



New Passive Sorbent Sampling Solutions for VOC Measurements in Air

While passive diffusive sorbent samplers are standard tools for workplace VOC monitoring, recent technological advancements have opened the door to their use for ambient air and soil gas sampling, giving environmental professionals an attractive alternative to conventional air methods. As compared to active/pumped sorbent sampling and Summa canister sampling, passive sorbent methods are not susceptible to equipment failure and require minimal training for the field technicians. Additionally, the small size of passive samplers, typically shipped and stored without preservation, translates to an economical solution for their deployment anywhere in the world, including remote locations. Aside from the practical benefits of sampler deployment, passive sorbent samplers can be used to provide time-integrated measurements ranging from hours to weeks and are capable of providing sub-ppbv reporting limits.

Eurofins Air Toxics has a comprehensive offering of passive sorbent solutions, each technology tailored to meet the objectives for the intended application whether an indoor air sampling event, an ambient monitoring program, or a soil gas survey. While a number of passive sorbent configurations are available and appropriate for specific sampling durations, environmental conditions, and VOCs, certain passive sampler types are well-suited for commonly required parameters.

Indoor Air Quality Assessments

To achieve the sensitivity required for indoor air measurements, the radiello® samplers are a good solution due to their high sampling rates. For sampling periods of several days or less, the thermally desorbable cartridge (RAD145) can provide the required reporting limits for key health risk drivers. If longer monitoring



periods are desired, the solvent-extracted cartridge (RAD130) can be deployed over periods of up to 30 days to achieve pptv sensitivity. Typical reporting limits for commonly requested durations and chlorinated solvents are detailed in Table 1.

Table 1. Example Reporting Limits for Radiello Samplers

Sampler ->	Reporting Limit (ppbv)			
	RAD145 24-hr	RAD145 3-day	RAD130 7-day	RAD130 14-day
Tetrachloroethene	0.015	0.005	0.025	0.012
Trichloroethene	0.012	0.004	0.026	0.013

Eurofins Air Toxics recently supported several EPA projects using both RAD145 and RAD130 samplers to measure chlorinated solvents in homes near Superfund sites. Due to the large number of homes targeted for testing, passive sorbent samplers provided a cost-effective and efficient solution for sample collection. Hundreds of homes have been tested over 24 hours using the RAD145 samplers and 7 to 14 days using the RAD130 samplers providing both short- and longer-term risk exposure information.

Ambient Air Monitoring Programs



The U.S. EPA recently promulgated Method 325 for ambient monitoring of VOCs using tube-style axial thermal desorption tubes. While incorporated in the updated Refinery Sector Rule to support continuous fence-line monitoring of benzene over 14-day periods, Method 325 is an appealing technology for a wide range of on-going air monitoring

programs due to the practical and technical benefits in collecting time-integrated measurements over days and weeks. Fewer trips to the field and fewer lab samples translates to significantly lower overall project costs as compared to conventional air monitoring methods without compromising sensitivity typically required for compliance or exposure assessments. Chemicals commonly monitored using Method 325 and their reporting limits are summarized in Table 2.

Table 2. EPA 325 Example Reporting Limits

Chemical	Reporting Limit (ppbv)	
	7-day	14-day
Benzene	0.25	0.12
Toluene	0.25	0.12
Ethylbenzene	0.25	0.12
Xylenes	0.25	0.12

In addition to monitoring fugitive emissions of benzene at petroleum refineries, Eurofins Air Toxics is supporting Method 325 at several former Manufactured Gas Plant (MGP) sites. The method was selected as a cost-effective alternative to canisters to monitor VOC concentrations during remediation activities. Since many MGP programs collect TO-15 canister samples over 3-day periods, the passive technology eliminates the equipment challenges with canisters and flow controllers, which can exhibit a greater number of failures when

operating at flow rates near 1 ml/min. Specific compounds of concern included BTEX, and reporting limits comparable to TO-15 were achieved in 6 days. As a result, the required number of samples and trips to the field were cut in half since two consecutive TO-15 3-day canister samples were replaced with one passive sorbent sample at each location.

Soil Gas Surveys

Passive sorbent devices for soil gas measurements have long been used for mapping contaminant plumes in the subsurface. Unlike active soil gas collection methods which generally require rigorous protocols and experienced field samplers to ensure a reliable soil vapor sample is extracted without intrusion of ambient air, passive soil gas collection is relatively simple by comparison. The passive sampler can simply be lowered into the vapor borehole, and the borehole sealed to prevent atmospheric leakage during the sampling period. One such passive device, the Waterloo Membrane Sampler™ (WMS™), has recently been developed as an innovative sampler designed with a hydrophobic membrane and a charcoal-based sorbent bed to effectively handle the range of moisture and VOC concentrations frequently encountered in the subsurface.



Despite their deployment advantages, passive sorbent samplers have traditionally been relegated to screening tools requiring confirmation by conventional active methods. Because of limited circulation of vapors in the subsurface, passive samplers can suffer from “starvation effects,” a condition in which the uptake of the sampler exceeds the supply of vapors resulting in a low bias in the measured vapor concentration. Recent studies have shown that modifying the geometry of the passive sampler to lower the uptake rate minimizes starvation effects and improves sampler accuracy^{1,2}. As part of this research, a Low Uptake Rate Waterloo

Membrane Sampler (WMS-LU) was developed and shown to provide quantitative soil gas concentrations comparable to samples collected using Summa canisters and EPA TO-15. Along with its lower uptake rate, the smaller size of the WMS-LU means that the sampler can fit within a ½ inch probe. In most cases, required soil gas screening levels can be achieved with deployment times of 1 to 2 days. Reporting limits for the commonly requested chlorinated solvents using the WMS-LU are tabulated in Table 3.

Table 3. WMS-LU Example Reporting Limits

Chemical	Reporting Limit (ppbv)	
	1-day	7-day
Tetrachloroethene	4.0	0.56
Trichloroethene	7.3	1.1

Eurofins Air Toxics has supported a large number of projects around the world using both the WMS and WMS-LU devices. The samplers have been used extensively in soil gas surveys as a cost-effective technology to both map contamination plumes and generate concentrations to determine the need for mitigation systems and to monitor progress against clean-up goals. The samplers have recently been approved by the Israeli Ministry of the Environment for passive soil gas sampling and have been deployed on multiple U.S. Naval sites to support vapor intrusion investigations².

Why Choose Eurofins Air Toxics?

Our experience with sorbents and passive technology for a wide range of applications including indoor air investigations, ambient monitoring programs, and soil gas assessments establishes Eurofins Air Toxics as the Center of Excellence for passive sorbent methods. Our experience includes over 20 years of sorbent analysis with a focus on evaluating passive sorbent solutions since 2008. Internal research and development efforts, as well as projects funded by the U.S. EPA and Department of Defense (DoD), have generated numerous publications and provided guidance to the regulatory community and environmental professionals on the use of passive sorbent samplers¹⁻⁹. Eurofins Air Toxics has NELAP and DoD-ELAP (ISO 17025) accreditation for commonly requested passive sorbent methods and target chemicals. Our commitment to quality and continuous improvement is central to our organization and laboratory operations.

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