Sampling artifacts in active and passive air sampling of semivolatile organic compounds

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While many advances have been made in the analysis of trace environmental chemicals, advances in the air sampling of semivolatile organic contaminants (SVOCs) have been more limited. A wide range of air sampling techniques are in use (i.e. active and passive samplers) and data from different sampling configurations are often compared. Different active sampler deployment configurations (e.g., sample volumes and types) can lead to different sampling artifacts. Comparing data from different samplers requires knowledge of sampling artifacts but limited attention has been given to clarify this. In particular, breakthrough and degradation within samplers are known to be a significant potential artifact in active air sampling, but these effects have not been recently examined (MELYMUK ET AL., 2014). This study compares different active sampler and passive sampling configurations and evaluates sampling artifacts for a range of SVOCs.

Individual experimental studies were designed to identify breakthrough of gas-phase compounds in different types of active air samplers, and within-sampler degradation in both active and passive samplers, and provide a quantitative measure of the uncertainty these effects introduce in typical air sampling configurations. Breakthrough was targeted through simultaneous co-deployment of various air samplers (high volume, low volume and cascade impactor) for different sample durations and volumes, and gas-phase sorbents (polyurethane foam) were analyzed in separate horizontal slices to identify distribution of SVOCs throughout the sorbent. Losses due to degradation of compounds within samplers were evaluated through parallel deployment of active samplers with and without ozone scrubbers, and sequential deployment of passive air samplers for different sampling durations.

These targeted case studies indicated that under particular conditions the effect of sampling artifacts on SVOCs can be significant, leading to underestimation of gas-phase and more reactive compounds and correspondingly in biases in determination of gas-particle partitioning. These effects are specific to sampler configurations and environmental conditions, and are most relevant for the polycyclic aromatic hydrocarbons, selected brominated flame retardants and the more volatile organochlorine pesticides.

Reference:
Melymuk, L., Bohlin, P., Sáňka, O., Pozo, K., Klánová, J., 2014. Current Challenges in Air Sampling of Semivolatile Organic Contaminants: Sampling Artifacts and Their Influence on Data Comparability. Environ. Sci. Technol. 48, 14077–14091.