

SEWAGE SLUDGE 'FERTILIZER' CONTAMINATES FARMS WITH TOXIC PFAS

'Forever Chemicals' Endanger Human Health, the
Environment and the Future of Our Food



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Executive Summary:

Recommendations from the Atlantic Chapter of the Sierra Club

The health of New Yorkers, our food supply, and our environment is threatened by the continued use of sewage sludge (also known as biosolids), the byproduct of wastewater treatment plants, as a fertilizer or soil amendment on agricultural and other lands. Sewage sludge contains dangerous per- and polyflouroalkyl substances (PFAS), a class of chemicals that is associated with a variety of cancers,¹ ulcerative colitis, thyroid disease, and liver damage, plus damage to the health of pregnant women and babies.² PFAS pass through the food chain and bioaccumulate in our food sources and bodies. PFAS pass through the umbilical cord to the fetus and through breast milk to nursing infants.³ Despite their danger, PFAS don't naturally degrade – hence their nickname of “forever chemicals.” And they were found in all recent New York State tests of wastewater treatment plant biosolids and effluent secured by the Atlantic Chapter of the Sierra Club in a Freedom of Information Law request in 2022. The dangers of PFAS are multiplied when the sewage sludge is not safely disposed of but used as a fertilizer or soil amendment on agricultural and other lands, in New York and beyond.

Maine has taken action to protect farmers and farmlands from toxic sewage sludge and the PFAS it contains while New York State is proposing to go in the opposite direction. The state DEC is projecting a staggering increase in land application of sewage sludge, almost tripling the current amount, in its draft state solid waste management plan released in the spring of 2023.⁴ It has proposed a dangerously weak interim standard for PFAS in biosolids that is significantly higher than Maine's was before its ban.⁵ Nor has New York state acted on the dangers of the PFAS it has uncovered. A Freedom of Information Law (FOIL) request from the Sierra Club discovered that the state's Department of Environmental Conservation (DEC) found alarming levels of PFAS in sewage sludge when it tested eight sewage treatment plants in 2017. Yet the department has not tested the land where this sludge was spread nor did it inform the landowners or farmers of the risk. Despite finding levels of PFOS and PFOA, the two types of PFAS singled out in 2022 by the US Environmental Protection Agency (EPA) as having no acceptable level, the state DEC did not inform the treatment plants of the findings or recommend restrictions.

Our FOIL request also discovered that in 2019, the state had compiled a list of 46 sites where sewage sludge or sludge-derived compost was spread. However this appears to be just the tip of the iceberg. We learned directly from the DEC staffer in charge of the state's biosolids program that the agency did not follow up by testing the soil or water at these sites.⁶ And it only recently contracted to expand testing of sewage sludge for PFAS.

Despite the dangers, farmers can freely purchase sewage sludge-based compost and fertilizer products from private corporations in New York State, notably the publicly traded, integrated waste services company Casella.⁷ The threat is not only to farmers. Gardeners, landscapers, and public agencies, such as school districts, can also buy compost made of sewage sludge by Casella and other companies,⁸ sewage districts, and municipalities.

Figure 1. PFAS contamination from wastewater to farm and garden. Adapted from Sierra Club and Ecology Center's "Sludge in the Garden" report.

PFAS Contamination from Wastewater to Farm & Garden



Source: *Sludge in the Garden: Toxic PFAS in Home Fertilizers Made From Sewage Sludge* (Ann Arbor, MI: Ecology Center and Sierra Club), May 25, 2021, <https://www.sierraclub.org/toxics/pfas/pfas-sludge>.

Continued use of dangerous sewage sludge as a “soil amendment” in New York State threatens the future of our farmland and compromises the safety of crops, the safety of our water resources drawn on for drinking water, and the health of farmers, gardeners, the environment and consumers who eat fruits, vegetables and grains, and the eggs, meat, milk and other dairy products from livestock fed crops grown on contaminated land.

Of particular concern to farmers, the practice of using sewage sludge as a fertilizer or soil amendment threatens the health and resiliency of our state’s soils. In 2021, New York joined the growing national trend of prioritizing soil health. The state’s Soil Health and Climate Resiliency Act “declared the policy of the legislature to promote the health and resiliency of New York’s agricultural soils, including the biological, physical, and chemical components of such soils, to sustain agricultural plants and animals, produce a health, affordable food supply, promote climate resilient farming and the reduction of agricultural greenhouse gas emissions, and further protect and promote natural resources and the health, safety and welfare of the people of this state.”⁹

Against the inaction of the state, local residents are taking action. In upstate Franklin County, local residents are concerned that Casella trucks in sewage sludge, including from other states and Canada, to its Grasslands processing plant, and that tens of thousands of tons of its product are spread on county farmland and elsewhere in the state to this day. With widespread support of local residents, the town board of Thurston in Steuben County enacted a moratorium in April 2023 on new solid waste facilities to block Casella from accepting sewage sludge for land application.¹⁰

While comprehensive federal action is obviously required, the state DEC can immediately take action to curb the spreading of sewage sludge under its existing powers both under state law and the federal Clean Water Act.¹¹ States including Michigan, Colorado, and North Carolina draw on the Clean Water Act in permitting to require key industries to pre-treat effluent to reduce PFAS from industrial hotspots, or limit the land disposal of highly contaminated sludges. But the state legislature should further direct and clarify the actions needed to keep New Yorkers safe and farmers’ livelihoods protected.

The Atlantic Chapter of the Sierra Club urges that New York State take the following actions to keep PFAS and other persistent chemicals out of sewage sludge, away from our water, and off our farmland:

1. The NYS Legislature should direct the NYS DEC to stop the spreading of sewage sludge in any form on fields and farms, and end the production, sale, and distribution of soil amendment products including “compost” from sewage sludge, due to strong evidence of their widespread contamination with PFAS.

2. The NYS Legislature should pass the PFAS Surface Water Discharge Disclosure Act requiring testing of wastewater treatment plant effluent for PFAS contamination.¹²

3. The NYS Legislature should direct the NYS DEC to ban wastewater treatment plants from accepting landfill leachate, unless PFAS contaminants are destroyed or removed beforehand.¹³ If filtered, contaminated filters should be treated as hazardous substances and dealt with in such a way that they do not end up in our water, air, soil, or otherwise contaminate the environment or enter the food chain.

4. New York State's Climate Scoping Plan, approved by the State's Climate Action Council in December 2022, dangerously encourages the mixing of food waste with sewage sludge/wastewater biosolids in anaerobic digesters in order to generate methane under controlled conditions.¹⁴ We ask the state to withdraw this policy recommendation so that it does not appear in the final regulations. Mixing food waste - a relatively clean organic feedstock - with sewage sludge/biosolids - which are highly contaminated with PFAS and numerous other unregulated pollutants - will dramatically increase the quantity of organic waste contaminated with PFAS. This dangerous practice that contaminates otherwise clean organic waste is actually being considered by municipalities.

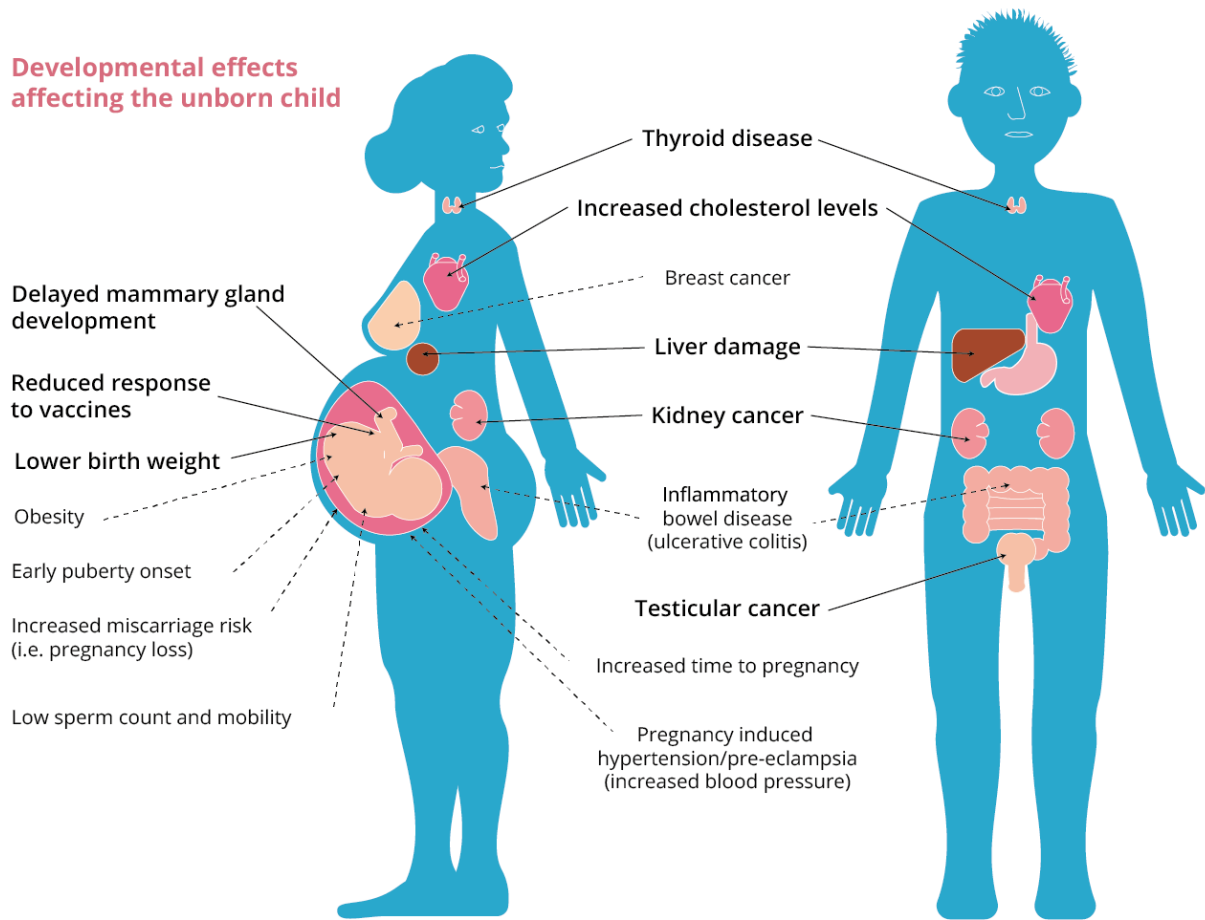
5. NYS Department of Health (DOH) should strengthen its drinking water standards for PFAS, issued in October 2021, to conform with the US Environmental Protection Agency's proposed federal maximum contaminant levels issued in March 2023. As maximum contaminant levels only cover public drinking water supplies and rural wells are also vulnerable to contamination, the state should develop a testing program for private drinking water wells. The state DEC should similarly strengthen its weak surface water standards to reflect the dangers PFAS pose to aquatic life, groundwater, and humans.¹⁵

6. The NYS Legislature should direct the NYS DEC to test for PFAS in soil, water, and agricultural products grown where sewage sludge-based soil amendments are known to have been spread. The state should also conduct free tests for PFAS at the request of farmers, landowners, or tenants, whether of their land or of PFAS in the blood of their family members or workers. It should promptly inform the land owner(s) and farmers and tenants of the test results. It should also provide them and other affected parties with information about PFAS toxicity, potential health effects, persistence, and other relevant characteristics. It should also create a mechanism for private individuals to determine the contamination of land related to a purchase or lease agreement.

Figure 2. Examples of demonstrated health effects of PFAS on the human body

— High certainty
 ---- Lower certainty

Developmental effects affecting the unborn child



Source: "Effects of PFAS on Human Health," European Environmental Agency infographic on PFAS, September 19, 2022, <https://www.eea.europa.eu/signals/signals-2020/infographics/effects-of-pfas-on-human-health/view>.

7. The NYS Legislature should direct the NYS DEC to require regular PFAS testing of all sewage sludge and industrial biosolids, such as paper factory sludge. It should inform wastewater treatment plants, farmers using sludge and others of the potential dangers of PFAS in sewage sludge.

8. The NYS Legislature should direct the NYS DEC to mandate that all reportable PFAS and water data collected by the State be posted online in a readily searchable format and submitted to the US EPA for inclusion in the agency's ECHO (Enforcement and Compliance History Online) database.¹⁶

9. NY State should apply for the maximum amount of support possible from the US EPA's \$4 billion fund to address PFAS and other emerging contaminants in drinking water, along with the EPA's Small and Disadvantaged Communities Fund.¹⁷

10. The NYS Legislature should take bold action to eliminate products and materials containing PFAS from the waste stream as much as possible, starting with an across-the-board ban on the intentional addition of all PFAS compounds in consumer and commercial products. Until that is accomplished, the state should require that content labels for every product sold in NYS disclose if any PFAS were used in the manufacturing process, or intentionally added to the products or their packaging sold in NYS.¹⁸

11. The NYS Legislature should establish a compensation fund to support farmers who may lose their livelihood and their ability to farm their agricultural lands when PFAS contamination is found. Further, the state should develop a program to support farms impacted by contamination with expenses related to testing, compensating losses in revenue due to contamination, and assistance in navigating future business plans.

12. The NYS Legislature should devise a system where the polluting company is held financially responsible for the harms created by the spreading of sewage sludge.

13. Cornell Cooperative Extension and each county's Soil & Water Conservation District should educate farmers on the dangers of sewage sludge/biosolids being spread on farmland and link them to public programs that can help them if their land was exposed.

