NACWA
A Clear Commitment to America's Waters

Statement

of the

National Association of Clean Water Agencies (NACWA)

Oversight on the State of Science and Potential Issues Associated with EPA's Sewage Sludge Program

Committee on Environment and Public Works
U.S. Senate
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Introduction

The National Association of Clean Water Agencies (NACWA) represents the interests of more than 300 municipally owned wastewater treatment agencies and organizations that have made the pursuit of scientifically based, technically sound, and cost-effective laws and regulations their objective. Our members are dedicated environmental stewards who work to carry out the goals of the Clean Water Act and who treat and reclaim more than 18 billion gallons of wastewater each day. In addition, these public agencies effectively manage and safely recycle the more than 7 million dry tons of biosolids generated each year.

In recent months, there have been a number of misleading stories in the media that have called into question the safety of land application as a practical means to recycle biosolids. NACWA would like to help set the record straight. First and foremost, it must be understood that the current management and disposal of biosolids throughout the United States is done within the parameters of a strict regulatory regime, established under the Clean Water Act, which has repeatedly been proven to be scientifically sound and environmentally safe. It is critical that municipalities continue to have the maximum flexibility envisioned by Congress in the Clean Water Act to decide the best method for managing biosolids. In fact, the law states that the "determination of the manner of disposal or use of sludge is a local determination.[1]" Cities need the predictability and consistency that come with the availability of a broad suite of tools in order to make biosolids management decisions that are best suited to meet local needs and address local conditions.

Currently, wastewater agencies employ a variety of different methods to manage the daily production of biosolids, including landfilling and incineration. However, land application has become, and remains, the most widely used practice, not only because it provides a safe, environmentally sound, and agriculturally beneficial way to recycle and reuse the nutrient-rich content of biosolids, but because the Clean Water Act called on municipalities to move in that direction. The Clean Water Act directs the U.S. Environmental Protection Agency

[1] Clean Water Act, Sec. 405(e)

(EPA) to "promote the safe and beneficial management or use of sewage sludge for such purposes as aiding the restoration of abandoned mine sites, conditioning soil for parks and recreation areas, agricultural and horticultural uses, and other beneficial purposes."[2]

Biosolids Usage

The latest comprehensive data compiled from state regulatory agencies, EPA, individual wastewater treatment facilities, and others indicate that about 7,180,000 dry tons of biosolids were produced and beneficially used or disposed of in the United States during 2004. Of this total, approximately 55% was recycled through land application for agronomic, silvicultural, and/or land restoration purposes, while 45% was primarily handled through landfilling or incineration. This means that the majority of biosolids produced in the U.S. – approximately 3,929,000 tons per year – are beneficially recycled through land application programs. Many of our largest cities, including Los Angeles, San Francisco, Oakland, Phoenix, Portland, Seattle, Milwaukee, Chicago, Philadelphia, Washington, DC, and New York City all have biosolids land application programs.

Regulatory Framework for Managing Biosolids

Biosolids reuse and disposal practices are currently regulated by multiple federal, state, and local agencies. The EPA is responsible for the development and implementation of federal rules and regulations regarding biosolids processing, use, and disposal. The primary federal regulation for biosolids management is 40 Code of Federal Regulations (CFR) 503 (Part 503). In Utah, as in California and other states, the 503 rule is enforced through National Pollutant Discharge Elimination System (NPDES) permits issued to all wastewater treatment facilities. Promulgated in 1993, the regulations under Part 503 apply to land application, surface disposal, and incineration of biosolids. The Part 503 standards include pollutant limits, management practices, and operational criteria, as well as monitoring, recordkeeping, and reporting requirements for biosolids use and disposal. For land application, the rule establishes strict metal limits, pathogen reduction standards, and vector attraction reduction

[2] Clean Water Act, Sec. 405(g)(1)

requirements. NACWA has worked closely with EPA, academia, and the scientific community to develop a peer-review process for assessing the efficacy of the Part 503 regulations. We continue to support what we believe to be a well-vetted and protective set of regulations.

Since Part 503 was promulgated in 1993, a number of environmental groups, a few local governments, and other individuals have expressed concern regarding the adequacy of the Part 503 regulations. Concerns have primarily focused on the land application of Class B biosolids. In response, EPA requested the National Research Council (NRC) of the National Academy of Science (NAS) to conduct two separate studies to assist in evaluating the effectiveness of existing regulatory requirements and nonregulatory measures with respect to the land application of biosolids.

In 1996, the NRC published *Use of Reclaimed Water and Sewage Sludge in Food Crop Production*. The report concluded that the application of biosolids to farmland, when practiced in accordance with existing federal guidelines and regulations, presents negligible risk to the consumer, to crop production, and to the environment. The report concluded that current technology to remove pollutants from wastewater, coupled with existing regulations and guidelines governing the use of reclaimed wastewater and sludge in crop production, are adequate to protect human health and the environment.

In 2000, EPA asked the NRC to review the science and methods supporting Part 503 to address concerns regarding alleged human health impacts of land application of biosolids. This 18-month study was completed in 2002, and the report, *Biosolids Applied to Land: Advancing Standards and Practices,* was issued. The NRC report concluded that there is no documented scientific evidence that the Part 503 rule has failed to protect public health. The report also concluded that "a causal association between biosolids exposures and adverse health outcomes has not been documented," and that "there are no scientifically documented outbreaks or excess illnesses that have occurred from microorganisms in

treated biosolids." Finally, the report found that additional studies should be conducted and risk assessments performed to update the scientific basis for the rule. EPA continues to reevaluate the Part 503 regulations and has not found a need to establish more stringent requirements or regulate additional pollutants at this time. Additionally, the wastewater industry continues to conduct significant research to further enhance our understanding of the environmental and human health effects associated with the beneficial reuse of this otherwise wasted product.

Beneficial Uses of Biosolids

Nationally, the vast majority of land-applied biosolids, approximately 74% (2,907,460 tons), are used for agricultural purposes. Only a small percentage 4% (157,160 tons) of land applied biosolids are used for land restoration/reclamation, or in silviculture. The remaining 22% (864,380 tons) are treated to meet EPA's highest quality biosolid standards (Class A, exceptional quality) and are either land applied or made available commercially to the public as a bagged product for a variety of uses including landscaping, horticulture and agriculture.[3] Class A exceptional quality biosolids have been used on golf courses, public parks and even the White House lawn.

