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The agency obtained research from 3M in 2003 revealing that sewage sludge, the raw material for the fertilizer, carried toxic “forever chemicals.”

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By Hiroko Tabuchi
Hiroko Tabuchi reviewed thousands of pages of decades-old documents to report this article.

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In early 2000, scientists at 3M, the chemicals giant, made a startling discovery: High levels of PFAS, the virtually indestructible “forever chemicals” used in nonstick pans, stain-resistant carpets and many other products were turning up in the nation’s sewage.

The researchers were concerned. The data suggested that the toxic chemicals, made by 3M, were fast becoming ubiquitous in the environment. The company’s research had already linked exposure to birth defects, cancer and more.

That sewage was being used as fertilizer on farmland nationwide, a practice encouraged by the Environmental Protection Agency. The presence of PFAS in the sewage meant those chemicals were being unwittingly spread on fields across the country.

3M didn’t publish the research, but the company did share its findings with the E.P.A. at a 2003 meeting, according to 3M documents reviewed by the The New York Times. The research and the E.P.A.’s knowledge of it has not been previously reported.

Today, the E.P.A. continues to promote sewage sludge as fertilizer and doesn’t require testing for PFAS, despite the fact that whistle-blowers, academics, state officials and the agency’s internal studies over the years have also raised contamination concerns.

“These are highly complex mixtures of chemicals,” said David Lewis, a former E.P.A. microbiologist who in the late 1990s issued early warnings of the risks in spreading sludge on farmland. The soil “becomes essentially permanently contaminated,” he said in a recent interview from his home in Georgia.

The concerns raised by Dr. Lewis and others went unheeded at the time.

The country is starting to wake up to the consequences. PFAS, which stands for per- and polyfluoroalkyl substances, has been detected in sewage sludge, on land treated with sludge fertilizer across the country, and in milk and crops produced on contaminated soil. Only one state, Maine, has started to systematically test its farms for PFAS. Maine has also banned the use of sludge on its fields.

David Lewis, a former E.P.A. microbiologist, issued early warnings. Will Crooks for The New York Times

In a statement, 3M said that the sewage study had been shared with the E.P.A., and was therefore available to anyone who searched for it in the agency's archives. The agency had sought 3M's research into the chemicals as part of an investigation in the early 2000s into their health effects.

3M also said it had invested in "state-of-the-art water treatment technologies" at its manufacturing operations. The company is on track to stop PFAS manufacturing globally by the end of 2025, it said.

The E.P.A. did not respond to detailed questions for this article, including about the 3M research. It said in an earlier statement that it "recognizes that biosolids may sometimes contain PFAS and other contaminants" and that it was working with other agencies to "better understand the scope of farms that may have applied contaminated biosolids" and to "support farmers and protect the food supply."

Farmland contamination has become a contentious environmental issue in both red and blue states.

In Oklahoma, Republican voters ousted a longtime incumbent in a state house primary in August after the lawmaker drew criticism for the use of sewage sludge fertilizer on his fields. The victor, Jim Shaw, said he planned to introduce legislation to ban sludge fertilizer across the state.

"There are other ways to dispose of excess waste from the cities," Mr. Shaw said in an email. "Contaminating our farmland, livestock, food and water sources is not an option and has to stop."

This year the E.P.A. designated two kinds of PFAS as hazardous substances under the Superfund law and mandated that water utilities reduce levels in drinking water to near zero. The agency said there is no safe level of exposure to those two chemicals. It also designated PFAS as "an urgent public health and environmental issue" in 2021 and has said it will issue a report on the risks of PFAS contamination in sludge fertilizer by the end of the year.

The decades-old research by 3M and the record of the company's interaction with the E.P.A. were found by The Times in a cache of tens of thousands of pages of internal documents that the company released as part of settlements in the early 2000s between the federal government and 3M over health risks of the chemicals.

Reusing human waste to fertilize farmland, a practice that dates back centuries, keeps the waste from needing other ways of disposing of it, such as incineration or landfill dumping, both of which have their own environmental risks. It also reduces the need to use synthetic fertilizer made from fossil fuels.

But the problem, experts say, is that sewage today contains a host of chemicals, including PFAS, generated by businesses, factories and homes. The federal government regulates certain heavy metals and pathogens in sludge that is reused as fertilizer; it has no limits on PFAS.

"There's absolutely enough evidence, with the high levels of contaminants that we see in the sludge, for the E.P.A. to regulate," said Arjun K. Venkatesan, director of the Emerging Contaminants Research Laboratory at the New Jersey Institute of Technology.

A step in the process of separating sludge from wastewater at a facility in Fort Worth, Texas. Jordan Vonderhaar for The New York Times

‘It’s Insidious’

The turn of the century was a turbulent time for 3M. After decades of hiding the dangers of PFAS — a history outlined in lawsuits and peer-reviewed studies based on previously secret industry documents — in 1998 it alerted the E.P.A. about the potential hazards.

The company had already found high levels of PFAS in the blood of its employees, and was starting to detect the chemicals in the wider population. It had also long tracked PFAS in wastewater from its factories.

Then in a 2000 study, 3M researchers noticed something alarming. While testing for PFAS in cities with “no known significant industrial use” of the chemicals, including Cleveland, Tenn., and Port St. Lucie, Fla., they found surprisingly high

concentrations in sewage sludge.

A question weighed on the researchers' minds: If there were no PFAS manufacturers present, where were the chemicals coming from?

Hints lay in 3M's other research. The company had been studying how the chemicals could be released by PFAS-treated carpets during washing. And they were also studying how PFAS could leach from food packaging and other products.

In an interview, Kris Hansen, a former chemist at 3M who was involved in the research, said the presence in sludge "meant this contamination was probably occurring at any city" that was using 3M's products.

