Air Quality

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Key legislation and policy

Legislation	• Environment Act 1995, including sections 82, 83 and 84 • Well-being of Future Generations (Wales) Act 2015 • Air Quality (Wales) Regulations 2000, as amended by the Air Quality (Wales) (Amendment) Regulations 2002 • Environment Act 2021
National policy and guidance	• The Clean Air Plan for Wales (2020) • Tackling roadside nitrogen dioxide concentrations in Wales - Welsh Government supplemental plan to the UK plan for tackling roadside nitrogen dioxide concentrations 2017 (2018) • Future Wales – The National Plan 2040, air quality is mentioned in various strategic and policy objectives • Planning Policy Wales ("PPW") – including section 6.7 – *Air Quality and Soundscape* • PPW Technical Advice Notes – air quality is mentioned in TAN 4 (Retail and Commercial Development), TAN 16 (Sport, Recreation and Open Space) and TAN 21 (Waste). TAN 18 (Transport) paragraph 2.12 addresses Local Air Quality. • Minerals Technical Advice Notes ("MTAN") – Both MTAN 1 (Aggregates) and MTAN 2 (Coal) address dust and particulate matter • Mineral Planning Guidance ("MPG") – MPG14 addresses the review of minerals planning permissions and conditions that will include those in relation to the control of dust and the sources of it • Local air quality management in Wales – Policy Guidance, PG(W)(17) (2017) • Local Air Quality Management: Technical Guidance (LAQM.TG16) (2021)
Judgments	• *Wealden DC v SSCLG* [2017] EWHC 351 Admin • *Smith v Secretary of State for the Environment, Transport and the Regions* [2003] Env LR 32

	• *R (Hereford Waste Watchers Ltd) v Herefordshire CC* [2005] Env LR 29 • *R (ClientEarth) v SoS EFRA,* [2015] UKSC 28

Contents

Background to air quality legislation and policy

1. Air quality is usually considered with reference to air pollution and the existing mechanisms for monitoring and controlling it. Air pollution not only has the potential to affect organisms living within the environment, but it can also affect built structures. Therefore, 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 and the things within it. Further details on the sources, types and effects of air pollution are available in Annex A. The effects of air pollution on health, ecosystems and heritage assets, and the effects of weather and topography on air pollution, are outlined in Annex B.

2. Various pieces of air quality legislation from the 19th century onwards, and the resulting work by architects, engineers, public health officials and planners, have sought to improve living conditions and public health. The Clean Air Act 1956 followed the thousands of excess deaths caused by the London "Great Smog" of 1952. It proved to be effective and was followed by other examples of targeted environmental legislation. Both the Clean Air Act 1956 and the Clean Air Act 1968, along with certain relevant provisions in other legislation, were repealed (and replaced) by the Clean Air Act 1993.

3. Annex C provides an overview of the hierarchy of existing air quality legislation that applies in Wales, including Retained EU Law. Following the UK's departure from the EU and from 1 January 2021, the following will continue:

    a) Wales' legal framework for enforcing domestic environmental legislation by the regulatory bodies that apply in Wales or court systems
    b) Environmental targets that have resulted from EU legislation as they are already covered in UK / Welsh legislation
    c) Permits or licences issued by the regulatory bodies that apply in Wales

4. The Environment Act 1995 requires every Local Authority to: review the present and likely future air quality within its area; designate an Air Quality Management Area ("AQMA") to address actual or likely failures in achieving air quality objectives; and implement an Air Quality Action Plan ("AQAP") to reduce pollution levels.

5. The *Clean Air Zone Framework for Wales (2018)* seeks to guide and facilitate Local Authorities establishing a CAZ in their areas. While the CAZ should consider the full range of sources of air pollution and environmental noise, the *Clean Air Zone Framework for Wales (2018)* notes that, given the significance of road traffic to air pollution, a CAZ will be constructed around a core of traffic access restrictions.

6. Welsh national air quality standards and objectives are contained within the Air Quality (Wales) Regulations 2000 (S.I 2000 No. 1940 (W.138)), as amended by the Air Quality (Wales) (Amendment) Regulations 2002 (S.I 2002 No. 3182 (W.298)).

7. Welsh Government policy for local authorities carrying out their functions under Part IV of the 1995 Act is contained within *Local air quality management in Wales – Policy Guidance, PG(W)(17)* (2017). Whilst this policy differs between the UK nations, the associated technical guidance is shared and, at the time of writing this ITM, is a very recent (2021) document.

