Evento Bimodal
Virtual / Presencial

28 Semana de la Salud Ocupacional

Lo humano y lo técnico
en un mundo que se transforma

Organiza:

CSOA
CORPORACIÓN DE SALUD OCUPACIONAL Y AMBIENTAL

42° Congreso de Ergonomía, Higiene, Medicina y Seguridad Ocupacional.

Hotel Intercontinental Medellín - Colombia

2, 3 y 4 de noviembre de 2022

PICARRO

Providing Solutions to the World's Most Challenging Environmental Questions

CO COLOMBIA · ACHO Capítulo Antioquia · ASASI Asociación Colombiana de Seguridad Integral · SCE Sociedad Colombiana de Ergonomía Capítulo Antioquia · Sociedad Colombiana de Medicina del Trabajo Capítulo Antioquia

AGENDA

1. Picarro Intro
2. What makes CRDS so special?
3. Analyzers for GHG & Trace Gases – Case Studies
4. Solutions for Hazardous Air Pollutants – Case Studies
5. Surrogate gas validation
6. Q/A

WHO ARE WE?

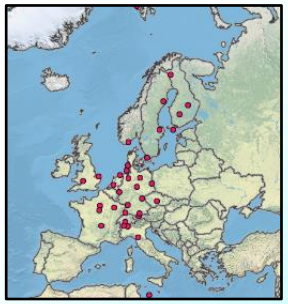
- **Leading provider of solutions** to measure greenhouse gas concentrations, trace gases and stable isotopes in **industrial monitoring**, air quality, **energy and utilities** markets.
- Over 45 patents owned by Picarro or exclusively licensed from Stanford University
- ISO 9001:2015 Certified Corporate Headquarters, including R & D, Engineering and Manufacturing/Operations in Santa Clara, California
- 220+ employees including 35+ STEM PhDs
- Thousands of Picarro instruments in 95 countries world-wide

20+ YEAR HISTORY OF CONTINUOUS MONITORING

NSF | neon Operated by Battelle

National Ecological Observatory Network

ICOS Integrated Carbon Observation System

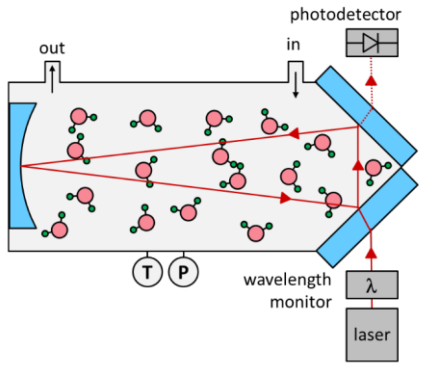


WMO GAW

World Meteorological Organization

Global Atmospheric Watch

WHAT MAKES PICARRO CRDS SO SPECIAL?



Real-Time, continuous measurements

No sample pretreatment, chromatographic separation, or complex peripherals

Specific & sensitive to a wide variety of compounds and applications

Turn-key, low operating costs, long-term stability

ANALYZERS FOR GHG & TRACE GASES

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Carbon Dioxide (CO_2)

Carbon Monoxide (CO)

Methane (CH_4)

Nitrous Oxide (N_2O)

Water (H_2O)

Acetylene (C_2H_2)

Ammonia (NH_3)

Ethane (C_2H_6)

Ethylene (C_2H_4)

CASE STUDY – GHG NETWORKS

G2301: CO_2, CH_4 and H_2O

G2401: CO_2, CH_4, CO and H_2O

Eiffel Tower
Paris, France
~320m

Penn State Tower
Centerville, IA
~110m

KCRA Walnut Grove Tower (LBL/CALGEM)
Walnut Grove, USA
~470m

Shenzhen Meteorological Gradient Tower (SZMGT)
Shenzhen, China
~350m

Tokyo Skytree
Tokyo, Japan
~630m

Stability

No need for constant adjustment for humidity or other atmospheric changes

The Gold Standard for Atmospheric GHG Measurements

CASE STUDY – METROCLIMA
MEGACITIES – Sao Paulo

G2301-m: CO_2, CH_4 and H_2O

G2201-i : d13C of CO_2 and of CH_4

G2311-f: CO_2, CH_4 and H_2O

- **PICARRO G2301-m - Pico do Jaragua**: http://www.metroclima.iag.usp.br/stations/pico-do-jaragua/
- **PICARRO G2401 - UNICID:** http://www.metroclima.iag.usp.br/stations/unicid/
- **PICARRO G2301 & G2201-I - IAG:** http://www.metroclima.iag.usp.br/stations/iag/
- **PICARRO G2311-f – ICESP:** http://www.metroclima.iag.usp.br/stations/icesp/

