

Sewage Sludge & Food Safety

A factsheet produced by the Institute for Agriculture and Trade Policy

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The *Code of Federal Regulations* defines sewage sludge as "solid, semi-solid, or liquid residue generated during the treatment of domestic sewage at a treatment works." [1] Many consumers became aware of the issue of sewage sludge use in agriculture when the National Organics Program of the U.S. Department of Agriculture (USDA) was considering allowance of its use in organic agriculture. Many concerned consumers contacted the USDA to express their concern. Yet most U.S. consumers are probably unaware of the fact that sewage sludge is often used for fertilizer in conventional agriculture.

According to the Water Environment Federation (WEF), by 1995, 36 percent of America's sewage sludge (sometimes called "biosolids") was applied to agricultural land. [2] That was about two million dry tons per year. The Environmental Protection Agency (EPA) has created rules to regulate the land application of sewage sludge to farms and other land. Many people believe that those rules are not enough.

The known potential health risks related to consuming food grown in sewage sludge-amended soils are discussed here in two main categories: toxic materials, such as heavy metals, dioxin, or other synthetic chemicals; and pathogens (organisms that cause disease). In addition to exposure through food, people may be exposed to sludge through direct contact or ingestion of sludge-amended soil, breathing dust from sludge-amended soil, or by drinking surface or groundwater into which toxic compounds or pathogens from sludge have leached. Likewise, sludge may have health effects on plants and wildlife in the environment. This factsheet, however, focuses solely on the risks of human exposure through food.

In 1993, the Environmental Protection Agency (EPA) created its Part 503(b) rules -- often called "503 rules" -- for land application of sewage sludge. These regulations set standards only for nine metals, and not for any toxic chemicals.

Threats from toxic materials: Heavy metals

Sewage treatment plants are unable to break down heavy metals such as lead, cadmium, mercury and chromium. Thus, the heavy metals are retained in the sludge. The Part 503 rules have standards for arsenic, cadmium, copper, lead, mercury, molybdenum, nickel, selenium and zinc.

Murray McBride of Cornell University has reviewed the impacts of heavy metals in sludge under the 503 Rules. He summarized,

This regulation allows the largest annual inputs and highest toxic metal concentrations in sludges that can be used in agriculture, and the largest cumulative metal pollutant loading limits that have ever been proposed in any industrialized country. [3]

Most plants do not absorb heavy metals well, but metal absorption will vary, depending on soil conditions. Certain heavy metals are taken up by some plants. Spinach can absorb mercury. [4] Many plants, including tobacco, wheat, corn, and leafy vegetables like lettuce and spinach, readily absorb cadmium. [5] Even plants that do not absorb significant amounts of cadmium can contribute a notable amount to the diet. "Grains and potatoes accumulate much smaller concentrations of Cd [cadmium] from contaminated soils than do leafy vegetables, but because of their greater dry weight content in most diets, can make a substantial if not dominant contribution to Cd intake by humans." [6]

Researchers at the Cornell University Waste Management Institute analyzed the implications of the EPA Part 503 rule in a critique called *A Case for Caution*. In it, they noted that the dietary risks for cadmium in the EPA rule presumed a diet lower in vegetables than recommended in the U.S. Department of Agriculture (USDA) "food pyramid" diet. [7] Cadmium is a probable human carcinogen and causes kidney, liver and nervous system damage.

Heavy metals in sludge are more of a risk to the grazing animals that ingest contaminated soil along with plants they eat. Although there have been no studies to assess the impacts on dairy cows, there are numerous reports of farmers who believe their animals' health problems are caused by sewage sludge. [8] One study found that hogs raised on corn grown on sludge-amended soils had elevated cadmium levels. [9] Since a grazing cow may ingest as much as 1100 pounds of soil annually, it seems likely that a portion of that ingested soil would contain sewage sludge, if sludge were applied to grazing land. [10] Any metals or other pollutants in the sludge could become part of animal products eaten by people.

Threats from other toxic chemicals

Sewage sludge has been found to contain more than 60,000 toxic substances and chemical compounds, [11] so there is a possibility for harm from those chemicals and contaminants that are not covered under the regulation. EPA chose not to regulate certain toxic pollutants because they were banned in the U.S.; detected in less than five percent of the sludge from sewage treatment plants sampled; or present in concentrations that did not exceed risk-based soil loading rates. A number of highly toxic chemicals fall into these three categories.

Dioxin has been found in sewage sludge. Dioxin is a very persistent organic compound that doesn't degrade easily. Land application of sewage sludge has been found to increase dioxin intake of people who ingest food products from cattle raised on sludge-amended soil. [12]

Polychlorinated biphenyls (PCBs), although banned for use in the U.S., still appear in sewage sludge. Some PCBs resemble dioxins in their toxicity and ability to persist in the environment.

