

BREATHE OUT **COMPLEXITY**
BREATHE IN **COMPLIANCE**



Outdoor Air Monitoring Solutions



END-TO-END SOLUTIONS FOR UNDERSTANDING OUR AIR

Now Everyone Can Breathe Easy

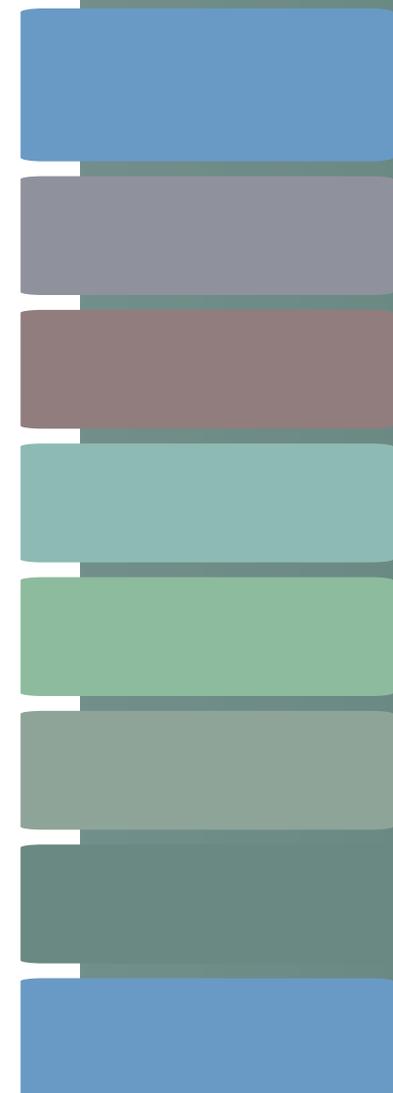
Urbanization and industrialization, population density, climate change, the advent of new and more potentially harmful chemicals in our air. These are just a handful of the myriad problems we – and the *planet* – are facing.

Understanding the quality and breathability of our air is the work of environmental labs, governments, and to an increasing degree, every citizen. Outdoor air monitoring requires fast, accurate, reliable – and *compliant* – volatile and semivolatile organic compound analysis: Automated thermal desorption and GC technologies to measure everything from ozone precursors to soil vapor intrusion, fenceline monitoring solutions for measuring harmful emissions, and even portable GC/MS systems for fast onsite analysis – everything environmental analysts need to help achieve a cleaner environment for *everyone*.



AIR QUALITY TECHNOLOGIES AND SOLUTIONS PORTFOLIO

Click on the photos below to learn more about the breadth of our outdoor air quality technologies and solutions.

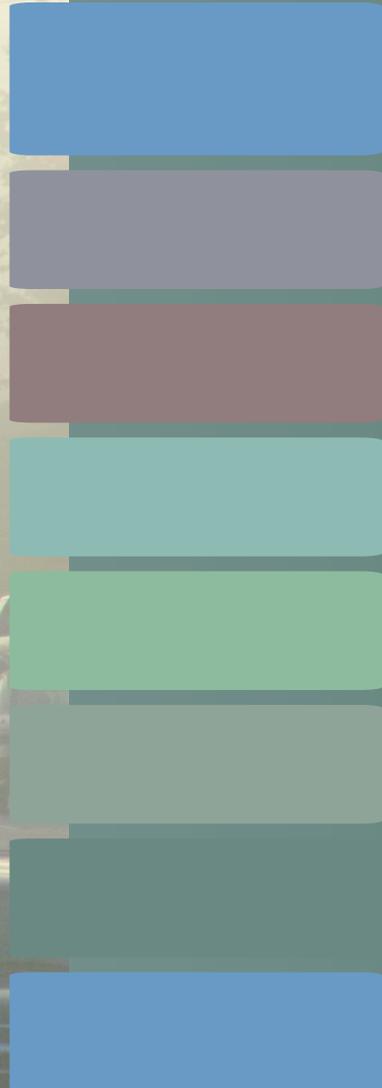


A Short History of Air Pollution

Air pollution has been with us in one form or another since at least the Roman Empire and the Han Dynasty, when human activity began releasing methane and other greenhouse gases into the atmosphere. In medieval London, the infamous smog was so noxious that King Edward II tried to ban the burning of some types of coal – *in the year 1272* – to no avail. Fast forward to the Industrial Revolution, when in 1872, 273 people died from bronchitis caused by air pollution.