8. Another document shared by the UK and devolved Governments is the *UK Plan for Tackling Roadside Nitrogen Dioxide Concentrations*. It addressed the production of revised Air Quality Plans after a Supreme Court judgement in 2015 [***R (ClientEarth) v SoS EFRA,*** [2015] UKSC 28, (on appeal from [2012] EWCA Civ 897)]. The judgment explicitly stated that the UK breached the 2008 EU Ambient Air Quality Directive, which sets limits (in Annex XI) for NO_2, not by failing to apply for a derogation, but by failing to put in place sufficient plans to secure compliance. Parts of the UK would not be compliant until 2030 (the Directive requires compliance by June 2010, which can be extended by 5 years under Article 22). The UK is divided into 43 zones (for UK air quality monitoring and reporting purposes). In 2013, 38 of the 43 zones were assessed as exceeding the maximum annual limit of NO_2 emissions.

9. In Wales, the UK air quality reporting areas have been north and south Wales, along with the Cardiff Urban Area and Swansea Urban Area. These are shown in Annex C of the *UK Plan for Tackling Roadside Nitrogen Dioxide Concentrations*.

10. Legal challenges led to the publication of a 'final' UK plan on 26 July 2017 and a supplemental plan to address inadequacies as required by one of the judgments was published on 5 October 2018.[1] The UK Air Quality Plan aims to focus on the most immediate air quality challenge, i.e. to reduce NO_2 concentrations around roads where the current levels are above legal limits within the shortest possible timescale. Welsh Government was also required to produce its supplemental Air Quality Plan by 30 November 2018, which is entitled "...*Tackling roadside nitrogen dioxide concentrations in Wales: Welsh Government supplemental plan to the UK plan for tackling roadside nitrogen dioxide concentrations 2017*...", dated November 2018.

11. The *Clean Air Plan for Wales* (2020) aims to integrate and complement other Welsh Government policies including plans for planning, de-carbonisation, noise and soundscape management, environment, infrastructure, land use, transport and marine and fisheries. In doing so, it addresses the 2008 EU Ambient Air Quality Directive. It sets out additional measures and actions to improve air quality, and where possible, achieve multiple beneficial outcomes, including the designation of CAZs. In casework where air quality is an issue, Inspectors will need to have regard to the *Clean Air Plan for Wales* and attach appropriate weight to the extent to which the scheme would meet the plan's aim "...*to improve air quality and reduce the impacts of air pollution on human health, biodiversity, the natural environment and our economy*...".

[1]Including *ClientEarth v SoS EFRA (No3)*, [2018] EWHC 315 (Admin).

12. *Future Wales* (2021) was published soon after the Clean Air Plan for Wales and provides Welsh Government's twenty year plan for shaping the future growth and development of Wales. In seeking to enable people to live active and healthy lives, *Future Wales* strategic and policy objectives address, amongst other things, air quality.

13. Various TANs and the two MTANs provide further advice on air quality in relation to their topics.

14. However, this is a specialist technical and professional area. The Inspector will need to ensure that they have, and consider, relevant consultation responses when addressing the potential significance of air quality impacts, for example, on protected habitats and species.

The nature of air and its potential pollutants

15. 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. However, pollutants, along with other factors such as topography and weather, can cause air quality to vary considerably over time and across geographic areas (and at different altitudes).

16. 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 the red Saharan dust that can be present in the atmosphere during long dry periods in Wales, the smoke from summer hill fires, or on a global level, volcanic dust and gaseous emissions, and other naturally occurring processes.

17. 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, and the *Clean Air Plan for Wales* describes its sources and effects. 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

General principles

18. Any air quality issue that relates to land use and its development is capable of being a material planning consideration. The weight, however, given to air quality in making a planning, environment or related decision, in addition to the relevant policies, will depend on such factors as:

    a) the impacts on air quality – the overall degradation or improvement in local air quality and its effect on compliance (or perhaps further non-compliance) with national air quality objectives and EU limit values;

b) the air quality in the area surrounding the proposed scheme – whether the scheme could materially affect any air quality action plan or other strategy in the area;
c) the likely use of the scheme - the length of time people likely would be exposed at that location and whether the scheme would introduce new public exposure; and
d) the positive benefits provided through other material considerations.

19. The *Clean Air Plan for Wales* aims to support the delivery of commitments within the national strategy *Prosperity for All: economic action plan*. Sections within *Prosperity for All* are structured around the well-being objectives that applied when the national strategy was published. *Future Wales* addresses the current Welsh Government well-being objectives for 2021 to 2026, which include: to make our cities, towns and villages even better places in which to live and work; and, embed our response to the climate and nature emergency in everything we do. These, and other, well-being objectives may be considered to be relevant to casework where air quality is an issue.