Biosolids provide primary nutrients — nitrogen and phosphorus — and secondary nutrients, such as calcium, iron, magnesium, and zinc for plants. This organic fertilizer helps to increase crop yields, maintain moisture in the soil, and maintain nutrients in the root zone. Unlike commercial chemical fertilizers, biosolids provide nitrogen that is released slowly over the growing season as the nutrient slowly interacts with the soil matrix, is mineralized, and made available for plant uptake. Nutrients in biosolids are much less likely to run off

[3]EPA has established a three-tiered system to evaluate the quality of biosolids produced in the United States based on the amount of potential pathogen content, Class B biosolids, Class A biosolids, and Class A Exceptional Quality (A EQ) biosolids. Class B biosolids may have low levels of pathogens which rapidly die off when applied to soils, essentially becoming pathogen free within a short period following application when the "Part 503" Rule requirements are followed. "Part 503" refers to the section in Vol. 40 of the Code of Federal Regulations, where various standards related to pathogens and metals in biosolids are codified. Class A biosolids are subject to higher levels of treatment and are essentially free of pathogens prior to land application. The metal contents requirements under the Part 503 Rule are the same for Class A and Class B biosolids. Class A EQ biosolids are treated to the highest standard for pathogen removal, have lower metals concentration requirements than either Class A or Class B biosolids, and are often sold or distributed as commercial fertilizer.

the site and contaminate nearby waterbodies because of their soil bonding characteristics and slow release for use by the plant's roots. In addition to their usefulness to plants and crops, biosolids also offer net greenhouse gas benefits by recycling carbon to the soil and fertilizing vegetation for carbon recapture. A move toward incinerating biosolids runs the risk of increasing the carbon footprint of the wastewater treatment industry. As we begin to consider the issue of climate change, particularly as it relates to clean water, it is clear that the land application of biosolids is an environmentally sound practice that we should encourage, not discourage.

While the public occasionally raises issues about the land application of biosolids, in our view, this practice is safe, protective of the environment, and cost-effective. Several biased and misleading Associated Press (AP) articles on biosolids management stoked these concerns this past year after making claims that human and animal health has been adversely affected by biosolids land application, alleging organized government cover-ups, and raising environmental justice concerns. The claims and statements casting doubt on land application in these articles have now been shown to be inaccurate, but the articles have, nevertheless, contributed to an ongoing and unfortunate public concern over the land application of biosolids. While we acknowledge the need to continue to study and analyze the potential environmental and public health risks associated with the land application of biosolids, to date, there have been no peer-reviewed studies directly linking the practice to adverse impacts on human health or the environment.

Additional Background: Where Do Biosolids Come From?

Biosolids are a natural by-product of the modern wastewater treatment process. Each person who has ever lived on this earth from the first bite of the apple in the Garden of Eden until today has produced the raw product that we at the nation's clean water agencies turn into treated biosolids. The generation and management of this product is an important and necessary function of the more than 16,000 publicly owned treatment works (POTWs) nationwide. These treatment plants receive wastewater from a variety of sources, but most

of it comes from our homes and businesses. When citizens take a shower, wash the dishes, or flush the toilet, for the most part they don't think about what happens to the water that's just gone down the pipes, and they don't have to. The sophisticated network of pipes and pump stations handles the waste efficiently and effectively. Part of that process involves separating solids from liquid. These solid residues, known as sewage sludge, are further treated to produce what we call biosolids.

Homes and businesses are not the only sources of wastewater. POTWs also handle the wastewater from a variety of industrial sources and play a unique role in being both regulated entities and regulators. In the case of industrial sources, POTWs are the regulators whose job is to ensure the proper management of wastewater before it enters the treatment works. This is done through stringent requirements under the pretreatment program of the Clean Water Act. POTWs issue pretreatment permits to individual industrial dischargers with strict limits designed to prevent toxic and hazardous compounds from passing through or interfering with the treatment works. These programs are also carefully crafted and monitored to ensure that toxic substances do not end up in the biosolids.

Communities cannot stop producing biosolids, and in fact, their production in the United States will only increase as the population grows. Our job, simply put, is to manage this product of the wastewater treatment process safely and effectively. As we do this, we will continue to work with EPA and the scientific community to ensure the regulations governing this practice continue to be safe and reliable.

Wastewater Sector Initiatives to Develop and Implement Best Management Practices

Proper, safe, and effective management of biosolids is a key part of clean water agencies' environmental mandate. Wastewater treatment professionals, like those working for the Central Davis Sewer District, are committed to promoting environmental stewardship and best management practices for their biosolids management programs. The National Association of Clean Water Agencies (NACWA) and the Water Environment Federation

(WEF) founded the National Biosolids Partnership (NBP) in coordination with EPA in 1997 to promote biosolids best management practices. The Partnership has created a set of management practices and a certified environmental management system (EMS) for biosolids that exemplifies the steps being taken at the local level to ensure biosolids safety and public participation in biosolids management decisions. Congress has supported this effort since 1999 through program funding and we encourage continued funding in the future for this purpose.

Conclusion

The production of biosolids on a massive scale is a practical reality of modern life in every city in America and around the world. Study after study has demonstrated that the federal and state regulations currently in place ensure that the land application of biosolids continues to be protective of the environment and human health. These regulations have evolved over the past three decades in a scientifically sound process that strives to ensure municipal flexibility while also guaranteeing that all land applied biosolids receive proper treatment and are applied in a manner that will protect public health. NACWA has been an active participant in the regulatory process over the years, including its involvement in the first *National Sewage Sludge Survey,* which is now being updated. But more important than these past actions is the future. NACWA recognizes that there are new challenges before us involving nutrient control, pharmaceuticals and other emerging compounds in our waterways, nanotechnology, and climate change. NACWA understands the need to be vigilant about the impacts these issues have on the regulation of biosolids. The public officials that run the nation's clean water agencies take their role as stewards of the public health and the environment very seriously. The Association is committed to protecting the health and environment of all Americans and looks forward to working with the Congress, EPA, and others to ensure we achieve this objective.

