Appendix

Exposures to volatile organic compounds in healthcare settings

Preliminary Sampling

A preliminary sampling campaign was conducted at a U.S. Veterans Affairs (VA) hospital for five consecutive days in April of 2009 to develop appropriate sampling protocols and refine the sampling and analysis methods. VOCs were sampled using active, passive and real-time methods. Each sampling method has unique advantages and drawbacks for exposure assessment in healthcare facilities. Thermal desorption tubes used with sampling pumps provide a useful means of personal sampling, the ability to concentrate low-level chemicals during sampling, and sample stability prior to analysis; however, adsorbent overload and the need for sampling pumps and tubing (which can be problematic in hospital settings), limit the applicability of this technique. Evacuated stainless steel canisters equipped with flow controllers allow whole-air samples to be collected over variable durations, provide large volume samples for multiple analyses, and do not require sampling pumps.[1] These whole-air samples require pre-concentration prior to analysis in order to detect low-level VOCs. Limitations of this method are adsorption onto walls or transformation effects within the sample vessel, which have been addressed in storage stability studies.[2] Sampling using passive badges is appealing because of the ease of use (no pumps or tubing are needed) and availability of a variety of sampling badges, but have drawbacks related to stationary air and the lack of diffusion coefficients for many substances of interest. Real-time VOC monitors provide immediate measurements of total VOC concentrations, but lack chemical specificity.

Personal and area VOC sampling was conducted using thermal desorption tubes (Carbotrap™ 300, Perkin Elmer, Shelton, CT) and 6 liter (L) evacuated canisters, and analyzed using EPA Methods TO-17 and TO-15 respectively.[3, 4] Personal and area samples were also collected for organic vapors using passive badges (Series 575 Passive Sampler for Organic Vapor, SKC, Inc., Eighty Four, PA) analyzed by OSHA Method 1002[5] with a mass spectrometer detector. The results of the preliminary sampling (data not shown) indicated elevated concentrations of alcohols amidst lower concentrations of other VOCs of interest. This combination of chemicals (greater than 50 identified per sample) and concentrations (ppb to ppm range) presented a challenging mixed exposure environment for sampling and analysis. The multi-bed sorbent in the thermal desorption tubes was overwhelmed by high-levels of alcohols, making them unsuitable for quantifying low-level VOC exposures in healthcare settings. Passive badges were also unsuitable for sampling in this work environment because of a lack of quantifiable adsorption kinetics as well as poor sensitivity for many low-level analytes. In contrast, evacuated-canister, whole-air samples offered a uniquely suitable approach for handling this wide range of exposures because a single sample could be split for multiple analyses at both μg/m^3- and mg/m^3-level concentrations.[2]

Exposure Estimates

Geometric means and standard deviations for VOC measurements are provided by occupation and sampler type in Table S1. In addition to the indoor air quality guidelines mentioned in the main text, the US Green Building Council promulgates a framework for the testing and certification of green building design, construction, operation, and maintenance; the framework is termed Leadership in Energy and Environmental Design (LEED) and includes consensus standards for VOC concentrations.[6] LEED recommends less than 200 μg/m^3 for the sum of VOCs measured by EPA Compendium of Methods for the Determination of Air Pollutants in Indoor Air,[7] which includes IP-1A (canister-based method) and IP-1B (sorbent-based method). This value is consistent with the German government’s recommendations and is two to three times lower than those of Japan and Hong Kong. TVOCMIX, an underestimate of TVOC, clearly exceeded these stringent recommendations by an order of magnitude or more. These recommendations were purportedly established to improve/maintain indoor air quality for health, comfort, and productivity.[8] While the strategy of the Canadian National Research Council for accomplishing these VOC levels, including source contaminant control and dilution ventilation, are practical and appropriate, these levels may not be realistically achieved in a hospital setting due to the variety of sources present and the general absence of fixed location sources. Hand sanitation and cleaning product use, for example, are two primary sources of VOC exposure in healthcare settings. These exposures are difficult to control at the source due to their ubiquitous use throughout a facility.

Qualitatively identified compounds are displayed in Table S2.

