

TOPICAL ALERT TOP STORY

Madison to use low-cost sensors to measure neighborhood air quality

Chris Hubbuch | Wisconsin State Journal Nov 27, 2022 0

Madison residents will soon have unprecedented access to real-time information about air quality in virtually every neighborhood thanks to new technology and federal funding aimed at erasing health disparities.

The Environmental Protection Agency has awarded the city and three community partner organizations \$429,746 to create an enhanced air quality monitoring program with a focus on low-income, minority and other underserved neighborhoods where air tends to be dirtier and people are often more vulnerable.

The goal of the three-year project is to understand where air pollution is a problem, give people information to guide their health decisions and ultimately take actions to address health disparities.

“This sensor network will enable everyone to see, for the first time, which areas of our city are most impacted by particulate matter pollution,” Mayor Satya Rhodes-Conway said in a statement announcing the grant award.

The partnership will help ensure all residents enjoy “the clean, safe and environmentally just neighborhoods we deserve,” said Lisa

Peyton-Caire, CEO of The Foundation for Black Women’s Wellness, one of three community partner organizations.



UW-Madison chemistry professor Tim Bertram shows a QuantAQ air quality monitor. Madison plans to place 68 of the low-cost monitors around the city to provide real-time data on air quality.

The project is **one of three in Wisconsin** chosen to receive a portion of the \$53.4 million allocated through the Inflation Reduction Act and American Rescue Plan to enhance air quality monitoring, particularly in historically underserved, marginalized or polluted communities.

The Wisconsin Department of Natural Resources and Children’s Hospital of Wisconsin received \$500,000 each to set up similar

monitoring networks in Milwaukee neighborhoods with high rates of asthma.

According to the grant application, the city will work with three nonprofit organizations and academic advisers at UW-Madison to place pollution sensors in 68 Census tracts across the city and publish the information on the internet.

“This is just unprecedented, the idea of having air quality measurements on the neighborhood scale that are real-time and accessible,” said [Tim Bertram](#), a professor of chemistry at UW-Madison and one of the advisers.

Solid particles and liquid droplets suspended in the air are known as [particulate matter](#) and include everything from dust and pollen to fine particles that result from smoke or from tailpipe and smokestack pollutants like nitrogen oxides and sulfur dioxide.

About 1/30th the width of a human hair, those fine particles (known as PM_{2.5}), can penetrate deep into the lungs and even the bloodstream, causing breathing problems, heart attacks and even premature death in people with heart or lung disease.

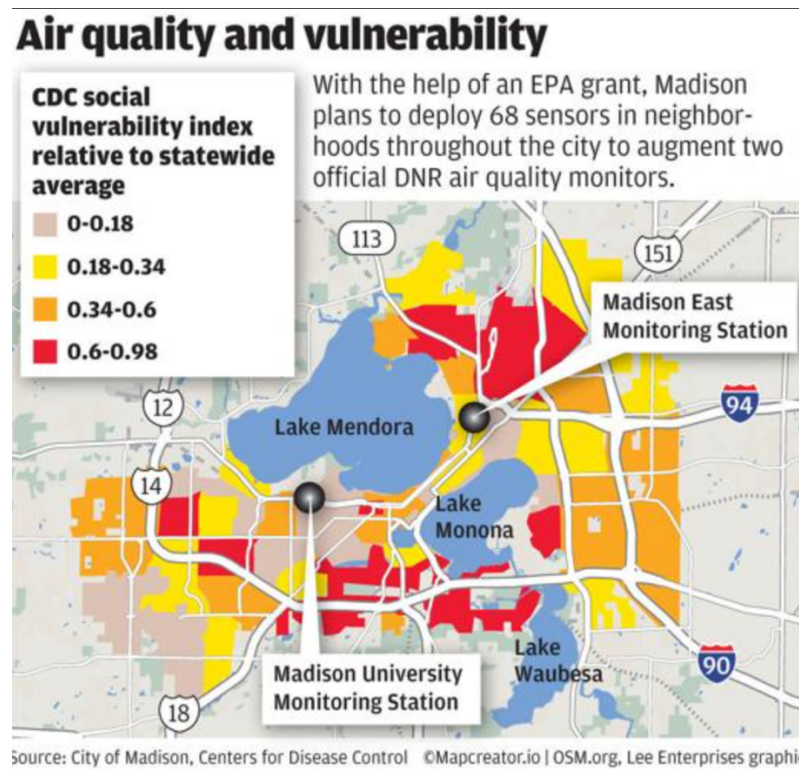
Exposure to even short-term spikes in fine particle pollution increases the risk of respiratory and cardiovascular disease, especially in vulnerable populations.

