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# TT24-7NRT

## Near-real-time monitoring of trace chemical vapours





**MULTI-GAS ENABLED**
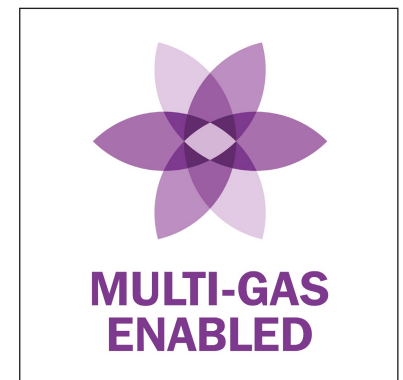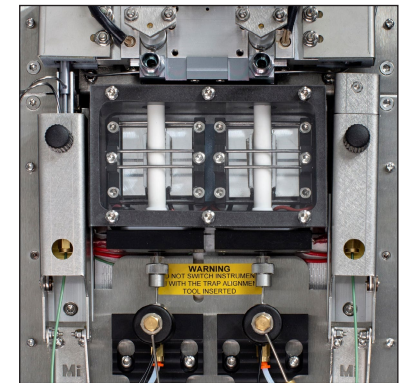
# TT24-7NRT™

**Introducing the TT24-7NRT near-real-time thermal desorber for GC and GC–MS – delivering continuous, uninterrupted monitoring of airborne chemical warfare agents (CWAs) and toxic industrial chemicals (TICs).**

TT24-7NRT meets the demand for near-real-time continuous monitoring of CWAs and TICs, with no gap in sampling or 'blind spots'. Its tandem trap technology provides exceptional 100% data capture at the lowest level of detection, enabling it to reliably meet worker protection limits (WPLs) and general population limits (GPLs).

Key features for robust near-real-time (NRT) analysis include:

- **No blind spots** – The use of two focusing traps working in tandem ensures 100% data capture.

- **Highly time-resolved data** – Used in conjunction with fast GC cycle times, TT24-7NRT provides confident detection and fast alerts to chemical events.

- **Easy remote deployment** – Multi-Gas technology enables the use of gas generators, minimising deliveries to site. TT24-7NRT is compatible with hydrogen and nitrogen carrier gas, as well as helium to support any GC or GC–MS methods.

- **Wide analyte range** – Trapping temperatures as low as –30°C, backflushed trap desorption and inert flow paths allow quantitative detection of nerve and blister agents, 'sticky' or high-boiling agents, and very volatile toxic industrial chemicals.

- **Cost saving** – The reliable electrically-cooled focusing traps eliminate the expense and inconvenience of liquid cryogen cooling, and remove the risk of ice blockages, maximising uptime.

- **Enhanced data security** – Internal standard addition enables performance to be monitored over time.

- **Single-tube desorption** – TT24-7NRT can be used with 3½″ × ¼″ or 4½″ × 6 mm tubes, for confirmation and troubleshooting.

- **Easy integration** – TT24-7NRT is compatible with GC and GC–MS systems from all major manufacturers, minimising the upfront investment.

TT24-7NRT
Continuous air sampler

TT24-7NRT

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# Reliable detection at trace levels

