Toxic Legacy

Pesticides used heavily for years tainted water supply

Second of two parts

By Dan Fagin
STAFF WRITER

When she was 28, she joined the teeming migration that carved Long Island's potato fields into subdivisions. When she was 67, she lost most of her left breast to cancer.

It never occurred to Genevieve Frey that there might be a connection between the two.

But there could be a connection, because the same pesticides that drenched pest-plagued potato fields in the years just before Long Island's suburbanization are now being tentatively linked to breast cancer by researchers.

What's known is that some of those now-banned pesticides were used in particularly heavy doses here, and did seep into underground drinking-water supplies. What isn't known is how badly they contaminated the tap water that Long Islanders like Frey drank.

But a Newsday examination found evidence that suggests many suburban pioneers were exposed to high levels of those chemicals, according to government records, well test results, interviews with dozens of experts and a computer model prepared for Newsday by the U.S. Environmental Protection Agency.

The computer model — based on Long Island's unique hydrogeology and the traits of two now-banned pesticides that were used heavily on local potato fields — estimates that drinking water was severely tainted with those chemicals, both of which are known to cause breast cancer in lab animals. In fact, according to the model, pesticide concentrations in groundwater were dozens of times higher than the current federal safety standard after those potato fields were treated.

But because pesticide testing of drinking water didn't begin until 14 years ago, Long Islanders are left with unanswered questions about how extensive the contamination really was during the suburban boom years.

"Nobody can tell me why I got breast cancer," said Frey, 69, who still lives in the same tract house in Hicksville that she bought with her husband in 1952. "Now I have to worry about my daughters, and about all the other people who lived in this area. They drank that water, too."

Today there's no indication that pesticides are a major problem in drinking water on Long Island, except in a few farming areas in eastern Suffolk County. Lawn and golf course pesticides still turn up in groundwater, but public water supplies are now tested for common pesticides, and filters remove any that are detected. Wells have been deepened to avoid the shallow aquifers that are most vulnerable to contamination. There is little cropland left, and the few farmers who till it have learned to get by with much lower pesticide doses. Perhaps most significantly, some of the most toxic chemicals were banned by the state starting in 1979, when local health officials began looking for pesticides in underground water supplies — and immediately found them.

But during the 1940s, 1950s and 1960s, not one drop of Long Island's tap water was tested for pesticides, and experts scoffed at the notion that weed- and bug-killers could penetrate the soil barrier and reach aquifers. Hundreds of thousands of people got their water from shallow private wells, and even public wells were unfiltered and were often less than 200 feet deep. The region was carpeted by hundreds of farms, which were repeatedly doused with pesticides in doses hundreds of times higher than today's standards. In one program, the U.S. Department of Agriculture spent $28.4 million and injected more than a million gallons of now-banned chemicals directly into more than 10,000 acres of nematode-infested potato fields on Long Island — and nowhere else.

The two nematode-killers that were used in that federal program — 1,2-dichloropropane and 1,3-dichloropropene, both of which were found to seep into groundwater by the EPA computer model — have been shown to cause breast cancer in rats. And human breast cancer has been linked to the insecticide DDT, banned in 1972, which was also heavily used on Long Island but is not found in local groundwater. More important, a growing number of pesticides — including DDT, chlordane and methoxychlor — are now being shown to have the ability to mimic estrogen in a woman's body. All three were common on Long Island, and methoxychlor is still widely used here. The connection is important, because high lifetime estrogen exposure is the common thread that ties together all of breast cancer's known risk factors, except family history.

Breast cancer is a complex disease, and no single factor is likely to explain the 70 percent of cases that cannot be traced to any of the known risks. So far, no pesticide has been definitively shown to cause human breast cancer.

Yet the signs of past pesticide contamination on Long Island are strong enough that federal scientists have made pesticides an important focus of their upcoming environmental study of breast cancer on the Island and other parts of the Northeast. Researchers already know the disease has a long la-

Please see. PESTICIDES on Page 30

Newsday File Photo

These barrels contained the pesticide D-D, used against nematodes on the Wesnofske potato farm on the East End in 1975

BREAST CANCER
A SPECIAL REPORT

Third in a series on the disease and its toll on LI

The Series So Far

JUNE 27: Are I Iers at greater risk? Study finds an average cancer risk but higher death rate.

JULY 25: Fran and Jerry Lenzo's Story.

SEPT 5: The Pesticide Connection

Newsday / Kathy Kmonicek

Genevieve Frey, a breast cancer survivor, in front of her Hicksville home

Farm Pesticides Reached

PESTICIDES from Page 7

tency period; decades can pass between exposure to a carcinogen and tumor development.

"It appears that in order for Long Island to be built up as a habitable place, in order to make it suitable for large-scale development, housing was built on land that had been heavily treated with pesticides," said Dr. Samuel Broder, director of the National Cancer Institute, which will run the study along with the National Institute of Environmental Health Sciences.

