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SPECIAL REPORT:

“Behind those barbed wire fences that we lived all around, what went on?”

Hope Grosse, Former Warminster resident who grew up adjacent to the Naval Air Warfare Center

Unclear and uncertain danger

The military admits chemicals it used have contaminated public and private wells around three facilities in Bucks and Montgomery counties.

By **KYLE BAGENSTOSE**
STAFF WRITER

Iwona Jodlowska was seeking answers about her husband's health, but only found questions about her own.

Sitting at a coffee shop in Warminster in January, the 53-year-old Warminster resident looked over a wealth of information Calkins Media had compiled about a pair of chemical compounds called PFOA and PFOS. Part of a class of chemicals called perfluorinated compounds, PFOA and PFOS had been found 1 1/2 years earlier in public and private water wells in parts of Warminster, Horsham and War-rington adjacent to military facilities.

Data from the Environmental Protection Agency showed the areas were among the most contaminated in the nation: samples from the three townships were among the 10 highest for both perfluorooctanoic acid (PFOA) and perfluorooctane sulfonate (PFOS) nationwide.



The perfluorinated compounds were a key ingredient in the firefighting foams used for decades at the former Naval Air Warfare Center in Warminster and the former Naval Air Station Joint Reserve Base in Horsham. Contamination from the chemical compounds also was found at the Horsham Air Guard Station, which is still a functioning military facility. The military hasn't officially identified a source there, although public affairs officer Master Sgt. Chris Botzum said firefighting foams were used in the station's hangars.

Jodlowska first learned of the NAWC contamination in the summer of 2014, when federal Environmental Protection Agency representatives knocked on the door of her home on Benn Lane, a quiet street off Bristol Road across from the Spring Mill Country Club in Warminster. Acting on behalf of the Navy, they asked if they could take water samples from the private well she and her husband, Robert Kucharski, had been drinking from since they moved to the home 15 years earlier.

“They took water from us to check it, and (later) told us that the chemicals were present in our water,” Jodlowska said.

The EPA returned a few months later and tested again. When the results came back higher than the first test, “the (Navy) offered to connect us to public water, free of cost,” Jodlowska said.

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CHLOE ELMER / PHOTOJOURNALIST

Hope Grosse stands above a creek that runs through the property of her former childhood home on Kirk Road, adjacent to the Naval Air Warfare Center in Warminster. The property is about 100 yards away from where training exercises were conducted using firefighting foam.

This portion of the now-defunct Naval Air Warfare Center in Warminster is near where that training took place. The Ann's Choice retirement community, built on former base land, rises in the background. The Navy has admitted that foam contaminated public and private wells around the NAWC. It has paid to connect homeowners to public water and to cleanse public wells.



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Clinton thunders to big win over Sanders in South Carolina

She captured a commanding victory in the South Carolina primary, drawing overwhelming support from black Democrats.

By **JULIE PACE** and **LISA LERER**
ASSOCIATED PRESS

COLUMBIA, S.C. — Hillary Clinton overwhelmed Bernie Sanders in Saturday's South Carolina primary, drawing staggering support from the state's black Democrats and seizing an increasingly strong position as the presidential race barrels toward Super Tuesday's crucial contests.

Clinton's lopsided win — she led by almost 50 points with about three-fourths of the vote counted — provided an important boost for her campaign and a moment to wipe away bitter memories of her loss to Barack Obama in South Carolina eight years ago. She won the support of nearly 9 in 10 black voters, crucial Democratic backers who abandoned her for Obama in 2008.

During a raucous victory rally, Clinton briefly reveled in her sweeping support from South Carolina voters, hugging backers and posing with them for selfie photos. But then she pivoted quickly to the contests to come.

“Tomorrow this campaign goes national,” she said. “We are not taking anything, and we are not taking any-one, for granted.”

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GERALD HERBERT / ASSOCIATED PRESS

Democratic presidential candidate Hillary Clinton greets supporters at her election night watch party after winning the South Carolina Democratic primary in Columbia on Saturday.



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Water

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The couple accepted the offer and began receiving weekly shipments of bottled water until work crews showed up the following summer, dug up their yard, and hooked the home into a public service line belonging to the Warminster Municipal Authority. The home became one of 12 in Warminster that were connected to public water because of the issue. The Navy said 40 homes in the Horsham area are being connected; residents are receiving bottled water until then.

Despite the connection to public water, Jodlowska's concerns remained. And she and her husband — a health-conscious couple who don't drink, smoke or use pesticides in their garden — were perplexed at Kucharski's melanoma diagnosis just a few months before the first tests on the well were performed.

"I was shocked," Jodlowska said of the skin cancer diagnosis. "I didn't know what to make of it."

As Jodlowska perused literature about the potential health effects of PFOA and PFOS at the coffee shop for a mention of melanoma, she didn't find much: research into the chemicals is incomplete and only a single, tenuous association with this deadliest form of skin cancer has been established.

But, something else caught her eye. "Oh, my God," she said, pointing to the words ulcerative colitis, an inflammatory bowel disease that has been more substantially associated with the chemical compounds. "I was diagnosed with this. And I eat really well, you know?"

