Title:

Defining Baseline Performance in Machine Olfaction:

The IEEE P2520.1 Standard and Its Role in Odour Monitoring

Artificial olfaction systems, often referred to as electronic noses, have developed continuously over the past four decades and are now routinely proposed for applications including ambient air quality monitoring, industrial process control, food freshness assessment, environmental regulation, and medical diagnostics. Despite these advances, wider regulatory and industrial adoption remains uneven. A persistent barrier is the absence of internationally recognised standards that define what performance is, how it should be measured, and how results should be reported. Without a common framework for validation and benchmarking, outputs from different platforms are difficult to interpret, compare, and reproduce, which reduces confidence among users, regulators, and manufacturers.

In odour management, standardisation has historically centred on human sensory methods. The German VDI 3880 series and the European EN 13725 standard specify procedures for odour sampling, field inspection, and dynamic olfactometry using trained panels. These documents underpin nuisance assessment and regulatory enforcement, but they are not designed for sensor-based systems that output digital responses and rely on pattern recognition. They also do not provide test structures that address practical instrument challenges such as cross-sensitivity, baseline drift, and environmental interference over time.

This keynote at NOSE 2026 will introduce IEEE-SA P2520.1, *Baseline Performance of Machine Olfaction Devices and Systems*, an initiative within the IEEE Standards Association intended to establish a baseline for sensor-based odour detection. The standard provides a repeatable test and reporting framework focused on three functional capabilities that are used in most deployments: differentiation, identification, and quantification. Devices under test are exposed to defined chemical mixtures at known concentrations, delivered in air as a carrier gas, and evaluated under controlled environmental conditions, including variations in temperature and humidity. Testing is conducted over extended time periods to assess stability and repeatability in a way that reflects common field issues.

Differentiation assesses whether a system can reliably distinguish between different odour profiles. Identification evaluates the ability to correctly label or classify a presented test chemicals. Quantification assesses whether concentration levels can be estimated with accuracy appropriate to the intended screening or monitoring task. For each capability, threshold criteria support transparent pass or fail decisions. The framework is modular and supports partial implementation, allowing systems to be benchmarked and, where appropriate, certified at individual capability levels when full compliance is not required for a specific application.

P2520.1 is being developed alongside European activity, including work within CEN to extend EN 13725 towards instrumental odour monitoring systems. Alignment across these efforts will be important if the community is to converge on consistent terminology, comparable test structures, and defensible reporting that can support procurement specifications and regulatory deployment.

The keynote will outline the rationale for the chosen performance architecture, discuss implications for developers and end users, and describe how baseline certification can become an entry point to a broader family of application-specific standards, including outdoor air quality monitoring, landfill emissions, indoor environmental sensing, and medical diagnostics. Establishing a clear, repeatable benchmark is a necessary step towards interoperability, fair comparison, and trusted deployment of machine olfaction technologies in odour management and beyond.