

Loss/Gain of VOCs from Tedlar Bags and Other Sampling Equipment

Cynthia J. Paul

U.S. Environmental Protection Agency

Office of Research and Development

National Risk Management Research Laboratory

Ground Water and Ecosystems Restoration Division

Ada, Oklahoma 74820

paul.cindy@epa.gov

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User Beware!

Potential Sources of Error in Soil Gas Sampling

- Casing material (if using wells)
- Tubing
- Syringe
- Leak check compounds
- Stainless steel tips (cutting oils/degreasers)
- Sample Container
 - Summa Canister
 - Tedlar Bag



Well Casing Material

- Stainless Steel
 - No sorption
- PFTE
 - VOC losses were greater than PVC
 - PCE – most rapid and extensively sorbed
- PVC – Rigid
 - Some VOC loss, but good if no PVC solvents are at the site.

(Parker and Ranney, 1994)



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Tubing/Syringe Material

- Nylon
 - Low levels detected, but <risk-based screening levels
- PEEK
 - VOC loss insignificant
- Teflon
 - VOC loss insignificant
(Hayes et al., 2006) (Oullette, 2004 showed nylon least absorption)
- Flexible Tubing (polyethylene, silicon, tygon)
 - Showed up to 80% VOC loss
(Oullette, 2004)
- Recommend rigid nylon or Teflon (more expensive)
(Hartman, 2007)



Summa Canister

Made of stainless steel. Available from 1 liter to >15 liters

Will hold high vacuum up to 30 days

Cumbersome to carry and ship

More expensive



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Tedlar Bags

- Leak through the valves or imperfect sealing of the bag
- Chemical reaction of the sample with the bag material
- Sorption onto or into the bag
- Short holding time 24 – 48 hrs
- Easier to handle and inexpensive
- No potential for carry over since bags are not reused

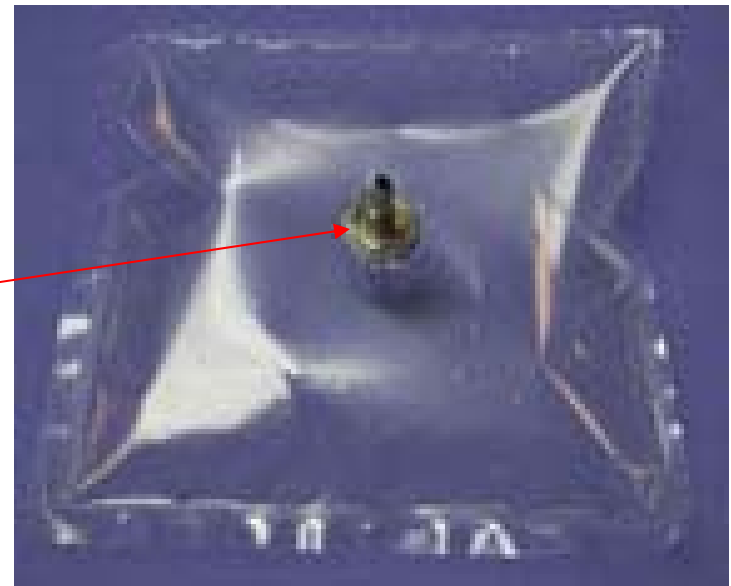


Laboratory Study

One-liter Tedlar® bags (7" by 7") with single stainless steel septum fitting were used in this study

*Made of PVF
Available in 0.5 L – 100 L*

*Fittings available in
polypropylene, stainless
steel, and Teflon®*



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Tedlar Bag Study

Analytes 100 ppb	Storage Time	Storage Temp.
TCE	8 hr	10°C
1,1,1-TCA	16 hr	25°C
Benzene	1 day	
Toluene	2 days	
	3 days	
	4 days	
	1 week	
	2 weeks	





*Gas mixture, flow meter,
and Tedlar® bag*

*Bags were initially flushed
three times w/high purity
N₂, then filled with one liter
gas mixture*

*Samples were stored in
incubator at 15°C and 25°C for
8 time periods*

*Container blanks were
prepared using high purity N₂*



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Analytical QA

- Samples were analyzed using ELCD for 1,1,1-TCA and PID for TCE, benzene, and toluene.
- Prior to analysis, a laboratory blank was analyzed to ensure that the syringe (used to inject the samples) and instrument were not contaminated.
- Samples were analyzed with a continuing calibration check standard (CCC) after every five samples or at the end of the queue if there were less than five samples.
- Injecting 5.0, 10.0, 20.0, 40.0, and 50.0 mL of the 100 ppb 4-component gas mixture into the GC accomplished the instrument calibration for each compound.

