

Biosolids

Pathogens. The most characteristic potential health hazard of biosolids are the wide range of pathogenic microbes carried in sewage. The list includes *Salmonella* and *Shigella* bacteria, the hepatitis A and Coxsackie viruses, the *Giardia* and *Cryptosporidium* protozoans, and helminths (parasitic worms) that cause roundworm, tapeworm, and hookworm. Based on microbial content, Part 503 established two categories of biosolids. To achieve Class A status, with pathogens below detectable levels, a treatment plant can either test directly for pathogens or use one of five specific treatments to kill them, including heating or increasing biosolids alkalinity. Class A biosolids can be applied in the same way as commercial fertilizer, without the restrictions that govern Class B sludge.

The process for making Class B sludge, which is produced by most large treatment plants, must be known to reduce indicator microorganisms (including some pathogens) below 2 million colony forming units of fecal coliform per gram of dry weight. (Fecal coliform, common, nonpathogenic bacteria that originate in the human gut, are considered "indicator organisms" for how effectively the treatment has killed all pathogens.) For Class B, the approved treatments include aerobic or anaerobic digestion, composting, heat treatment, and drying. Treatment can drastically reduce bacterial counts. According to the EPA, raw sewage typically contains about 1 billion **fecal coliform bacteria per 100 ml** of sewage; treated biosolids range from 30,000 to 6 million per 100 ml. Similarly, 100 ml of raw sewage contains an average of 8,000 *Salmonella* bacteria, while treated biosolids range from 3 to 62.

Indicators are used because it's expensive to identify and count microbes in biosolids. But Suresh Pillai, an assistant professor of environmental microbiology at Texas A&M University who has studied pathogens at the 128,000-acre New York City biosolids disposal site in west Texas, says counting fecal coliform can be "misleading and unreliable; it underestimates the actual presence of organisms." Pillai calls the bacterial genus *Clostridium* "a much better indicator of [bacterial] survival and transmission in anaerobically digested sludge."

A key concern with Class B sludge is the eggs of parasitic worms called helminths, which survive sewage treatment and soil processes better than most pathogens. To prevent transmission of helminths and other resistant organisms, farmers must wait before harvesting crops on land that has received Class B sludge. This allows time for many of the organisms to die in the soil.

Pathogens worried the NRC study group, which suggested the "EPA should continue to develop and evaluate effective ways to monitor for specific pathogens in sewage sludge." The NRC panel said that since the part 503 regulations rely so heavily on processes rather than pathogen tests, "reliability must be a critical element in the design and operation of wastewater treatment plants."

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