

5-1-2000

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Recommended Citation

Christopher J. Conrad, *Sewage Sludge and Land Application Practices: Do the Section 503 Standards Guarantee Safe Fertilization Usage*, 9 *Penn St. Env'tl. L. Rev.* 147 (2000).

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COMMENTS

Sewage Sludge and Land Application Practices: Do the Section 503 Standards Guarantee Safe Fertilizer Usage?

I. Introduction.

In 1993, Congress enacted legislation to promote the beneficial use of sewage sludge,¹ including statutory guidelines for applying sewage sludge to land as fertilizer.² Section 503, entitled “Standards of the Use or Disposal of Sewage Sludge,” is “intended to assure that what once was considered waste can now, in fact, be put to good use – as fertilizer on farms, lawns, gardens, and other lands.”³ Congress defines sewage sludge as a “solid, semi-solid, or liquid residue generated during the treatment of domestic sewage in a treatment works.”⁴ Sewage sludge includes

1. *See generally* Standards for the Use or Disposal of Sewage Sludge, 40 C.F.R. § 503 (1993).

2. *See generally id.*, Subpart B.

3. Sean McElheny, *EPA Rule Will Promote Beneficial Uses, Disposal of Sewage Sludge*, ENVTL. NEWS, Dec. 1, 1992 (release date), at *1, available in 1992 WL 395979.

4. *See* 40 C.F.R. § 503.10(w).

domestic septage,⁵ scum or solids removed in wastewater processes, or material derived from sewage sludge.⁶

The use of sewage as fertilizer is not a new practice, and opponents of such use sought to prevent the practice long before Section 503 codified federal guidelines for land application. In 1980, the Food and Drug Administration warned that crops that are eaten raw should not be grown on sewage sludge-treated land for three years after application because of the likelihood of ingestion of contaminants.⁷ In some instances, local municipalities disallowed the production of crops on sewage-treated land and passed zoning ordinances prohibiting the use of sewage sludge as fertilizer out of concern for public health.⁸ In other instances where no prohibitive ordinance existed, municipalities obtained injunctive relief against farmers and landowners who fertilized their lands with sewage.⁹

While Section 503 furnishes general requirements for sewage sludge treatment prior to land application in order to ensure that the fertilizer is not harmful when applied, the regulation has met with some opposition from public interest groups that believe Section 503 should be revised to provide more adequate safeguards. Though federal statutory law now governs sewage sludge land application, and many states have enacted their own regulations to supplement Section 503, problems continue to exist in instances when sewage sludge has been treated improperly or when sludge remains biologically hazardous though it satisfies the Section 503 standards.

5. Domestic septage is "either liquid or solid material removed from a septic tank, cesspool, portable toilet, Type III marine sanitation device, or similar treatment works that receives only domestic sewage." 40 C.F.R. § 503.9(f).

6. See 40 C.F.R. § 503.10(w).

7. See National Sludge Alliance, *Toxic Sludge: Timeline to Disaster* (visited November 4, 1999) <<http://www.essential.org/cchw/nsa/nsa114.html>>.

8. See *Sherner v. Culliton*, 382 N.W.2d 562 (Minn. Ct. App. 1986), in which the town board of Wrenshall Township, Minnesota passed a law prohibiting the use of sewage sludge as fertilizer within the township. See also *Perry v. Providence Twp.* 578 N.E.2d 886, 887 (Ohio Ct. App. 1991), in which Providence Township, Ohio's Zoning Ordinance prohibited "the dumping and/or spreading of sewage sludge, industrial sludge, and any by-product of the treatment of sewage or industrial waste." See also *Board of Trustees of Allen Township v. Chasteen*, 646 N.E.2d 542 (Ohio Ct. App. 1994), in which Allen Township, Ohio's Zoning Resolution prohibited "the dumping and/or burying and/or spreading, in any manner, of sewer [sic] and or sewage sludge and/or industrial waste."

9. See *Hempfield Twp. v. Hapchuk*, 620 A.2d 668, 669 (Pa. Commw. Ct. 1993), in which Hempfield Township, PA sought to enjoin the defendant farmers from fertilizing portions of its residentially zoned (R-1) land with sewage.

Although comprehensive studies have shown some of the flaws of Section 503,¹⁰ the Environmental Protection Agency (“EPA”) has yet to revise the regulation to establish stricter standards. In fact, thus far the EPA has taken a less rigid approach. On August 4, 1999, the EPA released a final rule lowering the minimum monitoring time period for certain qualities of sludge applied to land to less than once per year.¹¹ Prior to this recent ruling, if land held or contained 290 metric tons of sewage sludge or less, the land had to be monitored for chemical pollutants and pathogens at least once annually.¹² As of September 3, 1999, however, the monitoring of “exceptional quality” sludge may occur less frequently.¹³

Some states such as New Jersey and Pennsylvania have followed the EPA’s ruling and now are reducing their own monitoring requirements.¹⁴ Though this final rule suggests a trend

10. See generally ELLEN Z. HARRISON, ET AL. THE CASE FOR CAUTION, (working paper, revised Feb. 1999, Cornell Waste Management Inst).

11. See generally 64 Fed. Reg. 42552 (1999). See also *Monitoring Requirements Eased for Sewage Sludge Under EPA Final Rule*, BNA CHEMICAL REGULATION DAILY, Aug. 4, 1999, at 1.

12. 40 C.F.R. § 503.16 includes a table for required monitoring periods based upon total metric tonnage of sewage sludge applied to land. The information in the table is as follows:

TABLE 1 OF 503.16 – FREQUENCY OF MONITORING
LAND APPLICATION

Amount of sewage Sludge (metric tons per 365-day period)	Frequency
Greater than 0 but less than 290	Once per year
Equal to or greater than 290 But less than 1,500	Once per quarter (four times per year)
Equal to or greater than 1,500 But less than 15,000	Once per 60 days (six times per year)
Equal to or greater than 1,500	Once per month (twelve times per year)

13. See 64 Fed. Reg. 42552 (1999). See also *Monitoring Requirements, supra* note 11, at 1. The monitoring of chemical pollutants, enteric viruses, and helminth worm ova has been reduced for certain qualified sludges.

