

monitor with molecular selectivity

Volatile organic compound

Volatile organic compounds (VOCs) are major contributors to indoor and outdoor air pollution, with well-documented impacts on human health. VOC toxicity depends strongly on molecular identity and concentration, yet existing sensing technologies cannot identify specific VOCs in real time, making reliable classification of ambient air in complex mixtures impossible.

INL has developed Sample Ionization Potential Spectroscopy (SIPS), a novel approach enabling real-time, molecule-selective detection of VOCs under atmospheric conditions. The technology has demonstrated selective detection of benzene, toluene, ethylbenzene and xylene (BTEX) in gas mixtures, with sensitivity down to TLV-TWA concentrations used to assess long-term health risks. As highlighted by the World Health Organisation in 2019, benzene exposure remains a major public health concern.

SIPS supports regulatory efforts to reduce non-methane VOC emissions in line with the EU zero-pollution vision for 2050, and the EU Directive 2016/2284.

+ Key benefits

- **Molecular selectivity:** real-time tracking of specific VOCs within complex and variable backgrounds
- **Real-time operation:** rapid response to leaks and hazardous exposure events
- **No vacuum requirement:** simpler operation compared with competing technologies
- **Transportable:** designed for field deployment and mobile monitoring

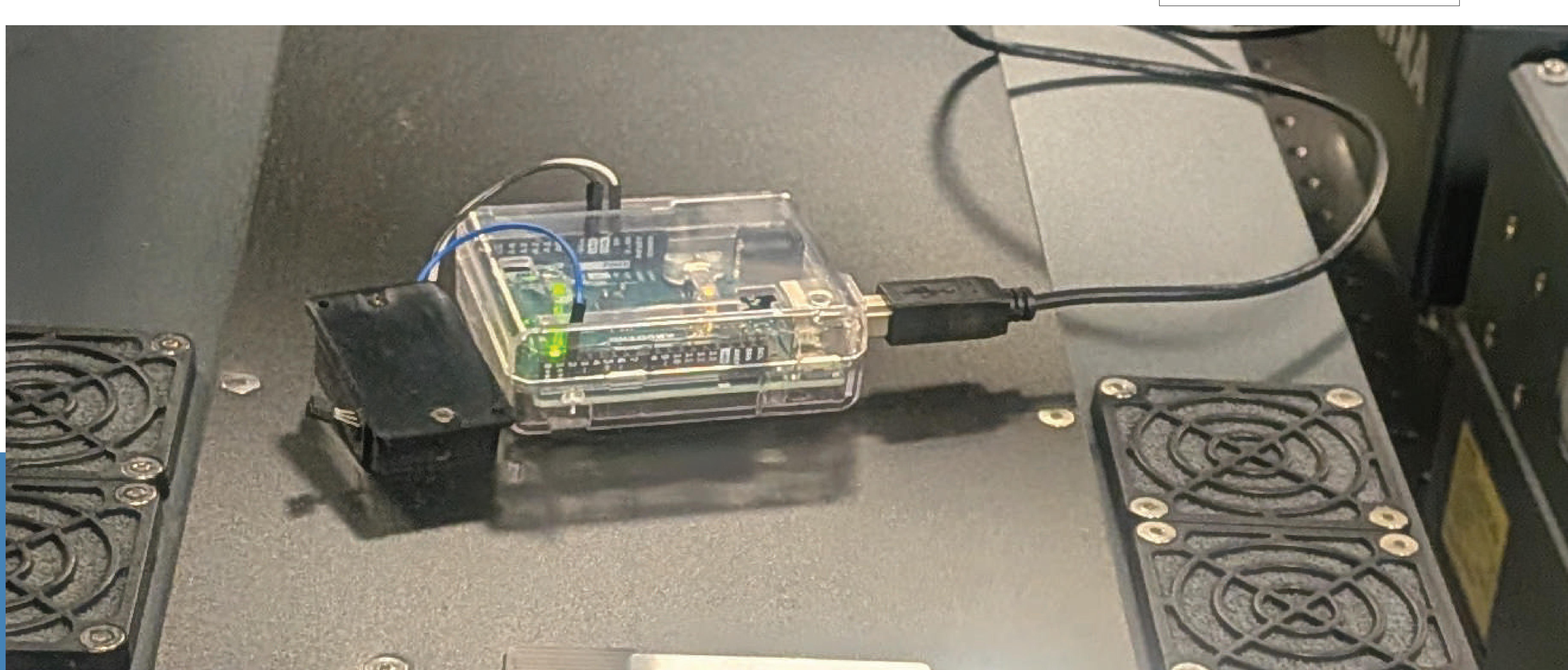
+ Suggested applications

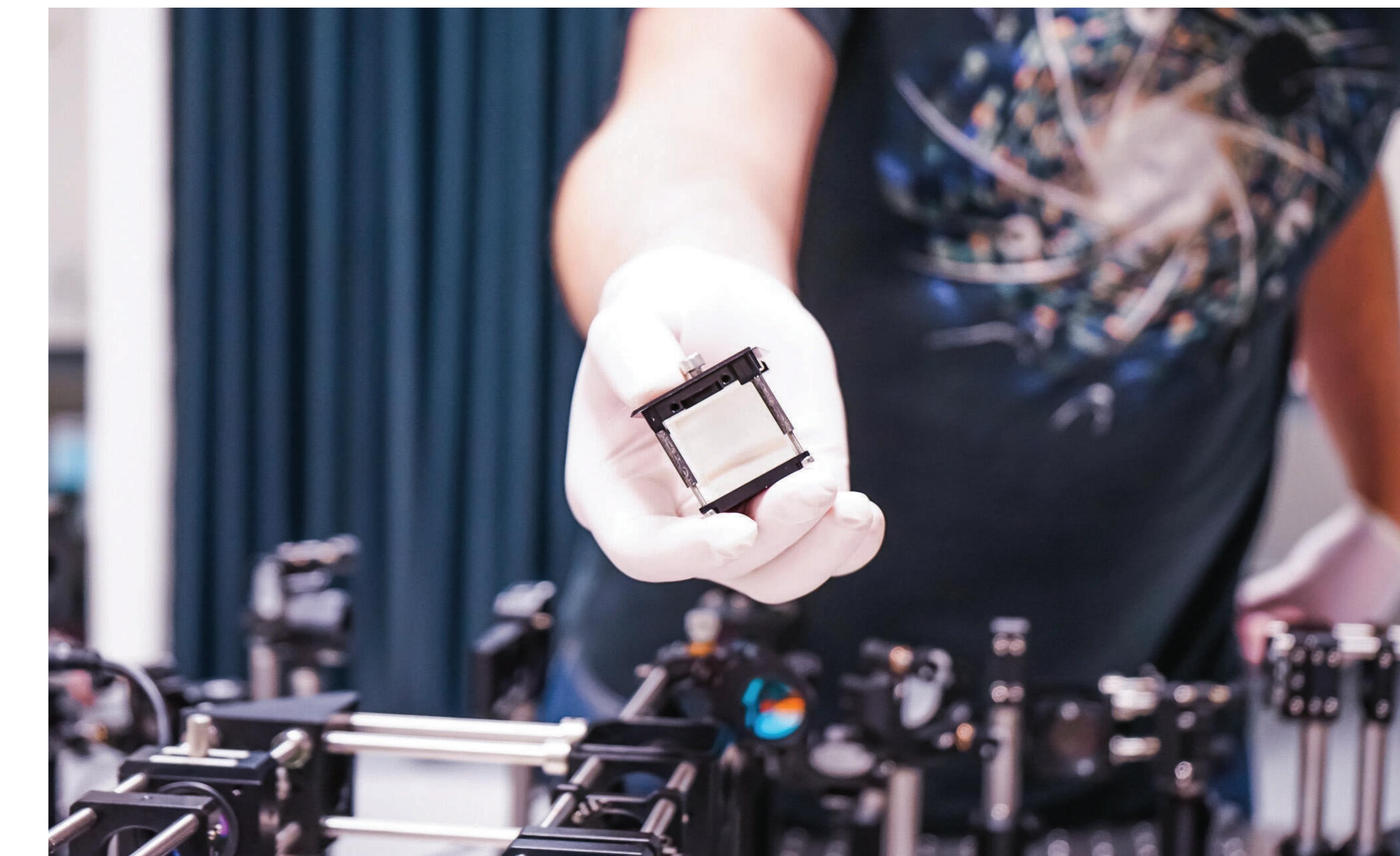
- **Industrial worker safety:** monitoring BTEX exposure in petrochemical plants, paint production, pesticide manufacturing, battery production, recycling, steel, and polymer industries
- **Environmental monitoring:** indoor and outdoor air quality assessment, including VOCs linked to cancer and neurological disorders
- **Commercial quality control:** demonstrated capability for fragrance identification, enabling use in food production, automotive manufacturing, and related sectors

+ Patent status

SIPS core technology protected under PCT/IB2025/057293.

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