

# 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,	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

### 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

### 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 Di-  
benzofuran (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,  
Alkylphenoethoxylates,  
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,  
Trichloroethylene, 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,  
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 [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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14. EPA "Technical Support Document for the Round Two Sewage Sludge Pollutants", EPA-822-R-96-003, August 1996.
15. "Pathogen risk assessment methodology for municipal sewage sludge landfilling and surface disposal", U.S. EPA, 1995, EPA 600/R-95/016.
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18. "National Survey of Elements & Other Constituents in Municipal Sewage Sludges", R. Mumma, et. al. Arch. of Environ. Contam. Toxicol. vol 13, 1, 1984.



**CSI: Center for Sludge Information**

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re: 12-5-12 Agenda Item 5-A - NPDES Compliance Evaluation Inspection (CEI)  
Report: Unsatisfactory Rating

- **Sewage Sludge Storage Deficiencies & Remediation**

date: 12-5-12

It is imperative that the SSLOCSD immediately cease storing sewage sludge directly on ground adjacent to the Arroyo Grande Creek levee.

The proximity of the sewage sludge storage area to Arroyo Grande Creek presents the potential for chronic leaching of contaminants into the associated groundwater system. The possibility of levee breaches near the sewage plant present the potential for acute contamination of the downstream environment.

CSI examined the US EPA/CCRWQCB CEI Report, and visited and photographed the site on 12-3-12, from without and within the plant. It is evident that sewage sludge is mixing with pooled surface water in the storage area, as demonstrated by the photos below.

(note date on photos 12-2-12 is wrong – correct date is 12-3-12)

Sewage Sludge Dumped on Ground – from creek levee:





Sewage Sludge Pile under Centrifuge Auger Chute – from inside plant



Sewage Sludge Pile adjacent to Pool of Water – from inside plant





The 12-5-12 Superintendent's Report (Agenda item #4) relates a desire to place a trailer under the centrifuge auger chute to prevent sewage sludge contact with the soil surface. This should be accomplished as soon as possible, before more rains. This should not wait until summer, as suggested in the Superintendent's Report.

The District Administrator's 12-5-12 Staff Report regarding the 3-14-12 CEI Report states, "A Major Budget item for a new lagoon lining is currently included in the current FY 2012-13 budget but was delayed because of the construction of a retaining wall in the lagoon area...". The Staff Report also states, "a new concept for the lining project has been suggested by operations staff... a concrete loading area for the centrifuge to dump directly into standby trailers that will be hauled out when filled. This project's concept is being reviewed by Staff and will be brought to the Board for authorization to proceed after the first of the year.". Action on this matter should be prioritized to speed up the time line for completion as soon as possible.

The Staff Report also states, "The follow-up action recommended by the EPA is to rate SSLOCSD as a 'Two (2)' or Medium priority ('paperwork and minor deficiencies') for follow-up". This rating is included in the 5-21-12 PG Environmental letter to the CCRWQCB in Table 1, as "Rating 2 – Medium Priority Follow-up". This letter also describes "Rating 1-High – Identified deficiencies threaten human health and environment, high priority for a follow-up inspection by Regional Board inspectors.". The SSLOCSD should act on this matter as if the deficiencies received a Rating 1-High.

The CEI Report lists two items under the heading "**Major Findings**", one of which pertains to sewage sludge storage (page 3):

**Biosolids / Solid Waste Handling & Disposal**

1. Central Coast Water Board Order No. R3-2009-0046, Section VI.C.5.a requires that solids and sludge treatment, storage, and disposal or reuse shall not create a nuisance, and shall not result in groundwater contamination. Biosolids did not appear to be adequately stored and contained, and resulted in a possible threat for groundwater contamination. The Discharger was not storing the biosolids processed by the centrifuge on the engineered drying beds, as stated in the permit. Rather, piles of biosolids from the centrifuge system were stored on a porous surface; located adjacent to the Arroyo Grande Creek levee, and approximately 45 yards north of Arroyo Grande Creek (refer to Photos 3 through 5). The primary on-site Facility representative stated that since the installation of the centrifuge, the drying beds are no longer necessary and are maintained as backup to the centrifuge. He also stated there are plans to pave the biosolids storage area, but no timeline has been set.

The CEI Report contains the "Unsatisfactory" rating for sewage sludge storage (page 18):

**BIOSOLIDS/SOLID WASTE HANDLING AND DISPOSAL: OVERALL RATING: U**

4. Storage at Facility: b. Controls leachate, runoff, and public access <b>4b. Biosolids are stored on a porous soil surface, and have the potential to contaminate groundwater (refer to Photos 3 through 5). Refer to the 'Major Findings - Biosolids/Solid Waste Handling and Disposal' section of this report for details.</b>	U
<b>Notes:</b> <b>This section was rated "unsatisfactory" due to checklist item 4b.</b>	

The SSLOCSD should rate this matter as a high priority, immediately cease dumping sewage sludge on the ground, place a trailer under the centrifuge auger chute, and proceed to prepare the storage area with an impervious surface as soon as possible.

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