But it wasn't until the middle of the twentieth century that scientists first started investigating the link between air pollution and health, and U.S. states began passing legislation to reduce air pollution. Then in 1970, the U.S. passed the Clean Air Act Amendments, leading to the establishment of the U.S.'s first nationwide air-quality standards.

Today, the U.S. Environmental Protection Agency (EPA), together with standards bodies in the European Union, China, and elsewhere, conducts a vast amount of research, produces findings, and develops technologies to help us understand air pollution causes and cures. This research is compiled and synthesized every five years to ensure that current air pollution standards and regulations meet the needs of a growing global population.



Clarus 590/690 GC with TurboMatrix TD

Based on our Clarus 590 and Clarus 690 GC systems complete with wide-range flame ionization detector (FID) and TurboMatrix TD technologies, our fully EPA-compliant Online Ozone Precursor Analyzer delivers extremely accurate quantitation measurements below 0.1 ppb and the ability to sample both high and low levels in a single run, for better uptime and continuous results.

This turnkey, single-vendor solution contains sophisticated network communications to ensure robust, 24/7 monitoring (providing 40 minutes per hour of actual sampling), making it the ideal system for field operations. And it's been shown to perform analysis to the following specifications:

- 2008 National Ambient Air Quality Standards
- European Union's Ozone Directive
- United Nations Economic Commission for Europe's VOC protocol



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Clarus SQ 8 GC/MS with TurboMatrix TD

Our Clarus SQ 8 GC/MS offers unsurpassed sensitivity and unparalleled stability for identification and quantitation of volatile and semivolatile compounds. It's designed to deliver high throughput, rugged dependability, and accurate results. And its patented high-performance oven provides the fastest heat-up and cool-down (from 350 °C to 40 °C in less than two minutes). Plus, the system provides:

- Our patented SMARTsource™ (for both EI and CI) for easy maintenance and more uptime for samples (no tools required)
- The Clarifi™ detector for exceptional signal-to-noise ratio and long operational life
- TurboMatrix TD technology for precise results and accurate, automated validation



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Spotlight 400 FT-IR

The Spotlight 400 FT-IR imaging system combines high sensitivity and rapid imaging with ease of use for fast qualitative and quantitative analysis of PM_{2.5} and particulates in outside air. The system incorporates a number of unique productivity tools and features an ATR imaging system that enables the collection of high-resolution infrared images of extremely small samples, making it easy to visualize the composition of materials based on FT-IR spectral data.

What's more, IR imaging of particulates takes only five minutes to complete, whereas ion chromatography requires solvent extraction which can mean sampling times of up to 25 minutes per run.



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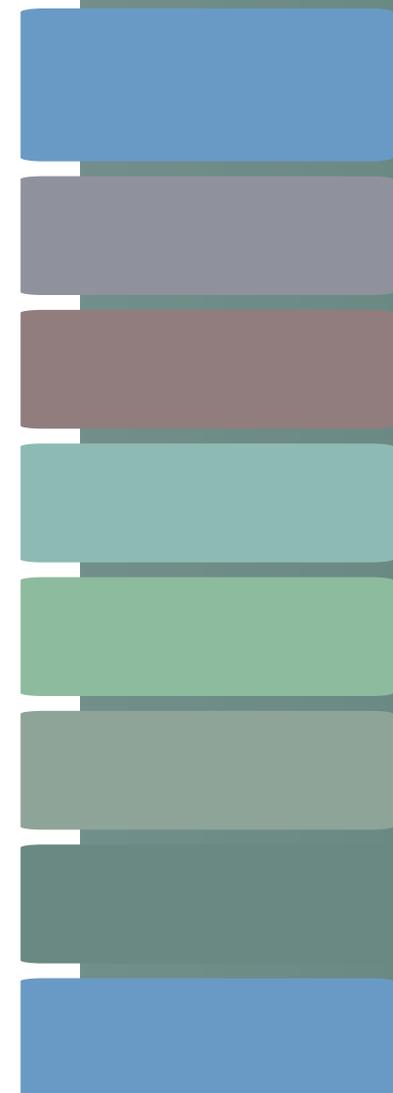
Frontier IR

Frontier FT-IR spectrometers deliver superior spectroscopic performance in demanding environmental applications. Powerful and adaptable, Frontier systems provide exceptional signal-to-noise ratio and photometric performance, assuring optimal spectral quality and best-in-class sensitivity. When combined with our MCT detector, it's the perfect system to measure target species such as 1, 3-Butadiene, a common hazardous air pollutant.