She slumped back in her chair, searching for words. After a few moments staring at the table and mulling the information, she found them.

"I'm pissed." If PFOA and PFOS do definitively cause illness, some residents of Warminster, Horsham and Warrington were among the most exposed in the nation before contaminated water wells were taken offline in 2014. Though it offered no specifics about the link to sickness, a federal disease registry concluded for the first time in January 2016 that exposure to the maximum PFOS levels found at and around the NAWC posed "a past public health hazard."

That the NAWC and joint reserve base introduced toxins into the soil, where they reached ground water, isn't disputed. The NAWC, which was first commissioned as a military base in 1944, was declared a national Superfund toxic waste site by the EPA in 1989. The Superfund program is responsible for cleaning up some of the nation's most contaminated properties and responding to environmental emergencies, oil spills and natural disasters, according to the EPA website.

Remediating the taint, which the government calls remediation, has been ongoing at the NAWC since the Superfund declaration. In the early 1990s, known toxins trichloroethylene (TCE) and tetrachloroethylene (PCE) were found in off-base wells, prompting the Navy to install water treatment systems to remove those toxins from wells at 40 homes and connect at least 20 others to public water systems.

In the mid-1990s, the broader environmental cleanup began: contaminated soil was removed, water treatment systems were constructed to pump and filter contaminated ground water, and monitoring programs were established to gauge the success of those efforts.

Navy data show at least 4,863 pounds of TCE have been recovered so far, along with 159 pounds of PCE and 165 pounds of a chemical called carbon tetrachloride. According to the federal Agency for Toxic Substances and Disease Registry, there is "strong evidence" TCE can cause kidney cancer, and less definitive evidence that chemical, PCE and carbon tetrachloride can cause other cancers. However, a 2002 investigation at the NAWC by that federal agency concluded there was "no apparent public health hazard" from those chemicals because residents were exposed "below levels that cause adverse health effects."

Some parcels at the former 817-acre NAWC were sold after it was closed in 1997 and the Navy concluded its investigation of TCE, PCE and other contaminants. A total of 103 acres were developed into the Ann's Choice retirement facility; 243 acres were turned into the Warminster Community Park; 59 acres became part of the North American Technology Center industrial park; and much of the rest was sold for other commercial development.

Glossary of Chemical Terms

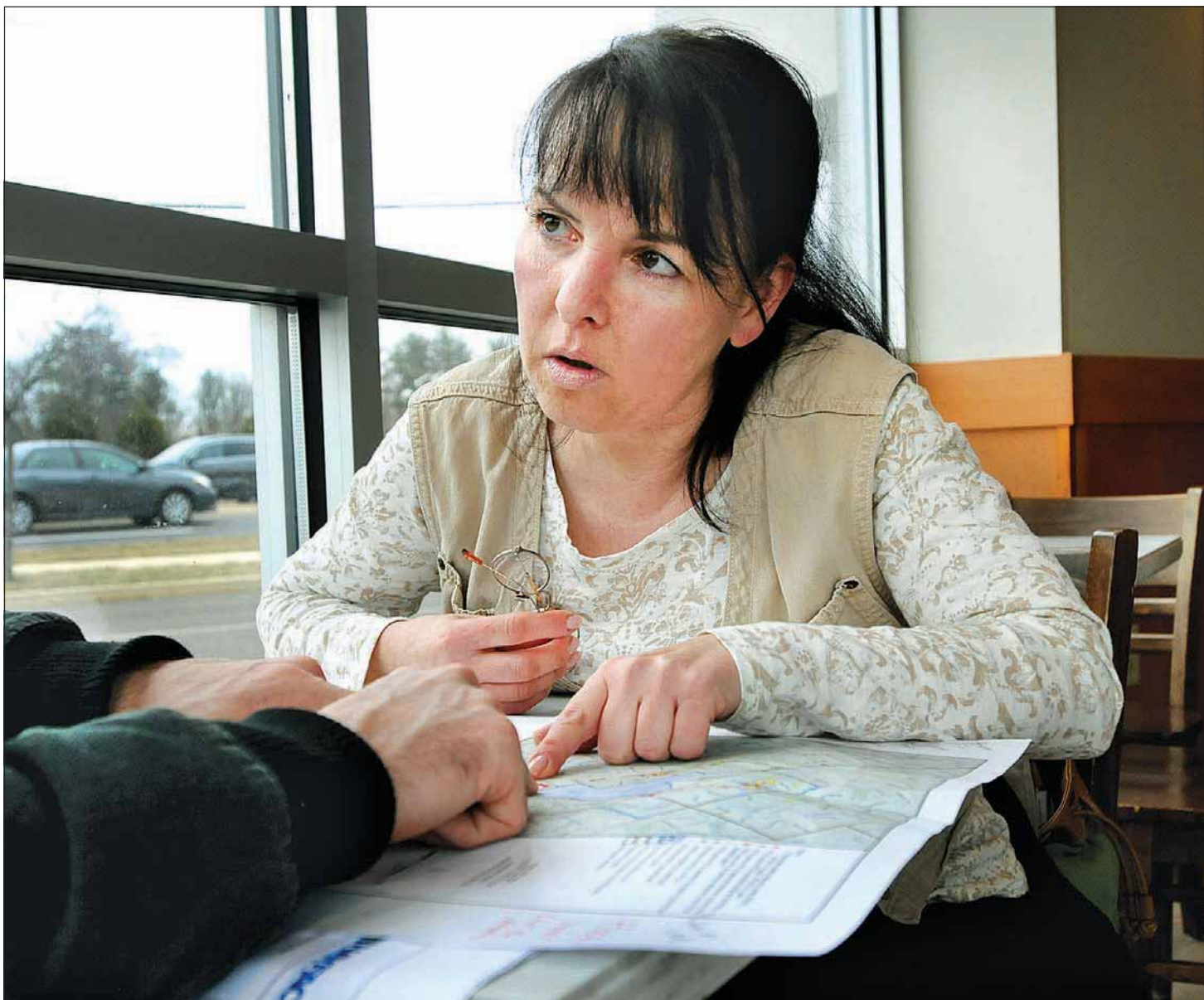
Carbon tetrachloride: A manufactured chemical compound previously used to produce refrigeration fluid, aerosol cans and pesticides, it also is used as a degreasing agent. It's a volatile organic compound, identified by the federal Agency for Toxic Substances and Disease Registry as an "anticipated" carcinogen that can affect the heart, liver and nervous system.

