Use of Low-Cost Sensor Systems for PM10 in the Vicinity of Demolition and Construction Sites and Considerations of PAS 4023:2023

September 2025 | Version 1.0

The IAQM issues Position Statements on matters that could affect the way in which Members carry out their professional tasks and on air quality topics and issues where the IAQM can provide a unique perspective from which to give a professional opinion.

The Issue: With the increasing availability and use of low-cost sensor (LCS) particulate matter (PM) monitoring systems (also known as indicative sensor systems), IAQM members have raised concerns about whether these systems are fit-for-purpose, and compatible with the aims of IAQM Guidance[i] and the Code of Practice[ii], when used to monitor PM_{10} concentrations around construction sites, particularly during elevated PM events. This position statement only relates to PM_{10}. The recent MCERTS updates and this guidance do not currently apply to $PM_{2.5}$ measurements. The indicative nature of LCS systems means they are not currently fit-for-purpose for reporting against air quality objectives, limit values or $PM_{2.5}$ targets.

Background: The IAQM Guidance on Air Quality Monitoring in the Vicinity of Demolition and Construction Sites (2018)[i]recommends the use of either a site-specific action level or a generic action level for PM_{10} of 190 µg/m^3 averaged over one hour, above which an alert should be triggered and sent to the site manager. This threshold-based approach is widely implemented across UK construction sites and requires reliable, real-time monitoring. The Guidance also sets out the advantages and limitations of different types of monitoring systems used to determine requirements for dust management actions at site.

Work by IAQM members has shown that some LCS systems now commonly used for ambient air dust monitoring at or just outside a construction site under-report PM_{10} concentrations, particularly at concentrations approaching or above the IAQM recommended site action level for PM_{10} concentrations of 190 µg/m^3. As a result, local pollution events may go undetected and, therefore, investigation of the cause and implementation of dust management actions may not be triggered as intended.

The UK Government has published guidance on the selection of monitoring systems[iii].

Throughout this document "**should**" is intended to indicate that compliance with a statement is **NOT** optional unless there are reasonable and justified circumstances to deviate, and this must be documented in any reporting e.g. a monitoring strategy, a dust monitoring plan or a monitoring report.

Applicability: Whilst this Position Statement addresses monitoring around construction sites it can be taken to be IAQM's position on monitoring around other sites using LCS systems where periods of elevated PM_{10} concentrations occur (e.g. mineral extraction or waste processing sites).

Current Standards and Limitations: Existing and emerging standards for LCS systems have generally been developed for typical ambient air quality conditions and do not fully account for short-term elevated PM episodes, such as those caused by construction activities.

- **MCERTS** currently certifies Indicative Ambient Particulate Monitors (IAPM), but this certification is limited to ambient environments. **PD CEN-TS 17660-2:2024**[iv], titled *"Air Quality – Performance evaluation of air quality sensor systems – Part 2: Particulate matter in ambient air"*, is expected to replace the existing MCERTS guidance but also does not address elevated concentrations.

- **PAS 4023:2023**[ii], developed for users, provides a code of practice for selecting and deploying LCS in outdoor ambient air. While it offers a useful framework, it places the burden of proof on users to demonstrate that any LCS employed is fit-for-purpose in its intended context. At present, there is limited published evidence demonstrating LCS performance in elevated PM_{10} concentrations relevant to construction monitoring.

- The **MCERTS Product Certification Bulletin PC4**[v] (published 1 July 2025) clarified that indicative MCERTS certification alone is not sufficient to demonstrate suitability where PM_{10} concentrations may exceed typical ambient levels. PC4 explicitly includes construction, demolition, waste, and industrial sites as examples of such environments. As part of this clarification, previous certification ranges have been withdrawn for all instruments.

Sensor-Specific Concerns: IAQM's current understanding is that some sensors do not reliably perform the intended purpose as set out in the IAQM Guidance. This is because some sensors have been validated, calibrated and/or contain algorithms developed by manufacturers based on concentrations below the IAQM recommended site action level (190 µg/m^3). This conclusion is supported by findings in Molina *et al*. (2023)[vi], which tested a range of sensors and concluded "*...these low-cost sensors (1) cannot discriminate particle size accurately and (2) only report linear and precise measures of aerosol concentrations in the range $PM_{0.1}$ to $PM_{1.0}$...*" and recommends "*...monitoring networks stop reporting coarse ($PM_{2.5-10}$) mode and PM_{10} mass concentrations from these sensors.*"

Some sensors have quite reasonably excluded the concentrations above a certain value from their capabilities (detection and/or algorithms) to account for other confounding factors to reliable data e.g. removing the influence of fog (water particles).

IAQM does not propose to exclude the use of LCS systems. IAQM highlights to its members, and other users of its Guidance, that LCS systems are not intended and have not been developed to operate reliably at concentration ranges such as those found around dusty construction sites.

MCERTS Product Certification Bulletin PC4 has removed the certified ranges for indicative sensors and states that the typical measurement range is up to a maximum of 150 µg/m^3 (as a 1-hour mean), well below the IAQM recommended site action level (190 µg/m^3). There are monitoring systems that use optical particle counters (OPCs) with heated inlets that can measure elevated PM_{10} concentrations up to and above the IAQM recommended site action level. These monitoring systems have traditionally been used for construction dust monitoring prior to the more widespread use of LCS.

