Is It Safe to Live Near a Gas Station?

The health concerns for you or your family
with living by the pump.

Despite all the modern health and safety guidelines they must follow, gas stations can still pose significant hazards to neighbors, especially children. Some of the perils include ground-level ozone caused in part by gasoline fumes, groundwater hazards from petroleum products leaking into the ground, and exposure hazards from other chemicals that might be used at the station if it's also a repair shop.

Ozone pollution is caused by a mixture of volatile organic compounds, some of which are found in gasoline vapors, and others, like carbon monoxide, that come from car exhaust. Most gas pumps today must have government-regulated vapor-recovery boots on their nozzles, which limit the release of gas vapors while you're refueling your car. A similar system is used by the station when a tanker arrives to refill the underground tanks. But if those boots aren't working properly, the nearly odorless hydrocarbon fumes, which contain harmful chemicals like benzene, can be released into the air.

Higher ozone levels can lead to respiratory problems and asthma, while benzene is a known cancer-causing chemical, according to the National Institutes of Health (NIH). The quest to reduce ozone levels has led the state of California to implement a more stringent vapor-recovery law, effective April 1, 2009, which requires that all gasoline pumps have a new, more effective vapor-recovery nozzle.
Underground gasoline storage tanks can also be a problem. The U.S. Environmental Protection Agency (EPA) estimates that there are some 660,000 of them from coast-to-coast. Many a lawsuit

has been filed against oil firms in communities across the country by people whose soil and groundwater were fouled by a gas station's leaking underground storage tank. In the past, most tanks were made of uncoated steel, which will rust over time. Also, pipes leading to the tanks can be accidentally ruptured.

When thousands of gallons of gasoline enter the soil, chemicals travel to groundwater, which the EPA says is the source of drinking water for nearly half the U.S. If buying a home, consider its potential loss in value if a nearby underground storage tank were to leak. Gasoline additives such as methyl tertiary-butyl ether (MTBE), which has been outlawed in some states, make the water undrinkable—and that is only one of 150 chemicals in gasoline.

Repeated high exposure to gasoline, whether in liquid or vapor form, can cause lung, brain and kidney damage, according to the NIH's National Library of Medicine.
Spilled or vaporized gasoline is not the only chemical hazard if the station is also a repair shop. Mechanics use solvents, antifreeze and lead products, and may work on vehicles that have asbestos in brakes or clutches. Auto refinishers and paint shops use even more potentially harmful chemicals.

In today's car-centric world, we can't escape exposure completely, because these chemicals are in our air just about everywhere. But by choosing where we live, keeping an eye out for spills, and pressuring the oil companies to do the right thing for the communities they occupy, we can minimize our exposures.

ARC classifies **benzene** as "**carcinogenic** to humans," based on sufficient evidence that **benzene** causes acute myeloid leukemia (AML). IARC (International Agency For Research On Cancer) International Agency For Research On Cancer) also notes that **benzene** exposure has been linked with acute lymphocytic leukemia (ALL), chronic lymphocytic leukemia (CLL), multiple myeloma, and non-Hodgkin lymphoma.Jan 5, 2016

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OCTOBER 7, 2014 https://medicalxpress.com/news/2014-10-small-gas-stations-significant-health.html

Small spills at gas stations could cause significant public health risks over time
by Johns Hopkins University Bloomberg School of Public Health

A new study suggests that drops of fuel spilled at gas stations—which occur frequently with fill-ups—could cumulatively be causing long-term environmental damage to soil and groundwater in residential areas in close proximity to the stations.

Few studies have considered the potential environmental impact of routine gasoline spills and instead have focused on problems associated with large-scale leaks. Researchers with the Johns Hopkins Bloomberg School of Public Health, publishing online Sept. 19 in the Journal of Contaminant Hydrology, developed a mathematical model and conducted experiments suggesting these small spills may be a larger issue than previously thought.

"Gas station owners have worked very hard to prevent gasoline from leaking out of underground storage tanks," says study leader Markus Hilpert, PhD, a senior scientist in the Department of Environmental Health Sciences in the Johns Hopkins Bloomberg School of Public Health. **"But our research shows we should also be paying attention to the small spills that routinely occur when you refill your vehicle's tank."**

Over the lifespan of a gas station, Hilpert says, concrete pads underneath the pumps can accumulate significant amounts of gasoline, which can eventually penetrate the concrete and escape into underlying soil and groundwater, potentially impacting the health of those who use wells as a water source. **Conservatively, the researchers estimate, roughly 1,500 liters of gasoline are spilled at a typical gas station each decade.**

"Even if only a small percentage reaches the ground, this could be problematic because gasoline contains harmful chemicals including benzene, a known human carcinogen," Hilpert says.