"From a scientific point of view, there has to be an extremely high priority attached to the presence of estrogen-like products in the environment," Broder said. "We need to get to the bottom of this question of the application of pesticides on Long Island."

That won't be easy. Federal researchers face a daunting, if not impossible task in trying to quantify past pesticide exposures on Long Island, Newsday found. Blood samples can be tested for residues of long-lasting pesticides — a technique that is likely to be used. But those residues are detectable only for certain pesticides, and they are often so minute that measuring them is difficult and expensive.

Without measurable data, researchers are left with statistical clues that point in conflicting directions.

Among the troubling clues is that Long Island's breast cancer rate is well above the national average. In addition, a 1980 state study concluded that long-time Nassau County residents face a higher risk of breast cancer than do women who are the same age but moved here more recently.

Women who have lived in Nassau at least 40 years are much more likely to get breast cancer than women of the same age who haven't lived here that long. The added risk drops from 72 percent to 16 percent for women who have lived in Nassau for 20 to 39 years, and there is no extra risk for women who have lived in the county less than 20 years. No such trend was detected among Suffolk women.

"Nobody really knows why length of residence is a risk factor in Nassau County," said Roger Grimson, a biostatistician at the State University at Stony Brook who is familiar with the breast cancer data. "It seems to me to be a proxy for an environmental factor, or for something else."

On the other hand, Long Island's breast cancer rate, while high, is not greater than the rates of many other affluent suburban areas, which suggests lifestyle may matter more than pesticides. Epidemiological studies have repeatedly shown that the Island is rich in risk factors for the disease, including having a large Jewish population and a high number of women who have their first child relatively late in life.

There is also some conflicting evidence on the question of pesticide exposures. For one thing, researchers have not detected unusually high breast cancer rates in heavily farmed areas elsewhere in the country where, presumably, more pesticides were used.

But the key issue for cancer researchers isn't the quantity of pesticides put into the soil, but the quantity ingested by Long Islanders.

For the past six months, Newsday has looked closely at the question of how high pesticide exposures really were. That examination found a striking confluence of natural and man-made circumstances that put Long Islanders at risk:

• **Pesticides and potato fields.** Long Island's potato fields — which dominated local agriculture for a half-century — have been repeatedly treated with an array of high-dose pesticides aimed at eradicating beetles, aphids, blight and the golden nematode.

Farming is the source of most pesticide use. And nationwide, potato farmers used more pesticides per acre than anyone except fruit growers, a 1980 federal report shows. Dosages were unusually high on Long Island. In 1979, for example, New York (mostly Long Island) had 25 percent of the Northeast's potato acreage but used 60 percent of the potato pesticides, according to another report. That's significant, hydrologists say, because pesticides are far more likely to reach groundwater if they are applied intensively in one area.

In fact, Long Island was the only site of one of the most intensive pesticide-use campaigns ever attempted in the Northeast, and perhaps in the country. For 40 years, the golden nematode was the target of a massive barrage orchestrated by federal and state agricultural officials, who were determined to eradicate the tiny crop-destroying eelworm, or at least confine it to Long Island.

Neither goal was fully achieved, and by the time groundwater contamination forced the treatment program's abandonment in 1984, more than 250 potato fields had been fumigated with more than 1 million gallons of pesticides. The nematode-killers were injected directly into the soil 6 inches below the surface, and the standard dosage of 90 gallons (or 900 pounds) per acre is staggering compared with current pesticide doses, typically about one pound per acre.

• **The vulnerable water supply.** Long Island's sandy soil, shallow aquifers and high population density make it acutely vulnerable to drinking water contamination.

When pesticides were found on the East End in 1979, it was one of the first times significant amounts had been found in groundwater anywhere in the United States, according to a federal report. And the same hydrologic traits that promote contamination in Mattituck generally also apply in Melville and most of western Long Island, hydrologists say. In virtually all of the Island there's no bedrock or heavy clay layer to stop pesticides from moving freely once they have penetrated a few feet of soil. That's why some pesticides are being detected a decade or more after they were banned, and at depths several hundred feet below the surface.

Moreover, until the 1960s and 1970s, most Long Islanders got their water from the shallowest aquifers, which are 50 to 200 feet below the surface. At those shallow depths, pesticides are likely to be found in higher concentrations because they have had less time to dissipate and chemically degrade.