Table S1 Geometric mean (GM) in µg/m^3 and geometric standard deviation (GSD) for area and personal samples by occupation

Occupation	Area or Personal	TVOCMIX		ethanol		2-propanol		benzene		toluene		ethylbenzene		m,p-xylene		o-xylene	
		GM	GSD	GM	GSD	GM	GSD	GM	GSD	GM	GSD	GM	GSD	GM	GSD	GM	GSD
NA	A	4179	1.8	1909	3.1	1650	1.5	0.73	1.9	4.0	1.7	0.35	2.3	1.4	2.1	0.38	1.9
	P	9153	1.7	4899	2.6	2936	1.6	2.2	2.0	9.9	2.9	1.2	15	5.4	2.8	1.5	17
LPN	A	6686	1.5	4591	1.8	1910	1.4	1.10	2.5	6.9	1.9	1.4	5.0	3.8	3.5	1.4	5.0
	P	8680	2.6	3708	7.0	1349	3.8	4.2	5.0	28.8	4.3	2.1	8.7	8.0	3.7	2.6	8.0
MEP	A	2605	3.6	32.5	-	1971	5.0	0.42	2.3	2.3	3.9	0.55	6.7	1.8	4.5	0.58	6.3
	P	7895	7.6	2.7	-	4566	11	0.15	-	7.5	3.2	<0.16	-*	0.35	19	<0.19	-*
RT	A	1361	2.2	759	2.7	160	-	0.73	2.0	17.3	3.3	1.2	4.2	3.3	2.6	1.2	4.0
	P	4640	3.3	984	11	70.4	-	0.64	2.7	28.9	6.9	0.51	7.4	4.0	3.4	1.0	5.6
PT	A	4315	3.0	115	-	365	-	1.1	1.7	11.1	2.4	2.3	6.2	12.7	3.9	1.8	4.6
	P	4123	5.9	176	19	290	-	1.2	1.6	5.5	5.6	<0.16	-*	1.2	4.4	0.45	5.3
FSW	A	2682	3.9	601	3.9	1607	4.5	0.68	2.7	3.8	1.7	1.5	4.9	6.2	4.7	2.1	3.7
	P	3915	3.6	1308	3.2	1859	5.1	0.88	3.8	20.7	4.0	1.4	5.4	7.7	2.4	1.3	4.7
RN	A	2808	2.9	685	14	533	-	0.69	2.0	4.0	3.7	0.37	7.2	1.2	5.8	0.60	6.5
	P	3849	2.8	1785	3.9	778	12	1.1	2.5	5.1	2.9	<0.16	-*	0.39	13	<0.19	-*
DA	A	9336	1.4	<0.13	-*	9014	1.4	0.88	3.1	11.5	2.1	0.89	11	5.7	3.9	1.2	9.2
	P	3755	4.5	0.41	-*	2696	6.9	<0.083	-*	28.7	2.0	<0.16	-*	<0.18	-*	<0.19	-*
HK	A	2990	2.2	1119	2.9	1437	2.7	0.50	2.8	4.0	3.9	0.44	6.2	1.9	4.2	0.45	5.8
	P	3254	1.9	1363	2.0	1123	3.4	0.70	4.1	23.6	4.5	0.50	7.9	1.9	7.2	0.73	6.3
ST	A	1731	2.3	446	1.4	1129	2.9	0.45	1.4	2.0	1.0	<0.16	-*	0.39	1.1	<0.19	-*
	P	2423	2.3	1031	2.7	1077	2.5	0.98	1.2	112	1.3	<0.16	-*	1.8	1.3	<0.19	-*
ET	A	1823	5.8	129	-	789	-*	0.59	3.4	4.9	3.2	0.45	11	1.9	4.5	0.33	12
	P	1731	4.8	327	7.1	777	7.1	0.17	18	9.8	7.0	<0.16	-*	0.63	-	<0.19	-*
CLT	A	876	3.5	157	16	66.8	16	0.68	2.4	10.3	1.7	4.1	15	14.1	17	3.9	13
	P	1615	4.6	431	3.6	203	1.8	<0.083	-*	162	2.5	2.7	-	25.6	-	2.9	-
MAT	A	1034	1.4	336	1.1	532	1.5	0.74	1.3	8.6	1.7	<0.16	-*	0.75	1.2	<0.19	-*
	P	1010	1.0	272	1.0	435	1.2	0.83	1.4	137	1.5	4.7	1.3	28.6	1.3	7.0	1.3
DLT	A	1720	1.2	279	1.1	1371	1.3	0.93	2.9	10.6	3.4	0.23	-*	2.0	6.5	<0.19	-*
	P	490	2.4	198	3.0	132	3.8	<0.083	-*	8.8	2.7	<0.16	-*	<0.18	-*	<0.19	-*
FB	A	2.0	4.7	<0.13	-*	<0.14	-*	<0.083	-*	<0.094	-*	<0.16	-*	<0.18	-*	<0.19	-*
	P	40.0	7.2	3.3	-*	3.3	17*	<0.083	-*	0.20	17	<0.16	-*	<0.18	-*	<0.19	-*
Outside	A	107.0	1.9	23.8	4.4	33.6	5.0	0.48	2.7	3.1	3.9	0.25	8.4	1.2	5.1	0.31	7.0

