

Krissy Hylton grew up with the rumbling of freight trains and the blaring of their horns. As a child, she loved laying pennies on the tracks before trains passed and collecting the flattened coins. Her home in East Palestine, Ohio—a small town near the Pennsylvania border—is about three blocks from train tracks owned by Norfolk Southern. “Now I hate hearing that train,” she says.

Last year on Feb. 3, a train transporting frozen vegetables, semolina flour, malt liquor, lube oil, and industrial chemicals derailed from those same tracks, upending the 49-year-old’s life and that of many other residents of East Palestine and nearby towns. According to a preliminary report released by the National Transportation Safety Board (NTSB), a wheel bearing overheated and caused the derailment. A video shows sparks and flames around the 23rd railcar that started a fire. Thirty-eight cars veered off the track. Eleven of them were carrying hazardous materials that spilled and fueled the large fire.

Especially worrisome were five tank cars containing vinyl chloride, a highly flammable carcinogen used to make the plastic polyvinyl chloride (PVC). Authorities intentionally released and burned the liquefied vinyl chloride on Feb. 6 to prevent a potential explosion.

A towering cloud of smoke wafted above the town and stretched into Pennsylvania. More than 2,000 people living near the derailment evacuated their homes. Hylton watched the thick black plumes from Patterson, Pennsylvania—a township about 20 minutes’ drive from East Palestine—and wondered when she and her family would be able to return to their home. “I thought we were going to be gone for just another day or two,” she says.

But to this day, her family and dozens of others remain displaced. They still don’t feel safe going back to their homes because they fear environmental contamination and health risks, including cancer, immune disorders, and infertility. Plagued by the same concerns, a few people have permanently relocated. But many residents returned to town soon after the evacuation order lifted on Feb. 8—and

In brief

If you drive through East Palestine, things seem normal. But look more closely, and reminders of a grim day in the town’s history still linger. On Feb. 3, 2023, a freight train carrying hazardous chemicals derailed as it passed through the town, upending the lives of many residents. Although no one was killed or injured, concerns about environmental contamination and health risks remain. The US Environmental Protection Agency maintains that the air, drinking water, and soil are safe, and rail operator Norfolk Southern continues to clean up the mess. Several community members have grown distrustful of the EPA and the railroad company; others just want to put the accident behind them.

others followed in the ensuing months—assured by the US Environmental Protection Agency that it was safe to do so.

The federal agency has been overseeing Norfolk Southern’s testing and cleanup effort. So far, the EPA has collected more than 115 million air-monitoring data points; analyzed over 45,000 soil, water, and air samples; dug out more than 150,000 metric tons of contaminated soil; and shipped off 132 million L of tainted wastewater. But some scientists and residents worry that the federal agency may have downplayed health harms and risks, and they’re skeptical of its claims that the air, water, and soil posed no danger to the community.

Although Norfolk Southern and the EPA have done a lot of testing, the tests aren’t nuanced enough to address many contamination and exposure concerns, says Stephen Lester, a toxicologist and the science director of the Center for Health, Environment, and Justice, a Virginia-based environmental advocacy group. “Instead of acknowledging or recognizing that we just don’t know, they’ve created a narrative very early on that says, ‘Our testing shows everything is fine.’”

When I met Hylton in January, she took me to the East Palestine residence that her parents have owned since 1970 and where she’s lived her entire life. Although Hylton and her family members are now staying in a Norfolk Southern–provided rental house in Columbiana, Ohio—a town 16 km from East Palestine, she still stops by her home to pick up the mail every week or so.

As Hylton opens the door and we step in, a stale, musty odor hits us. The house has been mostly closed this past year, she says. The calendar hanging in her dining room still shows January 2023, the wooden



The calendar in Krissy Hylton’s home still shows January 2023 because no one has lived in the house since last year.

CREDIT: JUSTIN MERRIMAN



On Feb. 3, 2023, a 149-car Norfolk Southern train derailed in East Palestine, Ohio. Thirty-eight cars veered off the tracks; 11 were carrying hazardous chemicals that fueled a large fire.



