

Policy disconnect: A critical review of UK air quality policy in relation to EU and LAQM responsibilities over the last 20 years[☆]

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Abstract

This paper critically reviews United Kingdom (UK) air quality policy in relation to European and Local Air Quality Management (LAQM) responsibilities over the last 20 years. The arguments articulated in this paper highlight the gulf between national and local air quality management in the UK, including differences in legislation, legal responsibilities, scales of operation, monitoring and modelling requirements, exceedence reporting and action planning. It is argued that local authorities cannot be held responsible for the UK's failure to achieve the European Union (EU) nitrogen dioxide (NO₂) limit values due to fundamental differences between local government responsibilities under LAQM and the UK compliance assessment reporting to the EU. Furthermore, unambitious and counterproductive national policies and the failure of EU light-duty vehicle type approval tests and Euro standards to reduce real-world nitrogen oxide (NO_x) emissions [\(Please change 'nitrous oxide \(NOx\) emissions' to 'emissions of nitrogen oxides \(NOx\)'\)](#) are the main reasons for continued NO₂ limit value exceedences. This failure of EU and national air quality policies has effectively undermined local authority action to improve local air quality, resulting in delays in achieving the standards, wasted resources at local and national levels, and, ultimately, unnecessary loss of life and increased morbidity in the UK population. This paper concludes that the current emphasis that the UK government is placing on implementation of Clean Air Zones (CAZs) to achieve the Ambient Air Quality Directive (2008/50/EC) (AAQD), and avoid substantial fines imposed by the European Court of Justice (CJEU), is flawed. Based on the arguments presented in this paper, a series of recommendations is proposed for the European Union, the UK government, devolved administrations and local authorities.

Keywords: Air quality policy; NO₂; Traffic pollution; [Public health](#); LAQM; EU limit values

1 Introduction

Air pollution is a significant global issue. In 2014, the World Health Organization (WHO) declared air pollution to be the world's largest single environmental health risk, with ambient air pollution causing 3.7 million deaths annually ([WHO, 2014](#)). The World Bank has also reported air pollution to be the fourth leading risk factor for premature deaths worldwide, resulting in 1 in 10 total deaths in 2013, at a cost to the global economy of about US\$225 billion in lost labour income ([World Bank and Institute for Health Metrics and Evaluation, 2016](#)). In urban areas, particularly in developed countries, road traffic is often the major contributor to local ambient air pollution and is largely responsible for elevated concentrations of nitrogen dioxide (NO₂), among other pollutants.

Exceedences of the Ambient Air Quality Directive (2008/50/EC) (AAQD) annual mean limit value for NO₂, derived from WHO health-based thresholds, are widespread across much of the UK (and Europe). In 2010, when the annual mean limit value for NO₂ was to be achieved (and five years after the UK's own parallel domestic NO₂ objectives should have been met), the UK was in breach of regulations in 40 (93%) of its 43 designated zones and agglomerations. The UK Government Department for the Environment, Food and Rural Affairs (Defra), which is responsible for compliance reporting against the AAQD to the European Commission, applied for a Time Extension Notification (TEN) of five years for 24 of its exceeding zones and agglomerations in September 2011, leaving the remaining 16 areas of exceedence in breach of the AAQD, resulting in infraction proceedings launched by the European Commission against the UK government in February 2014.

It is the European Commission's legal action against the UK government for its failure to achieve the annual mean limit value for NO₂ by ~~1st January 2010~~ [1st January 2010](#), as set in the AAQD, and the potential that this poses for the imposition of substantial fines by the European Court of Justice (CJEU) that set the policy context for the paper.

Within this context, in the same year that the government applied for the TEN, the UK Localism Act 2011 (Part 2) introduced a legal framework enabling fines imposed on national government by the EU to be passed down to local government. On receipt of the

infraction proceedings from the European Commission, Defra also reinforced this by sending an email to all local authorities reminding them of the discretionary powers of the Localism Act (Defra, 2014). This is despite an amendment to the Act, lobbied for by the UK Local Government Association (Local Government Association, 2011), which requires the local authority to have to have had a responsibility to comply with the AAQD, and despite local authorities not having any say over which zones or agglomerations were included in the TEN application.

Defra reported that in 2015 (the latest available data and the year by which the extension period granted by the European Commission expired) only six zones and agglomerations met the limit value for annual mean NO₂ (Defra, 2016a) and that exceedances are likely to continue until at least 2025 in eight urban areas (Defra, 2015a), meaning that rather than just the 16 zones and agglomerations currently subject to infraction proceedings, there are actually 37 areas currently reported in breach of the AAQD. Three years after its initial proceedings were launched, the European Commission (2017) issued a 'final warning' to the UK, escalating the potential for fines if the UK government cannot produce plans setting out 'appropriate measures, so that the exceedance period can be kept as short as possible' as per Article 23 of the AAQD.

The UK's decision to leave the EU means the AAQD may lose its relevance to UK air quality policy in the longer term. However, the process of leaving could take up to 2021, as the UK Prime Minister invoked Article 50 of the Treaty on European Union, the means by which a Member State officially gives notice of its intention to withdraw from the EU, on 29th March 2017, and has recently announced an intention to seek to extend the withdrawal process for two years beyond the original 2019 deadline. It is not clear what may happen if the European Commission imposes fines within this negotiation period, or whether, since the infraction proceedings were initiated within the period of EU membership, liability for fines would remain regardless of 'Brexit'.

The final warning, issued by the European Commission to the UK in February 2017, was also issued to Germany, France, Spain and Italy for their failure to address repeated breaches of air pollution limits for NO₂. It is clear that the inability to achieve the NO₂ limit value is widespread, with exceedances in 23 of the 28 Member States and infringement proceedings against 12 of them (European Commission, 2017). This critical examination of UK air quality policy may therefore have broader applicability for the majority of EU Member States as well as for other countries seeking to implement the EU model of air quality management.

Governments of many of the world's most polluted cities, particularly in developing nations, look to the EU and UK approach to air quality management as an example of better practice, for example in India (Gulia et al., 2015) and South Africa (Naiker et al., 2012). While it is clear that there has been considerable success in minimising exposure to industrial and domestic emissions since the Clean Air Act 1956 (Longhurst et al., 2016), the UK has not yet managed to achieve the same for road traffic, despite 20 years of air quality policy seeking to reduce traffic pollution (Longhurst et al., 1996; Beattie et al., 2001; Longhurst et al., 2006; Longhurst et al., 2009; Barnes et al., 2014).

This paper adds to this body of evidence critically reviewing the UK government's approach to managing traffic-related pollution, particularly NO₂, over the last two decades in order to present an appraisal of its achievements and limitations upon which lessons, both positive and negative, may be learnt. The unique premise for this paper, however, is its criticism of the dual approaches implemented in responding to separate EU and UK air quality legislation for NO₂. It is argued that local authorities cannot be held responsible for the UK's failure to achieve the EU limit values due to fundamental differences between local government responsibilities under Local Air Quality Management (LAQM) and the UK compliance assessment reporting to the European Commission. Furthermore, it is argued that unambitious and counterproductive national policy and the failure of EU light-duty vehicle type approval tests and Euro standards to reduce real-world NOx emissions are the main reasons for continued limit value exceedances. This failure of EU and national air quality policy has effectively undermined local authority action to improve local air quality, resulting in delays in achieving the standards, wasted resources at local and national levels, and, ultimately, unnecessary loss of life and increased morbidity in the UK population.

This premise is based on extensive policy research (Longhurst et al., 1996; Beattie et al., 2001; Longhurst et al., 2006; Longhurst et al., 2009; Barnes et al., 2014), and more than 60 person years' cumulative experience of the authors developing air quality policy in other countries, advising the European Commission on its review of the AAQD, assisting Defra and the Devolved Administrations with conducting the Review and Assessment aspect of LAQM, including contributing to the development of statutory guidance, and working with local government in fulfilment of their LAQM responsibilities.

1.1 Impacts of NO₂ exceedances in the UK

The ambient air quality objectives and limit values set in UK and EU legislation are derived from health-based standards, originally published by the WHO in 1987 and subsequently revised and interpreted by UK governmental advisory groups (Jones et al., 2016). In a recent review of the growing body of epidemiological and mechanistic evidence, the Committee on the Medical Effects of Air Pollution (COMEAP, 2015, p.5) stated that, as well as being a marker of the effects of other traffic-related pollutants, "...evidence now suggests that it would be sensible to regard NO₂ as causing some of the health impact found to be associated with it in epidemiological studies". Furthermore, evidence suggests that, similarly to fine particulates, NO₂ is a non-threshold pollutant (Jarvis et al., 2010; WHO, 2013) indicating that health effects are experienced at concentrations below the WHO standards (and consequently the existing EU limit values and national ambient air quality objectives).

Based on recommendations from COMEAP, Defra have revised previous estimates of the UK annual equivalent attributable deaths (29,000 based purely on long-term exposure to anthropogenic PM_{2.5} (COMEAP, 2010)) to include both PM and NO₂. The combined mortality (44,750 → 52,500 p.a.) is therefore greater than the combined impacts of obesity (~30,000 deaths), alcohol consumption (8697) and road traffic accidents (1732), and has an associated social cost in the range £25.3bn → £29.7bn and productivity costs of £2.6bn (Public Health England, 2016; Office for National Statistics, 2016; Department for Transport, 2016a; Defra, 2015b; Ricardo-AEA, 2014). With 81.5% of the 2011 population of England and Wales living in urban areas (Office for National Statistics, 2013), the potential for acute and chronic effects of traffic-related pollutants, including PM and NO₂, is substantial. In addition to the health effects and consequent cost of air pollution, there are also significant additional social impacts. With the young, elderly and infirm, and those living in the most deprived areas (Brunton et al., 2017), most at risk, there are environmental justice implications as families with young children and those living in poverty are more likely to reside in areas with the highest NO₂ and road NOx, although households in more affluent areas provide the greatest per household contribution to road NOx emissions by owning more vehicles, having on average higher household NOx emissions from private vehicles and driving further distances than poorer households (Barnes and Chatterton, 2016).

1.2 UK air quality policy

The UK has operated a twin-track approach to air quality policy since the UK Environment Act 1995 and the EU Air Quality Framework Directive (Council Directive 96/62/EC). At an EU level, the UK national government has a responsibility to comply with EU air quality legislation, such as the National Emissions Ceiling Directive (2001/81/EC) (now revised NECD 2016/2284/EU) and the Ambient Air Quality Directive (2008/50/EC), with responsibility for the latter devolved to the national administrations of England, Scotland, Wales and Northern Ireland, although Defra coordinates assessment and air quality plans for the UK as a whole.