1. <https://dceg.cancer.gov/research/what-we-study/pfas>

2. <https://www.atsdr.cdc.gov/pfas/health-effects/index.html>

3. <https://www.ecowatch.com/umbilical-cord-blood-pfas.html>

4. NYS Draft Solid Waste Management Plan, Page 78 Table 6: NY Waste Projections from 2023 - 2050. Biosolids Recycling Rate 2018: 22%; 2023: 31%; 2030: 37%; 2040: 45%; 2050: 57%. <http://www.dec.ny.gov/chemical/41831.html>

5. The draft regulation sets a limit of 20 parts per billion for PFOA and for PFOS, two PFAS chemicals whose production was phased out. This is very high, analogous to setting the speed limit at 300 mph, and ignores the many other PFAS compounds detected in sewage sludge/biosolids. Maine's thresholds for use of sewage sludge/biosolids as a soil amendment before banning land application entirely in 2022 were 2.5 ppb for PFOA and 5.2 ppb for PFOS, and 1900 ppb for PFBS. "DMM-Draft 7: Biosolids Recycling in New York State - Interims Strategy for the Control of PFAS Compounds," n.d., https://www.dec.ny.gov/docs/materials_minerals_pdf/dmmdraftpolicy7.pdf.

6. Phone call with Sally Rowland, NYS Department of Environmental Conservation, June 14, 2022.

7. Casella deceptively markets these materials as "organic." See its website's "Casella Organics" page <https://casella.com/casella-organics>.

8. *Sludge in the Garden: Toxic PFAS in Home Fertilizers Made from Sewage Sludge*, Michigan Sierra Club and Ecology Center, May 25, 2021; <https://www.ecocenter.org/our-work/healthy-stuff-lab/reports/sludge-garden>.

9. NYS Soil Health and Climate Resiliency Act, S.4722A/A.5386A, 2021-2022 Legislative Session, signed by Governor, <https://www.nysenate.gov/legislation/bills/2021/s4722/amendment/a>.

10. <https://waterfrontonline.files.wordpress.com/2023/04/moratoriumthurstoncam.pdf>

11. 40 CFR § 503.24(a) prohibits land application of sludge that "is likely to adversely affect a threatened or endangered species listed under section 4 of the Endangered Species Act or its designated critical habitat." The Maine delegation to Congress is promoting the federal Relief for Farmers Hit with PFAS Act authorizing "grants for states to provide financial assistance to affected farmers, expand monitoring and testing, remediate PFAS, or even help farmers relocate." <https://pingree.house.gov/news/documentsingle.aspx?DocumentID=4508>.

12. PFAS Surface Water Discharge Disclosure Act: S.227-A (May)/A.3296 (Kelles); Sierra Club Atlantic Chapter Memorandum of Support, <https://atlantic2.sierraclub.org/sites/newyork.sierraclub.org/files/documents/2023/04/S227A%20A3296%20PFAS%20in%20surface%20water%20disclosure%20MOS.pdf>.

13. Matt Jawowski, "America's First High-Volume 'PFAS Annihilator' is Up and Running in Western Michigan," WoodTV.com, May 4, 2023, <https://www.woodtv.com/news/kent-county/americas-first-high-volume-pfas-annihilator-is-up-and-running-in-westmichigan/>.

14. NYS Climate Action Council. Scoping Plan. Full Report. December 2022. pp. 330-331. <https://climate.ny.gov/-/media/project/climate/files/NYS-Climate-Action-Council-Final-ScopingPlan-2022.pdf>.

15. The DEC surface water standards for aquatic organisms are currently 16,000 times higher than current drinking water standard for chronic exposure, 71,000 times higher than current drinking water standard for acute exposure. <https://www.dec.ny.gov/chemical/122803.html>.

16. Maine's Department of Environmental Protection has been publishing drinking water well sample results alongside the location of fields licensed for sludge spreading on its PFAS Investigation ArcGIS map. Also see <https://echo.epa.gov/>.

17. NYS Department of Health email May 17, 2023 clarified which funds have been applied to or budgeted already: "The latest Drinking Water State Revolving Fund Intended Use Plan allocated \$30 million to Emerging Contaminants funding and can be found here as Amendment #2: <https://health.ny.gov/environmental/water/drinking/water.htm> Note that funding requirements outlined in the IUP allocate funds to disadvantaged communities... NYS also has funding for emerging contaminants (EC) projects through the WIIA program, which has recently been announced. This applies to municipalities that have violated the NYS MCL of PFOS/PFOA in drinking water." Also see <https://www.epa.gov/dwcapacity/emerging-contaminants-ec-small-or-disadvantaged-communities-grant-sdc#fundAI>, and https://www.epa.gov/system/files/documents/2023-03/EC%20SDC%20Factsheet_03142023.pdf; "EPA Announces New Drinking Water Health Advisories for PFAS Chemicals, \$1 Billion in Bipartisan Infrastructure Law Funding to Strengthen Health Protections," Press Advisory, U.S. Environmental Protection Agency, June 15, 2022, <https://www.epa.gov/newsreleases/epa-announces-new-drinking-water-health-advisories-pfas-chemicals-1-billion-bipartisan>.

18. Bills on the 2023 legislative calendar include PFAS in Products Ban: S.5648 (Hoylman-Sigal) / A.3556 (Zebrowski); Safe Personal Care & Cosmetics: S.4265 (Webb); PFAS in Menstrual Products: S.3529 (Fernandez) / A.5990 (Rosenthal, L); PFAS in Antifogging Sprays and Wipes: S.992A (Hoylman-Sigal) / A.5363A (Gallagher). Sierra Club Atlantic Chapter support memos here: <https://atlantic2.sierraclub.org/content/legislation>.

I. Introduction

Studies consistently reveal that the byproducts of sewage treatment plants, called “sewage sludge” or “biosolids,” contain dangerously high levels of per- and polyfluoro alkyl substances (PFAS), a class of highly persistent chemicals that build up in the bodies of humans and other animals, and are implicated in cancer, kidney failure, fatty liver disease, reduced sperm counts, hypertension during pregnancy, lower birth weights, and immune system disruption. PFAS are also harmful to soil health and the microbiome, interfering with the natural processes needed to tackle climate change and produce healthy food.

While sources of PFAS contamination are wide-ranging, a just-published University of Florida study focused attention on toilet paper, finding that the prevalent PFAS in twenty-one brands of toilet paper from four continents was also the prevalent PFAS in eight Florida wastewater treatment plants tested. [19]

Despite its dangers, the State of New York has not regulated the use of sewage sludge even as thousands of tons per year are spread on thousands of acres of New York farmland to fertilize soil, and distributed to gardeners and landscapers as compost. [20] It has also been spread to fertilize school athletic fields, like those in the town of Argyle, NY, a decade ago. [21] In Franklin County, the publicly traded, integrated waste services corporation Casella Waste Systems Inc. trucks in sewage sludge, including from other states and Canada, to its Grasslands production facility, and tens of thousands of tons of its product are spread on county farmland and elsewhere in the state. [22] The company recently purchased a Steuben County farm and applied to continue a sludge-spreading permit from the state Department of Environmental Conservation (DEC), prompting an ongoing struggle in the town of Thurston.[23]

In 2017, DEC found dangerous levels of PFAS in sewage sludge from eight wastewater treatment plants. Sewage sludge from these eight plants was spread on farmland in the state, according to DEC records obtained by the Sierra Club under the state Freedom of Information law. Yet last year the DEC informed us that it did not test any soil from the fields where sludge was spread, inform the sewage treatment plants of their test results, or notify communities to stop the giveaway or sale of sludge from their sewage treatment plants to residents and others to use as compost.[24] So, while it has detected dangerous levels of PFAS in sewage sludge, the DEC has not taken action to date to halt its spreading on land, an action the Maine state legislature enacted in 2022 after dangerously high levels of contamination were found on farms there. Instead, in the spring of 2023, the NYS DEC proposed a dangerously weak interim standard for PFAS in sewage sludge/biosolids that is significantly higher than the levels found in Maine before their enacted ban.[25]

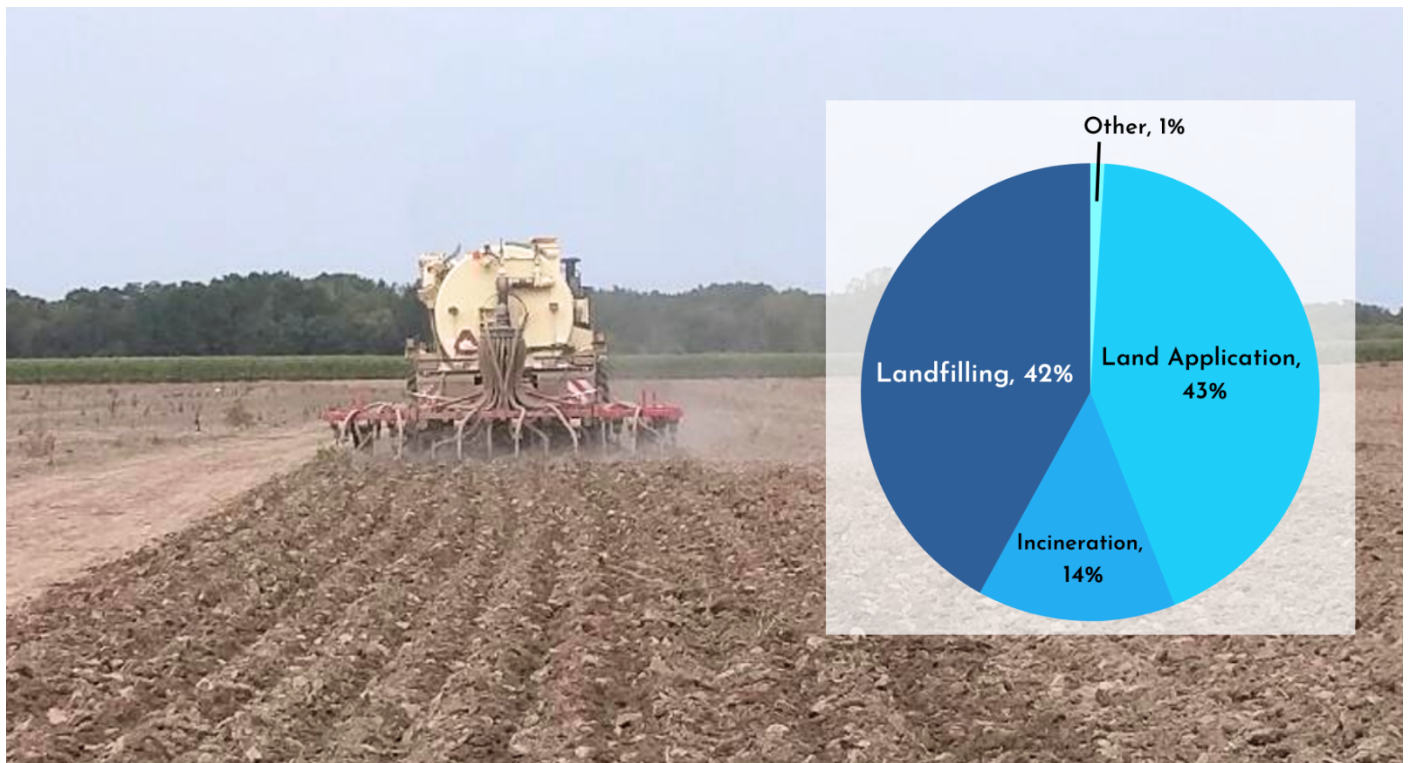
The Inspector General of the U.S. Environmental Protection Agency (EPA) in 2018 warned of the failure to assess, test for, and regulate PFAS and “hundreds of other unregulated pollutants” present in sewage sludge/biosolids that are applied for agricultural purposes. [26] Yet neither the EPA nor any states took vigorous action until Maine enacted a ban on all land application of sewage sludge in April 2022. Maine took action after dangerous levels of PFAS were documented on farms, in drinking water and irrigation wells, in farm products, livestock, and in the blood of farmers and their children. In some cases, it had been as long as four decades since the sludge was spread. In other cases, the farm’s soil, groundwater, and crops were contaminated as a result of sewage sludge spread on adjacent farms, or from the use of feed, mulch hay, or livestock manure originating on contaminated farms.

Many wastewater treatment plants whose sewage sludge gets land applied as compost or fertilizer also process leachate from landfills. Leachate is the wastewater that comes out as rain or other water moves through a landfill and its chemical-saturated trash. Wastewater treatment plants that accept leachate have much higher concentrations of PFAS than other wastewater treatment plants, both in their sewage sludge and in their effluent, which is discharged into surface waters. [27] Yet the state does not require landfills to use granular activated carbon units to remove contamination from its leachate beforehand, a process used to good effect in Michigan. Nor is New York promoting the use of “PFAS Annihilators” by sewage treatment plants, a new technology being implemented in Western Michigan. [28]

Furthermore, waste corporations like Casella sell sewage sludge-based fertilizers with minimal government oversight. Casella told us that it tests the sewage sludge it uses at its fertilizer plant for PFAS and other contaminants, but there is no requirement that it submit this test data to regulators, its fertilizer customers, or the public. [29] Moreover, the state permits Casella to process sewage sludge trucked in from other states and from Canada. The company then markets these “soil amendments” as Fertilimer and EarthLife. Thousands of tons of these products are applied to croplands each year.[30]

It isn’t only big companies that are to blame for contaminating our soils with PFAS. Well-intentioned municipal programs are also to blame. In February 2023, a New Yorker purchased sewage sludge compost from the Washington County sewer district and sent it to be tested. The lab analysis for PFAS was done by the premier testing company Eurofins. The test showed dangerously high levels of PFAS. The Washington County sewage sludge compost has been made available to gardeners, landscapers, and farmers for years.

