

Concerns with Application of Sewage Sludge Products on Farm Land

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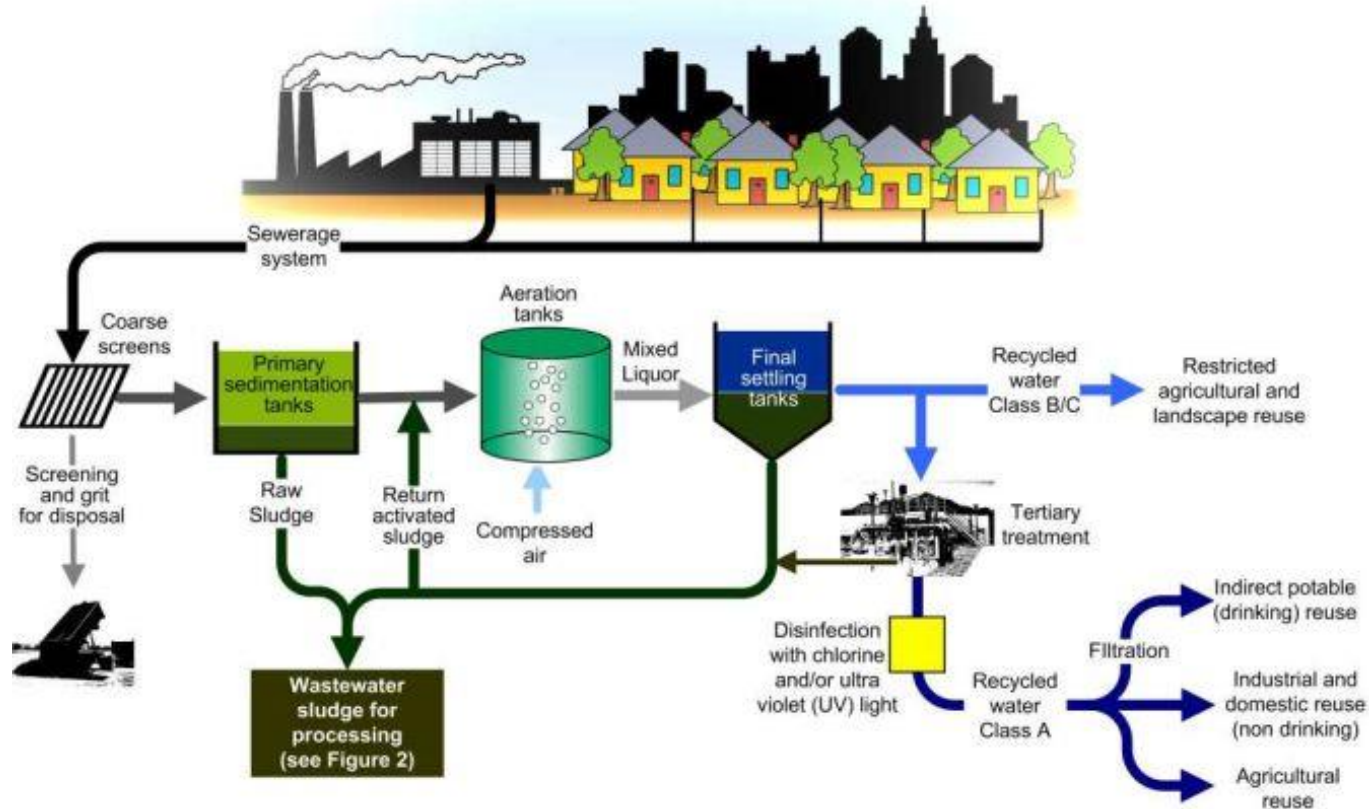


Sewage Sludge Generation

- **Influents are from homes, hospitals, research facilities, industries, businesses and street runoff**
- **Some industrial discharges to WWTPs are allowed**
- **WWTPs are designed to clean water**
- **Contaminants preferentially concentrated from wastewater into sewage sludges (at least 90-95% of persistent organic pollutants, microplastics and metals in wastewater end up in sludge)**
- **Biodegradation of many of the organic pollutants is minimal**
- **Sewage sludge quality varies over time at a single WWTP**



A Simplified Diagram of Sewer Wastewater Treatment



Note: The EPA's National Pretreatment Program permits each point source (business or industry) to discharge thousands of pounds of toxic waste into the sewer.

