Air Quality

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Responsibility of	**Subject Lead for Air Quality**

Legislation	• Environment Act 1995, including s82, s83 and s84 • Air Quality (Wales) Regulations 2000 (as amended) • Environment (Air Quality and Soundscapes) (Wales) Act 2024
Key national policy and guidance	• Planning Policy Wales (PPW) section 6.7; MTANs 1 and 2; Mineral Planning Guidance 14 • The Clean Air Plan for Wales (2020) • Clean Air Zone (CAZ) Framework for Wales (2018) • Tackling roadside nitrogen dioxide concentrations in Wales (WG supplemental plan) (2018)
Judgments	• R (ClientEarth) v SoS EFRA, [2015] UKSC 28 • Wealden DC v SSCLG [2017] EWHC 351 Admin • Smith v SoS ETR [2003] EWCA Civ 262 • R (Hereford Waste Watchers Ltd) v Hereford Council [2005] EWHC 191

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Background

Legislation and caselaw

1. Air quality is usually considered with reference to air pollution. Air pollution can be defined as the presence or introduction to the air of a substance which has harmful or poisonous effects on the environment, human health and material property. Examples of the sources, types and effects of air pollution are set out in **Annex A**. Effects on health, ecosystems and heritage assets, and the effects of weather and topography on air pollution, are outlined in **Annex B**.

2. **Annex C** provides an overview of existing air quality legislation applying in Wales, and related statutory targets, regulatory bodies and permitting/licensing regimes. In casework you are most likely to come across:

    - The **Environment Act 1995**, in relation to Local Authority-designated Air Quality Management Areas (AQMAs) and Air Quality Action Plan (AQAPs).
    - Air quality standards and objectives contained within the **Air Quality (Wales) Regulations 2000** (as amended in 2002).

3. The 2015 Supreme Court judgment ***R (ClientEarth) v SoS EFRA*** [UKSC 28] stated that the UK was in breach of the 2008 EU Ambient Air Quality Directive by failing to put in place sufficient plans to secure compliance with NO_2 limits. This resulted in revised guidance as described below.

Policy and guidance on air quality/pollution

4. The **UK Plan for Tackling Roadside Nitrogen Dioxide Concentrations (2017)** is shared between the UK and devolved governments and responds to the *ClientEarth* Supreme Court judgment of 2015. Its focus is to reduce NO_2 concentrations around roads where levels are above legal limits as quickly as possible. It divides the UK into 43 'air quality reporting' zones, of which four are in Wales: North Wales, South Wales, Cardiff Urban Area and Swansea Urban Area. Specific **Air Quality Plans** for each of these four zones were published concurrently with the UK-wide Plan in July 2017.

5. As required by a related *ClientEarth* judgment, supplemental plans were published in 2018. This includes the WG's '**Tackling roadside nitrogen dioxide concentrations in Wales: Welsh Government supplemental plan to the UK plan for tackling roadside nitrogen dioxide concentrations 2017**' **(November 2018)**, which sets out actions to be taken to achieve statutory NO_2 limits in Wales, including the production of a 'Clean Air Zone Framework' and 'Clean Air Plan'.

6. The subsequent **Clean Air Zone (CAZ) Framework for Wales (2018)** supports local authorities in establishing CAZs. Whilst a CAZ should consider all sources of air pollution and environmental noise, given the significance of road traffic to air pollution the document notes that CAZs will focus on traffic-restricted areas.

7. The **Clean Air Plan for Wales (2020)** integrates with and complements other WG policies and addresses the 2008 EU Ambient Air Quality Directive. It sets out measures and actions to improve air quality, including the designation of CAZs. Its core aim "to improve air quality and reduce the impacts of air pollution on human health, biodiversity, the natural environment and our economy" may be appropriate to consider and refer to in planning casework.

8. Policy and guidance has also been published in relation to statutory duties conferred by the Environment Act 1995. These include:

- **The Air Quality Strategy for England, Scotland, Wales and Northern Ireland (2007)**, and
- **Local air quality management in Wales (Policy Guidance, PG(W)(17)) (2017)** – which is published by WG and used by local authorities in carrying out their functions under Part IV of the 1995 Act.

9. Also of note are:

- **Document LA 105** of the **Design Manual for Roads and Bridges (DMRB)**, which provides a framework and methodology for assessing, mitigating and reporting impacts of road projects on air quality.
- **NRW Environmental Permitting guidance** – Including document "H4 Odour Management", which provides guidance on compliance with odour conditions placed on environmental permits.
- **NRW Operational Guidance Note 302** – an internal NRW document used by NRW officers to establish potential air quality impacts based on factors such as separation distances and critical load thresholds. The February 2025 version is available on iShare but note that this may be updated without notice, and should not be shared or referred to. Available here: https://documents.hf.wales.gov.uk/documents/fA4601225
- **WHO Air Quality Guidelines** – which aim to improve health by reducing air pollution and are reviewed on a regular basis.
- **Institute of Air Quality Management (IAQM)** documents such as: Land-Use Planning & Development Control: Planning for Air Quality (2017); and, Guidance on the Assessment of Odour for Planning (2018).
- **Air Quality – Certification of automated measuring systems (BS EN 15267 Series**) – part 1 specifies the general principles, including common procedures and requirements, for the product certification of automated measuring systems for monitoring ambient air quality and emissions from stationary sources.

The nature of air and its potential pollutants

10. Unpolluted air typically consists of 78.1% nitrogen, 20.9% oxygen, 0.93% argon, 0.037% carbon dioxide and lesser concentrations of neon, helium, methane, hydrogen and nitrous oxide. Pollutants, along with other factors such as topography and weather, can cause air quality to vary considerably over time, and across geographic areas and altitudes.