After the vent and burn, Ohio National Guard members prepared to enter an incident area to assess remaining hazards.

As part of the cleanup, workers installed booms and underflow dams in the creeks to restrict contaminated water and collect floating debris.





Krissy Hylton's home sits right above Sulphur Run, which was heavily contaminated after the Norfolk Southern train derailed and spilled chemicals and lube oil. Andrew Whelton, an environmental engineer at Purdue University, examined the basement, which has an open drainpipe that leads to the creek.

floor clock in the living room is stuck at 12:45, and the Christmas tree that Hylton typically takes down on Feb. 27 every year still stands on the second floor.

The duplex sits atop Sulphur Run, a creek that snakes through town and was grossly contaminated after the derailment. Her basement has an open drainpipe that leads to the creek. When Hylton popped into her home after the evacuation order lifted, the house smelled like nail

polish remover but sweet and somewhat metallic, she recalls.

"It was horrible," she says. That stench lingered for nearly 2 months, and every time she was in the house—or even in town—her eyes burned, her lips and tongue tingled, and she felt fatigued and off-balance. The chemical smell has since disappeared, but Hylton still feels heaviness in her chest and sometimes burning in her eyes when she's in the house.

After the derailment, many people living the area reported similar symptoms, as well as skin rashes, nosebleeds, nasal and throat irritation, coughing and asthma, nausea, and diarrhea.

"Those who live even 5 mi [8 km] and beyond also reported experiencing symptoms," says Erin Haynes, an environmental epidemiologist at the University of Kentucky who's been conducting health surveys in the area since April 2023. Some residents say they still feel sick and experience high levels of stress and trauma. Others feel fine. This divide has created tension between community members who still have concerns and want answers and accountability, and others who are ready to move on.

Chemicals of concern

Train derailments are fairly common in the US, but they rarely result in big disasters. US Department of Transportation data show that on average, more than 1,000 trains derailed every year in the US in the past decade. Even so, the Federal Railroad Administration recognizes rail as the safest way to ship chemicals long distances overland. "Hazardous chemicals are actually safer on rail because there's so much more potential for accidents on highways," says Russell Glenz, a retired voluntary hazmat technician who worked with the emergency response team of Beaver County, Pennsylvania, for 30 years.

The train that derailed on Feb. 3 was heading from Madison, Illinois, to Conway, Pennsylvania. It was carrying vinyl chloride, butyl acrylate, ethylhexyl acrylate, ethylene glycol monobutyl ether, and isobutylene. These compounds are used to manufacture plastics, paints, glues, and cleaning products.

High temperatures can convert vinyl chloride to hydrogen chloride, carbon monoxide, carbon dioxide, and traces of phosgene. Vinyl chloride is a known carcinogen. Its combustion by-products can irritate the skin, eyes, nose, throat, and lungs and cause fatigue and dizziness.

Inhaling butyl acrylate—which has a peculiar, pungent, fruity odor—can irritate the nose, throat, and lungs and cause headaches, dizziness, nausea, and vomiting. Direct contact can also burn and irritate the eyes and skin. Exposure to the other chemicals on board cause related symptoms, including abdominal pain, diarrhea, and other gastrointestinal issues.

