

Why Use Low-cost Sensors for Managing Occupational Exposures?

Occupational safety and health (OSH) professionals often use time-weighted average sampling methods (e.g. with a pump and filter) to evaluate exposures and demonstrate compliance with occupational exposure limits (OELs). They also may use direct reading instruments for real time measurements, but these are often expensive. While low-cost sensors are not currently standard compliance methods, they provide similar real-time data as direct reading instruments. They can therefore be used in situations where understanding the temporal variation of exposures is needed at a much lower cost. Low-cost sensors, to complement compliance methods, can enhance the OSH professionals' toolkit for solving exposure issues.

A low-cost quality sensor is a wearable or portable sensor module with significantly lower purchase and operating costs compared to direct reading reference-grade instruments measuring the same exposures. Low-cost sensors can cost 10-1000 times less than many direct-reading devices.

This guidance sheet answers the questions OHS professionals may have on why to use low-cost sensors for managing occupational exposures.

Low-cost sensors can help improve risk management.

- **They can be used to help protect the workforce better through real-time measurement**

Real-time monitoring using low-cost sensors can be used to assess and improve the working environment, helping reduce workers risk of short- and long-term health conditions. Low-cost sensors can provide continuous, real-time monitoring of air quality. Combined with contextual information gathered simultaneously (e.g. video, automatic logging by machinery, observation) low-cost sensors can enable immediate or earlier detection of potentially harmful levels of airborne contaminants, allowing remedial action to be implemented more quickly, as illustrated in Figure 1.

Figure 1: Example of real-time data for Particulate Matter (PM) 2.5 over a work shift in a bakery.

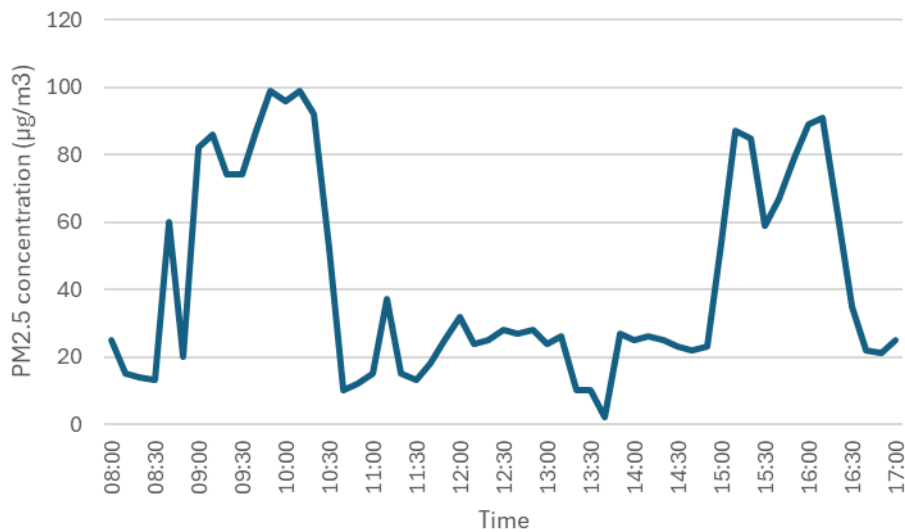


Figure 1 highlights the variation in PM_{2.5} concentrations over the work shift, showing time periods where higher levels of exposure occurred (~09:00-10:20 and ~15:00-16:20). The contextual information identified that bags of flour were being emptied into mixers during these periods.

- **Wider deployment**

The low cost of low-cost sensors make it more feasible to deploy a greater number more widely across different locations and for more workers, allowing more comprehensive coverage of a work environment. This can be used to map out the spatial and temporal concentration gradients at a workplace.

- **Identifying sources or activities that influence exposure**

Data accumulation from low-cost sensors can enable trend analysis, helping to identify exposure patterns and areas for improvements or workers at risk.

- **Evaluating the effectiveness of risk management measures**

Low-cost sensors can help inform about the effectiveness of risk management measurements (RMMs) by measuring real-time exposures before and after implementation, allowing earlier identification of the need for additional remedial action.

- **Enhancing training and engagement**

Sharing real-time data collected from low-cost sensors can be useful in training and engagement, allowing workers to more easily visualise where exposures are occurring. This also informs how correct use of RMMs can reduce exposure and/or changes in their working procedures and inform practices that contribute to lower exposures. Complementary collection of real-time contextual information (e.g. video or observation) will enhance the effectiveness of low-cost sensor data in understanding exposure patterns and decision making to reduce exposures. See [this](#) guidance sheet for more tips on this.

If you determine that you would like to use low-cost sensors in exposure monitoring, see the next guidance sheet: "[Considerations for using low-cost sensors](#)".