Optimised, electrically cooled sorbent traps, fast GC injection, and high sampling flow rates combine on the TT24-7NRT to deliver outstanding sensitivity. Limits of detection as low as $1 \times 10^{-7}$ mg/m³ can be achieved within a 10-minute cycle time, comfortably reaching general population limit levels for routinely monitored nerve and blister agents.
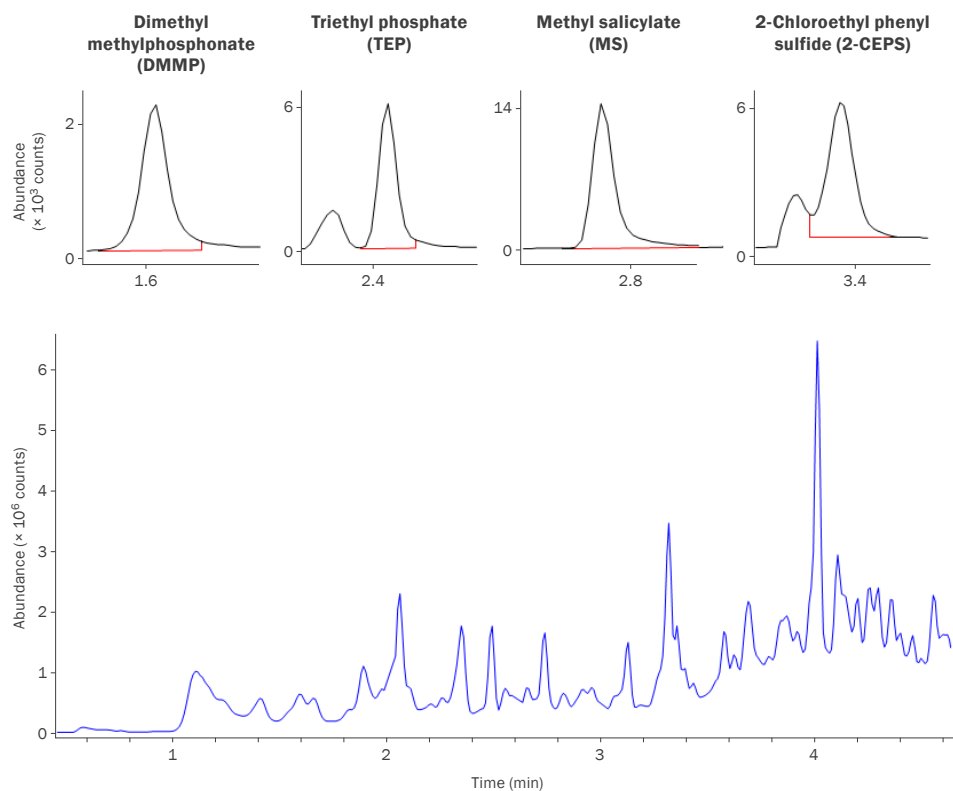


Optimal peak shape for volatile simulants ensures reliable compound identification, separation from interferences, and enhanced sensitivity within a 5-minute analysis window. The extracted-ion chromatograms, shown at 250 pg on-column for four simulants, highlight their effective detection in a complex air matrix.
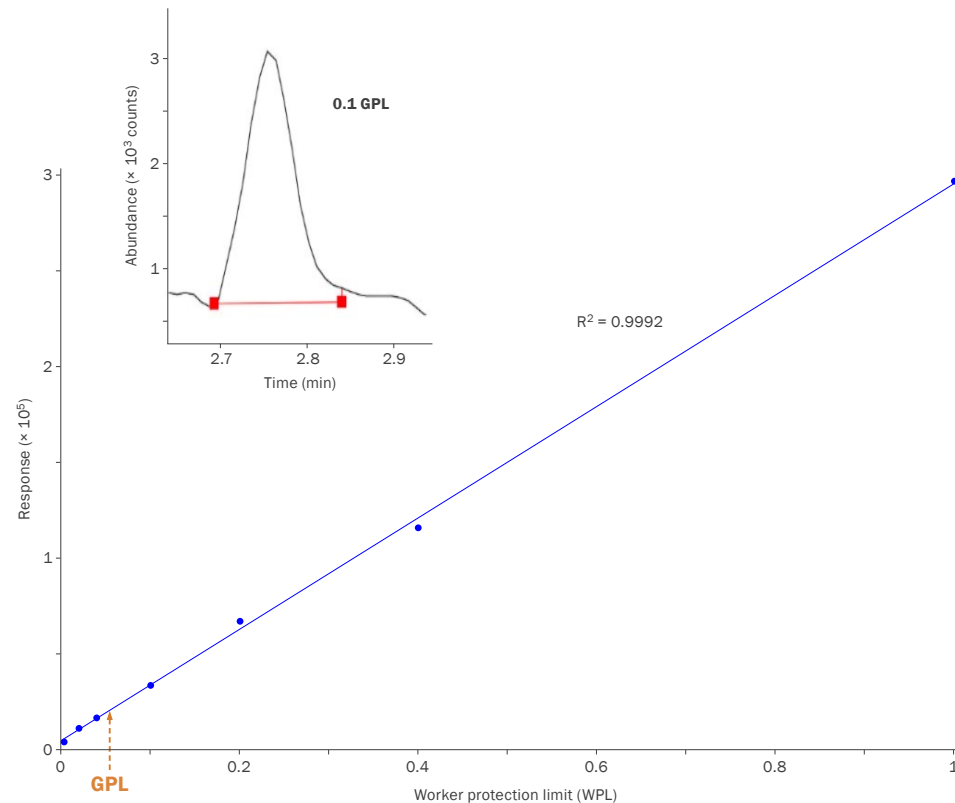


