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

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

Pathogens

Bacteria

FECAL COLIFORM, Salmonella (2,000 types), Shigella (4 spp.), E. coli 0157:H7, Staphylococcus aureus, Enteropathogenic E. coli, Yersinia enterocolitica, Campylobacter jejuni, Vibrio cholera, Leptospira, Listeria, Helicobacter, Mycobacteria, Aeromonas, Legionella, Burkholderia, Endotoxins, antibiotic resistant bacteria,

Viruses

Adenovirus, Astrovirus, Calcivirus, Coronavirus, Enterovirus (Poliovirus, Coxsackie A, Coxackie B, Echovirus, Enterovirus 68-72), Hepatitis A virus, Hepatitis E virus, Norwalk virus, Reovirus, Rotavirus

Protozoa

Cryptosporidium, Entamoeba histolytica, Giardia lamblia, Balantidium coli, Toxoplasma gondii

Helminths (Parasites)

Ascaris lumbicoides (roundworm), Ancylostoma duodenale (hookworm), Necator americanus (hookworm), Tainia saginata (tapeworm), Trichuris (whipworm), Toxocara (roundworm), Strongyloides (threadworm), Ascaris suum, Toxocara canis, Taenia solium, Hymenolepis nana

Fungi

Aspergillus fumigatus, Candida albicans, Cryptococcus neoformans, Epidermophyton spp., Trichophyton spp., Trichosporon spp., Phialophora spp.,

Prions (spongiform encephalopathy)

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

Dioxins & Furans

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

"Organics" (carbon-based)

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

Pesticides & Insecticides

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

PCBs (PolyChlorinated Biphenyls)

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

PBDEs (PolyBrominated Diphenyl Ethers)

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

Hydrocarbons, Petrochemicals, Organochlorines

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, Trichioroethylene, Tetrachloroethylene, Xylene,

Pharmaceuticals

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

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,
Stigmasterol, 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 [3, 1].

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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15. "Pathogen risk assessment methodology for municipal sewage sludge landfilling and surface disposal", U.S. EPA, 1995, EPA 600/R-95/016.
16. NSSS USEPA 1988 "National Sewage Sludge Survey Availability of Information & Data, and Anticipated Impacts on Proposed Regulations; Proposed Rule"; Fed Reg, vol. 55, # 218, 11-9-90, pgs 47210-47283, Table I-12.
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SLO Co. BofS & SSLATF Recommendation List *

Primary Recommendation = #s 1 – 6.

1. Identify Option No. 2 as the primary recommendation of the Task Force. [Create a local ordinance establishing more stringent requirements for quality of acceptable biosolids material, as well as local control and oversight of how, when and where biosolids may be applied. A public education campaign as described [above] would be implemented concurrently.]
2. Local standards for sewage sludge quality shall be derived from but not limited to state and federal regulations.
3. San Luis Obispo County should adopt a sewage sludge land application ordinance using pollution accumulation limits, considering local soil pollutant levels.
4. San Luis Obispo County should incorporate into an ordinance a comprehensive set of constituents including heavy metals, synthetic chemicals, pathogens and other pollutants not limited to those in current state and federal standards, for setting sewage sludge quality and land accumulation limits.
5. The County should establish a limitation on accepting or processing new land application projects for treated sludge beyond historical amounts of EQ treated sewage sludge until completion of the local ordinance to control and regulate land application of treated sludge. (EQ is "exceptional quality" material, as defined in the federal regulations 40 CFR 503.)
6. In developing an ordinance San Luis Obispo County should consider all feasible methods of treated sewage sludge/biosolids management and their relative impacts.

Notification and Public Information - San Luis Obispo County should incorporate into an ordinance:

7. specific procedures to ensure adequate public & community notification of project proposals, including opportunities to comment regarding them.
8. specific testing, written notification & reporting procedures to ensure consumers receive comprehensive information about treated sewage sludge/biosolids content, source, and usage guidelines.
9. specific procedures for delivering a notification to recipient landowners and users as to the potential problems and benefits associated with the use &/or misuse of treated sewage sludge/biosolids, and for obtaining formal & prior informed consent.
10. specific procedures to ensure property records document any land application activity and the availability of information regarding that activity, so prospective land purchasers and appraisers may be fully informed.

Fees and Financial Considerations - San Luis Obispo County should incorporate into an ordinance:

11. specific procedures to ensure that the fees imposed upon each project are sufficient to fund required assessment, monitoring & oversight activities.
12. provisions for the assessment of fines and/or penalties in case of violations to effectively and rapidly enforce its regulations.
13. requirements for project proponents to post performance bonds & obtain insurance coverage, including pollution liability, to recompense parties potentially impacted by related remediation and/or litigation.
14. General Use and Site Prohibitions - In preparing its ordinance, San Luis Obispo County should consider how, when, where, and whether treated sewage sludge/biosolids should be applied to:
    a. Human Food-Chain Crops
    b. Animal Feed Crops
    c. Grazing, Pasture Land
    d. Agricultural Soil Classifications
    e. Home Gardens
    f. Home Lawns
    g. Public Parks
    h. School Playgrounds
    i. Sports Fields
    j. Forests
    k. Sensitive Ecological Areas & Species
15. Program and Project Requirements - In preparing its ordinance, San Luis Obispo County should consider provisions related but not limited to:
    a. Transportation requirements
    b. Buffer Zones / Set Back Distances
    c. Water Supply Protection
    d. Wind Speed Limits
    e. Monitoring of heavy metals, pathogens, and other constituents.
    f. Weather / Season
    g. Incorporation into Soil
    h. Runoff Protection
    i. Erosion Control
    j. Agronomic Rates
    k. Crop Limitations
    l. Type and frequency of application.

* San Luis Obispo County Treated Sewage Sludge / Biosolids Land Application Task Force Report & Recommendations to SLO Co. Board of Supervisors, October 26, 2001.