



PICARRO

Novel, real-time
measurements of VOCs
using a Cavity Ring-Down
Spectrometer (CRDS)

EGU Annual Conference & Exhibition

D3295 | EGU2020-20831

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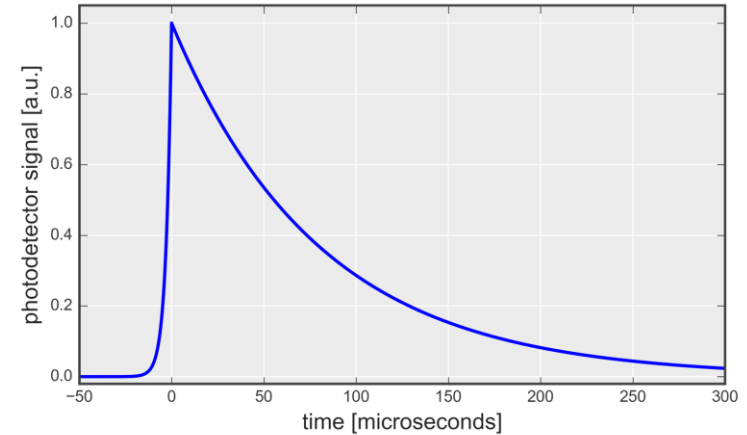
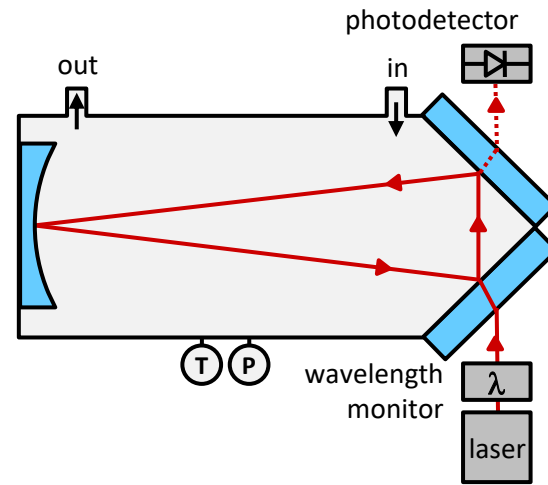
OVERVIEW

- Overview of novel Cavity Ring-Down Spectroscopy
- Measurements of VOCs
- Introduction to Ethylene Oxide (EtO)
- Performance Overview (EtO)
- Application Overview
- Summary

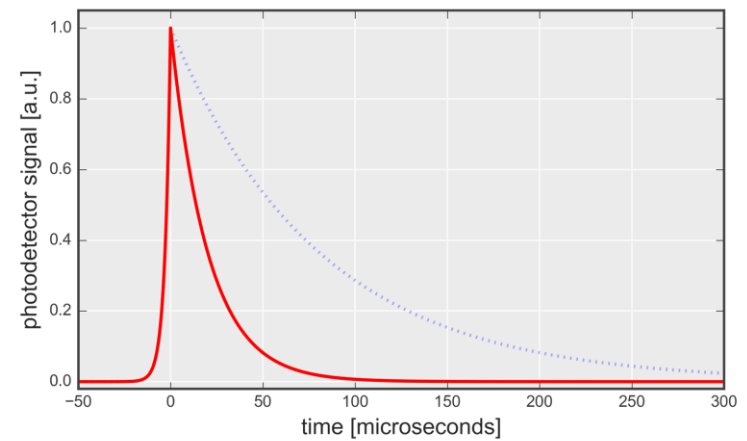
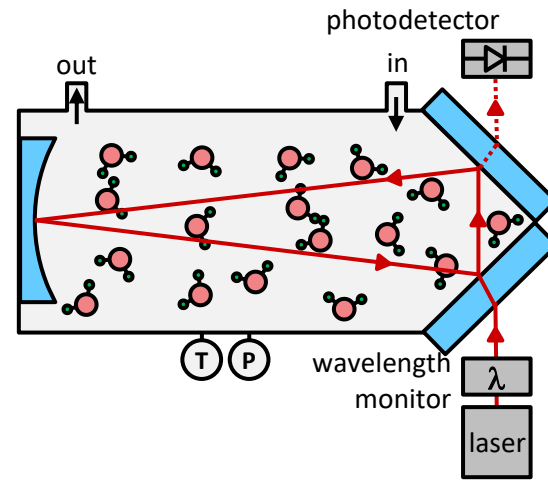


CAVITY RING-DOWN SPECTROSCOPY (CRDS)

