

Strategic Environmental Assessment

Guidance for Practitioners



SEA Topic: Air

Countryside Council for Wales



Foreword

This Guidance Note forms one of a series which covers six of the topics which need to be taken into account when undertaking Strategic Environmental Assessment (SEA) of plans and programmes. The topics covered are:

- Air
- Biodiversity
- Cultural Heritage
- Landscape
- Soil
- Water

CCW will also be producing guidance on climate change for internal use and in the specific context of Wales and CCW's remit, whilst guidance on the 'Material Assets' topic is under discussion with the DCLG and the other SEA consultation bodies.

Guidance Notes on the SEA 'Topics of Population' and 'Human Health' have not been produced as these topics are largely outside the remit of CCW.

The aim of the Guidance Notes is to highlight the key topic related issues that need to be considered by practitioners who are carrying out or providing input into SEA. The notes have been written in non-technical language in order that they are accessible to a wide audience.

The Guidance Notes have been produced for CCW by the Centre for Sustainability (C4S) with specialist input from environmental consultants ADAS for some of the topics. They have been written in consultation with the Environment Agency (Wales) and Cadw, the Welsh Assembly Government's historic environment service.

It is intended that the Notes will be updated periodically in order that they remain current and relevant, taking into account changes in legislation, guidance and baseline trends.

The authors would like to thank officers from CCW, the Environment Agency and Cadw for the topic specific input they have provided in the preparation of the Guidance Notes. They would also like to acknowledge the contributions provided by officers from DCLG and WAG in relation to the generic text and document structure, and to officers from local authorities for providing input from their perspective as potential users of the guidance.

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"This is a report commissioned by the Countryside Council for Wales. The Council has a programme of research in scientific and other areas, which supports the development of policies and practical work and helps point the way towards new countryside legislation. However, the views and recommendations presented in this report are not necessarily those of the Council and should therefore not be attributed to the Countryside Council for Wales"

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Purpose and Structure of the SEA Topic Guidance Notes

This is one in a series of guidance notes from the Countryside Council for Wales (CCW) on topics to be covered in Strategic Environmental Assessment (SEA) under the SEA Regulations for Wales¹ which implement the European Directive on SEA². The aim of these notes is to provide guidance to Welsh **Responsible Authorities** (the authorities by which, or on whose behalf the SEA is prepared) and others conducting SEA of plans and programmes, how issues related to certain SEA topics can be considered in the SEA of plans and programmes. These Guidance Notes also aim to help Responsible Authorities provide robust and sound reports which will enable CCW to comment and advise during the SEA process.

CCW provides information and advice related to the Habitats Directive and Regulations, and to protected species, designated sites including Sites of Special Scientific Interest (SSSIs) (including geological SSSIs), National Nature Reserves (NNR), Special Areas of Conservation (SAC) and candidate SACs, Special Protection Areas (SPA) and proposed SPAs.

Consultation in the SEA Process

CCW, Cadw and the Environment Agency (EA), have been designated as statutory '**Consultation Bodies**' in Wales in relation to the SEA Directive, and must be consulted at a number of stages during the SEA process (adapted from *The Practical Guide*):

- **Screening** – Determining whether a plan or programme requires SEA (NB: this is only required in a small number of cases);
- **Scoping** – Deciding on the scope, extent and level of detail of the information that must be included within the Environmental Report;
- **Reporting** – During full public consultation on the draft plan or programme and the Environmental Report; and

The advice that the Consultation Bodies aim to provide during periods of consultation is detailed in the '*Consultation Bodies' Services and Standards for Responsible Authorities in Wales*' (Environmental Agency *et al*, 2005).

NB: Where a plan or programme is likely to have significant effects on the environment in another Member State of the European Union, the SEA Directive requires that transboundary consultation should take place.

Annex 1(f) of the SEA Directive outlines the environmental topics that should be covered by the SEA process wherever relevant. These include Air, Biodiversity, Climate Change, Cultural Heritage, Human Health, Landscape, Material Assets, Population, Soil and Water. CCW is the statutory body responsible for advising on countryside, access, landscape and wildlife conservation in Wales. As regards SEA, CCW is primarily responsible for providing SEA consultation feedback and information on Biodiversity (including flora and fauna), Landscape and some aspects of Cultural Heritage issues, but also has an interest in the Soil, Water, Air, Climate Change and Material Assets topics.

Particular reference has been made to the requirements of "The SEA Regulations for the implementation of the Directive in Wales" and to the "Practical Guide to the SEA Directive" produced by ODPM³, the Administrations in Wales, Scotland and Northern Ireland (referred to hereafter as *The Practical Guide*). This guidance note uses the SEA process as set out in *The Practical Guide* as a framework for the topic-related guidance (see Figure 1).

¹ The SEA Regulations for the implementation of the Directive, 'Welsh Statutory Instrument 2004 No. 1656 (W.170): *The Environmental Assessment of Plans and Programmes (Wales) Regulations 2004*'.

² 'Directive 2001/42/EC of the European Parliament and of the Council on the Assessment of the Effects of Certain Plans and Programmes of the Environment' (June, 2001)

³ ODPM, the Office of the Deputy Prime Minister, was superseded by DCLG, the Department for Communities and Local Government, in May 2006

Link to the Environment Strategy for Wales

The Environment Strategy for Wales was published in May 2006 and includes a series of procedural and environmental 'outcomes' which the Welsh Assembly Government aims to achieve in the period up to 2026. Many of the Environment Strategy 'outcomes' are closely linked to the SEA topics and they have indicators which will be used to measure progress towards achieving the 'outcomes'.

The Strategy is supported by an Action Plan that provides details of the actions that will be taken to deliver the Strategy. This Action Plan includes milestones and responsibilities. It is also accompanied by a policy map which identifies the various influencing factors that will help in successful implementation of the Strategy. One of the contributory tools that is listed is Strategic Environmental Assessment.

Environmental Strategy outcomes which are linked to the SEA topics include:

- Climate change (outcomes 7 & 8); Material assets (waste) (9, 10, 11 & 39);
- Material assets (resources) (12, 17 & 18); Water (13, 14, 15, 31, 32, 35 & 36);
- Soil (16); Biodiversity (19, 20, 21 & 22); Landscape (23); Cultural heritage (26);
- Air quality (33); Human health (37 & 38).

NB: There are also other outcomes which cut across more than one SEA topic.

The 'outcomes' from the Strategy could be used when developing objectives for the plan that is subject to SEA.