Linear calibration below the WPL for a sulfur mustard simulant (methyl salicylate) demonstrates limits of detection below even GPL levels. The extracted-ion chromatogram (inset) shows a quantifiable peak at 10% of the GPL ($2 \times 10^{-6}$ mg/m³).

# Fast, continuous monitoring with no blind spots

Taking advantage of over 25 years of pioneering innovation in thermal desorption, TT24-7NRT has been optimised to balance sensitivity, speed, reliability and data integrity, ensuring exceptional performance in all monitoring settings.

Unparalleled near-real-time monitoring of trace levels is achieved by:

- Tandem operation of the twin traps, providing **complete sample coverage** without any data gaps.
- Sampling flow rates up to 1 L/min, facilitating rapid sampling with **maximum sensitivity**.
- **Backflush trap desorption** that extends the range of compounds measured in a single analysis.
- **Ballistic trap heating** that reaches maximum temperature in a matter of seconds, enhancing peak shape and ensuring efficient operation.
- **Fast trap electrical cooling** in less than 1.5 min.
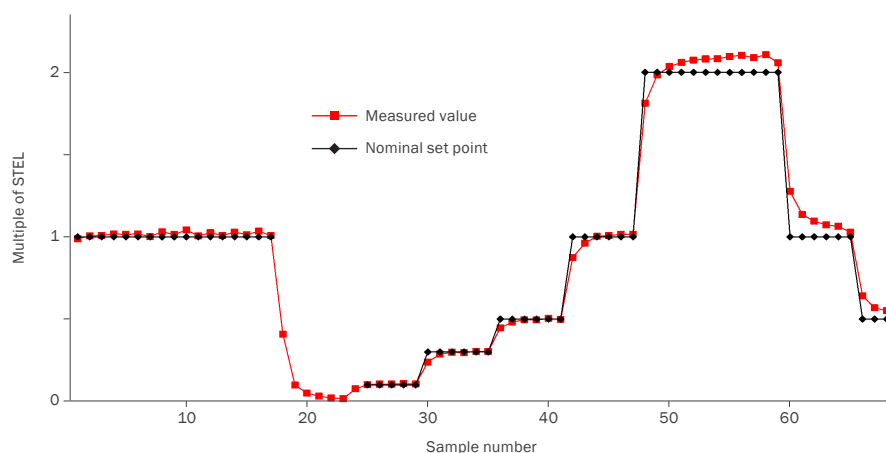
Airborne concentrations of sarin are closely tracked using tandem trapping for continuous monitoring of a generated atmosphere.

## How tandem-trap thermal desorption works

Two focusing traps working in tandem provide complete data-capture for on-line sampling of air using the TT24-7NRT, in the following process:

**1** The air sample is concentrated onto **Trap A**, and held at low temperature until the desired volume is acquired.

**2** The sample flow is then switched to **Trap B**, while Trap A is desorbed (rapidly heated with a flow of carrier gas) to send concentrated analytes to the GC column for analysis.

Sampling then begins on Trap A again, while Trap B is desorbed for analysis, and this automated process is repeated continuously.