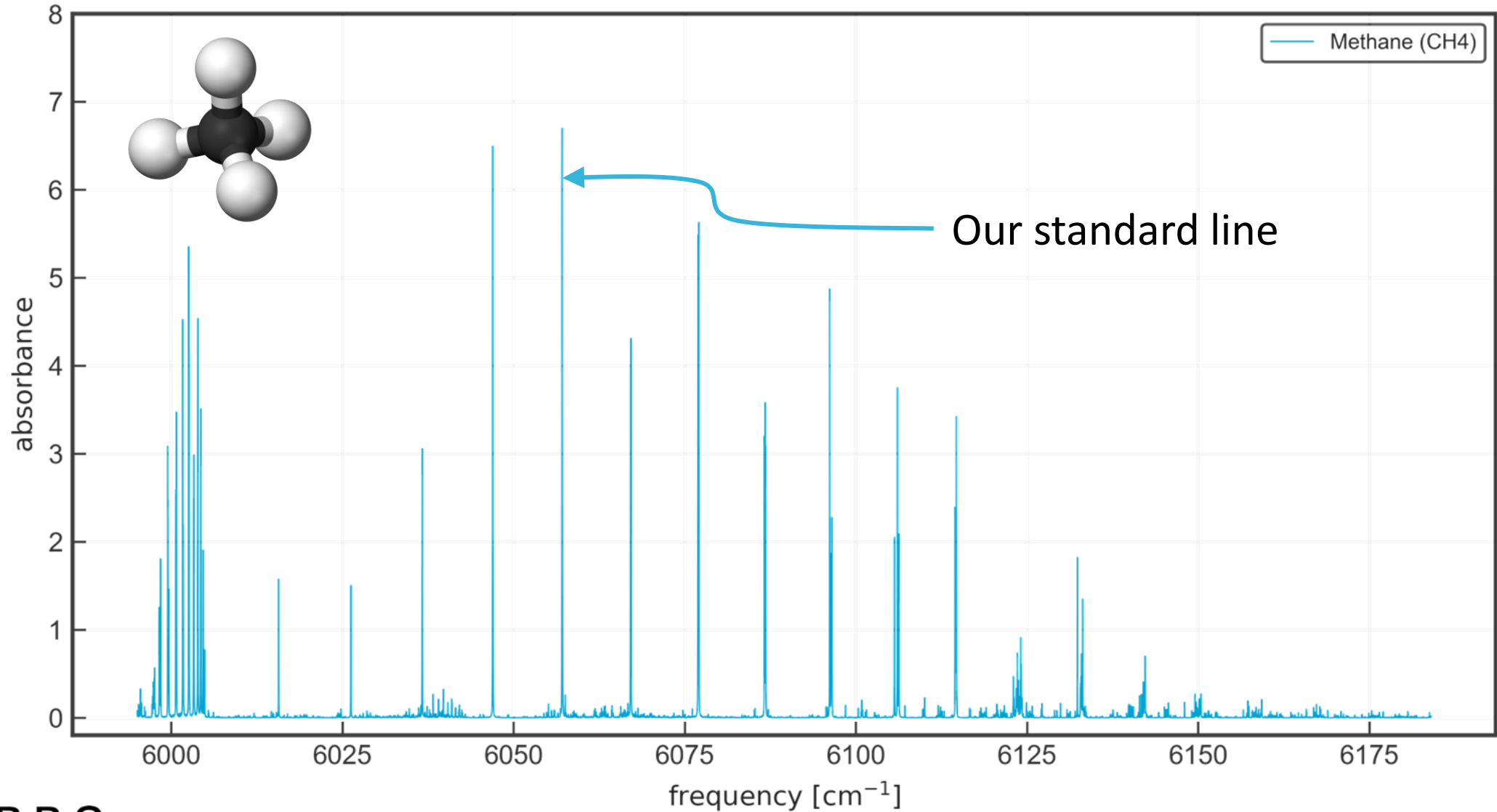
No gas molecules in cavity
(or absorbing at
measuring frequency)