Please find enclosed several key documents responding to some of the controversy over land application of biosolids and providing important information regarding the safety of this practice.

Newsweek

Johns Hopkins raps AP story on lead experiment

Johns Hopkins criticizes AP story, says treated sludge in Baltimore lead experiment not risky

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AP

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For about 20 years, Dr. Michael Klag has used a fertilizer made from Milwaukee municipal sludge on azaleas and yew shrubs at his suburban Baltimore home. And Klag, dean of the Johns Hopkins School of Public Health, says he's never had any question about its safety.

But in the past few weeks, he has found himself reassuring the public about a similar product, a compost made with treated municipal sewage sludge in Baltimore. Johns Hopkins researchers spread it on nine yards in poor black Baltimore neighborhoods in an experiment eight years ago.

That's become a cause for outrage among some politicians and others who have called for an investigation. The trigger was an Associated Press story in April that raised questions about the Baltimore experiment and whether there has been adequate testing to determine if sludge is safe.

The AP story described the Baltimore experiment, which was done in areas with high lead levels in soil and high rates of lead poisoning in children. Researchers reported that adding the compost to the dirt could cut the risk from lead by reducing the metal's ability to be absorbed by the body.

But the AP story described concerns about whether using treated sludge in such an experiment is itself hazardous.

In response, the Maryland NAACP asked the state attorney general to investigate the study. Sen. Barbara Mikulski and Rep. Elijah Cummings, both D-Md., asked for a federal investigation. And Sen. Barbara Boxer, D-Calif., cited the Baltimore study and said a committee she chairs will investigate the risks of using such material in neighborhoods.

Klag says the AP story was "inaccurate and misleading" because it gave the sense that "somehow we targeted vulnerable families for use of a product that we would never, ever consider using ourselves. It's just not true."

The sites of the experiment were chosen for their high lead levels, not to take advantage of people who lived there, Klag said.

And while the AP story said families in the Baltimore experiment weren't told of safety disputes and health complaints regarding use of treated sludge on land, Klag's school says it doesn't know of any research suggesting the compost itself poses a known risk to people.

"We used a commercial, off-the-shelf product that's highly regulated by both the federal and the state governments" and used widely at all levels of society, Klag said.

Mike Silverman, the AP's senior managing editor, said the story suggested the compost could be riskier than has been shown so far.

"It is a subject of scientific debate," Silverman said. "Many researchers believe the compost is

safe, but there are some who believe it may be dangerous and should be studied further.

"The original AP story leaned too heavily on the latter view. That was unbalanced, and it created a distorted impression about the level of risk in the Baltimore experiment."

The compost, sold under the brand name Orgro, also contains wood chips and sawdust. It has been applied on virtually every golf course within 50 miles of Baltimore's composting plant, according to the company that operates the plant. It was also used several years ago on the the grounds of the vice president's official residence, according to a spokeswoman for the vice president's wife, Lynne Cheney.

Peter Lees of Johns Hopkins, one of the researchers involved in the 2000 experiment, said he wasn't aware of any question "from anybody anywhere" about using the compost at that time.

"It was a product you could get at Home Depot (and) garden stores," he said. "It met federal and state standards, so I guess at that point, what's the question?"

In technical terms, the compost contains "Class A biosolids," meaning it's been treated to cut germs to undetectable levels, and is rated "exceptional quality," indicating it meets certain requirements for heavy metal content. It's approved for use on lawns and home gardens.

Experts contacted recently by the AP generally said they didn't consider such material to be dangerous.

Klag said the AP story didn't clearly distinguish the compost from a different category of material, Class B treated sludge, which has been the object of some health concerns. Class B material can still have detectable levels of germs and isn't approved for lawns or home gardens. It's used to fertilize farmland, reclaim surface mines, cover landfills and help forested areas regrow after fire or erosion damage.

The AP story said there's been a lack of research into possible harmful effects from spreading treated sludge on land. It quoted the chairman of a National Academy of Sciences committee that looked into the practice as saying more safety studies are needed, and that sludge contains "potential pathogens and chemicals that are not in the realm of safe."

But the chairman, Thomas Burke of Johns Hopkins, said in a recent interview he was not talking about Class A material. (A transcript of the original interview is not clear on this point). Asked in the recent interview about the safety of Class A, the designation for the compost used in Baltimore, he said he'd defer to other scientists, but added that it's widely used "and there's really not evidence out there that there's any kind of adverse effect."

The 2002 report from his committee said it considered both classes of sludge and concluded that while nobody had documented harm to human health, more health studies were needed to address "persisting uncertainty" about the potential risks. But Burke said the report was chiefly concerned with Class B rather than Class A.

"We really didn't focus on composting because of the extra level of treatment," Burke said in the recent interview. "We focused very much on Class B."

Another committee member, Ian Pepper of the University of Arizona, agreed that the report was "almost entirely focusing on Class B. ... The potential hazards associated with Class A are minimal." (Pepper directs a National Science Foundation center on water quality that receives some industry funding).

Sally Brown of the University of Washington, who studies ways to treat contaminated soil, called compost safe and said the Johns Hopkins experiment got impressive results for reducing the hazard from lead in soil.

But Murray McBride, director of the Cornell Waste Management Institute, who was quoted in the

original AP story, said he still sees cause for concern in materials that meet Class A and exceptional-quality standards.

The exceptional-quality standard doesn't include testing for some potentially harmful metals and other chemicals that can appear in sludge, he said. Without such testing, "how would you know" whether a product contained worrisome levels of those substances, he asked.

McBride said he was aware that Orgro, the compost in the Hopkins experiment, was used by consumers in the Washington area. But he suggested most buyers don't know it comes from treated sludge.

He said buyers of a commercial fertilizer made from sludge were surprised when he told them where it came from, and some said they would stop using it.

Rufus Chaney, a U.S. Department of Agriculture researcher who co-authored the Baltimore study, said he's not deterred by the possibility of undiscovered hazards in compost that comes from treated sludge.

"We don't have perfect knowledge, but we don't have any evidence that we're failing to be adequately protective," he said. It is "pretty far-reaching to claim there's a risk."