14. In 1997, Pennsylvania proposed several changes to its sewage sludge monitoring program. First, the one-year monitoring requirement would be eliminated. Second, the responsibility of finding acceptable places to spread the sludge, controlling the amount applied, and checking that no environmental problems develop, would belong to plant operators, not the State. Third, plant operators, and not the State, would keep all records of land application. See Susan Q. Stranahan, *Honor System for Use of Sewage Raises Stink; States Lift Controls of Fertilizing with Sludge*, THE PHILA. INQUIRER, May 6, 1997. See also

toward more flexible regulation of Section 503 standards, the EPA must pursue a different course to become more active in enforcing Section 503 and to establish more rigid regulations.

This Comment will advocate a revision of Section 503 to include more stringent regulation of the practice of applying sewage sludge to land. First, this Comment will discuss Section 503 in its present form, and analyze the particular sections that have raised some safeguarding questions. Second, this Comment will explain some of the major flaws of Section 503 and will provide examples of actual problems with land application since Section 503 passed in 1993. Finally, this Comment will suggest several means for revising Section 503 to ensure that applying sewage sludge to land is a safe and non-threatening practice.

II. Background.

A. *The Development of Section 503.*

Since Congress passed the Clean Water Act (“CWA”) in 1972,¹⁵ the EPA and its state-level counterparts have sought to develop and to promote programs designed to treat solid waste and to prevent such waste from harmfully affecting public health and the environment.¹⁶ The CWA, however, was not intended to be the primary source of sewage sludge regulation. In fact, the CWA was designed only as a cautionary measure to prevent sewage infestation in navigable waters caused by negligent land disposal and ocean dumping of sewage sludge.¹⁷

40 C.F.R. Section 503.5, which permits state-level authorities to add more stringent requirements to supplement Section 503. Section 503, however, does not allow states to enact less stringent requirements, and thus Pennsylvania could not enact these changes until September 3, 1999, when the new monitoring rule took effect.

15. See generally 33 U.S.C.A. § 1251.

16. See *id.* In part, the Clean Water Act set goals to provide Federal financial assistance to construct publicly owned waste treatment works (“POTWs”), to develop area-wide waste treatment management processes in each state, and to devote research to develop technology to eliminate the discharge of waste pollutants into navigable waters.

17. See National Sludge Alliance, *Toxic Sludge: Timeline to Disaster* (visited Nov. 4, 1999) <<http://www.essential.org/cchw.nsa/nsa114.htm>>. The National Sludge Alliance is a New York-based, non-profit, “grass roots” organization opposed to the use of sewage sludge as fertilizer. Its web site contains links to “Public Facts” sheets produced by the Alliance that seek to inform the general public of the potential hazards of such use.

By 1988, Congress prohibited ocean dumping as an alternative for sewage sludge disposal, and landfill space throughout the United States steadily continued to decline.¹⁸ In response to the increasing need to find means for sewage sludge disposal, the EPA's Office of Water, under authority of the Clean Water Act, developed and proposed new legislation for the beneficial use of sewage sludge as an alternative to dumping.¹⁹ On November 25, 1992, EPA Administrator William K. Reilly signed the National Sewage Sludge Rule.²⁰ This rule, which addressed three general categories of beneficial use and disposal practices,²¹ was published in the Federal Register December 11, 1992 as the proposed Section 503 to the Code of Federal Regulations.²²

B. Section 503—Standards for the Use and Disposal of Sewage Sludge.

1. General Provisions.

Subpart A of Section 503 establishes the general provisions for beneficial use and treatment of sewage sludge.²³ This subpart sets forth basic requirements, pollutant limits, management practices and operational standards for the use and disposal of sewage sludge generated by publicly owned treatment works ("POTWs").²⁴ In 1992, the EPA estimated that 13,000 to 15,000 POTWs generated between 110-150 million wet metric tons of sewage sludge each year.²⁵ The EPA predicted that, as a result of stricter wastewater treatment requirements, more highly efficient POTWs, and an overall expansion of the U.S. population served

18. See McElheny, *supra* note 3, at 10.

19. See *id.* at 6.

20. See *id.*

21. See *id.* The National Sewage Sludge Rule focused on "application of sewage sludge to land (including farms, gardens, and forests), surface disposal at dedicated sites or in sewage sludge-only landfills, and incineration at sewage sludge-only incinerators."

22. See *id.* See also 58 Fed. Reg. 9248 (1992), where the rule was titled Standards for the Use or Disposal of Sewage Sludge.

23. See generally 40 C.F.R. § 503, Subpart A.

24. See 40 C.F.R. § 503.1(a). Although Section 503.9(aa) defines "treatment works" generally as "either a federally owned, publicly owned, or privately owned device or system used to treat (including recycle and reclaim) either domestic sewage or a combination of domestic sewage and industrial waste of a liquid nature," the main focus of this Comment is the sewage sludge produced by the publicly owned works (POTWs).

25. See McElhany, *supra* note 3, at 1.

by the POTWs, over the next ten to twenty years the volume of such sludge would increase.²⁶

The General Provisions of Section 503 apply to any person preparing sewage sludge and applying it to land, to the sewage sludge that is to be applied to the land, and to the land where sewage sludge is applied.²⁷ Section 503, however, does not govern all aspects of sewage sludge use and procedure.²⁸ Compliance by any entity subject to Section 503 was required by February 19, 1995.²⁹

Once Section 503 was enacted, no person who used or disposed of sewage sludge in a manner described in Section 503 could do so without full compliance with the regulations in Section 503.³⁰ The EPA wanted to ensure that any application of sewage sludge to land was safe and not harmful to public health or the environment, and therefore forbade any use of sewage sludge on land without meeting the criteria of Section 503. Any POTW or other treatment works wishing to use its own generated sludge for land application was required to obtain a permit from either the EPA or an EPA-sanctioned State sludge management program.³¹ Also, Section 503 allows for implementation of more stringent requirements for sewage sludge use and disposal than those set forth in the regulations, either by the EPA or one of its state-sanctioned counterparts. Section 503 also does not preclude any

26. *See id.*

27. *See* 40 C.F.R. § 503.1(b).