At a national level, UK legislation (Environment Act 1995, Part IV) sets out national air quality objectives, embodied in statutory regulations, and a strategy requiring local government, through the LAQM regime, to identify and address local 'hotspot' exceedences of these air quality objectives and develop Air Quality Action Plans that complement action taken at a national level (Longhurst et al., 1996; Beattie et al., 2001; Longhurst et al., 2006; Longhurst et al., 2009; Barnes et al., 2014).

On the face of it, this subsidiarity approach would appear to be pragmatic, providing the scope for local management of sources to contribute to the reduction of pollutants to enable compliance with both national and European air quality legislation. The lack of commonality between the EU and national legislation, however, has meant that these twin approaches have not been adequately integrated within UK air quality policy, thereby undermining the potential for LAQM to contribute to achievement of the EU limit values. This paper explores this lack of integration.

2 Exploring the differences between EU and UK air quality legislation

Underpinning the twin-track approach to air quality policy in the UK are two different sets of regulations. The Air Quality (Standards) Regulations 2010 (preceded by the Air Quality Limit Values Regulations 2001) transposed into English law the requirements of the AAQD (2008/50/EC) and the 4th Daughter Directive (2004/107/EC), with equivalent regulations made by the devolved administrations (DAs) in Scotland, Wales and Northern Ireland. These Air Quality (Standards) Regulations therefore set out EU limit values for which Defra is the competent UK authority for ensuring compliance. The Air Quality (England) Regulations 2000 (amended 2002), however, set the national objectives for national and local governments in England with equivalent regulations set for the DAs (Table 1).

Table 1 Differences between UK implementation of EU AAQD and local air quality management. (I have added in markers before the headings in column 1 as when formatted the table rows are not clearly demarcated.)

| | EU AAQD | UK LAQM |
|---|--|--|
| Legislation | The AAQD (2008/50/EC) and the 4 th Daughter Directive (2004/107/EC) transposed into English law by the Air Quality (Standards) Regulations 2010 (preceded by the Air Quality Limit Values Regulations 2001) | The Air Quality (England) Regulations 2000 (amended 2002) |
| Responsibility | National government (Defra) | National governments and local authorities (although local authorities are only required to <i>work in pursuit</i> of the objectives) |
| Annual mean NO ₂ deadline | 1 st January 2010 (1 st January 2015 under TEN) | 31 st December 2005 |
| Scale of operation | 43 zones and agglomerations based on population size | 389 local authorities |
| Scale of NO ₂ annual mean limit value/ air quality objective exceedences | 37 (86%) zones and agglomerations (2015) | 613 Air Quality Management Areas (AQMAs) in 259 (67%) local authorities (September 2016) |
| Relevant exposure | As determined by the averaging period of the limit value. | As determined by the averaging period of the air quality objective, e.g. building facades of residential properties, schools, hospitals and care homes (annual mean NO ₂ objective) |
| Monitoring requirement | At least one monitoring station per zone/agglomeration, representing a maximum 100,000 km ² , where concentrations are highest and there is relevant exposure | No legal requirement to monitor, but recommended assessment should be made at the 'worst-case' location representative of relevant exposure |
| Monitoring site scale | Representative of street segments no less than 100 m in length, with traffic-oriented sampling at least 25 m from major junctions and no more than 10 m from the kerbside | 'Roadside' monitoring within 1–5 m (up to 15 m) from the kerb of a busy road; narrow, congested streets and junctions where there is a relatively high volume of traffic and relevant exposure |
| Monitoring site type (NO ₂) | Chemiluminescence | Chemiluminescence (or other MCERTS-approved monitor) and/or Palmes-type diffusion tubes |
| Monitoring site classifications | Urban/Suburban/Rural and Traffic/Industrial/Background | Urban centre, Urban background, Suburban, Roadside, Kerbside, Industrial, Rural and Other |
| Model | Pollution Climate Mapping (PCM) model | Dispersion modelling, e.g. ADMS-Roads |
| Model resolution | Background concentrations of NO ₂ at 1 km ² resolution and roadside NO ₂ for ~10,000 major road links nationally | Urban hotspots and locally-managed roads (~10 m ²) |
| Meteorological data | Single site (Waddington) | Local/regional representative site |

| | | |
|-----------------------------|------|------|
| Model verification accuracy | ±30% | ±25% |
|-----------------------------|------|------|

Although the EU limit value thresholds to be achieved under the Air Quality (Standards) Regulations are largely the same as the national objective thresholds under the Air Quality (England) Regulations, the achievement deadlines differ for many pollutants, including NO₂ (Table 1). For example, the annual mean NO₂ limit value of 40 µg/m³ (Please can you add a space between the superscript 3 and the footnote identifier as the numbers run together as 31.) was to be achieved by 1st January 2010. The AAQD also introduced the option for Member States to apply for an extension period of up to five years on the NO₂ limit value deadline up to 1st January 2015. As stated in the introduction, the UK government exercised this option in applying for an extension in 24 of the 40 exceeding zones in 2011 (European Commission, 2012). The Air Quality (England) Regulations 2000 (amended 2002) specified an achievement deadline for the 40 µg/m³ annual mean NO₂ objective of 31st December 2005. However, as stated in section 84(2) of the 1995 Environment Act, local authorities were only required to work “in pursuit of the achievement” in recognition that they cannot be held solely responsible for air pollution occurring in their areas due to transboundary emissions and sources beyond their control. Furthermore, as the 2007 Air Quality Strategy for England, Scotland, Wales and Northern Ireland states: “The air quality objectives in the Air Quality Strategy are a statement of policy intentions or policy targets. As such, there is no legal requirement to meet these objectives except in as far as these mirror any equivalent legally binding limit values in EU legislation” (Defra, 2007, p. 15).

By operating dual sets of regulations, applicable to national and local governments separately, with differing dates of achievement, the UK government divorced local air quality management from the goal of achieving EU limit values. Local government has no responsibility to achieve the Air Quality (Standards) Regulations (which transpose the AAQD), but the Air Quality (England) Regulations 2000 (amended 2002) (which are relevant for local authorities) are not directly related to the EU legislation. Indeed, the Environment Act (Part IV) (84 2b) requires local authorities only to work in pursuit of the national air quality objectives, in recognition that their jurisdictions are subject to sources beyond their control. In recent years, Defra, under their review of LAQM consultation, has attempted to streamline the two sets of regulations (Defra’s preferred Option (3) in the 2013 round of consultation (Defra, 2013a)) in order that local authorities may work towards achieving the EU limit values directly. However, this plan was not taken forward following concern from consultees that this would neglect local exceedences (Defra, 2013b) and therefore remove the prime purpose of LAQM. Nevertheless, moves towards alignment continue for other pollutants with the latest LAQM Policy Guidance (LAQM.PG (16)) stating that local authorities in England now have a “flexible role in working towards reducing emissions and concentrations of PM_{2.5}” (Defra, 2016b, p.7), and in Scotland a new air quality objective has been introduced for PM_{2.5} to assist national government in attaining its EU target and limit values for this pollutant.

2.1 Scales of operation

A key difference between EU and UK air quality legislation is their relative scales of operation (Table 1). The AAQD requires Member States to designate zones and agglomerations based on population size, with agglomerations representing those zones with more than 250,000 inhabitants or in excess of a Member State-defined population density. In the UK this results in 43 zones and agglomerations, within which the government is required to assess air quality exposure and report on compliance against the limit values set out in the AAQD to the European Commission.

By contrast, under the LAQM regime, compliance with the national air quality objectives is devolved to local authorities, of which there are 389 in the UK, covering unitary and metropolitan authorities, boroughs and districts. (This does not include ‘upper-tier’ county authorities, which although having transport management responsibilities do not have air quality management responsibility.) With the UK’s zones and agglomerations having been based on subsequently abolished Government Office Regions (which had never had any jurisdiction for air quality), there is no clear geographical relationship between these and the local authorities, i.e. boundaries are not coterminous and local authorities often fall within more than one zone or agglomeration (Figs. 1 & 2). This is despite European Commission advice that zones should be related to administrative areas for the purposes of management (European Commission, 2004). The effect of this lack of geographical ‘nesting’ is that reporting against the national air quality objectives cannot be easily aligned with reporting against the EU limit values, and that, in the event of implementation of the Localism Act 2011 (Part 2), responsibility for non-compliance in any zone or agglomeration could not therefore be directly attributed to particular local authorities.

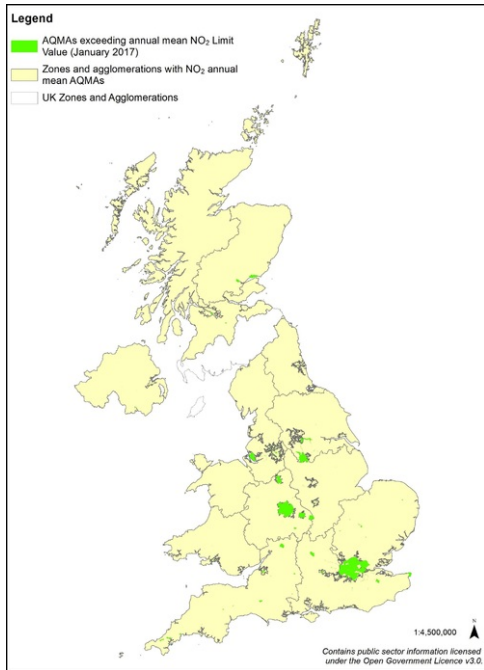


Fig. 1 AQMAs and Zones and Agglomerations (January 2017) [\(for colour image please view online\)](#).

alt-text: Fig. 1

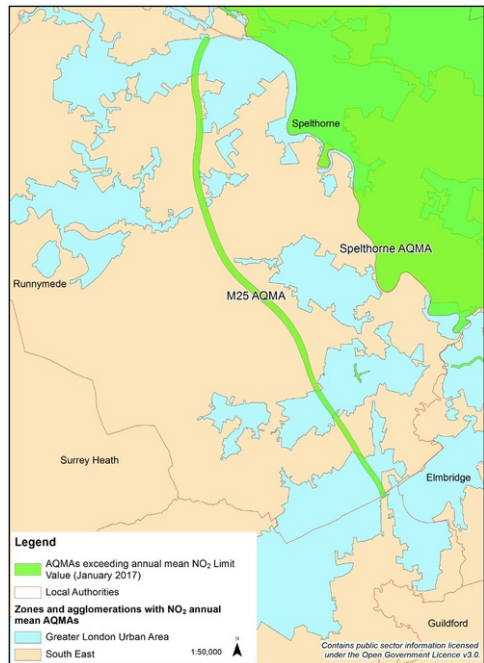


Fig. 2 M25 AQMA in Runnymede and Spelthorne AQMA demonstrating non-contiguity with the South East Zone and Greater London Agglomeration [\(for colour image please view online\)](#).