CASE STUDY – FLIGHT MONITORING

G2401-*m* : CO_2, CH_4, CO and H_2O for flight @ 1 Hz

The National Aeronautics and Space Administration (NASA) Alpha Jet and Warren Gore, NASA Ames Research Center's Wingpod team leader, using a custom Picarro analyzer built into the wingpod of an Alpha Jet to calibrate the Greenhouse gases Observing SATellite (GOSAT) that measured Earth's albedo, used to derive the atmospheric column averaged greenhouse gas concentrations.

Speed

Flight-optimized design elements minimize effects of aircraft vibration, pitch, roll, and rapidly changing ambient conditions.

CASE STUDY – EDDY COVARIANCE

G2311-*f* : CO_2, CH_4 and H_2O

Picarro's Superflux at the Cabauw Superstation: InGOS Flux Instrument Trial | Picarro

Speed

Flux mode precision of CO_2, CH_4 and H_2O at 10 Hz!

CASE STUDY – MID-IR SOLUTIONS

G5310: N_2O, CO and H_2O

Hai Luo Gou background station

ShenZhen CMA

Sensitivity

Parts-per-trillion (ppt) sensitivity meets WMO & ICOS performance requirements for N_2O and CO monitoring

CASE STUDY – SOIL FLUX

G2308: CH_4, N_2O and H_2O

G2508: CO_2, CH_4, NH_3, N_2O and H_2O

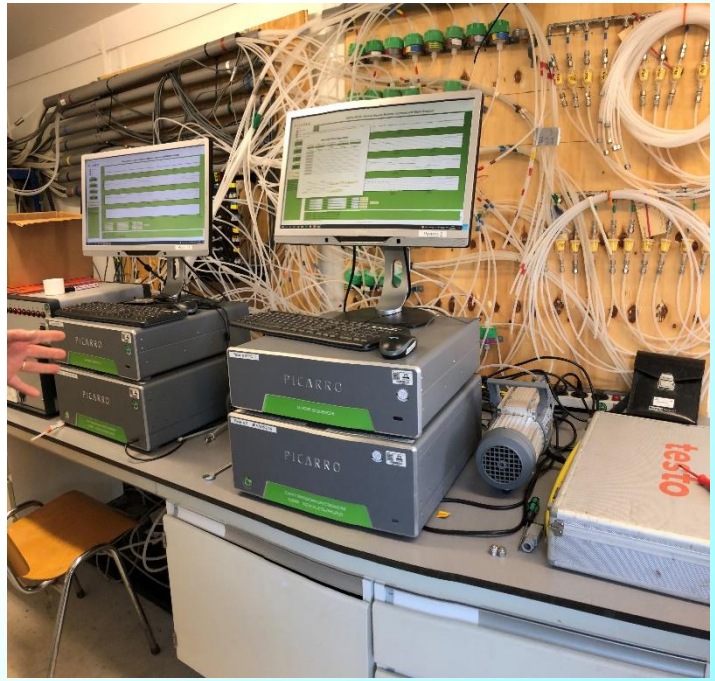
Eri Saikawa Emory University

Simplicity

N_2O, CH_4, CO_2, NH_3 and H_2O all in a single analyzer! Open or closed systems integrating easily with 3rd party/custom chamber systems

CASE STUDY – LIVESTOCK FARMING

G2509: CO_2, CH_4, NH_3, N_2O and H_2O



Speed

Optimized flow path for fast ammonia response!

Dairy Campus based in Leeuwarden, NL part of the Wageningen University & Research (WUR).

CASE STUDY – PORTABLE SOLUTIONS

G4301: CO_2, CH_4, and H_2O GasScouter

Methane emissions from trees: Resolving the drivers, fluxes and significance of this overlooked pathway...and how we got here | Picarro

Scouter!