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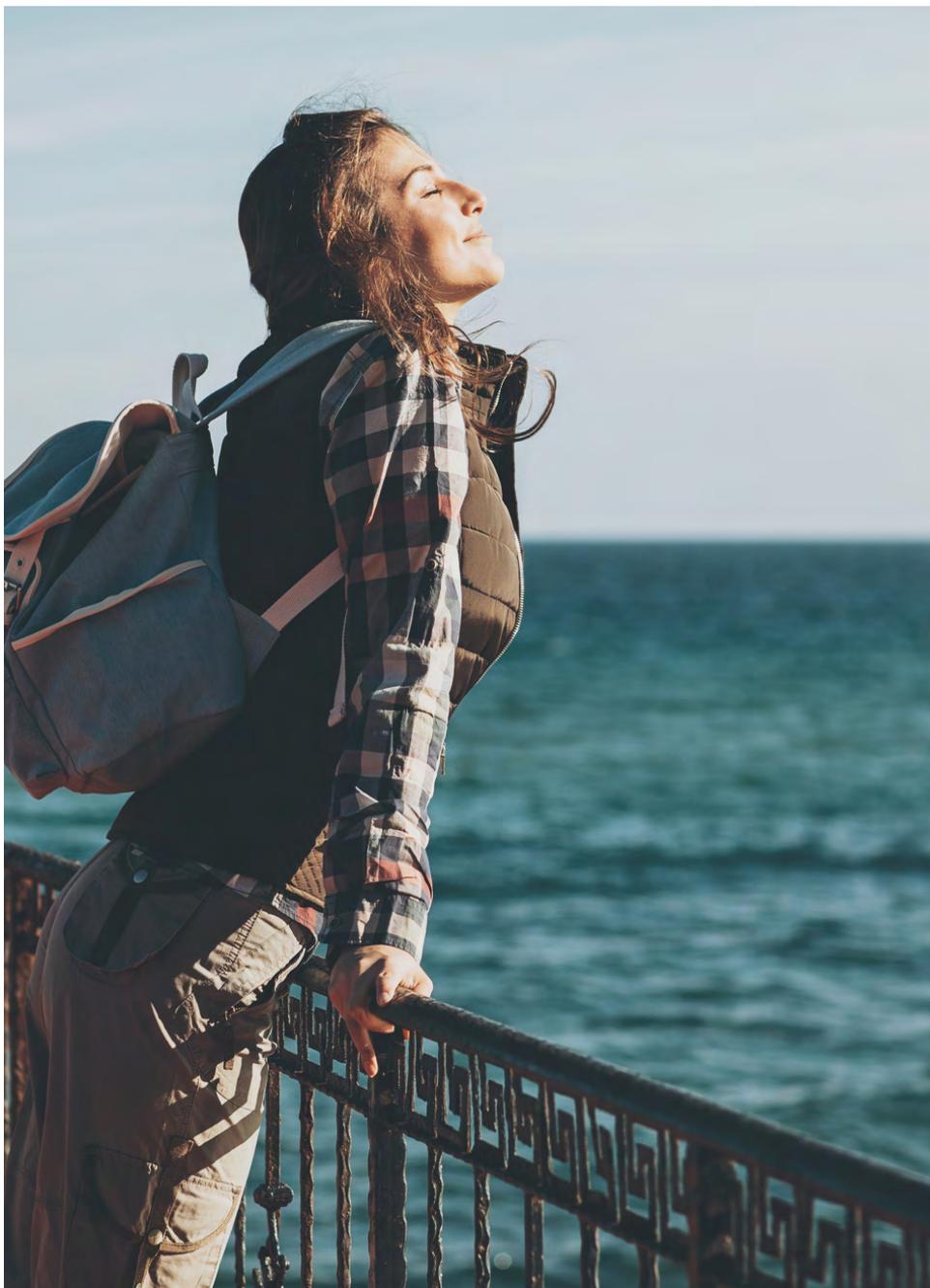
Online Ozone Precursor Analysis

In 1990, the Clean Air Act Amendments, Title 1 expanded its mandate to include measurements of volatile organic compounds (VOCs) that contribute to the formation of ground-level ozone, and are implemented in the Photochemical Assessment Monitoring Stations (PAMS) program. Cutoff for admissible presence of ozone has been lowered, and the EPA predicts many local governments will violate the latest standards. And analysis of certain ozone-precursor compounds can present real challenges to the researcher in the field, where much of this analysis needs to take place.

