Are we there yet? 25 Years of Local Air Quality Management

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Logika Noise
Air Quality
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On Clean Air Day 2021,
Steve Moorcroft and Tim Williamson
of Air Quality Consultants Ltd reflect
on the changes in air quality and air
quality policy over the last 25 years,
and the challenges still with us.

The Environment Act was passed in 1995 and the first set of UK Air Quality Objectives adopted in 1997 so, using a three-year average, Local Air Quality Management (LAQM) is 25 years old this year. As Clean Air Day 2021 focusses on children's health, it is worth considering what has improved over that period and what has not, and so what protection from air pollution a child born today can expect over the next 25 years. It is, of course, worth noting that this year a coroner investigated the tragic death of 9-year old Ella Adoo-Kissi-Debrah, and recorded one of the medical causes as air pollution exposure.

It seems incredible now, but in the late 1980s and early 1990s, many people thought that air pollution control in cities was, effectively, done. The Clean Air Act (1956 and subsequent) had reduced domestic coal burning to a few isolated areas and the system of Integrated Pollution Control brought in by the Environmental Protection Act 1990 was addressing the most severe industrial air pollution problems. Acid rain was a major campaign point, as was the protection of the ozone layer, but these were big picture issues and not related to local environments (although the United Nations Economic Commission for Europe Gothenburg Protocol was not passed until 1999). For most local authorities, air pollution monitoring was an aging set of smoke and SO2 bubblers.

However, better monitoring techniques and a series of ground-breaking health studies, including the 1993 Harvard Six Cities Study, brought attention right back to urban air pollution and, in particular, the increasing impact of road vehicle exhaust. The 1990 Government White Paper, Our Common Inheritance, set out a comprehensive environmental strategy, including for air pollution. However, apart from expressing support for the first "Euro" vehicle emission standards, there is little mention of controlling non-industrial air pollution in urban areas (and no mention of PM_{10}). By the 1995 Act, it was recognised that central Government action by itself could not address local air pollution problems and so the concept of LAQM was developed. However, it was envisaged by the Government that there would be a dozen or so Air Quality Management Areas (AQMAs) set up, not the 100s that resulted when local authorities really started to "review and assess" air quality in their areas.

This underestimation of the problem may explain why local authorities were never given the range of powers and tools needed to address air quality at the local scale. Added to that, a failure to fully align UK Objectives, which local authorities were required to pursue, with European Limit Values which the Government was required to meet, meant that there was (and still is) a lack of unity on where the problems

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The Great Smog of London, 1952

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exist and the actions needed to address them (i.e. there are many locations where the Objectives are exceeded, but the Limit Values are not, and vice versa). That said, countries where there is a unified programme between Government and local authorities, e.g. The Netherlands, still have numerous Limit Value exceedances.

It is not unusual for contemporary news stories to portray air quality as getting worse and being "in crisis". This does not really stand up to scrutiny but nevertheless highlights the conspicuous failure to address PM and NO_2 concentrations, and the fact that our understanding of effects is now wider and deeper than in 1995. The first set of UK Objectives covered sulphur dioxide, lead, nitrogen dioxide, benzene and 1,3-butadiene. Nitrogen dioxide stands out in this list as the only one which has not been reduced to barely detectable levels by the addition of 3 -way catalysts to petrol vehicles and the (virtual) removal of sulphur and lead from road fuel. Levels of nitrogen dioxide have reduced considerably – it is no longer common to see an orange haze over cities on clear winter days - but the dieselisation of the fleet as an early response to climate change, and the failure of Euro standards to deliver in real world conditions, has meant the original compliance date for the nitrogen dioxide Limit Value is far off in the rear view mirror.

Particulate matter, whether measured as PM_{10}, $PM_{2.5}$, particle number or any other metric, was slower out of the traps than the other air pollutants which comprise "modern" air quality policies. However, evidence suggests that it is the most damaging to health and also the most complex to control. We still do not know which component or characteristic of PM is driving health effects - World Health Organization (WHO) advice is still "all of them" - and there is no known lower threshold for effects. Nor do we fully understand the chemistry and physics of particle formation in the atmosphere, such as the influence of urban ammonia emissions from road vehicles. The multiplicity of sources means that suppressing any one will not be enough. Even though diesel particulate traps have dramatically reduced the mass of particles emitted from vehicle tailpipes, sources such as brake, tyre and road wear remain whereas others, notably PM from domestic burning, are (probably) on the rise. Add to this the lacklustre performance of most European countries in trying to control ammonia emissions from agriculture. It would appear passed time to implement a more comprehensive approach to PM and PM-precursor emissions.