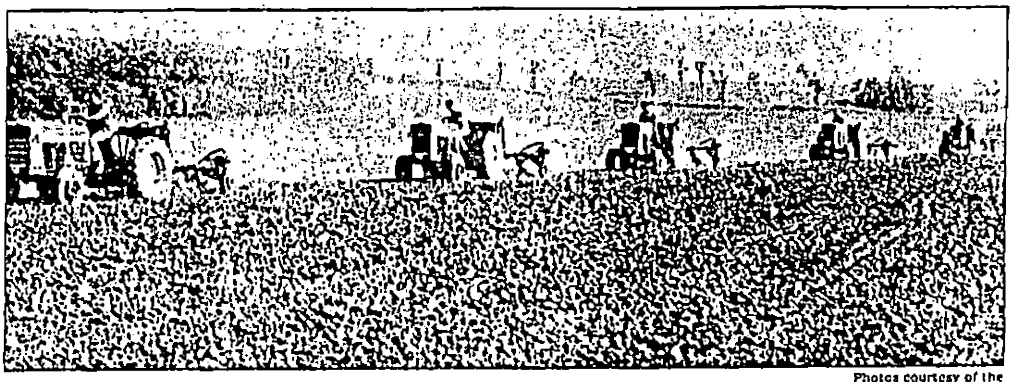
• **Signs of contamination.** There's no way to know for sure, but well test results and a computer model both strongly suggest that groundwater contamination was prevalent during the years when pesticides were used most heavily.

By the time testing for pesticides started in 1979, farming had virtually disappeared from most of Long Island. But those well tests quickly showed widespread contamination in the only area that was still dominated by agriculture: the East End, with sporadic contamination elsewhere. To date, pesticides have been detected at levels above federal safety standards in about 50 public and 4,100 private drinking-water wells in eastern Suffolk. That total is far higher than anywhere else in the state and many regions of the country, although it's partly due to the fact that Suffolk's sampling program is among the most extensive anywhere.

And in western Long Island, a computer model of the local hydrogeology suggests groundwater contamination was extensive just after the peak farming years there. That model, prepared for Newsday by the U.S. Environmental Protection Agency, predicts that in any given year, groundwater beneath one-fourth of all the fields fumigated that year with the two chemicals used in the anti-nematode program — dichloropropane and dichloropropene — contained concentrations of those chemicals that were at least 28 times higher than the safety standard of 5 parts per billion. There's no way to know how long the pesticides stayed in a particular place, but they can persist in the shallow aquifers for years.

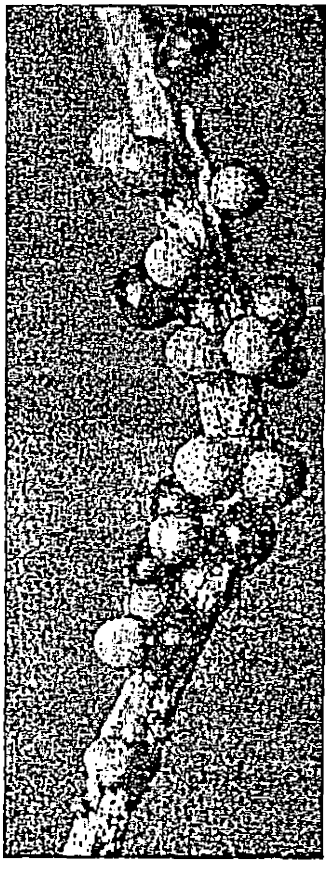
• **The links to breast cancer.** There is no proof that any pesticide causes breast cancer in humans, but many of the pesticides that were used most heavily on Long Island have been identified as prime suspects.

Dichloropropane and dichloropropene, which are both found in Long Island groundwater and are known to ac-



Photos courtesy of the U.S. Department of Agriculture

Insecticide being applied to a Long Island farm in the 1960s to battle nematode infestation. Dosages of pesticide were unusually high on Long Island. In one year, New York (mostly Long Island) had 25 percent of the Northeast's potato acreage but used 60 percent of the potato pesticides, according to a report.



Female nematodes become golden in color as they attach to roots. The golden nematode was the target of a massive barrage of fumigants by federal and state agricultural officials. By 1984, more than 250 potato fields had been fumigated with more than 1 million gallons of pesticides.

Water

cumulate in human fatty tissue, are among the relatively small group of pesticides that has been linked to increased breast tumors in laboratory rats. Other pesticides that have been used locally, including methoxychlor and chlordane, are known to mimic natural estrogen, and chlordane has been shown to cause liver cancer in mice. Methoxychlor is still used on Long Island; 1,3-dichloropropene is still used in other parts of the country. Chlordane and 1,2-dichloropropane have been banned nationwide.

The pesticide that was probably used most heavily of all on Long Island, the banned insecticide DDT, is also the only one so far that has been associated with higher risk of human breast cancer. But DDT is almost never found in groundwater, because it is not soluble in water. The most common way people are exposed to DDT is by eating tainted meat or fish. The insecticide is so persistent that its residues are still detectable in the blood of most Americans 21 years after it was banned. But even though DDT was used extensively here on farms, in homes and in mosquito-infested swamps, there's no particular reason to believe Long Islanders were exposed to more DDT than other Americans.

Chlordane and methoxychlor also are not often found in groundwater, but Long Islanders could have been exposed to them by breathing their vapors. Subterranean termites thrive in the Island's damp sandy soil, so the termiticide chlordane was used pervasively here until it was banned. Methoxychlor is still popular with gardeners and farmers as a tree spray.

