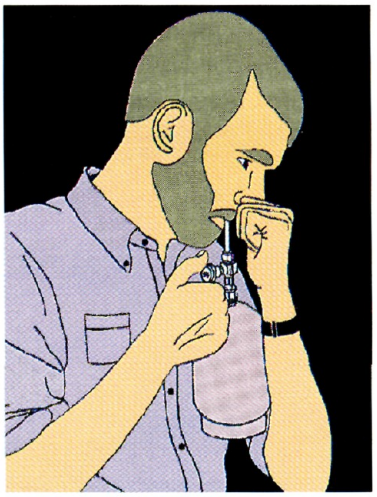
New method measures exposure to volatile organics

Just as the Breathalyser test reveals blood alcohol levels, a new analytical method measures exhaled breath for human exposure to airborne volatile organic compounds (VOCs). According to method developer Joachim Pleil of EPA's National Exposure Research Laboratory (Research Triangle Park, NC), researchers can use this technique to collect breath samples as often as every 15 seconds and to analyze these samples for VOCs at part-per-billion levels. Initial studies have tracked human uptake and elimination of potentially hazardous VOCs, allowing researchers to infer contaminant levels in blood and tissue.

Speaking at the International Symposium on Environmental Analytical Chemistry in June, Pleil said that the technique, dubbed the single-breath canister (SBC) method, combines a new breath collection device with mass spectrometric detection (see *Am. J. Ind. Med.*, 1995, *28*, 109). As a noninvasive measure of exposure, SBC addresses a gap in current monitoring of air contaminants. "We do a good job of measuring the air flying around your head, but we have to infer human exposure," said Pleil. Other methods of exposure monitoring, such as sampling blood and placing volunteers in environment chambers, are intrusive and expensive.

According to fellow EPA researcher and SBC method developer Andrew Lindstrom, the technique has been used in the field to measure exposure to trichloroethylene from contaminated well water, methyl-*tert*-butyl ether (MTBE) emitted during gasoline refueling, and halocarbons in showers and swimming pools. These initial studies, said Lindstrom, have detected chloroform and bromodichloromethane in swimmers and recorded a 100-fold increase in MTBE concentrations in breath 40 seconds after exposure during refueling.

Exposure data collected by the EPA researchers have been fitted to a model that calculates residence times in blood, blood-rich tissues, and, in some cases, blood-poor tissue. "These results should increase accuracy in modeling [exposure]," said Lindstrom.



An easy-to-use device is a key feature of a new analytical method to measure exposure to airborne organic compounds.

"It's extremely innovative work," commented Sydney Gordon of Battelle (Columbus, OH). "They have simplified the way you go about getting meaningful data."

A key development in this method is the hand-held collection device, which Pleil said is easy to operate. The device consists of a stainless steel canister that holds 1–1.6 L of alveolar breath—breath from the region of the lungs where gases are exchanged with the blood stream. Carbon dioxide, generally measured by SBC at 4.6% in exhaled breath, and natural concentrations of isoprene and acetone serve as markers to ensure that the collected sample is alveolar breath, added Pleil.

SBC is the first method to collect large-volume samples that are easily stored or shipped for later analysis, said Lindstrom. The larger sample allows replicate analyses for quality control.

Laboratory analysis of samples involves cryogenic focusing techniques to concentrate VOCs and remove water, gas chromatography to separate components, and ion trap mass spectrometry for detection. Special care is taken to eliminate contaminants, artifacts, and reactions. "Everything connected with the analysis is coated with deactivated fused silica," said Pleil, "and we're developing canisters with the same inert coating." —ALAN NEWMAN

Freshwater research agenda proposed

A cluster of national programs has been proposed by a panel of academic, federal, and nongovernmental freshwater experts. Called the Freshwater Imperative (FWI), the report recommends a new biodiversity research center, support for six interdisciplinary academic or nongovernmental programs on regional issues, and establishment of long-term research sites. These new programs are estimated to cost $200 million per year.

The effort began with mid-level federal employees concerned about the lack of science available for managing inland waterways, according to FWI report coauthor John Magnuson of the University of Wisconsin–Madison. "[Federal] support for freshwater research had fallen through the gaps," said Magnuson.

The FWI proposes a research agenda targeted at restoring ecosystems, maintaining biological diversity, and evaluating human impacts on freshwater systems. To accomplish these goals, researchers need to understand changes in water flow and identify key indicators of aquatic health. In addition, said Magnuson, FWI outlines a feedback loop between federal managers and research scientists to refine policies through "adaptive management." Copies of the Freshwater Imperative are available from Island Press, 202-232-7933 (Washington, DC). —ALAN NEWMAN