



Spotlight See Us at These Upcoming Conferences

Please visit our booth if you're attending either of these upcoming conferences. We'd love to talk with you about how our 2B Tech instruments could be put to work in your projects.

- **August 15-18: International Ozone Association (Pan American Group) 2022, Las Vegas, NV**
- **August 22-25: 2022 National Ambient Air Monitoring Conference, Pittsburgh, PA**

In Las Vegas, we'll feature our instruments that are proven workhorses for industrial applications such as water treatment and disinfection, including our Personal Ozone Monitor, Model 106-L Ozone Monitor, and Model 306 Ozone Calibration Source.

In Pittsburgh, the spotlight will be on our wide-ranging lineup for air quality monitoring:

- [FEM measurements of ozone](#) and [NO₂](#)
- the [AQSync](#) and [AQLite](#) packages that combine the best of both worlds, sensors and instruments
- [Calibration instruments](#) for use in the field or in the lab
- the [Personal Air Monitor](#) mobile sensor package, and enclosure options for deploying it either outside or mounted on the vehicle of your choosing



The powerful [AQSync](#) and [AQLite](#) packages are the newest members of our lineup and can be used as stand-alone air quality monitoring stations, or the AQSync can serve as a calibration checkpoint for your sensor-based monitoring program. Cloud-based data transmission puts the AQLite and AQSync measurements at your fingertips.

[Request a Quote](#)

[Check Out Our Full Product Lineup](#)

Air Pollution News

Rural Network of Sensors Reveals Fracking Air Pollution

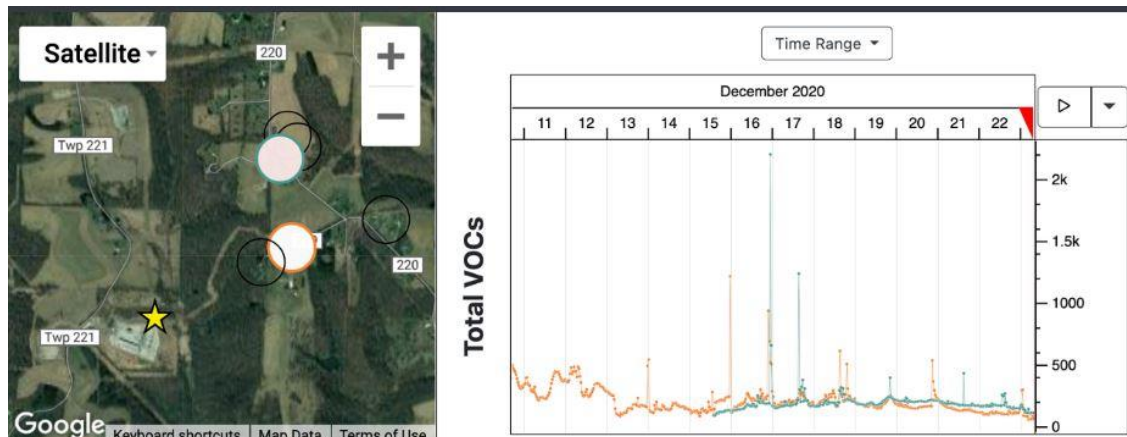
Ailing Ohio Residents Find What the Monitoring Stations Missed



Volunteer scientists with AGU's Thriving Earth Exchange program helped Ohio residents set up a network of low-cost sensors to monitor air pollution. Image Credit: Leatra Harper, Freshwater Accountability Project.

The Appalachian county of Belmont in eastern Ohio is the site of extensive fracking operations. In this otherwise bucolic rural setting, there are no highway traffic jams or tall skyscrapers. Yet the residents are suffering from headaches, fatigue, and burning sensations in their noses and throats, and they note frequently that the air "smells bad." The connection to fracking seemed logical, but the existing air quality monitoring stations were not showing elevated numbers.