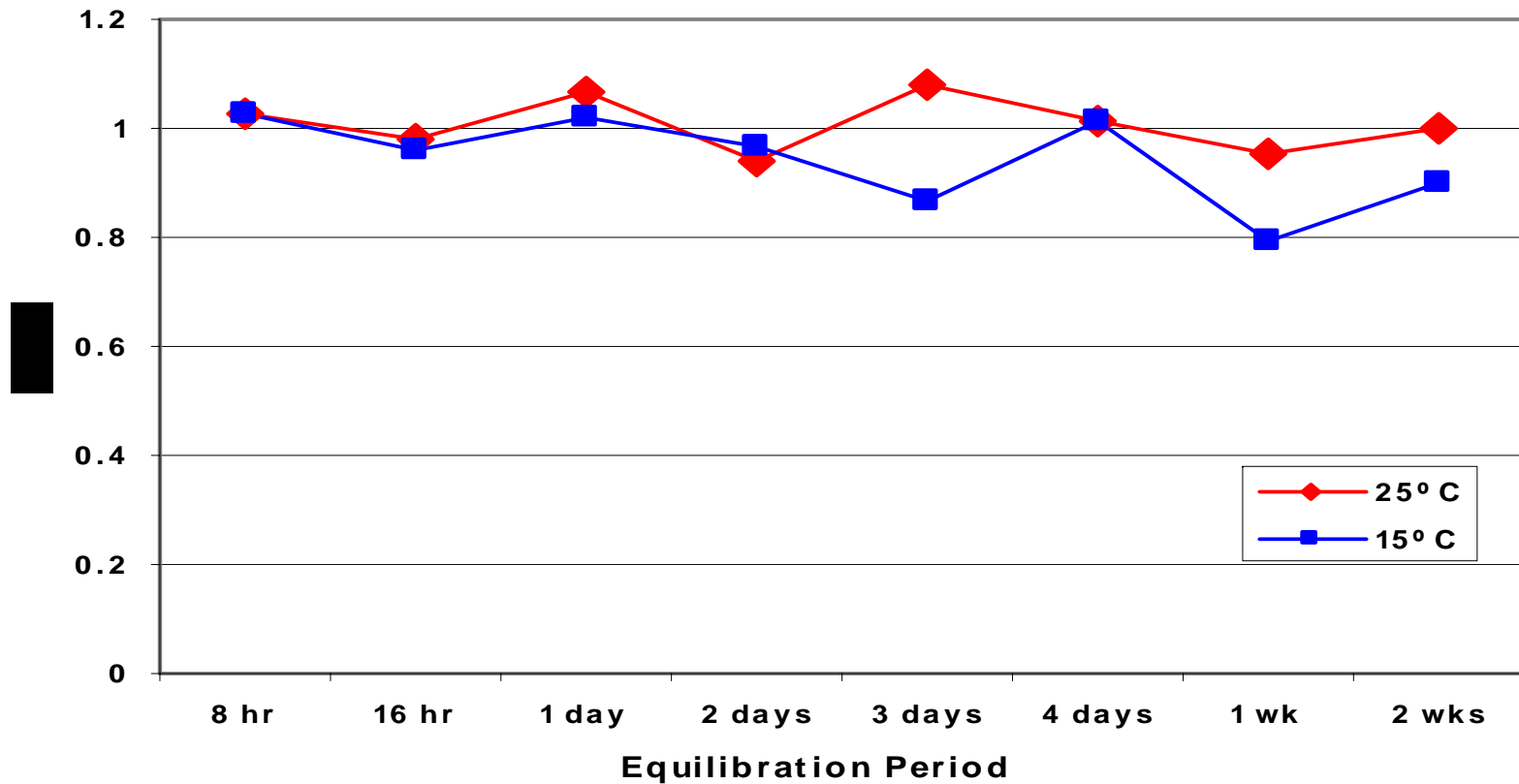


Blanks analyzed during Tedlar bag study - concentration shown as ppb

Blanks	1,1,1-TCA	Benzene	TCE	Toluene
8 hr bag	0.711	0.00	0.00	5.87
16 hr bag	0.506	0.00	0.00	1.79
1 day bag	0.508	0.00	0.00	6.27
2 day bag	0.00	0.00	0.00	7.38
3 day bag	0.253	0.00	0.00	0.00
4 day bag	0.364	0.00	0.00	0.00
1 wk bag	0.00	0.00	0.00	2.73
1 wk bag	0.00	0.00	0.00	0.00
2 wk bag	0.401	0.00	0.00	0.00
40 mL N ₂	0.315	0.00	0.00	0.00
40 mL N ₂	0.692	0.00	0.00	0.00
40mL N ₂	0.00	0.00	0.00	0.00
40mL N ₂	0.248	0.00	0.00	0.00
50mL N ₂	0.00	0.00	0.00	0.00
10 mL Room Air	0.493	0.00	0.00	0.00
40mL Room Air	1.20	2.24	4.06	4.81
40 mL Room Air	0.373	0.00	0.00	3.51



