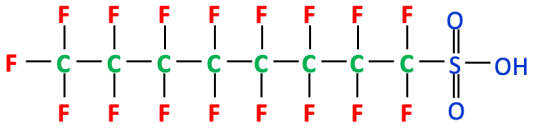
Cornell Cooperative Extension

Understanding PFAS Risk on Your Farm

Frequently Asked Questions

What are PFAS?



Perfluorooctanesulfonic acid (PFOS)

8 carbons

Perfluorohexanesulfonic acid (PFHxS)

6 carbons

Perfluorobutanesulfonic acid (PFBS)

4 carbons

Maine Department of Health and Human Services

PFAS (per- and polyfluoroalkyl substances) is the common acronym for a large group of synthetic chemicals used in manufacture of many items since their invention by 3M and DuPont in the 1940's. The exact definition of PFAS differs between the EPA, some individual states, and other agencies.

Broadly, a PFAS compound contains at least one or two fluorinated carbon atoms. The extremely strong carbon-fluorine bonds are what give PFAS compounds their unique and recalcitrant properties.

When first manufactured, PFAS were seen as a groundbreaking new technology in chemistry because they have persistent non-stick, water-, grease-, heat-, and stain-proof properties. PFAS are used in coatings and surface treatments in a range of everyday items: nonstick cookware, waterproof and stain-resistant fabric and clothing, cosmetics and personal care products, food packaging, and more. PFAS have also been used in firefighting foam.

Why should I be concerned?

The persistent properties of PFAS chemicals are also what cause them to be so problematic in the environment and for our health. They break down extremely slowly in the environment, which is why they are known as "forever chemicals" and may have a half-life in water of more than 92 years. They readily move through water, soil, plants, and animals. The CDC recently estimated that 97% of Americans have PFAS chemicals in their bodies.

Cornell Cooperative Extension Essex County
Cornell Cooperative Extension Eastern NY Commercial Horticulture Program
Cornell Cooperative Extension North Country Regional Ag Team

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Why should I be concerned?

Since they are so prevalent and persistent, PFAS eventually end up in wastewater treatment facilities. It is important to also understand that these compounds are considered toxic at extremely low levels and when we measure them in soils, we are measuring parts per billion (ppb) and when we are measuring in liquids (water, milk), we are measuring in parts per trillion (ppt).

Exposure to PFAS has been linked to health problems, including:

- High cholesterol
- Cancer
- Kidney and thyroid diseases
- Ulcerative colitis
- Birth defects
- Autoimmune disease
- Decreased vaccine response in children

How do PFAS enter a farm landscape?

Researchers who have conducted PFAS sampling studies have found that these compounds are ubiquitous in the landscape at low levels as a result of manufacturing pollution and use of PFAS-containing materials in a wide range of farm and household products. Recently, PFAS contamination on farms has received more attention in the Northeast after high profile cases in Maine involving contaminated milk, meat, and vegetables.

Beginning in the 1980's, the state of Maine encouraged spreading of industrial and municipal biosolids (sludge) on farms to repurpose the waste as a soil amendment. Routine monitoring of a water source near a dairy farm in southern Maine found detectable levels of PFOS, which prompted further testing and revealed a link between sludge application and PFOS contamination of water, soil, forage, and farm products (milk and meat). Maine CDC developed guidance and set interim adulteration standards for milk and meat and further testing revealed additional contaminated dairy and vegetable operations along with numerous adjacent well water contamination of private homeowner water supplies.

Blood testing of the farmers and homeowners with contaminated wells also revealed very high levels of PFAS in some instances. These cases have received national attention and have caused significant economic and personal harm to the farms, farmers, and adjacent landowners. Biosolids application occurs in many states around the country, including NYS.

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While a high inclusion of paper product manufacturing waste in a municipal wastewater treatment system is expected to be the root cause of the heaviest instances of PFAS contamination in Maine, PFAS contamination of agricultural lands was found from other sources in Maine, and elsewhere, and can include:

- Industrial waste and wastewater discharge
- Aqueous firefighting foam, commonly used on air force bases and airports
- Landfill leachate
- Compost made from food service products and packaging, particularly compostable bowls, plates, and cutlery
- Ground or surface waters contaminated by nearby sludge application, industry, or other sources
- Commercial fertilizers or amendments containing municipal biosolids
- Pesticides in which the active or inert ingredients are PFAS compounds. Since 1998, over 50% of registered pesticide products contain PFAS. PFAS have also been used in the manufacture of pesticide containers and been shown to leach into the pesticide over time.