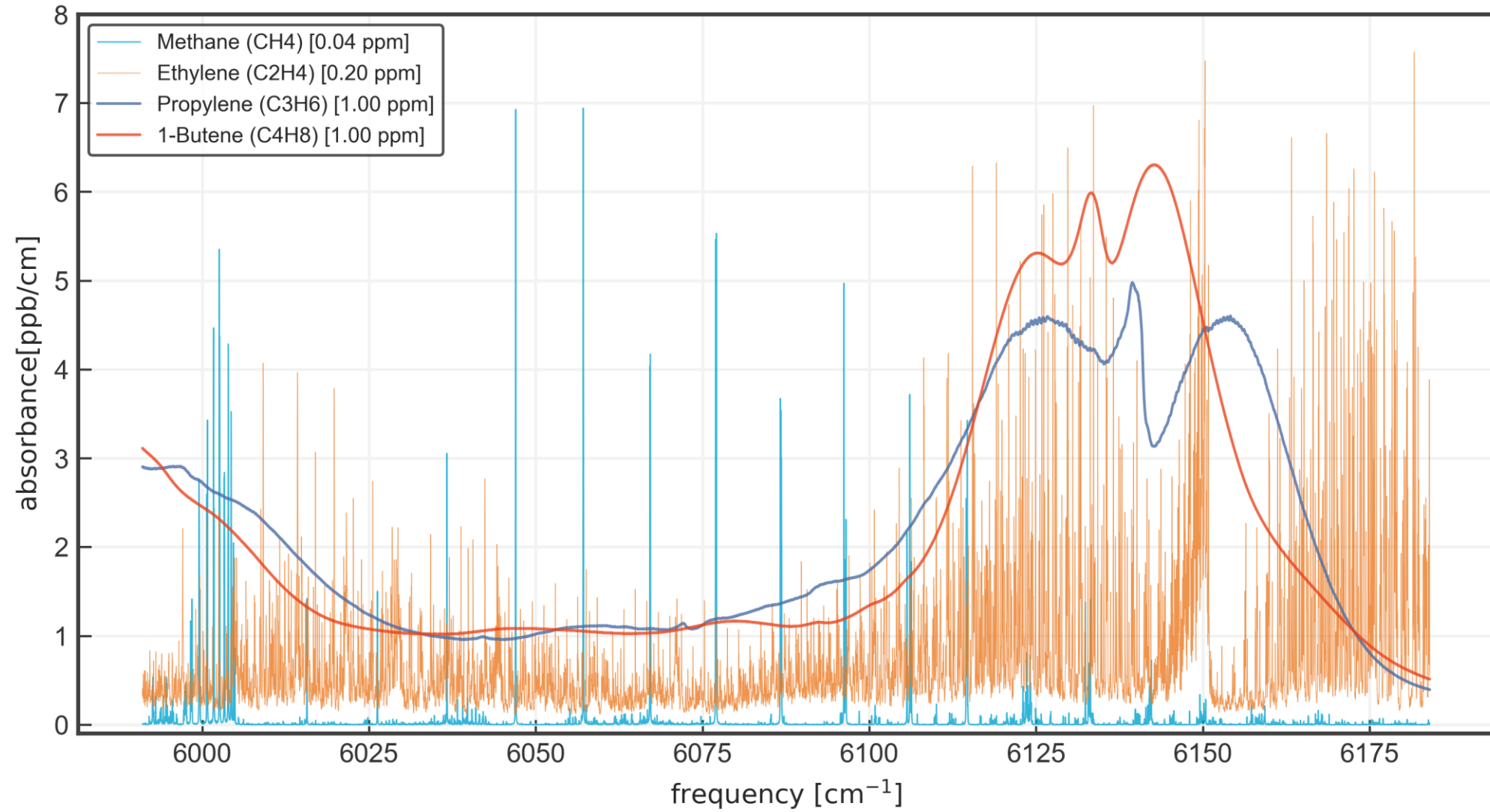
Gas molecules in cavity
(gas absorbing at