In their 1996 report, the National Research Council (NRC) noted that "Nevertheless, PCBs and aldrin/dieldrin occurred at higher than 5 percent detection frequency, and the concentrations of PCBs, hexachlorobenzene, benzo(a)pyrene, and N-nitro-sodimethylamine would result in pollutant loadings exceeding EPA's risk-based limits in a small percentage of sludges ... While the probability that the compounds would affect human-consumed crops is very low, the potential for human exposure through other pathways as defined in the Part 503 Rule should be re-evaluated." [13]

Other compounds, such as nonyl phenols and alkyl phenol ethoxylates (two surfactants commonly used in household detergents, cleaning products and many other items) are gaining attention as potential hormone disrupters. Hormone disrupters interfere with the body's natural hormones, which are responsible for regulating growth, sexual development and reproduction. Testing for these synthetic chemicals is not required, but they have been identified in some sludges. There are no comprehensive data on whether they represent a widespread problem, and no limits on their presence in sludge have been determined.

Threats from Pathogens:

Another potential problem with the 503 rules is that while the EPA has created regulations dictating the amount of time that must pass before certain crops can be harvested after sludge is applied, there are few provisions in the rule for enforcement. With regard to pathogens, in particular, these time limits may not be long enough.

"Pathogens" refers to disease-causing organisms, such as viruses, bacteria, parasitic worms, etc. The goal of the Part 503 Rule is to minimize human exposure to sludge-borne pathogens. (Class A sludge, which can be sold directly to the public, is supposed to have eliminated 90 percent of the pathogens.) However, in its 1996 report, the National Research Council (NRC) expressed several concerns about the ability of EPA's Part 503 Sludge Rule to adequately protect the public from pathogens.

Recommendations

- * Until a more sensitive method for the detection of salmonella in sludge is developed, the present test should be used for support documentation, but not be substituted for the fecal coliform test in evaluating sludge as Class A.
- * EPA should continue to develop and evaluate effective ways to monitor for specific pathogens in sewage sludge.
- * EPA should re-evaluate the adequacy of the 30-day waiting period following the application of Class B sludge to pastures used for grazing animals. [14]

In order to prevent listeriosis, a bacterial illness marked by headache, fever and nausea, Oregon State University warns, "... Do not use animal manure or sewage sludge in your vegetable garden." [15] The U.S. Food Safety and Inspection Service reports that *Campylobacter jejuni*, another gastrointestinal illness, has been found in sewage sludge. [16]

Other research indicates that some pathogens, including parasites *Giardia*, *Cryptosporidium* and *Ascaris*, *Salmonella* and *Streptococcus* bacteria may survive at least some sludge treatment processes (e.g., mesophilic anaerobic digestion). Germs that cause Hepatitis A, polio, typhoid, cholera and amoebic dysentery have all been found in sludge. [17] Dr. David Lewis, a microbiologist and whistleblower for the Environmental Protection Agency, noted in his *Journal of Commerce* editorial, "'Sludge Magic' at the EPA," that samples taken in 1999 from Kansas City-area farmland that had received sludge applications contained 650,000 *Salmonella* and *E. coli* bacteria. These levels are many thousands of times above safe levels and are believed to

have come from sludge applications that took place before 1992. [18] This indicates that some microorganisms may survive in soil for much longer than previously believed.

Some Companies Say "No" to Sludge

An informal telephone survey [19] of several fruit and vegetable processors revealed that they do not allow their contract growers to apply sewage sludge to cropland used to grow food for their products. Those processors include Seneca Foods, Hunt-Wesson, Inc., J.R. Simplot, Del Monte and Heinz. On the other hand, when grain companies Archer-Daniel-Midland (ADM), Cargill and Pillsbury were contacted about sludge use by their growers, all of the company representatives were ignorant of the issue and knew of no specific policy by their companies prohibiting or discouraging the use of sludge.

IATP's Policy on the Agricultural Use of Sewage Sludge

For many years, farmers of various cultures have used human and animal waste to nourish their soils, creating a closed natural "loop." The Institute for Agriculture and Trade Policy (IATP) advocates the creation of these nutrient cycles, particularly for nitrogen and phosphorus. However, IATP believes it is also important that all farmers should have access to *clean uncontaminated* agricultural inputs. Our research indicates that municipal sewage sludge can vary widely in quality and toxicity. For example, the Metro plant, which services the Twin Cities of Minneapolis and St. Paul, receives discharge from more than 600 industrial facilities. This high volume of toxic discharge greatly increases the likelihood that the sludge that results from the wastewater treatment process is itself contaminated. In addition to toxic compounds such as mercury, cadmium, lead, and dioxins, farmers must be aware of the potential for contamination of the sludge by pathogens and radioactive material.