Where appropriate the Indicators that are included in the Strategy should be considered for incorporation into the SEA assessment and monitoring frameworks.

Environment Strategy outcomes and indicators relating to the Air topic can be seen in Table 8.

The Environment Strategy can be found at:

<http://new.wales.gov.uk/topics/environmentcountryside/epq/Envstratforwales/?lang=en>



STAGE A: Setting the context and objectives, establishing the baseline and deciding the scope	A1: Identifying other relevant plans, programmes, and environmental protection objectives
	A2: Collecting baseline information
	A3: Identifying environmental problems
	A4: Developing SEA Objectives
	A5: Consulting on the scope of SEA
STAGE B: Developing and refining alternatives and assessing effects	B1: Testing the plan or programme objectives against the SEA objectives
	B2: Developing strategic alternatives
	B3: Predicting the effects of the draft plan or programme, including alternatives
	B4: Evaluating the effects of the draft plan or programme, including alternatives
	B5: Considering ways of mitigating adverse effects
	B6: Proposing measures to monitor the environmental effects of plan or programme implementation
STAGE C: Preparing the Environmental Report	C1: Preparing the Environmental Report
STAGE D: Consulting on the draft plan or programme and the Environmental Report	D1: Consulting on the draft plan or programme and the Environmental Report
	D2: Assessing significant changes
	D3: Decision making and providing information
STAGE E: Monitoring implementation of the plan or programme	E1: Developing aims and methods for monitoring
	E2: Responding to adverse effects

Figure 1: SEA Process and Stages (Adapted from *The Practical Guide*)

This Guidance Note focuses primarily on the topic specific advice at SEA Stages A, B and E and is supplementary to guidance on the SEA stages as set out in *The Practical Guide*.

Responsible Authorities should refer to *The Practical Guide* at all stages of undertaking SEA for Plans and Programmes, which sets out the SEA Directive legal requirements, procedures and methods.

See also *References and Further Reading* at the end of this note, for more topic specific information.

Air in the context of the CCW Remit

In relation to SEA, Air is a secondary topic for CCW, with the Environment Agency taking the lead in this area⁴. Air related data and information is not held by CCW. In Wales, the Welsh Assembly Government is responsible for looking at ambient air quality and sign off strategies with Defra regarding air quality. CCW is interested in the impacts of poor air quality on biodiversity, landscape, water quality etc. and has statutory responsibilities to advise on air pollution under IPPC (Integrated Pollution Prevention Control).

Background to the Topic: Air

Sources of Air Pollution: Air pollution was dominated in the early 1950s by high levels of smoke and sulphur dioxide, from the combustion of sulphur-containing fossil fuels such as coal, used for domestic and industrial purposes. This prompted policies towards the introduction of the Clean Air Acts and the use of cleaner fuels for power generation and domestic use. Road traffic activity and its associated emissions have continued to grow, reaching a peak around 2000. Due to the introduction of a series of stringent emission limits directed at road vehicles (commencing in the early 1970s), the emissions from individual vehicles are now significantly lower. These reductions in emissions from individual vehicles are offset by a continued increase in traffic activity. A wide variety of pollutants are emitted from petrol and diesel vehicles, including oxides of nitrogen (NO_x), particulate matter (PM), carbon monoxide (CO) and volatile organic compounds (VOCs). Other key emitters of harmful air pollutants include agriculture (ammonia, methane), and industry/fuel generation (NO_x, sulphur dioxide, carbon dioxide, VOCs). A brief description of air pollutants and their sources follows:



- *Carbon monoxide (CO)* – emitted as a result of the incomplete combustion of a hydrocarbon fuel. In European areas, CO is produced almost entirely from road traffic emissions.
- *Oxides of nitrogen (NO_x)* – formed during high temperature combustion processes from oxidation of nitrogen in the air or fuel. The main source of NO_x (nitric oxide (NO) and nitrogen dioxide (NO₂)) is road traffic, which accounts for about 50% of emissions in Europe. NO and NO₂ concentrations are therefore greatest in urban or built up areas. Other sources of NO_x include power stations, heating plants and other industrial processes.
- *Particulates - PM₁₀* – The main source of particulates in European cities is road traffic emissions, particularly from diesel vehicles. Industry, in particular combustion processes, is also a key source of particulates. PM_{2.5} are finer particles, which are more dangerous to human health as they can more readily be inhaled and penetrate deeper into the lungs. However, construction dust, industry and agriculture, as well as non-UK sources can also be important contributors.
- *Volatile organic compounds (VOCs)* – VOCs are released in vehicle exhaust gases as unburned fuels or as combustion products. There are also emitted by the evaporation of solvents and motor fuels.
- *Sulphur dioxide (SO₂)* – The main source remains power generation through the combustion of sulphur containing fossil fuels.
- *Ozone (O₃)* – Ozone is not emitted directly into the atmosphere, but is produced by a reaction between nitrogen dioxide, hydrocarbons and sunlight (Netcen, 2006a).
- *Ammonia* – the main source of ammonia is the decomposition and volatilisation of animal wastes.

⁴ SEA topic responsibility for each of the Welsh Consultation Bodies is outlined in the following: *Strategic Environmental Assessment: Consultation Bodies' Services and Standards for Responsible Authorities in Wales*, Environment Agency Wales, Welsh Assembly Government, Cadw, and CCW, (2005) UK.

- *Methane* – The majority of methane emissions come from landfill, followed by enteric fermentation and fossil fuel derived sources (APIS, 2007).

Air Pollution Impacts: Various air pollutants have known or suspected harmful effects on the environment and human health. Table 1 provides an overview of these effects and pollutant properties.