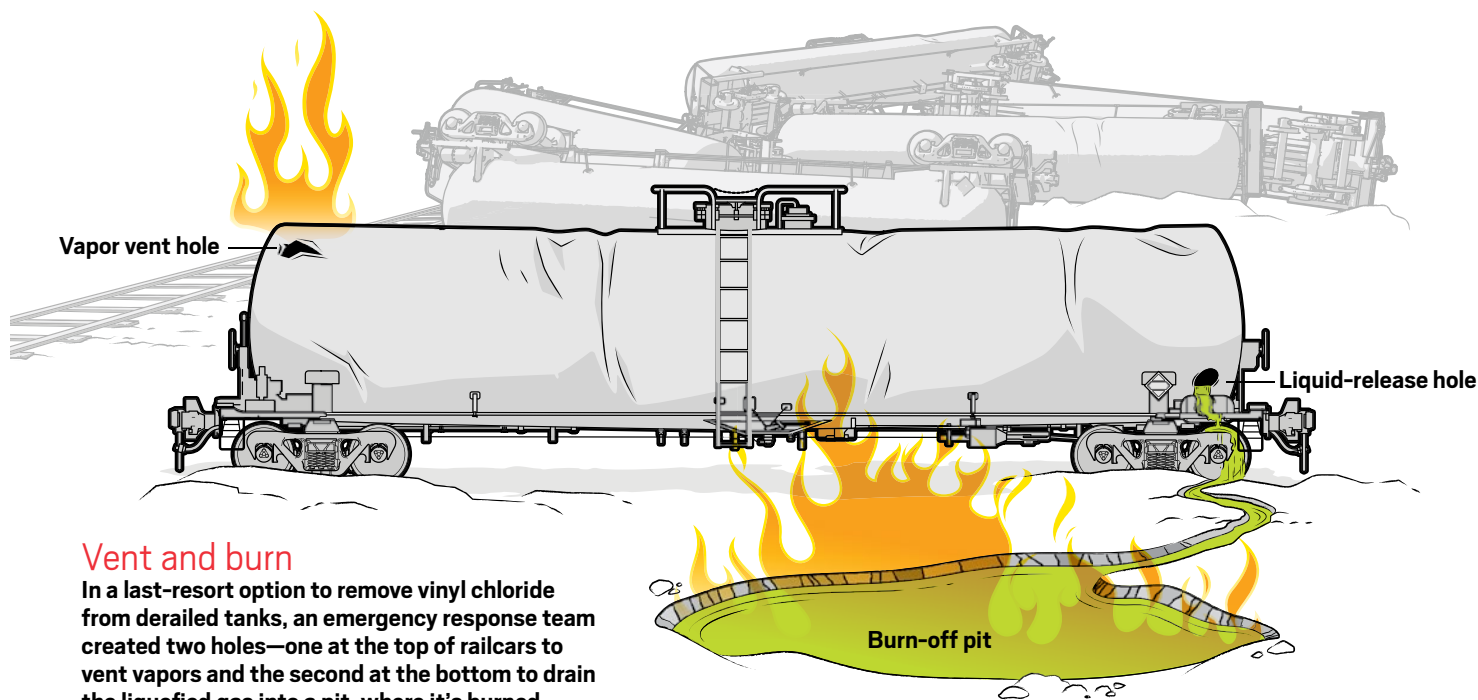
"At the end of the day, the primary concern was vinyl chloride," says Mark Durno, an emergency response coordinator for the EPA in East Palestine. The acrylates



— Likely train route
— East Palestine border

Ground zero
Norfolk Southern train 32N derailed in East Palestine, Ohio, a small town near the Ohio-Pennsylvania border.





Vent and burn

In a last-resort option to remove vinyl chloride from derailed tanks, an emergency response team created two holes—one at the top of railcars to vent vapors and the second at the bottom to drain the liquefied gas into a pit, where it's burned.

were also concerning because of short-term impacts, he adds, but they aren't cancer-causing agents.

Benzene was another important consideration. Two empty train cars that derailed and caught fire had residues of the chemical from past shipments. Inhaling benzene can lead to nose and throat irritation and cause headaches, nausea, and vomiting. And it's a carcinogen. Although it was present in only small amounts in the tanks, "we knew it needed to be monitored," Durno says.

Four cars carrying PVC pellets also derailed and caught fire. Burning PVC can release dioxins, a group of toxic chemicals that persist in the environment and can cause cancer, interfere with hormones—resulting in reproductive problems—and damage the immune system. The EPA maintains that the air monitoring it conducted before, during, and after the fire indicated a low probability of dioxin formation from the derailment. But on March 2—after weeks of community pressure—the agency ordered Norfolk Southern to test local soils for these chemicals.

The company is also testing for semi-volatile organic compounds (SVOCs) that could have formed during the burn and are associated with adverse health effects.

