Air Quality Analysis Systems

Grow Your Understanding of Air Quality

PICARRO

TECHNOLOGY

TOP VIEW
Self-contained thermal enclosures, housed in a 19" rack mountable allumunium frame.

BOTTOM VIEW
Windows PC with supporting analyzer electronics.

Standard 355 ml can for scale

INNOVATION AND PERFORMANCE IN A SMALL FOOTPRINT

Since 1998, Picarro has been designing and manufacturing Cavity Ring-Down Spectrometers (CRDS) that have seen deployments in hundreds of laboratories, measurements stations and mobile platforms around the world. Thanks to the patented CRDS analyzers, researchers, industrial communities and policy makers now have access to high-performance, real-time instruments capable of addressing questions and topics that were previously reserved for costly, stationary, difficult-to-use devices. High-grade components within the analyzer have been selected and configured to deliver excellent precision and stability over several weeks to months of continous operation, a perfect fit for short- and long-term monitoring campaigns. A strong research background within the company, combined with numerous collaborations with leading research organizations from around the world, have led to continous innovation and creation of unique product features.

THE INSTRUMENT BEYOND THE DATASHEET

Datasheet perfomance specifications for trace gas analyzers do not capture hidden measurement challenges. Picarro analyzers are designed with these hidden challenges in mind.

- ***ADSORPTION*** - A slow response to concentration changes can impact the accuracy of an analyzer. Picarro analyzers combine fast, low dead-volume sample handling, constructed with or coated by materials with low adsorbtion properties. The result is response times on the order of seconds (see example on right).

- ***VALIDATION*** - Accurate trace gas standards are difficult to generate, store and deliver to an analyzer (e.g. H_2CO). To bypass these procurement and sampling challenges, Picarro has developed a surrogate gas validation procedure that utilizes readily available and easy-to-handle gases (e.g. CH_4 or CO_2) for validation of analyzer accuracy and linearity.

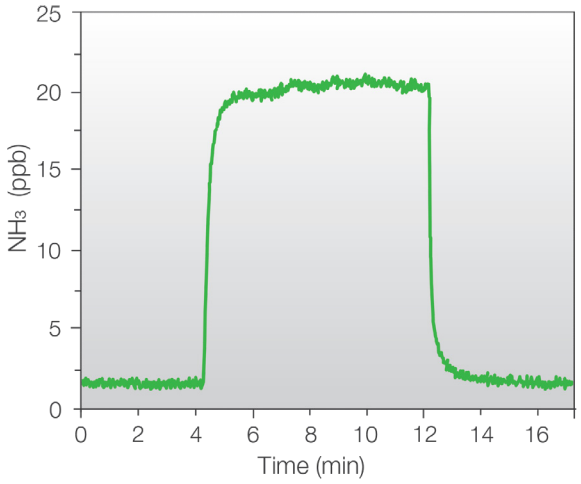
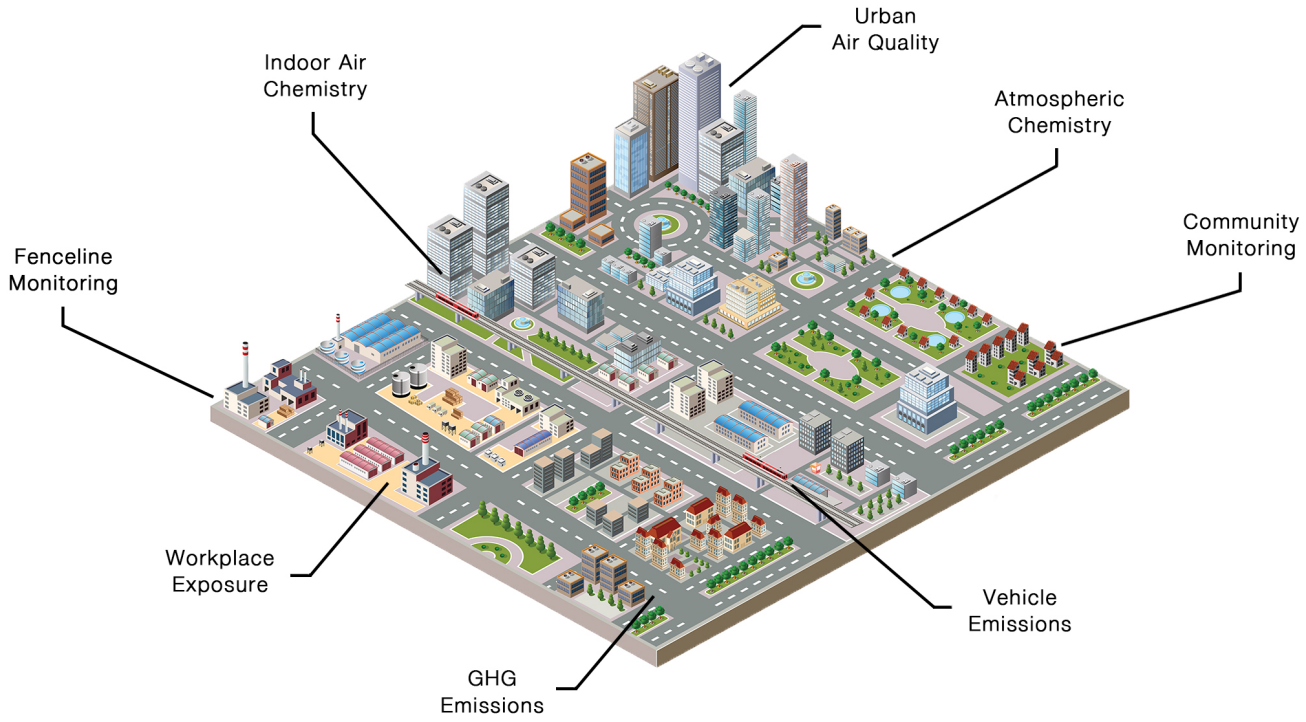


