



Toxic PFAS chemicals measured in Nashville fertilizer

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Executive Summary

Many home gardeners buy compost or commercial soil amendments to enhance soil nutrition. But new tests reveal concerning levels of toxic per- and poly- fluoroalkyl substances (PFAS) chemicals in a popular garden fertilizer.

Public Employees for Environmental Responsibility (PEER) and Sierra Club Tennessee measured concentrations of PFAS or “forever chemicals,” in three bags of Music City Gold, a fertilizer made of sewage waste from the Nashville Central and Whites Creek wastewater treatment plants.

Music City Gold is advertised as “all natural” and “organically rich” yet the fertilizer samples contained an average of 78.6 parts per billion (ppb) of 36 different PFAS chemicals. All three samples had concentrations of one chemical - PFOS - that exceeded a screening guideline set in the state of Maine to protect groundwater from contamination, the only state that currently regulates PFAS in biosolids.¹ The findings mirror results from a [2021 study of 9 similar sludge-based fertilizers](#) conducted by the Ecology Center of Michigan and Sierra Club.² All of these natural fertilizers are made from “biosolids” or processed sewage waste.

We are concerned that PFAS levels in these fertilizers could cause garden crops to be a source of exposure for home gardeners, and pose similar problems in the U.S. food supply. PFAS are per- and polyfluoroalkyl substances, a class of thousands of widely used human-made chemicals, that do not readily break down in the environment; many accumulate in people, fish and other living beings. Some PFAS that have been studied cause a myriad of health problems in people, including cancer. Industries are currently allowed to flush PFAS-containing waste into wastewater drains that flow to treatment plants. The chemicals are not removed during sewage treatment and some of the chemicals settle in solid materials left over in the treatment process, while the remaining portion is flushed back into surface waters where they contaminate fish and sully downstream drinking water.

Americans generate massive quantities of sewage waste each day. Nearly half of sewage sludges are treated to kill pathogens and then spread on farms, pastures, and wildlands for disposal, where nutrients like nitrogen improve soil productivity. The wastewater industry and EPA now

call treated sludge “biosolids,” a term used to hide its origin and make the product sound more acceptable. Unfortunately, the average person does not know this term, and biosolids can carry a variety of persistent and toxic chemicals, in addition to PFAS, which can threaten our food supply and contaminate water sources.

Our testing reveals that American gardeners can unwittingly bring PFAS contaminants home when they buy fertilizer that is made from sludge-biosolids. Our laboratory results provide a snapshot of PFAS levels in complex wastewater systems. The findings are in line with national surveys of PFAS in sludge-biosolids, and academic studies testing biosolids-based fertilizers and composts. Available evidence suggests that PFAS and related chemicals in sewage sludge could jeopardize the safety of the commercial food supply and home gardens, particularly in places where industrial contamination releases high levels of the chemicals.

The Tennessee Department of Environment and Conservation is [pledging to address PFAS pollution in the state](#), but appears to be primarily focusing on testing, not clean up. Like other states, it is moving slowly in a bureaucratic process that will likely take years to address and avert PFAS emissions from local industries, or clean up contaminated sites. TDEC has an [interdisciplinary work group](#) and pledges to be coordinating with the state Department of Health. Other states like Maine, Michigan and Colorado are trying to limit PFAS pollution from entering the wastewater system from industries like metal platers, tanneries, refineries, and requiring wastewater systems to measure the contamination and determine the major sources of pollution in their sludge.³

State and federal laws do not require that PFAS be measured in Tennessee sewage sludge. The state regulates the application of waste “biosolids” to lands in the state under a single [general permit](#) and requires permittees to file an annual report with the location of disposal site, crop, size of plot, application rate and measurements of a handful of EPA-regulated pollutants.⁴ We have been unable to locate the details in these reports, specifically the locations where biosolids are applied to crops in the state. EPA requires that wastewater systems heat-treat sludge and [test for a small number of pollutants](#) like heavy metals, but not PFAS, before applying the materials to food crops.⁵ EPA is assessing the [risks posed by PFAS in sludge](#), but this work will not be completed for several years.