Note: dash (-) = GSD > 20 or GM < LOD; asterisk (*) = ≥50% of values below LOD. Occupation Codes: NA=Nursing Assistants; LPN=Licensed Practical Nurses; MEP=Medical Equipment Preparers; RT=Respiratory Therapists; PT=Pharmacists/Pharmacy Technicians; FSW=Floor Strippers/Waxers; RN=Registered Nurses; DA=Dental Assistants; HK=Housekeepers; ST=Surgical Technologists; ET=Endoscopy Technicians; CLT=Clinical Laboratory Technicians; MAT=Medical Appliance Technicians; DLT=Dental Laboratory Technicians; and FB=Field Blanks.

Table S1 (continued) Geometric mean (GM) in µg/m^3 and geometric standard deviation (GSD) for area and personal samples by occupation

Occupation	Area or Personal	acetone		hexane		methyl methacrylate		methylene chloride		chloroform		α-pinene		*d*-limonene	
		GM	GSD	GM	GSD	GM	GSD	GM	GSD	GM	GSD	GM	GSD	GM	GSD
NA	A	57.7	1.7	0.40	2.6	<0.17	-*	0.52	2.0*	0.64	2.3	<0.28	-*	6.1	2.7
	P	105	1.6	1.4	3.3	1.2	12	2.6	3.0	0.79	8.4	0.43	13*	7.4	4.6
LPN	A	63.7	1.4	0.63	3.3	<0.17	-*	<0.36	-*	2.5	3.1	0.63	2.2	13	2.3
	P	139	3.6	1.8	19	<0.17	-*	3.1	7.1	2.1	7.0	<0.28	-*	3.9	7.0
MEP	A	23.8	1.2	0.84	1.7	<0.17	-*	<0.36	-*	0.77	4.4	<0.28	-*	7.8	2.2
	P	97.8	4.3	2.0	8.0	0.48	-	<0.36	-*	<0.14	-*	<0.28	-*	12.9	-
RT	A	29.7	1.4	0.85	2.2	<0.17	-*	0.72	3.6	1.3	3.3	0.49	4.3	4.2	1.3
	P	99	5.0	2.2	1.6	<0.17	-*	4.5	1.9	<0.14	-*	<0.28	-*	<0.53	-*
PT	A	59.9	1.2	1.7	3.1	0.38	3.1	0.72	5.3	0.63	2.4	0.81	2.3	10.6	2.3
	P	66.3	2.5	3.9	1.9	<0.17	-*	3.8	1.6	<0.14	-*	<0.28	-*	1.2	5.0
FSW	A	75.1	3.1	0.81	3.1	0.27	3.1	<0.36	-	0.80	1.6	0.71	3.7	12.1	6.6
	P	96.1	1.5	1.0	3.7	<0.17	-*	0.63	10	0.35	5.3	<0.28	-*	1.9	-
RN	A	44.5	2.3	1.1	2.9	<0.17	-*	<0.36	-*	0.91	3.1	<0.28	-*	5.2	2.9
	P	73	1.5	0.69	9.1	<0.17	-*	0.94	5.9	0.23	9.9	<0.28	-*	<0.53	-*
DA	A	42.5	1.5	0.56	1.4	36.5	2.5	<0.36	-*	1.4	5.2	<0.28	-*	5.6	1.4
	P	54.6	1.6	0.37	3.3	2.1	14	<0.36	-*	<0.14	-*	<0.28	-*	<0.53	-*
HK	A	46.4	1.6	0.57	2.3	<0.17	-*	<0.36	-*	1.1	3.3	0.57	2.3	11.3	3.4
	P	114	1.5	1.2	1.8	<0.17	-*	0.44	5.6*	0.64	5.8	<0.28	-*	6.1	4.8
ST	A	34.9	1.1	0.12	1.9*	<0.17	-*	<0.36	-*	0.40	2.1	<0.28	-*	2.1	1.4
	P	71.7	1.0	0.14	5.2*	<0.17	-*	3.1	1.1	0.18	4.0*	<0.28	-*	2.8	1.1
ET	A	30.4	1.5	0.63	1.6	<0.17	-*	<0.36	-*	1.5	3.8	<0.28	-*	2.8	2.8
	P	78.5	2.3	0.44	14	<0.17	-*	<0.36	-*	<0.14	-*	<0.28	-*	<0.53	-*
CLT	A	60.7	6.0	0.30	1.8	<0.17	-*	<0.36	-*	0.53	5.1	<0.28	-*	6.3	1.4
	P	160	3.0	2.1	2.2	<0.17	-*	4.0	1.5	<0.14	-*	<0.28	-*	2.0	3.1
MAT	A	71.6	2.1	0.36	2.0	<0.17	-*	<0.36	-*	0.38	1.3	0.8	1.1	67.8	1.4
	P	78.7	1.1	1.7	1.3	<0.17	-*	2.4	1.1	0.21	11*	<0.28	-*	23.6	1.1
DLT	A	29.5	1.2	0.30	1.5	10.4	4.0	<0.36	-*	0.61	6.4	<0.28	-*	9.5	1.1
	P	43.9	1.9	<0.11	-*	<0.17	-*	<0.36	-*	<0.14	-*	<0.28	-*	<0.53	-*
FB	A	<0.19	-*	<0.11	-*	<0.17	-*	<0.36	-*	<0.14	-*	<0.28	-*	<0.53	-*
	P	14.7	8.8	<0.11	-*	<0.17	-*	<0.36	-*	<0.14	-*	<0.28	-*	<0.53	-*
Outside	A	16.1	1.6	0.49	2.1	<0.17	-*	<0.36	-*	0.21	6.2	<0.28	-*	0.59	8.7*