Lightweight, portable rugged solutions

CASE STUDY – WATER TRACING

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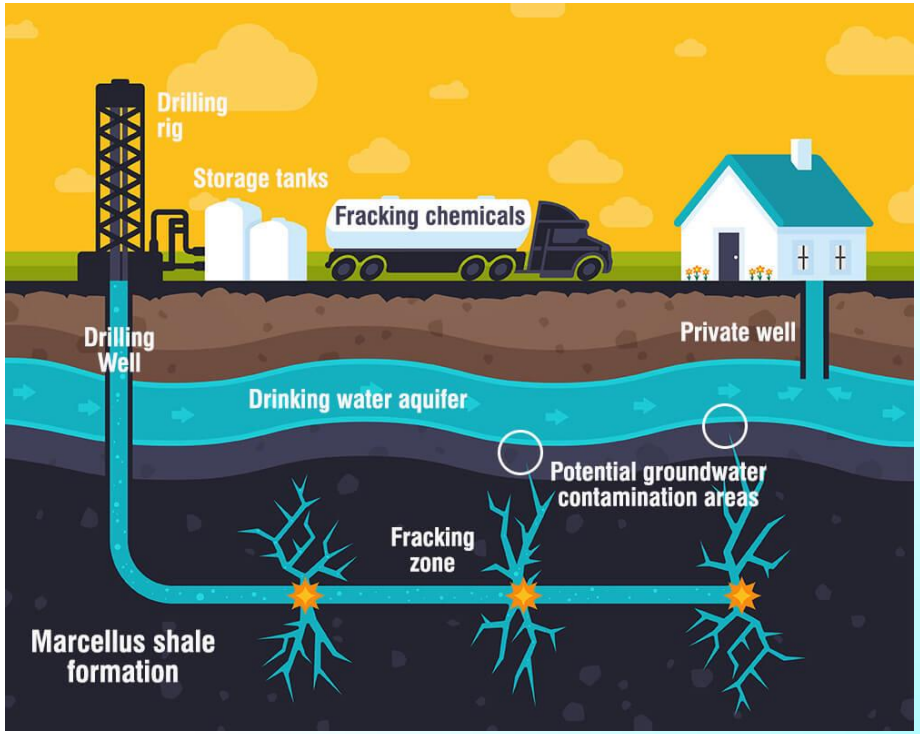
L2130-i: δ18O and δD



CASE STUDY – PALEOCLIMATE

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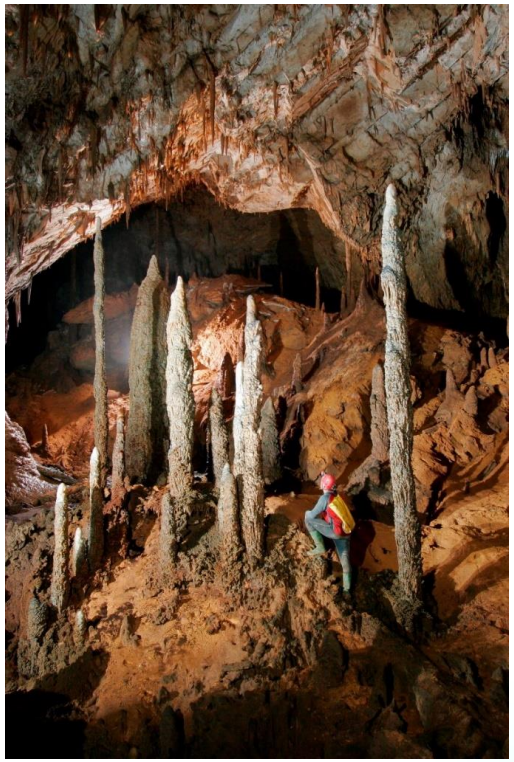
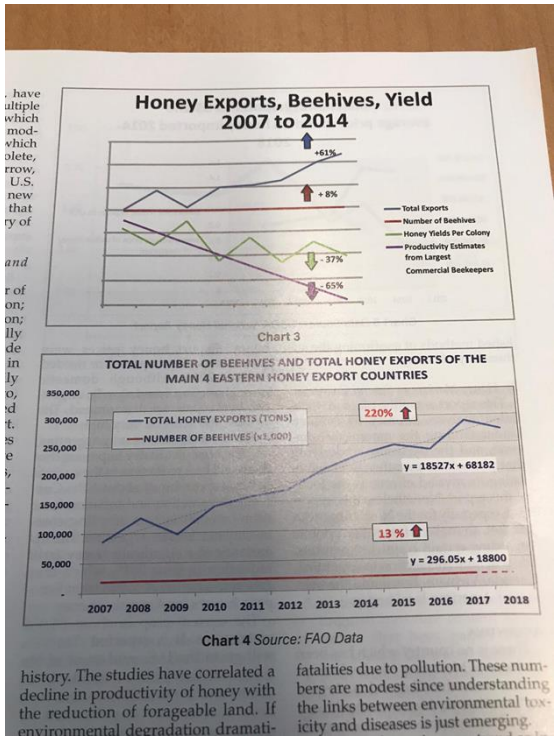
L2130-i: δ18O and δD