Working closely with the EPA in the early 90's, we developed the method to collect and measure C2 through C12 VOCs without the need for liquid cryogen trapping, and we were able to report unattended hourly results. Our **Online Ozone Precursor Analyzer**, based on the **Clarus 590/690 GC** with **TurboMatrix TD** technology, has a proven track record of several hundred thousand hours of reliable field operation, delivering a 24-hour-per-day field monitoring solution. And the TurboMatrix TD system performs ozone precursor analysis within the specifications required by the EPA's methods.

KEY COMPONENTS OF THE PERKINELMER ONLINE, FIELD-BASED OZONE PRECURSOR ANALYZER





Air Toxics / VOCs and SVOCs

The average person breathes in approximately 20,000 liters of air per day – so it's incumbent upon governments and the scientific community to gain a better understanding of how toxic substances – volatile organic compounds (VOCs) and semivolatile organic compounds (SVOCs) – impact human health. We've been on the forefront of the move to EPA Compendium Method TO-17 to replace methods TO-13 and TO-15, the standards for nearly 15 years. TO-17 provides a one-test solution for 1,3-butadiene, benzene, toluene, ethyl benzene, xylenes (BTEX), and the 16 regulated polynuclear aromatic hydrocarbons (PAHs) in air-monitoring locations near manufactured gas plant (MGP) remediation sites, meeting the regulatory compound analysis and method criteria for those sites.

Our solution is built on the **TurboMatrix TD** system, which accommodates a two-stage thermal desorption process that concentrates analytes before they're introduced into the **Clarus SQ 8 GC/MS** system. A new type of tube developed for this solution (and Method TO-17) uses no solvents, which makes it more environmentally friendly than previous methods. We've conducted site studies replacing a two-sampling analytical technique with a one-sampling analytical technique – with considerable success.





Fenceline Air Monitoring

As a result of U.S. federal regulations 40 CFR Parts 60 and 63, the U.S. EPA now has a mandate to reduce harmful VOCs at the perimeters (fencelines) of oil and petroleum refineries. The agency has developed two methods for fenceline monitoring (FLM) for compounds such as 1,3-butadiene; benzene; toluene; ethylbenzene; xylenes; and other harmful VOCs: EPA Method 325A deals with location and sampling procedures utilizing thermal desorption, whereas EPA Method 325B defines analyses using gas chromatography. Sampling is performed at the fenceline at two-week intervals using passive sorbent tubes and benzene is the target reported to the EPA.

Whichever method you're using, we provide a one-stop solution for fenceline monitoring, including sample shelters, passive sorbent tubes, and the award-winning combination of **Clarus SQ 8 GC/MS** systems and **TurboMatrix ATD** systems, along with installation, system and application training, and support – all from the company that invented automated thermal absorption technology.



Soil Gas Analysis/Soil Vapor Intrusion

Since the 1990s, soil vapor intrusion into residential and other buildings has been a major concern for the U.S. EPA. Two methods are available for determination of VOCs in air: TO-15, which employs summa canisters and only covers up to naphthalene (around nC12) and can't recover the higher boiling components of diesel, and TO-17, which utilizes a sorbent tube to collect samples and can recover a much greater number of analytes than TO-15.

We collaborated with Canadian testing laboratory CARO Analytical Services to design new tubes for TO-17 testing that ensure retention of the most volatile components, and recovery of the semivolatile components of diesel (nC26). The ability for quick tube cleanup with nondetectable carryover for resampling is easy, and increased sampling volumes to achieve regulatory compliance has been validated. Our **Clarus SQ 8 GC/MS** and **TurboMatrix TD** technology, in combination with this new patented tube technology, allows for analysis of a wider range of components present in soil gas with improved analytical results.

