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Dumping Sewage Sludge On Organic Farms?

Why USDA Should Just Say No

Overview

In December, 1997, the U.S. Department of Agriculture (USDA) proposed draft national standards for organic agriculture. As part of this proposal, the department invited the public to comment on the idea of allowing application of municipal sewage sludge on land used to grow organic foods.[1] The Environmental Protection Agency's top sludge regulator urged the department to allow "high quality biosolids" (i.e., sewage sludge) to be used in organic food production.[2]

The National Organic Standards Board (NOSB), a federally mandated advisory body established by the 1990 National Organic Standards Act, recommended to USDA that, in general, sewage sludge should not be allowed in organic food production. Experts within the organic food industry maintain that organic farmers extremely rarely, if ever, use sewage sludge now, and they resolutely oppose allowing its use under the final organic standards rule. The vast majority of the more than 115,000 public comments filed to date on the proposed rule explicitly object to the use of sewage sludge as a federally approved organic farming practice.

EWG Findings

Based on our analysis of the toxic constituents of sewage sludge and the likely contribution organic farmland can make to sludge disposal, the Environmental Working Group (EWG) strongly recommends that sewage sludge not be allowed in organic food production. Indeed, our review leads us to question the safety and advisability of using sewage sludge in *any* food production system.

- An EWG analysis of the Toxics Release Inventory (TRI) found that some 2 billion pounds of toxic chemicals—341 different chemicals in all—were transferred to sewage treatment plants between 1990 and 1995. Included were 33.6 million pounds of toxic heavy metals like mercury, lead, and cadmium, and more than 63 million pounds of carcinogenic substances.

- An EWG analysis of the only available national data on sludge content (the 1988 National Sewage Sludge Survey of 208 treatment plants) found a total of over 100 synthetic organic compounds (not including pesticides) in U.S. sludge, including phthalates, toluene, and chlorobenzene. The average sample contained almost 9 synthetic organic contaminants. Dioxins were found in sludge from 179 out of 208

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systems (80%). In addition, 42 different pesticides were found—at least one in almost every sample, with an average of almost 2 pesticides per survey sample. None of these chemical contaminants are regulated in sludge. The nine heavy metals that are regulated in sludge were routinely detected, often at high concentrations. No comprehensive data are available to assess if EPA regulations have reduced these toxic components of sludge since the late 1980s.

- Organic agriculture constitutes about one-tenth of one percent of all farmland—about 1 million acres out of 972 million acres. We estimate that allowing sludge to be used in organic agriculture will reduce the nation's sewage sludge disposal burden by about 0.03 percent—a trivial contribution, particularly when weighed against the potential for severe damage to consumer acceptance of organically grown foods and to the economic integrity of the $3.5 billion organic food industry.

  Use of municipal sewage sludge would be completely inconsistent with organic farming principles and practices, in light of the large number of toxic substances routinely found in sewage sludge, often at very high concentrations. Introducing synthetic pollutants through sewage sludge application into a food production system that is explicitly designed to scrupulously avoid synthetic chemicals such as pesticides and manufactured fertilizers would be the epitome of a flawed public policy.

Toxic Substances in Sewage Sludge

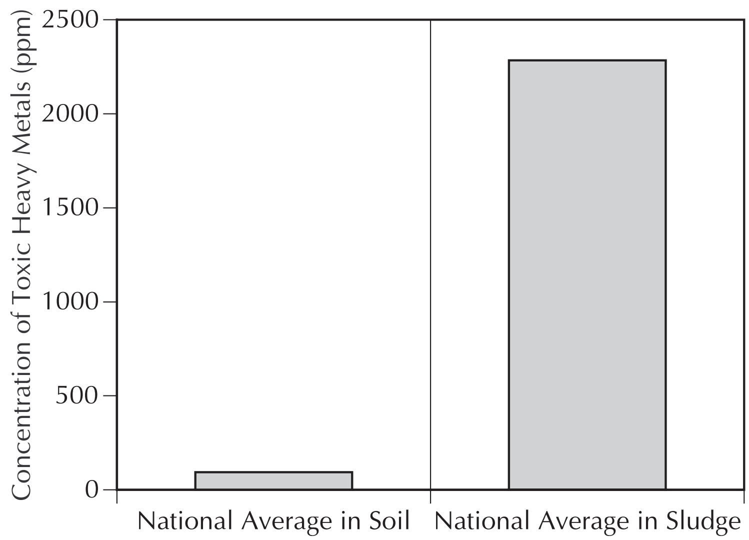
Sewage sludge is the thick, malodorous slurry left behind in a sewage treatment plant after its load of human and industrial chemical wastes has been treated and the wastewater discharged. The sewage treatment industry and the government often refer to sludge as "biosolids" for much the same reason that pesticide companies now call their products "crop protection chemicals."