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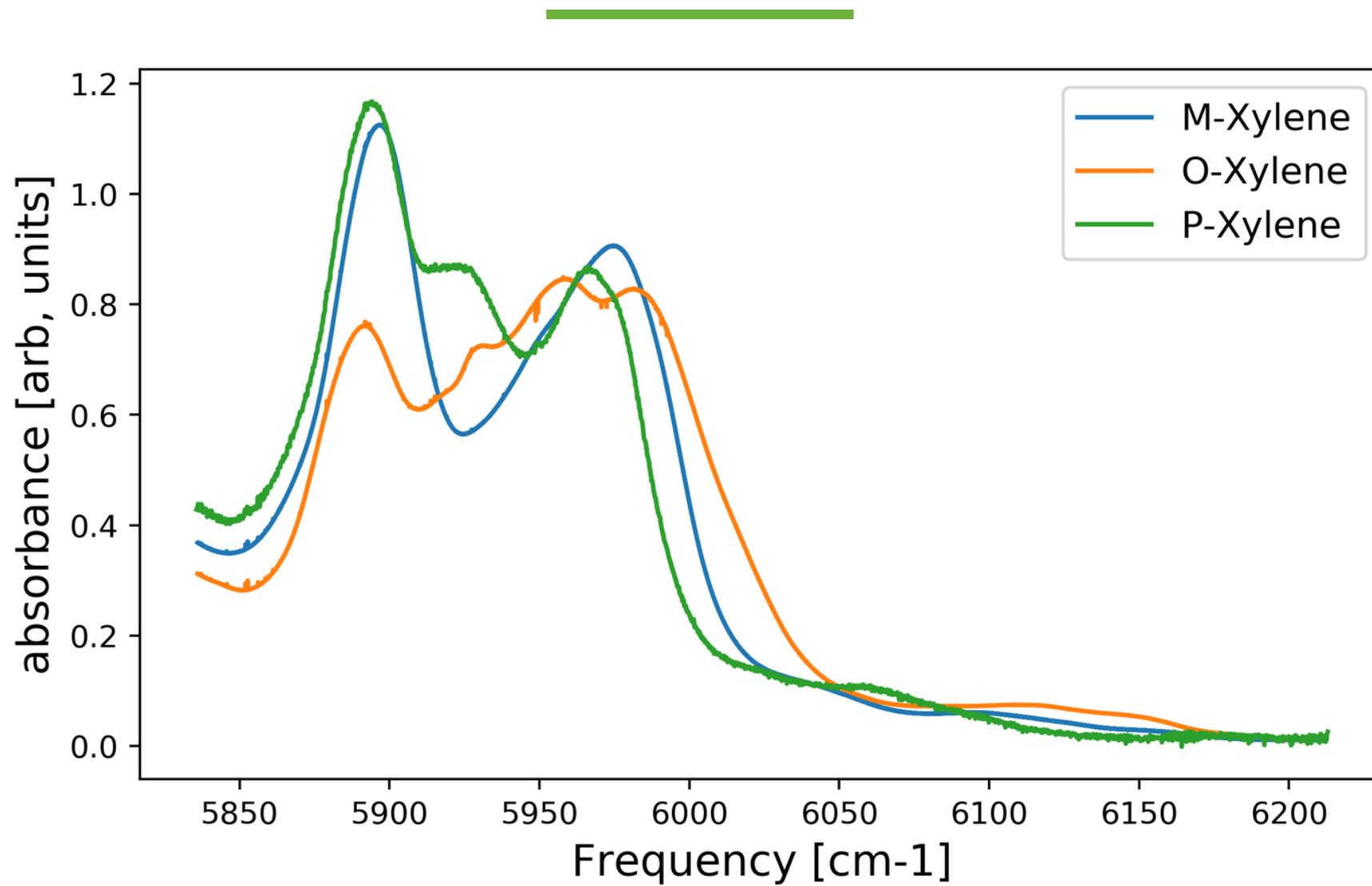
CRDS Today and Tomorrow