Table 1: Overview of Air Pollutants and their Environmental Impacts (Adapted from Netcen, 2006b)

	Environmental impact	Pollutant	Pollutant properties
Local	Reduction of local air quality - affecting human health and vegetation growth ⁵ , biodiversity (species and habitats), water and causing damage to materials (including buildings).	Lead, volatile organic compounds, sulphur dioxide, oxides of nitrogen, carbon monoxide, benzene, 1,3-butadiene, fine particles.	These chemicals are emitted directly into the atmosphere and are known as primary pollutants. (An exception is NO ₂ which is largely a secondary pollutant, rapidly formed from atmospheric reactions between NO and oxygen. Recent evidence also suggests an increase in primary NO ₂ emissions associated with some road transport and exhaust after-treatment systems.
	Acid deposition - leads to degradation of the terrestrial environment.	Sulphur dioxide, oxides of nitrogen, (sulphates and nitrates) and hydrochloric acid.	After release into the atmosphere these compounds can be deposited close to their source. Alternatively chemical reactions can convert them into other acidic compounds that can be transported long distances before deposition to the surface. Acid deposition has declined over recent years due to the investment in cleaner technologies at power stations.
Regional	Photochemical oxidants - reduce local air quality (as above).	Ozone, peroxyacetyl nitrate (PAN).	These chemicals are termed secondary pollutants, because they are formed by reactions involving primary pollutants (see above). The combination of sunlight and enhanced concentrations of VOCs and NO _x can lead to increased concentrations of these compounds (natural chemical cycles become disrupted). Impacts generally occur at a distance from the source, as the chemical reactions take time to produce the oxidants.
	Formation of secondary particles - human health impacts.	Fine particles (generally <2.5µm in diameter).	Unlike primary particles, which are emitted directly by various processes, secondary particles are formed in the atmosphere from chemical reactions mainly involving SO ₂ and NO _x . These secondary particles can be transported long distances.
Global	Enhanced greenhouse effect - leading to greater climate change.	Carbon dioxide, methane, nitrous oxide, halocarbons.	These chemicals are only slowly removed from the atmosphere and therefore their concentrations are continually increasing because their emission rate is greater than their removal rate. Each chemical can effectively absorb long wave radiation, which results in a warming of the atmosphere.
	Destruction of stratospheric ozone - causing increased UV radiation at the earth's surface.	Halocarbons.	These chemicals can build up in the atmosphere like the greenhouse gases above. They remain in the atmosphere long enough to be transported to the upper part of the atmosphere, where the protective 'ozone layer' is concentrated. They can disrupt natural chemical reactions, leading to ozone destruction.

⁵ There are separate Air Quality Strategy limits set for vegetation protection.

Air Pollution Impacts on Biodiversity, Habitats and Species: Atmospheric pollution deposition and high concentrations of pollutants in urban and industrial areas pose a significant effect to sensitive ecosystems. Nitrogen deposition and elevated levels of ground-level ozone are of particular concern (JNCC, 2007).



The National Expert Group on Transboundary Air Pollution report (NEGAP, 2001) details the main effects of air pollution-related problems of acid deposition, eutrophication and ground-level ozone on soils, freshwaters and vegetation.

- Soils: the sensitivity of soils varies according to its acidifying inputs.
- Freshwaters: Locations containing acid sensitive soils often contain acid-sensitive freshwaters.
- Vegetation: main threats to the health and productivity of vegetation are from nitrogen deposition and ozone. Nitrogen deposition can lead to the reduction of diversity.

Table 2 provides an overview of the key threats that air pollution poses on various ecosystems, and potentially on species.

Table 2: Key Threats of Air Pollution on Ecosystems (Adapted from APIS, 2007)

Ecosystem Type	Key Threats from Air Pollution
Arable Land	<ul style="list-style-type: none"> • Ground-level ozone – potential yield losses for both arable croplands and forests. • Heavy Metals – At high concentrations, heavy metals can have toxic effects on plants. • Particulates – dust covering leaf surface can reduce photosynthetic ability. • Hydrogen fluoride – can accumulate in the margins and tips of leaves, having a visual injury effect.
Bogs	<ul style="list-style-type: none"> • Nitrogen deposition – excess nitrogen can lead to the preferential growth of grass and tree species at the expense of bog forming Sphagnum mosses., and ultimately the development of bog systems. • Ozone – primary impacts on plants. • Hydrogen Fluoride - can accumulate in the margins and tips of leaves, having a visual injury effect. • Acid deposition
Coastal Habitats	<ul style="list-style-type: none"> • Eutrophication – many coastal habitats are not under any agricultural management (including fertilisers) and may therefore be more sensitive to nitrogen deposition. Salt water ecosystems (salt marshes/estuarine habitats) may be under threat from both nutrient inputs from rivers and atmospheric deposition. • Ozone – coastal habitats are likely to be sensitive to ozone, whereas impacts on marine ecosystems are not expected (ozone is rapidly destroyed following contact with sea surface). • Toxic air pollutants – toxic air pollutants can combine with riverine inputs to impact on coastal and marine ecosystems. Main receptors are fish, fish-eating birds, marine mammals and sediment-dwelling invertebrates.
Freshwaters	<ul style="list-style-type: none"> • Nutrients – responsible for eutrophication of rivers and lakes, leading to an increased growth and change in species of phytoplankton, zooplankton, sediment-dwelling invertebrates, fish and macrophytes and lower oxygen concentrations (particularly in deeper parts of lakes) • Acid deposition – leading to acidification. Organisms affected include fish, invertebrates, macrophytes and freshwater feeding birds such as the dipper. • Heavy metals and Persistent organic pollutants (POPs) – effects are not fully known, but can bioaccumulate and also adsorb onto sediments, with subsequent effects on sediment feeding organisms.
Grassland	<ul style="list-style-type: none"> • Ozone – Ozone is of particular concern for grassland, leading to the development of ozone tolerant sub-species, and potential altered competitive abilities between