Figure - Typical response time for a 10-90% and 90-10% 20 ppb NH_3 challenge on a G2103 analyzer. The sample handling uses high-grade stainless steel coated with Silconert®.

Learn more about Picarro's unique technology and analyzer features at: ***www.picarro.com/company/technology***

APPLICATIONS



ONE DESIGN FOR MULTIPLE APPLICATIONS

Picarro CRDS analyzers have established themselves as the "gold standard" measurement technology at atmospheric stations around the world (e.g. WMO, GAW). The innovative and disruptive nature of this technology has lead to a measurement revolution in other applications as well. At present, Picarro analyzers are deployed to monitor vehicle emissions (H_2S), fenceline emissions near industrial facilities (HF, H_2S) and air quality inside sterilized spaces (H_2O_2). They are used to quantify community exposure to toxic gases (H_2CO, HF), to quantify the emissions of greenhouse gases from urban, industrial and rural infrastructure (CO_2, CH_4, CO and NH_3), and many other applications. The portable form factor of these analyzers has allowed measurement campaigns to transfer bench-top performance to mobile deployments, be that on land, water or air.

FIND THE IDEAL PICARRO SYSTEM FOR YOU

MODEL	CO_2	CH_4	N_2O	H_2O	NH_3	CO	H_2CO	H_2O_2	C_2H_6	H_2S	HF	HCl	O_2	C_2H_4O
G2301	X	X		X										
G2401	X	X		X		X								
G2508	X	X	X	X	X									
G2509	X	X	X	X	X									
G2103	(s)			(s)	X									
G2108		(s)		(s)								X		
G2204		X		(s)						X				
G2205				(s)							X		(s)	
G2307		X		X			X							
G4301	X	X		X										
G5310			X	X		X								
G2910	(s)	(s)		(s)										X
G2920	(s)	(s)		(s)										X

X denotes a primary measurement, (s) denotes a supporting measurement.