Vent and burn

To remove highly pressurized gases in damaged train cars, authorities have a few options. They can pump the liquefied gas into tank trucks and haul them to a safe

facility. If the car's valves are damaged and the liquefied gas isn't accessible, hot tapping is another option. This process entails drilling a hole into an undamaged section of the tank that's in contact with the liquid, then attaching a new valve to transfer the contents to another tank.

In East Palestine, Norfolk Southern officials worried that vinyl chloride inside the railcars might be polymerizing because of heat from the fire. The polymerization reaction is exothermic: it releases heat that can raise the temperature and pressure inside the tanks. Officials feared that excessive heat and pressure buildup could cause the tanks to explode, sending toxic gas and shrapnel everywhere.

But during a June 22 NTSB hearing, William Carroll, a past president of the American Chemical Society, pointed out that heat alone couldn't initiate polymerization. ACS publishes C&EN but is not involved in editorial decisions. Carroll is an organic chemist who worked at OxyChem—a manufacturer of vinyl chloride—for 37 years. He said that the polymerization process requires compounds called initiators to trigger the reaction.

Paul Thomas, vice president of health, environment, safety, and security at OxyVinyls, the OxyChem affiliate that manufactured the vinyl chloride on the Norfolk Southern train, also testified at the same hearing. He pointed out that the company stabilized the vinyl chloride for shipping by maintaining the concentration of oxygen, a potential initiator,

below 200 ppm in the tanks. Polymerization couldn't have occurred without an external initiator, Thomas said.

But on the ground, Norfolk Southern's contractors suspected that the tanks' pressure-release devices may have been damaged. The audible hiss that they heard from one railcar—indicating normal pressure release—disappeared on Feb. 5. It suggested to them that the pressure-release devices may have been plugged, which they attributed to vinyl chloride polymerization.

In the hearing, Norfolk Southern's contractors also mentioned that the temperature of one railcar's shell, which had been stable at 57.2 °C, increased to 58.8 °C within an hour on Feb. 5. These observations and the cars' ongoing exposure to tremendous external heat from the fire led the team to conclude that polymerization may have begun and that venting and burning was the safest way to handle the vinyl chloride.

East Palestine's fire chief, Keith Drabick, had 13 min to decide whether to approve this last-resort option. The process would entail cutting a hole at the top of the damaged car to vent vapors and release internal pressure, and a second hole at the bottom to drain the liquid into a pit, where it would be burned. Drabick authorized the operation at noon on Feb. 6, 1 day after residents living in a 1.6 by 3.2 km area surrounding East Palestine were evacuated.

Computer models determined the size of the evacuation area from weather conditions and vinyl chloride's properties. The Ohio governor's office warned residents



According to the US Environmental Protection Agency's Mark Durno, lube oil that spilled from the derailed train cars and entered the creeks has caused rainbow-colored sheens to appear on creeks. The sheening problem still exists.

of “grave danger of death” and “high risk of severe injury, including skin burns and serious lung damage” if they stayed. His statement also mentioned that it was unknown when residents could return.

People began scrambling. Some stayed with relatives or friends. Others sought hotel rooms, which were becoming increasingly hard to find. Hylton took her family to a hotel in Columbiana. Christa Graves, whose house is 2 km from the derailment site, wanted to move her family farther away and stayed in a hotel in Alliance, Ohio—a town about 50 km from East Palestine. But paying for two rooms was a sizable expense for the stay-at-home mom. “I wasn’t financially prepared for this,” she says. Courtney Miller, who lived about a kilometer from the derailment site, hopped between friends’ houses while the single mom’s two young kids stayed with their father in Shippingport, Pennsylvania—about 40 km from East Palestine.

Testing for safety

As the evacuation continued, the EPA commenced testing for the vent and burn. Technicians monitored the air for hydrogen chloride and phosgene before, during, and after the controlled burn. They also tested the town’s municipal water source—five deep wells located about 2 km from the derailment site.

The tests did not detect phosgene or hydrogen chloride in the air, and the drinking water proved uncompromised. So local, state, and federal officials assured evacuated residents that it was safe to return home. They told households with

private wells to consume bottled water until the wells were tested.

