CAMPUS CLEAN AIR ZONES

As part of Strategy 2030 UWE Bristol has set the ambition to establish a clean air zone at each of its three campus locations, Frenchay, Glenside and City Campus. The purpose of the Clean Air Zone initiative is to improve air quality for staff students and visitors at each campus thus reducing the risk of exposure to adverse pollutant concentrations. Air pollution is described by the WHO, the EEA, the EU and the UK government as a major environmental health risk. The principal mechanism to deliver clear air will be through UWE's new travel plan.

The Current Position

The purpose of a Clean Air Zone is to reduce air pollution concentrations below levels known to be harmful to human health and ecosystems. The pollutants of current concern are particulate matter, both PM10 and PM 2.5, and nitrogen dioxide, NO_2. Tropospheric ozone, O_3, will in future years become a pollutant of concern. The majority of the emissions contributing to pollution experienced on a campus will be from traffic with some smaller contributions from gas fired heating systems, construction activity and background emissions. At present there are no measurements of air pollutants on any campus but in early 2021 measurements will commence at Frenchay Campus as part of the UMBRELLA network (see below).

The Clean Air Zone (CAZ) requires measurements of pollutants of concern, determination of risk in relation to statutory values, usually determined by a combination of monitoring and modelling. Having determined the nature and scale of any issues the final stage is to identify measures to bring air quality in line with air quality objectives or limit values. The measures mostly will be a combination of traffic and travel management and will be delivered through the Travel Plan alongside removal, energy management or technology improvements for point sources such as gas fired boilers and CHP engines.

Each campus provides different challenges but all will require measurements to confirm baseline positions and modelling to predict future concentrations. Some of this is available from published studies and national air quality databases. Much of the air quality on each campus is the result of emissions elsewhere that are transported to the estate. Traffic is the most important local source with background emissions contributing a significant fraction of the measured pollutants on campus.

- **City Campus** is within the Bristol CAZ and Air Quality Management Area, both of these are legally defined entities and the Bristol CAZ should not be confused with UWE's proposed actions which do not have the same legal status. The city centre locations of the campus should comply with English AQOs and EU Limit Values by 2024. Currently it will not meet WHO guidelines, it could do by 2030. It is heavily influenced by traffic emissions, particularly concentrations of nitrogen dioxide, PM10 and PM2.5. The nearest diffusion tube measurement are on Colston Avenue and on Anchor Road. The latter site reports an annual mean of 51 μgm^{-3}. The nearest automatic monitoring station is located on Colston Avenue and reports an annual mean of above 60 $\mu gm^{-3.}$ There are no measurements on the campus but concentrations can be inferred from measurements made by Bristol City Council and the future evolution of concentrations can be assessed from modelling undertaken by the Council as part of the CAZ proposals. There is no measurement location near to Bower Ashton, the closest diffusion tune monitoring sites are at Ashton Park School and on the roundabout on Blackmoors Lane. Both sites report an annual mean NO_2 below 40 μgm^{-3}. Traffic, gas boilers, construction activity and background emissions are the main issues affecting air quality on the Bower Ashton campus.

- **Glenside Campus** is not in a Council proposed CAZ or Air Quality Management Area. There is no monitoring location in the immediate vicinity of the Campus, Bristol City Council's nearest automatic monitor for NO_2 is located on Fishponds Road near the junction with Alexandra Park. This site reports an annual mean NO_2 below 40 μgm^{-3}.This location is part of Bristol's Air Quality Management area. It is likely that air quality at or nearby the campus will comply with most English AQOs and EU Limit Values. Traffic, gas boilers, construction activity and background emissions are the main issues affecting air quality on the campus. It may not meet all WHO guidelines but could by 2030. It is subject to dispersion of traffic emissions from road and background sources. Modelling of air pollution undertaken by the Horizon 2020 ClairCity project provides our best estimate of air quality on and in the vicinity of the campus. Deployment of passive samplers or low cost samplers is recommended to confirm this position.

- **Frenchay Campus** is likely to have a number of elevated concentrations of particulate matter and nitrogen dioxide has some hotspots such as in the vicinity of the bus station. Traffic, gas boilers, construction activity and background emissions are the main issues affecting air quality on the campus. The forthcoming UMBRELLA network will provide an instrumented dense network of low and medium cost sensors providing real time temporal and spatial air quality information from some 20 locations. Nitrogen dioxide, PM10 and PM2.5 initially will be the main pollutants of concern, in later years ozone will become increasingly problematic as will other photochemical pollutants. English AQOs and EU Limit Values could be met by 2023/4. Traffic volumes on Coldharbour Lane and the A4174 are very high particularly but not exclusively at peak travel times. South Gloucestershire Council monitors NO_2 using diffusion tubes at various locations along the A4174 but none of these are in the immediate vicinity of the campus. The closest location is the MOD roundabout which reports an annual mean of 32 μgm^{-3} in 2018.