The large amount of human waste in sewage treatment plants means that the sludge contains high concentrations of phosphates and nitrates, desirable components of fertilizer. However, the industrial wastes that are present in sewage cause highly toxic materials such as industrial solvents, heavy metals, and even nuclear waste to be left behind in sludge. When sewage sludge is applied to the fields, both the nutrients and the toxic chemicals are released to the environment. There are many of these toxic chemicals, and they are often found at high concentrations.

An EWG analysis of the Toxics Release Inventory (TRI) found that some 2 billion pounds of toxic chemicals—341 different chemicals in all—were transferred to sewage treatment plants between 1990 and 1995. This included 33.6 million pounds of toxic heavy metals like mercury, lead, and cadmium, and more than 63 million pounds of carcinogenic substances. Sewage treatment plants report discharges of some pollutants under the Clean Water Act, but do not report their discharges to the centrally maintained TRI. Thus, no recent comprehensive, national databases are available on the toxic constituents of effluent discharged by sewage treatment plants, or on the toxic components of more than 7.5 million tons of sludge generated in the United States annually.[3]

EWG also analyzed EPA's 1988 National Sewage Sludge Survey. This survey of 208 municipal sewage treatment plants was conducted prior to EPA's enforcement of regulations requiring pretreatment of industrial waste prior to its being sent to sewage treatment plants. The survey also predated EPA's regulatory restrictions on nine heavy metals that routinely contaminate sewage sludge—the only toxic components of sewage sludge for which monitoring is now required.[4] Nevertheless, in the absence of more recent data, the survey is the only available benchmark for evaluating toxic substances in sludge. Our analysis showed that over 100 synthetic organic compounds (not including pesticides) were detected in at least one survey sample. The average sample contained almost 9 synthetic organic contaminants. One sample had 32 compounds and 15 samples had at least 20. The most common organic contaminants in sludge were Bis(2-Ethylhexyl) Phthalate, which was found in the sludge of 142 different sewage treatment plants. Toluene and 2-Propanone were found in 126 and 125 plants, respectively (Table 1).

Figure 1. The average concentration of heavy metals in sewage sludge was 20 times the average concentration in soil.



Source: Environmental Working Group. Based on data from USEPA 1988 Sewage Sludge Survey and USEPA 1997.

Some 42 different pesticides were found; at least one pesticide was detected in almost every sample, with an average of almost 2 pesticides per sample and 25 samples containing 4 pesticides or more. The most common pesticide in sewage sludge was 2,4,5-Trichlorophenoxyacetic Acid (one of the active ingredients in Agent Orange), which banned for use by the EPA in 1985 yet was still found in 51 samples. Acetic Acid (2,4-Dichlorophenoxy) and 2,4,5-Trichlorophenoxypropionic Acid followed with 43 and 27 plants, respectively (Table 2).

In addition to pesticides and other organic contaminants, high levels of heavy metals were found in the sampled sludge. In one case, cadmium, a noted carcinogen and bio-accumulative heavy metal, constituted nearly one percent of the sludge mass. Overall, the average levels of 7 toxic heavy metals (arsenic, cadmium, copper, lead, mercury, nickel, and zinc) were over 20 times higher in sludge than in soil (Figure 1).

EPA's regulations governing the application of sewage sludge to agricultural land make the risks even worse. Of the hundreds of chemicals found in sewage sludge, EPA regulates only nine—a group of commonly occurring heavy metals. Numerous highly toxic and relatively common sludge contaminants, including dioxin, chromium, and industrial solvents, are unregulated.

Table 1. More than 100 organic contaminants were found in sewage sludge. None of these are regulated by EPA's sludge standards.