11. Air pollutants can be in the form of solid particles, liquid droplets or gases. They can result from man-made (anthropogenic) or natural releases to the atmosphere. Naturally occurring pollution can include red Saharan dust that can be present in the atmosphere during long dry periods, the smoke from summer hill fires, or on a global level, volcanic dust and gaseous emissions.

12. Pollutants can be "primary" or "secondary". A primary pollutant is in its original form, whereas a secondary pollutant is formed when primary pollutants react with each other in the atmosphere. Ozone is an example of a secondary pollutant (sources and effects are described in the *Clean Air Plan for Wales*). Once a pollutant has been introduced into the atmosphere, how it behaves and how long it remains in the atmosphere will vary depending on the pollutant.

Decision-making

Air quality as a main issue

13. Any air quality issue which relates to land use and its development is capable of being a planning consideration. The weight given to an air quality issue may depend on factors such as:

    - The overall change in local air quality and its effect on compliance (or further non-compliance) with air quality objectives and statutory limits,
    - Whether the scheme could materially affect any air quality action plan or other strategy in the area, and
    - The length of time people would likely be exposed at that location and whether the scheme would introduce new public exposure.

14. As air quality is a highly regulated and well understood topic, the main issue can often be defined quite narrowly – e.g.:

    - *The effect of the proposal on protected habitats, with regard to changes in air quality likely to result from the scheme.*
    - *Whether the proposed use would be suitable, having regard to the existing air quality within the locality.*

15. If the scheme sets out to improve air quality, a more generic main issue could be expressed in terms of the *Clean Air Plan for Wales* (2020); e.g. "*Whether the [proposed development] would improve air quality and reduce the impacts of air pollution on [human health / biodiversity / the natural environment and/or the economy]".*

Planning vs other regulatory regimes

16. The Courts have long recognised that although it may be acceptable for a planning decision-maker to leave certain matters to another regulatory regime, this does not absolve them of their duty to consider impacts relevant to the granting of planning permission. See, for example, ***Smith v Secretary of State for the Environment, Transport and the Regions*** [2003] EWCA Civ 262):

"...33. In my view it is a further important principle that when consideration is being given to the impact on the environment in the context of a planning decision, it is permissible for the decision maker to contemplate the likely decisions that others will take in relation to details where those others have the interests of the environment as one of their objectives. The decision maker is not however entitled to leave the assessment of likely impact to a future occasion simply because he contemplates that the future decision maker will act competently. Constraints must be placed on the planning permission within which future details can be worked out, and the decision maker must form a view about the likely details and their impact on the environment."

17. It is consequently important to be aware of the extent of any parallel regulatory responsibility. For example, in minerals casework an environmental permit may control emissions from a crushing plant, but planning conditions would still be necessary to control emissions from other activities on the site. Normally, such a planning condition would not seek to exempt part of the development from its controls as the permit, and area, could change during the lifetime of the development.

18. Evidence, including from air quality regulators, should provide some indication of any parallel regulatory progresses (or barriers) in relation to the scheme before you (e.g. if an environmental permit already has been granted, is expected to be granted, or is unlikely to be granted). If there is doubt you should seek the views of relevant parties, particularly in relation to specialist and technical matters (e.g. potential effects on protected species and habitats).

19. ***R (Hereford Waste Watchers Ltd) v Hereford Council [2005]*** EWHC 191 (Admin) provides a useful steer as to the approach to take, including in relation to the scope of evidence before a decision-maker (emphasis added):

"*34. I would therefore summarise the material principles in play here, as derived from Smith and Gillespie and the decisions to which they refer, as follows:*

1. The decision whether a process or activity has significant environmental effects is a matter for the judgment of the planning authority. In making that judgment it must have sufficient details of the nature of the development, of its impact on the environment and of any mitigating measures.
2. Equally, it is for the planning authority to decide whether it has sufficient information to enable it to make the relevant judgment. It need not have all available material provided it is satisfied that it has sufficient to enable a clear decision to be reached.
3. In making that determination, the planning authority can have regard to the mitigating measures provided that they are sufficiently specific, they are available and there is no real doubt about their effectiveness. However, the more sophisticated the mitigating measures and the more controversy there is about their efficacy, the more difficult it will be for the authority to reach a decision that the effects are not likely to be significant.

4. If the authority is left uncertain as to the effects, so that it is not sure whether they may be significant or not, it should either seek further information from the developer before reaching a conclusion, or if an ES has already been provided it should require a supplement to the ES which provides the necessary data and information. It cannot seek to regulate any future potential difficulties merely by the imposition of conditions.
5. The authority cannot dispense with the need for further information on the basis that it is not sure whether or not there are significant environmental effects, but that even if there are, other enforcement agencies will ensure that steps are taken to prevent improper pollution. However, it should assume that other agencies will act competently and it should not therefore anticipate problems or difficulties on the basis that those agencies may not do so."

20. It is important that conditions, for example in relation to dust or odour, take account of other regulatory controls and do not duplicate them unnecessarily.

21. Notwithstanding the above, there are occasional failures in regulatory responsibility. For example, ***Wealden DC v SSCLG*** [2017] EWHC 351 Admin) found that Habitats Regulations Assessment advice from Natural England that had been used for Local Plan policies had been flawed. While such instances may be rare, you should consider the implications of any suspected failure in regulatory responsibility which is brought to your attention.