	<p>plants.</p> <ul style="list-style-type: none"> • Nitrogen deposition – Where grassland is not fertilised, plant species composition is adapted to nutrient poor conditions, with low productivity. Enhanced nitrogen supply tends to favour some grasses at the expense of other herbs, bryophytes and lichens, which may be of more conservation interest. • Acid deposition – grasslands that are already moderately acidic are most at risk.
Heathlands	<ul style="list-style-type: none"> • Nitrogen deposition – heathlands are naturally poor in nutrients, and are therefore particularly sensitive to additional nitrogen inputs. Potential impacts include changes in species composition and increased dominance of grasses. • Ozone – high altitude ecosystems are more likely to be prone to the effects of ozone.
Parklands and hedgerows	<ul style="list-style-type: none"> • Expected to be at risk as air pollutants are deposited faster on aerodynamically rough surfaces. Hedgerows face an increased risk, as they act as boundary features, often adjacent to roads or agricultural land, which may be sources of pollutants. • Nitrogen deposition (particularly ammonia) – as hedges are often located close to farmland, key emitters of ammonia. • Persistent organic pollutants (POPs) and heavy metals.
Rocky habitats	<ul style="list-style-type: none"> • Nitrogen deposition – affect the competitive performance of species growing in rocky habitats. • Acid deposition – calcareous rocks tend to be weathered faster by acid deposition, but this weathering provides a buffering to protect species growing in such habitats. • Sulphur dioxide – Exposure to SO₂ will have direct impacts on epiphytes, particularly lichens, growing on rock surfaces. • Ozone – largest 'mean' concentrations, and therefore impacts, will be expected for high altitude and coastal rocky habitats.
Urban habitats	<ul style="list-style-type: none"> • The impacts of NO_x and SO₂, NH₃, O₃, HCl and particles on vegetation are well documented.
Wetlands	<ul style="list-style-type: none"> • Nitrogen deposition – excess nitrogen leads to preferential growth of grass and tree species at the expense of the habitat-forming species. Grazing marshes may be less sensitive to atmospheric deposition. • Ozone – primary impacts on higher plants causing leaf damage and reduced growth
Woodlands	<ul style="list-style-type: none"> • Nitrogen deposition – woodlands and forests are scavengers of air pollutants, and it is thought that forest decline can be as a result of nitrogen deposition. However, the most sensitive elements are the woodland ground flora and epiphyte communities, which are particularly relevant in defining conservation status. • Acid deposition – Mainly affects the soils of woodland habitats. This can lead to the mobilisation of naturally occurring aluminium in the soil, which may have toxic effects on plant roots, leading to problems of tree health. Other effects on woodlands include: <ul style="list-style-type: none"> ○ Reduced tree growth and canopy loss; ○ Reduced mycorrhizal (fungal) activity, vitality and frequency; and ○ Effects on soil properties and processes. • Ozone – Expected impacts include reduction in growth, as well as possible changes in epiphyte species composition. • Heavy metals – toxic effects can be experienced by plants, including reduced root growth, and inhibition of various physiological processes, including transpiration, respiration and photosynthesis.

Air Pollution Impacts on Human Health: In addition to the effects on the natural environment, air pollution poses a great risk to human health. The key air pollutants and their impact on human health are described in Table 3. These risks may be greater with a more elderly population.

Table 3: Air Pollutants and their Impact on Human Health (adapted from DETR 2000a.)

Pollutant	Effect on Health
Carbon monoxide (CO)	CO interferes with the oxygen carrying capacity of the blood, which can lead to a range of symptoms from drowsiness to asphyxiation. Those individuals with existing cardio-pulmonary stress can be particularly sensitive to CO. Moving towards cleaner environments can lead to recovery for those affected.
Oxides of nitrogen (NO _x)	NO _x can irritate the lungs and lower resistance to respiratory infections such as influenza. Continued or frequent exposure to concentrations that are typically much higher than those found in ambient air may cause increased incidence of acute respiratory illness in children.
Nitrogen Dioxide (NO ₂)	Exposure to nitrogen dioxide can cause inflammation of the airways, which affects the lung function, and enhances the response to allergens in sensitised individuals. Young children and asthmatics are most at risk.
Particulates (PM ₁₀ and PM _{2.5})	Particles can be carried deep into the lungs where they can cause inflammation and a worsening of the condition of people with heart and lung diseases. It is also possible that particles can carry surface-absorbed carcinogenic compounds into the lungs.
Volatile Organic Compounds (VOCs) (Benzene, 1,3-Butadiene)	Health effects are dependent upon the specific VOC. However, a number of VOCs are known or suspected carcinogens and mutagens.
Sulphur Dioxide (SO ₂)	Exposure to sulphur dioxide can lead to the constriction of the airways by stimulating nerves in the lining of the nose, throat and airways of the lung, particularly affecting asthmatics.
Ozone (O ₃)	Ozone can irritate the eyes and air passages causing breathing difficulties and may increase susceptibility to infection.
Lead (Pb)	Lead has toxic biochemical effects in humans. It can cause mental retardation, drowsiness and problems with the kidneys and reproductive system. Long term exposure interferes with normal development and functioning of the brain.

Responses to Air Pollution Problems: Opportunities are available to ensure that ecosystem effects are fully considered within pollution regulation, including obligations under the Habitats Regulations, the Countryside Rights of Way Act 2000 for England and Wales, and the Pollution Prevention and Control Regulations. The Air Pollution Lead Co-ordination Network (APLCN), run by the JNCC, provides strategic advice on air pollution in Wales. For example, the APLCN worked with the Highways Agency to produce guidance on undertaking environmental assessment of air quality for sensitive ecosystems in internationally designated nature conservation sites and SSSIs (HA, 2005).

One of the key problems associated with air pollution is the fact that it does not respect boundaries, for example, of nature reserves, conservation areas or designated areas. Therefore there may be potential habitat loss and threat to sensitive ecosystems in areas adjacent to or some distance away from pollution sources.

Many other air pollution controls, whilst tackling local pollution from key sources, are aimed at improving conditions for human health. The EU Directive 96/62/EC on ambient air quality assessment and management, commonly referred to as the 'Air Quality Framework Directive', established a strategic framework for tackling air quality by setting Europe-wide limit values for twelve pollutants in a series of 'Daughter Directives'. The First Daughter Directive (1999/30/EC) set binding limit values for nitrogen dioxide, oxides of nitrogen, sulphur dioxide, particulate matter and lead, to be met by various dates between 2001 and 2010 by



CCW Images

all Member States. The Second Daughter Directive (2000/69/EC) set limit values for benzene and carbon monoxide. It was adopted in November 2000. The Third Daughter Directive set target values and long-term objectives, for the protection of human health and vegetation, for 2010 and 2020 respectively. It was adopted in February 2002.

European Union Directives are transposed into English law in the form of the Air Quality Limit Values Regulations, which are implemented through Part IV of the Environment Act 1995. The pollutant limit values in the Regulations correspond, in almost all cases, with those contained in the EU Air Quality Daughter Directives². The Secretary of State was required to prepare a national strategy, which became the Air Quality Strategy (AQS) for England, Scotland, Wales and Northern Ireland (DETR, 2000). In 2003 an addendum was published incorporating tighter air quality objectives for particles and benzene, a revised objective for CO, and a new objective for polycyclic aromatic hydrocarbons (PAHs) (Defra, 2003)⁶.

In the AQS, the Government has set objectives for nine pollutants. Two of these pollutants (ozone and oxides of nitrogen) are being tackled at the national and European levels, but responsibility for addressing the remaining seven (benzene, 1,3-butadiene, carbon monoxide, nitrogen dioxide, ozone, particles (PM₁₀) and sulphur dioxide) is devolved to local authorities.