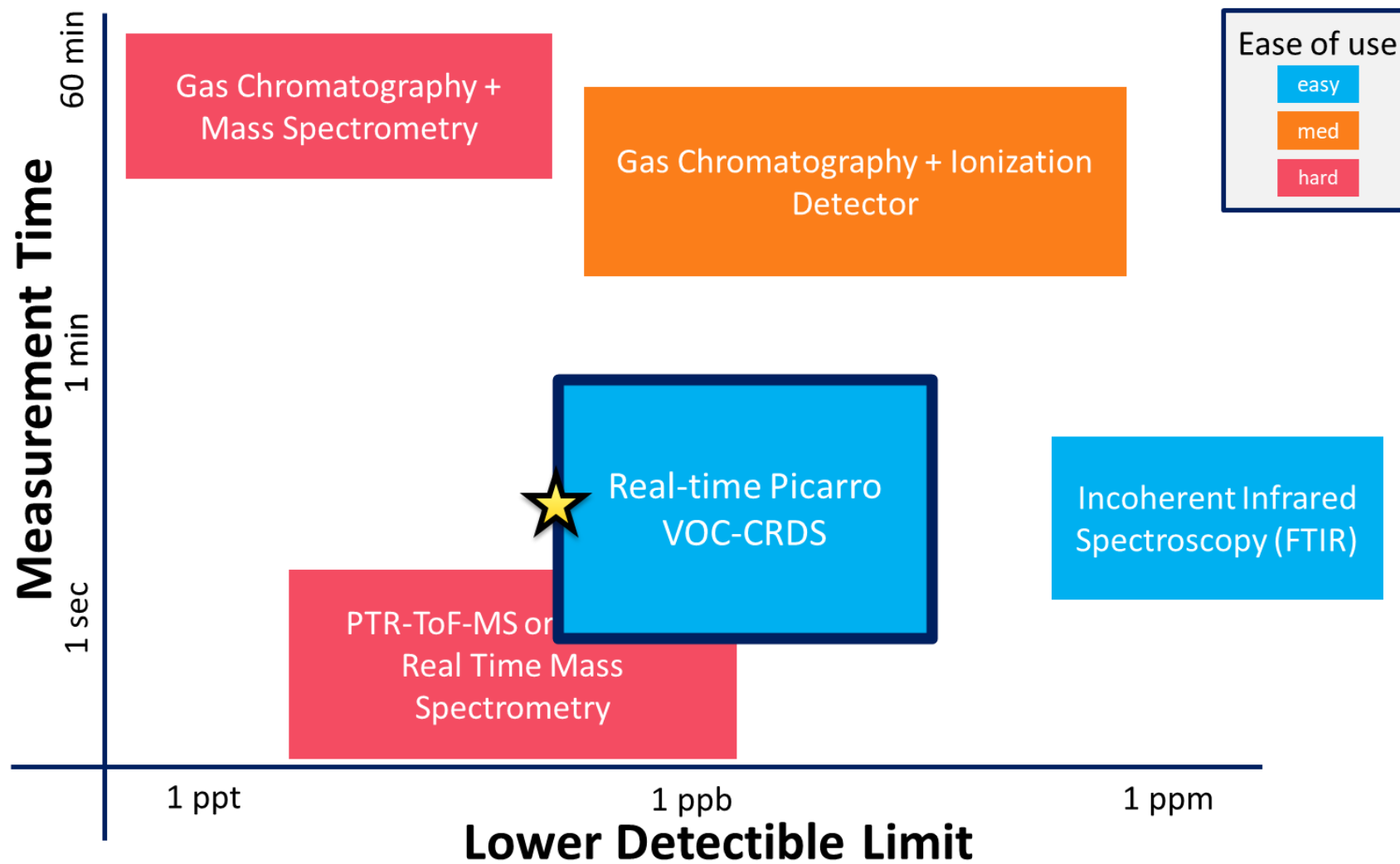
VOC characterization



VOC characterization - Speciation



VOC Summary



ETHYLENE OXIDE

- Volatile Organic Compound
- Common chemical (14th most-produced organic compound)
- Uses:
 - **Large scale chemical production** (textile industry, detergents, oil and gas, pharmaceuticals, perfumes, and others)
 - **Medical sterilization** (equipment, instruments, packaging materials, clothing, surgical equipment, and others)
- Properties:
 - Colorless gas with a sweet odor
 - Highly reactive (used in thermobaric weapons ...)
 - Toxic substance, mutagenic properties, Group 1 carcinogen

ETHYLENE OXIDE IN THE NEWS

Highest levels of cancer-causing gas found in communities near Sterigenics since U.S. EPA began testing

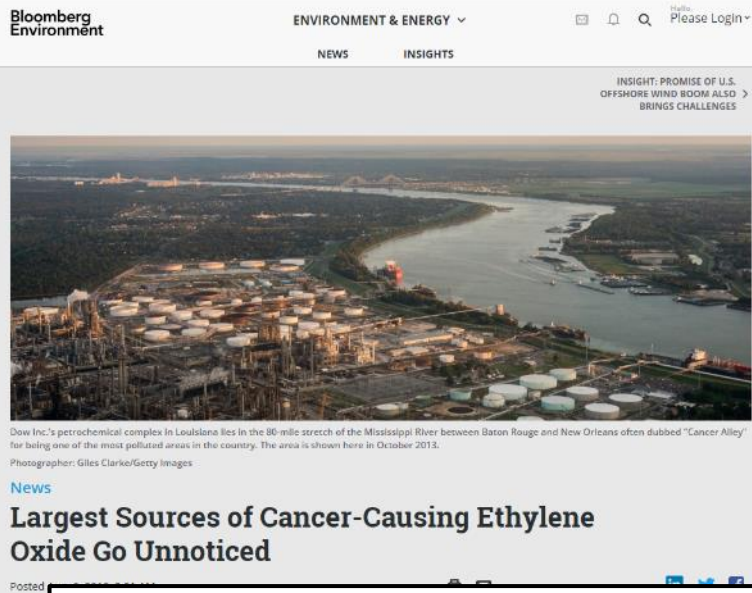
HEALTH, NEWS

Air Testing For Ethylene Oxide About To Ramp Up In Metro Atlanta

GEORGIA HEALTH NEWS • AUG 15, 2019

More Illinois Cancer Victims Sue Over Ethylene Oxide (1)