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2.2 Assessing the risk of exceedence

2.2.1 Monitoring

Under EU legislation, compliance assessment takes the form of monitoring (which may be supplemented with modelling). Each zone/agglomeration should have at least one monitoring station representing a maximum 100,000 km² where concentrations are highest and there is relevant exposure. In addition, macroscale siting criteria set out in Annex III of the Directive require sampling points to be representative of street segments no less than 100 m in length, with traffic-oriented sampling at least 25 m from major junctions and no more than 10 m from the kerbside. In 2015, Defra operated an Automatic Urban and Rural Network (AURN) of 131 monitoring sites for the purposes of reporting to the European Commission, using the mandatory reference method described in EN 14211:2005 'Ambient air quality — Standard method for the measurement of the concentration of nitrogen dioxide and nitrogen monoxide by chemiluminescence' (Defra, 2016c). To ensure a standardised and rigorous approach, Quality Assurance and Control (QA/QC) for the entire AURN is undertaken by one organisation, Ricardo Energy & Environment (AEA Group, 2009).

Under LAQM, local authorities are required to 'review and assess' ambient concentrations in their jurisdictions against the national air quality objectives. Assessment should be made at 'worst-case' locations representative of relevant exposure. According to the government's Technical Guidance LAQM.TG(16), a typical 'roadside' monitoring location should be "within one to five metres of the kerb of a busy road (although distance can be up to 15 m from the kerb in some cases)" (Defra, 2016d, p.7-40). Furthermore, local authorities are explicitly required to assess NO₂ at narrow, congested streets and junctions where there is a relatively high volume of traffic and relevant exposure, i.e. beyond the requirement of the AAQD.

The local authority reference method for monitoring NO₂ is chemiluminescence, however local authorities are also permitted to use alternative MCERTS-approved continuous monitors. In addition, passive monitoring, e.g. Palmes-type diffusion tubes, are also widely used as a cheaper and more easily-sited substitute for continuous monitoring (Defra, 2016d). However, some local authorities that have previously demonstrated likely compliance with the national air quality objectives do not operate, or, given that there is no explicit requirement for local authorities to monitor, in some cases have never operated, any monitoring regime. Where necessary, operation and QA/QC of local authority monitoring sites is normally assigned to Environmental Health Officers (EHOs). Some local authority-run monitoring sites do meet EU legislative requirement on quality, siting, etc. and are affiliated to the government's AURN but, despite efforts to standardise monitoring procedures and reporting through the implementation of technical guidance provided by Defra, there are inevitably inconsistencies between local authorities, for example in identification of suitable monitoring locations and in interpretation of the data (Woodfield et al., 2003; Barnes, 2014).

As of September 2016 there were 613 Air Quality Management Areas (AQMA) in up to 259 local authorities (Table 1) representing exceedences of the national air quality objective for annual mean NO₂ (Defra, 2016a). On that basis, even with affiliated local authority-run sites, there are insufficient AURN monitors to report against all local exceedence sites, necessitating a reliance on local authority monitoring to identify local hotspots. Inconsistencies between EU and LAQM monitoring requirements, however, mean that data from many local authority monitors are not reportable to the European Commission for the purposes of UK compliance assessment. Hence, the opportunity for local assessment to contribute to national reporting has not been fully utilised.

As well as differences between AURN and LAQM siting criteria, monitoring types and quality assurance, there are also discrepancies between site classifications (Table 1). EU compliance assessment under the AAQD has formal definitions relating to nomenclatures for site types reflecting environment and source, e.g. Urban/Suburban/Rural and Traffic/Industrial/Background. Local authority monitoring site types, however, have been loosely classified in the Technical Guidance (LAQM.TG(16)) as: Urban centre, Urban background, Suburban, Roadside, Kerbside, Industrial, Rural and Other, with no clear link between the two sets of definitions. In practice, this has resulted in local authorities identifying their AURN-affiliated sites in their LAQM reports using different classifications to those used by Defra to report the same sites to the European Commission. In the draft 2016 LAQM Technical Guidance, Defra proposed a synchronisation of the EU-approved and LAQM site classifications, albeit on a voluntary basis (Defra, 2015c); however, this recommendation was rescinded in the final version of the guidance, presumably to avoid confusion.

2.2.2 Atmospheric dispersion modelling

For the purposes of compliance assessment against the AAQD, in the UK (and the Netherlands) the national monitoring network is supplemented with modelling (Carslaw et al., 2013). The UK Pollution Climate Mapping (PCM) model represents background concentrations of NO₂ on a 1-km² resolution and roadside NO₂ for approximately 10,000 major, nationally-managed, trunk road links (Ricardo-AEA, 2015), using the National Atmospheric Emissions Inventory (NAEI) and COPERT emission factors, with meteorological data from a single weather station site (Waddington), to estimate NO_x and NO₂ concentrations across the UK. The model is calibrated using data from national monitoring network sites with >75% data capture. A combination of these national sites and approved local authority automatic monitoring sites are then used to verify that modelled NO₂ concentrations are within ±30%, i.e. the data quality objective (DQO) specified in Annex 1 of the AAQD. The spatial representivity of verification sites, however, is not assessed, and, although agreement between modelled and monitored NO₂ at background sites is generally good (R² = 0.71), there is poor agreement at roadside sites (R² = 0.45), with modelled concentrations failing to achieve the DQO at more than a third (34.9%) of the verification sites (Ricardo-AEA, 2015). In a comparison between AURN background sites and the 1-km² background maps, however, the Defra maps have been found to under-predict the background NO_x and NO₂ concentrations by 20.8% and 10.2% on average, respectively in 2016 (Air Quality Consultants, 2017). The government also uses the PCM model to make future year projections on the likely achievement of limit values for the purposes of developing air quality plans that demonstrate compliance in the shortest possible time, as per Article 23 of the AAQD. As discussed in Section 2.3 below, the accuracy of COPERT emission factors, on which the PCM model forecasts are based, has called into question the reliability of those projections.

Local authorities may also undertake dispersion modelling to supplement monitoring data in order to better understand the extent and local distribution of UK air quality objective exceedences. Contour maps are commonly used to identify the extent of an exceedence prior to declaration of an AQMA, and dispersion modelling can also be used to estimate source apportionment to inform the development of local air quality action plans. A range of local or regional forecast models are used to assess the impact of proposed measures for action plan development, and traffic and

land-use planning. In order to accurately reflect local conditions, local dispersion modelling is therefore at a much finer spatial resolution (~10 m²) than national modelling and more locally detailed, normally utilising regional meteorological data, local traffic count data, road widths and building heights. Modelled outputs are verified against local monitoring sites, often diffusion tubes in the absence of automatic monitors, and adjusted to within ±25%, or preferably ±10%, of the measured data (Defra, 2016d).

Although national modelling provides estimates of background concentrations and contributions from nationally-managed roads, it does not attempt to accurately model concentrations in urban areas or contributions from locally-managed roads. According to Defra, this is the responsibility of local government, but despite the relative spatial precision, a lack of resourcing to generate high quality input data and a reliance on relatively low-quality sensors to verify and adjust model outputs, means that there is often a high level of uncertainty inherent in local dispersion modelling. In addition, recognised inaccuracies between real-world emissions and the COPERT emission factors, on which both local and national models rely, calls into question the validity of modelled outputs at all scales. Indeed, local authorities are advised that, where representative local background monitoring data are available, these should be used to verify Defra's modelled background maps (Defra, 2016d).

2.2.3 Exceedence and exposure

Although the principle of relevant exposure in relation to the averaging period of the limit value/air quality objective is enshrined in both the AAQD (Annex III B 1(a)) and LAQM Technical Guidance (LAQM.TG(16)) respectively, the differences between the respective scales of assessment highlighted above (2.2.1 and 2.2.2, 2.2.1 and 2.2.2) mean that there are inconsistencies in how these translate into reported exceedences. There are instances where local authorities have identified exceedences of the UK air quality objectives, which are not reflected in Defra's reporting of EU limit value exceedences. For example, Blackpool and Preston, agglomerations were reported as compliant with the annual mean limit value for NO₂ in 2013 (Defra, 2015a), but, according to the 2014 LAQM Progress Reports (Blackpool Borough Council, 2014; Preston City Council, 2014), had active AQMAs (Figs. 3 & 4) and measured exceedences at sites of relevant exposure in that year. Highland and Northern Ireland zones were also reported as achieving the EU limit value for NO₂ in 2015, but have AQMAs (e.g. Inverness) in January 2017 (Fig. 1). Even within zones and agglomerations reported as non-compliant, the extent of exceedences is often underreported by Defra as, while modelling arguably registers more areas of exceedence than monitoring alone, neither AURN monitors nor PCM modelling capture local pollution hotspots where relevant public exposure exists.

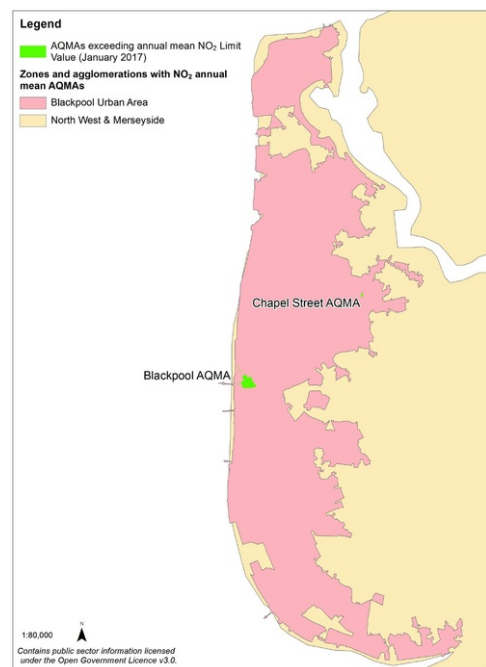


Fig. 3 Blackpool Urban Area with NO₂ annual mean AQMAs (for colour image please view online).

