Fact or Fiction

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Toxic Humans

Why should we fear to be crushed by savage elements, we who are made up of the same elements?

Emerson—*The Conduct of Life*[1]

Every human being is a "polluter," says Dr. Jane M. Orient, in a chapter in Jay Lehr's new treatise on Environmental Science, Health, and Technology.[2,3] She points out that many organic compounds of concern to the EPA are normal by-products of mammalian metabolism as revealed by gas chromatography and mass spectrometry. At least 15 of these products, including 1,4-dioxane, trichloroethylene (TCE), and chloroform, are on the "List of Hazardous Air Pollutants" to be regulated under Section 112 of the Clean Air Act. The EPA concerns itself at ambient-air concentrations less than one-ten-thousandth the level found in normal intestinal gases (about 1.4 $\mu g/m^3$ and 20 µg/L, respectively, for TCE. The typical human body exhausts 20 grams of organic products per day in intestinal gas, sweat, urine and feces, as shown in Table 1[3] on the following page, which reads like a freshman organic chemistry book. Remember how organic chemistry labs used to smell? Makes you wonder why we humans don't smell worse.

Now let's look at our breath. The medical community has long recognized that humans exhale volatile organic compounds (VOCs). The major VOCs in the breath of healthy individuals are isoprene (12-580 ppb), acetone (1.2-1,880 ppb), ethanol (13-1,000 ppb), methanol (160-2,000 ppb), and other alcohols, as shown in Table 2.[4] Minor components include pentane and higher aldehydes and ketones. Besides those compounds listed in Table 2, there are several others that appear to be present from 1 to 10 ppb in breath, including 1,1,1-trichloroethane, butane, cis- and trans-2-butene, 2-hexene, n-butyl alcohol, isobutyl alcohol, capryl alcohol, methyl isobutyl ketone, butyl acetate, ethyl benzene, indene, pentanal and propanal.[4] Add heavy smoking and high occupational exposure to the mix, and the list grows.

Our bodies also contain quite a few of the elements in the Periodic Table. We contain more than 60 minerals, but only need 22 of them for good health.[5] The more essential trace elements in our bodies include iron, iodine, copper, manganese, zinc, cobalt, molybdenum, selenium, chromium, tin vanadium, fluorine, silicon, nickel, and arsenic.[6] For some sample calculations, let's look at cadmium, chromium, and nickel, which are familiar to electroplaters. These are present in our bodies in approximate amounts of 30 mg (Cd), 6 mg (Cr), and 1 mg (Ni). These metals supply 2×10^6, 0.7×10^6, and 0.1×10^6 molecules per cell of Cd, Cr and Ni, respectively. Add up all the other trace elements, and you realize we carry around many molecules of the elements.[7]

There's more. We also have internal radiation in our bodies due to K-40, a long-lived radioisotope of potassium.[8] Stomach juice acidity is almost the same as the acid in our car batteries.[9] Body fluid consists of an aerated solution containing approximately one-percent sodium chloride, together with minor amounts of other salts and organic compounds at 36°C .[10] So the corrosivity of the human body is similar to that exhibited by warm, aerated seawater. Seawater tends to cause localized corrosion, including crevice attack, pitting, and galvanic corrosion.

Now let's talk about bugs. There are about 10^{12} E. coli bacteria in every person's digestive tract.[11] Human skin is host to a veritable entourage of microorganisms during its short life. The numbers of bacteria on one person's skin at any one time equal the number of people who have ever lived.[12] Skin cells progress through different stages of development until they slough off in a perpetual, silent shower of dead cells and debris. Some two- to three-billion cellular remnants are shed daily. Enough comes off the foot alone to add 190 mg of dead cells to a pair of socks.[13] No wonder old socks smell!

One last note: Some creatures living on our faces are crawling, plugged-up "poop machines." Follicle mites are found on practically all mammals, and are universally present in and on some parts of the human skin. Some live on our face, and because no creature lives forever, the follicle mites must be reproducing right there on our faces. Besides this, these face mites have no anus, so presumably, they die of terminal constipation before they get very old.[12] Makes you wonder how many of these you consume when you kiss a person.