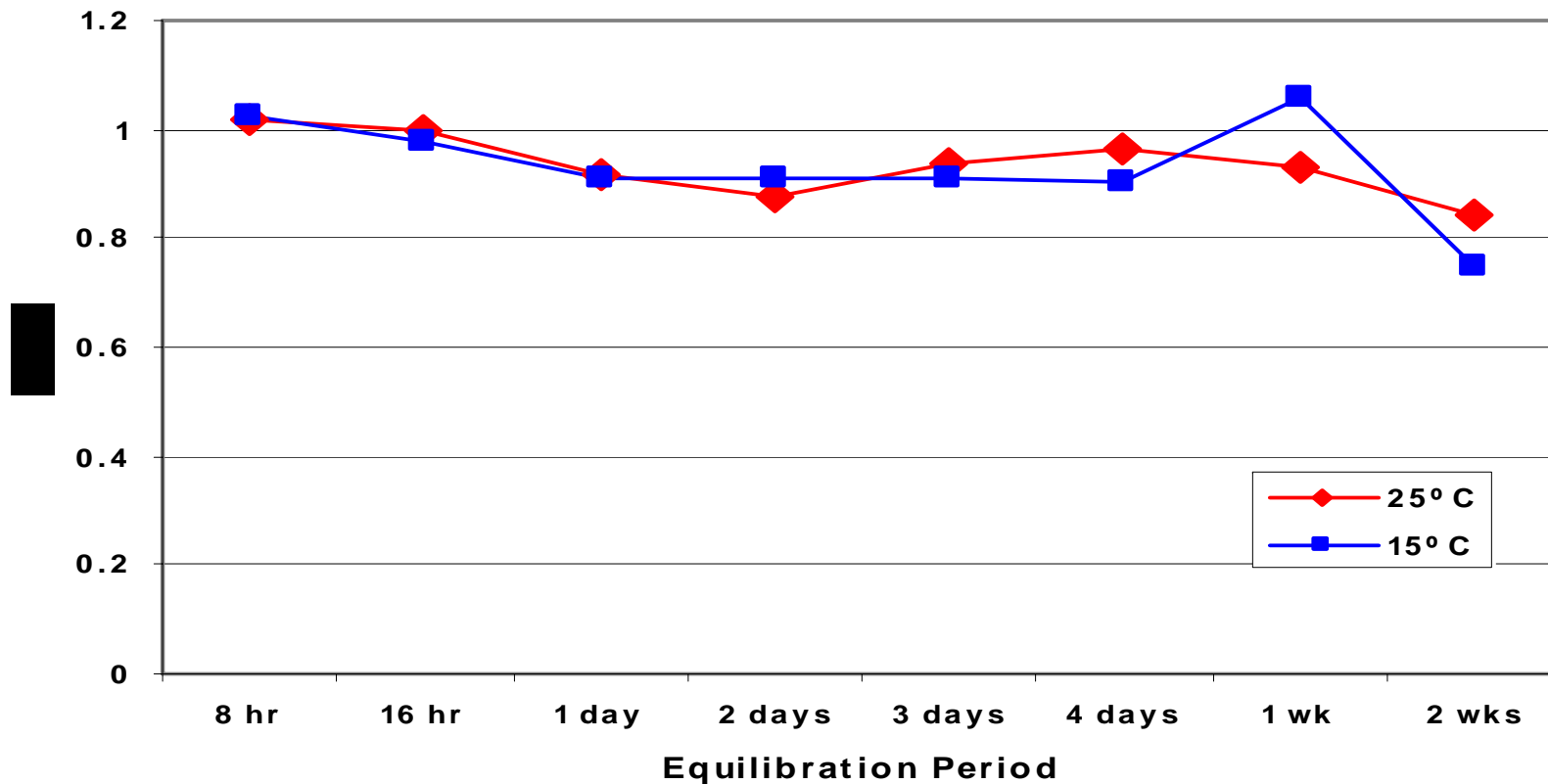
1,1,1-TCA



Slight differences seen at 1 week for 15°C set. Two week data appears to be acceptable at both temperatures for 1,1,1-TCA