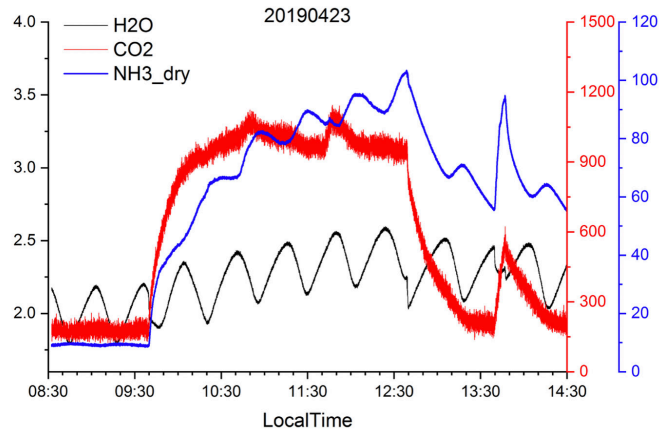
Learn about additional gas species and analyzers not listed here at: ***www.picarro.com/products***

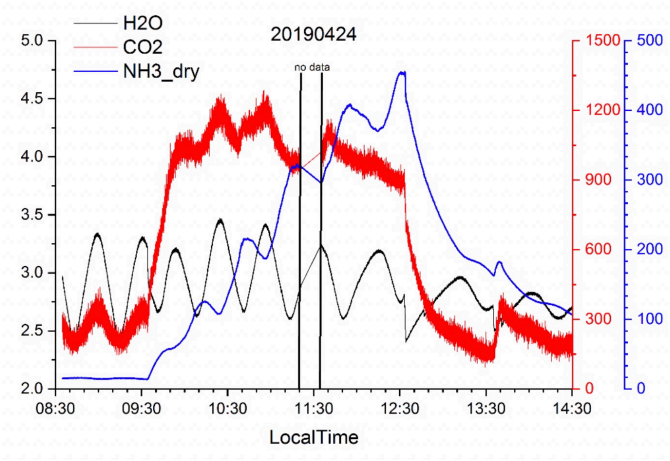
USE CASES

International Centre for Indoor Environment and Energy

HUMAN INFLUENCE ON INDOOR AIR - Sloan Foundation and iCHEAR, Denmark

iCHEAR (Indoor Chemical Human Emissions and Reactivity) is a Sloan-funded collaborative research project designed to examine the role of humans and human emissions on indoor air chemistry. It is led by research group leader Jonathan Williams (Max Planck Institute for Chemistry) in collaboration with Pawel Wargocki and Gabriel Bekö (Department of Civil Engineering, Technical University of Denmark-DTU) at the International Centre for Indoor Environment and Energy (ICIEE). iCHEAR investigates exhaled, dermally emitted and overall human emissions in carefully controlled stainless steel twin climate chambers (see photo above) under different conditions of clothing, temperature, relative humidity and ozone and their impact on OH reactivity.





The Picarro G2103 analyzer provides real-time measurements of ammonia emissions (red line) from the volunteers under well-characterized conditions. Although ammonia is emitted by humans and has a large impact on indoor acid/base chemistry, its emission from human occupants have been poorly characterized. These measurements enable researchers to determine the rate at which the volunteers emit ammonia under different temperature and relative humidity conditions. They also enable ammonia emissions from breath to be separated from those in dermal off-gassing. Early results show that ammonia concentrations are substantially higher at the higher temperature condition and more exposed skin (higher emission on the right-side plot, when compared to the plot on the left).