The Nematode Crusade

Geneviove Frey, of course, didn't know about any of that when she moved from New York City to Hicksville in 1952, and neither did hundreds of thousands of other participants in the post-war suburban boom. And neither did the only people who might have been expected to have some inkling of the possible threat to groundwater: local water-supply officials, and the Cornell University scientists who worked closely with Long Island farmers as they used more and more pesticides.

"It's true that there wasn't the rigorous testing that we do now," said Michael LaGrande, chairman of the Suffolk County Water Authority. "I don't question that things that were not conducive to good health were in the public and the private water supply in those years."

"The groundwater situation just never even came up," recalled Maurice Semel, 70, a former Cornell entomologist who worked with Long Island farmers for decades. "We were just trying to help the farmers in any way we could."

Potatoes have been grown on Long Island for more than a century, but the acreage greatly expanded during World War II, and by the end of the war the Nassau-Suffolk region was the biggest potato producer in the nation. In the peak year of 1947, potato vines carpeted more than 60,000 acres — 10 times more acreage than was planted with any other crop. Today, potatoes still cover more acreage than any other local crop, but less that 7,000 acres are left, almost all on the East End.

"In those years, from Hempstead to Farmingdale there wasn't a single store," said William Mul, 76, a retired Cornell plant pathologist. "It was all fields as far as you could see."

Despite the signs of success, it was a struggle to grow spuds on Long Island. Potato beetles, aphids and blight were a continual threat. And, then came the golden nematode.

For seven years, Charles Gellweiller had watched the potato vines wither in one corner of his farm on Bloomingdale Road in Hicksville. Finally, in 1941, a Cornell graduate student identified the reason: the golden nematode, named for the color of the females. The eelworm is harmless to humans, but is potentially devastating to potatoes because the worms form cysts that gradually destroy the vines.

By the end of the war, the nematode had spread throughout hundreds of acres of potato fields in the Hicksville area, and federal and state agriculture officials decided it was time for an all-out campaign against it. They quarantined all infested fields, and banned the sale of all seed potatoes from Long Island.

But the heart of the effort was a chemical assault. The chosen weapons were huge doses of two volatile petroleum derivatives that smelled like chloroform. The chemicals, 1,2-dichlodropropane and 1,3-dichloropropene, had been developed during the war and were marketed by Shell in a gaseous mixture known as D-D.

About 1,500 acres around Hicksville were fumigated with D-D in 1946, the first year of widespread treatments, program records show. But the nematodes kept coming back. So by 1950, the same year the nematode was first identified in Suffolk County, the dosage had been doubled to 90 gallons per acre.

"They used tremendous quantities and enormous dosages, and I think the nematode program was one of the highest," said Cornell entomologist Dave Pimentel.

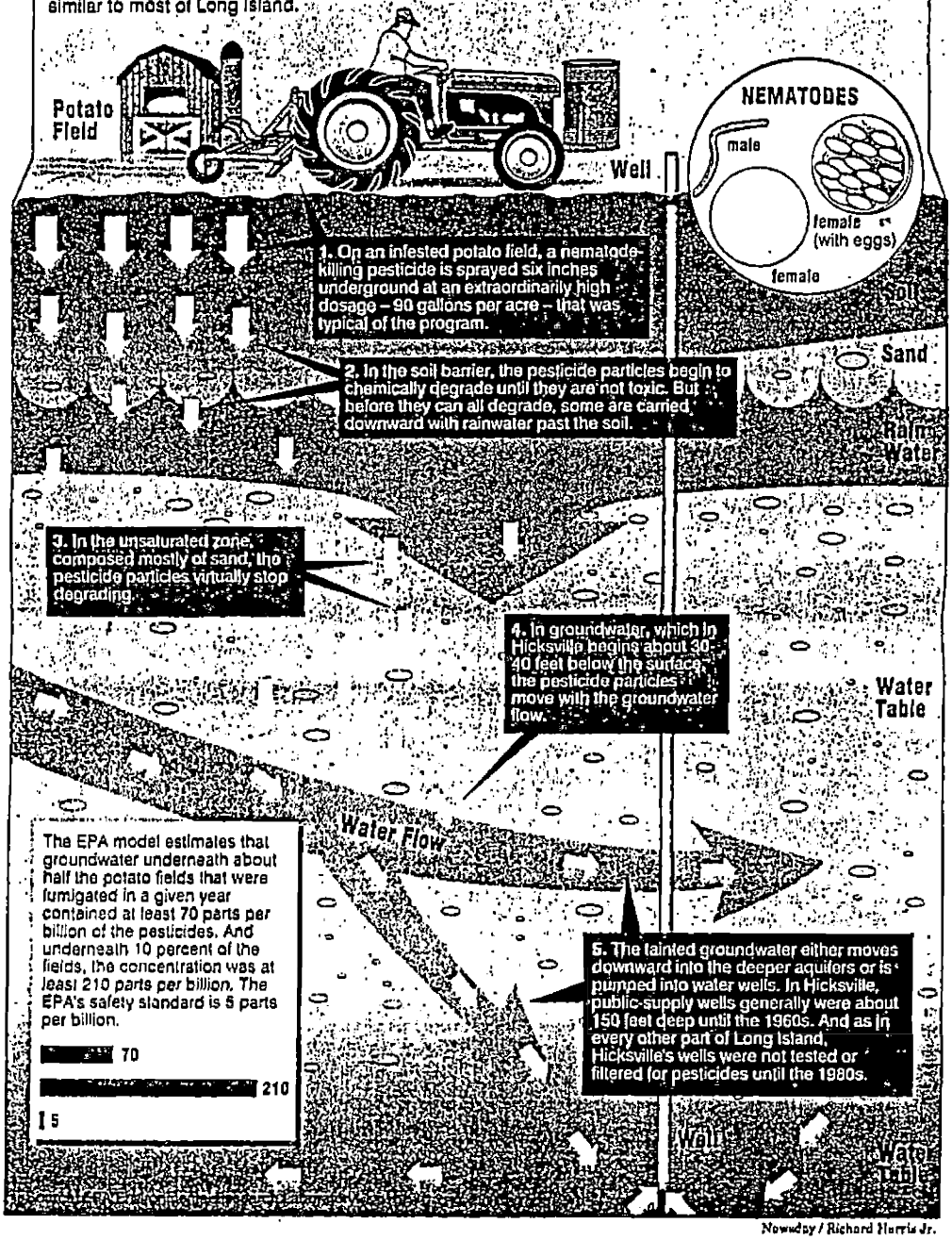
Meanwhile, another chemical developed during the war — DDT — had become a favorite of potato growers. They discovered it worked wonders against a pest that was even more widespread than the nematode: the Colorado potato beetle. Within a few years, as the beetles grew increasingly resistant to the chemical, farmers were spraying their fields with DDT as often as every

