Health & Medicine

The Pollution Inside Your Home

Researchers at Columbia’s Lamont-Doherty Earth Observatory measured the air in and around New York City apartment buildings. What they found surprised them.

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Columbia’s Lamont-Doherty Earth Observatory (LDEO), located in Palisades, New York, sixteen miles from the Morningside campus, isn’t easy for everyone to get to. But a virtual series called Earth Observations: Conversations with Lamont Scientists is bringing LDEO scientists to our screens to discuss their environmental research. In a recent installment, geochemist Benjamin Bostick and atmospheric chemist Róisín

Commane talked about air pollution, especially the health threats that lurk right under our noses — and our roofs.

Air pollution kills an estimated seven to eight million people a year worldwide, which makes it the biggest risk factor for human death after high blood pressure. And although the phrase evokes industrial smokestacks and clogged freeways, Bostick and Commane brought us closer to home — into kitchens and basements — to examine the impacts of fossil-fuel-powered cooking and heating.

Take asthma, which is often associated with bad air quality. In New York City, where programs provide residents with portable air purifiers to trap particles generated by gas stoves, Bostick and his students — including Columbia undergrads and high schoolers who live in the areas being served — are trying to figure out how to optimize the filtration process. Working in households, the team placed the filter in different rooms. What they found surprised them: When the filter is in the kitchen, where most indoor pollution is generated, the toxic concentrations are actually *higher*. The filter worked much better when placed at the opposite end of the apartment. Bostick explained that when an air filter is placed near someone cooking, “the air doesn’t leave the kitchen” — resulting in high concentrations of pollutants that weaken the filter. “It’s a completely counterintuitive result,” said Bostick, “and a great example of how there’s no substitute for real data.”

That goes, too, for another pollution enigma: the heavy presence in New York City of methane, the biggest climate-warming gas after carbon dioxide (CO_2). Potent and short-lived (it lasts ten years in the atmosphere), with eighty times the warming power of CO_2, methane is typically abundant around wetlands (through decaying organic matter), factory farms (through cattle emissions and waste pits), and oil and gas production sites (through leaks), as well as landfills and wastewater-treatment plants. Yet New York City, which has no feedlots or oil or gas production, is the largest urban source of atmospheric methane in the US. Why?

That’s what Commane wants to know. In her studies of the air in Harlem, Commane and her students have looked at how much natural gas — which is composed of more than 90 percent methane — is delivered to the metro area. Then they determined how much of the methane in the air is from natural gas. Over several months in 2023 and 2024, they calculated a 1.7 percent loss rate — hundreds of millions of dollars’ worth of methane that ended up in the atmosphere instead of being burned.

But where was it coming from? Along with the methane plumes over Harlem, Commane's team also saw high concentrations of carbon monoxide — a by-product of burning natural gas. "Somebody has tried to burn this natural gas and not done a very good job," said Commane.

To crack the riddle, the team started working with Brookhaven National Laboratory on Long Island, to do tests of natural-gas boilers. They found that when a boiler is operating properly — when it receives adequate airflow — only very small amounts of unburned methane escape. But when the researchers significantly reduced the airflow, to a point where the boiler barely worked, they started seeing what they saw on the Harlem rooftops. "This is not Con Ed's problem," said Commane. "This is the boilers, the appliances. This is *our* problem. And we need to do something about it."

For these scientists, there is no better way to clear the air than to study it.

"If we want to address air pollution," said Bostick, "we need to actually spend some time and research. We need to understand mechanistically what's going on, and we need to quantitatively evaluate solutions. Those are all things that are uniquely strong here at Columbia."

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