Perfluorooctanoic acid: PFOA is a chemical compound that has been commonly found in firefighting foams used by the military. Able to repel oil, grease, and water, it's also found in a variety of consumer products and packaging. It has been identified by the federal Environmental Protection Agency as "likely to be carcinogenic" and can affect the liver and renal systems, according to the ATSDR.

Perfluorooctane sulfonate: PFOS is a chemical compound that also has been commonly found in firefighting foams used by the military. Able to repel oil, grease, and water, it also is found in a variety of consumer products. It can affect the liver and renal system, according to the ATSDR. It has yet to be determined if it is cancerous to humans.

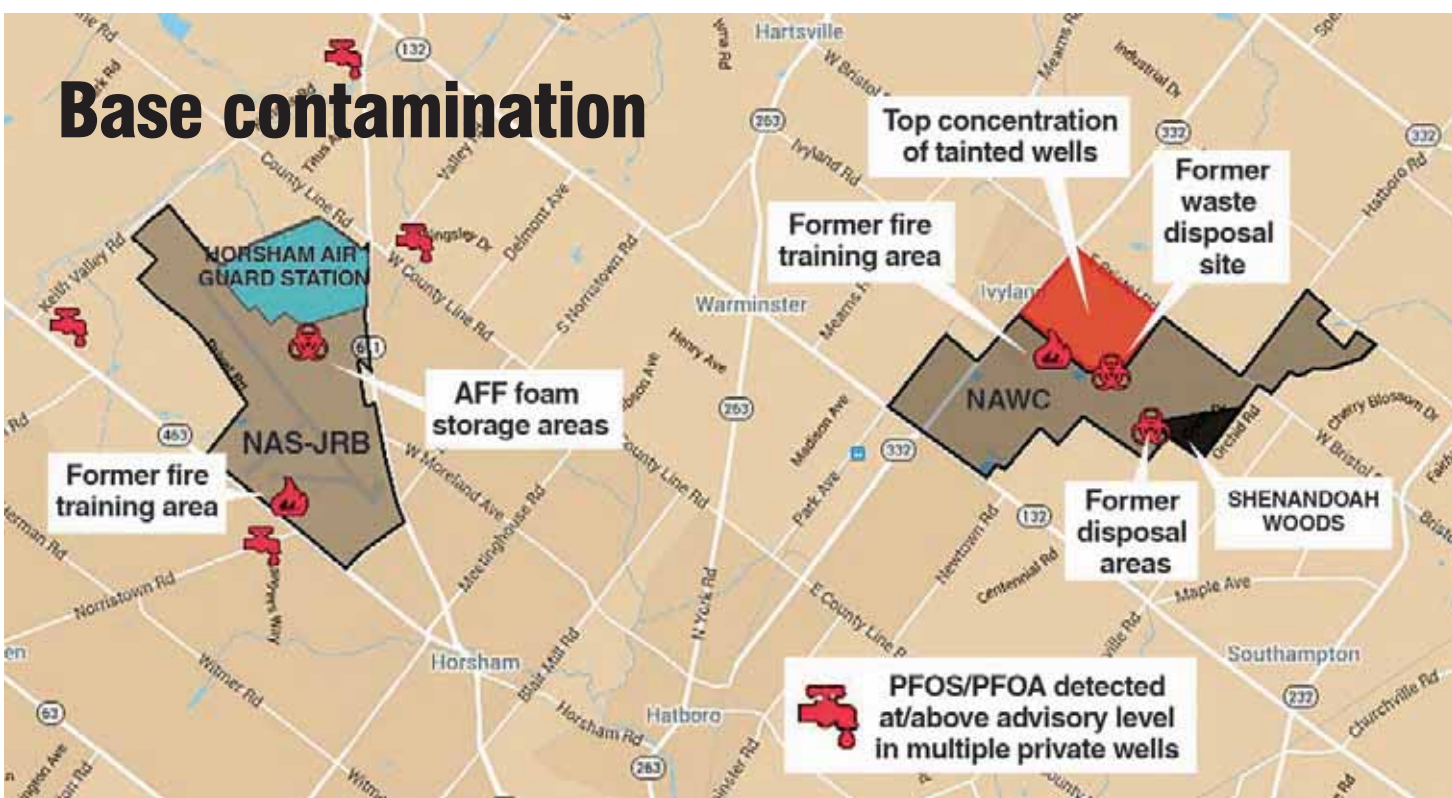
Tetrachloroethylene: PCE is a manufactured chemical compound that has been widely used for dry cleaning fabrics and as a metal degreaser. According to the ATSDR, it's "reasonably anticipated" to be cancerous and can affect human development, as well as the nervous and respiratory systems.