Figure 1. Sewage sludge/biosolids disposal methods from major publicly operated treatment works, 2016. Photograph source: U.S. Environmental Protection Agency



Land application is a major method for disposing of sewage sludge/biosolids in the United States including on farms and cultivated landscapes as “fertilizer.” Here a Wisconsin farm field’s soil is tilled and injected with biosolids. “Other disposal” refers to deep well injection, cement kiln energy, gas production, land cover, and others.[31]

II. The dangers of PFAS, a contaminant in sewage sludge

Per- and polyfluoroalkyl substances (PFAS) are now recognized as an ubiquitous contaminant in sewage sludge/biosolids, which is a byproduct of sewage treatment plants.[32] There are thousands of PFAS. PFAS of various types enter our wastewater and end up in our sewers when we wash our clothes, bodies or homes since they are in a wide range of everyday items, such as cosmetics, floor wax, toilet paper, clothing, and water-repelling and stain-resistant textiles used in rain gear, other outerwear, and carpets (see box 1). PFAS chemicals are highly persistent in soil and water, and are commonly called “forever chemicals” because the strength of their chemical bonds are hard to break. None of the sewage sludge treatment methods commonly used in the US, including anaerobic digestion, composting, dewatering, and liming, destroy, detoxify, or remove PFAS. PFAS are also not destroyed by heat or even the typical temperatures of incineration. Studies have found evidence that incinerators release PFAS in their air emissions. While treating leachate from landfills before it is processed by a sewage treatment plant shows promise,[33] we still do not have any clean up

by a sewage treatment plant shows promise,[33] we still do not have any clean up methods for PFAS contamination once it is in soil, sewage sludge, or other heterogeneous materials.[34]

Repeated applications of sewage sludge on farmland as fertilizer over the years results in highly elevated concentration of PFAS compounds in soil and in the dairy, meat and other foods produced on that land.

According to the US Environmental Protection Agency (EPA), more than 40% of the sewage sludge produced in the United States is applied to farms, gardens, golf courses and other cultivated landscapes as so-called biosolids.[35] Sewage sludge is composted and sold to home gardeners as a bagged fertilizer/soil amendment in stores like Lowe's and Home Depot. Yet when sewage sludge-based compost products are tested for PFAS compounds, as the Michigan Sierra Club and the Ann Arbor Ecology Center did in 2021, PFAS are detected at dangerously high concentrations.[36]

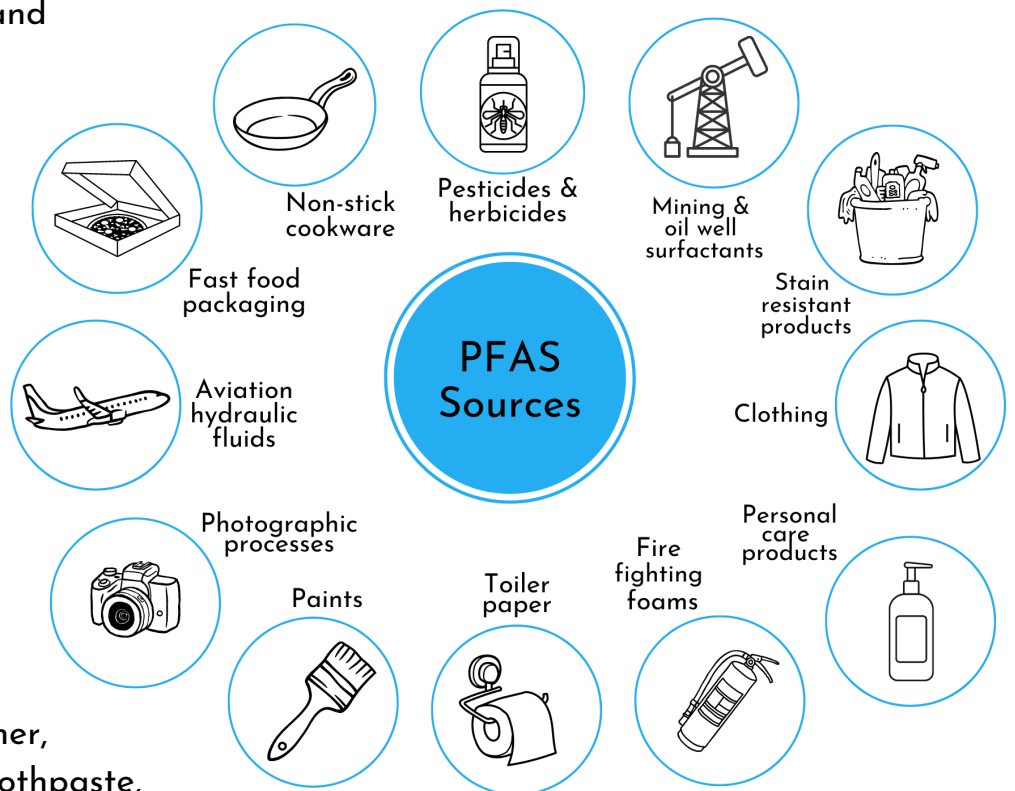
In the first study of the nationwide occurrence and concentrations of PFAS in sewage sludge/biosolids, published in 2013, ten out of the 13 PFAS compounds tested for were consistently detected in all of the samples tested.[37] The study also found that concentrations of PFOS in biosolids collected prior to the voluntary phase-out period for PFOS in 2002 were similar to levels reported in the literature for recent years. This suggests that phasing out the production of PFOS did not itself lead to a decline in that compound in sewage sludge years later.

Box 1. Sources of PFAS in sewage sludge [38]

PFAS are a class of chemical found in many consumer and commercial products ranging from personal care products and cosmetics to floor cleaner and stain and water resistant coatings on textiles. At the start of 2023, New York State began a ban of 1,4-dioxane, PFAS, and other chemicals used in household cleaning, personal care, cosmetics, food packaging, and children's products. [39] Given the multitude of PFAS chemicals, environmental health advocates argue that PFAS must be regulated as a class, rather than individually. The problem of sewage sludge contamination with PFAS from products cannot be adequately addressed by banning certain uses of PFAS or individual PFAS chemicals.

Below is a non-comprehensive list of sources of PFAS in landfills: [40]

- paper and packaging
- toilet paper
- clothing and carpets
- outdoor textiles, tents, and
- sporting equipment
- ski/snowboard waxes
- non-stick cookware
- cleaning agents
- polishes and waxes
- latex paints
- pesticide products
- hydraulic fluids
- windshield wiper fluid
- paints, varnishes,
- dyes, inks
- adhesives, caulk
- medical products
- personal care products
- (e.g. shampoo, conditioner,
- sunscreen, cosmetics, toothpaste,
- floss)
- firefighting foam/turnout gear[41]



A. Health Effects of PFAS

PFAS compounds are toxic. PFAS pass through the food chain and bioaccumulate in our food sources and bodies. They are strongly associated with a long list of health problems identified in human epidemiological and lab animal studies.[42] These include testicular, kidney and other cancers,[43] liver damage, kidney disease, thyroid disease, decreased fertility, low birth weight, immune suppression (resulting in a weak response to vaccines), and increased cholesterol.[44] PFAS damage the health of pregnant women and babies, passing through the umbilical cord to the fetus and through breast milk to nursing infants.[45] PFAS are considered endocrine-disrupting chemicals that affect various hormone systems.

PFAS “ride along in our blood, reaching all over the body. Researchers believe this is part of the reason why such a wide variety of ailments are associated with PFAS,” WBUR of Boston reports. Linda Birnbaum, former head of National Institute of Environmental Health Sciences, told the public broadcaster, “I’m not sure I know a tissue or an organ system where effects haven’t been reported.”[46]

And they don't go away very easily once they are circulating. PFAS have long "half lives," how long it takes for 50% of a substance to leave the body. One study found PFAS that take almost as long as five years (see graph).

Figure 2. Half-lives of PFOA, PFPeS, PFHxS, PFHpS and PFOS after end of exposure to contaminated drinking water.[47]

Half Life of PFAS chemicals in human blood

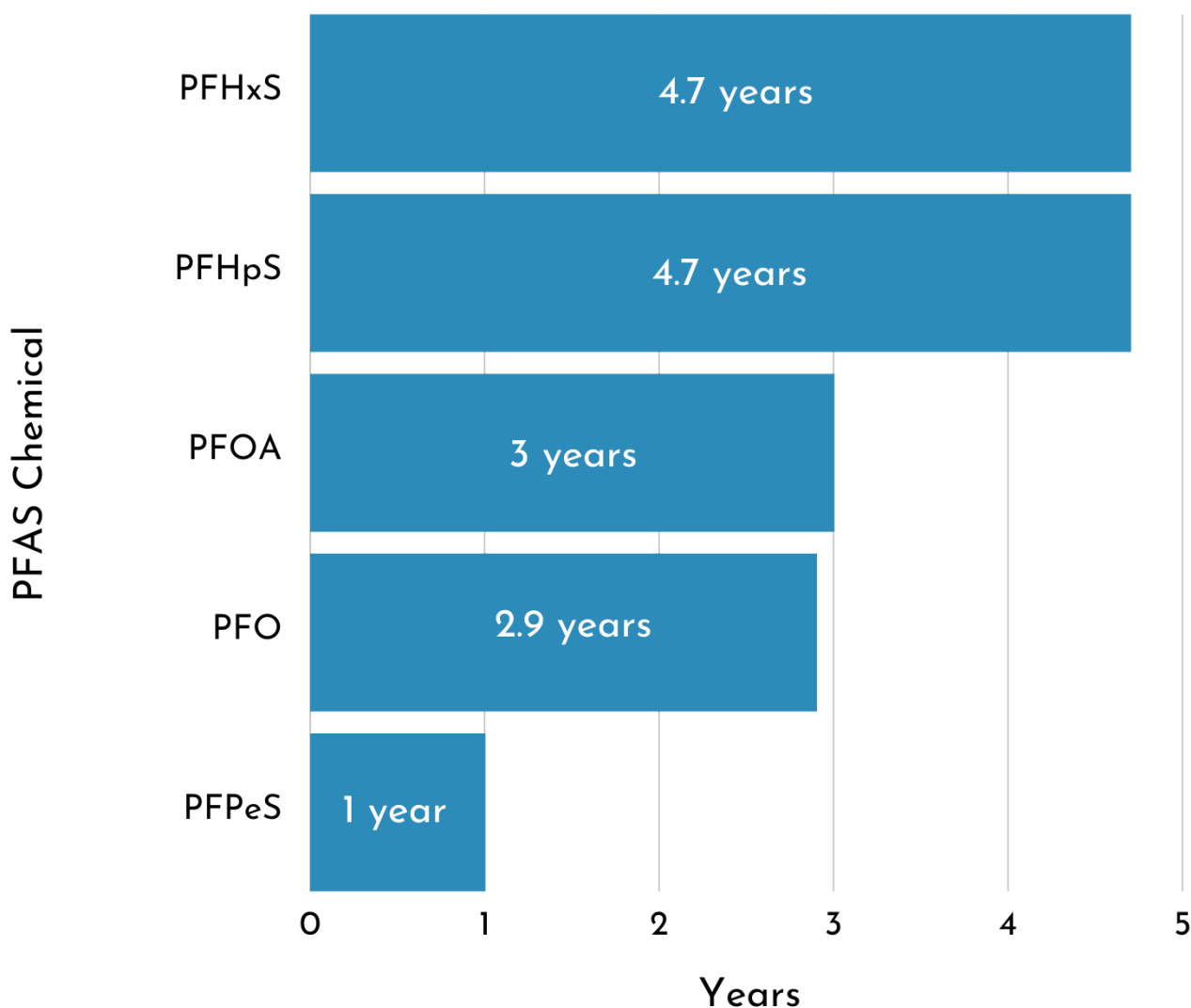
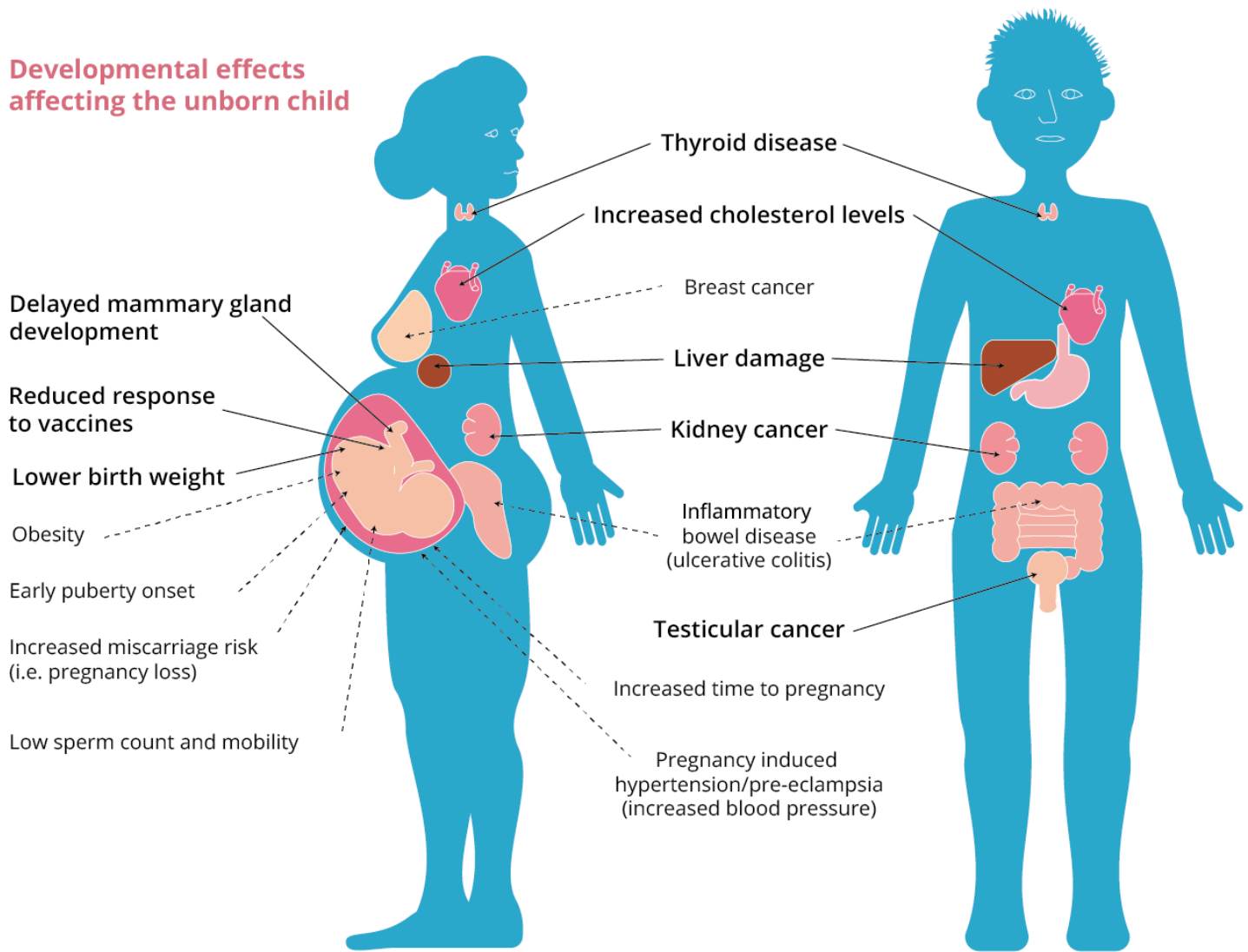


Figure 3. Examples of demonstrated health effects of PFAS on the human body[48]

- High certainty
- Lower certainty

Developmental effects affecting the unborn child



B. PFAS in food and soil

While headlines have focused on PFAS contamination from firefighting foam and Teflon manufacturing,[49] PFAS compounds are common contaminants in food, as well. A food study conducted by the 3M Corporation found high levels of two types of PFAS, PFOS and PFOA, in bread, apples, green beans, milk, and ground beef purchased from grocery stores in six cities in Alabama, Florida, Georgia, and Tennessee.[50] (3M in Minnesota first began manufacturing PFOA and PFOS in the early 1950s.)