Posted Aug. 28, 2019, 11:38 AM; Updated Aug. 28, 2019, 1:35 PM



Sterilization company fined \$51,000 for missed deadline on EtO filters



Congressional task force to press EPA on ethylene oxide emissions standards

November 21, 2019 By Nancy Crotti

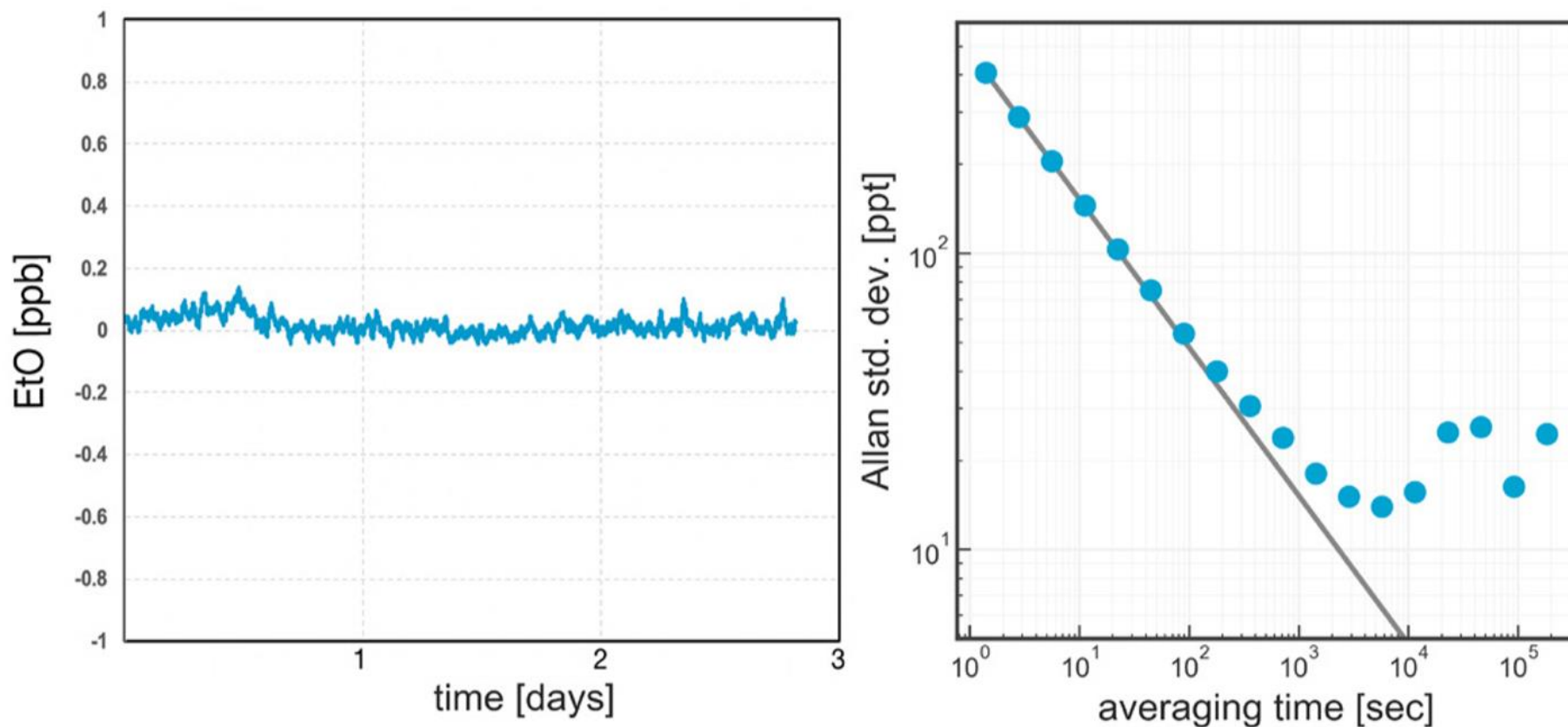
Cancer > News >

[WEBMD HEALTH NEWS]