Why apply sewage sludges on farms ? (the “beneficial use” argument)

- Recycle N and P from human waste
- Soil benefits ? - nutrients, organic matter
- Off-set of N and P fertilizer costs to farmer
- Low cost disposal option for municipality

50-60% of US sludges are land applied



***Average NPK nutrient values of
NYS sewage sludges (2009 DEC data)***

Total N = 4.51 ± 2.05

Total P = 1.93 ± 1.10

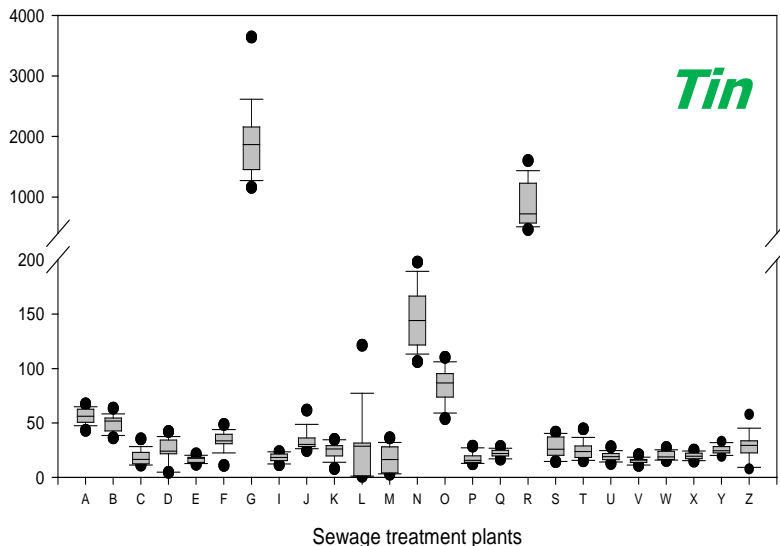
Total K = 0.20 ± 0.16

***Application rates are usually based on N
requirement of the crop, meaning
P is being applied in excess***

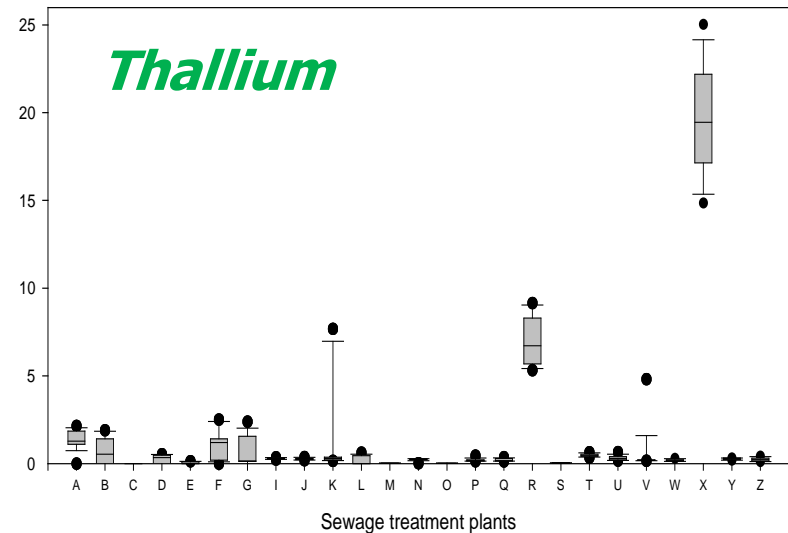
EPA Rules for Toxins in Sludge Biosolids

- Only 9 metals have sludge quality (ppm) and/or soil loading (lbs/acre) limits
- No synthetic (organic) chemicals are regulated
- Limits are based on a 1993 risk assessment using inadequate data and non-cautious assumptions
- Present-day sludges can contain “exotic” chemicals/toxic metals that are not regulated because earlier EPA research had not looked for or detected them