A gas-phase internal standard can be added to either focusing trap before analysis.
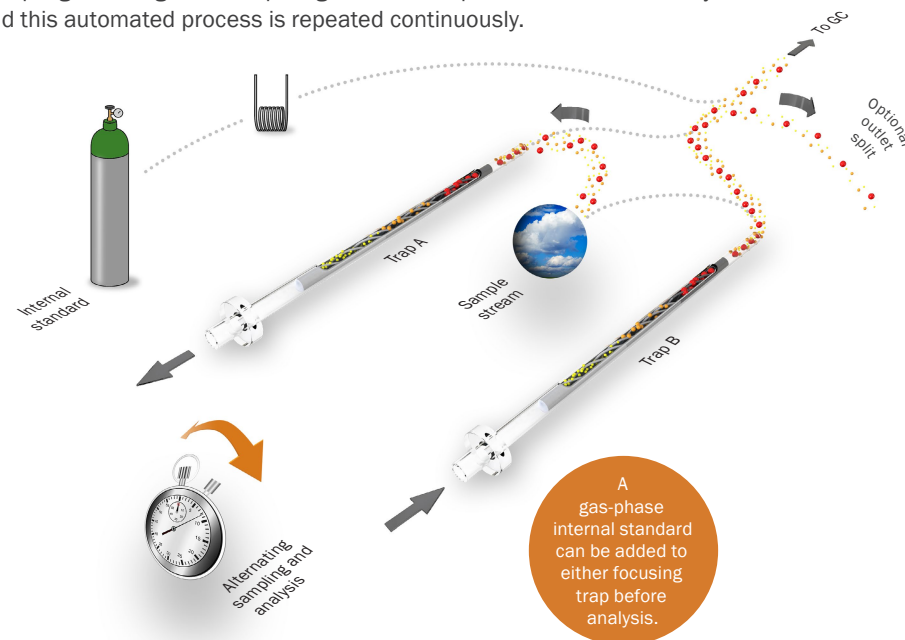
Operation of the TT24-7NRT. At the time-point shown, sampling is taking place onto Trap A, while Trap B is being desorbed.

# Unlock unparalled versatility

## TT24-7NRT: A flexible platform for comprehensive monitoring of hazardous airborne chemicals
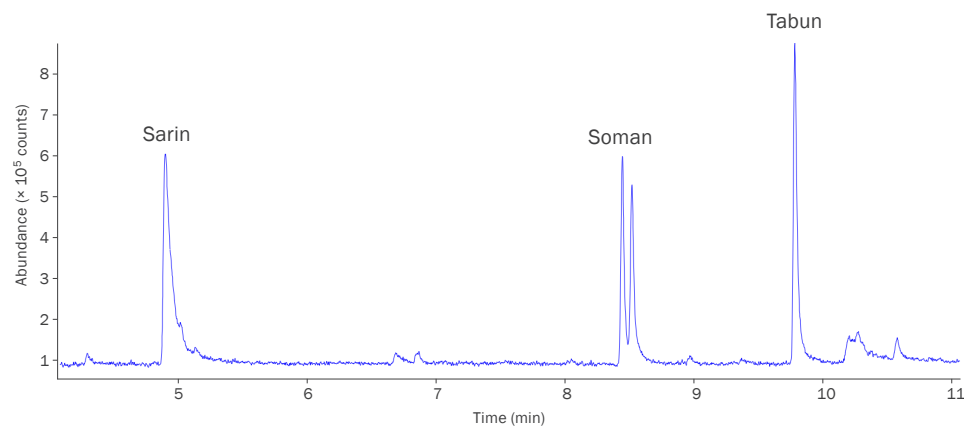


**Targeted measurement:** TT24-7NRT can be paired with selective GC–FPD for highly sensitive measurement of G agents, V agents and sulfur mustard.
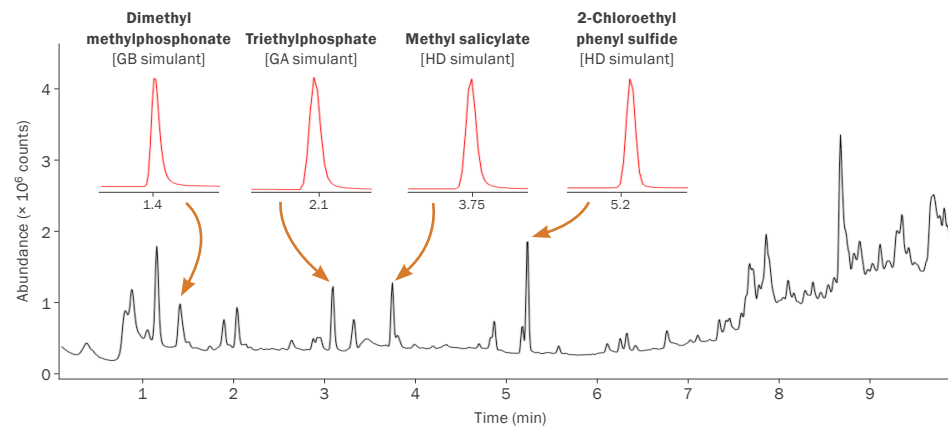