28. *See* 40 C.F.R. § 503.6. This section established topical "exclusions" that were not to be governed by Section 503. First, Section 503 does not establish requirements for the particular treatment process, such as composting, prior to final application to land. Second, Section 503 does not select a particular use or disposal method but rather leaves this as a determination to be made on a local level. Third, Section 503 does not establish requirements for sludge co-fired in an incinerator with other wastes, sludge generated at an industrial facility during the treatment of industrial waste water, hazardous sewage sludge as defined by 40 C.F.R. § 261 or sewage sludge with high PCB (polychlorinated biphenyls) content. Fourth, Section 503 does not establish standards for incinerator ash, grit (e.g., sand and gravel) and screenings (e.g., large materials such as rags) generated during preliminary treatment of domestic sewage, drinking water sewage sludge, or commercial and industrial septage.

29. *See* 40 C.F.R. § 503.2(a).

30. *See* 40 C.F.R. § 503.3(a)(2).

31. *See* 40 C.F.R. § 503(a)(1). *See also, e.g.*, Soaring Vista Properties, Inc. v. Board of County Commissioners of Queen Anne's County, 1999 Md. Lexis 801, 2 (Md. 1998). In Maryland, anyone seeking to apply sewage sludge to his or her land must apply for a "Sewage Sludge Utilization Permit" from the Maryland Department of the Environment.

state-level agency from enacting its own additional requirements for sewage sludge practice.³²

Prior to applying sewage sludge to land, samples of the sludge to be applied must be collected and analyzed according to the methods incorporated into Section 503, as approved by the Director of the Federal Register. Outside agencies, such as the American Public Health Association, developed these methods, and the EPA approved them after careful risk assessment of land application procedures, prior to the enactment of Section 503.³³ Samples of sewage sludge must be examined for specific types of pathogens,³⁴ such as enteric viruses,³⁵ fecal coliform,³⁶ helminth³⁷ worm ova, and salmonella³⁸ sp. bacteria. Samples must also be analyzed for inorganic chemical pollutants, the quantity of total, fixed and volatile solids,³⁹ and for its specific oxygen uptake rate.⁴⁰

2. Land Application.

a. *Guidelines for Land Application.*—Subpart B of Section 503 specifically governs land application practices. Prior to application to land, sewage sludge normally undergoes a composting process whereby the sludge is mixed with other organic materials to allow easy assimilation with the soil.⁴¹ Once

32. See 40 C.F.R. § 503.5.

33. See 40 C.F.R. § 503.8. The Director of the Federal Register may allow incorporations of references of sample analysis methods by way of 5 U.S.C. § 552(a) and 1 C.F.R. § 51.

34. A pathogen is “any microorganism capable of producing disease.” MOSBY’S MEDICAL, NURSING, AND ALLIED HEALTH DICTIONARY 1217 (5th ed. 1998) (hereinafter “MOSBY’S DICTIONARY”).

35. Enteric viruses exist and replicate primarily in the intestinal tract. See *id.* at 567.

36. Coliform is a microorganism, belonging to the *Escherichia coli* species, that comprises most of the intestinal flora in humans and other animals. See *id.* at 363.

37. A helminth is “a worm, especially one of the pathogenic parasites of the division Metazoa, including flukes, tapeworms, and roundworms. See *id.* at 739.

38. Salmonella is a “rod-shaped bacteria that includes species causing typhoid fever, paratyphoid fever, and some forms of gastroenteritis.” Certain species of salmonella, such as *Salmonella enteritidis*, may cause food poisoning in humans. See *id.* at 1446.

39. Humans produce about 2.3 billion fecal coliforms per day in their feces, and 120 different types of viruses have been found in wastewater, including hepatitis A, that cause severe gastrointestinal illness. See Martin Mittelstaedt, *Sewage Sludge Gaining Acceptance as Fertilizer*, GLOBE AND MAIL, Jan. 20, 1999, at A9.

40. See 40 C.F.R. § 503.8(b).

41. A typical composting process is described in *Penland v. Redwood*

sludge is subjected to the composting process, land application of sewage sludge may be accomplished by one of three approved techniques. First, sludge may be sprayed or spread onto the land surface. Second, sludge may be injected below the land surface. Third, sludge may be incorporated into the soil so that it either may condition the soil or fertilize crops and vegetation grown in the soil.⁴² Any one of these three methods sufficiently accomplishes the dual purpose of land fertilization and waste disposal.

Unless sludge has been treated to meet exceptional quality standards,⁴³ no one may apply sewage sludge to land without compliance with several specific mandates. Before applying sewage sludge in bulk to agricultural land, forest land, a public contact site,⁴⁴ or a reclamation site,⁴⁵ the individual must obtain written notification regarding the concentration of total nitrogen in the sludge from he or she who prepared the sludge.⁴⁶ The nitrogen concentration is a concern because it may indicate the total number of biologically active pathogens present in the sludge. Each bag or container that contains sewage sludge to be applied to land must be affixed with a label stating the name and address of the individual who prepared the sludge for land application, a disclosure statement claiming that application of

Sanitary Sewer Serv. Dist.:

In the initial stages of the composting process, sludge is solidified by being poured into an outdoor levy . . . which is exposed to the open air. After about two weeks, the material loses enough moisture to be mixed with organic material for composting. The reduced sludge, or bio-solids, is then mixed with organic materials, such as wood, animal bedding, including animal waste, and yard waste. The bacteria in the sludge break down the mixture. In order for the bacteria to decompose the sludge, the mixture must be exposed to air. Thus, the mixture is placed in a large pile, approximately nine feet high, twenty feet wide, and 100 feet long, and exposed to the open air. The composted material is first piled over a perforated pipe for aeration. After two to three weeks, the pile is removed from the pipe and is turned every two weeks for aeration.

965 P.2d 433, 435(Or. Ct. App. 1998).

42. See 40 C.F.R. § 503.11(h).

43. See 40 C.F.R. § 503.10(b)(1).

44. "Public contact site" is defined as "land with a high potential for contact by the public." This includes, but is not limited to, public parks, ball fields, cemeteries, plant nurseries, turf farms, and golf courses." 40 C.F.R. § 503.11(l).

45. "Reclamation site" is defined as "drastically disturbed land that is reclaimed using sewage sludge. This includes, but is not limited to, strip mines and construction sites." 40 C.F.R. § 503.11(n).

