

Ambient Air Monitoring System for Ethylene Oxide

PICARRO



- Continuous monitoring of EtO at community monitoring stations and industrial fencelines
- User-friendly setup and fully automated operation
- Seamless integration with a wide variety of monitoring infrastructures
- Robust data management and QA/QC features
- Detection of EtO at parts-per-trillion (ppt)

The ability to monitor and quantify low, background levels of ethylene oxide (EtO or EO) is central to eliminating sources and reducing long-term exposure to this hazardous air pollutant. The **Picarro Ambient Air Monitoring System** for Ethylene Oxide enables continuous monitoring and detection of EtO at extremely low levels in ambient air (Figure 1). The system can be deployed at community monitoring stations and as part of monitoring systems at industrial facilities (e.g. at the fenceline).

Picarro's Ambient Air Monitoring System replaces unreliable canister-based methods and legacy technologies such as Fourier Transform Infrared Spectrometers (FTIR) and Gas Chromatographs (GC). Leveraging Picarro's advanced Cavity Ring-Down Spectroscopy (CRDS), the G2920 Ambient Gas Concentration Analyzer, and Zero Reference Module (ZRM), it provides next-generation measurement speed and sensitivity. Setup and configuration can be done in a matter of minutes, allowing new operators to be onboarded in hours not weeks. The system provides intuitive indicators on system health, operation, and data quality, ensuring high confidence in data collection and reporting. The software interface displays real-time measurements of EtO and a summary of multi-day concentration trends, enabling the detection of short-term events (e.g., plumes) and long-term trends. With a database feature that generates custom exports capturing data over hours, weeks, or months, variable measurement periods can be easily analyzed and prepared for reports.

The Ambient Air Monitoring System is highly configurable. The operator or technician can customize the measurement method, schedule QA/QC checks, and manage data in a variety of ways (e.g., export or streaming). The Picarro system can integrate with other rack-based units, or it can be deployed as a stand-alone system on a desktop within a station (Figure 2).

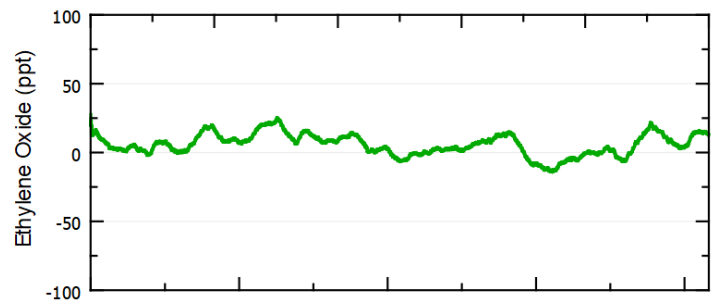


Figure 1 - The Ambient Air Monitoring System corrects for measurement variability, enabling extremely low ppt-level measurements of EtO over weeks of continuous operation (green line).



Figure 2 - There are different ways to build air monitoring infrastructure. Inlet design, tubing selection, calibration standards and other components can vary significantly. Drawing on years of Picarro's monitoring experience, the Ambient Air Monitoring System is packed with features and guidance on how to integrate with existing systems or as a stand-alone solution.

