

Considerations for using low-cost sensors for managing occupational exposure

If you are interested in using low-cost sensors in occupational exposure management, there are a number of aspects concerning your workplace that you should consider. These include:

Current exposure monitoring in place

Take some time to consider your current approach to exposure monitoring within your organisation.

1. What operational areas does the exposure monitoring cover?
2. Which worker groups come into contact with dangerous substances and are they subject to monitoring?
3. How many workers per group are you monitoring and are they representative for this group?
4. What exposure monitoring techniques/equipment and expertise are used?
5. How frequently is exposure monitoring data collected and analysed?
6. What constraints, if any, are there on your exposure monitoring (e.g. cost, resource, expertise)?
7. How is the exposure monitoring information used by the organisation?

Added value of low-cost sensors

It is then important to consider your reasoning for the inclusion of low-cost sensors in your exposure monitoring approach.

1. What value do you expect them to add beyond your current practice?
2. What gaps in knowledge might they help fill?
3. What benefits do you anticipate from the data they collect?

You should then clearly define the purpose and aims of using low-cost sensors in your working environment.

Engaging with your workforce around the use of low-cost sensors

Low-cost sensors can be a valuable addition to help you manage risks, but to use them effectively, you should ensure that your workforce understands why you are using them, how to use them, and how the data will be stored and used. See [here](#) for more information.

Technical specification considerations

It is important to consider whether a low-cost sensor is available that fulfils your requirements and carefully evaluate the technical specifications of the low-cost sensor in relation to this. The sensor manufacturers typically provide technical specifications of the low-cost sensors, but sometimes other relevant information can be available in the scientific literature. When reviewing candidate low-cost sensors ask yourself the following questions:

1. Does the low-cost sensor measure what you need to measure? For example, if you are interested in measuring the inhalable aerosol fraction, low-cost sensors that only measure PM_{2.5} will not be of interest.

2. Can the low-cost sensor measure the expected concentrations? What range of concentrations are expected at the workplace? This can be determined by previous monitoring, reports from other similar workplaces, or exposure modelling.
3. Can the low-cost sensor be used in specific types of workplace environment? For example, some low-cost sensors will be unsuitable for use in workplaces where there is a higher risk of explosions due to the activities taking place. Most low-cost particulate matter sensors are sensitive to high humidities.
4. Do you wish for the low-cost sensor to be used as an area or personal monitoring device (or both)? This then prompts size, weight and power (e.g. battery vs. mains electricity) aspects to be considered.
5. Do you need on-board data storage or are you able to enable Wi-Fi or LoRaWAN¹ connectivity? Some low-cost sensors may have limited ability to store data on the device itself and may need to connect to the internet to send data to the cloud, or you may need to download data directly from the sensor. If the latter, you should check the amount of data storage available to avoid over-writing data. If the low-cost sensor requires to connect to the internet, would this be done via Wi-Fi or LoRaWAN? Would it need to connect to a base station to transmit data?
6. How reliable is the data? Most low-cost sensors are very good at identifying relative differences in exposure (which is very valuable for comparative purposes), but the absolute value of the data points needs to be considered with care as these may have lower accuracy than standard methods. The level of quality assurance/quality control you choose should correspond with your purpose and aims. Please read the guidance sheet on “[Quality Assurance and Quality Control](#)” for more information. As a minimum you should check what type of calibration the manufacturer has performed and whether the manufacturer has any information about the reliable lifespan of the low-cost sensor.
7. How is data obtained and visualized from the low-cost sensor? What data processing is possible? This will depend on the purpose for which you are collecting the data for. We discuss these topics more in our guidance sheet on [Data cleaning, analysis and visualisation](#).

¹ Long Range Wide Area Network enabling devices to communicate wirelessly at long range.