Trichloroethylene: TCE is a chemical compound commonly used as a solvent to remove grease from metal parts, but it's also used in adhesives, paint removers, and other products. According to the ATSDR, it has been found to cause kidney and liver cancer and non-Hodgkin lymphoma. It also can affect human development and the nervous system.



Warminster's Iwona Jodlowska reviews a map of private wells contaminated with chemicals used at the former Naval Air Warfare Center. Jodlowska's home was one of about a dozen in Warminster that was hooked up to public water because of the contamination. Now, she wonders if the chemicals could have caused health issues for her and her husband.

ART GENTILE / PHOTOJOURNALIST



The only parcel that remains in military possession is the 55-acre Shenandoah Woods housing complex, a Warminster neighborhood of 199 abandoned homes that once housed military personnel.

In 2012, the Bucks County Planning Commission approved reuse plans from private developers to turn Shenandoah Woods into a neighborhood of 113 single and twin homes. However, a 2011 discovery of PFOA and PFOS, and investigations in 2012 and 2013, delayed the transfer. In September 2015, the Navy's Base Realignment and Closure program cleared the parcel for transfer, but Warminster is still assessing the agreement.

Less than five miles west of the NAWC, the Navy's former Joint Reserve Base faces a similar situation.

In 2011, the 862-acre base closed after 69 years of service, and nearly all the land remains in Navy possession. The base, along with the adjacent 162-acre Horsham Air Guard Station, was named a Superfund toxic waste site in 1995. PCE and other contaminants have been found in the soil and groundwater, according to the EPA. In 1999, soil was cleaned at one location on the base, and the cleansing and monitoring there and at the guard station continues, according to the EPA.

Looking to the future, the Horsham Land Redevelopment Authority has selected the Catellus Development Corp. to redevelop the reserve base. Plans call for more than 1,000 housing units, commercial space, a recreation center, a school, a museum, parks and other open space. A September 2014 update from the Horsham authority estimated annual local tax revenues from the site could reach \$13.6 million and 7,000 jobs could be created.

But, the development is on hold as the military investigates contamination. In an email to the newspaper in early February, BRAC public affairs officer Bill Franklin said the Navy expects to transfer approximately 700 acres of the reserve base in September 2018, and the rest in September 2020.

The waiting game

Meanwhile, residents continue to wonder about the health effects of the tainted drinking water they consumed.

A week after her meeting with the newspaper, Jodlowska posted for the first time on the public Facebook group "Ivyland—Warminster Toxic Contamination." Created in 2011, the group has amassed nearly 300 followers, primarily from Warminster, Warrington and Horsham — all communities that have dealt with contaminants from the bases.

The concerns shared by members focus on what neighbors have asked each other over their fence lines for decades: did the military bases near their homes make them sick?

Facebook group member Hope Grosse, 51, is adamant that has been the case.

She was 1 year old when her family, the Martindells, first moved to Warminster's Kirk Lane in 1965. The NAWC was a major fixture for Grosse as she grew up: she played in a creek that flowed onto her property from the base and she recalled watching on-base activity from her yard.

"I remember as a teenager, men in white jumpsuits and helmets looked like astronauts over the fence, almost in my front yard," she said.

Unusual illnesses struck her family and others in the neighborhood in the 23 years she lived there, according to Grosse, who added that pets developed tumors and died.

Then, in 1990, the illnesses turned tragic. Her 53-year-old father, Howard Martindell, died of brain cancer, as did the father of another nearby family a few years later.

Shortly after her father's death, when she was 23, Grosse developed a cancerous tumor on her leg that was eventually diagnosed as

Public water wells: Top PFOS Readings in America

Perfluorooctane sulfonate, a chemical compound found in firefighting foams used by the military

PLANT NAME	CONTAMINANT LEVEL (PBB)*
Artesian Water Co. Delaware	1.80
Security WSD, Colorado	1.30
Warminster Municipal Authority	1.09
Horsham Water & Sewer Authority	1.00
Artesian Water Company Delaware	0.93
Warminster Municipal Authority	0.79
Horsham Water & Sewer Authority	0.70
Warrington Township Water & Sewer Department	0.67
Security WSD, Colorado	0.65
Issaquah Water System, Washington	0.60

EPA Provisional Health Advisory Limit = .20

Public water wells: Top PFOA Readings in America

Perfluorooctanoic acid, a chemical compound found in firefighting foams used by the military

PLANT NAME	CONTAMINANT LEVEL (PBB)*
Warminster Municipal Authority	0.35
Oakdale, Minnesota	0.34
Oakdale, Minnesota	0.32
Warminster Municipal Authority	0.29
Horsham Water & Sewer Authority	0.29
Doylestown Twp. Muni. Authority	0.21
Artesian Water Company, Delaware	0.14
Artesian Water Company, Delaware	0.14
Vienna, West Virginia	0.13
Warminster Municipal Authority	0.13

EPA Provisional Health Advisory Limit = .40
*Parts per billion

melanoma skin cancer. It spread to her lymphatic system and took five years of treatment before she went into remission.