Technical evidence

22. If there are potential effects on human health, biodiversity and the natural or built environment from air pollution, there may be extensive air quality monitoring and modelling data before you. You should consider:

- Whether the sampling/monitoring and modelling points referred to are the most relevant and effective for describing the possible effects of the scheme (e.g., a residential roadside sampling location may have been used in the evidence, but if the effect is on a protected ecological site 1km away then the evidence may not be robust).
- The basis on which any forecasting has been made in areas which are not in compliance with statutory limits, or which may be brought into non-compliance as a result of the plan/proposal.
- The level of margin which may be required to avoid any potential new non-compliance or delay in achieving compliance.
- Whether there is information on factors which may influence distribution and concentrations of emissions and therefore air quality (e.g. topography, weather and chemical reactions in the air).
- Whether the evidence is reliable – taking account of known limitations to its accuracy, evidence of equipment failure, inappropriate sampling techniques, or apparent manipulation of air quality data.

23. The evidence should explain how these potentially complex factors have been considered, providing clear conclusions on either the implications of existing air quality on the scheme, or the likely effect of the scheme on air quality. If there is doubt, you should seek clarification from relevant parties.

24. **Annex D** outlines various casework considerations, including common evidence, monitoring, modelling and mitigation techniques, and types of transport emissions.

25. If the possible effects of highway emissions need to be considered, document LA 105 of the DMRB provides a framework for assessing and reporting effects of highway projects on air quality, and may be of relevance.

26. Publicly available information on current and forecast air quality, the location of monitoring points and AQMAs (etc), is provided at airquality.gov.wales. This website links to the UK Air Pollution Information System at www.apis.ac.uk, the resource used by NRW to access information on air pollution. The 'Site Relevant Critical Loads' tab on this website enables you to view the details for protected habitats, SACs, SPAs and A/SSSIs, and the air quality needed to sustain them.

Air quality as an 'other matter'

27. If air quality is raised as an 'other matter' you should be clear why a perceived problem has not been raised by the statutory consultee with a duty to regulate air quality in that regard. The regulator may be the Environmental Health Officer (EHO) who monitors air quality in the locality, or where an Environmental Permit addresses emissions from a particular process, the issuing regulator (either the EHO or NRW).

28. An odour or visible emission plume does not necessarily signal poor air quality. However, you will need to understand the likely source, the significance of what is observed, its possible effects, and the level of regulation in relation to it; i.e. the process may be regulated and be within permitted levels, even though concerns may be raised by those who experience the emissions. **Annex D** outlines a range of air quality mitigation techniques which may be delivered through design, planning and other forms of regulation.

Site visits

29. The evidence before you (and discussions at an oral event) should confirm the matters and locations which may need to be observed during a site visit.

30. If the proposal concerns an existing industrial facility, consider carrying out an unaccompanied pre-event visit to the area around the site. Alternatively, a visit immediately prior to or after the opening of the event can be very helpful to all parties in their understanding of the evidence.

31. A written representation case may require more site visit time than normal, especially if the proposal involves an industrial facility.

Annex A – Air pollution: sources, types and effects

Sources of air pollution

1. Sources of air pollution within casework can be expected to include emissions from a specific fixed point, such as a chimney; multiple emissions within an area, such as flues for central heating boilers and stoves; emissions from a specific development, such as large scale residential or industrial land uses, waste management facilities, or minerals extraction and handling operations.

2. Mobile sources of air pollution are often highway based, or from other forms of transportation and equipment with engines including boats, planes, trains, farm, gardening and construction equipment, and recreational vehicles.

Agricultural sources

3. Agricultural operations, those that raise animals and grow crops, can generate emissions of gases and particulate matter. For example, animals confined to a shed or restricted area (rather than field grazing), produce large amounts of manure. Manure emits various gases into the air, particularly ammonia which can be emitted from animal houses, manure storage areas, or from the land after the manure is applied. In crop production, the misapplication of fertilizers, herbicides, and pesticides can potentially result in aerial drift of these materials and harm may be caused. Other sources include land management techniques, mobile generators and other small plant for construction purposes.

Natural sources

4. Emissions can come from both anthropogenic sources and natural sources. An example would be Nitrogen Dioxide (NO_2), where the major sources are road transport (as a product of combustion) and from energy generation using coal or oil. It can also be produced naturally by lightning. High levels of NO_2 can cause respiratory problems (inflammation of airways and lung function), and may also have adverse effect of vegetation (leaf, needle damage and reduced growth) and acidification and/or eutrophication (nutrient enrichment) of sensitive habitats (especially water bodies), which leads to excess growth of algae and plants, which may result in oxygen depletion. Wildfires, dust storms and volcanic activity also contribute gases and particulates to our atmosphere.

Major air pollutants and their sources

5. The sources of major air pollutants subject to compliance are detailed below.

Pollutant	Source
Nitrogen Oxides (NOx)	All combustion processes in air produce oxides of nitrogen (NO_x). Nitrogen dioxide (NO_2) and nitric oxide (NO) are both oxides of nitrogen and together are referred to as NO_x. Road transport is the main source, followed by the electricity supply industry and other industrial and commercial sectors.