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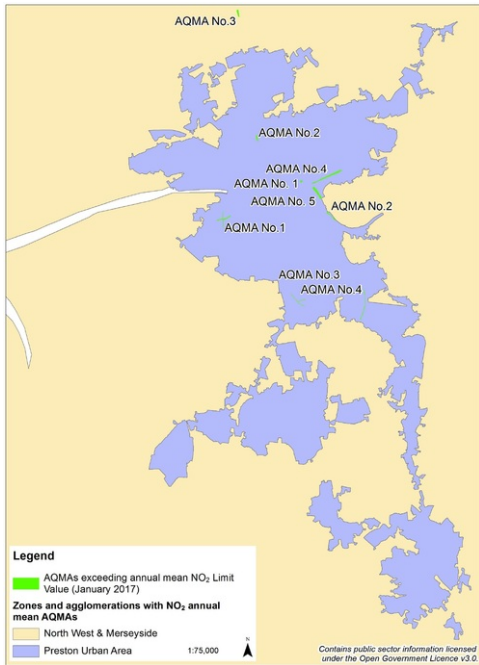


Fig. 4 Preston Urban Area with NO₂ annual mean AQMAs. [\(for colour image please view online\)](#).

alt-text: Fig. 4

2.3 Action planning

The differences between the diagnosis of air quality exceedences nationally and locally, as identified in [Section 2.2](#), continues with the management of air quality through their respective action plans. The obvious differences between national and local governments' scope, scale, resources and powers provides another key opportunity for local and national measures to be complementary, with national actions dealing with the broader, underlying issues cross-departmentally, which in turn facilitates implementation of local actions to reduce concentrations in hotspot locations ([Beattie et al., 2001, 2004](#)). In reality, however, the effectiveness of this elegant solution has been undermined by ineffectual leadership from national government and a lack of coordination between national and local actions ([Barnes, 2014](#)), as illustrated in these sections.

Article 23 of the AAQD requires Member States to produce air quality plans where exceedences of the limit values occur and Annex XV sets out the information to be included in the local, regional or national air quality plans for improvement in ambient air quality, including measures proposed; local, regional, national and international measures adopted prior to the AAQD and their effects; measures adopted following the AAQD, including timetables for implementation, estimated improvement in air quality and expected timescale to achieve limit values; planned long-term measures; and supporting evidence.

The 2007 Air Quality Strategy for England, Scotland, Wales and Northern Ireland, and its predecessors in 1997, 2000 and 2003, set out the national and local approaches to meet the national air quality objectives. Whilst acknowledging that the 2005 objective deadline had been missed and that many urban areas and major roads would continue to exceed by the AAQD deadline in 2010, the 2007 Strategy only recommended three new measures:

- Incentivising the early uptake of new tighter European vehicle emissions standards (Euro-standards);
- Increased uptake of low emission vehicles;

Reducing emissions from ships: [Reducing emissions from ships](#).

These limited measures rely primarily on future improvements in European emission standards, despite recognising their limited effectiveness to date. The Strategy also suggested that, at a local level, encouraging modal shift and active travel could be effective. The lack of ambition apparent in the 2007 Strategy has unsurprisingly resulted in similarly weak UK air quality plans.

The air quality plans submitted by Defra as part of their 2011 TEN application were partially rejected by the European Commission for lacking ambition and relying on discretionary implementation of Low Emission Zones by local authorities (European Commission, 2012). Environmental law group, ClientEarth, initiated legal proceedings against the UK government's interpretation of the AAQD as the TEN application did not include those zones and agglomerations that Defra's models indicated would not be able to achieve the limit value within the permitted five-year extension period. The case, which was heard in the UK High Court, Court of Appeal and UK Supreme Court and was referred to the CJEU, eventually resulted in a Supreme Court ruling [2015] UKSC 28 that the UK government must submit an air quality plan to the European Commission by 31st December 2015 that would set out measures to bring concentrations of NO₂ within legal levels as soon as possible in accordance with Article 23(1) of the AAQD (UK Supreme Court, 2015). In commenting on the government's previous air quality plans, the Supreme Court judge also noted that: "*the Commission observed that there appeared to have been a choice of 'less expensive and intrusive measures' than those that would be required to put an end 'to a string of continuous breaches of the limit values'*" (UK Supreme Court, 2015, p.7).

Although the Commission's response to the UK's Air Quality Plan (Defra, 2015a), duly submitted at the end of 2015, has yet to be heard, the UK High Court has already ruled on its inadequacy. In his ruling dated 2nd November 2016, Mr Justice Garnham quashed the Air Quality Plan (AQP) stating: "*In my judgement, the AQP did not identify measures which would ensure that the exceedance period would be kept as short as possible; instead it identified measures which, if very optimistic forecasts happened to be proved right and emerging data happened to be wrong, might achieve compliance. To adopt a plan based on such assumptions was to breach both the Directive and the Regulations.*" (UK High Court, 2016, para. 86). Garnham's criticisms of the 2015 AQP cited evidence that ministers had knowingly favoured the most optimistic modelled NO₂ forecasts. By relying on unrealistic COPERT emission factors the modelled exceedance areas and compliance forecasts are likely to have underestimated the challenge that the action plan seeks to address and therefore the proposed actions are unlikely to be sufficient to meet the AAQD requirement of ensuring the exceedance period will be kept "*as short as possible*" (Article 23(1)).

The government was thus ordered to produce a revised draft AQP by 24th April 2017 and a final plan by 31st July 2017, a tightening of Defra's formerly proposed deadline of September 2017, which the High Court ruled as "*far too leisurely*". Further proposed delays to the plan were also thwarted as a late request, received from the government on 21st April 2017, for a 'purdah'² extension to the draft AQP deadline until after the June General Election was refused by the High Court on 27th April. An extension until 9th April. An extension until 9th May, after local elections was permitted (ClientEarth, 2017a), however the draft plan (JAQU, 2017), which was released for consultation on 5th May 2017 and the final plan, published 26th July 2017, have received criticism from ClientEarth (2017b; 2017c) for their reliance on the voluntary implementation of non-charging Clean Air Zones (CAZs).

Under consultation, Defra's 2015 AQP was also heavily criticised for its reliance on local authority implemented CAZs (Defra 2016e). According to Defra, implementation of its AQP meant that modelled exceedances would be limited to six cities by 2020. Leaving aside London, where an Ultra Low Emission Zone (ULEZ) is planned for 2019, the 2017 plan set out requirements for the remaining five cities (Birmingham, Leeds, Nottingham, Derby and Southampton) to implement mandatory CAZs based on Euro vehicle standard restrictions, and instructing 22 other local authorities to submit draft CAZ feasibility studies by March 2018. Implementing Euro vehicle standard restrictions would therefore require local authorities to be able to identify the Euro standard of vehicles entering the CAZ, however currently national vehicle records held by the Driver Vehicle Licensing Agency (DVLA) do not systematically or consistently link vehicle number plates with emission standards making implementation of an efficient and effective system impossible. The UK Department for Transport (DfT) is investigating how this may be reconciled, however without comprehensively amending historic records for all vehicles in the DVLA database it is difficult to see how this can be achieved. Critically, in both of the 2015 and 2017 AQPs, the government does not mandate cities to implement a charging CAZ that includes private cars, motorcycles or mopeds. Local authorities may choose to implement a CAZ that extends to cars (Class D), but the proposed framework recommends that Euro 6 (diesel) or Euro 4 (petrol) cars should be allowed free entry (Defra, 2016f). This is despite evidence that real-world NOx emissions from Euro 6 diesel cars are on average twice as high as Euro VI heavy duty vehicles on a per vehicle kilometre basis and ten times higher per litre of fuel used (ICCT, 2016).

The UK national government has consistently adopted an overly simplistic approach to achieving the limit values, relying on the implementation of stricter vehicle emission standards to achieve emission reductions under the NECD targets, with the expectation that these would result in commensurate reductions in concentrations. This strategy assumed that the type approval tests, which assess and pass new vehicle emissions, were reflective of real-world driving conditions. The fallibility of this assumption has long been of concern for researchers (Kågeson, 1998) as the type approval tests had not been designed for that purpose, and discrepancies between test-derived emission factors and real-world emissions measurement had been identified in the first decade of the 21st century (Carslaw et al., 2011; Williams and Carslaw, 2011; Carslaw and Rhys-Tyler, 2013, Fontaras et al., 2014). Following the revelation of the 'dieselgate' scandal in October 2015 in which Volkswagen admitted using 'defeat devices' in some models to reduce emissions under test conditions, an independently-reviewed investigation of the most recent Euro 5 and 6 models of diesel light duty vehicles, carried out by the UK Department for Transport (2016b), found that on average on-road NOx emissions were six times greater than the test limits. The findings of the DfT report, therefore, confirmed critics' suspicions and seriously undermined Defra's 2015 AQP (ClientEarth, 2016).

The failure of Euro standards to deliver the expected emission reductions has been cited by Defra in defence of its inability to achieve the NO₂ limit value (UK Supreme Court, 2015) (i.e. prior to the preparation of its 2015 AQP that based forecast improvements on the future success of Euro standards). In recognition of the limitations of laboratory test cycles to reflect real-world emissions, the European Commission has introduced the use of Portable Emissions Measurement (PEM) to the type approval tests for light duty vehicles to provide an assessment of real-driving emissions (RDE). Defra's AQP (2015a, p.13) claimed that the "*UK has been pushing strongly for action to ensure that emissions testing works in practice for light duty vehicles*", however the setting of 'conformity factors'³ under the proposed new tests will allow motor manufacturers to exceed emission standards by up to 110% for all new vehicles up to September 2019 and then by 50% by January 2021 (European Commission, 2015). Although an improvement on the current discrepancies identified between real-world and test emissions, this permitted leeway on achievement of the Euro standards means that real-world emissions are likely to continue to exceed test values and therefore Defra's forecasts based on their achievement will be overestimated.

The European Commission has also indicated that it believes the UK did not go far enough in ensuring motor manufacturers were held to account over emission testing, having launched additional legal proceedings against the UK, and six other Member States, for failing to penalise the use of illegal defeat devices in type-approval tests and, additionally, for "*refusing to disclose, when requested by the Commission, all the technical information gathered in their national investigations regarding potential nitrogen oxide (NOx) emissions*

irregularities in cars by Volkswagen Group and other car manufacturers on their territories" (European Commission, 2016).