When PFAS are in soil or irrigation water, plants take up these compounds. When animals eat plants that contain PFAS, these toxic compounds accumulate in their bodies. Animals, including livestock, fish, shellfish, and game animals such as deer and

turkey, absorb PFAS from contaminated plants, aquatic organisms, feed, and/or water. PFAS may also be a contaminant in seaweed and fish meal. Animals higher up on the food chain, such as human beings, can end up with a high level of PFAS in their body from eating the meat, milk or eggs of other animals that have ingested PFAS. Repeated applications of sewage sludge on farmland as fertilizer over the years has resulted in highly elevated concentration of PFAS compounds in soil and in the dairy, meat and other foods produced on that land.[51]

Figure 4. PFAS contamination from wastewater to farm and garden. Adapted from Sierra Club and Ecology Center’s “Sludge in the Garden” report.[52]

PFAS Contamination from Wastewater to Farm & Garden



In 2019, the US Food and Drug Administration (FDA) conducted PFAS testing on a limited sample of foods and found levels above what the EPA considered safe at that time. Figure 5 below was included in the Natural Resources Defense Council’s chilling report that same year.[53] Note that New York State’s current maximum contaminant level for PFOA and PFOS in drinking water is 10 parts per trillion (ppt) and the EPA now says there are no safe levels of those two types of PFAS (see more on this below).

PFAS on your Plate

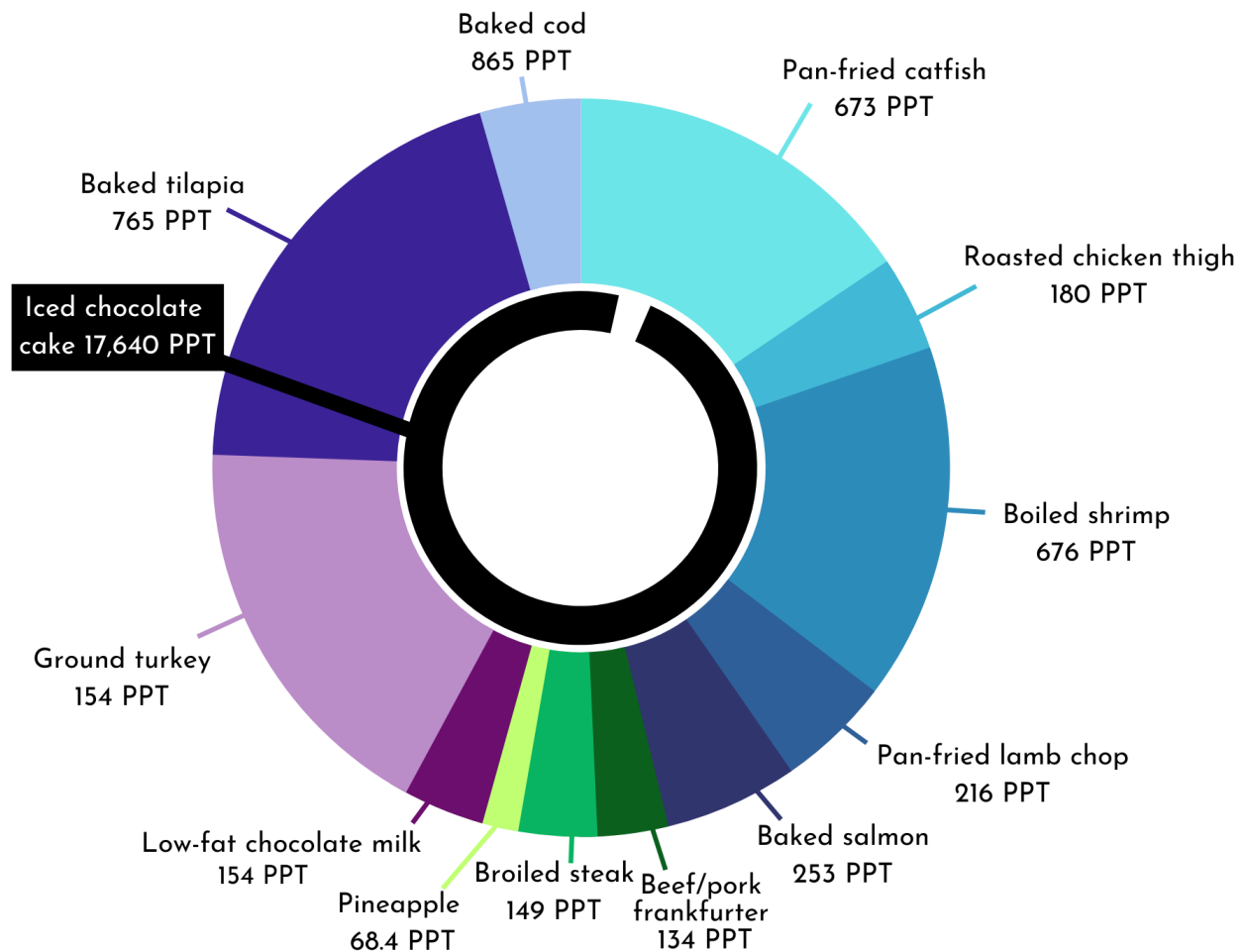


Figure 5. The National Resources Defense Council summarized PFAS levels found in a sampling conducted by the FDA. The then-accepted threshold for PFAS in drinking water was 70 ppt; the EPA now indicates that no safe level for PFAS. Source: Adapted from Susan Cosier, “America’s Dairyland May Have a PFAS Problem,” NRDC.org.[54]

Of related concern, recent studies found that PFAS harms soil health. PFAS in soil decreases bacterial diversity depending on the types of PFAS and their concentration.[55] Per- and polyfluorinated compounds such as PFAS have been implicated in harming earthworms and plants. Its presence in soil increased soil litter decomposition. PFAS in soil inhibits soil respiration and hampers water-stable aggregates. (Water-stable soil

aggregates are lumps of soil glued together with a compound made by fungi. They are a hallmark of soil health, preventing soil from dissolving into dust and being subject to erosion.) In addition, PFAS altered soil bacterial and fungal communities.[57] Together, these findings highlight the potential broad relevance of PFAS to soil health and broader ecosystems.

The carbon-fluorine bond found in all PFAS compounds is extremely strong. Since this bond is very rare in nature, microbes and other organisms have not evolved enzymes to break it apart. Similarly, animals also lack enzymes and other mechanisms to break down PFAS compounds that they have ingested. Thus, people and other animals excrete PFAS chemicals extremely slowly, over many months or years.

C. Limited federal regulation of sewage sludge for use as fertilizer

In June 2022, the US EPA issued a nonbinding health advisory, warning of risks for humans from even undetectable amounts of PFOA and PFOS - two PFAS voluntarily phased out by manufacturers - in drinking water.[58] It set the recommended health threshold for those two chemicals near zero, down from 70 parts per trillion under 2016 guidance.[59] The new advisories use threshold values of 0.004 parts per trillion for PFOA and 0.02 ppt for PFOS.[60]

While the European Union began considering a ban on the thousands of PFAS as a class in February 2023, the EPA has not taken steps to regulate PFAS as a class, despite the urging of environmental health experts.[61] The EPA's sewage sludge regulations are also extremely limited and out of date. Sewage sludge/biosolids are generally classified under EPA guidance into two classes: Class A or Class B.[62] Class A biosolids are dewatered and heated sewage sludge that meet US EPA guidelines for land application without restrictions. They can be used as fertilizer on farms and in vegetable gardens and can be sold to home gardeners as compost or fertilizer.

For both classes of biosolids, the EPA sets the same limits for 10 metals (arsenic, cadmium, chromium, copper, lead, mercury, molybdenum, nickel, selenium, and zinc). Testing for these metals is the only chemical testing of sewage sludge required for a wastewater treatment plant.

Class A biosolids are not supposed to contain detectable levels of pathogens or attract any disease vectors (such as insects or rodents that transmit human diseases). However fecal coliform and salmonella are the only pathogens for which testing is required.

III. PFAS in sewage sludge in New York State

Even in the absence of meaningful EPA rules for testing for PFAS pollution, New York State has the ability to do so on its own. Despite the dangers however, New York State does not require wastewater treatment plants in the state to test for PFAS and its proposed standards for PFAS in sewage sludge biosolids will not protect human health or the environment.[63] Nor does the state require companies that sell sewage sludge-based compost, soil amendments and fertilizers, whether directly to farmers or in retail outlets like Home Depot and Lowes, to test their products for PFAS. The figure below shows the testing results of samples of nine bagged biosolids-based composts, sold to home gardeners, from across the United States analyzed between 2021 and 2023.[64] This testing revealed PFAS concentrations consistently in the tens-to-hundreds of parts per billion. This is magnitudes greater than the drinking water maximum contaminant levels which is set in the very low parts per trillion by various state and federal entities. (More details on this research can be found in the Appendix.) In other words, sewage sludge soil amendments are being sold that are contaminated with PFAS levels thousands of times higher than the maximum contaminant limits for PFAS in drinking water, which are themselves contested as being insufficient.

Levels of Different PFAS Compounds Detected in Sewage Sludge Composts Sold to the Public

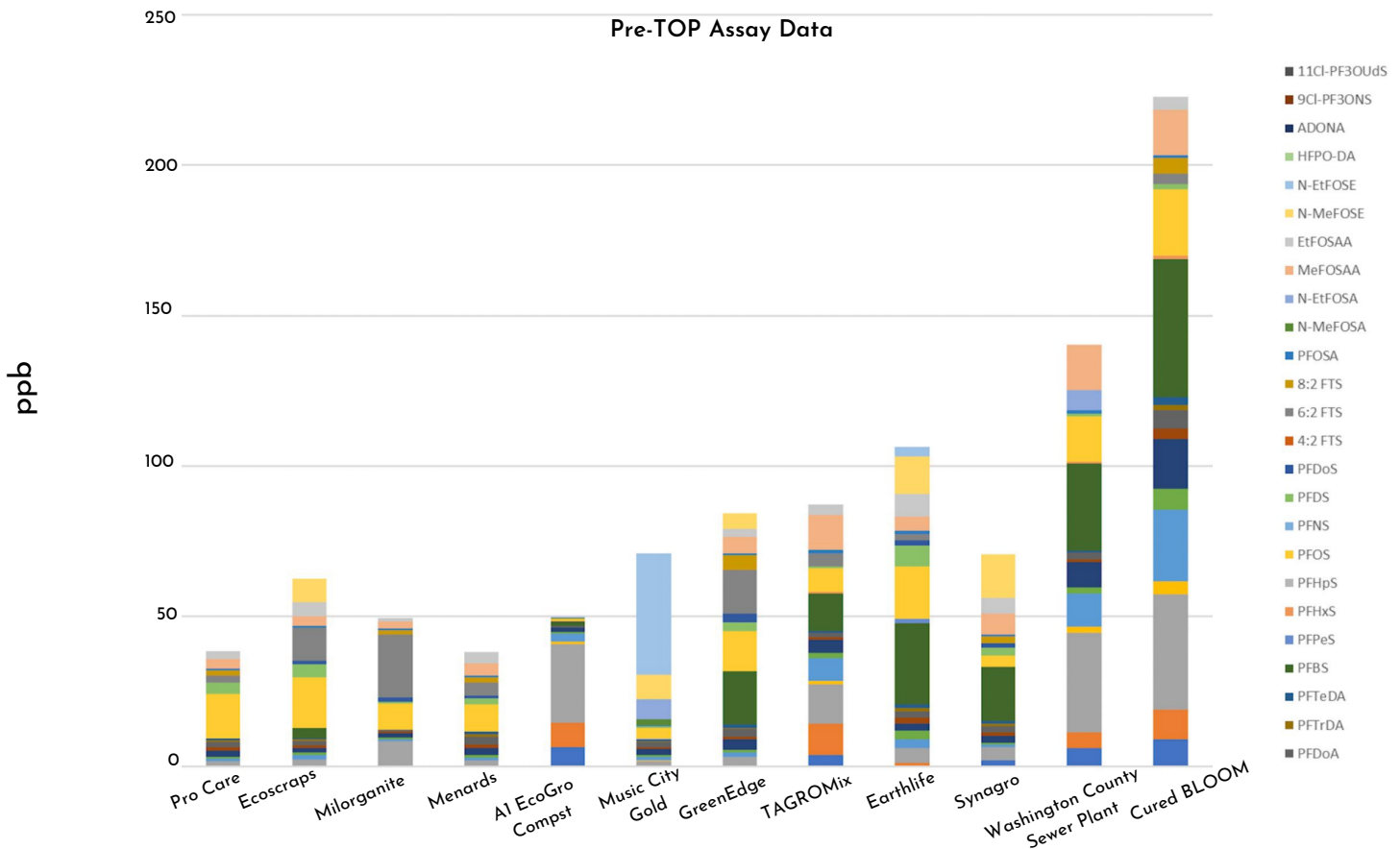


Figure 6. PFOA and PFOS are only two of many different PFAS compounds detected. Samples are from products sold in large commercial stores across the U.S. or from other region-representative samples. Source: All tests from Sludge in the Garden: Toxic PFAS in Home Fertilizers Made From Sewage Sludge (except for Washington County Sewer District which was purchased by an area resident and tested by Eurofins).