Sulphur Dioxide (SO_2)	UK emissions are dominated by combustion of fuels containing sulphur, such as coal and heavy oils by power stations/refineries.
Carbon Monoxide (CO)	Formed from incomplete combustion of carbon containing fuels. The largest source is road transport, with residential and industrial combustion making significant contributions.
Ozone (O_3)	Ozone is not emitted directly from any human made source. It arises from chemical reactions between various air pollutants, primarily NO_x and Volatile Organic Compounds (VOCs), initiated by strong sunlight. Formation can take place over several hours or days and may have arisen from emissions many hundreds, or even thousands of kilometres away.
Particulate Matter (PM_{10} / $PM_{2.5}$)	PM is categorised based on the size of the particles (e.g. $PM_{2.5}$ is particles with a diameter of less than 2.5µm). PM is made up of a range of materials and arise from many sources. Concentrations comprise primary particles emitted directly into the atmosphere from combustion sources and secondary particles are formed by chemical reactions in the air. PM derives from both human-made and natural sources (such as sea spray and Saharan dust). In the UK the biggest human-made sources are stationary fuel combustion and transport. Road transport gives rise to primary particles from engine emissions, tyre and brake wear and other non-exhaust emissions. Other primary sources include quarrying, construction and non-road mobile sources. Secondary PM is formed from emissions of ammonia, sulphur dioxide and oxides of nitrogen as well as from emissions of organic compounds from both combustion sources and vegetation.
Polycyclic Aromatic Hydrocarbons (PAHs)	Many different PAHs emanate from various sources. A benzo[a]pyrene (B[a]P) marker (i.e. an indicator compound for exposure) is used for the most hazardous PAHs. The main sources of B[a]P in the UK are domestic coal and wood burning, fires (e.g. accidental fires, bonfires, forest fires, etc.), and industrial processes such as coke production. Road transport is the largest source for total PAHs, but this source is dominated by chemicals thought to be less hazardous than B[a]P.
Benzene (C_6H_6)	Has a variety of sources, but primarily arises from domestic and industrial combustion and road transport.
1, 3-butadiene	Mainly from combustion of petrol. Motor vehicles and other machinery are the dominant sources, but it is also emitted from some processes, such as production of synthetic rubber for tyres.
Ammonia (NH_3)	Mainly derived from agriculture, primarily livestock manure/slurry management and fertilisers. A small proportion is derived from variety of sources including transport and waste disposal.

Annex B – Detailed effects of, and on, air pollution

Health effects of air pollution

1. Sources of air pollution within casework can be expected to include emissions from: a specific fixed point, such as a chimney; multiple emissions within an area, such as flues for central heating boilers and stoves; emissions from a specific development, such as large scale residential or industrial land uses, waste management facilities, or minerals extraction and handling operations.

2. **Particulates (PM_{10}/$PM_{2.5}$)** - Some estimates suggest that particulates are responsible for up to 10,000 premature deaths in the UK each year. The extent to which particulates are considered harmful depends largely on their composition. The effects of particulate emissions are considered detrimental due to their composition, containing mainly unburned fuel oil and polycyclic aromatic hydrocarbons (PAHs) that are known to be carcinogenic among laboratory animals. The categorisation of particles through size has become important when assessing their effects on health, as particles of less than 10 micrometres ("µm") in diameter can penetrate deep into the lung and cause more damage, as opposed to larger particles that may be filtered out through the airways' natural mechanisms. $PM_{2.5}$ can pass through the lung and into the bloodstream to reach other internal organs.

3. **Ozone (O_3)** - Ozone differs from most pollutants in that it is created as a secondary pollutant by the action of sunlight on volatile organic compounds (VOCs) and oxides of nitrogen, often over several days. This results in ozone being widely dispersed as a pollutant. It can form in greater concentrations in rural areas. As ozone concentrations are particularly dependant on sunlight, episodes are always likely to develop following sustained periods of warmth and calm weather. Ozone is a toxic gas that can bring irreversible damage to the respiratory tract and lung tissue if delivered in high quantities. Levels during air pollution episodes have peaked at around 250 ppb. At these concentrations ozone is likely to impair lung function and cause irritation to the respiratory tract. Asthma sufferers are known to adopt these symptoms more easily.

4. **Oxides of Nitrogen (NO_x)** - The oxides of most concern are nitric oxide (NO) and nitrogen dioxide (NO_2). The latter is more damaging to health, due to the toxic nature of this gas. NO is more readily emitted to the atmosphere as a primary pollutant and is often oxidised to nitrogen dioxide following dispersal. Health effects of exposure to NO_2 include shortness of breath and chest pains. The effects of NO include changes to lung function at high concentrations.

5. **Carbon Monoxide (CO)** - Its link with haemoglobin, the oxygen carrying component of the blood stream, forms carboxyhaemoglobin (COHb) which can be life-threatening in high doses. The effects of carbon monoxide pollution are more damaging to pregnant women and their foetus.

6. **Lead (Pb)** - Lead emissions have significantly reduced in recent years but lead is still a serious air pollutant especially to those living near to areas of dense traffic in cities where leaded fuel may still be in use. Damage to the central nervous system, kidneys and brain can result when levels in the blood reach concentrations of 800 mg/litre. Much of the concern regarding pollution from lead centres around its effects on child health. Children exhibit vulnerability to the toxic effects of lead at much lower concentrations than for adults. It has been shown that there is a strong link between high lead exposures and impaired intelligence.

7. **Sulphur dioxide (SO_2)** - The health effects of sulphur dioxide pollution were exposed during the "Great Smog" of London in 1952, resulting in around 4,000 premature deaths through heart disease and bronchitis. Since then, emissions have been significantly reduced through legislation. Research has shown that exposure for people with asthma is significantly more damaging than for others. Sulphur dioxide pollution is considered more harmful when particulate and other pollution concentrations are high. This is known as the synergistic effect, or more commonly the "cocktail effect." Therefore, the monitoring networks in the UK incorporate both smoke and sulphur dioxide.