Hilpert and Patrick N. Breysse, PhD, a professor in the Department of Environmental Health Sciences, developed a mathematical model to measure the amount of gasoline that permeates through the concrete of the gas-dispensing stations and the amount of gasoline that vaporizes into the air.

The model demonstrates that spilled gasoline droplets remain on concrete surfaces for minutes or longer, and a significant fraction of spilled gasoline droplets infiltrate into the pavement, as concrete is not impervious.

"When gasoline spills onto concrete, the droplet will eventually disappear from the surface. If no stain is left behind, there has been a belief that no gasoline infiltrated the pavement, and all of it evaporated," Hilpert says. "According to our laboratory-based research and supported by our mathematical model, this assumption is incorrect. Our experiments suggest that even the smallest gasoline spills can have a lasting impact."

Since the health effects of living near gasoline stations have not been well studied, Breysse says there is an urgency to look more closely, especially since the new trend is to build larger filling stations with many more pumps. These stations continue to be located near residential areas where soil and groundwater could be affected.

"The environmental and public health impacts of chronic gasoline spills are poorly understood," says Breysse. "Chronic gasoline spills could well become significant public health issues since the gas station industry is currently trending away from small-scale service stations that typically dispense around 100,000 gallons per month to high-volume retailers that dispense more than 10 times this amount."

"In a perfect world, it would be ideal to avoid chronic spills," Hilpert says. "However, if these spills do occur, it is also important to prevent rainwater from flowing over the concrete pads underneath the pumps. Otherwise, storm runoff gets contaminated with benzene and other harmful chemicals and can infiltrate into adjacent soil patches or form stormwater that may end up in natural bodies of water."

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Health: https://motherboard.vice.com/en_us/article/wnjzkm/theres-a-slow-motion-oil-spill-underway-at-every-gas-station-in-the-nation
|By Brian Merchant Oct 7 2014, 5:00pm
|There's a Slow Motion Oil Spill Underway at Every Gas Station in the Nation. Every time a drop of gasoline dribbles to the ground when you fill up your tank, you're contributing to a slow-motion oil spill.

No matter how may times you jostle that nozzle, no matter how long you let it drip into your tank, it always seems to happen: a few precious drops of gasoline fall onto the stained concrete below. They might not seem like much, but combined with the dribble of every other hurried gas station customer, they're contributing to what amounts to a cumulatively large, slow-motion oil spill.

Because it's not just happening to you, of course, but to everyone who stops by to fill up their tank, every day. Hundreds of customers frequent a given station, all leaving a tiny trail of spilled gasoline in their rushed, mildly agitated wake. Plenty of those people are less fastidious than you, too, and just let all that the excess gas left in the hose run on out after they hear that signature 'click'—an unleaded stream of petroleum, ethanol, and benzene.

John Hopkins University's Markus Hilpert, whose team recently **concluded a study** of the phenomenon, estimates, conservatively, that 1,500 liters (roughly 400 gallons) of fuel spills at the average American gas station over a decade. And a lot of that spillage is actually making its way below the pavement—the bulk of it is not simply evaporating as was long assumed.

