AIR POLLUTION

Growth of legal pot farms drives smog worries

Colorado to launch study of potential air quality effects of indoor cannabis facilities

By **Jason Plautz**, *in Boulder, Colorado*

Atmospheric scientist William Vizuete grew his dozen pot plants in a garage here, on shelves tucked between some bicycles and a lawn mower. The researcher at the University of North Carolina in Chapel Hill wasn't looking for a high—just data. His team aimed to measure the volatile organic compounds (VOCs) released into the air by four varieties of cannabis—including strains dubbed Lemon Wheel, Elephant Purple, and Rockstar Kush—as they grew, rather than when they were smoked.

Those measurements, recently published in *Atmospheric Environment*, are just one product of an emerging effort to understand how expanding pot farms in Colorado and the nine other U.S. states and Washington, D.C., that have legalized recreational marijuana might be affecting air quality. Vizuete's study, for instance, suggested the more than 600 indoor pot farms in Denver could be worsening the city's air pollution, which sometimes violates federal limits. Next month, in a bid to understand that issue, Colorado officials will launch one of the largest studies to date of pot farm emissions.

Those findings could also aid regulators across the nation, who face a dearth of data as they try to evaluate the pot industry's potential effects on indoor and outdoor air quality as well as worker health. "To be able to permit [pot farms], we have to at least estimate their emissions," says Mike Wolf, a regulator in Washoe county in Nevada.

Such estimates have been scarce, largely because the federal government still considers cannabis an illegal industry. That has made it difficult for researchers to obtain funding from federal agencies, including the Environmental Protection Agency (EPA) and the Occupational Safety and Health Administration. Vizuete, for example, had to work in a garage because cannabis plants aren't allowed in the federally funded National Center for Atmospheric Research here, where he had hoped to run the study. Scientists wanting to study pot, he says, "are stuck in a position where we have to cobble this together on our own."

Researchers have long known that VOCs emitted by plants can contribute to smog. VOCs can mix with nitrogen oxides—produced by cars and industrial sources—in sunlight-driven reactions that produce ground-level ozone, a pollutant. Vizuete's study confirmed that pot plants are a rich source of potent VOCs called terpenes, which give cannabis its dank smell. And it suggested the tens of thousands of plants in Denver's indoor farms—which are mostly found along two busy highways—could, under a worst case scenario, double the city's volume of smog-forming VOCs. If the farms "are putting out a significant amount of terpenes, there is not a worse place to put them," Vizuete says. "If I was designing an ozone reactor, this is what I'd do."

Ultimately, researchers will plug the findings into computer simulations that help scientists and regulators understand the factors driving air pollution. Normally, EPA provides those numbers for industrial emissions. But it doesn't recognize pot growing and Urso says agency officials don't like to discuss the matter, leaving states to fill the gap. "EPA has left us holding the bag," Urso says.

If pot farm emissions do pose air quality problems, it's not clear what regulations would require growers to do. Farms are exempt from many clean air rules, although worker safety regulations and some state rules could apply. Placing carbon filters on grow house exhausts could capture up to 98% of volatile emissions, but so far the filters aren't required. The industry, meanwhile, is eager to work with researchers. "We want more data, we want to know how we can promote best practices and be good neighbors," says Morgan Fox of the National Cannabis Industry Association in Washington, D.C.

Some help could soon come from Canada, which recently legalized pot—opening the door to studies that don't have to hide in a garage. But Vizuete says there also "needs to be some leadership from federal agencies" in the United States, including EPA. "Nobody is helped," he says, "by refusing to acknowledge that this is a public health issue." ■

Researchers want to know more about how pot farms, like this one in Avondale, Colorado, affect air quality.

PHOTO: MATTHEW STAVER/BLOOMBERG VIA GETTY IMAGES

Vizuete's team notes its study—one of the first of its kind—was not definitive. It was small: just three plants each of four of the 620 available cannabis strains. And the plants were "pathetic," says study co-author Christine Wiedinmyer, an atmospheric chemist at the University of Colorado here—nothing like the lush crops grown by professionals.

The Denver study, funded by a state program, will collect more data. It will measure VOC emissions at four farms—two large and two small—over the monthslong cultivation cycle, from planting to processing. The goal is to track emissions across pot varieties, growing conditions, and plant size and age, says project leader Kaitlin Urso of the Colorado Department of Public Health and Environment in Denver.

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