We call for the city of Nashville to stop contracting with Tycowa to process and sell its sewage waste to the public. Quick fixes are more elusive for the larger issue of sewage waste disposal. Our test results suggest that urgent changes are needed to halt the unnecessary uses of PFAS in commerce and minimize the amounts that are discharged into our wastewater system. The EPA and the Tennessee Department of Environment and Conservation must keep PFAS and other persistent chemicals out of wastewater systems, biosolids, and the food supply. This means preventing industrial polluters from discharging PFAS in their wastewater. Agencies must survey the hazard of food production on highly contaminated soils and regulate land application of biosolids with high levels of PFAS and other chemicals.

Ultimately the companies that made and used PFAS must pay for the damages that their chemicals pose to people and the environment, including costly cleanups of contaminated places. The most efficient and effective way to protect people from the growing threat of PFAS exposure is to end the use of PFAS, with limited exemptions.



Music City Gold Product Package Front: Image source: <https://www.tycowallc.com>

Recommendations

The only way to keep PFAS and other persistent chemicals out of biosolids is to limit the chemical's production and use. Federal and state governments can do this by banning the uses of PFAS in all non-essential products. They can also ensure industry and wastewater treatment systems take urgent action to reduce the amount of PFAS that is discharged into water supplies, control the disposal of biosolids, and stop selling these products for home garden use.

Federal agencies -

The government must urgently act to end PFAS use in commercial products and releases from industrial sites. These include industries producing and using PFAS—metal plating, paper, textiles, and plastics—and industries who have used PFAS for fire suppression (airports, refineries, military bases and fire training sites). It must require these industries stop washing PFAS down wastewater drains and clean up soil contaminated from historic uses.

EPA must set enforceable limits for PFAS and other persistent chemicals in biosolids products applied to farmlands or home gardens. Sewage sludge products are not allowed to be applied to lands used to raise certified organic foods, and these protections should be extended to all agricultural sites and dairies.

States -

Unfortunately the federal government has not moved quickly to regulate PFAS or their emissions into the environment. Forty-seven states have direct oversight over chemicals discharged into the wastewater system and can set permit limits on PFAS in wastewater. Several states are way ahead of the federal government in investigating contamination of food and farmland, setting up new permit systems to keep contaminated sludge off of farmland, and pursuing remedial actions against industrial polluters.³ Most states also have the power to set rules related to biosolids disposal. The state of Maine has banned all land application of sewage waste due to PFAS concerns.⁶

While PFAS are a national, even global, problem, Tennessee has done some basic work to identify contamination in state surface water, drinking water and even fish. Over the past several years

the state has identified several types of industries as posing “high” priority industries including: fabric and plastic companies, metal platers, landfills and sites contaminated by the historic and ongoing use of PFAS in fire fighting foams (military bases, airport sites and fire training sites).

Tennessee should address PFAS in wastewater by identifying sources of historic and ongoing contamination, setting permit limits for discharging industries, and prohibiting the use of biosolids on food crops.

City of Nashville -

Nashville can and should take action to reduce the amounts of PFAS and other contaminants in wastewater and the byproduct, [Music City Gold](#), that it contracts to sell as a home fertilizer. Nashville reports that selling sewage sludge has saved \$4 million in waste disposal for the [18,500 tons of biosolid it has produced](#) since October 2018. It should stop marketing sewage waste to the public due to PFAS and other persistent contaminants in sludge. The city should test for PFAS in sludge and wastewater effluent (liquid waste). At a minimum it could require the contractor to clearly label Music City Gold so that it is not used on food crops or in a way that threatens groundwater in places with shallow wells. Ultimately it must find safer disposal alternatives for city waste.

Other players-

- **The chemical industry** must stop releasing PFAS into air, wastewater, surface water, and as solid wastes. It must immediately look for safe alternatives to PFAS in all products. PFAS chemicals should be phased out, with only limited exceptions for essential uses where safer alternatives are not presently available, such as certain materials used in medical devices.
- **Wastewater treatment plants** must investigate sources of PFAS discharged into their systems and require industries intervene to capture PFAS before it enters their systems. This is important for all systems, not just those that sell biosolids-based fertilizers to home gardeners and landscaping services.
- **Agricultural producers** should not apply biosolids to their crop and pasture lands. Doing so risks [permanently contaminating their soils with PFAS](#) and other long-lasting chemical contaminants.

