Project title: Transmission and the Environment: Environmental Monitoring
Lead Investigator: Prof Tim Sharpe
Funder: HSE
End date: 31st March 2021 (with possible extension)

Project summary:

This project comprises collection of real-world environmental and occupancy data in a range of workplace settings to evaluate environmental conditions and relationship to airborne transmission risk. It will involve detailed longitudinal monitoring of carbon dioxide (CO_2) and environmental conditions (temp, RH, PM2.5, PM10, TVOCs) in workplace settings over several months to capture temporal, spatial and seasonal variations. Short term intense monitoring will also be undertaken in some outbreak settings over several weeks (which will be linked to the rapid investigation of outbreaks under Theme 1). These investigations will be undertaken sequentially to provide rich data to assess environmental conditions and address critical knowledge gaps on associations between environmental and transmission factors during outbreaks.

An external company will be used to provide indoor air quality sensors, maintain the sensor networks and provide a cloud based data portal. An array of sensors will be used to generate high granularity mapping of environmental conditions in each workplace setting. The number of sensors will depend on the layout and size of the workplace, but we will identify spaces where CO_2 can be used to identify ventilation and indoor air quality (IAQ), and risk (i.e. avoiding large volume spaces or those with low occupancy).

Fine-grain CO_2 and environmental data will be collated along with other contextual data about the building design, construction information, heating and ventilation systems, occupancy patterns and behaviours. These will be compared with other sources, such as BMS system data (if available), ventilation data (energy, flow rates, filtration systems) ambient air quality data and building usage information (activities, duration, COVID risk assessment) to establish levels of occupancy or ventilation that may denote levels of risk.

Occupant behaviour is critical - we will explore additional data capture methods (such as PIR, window / door contact sensors, energy monitoring, differential pressure, apps) and define protocols and methods for collecting building, environmental and occupancy data to understand the applicability of environmental monitoring approaches.

The data will be collated and analysed to explore the importance of ventilation and environmental conditions on airborne pathways and transmission risk in workplace settings. This will include comparison against recognised guidelines, (e.g. 8 l/s/p, 1,000ppm, 40% RH), examination of airflow pathways, temporal and spatial variations, and estimation of airborne transmission risk using CO_2 data. We will draw together data from occupant surveys, building information and usage, ventilation systems, environmental monitoring and infection data, which can be used to inform computational and experimental models.

Tools will be developed, tested and refined to support the visualisation and mapping of temperature, RH, CO_2 and PM distribution within a space to identify high-risk areas and assist with the synthesis, analysis and interpretation of environmental data. This might include the development of alert systems for airborne transmission risk and/or the development of recommendations to provide practical advice to reduce this risk.