As families returned, sharp, unpleasant odors made people and their pets sick. The creeks running through East Palestine sported rainbow sheens and thousands of dead fish. Yet officials had given the green light to return, leaving residents baffled and distrustful of agencies in charge.

Starting Feb. 4, the EPA worked with Norfolk Southern’s contractor, CTEH, to monitor outdoor air for particulate matter and 79 chemicals, including volatile organic compounds (VOCs) such as vinyl chloride. The agencies identified locations in the wreckage area and nearby residential neighborhoods to continuously measure air quality using portable photoionization detectors (PIDs) and stationary gas detectors. Between March and May, the federal agency also brought in a mobile van equipped with more-sophisticated air-monitoring instruments known as trace atmospheric gas analyzers (TAGAs) and proton-transfer-reaction mass spectrometers to measure VOCs and butyl acrylate generated by the cleanup process.

All monitoring results to date indicate to the EPA that the air is safe. “Ever since the evacuation was lifted, we’ve never seen any sustained levels of contaminants,” Durno says. “The size and scope of the outdoor testing shows us that there is no problem.”

And because the outdoor air has been OK, the agency believes that indoor spaces are

unlikely to be contaminated. Last February, it oversaw CTEH’s visit to 631 homes and businesses to measure the vent and burn’s by-product, hydrogen chloride, and total VOCs, including many of the chemicals of concern on the train. Handheld PIDs identified VOCs in about 110 buildings, and the team noted the presence of a chemical odor in fewer than 20. “We never saw any vinyl chloride,” Durno says, and the EPA suggested ventilation to get rid of the smell.

Like other residents, Hylton was surprised when CTEH tested the air in her house and told her it was safe, while the overwhelming odor kept making her sick. Butyl acrylate has a low odor threshold, meaning that people can smell it even when it’s present at very low levels. But a document obtained by the energy and environmental news organization E&E News revealed that the PIDs may not have been sensitive enough to detect the chemicals at levels that elicit symptoms.

Federal and state officials learned on March 10 that the instruments’ minimum detection limit of 160 ppb for butyl acrylate well exceeded the 50 ppb limit for irritation effects. But according to Pennsylvania’s Departments of Health and of Environmental Protection, there are no established public health screening thresholds for intermediate or chronic exposure to butyl acrylate in a household setting. CTEH rejected the 50 ppb limit as irrelevant to health effects.

Andrew Whelton, an environmental engineer at Purdue University, argues that there’s another problem with PIDs. “The devices can sometimes be confounded by the complex air samples that they’re taking in, leading to erroneous results,” he says.

Meanwhile, Lester thinks that relying

Stationary gas detectors operated 24/7 in East Palestine, Ohio, to monitor the outdoor air for 79 chemicals, including volatile organic compounds such as vinyl chloride.



CREDIT: JUSTIN MERRIMAN (ALL)



Along with his students, Andrew Whelton, an environmental engineer at Purdue University, made several trips to East Palestine, Ohio, to independently collect and test water samples from creeks and private wells. His team is also testing for chemicals potentially deposited on building surfaces and inside homes and shops.

solely on single chemical analyses may be problematic. Tracking multiple chemicals at low levels, since that is typical of how people are exposed, may be relevant to understanding why people in this community have felt sick.

To address this gap, researchers are using silicone wristbands that absorb low levels of chemicals in a person's environment. In July, Haynes and her team launched a study in which about 80 community members wore the bands for a week as they went about their daily chores. Her collaborators are now analyzing the bands for dangerous combustion compounds known as polycyclic aromatic carbons as well as acrylates and other compounds. In a separate project, Beatrice Golomb, a professor of medicine at the University of California San Diego, is using the silicone bands to find unknown chemicals that others may not be testing for.

Haynes worries that the teams may have missed a crucial window to do these tests, but Durno raises another challenge. He says it may be hard to distinguish low-level chemicals linked to the derailment from chemicals already in homes from cleaning products, paints, and glues. For that



Norfolk Southern is backfilling new stone and gravel in areas where the contaminated soil was excavated. With oversight from the US Environmental Protection Agency, the company is testing this backfill to ensure that the new soil does not contain volatile organic compounds from the derailment.



