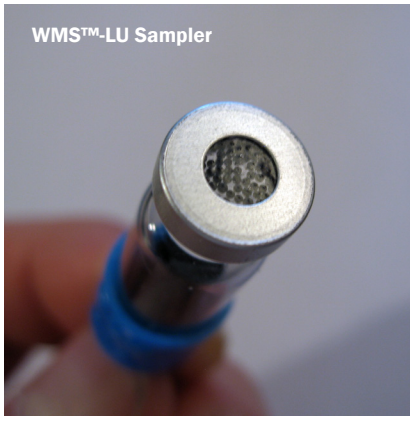
SiREM
Leading Science · Lasting Solutions

WATERLOO MEMBRANE SAMPLER™

Quantitative Passive Soil Vapor Sampling with the Waterloo Membrane Sampler™ (WMS™)

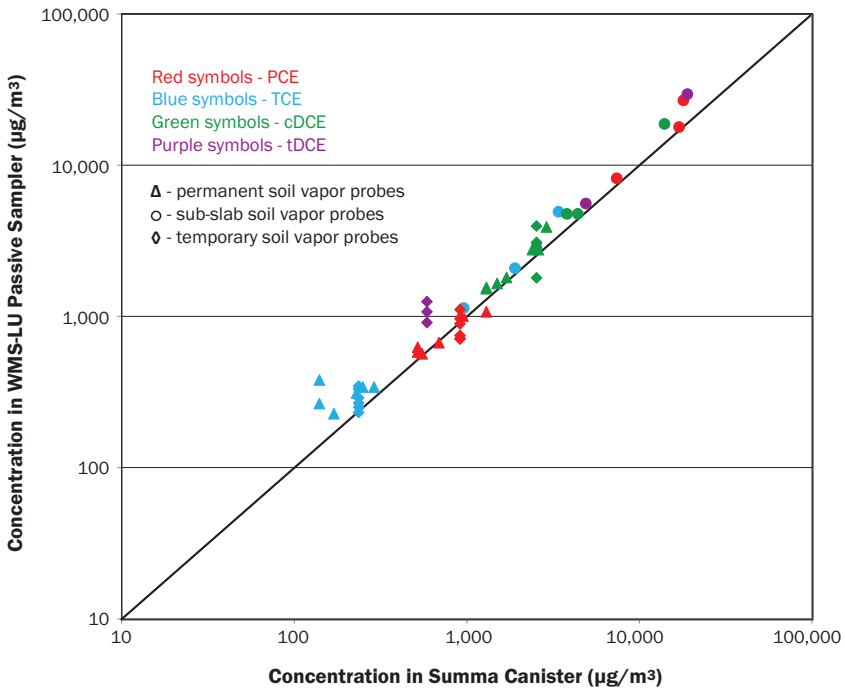


The membrane is protected from coming in contact with the soil by a wire hanger.

The WMS-LU™ and the WMS-TM™ sampler can be installed in temporary or semi-permanent probes (see above, left). For shallow samples, hand-tools can be used, which makes the process very fast, with minimal disruption.

Until recently, passive soil vapor sampling has shown limited ability to quantify concentrations, and has therefore been typically used as a screening tool needing verification by other methods. The Low Uptake rate version (WMS-LU™) and the Thick Membrane version (WMS-TM™) of the Waterloo Membrane Sampler™ (WMS-LU™) have recently emerged as a breakthrough in this field, and have been shown to provide quantitative concentration measurements with similar accuracy and precision to conventional active soil vapor samples collected using Summa canisters and EPA Method TO-15. The method has been awarded a US patent.[1] The chart below shows the correlation for soil vapor and sub-slab soil vapor samples collected using the WMS-LU™ as part of a Department of Defense funded study:

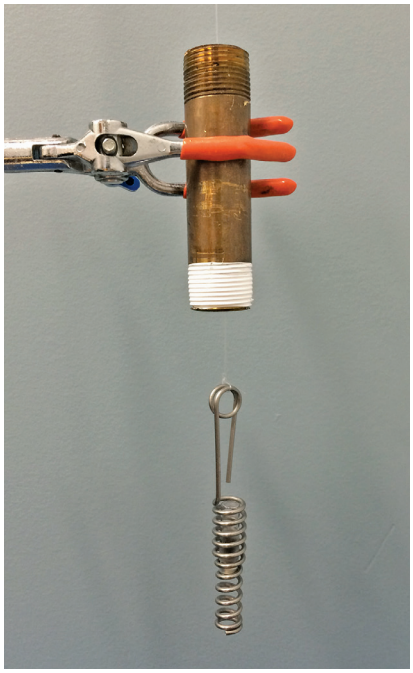
Soil Vapor Sampling with the Waterloo Membrane Sampler - Low Uptake



[1] US Patent Number: 9399912

SiREM

Leading Science · Lasting Solutions



The WMS-LU™ and the WMS-TM™ fit through an open hole, or through a 3/4" sub-slab probe (see photo on left), both of which can be easily sealed at surface.

Advantages:

- Simpler sampling protocols (see over) for less training and less risk of inter-operator error
- Smaller size for ease of shipping and handling
- Lower cost (save as much as half the cost for a sampling program)
- Hydrophobic membrane excludes water, which reduces sorbent saturation
- Membrane also prevents turbulent uptake, so the WMS™ sampler can be deployed in high velocity environments, such as soil gas extraction system vent-pipes

Determination of Concentration (Equation 1)

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

C = concentration in sampled air (µg/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 (µg/m^3)
UR = known analyte-specific uptake rate (mL/min)

Sample durations of about 24 hours are typically sufficient to provide reporting limits that meet data quality objectives for most vapor intrusion screening levels.

Equation 1

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

Equation 2

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

For more information contact
Brent Pautler
toll free: 1-866-251-1747
direct: (519) 515-0837
bpautler@siremlab.com

siremlab.com

References

McAlary, T., X. Wang, A. Unger, H. Groenevelt, T. Gorecki, 2014. Quantitative passive soil vapor sampling for VOCs - part 1: theory. Environ. Sci.: Processes Impacts, 2014, 16, 482. DOI: 10.1039/c3em00652b.

McAlary, T., H. Groenevelt, S. Seethapathy, P. Sacco, D. Crump, M. Tuday, B. Schumacher, H. Hayes, P. Johnson, T. Gorecki, 2014. Quantitative passive soil vapor sampling for VOCs - part 2: laboratory experiments. Environ. Sci.: Processes Impacts, 2014, 16, 491. DOI: 10.1039/c3em00128h.

McAlary, T., H. Groenevelt, P. Nicholson, S. Seethapathy, P. Sacco, D. Crump, M. Tuday, H. Hayes, B. Schumacher, P. Johnson, T. Gorecki, I. Rivera-Duarte, 2014. Quantitative passive soil vapor sampling for VOCs - part 3: field experiments. Environ. Sci.: Processes Impacts, 2014, 16, 501. DOI: 10.1039/c3em00653k.

McAlary, T., H. Groenevelt, S. Seethapathy, P. Sacco, D. Crump, M. Tuday, B. Schumacher, H. Hayes, P. Johnson, L. Parker, T. Gorecki, 2014. Quantitative passive soil vapor sampling for VOCs - part 4: flow-through cell. Environ. Sci.: Processes Impacts, 2014, 16, 1103. DOI: 10.1039/c4em00098f.

McAlary, T., H. Groenevelt, S. Disher, J. Arnold, S. Seethapathy, P. Sacco, D. Crump, B. Schumacher, H. Hayes, P. Johnson, T. Gorecki, 2015. Passive sampling for volatile organic compounds in indoor air-controlled laboratory comparison of four sampler types. Environ. Sci.: Processes Impacts, 2015, 17, 896. DOI: 10.1039/c4em00560k.