Another GA Neighborhood At Risk From Toxic Gas

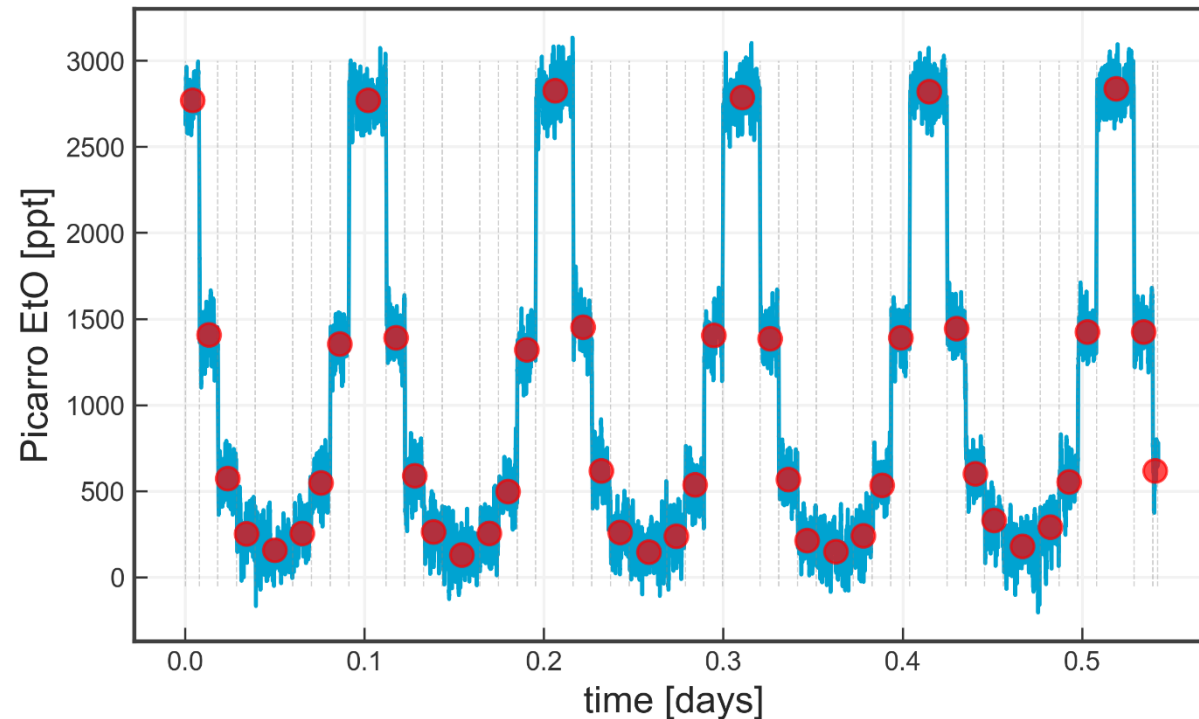
By Brenda Goodman, MA, Andy Miller

PRECISION AND STABILITY

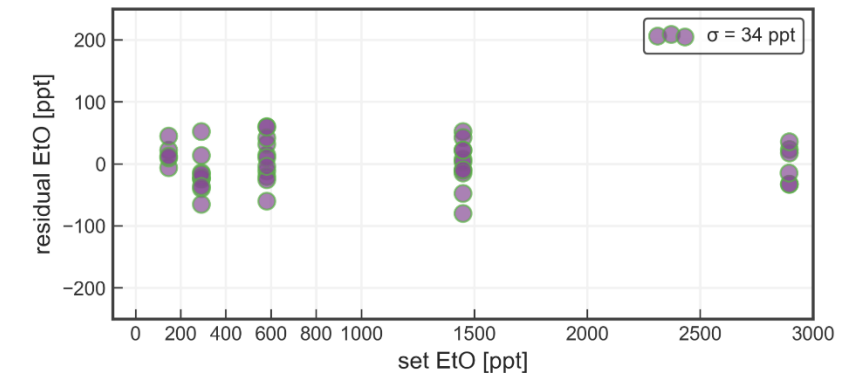
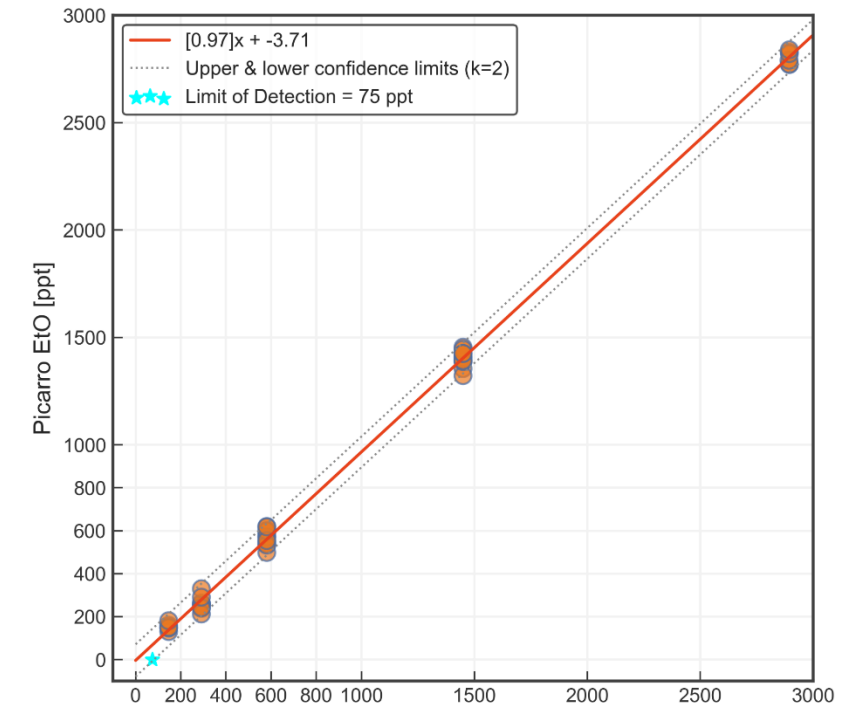


- Typical zero drift over 72 hours = **120 ppt** (peak-to-peak 50-minute average, no zero correction)
- Typical precision at 2 seconds = **350 ppt**
- Typical precision at 300 seconds = **30 ppt** (1-sigma)