Chemical	Number of sewage treatment plants where contaminant was found	Chemical	Number of sewage treatment plants where contaminant was found
Bis(2-Ethylhexyl) Phthalate	145	Benzo(A)Anthracene	5
Toluene	126	Dibenzofuran	5
2-Propanone	125	Phenanthrene	5
2-Butanone	84	2-Methylnaphthalene	4
P-Cresol	76	2-Picoline	4
Methylene Chloride	73	Alpha-Terpineol	4
Hexanoic Acid	65	Benzene	4
N-Tetracosane	55	Benzyl Alcohol	4
N-Dodecane	53	1,1,1-Trichloroethane	3
N-Hexadecane	50	1,4-Dioxane	3
Phenol	50	2-Chloronaphthalene	3
N-Octadecane	46	1,2,4-Trichlorobenzene	2
N-Tetradecane	46	1,2-Dichlorobenzene	2
N-Hexacosane	45	1,3-Dichlorobenzene	2
N-Triacontane	45	2-Propen-1-Ol	2
N-Eicosane	44	3-Chloropropene	2
N-Decane	40	4-Chloro-3-Methylphenol	2
Carbon Disulfide	36	Acetophenone	2
N-Octacosane	33	Anthracene	2
Ethylbenzene	32	Benzo(Ghi)Perylene	2
M-Xylene	31	Dimethyl Phthalate	2
N-Docosane	31	Diphenyl Ether	2
O+P Xylene	23	N-Nitrosodiphenylamine	2
Chlorobenzene	19	Nitrobenzene	2
Tetrachloroethene	19	Squalene	2
P-Cymene	17	1,1,2,2-Tetrachloroethane	1
2-Hexanone	14	1,1-Dichloroethane	1
Butyl Benzyl Phthalate	14	1,2,3-Trichlorobenzene	1
Di-N-Butyl Phthalate	14	1,2-Dichloropropane	1
Fluoranthene	11	1,4-Dinitrobenzene	1
Di-N-Octyl Phthalate	10	1-Methylphenanthrene	1
P-Chloroaniline	10	2,4-Dimethylphenol	1
Pyrene	10	2,6-Dinitrotoluene	1
1,2:3,4-Diepoxybutane	9	2-(Methylthio)Benzothiazole	1
Benzo(B)Fluoranthene	9	2-Propenenitrile, 2-Methyl-	1
Naphthalene	9	3,6-Dimethylphenanthrene	1
Tetrachloromethane	9	Acenaphthene	1
Trans-1,2-Dichloroethene	9	Aniline, 2,4,5-Trimethyl-	1
Benzo(K)Fluoranthene	8	Benzenethiol	1
Benzoic Acid	8	Chloroethane	1
Biphenyl	8	Chloromethane	1
Trichlorofluoromethane	8	Crotonaldehyde	1
1,4-Dichlorobenzene	7	Dibenzothiophene	1
Benzo(A)Pyrene	7	Dimethyl Sulfone	1
Chrysene	7	Diphenylamine	1
O-Cresol	7	Ethyl Cyanide	1
Styrene	7	Pentachlorophenol	1
Trichloroethene	7	Perylene	1
4-Methyl-2-Pentanone	6	Thioxanthe-9-One	1
Chloroform	6	Triphenylene	1
Isobutyl Alcohol	6		

Source: Environmental Working Group. Based on data from U.S. EPA's 1988 Sewage Sludge Survey

Many scientists and public health organizations have criticized the agency for its failure to enact tougher, health based standards for sludge that is land applied. In a 1997 evaluation of heavy metals in fertilizer materials, for example, Texas A&M researchers found that sewage sludges had elevated levels of nearly every heavy metal evaluated. In some cases, the concentration of such heavy metals as lead and chromium were between 30 and 100 times higher in sewage sludge than in organic fertilizers. In fact, the researchers concluded that sludges should be some of the "primary target materials for environmental evaluation" (Raven 1997).

Scientists at Cornell University recently criticized the EPA's regulatory framework for only focusing on a handful of the dozens of toxic chemicals that are found in sludge, and for formulating regulations based on underestimates of human vegetable consumption, absorption of toxic chemicals by plants grown on sludge, and the safe exposure dose for toxics found in sludge. (Harrison 1997) In addition, the Cornell review concluded that the agency did not use a safety factor in

Table 2. 42 different pesticides were found in sewage sludge. None of these are regulated by EPA's sludge standards.