8. **Volatile Organic Compounds (VOCs)** - Some VOCs are quite harmful. Benzene may increase susceptibility to leukaemia, if exposure is maintained over a period of time. Forms of Polycyclic Aromatic Hydrocarbons (PAH) can cause cancer. Dioxins, produced from the manufacturing of organic compounds as well as combustion or waste incineration, cause health effects from ingestion (inhalation or from entering the food chain via soil pollution). There is an apparent correlation between butadiene exposure and cancer.

Effects on ecosystems and wildlife

9. Air pollution can result in significant impacts on the natural environment, biodiversity and ecosystems, with resulting impacts on agriculture/aquaculture and other ‘ecosystem services’. For example:

   - **Sulphur dioxide** and **nitrates** cause acidification (via 'acid rain'), which can cause significant damage to both living and non-living components of ecosystems.
   - Eutrophication occurs when pollution delivers an **excess of nutrients** to ecosystems, for example by causing algal blooms in that can wipe out fish populations through oxygen depletion as the bloom decomposes.
   - **Ozone** and **nitrogen** can directly cause toxic damage to all living components of an ecosystem, particularly to plants.
   - Deposited **heavy metals** are stable and persistent environmental pollutants which cannot be degraded or destroyed and so may accumulate in soil, water and sediments.

10. The extent of these impacts are assessed using critical loads and levels, which are estimates of the concentration of one or more air pollutants above which there is risk of damage to the environment. The term '**Critical Load**' refers to the deposition of pollutants from the air to land and water and can be

defined as the "*quantitative estimate of exposure to one or more pollutants below which significant harmful effects on specified sensitive elements of the environment do not occur according to present knowledge*", while '**Critical Level**' refers to pollutant concentrations in the atmosphere and can be defined as "*concentrations of pollutants in the atmosphere above which direct adverse effects on receptors, such as human beings, plants, ecosystems or materials, may occur according to present knowledge*". These are important parameters and are often referred to in ESs and Habitat Risk Assessments where, for example, a new road project or proposed poultry shed would result in the release of nitrogen oxides and ammonia (NH_3) respectively, resulting in nitrogen deposition (N-deposition) on nearby protected sites/habitats/species.

Effects on historic assets

11. Most materials are liable to some degree of damage by acidic deposition. Those most vulnerable are limestone and calcareous stones (often found in historic buildings), marble, carbon-steel, zinc, nickel, paint and some plastics. Stone decay can take several forms, including the removal of detail from carved stone, and the build-up of black gypsum crusts in sheltered areas. Metal corrosion is caused primarily by oxygen and moisture, although SO_2 accelerates the process. Structures submerged in acidified waters such as foundations and pipes can also be corroded.

Effects of weather on air quality

12. Generally, windy weather causes pollution to be dispersed whilst still weather allows pollution to build up. Coastal and open areas thus often experience better air quality. Wind direction also has an effect; if the wind is blowing towards an urban area from an industrial area, pollution levels are likely to be higher in the town than if the air was blowing across farmland. Sunshine can also affect pollution levels; on hot, summer days, pollution from vehicles can react in the presence of sunlight to form ozone. The pollution that causes ozone to be formed is usually generated from vehicles in cities and towns but because this pollution can be transported by winds, high levels of ozone may be found in the countryside. Air pressure also has an effect: during high pressure systems, the air is usually still which allows pollution levels to build up; during low pressure systems the weather is often wet and windy which causes pollutants to be dispersed or washed out of the atmosphere by rain.

Effects of topography on air quality

13. Concentrations of pollutants can be greater in valleys than areas of higher ground. This is because some weather conditions (often following a clear cloudless night with light wind) can cause polluted air to become trapped in valleys, dips in the landscape or a (partial) 'bowl'. A 'temperature inversion' occurs when cold air becomes trapped under a layer of warmer air above it. Polluted air can also become trapped in cold, calm and foggy days during winter. The term 'smog' may be used to describe trapped polluted air.

Annex C – Legislation, policy and guidance

International legislation

1. **United Nations Economic Commission for Europe (UNECE) Convention on Long-Range Transboundary Air Pollution (CLRTAP)** – Ratified in 1983, the aim of the Convention is that Parties shall endeavour to limit and, as far as possible, gradually reduce and prevent air pollution including long-range transboundary air pollution. Parties develop policies and strategies to combat the discharge of air pollutants through exchanges of information, consultation, research and monitoring.

2. **UNECE Protocol to Abate Acidification, Eutrophication and Ground Level Ozone ("the Gothenburg Protocol")** – extension of the CLRTAP set national emissions ceilings for 2010 up to 2020, with amendments to cover the period up to 2030 for four pollutants: sulphur dioxide (SO_2), nitrogen oxides (NO_x), volatile organic compounds (VOCs) and ammonia (NH_3). It builds on previous Protocols that addressed sulphur emissions.

3. **UNECE Protocol Concerning the Control of Emissions of Nitrogen Oxides or Their Transboundary Fluxes ("the Sofia Protocol")** – extension of the CLRTAP, the Protocol requires Parties to control or reduce emissions of nitrogen oxides. Furthermore, Parties are requested to introduce pollution control measures for major existing stationary sources and to apply national emissions standards to major new stationary and mobile sources, based on best available technologies that are economically feasible.