46. See 40 C.F.R. § 503.12(d).

sewage sludge to land is prohibited except in accordance with instructions on the labels, and the annual whole sludge application rate for land application so as not to exceed the annual pollutant loading rate.⁴⁷ The individual applying sewage sludge to land must also be made aware of any other information that is necessary to comply with Section 503's safeguards.⁴⁸

b. Chemical Pollutant Loading Rates.—Whoever wants to apply sewage sludge to land must contact the EPA or its state-sanctioned counterpart in the state where the sludge will be applied to determine whether sewage sludge subject to particular cumulative chemical pollutant loading rates⁴⁹ has been applied to the chosen site since July 20, 1993.⁵⁰

If sewage sludge subject to the cumulative pollutant loading rates has not been applied since July 20, 1993, the cumulative amount of each pollutant is permitted on the particular piece of land.⁵¹ If such sewage sludge has been applied since July 20, 1993, and the cumulative amount of each chemical pollutant applied in sewage sludge since then is known, then that figure will be used to calculate the concentration of each pollutant allowed for subsequent land application.⁵² The individual who wants to apply sewage sludge to land must be certain that the proper

47. See 40 C.F.R. § 503.14(e).

48. See 40 C.F.R. § 503.12(e)(1).

49. Section 503.13(b)(2) provides a table of the amount of particular pollutants that may be allowed in sewage sludge that is applied to land. Information in the table is as follows:

TABLE 2 OF § 503.13 – CUMULATIVE POLLUTANT LOADING RATES.

Pollutant	Ceiling concentration (milligrams per kilogram)
Arsenic	75
Cadmium	85
Copper	4300
Lead	840
Mercury	57
Molybdenum	75
Nickel	420
Selenium	100
Zinc	7500

50. See 40 C.F.R. § 503.12(e)(2)(i).

51. See 40 C.F.R. § 503.12(e)(2)(ii). See also Table 2, *supra* note 49.

52. See 40 C.F.R. § 503.12(e)(2)(iii).

concentration of each pollutant exists in the sewage sludge. If the cumulative amount of the concentration is not known, no more sewage sludge may be added to that particular land.⁵³

c. Class A and Class B Pathogen Monitoring.—If the sewage sludge meets the cumulative chemical pollutant loading rate, the sludge then must comply with specific Class A and Class B pathogen requirements.⁵⁴ If sewage sludge is applied to agricultural land, forests, a public contact site, or a reclamation site, whether the sludge is Class A or Class B sewage sludge, the sludge must meet specific criteria.⁵⁵ Class A sludge permits a specific density of a number of pathogens, including fecal coliform, salmonella sp., enteric viruses and helminth ova, while Class B deals only with the density of fecal coliform, and generally allows for a higher density of fecal coliform than does Class A sludge.⁵⁶ Class A sludge is treated at very high temperatures with the goal of eliminating all pathogens, while Class B sludge receives

53. See 40 C.F.R. § 503.12(e)(2)(iv).

54. See 40 C.F.R. § 503.15.

55. Section 503.32 establishes six alternatives for sludge to be classified as Class A sludge. Alternative 1 deals specifically with the density of fecal coliform and salmonella sp. in the sewage sludge, and sets standards for the temperature (in degrees Celsius) at which the sludge must be maintained to achieve a total solid waste percentage near seven percent. Alternative 2 deals with the density of fecal coliform and salmonella sp., and sets standards for temperature and pH regulations over a seventy-two-hour period to establish sludge with a solid waste percentage of fifty percent or higher. Alternative 3 deals with the density of fecal coliform and salmonella sp., and requires that tests be run to reduce the amount of enteric viruses and helminth ova in the sludge. Alternative 4 deals with the density at which fecal coliform, salmonella sp., enteric viruses and helminth ova must be at the time the waste is disposed. Alternative 5 deals only with the density of fecal coliform and salmonella sp. prior to the sludge being used or disposed; no consideration is made for treatment at any particular temperature, but must be treated as prescribed by Appendix B of Section 503. Alternative 6 deals only with the density of fecal coliform and salmonella sp., but the authority granting the permit may further scrutinize this type of sewage sludge.

Section 503.32 establishes three alternatives for classifying sludge as Class B sludge. Alternative 1 permits a higher density of fecal coliform per gram than Class A sludge allows, and is concerned with no other type of pathogen. Alternative 2 requires that sludge be treated according to Appendix B of Section 503. Alternative 3 states that the authority granting the permit may scrutinize sludge.

56. See 40 C.F.R. § 503.32(a)(3). Class A sludge (Alternative 1) permits fecal coliform in sewage sludge if its density is less than 1,000 Most Probable Number per gram of total solids. See also 40 C.F.R. § 503.32(b)(2). Class B sludge (Alternative 1) permits fecal coliform in sewage sludge if its density is less than 2,000,000 Most Probable Number per gram or less than 2,000,000 Colony Forming Units per gram.

treatment to reduce, but not to eliminate, all pathogens.⁵⁷ Thus, Class B sludge inherently is more volatile, and should be monitored much more carefully and frequently.

d. Vector Attraction Reduction.—Vector attraction reduction fits part and parcel with the cumulative pollutant loading rates and pathogen requirements. Vector attraction is the characteristic of sewage sludge that attracts rodents, flies, mosquitoes, or other organisms capable of transporting infectious agents.⁵⁸ The potentially infectious nature of sewage sludge stems from the chemicals and pathogens that partially compose the sludge. Together, the chemicals and pathogens amass the total volatile solids that must be reduced prior to land application.⁵⁹ Generally, before applying sewage sludge to agricultural land, forests, public contact sites or reclamation sites, the goal is to reduce vector attraction at least thirty-eight percent by firing the sewage sludge at 500 degrees Celsius in an incinerator.⁶⁰

e. Site Restrictions.—Subpart B also places various restrictions on sites that have been treated with sewage sludge. Several of these restrictions are directed specifically toward crops and crop harvesting. First, crops with harvested parts that touch the sewage sludge/soil mixture and are totally above the land surface cannot be harvested until fourteen months after the sewage has been applied to the land.⁶¹ Second, crops with harvested parts below the surface cannot be harvested for twenty months if the sewage sludge sat on the soil for four months or longer prior to being mixed with the soil.⁶² Third, crops with harvested parts below the surface cannot be harvested for thirty-eight months if the sewage sludge sat on the soil four less than four months prior to being mixed with the soil.⁶³ Fourth, food crops⁶⁴, feed crops⁶⁵ and fiber crops⁶⁶ cannot be harvested for thirty

57. See *Land Application of Sewage Sludges* (visited Nov. 3, 1999) <<http://www.cfe.cornell.edu/wmi/Sludge/Recommends.html>>.