Tin concentrations in Ontario sewage biosolids



Thallium concentrations in Ontario sewage biosolids



EPA Terminology

*Class B sludge - pathogens reduced to levels thought to protect public health **UNDER SPECIFIC USE CONDITIONS** (site restrictions apply)*

*Class A sludge - treated to further **REDUCE** pathogens so that **NO PATHOGEN-RELATED RESTRICTIONS APPLY***

“Exceptional Quality” (EQ) – there is no “official” definition of EQ in the 503 Rule. The term is, however, commonly used to describe class A biosolids with concentrations of the 9 regulated metals lower than the risk-derived limits (e.g., 39 ppm Cd, 2800 ppm Zn)

*EQ sludges can be farm-applied without regard for total toxic metal loading on soil –they are **COMPLETELY UNREGULATED***

EQ metal levels allow much higher metal loading on soil than standards of most other countries

*EQ classification **IN NO WAY SUGGESTS LOWER LEVELS** of toxic synthetic chemicals or non-regulated metals in sludges*

Are Pathogens a Concern in Class A Sludges ?

- EPA position is that Class A “biosolids” are pathogen-free when either *Salmonella* spp. are absent or fecal coliforms are < 1000/dry gram
- Recent research reveals that class A “biosolids” are not pathogen-free, and that fecal coliform removal is a poor indicator of non-*Salmonella* pathogen content in biosolids¹
- Regrowth of some pathogenic bacteria in Class A materials can occur in storage, after field application, or upon mixing with fresh organic material²
- Sludge products and composts meeting Class A/EQ standards at the point of origin may exceed pathogen standards later

1. Viau, E et al. (2011). Environ. Sci. Technol. 45, 5459-5469

2. Zaleski et al.(2005). J. Residuals Science & Technol., 2,49.

Table 1. Standards for land application of sewage sludges

<i>Contaminant</i>	<i>NYS DEC¹</i>	<i>EPA 503</i>	<i>EPA 503</i>	<i>NYS DEC⁴</i>	<i>Cornell Field Crop Guide⁵</i>
	<i>Monthly Average/ Maximum (ppm)</i>	<i>EQ limit (ppm)</i>	<i>Ceiling limit (ppm)³</i>	<i>Cumulative limit (lb/ac)</i>	<i>Recommended Maximum Concentration (ppm)</i>
	<i>Sludge Concentration</i>	<i>Sludge Concentration</i>	<i>Sludge Concentration</i>	<i>Applied to Soil</i>	<i>Soil Concentration</i>
Arsenic	41/75	41	75	none	1-10 ⁶
Cadmium	21/85	39	85	3/4	2 ⁷
Chromium	1,000/1,000	none	none	300/446	⁸
Copper	1,500/4,300	1,500	4,300	75/112	40-100 ⁹
Lead	300/840	300	840	267/267	¹⁰
Mercury	10/57	17	57	none	1 ¹¹
Molybdenum	40/75	none ²	75	none	2-4 ¹²
Nickel	200/420	420	420	30/45	25-50 ¹³
Selenium	100/100	100	100	none	5 ¹⁴
Zinc	2,500/7,500	2,800	7,500	150/223	75-200 ¹⁵

Note: Concentrations are in dry weight.

NYDEC soil cumulative loading limits do not apply to Class A products that meet the sludge metal concentration limits

EPA and NYDEC-permitted loadings of metals on soils allow Cornell recommendations to be exceeded

Concerns about using sludges on farmland

Contaminants (pathogens, metals, synthetic chemicals)

- potential food crop contamination
- potential dairy product and meat contamination
- reduced forage quality due to contaminant uptake and effects on livestock health
- possible groundwater contamination

Excess nutrients

- too much N and especially P for livestock farms
- aquifer contamination, surface water eutrophication

Odor and bioaerosols (pathogens & endotoxins)