Regulatory principles

20. Casework where air quality is a potentially significant issue will often have more than one regulatory regime controlling air quality. It has long been recognised that the decision in such cases may assume that a subsequent regulatory authority will act with competence. See, for example (there are also later judgements), ***Smith v Secretary of State for the Environment, Transport and the Regions*** [2003] Env LR 32 where the judgement included:

"...*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*."

And, ***R (Hereford Waste Watchers Ltd) v Herefordshire CC*** [2005] Env LR 29, with 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."

21. Evidence, including consultation responses from other air quality regulators, should provide some indication of any likely parallel regulatory progress, or barriers, in relation to the scheme before the Inspector e.g. if an environmental permit already has been granted, is expected to be granted, or would be unlikely to be granted.

22. Inspectors must be aware of the extent of any parallel regulatory responsibility. For example, in minerals casework an environmental permit may control emissions from crushing plant but planning conditions would still be necessary to control emissions from the 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.

23. However, there have been recent significant failures in regulatory responsibility. Firstly, the Wealden judgement (***Wealden DC v SSCLG*** [2017] EWHC 351 Admin) found Habitats Regulation Assessment advice from Natural England that had been used for Local Plan policies to have been flawed. Secondly, and again with implications for Local Plan policies, there was manipulation of air quality data in Cheshire East Council. While such instances may be rare, any suspected failure in regulatory responsibility that is brought to the Inspector's attention will need to be addressed by the Inspector dealing with the case.

The main issue

24. Air quality is highly regulated and a well understood issue. Therefore, casework has often concentrated on either:
    a. the possible effects on protected habitats of changes in air quality that result from the scheme; or,
    b. the effect of existing air quality on the suitability of a proposed new land use.

    However, the possible effects of a scheme now can also be expected to be placed within the context of whether they would support the aim of the *Clean Air Plan for Wales*.

25. Where the scheme sets out to improve air quality, a more generic main issue could be framed around the aim of the *Clean Air Plan for Wales* (2020). Such a main issue could be "...*Whether the* [proposed development / scheme] *would improve air quality and reduce the impacts of air pollution on* [human health / biodiversity / the natural environment and/or the economy] ...".

Evidence

26. The *Clean Air Plan for Wales* (2020) seeks to improve air quality and reduce impacts of air pollution on human health, biodiversity, the natural environment and our economy. Casework dealing with such matters may have extensive air quality monitoring and modelling data. It may be prudent to consider whether the monitoring and modelling points that are being referred to in the evidence are the most relevant and effective for describing the possible effects of the scheme before you. In reaching their decision or recommendation, the Inspector will have to consider such evidence, and the conclusions derived from it, within the context of relevant policy and Welsh Government's well-being objectives.

27. Annex D outlines various casework considerations including:
    a) air quality monitoring and modelling techniques;
    b) the reports and submissions that can be expected in air quality evidence;
    c) mitigation techniques, including air pollution control; and,
    d) emissions from transport and their reduction.

28. Publicly available information on current (provisional data) and forecast air quality for Wales, along with the location of monitoring points, is provided at https://airquality.gov.wales/. The website also includes other relevant information, for example, other maps and data, reports, and on Local Air Quality Management ("LAQM") and the AQMAs that have been designated by Local Authorities. The website is clear that the purpose of LAQM is to improve human health and quality of life, and that the policy and guidance issued in 2017 aligned LAQM with the *Well-being of Future Generations (Wales) Act 2015*.

29. The https://airquality.gov.wales/ website can inform the evidence before the Inspector and provide a common reference point for parties, but it is not a comprehensive source of information. At the time of writing this ITM, the "Policy" section of the website does not make reference to the recent *Clean Air Plan for Wales (2020)*.

30. The Welsh air quality website provides a link to the UK Air Pollution Information System ("APIS") website http://www.apis.ac.uk/. The APIS website is the resource for NRW, and the environmental bodies in the other UK nations, to access information on air pollution. Therefore, it can be expected to be referred to in air quality evidence before you. This is especially so for casework dealing with possible effects on protected habitats. The "Site Relevant Critical Loads" tab on the home page enables anyone to select and look at the details for specific protected habitats, SACs, SPAs and A/SSSIs, and the air quality needed to sustain them.

31. There are many factors that can influence distribution and concentrations of emissions and therefore air quality, these include topography, weather and chemical reactions in the air. The evidence before the Inspector, including that from environmental professionals, should explain how these potentially complex factors have been taken into account by the cases being made to you. These cases should provide clear and distinct conclusions on either the implications of existing air quality on the scheme, or the likely effect of the scheme on air quality.

32. Inspectors considering air quality evidence will need to understand: the basis on which any forecasting has been made in areas which are not in compliance with the EU retained law Directive limits, or may be brought into non-compliance as a result of plans or proposals; and, what level of margin may be required to avoid any potential new non-compliance or delay in achieving compliance.