Over the next decade changes in the emission profile of many sources contributing to air quality on each campus will help us meet the Clean Air Zone ambition. In particular the penetration of EVs in to the car and van fleet, reduction in petrol and diesel vehicles in the car and LDV fleet, improvements in the emission characteristics of buses and the changing fuel mix in power generation will reduce local and background air pollution. However, the type of pollutants we are concerned about may change with more emphasis on even finer particles from road, tyre and brake wear. As the average temperature rises over the next decade we will see changes in the reaction behaviour of pollutants driven by photochemistry. We will need to pay much more attention to ozone concentrations and other photochemical reaction products in the later years of this decade. A low cost ozone sensor will be part of the UMBRELLA network alongside two of the more sophisticated Zephyr instrument (https://www.earthsense.co.uk/zephyr).

The Clean Air Action Plan to deliver the Clean Air Zone initiative.

A key decision to make relates to the definition of what we mean by a Clean Air Zone. This needs to identify pollutants of concern and set a target year. The regulatory reference points are the Air Quality Objectives for England (AQOs), EU Limit Values and WHO Air Quality Guidelines. Each provides different challenges and opportunities for health and ecological protection. A target year of 2025 will enable the AQOs and EU Limit Values. WHO guidelines will be more challenging and probably require a target year of 2030. Much of the improvement in air quality will come from measures introduced in UWE's new Travel Plan but will also require actions in terms of on-site gas

consumption (CHP etc.) and other emissions that are within the scope of the definition. Monitoring and modelling of air quality concentrations will be required.

Action on clean air particularly those addressing student and staff commuting travel choices, will also support wider clean air initiatives in South Gloucestershire and Bristol.

Actions to Deliver Campus Clean Air Zones

- Define the spatial extent of the area of each campus designated as a Clean Air Zone and subject to air quality improvement.
- Deploy signage as a visual signifier of intent to change pollutant concentrations and commuter behaviours.
- Establish the baseline of pollutants of concern at each location
- Establish reduction targets of key pollutants at each location
- Deploy monitoring instruments and establish reporting requirements for each site
- Within the Travel Plan identify vehicular restrictions within the zones (including own fleet, commuting & supply chains) and incentives for change.
- Identify mitigation measures to reduce pollutants caused by building and construction related activity on each campus
- Identify requirement to reduce emissions from gas boiler flues and the CHP engines.
- Explore options for logistics consolidation and delivery access for student groceries etc.
- Work with and influence local and national policy makers to improve background air quality
- Consider/ develop pollution control measures to limit exposure and reduce reactivation of particulates.
- Develop advice and guidance for students, staff and visitors on commuting options and travel choices.

The route to clean air will follow the reduction hierarchy, ensuring that emissions are avoided, reduced and where necessary, emission sources replaced.

UMBRELLA Network

UMBRELLA is an ambitious £7M IoT Network funded by South Gloucestershire Council, WECA and Toshiba, linking Bristol and Bath Science Park with UWE, BRL and Future Space via the A4174 ring road. Around 200 multi-radio multi-sensor UMBRELLA IoT (node) units will be deployed in total, with over a thousand radios and sensors available for researchers and business trials. The aim is to accelerate research and technological innovation by establishing a test bed for developing new technologies and innovative applications, processes and products. The project commenced in June 2019 and Phase 1 will complete on 31st March 2021. UMBRELLA will instrument Frenchay Campus with low and medium cost sensors to measure NO_2, ozone and particulate matter. Sensors will be deployed at 20 locations on the Campus and generate spatial and temporal data on air quality across the site. Some 50 nodes on the route from the Science Park to Frenchay Campus will be instrumented with the same low cost sensors thus providing a rich data resource for air quality studies into pollutant behaviour and possible management issues. The low cost sensor network will be enhanced by the deployment of two Zephyr instruments on the Frenchay Campus, one at the Science Park and one at the Hambrook roundabout.

Monitoring Progress

Clean air cut across all element of institutional business. The Climate Action and Sustainability Strategy (CASS) 2030 sets out the framework in which progress will be managed and monitored. The CASS is supported by a series of Action Plans providing the shorter term engagement (1-3 year time horizon) with the ambitions of the CASS. Each of these Action Plans will contribute to improving campus air quality.

The Sustainability Board will review progress with each of the actions on a quarterly basis.

Further Information

Definition of terms - https://uk-air.defra.gov.uk/air-pollution/uk-eu-limits

National air quality objectives and European Directive limit and target values for the protection of human health
https://uk-air.defra.gov.uk/assets/documents/Air_Quality_Objectives_Update.pdf

WHO Air Quality Guidelines https://www.euro.who.int/en/health-topics/environment-and-health/air-quality/activities/update-of-who-global-air-quality-guidelines

Bristol air quality data - https://opendata.bristol.gov.uk/pages/air-quality-dashboard-new/air-quality-now#air-quality-now

South Gloucestershire air quality data - https://www.southglos.gov.uk//documents/2019-SGC-Air-Quality-Annual-Status-Report.pdf

ClairCity Bristol Policy Report http://www.claircity.eu/wp-content/uploads/2020/01/D7.4-Final-City-Policy-Package-First-City-REVISED.pdf

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