Research shows Black, Latino and low-income residents suffer higher rates of respiratory and cardiovascular disease than white Wisconsinites and are much more likely to wind up in the hospital or die as a result.

“There is very clear data that there are disparities in health outcomes ... as there is, unfortunately, for all communities of color,” said Shiva Bidar-Sielaff, co-chair of the Latino Health Council of Dane County, one of the three partner organizations. “This is exciting to see a project that really looks at the correlation between environmental justice and health equity.”

Two is not enough

The DNR uses high-tech equipment on Madison’s East and West sides to ensure [compliance with the Clean Air Act](#). While Madison’s air has generally [met federal ozone and particulate standards](#) during the past decade, those sensors have also recorded some of the state’s highest concentrations of particulate matter in recent years, according to the project application.



Those sensors provide a broad understanding of the city's air quality but don't tell the whole story, said **Tracey Holloway**, a professor of atmospheric science at UW-Madison and project adviser.

That's because air quality can vary enormously even within a city.

For example, air tends to be dirtier near busy highways or factories, but even proximity to an unpaved lot or a restaurant can affect air quality.

"If we really want to know how different communities are being affected just having two monitors is not giving us that information," Holloway said. "Understanding what's in the air and where it might be coming from are the first step in solving problems if they exist."

And the DNR monitors, located near the UW campus and in Demetral Field, aren't near the city's most disadvantaged neighborhoods or suspected pockets of pollution.

Bidar-Sielaff said the project follows three simple principles: find, share and act.

"If there is more pollution in certain neighborhoods, what can we do to reduce that?" she said. "Are there policies, programs, actions that can be taken?"

More sites, more data

While regulatory air monitors typically cost \$20,000 to \$50,000, the project will deploy a network of \$1,500 sensors made by a company called **QuantAQ**.

Encased in a hard plastic shell about half the size of a shoe box, the sensors use laser beams to measure the density and size of particles,

which scatter the light much in the same way that smoke in the atmosphere makes sunsets appear red.

The solar-powered sensors are connected to the cell network, sending measurements back to QuantAQ for quality assurance and control before they are instantaneously uploaded to the cloud.



QuantAQ's \$1,500 Modulair sensors measure small and large particulate matter that can contribute to serious health problems. The Boston startup says its monitors can expand the geographic and temporal scope of regulatory monitors, which can cost more than \$50,000.

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And unlike regulatory sensors, which provide hourly readings, QuantAQ sensors update every minute, which means they can capture a plume of diesel exhaust from a passing truck that might be lost in the averages of a regulatory sensor.

“We’re trying to do the job of those regulatory monitoring networks but in 50 to 100 locations for the same capital cost,” said Eben Cross,

co-founder and chief science officer of the Boston-based startup. “We’re multiplying the total number of locations and a 60-fold increase in time resolution.”

The technology is similar to that used by [PurpleAir](#), which sells monitors for about \$260 that can relay data to a [publicly-accessible website](#).

There are about a dozen PurpleAir monitors in Madison, but those devices are typically deployed in affluent neighborhoods and without scientific controls — so it’s impossible to know if someone put a monitor next to a grill or a fireplace that could skew the data. And most consumer air monitors only detect fine particles.

“The thing that makes our technology different is we combine two different light scattering approaches in one system,” Cross said. “It helps us to do things like differentiate between wildfire smoke, which tends to be very, very small and resuspended dust or pollen, which tends to be larger.”