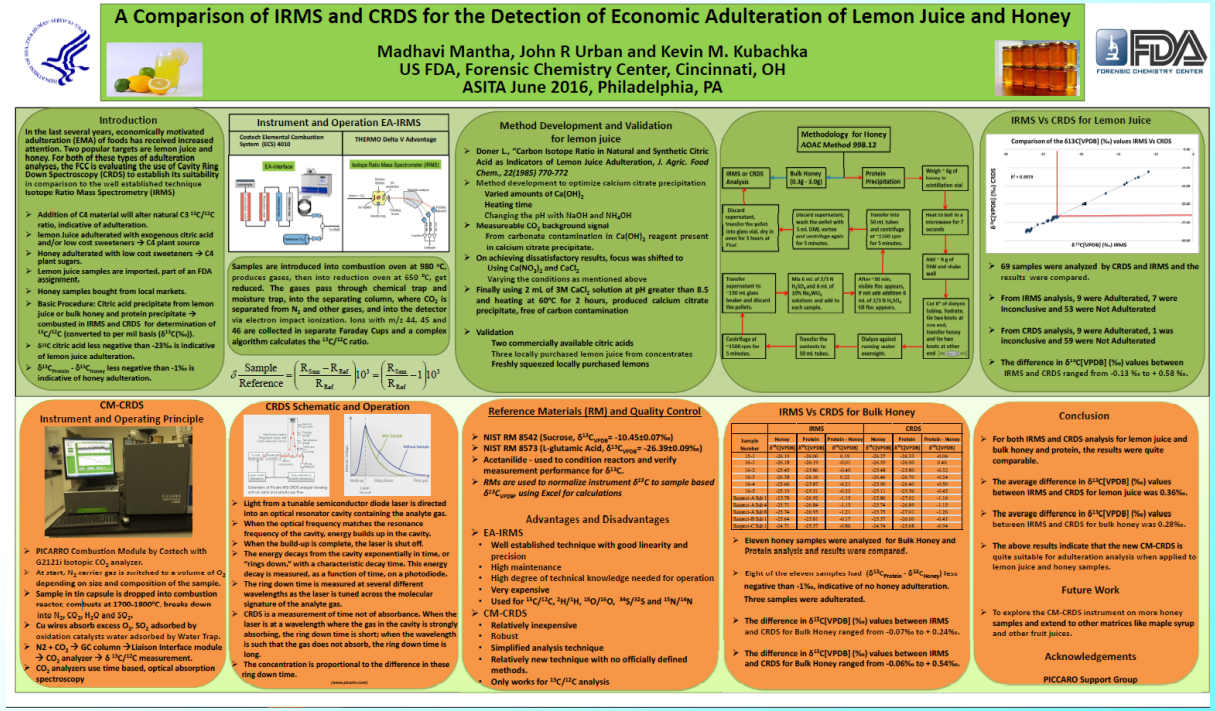


Paleoclimate Research • Georgia Tech • Cobb Lab

CASE STUDY – HONEY, LEMON JUICE ADULTERATION

G2121-i : d13C of CO_2
A0201: Combustion Module





SOLUTIONS FOR HAZARDOUS AIR POLLUTANTS

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Acetylene (C_2H_2)

Ammonia (NH_3)

Ethylene Oxide (C_2H_4O)

Formaldehyde (H_2CO)

Hydrogen Chloride (HCl)

Hydrogen Fluoride (HF)

Hydrogen Sulfide (H_2S)

HOW IS PICARRO CRDS BEING UTILISED?