- **Home and community gardeners** should check the label of fertilizers to ensure products are not made from biosolids. Look for a text box labeled “Guaranteed Analysis” or a disclaimer on the back that would use the term “biosolids.” Ask landscapers or commercial nurseries if soil, topsoil, composts or other garden products are made from “biosolids”—which they may describe using other vague terms like “residuals” or “municipal wastes”—and avoid purchasing them.
- **Companies making public-use fertilizers from biosolids** must - at a minimum - clearly disclose the presence of potentially harmful chemicals in their products. Sludge is not allowed on certified organic farms, and usually not allowed to be used on fruits and vegetables that are eaten raw. It is irresponsible to call these products “natural”, “organic” or “safe.”

Federal and state regulators should end the sale of sludge-based fertilizers for home uses. Short of that they should fix the labeling rules to say they are made from sewage waste, disclose the fact that wastes contain a number of different types of persistent and toxic chemicals, and ban terms like “natural” “organic” or “safe” from the labels.

The problem with 'natural' home fertilizers made from sewage biosolids

The product we tested, Music City Gold, is just one of many home fertilizers made out of human waste or treated sewage sludge. While EPA and state laws may restrict the application of sewage sludge on certain types of food crops, these products are marketed for use on vegetable gardens and container gardens where people may unwittingly eat food raw and unwashed where they could be exposed to pathogens or other harmful compounds in the products. PFAS and other pollutants can be taken up into the plants themselves and not removed during washing, cooking or peeling of produce.

Wastewater sludges can contain dozens of different types of persistent, synthetic chemicals which are not broken down in the normal heating or treatment process. These include chemicals used in industrial or consumer products, heavy metals, and even residues of human antibiotics that are present in our waste. EPA tracks the variety of chemicals measured in sludge, and is undergoing a

Music City Gold is a natural alternative to chemical fertilizers, and is safe for human or pet contact. It is a pelletized source of micronutrients that will restore your soil health and increase organic matter. Music City Gold will build soil structure and moisture retention, and the slow release of nutrients will sustain your plants throughout the growing season.



Vegetable Gardens

Application Date	Application Rate	Additional Information
Before planting	5 lbs per 100 sq ft.	Rake in and plant
During growing season	5 lbs per 100 sq ft.	Between plants, rake in lightly

Container Gardens

Application Date	Container Size	Application Rate
Apply every 6-8 weeks	1/2 gallon	1 tbsp
Apply every 6-8 weeks	1 gallon	2 tbsp
Apply every 6-8 weeks	2 gallon	4 tbsp

Lawns (Zone 7)

Application Date	Application Rate
April	2 lbs per 100 sq ft
May	2 lbs per 100 sq ft
September	2 lbs per 100 sq ft
November	2 lbs per 100 sq ft

Avoid nitrogen applications to summer grasses less than one month before the average first frost date in area.

Nutrient Analysis

45 lb/ft³ Density

7.5 pH

5.0% Nitrogen (N)	0.8% Sulfur (S)	0.0008% Molybdenum (Mo)
5.0 % Available Phosphorus(P ₂ O ₅)	0.0025% Boron (B)	0.003% Nickel (Ni)
0.2% Soluable Potash (K ₂ O)	0.02% Copper (Cu)	0.04% Sodium (Na)
3.0% Calcium (Ca)	2.0% Iron (Fe)	0.05% Zinc (Zn)
0.3% Magnesium (Mg)	0.15% Manganese (Mn)	

Music City Gold is manufactured by Metro Water Services in Nashville, TN. It is made from heat-dried, natural microbes that are used to clean water. The microbes are heat-treated at over 1,000°F to kill pathogens, and then screened for a uniform 1-4mm pellet for easy application. Pellets meet or exceed all EPA 503d requirements for Class A Exceptional Quality Biosolids and agricultural fertilizers.