Pesticide	Number of sewage treatment plants where pesticide was found
2,4,5-Trichlorophenoxyacetic Acid	51
Acetic Acid (2,4-Dichlorophenoxy)	43
2,4,5-Trichlorophenoxypropionic Acid	27
Pentachloronitrobenzene	22
Endosulfan-Ii	21
PCB-1248	20
PCB-1260	17
Beta-BHC	15
Chlorpyrifos	15
Endrin	11
PCB-1254	10
Chlorobenzilate	9
4,4'-DDT	7
Aldrin	7
Delta-BHC	7
Phosphoric Acid, Tri-O-Tolyl Ester	7
Tetraethylpyrophosphate	7
Dieldrin	6
Endosulfan-I	6
Naled (Dibrom)	6
Nitrofen (Tok)	6
Alpha-BHC	5
Dimethoate	5
4,4'-DDE	4
Phosphamidon	4
Leptophos	3
Santox (Epn)	3
Trifluralin (Treflan)	3
Azinphos Methyl	2
Captan	2
Diallate	2
Heptachlor Epoxide	2
Lindane (Gamma-BHC)	2
Mevinphos (Phosdrin)	2
Trichlorofon	2
4,4'-DDD	1
Azinphos Ethyl	1
Chlordane	1
Ciodrin	1
Diazinon	1
Dicrotophos (Bidrin)	1
Heptachlor	1

Source: Environmental Working Group. Based on data from U.S. EPA's 1988 Sewage Sludge Survey developing their risk estimates, a common practice when regulators are forced to make public health decisions based on very little data. The Cornell scientists further concluded that the “allowable risks” in the agency’s sludge regulations are unusually high. The EPA cancer risk standards on which the sludge standards are based are 100 times weaker than the EPA’s commonly used “acceptable risk” standard.[5]

Organic Farms Won’t Help Sludge Disposal Problem

Both municipalities and government agencies are under intense pressure to dispose of municipal sewage sludge, an unpleasant material whose the quantities increase each year. Within the sewage treatment sector, land disposal of sewage sludge is universally considered to be an imperative, due to the cost and environmental constraints associated with other disposal options. The nation’s roughly 1 billion acres of farmland figure prominently in both regional and national sewage sludge disposal strategies.

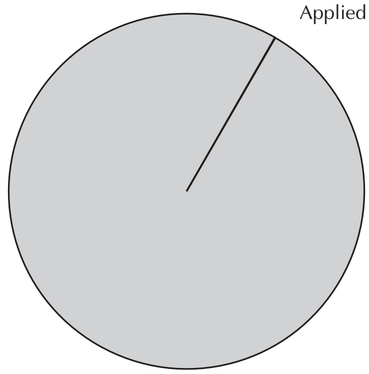
USDA requested public comment on the use of sewage sludge in organic agriculture in part because the EPA’s Assistant Administrator for Water—in effect, the nation’s top sludge regulator—formally recommended the practice when the department was preparing the proposed national organic standards rule.

EWG’s analysis indicates, however, that allowing organic farmers to use sewage sludge would dispose of a vanishingly small fraction of nation’s sewage. Yet, if sewage sludge were allowed in organic agriculture, even if it were used by a small fraction of organic producers, the practice could severely damage the consumer acceptance and economic integrity of the burgeoning, multi-billion dollar organic food industry.

According to a 1996 report by the National Research Council, sewage treatment plants in the United States produce an average of 5.7 million dry tons of sludge per year (NRC 1996). The NRC estimated that approximately 36 percent of this sludge — 2.1 million dry tons — was applied to land, either as fertilizers for farms, golf courses, cemeteries, or other lands, or was used in reclamation of strip mines. The federal government has no idea how much sewage sludge is applied to these various land categories, and no data on how many acres of farmland or other land types have sewage sludge applied each year. We found no national source of data with which to analyze the location of sludge application on farmland, or for that matter on any land type. Information about how much sludge is used, and where, is available locally and anecdotally, if at all. It is a state of ignorance that parallels the absence of current, public information on the toxic constituents in sludge.

The NRC recommended that when sludge is used as farmland fertilizer that it be applied at an average of 4.5 tons per acre. This level reflects average crop nitrogen needs and sludge nitrogen content, not any safety standard or risk threshold (NRC 1996). In our analysis, we sought to estimate how much land would be treated with sludge at this rate, and how much of a contribution organically farmed land could make to sludge disposal. Simply framed, how much can 1 million acres of organic farmland contribute in the context of about 1 billion acres of land in farms?

Figure 2. Organic Farms Won't Help the Sludge Problem.



Source: Environmental Working Group.