58. See 40 C.F.R. § 503.31(k).

59. “Volatile solids” are defined as “the amount of the total solids in sewage sludge lost when the sewage sludge is combusted at 500 degrees Celsius in the presence of excess air.” 40 C.F.R. § 503.31(l).

60. See 40 C.F.R. § 503.33(b)(1). See also §503.11(h). Thirty-eight percent is the minimum reduction standard for Class B sludge.

61. See 40 C.F.R. § 503.32(b)(5).

62. See *id.*

63. See *id.*

64. Food crops “are crops consumed by humans. These include, but are not

days after application of sewage sludge to the land.⁶⁷ Sixth, turf grown on land where sewage sludge is applied may not be harvested for one year after application if the turf will be placed either on land with high public exposure or on a lawn.⁶⁸

Subpart B also restricts access of people and animals to land applied with sewage sludge. Animals may not graze on land for thirty days after application of sewage sludge to the land.⁶⁹ Public access to land with a high potential for public exposure is restricted for one year after application of sewage sludge to the land,⁷⁰ and public access to land with a low potential for public exposure is restricted for thirty days after application.⁷¹

f. Further General Restrictions.—Subpart B also places broad restrictions on the types of locations upon which sewage sludge may be applied. Sewage sludge may not be placed on land if there is a likelihood of an adverse effect on threatened or endangered species or their designated critical habitat.⁷² In order to prevent contamination of waterways, sewage sludge also may not be applied to any land that is flooded, frozen, or snow covered, or to land that is located ten meters or less from any water or wetland.⁷³

3. *Requirement of Written Notice of Land Application.*

If an individual has treated sewage sludge to the prescribed specifications and has selected a site not in violation of Subpart B's general restrictions, he or she still must take several other steps before commencing with land application. Prior to applying the sewage sludge to any land, the applicant must provide written notice to the state authority granting such permits.⁷⁴ This notice

limited to, fruits, vegetables, and tobacco." 40 C.F.R. § 503.9(l).

65. Feed crops "are crops produced primarily for consumption by animals." 40 C.F.R. § 503.9(j).

66. Fiber crops "are crops such as flax and cotton." 40 C.F.R. § 503.9(k).

67. See 40 C.F.R. § 503.32(b)(5).

68. See *id.*

69. See *id.*

70. See *id.*

71. See *id.*

72. See 40 C.F.R. § 503.14(a). See also The Endangered Species Act, 16 U.S.C. § 1531, et. seq.

73. See 40 C.F.R. § 503.14(b). See also 40 C.F.R. § 122.2 for definition of "wetland or other waters of the United States."

74. See 40 C.F.R. § 503.12(j).

must include the location of the land application site⁷⁵ and specific information regarding the person applying the sewage sludge to the land.⁷⁶ The state authority then will retain this written notice and provide access to the notice to any interested party.⁷⁷

III. Problems Since the Enactment of Section 503 and Suggestions for Revising the Standards.

Although the requirements that the EPA has set forth in Section 503 may seem stringent and more than sufficient to safeguard public health and safety, there are still many problems created by the practice of applying sewage sludge to land. Section 503, as it exists currently, does not regulate efficiently or effectively. Though the main goals of Section 503—maximizing landfill space and eliminating waste while providing a natural means for fertilizing land—are important to public health and environmental preservation, the means set forth in Section 503 for achieving these goals have not been entirely successful. However, by amending Section 503 to enforce stricter standards, the goals may be reached.

A. Evidence That Section 503 is Not Working.

Though Section 503 was enacted in 1993, and the EPA required compliance with its regulations by February 19, 1995,⁷⁸ threats to public health from the use of sewage sludge as fertilizer still occur. Incidents of harm to individuals, animals and waterways from sewage sludge have become the subject of many newspaper headlines, and lawsuits have been brought against both public and private entities to remedy the damage.

Tony Behun, an eleven-year-old boy in Osceola Mills, PA, died after riding his bike through land treated with Class B sludge in 1999.⁷⁹ Though the EPA placed a thirty-day restriction of public access to the site, no steps were taken to prevent

75. Location may be established either by the site's street address or by the site's latitude and longitude coordinates. 40 C.F.R. § 503.12(j)(1).

76. The applicant is required to list his or her name, address, telephone number and National Pollutant Discharge Elimination System permit number (if appropriate). 40 C.F.R. § 503.12(j)(2).

77. See *id.*

78. See 40 C.F.R. § 503.2(a).

79. See Arnold Mann, *Follow-up More Sludge Slinging: How Safe is That Dump?* TIME MAG., Oct. 4, 1999, at 36.

trespassing or to ensure that the sludge would not be "biologically active" after the thirty-day period.⁸⁰

Also in 1999, two Georgia dairy farms, R.A. McElmurray & Sons and Boyceland Dairy, brought federal lawsuits against the city of Augusta, claiming the ninety-three million gallons of sewage sludge provided by the city and applied to their land contained toxic metals that slowly poisoned their cattle and contaminated the land.⁸¹ Though Augusta claims the city complied with Section 503, the plaintiffs contend the application of sewage sludge to the land constituted illegal disposal of hazardous waste.⁸² Twenty percent of the samples analyzed have shown metal concentrations above the chemical pollutant loading rate permissible for toxic chemicals.⁸³

In 1998, citizens of Northampton and Carbon counties in Pennsylvania complained about odors and sludge that oozed onto township streets after a New Jersey-based company, working under a permit granted by the Pennsylvania Department of Environmental Protection ("DEP"), spread sewage sludge on community land. The sludge-and-lime fertilizer mix greatly exceeded the chemical pollutant limits set by Section 503 and the Pennsylvania DEP, because much of the sewage originated from industrial sites in New Jersey, and contained chemical waste as well as human waste.⁸⁴

As these three instances of improper use of sewage sludge demonstrate, Section 503 does not guarantee safe land application practices. In its current form, Section 503 is entirely too lenient

80. *See id.* Joseph Cocalis, of the U.S. EPA, expresses concern of the level of biological activity in sewage sludge, even after the thirty-day restriction period. Cocalis states that certain pathogens in sewage sludge may survive much longer than thirty days, and that pathogens have the capability of becoming airborne and have the potential to be carried beyond the land application site while the pathogens are still biologically harmful.

