Equilibrium partitioning of organic compounds

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Mine sweeper for environmental chemists - not a game!

Question: Can one make a general statement on whether the explosive concentrations that the dogs are exposed to in the REST system are higher, equal or lower than the explosive concentrations to which the dogs would have been exposed in the field?

Additional information: Mines are typically buried within the top 20 cm of a soil.

In the field situation, it is reasonable to assume that there is a partition equilibrium of chemicals between the soil surface and an adjacent air layer of a few mm thickness. Further away from the soil surface, all scents are quickly diluted by turbulent air movement. The dogs get their nose very close to the ground during sniffing in order to access the equilibrium concentrations close to the surface.

Neglect potential temperature effects.

Help 1: Assume that in the REST procedure dust is sampled evenly from a soil surface with an area of 200 m^2 . This dust is collected in a container. Assume further that there was one mine buried in the area from which dust was sampled. It is reasonable to assume that the explosives from the mine spread out a little on the soil surface thus

contaminating an estimated maximum area on the surface of about 10 m². This is 5% of the total surface area that was sampled.

Help 2: Making the above assumptions, 95% of the collected dust is free of explosives. What happens when this dust free of explosives (fraction 0.95) is stored together with the contaminated dust (fraction 0.05) in a closed container for a few days? What does this mean for the air concentration that will build up in equilibrium with this sample as compared to the air concentration that was in equilibrium with the contaminated dust/soil in the field above the mine?



Answer: Help 2 provided most of the answer. In the REST procedure one will inevitably mix contaminated soil with clean soil. This will lead to some reequilibration of the explosives during storage such that the overall concentration on the soil particles decreases. Hence, the equilibrium air concentration will also decrease as compared to the air concentration in equilibrium with the contaminated soil directly above a mine (not mixed with clean soil).

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