



The Waterloo Membrane Sampler™ (WMS™) for Monitoring VOC Vapor Concentrations

The Waterloo Membrane Sampler™ (WMS™) is a passive permeation sampler for monitoring time-weighted average concentrations of volatile organic compound (VOC) vapors. Originally developed at the University of Waterloo nearly a decade ago, this technology has undergone years of pure and applied research and has been available for commercial use since 2010 through SiREM Laboratories.

The design incorporates a polydimethylsiloxane (PDMS) membrane across the face of a vial filled with a sorbent medium. VOC vapors partition into and permeate through the membrane. The sorbent then traps the vapors, and the mass of each compound is determined by GC/MS. The uptake rate has been experimentally measured for many common VOCs and can easily be calculated for other compounds because it is directly proportional to the retention index, a property that is readily available in the scientific literature. Thus, you can use the WMS™ sampler to measure time-weighted average concentrations for virtually any VOC.

The WMS™ sampler offers several advantages compared to conventional air sampling methods:

- Lower cost
- Simpler sampling protocols
- Lower reporting limits without a premium price
- Longer time-integrated samples (less temporal variability)
- Very small size (discrete to deploy, and easy to ship)

Furthermore, the WMS™ sampler provides significant benefits compared to other quantitative passive air samplers:

- Predictable uptake rates for less common compounds
- Ability to measure Total Petroleum Hydrocarbons/Gasoline Range Organics
- Minimal effect of moisture (good for subsurface monitoring)
- Insensitive to wind velocity (good for outdoor and vent-pipe monitoring)
- Ability to modify uptake rate to avoid starvation effect for soil vapor monitoring
- Small diameter (easy to put in vent-pipes or sub-slab probes)
- Competitive pricing

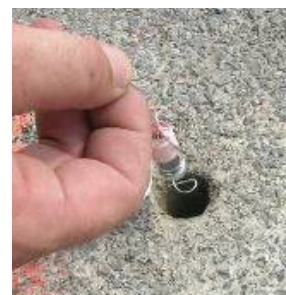
Cost-effective sampling and analysis for VOCs in indoor air, outdoor air, vent-pipes and quantitative passive sub-slab and soil vapor sampling



WMS™ Sampler in a glass overpack for shipping



WMS™ Sampler collecting an indoor sample



WMS™ Sampler being deployed for sub-slab gas sampling

Equation 1

$$C = \frac{M}{t \times UR}$$

Equation 2

$$t = \frac{M_{LOQ}}{C_{RL} \times UR}$$

Determination of Concentration (Equation 1)

Concentrations in the sampled air are calculated according to Equation 1, where:

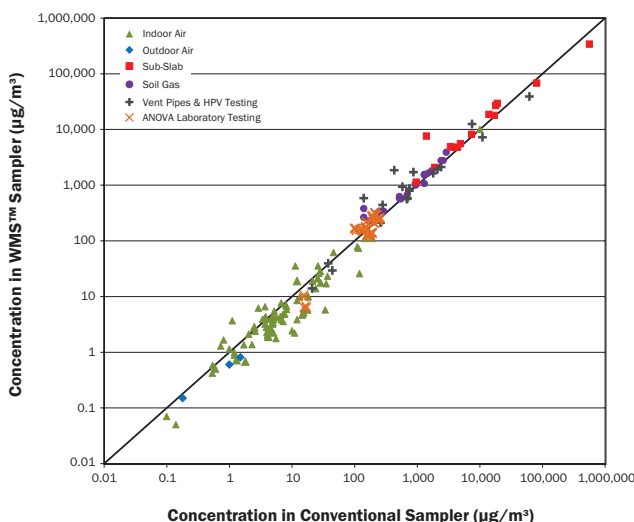
- C = concentration in sampled air ($\mu\text{g}/\text{m}^3$)
- M = mass on sampler (picograms)
- t = sampling time (min)
- UR = known analyte-specific uptake rate (mL/min)

Reporting Limits and Sampling Time (Equation 2)

The sampling time required to meet a desired reporting limit can be calculated using Equation 2, where:

- t = sampling time required to achieve the reporting limit (min)
- M_{LOQ} = minimum mass on sampler that analytical method can measure (picograms)
- C_{RL} = reporting limit required ($\mu\text{g}/\text{m}^3$)
- UR = known analyte-specific uptake rate (mL/min)

Example Correlation Between Waterloo Membrane Sampler™ and Active Sampler



The WMS™ sampler results compare very well to “conventional” sampling results (Summa canisters, US EPA’s Trace Atmospheric Gas Analysis (TAGA) unit, or active sorbent tubes) over at least six orders of magnitude including indoor air, outdoor air and soil gas sampling.

References

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