81. *See* Robert Pavey, *Sludge Practice Probed: U.S. EPA Branch Investigates Claims That Augusta Sewage Used as Fertilizer Contained Hazardous Waste*. AUGUSTA CHRON., Oct. 5, 1999, at A1.

82. *See id.* Ed Hallman, attorney for the family farmers, stated in a letter to the EPA that since the plaintiffs' expert witnesses concluded the application "constituted illegal disposals of hazardous waste," Augusta had an obligation under the Comprehensive Environmental Response, Compensation and Liability Act ("CERCLA") to report the improper release of sludge and dispose of the material in hazardous waste landfills. However, Augusta stated the material was "safe and appropriately applied" to the crops. The lawsuits are pending.

83. *See id.* *See also* 40 C.F.R. § 503.13.

84. *See* *New Jersey Company Denied Permit to Spread Sludge Mix: In Two Years, State Won't Allow Spreading of 'Hazardous' Product*. ALLENTOWN MORNING CALL, Dec. 31, 1998, at B1.

with its permissive limits for chemical pollutants and pathogens in sewage sludge, and also is too lenient with respect to the degree of supervision required for the land application process. In “The Case for Caution,” the Cornell University Waste Management Institute explains in further detail these and other flaws in Section 503.

B. “The Case for Caution”—Cornell University’s Analysis of the Flaws in Section 503.

In 1997, the Cornell University Waste Management Institute conducted a comprehensive study (“the study”) of the land application practices set forth in Section 503, and though the study does not recommend total prohibition of sewage sludge land application, the study does caution for more restrictive use.⁸⁵ The study cites “the potential for widespread use of sludge on agricultural land and residential land, the persistence of many of the pollutants which may remain in soils for a very long time, and the difficulty of remediation” as reasons to revise Section 503 with a more cautious approach to public health and safety.⁸⁶

The study emphasizes numerous non-protective aspects of the current Section 503, believing certain standards to be questionable and lacking a more conservative approach.⁸⁷ First, the study indicates that allowing pollution to reach a maximum “acceptable” level is problematic,⁸⁸ because future analysis of the chemical content of sewage sludge may possibly reveal that the pollutants are much more harmful than once believed.⁸⁹

The study also points out that Section 503 does not include “safety or uncertainty factors,” which should be applied to account for the likelihood of error arising from both missing data and incomplete understanding of how the available data should be applied to a complex procedure with such inherent biologic variation.”⁹⁰ The study explains that many typical risk assessment systems divide calculated figures by 2, 10, 100 or 1,000, depending on the level of uncertainty of the figures derived from the

85. See HARRISON, ET. AL., *supra* note 10, at 1.

86. See *id.*

87. See *id.* at 14.

88. This “acceptable” level is established through risk assessment, whereby “some contaminant level is selected as a maximum level to which people, crops, or other receptors can be exposed without creating unacceptable harm.” *Id.*

89. See *id.*

90. See HARRISON, ET. AL., *supra* note 10, at 1.

available data.⁹¹ Because Section 503 allows pollution to reach a maximum “acceptable” level without accounting for “uncertainty factors,” treated land will be much more difficult to cure or to remediate to a safe level if future analysis deemed particular sewage samples to be harmful.

Second, the study explains miscalculations and underestimated conclusions relating to ingestion of pathogens or pollutants from exposure to sludge-treated soil. Section 503’s risk assessment does not consider exposure from several “pathways,”⁹² when an individual may be subjected to pollutants from multiple sources at the same time, in calculating its maximum “acceptable” level.⁹³ The risk assessment also does not address chemical “synergy,”⁹⁴ in calculating its maximum “acceptable” level. Without complete understanding of how certain chemicals may react upon simultaneous ingestion, it is not possible to evaluate the impact resulting from exposure to multiple pollutants at once.⁹⁵ The risk assessment also determined that a risk of cancer of 1-in-10,000 was an acceptable rate as a result of ingestion, instead of using the 1-in-1,000,000 standard used in numerous regulatory schemes (such as drinking water regulation).⁹⁶ Section 503 does not require testing for radioactivity in sewage sludge, and does not set any standards for permissible levels of radioactivity.⁹⁷

Section 503’s risk assessment also may have underestimated the total ingestion of pollutants and metals present in sewage sludge. First, the risk assessment determined that children inadvertently ingesting sludge from soil through typical outdoor activity would be subjected to the nine regulated metals⁹⁸ only at a rate of 200 mg per day for a period of five years. Section 503 suggests this average ingestion rate of typical children

91. *See id.*

92. The study explains a possible scenario where “the child of a home gardener using sewage sludge will likely eat vegetables from the garden, and ingest soil that has received the sludge.” The child “may also drink from a well or eat animals or animal products that have been impacted by sludge use.” *See id.* at 15.

93. *See id.*

94. The study explains “synergy” as “the way in which the effects of exposure to multiple chemicals simultaneously can affect the toxicity impacts.” *See id.*

95. *See* HARRISON, ET. AL., *supra* note 10, at 15.

96. *See id.*

97. *See* Gary Gardner, *Recycling Human Waste: Fertile Ground or Toxic Legacy?* WORLD WATCH, Jan. 1, 1998, at 28.

98. *See* 40 C.F.R. § 503.8.

is acceptable, but does not consider the fact that through normal activities, inadvertent ingestion continues throughout life, though at lesser rates (although rates may actually peak in teenage years).⁹⁹ Second, the risk assessment underestimated intake of contaminants through food. The Section 503 risk assessment utilized an average late 1970s diet, and did not consider that Americans today consume greater amounts of fruits and vegetables as a response to health recommendations by the USDA.¹⁰⁰ Even by the EPA's estimation that only 2.5% of vegetables consumed by the total U.S. population are grown on sludge-treated soil, an increase in the consumption of produce suggests that Section 503 has not established accurate averages of pollutant ingestion from sewage sludge.¹⁰¹

Third, the study claims that Section 503's risk assessment is inadequate in regulating the total volume of pollutants in sewage sludge. Section 503 does not monitor pollutants that are infrequently found in sludge,¹⁰² but only requires monitoring of those pollutants that are currently regulated by Section 503. Contaminants not proven to be harmful need not be monitored.¹⁰³ The study states that the current position of the EPA that further research is not needed on land application of sludges is inconsistent with the evidence of insufficient data regarding the elimination of contaminants.¹⁰⁴

Fourth, the study asserts that the overall mechanisms for enforcement of Section 503 practices are grossly inadequate. Under Section 503, sludge producers are required to follow certain processing procedures and sludge users are required to conduct monitoring of the land once sludge has been applied. Though periodic reporting to the EPA or a state-level agency is required, there is no requirement for the record keeping of land application of "exceptional quality" Class A sludge.