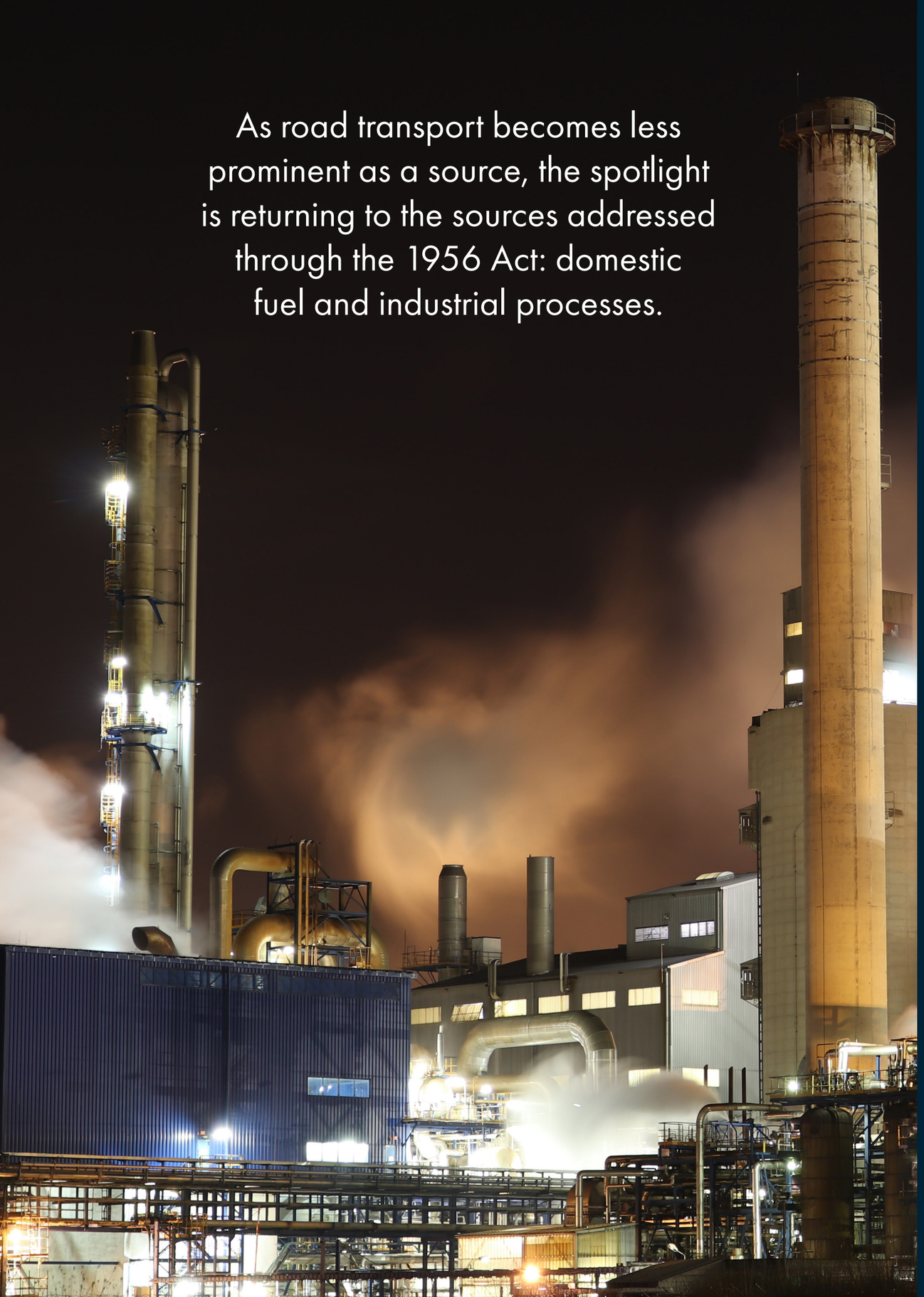
In spite of these past failures, there have been recent and significant improvements to controlling emissions and reducing exposure to poor air quality. The introduction of real-world driving emissions (RDE) tests sees cars and vans being taken out of laboratories onto the roads to be tested using Portable Emissions monitoring