While national Air Quality Plans should have the capacity to be able to reduce background concentrations of pollutants, the role of LAQM is to focus on local hotspots. Following declaration of an AQMA, local authorities are required to produce Air Quality Action Plans (AQAPs) setting out measures to work in pursuit of reducing concentrations below the air quality objectives. In England, these AQAPs can be incorporated within an authority's Local Transport Plan, where the exceedences are traffic-related (Defra, 2005). The production and implementation of an AQAP necessarily relies on engagement and support from departments across the authority (or even between two-tier district and county authorities), in particular those departments with responsibility for transport and land-use planning (Beattie et al., 2001, 2004).

Resources (both financial and staff) are also a significant limiting factor in the ability of local authorities to be able to implement effective measures and strategies. In recent years, Defra's Air Quality Grant, a competitive scheme by which all local authorities in England bid annually for funding to help improve air quality, has decreased from £2m to £0.5m p.a. (although in the 2016/17 round this has been increased to £3.7m (Defra, 2017c)). At the same time, severe cuts in local government central funding have reduced personnel, leading to a loss of local knowledge and capabilities, and curtailed investment in previously proposed AQAP measures (Moorcroft and Dore, 2013).

Ultimately, the effectiveness of local authorities' measures to reduce local hotspots are limited by the effectiveness of national air quality policy to reduce background concentrations of NO₂ and by national transport policy as it is this that sets the overall context of vehicle usage across the country. As has been seen, the effectiveness of national air quality plans has been heavily criticised in the UK courts and by the European Commission. The following section highlights how a lack of interdepartmental responsibility has also undermined the effectiveness of air quality policy both nationally and locally.

2.3.1 Lack of interdepartmental responsibility

Increasing interdepartmental responsibility was one of the key recommendations of each of the three House of Commons Environmental Audit Committee (EAC) reviews (House of Commons Environmental Audit Committee, 2010; House of Commons Environmental Audit Committee, 2011; House of Commons Environmental Audit Committee, 2014), in which they identified a lack of joined-up policy and failure of departments to understand policy impacts on air quality. Indeed, in their final report the EAC were heavily critical of the government stating: "*Our main recommendations for the Government in 2010 and 2011 were not implemented, prompting our third Inquiry in the hope that this time the Government will take this as seriously as we do. It is unacceptable that a whole generation of people living in our towns and cities could have their health seriously impaired by air pollution above EU limits before the Government brings this public health problem under control. It should not need a European court case to focus Government attention on air pollution. [...] The challenge for policy makers is that no one single solution can solve this problem and no one single department has all the necessary levers.*" (House of Commons Environmental Audit Committee, 2014, p. 37).

However, perhaps one of the key reasons for the failure of air quality policy has been its treatment as an 'environmental' issue. Whilst it is true that air pollution has environmental impacts, for example deposition of nitrates on vulnerable ecosystems, the detrimental effects of ozone on agricultural crops, and climate impacts of sulphates, ozone and particulate matter, the primary driver for EU and UK air quality policy has been the protection of human health. However, apart from expert advisory groups such as COMEAP, public health bodies have never been at the fore in developing or implementing air quality policy either locally or nationally (Beattie et al., 2001, 2004; Brunt et al., 2016). More recently, Public Health England (Defra, 2017a), the Royal College of Physicians (RCP, 2016), and the National Institute for Health and Care Excellence (NICE, 2016) have published guidance, which, to some extent, have helped to champion the issue. These may provide some assistance to local government departments with responsibility for public health and provide EHOs with an ally in their campaign to raise the political agenda of air quality improvements in their local area. However, similar interdepartmental support is required by Defra from the Department of Health.

The separation of responsibility at a national level for managing air quality from the main pollution source, road transport, between Defra and the DfT respectively, arguably underpins the failure of national policy to achieve necessary reductions in NO₂ concentrations. Despite a joint Public Service Agreement (PSA 28) (HM Treasury, 2007) on air quality between the two departments between 2007 and 2010, there has not been a coordinated approach to air quality management since the Department for Environment, Transport and the Regions (DETR) was dissolved in 2001. The DfT and Defra have formed a Joint Air Quality Unit (JAQU) in 2016, which is intended to ensure a coordinated approach across Whitehall (Environment, Food and Rural Affairs Commons Select Committee, 2016), however an Environmental Information Request for the minutes of this group in relation to the development of the AQP for NO₂ was refused (Defra, 2017b), and no further detail regarding the full remit of the JAQU has been identified.

Indicative of a lack of coordinated policy on air quality management between departments at a national level is the absence of relevant in-service vehicle emissions testing. Currently the DfT annual vehicle safety check (MOT test) only requires emission testing for carbon monoxide (CO) and hydrocarbons for petrol-fuelled vehicles and smoke tests for diesel vehicles. In the test's current format, inclusion of NO_x and NO₂ would be impracticable, however this provides no opportunity to assess whether the national emissions reduction strategy is effective in practice or how emissions are affected by use or age of vehicle.

Another example of uncoordinated policy on air quality is the reduced Vehicle Excise Duty on the purchase of new vehicles with lower CO₂ emissions, which resulted in an increase in the proportion of diesel cars in the car fleet of more than 30% between 1994 and 2016. This policy was driven by a need to achieve domestic CO₂ reduction targets (20% below 1990 levels by 2010 and 60% by 2050) under the Climate Change Programme 2006 (HM Government, 2006), set in response to the Kyoto Protocol. This was despite the fact that diesel vehicles had long been recognised as contributing a higher proportion of PM and, more recently, also NO_x and primary NO₂ (Carslaw et al., 2011). The expectation had been that emissions of both CO₂ and NO_x would reduce based on tightening Euro emission standards; however, this was undermined by the failure of the Euro standards to deliver real-world emission reductions. Whilst it may be arguable that policymakers were initially unaware of the public health implications of this fiscal policy, there is now widespread recognition that the promotion of diesel vehicles across the EU has resulted in higher concentrations of NO₂ and PM₁₀ than would otherwise have been the case. Despite this, Vehicle Excise Duty and company car tax continue to promote diesel. Had UK policy followed the example of the US and Japan and had the foresight to be more proactive in incentivising alternative fuels and low emission vehicles there may not have needed to be a trade-off between climate change and public health.

Ultimately the incentivisation of diesel light duty vehicles has directly contributed to higher primary NO₂ emissions, with the effect that even where local authorities have implemented AQAP measures, the local impact on NO₂ concentrations has been negligible. Shifting the burden of responsibility onto local government now to implement CAZs or similar measures to restrict high polluting vehicles from local hotspots, without high level national measures to disincentivise purchase of diesel cars and facilitate their removal from the fleet, not only sends mixed messages to the public, but is counterproductive and undermines the cost-effectiveness of any local action.

Differing priorities between national departments often translate downwards into competing priorities at a local level as divergent agendas are enforced through top-down policy and practice guidance. For example, the inclusion of a mandatory air quality indicator (LTP8) in Local Transport Planning guidance was undermined by allowing transport planners discretion over the setting of the indicator, rather than aligning it with the national air quality objectives, stating that "[t]here is no suitable methodology for the annual assessment of pollutant concentrations" (Department for Transport, 2004, p.21) in disregard of years of LAQM policy and technical guidance to the contrary. Three months later, and nine months before the deadline (31/12/2005) for the achieving the national air quality objective for NO₂, EHOs in local authorities in England were strongly encouraged by Defra, in a policy guidance update (LAQM.PGA(05)) (Defra, 2005), to subsume their AQAPs within the Local Transport Plan, despite the obvious differences in priorities.

It is therefore unsurprising that effective implementation of local AQAPs has been regularly undermined by the inability of the environmental health department to adequately engage both transport and land-use planning colleagues, particularly where those departments are divided between district and county level authorities (Beattie et al., 2005; Olowoporoku et al., 2010; Olowoporoku et al., 2011; Olowoporoku et al., 2011, 2012; Barnes et al., 2014). Local authorities have also had difficulties implementing AQAP measures where the road sources fall within national jurisdiction, having to rely on Highways England (formerly the Highways Agency), a government company with responsibility for motorways and major trunk roads in England, to determine prioritisation (Barnes, 2014).

Similarly, air quality considerations rarely carry sufficient weight in development control decisions, even where developments are expected to lead to a worsening of public health, either by increasing emissions or introducing new exposure. The National Planning Policy Framework⁴ determines that the presence of an AQMA should not necessarily preclude development, and pressure from the government for more housing stock means that local authorities are effectively forced to accept planning applications. Protection of public health can therefore sometimes be seen to be in opposition to national priorities for growth and an authority's ambitions for economic development and, despite air quality being a material consideration, there are very few citable examples where a potential worsening of air quality has resulted in rejection of a planning proposal. Unfortunately this is also the case in national planning decisions, such as the expansion of Heathrow Airport, which, despite being within an area that is exceeding the EU limit value for NO₂, has been granted permission even though it is predicted to worsen air quality on local roads (WSP Parsons Brinkerhoff, 2016). It is of course the case that it is land use policy and plans and associated transport policies and strategies that provide the context for the long term management of air quality, yet rarely in the period under consideration can these policy processes be said to be aligned and directed to the goal of improving air quality and protecting the public's health.

3 Conclusion

This paper has reviewed UK air quality policy in relation to EU and LAQM responsibilities over the last 20 years and has highlighted how the two-tier approach of national and local air quality management has failed to result in achievement of European or national ambient air quality regulations. This paper highlights the gulf between national and local air quality management in the UK which, together with a failure of EU and national emissions reduction policy, has undermined any liability on local government for CJEU-imposed fines passed on via the Localism Act 2011 (Part 2).

First and foremost, differing legislation for national and local governments mean that local authorities are not legally responsible for achievement of limit values under the AAQD. Moreover, local authorities were not even legally responsible for achievement of national air quality objectives, for which they did have a formal responsibility to work towards. Although national government has sought to close the gap between EU and UK air quality legislation and more closely align local responsibilities with the former, there has been resistance from consultees for fear that the different scales of operation would result in local exceedences being neglected.

The different scales of operation have also undermined the potential for a nested reporting mechanism. If it was ever the intention that local government should play a responsible role in achievement of EU limit values then, in designing its zones and agglomerations for compliance assessment to the EU, the UK government should have recognised the need to ensure that they were coterminous with local authority borders. Without this, reporting against the national air quality objectives cannot be easily aligned with reporting against the EU limit values and, therefore, responsibility for compliance in any zone or agglomeration cannot be directly placed on local authorities.

Even if responsibility could be given to local authorities, inconsistencies between EU and LAQM monitoring requirements mean that data from most local authority monitors are not reportable to the European Commission for the purposes of compliance assessment. Furthermore, differences between EU and local authority site type classifications would complicate any accurate reporting. In order for local assessment to contribute to national compliance assessment reporting these fundamental issues should have been considered in the design and evolution of LAQM. This missed opportunity demonstrates a failure of strategic policy.