"The father of another family ... had the exact same cancer I had," Grosse said. "He passed in 30 days."

After growing up drinking from the private well on her family's property and playing in the creek that flowed from the base, Grosse doesn't hesitate to say what she believes caused the illnesses in her neighborhood.

"The conversations I have with people I grew up with, they all believe it was the base," Grosse said. "Behind those barbed wire fences that we lived all around, what went on?"

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Water

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What is known is that the NAWC and the reserve base used foam that contained PFOS and PFOA to fight and train for fighting fuel fires, which are notoriously difficult to extinguish. Water is ineffective because the two liquids don't mix; the water sinks to the bottom, where it can expand and increase volatility.

The military began using the firefighting foams in the late 1960s because the compounds mix easily with water to produce a solution that blankets and smothers oil fires and vapors. The foams quickly became an essential tool for the military, according to Jennifer Field, a professor of environmental and molecular toxicology at Oregon State University who has been studying these compounds for decades.

An inventory compiled by the Department of Defense shows 664 known fire and crash training sites where such foams could have been used nationwide, including on the NAWC, the joint reserve base and the Horsham guard station in Bucks and Montgomery counties; the North Penn U.S. Army Reserve Center heliport in Worcester, Montgomery County; the former Naval Air Warfare Center in Trenton; and Joint Base McGuire-Dix-Lakehurst in Burlington County, New Jersey.

Field said her research team has collected samples from 15 military sites around the country to date (none of them in the area) and found PFOS and PFOA at 14 of them. The problem now is figuring out what their presence in the environment means for human health, she said.

"The toxicology of these substances is running behind our knowledge of where they are and how much are out there," Field said.

While there's no definitive consensus on the health effects of PFOS, PFOA or other perfluorinated chemical compounds, there isn't a complete lack of information, either.

A fact sheet from the National Institute of Environmental Health says the agency is studying the effects of the compounds in humans, but animal studies have shown the chemicals can disrupt endocrine activity and immune function, adversely affect organs including the liver and pancreas, and cause developmental problems in rodent offspring that were exposed in the womb.

The largest study on the effects of PFOA in humans stemmed from a lawsuit filed against chemical company DuPont in West Virginia. On Jan. 6, The New York Times Magazine published a story by Nathaniel Rich that chronicled a decades-long legal battle between residents along a portion of the Ohio-West Virginia border and DuPont, the chemical giant.

Legal action began in 1999, when attorney Rob Bilott took the case of Parkersburg, West Virginia, farmer Wilbur Tennant, who said he lost hundreds of cattle to mysterious illnesses. The farmer suspected a DuPont waste site upstream from a creek on his land was the cause, Rich reported. As part of the suit, Bilott found internal DuPont documents from as far back as the 1960s that showed the compounds might pose a health risk — and the company still deposited thousands of tons of PFOA into the environment. Bilott ultimately filed a class action lawsuit on behalf of 70,000 nearby residents.

Because little was known about the health impact of PFOA, the EPA conducted a study in 2002 that found the compound could pose health risks to those who drink it or use materials that contain it, such as non-stick pans. The EPA reached a \$16.5-million settlement against DuPont in 2005 and Bilott secured a 2004 settlement in which DuPont agreed to install filtration systems for affected water authorities and pay \$70 million to the plaintiffs in the class action suit.

DuPont also agreed to pay for a study into possible links between PFOA and a variety of illnesses. The results of that study, released over several years starting in 2011, found "probable links" between PFOA and "diagnosed high cholesterol, ulcerative colitis, thyroid disease, testicular cancer, kidney cancer, and pregnancy-induced hypertension."



(File) The Ann's Choice senior development, shown here in 2006, was built on land that once was part of the now-defunct Naval Air Warfare Center in Warminster. The Navy admits its use of firefighting foam over decades has tainted some area water.



(File) This facility once was part of the Naval Air Warfare Center in Warminster.

Following the release of that data, Ohio and West Virginia residents began to file personal-injury lawsuits against DuPont. The first, settled in October 2015, resulted in a \$1.6-million payout for a survivor of kidney cancer, Rich reported. At least 3,534 similar suits have been filed.

In 2009, the EPA set a provisional health advisory level of .4 parts per billion for PFOA and .2 ppb for PFOS in drinking water. The agency also placed the chemicals on its list of "emerging contaminants" and required water authorities nationwide to begin testing for them for the first time. That testing ultimately led to the discovery of the chemical compounds in the public wells near the military facilities in Bucks and Montgomery counties.