- Ambient Air Quality monitoring
- Fenceline monitoring stations
- Mobile monitoring surveys
- Leak Detection & Repair (LDAR)
- Continuous Emissions Monitoring (CEMS)
- Multipoint Indoor Air Quality monitoring
- Stack Testing

Real-Time Analyzers

Turnkey Systems

Mobile Solutions

CASE STUDY – REFINERY COMMUNITY AMMONIA

G2103: NH_3 and H_2O

Stability

Existing fenceline monitors in use required constant calibration and service

CASE STUDY – INDOOR AIR HCl

G2108: HCl and H_2O

Speed

Measurement rate at 0.5 Hz major advance in observational capability compared to other established techniques

Formation and emission of hydrogen chloride in indoor air | Picarro

CASE STUDY – MOBILE MEASUREMENTS

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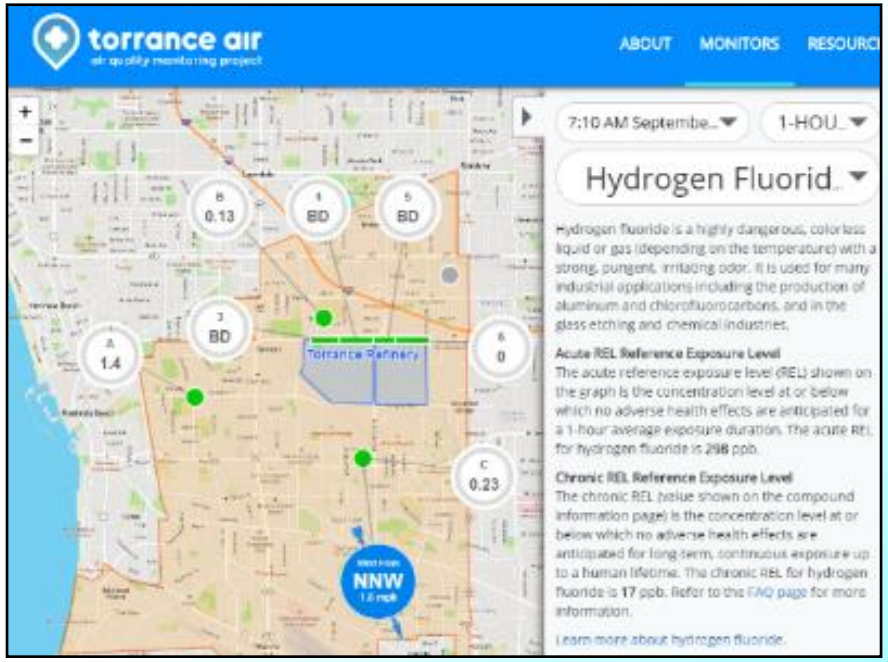
G2204: H_2S, CH_4 and H_2O

Advanced Monitoring
GMAP – Field Monitoring
NEIC's Field Support Capabilities

CASE STUDY – COMMUNITY MONITORING HYDROGEN FLOURIDE

G2205: HF and H_2O

torrance air
air quality monitoring project



Selectivity

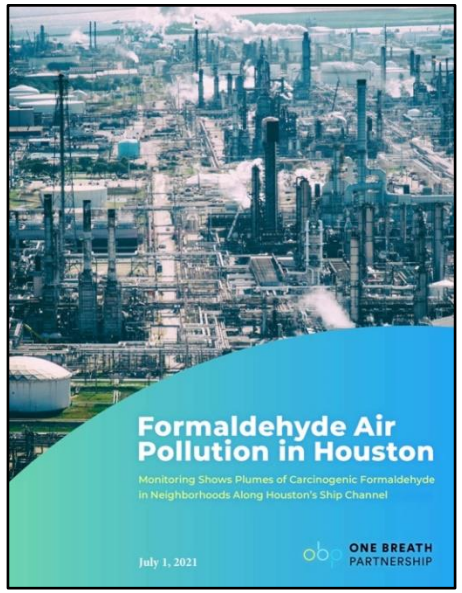
Presence of other compounds causes interference for legacy measurement systems

https://www.torranceair.org/monitors.html

CASE STUDY – SHIPPING LANE FORMALDEHYDE

G2307: H_2CO, CH_4 and H_2O

HOUSTON HEALTH DEPARTMENT



https://environmentalintegrity.org/wp-content/uploads/2021/06/Houston-Formaldehyde-Report-Final-7.1.21.pdf

Table 1: Demographic Information and Cancer Risk in Census Tracts Surrounding Monitors