Benzene



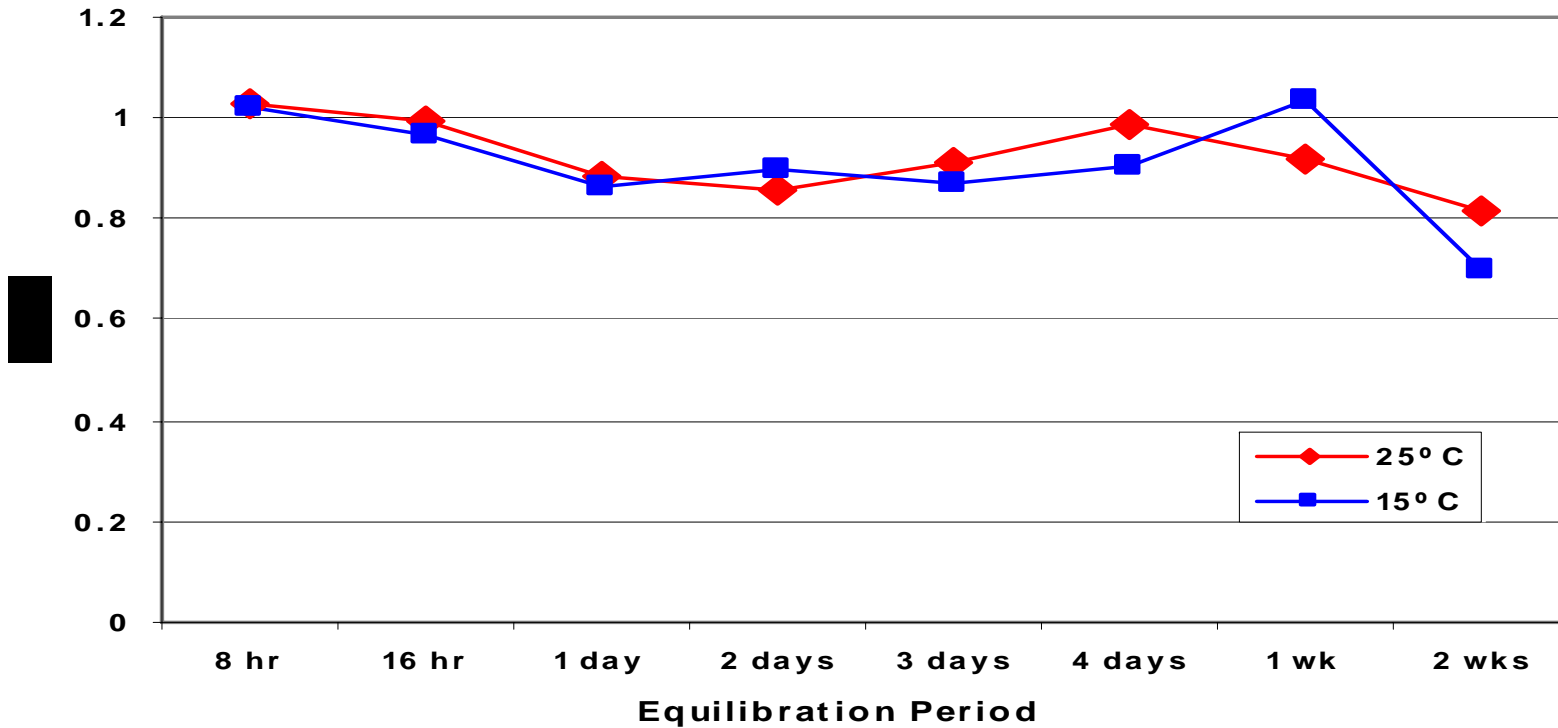
Only slight differences for Benzene until 2 weeks. One week appears acceptable for Benzene