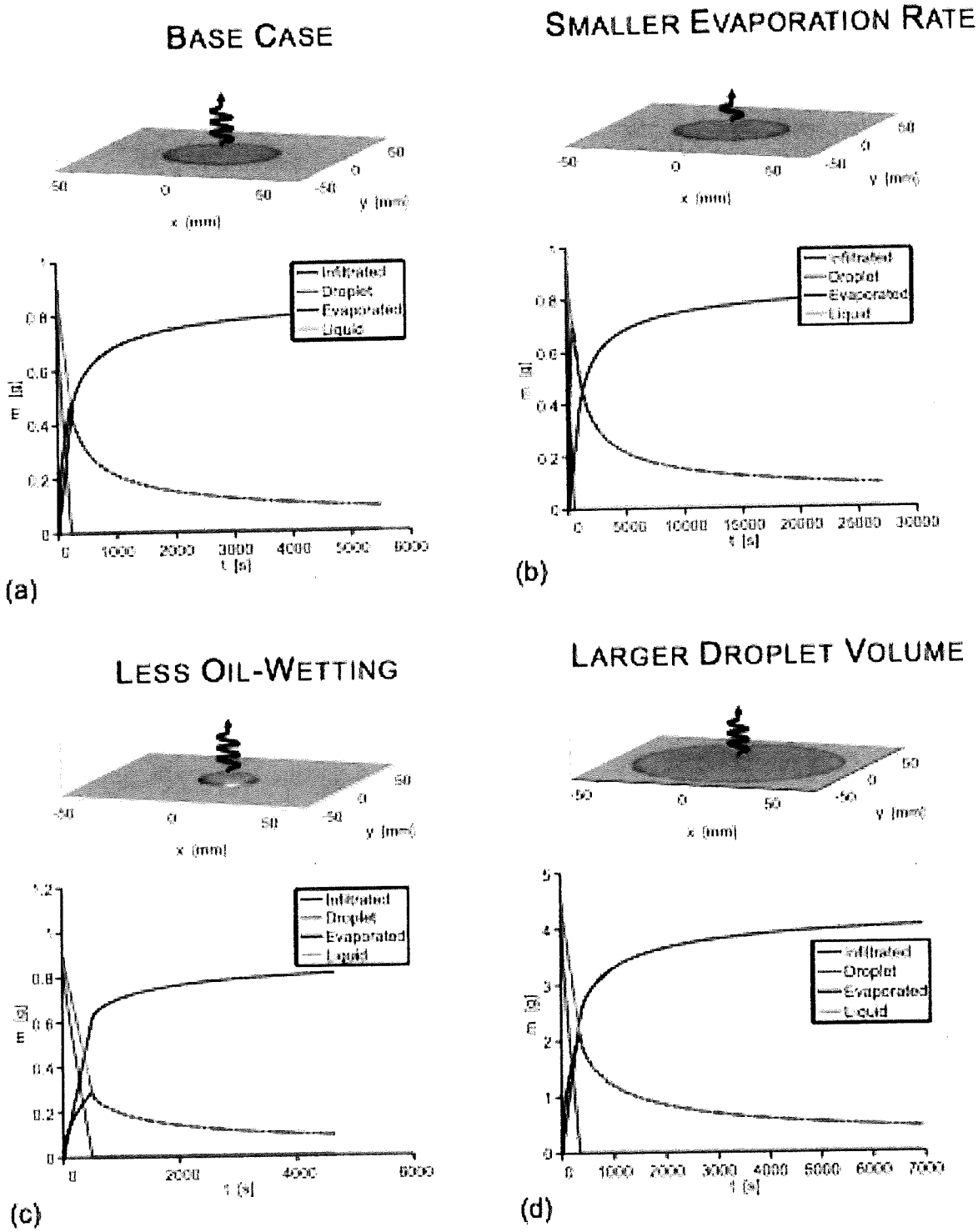
That's an issue, because gasoline contains benzene, **a known carcinogen**, as well as other toxic chemicals. The study, published in the **Journal of Contaminant Hydrology**, finds that the oil accumulates at the concrete pads underneath the pumps, and can eventually contaminate soil and even watersheds underground.

"I am concerned about the large fraction of spilled gasoline droplets that infiltrates into concrete, which at times is assumed to be impervious," Hilpert told me in an email. "Once the gasoline is in the concrete it may then move into underlying sediment and/or groundwater, either as a liquid or as a vapor. Soil and groundwater contamination then provides opportunity for exposure of human to harmful chemicals."

Spilled droplets of gasoline amount to "large cumulative spills" and turn out to have "relatively long life times," according to Hilpert. "This can become a problem if clean rainwater is allowed to flow over the pavement, because the water can pick up the pollutants and move them into uncontaminated environments. For instance, the contaminated rainwater runoff can infiltrate into soil or contaminate surface water." So, the pollution can wind its way into soil patches and natural bodies of water.

The John Hopkins team used a mathematical model, with (likely lowball) estimates provided by the American Petroleum Institute for inputs, to determine just how much

of the gasoline can penetrate the pavement.



The model found that smaller droplets were absorbed more wholly than large ones, as less evaporated.

"Our experiments suggest that even the smallest gasoline spills can have a lasting impact," Hilpert said. "I think it is fair to characterize this phenomenon as sort of slow

motion of a more instantaneous release of 400 gallons... Even if only a small percentage reaches the ground, this could be problematic because gasoline contains harmful chemicals including benzene, a known human carcinogen."
"Gasoline contains about 0.62 volume percent of benzene, a known human carcinogen, which can cause leukemia," he added. "Toluene, ethylbenzene and xylenes are also toxic or suspected to be carcinogenic."