How can I assess the PFAS risk on my farm?

To determine whether your farm is at risk for PFAS contamination, an important first step is to consider your land use history. Have municipal biosolids been applied to your land in the past? Because PFAS are “forever chemicals” it is important to look back several decades. Some state records may provide data. Other data may be available from prior landowners, managers, or neighbors. Many of the contaminated sites in Maine were spread in the 1980’s. If there is a history of biosolid applications, the next step would be to test the farm fields for PFAS. Knowing the level of PFAS in the soil will help you make cropping decisions that will lower the risk of adulterating your final farm product.

Research has shown that different farm products will have varying risks of PFAS accumulation. Grass forages and leafy vegetables pose the highest risk of contamination because these plants will take up and accumulate the largest amounts of PFAS chemicals from soil and water. Research has also shown that corn silage, grains, fruits, and fruiting vegetables accumulate less PFAS. Contamination of forages fed to livestock has shown to quickly contaminate milk and meat. Maine has been able to decrease PFAS levels in three dairy herds by changing the forage base and feeding non-contaminated forages. Research is needed to better understand accumulation risks and to inform thresholds in various agricultural products.

- Transfer factor (soil to crop) risk: Soil > Leaves and stems > Fruits and seeds
- Transfer factor (soil to crop to animal): Soil > Grass and legume forages > corn silage > high moisture ear corn > snaplage > grain > animal

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How can I reduce risk of PFAS contamination on my farm in the future?

If your farm does not currently have high PFAS levels in its soil or water, you can take several steps to limit the introduction of PFAS in the farm landscape. Avoid application of both municipal and industrial biosolids to your property. Do not compost "compostable" plates, bowls, and cutlery on the farm, and test compost you purchase if foodservice waste is used in its formulation. If switching to a new water source for irrigation or animal use, test before using if you suspect the possibility of PFAS contamination.

Many synthetic pesticides contain PFAS compounds. Familiarize yourself with the list of PFAS pesticide ingredients and avoid their use on the farm. Lastly, you may choose to purchase PFAS-free products for use on the farm. For example, certain companies offer PFAS -free food packaging that you could use for your farm products, and PFAS-free rain gear for outdoor working. See "Resources" for more information.

How can I test my farm for PFAS contamination?

Soil and water testing for PFAS is a useful tool if you or your customers are concerned with contamination on your farm. Soil, water, and agricultural products (such as crops, meat, hay, or milk) can be tested, costing $300 to $500 per sample for the most common PFAS compounds.

Collecting, submitting, and analyzing samples for PFAS compounds is more complex than for other types of more standard soil, water, and plant testing since cross contamination and adulteration of the sample can easily happen. Specific protocols must be followed for meaningful results and may require the use of nitrile gloves, special provided containers, or additives. Contamination of the sample must be avoided since PFAS can shed from bottle caps, packing materials, clothing, and personal care products on your skin during sampling. Each lab will provide specific guidance for sample collection, chain of custody, and transport. The New York Department of Health has a quality control and accreditation system for labs offering environmental PFAS testing.

A link to their database of accredited labs is provided in the resource list at the end of this document. Before sampling, reach out to your county Soil & Water Conservation District, CCE, or other agricultural service provider for assistance.

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How can I test my farm for PFAS contamination? (cont.)

Before testing, it is important to think through the following:

- You are likely to find PFAS, at least at low, background levels.
- Where will you sample? Do you have reason to suspect that PFAS are present in your water, soil, or soil amendments? If you have a well, a logical first step is to perform a test of your water, which often coincides with soil contamination.
- What will you do if you obtain a high test result? If a test result reveals PFAS contamination in a field, you may want to consider altering the crops produced based on the uptake or transfer factor of the crop. It is also useful to then test specific farm products to determine if there is uptake by plants or animals, and whether there is risk to the consumer.
- Do you have a traceability program in place if you decide to recall your farm's products if contamination is found, and/or will you suspend future sales if unsafe PFAS results are found?

If my farm is contaminated, are there remedial actions I can take?

