CIVIL EATS

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New Evidence Shows Pesticides Contain PFAS, and the Scale of Contamination Is Unknown

The EPA knows that plastic containers are leaching toxic 'forever chemicals' into pesticides. But PFAS are also ending up in pesticides from other sources—in much higher quantities.

BY LISA HELD NOVEMBER 7, 2022

Once a year, researchers, agrichemical company representatives, and government officials get together at a conference dedicated to what they call pesticide stewardship. By their definition, stewardship includes improving the safety of pesticides, from manufacture to use to disposal.

At the most recent event last February, Ed Messina, director of the Office of Pesticide Programs at the U.S. Environmental Protection Agency (EPA), spoke to the virtual crowd. After running through at least a dozen other topics, he turned to per- and polyfluoroalkyl substances, or PFAS—"forever chemicals" that companies have used for decades in products including non-stick pans, takeout containers, and cosmetics—causing long-term damage to the environment and human health.

Recent tests had detected PFAS in pesticides, Messina told the group.

The agency planned to release the results of more thorough tests done to determine whether PFAS were leaching from plastic containers into the pesticides, he added. "The data does indicate that the amount of PFAS entering the environment [via pesticides] is extremely small," he assured attendees, "but we do want to get a handle on where the PFAS is coming from."

Now, the EPA has released the results of the study on leaching, which confirmed the issue. But while the agency maintains Messina's assertion that the amount getting into the environment as a result is not significant, it's not the only source.

Investigation Highlights

• Scientists in multiple labs have found dangerous levels of PFAS in commonly used pesticides.
• EPA tests have confirmed some PFAS are leaching from plastic containers into the pesticides.
• Civil Eats discovered that two other sources of PFAS in pesticides—inert ingredients added to help disperse the chemicals and the pesticides themselves—could lead to higher levels of contamination of soil, water, and food.
• Maine, the first state to try to restrict PFAS in pesticides, is wrestling with how to identify and regulate these emerging sources.

A Civil Eats investigation has found that leaching is only one of three sources of PFAS in pesticides. In addition, the scale of PFAS contamination in pesticides is far from understood. Using an internationally recognized definition, dozens of pesticides registered in the U.S. inherently qualify as PFAS themselves, based on their molecular structure, and some PFAS are still approved by the EPA as additives to pesticide formulations.

In a recent email, the EPA told Civil Eats it "will continue to look closely at existing pesticide products to determine whether they contain PFAS as a result of the active

and evolves, EPA will also continue to follow the science and adjust, as appropriate, to help ensure that pesticide products do not cause unreasonable adverse effects on human health or the environment."

While recent data suggests the levels of PFAS in pesticides are lower than the concentrations found in now-familiar sources of contamination such as firefighting foam and sewage sludge, advocates are alarmed by the volume: Every year, farmers apply about 1 billion pounds of pesticides to nearly 900 million acres, touching soil, water, and food. Since so few pesticides have been tested, it's impossible to say how many might be contaminated, but even a tiny percentage would be significant, experts say.

"Not everybody you know is buying carpets with PFAS in them, and not everybody is exposed to firefighting foam," said Ruth Berlin, director of the Maryland Pesticide Education Network (MPEN), "but everybody is exposed to pesticides, whether they like it or not."

Many pesticides are associated with health risks (especially at the levels that farmers, farmworkers, and people in neighboring communities are exposed to) and adverse effects on the environment, including harm to aquatic organisms and pollinators. There are thousands of chemicals classified as PFAS with a range of impacts, but some of the most commonly used are linked to an increased risk of multiple cancers, liver damage, reduced immune response, and decreased vaccine response in children. PFAS can also accumulate in fish and other wildlife and can persist in the environment indefinitely. Currently, there is no safety data on the combined effects of PFAS and pesticides.

"That's definitely something that we're very worried about," said Willa Childress, organizing co-director at Pesticide Action Network North America (PANNA). "But the level of contamination we could be talking about is also a huge concern. If there is even moderate contamination in pesticides . . . the exposure and contamination of farmland could already have happened."

A crop duster airplane sprays an organophosphate pesticide on cotton and potato fields near Arvin, California. (Photo by David McNew/Getty Images)

It would also likely be piled onto PFAS from other sources. In mid-October, researchers at Northeastern University estimated that 57,000 sites in the U.S. can be presumed contaminated based on other confirmed sources of PFAS that are already being tracked. One of those sources was sewage sludge, which has already contaminated farms in multiple states. “I’m concerned about *all* sources of PFAS, because these chemicals are never going to leave our environment,” said Linda Birnbaum, a toxicologist who spent 19 years at the EPA and was later the director of the National Institute for Environmental Health Sciences. “It all adds up.”

Hunting for the Source

“Where is it coming from?” is the question that stumped environmental toxicologist Steven Lasee when he began finding PFOS—one of a few PFAS that has been found to be particularly harmful—in a greenhouse used for crop research in 2017. Lasee

that he was finding the chemicals in his control plants and other places where he hadn't planned to find them. He began testing everything around until he homed in on 10 insecticides that had been used on and were stored at the site.