Nashville Metro Water Services
1810 Cement Rd.
Nashville, TN 37208
615-862-4892



Music City Gold is a natural soil amendment and is not intended for human consumption. It should be stored in a cool, dry place out of the reach of children or pets. Use in a well-ventilated area and avoid breathing dust. To prevent nutrient pollution, do not dispose in storm drains, streams, or waterways.


Tycowa, llc
Organic Rich Bio-fertilizer

Distributed by Tycowa, LLC
4714 Mt. Zion Rd. Springfield TN
(615) 533-3981
www.tycowallc.com

Music City Gold Product Package Back: Image source: <https://www.tycowallc.com>

multi year study to determine if PFAS pose a risk in food crops treated with biosolids.

Music City Gold advertises itself as “all natural” and “organically rich” on the front of the label, and the back label claims to be “safe for human contact” to be used on vegetable and container gardens. The only indication of the product’s origin is in the lower back portion, which specifies the product is made from “heat-dried, natural microbes” and meets EPA’s requirements for “Class A Exceptional Quality Biosolids and agricultural fertilizers.” While this product meets labeling requirements it obscures the fact that the product is made from sewage waste.

We believe that Music City Gold and other biosolids-based home fertilizers should not be sold until EPA and states set contaminant limits and inform purchasers about the risk of PFAS and other contaminants in sewage wastes.

If you want to [purchase a sludge-free fertilizer](#), look for and avoid products that say they are made from “residuals” or “biosolids” on the packaging. If you are purchasing compost or topsoil from a landscaping company or contractor, ask for details about the origin of the product. Terms like “residuals” “biosolids” and “municipal waste” or “microbes” are code words for fertilizers made from human sewage and industrial waste.



Photo Nashville Central Wastewater Treatment Plant, image source: [USGS](#)

Persistent chemicals measured in sewage sludge solids:⁷

- dioxins and furans
- polychlorinated biphenyls (PCBs)
- flame retardants (PBDEs)
- volatile hydrocarbons
- pharmaceutical drugs
- polycyclic aromatic hydrocarbons (PAHs)
- persistent pesticides
- antimicrobial ingredients (parabens),
- heavy metals
- fragrance additives

Challenges of Sludge-Biosolids Disposal

PFAS and other highly persistent chemicals are not removed by sewage treatment, and leach from fields and landfills back into the environment.

The biosolids industry and governments have aggressively marketed land application of biosolids as a cost-effective disposal solution for the massive quantities of human waste, residential, and industrial wastewater produced daily. While the tenets of a circular economy and recycling would support the reuse of nutrients from human sewage, our homes and industries are the source of [hundreds of persistent chemicals](#) that are spread back to land via this practice.⁸

There have been several high-profile cases where land application of biosolids spread harmful amounts of PFAS into the environment. In Alabama, [3M and Daikin released large amounts of PFAS wastes](#) from Decatur facilities into the local wastewater system. The land application of highly contaminated biosolids over more than a decade [contaminated 5,000 acres of farmland, community water supplies](#), and agricultural products. In Maine, several farmers and dairy producers have discovered that biosolids applications have permanently contaminated their pasture lands, [rendered their products unsellable](#), and impacted dozens [of nearby wells](#).

The land application of sewage wastes is also a hidden but pervasive social equity issue. As with all issues of waste disposal, facilities tend to be located near marginalized communities that have less power to influence local land use decisions. People living near biosolids composting facilities experience odors, increased vehicle traffic, and the threat of local water contamination.⁸ Neighbors of farmers applying biosolids as fertilizer complain of illness, contaminated water supplies, and loss of property values and quality of life.

Unfortunately, other disposal options are also problematic. They can be expensive as well as energy- and space-intensive. When it comes to highly persistent and mobile chemicals like PFAS, each of these disposal options will not fully destroy the chemical wastes. The EPA estimates that about 16 percent of the nation's biosolids are incinerated for energy recovery or waste reduction.⁹ However, incineration is energy-intensive and does not destroy PFAS, which are highly heat-resistant. Instead, incineration can spew a range of harmful breakdown products into the air, ultimately contaminating land and water far from the incineration site.¹⁰ Waste ash from incinerators still needs to be disposed of in landfills and managed in perpetuity.