When New York State tested sewage sludge from eight sewage treatment plants in 2017, it looked for PFOS and PFOA contamination -- the two types of PFAS singled out in 2022 by the EPA as having no acceptable level -- as well as a small number of other PFAS compounds.[65] Despite finding levels of these PFAS compounds, which were concerning even under the EPA's old guidelines, the state DEC did not inform the treatment plants of the findings or recommend restrictions. The Sierra Club's Freedom of Information law request discovered that in 2019, the state compiled a list of 46 sites where sludge or sludge-derived compost was spread. We learned directly from the DEC staffer in charge of the state's biosolids program that the agency did not follow up by testing the soil or water at these sites.[66] This remained the case even in 2020, when New York State adopted a maximum contaminant level for drinking water of 10 parts per trillion for PFOA and PFOS, the two most notorious PFAS compounds that the EPA now warns are unsafe at any level. As the staffer explained, they were waiting for the EPA to provide direction.

8 NY WWTP PFAS in Biosolids

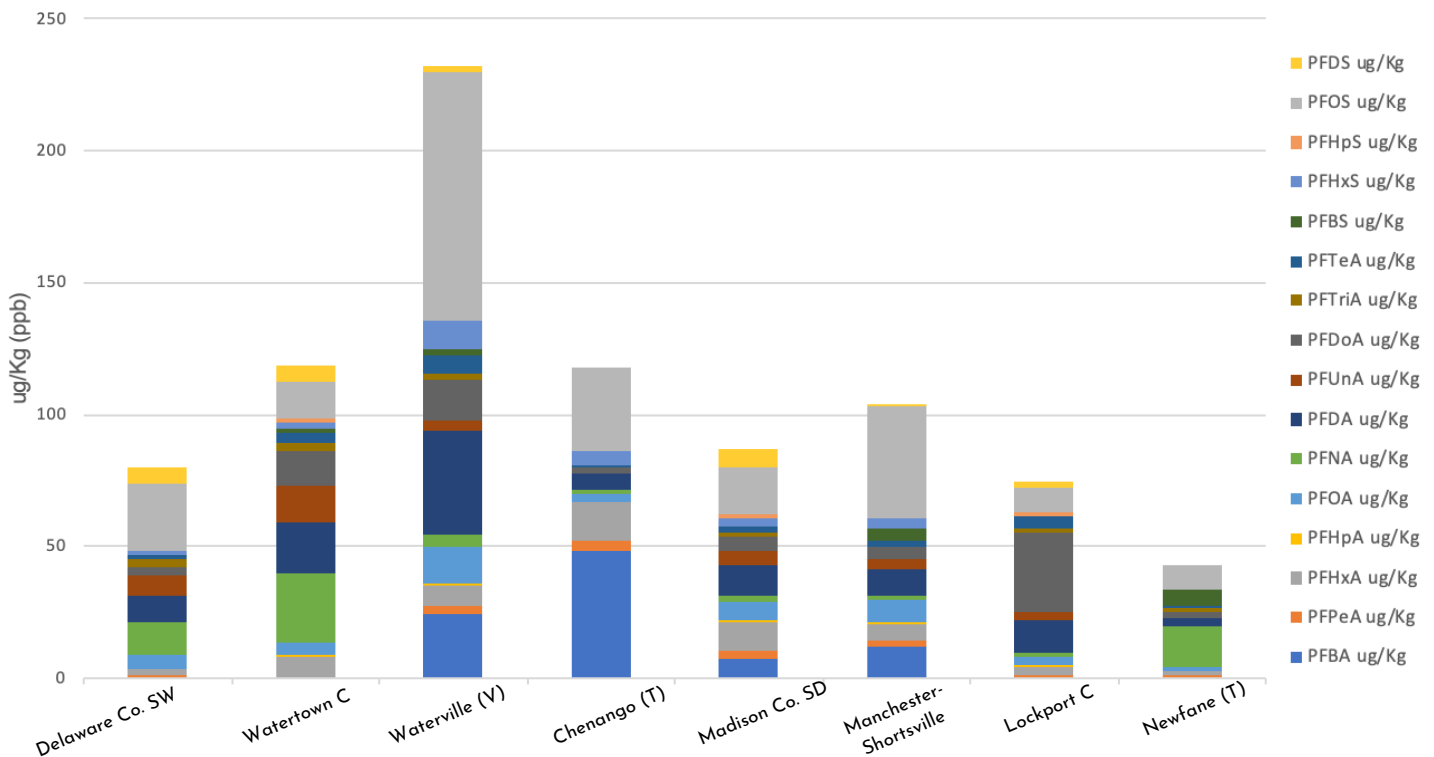
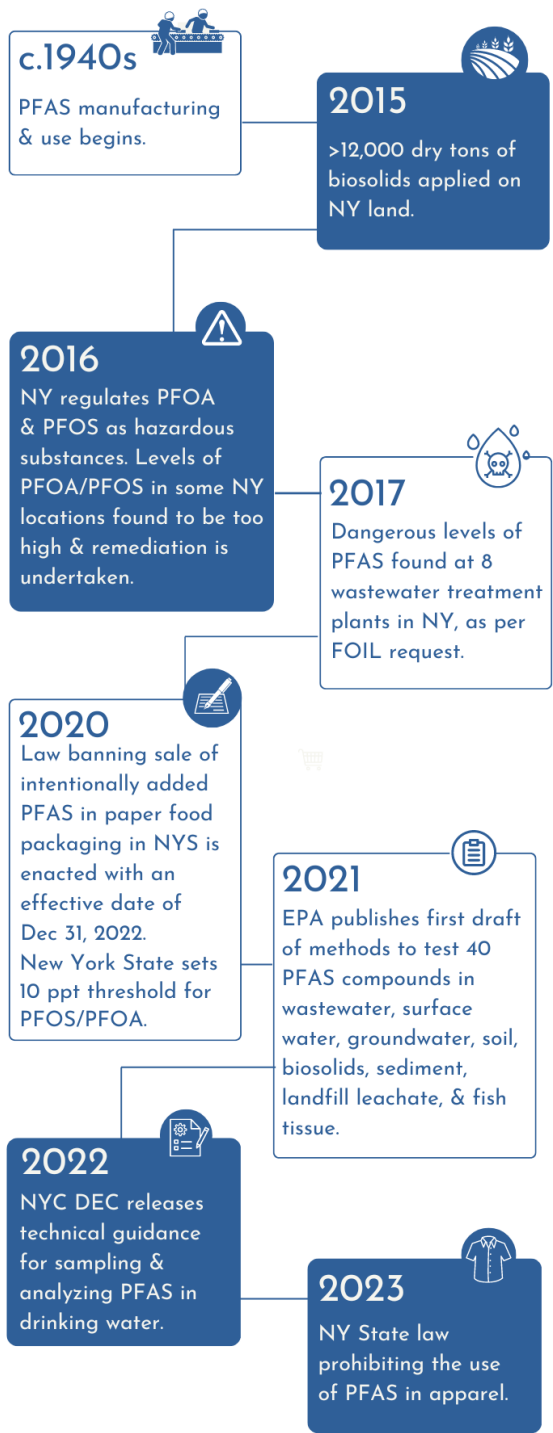


Figure 7. This graph shows the concentrations of 16 PFAS compounds in sewage sludge biosolids from eight NY wastewater treatment plants. These test results were secured in the Sierra Club's May 2022 Freedom of Information Law request. Total concentration (additive) is charted for these locations, in parts per billion. Note that national and state standards for maximum PFAS concentrations have been in the parts per trillion, thousands of times less than concentrations found in these samples. For more information on biosolids and compost for these locations, see Appendix.

Farmers can purchase sewage sludge-based compost and fertilizer products from private corporations in New York State, notably the publicly traded, integrated waste services company Casella.[67] There are no record keeping requirements for such products. These

sewage sludge products can be used in agriculture for food production and on other farmland with no limitations. They can be applied on athletic fields, used on lawns and in landscaping, and on home gardens. The routes through which a person may be exposed to PFAS include ingestion, inhalation, and absorption through the skin. When soil dries out, PFAS in soil dust particles can be breathed in. Thus, people may become contaminated with PFAS through soil dust, whether they are playing sports on an athletic field where sewage sludge compost has been applied or working in crop production on land fertilized by sewage sludge-based products.

PFAS in New York State: A Timeline



The DEC told us in June 2022 that it is tapping into \$500,000 from the Environmental Protection Fund for PFAS testing of sewage sludge. The testing would be done under contract with the State University of New York College of Environmental Science and Forestry, coordinated by Professor Doug Daley.[68] This testing would target the 100 of the state's 600 wastewater treatment plants whose sewage sludge is currently "recycled" through composting, farmland application, or other "technologies," the DEC staffer told us.

Meanwhile, local residents are starting to fight the spreading of sewage sludge in their areas. In February 2023, the town board of Thurston in Steuben County responded to public pressure and unanimously voted on a one-year moratorium on permits for solid waste operations. This could challenge Casella's effort to continue spreading sewage sludge on a large, more than 2,000-acre Steuben County farm it purchased in July 2022; the company applied to the state DEC to continue spreading sludge on the farmland.[69] Documents show sludge spreading in Bath, Cameron and Thurston starting in 1987.[70]

In Franklin County, local residents are concerned that Casella trucks in sewage sludge, from a broad region that includes other states and Canada, to its Grasslands processing plant, and spreads tens of thousands of tons of its product on county farmland and elsewhere in the state to this day (see box 2).

Box 2. Case Study: Franklin County, NY, and Casella

While sewage sludge is a problem for all agricultural areas in the state, Franklin County carries a heavy burden. It is home to a facility owned by a subsidiary of the waste giant Casella that processes sewer plant sludge/biosolids. More of its "product" is spread on agricultural lands in this county than is applied in the rest of New York State combined – more than 11,000 tons (22,238,000 pounds) in 2017.[71] Yet neither the state nor the federal government require PFAS testing of either the sewage sludge feedstock or any Casella fertilizer manufactured with the sludge product.

FOIL requests to the state DEC have yet to yield a full list of wastewater treatment plants and industrial sources authorized to send their sludge to Casella's Grasslands plant, located on Smith Road in Chateaugay. But we found out some of the sources through other means. A 2022 phone conversation with the NYS DEC Region 5 Materials Management Engineer confirmed that his office has approved sources from various parts of the state, as well as Toronto.[72] FOIL requests further revealed that DEC approved processing sludge from Ottawa and several wastewater treatment plants in Vermont. Documents from Vermont state that the city of Burlington sends its sludge to this plant. Casella's Grasslands plant is permitted to receive 250 tons of wastewater treatment plant sludge per day. The plant employs the Bioset process, which kills organisms, but is not capable of removing PFAS.

Figure 8. DEC letter approving Casella request to accept sludge from Suffolk County at Grasslands facility.

New York State Department of Environmental Conservation
Environmental Quality – Division of Materials Management
232 Golf Course Road, Warrensburg, NY 12885
Phone: (518) 623-1200 • Fax: (518) 623-1311
Website: www.dec.ny.gov



March 22, 2013

Mr. Jeffrey McBurnie, P.E.
Director of Permitting & Regulatory Affairs
Casella Organics
135 Presumpscot St, Unit 1
Portland, ME 04103
jeff.mcburnie@casella.com

**Re: Grasslands Variance & Biosolids Approvals
Chateaugay (T), Franklin (Co)**

Dear Mr. McBurnie:

This letter serves as Department approval of the Application for Variance dated 1/16/13 and of your prior requests to accept biosolids from Suffolk County and the City of Ottawa at the Grasslands facility in Chateaugay.

Department staff has reviewed Casella's 10/10/12 request to accept biosolids from Suffolk County Sewer Department's No. 3 Southwest Plant, as well as Casella's responses to the Department's comment letters dated 10/30/12 and 1/15/13, and find them acceptable. Therefore, your request is approved.

Further, Department staff has reviewed Casella's 1/22/13 request to accept biosolids from the City of Ottawa's WWTP and, coupled with granting of the variance, finds it acceptable. Therefore, your request is approved. With respect to the Ottawa sampling data; although acceptable test methods were used, it appears the lab is not a NYS certified lab. Please ensure that all future analyses are performed by a NYSDOH ELAP certified lab.