URL: http://www.newsweek.com/id/141291

Questions and Answers on Land Application of Biosolids

Every day, wastewater treatment facilities across the country treat billions of gallons of wastewater generated by homes and businesses. The stringent controls and sophisticated treatment technologies mandated by the Clean Water Act have yielded significant improvements in public health and the condition of our nation's waters. Wastewater treatment facilities produce a high-quality liquid effluent for discharge to water bodies or for reuse. As a byproduct of the treatment process, these facilities also produce solid residues (sewage sludge) that, with further treatment, can yield biosolids, defined by the Environmental Protection Agency (EPA) as "*nutrient-rich organic materials resulting from the treatment of domestic sewage in a treatment facility . . . that can be recycled and applied as fertilizer to improve and maintain productive soils and stimulate plant growth*."[1]

1. What is the federal regulation that governs the management of biosolids?
The federal regulation governing the management of biosolids is 40 CFR Part 503 and is based on statutory requirements under the Clean Water Act.

2. How was the 40 CFR Part 503 Regulation Developed?
The 1987 Clean Water Act amendments directed EPA to research and promulgate regulations for use and disposal of sewage sludge.[2] EPA undertook a comprehensive process to study land application and other biosolids management practices such as mine reclamation, silviculture, and incineration. Based on the results of its risk assessment, EPA identified and set numeric limits for nine trace elements (heavy metals) that may be found in biosolids. EPA also mandated that treatment facilities use at least one of several alternative technologies to significantly decrease or eliminate levels of pathogens in biosolids.[3]

3. What are the various options to manage biosolids?
There are several options that wastewater treatment facilities use to manage their solids. These include land filling, incineration, or treatment to meet criteria allowing beneficial recycling as a soil amendment. Beneficial recycling of biosolids can include heat and energy recovery following solids combustion, home use of dried and pelletized products, distressed land restoration, and fertilization and soil conditioning of farmland. When practiced in accordance with federal and state regulations and sound management practices, biosolids recycling is protective of public health, environmentally beneficial, and efficient.

4. How much biosolids are produced annually in the U.S.?
Approximately 7,100,000 dry tons of biosolids are generated each year at approximately 16,500 municipal wastewater treatment facilities in the U.S..[4]

[1] EPA, Biosolids: Frequently Asked Questions, http://www.epa.gov/owm/mtb/biosolids/ genqa.htm (last visited May 30, 2008), see also, EPA, Biosolids Recycling: Beneficial Technology for a Better Environment (1994).

[2] Water Quality Act of 1987, Pub. L. No. 100-4, § 405, 101 Stat. 7, 72 (1987) (codified at 33 U.S.C. § 1345).

[3] EPA, Standards for the Use or Disposal of Sewage Sludge, 58 Fed. Reg. 9,248 (Feb. 19, 1993)

[4] 2004 U.S. EPA data

5. How much of the biosolids produced annually is land applied?
Approximately 55% of the total biosolids generated each year are land applied, with the remainder either incinerated/processed for energy recovery, composted or landfilled.[5]

6. Are biosolids treated before they are land applied?
Biosolids that are land applied have been further treated to minimize odors and to reduce or eliminate pathogens and trace metals. There are two classes of biosolids that are land applied, referred to as "Class B" and "Class A."

7. What is the difference between Class B and Class A biosolids?
Biosolids that are treated to achieve significant (i.e., 99%) pathogen reduction and subject to site use and access restrictions are categorized as "Class B" biosolids. Biosolids disinfected to a level that inactivates pathogens are subject to fewer site-specific controls and are called "Class A" biosolids. If, in addition, heavy metal concentrations are sufficiently low, Class A biosolids can be bagged and distributed for home garden use without further regulation (referred to as Class A, EQ (exceptional quality) biosolids).[6] In fact, Class A biosolids have been used to fertilize the White House grounds. According to 2004 data, approximately 23% of all biosolids produced were processed to meet Class A treatment standards; 34% were processed to meet Class B treatment standards.[7]

8. Do states implement their own land application programs?
After EPA issued the final Part 503 Rule in 1993, most states implemented complementary land application programs to strengthen oversight and safety of the practice. Only nine states have no biosolids-specific regulations and rely exclusively on Part 503.[8]

9. Has EPA requested any independent studies to determine if the science supports biosolids land application?
Since the implementation of Part 503 Rule, two reports of the National Research Council (NRC) of the National Academy of Sciences have considered whether land application of biosolids is safe and beneficial.

10. What did these reports conclude about biosolids land application practices?
In 1996, the NRC published *Use of Reclaimed Water and Sewage Sludge in Food Crop Production*. The report concluded that the application of biosolids to farmland, when practiced in accordance with existing federal guidelines and regulations, presents negligible risk to the consumer, to crop production, and to the environment. The report concluded that current technology to remove pollutants from wastewater, coupled with existing regulations and guidelines governing the use of reclaimed wastewater and sludge in crop production, are adequate to protect human health and the environment.[9]

In 2000, EPA asked the NRC to review the science and methods supporting Part 503 to address concerns regarding human health impacts of land application of biosolids. As a result of its "search for evidence on human health effects related to biosolids," the NRC's 2002 report reached several important conclusions:

- "There is no documented scientific evidence that the Part 503 Rule has failed to protect public health."

[5] North East Biosolids and Residuals Association (NEBRA), *A National Biosolids Regulation, Quality, End Use & Disposal Survey* (2007); www.nebiosolids.org.
[6] 40 C.F.R. § 503.10(g) (2008).
[7] Ibid. NEBRA.
[8] Ibid.
[9] National Research Council (NRC), *Use of Reclaimed Water and Sewage Sludge in Food Crop Production* (1996).

- "[A] causal association between biosolids exposures and adverse health outcomes has not been documented."
- "There are no scientifically documented outbreaks or excess illnesses that have occurred from microorganisms in treated biosolids."[10]

The NRC also observed that "persistent uncertainties" regarding the safety of land application necessitate more scientific research, but it did not call for any specific changes to Part 503. EPA continues to reevaluate the adequacy of the Part 503 regulations and has not found a need to establish more stringent requirements or regulate additional pollutants.