Note: dash (-) = GSD > 20 or GM < LOD; asterisk (*) = ≥50% of values below LOD. Occupation Codes: NA=Nursing Assistants; LPN=Licensed Practical Nurses; MEP=Medical Equipment Preparers; RT=Respiratory Therapists; PT=Pharmacists/Pharmacy Technicians; FSW=Floor Strippers/Waxers; RN=Registered Nurses; DA=Dental Assistants; HK=Housekeepers; ST=Surgical Technologists; ET=Endoscopy Technicians; CLT=Clinical Laboratory Technicians; MAT=Medical Appliance Technicians; DLT=Dental Laboratory Technicians; and FB=Field Blanks.

Table S2 Qualitatively identified compounds by NIST Mass Spectral Library with ≥ 75% quality factor

Alcohol
2-methyl-1-propanol
1-butanol
3-methyl-1-butanol
2-methyl-1-butanol
2-ethyl-1-hexanol
1-octanol
benzyl alcohol

Aldehyde
butanal
pentanal
hexanal
heptanal
octanal
nonanal
decanal
undecanal
methacrolein
benzaldehyde

Cycloalkane
methylcyclohexane
1,3-dimethylcyclohexane, c&t
trans-1,2-dimethylcyclohexane
trans-1,3-dimethylcyclohexane
ethylcyclohexane
1,1,3-trimethylcyclohexane
1,2,4-trimethylcyclohexane
2-methylcyclopentanone
1,2,3-trimethylcyclohexane
1-ethyl-4-methylcyclohexane
Butylcyclohexane
trans-decahydro-naphthalene
cis-decahydro-naphthalene
methylene-cyclobutane

Halogenated
1,3-dichlorobenzene
1-chloro-1,1-difluoroethane
trichloromonofluoromethane
1H-perfluorohexane
tetrachloroethylene
1,1-difluoroethane