According to EPA data, PFOA has been detected, in varying levels, in 324 water samples taken from public water authorities nationwide. Twenty-five of them — nearly 8 percent of the nation's total — were taken from water authorities in Bucks and Montgomery Counties. And of the top 11 readings for PFOA nationwide, six were found in the region, although none were above the EPA's advisory levels.

Findings for PFOS in public wells were also among the top 10 in the nation — and were above the EPA's levels. And some private wells around the NAWC have had PFOS levels more than seven times the agency's provisional health level.

The situation is worse around the joint reserve base: there, private wells reached

as high as 3.8 ppb for PFOS, or 19 times higher than the EPA's provisional health advisory, according to the EPA. Levels for PFOA reached 5 ppb, or more than 12 times higher than the EPA level.

Some water systems act

Although PFOA and PFOS aren't yet formally regulated by the EPA, the Horsham, Warminster and Warrington water authorities stopped using wells containing the chemicals above the EPA's provisional advisory limit — and some that showed levels that were elevated but still below the EPA advisory level.

In June 2014, Warminster stopped using three wells. Well 26, off Ivyland Road, had a PFOS level more than five times the limit of the EPA's provisional advisory level. Well 13, off Vista Drive, and Well 10, near the intersection of Bristol and Twin Streams roads, were taken offline because of their elevated levels — though they didn't exceed the EPA advisory.

Horsham stopped using Well 40 off Keith Valley Road and Well 26 near the Sawmill Valley development after PFOS levels came back several times higher than the EPA's limits in June 2014. Warrington wells 1, 2 and 6, whose water ultimately is combined before being distributed, were all taken offline after water in two wells tested above the EPA's provisional levels in November 2014. The highest, well 2, was

found to have a PFOS reading eight times higher than the EPA's provisional advisory.

Two other wells — one each in Doylestown Township and Bristol Township — had levels of the compounds that were elevated, but below the EPA advisory.

Scott Miele, water superintendent with the Doylestown Township Municipal Authority, said the Cross Keys well in his system remains online. A PFOA reading taken from the well in February 2014 was the sixth-highest in the country, but still only half of the EPA's provisional advisory limit.

"It's definitely on our radar," Miele said. "At this time, we're more or less waiting for direction from the EPA and DEP (state Department of Environmental Protection) ... we're not quite sure where they're going with it (regulating the compounds)."

Donna Alston, communications manager with Aqua PA, which runs a water system in Bristol Township, said the authority didn't take any action there because the levels detected in one of their wells were far below the EPA's provisional levels in 2013 and 2014. "All results are an order of magnitude below EPA's (levels), which is the only health reference standard we have to evaluate the results," Alston added.

The Navy response

Multiple local water authority officials praised the response of the Navy and National Guard Bureau, which have agreed to pay for sampling hundreds of private wells in Horsham, Warminster and Warrington. Homeowners whose well water contained PFOS or PFOA higher than the EPA's advisory levels are being paid to have their homes connected to public water and are being given free bottled water in the meantime. The Navy also agreed to compensate water authorities for filtration systems to cleanse contaminated wells, and to reimburse them for the water they've had to buy from other utilities to offset the lost wells.

"The Navy did readily acknowledge that there had to be a connection (between the base and the public wells)," said Tina O'Rourke, business administrator with the Horsham Water and Sewer Authority.

■ A \$3.9-million agreement was signed with the Warminster Municipal Authority in March 2015, according to the Navy. It provides for carbon filtration systems at the three public wells above or near the EPA's levels, reimbursement for replacement drinking water, and the connection of affected homes to public water.

■ In July 2015, the Navy signed an \$8.8-million agreement with the Horsham Water and Sewer Authority for the same measures for public and private wells. According to a January letter from the township, Horsham also signed a \$250,000 agreement with the National Guard Bureau to connect affected properties near the Horsham Air Guard Station to public water.

■ The Warrington Water and Sewer Authority is receiving \$5.88 million from the National Guard Bureau for a similar cleanup, according to director Christian Jones.

■ As of early January, 13 of the 114 private wells tested around the NAWC had levels of PFOA or PFOS above the agency's provisional health advisory, EPA press officer Bonnie Smith said. Around the Joint Reserve Base, 66 of the 273 private wells that were sampled had PFOA or PFOS levels at or above the provisional advisory limits.

All together, the military has agreed to pay approximately \$18.9 million to reduce human exposure to the nearly 100 public and private wells contaminated above the EPA's provisional health advisory. But none of the agreements have called for any medical studies to assess whether residents have been sickened from prior consumption.

In the case of the DuPont contamination in Ohio and West Virginia, more than \$30 million was spent over seven years before an independent panel established "probable links" between PFOA and a host of illnesses.



KYLE BAGENSTOSE / STAFF

A truck drops off bottled water at the Horsham Water and Sewer Authority. The military is providing bottled water to owners of private wells that have been contaminated by activity at the former Naval Air Station Joint Reserve Base and the Horsham Air Guard Station. Eventually, homes with wells tainted above an EPA advisory will be connected to public water.