Finally, Grasslands is granted a variance from the 360-5.5(a)(1)(ii)(a) requirement to sample incoming biosolids for the Group C parameters. Please note that the Department may modify or revoke any variance on the basis of any of the following grounds:

1. Materially false or inaccurate statements in the variance application or supporting documentation.

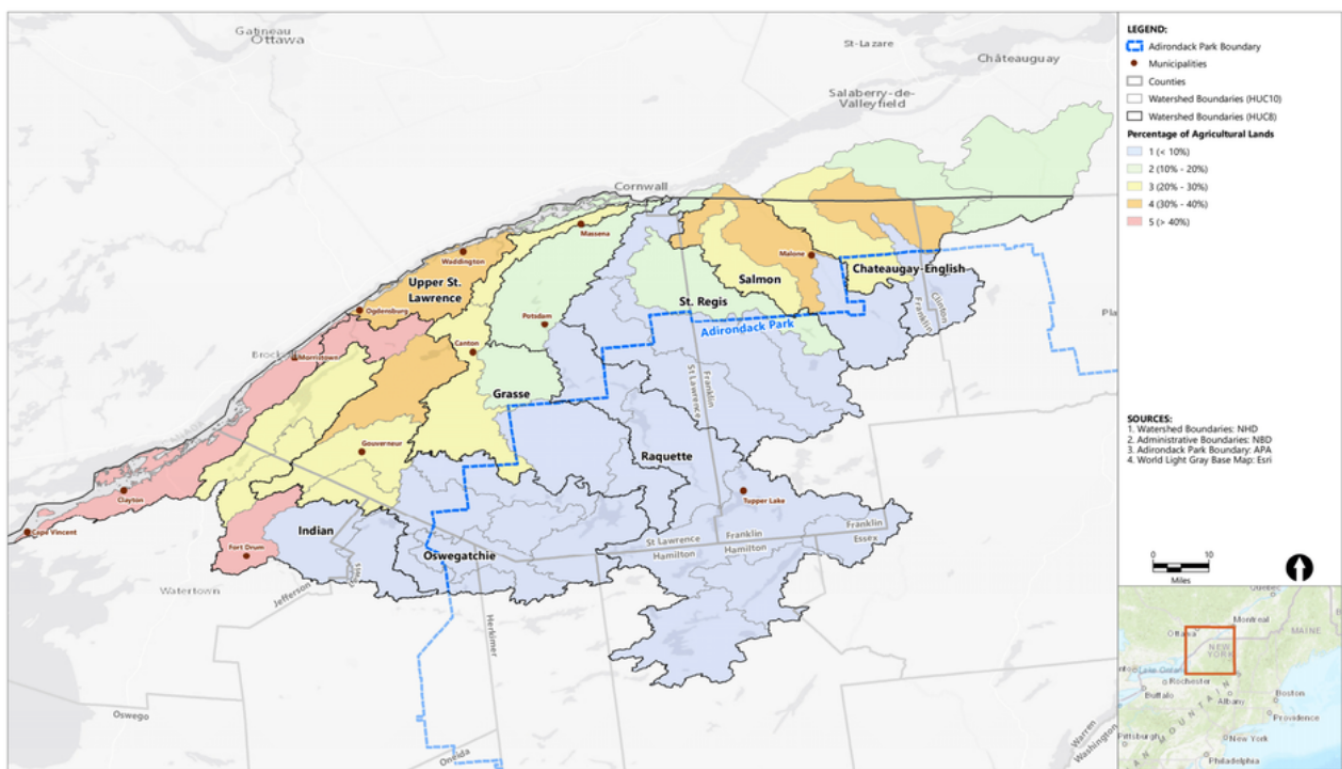
This letter from DEC to Grasslands Organic, a Casella subsidiary, is an example of approvals Grasslands' requests to accept sludge from a wastewater treatment plant or paper mill for processing prior to application to agricultural lands.[73]

Separate from that waste stream, sewage sludge from the Town of Malone wastewater treatment plant is trucked to the Franklin County Solid Waste Authority's regional landfill in the town of Westville. In 2021, DEC tested the leachate from the county's regional landfill. This documented PFAS levels of 9,470 parts per trillion (ppt), with the levels of PFOA and PFOS, legacy PFAS, at 1100 ppt and 240 ppt, orders of magnitude higher than New York's drinking water limit of 10 ppt for PFOA.[74]

The manager of the landfill reported in an April 2022 phone conversation that 50,000 gallons per day of untreated leachate is then returned to the Malone wastewater treatment plant for treatment. The Malone wastewater treatment plant has no process in place to remove PFAS before its effluent is released into the Salmon River, a trophy fishing river that flows through Lac Saint-Francois National Wildlife Area, a Quebec nature preserve a few miles downstream. The authors of this report have been unable to determine if any testing for PFAS in the effluent has ever occurred. Neither the Town of Malone nor Franklin County have a planning department. Casella's Grasslands Organics operation, the Malone wastewater treatment plant, and the Franklin County Landfill all lay in the northern half of the county between the Adirondack Park with its planning and oversight authority, and the Canadian border.

The difficulty in tracking this information highlights why the state should end land application of sewage sludge, identify safe protocols for safe processing and disposal of sludge, and institute a comprehensive and transparent testing program for PFAS in sewage sludge and wastewater treatment plant effluent. The state DEC must provide more detailed information about all the sources of sludge, all the land upon which Casella's Fertilimer and EarthLife products have been applied, and the results of any testing related to PFAS contamination. Here is a snapshot of the amounts and towns where the Fertilimer was spread in a single year - 2019 - with only a partial list of sludge sources from New York State, Vermont, and Ontario, obtained from a FOIL request.

Figure 9. Percentage of Agricultural Lands in St. Lawrence Watershed in NYS [75]



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Farmers, consumers, and elected officials must take seriously the prospect that rivers and tributaries that run through or near agricultural land spread with these products or flowing with effluent from the Malone wastewater treatment plant or the Grasslands plant may well be contaminated.

Franklin County has a total area of 1,697 square miles, of which 68 square miles (4%) is water,[76] including five river systems (Saranac, Chateaugay/English, Salmon, Racquette, and St. Regis) and their tributaries. It is the fourth-largest county in New York by land area. The northern edge borders Quebec and Ontario provinces of Canada. Large aquifers underlie large sections of the County. Private and municipal wells and some wells that directly serve public facilities such as schools, public housing, senior centers, campsites and parks, draw water directly from these aquifers.

IV. States taking action against PFAS in sewage sludge

Vermont and Maine are among the states addressing the crisis posed by these ubiquitous chemicals in the environment. They are conducting studies and passing tighter restrictions. The Midwestern states of Michigan and Minnesota also have begun to take stock of the harms of PFAS and added PFAS to the list of industrial chemicals that companies need to somehow filter before discharging wastewater into sewers. [77]

A. Vermont

The State of Vermont commissioned a study of PFAS at wastewater treatment plants and in landfill leachate in 2019, detecting PFAS compounds in all samples tested from every wastewater treatment plant.[78] When analyzed as solids, the sewage sludge samples had concentrations of 20 to 27 parts per billion for five different PFAS compounds combined, regardless of the type of sewage sludge (thickened,[79] Class A or Class B). Given that previously defined thresholds were in parts per trillion, these values are orders of magnitude greater than what could arguably be considered safe.

The two wastewater treatment plants in Vermont that accept landfill leachate also had the highest concentrations of PFAS compounds in their sewage sludge.[80] Not surprisingly, these two plants in Montpelier and Newport also had significantly higher concentrations of PFAS in the effluent leaving the plants. The state of Vermont required Casella, the waste corporation that owns and operates the Coventry, VT landfill, to study PFAS levels in incoming waste. Textiles, including furniture, clothes, umbrellas, and carpeting had the highest PFAS levels of any waste coming into the landfill. One piece of clothing contained over 1,500 parts per billion (1.5 parts per million) PFAS. The Montpelier plant receives leachate from the Randolph landfill, which is closed, but in the past had received PFAS-containing waste from a Teflon-coating factory in Bennington.

In the Vermont study, all landfill leachate samples contained quantifiable concentrations of nearly all of the 24 PFAS compounds that the laboratory was able to detect. Concentrations of the five PFAS compounds regulated in Vermont ranged from 376 parts per trillion to 4.7 parts per billion in the leachate. When this liquid leachate is run through a wastewater treatment plant, the PFAS contaminants concentrate in the sewage sludge.

As part of its PFAS Roadmap, in 2020, Vermont required testing solid waste for PFAS, and testing for PFAS in soil, ground water, and crops where sewage sludge was spread.[81] It “required the state’s one operating landfill to evaluate two onsite and two offsite treatment methods for PFAS in landfill leachate.”[82] It is due to release an update to its PFAS Roadmap in 2023.[83]

B. Maine

On April 15, 2022, the Maine legislature took the most decisive action of any state to date, banning the spreading of sewage sludge and sludge-derived compost and other soil amendment products on farmland, providing medical monitoring and funding to farmers affected by the PFAS crisis; and allocating \$60 million to help compensate farmers and well owners harmed by PFAS contamination from sewage sludge.[84] It also dedicated funds to study how to prevent contaminated landfill leachate from continuing to pollute.

PFAS contamination of farmland in Maine was first exposed in 2017.[85] The ensuing years were a drip-drip-drip of disturbing data.[86] PFAS contamination of milk has been reported in several dairy farms around the nation, including two in Maine. On Fred Stone’s dairy farm in Maine, the highest PFAS level detected was 1,420 parts per trillion. Mr. Stone spread sewage sludge in the 1980s under a state program encouraging its application to farmland. To enlist farmer participation in the program, the state offered written assurances that the practice was safe. In 2016, after the local water district discovered high PFAS levels in a well located on the Stone farm, the Stones informed their milk distributor and the state DEP. Subsequent testing found high PFAS concentrations in the herd’s milk, soil, hay, and cow manure. The Stones cannot sell their milk, beef, or crops and the family’s blood levels of PFAS are high.

A Maine DEP investigation has identified 56 farms with some level of PFAS contamination tied to sludge spreading on agricultural land. At least three of these farms have been put out of business by the contamination (Stone Ridge Farm, Toziers Dairy Farm, Songbird Farm). There are at least four impacted dairies whose milk has tested above the state’s interim threshold in the list of 56 impacted farms - Stone Ridge, Toziers Dairy Farm, Dosty’s Farm and Misty Brook Farm. The interim threshold is based on EPA’s old PFOS guidance of 70 ppt in drinking water. Maine Center for Disease Control in its health department has not updated its milk threshold to correspond with the toxicological assumptions underlying its current drinking water standard of 20 ppt but the new milk threshold is anticipated to be around 44 ppt.

PFAS concentration in milk has been detected as high as 32,200 parts per trillion at one farm.

The young farm couple at Songbird Farm in Unity, Maine had been growing certified organic produce and heirloom grains for local markets since 2014, when they discovered that their farm had received repeated applications of sewage sludge decades earlier - the state of Maine had posted a searchable map of historic sewage sludge applications on its public website. The couple sent samples of their water, soil, and crops to a testing lab, which found alarming levels of PFAS contamination. For example, PFAS was detected in drinking water from their domestic well at 400 times the level set by the state for safety. They had been drinking and cooking with this water and giving it to their young son. Their soils were also highly contaminated, so the couple had to stop farming.[87]

Previous testing by the state of Maine found that sewage sludge from over 30 different wastewater treatment plants exceeded the state's PFAS advisory level for sewage sludge. Similarly, the sewage sludge from the eight wastewater treatment plants that were tested by NYS DEC exceeded Maine's PFAS advisory level. New Hampshire detected PFAS in sewage sludge from about 25 permit holders.[88] Unacceptable concentrations of PFAS in biosolids, linked to contamination of farmland, have also been detected by the state of Michigan.

As of January 2023, the Maine Department of Environmental Protection identified 1037 sites to conduct PFAS testing of soil and water, on which farmers had previously spread sewage sludge biosolids.[89] New York State must also test farms where biosolids have been applied and follow Maine's lead in entirely banning the use of sewage sludge on farmland and gardens.

Box 3. Microplastics

In addition to PFAS, there is increasing evidence that microplastics are also present in sewage sludge and can contaminate agricultural land. A 2020 scientific review article published in the journal *Current Opinion in Environmental Science and Health* comprehensively covered this topic.[90] The authors found that microplastics have been identified in sludge from wastewater treatment plants worldwide and that they predominantly enter the environment through the application of biosolid waste on farmland. This point was highlighted in a recent *Civil Eats*[91] article, which claims that "more microplastics are contaminating agricultural lands than oceans."

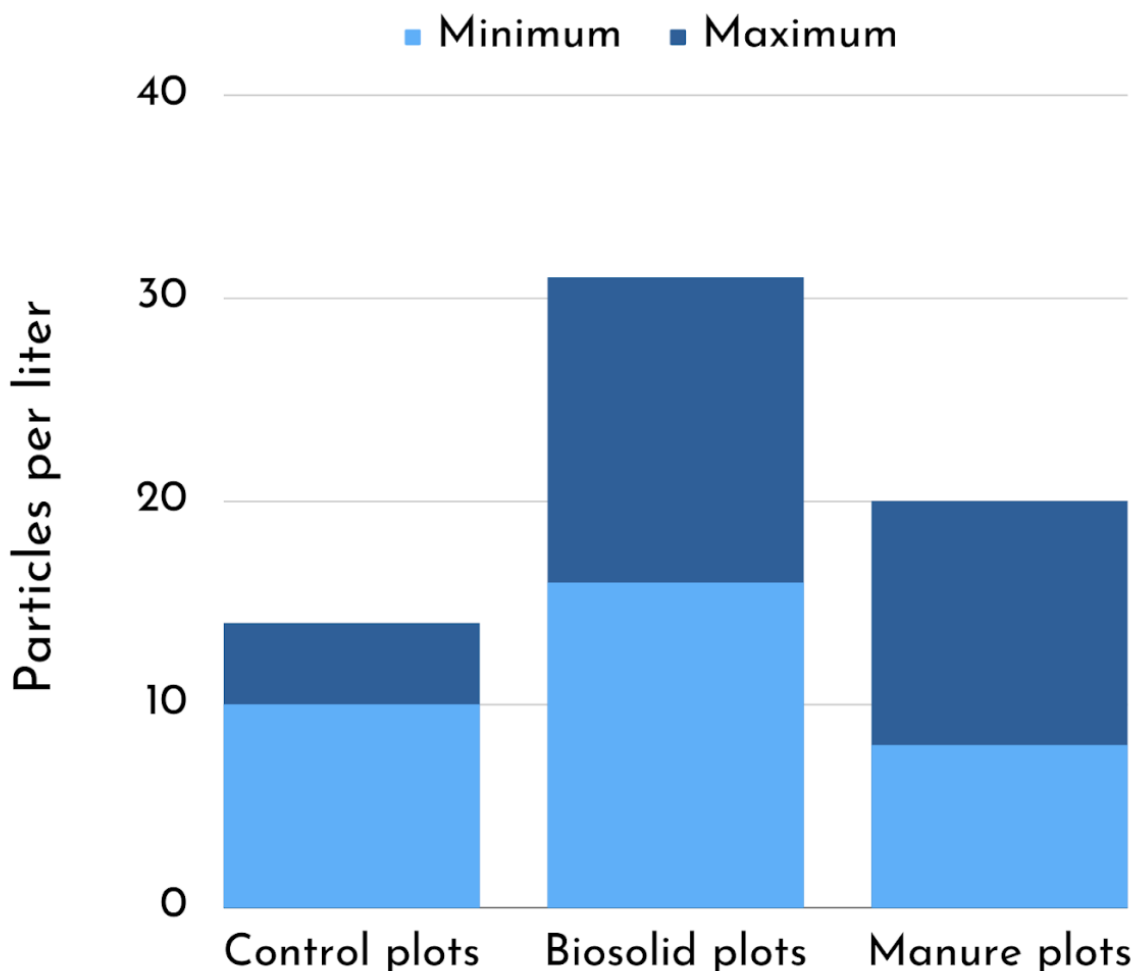
Of particular interest to the New York State agricultural community is the fact that microplastics have been shown to harm key indicators of soil health, including bulk density, the soil microbiome, water holding capacity, and plant development.[92]