Two blue tanks temporarily hold wastewater collected from the cleanup site that has yet to be treated or sent for disposal.

reason, the EPA has refused to conduct sophisticated indoor air-monitoring tests, despite demands for them from the community. But Thomas Pritchett, an analytical chemist who worked with the EPA's Emergency Response Team between 1986 and 1995, argues that the agency has done such indoor air quality testing during past environmental disasters. His team, for example, used TAGAs to look for chemicals specific to the incident that weren't normally found in homes. Butyl acrylate would've been a good candidate in the East Palestine case, Pritchett says.

Meanwhile, the two contaminated creeks are another concern for locals. In the summer and spring, kids play in Sulphur Run, which winds through town and joins Leslie Run, another creek. When the train derailed, butyl acrylate, ethylhexyl acrylate, benzene residues, and the lube oil swiftly made their way into the waters.

As the cleanup began last February, booms and underflow dams trapped contaminated water, and aerators placed in the creeks caused dissolved VOCs to escape into the air. These actions created a chemical exposure risk, Whelton says.

Since then, CTEH has been testing the creek's surface waters and sediments for VOCs and SVOCs while monitoring the sheens along the creeks. "Keep Out—Testing & Cleaning In Progress" signs still line Sulphur and Leslie Runs.

With time, contaminants of concern have largely gone away, Durno says. "The surface water is now clean," he says. But regarding the sediments, "there are still a couple of areas where those contaminants are at or above what we call human health screening levels," he says. The sheens, which form when the sediments are stirred, continue to appear—albeit

in fewer spots than before. Rick Tsai, a chiropractor in East Palestine who's been documenting the sheens, is frustrated. "It's been a year," he says.

The EPA is now reviewing Norfolk Southern's plan to address contamination in the creeks. The cleanup may involve washing the sediment to drive contaminants bound to mud into the water, which will be collected for disposal. The plan may also call for excavating tainted dirt.

On the other hand, the soil samples that the company took between March and April and tested for dioxins didn't raise concerns. Collected from 146 locations in and near East Palestine, these samples had dioxin concentrations close to background levels. But the numbers were higher at a few industrial sites and at locations near roads and highways. As the EPA evaluated these outlier spots, it told residents to continue using their own properties for recreation and gardening.

At the derailment site, Norfolk Southern's team has been scrapping railcars and debris; excavating soils affected by the vent and burn and chemical spills; removing contaminated liquids, including rainwater; and transporting waste to approved facilities. A lot of the hazardous waste has gone to landfills in Indiana and Michigan and to incinerators in nearby East Liverpool and Grafton, Ohio. Some contaminated liquids have gone to deep-well injection sites in Texas, Ohio, and Michigan.

An on-site wastewater facility that Norfolk Southern built last summer also processes some of the tainted liquids. Two giant blue tanks that hold pretreated wastewater are now the biggest structures in town. After being treated, the water is tested to verify that its vinyl chloride content meets drinking-water standards. Then it's

shipped off-site. In August, East Palestine's local wastewater treatment facility agreed to accept this treated wastewater, but residents have strongly opposed the proposal.

"I would be confident in the quality of the water that would go into the [town's] treatment plant and then be discharged," Durno says. "But I understand the anxiety."

Living the displaced life

The 32 days that Hylton's family lived in the hotel in Columbiana were a challenge for Hylton's mother, who has Parkinson's disease, and her stepfather, who has dementia. The parents struggled to use hotel key cards, and the room's metal door was too heavy for them to open. On many days, the only walking her mother was able to do was the 2 m stroll from the bed to the bathroom or from the bed to the tiny loveseat in the room.

While Hylton worked her cashier job at Circle K in East Palestine, she couldn't get to the Columbiana hotel quickly when her mother needed her. She knew her mother wasn't getting enough exercise; her neck had started to lean, Hylton says. "I had to get her into a home setting again."

Norfolk Southern provided her family a rental home and furniture allowance. But how long they'd be able to live in that house was a looming question. "They wouldn't tell me," Hylton says. "I would lie in bed every night and think, Are they going to call me tomorrow and say we have to leave?"

