A.1 Technology Name

Waterloo Membrane Sampler™ tube-type (WMS™)

A.1.1 Source

Environmental Security Technology Certification Program (ESTCP) Cost and Performance Report, ER-200830, 2015. Development of More Cost-Effective Methods for Long-Term Monitoring of Soil Vapor Intrusion to Indoor Air Using Quantitative Passive Diffusive-Adsorptive Sampling Techniques, May.

A.1.2 Summary

Media:	Indoor/outdoor air, soil gas
Study Type:	Side-by-side comparison
Technology:	Accumulation – WMS™
Peer Reviewed:	Yes
Publication Date:	May 2015

A.1.3 Site Description

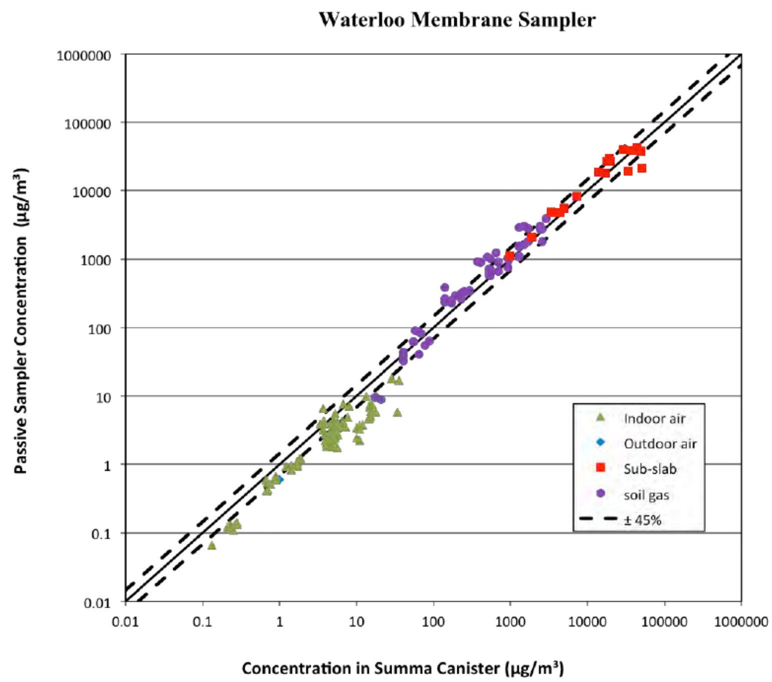
- Laboratory and field testing of WMS™ with multiple sorbent types (regular or low uptake rate, solvent extraction or thermal desorption).
- Laboratory chamber testing under controlled conditions to assess influence of temperature, humidity, sample duration, concentration, and face velocity on sampler performance. Testing divided into low concentrations (1 to 100 ppbv range), representing typical range for indoor air monitoring, and high concentrations (1 to 100 ppmv range) representing typical range for soil vapor monitoring.
- Field testing included indoor/outdoor air, sub-slab vapor or deeper soil vapor samples collected from five DoD facilities. Side-by-side collection of indoor/outdoor air and soil vapor samples with passive samplers and active Summa canisters.
- Contaminants of concern tested included chlorinated compounds (ethenes, ethanes, and methanes) and petroleum hydrocarbons (aromatics and aliphatics) spanning a range of chemical properties (Henry's Constant, vapor pressure, diffusion coefficient and water solubility).

A.1.4 Remedial Phase

ESTCP laboratory and field testing to determine if WMS™ samplers provide good data quality measurements of VOC concentrations, comparison with active sampling methods to identify advantages and disadvantages of each method, and development and testing of quantitative passive methods for soil vapor sampling.

A.1.5 Outcome

As shown in the figure below, the field testing results from all five field sites demonstrated the WMS™ sampler provided good accuracy with active Summa canisters based on a relative percent difference (RPD) of < 45% across a broad range of concentrations, sample durations and meteorologic conditions.



Low concentration laboratory testing results also demonstrated the WMS™ sampler provided good accuracy based on the RPD < 45%, corresponding to mean C/C_o (passive concentration/active control) range of 0.63 to 1.58 for 8 of the 10 compounds tested. The WMS™ sampler also provided good precision based on an intra-chamber coefficient of variation (COV) < 30% for all 10 compounds under a specific set of conditions, but only two compounds for the inter-chamber COV under a wider range of conditions.

High concentration laboratory testing results demonstrated the WMS™ sampler provided good accuracy based on the relative concentration C/C_o (average passive concentration/average Summa canister concentration) range of 0.6 to 1.7 meeting the RPD < 50% for 6 of the 10 compounds for the C/C_o for 1 ppm, 8 of 10 compounds for 10 ppm, and 8 of the 10 compounds for 100 ppm. The WMS™ sampler also provided good precision based on the COV < 30% at 1 ppm for 8 of the 10 compounds, all 10 compounds at 10 ppm, and 8 of the 10 compounds at 100 ppm.

Ease of use was generally comparable or better with minimal training necessary; and cost was comparable or better (improving with larger numbers of samples) to conventional methods due to less time required for sample deployment and collection and reduced shipping costs.

A.1.6 References

Environmental Security Technology Certification Program (ESTCP) Cost and Performance Report, ER-200830, 2015. Development of More Cost-Effective Methods for Long-Term Monitoring of Soil Vapor Intrusion to Indoor Air Using Quantitative Passive Diffusive-Adsorptive Sampling Techniques, May.

U.S. Navy, SPAWAR Systems Center Pacific Division, 2013. Improved Assessment Strategies for Vapor Intrusion Passive Samplers and Building Pressure Control. Technical Report 2018. September.

U.S. Navy, Naval Facilities Engineering Command, Technical Memorandum TM-NAVFAC EXWC-EV-1503, 2015. Passive Sampling for Vapor Intrusion Assessment, July.