Microplastics contaminate New York's waterways, including the Mohawk River and Hudson River, demonstrating the extent to which they pervade our environment.[93]

A scientific article in the journal *Environmental Pollution*, details the presence of microplastics in California agricultural land.[94] This study suggests that more microplastics are released onto farmland than into the oceans, a particularly surprising finding considering the amount of concern over marine microplastics. In fact, over a 12-year period, it was estimated that in California 14.5 kilotons, or 66% of the total microplastics shed from apparel washing, were applied to land in the form of biosolids (with the potential that some were also applied through irrigation with recycled water).

Microplastics have been found in our soil. It is likely that (at least) one source is sewage sludge applied to farmland. It is critical to act now, for the health of people and the health of our environment.

Figure 10. Higher concentrations of microplastics in runoff from biosolid-amended croplands than manure-amended croplands.



IV. Disposing of Sewage Sludge and the Danger of Incineration

Wastewater treatment plants and the state Department of Environmental Conservation promote land spreading of sewage sludge as a way to dispose of it.[96] While sewage sludge is a rich source of plant nutrients that boosts crop production, it also disperses toxic contaminants, notably PFAS, microplastics, and, in many cases, heavy metals on farmland and poisons groundwater and surface waters.[97] The pollution burden it creates far outweighs any benefits.

But other disposal methods for sewage sludge pose serious threats as well, leaving disposal in a lined landfill as the least risky alternative.[98] However, any sewage sludge disposed of in a landfill requires robust pre-treatment of leachate to remove PFAS and other persistent organic pollutants and hazardous substances using existing technology like granulated activated carbon.[99] Untreated, the inevitable leachate from landfills typically winds up back at a wastewater treatment plant, creating a vicious cycle of PFAS pollution.

Many municipalities still rely on sewage sludge incinerators, or have their sewage sludge trucked to a trash incinerator. Recent research shows that incineration does not destroy PFAS, but rather disperses it in the air. PFAS then falls to the ground in a wide radius from the smokestack.[100] Many PFAS compounds readily leach through the soil into groundwater. This scenario has been documented in the case of factories with PFAS emissions, where private drinking water wells miles away were contaminated with PFAS. Similarly, environmental PFAS contamination was documented after the Norlite hazardous waste incinerator in the Capital District city of Cohoes, NY, burned aqueous firefighting foam, which consists of PFOS, under contract with the US Department of Defense.[101]

Pyrolysis is another process that can be used to dispose of sewage sludge. Pyrolysis is defined as the thermal decomposition of materials at elevated temperatures in an inert atmosphere. In other words, it burns materials in the absence of oxygen. Critics call it “incineration in disguise.” Pyrolysis produces char and “syn gasses,” which are typically burned (incinerated) as part of the process. Pyrolysis can also be used deliberately produce charcoal also called biochar which Saratoga Biochar trademarked as “a carbon fertilizer.”[102] EPA research scientists unsuccessfully attempted to determine the fate of the PFAS in sewage sludge when biochar was produced through pyrolysis at a California sewage sludge biochar plant. In their peer reviewed journal article, they state that more research is required.[103]

One of the many factors hampering this sort of research is the lack of analytical methods for measuring PFAS air emissions. Another is the fact that under high heat, PFAS compounds are prone to partial decomposition into products of incomplete combustion and recombination into new PFAS compounds.

In a recent presentation at the American Association for the Advancement of Science, an EPA research scientist stated that a temperature of 1,440 C (2,624 F) is required to break the carbon-fluorine bond that characterize all PFAS compounds.[104] A byproduct of such thermal decomposition is hydrogen fluoride, a highly corrosive gas.

Discussing the pros and cons of incineration and pyrolysis is outside the scope of this paper. However, since neither process destroys PFAS, they should not be seen as a desirable alternative for managing sewage sludge.

V. Conclusion and Recommendations

Continued use of dangerous sewage sludge as a “fertilizer” in New York State threatens the future of our farmland and compromises the safety of crops, water resources drawn on for drinking water, and the general environment, including the microbiome. Furthermore, it endangers the health of farmers, gardeners, and consumers who eat fruits, vegetables, and grains, and the eggs, meat, milk, and other dairy products from livestock fed crops grown on contaminated land. This practice threatens our health and the environment.

The Atlantic Chapter of the Sierra Club urges immediate action to end the use of this contaminated material on farms and fields, track the damage it has already caused, and begin to provide support to the communities, farmers, and others harmed by its presence. The state can start by banning sewage sludge as a soil amendment.

In the past year, New York joined the growing number of states to prioritize the health of soil in agricultural lands when it enacted the New York Soil Health and Climate Resiliency Act. Whether it is through the lens of climate and resiliency, community health and environmental justice, or protecting food and water quality, New York State has recognized that soil provides valuable ecosystem services that are too important to ignore. The state cannot permit the spreading of sewage sludge contaminated with PFAS while claiming to promote and value soil health.

While comprehensive federal action is obviously required, the state DEC can immediately take action to curb the spreading of sewage sludge under its existing powers both under state law and the federal Clean Water Act.[105] States including Michigan, Colorado and North Carolina draw on the Clean Water Act in permitting to require key industries to pre-treat effluent to reduce PFAS from industrial hotspots, or limit the land disposal of highly contaminated sludges. But the state legislature should further direct and clarify the actions needed to keep New Yorkers safe and farmers’ livelihoods protected. The Atlantic Chapter of the Sierra Club implores the New York State Legislature and executive branch to quickly act to keep any additional PFAS and other persistent toxins out of our waste stream, away from our water, and off our farmland.

The Atlantic Chapter of the Sierra Club urges that New York State take the following actions to keep PFAS and other persistent chemicals out of sewage sludge, away from our water, and off our farmland:

1. The NYS Legislature should direct the NYS DEC to stop the spreading of sewage sludge in any form on fields and farms, and end the production, sale, and distribution of soil amendment products including “compost” from sewage sludge, due to strong evidence of their widespread contamination with PFAS.
2. The NYS Legislature should pass the PFAS Surface Water Discharge Disclosure Act requiring testing of wastewater treatment plant effluent for PFAS contamination.[106]
3. The NYS Legislature should direct the NYS DEC to ban wastewater treatment plants from accepting landfill leachate, unless PFAS contaminants are destroyed or removed beforehand.[107] If filtered, contaminated filters should be treated as hazardous substances and dealt with in such a way that they do not end up in our water, air, soil, or otherwise contaminate the environment or enter the food chain.
4. New York State’s Climate Scoping Plan, approved by the State’s Climate Action Council in December 2022, dangerously encourages the mixing of food waste with sewage sludge/wastewater biosolids in anaerobic digesters in order to generate methane under controlled conditions.[108] We ask the state to withdraw this policy recommendation so that it does not appear in the final regulations. Mixing food waste - a relatively clean organic feedstock - with sewage sludge/biosolids - which are highly contaminated with PFAS and numerous other unregulated pollutants - will dramatically increase the quantity of organic waste contaminated with PFAS. This dangerous practice that contaminates otherwise clean organic waste is actually being considered by municipalities.
5. NYS Department of Health (DOH) should strengthen its drinking water standards for PFAS, issued in October 2021, to conform with the US Environmental Protection Agency’s proposed federal maximum contaminant levels issued in March 2023. As maximum contaminant levels only cover public drinking water supplies and rural wells are also vulnerable to contamination, the state should develop a testing program for private drinking water wells. The state DEC should similarly strengthen its weak surface water standards to reflect the dangers PFAS pose to aquatic life, groundwater, and humans.[109]
6. The NYS Legislature should direct the NYS DEC to test for PFAS in soil, water, and agricultural products grown where sewage sludge-based soil amendments are known to have been spread. The state should also conduct free tests for PFAS at the request of farmers, landowners, or tenants, whether of their land or of PFAS in the blood of their family members or workers. It should promptly inform the land owner(s) and, if different, the farmer or tenant, of the test results. It should also provide them and

other affected parties with information about PFAS toxicity, potential health effects, persistence, and other relevant characteristics. It should also create a mechanism for private individuals to determine the contamination of land related to a purchase or lease agreement.

7. The NYS Legislature should direct the NYS DEC to require regular PFAS testing of all sewage sludge and industrial biosolids, such as paper factory sludge. It should inform wastewater treatment plants, farmers using sludge and others of the potential dangers of PFAS in sewage sludge.

8. The NYS Legislature should direct the NYS DEC to mandate that all reportable PFAS and water data collected by the State be posted online in a readily searchable format and submitted to the US EPA for inclusion in the agency's ECHO (Enforcement and Compliance History Online) database.[110]

9. NY State should apply for the maximum amount of support possible from the US EPA's \$4 billion fund to address PFAS and other emerging contaminants in drinking water, along with the EPA's Small and Disadvantaged Communities Fund.[111]

10. The NYS Legislature should take bold action to eliminate products and materials containing PFAS from the waste stream as much as possible, starting with an across-the-board ban on the intentional addition of all PFAS compounds in consumer and commercial products. Until that is accomplished, the state should require that content labels for every product sold in NYS disclose if any PFAS were used in the manufacturing process, or intentionally added to the products or their packaging sold in NYS. [112]

11. The NYS Legislature should establish a compensation fund to support farmers who may lose their livelihood and their ability to farm their agricultural lands when PFAS contamination is found. Further, the state should develop a program to support farms impacted by contamination with expenses related to testing, compensating losses in revenue due to contamination, and assistance in navigating future business plans.

12. The NYS Legislature should devise a system where the polluting company is held financially responsible for the harms created by the spreading of sewage sludge.

13. Cornell Cooperative Extension and each county's Soil & Water Conservation District should educate farmers on the dangers of sewage sludge/biosolids being spread on farmland and link them to public programs that can help them if their land was exposed.

Appendix I. Lab Results for NYS DEC testing of wastewater treatment plants, October 2017^[113]

Treatment Plant	PFOA (ppb dry weight)		PFOS (ppb dry weight)		PFOA		PFOS	
	Compost	Biosolids	Compost	Biosolids	Compost	Biosolids	Compost	Biosolids
Delaware County SW	35.00	5.10	27.70	26.00	376.00	18.60	105.00	4.51
Watertown (C)		4.37		13.90		17.70		18.00
Waterville (V)	14.30	13.30	42.70	94.70	118.00	41.40	22.00	19.80
Chenango (T)	5.95	2.99	7.66	31.70	104.00	9.07	ND	2.25
Madison Co. SD	53.30	7.37	36.60	18.40	356.00	25.40	14.30	4.95
Manchester-Shortsville	3.04	116.00	17.00	145.00	145.00	34.00	ND	11.70
Manchester-Shortsville *	24.50	8.15	42.00	42.70	215.00	27.30	13.20	6.31
Lockport (C)	19.90	3.02	13.90	9.64	240.00	6.12	ND	4.12
Newfane (T)	25.40	1.28	34.70	9.72	364.00	5.49	25.40	8.35
*Wastewater Treatment Plant was sampled twice								

Appendix II. The Sierra Club and the Ann Arbor Ecology Center study of biosolids compost sold to consumers ^[114]

The Sierra Club and the Ann Arbor Ecology Center identified dozens of home fertilizers made from biosolids (sewage sludge) and purchased 9 different brands made from biosolids sourced from around the country. Then they sent samples from the different biosolids products to testing labs to be analyzed for 33 PFAS compounds. Eight of the 9 products tested exceeded the allowable concentrations for PFOA or PFOS previously set by Maine, which had the strongest standards of any state.

Each biosolids fertilizer product tested contained between 14 and 20 detectable PFAS compounds. Twenty-four of the 33 PFAS compounds tested for were detected in one or more products. Additional testing found that these products also contained two to eight times greater mass of precursor compounds and hundreds to thousands of times more unidentifiable synthetic fluorine compounds.

The findings of the Sierra Club - Ecology Center study are consistent with national surveys of PFAS in sewage sludge/biosolids, and academic studies that tested biosolids-based fertilizers and composts. The report recommends that consumers refrain from using such products.

The report notes that, "For the large-scale problem of disposing of sewage waste, however, simple solutions are elusive. The federal government and most states have done little to study the issue, let alone address it."

The report recommends immediate action to keep PFAS and other persistent chemicals out of sewage sludge by banning unnecessary uses of PFAS in commerce. It also calls for an end to the use of PFAS, with limited exemptions, in order to protect people from the growing threat of PFAS exposure. In addition, industrial polluters should be prevented from discharging PFAS-containing wastewater into sewers and PFAS-containing effluent into water bodies. It urges stronger regulation of land application of biosolids with high levels of PFAS and other harmful chemicals. Industry should be required to pay for the damages that PFAS production and use poses to people and the environment, including costly cleanups of contaminated places.