**Untargeted screening:** Combining TT24-7NRT with GC–MS delivers comprehensive screening, ensuring confident identification and sensitive detection.
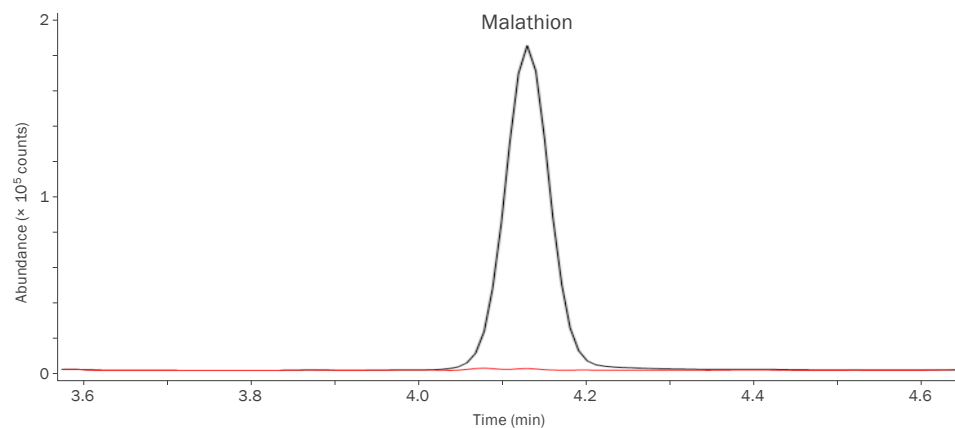


**Enhanced detection of low-volatility agents:** Quantitative recovery of higher-boiling, 'sticky' compounds like malathion (a VX simulant) with no carryover (red trace) is crucial for reliable trace-level measurements.
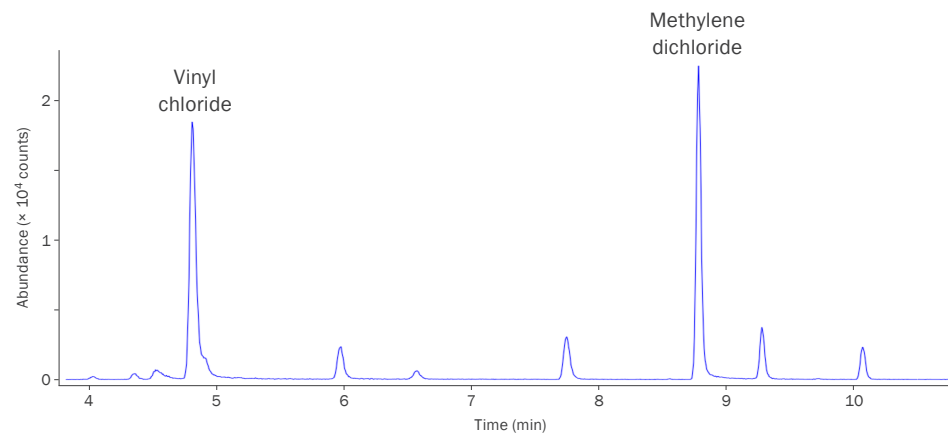


**Toxic industrial chemicals:** The quantitative trapping of volatile TICs on TT24-7NRT enables rapid compound identification in emergency situations.

