



Bench Test of the Dual Membrane Passive Diffusion Sampler for Metals

Purpose:

Controlled laboratory tests were conducted to validate that water samples acquired using the Dual Membrane Passive Diffusion Sampler (DMPDB) represent the concentrations of dissolved metals in the water surrounding the sampler after a designated residence time. Four commonly sampled metals were studied during this bench test. Results of side by side field data testing has been acquired separately.

Test Method:

1. The sampling tests were conducted in a controlled environment using a PVC test chamber filled with approximately 72.34 Liters of water and the spiked with four, lab certified metals; Aluminum, Arsenic, Cadmium, Chromium, Lead. The water in the DMPDB samplers comprised about 9.8% of the total water volume.
2. A mixture of VOCs was also added to the chamber and sampled separately.
3. The chamber was sealed and the water was mixed using a low volume peristaltic lab pump and allowed to circulate for 24 hours after spiking.
4. After spiking, 9 DMPDB samplers were filled with 600ml each of deionized water and installed in the chamber using EON's polypropylene suspension tether assemblies. The chamber was sealed again and the samplers were left in place for 23 days to allow for the concentration gradient to cause the dissolved metal molecules to diffuse from the fluid in the chamber, through the membranes and into the samplers.
5. At 23 days after sampler installation, a control sample of the chamber water was obtained through a port midway along the height of the chamber, and decanted into lab supplied bottles. All 9 DMPDB samplers were then removed from the chamber, one at a time, and the contents decanted into lab supplied bottles.
6. After the 9 samplers were removed and sampled, a second control sample was taken of the chamber water and decanted into lab supplied bottles.
7. The samples were sent to TestAmerica and analyzed for the four metals using Method: 200.8-1994 R5.4 - Metals (ICP/MS) and the data is shown below.

Results can be evaluated by comparing the concentration from the samplers with the concentration of the two control samples for the same metal shown in the same row.

Method: 200.8-1994 R5.4 - Metals (ICP/MS)	Control		Dual Membrane Passive Diffusion Sampler (ug/L) 23 Days Residence								
	3MC-24	3MC-14	3U4-14	3U4-24	3U4-34	3M4-14	3M4-24	3M4-34	3L4-14	3L4-24	3L4-34
Aluminum	97.0	96.0	94.0	93.0	96.0	99.0	97.0	94.0	96.0	94.0	93.0
Arsenic	25.0	24.0	22.0	22.0	22.0	22.0	23.0	22.0	23.0	22.0	22.0
Cadmium	30.0	30.0	29.0	28.0	29.0	29.0	30.0	29.0	29.0	28.0	28.0
Chromium	67.0	65.0	62.0	61.0	63.0	63.0	65.0	61.0	64.0	61.0	62.0
Lead	110.0	110.0	110.0	110.0	110.0	110.0	110.0	110.0	110.0	100.0	110.0



Discussion & Notes:

- Since the test objective was to determine if the sampler concentrations match the concentrations of the surrounding water in the chamber at a point in time, pre-test concentrations of metals in the chamber were not collected.
- Two control samples were acquired at each sample event, one immediately before and one immediately after the samplers were removed from the chamber and sampled. This provided a way to gage repeatability and set a reference for test variability outside of the samplers.



- The control samples were acquired from a port midway along the height of the chamber in such a way that the control samples did not come in contact with any materials other than the test chamber and the sample bottles.
- The laboratory results from the two control samples taken at each sampler removal can be compared to the results from the sampler contents from that test to determine if the sampler produces results equivalent to the water surrounding the samplers.
- The data suggests that 23 days residence is adequate to produce a representative metals sample. A lower limit has not been established. Additional time may be required in slow recharge wells to accommodate the well returning to “normal” conditions after being disturbed when the samplers are added, however that time is not related to membrane diffusion time.