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TCE



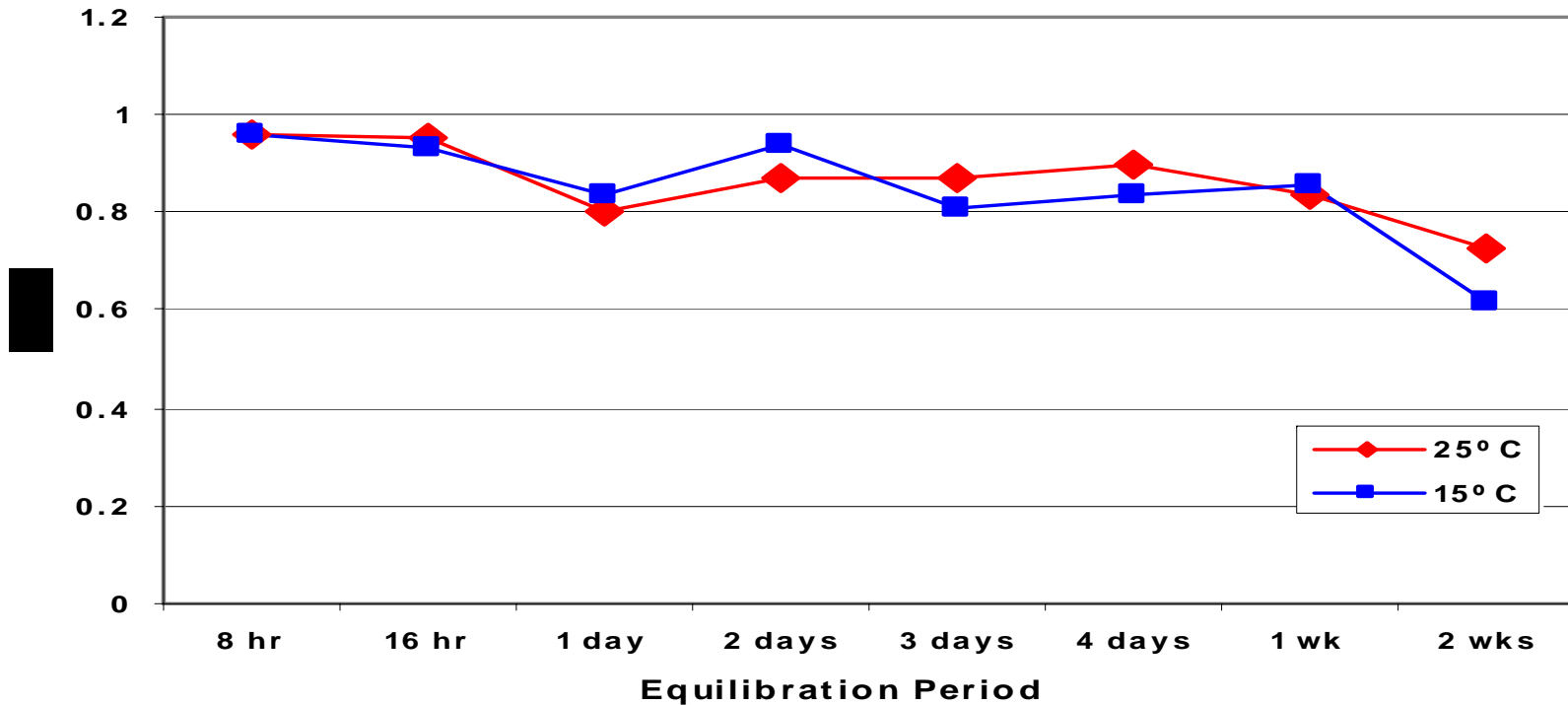
Concentrations vary but all are within 20% except at 2 weeks. Indicates storage for up to one week for TCE



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Toluene



Lowest concentrations were seen for Toluene. Very little difference seen between 15°C and 25°C.



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Tedlar Bag Study

Conclusions

- Results show concentration loss at one week to be <20% for TCE, 1,1,1-TCA and benzene.
- Toluene results are less conclusive.
- No consistent differences were seen between storage at 15°C and 25°C; however, lower concentrations would be expected at lower temperatures due to loss from condensation.
- “Container” blanks must be used to ensure that Tedlar bags are not a source of VOCs when detection limits are low (e.g., less than 5 ppbv).



References

- Hartman, Blayne. (2007) “How to collect reliable soil-gas data for risk-based applications – specifically vapor intrusion: Part 4 – updates on soil-gas collection and analytical procedures”, Lustline53, Feb.
- Hayes, Heidi C., Diane J. Benton, and Noor Khan. (2006) “Impact of sampling media on soil gas measurements” A&WMA “Vapor Intrusion- The Next Great Environmental Challenge – An Update”, September 13-15, Los Angeles, CA.
- Ouellette, G. (2004) “Soil vapor sampling and analysis – lessons learned. DOE/PERF workshop, Brea, CA, Jan.
- Parker, Louise P. and Thomas A. Ranney. (1994) “Effect of concentration on sorption of dissolved organics by PVC, PTFE, and stainless steel well casings”. GWMR, Summer, pp 139-149.