Hylton now knows that her family can stay in the rental home until May. The company hopes she'll return to her East Palestine home, but Hylton is seeking an alternative. She believes her house was recommended to be torn down given how

badly it was exposed—a claim that Norfolk Southern denies. But in an email, company spokesperson Connor Spielmaker says, “For residents who wish to not return home, or sell their home, Norfolk Southern’s interim Value Assurance Program is in place to assist them with the sale of their home.”

Another East Palestine resident, Jeff Drummond, has been displaced for a year. The retired truck driver and Gulf War veteran was evacuated from his home, less than a football field away from the derailment site. The property sits in a restricted area where major cleanup operations are still underway. Not allowed to enter his building, the 64-year-old spent 11 months in a motel in North Lima, Ohio—about 15 km from East Palestine. The room had a microwave, minifridge, and no windows. Most meals he ate out.

For the first 2 months, Drummond had to pay the motel out of pocket and take receipts to Norfolk Southern’s assistance center. Twice a week, he would travel to New Waterford, Ohio, and wait in line for 3–4 h to get reimbursed for his stay, food, and gas. “It was a real hassle,” Drummond says. “I’m on a fixed income. I don’t have a whole lot of money.” The company later switched to paying the motel directly.

Finally, in January, Drummond bought a camper and moved in. In an interview, he shows me several photos of medals from his time in the US military, all of which are displayed in his East Palestine home. “I don’t think I’ll ever be able to go back there, he says. “I don’t see them being able to clean this up.”

Zsuzsa Gyenes doesn’t see herself returning to East Palestine either. The 32-year-old has been displaced since the night of the derailment, living in hotel rooms with her 10-year-old son and two cats. The fear of living in a house that smelled of chemicals and might be tainted forced Gyenes to relocate. Tests indicate no residual contamination. But the air in her house had made her nauseated.

I met Gyenes at the one-bedroom hotel room she’s been staying in since May. Located 50 km from East Palestine in Cranberry, Pennsylvania, this is her fourth hotel room. It’s a mild upgrade from the studios she and her son were living in previously.

“It’s slightly bigger; we can shut the door and have a different room,” she says. “We’ve stayed here because it felt like there were no options.” Gyenes had hoped for more-sophisticated air testing in the East Palestine home she was renting and for a thorough cleaning. But that didn’t happen, so Gyenes gave up her lease last summer and stayed put in the hotel room.



Jeff Drummond’s rented home in East Palestine, Ohio, sits in the remediation area along the train tracks. After being displaced from the train derailment and staying in a motel for 11 months, he bought a camper in which he’s lived since January 2024.

The journey has been stressful, she says. Living in limbo not knowing when Norfolk Southern might cut off assistance, while trying to get answers about medical tests that may indicate exposure, hasn’t been easy. Gyenes is now looking for a home in suburban Pittsburgh that will be near her family but away from derailment contamination.

Monitoring long-term health

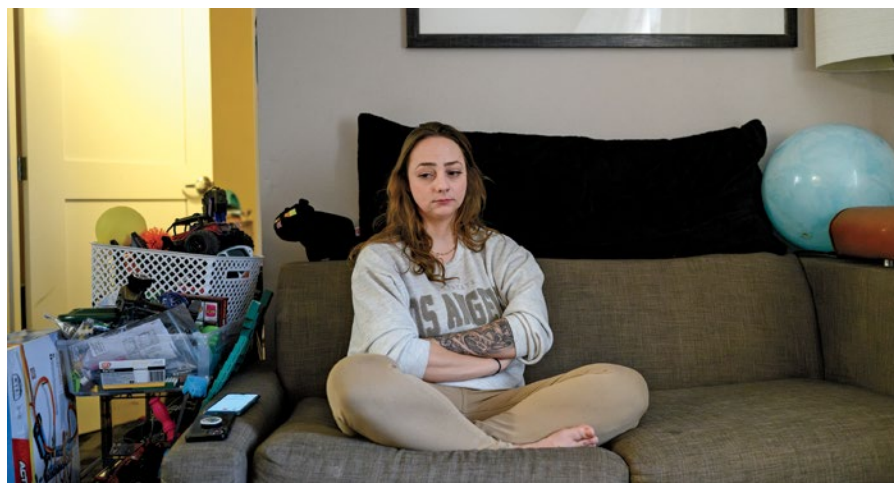
Several people who did not relocate share some of the frustration and confusion that Hylton, Gyenes, and others are experiencing.