11. What is the scientific basis for biosolids land application?

The broad weight of scientific evidence and opinion supports recycling biosolids to land as an environmentally responsible disposal method when managed utilizing best practices and in compliance with the Part 503 rule. Federal policies supporting and promoting the beneficial recycling of biosolids are based upon science demonstrating the safety and benefits of such recycling. These policies are not driven by economics and the choice to recycle biosolids remains a local decision.

12. What are some of the benefits of biosolids land application?

The benefits of biosolids for both soil and vegetation are numerous and well recognized.[11]

- Biosolids provide primary nutrients (nitrogen and phosphorous) and secondary nutrients such as calcium, iron, magnesium and zinc;
- Use of biosolids increases crop yields and maintains nutrients in the root zone;
- Unlike chemical fertilizers, biosolids provide nitrogen that is released slowly over the growing season as the nutrient is mineralized and made available for plant uptake;[12]
- Land application of biosolids can also offer net greenhouse gas benefits by recycling carbon to the soil and fertilizing vegetation for further carbon dioxide capture.[13]

13. How do biosolids differ from other fertilizers?

Biosolids also offer a sound alternative to chemical and manure-based fertilizers. Because manure is often untreated or is minimally treated before field application, it may pose a greater risk of transmitting pathogens or trace organic constituents such as antibiotics to soil or humans. Pathogen concentrations are magnitudes higher in untreated manures than in biosolids and, unlike biosolids, pathogen concentrations in manures are not strictly regulated.[14] Many chemical fertilizers are petroleum-based products, which increases the costs to farmers and contributes to the release of greenhouse gas emissions in the production cycle.

[10] NRC, *National Biosolids Applied to Land: Advancing Standards and Practices* (2002).
[11] Eliot Epstein, *Land Application of Sewage Sludge and Biosolids* 143-158 (2003).
[12] See generally Gary Pierzynski, *Soils and Environmental Quality* 174-80 (3d ed. 2005); Gary Pierzynski, *Plant Nutrient Aspects of Sewage Sludge, in Sewage Sludge: Land Utilization and the Environment* 21 (C.E. Clapp et al., eds. 1994).
[13] Sally Brown & Peggy Leonard, *Biosolids and Global Warming: Evaluating the Management Impacts*, BioCycle, Aug. 2004, at 54, 58 (conducting a carbon accounting of the King County, WA, biosolids program and finding that "using biosolids as a substitute for commercial fertilizers results in a net savings in CO_2 for both agricultural and forest application sites," even without including the potential for biosolids to increase carbon reserves in soil).
[14] Lynne H. Moss et al., *Comparing the Characteristics, Risks and Benefits of Soil Amendments and Fertilizers Used in Agriculture*, 16th Annual Water Environment Federation Residuals and Biosolids Management Conference 14 (2002).

14. Did EPA assess trace metals and chemicals in biosolids?

After reviewing over 200 specific compounds and elements from an initial candidate list of thousands, EPA targeted at least 22 constituents for a formal risk assessment to examine the quantities of the metals and chemicals in biosolids, their toxicity, routes of potential exposure to humans and the environment, and many other factors. The risk assessment ultimately determined that limits were advisable for nine trace elements (arsenic, cadmium, copper, lead, mercury, molybdenum, nickel, selenium, and zinc), primarily to protect against toxic effects to plants and entry into the food chain.[15] A 4-year study by the U.S. Geological Survey (USGS) of Denver Metro Wastewater Reclamation District land application sites measured the effects of the application of Class B biosolids on the nutrient and metal content of soils, groundwater, and surface waters and found that "soil data indicated that biosolids have no measurable effect on the concentrations of constituents monitored." Further, the study did not establish any adverse biosolids-related effects on soils, crops, or groundwater on or near the biosolids application site. [16]

15. How do biosolids programs and regulations reduce or mitigate the risk of these trace metals and chemicals?

Current biosolids programs mitigate the risk of contamination by anthropogenic chemicals and trace metals in the following ways:

- Federal guidelines limit the amount of biosolids that may be applied to the land, ensuring metal concentrations on biosolids-amended soils do not exceed safe levels;
- Trace chemicals that on occasion have been identified in biosolids have not been found in environmentally or toxicologically significant amounts; and, the trace amounts of these substances that may be present typically bind to soil constituents, limiting human exposure. [17]
- Industrial pretreatment programs required under the Clean Water Act reduce or eliminate many hazardous chemicals entering the treatment facility, protecting biosolids quality.[18]

16. What does the scientific literature state about the potential risk of these contaminants?

A 2005 literature review on the issue of trace contaminants concluded that "[b]ecause of the capacity of land-based systems to buffer the potential toxic effects of waste-associated organic contaminants and to contribute to their assimilation into the soil, the majority of studies conclude that they pose little or no risk to the environment when applied appropriately."[19]

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[15] EPA, *A Guide to the Biosolids Risk Assessments for the Part 503 Rule* (1995).

[16] Tracy J.B. Yager, et.al., U.S. Geological Survey Scientific Investigations Report, *Effects of Surface Applications of Biosolids on Soil, Crops, Groundwater, and Streambed Sediment Near Deer Trail, Colorado, 1999-2003*, 5289 (2004).

[17] Ian Pepper et al, *Environmental and Pollution Science* 459 (2nd. ed. 2006) *See also* R.Y. Surampalli et al., *Long-term Land Application of Biosolids—A Case Study*, 57 Water Sci. & Tech 345, 349 (2008) (finding "the cumulative metal loading rates after 10 years of biosolids application were far less than USEPA limits") Gregory Evanylo et al., *Bioavailability of Heavy Metals in Biosolids Amended Soil*, 37 Comm'n in Soil Sci. & Plant Analysis 2157, 2163 (2006) (finding that crops grown in biosolid-amended soils had higher metal concentrations than a control, but that metal concentrations in all plants were within the values observed for uncontaminated soils); Rufus Chaney, *Trace Metal Movement: Soil-Plant Systems and Bioavailability of Biosolids-Applied Metals* in *Sewage Sludge: Land Utilization and the Environment* (1994).

[18] Clean Water Act §§ 301(b)(2), 304(g) (33 U.S.C. §§ 1311(b)(2), 1314(g)); and, National Ass'n of Clean Water Agencies (NACWA), *Biosolids Management: Options, Opportunities and Challenges* 10-13 (2006) (case studies of reduction of metals in influent and biosolids in Los Angeles and greater Cleveland).

