A Case Study using IOMSs for Continuous Odor Monitoring at Metallurgic Industry Fenceline

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Industrial operations involving metal deformation and thermal processing generate emission patterns that are both intricate and subject to marked temporal shifts, in which exert measurable impacts on ambient air quality and frequently give rise to odor-related annoyance. Under these circumstances, maintaining continuous odor surveillance becomes essential—not only to meet regulatory requirements, but also to protect public wellbeing and sustain a sense of environmental assurance among nearby residents. [1].

This work presents the field implementation and comparative assessment of two IOMS units—WT1 (Ellona, France) and MSEM 3200 (Sensigent, USA)—positioned along the perimeter of a metalworking facility using mineral oils, as part of a collaborative activity with ARPA Lombardia. Odor samples collected from the stack were analyzed through gas chromatography–mass spectrometry (GC/MS) and subjected to dynamic olfactometric testing in compliance with EN 13725:2022 [2]. The analytical investigations showed a broad range of volatile organic compounds—including VOCs, ketones, alcohols, and sulfur-containing molecules—with odor concentrations at the source reaching 6896 ou_E/m^3. These measurements informed a structured calibration and training protocol for the IOMS based on systematically diluted odor samples.

Evaluation of the temporal dataset highlighted two recurring periods of elevated VOC levels on weekdays: a morning interval (08:30–10:00; 0.02–0.036 ppm) and an evening interval (19:00–20:00; 0.032–0.074 ppm). During weekends, concentrations remained consistently lower. The WT1 instrument recorded late-afternoon increases in H_2S levels (up to 0.036 ppm), whereas the MSEM unit—with its heterogeneous array of 32 MOS, electrochemical, and polymeric sensors—registered more sustained odor-related signals, particularly during nighttime operations. Moderate odor peaks (251–1000 ou_E/m^3) were commonly observed throughout the day, while high-intensity episodes (>1000 ou_E/m^3) occurred predominantly during evening and nighttime periods. The analysis indicates that meteorological variables, particularly relative humidity and air temperature, exercise sensor-specific and non-linear influences on odour estimates, with MSEM showing cross-sensitivity effects while WT1 remained comparatively stable.

Given the rapid expansion of commercially available IOMS technologies, the establishment of harmonized protocols is becoming increasingly important to ensure consistent, reproducible, and comparable odor measurements across different devices. In this context, citizen-based observations can provide a valuable complement to instrumental monitoring.

References

[1] C. Franchina, et al., **2024**, Innovative Approaches to Industrial Odour Monitoring: From Chemical Analysis to Predictive Models, *Atmosphere*, 15, 1401, https://doi.org/10.3390/atmos15121401.

[2] CEN TC264 EN 13725:**2022**, Stationary Source Emissions—Determination of Odour Concentration by Dynamic Olfactometry and Odour Emission Rate, CEN: Brussels, Belgium.