All this leads me to ask the question: Are we humans living, breathing, walking Superfund sites? ***P&SF***

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Table 1
Organic Compounds Exhausted by Human Beings*

Total grams/hr exhausted in intestinal gas, sweat, urine, and feces:

Saturated hydrocarbons	0.169 g/hr
Unsaturated hydrocarbons	0.096 g/hr
Naphthenic hydrocarbons	0.031 g/hr
Aromatic hydrocarbons	0.058 g/hr
Aldehydes	0.016 g/hr
Ketones	0.027 g/hr
Alcohols	0.097 g/hr
Ethers	0.024 g/hr
Other compounds	0.239 g/hr
Sulfur compounds	0.059 g/hr
Nitrogen compounds	0.002 g/hr
Chlorine compounds	0.010 g/hr

By type, in order of decreasing concentration:

saturated hydrocarbons
methane, ethane, propane, pentane, isopentane, 2-methylpentane, 3-methylpentane, 2,2,5-trimethylhexane, heptane, nonane and its isomers, 2,5,5,-trimethylheptane, decane and its isomers, undecane and its isomers, dodecane and its isomers, tridecane and its isomers

unsaturated hydrocarbons
ethylene, butylene, isoprene, heptene, decene, diisoamylamine, undecene, dodecene, tridecene, 4-methyloctadiene, decine

naphthenic (cyclic) hydrocarbons
cyclobutane, cyclopentane, methylcyclopentane, cyclohexane, trimethylcyclopentane, 1,3-dimethylcyclohexane, ethylcyclohexane, trimethylcyclohexane, propylcyclohexane, amylcyclohexane, indan, hexahydroindan

aromatic hydrocarbons
benzol, toluene, ethylbenzene, xylol, styrene, n-propylbenzene, 1-methyl-3-ethylbenzene, 1-methyl-4-ethylbenzene, 1-methyl-2-methylbenzene, butyl benzene, 1,2,4-trimethylbenzene, 1-methyl-4-isopropylbenzene, 1-methyl-3-isopropylbenzene, 1,3-dimethyl-5-ethylbenzene, 1,2-dimethyl-4-ethylbenzene, 1,3-dimethyl-4-ethylbenzene, 1,2,3,4-tetramethylbenzene, naphthalene, 2-methylnaphthalene

aldehydes
formaldehyde, acetaldehyde, 2-methylpropanol, 3- methylpropanol, pentanol, 2,4-hexadienal, hexanol, furfural, heptanol, octanol, benzaldehyde, nonanol, decanol, undecanol

ketones
acetone, methylethylketone, 2-butanone, methylisobutylketone, 2-hexanone, 2-heptanol, 3-octene-2-one, 2-decanone, 2-undecanone, methylcyclopentanone

alcohols
methanol, ethanol, propanol, isopropanol, butanol, cyclohexyl alcohol, 3-methyl-1-butanol

ethers
ethyl acetate, 1,4-dioxane, butylacetate, isobutylacetate, isoamylacetate, ethylhexanoate, ethyloctanoate, 3-methyl-2-butylacetate

other compounds
carbon monoxide, phenol, furan, p-cresol, menthol, formic acid, acetic acid

nitrogen-containing compounds
methylamine, isopropylamine, pyrrolidyl, indole, skatole, 2,2-dipyridyl, n-methylpyrrole, methylpiperazine, methacrylonitrate

sulfur-containing compounds
methylmercaptan, ethylmercaptan, dimethyldisulfide, amylmercaptan, 2,3,4-trithiopentane, allylthioisocyanate, ethylenesulfide

chlorine-containing compounds
chloroform, trichloroethylene, tetrachloroethylene, chlorobenzene, methylchloride, tetrachlorohydrate, dichloromethane, 1,1,1-trichloroethane

Compiled by Adam Paul Banner from Russian studies, 1992.
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Table 2
Concentrations of VOCs In Exhaled Human Breath

Compound	Weighted Average ppb*	Weighted Average ug/m^3
Acetaldehyde	18	35
Acetone	985	2,330
Butanone	16	47
1-Butene	63	140
Dimethyl sulfide	12	30
Ethanol	770	1,400
Ethyl acetate	17	62
Ethylene	23	26
Furan	14	39
Hexanal	11	45
Isoprene	210	590
Isopropanol	150	370
Methanol	330	430
Methyl ethyl ketone	10	29
Pentane	12	35
1-Pentene	21	60
n-Propanol	130	320

Adapted from Fenske and Paulson, reference 4
** Parts per billion*