Please see PESTICIDES Next Page

Seeping Into the Ground

A computer model prepared for Newsday by the U.S. Environmental Protection Agency estimates how aquifers were affected by a program -- halted in 1984 -- that fumigated more than 10,000 acres of potato fields infested with the golden nematode, which was found only on Long Island.

The estimates are based on soil and weather conditions in Hicksville, and the characteristics of the pesticides most used in the anti-nematode campaign: 1,2-dichloropropane and 1,3-dichloropropene. Hicksville was a potato center during the early years of the program, and the area's hydrogeology is similar to most of Long Island.



Newsday / Richard Harris Jr.

Pesticide Use Haunting LI's

PESTICIDES from Preceding Page

two weeks during the growing season.

"DDT was the miracle chemical. You sprayed it on once and that was the end of it," remembered Raymond Wesnofske, 55, a Bridgehampton potato grower whose father farmed in Hicksville. "At first the usage wasn't particularly heavy, but then as they grew resistant to it you'd get more and more heavily into it."

Potato farmers weren't the only people using DDT. As it was in other parts of the country, DDT spraying until the mid-1960s was a major part of county mosquito-control and gypsy moth programs, and was also widely used on vegetable crops, in backyard gardens and even inside houses.

The termiticide chlordane also began to be used pervasively during the 1950s on Long Island. Like the nematode-killers, chlordane typically was injected directly underneath the topsoil.

By the early 1950s, farming was in rapid decline in Nassau. Starting in 1947, William Levitt had enticed thousands of veterans and their families to move into $8,000 cookie-cutter houses. And while much of the land that became Levittown was not in active potato cultivation just before it was developed, many other builders did subdivide thousands of acres of nematode-infested fields in the surrounding areas.

In Suffolk, meanwhile, the war on the nematodes was intensifying. The dosages grew higher as the insects developed biological resistance, and as federal regulators adopted the policy of repeatedly treating potato fields until not a single nematode could be detected.

"We had some farm fields that were just horrendous, so much stuff had been dumped on it," said Tom Martin, a groundwater specialist with the Suffolk health department. A 17-acre farm in Jamesport, for example, got 4,190 gallons in a single year, 1963. An 18-acre farm in Bridgehampton got 6,655 gallons in 1967 and 1,815 gallons in 1973, Martin said.

Newsday File Photo

A state conservation officer confiscates banned insecticides in 1972

The dosages in the fumigation program were so intense that by one estimate, that of retired Cornell plant pathologist Martin Harrison, the anti-nematode program represented about one-fourth of all the agricultural pesticides used on Long Island at that time.

There's no way to know for sure how much D-D was really applied. Records of the federal-state program go back only to 1955 so they don't include most of the Nassau acres that were treated. The records show that from 1955 to 1984, 8,677 acres on Long Island were fumigated with about 960,000 gallons of D-D, and about 150,000 gallons of related fumigants.

"The USDA guys were on a crusade," Martin said. "For years and years, they were dumping this stuff, and the nematodes were still there."