EU retained legislation

4. **EC Directive relating to Arsenic, Cadmium, Mercury, Nickel and Polycyclic Aromatic Hydrocarbons in Ambient Air 2004/107/EC** (the air quality "fourth daughter Directive") - completes the list of pollutants initially described in the Framework Directive. Target values for all pollutants except mercury are defined for the listed substances, though for PAHs, the target is defined in terms of concentration of benzo(a)pyrene which is used as a marker substance for PAHs generally. Only monitoring requirements are specified for mercury.

5. **EC Ambient Air Quality and Cleaner Air for Europe Directive 2008/50/EC ("the Ambient Air Quality Directive")** – merges most of existing legislation into a single directive (except for the fourth daughter directive) with no change to existing **air** quality objectives. There are new air quality objectives for $PM_{2.5}$ including the limit value and exposure related objectives. Includes the possibility to discount natural sources of pollution when assessing compliance against limit values and the possibility for time extensions of three years (PM_{10}) or up to five years (NO_2, benzene) for complying with limit values, based on conditions and the assessment by the European Commission. Subsequently transposed into UK law under the Air Quality Standards Regulations 2010.

6. **EC Directive on National Emissions Ceilings for Certain Atmospheric Pollutants 2016/2284/EU** ("the National Emissions Ceiling Directive") – sets equivalent ceiling limits as the Gothenburg Protocol for SO_2, NO_X, NH_3 and volatile organic compounds for countries to meet from 2010 onward in European law. Subsequently transposed into UK law under the National Emission Ceilings Regulations 2018 (S.I. 2018 No.129).

7. **EU industrial emissions (integrated pollution prevention and control) Directive 2010/75/EU** ("Industrial Emissions Directive" or the "IED") - is also of relevance, although it has a specific context to the regulation of industrial activities **through** the integrated prevention and control of pollution. It requires that all industrial operations in sectors covered by this EU Directive carry out air quality assessments and make provisions to minimise emissions. This Directive also requires that Best Available Techniques ("BAT") is be used to control air emissions, taking into account the cost, which should be reasonable for the changes to be implemented.

8. EC Directive 84/360/EEC introduced the term *Best available techniques not entailing excessive cost* ("BATNEEC") for the regulation of air pollution from industrial plants. That term was superseded by the integrated pollution prevention and control ("IPPC") Directive 96/61/EC, which referred to best available techniques ("BAT") for IPPC in relation to air, land and water. The definition of BAT in Directive 96/61/EC included that "available" was "...*taking into consideration the costs and advantages....so long as they are reasonably accessible to the operator*...". Therefore, both BATNEEC and the subsequent definition of BAT took into consideration the potential costs of techniques for regulatory compliance. BAT was carried through to IPPC Directive 2008/1/EC and the subsequent Industrial Emissions Directive 2010/75/EU.

Domestic legislation

9. **Environmental Protection Act 1990** - imposes duties on local authorities to deal with 'statutory nuisances'. These include smoke emitted from premises that is prejudicial to health or a nuisance; fumes or gases emitted from premises that is prejudicial to health or a nuisance or any dust, steam, smell or other effluvia arising on industrial, trade or business premises that is prejudicial to health or a nuisance.

10. **Clean Air Act 1993** - regulates combustion and other activities (including domestic combustion) which contribute to air pollution, including smog caused by burning of coal for heating or by industry. The legislation targets smoke emission from chimneys and premises and smoke emissions from residential and non-residential furnaces. Although some activities fall on WG, the key measures are applied by Local Authorities and include:

    a) Control of dark smoke,
    b) Prohibition of cable burning except at authorised installations,
    c) Designation and supervision of smoke control areas,
    d) Approval of chimney heights for non-residential furnaces,
    e) Control of grit and dust emissions from non-residential furnaces,

f) Approval of new non-residential furnaces, and
g) Approval of abatement equipment for use on non-residential furnaces.

11. **Environment Act 1995** – this Act requires the UK to produce a national Air Quality Strategy. Part IV of the Act requires local authorities in the UK to review air quality in their area and designate AQMAs if improvements are necessary. Where an AQMA is designated, local authorities are also required to work towards the Strategy's objectives prescribed in regulations. An Air Quality Action Plan describing the pollution reduction measures must then be put in place. These plans contribute to the achievement of air quality limit values at local level to contribute to the requirements of the Ambient Air Quality Directive.

12. **The Air Quality Standards Regulations 2010 (S.I. 2010 No.1001)** - These regulations apply in England, except for regulations 3(a), 23, 24, 25(4) and 32 which extend to the UK in regard to the competent authority for the purposes of article 3(f) of EU Directive 2008/50/EC, exposure reduction for $PM_{2.5}$, and transboundary air pollution.

13. **National Emission Ceiling Regulations 2018** - sets emission limits for which sets national emission limits (ceilings) for SO2, NOX, NH3 and volatile organic compounds for countries to meet until 2030, equivalent to those in the amended UNECE Gothenburg Protocol.

14. The **Environment (Air Quality and Soundscapes) (Wales) Act 2024** empowers WG to set air quality targets and amends existing legislation in relation to local air quality management, road user charging, anti-idling and smoke control. The Act also places WG and local authorities under a duty to promote active travel as a way of reducing or limiting air pollution and makes provision for this duty to be imposed, by regulations, on other public authorities.

15. **Air Quality (Wales) Regulations 2000 (S.I. 2000 No. 1940)** – Regulation 3 prescribes the "relevant period" for air quality objectives to be met for the purposes of Part IV sections 82 to 85 of the Environment Act 1995. The air quality objectives are subject of Regulation 4, with the substances and dates listed in a Schedule. It was amended by the **Air Quality (Wales) (Amendment) Regulations 2002 (S.I. 2002 No.3182)** through additional air quality objectives and to the meanings in the Part II "Interpretation".

