). The pesticides or their metabolites are measured at the low parts-per-trillion levels in 10 mL of urine by using liquid extraction (by robot), derivatization, GC/MS/MS and isotope dilution techniques for quantification (2).

Twelve of the VOCs and six of the pesticides were found in measurable amounts in samples from more than 50% of the 1,000 people in this study. p-Dichlorobenzene and its primary metabolite, 2,5-dichlorophenol, were found to have the highest prevalence.

These reference ranges have been used to evaluate possible human exposures to oil well fires in Kuwait and Uzbekistan; to indoor air at occupational sites; drinking water containing selected toxicants; to the

environment around chemical waste sites; and to other sources of environmental toxicants.

References

1 Ashley DL. et al., Anal. Chem. 1992;64:1021-1029.
2 Hill RH Jr. et al., manuscript in preparation.

Table 1. 32 VOCs Quantified in Reference Range Study

Benzene	1,1-Dichloroethane	Methylene Chloride
Toluene	1,2-Dichloroethane	Chloroform
Styrene	1,1,-Dichloroethene	Carbon Tetrachloride
Ethyl Benzene	cis-1,2-Dichloroethene	1,2-Dichloropropane
1,2-Xylene	trans-1,2-Dichloroethene	Bromoform
1,3-Xylene	1,1,1-Trichloroethane	Dibromomethane
1,4-Xylene	1,1,2-Trichloroethane	Bromodichloromethane
Chlorobenzene	Trichloroethene	Dibromochloromethane
1,2-Dichlorobenzene	1,1,2,2-Tetrachloroethane	Acetone
1,3-Dichlorobenzene	Tetrachloroethene	2-Butanone
1,4-Dichlorobenzene	Hexachloroethane	

Table 2. Selected Chemicals Measured in Human Urine and Their Pesticide Origin

Chemical Measured	Pesticide Origin
1-Naphthol	Naphthalene, Carbaryl
2-Naphthol	Naphthalene
Isopropoxyphenol	Propoxur
Carbofuran phenol	Carbofuran
3,5,6-Trichloro-2-pyridinol	Chlorpyrifos
2,4-Dichlorophenoxyacetic acid (2,4-D)	2,4-D
Pentachlorophenol	PCP, HCB, γ-BHC
2,4,5-Trichlorophenol (2,4,5-TCP)	2,4,5-TCP; 1,2,4-trichlorobenzene; γ-BHC; HCB
2,4,6-Trichlorophenol (2,4,6-TCP)	2,4,6-TCP; 1,3,5-trichlorobenzene; γ-BHC
2,5-Dichlorophenol (2,,5-DCP)	p-Dichlorobenzene
2,4-Dichlorophenol (2,4-DCP)	m-Dichlorobenzene
4-Nitrophenol	Methyl and ethyl parathion; nitrobenzene