Local authorities are required to undertake Review and Assessments of air quality in their areas to measure their progress in attaining national air quality objectives. If an area is identified where objectives are not likely to be achieved, then it is declared as an Air Quality Management Area (AQMA). Local authorities are then required to prepare an Air Quality Management Plan for the AQMA illustrating the actions they intend to take to achieve air quality objectives in the future.

During 2006, a further consultation on an updated Air Quality Strategy for the UK took place (Defra *et al*, 2006). The new Air Quality Strategy was published in July 2007, and it offers a package of measures which will reduce over-exposure to air pollutants for everyone (Defra *et al*, 2007). Defra expects that it could see average life expectancy increase by 3 months by 2020. The strategy consists of a range of measures, including:

- New tighter European Vehicle Emission Standards;
- Incentives for cleaner vehicles;
- Further reductions in emissions from small combustion plants; and
- Further reductions in emissions from ships.



Image : J.Farrar, Bangor University

The Strategy is moving away from focusing on hotspots where Air Quality Standards are not being met, towards a wide-ranging approach for pollutants, such as fine particulates (PM_{2.5}), is cost effectiveness and geared to improving the public health of the UK.

Image shows photochemical smog over Snowdonia.

UK legislation controlling air pollution also includes the Pollution Prevention and Control Act 1999, which transposed into UK law the 1996 Integrated Pollution Prevention and Control Directive (IPPCD) and also, following amendment, key parts of the 2000 Waste Incineration Directive (WID), the 2001 Large Combustion Plants Directive (LCPD) and the 1999 Solvent Emissions Directive (SED).

In addition the 1993 Clean Air Act controls air pollution at the domestic and small industry level,

The UK Pollution Prevention and Control regime aims at “a high level of protection of the environment taken as a whole by, in particular, preventing or, where that is not possible, reducing emissions to air, water and land” (Defra, 2002a). The regime, focussing on emissions from industrial installations, replaces the previous IPC (Integrated Pollution Control) /LAPC (Local Air Pollution Control) regime under Part 1 of the 1990 Environment Protection Act, with which it shares various elements. PPC takes into consideration a wide range of environmental impacts, including emissions to land, water and air; waste avoidance or minimisation, energy efficiency, accident avoidance, and minimisation of noise, heat and vibrations (Defra, 2002a).

⁶ The 2006 AQS consultation includes ozone (O₃) in the LAQM regime (Defra, 2006).

Cleaner vehicles using alternative fuels may also help to reduce emissions and improve air quality. The Energy Saving Trust (EST) is a non-profit organisation funded by the Government and the private sector to promote energy saving. The EST has identified and promotes a range of alternative/cleaner fuels that are either currently available or under development, including Liquefied Petroleum Gas (LPG), natural gas, biodiesel, pure plant oils (PPO), biogas, bioethanol, hydrogen and fuel cells. There are other ways of reducing emissions, such as more efficient driving (choosing the right vehicle for the job and reducing fuel consumption through regular servicing and maintenance), and considering the way in which we travel (more sustainable modes including cycling, walking and public transport, car sharing, and reducing the need to travel) (EST, 2006).

Stage A: Setting the context and objectives, establishing the baseline and deciding on the scope

A1: Identifying other relevant plans, programmes and environmental protection objectives

Table 4 below lists relevant plans, programmes, policies and legislation that should be taken into account in relation to SEA work on the air topic and Table 5 provides an example of a review of one document. It should be noted that the list below is not definitive as legislation and guidelines are subject to change.

Table 4: Potential plans, programmes, objectives, policies and legislation to be taken into consideration for the Air Topic

International
<ul style="list-style-type: none"> • Convention on Long Range Transboundary Air Pollution (1979) • EU Directive on Ambient Air Quality and Management (1996/62/EC) • Environment 2010: Our Future, Our Choice – EU Sixth Environmental Action Programme (2002) • EU Clean Air For Europe Programme (CAFÉ) • European Climate Change Programme (ECCP) • IPPC Directive (96/61/EC) • Waste Incineration Directive (2000/76/EC) • Large Combustion Plant Directive (2001/80/EC) • National Emissions Ceiling Directive (NECD) • Solvent Emissions Directive (1999/13/EC)
National
<ul style="list-style-type: none"> • UK Air Quality Strategy (2007) • The Air Quality Strategy for England, Scotland, Wales and Northern Ireland: A Consultation Document on Options for further Improvements in Air Quality (Defra <i>et al</i>, 2006) • Air Pollution in Wales (2004) • Environment Strategy for Wales (2006) • Road Safety Strategy for Wales (2003) • Welsh Energy Route Map (Consultation Document) (2005) • Wales: A Vibrant Economy (Consultation Document) (2005) • Wales Transport Strategy (2006) • Wales Freight Strategy (2007)
Regional/Local
<ul style="list-style-type: none"> • Local Air Quality Management, incorporating the Review & Assessment process and the use of Air Quality Management Areas (AQMAs) • Air Quality Action Plans (AQAPs) • Regional Transport Plans (forthcoming)

Table 5: Example of review of other relevant plans, programmes, objectives etc

EU Directive on Ambient Air Quality and Management (1996/62/EC)	
Introduces a framework for air quality management and standards through a series of associated Daughter Directives covering specific pollutants. The list of atmospheric pollutants to be considered include sulphur dioxide, nitrogen dioxide, particulate matter, lead, ozone, benzene, carbon monoxide, poly-aromatic hydrocarbons, cadmium, arsenic, nickel and mercury.	
Objectives, requirements and targets	Implications for the Plan or Programme
Establishes mandatory standards for air quality and sets limits and guide values for sulphur dioxide, nitrogen dioxide, suspended particulates, benzene, butadiene, carbon monoxide, ozone and lead in air.	The plan, policy or programme should ensure that standards for ambient air quality are not exceeded.

Informal consultation, with statutory consultees (referred to here as 'Consultation Bodies') and non-statutory consultees, is also a useful tool for identifying relevant plans, programmes, objectives etc (see Stage A5 for more information on consultation).

A2: Collecting Baseline Information

Box 1 below describes some potential sources of baseline data for the air topic and Box 2 provides some key facts and figures about this topic. Once again, consultation bodies and non-statutory consultees may be good sources of data.