Monitor Location	2014-2018 population	2014-2018 % Below Poverty Level	2014-2018 % Minority	EPA Modeling Estimate* of Formaldehyde Cancer Risk per 1 Million People	EPA Computer Modeling Estimate of Formaldehyde Concentration (µg/m3)
Clinton Dr. census tract (Galena Park)	2,095	40%	97%	49	1.58 (1.29 ppb)
HRM3 census tract (Cloverleaf)	3,779	23%	67%	96	1.56 (1.27 ppb)
Lynchburg Ferry census tract (east of Channelview)	2,969	14%	40%	70	1.22 (0.99 ppb)

Figure 3: Formaldehyde Point Sources Plotted Across Houston Ship Channel

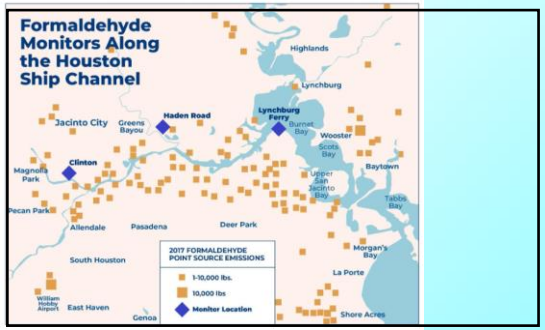
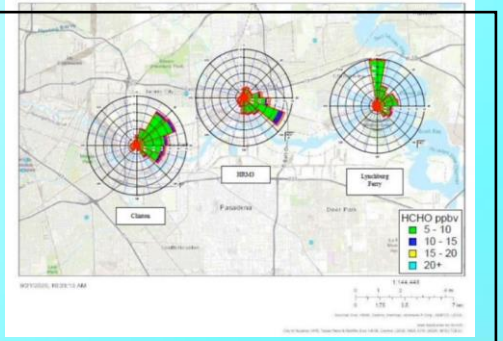
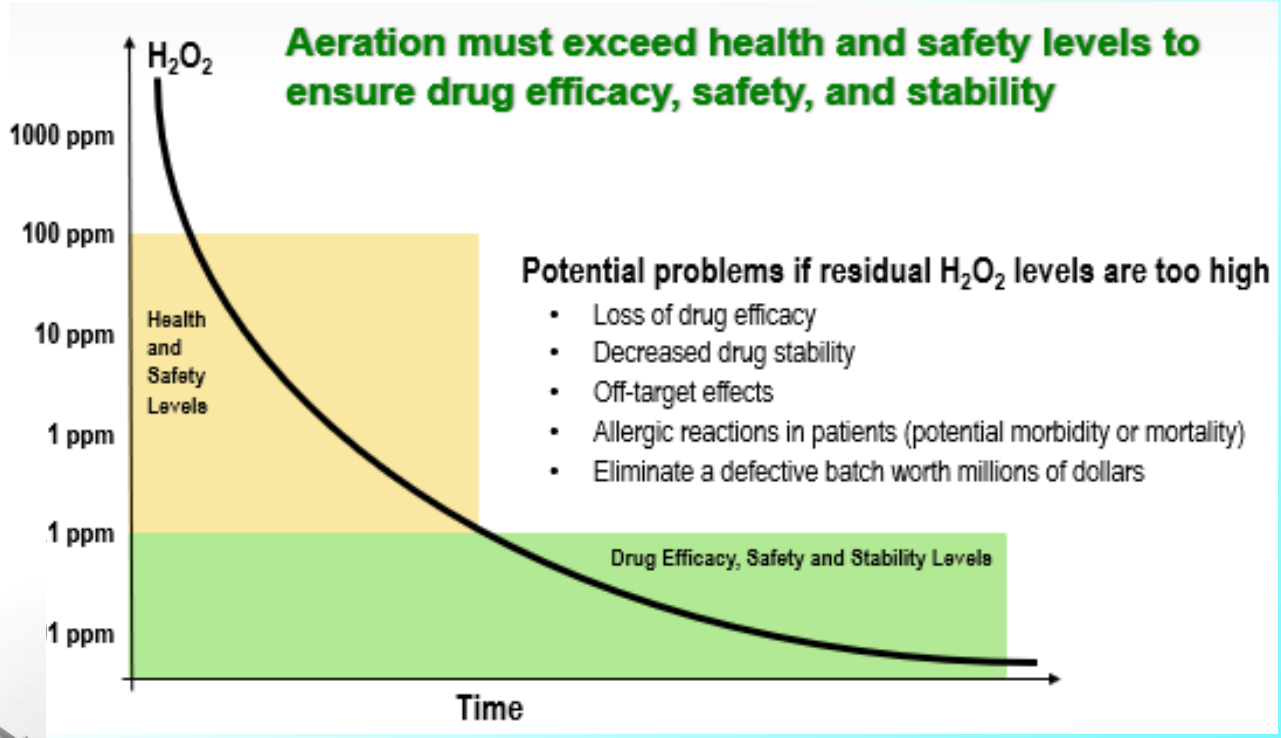