According to the EPA, 22 percent of biosolids are disposed of in landfills.⁹ Landfilling biosolids is space-intensive and expensive due to the volume produced. PFAS and other mobile chemicals

leach out of the liquid wastes produced by landfills and need to be managed—either by reinjecting them back into the landfill or by filtering liquids to concentrate the chemicals onto a polymer or carbon filter material, which itself must be contained for centuries. Some landfills send liquid wastes to local wastewater treatment plants, which has the effect of sending PFAS and persistent chemicals back into circulation in land and waterways. Furthermore, even lined landfills will eventually leak, and PFAS and other persistent pollutants are commonly measured in the groundwater near landfills.

New technologies—supported by financial incentives from the government to invent them—are desperately needed to address PFAS and other persistent chemicals in wastewater. In the interim, we must act with haste to prevent controllable sources of PFAS discharge and ensure polluting industries—and not the public—pay for the cost of disposal.

Top things states can do now to control PFAS pollution

- Identify sources of historic and ongoing PFAS pollution in state soil, water, drinking water, agricultural lands, wildlife and food crops
- Limit discharges to wastewater or sewer systems or into air
- Ban the sale of PFAS-containing consumer products
- Sue the companies responsible for PFAS pollution and spend the money on clean up
- Restrict the sale and use of PFAS foams in fire fighting
- Test wastewater and sewage sludge for PFAS and other contaminants. End the sale of sewage-based fertilizers and stop land applying industrial sewage waste to food and dairy fields.