Years of poor health led residents to take action. The monitoring stations are sparse, with only 3 to cover Belmont County's highly heterogeneous ~500-square-mile expanse of rolling hills and valleys dotted with fracking sites and compressor stations. Community leaders obtained a grant, and with technical help from scientists, the residents established a network of 60 low-cost sensors to measure particulate matter and volatile organic compounds. Still in operation, the network has a ~2-year data record that shows what the residents suspected.



Spikes in total VOCs as recorded by two sensors in the community network, shown as white circles near the Williams Salem Compressor Station (yellow star) on the map at left. The spikes correlated with residents' log notes of health problems such as headache, eye irritation, and respiratory difficulty. Figure 4 of Raheia et al., 2022.

The sensor data, along with modeling work by the collaborating scientists, show how the three established brick-and-mortar monitoring sites are often outside of areas that experience high emissions. The data allowed residents to note patterns, identify problem spots, and modify

their plans (and even evacuate their homes) when spikes occurred. Air quality officials have taken note and are more receptive to residents' concerns, as the data fills in gaps with information that "speaks their language."

The study illustrates that sensors have their place in monitoring air pollution in vast heterogeneous landscapes, supplementing established networks of more robust but much more expensive and sparsely located instruments for air quality monitoring. And it shows that citizen-scientists can arm themselves with data that makes them more effective advocates for their own health.

[Community-Based Participatory Research for Low-Cost Air Pollution Monitoring in the Wake of Unconventional Oil and Gas Development in the Ohio River Valley: Empowering Impacted Residents through Community Science](#), G. Raheja, L. Harper, A. Hoffman, Y. Gorby, L. Freese, B. O'Leary, N. Deron, S. Smith, T. Auch, M. Goodwin, and D.M. Westervelt, *Environmental Research Letters* (2022), **17**, 6, 065006.

Case Study: 2B Tech's Model 205 Ozone Monitor

Indoor Air Quality: What's the Role of People Themselves?

Ozone is a Multiplier of the Human VOC Emission Rate

We hear a lot about air quality and tend to think about it as an "outdoors" problem. But indoor air quality can be even more important. After all, most people spend a larger fraction of their time inside than outside. So, what kinds of factors influence the quality of the air indoors? Furnishings and building materials get a lot of attention (their outgassing is analogous to the "new car smell" experienced when buying a new vehicle). But what about humans themselves? A [new study](#) looked at human emissions of volatile organic compounds (VOCs), and found that the presence of ozone in the air more than doubles the rate at which humans emit VOCs.

Nijing Wang and colleagues at the Max Planck Institute for Chemistry in Germany and the Technical University of Denmark took a comprehensive look at how the emissions changed with the room's environmental factors such as temperature, relative humidity, and (this is where 2B Tech comes in!) ozone level. They further broke down the components of the human emissions by source (breath versus skin versus whole body) and looked at how the degree of clothing coverage affected the emission rate. The indoor "room" was actually a stainless steel environmentally controlled chamber, and was either "ozone-free" or contained a controlled 35-40 ppb amount of ozone, with ozone measurements provided by [2B Tech's Model 205 Ozone Monitor](#). VOCs in the chamber exhaust were measured by mass spectrometry.