East Palestine resident Graves was among the first to return to her home

when the evacuation order was lifted and has been experiencing nearly daily headaches since. She has a history of migraines, but those headaches previously surfaced four to five times every month. Frequent vomiting has been an issue for Lori and Wayne O’Connell’s 24-year-old daughter since the vent-and-burn operation. The family lives across the state border in Darlington, Pennsylvania, and sheltered in place after the train derailed. But because their home fell just outside the designated impact area, environmental testing and access to resources have been limited for their town.

The O’Connells, like others, want to know if, and to what extent, they were exposed to hazardous chemicals and if those exposures are causing harm now or could

Zsuzsa Gyenes has lived in hotel rooms with her 10-year-old son and two cats since Feb. 3, 2023. Fear of getting sick from the toxic chemicals released after the train derailed forced her to give up the lease for her home in East Palestine, Ohio, and relocate.





Lori and Wayne O'Connell live in Darlington, Pennsylvania, about 5 km from the derailment site. Although affected by the incident, they've received fewer resources than those in the evacuation zone to deal with the vent and burn's impacts.

do so in the future. Figuring this out isn't straightforward.

"Many chemicals don't stay in the body very long," says Arthur Chang, a chief medical officer at the National Center for Environmental Health at the US Centers for Disease Control and Prevention. Testing early is key to detecting a significant exposure in the aftermath of an event, he adds.

But UC San Diego's Golomb argues that sometimes chemicals can stay in the body by binding to DNA or fatty tissues. And even when they're flushed out, "the injury that was incurred doesn't go away."

Within weeks of the derailment, some community members had their urine

tested for metabolites of vinyl chloride. But there were issues with the test. "The metabolite that they looked for was not specific to vinyl chloride and could also be produced by other chemicals," Haynes says. "It wasn't conclusive."

She's now testing urine samples her team collected in East Palestine last year for other vinyl chloride metabolites, along with metabolites for butyl acrylate, ethyl acrylate, 2-ethylhexyl acrylate, and acrolein. Her team is also looking for dioxins in blood. In addition, Golomb has been collecting and analyzing urine and blood samples to test for markers of liver function, kidney function, organ inflammation, and

reproductive hormones. Her team is also collecting toenail clippings and hair samples to potentially detect chemical exposure in the past few months. In addition, the researchers are taking cheek swabs to look for genetic markers in residents' DNA that could confer protection or risks for developing certain health problems.

Chemical sensitivity is also key to making sense of what might be unfolding in East Palestine. Some individuals may be more sensitive to various chemicals than others exposed to the same chemicals at the same level, Haynes says. This difference in sensitivity could partly explain why some people have felt fine while others were sick—an issue that strained the social fabric of East Palestine.

"I know couples that were together 20–30 years and divorced over this, separated over this," Hylton says. "They're in the same house and one doesn't feel right, and the other one thinks it's all in their head."

To better understand the link between the derailment and health outcomes, researchers aim to continue working with the community. Flyers that inform East Palestine residents about studies they can enroll in still hang on bulletin boards at Sprinklz On Top, a downtown diner, and at the nearby Sparkle Market.

A year later, there are more questions than answers. Lester urges officials to recognize the limitations of what science can address today and to provide affected people with long-term health care and relocation options.

"If I could get just get a permanent, safe home out of town for my family, I believe I could start to heal," Hylton says. ■

As part of a health study led by the University of California San Diego's Beatrice Golomb, residents of East Palestine, Ohio, use a peak flow meter to monitor lung function. In previous surveys Golomb conducted, many people in town reported upper respiratory tract issues when they returned to their homes after the vent-and-burn operation.