Box 1: Relevant and Appropriate Sources of Baseline Data – Air

- The UK National Air Quality Information Archive: www.airquality.co.uk (data and statistics, Air Quality Management Areas)
- National Atmospheric Emission Inventory: www.naei.org.uk (emissions mapping by pollutant for rural and urban areas in the UK).
- Regional air pollution background concentration maps.
- Critical loads maps
- Ammonia maps produced by CEH (who run the UK Ammonia network): <http://www.cara.ceh.ac.uk/nh3network/>
- DEFRA e-Digest Statistics for Air Quality: <http://www.defra.gov.uk/environment/statistics/airqual/alltables.htm> (monitoring data for various pollutants including ozone, nitrogen dioxide, sulphur dioxide)
- Air Quality in Wales – Welsh Air Quality Data and Statistics Database: www.welshairquality.co.uk (Monitoring data, statistics)
- National Assembly for Wales (NAW) – Key Environmental Statistics: www.wales.gov.uk (air pollution in rural and urban areas, habitats exceeding critical load (acidification, eutrophication))

Box 2: Wales Air Facts and Figures

- Trends suggest that air quality improved in Wales until 2000, when air pollution levels started to increase. However, urban air quality in Wales is generally worse than in England (particularly for ozone, due to imported air masses which haven't passed over activities that can scavenge the ozone), and people living in urban areas are at greater risk of being exposed to poorer air quality.
- 14 Air Quality Management Areas have been declared in Wales; Cardiff (4 AQMAs all for NO₂), Newport (7AQMAs, all for NO₂), Monmouthshire (1 AQMA for NO₂), Neath Port Talbot (1 AQMA for PM₁₀) and Swansea (1 AQMA for NO₂).
- In 2004, the number of days when air pollution was moderate or higher in urban areas was 24 in Cardiff, 50 in Port Talbot and 17 in Cwmbran. The main causes of moderate or higher pollution at urban sites were particulate matter (PM₁₀) and ozone (NAW, 2006).

- In 2004, the number of days when air pollution was moderate or higher in rural areas was 21 at Aston Hill. At each rural site, the number of days when pollution was moderate or higher has fluctuated from year to year. This is a reflection of the variations in ozone levels, which is the main cause of pollution in rural areas. Concentrations of ozone are driven by a combination of the availability of precursors such as oxides of nitrogen, and meteorology (NAW, 2006). Background concentrations of ozone are increasing by approximately 0.4 ppb/yr, derived from measurements at Mace Head.

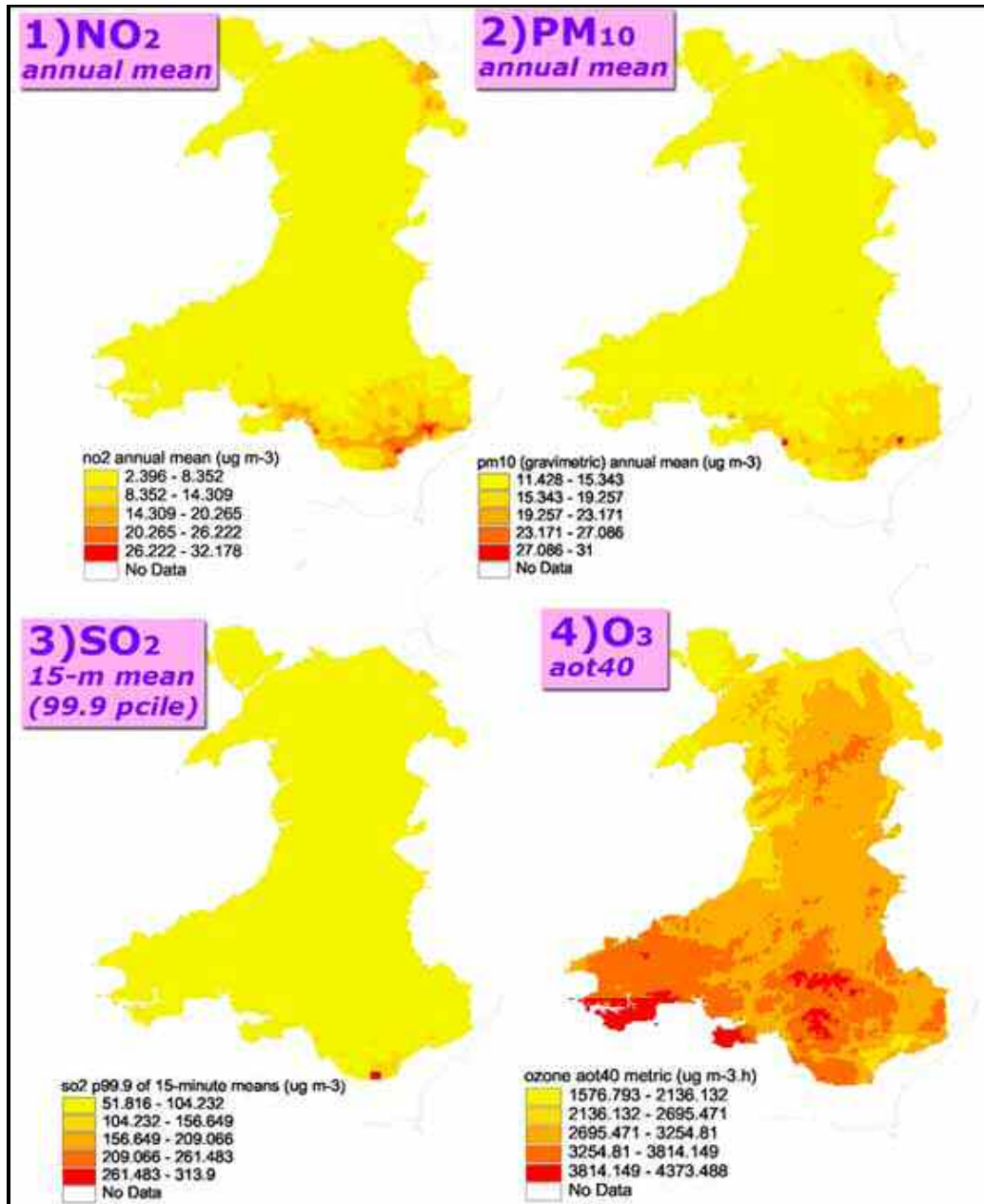


Figure 2: Geographical Variations of Air Quality in Wales

Maps produced by AEA Technology, Netcen on behalf of the Welsh Assembly Government and Welsh Air Quality Forum (WAQF, 2005).