Alkane
2,2-dimethylbutane
pentane
heptane
octane
nonane
decane
undecane
dodecane
heptadecane
2-methylpentane
3-methylpentane
3-methyloctane
3-methylnonane
2-methylhexane
3-methylhexane
4-methyldecane
4-ethylheptane
3-ethyl-2-methylheptane
2,2-dimethyldecane
2,3-dimethyldecane
2,4-dimethylpentane
2,6-dimethylpentane
2,6-dimethylheptane
3,7-dimethylnonane
2,3,4-trimethylpentane
2,2,4-trimethylpentane
2,2,4-trimethylhexane
2,3,8-trimethyldecane
2,2,3-trimethyldecane
2,3,3-trimethyloctane
5-ethyl-2,2,3-trimethylheptane

Ketone
2-butanone
methyl isobutyl ketone
cyclohexanone
6-methyl-5-hepten-2-one
2-hexanone

PAH/Inorganic Carbon/Terpene
naphthalene
carbon disulfide
beta-pinene

Alkene
2-methyl-1-propene
2,2,4,6,6-pentamethyl-3-heptene
Isoprene

Aromatic
1-methylethyl-benzene
1-ethyl-3-methylbenzene
alpha-methylstyrene
1,2,3-trimethylbenzene
1-ethenyl-3,5-dimethylbenzene
1,3-diazine
p-cymene
1,4-bis(1-methylethyl)benzene

Ether
sevoflurane
isoflurane
norflurane
eucalyptol
ethyl ether
2-butoxyethanol
dimethyl ether
methoxyethane
tetrahydrofuran
2-(1-methylethoxy)-ethanol
1-(2-chloroethoxy)butane
1-butoxy-2-propanol
2-(2-ethoxyethoxy)-ethanol

Ester
ethyl acetate
methyl isobutyrate
butyl ester formic acid
butyl ester acetic acid
1-methoxy-2-propyl acetate
hexyl ester formic acid
3-methyl-1-butanol acetate
2-ethylhexyl ester acetic acid

Supporting Task and Product Information

An understanding of the tasks performed and products used by occupation (Table S3) are useful in the interpretation of the principal component analysis below. Tasks performed are listed in the table with associated occupations who perform the tasks and chemical groups that are contained in the products used. Products had to be used for at least 15 minutes to be included in the table.

Table S3 Occupation and chemical group corresponding to products used for specific tasks

Tasks where Products Used	Occupation	Chemical Groups of Products Used		
Bathroom cleaning	HK	Fragrance Carboxylic acid Alcohol	Amide Amine Quats	Salt Acid
Dental laboratory procedures	DLT, DA, CLT	Metal Acrylate Oxidizers Alcohol	Metalloid Carboxylic acid Salt Halogenated	Phenolic Amine Ester
Deodorizing	HK, DA	Surfactant	Alcohol	Phenolic
Floor cleaning	HK, FSW	Surfactant Fragrance Glycol ether	Ether Quats Acid	Aromatic Salt
General surface cleaning	HK, MEP, RN, ET, DA, LPN, FSW, RT, CLT, NA	Alcohol Quats Salt Base Amine	Ether Carboxylic acid Terpene Oxidizers Phenolic	Surfactant Acid Glycol ether Amide Metalloid
Glass cleaning	HK, FSW	Amine Carboxylic acid	Ether Fragrance	Alkane Glycol ether
Hand cleaning	RN, RT, NA, MEP, ST, SPN, HK, ET	Alcohol Alkane	Halogenated Salt	Phenolic Amide
Instrument cleaning	MEP, ET, RN, LPN, FSW, ST, CLT	Enzyme Surfactant Alcohol	Amine Acid	Amide Salt
Clinical laboratory procedures	CLT, LPN, DLT, ET	Aldehyde Salt	Alcohol Aromatic	Carboxylic acid Metal salt
Patient cleaning	RN, ET, NA, PT, RT, MEP, LPN, DA, HK, CLT	Alcohol Amide Ether Amine Salt	Ester Glycol ether Carboxylic acid Aromatic Quats	Alkane Enzyme Oxidizer Metalloid Surfactant
Stainless Steel cleaning	MEP, HK	Alkane	Ester	
Sterilizing & high-level disinfecting	ET, LPN, MEP	Carboxylic acid Oxidizer	Aldehyde	Ether
Stripping and finishing floors	FSW, HK	Glycol ether Amine Aromatic Base	Ether Ammonia Ester Alcohol	Alkane Acid Acrylate

Notes: NA=Nursing Assistants; LPN=Licensed Practical Nurses; MEP=Medical Equipment Preparers; RT=Respiratory Therapists; PT=Pharmacists/Pharmacy Technicians; FSW=Floor Strippers/Waxers; RN=Registered Nurses; DA=Dental Assistants; HK=Housekeepers; ST=Surgical Technologists; ET=Endoscopy Technicians; CLT=Clinical Laboratory Technicians; MAT=Medical Appliance Technicians; DLT=Dental Laboratory Technicians; and FB=Field Blanks.