33. Where the possible effects of highway emissions need to be considered in casework, document LA 105 of the Design Manual for Roads and Bridges ("DRMB") provides a framework for assessing and reporting effects of highway projects on air quality. Inspectors should be aware of its potential relevance to their work.

Air quality as an "Other matter"

34. Air quality may be raised as an "other matter" in a range of casework. In such cases, the Inspector needs to 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, be that the EHO or NRW.

35. 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. Of course, planning also provides forms of regulatory control, including mitigation. Annex D outlines a range of air quality

mitigation techniques that may be delivered through design, planning and other forms of regulation.

Conditions

36. Air quality conditions, for example in relation to dust or odour emissions, will often require some bespoke wording. The section above in relation to “Regulatory principles” highlights the importance of the Inspector understanding which regulatory controls apply to the air quality effects of the scheme before them e.g. through planning conditions, an environmental permit, or would both be appropriate.

Site visits

37. The evidence before the Inspector, and discussed during any oral event, should confirm the matters and locations that need to be observed during a site visit. Annex E contains additional advice on preparing for casework and associated site visits where air quality may be a main issue.

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 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. As mentioned above, it is important to note that emissions can come from both anthropogenic sources and natural sources, a further example would be Nitrogen Dioxide (NO_2), where the major sources are road transport (as a product of combustion) and also from energy generation using coal or oil. It can also be produced naturally by lightning, where the very high temperature in the vicinity of the lightning bolt causes atmospheric oxygen and nitrogen to react and form NO_2. High levels of NO_2 can cause respiratory problems (inflammation of airways and lung function), 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 in the UK - Sources

5. The sources of major air pollutants present in the UK and subject to compliance under international conventions and associated protocols as well as European Directives (within EU retained law), transposed into UK law are detailed below.

Nitrogen Oxides (NO_x)

6. 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)

7. UK emissions are dominated by combustion of fuels containing sulphur, such as coal and heavy oils by power stations and refineries. In some parts of the UK, notably Northern Ireland, coal for domestic use is a significant source.

Carbon Monoxide (CO)

8. 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)

9. 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}/$PM_{2.5}$)

10. Particulate Matter is generally categorised on the basis of the size of the particles (for example $PM_{2.5}$ is particles with a diameter of less than 2.5μm). PM is made up of a wide range of materials and arise from a variety of sources. Concentrations of PM comprise primary particles emitted directly into the atmosphere from combustion sources and secondary particles 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)

11. There are many different PAHs emanating from a variety of 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)

12. Has a variety of sources, but primarily arises from domestic and industrial combustion and road transport.

1, 3 Butadiene –

13. 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) –

14. Mainly derived from agriculture, primarily livestock manure/slurry management and fertilisers. Small proportion 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. **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. Particulates may originate from many other sources including cement manufacturing processes, incineration and power generation, meaning localised instances of particulate pollution are common. The categorisation of particles through size has recently become important when assessing their effects on health. This is due to the fact that 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.

2. **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. Asthmatics are known to adopt these symptoms more easily.

3. **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, from traffic and power stations, 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.

4. **Carbon Monoxide (CO)** - Transport, tobacco smoke and gas appliances are the major sources of carbon monoxide. 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. Research into smoking and pregnancy shows that concentrations within the blood stream of unborn infants is as high as 12%, causing retardation of the unborn child's growth and mental development.

5. **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.

6. **Sulphur dioxide (SO_2)** - The health effects of sulphur dioxide pollution were exposed graphically during the "Great Smog" of London in 1952. This resulted in approximately 4,000 premature deaths through heart disease and bronchitis. Since then, however, emissions have been significantly reduced through legislative measures. Research has shown that exposure for asthmatics is significantly more damaging than for normal subjects. Concentrations above 125 ppb may result in a fall in lung function in asthmatics. Tightness in the chest and coughing may also result at levels approaching 400 ppb. At levels above 400 ppb the lung function of asthmatics may be impaired to the extent that medical help is required. 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.

7. **Volatile Organic Compounds (VOCs)** - Some VOCs are quite harmful, including the following: Benzene - may increase susceptibility to leukaemia, if exposure is maintained over a period of time. Polycyclic Aromatic Hydrocarbons (PAH) - forms of this compound can cause cancer. There are several hundred different forms of PAH, and sources can be both natural and man-made. Dioxins - sources of dioxins vary, although the manufacturing of organic compounds as well as the incineration of wastes and various other combustion processes involving chlorinated compounds may also produce dioxins. Health effects are as much a problem due to ingestion, as inhalation, such is the problem of dioxins entering the food chain from soils. 1,3 Butadiene - there is an apparent correlation between butadiene exposure and a higher risk of cancer. Sources include the manufacturing of synthetic rubbers, petrol driven vehicles and cigarette smoke.