- Filter water: granulated active carbon (GAC) filters are the most economical. Other filtration systems for PFAS are available but are typically not practical for large volumes of water, e.g., bubble concentration and/or reverse osmosis or ion exchange filtration.
- There are no soil remediation practices recommended for PFAS until further research has been conducted. If a farm identifies contaminated fields, they may consider ceasing production in those fields or transitioning production to a lesser risk product.
- Some farms have been successful in producing alternative farm products that accumulate fewer PFAS, e.g., producing fruit or grain crops versus leafy vegetables or feeding grain to livestock versus hay produced on the farm. In some instances of contaminated water sources but minimal soil contamination, filtration or new supply of irrigation water has allowed for continued production of leafy greens with no detectable PFAS.
- Carefully select which fields are used for forage vs grain production or consider buying in forage harvested from fields which have little or no PFAS found in soil tests.

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Are there resources available to help me assess my farm's risk?

There are many resources available to assist farmers and agricultural service providers with understanding PFAS contamination on farms. Research is ongoing, and new regulatory information from federal and state governments is released regularly. Many scholarly research articles have been published on PFAS health, environmental, and agricultural risks, but some are behind a paywall. If you are seeking a particular resource, contact Cornell Cooperative Extension for assistance and access to publications and other documents.

Information for farms and agricultural service providers

Physical health concerns: *Please consult your physician if you have concerns about your own health.*

"Per- and Polyfluoroalkyl Substances (PFAS) and Your Health," from the Center for Disease Control's Agency for Toxic Substances and Disease Registry https://www.atsdr.cdc.gov/pfas/index.html

Maine resources:

- Maine Department of Agriculture, Conservation, and Forestry PFAS resources—https://www.maine.gov/dacf/ag/pfas/index.shtml
- Assessing PFAS contamination and managing risks on dairy farms in Maine— https://www.maine.gov/dacf/ag/pfas/docs/Dairy%20Risk%20Management%20March%202023.pdf
- Recommendations to farmers managing PFAS risks: Hay— https://www.maine.gov/dacf/ag/pfas/docs/Hay%20Farmer%20Recommendations.pdf
- Guide to investigating PFAS risk on your farm—https://extension.umaine.edu/agriculture/guide-to-investigating-pfas-risk-on-your-farm/
- Board of Pesticide Control report on pesticide products containing PFAS, including list of active ingredients to be banned in the state by 2030: https://www.maine.gov/dacf/php/pesticides/documents2/bd_mtgs/Oct22/3a-2022%20PFAS%20October%20Memo%20Tox.pdf

Currently, NYS has not taken action to ban PFAS-containing pesticides.

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Testing in NYS:

NYS Department of Environmental Conservation has adopted standards for PFAS sampling and testing and has published guidance in a handbook titled "PFAS sampling guide: Sampling, analysis, and assessment of per- and polyfluoroalkyl substances (PFAS)." Access this handbook here https://www.dec.ny.gov/docs/remediation_hudson_pdf/pfassampanaly.pdf

NYS Department of Health's Wadsworth Center operates an Environmental Laboratory Approval Program and publishes a database of accredited laboratories, located anywhere in the US, which are approved to handle samples to their standards from NYS. Several environmental testing labs are accredited in NYS for PFAS testing using the standardized EPA methods. As awareness of PFAS contamination increases, more labs may be added to this list. Search the NYS DOH database at the link below. Select the appropriate method in the METHOD field, and a search will reveal lab options offering tests for PFAS-type compounds in soils and solids. Several labs currently offer approved PFAS testing packages for a set of the most common PFAS chemicals. Access the laboratory database here: https://apps.health.ny.gov/pubdoh/applinks/wc/elappublicweb/

For testing soil or biosolids, as well as plant or animal tissues, milk (cow, goat, sheep) select "EPA 1633" or "EPA 1633 Draft" in the Method field for a list of all labs that meet NYS standards for analyzing 21 to 40 PFAS compounds in solid materials. Cost will likely be $400-500/sample.

For testing non-potable water, select "EPA 1633" or "EPA 1633 Draft" again. Labs listed will test for 21 to 40 PFAS compounds for $375-450/sample.

Drinking water should be tested using "EPA 537.1" or "EPA 533" methods and will likely cost $250-300/sample.

Goods manufactured without PFAS: PFAS Central database—https://pfascentral.org/pfas-free-products/

Financial, farm business, and mental health resources:

NY FarmNet is a free and confidential counseling resource for farmers dealing with financial, business, family, and personal crises, and concerns. They can be reached from 9 am – 4:30 pm weekdays at 1-800-547-FARM (3276) or NYFarmNet@cornell.edu.

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Guide Authors:

Elisabeth Hodgdon, CCE ENYCHP
Kitty O'Neil, CCE NCRAT
Elizabeth Lee, CCE Essex
Caleb Goosen, MOFGA
Richard Kersbergen, UMaine emeritus

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