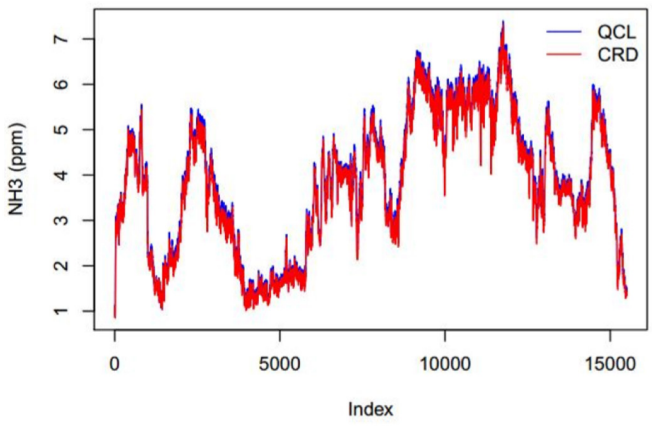
Learn more about the Sloan Foundation program and iCHEAR at: ***https://indoorchem.org/projects/indoor-chemical-human-emissions-and-reactivity-ichear***

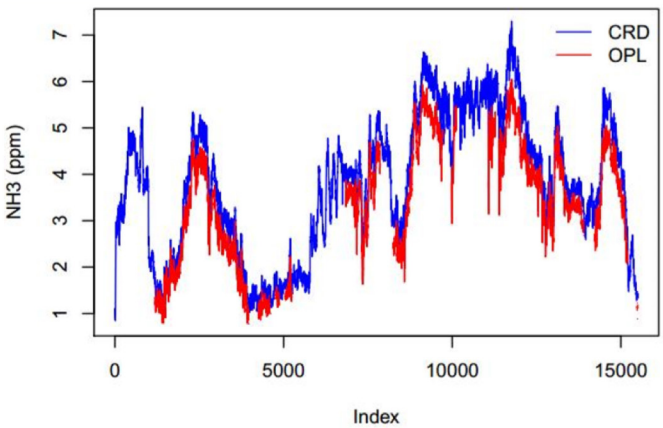
USE CASES

EMISSIONS FROM LIVESTOCK BARNS - ILVO, Belgium

Agricultural activities and processes emit greenhouse gases like carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O), as well as ammonia (NH_3). While greenhouse gas emissions affect the global climate, ammonia is a toxic pollutant that affects human health and the environment on a regional level, e.g. by threatening biodiversity. The agricultural sector is the highest ammonia emitter and most of the emissions come from fertilizer use, decomposition of biological material and animal excretions. In many regions, the level of ammonia emissions is increasing further, and therefore, there is a general interest in reducing emissions in order to meet environmental regulations.

Researchers Shaojie Zhuang and Philippe van Overbeke from the Flemish Research Institute for Agriculture, Fisheries and Food (ILVO) in Belgium used the Picarro G2508 multi-species gas analyzer when testing for ammonia and greenhouse gas concentration measurements in a dairy and a pig barn. The focus of the study was to determine how several instruments would perform when measuring challenging, high adsorption gases such as ammonia. For this study, parts of the internal sample handling line of the Picarro G2508 were replaced with Teflon instead of stainless-steel, to improve the response time. The upgraded Picarro G2508 showed very good accuracy for ammonia and no evident drift over the two-month field test. The performance of the G2508 for ammonia measurements was compared to an open-path tunable diode laser gas analyzer (OPL) as well as a closed-path quantum cascade laser (QCL), see figures below.





The Picarro G2508 was able to accurately measure ammonia concentrations along with CO_2, CH_4 and N_2O concentrations. The ammonia concentration range and the response time of the analyzer are suitable for a variety of applications in agricultural science.

Learn more about this research project at ILVO: ***https://pure.ilvo.be/portal/en/***

USE CASES

AIR QUALITY IN VEHICLE CABINS - Airlabs, UK

Air quality in urban areas is often poor due to a range of pollutants emitted by traffic and industrial point sources. The closer one is to the emission source, like traffic, the higher the exposure level. This also applies to car drivers themselves since the emissions of the nearby cars will also enter the vehicle cabins. The London-based clean air technology company Airlabs set its goal to improve the air quality in cities and to provide solutions for citizens to minimize exposure they encounter throughout the day. One of their consumer products is a portable air cleaner, the airbubbl, that removes particulate matter, NO_2 and other pollutants from air. Knowing that elevated H_2CO concentrations can cause irritations of the respiratory tract, Airlabs used the Picarro G2307 analyzer to verify and improve the H_2CO removal rates of the airbubbl. Inside vehicles, formaldehyde levels can be elevated due to the intake of polluted air from outside or due to outgassing of fabrics inside the vehicle. Continous, real-time operation of the analyzer, along with its stability and rapid response rates were essential to the success of these measurements.