- Off-site impacts on human health

Variable and unpredictable composition of sludge

EPA 503 Rules Have Not Prevented Land Contamination

EPA has concerns about illegal dumping into POTWs:

*"Every discharge has the potential to affect the POTW. Unlike discharges from IUs directly connected to the POTW, **the makeup of a load of hauled waste is virtually unknown without some type of monitoring**, be it visual or analytical. Most waste haulers are reputable business people who provide a valuable service to the public and industry; However, the unique attributes of hauled waste can be devastating when unethical haulers dump incompatible wastes at POTWs"*

From "USEPA. June 2011. Introduction to the National Pretreatment Program. Office of Wastewater Management. EPA-833-B-11-001



More Action Is Needed to Protect Water Resources From Unmonitored Hazardous Chemicals

Report No. 14-P-0363

September 29, 2014

EPA Has Not Taken Actions to Address Discharges of Hundreds of Hazardous Chemicals From Sewage Treatment Plants	8
EPA Does Not Clearly Identify and Regulate Hazardous Chemical Discharges From Sewage Treatment Plants	8
Sewage Treatment Plants Monitor for Few Toxic Chemicals	11
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. The U.S. EPA's Inspector General (U.S. EPA 2000) found that,

while EPA promotes land application, EPA cannot assure the public that current land application practices are protective of human health and the environment.

From "Land Application of Treated Sewage Sludge: Community Health and Environmental Justice"

*A. Lowman, M.A. McDonald, S. Wing, N. Muhammad (2013)
Environmental Health Perspectives, 121,537.
Dept. of Epidemiology, Univ. of North Carolina*

FEDERAL AND STATE RULES HAVE NOT PREVENTED SERIOUS CONTAMINATION OF LAND, HARM TO LIVESTOCK, AND HEALTH EFFECTS IN RESIDENTS .

NUMEROUS CASES OF SOIL AND WATER CONTAMINATION HAVE BEEN DOCUMENTED

MANY MORE UNKNOWN CASES PROBABLY EXIST AS MONITORING AND OVERSIGHT ARE NEARLY NONEXISTENT

4/23/2009

Lawsuit Alleges Fertilizer Was Contaminated Around Cameron, Mo.

CAMERON, Mo. | The investigation into the cause of brain tumors here took a new twist Wednesday with a lawsuit that accuses a tannery of spreading contaminated sludge on farmland.

The sludge from Prime Tanning Corp. in St. Joseph contained high levels of hexavalent chromium, a known carcinogen, the lawsuit filed in Clinton County alleged.

For years, farmers in at least four counties in northwest Missouri have received the sludge for free to use as an agriculture fertilizer, according to the lawsuit. The lawsuit was filed with the assistance of environmental activist Erin Brockovich, who spoke to several hundred people Wednesday night in Cameron.

PCBs in sludge draw scrutiny by South Carolina regulators

BY SAMMY FRETWELL March 13, 2014

COLUMBIA, SC — Threats to the environment from a toxic industrial chemical sparked action Thursday from state regulators, who are concerned the material could show up in sewage sludge that farmers use to fertilize their fields.

Perfluorinated alkyl substances (PFAS) are just the latest-discovered of the many persistent toxic synthetic chemicals in sewage sludges now shown to be contaminating farm soils, crops and groundwater.

PFAS are termed "forever chemicals" because of their extremely long half-lives in the environment

Hundreds of PFAS have been in use for decades, but only a few (PFOA, PFOS) are now being monitored at sludge application sites on farms.

EPA 503 rules do not regulate PFAS in sludges for farmland application



EPA finds record PFOS, PFOA in Alabama grazing fields

Rebecca Renner

Environ. Sci. Technol., Article ASAP

Publication Date (Web): December 24, 2008

Because of very high levels of perfluorooctane sulfonate (PFOS), perfluorooctanoic acid (PFOA), and other perfluorochemicals found in agricultural soils near Decatur, Ala., scientists with the U.S. EPA, the U.S. Department of Agriculture (USDA), and the U.S. Food and Drug Administration (FDA) are investigating whether perfluorinated chemicals have entered the human food chain and contaminated meat.