[19] Michael Overcash et al., *Beneficial Reuse and Sustainability: The Fate of Organic Compounds in Land-Applied Waste*, 34 J. Envtl. Quality 29, 30 (2005).

17. How are pathogens in biosolids regulated?

As established by the Part 503 Rule, treatment of biosolids to Class B or Class A standards eliminates 99% or more of the pathogens that may exist in biosolids. Research has continued to validate a technology-driven approach to reducing or eliminating pathogens in biosolids and shows low risk for the transmission of pathogens from land application sites to surrounding residents:

- No scientific studies have demonstrated any link between the existence of human pathogens in biosolids and illnesses in nearby residents.
- The conclusion that application of biosolids utilizing best management practices poses negligible health risks from pathogens is based on scientific understanding about pathogen survivability in the environment.
- Pathogens are enteric organisms that prefer and need the conditions inside the human body to thrive. Many pathogens do not survive passage through the collection and treatment system and through the additional treatment processes that further disinfect solids and effluent.[20]

18. What does the scientific literature conclude about pathogens in biosolids?

A recent review of biosolids pathogen research literature concluded: "The overall conclusion we have reached based on all of our land-application studies over the past two decades and an in depth review of other relevant land application studies is that land-application of Class B biosolids is sustainable. Specifically, the risks to human health posed by many microbiological entities within biosolids have been shown to be low if current EPA regulatory guidelines are followed. In addition, risks from indirect exposures such as aerosolized pathogens or contaminated groundwaters appear to be particularly low." [21] This conclusion is consistent with the practical experience in the wastewater treatment sector where exposure to biosolids has not been associated with illness.[22] Microbial risk assessment and control remains a priority for the scientific community, however, and pathogen-related issues continue to be closely monitored.[23] The 2002 NRC study recommended that an epidemiological study be completed to determine whether there is a link between land applied biosolids and adverse health impacts; however, NRC also recognized that such a study would be expensive and that "priority should be given to studies that can address serious or widespread problems and help reduce uncertainty." [24]

19. What is the potential for contamination of water resources from biosolids land application?

Like any nutrient-rich fertilizer, biosolids should only be applied in ways that minimize risk of leaching of nutrients or other constituents to groundwater or runoff to nearby surface waters. Current land application programs have been successful in

[20] Raina M. Maier et al., *Environmental Microbiology* 512-13 (2000).

[21] Ian Pepper, Huruy Zerzghi, John P. Brooks, and Charles P. Gerba, *Sustainability of Land Application of Class B Biosolids*, J. of Envtl. Quality (In Press) (2008).

[22] Studies demonstrate that workers at wastewater treatment facilities, highly exposed to untreated sewage and biosolids, do not have significantly higher rates of illness than similar unexposed workers. California State Water Resources Control Board, *Statewide Program Environmental Impact Review (EIR) covering General Waste Discharge Requirements for Biosolids Land Application* (2004), ("Studies of the incidence of disease among wastewater personnel have indicated that they have no greater incidence of disease than the population in general."). Similarly, no differences have been found in the health of farm families from farms using biosolids compared to the health of families on farms not using biosolids. *Id.*

[23] For example, Water Environment Research Foundation is studying pathogen reactivation and regrowth.

[24] Ibid, NRC (2002).

minimizing these risks through regulation and best management practices, including:

- The amount of biosolids applied to a field is limited to the amount needed to meet the nitrogen requirement of the crop grown (referred to as the agronomic rate);
- Biosolids may not be applied within a 10 meter setback from waterbodies;
- State regulations typically require site-specific data on proposed land application sites so that sites with shallow water tables or inappropriate soils will be precluded.[25]
- Additional state requirements include limits on maximum slopes, prohibition on application during significant precipitation, and bans on biosolids application on standing water or wetlands.

20. Have there been long-term studies on ground water safety where biosolids have been land-applied?

Studies have concluded the lack of impacts on groundwater quality at properly managed sites, for example:

- A 1999 study reported that after 20 years of land application, tests of deep wells at an agricultural research site demonstrated no evidence of nitrate leaching and negligible fecal coliform concentrations.[26]
- A 2008 literature survey concluded: "[G]roundwater contamination from land-application of biosolids does not appear to be likely other than in areas where karst soils predominate with the potential for preferential flow."[27]

[25] The extent to which biosolids affect groundwater or surface water quality depends upon "a wide range of factors, including climate, topography, land use, soil characteristics, and the chemical composition and application rate of the biosolids" and therefore requires case-by-case analysis. Kathryn J. Draeger et al., Water Env't Research Found., *Watershed Effects of Biosolids Land Application: Literature Review* 2-8 (1999). This is true of any fertilizer. *Id.*

[26] See, e.g. Draeger et al., supra, at 3-13 (1999).

[27] Ibid. *Sustainability in Land Application of Biosolids* (2008)

21. Are there federal and state regulations for other fertilizers?

Federal and state requirements for biosolids are significantly more stringent than the controls over the use of chemical fertilizers and manures. In many cases, untreated manure and chemical fertilizers may legally be applied in the setback areas where biosolids land application is prohibited.

22. Can odors from biosolids land-applied sites cause health problems?

No data have shown that odors from biosolids can cause toxicological effects on individuals.[28] Most odors in biosolids are caused by sulfur compounds that only cause toxic effects in concentrations vastly greater than that which triggers a smell. Any gases with a possible toxic effect simply are not present in biosolids in concentrations that anyone living near a land application site would be exposed to them in dangerous amounts. Though there have not been observed health risks, good BMPs and site and process-specific stabilization or vector attraction reduction criteria are essential. Accordingly, local agencies invest significant resources for odor control.