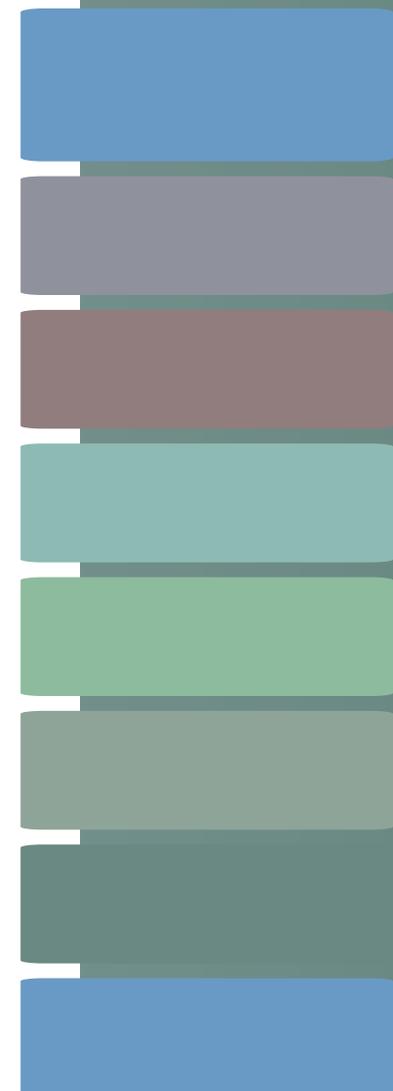


OneSource Laboratory Services

In today's complex air quality regulatory landscape, every laboratory function has to work together toward the goal of efficiency in the service of a cleaner, safer environment. And that's the goal of OneSource® Laboratory Services, too. We deliver solutions that cover all aspects of scientific lab operations and can be customized for the scientific workflows – and business outcomes – you're driving toward.

OneSource is the one service organization with the requisite understanding of lab and R&D needs, delivering a customized systems approach to your success. With insights and expertise, our consultants pinpoint the issues and inefficiencies and engineer the right solutions to solve your scientific and business challenges. From everyday instrument repair and service to compliance and validation, from laboratory IT service to consulting and scientific staffing, OneSource Laboratory Services can help streamline your lab routines and get your scientists back to their main order of business – *science*.

OneSource
Laboratory Services



Consumables and Accessories

As a recognized leader in sample handling accessories and consumables, we offer an array of innovative frontend technologies to help you get more out of your air-quality monitoring systems.

Tube conditioning is key to successful thermal desorption. You can condition tubes individually on your thermal desorber, or for greater efficiency, you can use the TurboMatrix TC 220, an offline conditioner/dry purge accessory that prepares several tubes at once while your instrument is running samples.



TURBOMATRIX THERMAL DESORBERS

From single-tube configurations to automated 50-tube systems, our TurboMatrix TD systems can be optimized with programmable pneumatic control options – the simplest, most convenient way to set gas flows and pressures. It simplifies air toxics testing and ensures the best possible analytical performance.

THERMAL DESORBER TUBES

Our TD tubes are offered in both stainless steel and glass. Each tube maintains its unique serial number, which is etched for easy identification. Tubes are offered with a variety of sorbent packing materials for many GC applications, including indoor and outdoor air monitoring. They're available conditioned and unconditioned and ship with end caps for short-term storage.

SOIL VAPOR INTRUSION (SVI) TUBES

These patented multibed-construction SVI tubes extend the hydrocarbon range past naphthalene while retaining lighter compounds (boiling point range nC3 to nC26). This unique design enables larger sample volumes, enhances detection limits – and meets current EPA standards for air monitoring.

XRO 440 AND XRO 640 EXTENDED-RANGE TUBES

These patent-pending sorbent tubes are perfect for volatile and semivolatile analyses. XRO 440 and XRO 640 tubes can retain and recover from the boiling point range of nC4 to nC44 and nC6 to nC44, respectively. They're very hydrophobic, so water management occurs during sampling, with one- to two-minute dry-purge time. They've been validated on several site studies comparing other tubes, with 50-liter sample volumes in humid conditions.

For more information on our Outdoor Air Monitoring Solutions visit www.perkinelmer.com

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