The source of PFOA and PFOS, both of which occur at low part-per-million levels, is treated municipal sewage sludge, or biosolids, that were applied to some 5000 acres of agricultural land, according to Gail Mitchell, [EPA Region 4's](#) deputy director of water management. EPA is still investigating how the chemicals got into the sludge, adds Cathy Fehrenbacher, chief of EPA's exposure assessment branch, which is tasked with investigating the fate and transport of PFOA.

News Articles Reporting Farm Contamination by Biosolids PFAS

VERMONT

Sewage sludge spreading leads to farm groundwater PFAS contamination

By [Elizabeth Gribkoff](#)

Posted. [Apr 12 2020](#)

WISCONSIN

DNR: Tyco must provide drinking water to residents with PFAS contaminated wells

Tuesday, April 14th 2020

MASSACHUSETTS

‘Forever chemicals’ are found in MWRA fertilizer, drawing alarm

By [David Abel](#) *Globe Staff, December 1, 2019, 7:32 p.m.*

MICHIGAN

The hunt for PFAS turns to Michigan farms using human waste as fertilizer

Posted Jun 19, 2019

Michigan is tiptoeing around PFAS in dairy agriculture

Updated Jul 30, 2019; Posted Jul 30, 2019

MAINE

TOXIC PFAS CHEMICALS FOUND IN MAINE FARMS FERTILIZED WITH SEWAGE SLUDGE

[Sharon Lerner](#)

Posted June 7 2019

State investigating ‘very startling’ levels of PFAS chemicals on central Maine dairy farm

State officials declined to identify the farm, but said Maine's milk supply remains safe because the farm was sending a relatively small amount of milk to a processor that was blending it with milk from other farms.

BY KEVIN MILLER PORTLAND PRESS HERALD JULY 29, 2020

Milk from a Central Maine dairy farm contained levels of a harmful “forever chemical” that were 60 to 150 times higher than health standards, triggering a state investigation and raising new concerns about PFAS contamination on farms.

Why sewage sludge on farmland is inadvisable

- **Toxic organic pollutants (dioxins, brominated fire retardants, perfluorinated chemicals, etc.) may transfer and bioaccumulate in milk and animal fat of livestock.**
- **Crops can take up some toxic metals and numerous synthetic chemicals**
- **Most chemicals in present-day sludges have not been tested for toxicity or impacts on soils, animals or humans**
- **Contamination of wells and surface waters, especially by pathogens and pharmaceuticals, is possible**
- **Nitrogen and phosphorus import to modern livestock farms usually represents a nutrient excess and is an environmental liability, not a benefit**



Toxic metals in sewage sludge-amended soils: has promotion of beneficial use discounted the risks?

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1. Introduction

There is an increasing tendency to favor land application over other means of disposal of industrial or commercial waste material that have characteristics potentially beneficial for agriculture (the 'beneficial use' philosophy) despite the fact these wastes may have other properties undesirable for agriculture or may contain significant concentrations of numerous contaminants. Because wastes such as sewage sludge are not designed for agricultural use, contain some level of industrial and commercial discharge, and are of variable and unpredictable composition, it would be fortuitous indeed if virtually none of them contained contaminants detrimental to soils or the environment in the short or

long term. The large number of potential toxic pollutants in municipal wastes such as sewage sludge renders thorough monitoring and regulation expensive and incomplete at best. Funding has not been sufficient to conduct the necessary research to examine the nature and behavior of all known toxic chemical contaminants in wastes and their potential long-term impact on soil productivity, as well as on human and ecosystem health. In the absence of this research, the 'beneficial use' philosophy presumes that the known and immediate economic benefits outweigh less certain foreseen (and unforeseen) negative impacts.

In the case of sewage sludge applied to farmland, research emphasis has been placed on a few heavy metals—those metals considered most likely to produce toxic effects on plants, animals and humans. In the United States, the US EPA conducted a detailed risk assessment and promulgated regulations in 1993 (Part

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