Effects on ecosystems and wildlife

8. Atmospheric pollution can adversely affect the natural environment in a number of ways. Pollutants such as sulphur dioxide and nitrate 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 resulting in decreased biodiversity, for example, by causing algal blooms in rivers and lakes that can wipe out fish populations through oxygen depletion as the algal bloom decomposes.

9. Pollutants such as ozone and nitrogen can directly cause toxic damage to all living components of an ecosystem, and particularly to plants. Deposited heavy metals are stable and persistent environmental pollutants which cannot be degraded or destroyed. As such they may accumulate in soil, water and sediments and cause damage to both the environment and human health.

10. All of these effects result in significant subsequent impacts on both biodiversity and ecosystems, with resulting impacts on agriculture/aquaculture and other activities in these areas.

11. 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 Environmental Statements 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 sensitive areas, i.e. 'European Sites' - SPAs/SACs and/or areas where protected species exist.

Effects on heritage assets

12. There are many materials affected by acidic deposition as most materials are liable to some degree of damage. Those most vulnerable are: limestone; 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 does accelerate the process. Most structures and buildings are affected by acid deposition to some degree because few materials are safe from these effects. In addition to atmospheric attack, structures that are submerged in acidified waters such as foundations and pipes can also be corroded. The effects of acid deposition on modern buildings are considerably less damaging than the effects on ancient monuments. Limestone and calcareous stones which are used in most heritage buildings are the most vulnerable to corrosion and need continued renovation.

Weather and air quality

13. The weather has an important effect on air pollution levels. Generally, windy weather causes pollution to be dispersed whilst still weather allows pollution to

build up. Coastal locations and open areas often experience more windy weather and are therefore likely to experience better air quality. The wind direction also affects air pollution. If the wind is blowing towards an urban area from an industrial area then pollution levels are likely to be higher in the town or city than if the air is blowing from another direction of for example, open 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 rural countryside. The pressure of the air also affects whether pollution levels build up. During high pressure systems, the air is usually still which allows pollution levels to build up, but 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

14. Concentrations of pollutants can be greater in valleys than for areas of higher ground. This is because certain weather conditions (often following a clear cloudless night with light wind), can cause air polluted by vehicles, homes and other sources to become trapped in valleys, dips in the landscape or a (partial) ‘bowl’ that is created by hills being present around a city. This ‘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

Legislative Hierarchy

1. In general terms, like other environmental objectives UK Air Quality legislation is driven by EU Retained law and international obligations, which can be summarised in the following hierarchy:

   International – Conventions, protocols

   European – [EU Retained law] Directives, Daughter Directives, Regulations

   National – Acts and Regulations [(Ministerial?) Directions also in Wales?]

   Local – Council Order e.g. AQMA designation

2. EU Retained Law is a new category of UK law created under sections 2 to 4 of the EU (Withdrawal) Act 2018 at the end of the UK-EU transition period to retain EU-derived domestic legislation, directly applicable EU legislation and most of the EU rights (etc) as they had effect in UK law / EU law at the end of the transition period. EU Retained Law also includes any post-transition additions/modifications and interpretations by the UK courts.

International Legislation

United Nations Economic Commission for Europe ("UNECE")

3. **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.

4. **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.

5. **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

6. **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.

7. **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.

8. **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).

9. **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.

10. Principles akin to BAT were introduced into UK legislation in the nineteenth century. EC Directive 84/360/EEC introduced he 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.

UK Legislation

11. **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.

12. **Clean Air Act 1993** - introduced to address air pollution from smogs caused by widespread burning of coal for residential heating and 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 Defra and the Devolved Governments, the key CAA measures are applied and supervised by Local Authorities and include the:
    a) Control of dark smoke;
    b) Prohibition of cable burning except at authorised installations;
    c) Designation and supervision of smoke control areas – control of smoke emission and constraints on the types of appliances and fuels which can be used in such areas;
    d) Approval of chimney heights for non-residential furnaces;
    e) Control of grit and dust emissions from non-residential furnaces (up to thresholds in EPR);
    f) Approval of new non-residential furnaces;
    g) Approval of abatement equipment for use on non-residential furnaces.

13. The CAA regulates combustion and other activities (including domestic combustion) which provide significant contribution to the UK total emission for many pollutants. Consequently, they are also important contributors to local air quality.

14. **Environment Act 1995** – as mentioned above the Act requires 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 air quality management areas ("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 for that purpose. 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.

15. **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.

16. **National Emission Ceiling Regulations 2018** - transposes the National Emissions Ceiling Directive. As such, it 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.