NRC's estimate of 2.1 million tons of sludge that is applied to *all* lands would treat a total of no more than 466,000 acres at the recommended rate for farmlands (i.e., assuming that the average farmer uses sludge at the NRC–recommended rate: 2.1 million tons/4.5 tons per acre = 466,000 acres).[6] That acreage amounts to just 0.05 percent of the 972 million acres of land in farms in the United States.

According to the only available estimate, less than 1 million acres of farmland were devoted to organic agriculture on average in the early 1990s (Anton Dunn 1997). Assuming that organic farmers would apply sludge at the same frequency (0.05 percent of organic acres) as all other farmers, and at the NAS recommended rates (4.5 acres per ton), this would mean that only two thousand dry tons of sludge would be used on organic farms. This amounts to 0.03 percent of the total amount of sludge produced in the U.S. every year.

Simply because the organic sector occupies such a small fraction of the nation's farmland mall, and such a small number of all farmers use sludge, allowing sludge to be used on organic farms will not be an effective disposal mechanism. The sewage treatment sector will benefit little, but the organic sector stands to lose a great deal, if sludge is allowed in organic farming (Figure 2).

Granted, the organic industry is expected to grow, and some may argue that, because the organic regulations would not allow the use of synthetic fertilizer, that organic farmers would use more sewage sludge per acre than conventional farmers. However, our analysis makes clear that even if the organic industry grew tenfold, and organic farmers applied sludge at three times the rate of conventional farmers, they could still dispose of less than one percent of the nation's annual sludge production.

Ironically, allowing the use of sewage sludge in organic food production is probably a surefire way to ensure that organic acreage will not expand, based on the strong opposition consumers have voiced to USDA at the prospect of sewage sludge being legal for use by organic growers.

Notes

[1]The Department also asked for public comment on the admissability of genetically modified organisms and food irradiation for foods that would bear the national organic label. This analysis is confined to the issue of sewage sludge in organic food production.

[2] Letter to Richard Rominger, Deputy Secretary of Agriculture, from Robert Perciasepe, EPA Assistant Administrator for Water, Nov. 10, 1997.

[3] Tons are as dry weight. The National Research Council's 1996 study (NRC 1996) estimated 5.7 million tons of sewage sludge were generated in the early 1990s. EPA officials estimates that sewage sludge generation may now exceed 7.5 million tons per year (Personal Communication with USEPA Office of Wastewater Management).

[4] These nine heavy metals are: arsenic, cadmium, copper, lead, mercury, molybdenum, nickel, selenium, zinc.

[5]EPA commonly sets standards for pesticides and other chemicals at a level such that cancer risks do not exceed the "one in a million level" — one cancer case per ten million exposed individuals. This risk standard was a key part of the Food Quality Protection Act, passed by Congress in 1996. For the sludge standards, EPA uses a risk standard of 1 in 10,000 — 100 times weaker than the standards for pesticides in food.

[6]This is actually an overestimate, because it assumes that all two million tons of sludge were applied entirely to farmland. In fact sewage sludge is applied to other land categories, such as strip mines (for reclamation), forest lands, golf courses, and cemeteries.

References

Anton Dunn, Julie. "Certified Organic Production in the United States: Half a Decade of Growth." Agrisystems International, 1997. 125 West Seventh Street, Wind Gap, Pennsylvania, 18901. 33 pp.

Environmental Protection Agency. Fertilizers: A Background and Characterization of Use, Contaminants and Regulations. Draft Report. Prepared by Batelle. Office of Pollution Prevention and Toxics. December, 1997.

Harrison, Ellen Z., et al. "The Case for Caution: Recommendations for Land Application of Sewage Sludges and an Appraisal of the US EPA's Part 503 Sludge Rules." Cornell Waste Management Institute Working Paper. August 1997.

National Research Council (NRC). Use of Reclaimed Water and Sludge in Food Crop Production. Washington, D.C.: National Academy Press, 1996.

Raven, K.P. and R.H. Loeppert. "Heavy Metals in the Environment: Trace Element Composition of Fertilizers and Soil Amendments." Journal of Environmental Quality. 26: 551-557 (1997).

United States Department of Agriculture (USDA). "National Organic Program"; Proposed Rule. Federal Register, December 16, 1997.

United States Environmental Protection Agency (USEPA). "National Sewage Sludge Survey." NTIS: PB93-500403. 1988.

Acknowledgments

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