By some measures, the treatment program was a success. Like DDT and a succession of other potato pesticides, D-D helped keep Long Island's potato industry alive. It also prevented the golden nematode from spreading anywhere else except a few isolated pockets of upstate New York. And research funded under the anti-nematode program led to the development of nematode-resistant potato strains used on Long Island today.

"It's one of the rare times that a quarantine worked, and I'm extremely proud of it," said Mai, the retired Cornell plant pathologist. "When tests were adequate to find it [pesticides] in the groundwater, then we totally altered the program. You can't look ahead and see things that you don't know are coming."

A Surprise In the Groundwater

The first hint of what was coming occurred in 1976, when the first tests of local groundwater for volatile chemicals showed that public wells near Grumman's Bethpage factory were tainted with the solvent tetrachloroethylene. Just as they had with pesticides, health officials had assumed that the soil barrier would hold the chemicals long enough for them to volatilize harmlessly into the air. Instead, they found out that moisture was carrying the solvents down through the soil into the aquifer, where the chemicals persisted for years.

So in 1979, Cornell hydrologists decided to look for a new and wildly successful beetle-killer, aldicarb, in 10 wells on East End potato farms. They didn't expect to find it. After all, no one thought pesticides could reach groundwater.

To their surprise, they found high levels of aldicarb in every one of the 10 wells.

"People have a mindset, and they think they understand the way things work, and it takes a long time for people to understand that they're wrong," said Rosemary Loria, a plant pathologist at Cornell. "I think that's what happened with groundwater contamination and pesticides."

By 1980, aldicarb had been withdrawn from Long Island. The insecticide had been used for only three growing seasons, but Suffolk health officials have subsequently found it in more than 3,500 private wells. Today, about 10 new tainted wells are identified each month, and each well is fitted with protective filters paid for by aldicarb's manufacturer, Union Carbide.

With aldicarb showing up in such huge quantities, health officials quickly decided to look for other pesticides, too. In 1980, they took samples from 12 private wells on farms near the Southold Town landfill, which the USDA had been using to store chemicals used in the nematode program. All but one of the samples came back positive for dichloropropane.

By that time, D-D had given way as the fumigant of choice to Telone, which was a different mixture of the two nematode-killing chemicals. But the news that Telone was reaching groundwater forced its withdrawal from Long Island. And in the early 1980s, other fumigants were abandoned or banned when they too were detected in groundwater.

In 1984, the U.S. Agriculture Department ended its 38-year anti-nematode fumigation program because of the groundwater contamination.

But the program's legacy lives on today: During the past 13 years, dichloropropane has been found in more than 30 public wells and at least 527 private wells in Suffolk County, mostly on the East End but also in Dix Hills, Melville, Manorville and Mt. Sinai — all areas that were infested with the nematode.

And even in Nassau, where the last nematode fumigation was in 1967 (except for a single field that was retreated in 1975), dichloropropane or dichloropropene are still being detected in public wells. During the past decade, the chemicals have been found in 23 public wells at depths as great as 700 feet below the surface, though always at low levels. It's possible that some of those detections may be due to industrial pollution, because dichloropropane was also used as a paint stripper and is still used as an intermediate in chemical manufacturing. But all six wells in which the chemical has been detected more than once are in parts of Nassau that were once infested by the nematode.

Those wells are now filtered to remove any of the detected dichloropropane, and in most cases the concentrations before filtering are below the federal standard of 5 parts per billion. But not always. One now-abandoned East End well sampled shortly after groundwater testing began registered 550 parts per billion, the highest concentration of dichloropropane ever found in groundwater anywhere, according to the EPA.

Looking for Clues

Given what's known about the pesticides that are still showing up in wells, it's possible to draw some conclusions about water contamination in the early years, before pesticide testing began, experts say.

For one thing, those pesticides are proving to be remarkably persistent and are being detected at progressively greater depths.

For example, a 508-foot-deep well on Woodchuck Hollow Road in Huntington Station began routinely registering low levels of dichloropropane in 1986 — more than 20 years after potato farming ended in the area.

That's a significant clue that pesticide levels in groundwater remained high in areas where potato fields were replaced by housing, according to Sy Robbins, county hydrogeologist in the Suffolk health department.

Long Island's consistent geology is another clue, he said. The water table is unusually high on the East End, but what matters more is that throughout the Island the soil barrier is relatively thin, and there is no layer of clay or bedrock to protect the aquifers. If rainwater carries pesticides down through the soil barrier relatively quickly, before the chemicals degrade, the pesticides can then move freely and quickly within the so-called unsaturated zone between the soil and groundwater. That means the depth from the bottom of the soil barrier to the top of the water table doesn't influence pesticide contamination very much, Robbins said.

If anything, he said, exposures may have been higher in western Long Island than on the East End. In the west, groundwater descends twice as slowly through the aquifer system as it does on the East End. Groundwater typically moves about 6 inches per day in western Long Island compared with 1 foot on the East End, so pesticides would remain longer in portions of the aquifer that are tapped by wells.