Reliance on local authority monitoring, including passive monitoring techniques, to verify and adjust dispersion modelling, together with the myriad of other inherent assumptions and inaccuracies, also limits the suitability of local modelled data for inclusion in compliance assessment reporting. However, as national models have a spatially coarse resolution, local hotspots go unreported to the European Commission.

However, of most concern is the lack of coordination between national and local action planning that has undermined efforts to achieve the EU limit values and national air quality objectives. National policies have failed to reduce background concentrations, having relied almost entirely on emission reductions through the implementation of Euro standards for new vehicles, while at the same time incentivising more polluting diesel light duty vehicles in pursuit of CO₂ targets. This, together with a 75% reduction in funding for local action plans in recent years has meant that the limited AQAP measures that local authorities have been able to implement have been effectively undermined. Also, inconsistency between departmental policies nationally has translated into divergent agendas at a

local level, obstructing interdepartmental cooperation in implementing local actions.

Unambitious and counterproductive national policy and the failure of EU light-duty vehicle type approval tests and Euro standards to reduce real-world NO_x emissions are the main reasons for continued limit value exceedences. This failure of EU and national air quality policies has reduced the effectiveness of local authority action to improve local air quality, resulting in delays in achieving the standards, wasted resources at local and national levels, and, ultimately, unnecessary loss of life and increased morbidity in the UK population.

To return to the policy context of this paper with regard to the risk of fines resulting from progression of the European Commission's legal proceedings and the potential held in Part 2 of the Localism Act 2011 for these fines to be passed to local government, the evidence and arguments presented reveal that there is no basis on which local government should be held accountable for non-compliance with the AAQD. Furthermore, without the implementation of a suite of stronger measures by national government, attempts to further devolve responsibility for reducing concentrations of NO₂ through the implementation of CAZs (as seen in Defra's most recent Air Quality Plan) will fail to achieve compliance in the shortest possible time.

4 Recommendations

On the basis of the arguments presented in this paper, a series of recommendations is proposed for the European Union, the UK government, devolved administrations and local authorities:

- For the UK and EU to align air quality limit values and air quality objectives and to include within UK national reporting practices appropriate local authority monitoring.
- For the UK government to withdraw fiscal incentives for diesel vehicles that do not meet real-world driving emission standards.
- For the UK government to introduce emissions testing of NO_x in real-world scenarios and to tighten emissions testing in annual road-worthiness tests to ensure emission standards continue to be met throughout the lifetime of the vehicle.
- For the UK government and devolved administrations to ensure that air quality is given priority status in national planning and transport policy in order to protect public health and that local government give due consideration to the issues in reaching land use and transport planning decisions.
- For the UK government and devolved administrations to incorporate local authority assessment of exceedences of the air quality objectives more explicitly into national strategic air quality assessments.
- For the UK government and devolved administrations to target rapid reductions in background air quality concentrations through strategic interventions to address major emission source categories.
- For the UK government and devolved administrations to ensure that local authorities are adequately resourced to implement their air quality management duties and have sufficient powers to address sources of concern.
- For the UK government to withdraw the threat of EU fines being passed to local authorities by revoking Part 2 of the Localism Act 2011.

Uncited references (Please remove this section as the uncited references have been removed.)

~~Environmental Audit Committee (2006), Environmental Audit Committee (2015), Royal College of Physicians (2016), and Tran (2015).~~

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References

- AEA group, QA/QC Procedures for the UK Automatic Urban and Rural Air Quality Monitoring Network (AURN), AEAT/ENV/R/2837, Defra, http://uk-air.defra.gov.uk/assets/documents/reports/cat13/0910081142_AURN_QA_QC_Manual_Sep_09_FINAL.pdf, 2009, (Accessed 06 March 2016).
- Air Quality Consultants, Calibrating Defra's Background NO_x and NO₂ Maps ~~Against~~ 2016 Measurements, 2017, <http://www.aqconsultants.co.uk/AQC/media/Reports/2016-Background-Map-Calibration.pdf>, 2017, (Accessed 14 May 2017).
- Barnes J., A ~~critical evaluation of Local Air Quality Management and its contribution to meeting the EU annual mean nitrogen dioxide limit~~ [Critical Evaluation of Local Air Quality Management and its Contribution to Meeting the EU Annual Mean Nitrogen Dioxide Limit](#) ~~Value~~, PhD, 2014, University of the West of England.
- Barnes, J., Chatterton, T., 2016. An environmental justice analysis of exposure to traffic-related pollutants in England and Wales. To be published in *WIT Transactions on Ecology and the Environment*, Sustainable Development and Planning 2016 conference, vol. 210, WIT Press [preprint]. (Accessed 09 October 2016) Available from: <http://eprints.uwe.ac.uk/28882>.
- Barnes J., Hayes E.T., Chatterton T. and Longhurst J., Air quality action planning: ~~Why~~ do barriers to remediation in local air quality management remain?, [Journal of Environmental Planning and Management, Environ. Plan. Manage.](#) **57** (5), 2014, 660–681, ISSN

0964-0568.

Beattie C.I., Longhurst J.W.S. and Woodfield N.K., Air quality management: evolution of policy and practice in the UK as exemplified by the experience of English local government, *Atmospheric Environment, Environ.* **35** (8), 2001, 1479–1490.

Beattie C.I., Longhurst J.W.S. and Elsom D.M., Evidence of integration of air quality management in the decision making process and procedures of English local government, *Local Environment, Environ.* **9** (3), 2004, 255–270.

Blackpool Borough Council, 2014 Air Quality Progress Report for Blackpool Borough Council, April 2014, <https://www.blackpool.gov.uk/Residents/Planning-environment-and-community/Documents/Air-Quality-Annual-Progress-Report-2014.pdf>, 2014, (Accessed 01 October 2016).

Brunt H., Barnes J., Longhurst J., Scally G. and Hayes E.T., Local *Air Quality Management policy and practice in the UK: The case for greater public health integration and engagement* *Environmental Science & air quality management policy and practice in the UK: the case for greater public health integration and engagement*, *Environ. Sci. Policy* **58** (52–60), 2016, ISSN 1462-9011.

Brunt H., Barnes J., Jones S., Longhurst J., Scally G. and Hayes E.T., Air pollution, deprivation and health: *Understanding relationships to add value to local air quality management policy and practice in Wales, UK* *Journal of understanding relationships to add value to local air quality management policy and practice in Wales, UK*, *J. Public Health* **39** (3), 2017, 485–497, <https://doi.org/10.1093/pubmed/fdw084>, ISSN 1741-3842.

Carslaw D.C., Beevers S.D., Tate J.E., Westmoreland E.J. and Williams M.L., Recent evidence concerning higher NOx emissions from passenger cars and light duty vehicles, *Atmospheric Environment, Environ.* **45**, 2011, 7053–7063, <https://doi.org/10.1016/j.atmosenv.2011.09.063>.

Carslaw D.C. and Rhys-Tyler G., New insights from comprehensive on-road measurements of NOx, NO₂ and NH₃ from vehicle emission remote sensing in London, UK, *Atmospheric Environment, Environ.* **81**, 2013, 339–347, <https://doi.org/10.1016/j.atmosenv.2013.09.026>.

Carslaw D., Williams M. and Stedman J., An *Investigation of Different Approaches to Compliance Assessment in the Air Quality Directive 2008/50/EC*, Version: February 2013, https://uk-air.defra.gov.uk/assets/documents/reports/cat05/1302150859_130213_Compliance_Assessment_Final.pdf, 2013, (Accessed 28 October 2017).

ClientEarth, 'UK Government's *faulty projections could mean dirty air for decades*', 24 August 2016, <http://www.clientearth.org/uk-governments-faulty-projections-mean-dirty-air-decades/>, 2016, (Accessed 01 October 2016).

ClientEarth, 'High Court *rules air pollution plans must be published before General Election*', 27 April 2017, <https://www.clientearth.org/judge-refuses-uk-government-permission-delay-air-quality-plan-til-general-election/>, 2017a, (Accessed 29 April 2017).

ClientEarth, 'UK Government *releases 'weak' air quality plans*', 5 May 2017, <https://www.clientearth.org/uk-government-releases-weak-air-quality-plans/>, 2017b, (Accessed 14 May 2017).

ClientEarth, 'ClientEarth *demands urgent clarification on UK government's air quality plans*', 16 August 2017, <https://www.clientearth.org/clientearth-demands-urgent-clarification-uk-governments-air-quality-plans/>, 2017c, (Accessed 28 October 2017).

COMEAP, The Mortality Effects of Long-Term Exposure to Particulate Air Pollution in the United Kingdom, https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/304641/COMEAP_mortality_effects_of_long_term_exposure.pdf, 2010, (Accessed 01 October 2016).

COMEAP, Statement on the *evidence for the effects of nitrogen dioxide on health* *Evidence for the Effects of Nitrogen Dioxide on Health*, https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/411756/COMEAP_The_evidence_for_the_effects_of_nitrogen_dioxide.pdf, 2015, (Accessed 01 October 2016).

Defra, Part IV of the *Environment Act 1995 - Local air quality management - Environment act 1995 - local air quality management* - policy guidance: addendum LAQM, PGA(05), 2005, The Stationary Office; London.

Defra, The Air Quality Strategy for England, Scotland, Wales and Northern Ireland, 1, 2007, The Stationery Office; Norwich.

Defra, Local Air Quality Management Consultation on *options to improve air quality management in England*, July 2013, https://consult.defra.gov.uk/communications/https-consult-defra-gov-uk-laqm_review/supporting_documents/Consultation%20doc%20%20LAQM%20review.pdf, 2013a, (Accessed 28 October 2017).

Defra, Local *air quality management review, Summary of responses and government reply* *Air Quality Management Review, Summary of Responses and Government Reply*, December 2013,

https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/265819/laqm-sum-resp-20131213.pdf, 2013b, (Accessed 01 October 2016).

Defra, FOI ~~release, Air pollution infraction f~~Release, Air Pollution Infraction Fines, 15 May 2014, <https://www.gov.uk/government/publications/air-pollution-infraction-fines>, 2014, (Accessed 14 April 2017).

Defra, Draft Air Quality Plans, <https://consult.defra.gov.uk/airquality/draft-aq-plans>, 2015a, (Accessed 01 October 2016).