A3: Identifying Environmental Issues and Opportunities

Environmental issues and opportunities are identified following the work undertaken in stages A1 and A2 and stage A3 often benefits from stakeholder workshops. Table 6 provides examples of various air issues in Wales and their trends, based on available baseline information.

Table 6: Examples of Air Issues in Wales

Air Issues affecting Wales	Description
Adverse impacts on habitats and species	<ul style="list-style-type: none"> The percentage of sensitive habitats in Wales where eutrophying pollutants exceeded critical loads was 87.4% in 2001-2003, compared with 94.5% in 1995-1997 (NAW, 2006) Acidification in Wales is a significant environmental issue. Within the UK, Wales is the country believed to be most affected by acidification as indicated by impacts on terrestrial and freshwater ecosystems, due to the high rates of deposition combined with soils of relatively low neutralising capacity (CEH, 2000). In Wales most priority habitats have the majority of their distribution in areas that are likely to exceed critical levels for ozone (Morrissey 2007)
Radon from granite and other rocks	<ul style="list-style-type: none"> 820 dwellings at or above 'action level', primarily in Flintshire, Pembrokeshire, Powys and Anglesey (NRPB, 2002)
Ammonia from agriculture	<ul style="list-style-type: none"> Intensive poultry and pig farming contribute towards locally high levels of ammonia.
Air quality in urban/rural areas	<ul style="list-style-type: none"> In 2004, the number of days when air pollution was moderate or higher in rural areas was 21 at Aston Hill. At each rural site, the number of days when pollution was moderate or higher has fluctuated from year to year. This is a reflection of the variations in ozone levels, which is the main cause of pollution in rural areas and which is reflected by weather (NAW, 2006). In 2004, the number of days when air pollution was moderate or higher in urban areas was 24 in Cardiff, 50 in Port Talbot and 17 in Cwmbran. The main causes of moderate or higher pollution at urban sites were particles (PM₁₀) and ozone (NAW, 2006). Wales is unusual in that it is the least deprived areas that are affected by local air pollution problems, due to the fact that a higher proportion of deprived communities are located within less densely urbanised locations, and relatively fewer deprived communities are located within the main urban centres where pollution levels are highest.
Declaration of AQMAs	<ul style="list-style-type: none"> 14 Air Quality Management Areas have been declared in Wales; Cardiff (4 AQMAs, all declared for NO₂), Newport (7 AQMAs, all for NO₂), Monmouthshire (1 AQMA for NO₂), Neath Port Talbot (1 AQMA for PM₁₀) and Swansea (1 AQMA for NO₂).
Health effects of poor air quality	<ul style="list-style-type: none"> Local air pollutants can have major environmental and health effects. Ambient air quality is already a problem in some urban areas of Wales, and the continuing rise of road traffic is of particular concern since it counteracts the effect of pollution control measures.
Aviation and air quality	<ul style="list-style-type: none"> The planned expansion of Cardiff International Airport to a capacity of 7.8 million passengers per annum may have a negative impact on local air pollution in the Cardiff area. The increased emission of greenhouse gases from the planned expansion will have wider impacts, contributing to climate change (see Climate Change Guidance Note). There is also likely to be an increase in NO₂ and PM₁₀ as a result of an increase in both aircraft activity, air side support operations and surface access activity (Cardiff International Airport, 2006).

Table 7 below is a non-exhaustive list of potential air-related environmental issues that plan-makers may identify in the preparation of various plans and programmes.

Table 7: Potential Air-Related Environmental Issues and Opportunities

Type of Plan or Programme	Environmental Issues and Opportunities
Transport	<ul style="list-style-type: none"> Emissions from transport significantly contribute to poor air quality, and are continuing to increase. As traffic and the number of journeys increase, so does congestion and increases in emissions. Development of bypasses can increase overall journey length, but can reduce urban congestion and human exposure to pollution. Odour nuisance may arise as a result of traffic increases (particularly diesel combustion).
Urban expansion / new development	<ul style="list-style-type: none"> Careful land use planning can reduce the need to travel, for example, creating mixed use developments, therefore helping to reduce emissions from transport, having a positive effect on air quality. Planning can also locate industries which emit harmful pollutants away from vulnerable populations and Air Quality Management Areas. Local air pollution problems will potentially be exacerbated due to the increase in temperatures predicted to occur as a result of climate change. Consideration of radon (naturally occurring radioactive gas) issues during urban expansion and new development and appropriate mitigation measures.
Mineral	<ul style="list-style-type: none"> Dust resulting from mineral extraction and processing activities can form a nuisance.
Waste management	<ul style="list-style-type: none"> Methane and hydrogen sulphide gases may be produced/emitted from landfill sites. This can lead to associated odour nuisance.
Agriculture / Forestry / Fisheries	<ul style="list-style-type: none"> Agriculture is a major source of ammonia, and increased nitrogen (N) inputs to livestock farming have increased ammonia emissions over the last 50 years. Ammonia may damage sensitive habitats by nitrogen enrichment and acidification (Defra, 2002b). Certain pollutants, such as photochemical oxidants (e.g. ozone) can cause crop damage through retardation of growth. Ozone burn can affect sensitive habitats. Woodland can help to provide a buffer from airborne pollution from traffic and agriculture. However, woodland can also produce ground level ozone.
Energy / Industry	<ul style="list-style-type: none"> Emissions from industry and energy generation contribute to poor air quality. A move towards more sustainable/renewable energy production could help reduce emissions compared to more traditional energy production methods.
Tourism	<ul style="list-style-type: none"> The majority of leisure trips are made by private car, which can have a detrimental effect on visitor attractions through poor air quality (particularly designated sites). The promotion of alternative more sustainable modes to leisure destinations could have a positive effect on reducing air pollution.
Water and Flood Management	<ul style="list-style-type: none"> Air pollutants can affect water quality, primarily through eutrophication and acidification.

A4: Developing SEA Objectives

SEA Objectives are not a legal requirement but are a useful way of analysing the environmental affects of a plan or programme. Table 8 and Table 9 below describe some possible air-related outcomes, objectives, sub-objectives and indicators. Those in Table 8 have been taken from the Wales Environment Strategy, with Table 9 providing a wider range which could be used in sector or area specific SEAs.

