LOCAL AUTHORITY WEBINAR Q&A

Spotlight on Local Air Quality: New Technology & Tools – 9th May 2023

Webinar Topic	Question	Response
Sensors	Can you explain a bit how you have used sensors as mobile monitors	We have used mobile monitoring in a number of projects primarily looking at how pollutant concentrations (usually PM_{10}, $PM_{2.5}$ and NO_2) vary spatially as well as with time. Combining high-resolution (1-minute or less) with GPS measurements enables us to build up a picture of relative concentrations similar to a contour plot from a dispersion model. The results have been used to investigate hotspots e.g. are we seeing hotspots where we expect; and to inform diffusion tube monitoring, for example. The following are a couple of more research-based examples but provide a good idea of what's possible: • Air quality study: assessing variations in roadside air quality with sampling height – https://www.gov.scot/publications/air-quality-study-scotland-assessing-variations-roadside-air-quality-sampling/pages/5/ • Pollutant concentration fall-off from the roadside, measured in a SSSI – https://airquality.gov.wales/sites/default/files/documents/2018-03/08_NickRand%26OliverMatthews_Traffic_Impact_on_Ecology.pdf
	Will Defra accept data from these sensors when assessing localised AQ exceedances?	Defra recognise that low-cost sensors (LCS) are indicative at best and so data should be treated as such. As a result, as with diffusion tubes, you can't conclude that there is an exceedance but that there is only an indication of an exceedance. More accurate reference monitoring would need to be carried out to confirm an exceedance, or you could use LCS in combination with reference monitoring to investigate the spatial extent of potential exceedances. The added complication for sensors is the QA/QC process and building the evidence to demonstrate the accuracy of the sensors; and so if you were to report result from LCS, I would recommend including details of the QA/QC regime and assessment of potential accuracy.
	Any mobile monitoring for PM?	Yes – examples above.

Webinar Topic	Question	Response
Sensors	Could you elaborate on QA/QC. If we use MCERT sensors, do we still need to carry out co-location study 12 months on and how to choose/take out from the continuous monitoring period?	Yes you do, strictly speaking, an MCERTS indicative certified PM LCS remains indicative if the following conditions are met: - The firmware/algorithm version(s) used is the same as that used for the certification - The sampling regime is the same as that used for certification e.g. if the LCS was certified when monitoring continuously then it is not indicative if measuring spot values - The maintenance requirements as specified in the MCERTS certificate are adhered to e.g. the optical sensor might need replace every two years or the sample inlet might need checked every six months However, an indicative PM LCS has a measurement uncertainty of up to 50% and so annual co-locations provide the opportunity to assess the accuracy and to correct the data further, improving the accuracy. Local authorities have routinely carried out co-locations for Osiris indicative PM monitors, for example. We would recommend carrying out regular co-locations, ideally 3-monthly. However, we recognise that there is a fine balance between the ideal and practicality/cost and so the colocation frequency may be reduced, we suggest annual co-locations as a minimum. It is important to consider that reference-equivalent PM analysers are not plug and play, there is a QA/QC regime put in place to track changes in response, identify faults and correct data where required to ensure they meet the data quality objective. It is therefore a logical step to conclude that a robust QA/QC regime is required for LCS to ensure the best quality data.
	Can you co-locate a more low-cost PM sensor against an MCERTS indicative PM as this is better than nothing?	Similar co-locations have been carried out using NO_2 diffusion tubes and sensors and so if there is no alternative then you could do this. However, as discussed above the measurement uncertainty of an indicative PM monitor is 50%, and some units may not meet these criteria, so correcting data from an LCS will likely result in an uncertainty far greater than 50%, therefore we wouldn't recommend this approach if concentration information is required. In order to improve this, I would recommend that the MCERTS indicative monitor be co-located with a reference equivalent monitor, if possible, and then use this as a standard for other LCS.

Webinar Topic	Question	Response
Sensors	How to select a low-cost sensor that is accurate?	This has been the question historically and the lack of Standards has been the main problem. The Technical Specification (CEN TS 17660-1) being published for gaseous sensors will help LAs once LCS start being tested through this regime. A TS for PM LCS (Part 2) will also be published specifically for PM sensors and so this will provide additional clarity for LAs once LCS are tested under that regime. In the meantime, for PM, we only have the MCERTS testing regime (BS EN 16450) and there are LCS available that have met the requirement for indicative monitoring. The other recommendation we would make is to ask/look for evidence of independent performance test reports as part of the procurement process, or alternatively we can provide assistance.
	What are the strengths and weaknesses of low-cost sensors vs other measurement approaches?	Strengths: - LCS can be easily deployed and moved - High resolution measurements (down to 10 second) - There is flexibility in how LCS are powered e.g. battery, mains, solar etc. - Multiple pollutants and other parameters such as meteorological conditions can be measures for relatively low capital cost Weaknesses: - Accuracy and precision can still be variable from manufacturer to manufacturer and sensor to sensor - QA/QC can be challenging and costly - The above can make it difficult to pin down how to use the data
Public Engagement & Pollution Forecasting	Using the forecasting for Bradford Met. District as an example, how accurate are these forecasts if an authority does not have its own automatic monitors?	Sections 7.565 to 7.569 of the LAQM TG22[1] document details best practice with regards to using monitoring data for the verification of an air pollutant dispersion model. The approach to model verification will depend on the pollutant modelled. Ideally, data collected by reference or reference equivalenced should be used for model verification. NO_2 diffusion tube data can also be used to supplement the automatic data. Standalone diffusion tube data can be used in a worst-case scenario; providing that the measurements have been processed in accordance with sections 7.212 to 7.234 of LAQM TG22.

[1] LAQM-TG22-August-22-v1.0.pdf (defra.gov.uk)

Webinar Topic	Question	Response
Public Engagement & Pollution Forecasting	Do you have to use a specific monitoring system to use the forecaster, or can it be used with any automatic monitor?	As above.
Air Quality & Data Reporting	Can data be flagged to advise when data capture is poor?	The "Summary Plot" function in openair (which is also available on the website) is useful to show where data is missing and provides a data capture rate. If importing your own data in R, then a flag can be added to the data to state when the data capture is poor. As good practice it is always useful to plot a timeseries of the data first and this helps to identify missing periods of data.
	How can local authorities use their own air quality data in openair and R?	The "importLocal" function in openair can be used to import data from local authorities that are available on the UKAir website. To use this function you will need to download R and write a small piece of code. Further information is available on the openair book here: https://bookdown.org/david_carslaw/openair/sections/data-access/UK-air-quality-data.html However, almost any air quality data can be used in R and openair. There are standard functions available to import from a text file or excel (e.g. .csv or .xlsx). When using the functions in openair the data will need to be in a specific format, which is described here: https://bookdown.org/david_carslaw/openair/sections/intro/openair-package.html
	When using our own data Is it 15-minute data, hourly data, 24-hour data or other that should be used and imported in r/openair for best results?	It will depend on what you would like to do with the data. Hourly data is typically used, and all openair functions will work with this. However, if you would like to see a time series of 15 minute data, then this can also be imported and then averaged to hourly or daily later on using openair functions, if needed. 24-hour data can also be used, but some functions, such as the diurnal plot in "timeVariation", will not work.