Defra, Valuing ~~impacts on air quality: Updates in valuing changes in e~~Impacts on Air Quality: Updates in Valuing Changes in Emissions of Oxides of Nitrogen (NO_x) and ~~e~~Concentrations of Nitrogen Dioxide (NO₂), https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/460401/air-quality-econanalysis-nitrogen-interim-guidance.pdf, 2015b, (Accessed 01 October 2016).

Defra, Local Air Quality Management Draft Technical Guidance, https://consult.defra.gov.uk/communications/laqm_changes/supporting_documents/LAQM%20Technical%20Guidance%202016.pdf, 2015c, (Accessed 01 October 2016).

Defra, Air Pollution in the UK 2015, <https://uk-air.defra.gov.uk/library/annualreport/index>, 2016a, (Accessed 09 April 2017).

Defra, Local Air Quality Management Policy Guidance (PG16), April 2016, <http://laqm.defra.gov.uk/documents/LAQM-PG16-April-16-v1.pdf>, 2016b, (Accessed 01 October 2016).

Defra, Data ~~a~~Availability, <http://uk-air.defra.gov.uk/data/data-availability>, 2016c, (Accessed 21 February 2016).

Defra, Local Air Quality Management Technical Guidance (TG16), April 2016, <http://laqm.defra.gov.uk/technical-guidance/>, 2016d, (Accessed 01 October 2016).

Defra, Summary of ~~responses to the government's consultation on draft air quality p~~Responses to the Government's Consultation on Draft Air Quality Plans, January 2016, https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/496881/air-quality-plans-consult-sum-resp.pdf, 2016e, (Accessed 01 October 2016).

Defra, Draft Clean Air Zone Framework, October 2016, https://consult.defra.gov.uk/airquality/implementation-of-cazs/supporting_documents/161012%20%20Draft%20Clean%20Air%20Zone%20Framework%20%20consultation.pdf, 2016f, (Accessed 29 April 2017).

Defra, Air Quality: A Briefing for Directors of Public Health, March 2017, <https://laqm.defra.gov.uk/assets/63091/defraairqualityguide9web.pdf>, 2017a, (Accessed 30 April 2017).

Defra, Response to 'REQUEST FOR INFORMATION: Agendas and Minutes of the Air Quality Plan for NO₂ Project Board', RFI 8669, 6 February 2017, <https://www.whatdotheyknow.com/request/371105/response/932969/attach/3/20170206%20RF8669%20Air%20Quality%20Plan%20Response.pdf>, 2017b, (Accessed 30 April 2017).

Defra, Air ~~quality grant p~~Quality Grant Programme, 23 February 2017, <https://www.gov.uk/government/collections/air-quality-grant-programme>, 2017c, (Accessed 28 October 2017).

Department for Transport, Technical Guidance on Monitoring the LTP2 Mandatory Indicators, December 2004, <http://webarchive.nationalarchives.gov.uk/20070506093704/http://www.dft.gov.uk/pgr/statistics/datatablespublications/ltp/technicalguidanceonmonitorin5174>, 2004, (Accessed 01 October 2016).

Department for Transport, Reported ~~road casualties in Great Britain: main r~~Road Casualties in Great Britain: Main Results 2015, Statistical Release, 30 June 2016, https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/533293/rrogb-main-results-2015.pdf, 2016a, (Accessed 01 October 2016).

Department for Transport, Vehicle Emissions Testing Programme, April 2016, https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/518437/vehicle-emissions-testing-programme.pdf, 2016b, (Accessed 01 October 2016).

~~Environmental Audit Committee, Reducing Carbon Emissions from T~~carbon emissions from Transport, Ninth Report of Session 2005-2006 vol. 1, 2006, House of Commons, The Stationery Office, London <http://www.publications.parliament.uk/pa/cm200506/cmselect/cmenvaud/981/981-i.pdf>, (Accessed 17 April 2016). (Please delete this reference.)

~~Environmental Audit Committee, Environmental Audit Committee response to Defra consultation on air q~~Response to Defra Consultation on Air Quality, http://www.parliament.uk/documents/commons_committees/environmental_audit/Defra-air-quality-consultation-response.pdf, 2015, (Accessed 01 October 2016). (Please delete this reference.)

European Commission, Guidance on Assessment ~~u~~Under the EU Air Quality Directives – FINAL DRAFT, <http://ec.europa.eu/environment/archives/air/pdf/guidanceunderairquality.pdf>, 2004, (Accessed 28 February 2016).

European Commission, Commission Decision of 25.6.2012 on the ~~notification by the United Kingdom of Great Britain and Northern Ireland of a postponement of the deadline for attaining the limit values for NO2 in 24 air quality z~~Notification by the United Kingdom of Great Britain and Northern Ireland of a Postponement of the Deadline for Attaining the Limit Values for NO₂ in 24 Air Quality Zones, Brussels, (C(2012) 4155 final)2012.

- European Commission, Commission ~~w~~Welcomes Member States' ~~agreement on robust testing of air pollution emissions by e~~Agreement on Robust Testing of Air Pollution Emissions by Cars, Press release, 28 October, Brussels. (Accessed 01 October 2016)http://europa.eu/rapid/press-release_IP-15-5945_en.htm, 2015.
- European Commission, Car ~~emissions: Commission opens infringement procedures a~~Emissions: Commission Opens Infringement Procedures Against 7 Member States for ~~breach of EU r~~Breach of EU Rules, Press release, 8 December, Brussels. (Accessed 0 May 2017)http://europa.eu/rapid/press-release_IP-16-4214_en.htm, 2016.
- European Commission, Commission ~~warns Germany, France, Spain, Italy and the United Kingdom of continued air pollution b~~Warns Germany, France, Spain, Italy and the United Kingdom of Continued Air Pollution Breaches, Press release, 15 February, Brussels. (Accessed 09 April 2017)http://europa.eu/rapid/press-release_IP-17-238_en.htm, 2017.
- Environment, Food and Rural Affairs Commons Select Committee, Air ~~quality: Government r~~Quality: Government R Response to the Committee's Fourth Report of Session 2015-16, Appendix: Government ~~r~~R Response, 9 September, <http://www.publications.parliament.uk/pa/cm201617/cmselect/cmenvfru/665/66504.htm>, 2016, (Accessed 01 October 2016).
- Gulia S., Shiva Nagendra S.M., Khare M. and Khanna I., Urban air quality management- a review, *Atmospheric Pollution Research*, *Pollut. Res.* 2015, 6, <https://doi.org/10.5094/APR.2015.033>.
- HM Government, Climate Change The UK Programme 2006, CM6764 SE/2006/43, HMSO; Norwich, https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/272269/6764.pdf, 2006, (Accessed 01 October 2016).
- HM Treasury, PSA Delivery Agreement 28: Secure a ~~healthy natural environment for today and the f~~Healthy Natural Environment for Today and the Future, 2007, HM Treasury; London.
- House of Commons Environmental Audit Committee, Air Quality: Fifth Report of Session 2009–10, 2010, The Stationery Office; London.
- House of Commons Environmental Audit Committee, Air Quality: A Follow-Up Report, Ninth Report of Session 2010–12, 2011, The Stationery Office; London.
- House of Commons Environmental Audit Committee, Action on Air Quality, Sixth Report of Session 2014–15, 2014, The Stationery Office; London.
- Fontaras G., Franco V., Dilara P., Martini G. and Manfredi U., Development and review of Euro 5 passenger car emission factors based on experimental results over various driving cycles, *Science of the Total Environment*, *Total Environ.* **468–469**, 2014, 1034–1042.
- ICCT, NO_x ~~emissions from heavy-duty and light-duty diesel vehicles in the EU: Comparison of real-world performance and current type-approval r~~Emissions from Heavy-duty and Light-duty Diesel Vehicles in the EU: Comparison of Real-world Performance and Current ~~Type-approval~~ Requirements, December 2016, http://www.theicct.org/sites/default/files/publications/Euro-VI-versus-6_ICCT_briefing_06012017.pdf, 2016, (Accessed 29 April 2017).
- JAUQ, Improving ~~air quality in the UK: tackling nitrogen dioxide in our towns and cities. Draft UK Air Quality Plan for tackling nitrogen d~~Air Quality in the UK: Tackling Nitrogen Dioxide in Our Towns and Cities. Draft UK Air Quality Plan for Tackling Nitrogen Dioxide, May 2017, https://consult.defra.gov.uk/airquality/air-quality-plan-for-tackling-nitrogen-dioxide/supporting_documents/Draft%20Revised%20AQ%20Plan.pdf, 2017, (Accessed 14 May 2014).
- Jarvis D.J., Adamkiewicz G., Heroux M.E., Rapp R. and Kelly F.J., Nitrogen dioxide, WHO Guidelines for Indoor Air Quality: Selected Pollutants, 2010, World Health Organization; Geneva, 5, (Accessed 21 February 2016). Available from: <http://www.ncbi.nlm.nih.gov/books/NBK138707/>.
- Jones E.M., Overy C. and Tansey E.M., Air ~~Pollution R~~pollution r research in Britain c.1955–c.2000, *Wellcome Witnesses to Contemporary Medicine* vol. **58**, 2016, Queen Mary University of London; London <http://www.histmodbiomed.org/sites/default/files/W58LoRes.pdf>, (Accessed 09 October 2016).
- Kågeson P., Cycle-beating and the EU test cycle for cars, Report T&E 98/3, 1998, European federation for transport and environment. Bd. De Waterloo 34, 1000 Brussels; Belgium http://www.transportenvironment.org/sites/te/files/media/T&E%2098-3_0.pdf, (Accessed 01 October 2016).
- Local Government Association, LGA Briefing – The Localism Act Part 2: EU Financial Sanctions, November 2011, (Accessed 28 October 2017). <https://files.datapress.com/barnet/dataset/municipal-waste---recycling-strategy---economic-and-financial-outlook/2015-12-07T11:07:15/EO1%20LGA%20briefing%20%20Localism%20Act's%20EU%20financial%20sanctions%20Nov%202011.pdf>2011.
- Longhurst J.W.S., Lindley S.J., Watson A.F.R. and Conlan D.E., The introduction of local air quality management in the United Kingdom. A review and theoretical framework, *Atmospheric Environment*, *Environ.* **30** (23), 1996, 3975–3985.
- Longhurst J.W.S., Beattie C.I., Chatterton T., Hayes E.T., Leksmono N.S. and Woodfield N.K., Local air quality management as a risk management process: assessing, managing and remediating the risk of exceeding an air quality objective in Great Britain, *Environment International*, *Int.* **32** (8), 2006, 934–947.