17. **Environment Act 2021** - this UK Act makes provision for targets, plans and policies to improve the natural environment. It established the Office for Environmental Protection, which has a (post-EU) scrutiny role in England and Northern Ireland; it also addresses reserved matters across the UK on which UK Parliament legislates. The parts of the Act that are relevant to the Welsh Ministers extend beyond air quality to water quality, and the management of other environmental resources and compounds within the environment.

18. The *Clean Air Plan for Wales* notes the Environment Act 2021 would be used to amend legislation to allow the Welsh Ministers to publish any online list fuels and outdoor appliances that address air quality in Smoke Control Areas. Schedule 12 of Environment Act 2021 addresses these matters through its "...*Part 2 Principal Amendments To The Clean Air Act 1993: Wales*...".

Welsh Legislation – Existing and future statutes

19. **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 the Schedule to the Statutory Instrument. This statute 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".

20. The *Clean Air Plan for Wales* states that a 'Clean Air Act for Wales', and associated regulations, will consolidate and improve existing legislation and regulatory frameworks to address air pollution.

UK-wide policy and guidance

21. **The Air Quality Strategy for England, Scotland, Wales and Northern Ireland** (2007) – Required by the Environment Act 1995, it sets out the air quality objectives and policy options to further improve air quality in the UK from the present and in the long term. As well as direct benefits to public health, these options are intended to provide important benefits to quality of life and help to protect the environment across the UK.

22. The Environment Act 1995 requires the strategy to include statements on 'standards relating to the quality of air' and objectives for the restriction of levels at which substances are present in the air. Standards have been used as benchmarks or reference points for the setting of objectives.

23. **Design Manual for Roads and Bridges ("DMRB")** – The Highway Standards that apply to the Welsh motorway and trunk road network are contained within DRMB. Document LA 105 of the DMRB provides a framework for assessment, mitigation and reporting of impacts that road projects may have on local and regional air quality. It includes calculation methods to estimate local pollutant concentrations and regional emissions for air. Where appropriate, this guidance may be applied to existing roads.

Welsh Policy

24. Policy documents are listed at the beginning of this ITM, and other relevant policies may be referred to in casework. Through its focussed content, scope and recentness, The Clean Air Plan for Wales (2020) will be highly relevant to casework that addresses air quality issues and the meeting of well-being objectives.

25. **NRW Environmental permitting guidance** – Including document "H4 Odour Management", which provides environmental permit holders with guidance on compliance with odour conditions placed on environmental permits.

26. **Nationally Significant Infrastructure Project ("NSIP") National Policy Statements ("NPSs")** – NPSs are for NSIP determinations under Planning Act 2008. However, they may be referred to in other (Welsh) casework. The following NPSs seek to address air quality:

    i. Overarching Energy (EN-1)
    ii. Fossil Fuel Electricity Generating Infrastructure (EN-2)
    iii. Renewable Energy (EN-3)
    iv. Gas Supply Infrastructure and Gas and Oil Pipelines (EN-4)
    v. Nuclear Power Generation (EN-6)

Other relevant legislation, policy and guidance

27. **WHO Air Quality Guidelines** – These aim to improve health by reducing air pollution and are reviewed on a regular basis.

28. **Institute of Air Quality Management ("IAQM")** – such as: Land-Use Planning & Development Control: Planning for Air Quality (2017); and, Guidance on the Assessment of Odour for Planning (2018).

29. **Building Regulations (Approved Document F: – Means of ventilation78)** – deals with the requirements and provisions for adequate ventilation provided for buildings where people go.

30. **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.

Annex D – Casework considerations

Air Quality 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. **National Atmospheric Emissions Inventory ("NAEI")** - The UK NAEI is funded by the four UK nations. It 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** – Automatic Networks produce hourly pollutant concentrations, with data being collected from individual sites by modem. The data go back as far as 1972 at some sites. These include:

    a) 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.
    b) The Automatic Hydrocarbon Network takes hourly measurements of speciated hydrocarbons, starting in the UK in 1992. Currently there are 4 sites measuring 29 pollutants continuously at urban and rural locations.

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

5. **Design Manual for Roads and Bridges ("DMRB")** – Current guidance can be found in DMRB Document LA 105. The model can be run to predict pollutant concentrations at receptor locations near to roads.

6. **Stack height calculations – HMIP 1993** '*Guidelines on Discharge Stack Heights for Polluting Emission. Technical Guidance Note D1 (Dispersion)*'. 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.

7. **Emissions Factors Toolkit ("EFT")** - 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.

8. **Pollution Climate Mapping ("PCM")** – Can be used to map data from the automated AURN network (see above).