In assessing whether or not to apply sewage sludge to agricultural land, IATP advocates using the Precautionary Principle, which dictates, "When an activity raises threats of harm to human health or the environment, precautionary measures should be taken, even if some cause-and-effect relationships are not fully established scientifically. In this context, the proponent of an activity, rather than the public, should bear the burden of proof. ..." [20] The responsibility to prove that sludge is clean and safe falls upon the community that generates it, and the government to impose and enforce regulations that protect public health and the environment. Any liability caused by contaminated sludge must be borne by the generator of the sludge, rather than by the farmer.

Farmers and food producers want to raise healthy, wholesome food. Given the limits of scientific knowledge, the limits of current technology (especially mixing domestic and industrial waste), the concerns around food safety, the potential for soil degradation, and risk of economic liability, IATP proposes a 2-year moratorium on the application of sewage sludge to agricultural land.

What You Can Do If You are Concerned about Food Safety and Sewage Sludge

- Use non-toxic products in your household, to minimize the amount of toxic pollution you add to the sewage system. Remember, homeowners add a lot of toxic pollution, as well as pathogens, to the sewage system!
- Don't buy fertilizer made from sewage sludge for home, garden or agricultural use.

- If you are concerned about the use of sewage sludge used to grow your food, contact food processors to let them know how you feel. Buy organic food if you can afford it (organic certification rules currently prohibit the use of sewage sludge as a fertilizer).
- Find out what happens to the sludge generated by your local sewage treatment plant.
- Inquire about the pollution prevention plans being used by your local sewage treatment plant and the industries that discharge into it. Contact them directly to express your concerns and encourage them to adopt aggressive pollution prevention strategies.
- Encourage your local, state and federal environmental regulators to apply the Precautionary Principle when they seek to determine the potential risks posed by the use of sewage sludge.
- Call for the separation of industrial wastewater treatment from municipal sewage treatment systems.

For more information about IATP's work to keep industrial pollution (such as that which is potentially in sewage sludge) out of the food system, visit our web site at www.iatp.org/edrc, or contact Jackie Hunt Christensen, Food Safety Project Director, Institute for Agriculture and Trade Policy, 2105 1st Ave. S., Minneapolis, MN 55404. 612-870-3424 or [<jchristensen@iatp.org>](mailto:jchristensen@iatp.org).

Citations:

1 *Code of Federal Regulations*, "Part 503 - Standards for the Use or Disposal of Sewage Sludge, Sec. 503.9 General Definitions."

2 "Biosolids: A Short Explanation and Discussion," WEF/U.S. EPA Biosolids Fact Sheet, <http://www.wef.org/docs/biofact/explanation.html/>

3 Murray B. McBride, "Growing Food Crops on Sludge-Amended Soils: Problems with the U.S. Environmental Protection Agency Method of Estimating Toxic Metal Transfer," *Environmental Toxicology and Chemistry*, Vol. 17, No. 11, pp. 2274-2281. 1998.

4 *EPA Mercury Report to Congress*, December 1997.

5 Greg D. Horstmeier, "Heavy Metal Fertilizer," *Farm Journal; Case for Caution*, p. 16.

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7 *Case for Caution*, p. 16.

8 *Toxic Sludge Is Good For You, Lies, Damn Lies And The Public Relations Industry*, John Stauber and Sheldon Rampton, Common Courage Press, 1995.

9 D.J. Lisk and others, "Toxicologic Studies with Swine Fed Corn Grown on Municipal Sewage Sludge-Amended Soil," *Journal of Animal Science*, Vol. 55, No. 3 (1982), pgs. 613-619, as cited in "New U.S. Waste Policy, Pt. 2: Sewage Sludge," *Rachel's Environment & Health Weekly*, August 28, 1997.

10 *Rachel's*, August 28, 1997.

11 *Toxic Sludge Is Good For You*, p. 104.

12 Simon R. Wild and others, "The Influence of Sewage Sludge Applications to Agricultural Land on Human Exposure to Polychlorinated Dibenzo-P-Dioxins (PCDDs) and -Furans (PCDFs)," *Environmental Pollution*, Vol. 83, (1994), pgs. 357-369, as cited in "A New U.S. Waste Strategy Emerges, Part I," *Rachel's Environment & Health Weekly*, August 21, 1997.

13 *Use of Reclaimed Water and Sludge in Food Crop Production*, p. 6.

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15 Listeriosis fact sheet, Oregon State University, Corvallis, OR. 1998. [http://www.orst.edu/food-resource/index.htm/.](http://www.orst.edu/food-resource/index.htm/)

16 "Bacteria That Cause Foodborne Illness," Food Safety and Inspection Service, United States Department of Agriculture, October 1997.

17 Debora MacKenzie, "Waste Not," *New Scientist*, August 29, 1998.

18 David Lewis, "'Sludge Magic' at the EPA," *Journal of Commerce* opinion, January 27, 1999.

19 Conducted by IATP by phone in the fall of 1998.

20 *Wingspread Statement on the Precautionary Principle*, January 23-25, 1998.