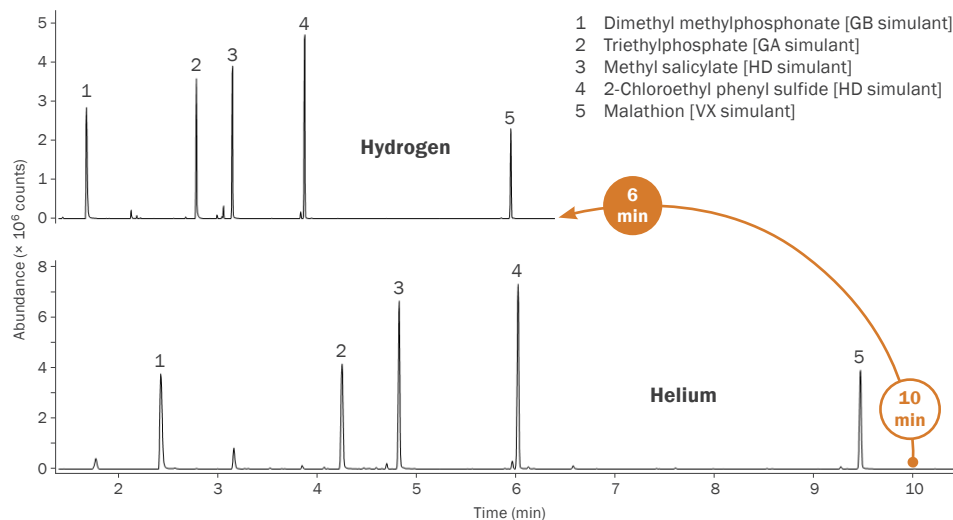# Multi-Gas: Uncompromised operation wherever you're working

Engineered for adaptability, TT24-7NRT incorporates Markes' award-winning Multi-Gas technology. Compatible with helium, hydrogen or nitrogen carrier gas, TT24-7NRT delivers the flexibility to optimise gas requirements to meet both operational and analytical demands. Switching between gases is simple and effortless, ensuring maximum versatility with minimal interruption.

**MULTI-GAS ENABLED**

## Benefits of Multi-Gas enabled systems:

- **Confident continuous operation:** Achieve secure and uninterrupted gas supply when paired with hydrogen or nitrogen generators, and eliminate the need for cylinder deliveries to remote, discreet, or mobile laboratories.

- **Future-proofing:** Safeguard against helium supply chain uncertainties and escalating costs, and so ensure continued autonomous operation.

- **Cost-efficiency:** Reduce operational expenses significantly by removing the hidden costs associated with cylinders use, deliveries and rentals, personnel training and site visits.

- **Accelerated insights:** Deliver rapid, actionable alerts to chemical events with faster analytical cycles.



1   Dimethyl methylphosphonate [GB simulant]
2   Triethylphosphate [GA simulant]
3   Methyl salicylate [HD simulant]
4   2-Chloroethyl phenyl sulfide [HD simulant]
5   Malathion [VX simulant]

Hydrogen allows significantly faster TD–GC–MS analysis without compromising separation, as shown here for a mix of chemical warfare agent simulants from GB to free-VX.
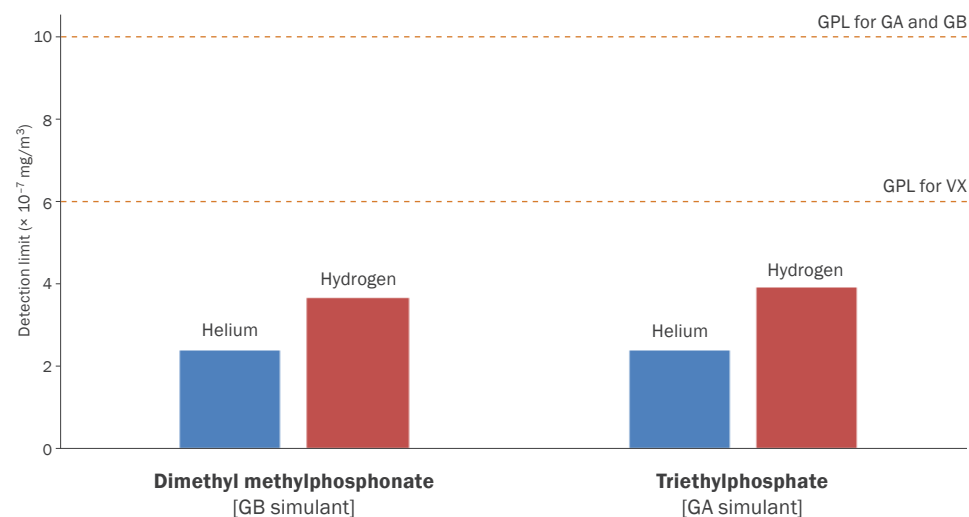


Ultra-sensitive, sub-GPL detection limits are achieved with both helium and hydrogen carrier gases, comfortably meeting even the most stringent reporting requirements with either gas.

