

# Sewage Sludge Contents / Tip of Iceberg

Heavy Metals, Pathogens, Synthetic Chemicals, Hydrocarbons, Petrochemicals & Organochlorines, Pharmaceuticals, Steroids & Hormones.

This list of contents represents only the "tip of the iceberg" of toxics concentrated in sewage sludge. Federal and most state and local land application regulations limit concentrations of only nine heavy metals and one "indicator" pathogen in land applied sewage sludge (in **BOLD**).

## Heavy Metals [1, 2]

Aluminum,	Dysprosium,	<b>MERCURY,</b>	Tantalum,
Antimony,	Erbium,	<b>MOLYBDENUM,</b>	Tellurium,
<b>ARSENIC,</b>	Europium,	<b>NICKEL,</b>	Terbium,
Barium,	Gadolinium,	Niobium,	Thallium
Beryllium,	Germanium,	Palladium,	Thorium,
Bismuth,	Gold,	Praseodymium,	Thulium,
Boron,	Hafnium,	Rhodium,	Tin,
Bromine,	Holmium,	Rubidium,	Titanium,
<b>CADMIUM,</b>	Iron,	Ruthenium,	Tungsten,
Cerium,	Lanthanum,	Samarium,	Uranium,
Cesium,	Lutetium,	Scandium,	Vanadium,
Chromium,	<b>LEAD,</b>	<b>SELENIUM,</b>	Yttrium,
<b>COPPER,</b>	Magnesium,	Silver,	Ytterbium,
Cobalt,	Manganese,	Strontium,	<b>ZINC</b>

## Pathogens [3, 4, 5, 11, 15]

### Bacteria

#### **FECAL COLIFORM,**

Salmonella (2,000 types),  
Shigella (4 spp.),  
E. coli 0157:H7,  
Staphylococcus aureus,

#### **Viruses**

Adenovirus, Astrovirus,  
Calicivirus, Coronavirus,  
Enterovirus (Poliovirus),

#### **Protozoa**

Cryptosporidium,  
Entamoeba histolytica,  
**Helminths** (Parasites)

Ascaris lumbricoides  
(roundworm),  
Ancylostoma duodenale  
(hookworm), Necator  
americanus (hookworm),

#### **Fungi**

Aspergillus fumigatus,  
Candida albicans,  
Cryptococcus neoformans,

**Prions** (spongiform encephalopathy)

Enteropathogenic E. coli,  
Yersinia enterocolitica,  
Campylobacter jejuni,  
Vibrio cholera, Leptospira,  
Listeria, Helicobacter,

Coxsackie A, Coxsackie B,  
Echovirus, Enterovirus 68-  
72), Hepatitis A virus,

Giardia lamblia,  
Balantidium coli,

Tainia saginata (tapeworm),  
Trichuris (whipworm),  
Toxocara (roundworm),  
Strongyloides (threadworm),  
Ascaris suum,

Epidermophyton spp.,  
Trichophyton spp.,  
Trichosporon spp.,

Mycobacteria, Aeromonas,  
Legionella, Burkholderia,  
Endotoxins,  
antibiotic resistant bacteria,

Hepatitis E virus,  
Norwalk virus,  
Reovirus, Rotavirus

Toxoplasma gondii

Toxocara canis,  
Taenia solium,  
Hymenolepis nana

Phialophora spp.,

While Federal law and regulations limit none of contents below, they allow localities to set more restrictive limits on sewage sludge and soil contamination. Some states do so &/or permit precautionary local control, and others do neither.

Once spread on land, the contaminants above and below persist for centuries - to decades - to months affecting soil, water, plants, air, animals and people.

Unlike pesticides (distinct chemicals subject to specific analysis), sewage sludge is a very complex, variable and concentrated mixture of the vast multitude of unstudied and unregulated hazardous wastes dumped into sewer systems.