To his surprise, Lasee found PFOS in six out of the 10 chemicals, at levels ranging from 4 million to 19 million parts per trillion (ppt). Although the pesticides are significantly diluted before use and the amount that would end up in waterways is unknown, the levels would still be hundreds of thousands of times higher than what is considered safe to ingest. For comparison, this June, the EPA updated its lifetime health advisory for PFOS in drinking water to 0.02 ppt, a level that's barely detectable. "The EPA is basically saying that no exposure is safe long-term," Lasee said.

One of the insecticides he tested was imidacloprid. In addition to farmers spraying more than a million pounds of the chemical on crops annually, the neonicotinoid is a component of seed coatings used on commodity farms.

At the time, no one was talking about PFAS in pesticides, and Lasee didn't know what to make of his results. That changed last year, when he began to see news coming out of two states.

First, in December 2020, the nonprofit organization Public Employees for Environmental Responsibility (PEER) tested a jug of Anvil 10+10, an insecticide that the state of Massachusetts has sprayed on millions of acres for decades to kill mosquitos. They found it contained multiple PFAS, including about 250 ppt of PFOA. Like PFOS, the EPA's health advisory limit for PFOA is so low (.004 ppt), it's nearly zero. When the state Department of Environmental Protection ran its own tests on a larger set of samples, it found eight different PFAS, including PFOA and PFOS.

In Maryland, PEER executive director Tim Whitehouse then called MPEN's Ruth Berlin. "He said, 'What do you think about testing pesticides used for mosquito control in Maryland?'" she recalled. So MPEN joined forces with PEER to test Permanone 30-30, the insecticide used for the same purpose in Maryland. By March 2021, the results were in: PEER and MPEN's tests found PFOA at 3,500 ppt, along with other PFAS. "In our state, 2,100 communities signed up . . . for mosquito control in the spring," Berlin said. "Some are being sprayed every week, and the pesticide itself is an endocrine disruptor. This is pretty scary stuff."

The EPA stepped in and halted the use of Permanone 30-30, but they allowed the use of a substitute product, she said—and to her dismay, there was no testing done on the new insecticide. In October, the agency ran its own tests on Permanone samples provided by Bayer

and the Maryland Department of Agriculture using a different process and found no detectable PFAS, which muddied the findings.

But they continued their investigation into whether PFAS were leaching from plastic containers into other pesticides. About 20 to 30 percent of the pesticide containers used in agriculture have likely gone through a process called “fluorination,” which makes the plastic stronger but can also produce PFAS.

This August, the EPA released its results. Researchers tested three different brands of containers for 31 different PFAS, taking measurements at different lengths of time, from one day to 20 weeks. They found the same eight PFAS identified in the earlier tests and concluded that PFAS “do leach from container walls into the products they contain” and that the amount increases as pesticides are stored for longer periods of time. As a result, agency officials notified companies that manufacture, use, and dispose of the containers that PFAS formed during the fluorination process “may be a violation of the Toxics Substances Control Act.”

PFAS Used as ‘Inert’ Ingredients

That might have closed the book on how PFAS were getting into pesticides, except that Lasee finally published his study on insecticides around the same time. He and other experts say the EPA’s study was done well and confirms one source: containers. But based on the science, there is almost no way the PFAS *he* found came from containers because of the levels and types identified. “The concentrations I found are essentially around a million times larger,” he said.

And the PFAS he found are mainly from a different family than the ones identified by the EPA. In fact, while it’s impossible to prove whether they had been intentionally added to the pesticides, the types he found are consistent with the PFAS that are commonly used to allow people to spray liquids more effectively, said Graham Peaslee.

Peaslee is a nuclear chemist and a professor at Notre Dame. He has been working on testing for PFAS since 2014 and is now considered one of the country’s top experts. He agreed with Lasee’s contentions that the PFAS levels were “way too high” to have come from the containers and that they were likely added to the formulations. Different PFAS have different “signatures,” he said, and the ones Lasee found are typically used as additives to help disperse liquids. “PFOS is the world’s best dispersal agent,” he said. “It’s a surfactant extraordinaire.”

That would suggest companies were adding PFAS to pesticide formulations as "inert ingredients." These are not the active bug- or weed-killers, but they help make the chemical useful in other ways. The EPA determines which inert ingredients are approved for use, but pesticide companies do not have to disclose them on product labels.

"This has been something that has been highly protected at the industry level for a long time," said Childress at PANNA. "We don't have access as advocates or rural communities really to any information on what's getting sprayed."
In September, the EPA announced that it was removing 12 PFAS from its list of approved inert ingredients. In the press release, the agency said the chemicals it was removing were no longer used in any registered pesticide formulations, but that the action would prevent future use. But the announcement begged the question: Are there any other PFAS still approved for use?