# Dependable unattended operation

Near-real-time air monitoring systems are commonly installed in hard-to-reach, non-laboratory settings such as field monitoring stations, government and public buildings, military installations, and mobile labs. These units are required to operate autonomously for extended periods, often several weeks at a time, without the need for hands-on supervision.

Designed for the rigours of unattended, remote operations, the TT24-7NRT is equipped with advanced features to ensure dependable performance:

- **Continuously monitor system integrity** with automated leak testing without interrupting monitoring.

- **Enhance uptime** and schedule maintenance visits effectively with the help of preventive maintenance counters and diagnostic feedback.

- **Streamline remote troubleshooting** with automated diagnostic routines.

- **Ensure data security** with support for multi-user account login, without disrupting on-going monitoring.

- **Ensure rapid recovery** from power interruptions or PC reboots by automatically resuming sequences.

- **Easily integrate into control systems** with a continuous stream of system performance metrics that can be fed into fleet control dashboards and laboratory management systems.

- **Ensure data quality**, facilitate trend analysis, and prolong maintenance intervals through automated addition of internal standards.
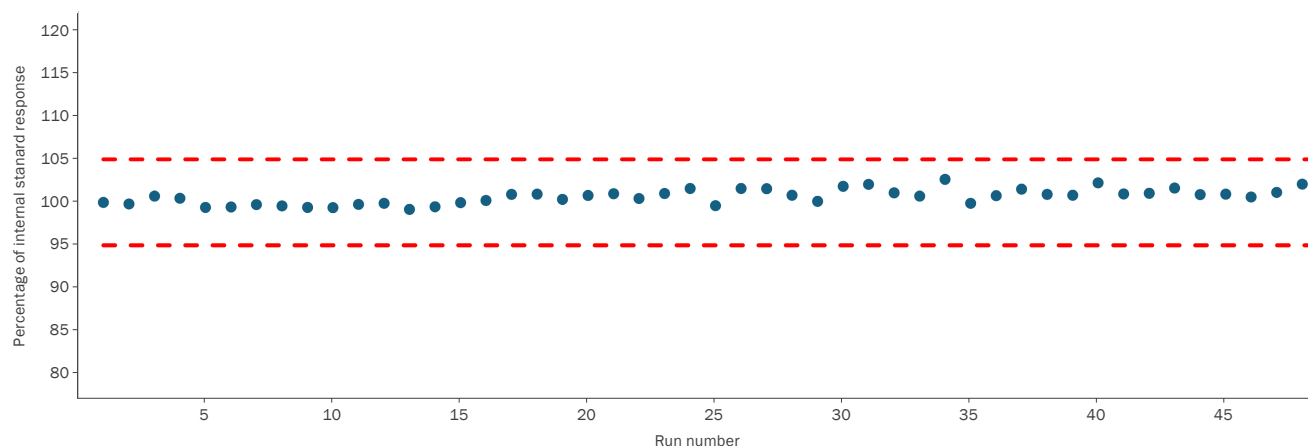


Automated addition of internal standards enables independent performance monitoring, ensuring the instrument operates within control limits and affirming data integrity.

# Markes International – The TD experts

## World-leading instruments and unmatched expertise in VOC and SVOC monitoring

Markes International has for 20 years been at the forefront of innovation for enhancing the measurement of trace-level VOCs and SVOCs by thermal desorption–gas chromatography. Our suite of instruments for thermal desorption sets the benchmark for quality and reliability:

**TD100-xr™**
High-throughput 100-tube automated thermal desorber.

**UNITY-xr™**
Single-tube thermal desorber featuring sample re-collection of all split flows.

**UNITY–Air Server-xr™**
Versatile on-line VOC monitoring system.

**ULTRA-xr™**
High-throughput 100-tube autosampler for UNITY-xr.

**CIA *Advantage*-xr™**
Cryogen-free automated canister autosampler and pre-concentrator.

**TC-20™ & TC-20 TAG™**
Cost-effective systems for off-line multi-tube conditioning and dry-purging.

**Micro-Chamber/Thermal Extractor™**
Unique sampling device for emissions of VOCs and SVOCs from products and materials.

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