Water

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Asked whether the Navy had plans to provide health screening or monitoring, Navy news desk action officer Lt. Chika Onyekanne referred comment on that to the federal Agency for Toxic Substances and Disease Registry. "ATSDR determines if medical screening or monitoring is necessary to determine a relationship between exposure to a hazardous substance and illness," Onyekanne said in an email.

A "health consultation" letter sent from the Agency for Toxic Substances and Disease Registry to the Navy in January 2016 doesn't list medical evaluations or studies among its recommendations. It recommends continued investigation of the contamination, long-term remediation, outreach to private well users, and the development of educational materials for residents. It also states that "women make their own personal choices about breastfeeding," but recommends concerned mothers use premixed baby formula or reconstitute dry formula with bottled water "to reduce potential exposure of formula-fed infants."

What the substances and disease registry's January letter does provide is official documentation stating that water contaminated from activities of the Naval Air Warfare Center could have sickened people, up until the time the military and water authorities responded and closed down wells.

"Based on the current toxicological literature ... ATSDR finds that exposure to the maximum levels of PFOS found in private and



CHLOE ELMER / PHOTOJOURNALIST
Hope Grosse recalls her childhood on Kirk Road, where she lived next to the Naval Air Warfare Center in Warminster.

public drinking water supplies at this site (NAWC) were a past public health hazard," stated the letter signed by the agency's regional director, Lora Werner.

The letter also states the EPA provisional levels are based on short-term exposure data, which the letter defines as five to 90 days of exposure. That means the EPA levels "may not be protective of long-term exposure," and that past exposures at the NAWC were "likely greater than one year," the letter states. That means undetermined chronic health risks for residents with private well water below the EPA's provisional levels, or public water consumers near public wells that fit the same description.

However, the letter contains caveats. For one, much of the current data on the health effects of PFOA and PFOS is based on animal research, and there is "limited information" on whether or not the chemicals can cause cancer in humans. The letter also stated its conclusion about the health impact was based on a "conservative" analysis that assumed some public water users were exposed to the maximum PFOS levels in Warminster Municipal Authority wells.

"Some water customers could potentially have received the majority of their water from one of the contaminated wells in the past, but the majority of water customers likely received water that did not contain (perfluorinated compounds) or contained less than the (EPA levels)," the letter stated. "Customers located geographically closest to a given water supply well will likely receive more water from that well than users located further away."

Werner told the newspaper, in a phone interview, that the lack of conclusive evidence about health effects from PFOS and PFOA

would make medical screenings problematic.

"There's just so much uncertainty about what (PFOS and PFOA) means for people and their individual health," Werner said. "Even knowing the level of (perfluorinated chemicals) in a person's blood, I still can't give that person the certainty that people are looking for: 'What does that mean for me; am I going to get sick?'"

Werner added that funding a larger study of the area, such as the one conducted near the DuPont plant in West Virginia, would likely cost a significant amount of money. "They're very complicated endeavors ... you need funding to do that kind of work. In the case of the Warminster site, it would then be up to either the Navy or Congress to make a decision about that kind of funding," she said.

And whether or not there was a similar public health risk around the joint reserve base in Horsham is yet to be determined: Werner said an analysis is currently being conducted and might be completed by the end of the year. For those near the station in Horsham, the question is whether they were exposed to the chemicals at levels the disease registry considers potentially harmful. And for many around the NAWC, it's what their exposure means for their health.

Asked about whether additional studies, or even eventual compensation for medical care, could provide a sense of relief, Jodlowska said she wasn't sure. "Yeah, you would have money, but you can't really put a price on somebody," Jodlowska said. "To the people who love you, you're priceless."

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Much is unknown about the health effects of perfluorinated chemicals

By KYLE BAGENSTOSE
STAFF WRITER

Perfluorinated chemicals, which have been detected in some public and private wells near three military facilities in Bucks and Montgomery counties, are commonly found throughout the USA.

First developed commercially by chemical company 3M in the 1940s, the chemical compounds have been employed in firefighting foams used by the military as well as in nonstick cookware, carpets, clothes, mattresses, industrial degreasers, dry cleaning fluids and some food packaging, according to the National Institute of Environmental Health Sciences.

Jennifer Field, professor of environmental and molecular toxicology at Oregon State University, says perfluorooctane sulfonate (PFOS) and perfluorooctanoic acid (PFOA) are just two of many chemicals found in that family of compounds. What they all have in common is their chemical structure: multiple carbons each possessing two fluorine atoms.

"Why that matters is because the carbon-fluorine bond is the shortest and strongest in nature," Field said. "While (that quality) in firefighting foams is great for blanketing fuel fires or deflecting liquids in nonstick pans, we don't know what the effects are for the environment."

Field said the chemical compounds have two properties that make them particularly detrimental to the environment.

First, their strong bonds keep them from breaking down.

"To destroy these chemicals takes a lot of energy and effort, Field said. "There's a lot of research and a lot of funding to find cost-effective ways to destroy these chemicals ... (but) it's a tough nut to crack."

Second, once they're released into the environment, the high solubility of the chemicals allows them to be dispersed through groundwater and surface water, including public wells and shallower private wells.