Systems (PEMS). New transient and stationary duty cycles and off-cycle and in-use PEMS testing is now applied to Heavy Duty Vehicles. While there is evidence that many Euro 6 diesel cars exceed the emissions standard, there is also evidence from monitoring data that levels of nitrogen dioxide are, at last, beginning to decline across the UK (https://www.aqconsultants.co.uk/news/january-2020/nox-trends-in-the-uk-2013-to-2019)

And while it has taken the UK Government a long time to act, eventually driven by a series of legal cases that were brought against it, Clean Air Zones are now starting to emerge in our major cities. The Ultra-Low Emissions Zone (ULEZ) in London recorded a 29% drop in nitrogen dioxide levels over the period up to September 2019 (solely attributable to the ULEZ - https://www.london.gov.uk/press-releases/mayoral/ulez-reduces-polluting-cars-by-13500-every-day). Elsewhere, the first CAZ was introduced in Bath in 2020, and in June this year Birmingham introduced a Class D Zone targeting all classes of vehicles. AQC was very pleased to have worked on both of the schemes and we are delighted to see them come into operation.

The past year has, of course, been like no other, with the restriction enforced by the Covid-19 pandemic dramatically changing the traffic patterns in our cities. Funded by the Brussels-based NGO (Transport & Environment), AQC carried out a detailed study in six European cities to identify how the air quality benefits seen during the most stringent phases of lockdown could be replicated by ambitious changes to mobility polices - https://www.aqconsultants.co.uk/news/march-2021/blue-sky-recovery-how-zero-emission-vehicles-and. This gave us the opportunity to unequivocally demonstrate that road traffic emissions lie at the heart of our current air quality problems with regard to nitrogen dioxide, and that we need to make changes to the way in which we travel if we are to deliver the improvements that are required. It also highlighted that road traffic emissions make a relatively small contribution to urban concentrations of $PM_{2.5}$, and if we are to control exposure to this pollutant then additional and alternative actions need to be taken.

And then there are emerging problems. Ultra-Fine Particles (UFPS) are so small (less than one 10 millionth of a metre in diameter) that they effectively have no mass. Whilst we have known about UFPs for many years, our understanding is limited, and little monitoring is carried out even in our major urban areas. There is strong medical evidence that these tiny particles can penetrate very deep into the lung, and can also directly enter the bloodstream or the brain, but as yet, we have no regulatory standards in place to drive the control of exposure. And while interest in



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microplastics has largely focused on the impacts to rivers and oceans, new research is drawing attention to the threat on airborne microplastics to human health, citing road transport as the predominant source in urban environments.

It is tempting to assume that, as time goes on, achieving ambitious climate change goals will deliver all of the necessary air quality improvements. After all, carbon reduction is closely tied to the removal of combustion based energy generation, except where it isn't, such as in biomass burning. Nevertheless, the increase in electric vehicles to the point where they make up most of the vehicle fleet, the banning of new gas boilers, and renewable (non-combustion) electricity generation will bring huge air quality benefits, and specifically in reducing nitrogen dioxide levels. However, carbon reduction will be prioritised to where it is most economically efficient, which is not necessarily where the air quality problems are. Moreover, carbon reduction is unlikely to significantly reduce ammonia emissions from agriculture, or brake, tyre and road wear; in fact, it might make them worse. We will still need dedicated air quality policies to help direct and supplement action on climate change.

This is recognised in the Environment Bill, currently making its way though Parliament, and which will set the groundwork for environmental policy in the UK for the foreseeable future, much as the Environment Act did in 1995. There will be a new target for $PM_{2.5}$ and new long term environmental targets, including for air quality. Defra is currently working out what form these will take and is developing a new approach to population exposure reduction. This, and the policies associated with it, will need a more comprehensive approach to the control of $PM_{2.5}$ if the much anticipated update to the WHO air quality guidelines does what is expected: reduce the guidelines for PM. Achieving an annual average of, say, 7.5µg/m3 across the country will need controls on all sources of PM and its precursors. As road transport becomes less prominent as a source, the spotlight is returning to the sources addressed through the 1956 Act: domestic fuel and industrial processes. The more comprehensive approach, which this implies, bodes well for the children of tomorrow; some will say it can't come soon enough.

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The Logika Group comprises Air Quality Consultants Ltd, Noise Consultants Ltd and Logika Consultants Ltd. The Group supports a wide range of public and private sector clients in the UK and internationally in the provision of services in the fields of air quality, climate change, environmental policy, evaluation and impact assessment, environmental noise, strategic environmental advice, biodiversity, water management green infrastructure and landscape design solutions.

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