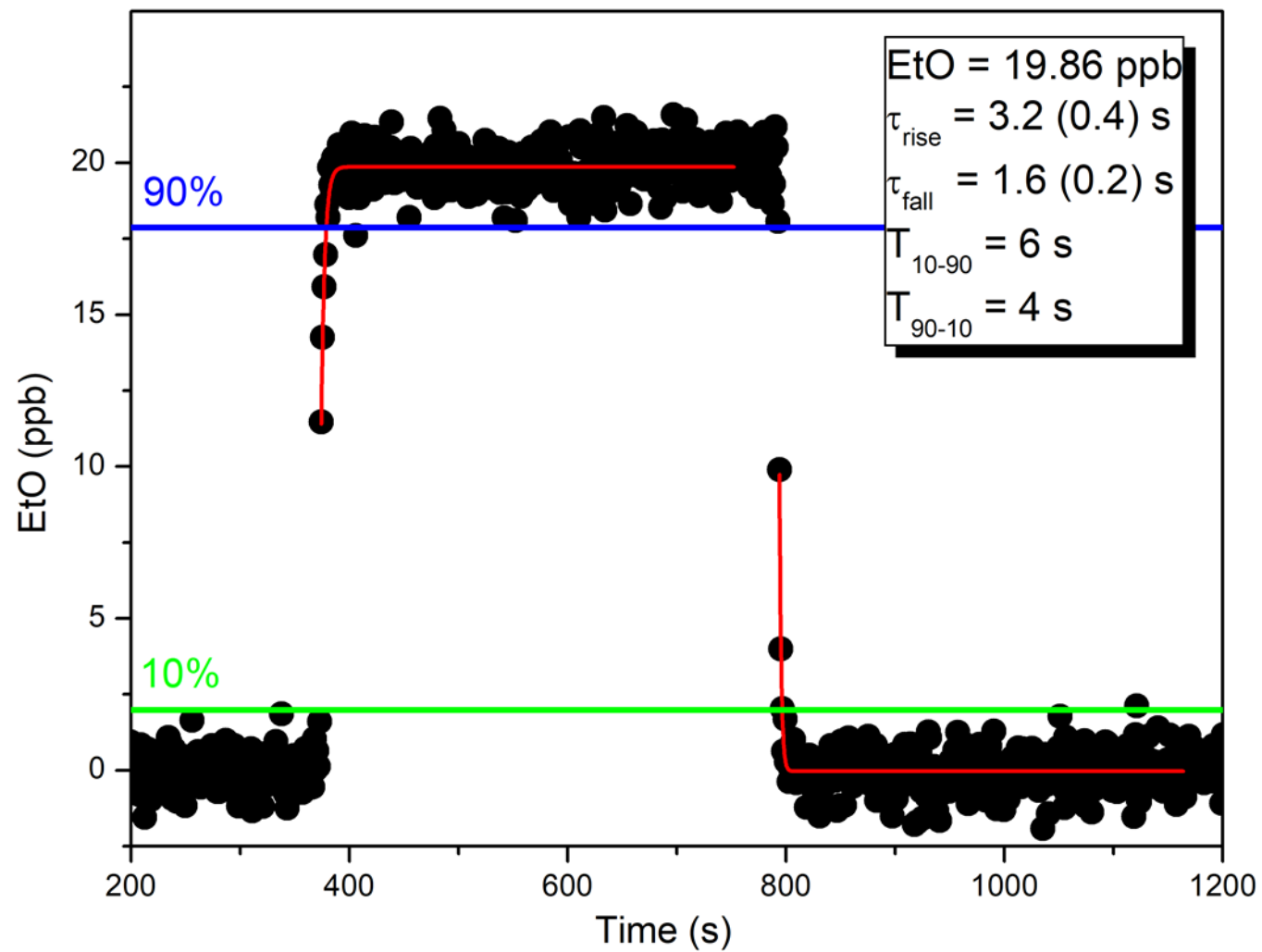
LIMIT OF DETECTION



- Blue line = 30-second moving average of the measurement
- Red circles = average of each 15-minute step. The standard deviation of the 15-minute steps is just 34 ppt.
- From the dataset, a **typical limit of detection of 75 ppt** can be determined ($k=2$, 95% confidence).



RESPONSE TIME



APPLICATION OVERVIEW



G2910 Stack and Indoor Air Quality Analyzer

Ultra-precise, continuous measurements of EtO at the source of emission. Enables fast and efficient deployments over a range of applications.

Performance highlight:

- <250 ppt LOD
- Optimized for complex gas mixtures

Applications:

- Stack Measurements
- Indoor Air Quality Assessment (Hospital and Industrial Sterilization)



G2920 Fugitive Analyzer

High-sensitivity, continuous measurements of EtO at the fenceline. Enables detection of fugitive emissions away from the source.

Performance highlight:

- <100 ppt LOD
- Optimized for long-term monitoring

Applications:

- Fenceline Monitoring
- Emission Source Determination



G2930 Ambient Analyzer

Best-in-class LOD. Enables long-term community monitoring and characterization of air quality.

Performance highlight:

- <25 ppt LOD
- Optimized for ultra-high sensitivity

Applications:

- Community Monitoring
- Ambient Air Quality Assessment

SUMMARY

- Picarro has developed a CRDS analyzer that can measure and detect VOCs emissions at ppb and ppt levels, in real-time (interval of 1-2 seconds).
- The precision, stability and LDL of the analyzer makes it suitable for source and ambient emissions characterization.
- Picarro is excited to support researchers and services providers as the need for EtO measurements evolves and increases.
- Interested in learning more about your real-time VOC needs.

Thank you!

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