[28] *See* Paul Chrostowki & Sarah Foster, *Odor Perception and Health Effects*, 76th Annual Water Environment Federation Technical Exhibition and Conference Workshop (2003). A 2004 literature review of the health effects of odors from municipal wastewater operations presented five reasons to conclude that odors do not cause illness: (1) odors do not cause signs of illness in healthy individuals; (2) odor acceptability varies with circumstances of exposure and the meaning people associate with the exposure; (3) below toxic levels of exposure, symptoms associated with odors involve no pathology; (4) symptoms are reduced almost immediately when the source of an odor is removed; and (5) nonphysical variables, such as anxiety and stress, seem to mediate symptoms from odors. William S. Cain and J. Enrique Cometto-Muñiz, Water Env't Research Found., *Identifying and Controlling Odor in the Municipal Wastewater Environment* 6-1 (2004).

23. What is being done to address complaints of alleged health impacts from individuals living near land-application sites?

The Water Environment Research Foundation (WERF) recently completed a project that produced a draft investigative protocol entitled *Epidemiologic Surveillance and Investigation of Illness Reported by Neighbors of Biosolids Land Application Sites* [Available online at http://www.werf.org/AM/CustomSource/Downloads/uGetExecutiveSummary.cfm?FILE=06HHE5PP.pdf&ContentFileID=4741]. The protocol is intended to be used by medical providers and public health officials when citizens report health symptoms that they attribute to the application of soil amendments such as fertilizer, biosolids, animal manures, and food residuals. The goal is to provide a practical, objective and reliable protocol that will be broadly implemented. The protocol collects the following information: documentation of reported symptoms; recent land application of soil amendments in the vicinity; sources, amounts, and characteristics of the soil amendment; factors that could lead to off-site impacts; and other exposures that could be related to reported symptoms of illness.

In addition, WERF is providing up to $400,000 for researchers to pilot test and refine the draft investigative protocol. Pilot testing will take place under real-world land application conditions by those local health officials and environmental agencies that have direct responsibility for local health issues and/or biosolids land application practices and requirements.

24. Are there any initiatives to develop and implement good best management practices for biosolids?

Wastewater treatment professionals are committed to promoting environmental stewardship and best management practices by utilities for their biosolids management programs. The Water Environment Federation (WEF) publishes technical books, peer-reviewed journal articles and technical practice bulletins on issues relating to biosolids. WEF also sponsors annual conferences on biosolids management practices. The Water Environment Research Foundation conducts on-going scientific research on biosolids management questions. In addition to these efforts, WEF, the National Association of Clean Water Agencies and the EPA founded the National Biosolids Partnership (NBP) to promote biosolids best management practices. The Partnership has over 100 municipal members and has created a certified environmental management system (EMS) for biosolids that exemplifies the steps being taken at the local level to ensure biosolids safety and public participation in biosolids management decisions. Congress has supported this effort since 1999.

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Founded in 1928, WEF is a non-profit technical and educational organization with members from varied disciplines who work toward the WEF vision of preservation and enhancement of the global water environment. The WEF network includes water quality professionals from 79 Member Associations in 32 countries.

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REVIEW OF PUBLICATION
"Health Survey of Residents Living Near Farm Fields Permitted to Receive Biosolids"
Ian Pepper and Chuck Gerba
The University of Arizona

Authors: S. Khuder, S. Milz, M. Bisesi, R. Vincent, W. McNulty and, K. Czajkowski

Overall Review

This publication has several critical flaws, any one of which should have precluded publication. Specifically the publication implies that land application of biosolids results in the impaired health of residents close by, but based on the above assessment, none of the (preliminary) conclusions drawn from this study have merit.

Specific Flaws

1. This study utilized self reporting of symptoms and as such has limited value.

2. The study only focuses on farm fields permitted to receive biosolids. There is no confirmation that the fields actually received biosolids, and certainly no information on application rates and dates of application.

3. There is no control for this study. It is well established that farm operations without land application of biosolids result in the aerosolization of endotoxin and heterotrophic plate count bacteria (Brooks et al., 2006, 2007a), which can cause respiratory problems. Therefore the appropriate control for this study would have been farm fields that had not received biosolids. Without this control, the study is invalid.

4. The authors did not undertake the appropriate literature review on land application and appear to have been "cherry picking" the references they cite in this publication. Key references are missing on the potential for transmission of *Staphylococcus aureus* from biosolids (Rusin et al., 2003); endotoxin (Brooks et al., 2006); bioaerosols (Brooks et al., 2005a&b).

5. Of all the chronic diseases listed (Table 3), the highest incidences reported were asthma and allergies, which are likely to be highly prevalent in farming communities due to aerosolization of endotoxin, regardless of whether or not biosolids are land applied.

6. The listing of chronic diseases such as poliomyelitis is remarkable since the last indigenously acquired cases of polio caused by wild poliovirus was in 1973.

Brooks, J.P., B.D. Tanner, C.P. Gerba, C.N. Haas, and I.L. Pepper. 2005a. Estimation of bioaerosol risk of infection of residents adjacent to a land applied biosolids site using an empirically derived transport model. J. Appl. Microbiol. 98:397-405.

Brooks, J.P., B.D. Tanner, K.L. Josephson, C.N. Haas, C.P. Gerba, and I.L. Pepper. 2005b. A national study on the residential impact of biological aerosols from the land-application of biosolids. J. Appl. Microbiol. 99:310-322.

Brooks, J.P., B.D. Tanner, C.P. Gerba, and I.L. Pepper. 2006. The measurement of aerosolized endotoxin from land-application of Class B biosolids in Southeast Arizona. Can. J. Microbiol. 52:150-156.

Brooks, J.P., C.P. Gerba, and I.L. Pepper. 2007a. Diversity of aerosolized bacteria during land-application of biosolids. J. Appl. Microbiol. 103:1779-1790.

Rusin, P., S. Maxwell, J. Brooks, C. Gerba, and I. Pepper. 2003. Evidence for the absence of *Staphylococcus aureus* in land applied biosolids. Environ. Sci. Technol. 37:4027-4030.

Health Survey of Residents Living Near Farm Fields Permitted To Receive Biosolids Fact Sheet

Sadik Khuder, PhD[1], Sheryl Milz, PhD[1], Michael Bisesi, PhD[1], Robert Vincent, PhD[2], Wendy McNulty, MS[3], Kevin Czajkowski, PhD[4]. Health survey of residents living near farm fields permitted to receive biosolids. 2007. *Archives of Environmental and Occupational Health*, 62(1), 5-11.