Pesticide toxicologist Pamela Bryer brought up that question at the end of October, at the monthly meeting of the Maine Board of Pesticides Control. First on the agenda was a long discussion of Maine's state law requiring the Board to regulate PFAS in pesticides. When it went into effect at the end of April, it became the first law of its kind.

Bryer said that after the EPA announced that it had removed PFAS from the inert list, the agency held a call with state agencies. "Someone did ask the question, 'Does this mean that all PFAS have been removed from [the inert list]?' And the answer was, 'No,'" she said. By her rough estimation, there may be six or seven others still approved for use that appeared to meet the definition of PFAS, she said.

The EPA did not say whether or not there are still approved inert ingredients that qualify as PFAS, but it said it's currently evaluating the list to "determine if any meet the current structural definition of PFAS or are part of other related chemistries that have been identified by stakeholders as being of concern and if additional data are needed to support the risk assessments for these compounds." The agency said it will share results of that investigation "as soon as possible."

When Pesticides *Are* PFAS

In addition to "inerts," under the new law, Bryer explained at the meeting, Maine's Board would also have to address a list of 69 active pesticide ingredients used in 1,493 products currently on the market. Those would likely qualify as PFAS on their own, she explained, based

Although final determinations are still being made about their classification, it makes sense based on the earlier findings on the plastic containers for pesticides. It turns out containers are not the only products that undergo the process of fluorination. All of the pesticides on the list have undergone some level of fluorination themselves. And in fact, in recent years, fluorination of pesticides has become more common. Not all fluorinated pesticides are PFAS, but some are.

Examples of pesticides that made Maine's list include sulfentrazone and bifenthrin. In 2019, farmers sprayed more than 3 million pounds of sulfentrazone, mainly across pasture and hayfields in the Midwest. They used about 1.3 million pounds of bifenthrin on corn, soybean, cotton, and fruit and vegetable crops in the Midwest and the Mid-Atlantic.

Complicating the issue is the fact that while Maine, the first state to try to regulate PFAS in pesticides, is wrestling with how to classify them, the EPA's Office of Pesticide Programs is defining PFAS differently.

Maine is using a broader definition of PFAS that was established by the Organization for Economic Co-operation and Development (OECD) and is generally recognized as a global standard. But the EPA has adopted a much narrower definition, and experts estimate that it cuts the number of chemicals that qualify in half.

Based on that difference, Bryer said the EPA would likely only consider two of the chemicals on her list PFAS.

The EPA did not confirm that number. But the agency did confirm that there are no regulations that prevent pesticides that qualify as PFAS from being approved for registration. In other words, a pesticide that fits into the PFAS group would be reviewed in the same way as any other "to ensure it meets the FIFRA standard of no unreasonable risks to human health and the environment."

The Path Forward

If Maine is the test case, figuring out how to identify the various sources of PFAS in pesticides and then eliminate them nationwide is going to be a difficult process, to say the least. At the October meeting, Board members in the state frequently expressed a sense of hopelessness around the scale of the task, and despite work on the issue, they are nowhere near meeting deadlines lawmakers set for them. "This is going to be a nightmare," one member said.

Still, some say it's a huge step toward understanding and tackling the issue, especially since starting in 2023, companies registering pesticides for use in Maine will be required to submit affidavits indicating whether their product contains PFAS and whether it has been stored in a fluorinated container. The legislation requires the state to create a public database with some of the information from those affidavits.

"We should be able to look at what these products are and then correlate that with where and how they're being used in our state and start to figure out how big of a problem we have," said Sharon Treat, a public policy consultant in Maine who has been working on the issue.

Of course, if the federal government stepped up, advocates say, states wouldn't have to take on this burden. At a baseline, they argue the agency should be using the broader, globally recognized definition of PFAS. Then, it should require companies to disclose all ingredients in their pesticide formulations, whether inert or active. But the EPA pointed to Section 10 of the federal law that regulates pesticides and does protect the identity of inert ingredients as trade secrets. However, the law does allow for disclosure of the inert ingredient if the agency has determined it "necessary to protect against an unreasonable risk of injury to health or the environment."

An affidavit system similar to what's being set up in Maine could also be effective, PANNA's Childress suggested.

Ruth Berlin at MPEN has a simpler, albeit far-reaching suggestion: "Every pesticide on the market should be tested to ensure it's PFAS-free," she said. In its responses, EPA said it does not have sufficient resources to test all approved pesticides. Without legislation providing those, that's unlikely to happen any time soon. But given the fact that "forever chemicals" could be contaminating water and soil across the country in ways that are next to impossible to undo, it's not a big ask, Treat said. "This is a three-alarm fire. It needs to be dealt with in that way."

Lisa Held is Civil Eats' senior staff reporter. Since 2015, she has reported on agriculture and the food system with an eye toward sustainability, equality, and health, and her stories have appeared in publications including *The Guardian*, *The Washington Post*, and *Mother Jones*. In the past, she covered health and wellness and was an editor at Well+Good. She is based in Baltimore and has a master's degree from Columbia University's School of Journalism. Read more >

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