The study is concerned that neighbors or other interested parties have no way of knowing whether such sludge has been applied to the land, and that it is difficult to track the cumulative load of metals present in the sludge.¹⁰⁵ Also, sludge that meets

99. HARRISON, ET. AL., *supra* note 10, at 15.

100. *See id.* at 16.

101. *See id.*

102. *See id.* at 20. Section 503 does not monitor pollutants present in less than ten percent of sewage sludge.

103. *See id.*

104. *See* HARRISON, ET. AL., *supra* note 10, at 20.

105. *See id.* at 30.

certain “exceptional quality” standards need not be labeled with information for users, and therefore the user cannot readily ascertain the quality and characteristics of the sludge.¹⁰⁶ The study recommends labeling that includes analytic information about the concentration of contaminants and nutrients of the material, because growers need such information to make founded decisions regarding nutrient management.¹⁰⁷

C. Solutions and Recommendations for Revising Section 503.

As the Cornell study suggested, the application of sewage sludge to land is a practice with potential benefits, but the current methodology and guidelines for analyzing sludge and for monitoring treated land under Section 503 are far too lax. The EPA set forth three main goals in enacting Section 503: improvement of soil fertility, reduction of hazardous air emissions from incinerators, and reduction of the volume of waste to be disposed in landfills.¹⁰⁸ Section 503 is a potentially viable means for achieving these goals. Section 503 must be amended, however, to provide more adequate safeguards to protect public health and the environment from the possible harms from improperly treated sewage sludge.

1. Enforce More Rigorous Monitoring Requirements.

The final rule that took effect September 3, 1999,¹⁰⁹ lowering the minimum monitoring time for chemical pollutants, enteric viruses, and helminth worm ova to less than once per year was a step in the wrong direction. The EPA recommended the change to Section 503 to grant the state-level permitting authority flexibility to tailor monitoring requirements to specific circumstances within its own state.¹¹⁰ The EPA believed that more flexibility would allow for more rapid disposal of sewage sludge and for reducing costs by eliminating paperwork and monitoring

106. *See id.*

107. *See id.*

108. *See* McElheny, *supra* note 3, at 1.

109. *See* 64 Fed. Reg. 42552 (1999). *See also* *Monitoring Requirements Eased for Sewage Sludge Under EPA Final Rule*. BNA CHEMICAL REG. DAILY, Aug. 4, 1999, at 1.

110. *See id.*

expenses.¹¹¹ Rapid disposal and cost efficiency, however, do not justify the lack of assurance in properly treated land.

First, the August 4th final rule should be overturned, and minimum monitoring for chemical pollutants, enteric viruses and helminth worm ova should be required once per year. If the particular site is a public contact site, or if there is a high likelihood of contact by animals or water, the land should be monitored more frequently to ensure that pollutants and pathogens are not carried to sites where public health may be affected.

Second, Section 503 should require monitoring the flow of groundwater beneath land application sites. The Cornell study suggests developing groundwater monitoring requirements, taking into account spatial, temporal, and analytic issues.¹¹² By implementing such requirements, land chosen to be a site for sewage sludge application can be examined beforehand for underground water flow, and determinations can be made of potential contamination of nearby waterways. If groundwater is prevalent and sewage sludge is still applied to the land, monitoring should occur at a frequency of more than once per year to ensure chemicals or pathogens do not contaminate waterways. For example, Pennsylvania, with its own sludge regulation scheme, has taken steps to prevent such water contamination by forbidding application of sewage sludge to land within 300 feet of water or underground wells.¹¹³

Third, sewage sludge should be monitored for radioactivity to reduce the risk of cancer for anyone treating the sludge, applying sludge to the land, or anyone that will come into contact with the treated site. A 1994 study by the U.S. General Accounting Office found that from 1983 to 1991, nine cases of radioactive contamination in sewage treatment facilities occurred where no type of inspection or monitoring requirement was in place.¹¹⁴ The Cornell study suggests that the EPA review existing data on use

111. See Stranahan, *supra* note 14. In 1997, the administration of Governor Tom Ridge of Pennsylvania estimated savings for the state of \$83 million if less stringent monitoring requirements were implemented.

112. See HARRISON, ET. AL. *supra* note 10, at 34.

113. See Tom Joyce, *Springetts Seeks Permit for Sludge Fertilization: Some Property Owners Object to the Treated Sewage Being Dumped Near Their Land*. YORK DAILY REC., June 11, 1999, at C2.

114. See Gardner, *supra* note 97, at 28.

and disposal of radionuclides and assess potential exposure to radioactivity.¹¹⁵

2. *Require Limits on Infrequently Occurring Metals and Biological Contaminants.*

Currently, Section 503 only requires monitoring of nine frequently occurring metals in sewage sludge: arsenic, cadmium, copper, lead, mercury, molybdenum, nickel, selenium and zinc.¹¹⁶ Sewage sludge, however, may contain other types of metals potentially dangerous to humans and animals. By some estimates, nearly 70,000 unregulated chemicals used by different industries can make their way into the sewer system, mix with human waste, and become part of sewage sludge.¹¹⁷

The Cornell study suggests additional monitoring of antimony, beryllium, chromium and silver.¹¹⁸ Also, monitoring for fluoride, iron, molybdenum and selenium should be required for land where animals graze or forage grows.¹¹⁹ The reason for such additional monitoring is simple—not all sewage sludge is derived from the same source, and thus there is no guarantee that infrequently occurring metals are not present unless Section 503 mandates their regulation.¹²⁰

For example, in Augusta, Georgia, forty-four local industries contribute to the sewage sludge that is processed for land application. Although the city of Augusta purports to comply with Section 503, additional, unmonitored contaminants such as oil, grease, heavy metals, and toxic chemicals like benzene and toluene have been found in the discharge contributed from the different industries.¹²¹

115. *See id.*

116. *See* 40 C.F.R. § 503.13.