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[2]Bowling Green State University (Department of Geology)
[3]University of Nebraska-Lincoln (Health and Human Services)
[4]The University of Toledo (Department of Geography and Planning)

1. What was the purpose of the study?

Faculty members and students at The University of Toledo and Bowling Green State University assessed the self-reported health status of residents in Wood County, Ohio. The residents were divided into two groups: (1) those residents living on or within one mile of farm fields that were permitted to receive biosolids; and (2) those residents living greater than one mile from biosolids-permitted farm fields.

2. What are biosolids and what are they used for?

Biosolids, also known as sewage sludge, are the liquid, semi-solid and solid residues generated by the treatment of wastewater at municipal wastewater treatment plants. Before use as a soil amendment, the biosolids are treated more to further reduce pathogens (disease causing microorganisms), monitored, and regulated. Biosolids are rated in two categories according to how they are treated — Class B biosolids which are treated to reduce the amount of pathogens and Class A biosolids, which are treated further and contain no detectable levels of pathogens.

Biosolids are used as a less expensive alternative to chemical fertilizer and use of this material in this manner helps to conserve dwindling landfill space for more appropriate solid waste. They are used on agricultural fields, in gardens and parks, and to reclaim mining sites.

3. What is the current consensus on biosolids?

It depends on who you talk to and we are not the ones to make policy decisions. However, if appropriately treated and managed, biosolids are an excellent source of organic carbon to improve soil quality and nutrients to enhance growth of vegetation.

4. Who regulates biosolids?

The USEPA promulgated comprehensive National Standards for the Use or Disposal of Sewage Sludge codified at 40 Code of Federal Regulations Part 503 in 1993. The Ohio EPA has a biosolids program for the state of Ohio and the regulations were last revised in 2007 (effective October 1, 2007).

For more information:
USEPA Biosolids information: http://www.epa.gov/owm/mtb/biosolids/index.htm
Ohio EPA Biosolids Program: http://www.epa.state.oh.us/dsw/sludge/biosolid.html

5. How was the study conducted?

The researchers mailed an 80 question health survey to 607 households and received a completed survey from 437 people living on or within one mile of the fields where biosolids application was permitted, and from 176 people living more than one mile from the fields where application was permitted. The authors allowed for up to 6 surveys per household.

6. Who funded the study?

The U.S. Department of Agriculture. Many organizations are conducting biosolids research in the country, including universities. The research is being supported through grants from the federal government and by non-profit groups and associations focused on wastewater and biosolid treatment and management**.**

7. What were the major conclusions of the study?

Taking into consideration the study's design and statistical limitations, the findings suggest an increased risk for self-reported respiratory, gastrointestinal, and general diseases among residents living near biosolids-permitted farm fields. Results revealed that some self-reported health-related symptoms were significantly elevated among the residents living near permitted fields, including excessive secretion of tears, abdominal bloating, jaundice, skin ulcers, dehydration, weight loss, and general weakness. The frequency of occurrence of bronchitis, upper respiratory infection and giardiasis were also significantly elevated. The findings suggest an increased risk for self reporting of certain respiratory, gastrointestinal and other diseases by residents living near farm fields on which the use of biosolids was permitted. It must be noted, however, that the study results did not show statistical differences or increased risk for several symptoms (i.e. diarrhea) that one would expect if biosolid exposure occurred among those living near the farm fields. Accordingly, the results remain inconclusive.

8. Do the results and conclusions from your published paper demonstrate that people who reside in close proximity to biosolids land application sites develop a variety of illnesses?

No. Because these results are based on self-reported symptoms, it is possible that reporting bias and self-selection could have influenced results. Surveys that require self-reporting of data have limitations and should be interpreted with caution. Respondents may have the tendency to under-report behaviors that are socially undesirable, unhealthy, or illegal and over-report desirable behaviors screening. The accuracy of self-reported information also is affected by the ability of respondents to fully recall past behaviors or health screening results. Additionally, the symptoms and diseases were listed for respondents and the questions were not open-ended. This study did not firmly demonstrate that there is a threat to health by living near fields where biosolids are permitted. The study showed statistical associations, which is not the same as causation. Other influences may be at work, including the possibility that individuals living near biosolids-permitted fields relate odors and other biosolid debris to possible health effects and the possibility that the people surveyed may be more prone to report diseases and symptoms. This research is a starting point. Additional studies are needed to further determine any potential for health risk.

9. Have any of the illnesses reported in your paper been confirmed/documented either by physicians and/or other qualified medical personnel? If not, how do these self reported illnesses affect the results and conclusions of your paper?

No, the specific causes of symptoms that were reported in this study cannot be ascertained because although we asked respondents to report only medically diagnosed diseases, we did

not verify with medical records. There are major gaps in data that impeded the analysis including lack of objective data on specific environmental exposures, the lack of baseline health assessments among those who returned the surveys, and lack of objective measures of health status before and after the applications of the biosolids.

10. What are the strengths of the study?

First, it was conducted by university faculty members who have extensive experience and expertise in research design and statistical analysis and who are highly regarded in the public and environmental health science fields. The study is one of the most comprehensive health surveys performed on biosolids-permitted fields. The statistics are sound and the research methodology was used to eliminate as much bias as possible. Second, the article was peer reviewed, meaning an independent group of experts assessed whether study results should be published. Peer review is a bedrock of modern science. Third, the study appears in a widely read, highly respected journal in the field of public, environmental and occupational health science. Fourth, some of the findings in this study do agree with findings in other studies.

11. What were some of the limitations of the study?

While the disease symptoms documented in this study have also been documented in studies involving wastewater treatment plant workers, there also are symptoms/diseases that have been seen in wastewater treatment plant workers that were not seen among the survey group. The findings are interesting, but they are not proof that biosolids were the cause of any illnesses and we are not suggesting any policy action be taken based on this study. At the time of the study it was not known if biosolids were applied to the permitted fields. Other limiting factors include: the use of postal questionnaire compared to interviews and exposure misclassifications. Without taking these factors into account in the research design, we cannot be certain that the statistical association between living on or within one mile of biosolids-permitted fields and self-reported symptoms like excessive secretion of tears, abdominal bloating, jaundice and other symptoms is directly related to biosolids.

This study suggests that additional studies are needed.

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