PERFORMANCE IN AMBIENT AIR

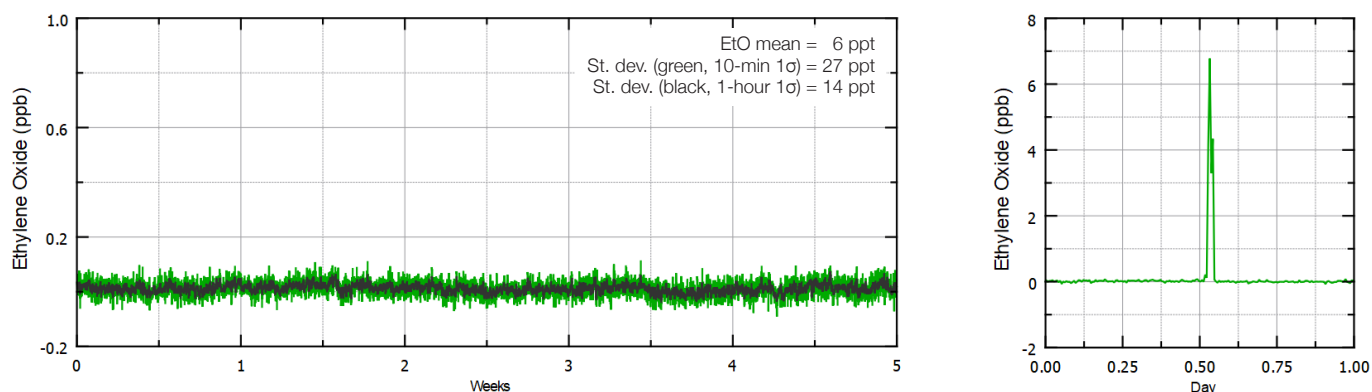


Figure 3 - Performance of the Ambient Air Monitoring System over a continuous 5-week measurement campaign. The system was configured at the beginning of the 5 weeks and left unattended until the end. (Left) EtO concentrations in ambient air were measured using a 10-minute sampling interval [green] and averaged using a 1-hour moving average [black]. (Right) At the end of the measurement campaign, a plume of EtO was simulated using a known source of EtO released under controlled conditions. The system was easily able to resolve a single-digit ppb-level EtO plume.

Performance Specifications	Mole Fraction	Mass Density
Lower Detection Limit (3σ, 1-hour)	30 ppt	0.06 $\mu\text{g}/\text{m}^3$ *
Precision (1σ, 5-min)	33 ppt + 0.02% of reading	0.06 $\mu\text{g}/\text{m}^3$ + 0.02% of reading
Precision (1σ, 1-hour)	10 ppt + 0.02% of reading	0.02 $\mu\text{g}/\text{m}^3$ + 0.02% of reading
Zero Drift:		
1 month (peak-to-peak, 24-hour)	20 ppt	0.04 $\mu\text{g}/\text{m}^3$
6 months (peak-to-peak, 24-hour)	25 ppt	0.05 $\mu\text{g}/\text{m}^3$
1 month (peak-to-peak, 50-min)	150 ppt	0.27 $\mu\text{g}/\text{m}^3$
6 months (peak-to-peak, 50-min)	180 ppt	0.32 $\mu\text{g}/\text{m}^3$
Guaranteed Measurement Range	0–2 ppm	0–3.6E ⁻³ g/m ³
Compatible Air Matrix:		
• Background	(Ambient)	(Ambient)
• Carbon Dioxide	(0–2,000 ppm)	(0–1.8 g/m ³)
• Methane	(0–10 ppm)	(0–6.0 E ⁻³ g/m ³)
• Water Vapor	(0–30,000 ppm)	(0–22.1 g/m ³)
• Ammonia	(0–0.04 ppm)	(0–2.8 E ⁻⁵ g/m ³)

*Conversion to $\mu\text{g}/\text{m}^3$ at 1 atm and 25°C.

Operating Specifications	A0601 Zero Reference Module	G2920 Ambient EtO Analyzer
Operating Technique	Removal of EtO from sample via a Phosphoric Acid Impregnated Activated Charcoal (PAIAC) scrubber. Real-time correction of EtO measurements.	Cavity Ring-Down Spectroscopy (CRDS)
Sample Temperature	-10 to 80°C	
Sample Flow Rate and Pressure	~ 1 slpm at 760 Torr; 600 to 1000 Torr (80 to 133 kPa)	
Sample Humidity	<99% R.H. non-condensing @40°C, no drying required	
Ambient Temperature Range	10 to 35°C (operating); -10 to 50°C (storage)	
Ambient Humidity	<85% R.H. non-condensing	
Accessories	Included: External filter, service tools, leak check kit Optional: PAIAC replacement kits (S3193, S3196), PAIAC with cartridge (S3197), gas kit (A0956)	Included: Pump (external), keyboard, mouse Optional: LCD Monitor (A0901), rack mount (A0950)
Operating System (and Data Outputs)	Windows 10 OS (RS–232, Ethernet)	
Fittings	¼" Swagelok® SS fittings	
Dimensions	17" w x 5 1/4" h x 17" d (43.2 x 13.3 x 43.2 cm), not including 0.5" feet Service cover open: 11 1/2" (29.3 cm), not including 0.5" feet	17" w x 7" h x 17.5" d (43.2 x 17.9 x 44.6 cm), not including 0.5" feet External Pump: 7.5" w x 4" h x 11" d (19 x 10.2 x 28 cm)
Installation	Benchtop or 19" rack mount chassis	
Weight	25.7 lbs (11.7 kg)	47 lbs (21.3 kg) for analyzer and 14.2 lbs (6.5 kg) for external pump
Power Requirements	100–240 VAC at 60 Hz, at 2 A	100–240 VAC; 47–63 Hz (auto-sensing); <375 W at start-up (total) Steady-state operation: 120 W (analyzer), 150 W (pump)