Some useful information on which PM sensors are used in which monitoring systems are published on the Air Quality Sensor Performance Evaluation Centre [vii]

IAQM Recommendations

(1) Any automatic measurement monitoring survey for construction sites should be **designed** to identify elevated PM_{10} concentrations. It should also complement other measures e.g. regular site inspections and the consistent and effective implementation of dust reduction measures. LCS systems should only be used when they can meet the objectives of the monitoring. Where deployed systems are shown not to meet the objectives action should be taken (e.g. replace the LCS system with a system that meets the monitoring objectives, select lower site-specific action level(s) providing there is evidence the system can robustly identify concentrations at these levels noting that algorithms can intentionally remove peaks as part of cleaning the 'noise' in the data, or add additional equipment).

(2) Those with responsibility for dust management using IAQM Guidance should ensure that LCS systems are **fit-for-purpose** when used in the context of construction site dust monitoring. The IAQM Guidance recognises LCS systems have their limitations but can still be useful in certain circumstances to provide an early alert system and indication of potential issues surrounding construction works.

(3) MCERTS certification alone is not sufficient to demonstrate that LCS systems are suitable for this application. Those with responsibility for dust management using IAQM Guidance should collect and report robust, **independent evidence** to support the use of PM_{10} monitoring systems to demonstrate that they are capable of detecting elevated concentrations associated with construction activities, particularly their ability to identify exceedances of the IAQM recommended site action level.

(4) Those with responsibility for dust management using IAQM Guidance should seek **assurance** from manufacturers that the monitoring system is suitable for PM_{10} concentrations appropriate for the conditions and are capable of reliably detecting concentrations at or above the IAQM recommended site action level if that is being applied. This applies especially to those without heated inlets, whose performance should be independently verified prior to deployment, particularly in environments with high humidity or elevated coarse dust concentrations (see Annex D of PAS 4023:2023).

(5) Those with responsibility for dust management using IAQM Guidance should make **reasonable efforts to confirm** which sensor(s) are used: noting that sensor type, configuration (e.g. path length, heated inlet) and any algorithms used to adjust raw measurements to reported measurements affect performance.

(6) To support effective implementation of PAS 4023:2023 and enhance clarity for members, manufacturers and users of these LCS systems should collate and publish independent evidence demonstrating the effective performance of PM_{10} LCS systems exposed to elevated PM_{10} concentrations.

(7) IAQM recognises the potential of LCS systems to increase spatial coverage at and around construction sites. However, the **specific purpose (e.g. regulations, planning conditions, commitments to neighbours and other stakeholders)** of monitoring should be considered, particularly if the goal is to identify short-term peaks in PM$_{10}$ concentrations related to site activities. LCS systems may still provide useful indicative information, but any site-specific action level applied should be appropriate to the sensor's capabilities. Evidence should be provided to support the LCS system use in the applied context. Those with responsibility for dust management using IAQM Guidance and where LCS systems are deployed should be familiar with the considerations outlined in PAS 4023:2023 and justify the selection and use of the systems deployed.

(8) Where such LCS systems are **currently in use** or its use has been agreed by stakeholders, if the LCS system is not replaced, **lower site-specific action levels** should be considered. Use of existing background data and how the site-specific action level has been derived and agreed should be documented in any reporting. The site-specific action level(s) is dependent on the equipment and ambient concentration range but should be well within the measurement range against which the equipment has been validated. Where stakeholders have agreed that continued use of LCS systems is practical or where data have already been collected, any variability and rapid increases in PM$_{2.5}$ and PM$_{10}$ concentrations should be investigated in the context of the adjusted (lowered) site-specific action levels appropriate to the LCS system. Comparing upwind and downwind monitoring location data can help determine whether the observed increases are attributable to site activities or to regional or background sources.

(i) IAQM (2018) Guidance on Air Quality Monitoring in the Vicinity of Demolition and Construction Sites

(ii) British Standards Institution sponsored by the Department for Environment, Food and Rural Affairs) (DEFRA) (2023) **Selection, deployment and quality control of low-cost air quality sensor systems in outdoor ambient air – Code of Practice** (PAS 4023:2023)

(iii) Monitoring ambient air: choosing a monitoring technique and method - GOV.UK

(iv) British Standards Institution (2024) **Air Quality. Performance evaluation of air quality sensor systems Particulate matter in ambient air** (PD CEN TS 17660-2:2024)

(v) https://www.csagroup.org/en-gb/services/mcerts/mcerts-product-certification/application-forms-documents/

(vi) Emilio Molina Rueda, Ellison Carter, Christian L'Orange, Casey Quinn, and John Volckens (2023) **Size-Resolved Field Performance of Low-Cost Sensors for Particulate Matter Air Pollution** Environmental Science & Technology Letters Vol 10 (3), 247-253 DOI: 10.1021/acs.estlett.3c00030

(vii) This resource has details on many systems: https://www.aqmd.gov/aq-spec