Learn more about Airlabs and Airbubbl at: ***www.airlabs.com***

SECONDARY AEROSOL FORMATION - KORUS-AQ, South Korea

The formation and health impacts of secondary aerosols is an important scientific and socio-political subject in the Asia-Pacific region. Picarro analyzers are being used to support research and monitoring initiatives whose objective is to detect and quantify emissions from a variety of urban and rural sources. The Korean National Institute of Environmental Research (NIER) maintains a network of Picarro analyzers (HF, HCl, NH_3 and others) that are being used as part of NASA's International Cooperative Air Quality Study known as KORUS-AQ. One potential source of poorly quantified NH_3 emissions are local livestock farms. Although a marked increase in NH_3 emissions near these sites could lead to a rise in $PM_{2.5}$, more measurements are required to quantify its effects on regional air quality.

Learn more about the KORUS-AQ and NIER at: ***https://espo.nasa.gov/korus-aq/content/KORUS-AQ***

USE CASES

AMBIENT AIR MONITORING - North America and Europe

Ambient air monitoring plays an important role in understanding long-term global climate evolution, as well as changes that may be occuring on local and regional scales. Picarro analyzers have a long and proven track record of stationary deployments at numerous obervation networks around the world (e.g. ICOS-ATC). An important subset of stations is responsible for the quatification and source attribution of criteria pollutants that have a direct, or indirect, impact on ambient air quality (e.g. H_2S and H_2CO). Collaboration with thought leaders in the community (EPA, CARB, Environment Canada, NPL and others) have lead to numerous improvements in the measurement technology. The results of which have been analyzers that are easy to integrate into station infrastructure and produce data that requires little to no post-processing. The reliability of Picarro analyzers in monitoring applications has made them a “gold standard” instrument, used to evaluate newer, more portable sensor technologies.

Learn more about technology and sensor evaluation at: ***www.picarro.com/company/blog***

STi
Sonoma Technology, Inc.

COMMUNITY AND REGULATORY MONITORING - Sonoma Technology Inc.

Identifying and understanding air pollution exposure is essential for maintaining vibrant and healthy communities. Sonoma Technology, Inc. is a leader in providing technical support to communities and industry clients to monitor local air quality. They design, conduct, and report on scientifically valid air quality measurement studies. Picarro analyzers are a key component to these successful projects. Sonoma Technology deploys Picarro analyzers to monitor H_2S (G2204) and HF (G2205) concentrations to provide robust real-time air quality data to local communities and meet regulatory requirements. Through these air monitoring campaigns, they provide science-based evidence to help engage decision makers to create scientifically sound action plans for positive change.

Learn more about Sonoma Technology at: ***http://www.sonomatech.com/services/airquality***

The Original
Near-IR
G2000 platform

High Performance
MID-IR
G5000 platform

16-Port Distribution
Manifold

Visit
WWW.PICARRO.COM
to learn more about products, peripherals and customer testimonials.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

NPL National Physical Laboratory

CNEMC

NASA

CALIFORNIA AIR RESOURCES BOARD

WORLD METEOROLOGICAL ORGANIZATION

neon National Ecological Observatory Network, Inc.

STi Sonoma Technology

National Institute Of Environmental Research

Environment Canada

MetNH3

CleanAir

Bay Area Air Quality Management District

NOAA National Oceanic and Atmospheric Administration U.S. Department of Commerce

PICARRO

3105 Patrick Henry Drive Santa Clara, CA 95054 | +1 408-962-3900 | sales@picarro.com | picarro.com

© 2022 PICARRO, INC.
LIT CODE: AQ-BR03-V1.2-220408