"Because they're persistent and mobile ... that has created the situation today (with their widespread presence)," Field said.

Field has been studying the chemicals since the late 1990s, and says data show they're often found in water samples collected from military bases and landfill leachates. A leachate is water that has passed through a solid mass. She suspects airports also could be a common source of the compounds in the environment.

"In our experience ... anywhere you see repeated historical practice with (firefighting foams),



ART GENTILE / PHOTOJOURNALIST
The NAWC, which was first commissioned as a military base in 1944, was declared a national Superfund toxic waste site by the EPA in 1989.

you have potential for higher concentrations," Field said.

The federal Centers for Disease Control and Prevention goes further. It says just about everyone in the U.S. has been exposed to perfluorinated chemicals. Citing a 2004 CDC study that found PFOA was found in "nearly all" of 2,094 study participants' blood, the agency concluded, "PFOA exposure is widespread in the U.S. population."

What that means for human health is still very much unknown, according to a number of sources, ranging from investigators like Field to the National Institute of Environmental Health Sciences, which is part of the National Institutes of Health. Because technologies to detect perfluorinated chemicals didn't become widely available until about a decade ago, researchers are only starting to analyze whether or not there is a link between their presence and human health.

The largest study has been the C8 Science Panel. As part of a class-action settlement following PFOA contamination in Ohio and West Virginia, chemical company DuPont agreed to fund an eight-year study that analyzed 69,000 people in the affected area.

By comparing the level of PFOA in participants' blood to their medical histories, a panel of independent epidemiologists

found "probable links" to "high cholesterol, ulcerative colitis, thyroid disease, testicular cancer, kidney cancer, and pregnancy-induced hypertension." Further research found very high exposure rates could also potentially be associated non-Hodgkin lymphoma, ovarian and prostate cancers.

Experts with whom Calkins Media spoke cautioned against drawing parallels between the C8 Science Panel study and the contamination in this region.

Dr. Marilyn Howarth, director of the Community Outreach and Engagement Core at the University of Pennsylvania's Center of Excellence in Environmental Toxicology, said research into the health effects of PFOA and PFOS in humans is incomplete.

"PFOA and PFOS have been very difficult to link to cancer in humans," Howarth said. "They are clearly cancer causing in rodents, but the mechanisms by which they cause cancer in rodents ... we think, truly don't happen in people."

Howarth added that cancer risks can follow two patterns. Dose-response relationships occur when the cancer risk clearly increases with greater exposure to a toxin, while idiosyncratic cases occur based on variable factors, like genetic susceptibility. There is

no consensus yet on dose-response relationships with PFOS and PFOA, Howarth said.

"Based on currently available evidence, we do not know for sure what a safe level of exposure is for PFOA and PFOS," Howarth said.

The C8 Science Panel also looked for health links to PFOA. (PFOS is the contaminant found in higher concentrations in Bucks and Montgomery.)

An EPA fact sheet on the compounds states the EPA Science Advisory Board found PFOA is "likely to be carcinogenic to humans," but the EPA is "still evaluating this information and additional research."

The fact sheet referenced a number of studies. One found chronic exposure of PFOS and PFOA could lead to the development of the tumors in rats. Another study found mortality rates of kidney cancer and diabetes increased for employees exposed to PFOA at an industrial plant. And a third study found an association between PFOS exposure and bladder cancer.

But even Bruce Alexander, the University of Minnesota environmental health sciences professor who conducted the study showing an association between PFOS and bladder cancer, is cautious about declaring the compound carcinogenic.

"We went in looking at all the

different kinds of cancer ... and in our first study, (the findings) were only based on three deaths and that was for bladder cancer, but it did suggest a risk," Alexander said. "Because bladder cancer is not frequently fatal, it was important to look closer. When we did a followup survey, we didn't find the number of nonfatal cases that would corroborate our finding."

Alexander said the situation is further complicated because bladder cancer can be caused by a number of chemicals commonly used at industrial plants — and also can be caused by smoking and other factors.

"There's so much research to be done ... I don't think anybody can come out and say with certainty that, at low levels, (there will be health effects), but many legitimate questions remain," Alexander said, adding that another study conducted by his team found that workers exposed to PFOA didn't show an excessive risk for kidney cancer.

Pennsylvania has the sixth highest annual incidence of bladder cancer in the nation, at 24.4 for every 100,000 people, according to the National Cancer Institute. Bucks County's rate of 26.5 per 100,000 ranks 22nd among counties in the state; Montgomery County's 26.2 per 100,000 ranks 26th.

Warminster has a bladder cancer rate of 69 for every 100,000 people — or nearly three times the state and county averages. But Warminster also has one of the largest elderly populations in the county: more than a quarter of the township's population is 62 or older, according to 2010 census data. Pennsylvania Health Department statistics show that, in the five-year period from 2009 to 2013, only eight of the 113 bladder cancer cases in Warminster occurred in people younger than 60.

Alexander cautioned medical screening, given the current lack of consensus on the health effects of PFOA and PFOS exposure.

"Medical screening is a very expensive endeavor, and can lead to false positives that require additional medical interventions that carry their own risk," Alexander said. "It's not necessarily the best option unless you really know what you're looking for."

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