Principal Component Analysis

Principal component analysis was used to analyze the log-transformed area sample data for the 14 target VOC analytes as inputs; field blanks (n=40) and outside (n=1) samples were excluded from analysis. Kaiser criterion (eigenvalue > 1) and scree plots indicated that five principal components captured 68.7% of the variance. Principal components 1 through 5 explained 32.3, 11.9, 8.81, 8.09, and 7.67% of the variance, respectively. These five components were subsequently rotated using a maximization of the variance (varimax rotation) to produce orthogonal factor loadings.

The analyte influence on the five factors is displayed as factor loadings in Figure S1A. Positive values indicate a positive influence on the factor while the converse is true for negative values. The following analyte influence is apparent from the factor loading distribution as indicated by open diamonds above the bars when the factor loading was greater than 0.4 or less than -0.4 (Figure S1a): Factor 1 – benzene, chloroform ethylbenzene, m,p-xylene, o-xylene, and toluene, which are mostly aromatics and may be indicative of solvent use; Factor 2 – *d*-limonene and α-pinene, which are terpenes and may be indicative cleaning product use or due to the sampling environment from natural sources such as citrus fruit and coniferous trees; Factor 3 – 2-propanol, which is an alcohol used for disinfection; Factor 4 – toluene, which is an aromatic and may be indicative of solvent use; and Factor 5 – methyl methacrylate, which is a monomer of acrylic resin used in dentistry. All the chemicals listed in the factors above were positively correlated with the factor except for methyl methacrylate, which was negatively correlated. Factor loadings were not influenced by three chemicals: ethanol, acetone, and methylene chloride. While specific sources could not be associated with each factor, these factors may represent a combination of tasks, occupations, and chemical groups contained in the products (Table S3).

The factor loadings are subsequently linked to the occupations as mean factor loadings in Figure S1b. The previous interpretation of positive and negative influence of analyte on factor is analogous to this interpretation of factor on occupation. This part of the figure may be used to relate the factor loadings, which are indicative of analyte influence, on the occupations that were measured to identify trends in exposure among specific occupations. Factor 1 (i.e., solvent use) is positively correlated with PT and CLT, which is consistent with observations that, e.g., CLT used aromatics for clinical laboratory procedures, but is negatively correlated with NA, LPN, MEP, DA, HK, ET, and DLT who more often perform cleaning tasks rather than laboratory tasks with solvents. Factor 2 is positively correlated with LPN, PT, FSW; limonene and pinene are fragrances used in floor cleaners and their positive associations in this factor are in line with product usage by FSW and these compounds are likely to be exposure sources for LPNs and other occupations that work among various locations in a ward. Factor 2 is negatively correlated with RT and ET and may reflect the relative immobility of these professions to specific areas within a ward. Factor 3 is positively correlated with DA which is linked with disinfectant use of 2-propanol by the previous analysis and possibly general cleaning performed by this occupation between patients. Factor 3 is negatively correlated with RT and CLT, who may not perform these disinfectant tasks or infrequently use products containing 2-propanol. Factor 4 is positively correlated with RT and DA; the link between these occupations and toluene is not fully understood but could, in the case of DA, be related to use of adhesives or glues that contain toluene but were not captured in our product inventory. Factor 5 is not appreciably positively correlated with any occupation; factor 5 is negatively correlated with MEP, PT, DA, CLT, and DLT, but most notably with DA and DLT, which is contrary to expectation. The lack of association with occupations may be due to the following: the inability of this factor to be realistically interpreted since factor 5 describes the least amount of variance retained in the model; the relatively small magnitude of the methyl methacrylate exposure compared to alcohols and aromatics.