16. **Building Regulations (Approved Document F: – Means of ventilation)** – deals with the requirements and provisions for adequate ventilation provided for buildings where people go.

Annex D – Casework considerations

Monitoring and modelling techniques

1. The **DEFRA UK-wide air quality assessment** provides data for each pollutant that is derived from a combination of measured and modelled concentrations.

2. The **National Atmospheric Emissions Inventory ("NAEI")** is funded by the four UK nations and estimates annual pollutant emissions from 1970 to the most current publication year for the majority of pollutants, although a number of pollutants are estimated from 1990 or 2000 to the most current publication year. The NAEI is made up of the Greenhouse Gas Inventory (GHGI) and the Air Quality Pollutant Inventory (AQPI).

3. **Automatic Monitoring Networks** – these produce hourly pollutant concentrations, with data being collected from individual sites by modem. The Automatic Urban and Rural Network (AURN), which is the UK's largest automatic monitoring network and is the main network used for compliance reporting against the Ambient Air Quality Directives. The more limited Automatic Hydrocarbon Network has, since 1992, taken hourly measurements of speciated hydrocarbons.

4. **Non-Automatic Monitoring Networks** measure less frequently compared to automatic networks (i.e. either daily, weekly or monthly) and samples are collected by some physical means.

5. **Stack height calculations –** HMIP 1993 '*Guidelines on Discharge Stack Heights for Polluting Emission. Technical Guidance Note D1 (Dispersion)*' is now out of print and the default values set out in the HMIP document are out-of-date. However, it provides a simple but versatile method for calculating the minimum permissible chimney height to safeguard against short-term air quality impacts. It allows for building downwash effects but not terrain effects.

6. The **Emissions Factors Toolkit (EFT)** is published by the four nations to assist local authorities in carrying out Review and Assessment of local air quality as part of their duties under the Environment Act 1995.

7. **Pollution Climate Mapping (PCM)** can be used to map data from the automated AURN network (see above).

8. The **Community Multiscale Air Quality (CMAQ) Modelling System** is a sophisticated atmospheric dispersion model developed in the US; evidence may cite comparisons to this methodology.

Typical evidence

9. An **air quality report** should focus on evidence of current and predicted emissions. However, more specific reports may be needed for particular types of development site, such as:

a) **Local Air Quality Data** – obtained from an established national network monitoring/NEAI and/or an independent local assessment.

b) **Air Quality Assessment Report** – Such a report should:

i. Provide details of the scheme being considered;
ii. Set out the policy context for the assessment, describe the relevant air quality standards, and identify the basis for determining the significance of effects;
iii. Detail the assessment methods, and any model verification;
iv. Identify potentially sensitive locations;
v. Describe the existing air quality/baseline conditions;
vi. Predict the future air quality without the proposed scheme;
vii. Predict the future air quality with the proposed scheme, including construction phase impacts on air quality;
viii. Assess the possibility of cumulative effects; and,
ix. Conclude on significance of effects and policy / standards compliance; and,
x. Identify possible mitigation measures.

c) **Traffic Assessment** – using Trip Rate Information Computer System (TRICS) for trip generation from developments; WebTAG and/or DMRB methodology for impact appraisal as part of the cost-benefit analysis.

10. Data may contain 'bias adjustment factors' (for year, locality and interference) and/or figures derived from conversion calculations (i.e. from NO_x to NO_2). Evidence may also refer to "decay rate", which is the rate at which a pollutant 'disappears' as a result of absorption, chemical reaction or removal by rain.

Mitigation

11. Mitigation should be considered in relation to its likely effectiveness, cost and practicality. Measures designed or engineered to operate passively are less likely to require ongoing intervention, management or a change in people's behaviour and thus are likely to be preferable.

12. **Prevention** measures aim to prevent/avoid exposure and/or impacts to/of the pollutant by eliminating or isolating potential sources or by replacing sources or activities with alternatives. This is usually best achieved through taking air quality considerations into account at the scheme design stage.

13. **Minimisation** measures to reduce/minimise exposure/impacts should next be considered, once all options for prevention/avoidance have been implemented so far as is reasonably practicable (both technically and economically). To achieve this reduction/minimisation, preference should be given first to:

a) mitigation measures that act on the source; before
b) mitigation measures that act on the pathway; then

c) mitigation measures at or close to the point of receptor exposure.

14. **Enhancing dispersion** of an emission has the effect of lowering the pollutant concentration to which receptors are exposed to within a more acceptable threshold. This can be achieved by increasing the stack height or decreasing the process which causes the emission. However, this merely displaces the problem and does not provide a longer-term solution and is therefore not considered appropriate for most scenarios.

15. **Offsetting** the impact of a new development on air quality may be achieved by proportionately contributing to air quality improvements elsewhere (including those identified in Air Quality Action Plans and other strategies). This option should only be considered once all others have been exhausted.

16. Where the relevant tests are met, mitigation can be secured using planning conditions (e.g. to require the installation of a suitable ventilation system) or planning obligations (e.g. to secure a travel plan). Examples of mitigation include:

    a) alteration of the design and layout of a development to increase separation distances from sources of air pollution,
    b) using green infrastructure, in particular trees, to absorb dust and other pollutants,
    c) improving the means of ventilation,
    d) promoting modes of transport with low impact on air quality,
    e) controlling dust and emissions from construction, operation and demolition, and
    f) contributing funding to offsetting measures, including those identified in Air Quality Action Plans and low emission strategies.