117. *See* Todd Hartman, *Sewage Spawns Controversy/ Sludge Dangerous, Some Say*. COLO. SPRINGS GAZETTE, Feb. 7, 1998. Such unregulated chemicals include “chlorinated pesticides, dioxin, carcinogenic polynuclear aromatic hydrocarbons, flame retardants (asbestos), [and] industrial solvents.”

118. *See* HARRISON, ET. AL. *supra* note 10, at 34.

119. *See id.*

120. *See id.* at 20. The study illustrates this point further with an example of a hypothetical small city where an industry infrequently discharges a highly toxic contaminant not included in Part 503 rules. A 1984 survey of twenty-four different types of sludges in New York and thirty types of sludges from around the US evidenced elevated levels of various exotic contaminants in sludges from communities where a particular industry operated.

121. *See* Pavey, *supra* note 81, at A1.

Under Section 503, there are no safeguards against contamination by biologically active products such as oil and grease, but as is evident in Augusta, Georgia, their presence in sewage sludge is not unlikely. Section 503 also does not protect against contamination by other compounds, such as gravel, sand, incinerator ash, or large physical materials like rags or cloth.¹²² It is crucial, however, to document the levels of potentially harmful, extraneous material destined for land application.¹²³ Section 503 also only requires monitoring for certain types of pathogens, such as enteric viruses, helminth worm ova and salmonella. Though these pathogens are naturally occurring, their presence in sewage sludge depends largely on the overall health of the population contributing to the sewage.¹²⁴ Since Section 503 does not take into account the health of the contributing population, certain, unmonitored pathogens such as *E. coli*,¹²⁵ a bacteria that can spread in epidemic proportions, can easily make its way into the sewage of an infected populous. Thus, not only should Section 503 require additional testing for more types of pathogens, but also the health of the contributing population should be considered before sewage sludge is processed for land application.

3. *Increase Public Awareness and Notice of Treated Land, and Universal Labeling of Sewage Sludge Products.*

As in the unfortunate case of 11-year-old Tony Behun in Osceola Mills, PA, if the public is not notified that land has recently been treated with sewage sludge, dire consequences may result.¹²⁶ Though Section 503 places restrictions on access to sludge-treated sites—one year restriction of public access to land with “high potential for public exposure,” and 30-day restriction to land with “low potential for public exposure”¹²⁷—Section 503 provides no means for enforcing these site restrictions.

122. See 40 C.F.R. § 503.6

123. See Gardner, *supra* note 97, at 28.

124. See HARRISON, ET. AL. *supra* note 10, at 28.

125. *Escherichia coli* (*E. coli*) is a species of coliform bacteria normally present in the intestines, and is commonly found in water, milk and soil. *E. coli* frequently causes urinary tract infection, and certain types of *E. coli*, such as *E. coli* septicemia, may cause shock or even death through the release of an endotoxin present in the bacteria. See MOSBY'S DICTIONARY, *supra* note 34, at 587-588.

126. See Mann, *supra* note 79, at 36.

127. 40 C.F.R. § 503.32(b)(5).

Section 503 should be revised to require public notice of treated land. Joseph Cocalis of the Center for Disease Control believes that any site treated with sewage sludge must be posted with warning signs about the pathogens and contaminants potentially present in the sludge.¹²⁸ The Cornell study suggests requiring posting on sites where sludge has been applied, and providing information for farmers regarding the potential hazards of exposure and how to minimize such harms.¹²⁹ Also, Section 503 should include provisions for civil or criminal liability for anyone who applies sewage sludge to land but fails to provide sufficient public notice.

Labeling of sewage sludge products must also become a universal practice. Though Section 503 sets general guidelines for labeling sewage sludge products,¹³⁰ if sludge meets the pollution concentration requirements in Section 503.13(b)(3),¹³¹ the Class A pathogen requirements as set forth in Section 503.32(a),¹³² and only one of the vector attraction reduction requirements in Section 503.33, the sewage sludge product need not be labeled to explain its content.¹³³

Only sludge that fails to meet one or more of the "exceptional quality" pollutant or pathogen concentration requirements must be placed in a labeled container that provides information to the user regarding the annual pollutant loading rate.¹³⁴ In other

128. See Mann, *supra* note 79, at 36.

129. See HARRISON, ET. AL. *supra* note 10, at 34.

130. See 40 C.F.R. § 503.14.

131. Section 503.13(b)(3) provides a table for acceptable pollutant concentrations in sewage sludge on a dry weight basis. The information from the table is as follows:

TABLE 3 OF § 503.13 – POLLUTANT CONCENTRATIONS

Pollutant	Monthly average concentration (mg/kg)
Arsenic	41
Cadmium	39
Copper	1500
Lead	300
Mercury	17
Nickel	420
Selenium	100
Zinc	2800

132. See 40 C.F.R. § 503.32.

133. See 40 C.F.R. § 503.10.

134. See HARRISON, ET. AL., *supra* note 10, at 5.

words, sewage sludge that Section 503 deems to be of “exceptional quality” need not be labeled, and no public notice of the sewage sludge content is required. Since even the sludge that Section 503 deems exceptional may create potential risks to public health or the environment, all sewage sludge sold, distributed and applied to land must be labeled with a detailed description of its content and instructions for the means of safe land application.

IV. Conclusion.

The passage of the Clean Water Act in 1972 helped to begin a gradual progression toward regulatory treatment of sewage sludge. Instead of standing idly by as waste in landfills piled at a progressive rate, and instead of showing continued complicity toward industries and municipalities dumping waste into waterways, Congress chose a proactive approach to solving the solid waste problem. Section 503 of the Code of Federal Regulations was to be the culmination of this progression by providing statutory means for beneficial use of sewage sludge. Section 503, however, has not proven to be completely effective means for the beneficial use and disposal of sewage sludge.

The EPA, in its risk assessment study of land application practices, failed to account for the variability of contaminants found within sewage sludge, and how various combinations of these contaminants may affect public health or the environment. The EPA also failed to foresee the problems that might be caused by lackadaisical monitoring and labeling requirements, and by not establishing any remedies for failure to comply with these requirements. Once again, Congress needs to take a proactive stance to revise Section 503 to include much stricter standards to guarantee the safe use of sewage sludge as fertilizer.

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