9. **Community Multiscale Air Quality ("CMAQ") Modelling System** – Is a sophisticated atmospheric dispersion model developed by the United States Environmental Protection Agency (EPA) to address regional air pollution problems. Evidence submitted in casework may cite comparisons to this methodology.

Air Quality Evidence

Reports and submissions

10. An air quality report before an Inspector should, in general, 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 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 data from new developments; WebTAG and/or DMRB methodology for impact appraisal as part of the cost-benefit analysis

11. It should be noted that data is likely to contain 'bias adjustment factors' (for year, locality and interference) and/or figures derived from conversion calculations (i.e. from NO_x to NO_2).

12. 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.

13. How reliable is the evidence base? Are there known limitations to its accuracy? Is there any evidence of equipment failure, or inappropriate sampling techniques or manipulation of air quality data?

14. Have the most appropriate sampling locations been used for the potential receptor that you are considering? For example, a roadside sampling location

in a residential area may have been used for the evidence base, but you are considering a protected ecological site 1-2km away that has a closer, more appropriate, sampling location i.e. the air quality report may not have been focussed on what you end up considering to be a likely key determinant matter.

Mitigation techniques

Approaches to mitigation

15. Mitigation options need to be considered in relation to their potential effectiveness, cost and practicality. Measures that are designed or engineered to operate passively are less likely to require ongoing intervention, management or a change in people's behaviour.

16. Prevention – This would prevent or avoid exposure and/or impacts to/of the pollutant in the first place 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 development scheme design stage.

17. Minimisation – Reduction and minimisation of 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:
    i. mitigation measures that act on the source; before
    ii. mitigation measures that act on the pathway;
    which in turn should take preference over
    iii. mitigation measures at or close to the point of receptor exposure.

18. Enhancing Dispersion – improving the 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 (see paragraphs 3.31-3.32 on stack height calculations above) or decreasing the process which causes the emission. However, this merely displaces the problem and does not provide a longer-term solution and therefore is not considered appropriate for most scenarios.

19. Offsetting – the impact of a new development's air quality impact may be offset by proportionately contributing to air quality improvements elsewhere (including those identified in air quality action plans and low emission strategies). This option should only be considered once all the above the options have been exhausted.

Securing mitigation

20. Where the relevant tests are met, mitigation can be secured using planning conditions, for example, to require the installation of a suitable ventilation system, and planning obligations, which could be used to secure financial contributions toward measures to reduce air emissions, such as a ‘car club’.

21. 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 infrastructure to promote modes of transport with low impact on air quality;
e) controlling dust and emissions from construction, operation and demolition; and
f) contributing funding to measures, including those identified in air quality action plans and low emission strategies, designed to offset the impact on air quality arising from new development.

Air Pollution Control ("APC") Techniques

22. Industrial processes with air emissions regulated through Environmental Permits issued by NRW or Local Authorities can be expected to have techniques to minimise or prevent the pollution occurring through the control of emissions at source. These techniques 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

23. Some techniques can be used to control both the particulates and gases; others are applicable to only one. The following paragraphs briefly describe some of these APC techniques:
    a) **Control of smoke –** can be achieved by use of more efficient combustion through design alterations to the combustion chamber and the control of the fuel and air supply.
    b) **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:
        i. 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:
        ii. gravity and inertial forces in a mechanical separator by e.g. a cyclone dust separator;
        iii. 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);
        iv. a fabric filter by use of bag or cartridge filters; or
        v. electrostatic forces in an electrostatic precipitator.
    c) **Control of gaseous pollutants** – it is necessary to use control systems to minimise gaseous emissions by either combustion or recovery. These are briefly detailed below:
        i. 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);

ii. 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).

d) **Odour Control** - There are several industrial, agricultural and domestic activities that can give rise to odours. Some offensive odours (e.g. hydrogen sulphide – 'rotten eggs' smell) are due to toxic gases, but others may be non-toxic at the concentrations emitted. Waste gases with offensive odours can originate from a variety of sources, such as:

i. The production process;
ii. The storage area;
iii. Leakage from pumps and compressors;
iv. During transfer of material;
v. Open wastewater treatment or waste composting plants;
vi. Spreading of sewage sludge and farm slurry on land;
vii. Facilities such as rendering plants and maggot farms have the potential to produce odours that may be considered the strongest / most offensive by those who experience them.