"The aquifer material isn't substantially different on the East End and the west end, except that the residence time in the aquifer is much longer in the west," Robbins said.

And there's a final clue: In the days before pesticides were detected in groundwater, public water wells were routinely dug near farms, and were quite shallow.

When Genevieve Frey moved into her new house in 1952, for example, the Hicksville Water District was relying on seven public wells that were all less than 170 feet deep, said Robert Holzmacher, a consultant to the district. There were also numerous private wells that were 60 feet deep or less. Today, all of the district's wells are at least 500 feet deep.

"In those years, the wells were so shallow, and the pumping was so heavy, that some of the pesticides may have been removed from the groundwater by pumping them out — by drinking them," said Robbins.

The groundwater model prepared for Newsday by the EPA demonstrates how the massive use of pesticides would have affected Long Island's groundwater.

The computer model, known as PATRIOT, simulates the way chemicals move into groundwater, and predicts the concentrations in which those chemicals will be detected. The model is used by the U.S. Environmental Protection Agency in its own groundwater studies, and at Newsday's request the EPA used it to predict what would happen to groundwater below a

Suburban Pioneers

Long Island potato field that had been treated with 90 gallons per acre of dichloropropane and dichloropropene. The model is based on the chemical characteristics of both pesticides, as well as Long Island's rainfall pattern and the characteristics of one of the Island's most common soil types, called Riverhead.

The results showed that while the chemicals degraded relatively quickly while still in the soil barrier, losing half their potency within about 15 days, they moved so quickly through the soil that high concentrations were still reaching the sandy earth beneath the topsoil. Once the chemicals hit that sandy unsaturated zone they degraded much more slowly, and there was nothing to prevent them from moving downward into the water table.

"The amount of material that was applied is so overwhelming that it's getting into groundwater," said Robert Carsel of the EPA's environmental research laboratory in Athens, Ga., which constructed the model for Newsday. "Ninety gallons an acre is horrendous."

The model calculates the probability of contamination in a particular place. For the nematode-killers used on Long Island, the model predicted that in groundwater beneath half the treated fields, the chemicals would be found at concentrations of at least 70 parts per billion. And for 10 percent of the fields, the concentrations would be at least 210 parts per billion. The EPA's safety standard for both chemicals in groundwater is 5 parts per billion.

The model does not predict how long the chemicals stayed in the shallow aquifers that were pumped for drinking water. But unless the pesticides were disturbed by well pumping, it's likely that they moved at the same speed as the groundwater — about six inches per day.

How Big a Risk?

No one can say for sure what kind of a cancer risk would be faced by someone who drank water tainted by a pesticide.

Dichloropropane and dichloropropene, for example, both have been labeled probable human carcinogens by the EPA. Federal researchers at the National Institute of Environmental Health Sciences have concluded that dichloropropane causes breast cancer in female rats and liver cancer in male rats. And the EPA has identified "positive trends" that link exposures of dichloropropene to the rate of breast, thyroid and adrenal tumors in rats, but concluded that the strongest links were to stomach tumors in rats, and stomach, bladder and lung cancers in mice.

Perhaps most significantly, both chemicals can be stored in human fatty tissue, where they can gradually accumulate. Some researchers believe cancer risk increases with this bioaccumulation, magnifying the chemical's effects over time.

Bioaccumulation is the reason virtually all Americans have DDT in their bodies, and why DDT has been linked to cancer in humans. In an article published in April in the Journal of the National Cancer Institute, Mary Wolff of New York's Mount Sinai Medical Center analyzed blood samples from 229 women and found that the 10 percent of women with the highest amount of DDT residue in their blood were four times as likely to get breast cancer as the 10 percent with the lowest.

Aldicarb, on the other hand, does not bioaccumulate and the EPA does not consider it a carcinogen. However, some researchers consider it a possible suspect for breast cancer because it has been linked to hormone-related effects in animals, such as decreased testicle weight in dogs exposed to aldicarb.

What isn't known about the pesticides found in local groundwater is whether they are estrogenic — whether they initiate the same chemical reactions in human cells that are triggered by natural estrogen.

Of the local pesticide suspects, only chlordane and DDT have so far been identified by researchers as estrogenic. The others are still waiting to be tested, a task that a New York City researcher hopes to complete within a few months.

"They're all on my list," said the researcher, H. Leon Bradlow, director of the laboratory of biochemical endocrinology at the Strang Cornell Cancer Research Laboratory. "It's certainly worth investigating because of what we already know about pesticides and breast cancer. Hopefully, we'll have some results before the end of the year."

And then, probably sometime next year, federal epidemiologists will begin their 30-month environmental study of breast cancer in the Northeast, including Long Island. The scope of that study still has not been decided, but the congressional bill that authorized it specified that researchers must look at air pollution, electromagnetic fields, hazardous waste sites, landfills, incinerators — and pesticides.