Contaminated groundwater could pose longterm health risks to those who get water from underground watersheds, and the pooling gasoline could be a threat to those who spend a lot of time at or nearby gas stations.

The bigger the gas station, of course, the bigger spills, and the bigger the risk—and the researchers point out that the current trend is away from smaller service stations and towards bigger, multi-pump emporiums. The impact of larger stations, and potential threat to nearby communities, will be even more pronounced. And there are the employees, who essentially spend their days working above a small oil spill, to consider, too.

"I would expect the potential health effects to increase if you live in the proximity of a gas station, or if you work there, there is just more opportunity for exposure," Hilpert said. "There are indeed epidemiological studies that suggest that gas station attendants are at a higher risk." He's not as worried about the short-term exposure of gas station users. "Nonetheless," he said, "I recommend to avoid inhaling gasoline vapors when you refill your tank, simply by not standing downwind from the dispensing nozzle."

Do your part to stop a local oil spill: Try not to let it drip, either.

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ENVIRONMENTAL HEALTH Oct. 04 2018

https://www.mailman.columbia.edu/public-health-now/news/gas-stations-vent-far-more-toxic-fumes-previously-thought

Gas Stations Vent Far More Toxic Fumes Than Previously Thought
A study led by environmental health scientists at Columbia University Mailman School of Public Health examined the release of vapors from gas station vent pipes, finding emissions were 10 times higher than estimates used in setback regulations that determine how close schools, playgrounds, and parks can be to the facilities. Findings appear in the journal Science of the Total Environment.
Gasoline vapors, invisible but odorous, contain a number of toxic chemicals, notably benzene, a carcinogen.

The researchers attached gas flow meters to venting pipes at two large gas stations in the Midwest and Northwest and took measurements over a three-week period. They report average daily evaporative losses of 7 and 3 gallons of liquid gasoline, respectively, or 1.4 pounds and 1.7 pounds per 1,000 gallons dispensed at the pump. By comparison, the California Air Pollution Control Officers Association (CAPCOA) used an estimate of 0.11 pounds per 1,000 gallons. Based on CAPCOA emission estimates, the California Air Resources Board (CARB) determined their setback regulation of 300 feet (91 meters) from large gas stations. Similar rules exist in many, but not all states and localities. In urban areas like New York City, some gas stations are located directly adjacent to apartment buildings.

The study also simulated how the fuel vapor was carried in the air to assess the potential for short- and medium-term benzene exposures, comparing their measurements to three established thresholds. The California Office of Environmental Health Hazard Assessment one-hour Reference Exposure Level (REL) for benzene—defined as a continuous hour of exposure to the chemical—was exceeded at both gas stations at distances greater than 50 meters. At the Midwest gas station, REL was exceeded on two different days at distances greater than 50 meters, and once as far as 160 meters. The Agency for Toxic Substances and Disease Registry's Minimal Risk Level (MRL) for benzene exposure over a period between two weeks and a year was exceeded within 7 or 8 meters of the two gas stations. A less stringent measure used for short-term exposures of first responders, the American Industrial Hygiene Association's Emergency Response Planning Guidelines (ERPG), was not exceeded.

"We found evidence that much more benzene is released by gas stations than previously thought. In addition, even during a relatively short study period, we saw a number of instances in which people could be exposed to the chemical at locations beyond the setback distance of 300 feet," said first author Markus Hilpert, PhD ,

associate professor of Environmental Health Sciences at the Columbia Mailman School. "Officials should reconsider their regulations based on these data with particular attention to the possibility of short spikes in emissions resulting from regular operations or improper procedures related to fuel deliveries and the use of pollution prevention technology."

In previous work, Hilpert and colleagues documented the release of gasoline as fuel is stored and transferred between tanker trucks, storage tanks, and vehicle tanks, and how these spills can contaminate the surrounding environment. Next, the researchers will explore additional short-term measures of vapor spread to determine the bounds of safe setbacks.

Co-authors of the new study include Ana Maria Rule at Johns Hopkins, Bernat Adria-Mora formerly at Columbia, and Tedmund Tiberi at ARID Technologies, Inc. In a competing interest statement, the authors note that Tiberi directs a company that develops technologies for reducing fuel emissions from gasoline-handling operations. The research is supported by a grant from the National Institutes of Health (ES009089).

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