The options for controlling odours (at source) are largely similar to those controlling gaseous pollutants, including:

i. Chemical reaction by oxidation to neutralize the odour;
ii. Use of scrubbers;
iii. Thermal oxidation (i.e. incineration of the gases emitted);
iv. Adsorption on activated charcoal;
v. Biotechnical methods, e.g. bioscrubbers/biofiltration
vi. Enhanced dispersion

e) **Air Pollution Control Regulation** – NRW regulates the emission of gases, smoke or odours emitted from certain industrial and agricultural activities if they are subject to controls under the Environmental Permitting regime. Local authorities also issue environmental permits for smaller processes that can include concrete batching plants, quarry plant, rock crushers used in waste management facilities for secondary aggregate production, petrol stations, and rendering plant. Processes associated with concrete plants, crushers and petrol stations may be considered fairly routine matters for local authority air pollution prevention and control. However, rendering processes often produce extremely odorous gases that can result in complex and challenging casework given the nature of the effects, and due to their potency, the possible extent of the geographic coverage (even from a relatively small release of the gas).

Local Authorities are also able to regulate air pollution if it becomes a statutory nuisance under Part III of the Environmental Protection Act 1990. (NRW can also address impacts on living conditions/amenity, for example through odour, if the activity is being regulated through an Environmental Permit issued by NRW)

f) **Planning and Air Pollution Control -** The planning system has an important 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.

g) **Smoke Control Areas** – In these areas you cannot emit smoke from a chimney unless you're burning an authorised fuel or using 'exempt appliances' as specified under the Clean Air Act 1993. The *Clean Air Plan for Wales* seeks to review how **Clean Air Zones** and **Smoke Control Areas** could be integrated with, and contribute to, LAQM.

Emissions from transport and their reduction

Introduction

24. Nitrogen dioxide (and to a lesser extent other pollutants) emissions from transport sources remain the most pressing of the air quality problems facing Wales (and the UK), both from the effects on health/environment and compliance with the AQ objectives derived from the EU retained law Ambient AQ Directive. There are various options to mitigate emissions from transport, some of these have already been covered above, e.g. CAZs, and include the following.

25. **Modal shift –** One form of mitigation would be to shift to more sustainable transport modes, 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 housing and other developments that generate traffic within easy access of public transport hubs and/or shared pedestrian/cycle ways may facilitate modal shifts.

26. **Traffic speed and flow –** Both 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.

27. **Low emission vehicles –** These address air quality by reducing transport related emissions.

28. **Alternative Fuels –** Vehicles using alternative (cleaner) fuels, i.e. liquefied natural gas, hydrogen or liquefied petroleum gas could reduce emissions of NO_x and other gases. This may result in proposals for associated energy and fuel delivery infrastructure.

29. **Other measures within Air Quality Action Plans –** Other measures could include local traffic routing and low emission zones, green travel plans and fuelling vehicle fleets, congestion charging schemes, and commitments to work toward such measures.

30. **Rail electrification –** Providing lower emissions and greater efficiency than diesel trains.

31. **Aviation –** Steps can be taken to improve emissions released from traffic and transport associated with airports, and from aircraft using the airport.

32. **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, and the overwhelming majority of states, including the UK, are parties to it.

Annex E – Preparation for examinations, inquiries, hearings and site visits where air quality is a main issue

1. Air quality can be a main issue in many types of case. Proposals of a significant scale, which are likely to be dealt with through examination or inquiry. There may also be an EIA in such cases, and the Environmental Statement is likely to be complex. Relevant regulations and guidance, which may include the ITM chapter(s), should be referred to when preparing for the case. Case files may be large with many plans and drawings, perhaps a copy of the Environmental Permit application, and the Permit decision document and Permit/Varied Permit (if the decision is known).

2. If the proposal concerns an existing industrial facility, consider carrying out an unaccompanied pre-inquiry visit to the area around the site. Alternatively, a visit immediately prior to or after the opening of the examination/inquiry sessions can be very helpful to all parties in their understanding of the evidence. An opening site visit should also shorten any site visit carried out after the examination/inquiry sessions. to set matters that were examined into context. In some circumstances, parties may agree that, with an early accompanied site visit, the end of event site visit can be carried out unaccompanied.

3. A written representation case may require more site visit time than normal, especially, where the proposal involves an industrial facility. The site may cover a large area and you should ensure that there is no ambiguity about the meeting place, asking the office to liaise with the parties about this if necessary. Sometimes the parties will offer to convey you around the site by vehicle: it is for you to decide whether this is appropriate, balancing the savings in time against the better impression that might be gained on foot. You will usually need to use your PPE as necessary/required. If additional specific protection is required (e.g. eyewear) this should be provided by the site operator.

4. Much of this advice also applies to site visits carried out in inquiry or hearing cases. With a large site, plan your itinerary carefully to ensure you see all that you need to see. The same applies where you need to see other locations in the vicinity. Where the parties request you to tour a lot of locations, get them to suggest an itinerary and perhaps provide transport if that is the best way to carry people to locations and around the sites. If everyone involved can fit into a minibus or similar, this can be more effective (and safer) than travelling in a convoy of cars.