Air Pollution Control (APC) Techniques

17. Industrial processes with air emissions regulated through Environmental Permits can be expected to have techniques to minimise or prevent the pollution occurring through the control of source emissions. These include:

    a) Modification of the process to minimise the production of wastes or to avoid releasing the wastes to the atmosphere,
    b) collection of particulate materials, and
    c) absorption of toxic gases.

18. Some techniques can be used to control both the particulates and gases; others are applicable to only one. Some examples are set out below.

19. **Control of smoke** – achieved by more efficient combustion through design alterations to the combustion chamber and the control of fuel and air supply.

20. **Control of grit, dust and fumes from industrial plant** – there are broadly five ways to in which the escape to the atmosphere of particulate matter can

be controlled or prevented at source. The best solution for a particular process will depend on the size and shape of the particle(s) involved:

a) process modification to prevent particulates becoming airborne by use of protective enclosures.
If this method is not practically possible, airborne particulate matter can be separated out of a contaminated gas stream by the use of:
b) gravity and inertial forces in a mechanical separator by e.g. a cyclone dust separator;
c) a liquid (wet method) for 'washing' the particulates out of the atmosphere by using either scrubbers or wet arrestors e.g. simple demisters/dedusters or tower/spray scrubbers (e.g. venturi scrubber);
d) a fabric filter by use of bag or cartridge filters; or
e) electrostatic forces in an electrostatic precipitator.

21. **Control of gaseous pollutants** – control systems are needed to minimise gaseous emissions by either combustion or recovery:

a) Combustion techniques – the use of flares, conventional furnace systems or thermal/catalytic oxidiser (= a form of gaseous incineration that is often found as part of the emission controls in the most odorous plants e.g. animal / meat waste rendering plants);
b) Recovery techniques – the use of adsorption by activated charcoal or absorption by dissolution in e.g. wet scrubbers or condensers or by simple chemical reaction e.g. flue gas desulphurisation (FGD).

22. **Odour Control** – Several industrial, agricultural and domestic activities can give rise to odours. Some offensive odours (e.g. hydrogen sulphide – 'rotten eggs') are due to toxic gases, but others may be non-toxic at emitted concentrations. Waste gases with offensive odours may originate from:

a) The production process,
b) The storage area,
c) Leakage from pumps and compressors,
d) During transfer of material,
e) Open wastewater treatment or waste composting plants,
f) Spreading of sewage sludge and farm slurry on land, or
g) Facilities such as rendering plants and maggot farms, which have the potential to produce odours that may be considered the strongest / most offensive by those who experience them.

23. Options for controlling odours at source include:

a) Chemical reaction by oxidation to neutralize the odour;
b) Use of scrubbers;
c) Thermal oxidation (i.e. incineration of the gases emitted);
d) Adsorption on activated charcoal;
e) Biotechnical methods, e.g. bioscrubbers/biofiltration
f) Enhanced dispersion

24. **Air pollution control** – NRW regulates the emission of gases, smoke or odours emitted from certain industrial and agricultural activities under the Environmental Permitting regime. Local Authorities also issue environmental permits for smaller processes (e.g. concrete batching plants, quarry plant, rock crushers for secondary aggregate production from waste management, petrol stations, and rendering plant). Processes associated with concrete plants, crushers and petrol stations are fairly routine, whereas rendering processes often produce extremely odorous gases that can result in complex and challenging casework, due to their potency and possible geographic extent, even from small gas releases. Local Authorities may also regulate air pollution if it becomes a statutory nuisance under Part III of the Environmental Protection Act 1990. NRW can also address impacts on amenity (e.g. odours) if regulated through an Environmental Permit issued by NRW.

25. **Planning and air pollution control** – The planning system has a role in preventing or minimising particulate, gaseous or odour impacts from new or changed developments by regulating the location and, to a certain extent, the specification of some design and control parameters of these activities. Inspectors should be aware of any relevant representations from NRW or the Local Authority's Environmental Health Officer/air pollution control team.

Emissions from transport and their reduction

26. Nitrogen dioxide (and to a lesser extent other pollutants) from transport sources remain the most pressing of the air quality problems facing Wales, both from the effects on health/environment and compliance with the air quality objectives derived from the Ambient Air Quality Directive. There are various options to mitigate emissions from transport, e.g. CAZs, and include the following:

- **Modal shift** i.e. from private vehicles to public transport, cycling or walking. Other modal shifts could include switching freight movements from road to rail, sea or waterway. Siting developments that generate traffic near to public transport or active travel routes may facilitate modal shifts.
- **Traffic speed and flow** can change NO_x emissions, which are typically higher when an engine is under higher loads (e.g. during acceleration). Schemes that tackle road congestion will reduce the 'stop-start' traffic and higher engine loads, and consequently will reduce engine emissions.
- **Low emission vehicles** – used to reduce transport-related emissions.
- **Alternative fuels** – Vehicles using liquefied natural or petroleum gas or hydrogen) could reduce emissions of NO_x and other gases.
- **Measures within Air Quality Action Plans** – such as local traffic routing and low emission zones, green travel plans, congestion charging schemes and commitments to work toward such measures.
- **Rail electrification** – providing lower emissions than diesel trains.
- **Aviation** – steps can be taken to improve emissions released from traffic and transport associated with airports, and from aircraft using the airport.
- **Ports and shipping** – steps can be taken to reduce vessel emissions in ports and near populated areas e.g. reducing the need for on-board energy generation. The International Convention for the Prevention of Pollution from Ships (MARPOL) regulates pollution from ships; the UK is a party to it.