Figure 2: Wind Direction Analysis of Formaldehyde Exceedances, 2019-2020



CASE STUDY – MANAGING PHARMACEUTICAL RISK – HYDROGEN PEROXIDE

PI2114: H_2O_2



Aeration must exceed health and safety levels to ensure drug efficacy, safety, and stability

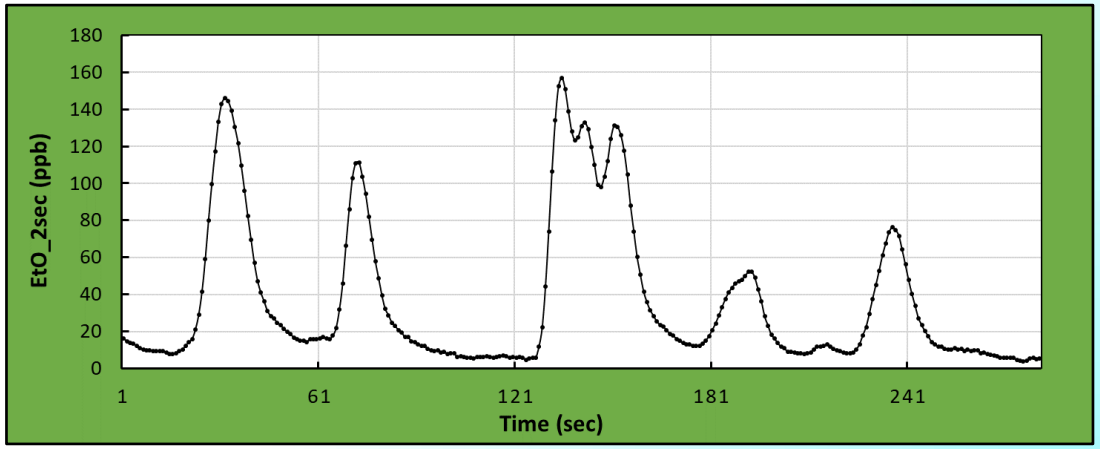
Potential problems if residual H_2O_2 levels are too high

- Loss of drug efficacy
- Decreased drug stability
- Off-target effects
- Allergic reactions in patients (potential morbidity or mortality)
- Eliminate a defective batch worth millions of dollars

CASE STUDY – PROCESS MONITOR ETHYLENE OXIDE

G2910: C_2H_4O CO_2, CH_4 and H_2O

EVENT DETECTION



- 2-sec measurement interval measurements of a process stream
- 2-sec MDL at 2-3 ppb
- **Events invisible to many incumbent technologies**

Unprecedented Insight!

Sensitivity

Real-time quantification at parts-per-trillion (ppt) sensitivity designed to meet the most demanding regulatory requirements

CASE STUDY – COMMUNITY MONITORING ETHYLENE OXIDE

G2920: C_2H_4O CO_2, CH_4 and H_2O

A0601: Zero Reference Module

Ambient Air Monitoring System (AAMS)

Zero Reference Module (ZRM) - peripheral

Picarro G2920 Ambient EtO - analyzer

VALIDATION WITH SURROGATE GASES

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PROBLEM:

- HAPS = hazardous gases
- Standards are challenging
- Hard to procure

SOLUTION:

- SURROGATE gases = safer alternative
- Absorption spectra adjacent to original gas
- Commercially available gases

Model	Primary Gas	Surrogate Gas	Recommended Gas Concentrations
G2103	NH_3	CO_2	0, 200, 1000, 10000 ppm
G2108	HCl	CH_4	0, 7, 50, 100 ppm
G2205	HF	O_2	0, 20.94% (ambient)
G2307	H_2CO	CH_4	0, 7, 50, 100 ppm

Surrogate Gas Validation: A Safer, Easier Way to Validate Measurements of Hazardous, Corrosive, and Reactive Trace Gases | Picarro

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or email info@picarro.com

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MUCHAS GRACIAS

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