- Longhurst J.W.S., Irwin J.G., Chatterton T.J., Hayes E.T., Leksmono N.S. and Symons J.K., The development of effects based air quality management regime, *Atmospheric Environment, Environ.* **43** (1), 2009, 64–78.
- Longhurst J.W.S., Barnes J.H., Chatterton T.J., Hayes E.T. and Williams W.B., Progress with Air Quality Management in the 60 years since the UK Clean Air Act, 1956. Lessons, *Failures, Challenges and Opportunities International Journal of Sustainable Development and Planning*, *Int. J. Sustain. Dev. Plan.* **11** (4), 2016, 491–499.
- Moorcroft S. and Dore C., Review of Effectiveness of Local Authority Action Plans and Future Policy Options for LAQM. Defra, Report no. 1372/1/F1, https://uk-air.defra.gov.uk/assets/documents/reports/cat09/1306281250_AQAP_Review_Final_Report.pdf, 2013, (Accessed 01 October 2016).
- Naiker Y., Diab R.D., Zunckel M. and Hayes E.T., Introduction of local Air Quality Management in South Africa: overview and challenges *Environmental Science & Air Quality Management in South Africa: overview and challenges*, *Environ. Sci. Policy* **17**, 2012, 62–71 <http://eprints.uwe.ac.uk/16506/>, (Accessed 07 August 2016).
- NICE, Air Pollution: Outdoor Air Quality and Health. Draft Guidance Consultation, <https://www.nice.org.uk/guidance/indevelopment/gid-phg92>, 2016, (Accessed 01 May 2017).
- Office for National Statistics, 2011 Census Analysis - Comparing Rural and Urban Areas of England and Wales, http://www.ons.gov.uk/ons/dcp171776_337939.pdf, 2013, (Accessed 01 October 2016).
- Office for National Statistics, Alcohol Related Deaths in the United Kingdom: Registered in 2014, Statistical Bulletin, 2 February 2016, <https://www.ons.gov.uk/peoplepopulationandcommunity/healthandsocialcare/causesofdeath/bulletins/alcoholrelateddeathsintheunitedkingdom/registeredin2014/pdf>, 2016, (Accessed 01 October 2016).
- Olowoporoku A.O., Hayes E.T., Leksmono N.S., Longhurst J.W.S. and Parkhurst G., A longitudinal study of the links between Local Air Quality Management and Local Transport Planning policy processes in England *Journal of Environmental Planning and Management*, *J. Environ. Plan. Manage.* **53** (3), 2010, 385–403. (Local Air Quality Management and Local Transport Planning should keep initial capital letters.)
- Olowoporoku A.O., Hayes E.T., Longhurst J.W.S. and Parkhurst G., Improving road transport-related air quality in England through joint working between Environmental Health Officers and Transport Planners *Local Environment*, *environmental health officers and transport planners*, *Local Environ.* **16** (3), 2011, 603–618. (Environmental Health Officers and Transport Planners should keep initial capital letters.)
- Olowoporoku A.O., Hayes E.T., Longhurst J.W.S. and Parkhurst G., The rhetoric and realities of integrating air quality into the local transport planning process in English local authorities, *Journal of Environmental Management, Environ. Manage. [online]* **101**, 2012, 23–32.
- Preston City Council, 2014 Air Quality Progress Report for Preston City Council, June 2014, <http://www.preston.gov.uk/yourservices/environmental-health/pollution--noise-and-other-nuisances/air-quality/>, 2014, (Accessed 01 October 2016).
- Public Health England, Obesity and Mortality, https://www.noo.org.uk/NOO_about_obesity/mortality, 2016, (Accessed 01 October 2016).
- Ricardo-AEA, Valuing the Impacts of Air Quality on Productivity, Issue 3.0, ED59269, 18/06/14, https://uk-air.defra.gov.uk/assets/documents/reports/cat19/1511251135_140610_Valuing_the_impacts_of_air_quality_on_productivity_Final_Report_3_0.pdf, 2014, (Accessed 14 May 2017).
- Ricardo-AEA, Technical report on UK supplementary assessment under the Air Quality Directive (2008/50/EC), the Air Quality Framework Directive (96/62/EC) and Fourth Daughter Directive (2004/107/EC) for 2013 Issue 1, ED57728, 15/10/15, https://uk-air.defra.gov.uk/assets/documents/reports/cat09/1511251423_AQ0650_2013_MAAQ_technical_report.pdf, 2015, (Accessed 01 October 2016).
- Royal College of Physicians, Every breath we take: the lifelong impact of air pollution, *Breath We Take: The Lifelong Impact of Air Pollution*, <https://www.rcplondon.ac.uk/projects/outputs/every-breath-we-take-lifelong-impact-air-pollution>, 2016, (Accessed 01 May 2017).
- ~~Tran M., UK pushing for limits on air pollution to be relaxed, documents reveal, The Guardian [online], 13 December, 2015, Available from: <https://www.theguardian.com/environment/2015/dec/13/uk-pushing-for-limits-air-pollution-relaxed-documents-reveal>, (Accessed 01 October 2016).~~ (Please delete this uncited reference.)
- UK Supreme Court, [2015] UKSC 28: Judgement given on 29 April 2015 — R on the application of ClientEarth v Secretary of State for the Environment, Food and Rural Affairs *Official Journal of the European Union [online]*, *secretary of state for the environment, food and rural affairs*, *Off. J. Eur. Union [online]* 2015 <https://www.supremecourt.uk/cases/docs/uksc-2012-0179-judgment.pdf>, (Accessed 01 October 2016).
- Williams M.L. and Carshaw D.C., New directions: Science and policy – Out of step on NOx and NO₂?, *Atmospheric Environment, Environ.* **45**, 2011, 3911–3912, <https://doi.org/10.1016/j.atmosenv.2011.04.067>.
- WHO, Review of Evidence on Health Aspects of Air Pollution – REVIHAAP Project: Technical Report, http://www.euro.who.int/_data/assets/pdf_file/0004/193108/REVIHAAP-Final-technical-report-final-version.pdf?ua=1,

2013, (Accessed 14 April 2017).

WHO, 7 million premature deaths annually linked to air pollution, News+Million Premature Deaths Annually Linked to Air Pollution, News Release, (Accessed 25 March 2014). Available from:<http://www.who.int/mediacentre/news/releases/2014/air-pollution/en> 2014.

Woodfield N.K., Longhurst J.W.S., Beattie C.I. and Laxen D.P.H., Judging the risk of exceedance: local authority decision-making for air quality management area designation, *Local Environment*, 8 (4), 2003, 423–436.

World Bank and Institute for Health Metrics and Evaluation, The Cost of Air Pollution: Strengthening the Economic Case for Action, World Bank; Washington, DC, <https://openknowledge.worldbank.org/bitstream/handle/10986/25013/108141.pdf?sequence=4&isAllowed=y>, 2016, License: Creative Commons Attribution CC BY 3.0 IGO. (Accessed 1 October 2016).

WSP Parsons Brinkerhoff, Air quality re-analysis: Impact of new Pollution Climate Mapping projections and national air quality plan, Final Rev(2), October 2016, https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/562180/air-quality-re-analysis-impact-of-new-pollution-climate-mapping-projections-and-national-air-quality-plan.pdf, 2016, (Accessed 14 May 2017). (Please check the formatting of this reference as the hyperlink is running off the page in the proof copy.)

Dr Barnes has 13 years' experience working in air quality management, policy and practice at local, national and European levels. Since 2008, she has been employed in the Air Quality Management Resource Centre at the University of the West of England, Bristol, where she has also completed her PhD researching the effectiveness of Local Air Quality Management. In this role, she has worked with and on behalf of numerous local authorities, Defra and the Devolved Administrations of Scotland, Wales, Northern Ireland and Greater London, other Member States, the European Environment Agency and the European Commission to implement and develop air quality management policies and practices.

Dr Hayes has been working in the environmental field for over a decade with a primary focus on atmospheric emissions and their management including odour, bioaerosols, conventional air pollution (e.g. particulate matter, nitrogen dioxide, ozone) and greenhouse gases. He has worked with local, national and international government on a range of air quality and carbon management projects including UK local authorities, Defra and the Devolved Administrations, the South African government and providing services to support the European Commission and European Environment Agency. His research has been supported by many sources including the NERC, MRC, Defra, EU Horizon 2020 and various national governments.

Dr Chatterton has a background in social and physical sciences. He has spent over a decade working at the interface between policy and academia, with a particular focus on air pollution, climate change and energy, public health and land-use and transport planning. He has worked extensively with a range of UK government departments, including DECC, Defra and DfT, and with the UK Devolved Administrations. He is also involved in providing support services for the European Commission, and has helped write the National Air Quality Framework for South Africa. He also works at a local level (both in the UK and abroad).

Prof. Longhurst is Professor of Environmental Science and Assistant Vice Chancellor for Environment and Sustainability at UWE, Bristol. He is Executive Director of the Air Quality Management Resource Centre, provides executive leadership for the WHO Collaborating Centre on Healthy Urban Environments. His national roles include Vice President of the UK Institution of Environmental Sciences and Honorary Vice President of Environmental Protection. He co-chairs the annual Air Pollution conference now in its 26th year. His research has been supported by many sources including the EPSRC, ESRC, NERC, Defra, the Environment Agency, the EC and various national governments.

Footnotes

¹Originally set under the Air Quality Limit Values Regulations 2001 (which transposed the 1st Daughter Directive (1999/30/EC) of the Air Quality Framework Directive (96/62/EC)).

²"The term 'purdah' is in use across central and local government to describe the period of time immediately before elections or referendums when specific restrictions on the activity of civil servants are in place. The terms 'pre-election period' and 'period of sensitivity' are also used." (<http://researchbriefings.parliament.uk/ResearchBriefing/Summary/SN05262>)

³"A conformity factor of 2.1 or 1.5 means that emissions may not exceed more than 2.1 or 1.5 times the regulatory emissions on any possible RDE trip." <http://www.europarl.europa.eu/sides/getAllAnswers.do?reference=E-2016-007748&language=EN>

⁴<https://www.gov.uk/guidance/air-quality--3>

Highlights

- A gulf exists between UK national and local air quality management
- Failure of EU/national emissions reduction policy reliant on vehicle Euro standards. ~~Failure of unambitious and counterproductive national air quality policy. No basis for local government to be held accountable for non-compliance with AAQD.~~
! Failure of unambitious and counterproductive national air quality policy.
! No basis for local government to be held accountable for non-compliance with AAQD.
- Local government liability for CJEU fines via the Localism Act 2011 is undermined.

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