In Hicksville, Genevieve Frey will be waiting and watching. She'll be worrying about her three daughters, and about a relapse of her own cancer. "I've learned a lot about this in the last two years. What I'd really like to know is why it happened. Does anyone know why?"

Sprayed on the Island

Here are some of the pesticides that were used in particularly high quantities on Long Island until the 1980s, when groundwater contamination or evidence of health hazards forced their abandonment. Of this group, only methoxychlor is still in wide use here.

DDT

Insecticide used heavily on Long Island on farms, homes, swamps and elsewhere.
Status: Banned in the United States in 1972. DDT is still manufactured for export and is heavily used in India and other Third World nations.
Possible links to breast cancer: Women with high levels of DDT in their blood have been shown to be four times as likely to get breast cancer as women with low levels in their blood. DDT has also been shown to be estrogenic, or to mimic natural estrogen.

Chlordane

Termite killer used particularly heavily here because subterranean termites thrive in damp sandy soil.
Status: Banned in New York in 1985, and banned for most uses nationwide in 1988.
Possible links to breast cancer: Has been shown to cause liver but not breast cancer in laboratory animals, and has been shown to be estrogenic.

Methoxychlor

Insecticide structurally similar to DDT, still used as a tree and crop spray and in gardens.
Status: Still in wide use.
Possible links to breast cancer: Has not been shown to cause cancer, but is estrogenic.

Aldicarb

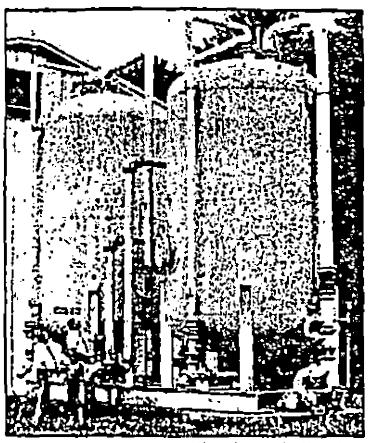
Insecticide was heavily used on local potato fields, contaminating more than 3,500 wells (most of them private).
Status: Used on Long Island only from 1977-1980, aldicarb is still frequently found in local groundwater. Still in wide use in other parts of the country.
Possible links to breast cancer: Has not been shown to cause cancer and has not been tested for estrogenicity. Aldicarb has been linked to hormone-related problems in test animals.

1,2-Dichloropropane

Nematode-killer was heavily used on infested potato fields for 38 years.
Status: Withdrawn from Long Island in 1984, and subsequently withdrawn from pesticide use nationwide.
Possible links to breast cancer: Has been shown to cause breast and liver cancer in lab animals, has not been tested for estrogenicity.

1,3-Dichloropropene

Nematode-killer was heavily used on infested potato fields for 38 years.
Status: Withdrawn from Long Island in 1984, still widely used in other parts of the country.
Possible links to breast cancer: Has been linked to breast cancer in lab animals, but stronger animal links are to stomach, bladder and lung cancers. Has not been tested for estrogenicity.



Newsday / Kathy Kmonicek
A filtration system in Hauppauge

LI Water: How Safe?

By Dan Fagin
STAFF WRITER

For women concerned about breast cancer, here are some questions and answers about pesticides and the water supply today:

Question: Should I worry about pesticides in my drinking water now?
Answer: For the 95 percent of Long Islanders who get their water from water-supply companies or local authorities, there's no sign that pesticides are a major problem. Pesticide testing of public water supplies began in 1979, and routine testing was in place by the mid-1980s. Low levels of pesticides are still frequently detected in the water supply, but wherever they are found, filters are installed to remove them. Also, water wells are much deeper now, and thus less vulnerable to contamination. Farms, where pesticides are used most intensively, are largely confined now to eastern Long Island. And some of the most toxic pesticides were banned when tests began revealing they were present in groundwater.

Q: What if I get my water from a private well?
A: Unless you have your well regularly tested, there's no way to know whether or not your drinking water is contaminated. Almost all of the private wells remaining on Long Island are in central and eastern Long Island, and pesticides have been detected in more than 4,000 of them. Private wells are often in farming areas and are usually less than 100 feet deep, which makes them particularly vulnerable to pesticide contamination.

Q: How can I get my backyard well tested?
A: The Suffolk County Department of Health charges $65 to screen a private well for pesticides and other contaminants. The number to call is (516) 853-3076. But be prepared to wait a few weeks to be tested, and at least a month after that before getting any results. Private testing firms are much faster, but are also generally much more expensive. In Nassau, where there are few private wells left, the health department typically tests them only when there is some evidence of a health hazard.

Q: Am I less likely to be exposed to pesticides if I switch to bottled water?
A: Pesticides are no more likely to be in public water than in domestically produced bottled water. Both are regularly tested for pesticides. Regulation is less strict, however, for imported bottled water.