The study showed, moreover, that PFAS was not getting broken down at wastewater treatment plants. "It was ending up in the sludge, and that was becoming biosolids, being mixed into soil," Dr. Hansen said. "From there it can run into the groundwater, go back into people. It's insidious."

In September 2003, 3M officials met with the E.P.A. to discuss the company's study of sludge contamination and other research, according to the internal records. At the end of the meeting, the E.P.A. requested "additional background information supporting this monitoring data," the records show.

Sewage sludge has now been spread on millions of acres across the country. It's difficult to know exactly how much, and E.P.A. data is incomplete. The fertilizer industry says more than 2 million dry tons were used on 4.6 million acres of farmland in 2018. And it estimates that farmers have obtained permits to use sewage sludge on nearly 70 million acres, or about a fifth of all U.S. agricultural land.

"If we really wanted to figure this problem out because we believe it's in the interest of public health, we really needed to share that data widely," said Dr. Hansen, who has become a whistle-blower against 3M. "But my memory is that the corporation was kind of caught up in the, 'Oh my gosh, what do we do about this?'"

Kris Hansen, a former 3M chemist who became a whistle-blower. Tim Gruber for The New York Times

Early Warning, Unheeded

Dr. Lewis was a rising star in the late 1990s as a microbiologist at the E.P.A. He discovered how dental equipment could harbor H.I.V., winning him kudos within the scientific community.

Then he turned his attention to sewage sludge.

The E.P.A. was encouraging farmers to use sludge as fertilizer. Human beings had used waste to fertilize the land for millenniums, after all. But, as Dr. Lewis pointed out with his research, modern-day sewage most likely contained a slew of chemicals, including PFAS, that made it a very dangerous fertilizer.

He collected and examined sewage samples. He investigated illnesses and deaths he said could be linked to sludge. He started presenting his findings at scientific conferences.

“The chances that serious adverse effects will occur from a complex and unpredictable mixture of tens of thousands of chemical pollutants is a virtual certainty,” he said at the time. His research prompted the Centers for Disease Control and Prevention to issue guidelines protecting workers handling processed sewage sludge.

The E.P.A. eliminated his job in 2003.

He was a prominent voice on the issue at the time, but not the only one.

Rolf Halden, a professor at the School of Sustainable Engineering at Arizona State University and an early researcher of contamination in biosolids, met with E.P.A. officials at least nine times since 2005 to warn about his own research, according to his records.

“The history of biosolids is that it was a toxic waste,” he said. For decades, he noted, sludge from New York City “was loaded on trains and shipped to the back corners of the country,” he said. Farmers often took the sludge without knowledge of its possible contamination.

In 2006, an E.P.A. contractor offered him samples of municipal sewage sludge left over from earlier agency testing. The E.P.A. had been about to throw them out.

Those samples led to a study that confirmed elevated PFAS levels in sludge nationwide. (The early research into sewage samples eventually led to wastewater testing that has helped researchers track the virus that causes Covid.)

Another researcher, Christopher Higgins, was starting his academic career in the early 2000s when he began looking at sludge. He presented his work to E.P.A. officials, he said, and was left with the impression that it wasn't a priority. "I was really surprised by how few people were working for E.P.A. on the topic," said Dr. Higgins, who is now a professor at the Colorado School of Mines.

Signs at a lake near Dr. Hansen's Minnesota home warn of PFAS contamination in fish. Tim Gruber for The New York Times

Betsy Southerland, a former director of science and technology in the E.P.A. Office of Water, which oversees biosolids, said the program had been hurt by staffing shortages as well as an arduous process for setting new restrictions. Action has been slow, she said, even though E.P.A.'s surveys of sludge had shown "all kinds of pollutants — flame retardants, pharmaceuticals, steroids, hormones," she said. "It's the most horrible story," she said.

Researchers at E.P.A. later found elevated levels of PFAS in sludge fertilizer. In its most recent survey of biosolids, the agency discovered 23 pollutants that its scientists identified as PFAS. A 2018 report by the E.P.A.'s inspector accused the agency of failing to properly regulate biosolids, saying it had "reduced staff and resources in the biosolids program over time, creating barriers."

The Biden administration has said it would publish a risk assessment of PFAS in biosolids by the end of 2024. That would be a first step toward setting limits on PFAS in sewage sludge used as fertilizer.

There is another solution, experts say. Under the Clean Water Act, wastewater treatment plants have a legal authority to limit PFAS pollution from local factories. It's known as the Clean Water Act "pretreatment program," preventing chemicals from reaching sewage in the first place.

In the past two years, two cities — Burlington, N.C., and Calhoun, Ga. — have ordered industries to clean up the effluent they send to wastewater treatment plants. In one instance, a textile producer decided to stop using PFAS entirely.

Those actions came after a local environmental group sued the cities. "Industry is in the best position to control their own pollution, rather than treating wastewater treatment plants like industrial, toxic dumping grounds," said Kelly Moser, an attorney at the Southern Environmental Law Center, which filed the lawsuits.

The National Association of Clean Water Agencies, which represents wastewater treatment plants, said more than 1,600 utilities already had pretreatment programs in place, though not necessarily for PFAS. (The group also said research showed

that the chemicals were coming from household waste, including human waste, not just factories.)

Adam Krantz, the group's chief executive, said many utilities were waiting for the E.P.A. to set standards. That would strengthen treatment plants' ability to hold the ultimate polluters responsible, he said. "If these chemical companies were aware of PFAS' potential dangers and kept it quiet," he said, "then these polluters have to pay."

Hiroko Tabuchi covers pollution and the environment for The Times. She has been a journalist for more than 20 years in Tokyo and New York. More about Hiroko Tabuchi

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