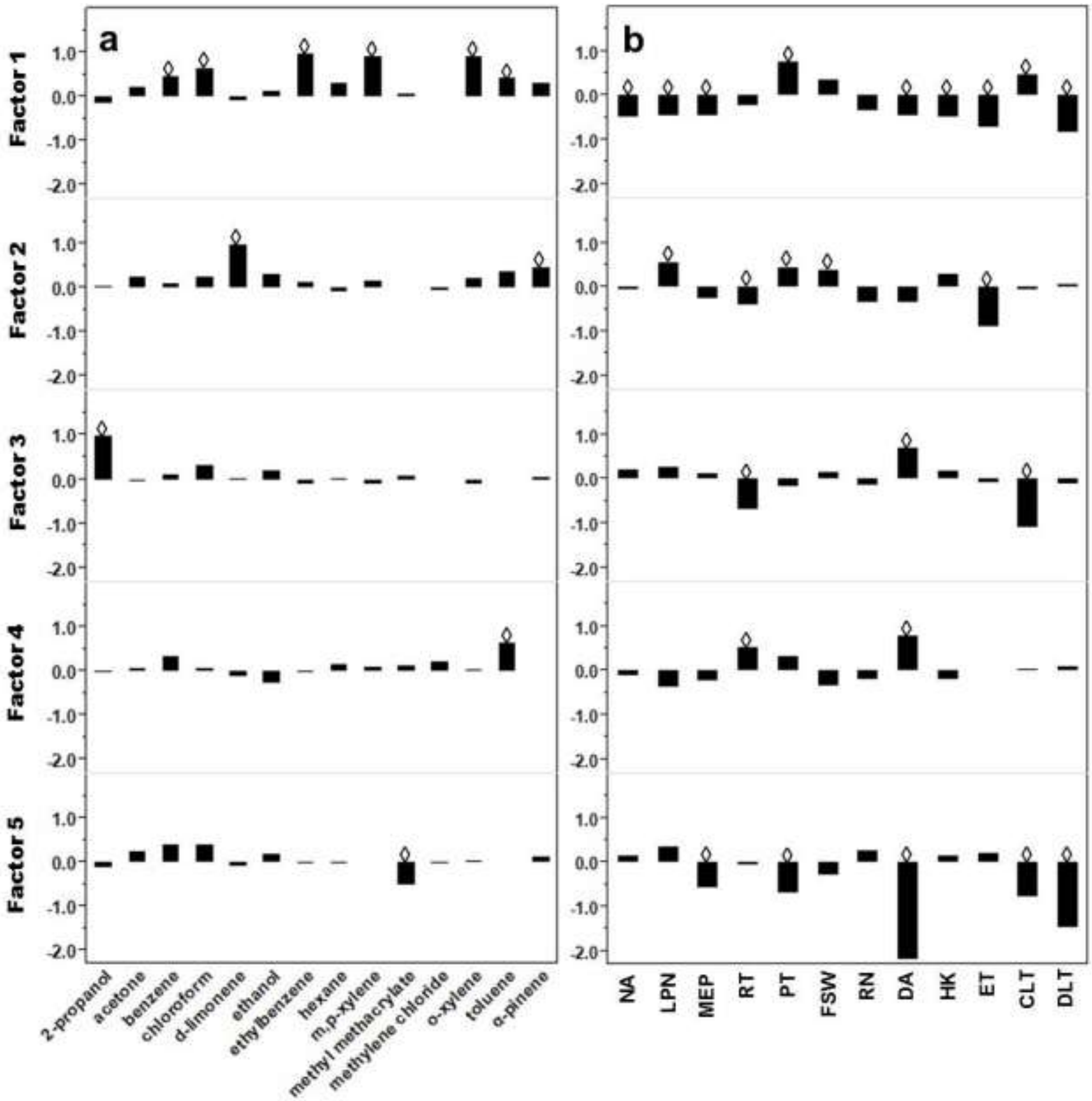

Figure S1 Factor loadings for by analyte (a) and occupation (b) based on area samples.

Notes: NA=Nursing Assistants; LPN=Licensed Practical Nurses; MEP=Medical Equipment Preparers; RT=Respiratory Therapists; PT=Pharmacists/Pharmacy Technicians; FSW=Floor Strippers/Waxers; RN=Registered Nurses; DA=Dental Assistants; HK=Housekeepers; ST=Surgical Technologists; ET=Endoscopy Technicians; CLT=Clinical Laboratory Technicians; MAT=Medical Appliance Technicians; DLT=Dental Laboratory Technicians; and FB=Field Blanks.

References

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