## Synthetic Chemicals [2, 6, 7, 8, 9, 12, 16]

### Dioxins & Furans

Dioxins,	2,3,4,6,7,8- Hexachlorodibenzo-Furan,
Octachlorodibenzo-P-Dioxin,	1,2,3,4,7,8,9-Heptachlorodibenzo-Furan,
1,2,3,4,6,7,8-Heptachlorodibenzo-P-Dioxin,	2,3,4,7,8-Pentachlorodibenzo-Furan,
Octachlorodibenzo Furan, 1,2,3,4,6,7,8-	1,2,3,4,7,8- Hexachlorodibenzo-P-Dioxin,
Heptachlorodibenzo-	1,2,3,7,8- Pentachlorodibenzo-Furan,
Furan (71), 2,3,7,8-Tetrachlorodibenzo-Furan,	1,2,3,7,8- Pentachlorodibenzo-P-Dioxin,
1,2,3,6,7,8-Hexachlorodibenzo-P-Dioxin,	1,2,3,7,8,9- Hexachlorodibenzo-Furan,
1,2,3,4,7,8-Hexachlorodibenzo-Furan ,	2,3,7,8- Tetrachlorodibenzo-P-Dioxin,
1,2,3,7,8,9- Hexachlorodibenzo-P-Dioxin,	Polychlorinated Dibenzodioxin/Polychlorinated Di-
1,2,3,6,7,8-	benzofuran (PCDD/PCDF), Tetrahydrofuran, 2,4-
Hexachlorodibenzo-Furan,	D, 2,4,5-T, dioxin (TCDD),

### "Organics" (carbon-based)

Acetone, Chloroform,	2,2'-methylenebis[4-methyl-	N-Tetradecane,
Cyclohexanone,	6- nonyl-Phenol, p-	N-Triacontane,
Bis(2-ethylhexyl) Phthalate,	Nonylphenol, 4,4'-	N-Eicosane, N-Hexadecane,
Bis(2-ethylhexyl)	butylidenebis[2-(1,1-	N-Octacosane,
tetrabromophthalate,	dimethylethyl)-5-methyl-,	Carbon Disulfide,
Di-n-undecyl phthalate,	4-Methylphenol,	N-Decane, N-Docosane,
Alkyl benzyl Phthalate, Di-(2-	Phenol, 4,4'-(1-	N-Octadecane, P-Cymene,
Ethylhexyl) Phthalate	methylethylidene)bis[2-(1,1-	Benzo(B)fluranthene,
(DEHP), Butyl Benzyl	dimeth,	Fluoranthene,
Phthalate, Toluene,	Phenol, 4,4'-(1-	P-Chloroaniline,
2-Propanone,	methylethylidene)bis[2-(1,1-	Pyrene, Tetrachloromethane,
Methylene Chloride,	dimeth,	Trichlorofluoromethane, 2-
Hexanoic Acid,	2,4-dicumylphenol,	Hexanone,
2-Butanone, Methyl Ethyl	p-Dodecylphenol, 2,4,5-	2-Methylnaphthalene,
Ketone, Alcohol Ethoxylate,	Trichlorophenol,	4-Chloroaniline,
Alkylphenoethoxylates,	N-Hexacosane,	Benzo(a)pyrene
Phenol, Nonylphenol,	N-Tetracosane, N-Dodecane,	

### Pesticides & Insecticides

Aldrin, Chlordane,	Acetic Acid (2,4-	Pentachloronitrobenzene,
Cyclohexane, Heptachlor,	Dichlorophenoxy),	Chlorobenzilate, Beta-BHC,
Endosulfan, Endosulfan-II,	2,4,5-	Kepone, Mirex,
Lindane, Dieldrin, Endrin,	Trichlorophenoxypropionic	Methoxychlor,
DDT, DDD, DDE, 2,4,5-	Acid,	
Trichlorophenoxyacetic Acid,		

### PCBs (PolyChlorinated Biphenyls)

PCB-1016,	PCB-1232,	PCB-1248,	PCB-1260
PCB-1221,	PCB-1242,	PCB-1254,	

### PBDEs (PolyBrominated Diphenyl Ethers)

BDE-28,	BDE-85,	BDE-138,	BDE-183,
BDE-47,	BDE-99,	BDE-153,	BDE-209,
BDE-66,	BDE-100,	BDE-154,	

## Hydrocarbons, Petrochemicals, Organochlorines [7, 8, 9, 10, 12, 16]

PCBs, PCT, PBB, PBT,  
Anthracene,  
Pentachlorophenol,  
Benzo(g,h,i)perylene,  
Benzene, Benzene,  
C14-C24-branched,  
Polyethylbenzene  
residue, Octane,  
Hexachlorobenzene,  
Ethylbenzene,