It notes that the US EPA's "anemic responses to date, as well as structural barriers created by key environmental laws, make quick action unlikely and hinder even the most common-sense measures to contain the chemical crisis."

The list of compounds found that is included in the chart in the preceding section on tested bio-solids based fertilizer/amendment is provided here:

PFBA	PFUnA	PFHpS	8:2 FTS	N-EtFOSE
PFPeA	PFDoA	PFOS	PFOSA	HFPO-DA
PFHxA	PFT _r DA	PFDS	N-MeFOSA	ADONA
PFHpA	PFT _e DA	PFNS	N-EtFOSA	9Cl-PF3ONS
PFOA	PFBS	PFDoS	MeFOSAA	11Cl-PF3OUdS
PFNA	PFPeS	4:2 FTS	EtFOSAA	
PFDA	PFHxS	6:2 FTS	N-MeFOSE	

Appendix III. Maine law bans spreading of sewage sludge on farmland

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L.D. 1911

Date: (Filing No. S-)

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STATE OF MAINE
SENATE
130TH LEGISLATURE
SECOND REGULAR SESSION

SENATE AMENDMENT “ ” to COMMITTEE AMENDMENT “A” to H.P. 1417, L.D. 1911, “An Act To Prohibit the Contamination of Clean Soils with So-called Forever Chemicals”

Amend the amendment by striking out all of section 5 and inserting the following:

Sec. 5. 38 MRSA §1306, sub-§7 is enacted to read:

7. Prohibitions on land application of sludge and sale and distribution of compost and other agricultural products and materials containing sludge and septage. This subsection governs the land application of sludge and the sale and distribution of compost and other agricultural products and materials containing sludge and septage.

A. Notwithstanding any provision of law to the contrary, except as provided in paragraph B, a person may not:

(1) Apply to or spread on any land in the State:

(a) Sludge generated from a municipal, commercial or industrial wastewater treatment plant;

(b) Compost material that included in its production sludge generated from a municipal, commercial or industrial wastewater treatment plant or septage; or

(c) Any other product or material that is intended for use as a fertilizer, soil amendment, topsoil replacement or mulch or for other similar agricultural purpose that is derived from or contains sludge generated from a municipal, commercial or industrial wastewater treatment plant or septage; or

(2) Sell or distribute in the State:

(a) Compost material that included in its production sludge generated from a municipal, commercial or industrial wastewater treatment plant or septage; or

(b) Any other product or material that is intended for use as a fertilizer, soil amendment, topsoil replacement or mulch or for other similar agricultural purpose that is derived from or contains sludge generated from a municipal, commercial or industrial wastewater treatment plant or septage.

B. The prohibitions in paragraph A do not apply to:



NOTES

1. PFAS Exposure and Risk of Cancer," NIH National Cancer Institute, Division of Cancer Epidemiology website, <https://dceg.cancer.gov/research/what-we-study/pfas>.
2. "What are the health effects of PFAS?" US Center for Disease Control and Prevention Agency for Toxic Substances and Disease Registry, November 1, 2022, <https://www.atsdr.cdc.gov/pfas/health-effects/index.html>.
3. Paige Bennett, "Umbilical Cord Blood Tests Reveal Widespread PFAS Contamination, *Ecowatch*, September 23, 2022, <https://www.ecowatch.com/umbilical-cord-blood-pfas.html>.
4. NYS Draft Solid Waste Management Plan, page 78, Table 6: NY Waste Projections from 2023 - 2050. Biosolids Recycling Rate 2018: 22%; 2023: 31%; 2030: 37%; 2040: 45%; 2050: 57%. <http://www.dec.ny.gov/chemical/41831.html>.
5. The draft regulation sets a limit of 20 parts per billion for PFOA and for PFOS, two PFAS chemicals whose production was phased out. This is very high, analogous to setting the speed limit at 300 mph, and ignores the many other PFAS compounds detected in sewage sludge/biosolids. Maine's thresholds for use of sewage sludge/biosolids as a soil amendment before banning land application entirely in 2022 were 2.5 ppb for PFOA and 5.2 ppb for PFOS, and 1900 ppb for PFBS. "DMM-Draft 7: Biosolids Recycling in New York State - Interims Strategy for the Control of PFAS Compounds," n.d., https://www.dec.ny.gov/docs/materials_minerals_pdf/dmmdraftpolicy7.pdf.
6. Phone call with Sally Rowland, NYS Department of Environmental Conservation, June 14, 2022.
7. Casella deceptively markets these materials as "organic." See its website's "Casella Organics" page <https://casella.com/casella-organics>.
8. *Sludge in the Garden: Toxic PFAS in Home Fertilizers Made from Sewage Sludge*, Michigan Sierra Club and Ecology Center, May 25, 2021; <https://www.ecocenter.org/our-work/healthy-stuff-lab/reports/sludge-garden>.
9. NYS Soil Health and Climate Resiliency Act, S.4722A/A.5386A, 2021-2022 Legislative Session, signed by Governor, <https://www.nysenate.gov/legislation/bills/2021/s4722/amendment/a>.
10. "Establishing a Solid Waste Management Facilities One (1) Year Moratorium," Thurston Town Board Local Law Filing, NYS Department of State, February 21, 2023; <https://waterfrontonline.files.wordpress.com/2023/04/moratoriumthurstoncam.pdf>.

11. 40 CFR § 503.24(a) prohibits land application of sludge that “is likely to adversely affect a threatened or endangered species listed under section 4 of the Endangered Species Act or its designated critical habitat.” The Maine delegation to Congress is promoting the federal [Relief for Farmers Hit with PFAS Act](#) authorizing “grants for states to provide financial assistance to affected farmers, expand monitoring and testing, remediate PFAS, or even help farmers relocate.” <https://pingree.house.gov/news/documentsingle.aspx?DocumentID=4508>.
12. PFAS Surface Water Discharge Disclosure Act: S.227-A (May)/A.3296 (Kelles); Sierra Club Atlantic Chapter Memorandum of Support, <https://atlantic2.sierraclub.org/sites/newyork.sierraclub.org/files/documents/2023/04/S227A%20A3296%20PFAS%20in%20surface%20water%20disclosure%20MOS.pdf>.
13. Matt Jawowski, “America’s First High-Volume ‘PFAS Annihilator’ is Up and Running in Western Michigan,” WoodTV.com, May 4, 2023, <https://www.woodtv.com/news/kent-county/americas-first-high-volume-pfas-annihilator-is-up-and-running-in-west-michigan/>.
14. NYS Climate Action Council. Scoping Plan. Full Report. December 2022. pp. 330-331. <https://climate.ny.gov/-/media/project/climate/files/NYS-Climate-Action-Council-Final-Scoping-Plan-2022.pdf>
15. The DEC surface water standards for aquatic organisms are currently 16,000 times higher than current drinking water standard for chronic exposure, 71,000 times higher than current drinking water standard for acute exposure. <https://www.dec.ny.gov/chemical/122803.html>.
16. Maine’s Department of Environmental Protection has been publishing drinking water well sample results alongside the location of fields licensed for sludge spreading on its [PFAS Investigation ArcGIS map](#). Also see US Environmental Protection Agency database Enforcement and Compliance History Online (ECHO), <https://echo.epa.gov/>.
17. NYS Department of Health email May 17, 2023 clarified which funds have been applied to or budgeted already: “The latest Drinking Water State Revolving Fund Intended Use Plan allocated \$30 million to Emerging Contaminants funding and can be found here as Amendment #2: <https://health.ny.gov/environmental/water/drinking/water.htm> Note that funding requirements outlined in the IUP allocate funds to disadvantaged communities... NYS also has funding for emerging contaminants (EC) projects through the WIIA program, which has recently been announced. This applies to municipalities that have violated the NYS MCL of PFOS/PFOA in drinking water.” Also see <https://www.epa.gov/dwcapacity/emerging-contaminants-ec-small-or-disadvantaged-communities-grant-sdc#fundAll>, and https://www.epa.gov/system/files/documents/2023-03/EC%20SDC%20Factsheet_03142023.pdf ; “EPA Announces New Drinking Water Health Advisories for PFAS Chemicals, \$1 Billion in Bipartisan Infrastructure Law Funding to Strengthen Health Protections,” Press Advisory, U.S. Environmental Protection Agency, June 15, 2022, <https://www.epa.gov/newsreleases/epa-announces-new-drinking-water-health-advisories-pfas-chemicals-1-billion-bipartisan>.
18. Bills on the 2023 legislative calendar include PFAS in Products Ban: S.5648 (Hoylman-Sigal) / A.3556 (Zebrowski); Safe Personal Care & Cosmetics: S.4265 (Webb); PFAS in Menstrual Products: S.3529 (Fernandez) / A.5990 (Rosenthal, L); PFAS in Antifogging Sprays and Wipes: S.992A (Hoylman-Sigal) / A.5363A (Gallagher) . Sierra Club Atlantic Chapter support memos here: <https://atlantic2.sierraclub.org/content/legislation>.
19. That PFAS compound, 6:2 diPAP, is described as extremely persistent in the environment. It tends to break up into smaller PFAS compounds that are harmful to human health. “Our results suggest that toilet paper should be considered as a potentially major source of PFAS entering wastewater treatment systems.” Jake E. Thompson, et.al., “Per- and Polyfluoroalkyl Substances in Toilet Paper and the Impact on Wastewater Systems,” Environ. Sci. Technol. Lett. 2023, 10, 3, pp. 234-239, Publication Date: March 1, 2023, <https://pubs.acs.org/doi/10.1021/acs.estlett.3c00094>.
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21. Statement by Argyle Town Supervisor Bob Hanke at a Washington County Board of Supervisors Public Works subcommittee meeting. n.d.
22. Table 5. Permitted Biosolids Beneficial Use Facilities in NYS (2017), Biosolids Management in New York State, Albany, Division of Materials Management: March 2018, p.9.
23. Peter Mantius, “[Ignoring Casella’s Request, Thurston Board Votes 5-0 for Moratorium That May Interfere With Its Sludge Business](#),” Water Front, February 16, 2023, <https://waterfrontonline.blog/2023/02/16/ignoring-casellas-request-thurston-board-votes-5-0-for-moratorium-that-may-interfere-with-its-sludge-business/> ; Peter Mantius, “Three Casella Officials Watch in Silence as Thurston Warms to Idea of Banning Permits for Sewage Sludge Spreading,” Water Front, February 2, 2023, <https://waterfrontonline.blog/2023/02/02/three-casella-officials-watch-in-silence-as-thurston-warms-to-idea-of-banning-permits-for-sewage-sludge-spreading/>.

24. Phone call with Sally Rowland, NYS Department of Environmental Conservation, June 14, 2022.
25. The draft regulation sets a limit of 20 parts per billion for PFOA and for PFOS, two PFAS chemicals whose production was phased out. This is very high, analogous to setting the speed limit at 300 mph, and ignores the many other PFAS compounds detected in sewage sludge/biosolids. Maine's thresholds for use of sewage sludge/biosolids as a soil amendment before banning land application entirely in 2022 were 2.5 ppb for PFOA and 5.2 ppb for PFOS, and 1900 ppb for PFBS. "DMM-Draft 7: Biosolids Recycling in New York State - Interim Strategy for the Control of PFAS Compounds," n.d., https://www.dec.ny.gov/docs/materials_minerals_pdf/dmmdraftpolicy7.pdf.
26. "The EPA's controls over the land application of sewage sludge (biosolids) were incomplete or had weaknesses and may not fully protect human health and the environment." In "EPA Unable to Assess the Impact of Hundreds of Unregulated Pollutants in Land-applied Biosolids on Human Health and the Environment," Office of the Inspector General, Environmental Protection Agency, November 15, 2018, https://www.epa.gov/sites/default/files/2018-11/documents/_epaig_20181115-19-p-0002.pdf.
27. "In two reports: PFAS Waste Source Testing Report and Conceptual Leachate Treatment Scoping Study for New England Waste Services of Vermont (NEWSVT) Landfill Report, NEWSVT summarizes its sampling work and presents landfill leachate management and treatment options to reduce or eliminate the discharge of PFAS from leachate at wastewater treatment facilities. After taking over 100 PFAS samples from waste at the NEWSVT landfill, NEWSVT found PFAS in all landfill waste materials sampled. These materials included wastewater treatment plant and industrial sludges, contaminated soils, bulky waste, textiles, carpeting and commercial customer wastes. The report concludes that the most significant contributors of PFAS are residential materials, such as textiles, furniture and carpets." From press release, "Department of Environmental Conservation Releases Reports on PFAS Chemicals," Vermont Department of Environmental Conservation, February 5, 2020, <https://dec.vermont.gov/press-release/department-environmental-conservation-releases-reports-pfas-chemicals>. Also see, "2021 Vermont PFAS Surface Water, Fish Tissue, and Wastewater Treatment Facility Effluent Monitoring Report," Vermont Agency of Natural Resources, April 2022, <https://dec.vermont.gov/sites/dec/files/wsm/mapp/docs/2021-PFAS-Surface-Water-Fish-Tissue-and-WWTF-Effluent-Monitoring-Report.pdf>.
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34. Scientists found promise in a lye concoction used at 250-plus degrees on relatively small batches of contaminated material but have no idea how to heal an ecosystem. Dennis Thompson, "Breakthrough Might Break Down PFAS 'Forever Chemicals'," US News and World Report, August 22, 2022, <https://www.usnews.com/news/health-news/articles/2022-08-19/breakthrough-might-break-down-pfas-forever-chemicals> ; "PFAS," Commission Staff Working Document, European Commission, October 14, 2020, <https://www.documentcloud.org/documents/7333733-EU-PFAS-10-14-20.html>.
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