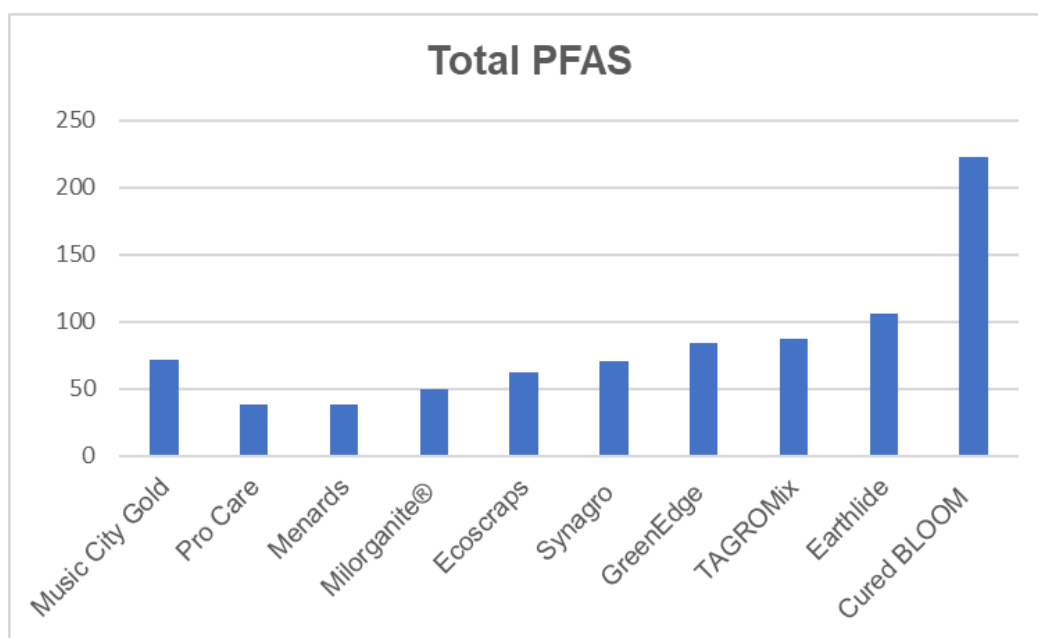
Full test results for Music City Gold

PEER purchased 3 bags of Music City Gold from the Davidson County Farmers Coop in Nashville. The samples were sent to Eurofins Analytical Services for analysis of 36 PFAS chemicals and 19 were detected. Reporting limits are 0.6 ppb for most compounds and 2 ppb for Me-FOSE Et-FOSE). The concentrations of PFAS measured in the Music City Gold fertilizers ranged from 75 to 81 parts per billion in the three samples. For perspective, this is roughly 1,000 times higher than the concentrations found in most places where PFAS contaminated drinking water, and a million times greater than EPA's new updated health advisory for PFOS and PFOA in drinking water (4 and 20 parts per quadrillion for PFOA and PFOS respectively).¹¹

PFAS measured in 3 bags of Music City Gold (parts per billion)

	PFOA	PFOS	Et-FOSAA	Me-FOSAA	Sum of 36 PFAS chemicals
Bag 1	1.2	9.3*	38	7.9	75.0
Bag 2	1.2	11*	41	8.3	81.0
Bag 3	1.1	10*	42	8.3	79.9
Avg of bags	1.2	10.1*	40.3	8.2	78.6

* = Exceeds Maine screening limit for beneficial use of biosolids, which is 5.2 ppb for PFOS and 2.5 ppb for PFOA.¹