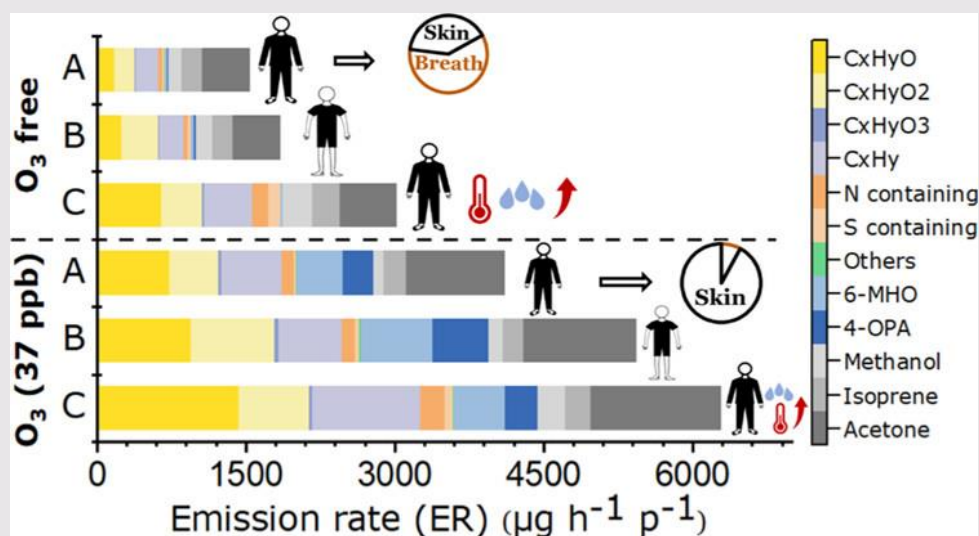
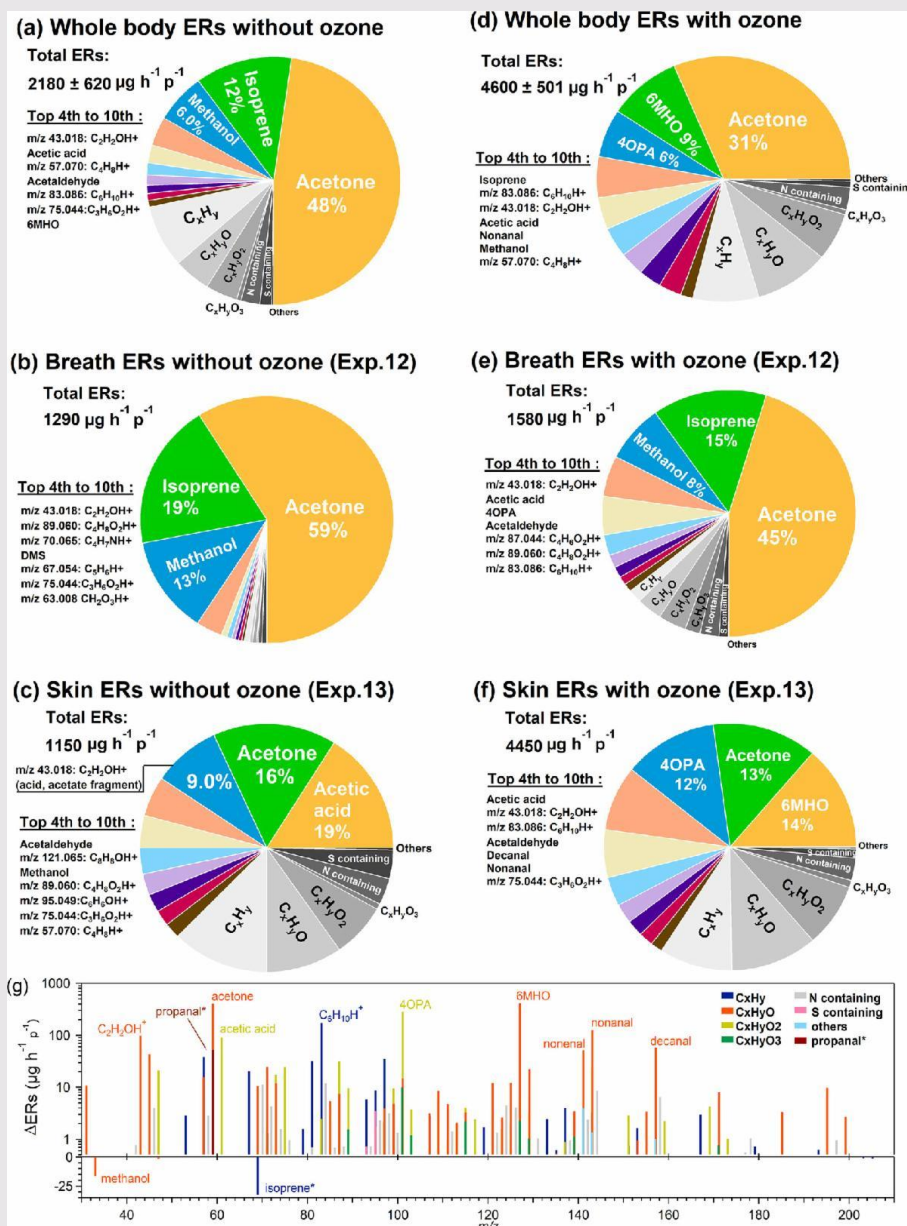


Figure Credit: American Chemical Society, Wang et al., 2022.