Chlorinated Benzenes,  
Naphtha (petroleum),  
turpentine-oil,  
Hydrotreated kerosene,  
Hydrocarbon oils,  
Hydrocarbons, C10 and  
C12, Distillates  
(petroleum), Fuel oil,  
Creosols, P-Cresol, O-  
Cresol,

2-(2H-Benzotriazol-2-yl)-p-cresol,  
Hexachlorobutadiene,  
N-Nitrosodimethylamine,  
Toxaphene, Trichloroethane,  
Tetrachloroethane, Hexachloroethane,  
Carbon Tetrachloride, Dichloroethylene,  
Trichloroethylene, Tetrachloroethylene,  
Xylene,

## Pharmaceuticals [2, 12, 16]

1,7-Dimethylxanthine,  
4-Epianhydrochlortetracycline,  
4-Epianhydrotetracycline,  
4-Epichlortetracycline,  
4-Epioxytetracycline,  
4-Epitetracycline,  
Acetaminophen,  
Albuterol,  
Anhydrochlortetracycline,  
Anhydrotetracycline,  
Azithromycin,  
Caffeine,  
Carbadox,  
Carbamazepine,  
Cefotaxime,  
Chlortetracycline,  
Cimetidine,  
Ciprofloxacin,  
Clarithromycin,  
Clinafloxacin,  
Cloxacillin,  
Codeine,  
Cotinine,  
Dehydronifedipine,  
Demeclocycline,  
Digoxigenin,

Digoxin,  
Diltiazem,  
Diphenhydramine,  
Doxycycline,  
Enrofloxacin,  
Erythromycin-Total,  
Flumequine,  
Fluoxetine,  
Gemfibrozil,  
Ibuprofen,  
Isochlortetracycline,  
Lincomycin,  
Lomefloxacin,  
Metformin,  
Miconazole,  
Minocycline,  
Naproxen,  
Norfloxacin,  
Norgestimate,  
Ofloxacin,  
Ormetoprim,  
Oxacillin,  
Oxolinic Acid,  
Oxytetracycline,  
Penicillin G,  
Penicillin V,

Ranitidine,  
Roxithromycin,  
Sarafloxacin,  
Sulfachloropyridazine,  
Sulfadiazine,  
Sulfadimethoxine,  
Sulfamerazine,  
Sulfamethazine,  
Sulfamethizole,  
Sulfamethoxazole,  
Sulfanilamide,  
Sulfathiazole,  
Tetracycline,  
Thiabendazole,  
Triclocarban,  
Triclosan,  
Trimethoprim,  
Tylosin,  
Virginiamycin,  
Warfarin,

## Steroids & Hormones [2,12, 16]

17 Alpha-Dihydroequilin,  
17 Alpha-Estradiol,  
17 Alpha-Ethinyl-Estradiol,  
17 Beta-Estradiol,  
Androstenedione,  
Androsterone,  
Beta Stigmastanol,  
Campesterol,  
Cholestanol,

Cholesterol,  
Coprostanol,  
Desmosterol,  
Epicoprostanol,  
Equilenin,  
Ergosterol,  
Estriol,  
Estrone,  
Ethinylestradiol,

Norethindrone,  
Norgestrel,  
Progesterone,  
Stigmastanol, Sitostanol,  
Beta-Estradiol 3-Benzoate,  
Beta-Sitosterol,  
Equilin,  
Testosterone,

“Acceptable” levels of exposure to sewage sludge contaminants are based on obsolete and faulty scientific data and processes. In 2002 and 2010, the National Academy of Sciences and National Institutes of Health established those facts [13, 14].

The risk assessments upon which these levels are based neglected dietary impacts on children; multi-pathway exposure; synergistic impacts; infectious organism exposure; ecological, wildlife, food chain, soil microorganism & forest soil impacts; long-term heavy metal accumulation; and used a cancer risk safety factor 100 times less protective than used for air and water pollution.

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