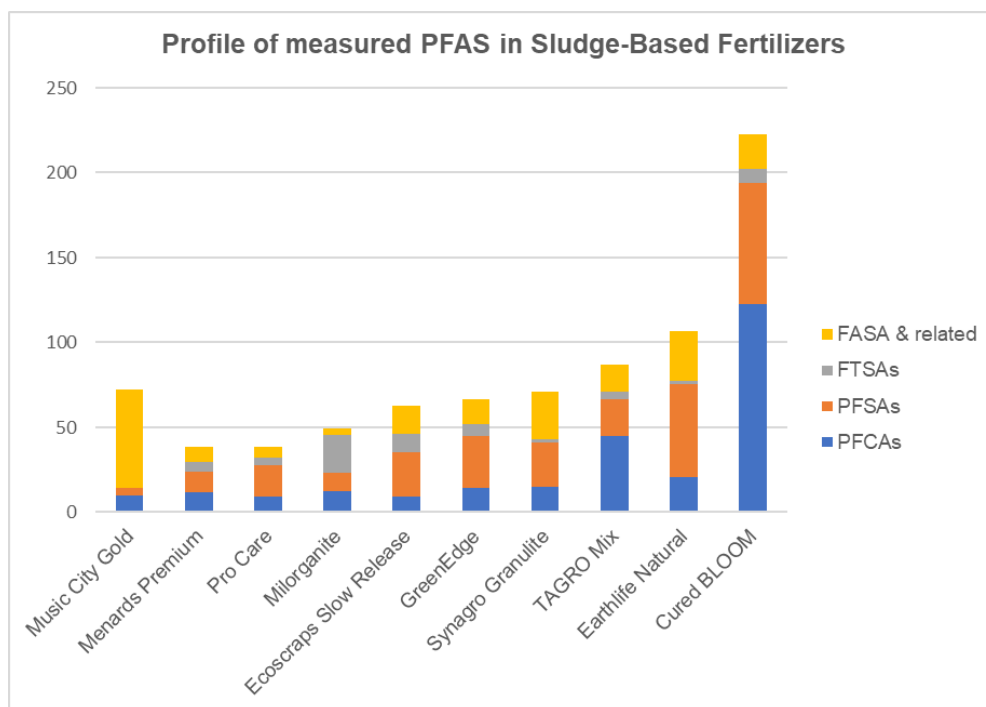


Source: Sierra Club and Ecology Center²

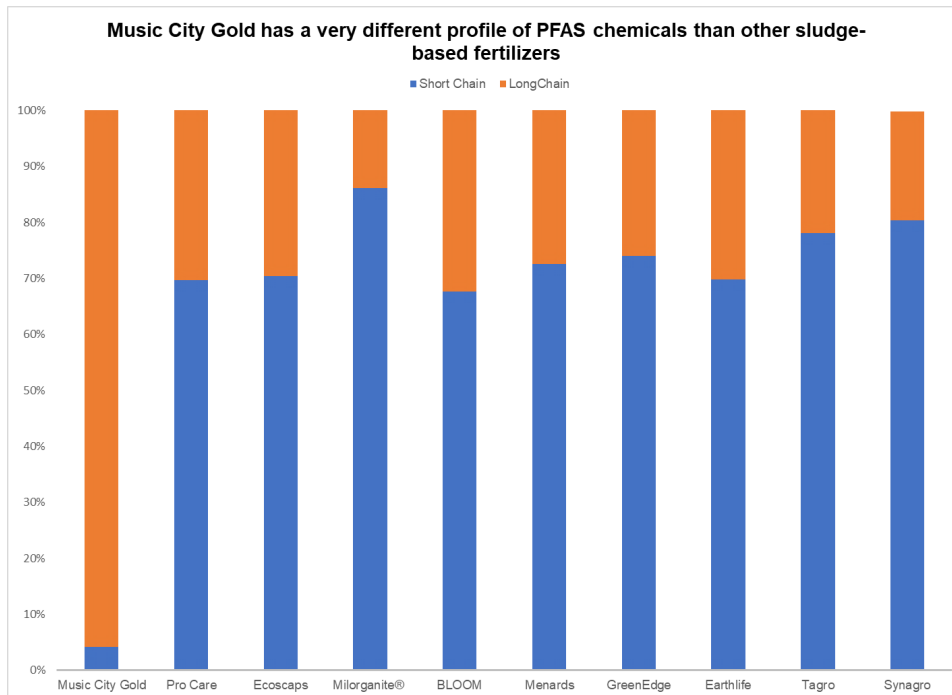
The total amount of PFAS in Music City Gold measurements are otherwise in a similar range to the nine products that the Sierra Club and Ecology Center purchased and analyzed in 2021.² The PFAS measurement for those samples ranged from 38 to 233 parts per billion with the highest level being Cured Bloom (made from waste in the Washington DC wastewater system). Like Music City Gold, the other fertilizer products also exceeded the State of Maine screening level for PFOS and some also violated the screening level for PFOA, two historically used PFAS. Those two chemicals were largely phased out of commerce in the U.S. in the early 2000s due to concerns about their persistence and harmful effects to people and wildlife. They may still be used in [products imported into the United States](#), and older PFAS-based fire fighting foams held by many fire departments or heavy industries. PFOS and PFOA contamination still persists in commercial and wild foods, drinking water, and the environment.

The types of PFAS in Music City Gold samples were very different from other products we've tested. These samples were dominated by two chemicals known as Ethyl-FOSAA and Methyl-FOSAA. Both chemicals were not detected in any samples in our prior study. These chemicals are used as replacements to legacy PFAS compounds, used to treat paper and textiles and make them water- and stain-resistant. FOSA chemicals can degrade to form the types of PFAS most commonly regulated in drinking water, [including PFOS](#).¹¹ We are concerned that

Me-FOSAA and Et-FOSAA measured in Music City Gold will break down over time to yield even more PFOS in home garden soils.



On balance, the Nashville sewer system has much higher loads of newer generation PFAS that are in current use, rather than legacy forms. If motivated, city and state representatives could identify the industries responsible for this pollution from the wastewater system and require them to replace the PFAS compounds with alternatives, and in the interim, treat wastewater to remove the chemicals.



Our laboratory was able to measure 36 of the thousands of possible PFAS chemicals on the market. The testing we conducted in 2021 included two other innovative methods to demonstrate the mass of unidentifiable fluorine-based compounds in the samples. In those samples we demonstrated that the samples contained 2 to 8 times more chemicals that can break down into PFAS in the environment. The samples also contained hundreds to thousands of times more unidentifiable synthetic fluorine compounds.²

Sierra Club Tennessee and PEER recommend that Nashville, the State of Tennessee, and federal agencies quickly move to identify and limit the source of PFAS in the environment, particularly wastewater sludges. These contaminated materials should not be applied to food crops, and not sold to unwitting home gardeners.

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