In the ozone-free experiments, breath and skin were approximately equal sources of VOCs. Acetone and isoprene were the top two emissions from breath and accounted for almost 80% of the breath emissions. Skin emissions were a much more complex mixture and not as dominated by the two top emissions (acetone and acetic acid).

The presence of ozone had a significant effect on human-related VOC emissions. With ozone present, all the total emission rates went up and the number of different VOC species increased. The dermal-related emissions increased the most, quadrupling, and they became the source of most of the VOC emissions. The ozonolysis of skin lipids is a source of several of the observed compounds.

Not surprisingly, emissions went up when the subjects wore short sleeves and short pants, exposing more skin. They also went up with increased humidity in the ozone-containing chamber. Age of the subjects was not a big factor (teenagers, young adults, and seniors were tested).



Emissions of VOCs from human subjects in an environmentally controlled chamber, with and without ozone present. The bottom chart (panel g) shows how most VOCs increased when ozone was present, though methanol and isoprene decreased. Figure Credit: American Chemical Society, Wang et al., 2022.

The study by Wang et al. is probably the most comprehensive and the most controlled investigation to date of how human emissions affect indoor air quality, as previous research has looked at real-world environments like classrooms and theaters where other emission sources are present, and did not control for the type of personal care products used or the clothing of the participants. The results will help to advance efforts to model indoor air quality.

[Emission Rates of Volatile Organic Compounds from Humans](#), N. Wang, L. Ernle, G. Beko, P. Wargocki, and J. Williams, *Environmental Science & Technology* (2022), **56**, 4838-4848.

[Link to ACS Paper](#)

[The 2B Tech Model 205 Ozone Monitor](#)

Employee Spotlight

Luke Greenidge: Engineering at the 2B Tech Frontiers Meet Our Mechanical Engineer

Q: What does a classic 1970s VW bus have in common with 2B Technologies?

A: Luke Greenidge!

If a system needs to be designed and built, 2B Tech's Mechanical Engineer, Luke Greenidge, is your guy. One of 2B Tech's newest employees, he's already indispensable and has had a key role in the frontier-busting products we've recently released (the AQSync, AQLite, and CarTopper come to mind). These projects had already been started when Luke joined 2B Tech in January 2021, but he applied his engineering skills to make the products easier to build and service, and all-around better for the customer to use.



And so... what about that VW bus? Well, while getting his B.S. in Mechanical Engineering at the Colorado School of Mines, Luke was part of a team that transformed a 1970s VW bus into an electric vehicle. Equipped with Tesla batteries, the bus was a senior project in the engineering department for Luke and his team members. Luke did the weight analysis and subsequent mechanical design to transform the frame so that it could house the special motor and several pounds of batteries. He credits the experience with giving him an appreciation of the need for teamwork and good communication skills, a lesson he applies directly every day in his work now with 2B Tech.



Luke has already started to expand beyond typical boundaries of mechanical engineering in his work here. For example, he's working on designing the solar power systems for use with our monitoring packages. He hopes to continue learning and expanding his skills to include designing circuit boards and doing the kinds of coding that our instruments depend on.

Luke's love of learning was integrated into his life at an early age. He was home schooled and had the equivalent of an associate's degree when he entered college at the Colorado School of Mines. A Colorado native, Luke has 5 younger siblings and a busy home life that includes 2 goats, 8 chickens, a cat, and a dog. Besides loving to "tinker" with anything and everything that needs building or fixing, Luke is an avid football fan who was the commissioner for the 2B Tech NFL fantasy football league last fall. He'll reprise that role again this fall, but also will be busy on another front: Wedding bells will ring for Luke, so his life will transform to a happy new adventure!

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