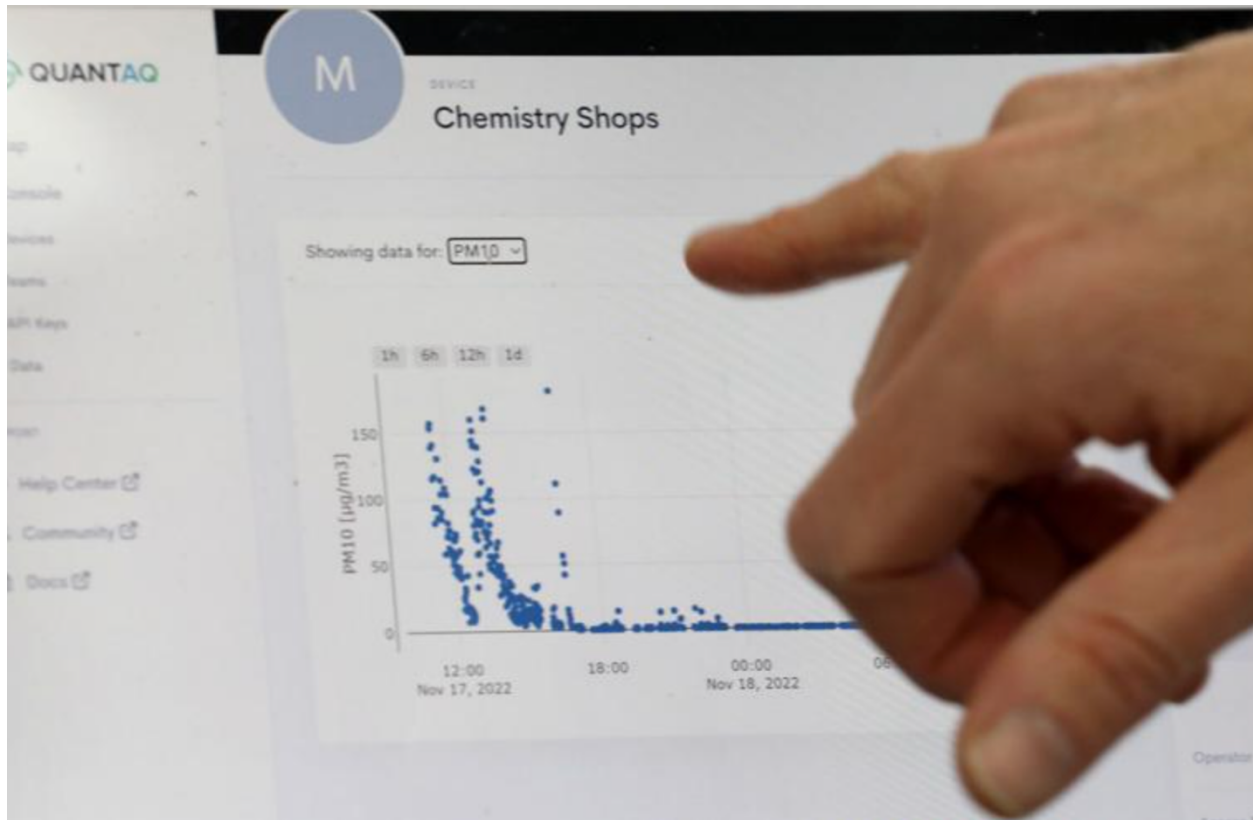
Partners help out

The city plans to set up a website where the air quality data, along with explanations and other social and demographic information will be displayed in English, Spanish and Hmong.

The community partners, The Foundation for Black Women’s Wellness, The Hmong Institute, and the Latino Health Council, will work to help disseminate and interpret the information.

Bertram said the data will help individuals make day-to-day decisions — like when and where it’s safe for someone with asthma to go for a walk — and guide local policy decisions.

“From a planning perspective if you’re starting to think about new construction planning, where to put electric buses you have a lot of information to go on,” he said.



QuantAQ monitors deliver air quality measurements on a minute-by-minute basis. Madison plans to install 68 monitors around the city and publish a map with real-time data to guide individual and policy decisions.

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In addition to funding for equipment and support, the grant includes \$50,000 each for the partner organizations, which Bidar-Sielaff said is just as important as those community organizations having a role in designing the project.

“We are often asked to provide expertise for free,” she said.

“Community partners have a role in bringing through their trust and knowledge but also being recognized for their contributions.”