Keynote

Low-cost sensors and citizen science: prospects, pitfalls, and paradigm shifts

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The advent of low-cost sensors for air quality monitoring provides an attractive prospect for environmental and occupational health. These devices, which typically generate real-time data, may be distributed at scales that offer unprecedented levels of spatial and temporal resolution. Both gas and particle sensors exist. When combined with other low-cost devices (e.g., wireless communications, microprocessors), these technologies show potential for enabling a paradigm-shift in the science and application of air quality measurement. Furthermore, when deployed in a crowdsourced (or citizen-science) framework, a compelling case can be made for revolutionary changes in how we conduct air quality monitoring.

A flood of such low-cost sensors has permeated our field over the past few years. However, with these new sensors come age-old performance issues that have confounded measurement science for decades, namely: reliability, bias, repeatability, and specificity. This presentation will discuss the prospects and pitfalls of the growing low-cost sensor revolution, highlight recent research efforts in this area, and will provide recommendations for further development and implementation of these technologies to improve our ability to study air quality and its adverse effects on health.

Workplace monitoring of diisocyanates at construction sites

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Isocyanates are widely-used in the construction industry. The applications include e.g. usage in adhesives, coatings, foams and gaskets. To produce polyurethane systems mainly diisocyanates like HDI (1,6-hexane diisocyanate), TDI (tolylene-2,4-diisocyanate and tolylene-2,6-diisocyanate) and MDI (2,2‘-methylenediphenyl diisocyanate, 2,4‘-methylenediphenyl diisocyanate and 4,4‘-methylenediphenyl diisocyanate) are used. Together with alcohols isocyanates form so-called polyurethanes (PU) due to the amount of arising urethane groups.

Diisocyanates can trigger respiratory and skin sensitisation. Furthermore some (TDI, MDI) are suspected for causing cancer. Consequently occupational exposure limits (OEL) have been defined.

Since 2004 dimers and oligomers were additionally taken into account. Still containing isocyanate groups they also cause toxic effects. For the evaluation of isocyanates based on the total concentration of reactive isocyanate groups (TRIG) an exposure orientation value (Expositionsleitwert, ELW) has been established.

Since the 1980s the BG BAU conducts isocyanate workplace assessments for

- parquet laying (using parquet adhesives and parquet seals),
- manual surface coating,
- building of sports flooring,
- spray coating,
- usage of PU foams,
- usage of anticorrosive coatings.

Nearly 1800 isocyanate-results were obtained until the end of 2015. In 90% results were below the limit of determination. Only 11 times the OEL was exceeded.

Since 2004 about 200 TRIG measurements were conducted with 75% of the results going below the level of determination. Less than 1% of the samples exceeded the ELW.

High values were detected when the products had been sprayed (building of sports flooring, spray coating, anticorrosive coatings) however personal protective equipment (protective clothes, gloves, respiratory protection) is already standard when those works are performed.

Due to the dermal exposition, parallel biomonitoring procedures were done before and after a shift, inter alia, when parquet adhesives and seals were used.

These confirm that parquet laying and sealing does not lead to a significant exposure of the used diisocyanates.

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