Table 8: Wales Environment Strategy Outcomes and Indicators: Air

Environment Strategy Outcomes	Indicators
A reduction in air pollution leads to increased life expectancy and ecological protection	<ul style="list-style-type: none"> Trends in number of days when air pollution is moderate or higher in rural zones and urban agglomerations Number of Air Quality Management Areas Level of emissions from Wales of sulphur dioxide, ammonia, nitrogen oxides, fine particulates and volatile organic compounds from the National Atmospheric emissions inventory Area of natural and semi-natural habitat where deposition of (a) acid and (b) nitrogen compounds exceeds critical loads

Table 9: Examples of SEA Objectives/Sub-Objectives and Indicators for Air

Example Objectives (in bold) and Sub-Objectives (in italics)	Example Indicators
<i>Reducing emissions of air pollutants</i>	
Maintain and improve air quality across Wales	<ul style="list-style-type: none"> Annual statistics for PM₁₀ (x number of days over y period) Annual statistics for NO₂ (x number of days over y period) Population living within AQMAs
To reduce negative effects of power generation, heavy industries and transport on local air quality	<ul style="list-style-type: none"> Modal split of transport in urban areas Area of sensitive habitats exceeding critical loads for acidification and eutrophication measured as (i) acidity and (ii) nutrient nitrogen (NAW, 2006)
To reduce levels of UK National Air Quality Pollutants	<ul style="list-style-type: none"> National Atmospheric Emissions Inventory (NAEI) levels of key air pollutants (e.g. Benzene, 1,3-Butadiene, NO₂, PM₁₀, SO₂) Days when air pollution is moderate or higher in (i) urban [Cardiff, Swansea, Port Talbot and Cwmbran] and (ii) rural areas [Aston Hill and Narberth] (NAW, 2006)
To reduce levels of acid and ammonia deposition;	<ul style="list-style-type: none"> Levels of acid deposition Levels of ammonia deposition
To reduce levels of stratospheric ozone depletors	<ul style="list-style-type: none"> Emissions of stratospheric ozone depletors (chlorine and bromine-containing substances (halocarbons) such as: CFCs, halons, and hydrochlorofluorocarbons (HCFCs)⁷.
To encourage cleaner technology for power generation, heavy industry and transport	<ul style="list-style-type: none"> Selected alternative fuels and powertrains Industrial exhaust gas clean up
<i>Protection from poor air quality</i>	
To avoid siting new developments in areas of poor air quality	<ul style="list-style-type: none"> Number of new developments in AQMAs
To reduce the need for travel; through appropriate siting of new developments and provision of public transport infrastructure.	<ul style="list-style-type: none"> Modal split of transport overall Per capita total number of journeys

⁷ <http://www.defra.gov.uk/environment/statistics/ozone/ozdep.htm>

Link to Welsh Assembly Government Sustainable Development (SD) Indicators

As part of its commitment to achieving sustainable development the Welsh Assembly Government has developed a series of indicators which will be used to measure progress towards that commitment⁸.

Some of these indicators may not be suitable for many SEAs, particularly those for plans at a local level, as they are fairly 'broad-brush' and will not be able to either be measured at a local level, or respond to the policies and measures included within individual plans and programmes. Nevertheless they should be considered for inclusion wherever appropriate.

NB: a revised set of indicators is currently being developed and some of these are likely to be more appropriate for incorporation into SEAs.

Other indicators reported by the Welsh Assembly Government at a national level include those in the Environment Strategy (WAG, 2006) and those from the Key Environment Statistics Indicators.

WAG reports each year on its suite of sustainable development indicators, some of which include environmental indicators. It also reports separately on progress in implementing its Environment Strategy using a number of ES indicators, some of which overlap with its suite of SD Indicators. These reporting mechanisms provide useful data which can be used to inform SEA scoping and environmental reports. They also help to form a framework against which environmental indicators for the plan or programme can be developed.

A5: Consulting on the Scope of SEA

In addition to the three statutory Consultation Bodies (CCW, Cadw and EA) there are other organisations or bodies who could be consulted on the scope of the SEA, and on the Environmental Report. For the Air topic, these may include:

- Welsh Air Quality Forum
- CPRW
- Regional Transport Consortia

Stage B: Developing and Refining Alternatives and Assessing Effects

The 'Practical Guide' provides guidance for undertaking SEA Stages B1 (Testing the plan or programme objectives against the SEA objectives), B2 (Developing strategic alternatives) and B3 (Predicting the effects of the draft plan or programme, including alternatives). This note provides no topic specific guidance for these stages.

B4: Evaluating the effects of the draft plan or programme, including alternatives

At Stage B4 the significance of the environmental effects forecast in Stage B3 is evaluated. Part of this concerns the interrelationship of the air topic with other SEA topics and Table 10 below describes some of these interrelationships.

⁸ Sustainable Development Indicators for Wales can be found at:
<http://new.wales.gov.uk/topics/statistics/headlines/sustain-2007/?lang=en>

Table 10: Interrelationships with other SEA topics

SEA Topic	Interrelationship with Air Topic
Biodiversity and Geodiversity	Reductions in local air quality can affect vegetation growth. At a regional level, acid deposition can lead to the degradation of the terrestrial environment. Certain rock types, in particular granites, are responsible for emissions of radon gas.
Climate Change	Global air pollutants, including carbon dioxide, methane, nitrous oxide and halocarbons contribute to the greenhouse effect, global warming and therefore climate change.
Cultural Heritage	Air pollutants can cause damage to materials and thus have the potential to affect cultural heritage assets.
Material Assets	Housing, transport, energy, waste, mineral extraction and other areas which may be covered by the Material Assets topic are all responsible for contributing to air pollution in some form. The location of housing and transport infrastructure can have major implications for air quality; including the reduction in the need to travel that can be achieved through the development of mixed use developments. Mineral extraction has the potential to increase dust levels in the atmosphere. Agricultural and forestry resources could be negatively affected by certain air pollution emissions.
Soil	Soils, air and water are all inextricably linked. The atmosphere, surface and groundwaters, above-ground habitats and human activity are all linked through soils, primarily through the exchange of gases (e.g. CO ₂) with the atmosphere, regulating the flow of water and rainfall in the water cycle, degradation and storage of organic matter, and storage degradation and transformation of solid materials such as nutrients and contaminants.
Health	Air pollutants have both known and suspected harmful effects on human health (see Table 3 for more details).
Water	Air pollution can affect the quality of water resources.

Stage C: Preparing the Environmental Report

Refer to *The Practical Guide* for details relating to SEA Stage C.

Stage D: Consulting on the Draft Plan or Programme and the Environmental Report

Refer to *The Practical Guide* for details relating to SEA Stage D.

Stage E: Monitoring Implementation of the Plan or Programme

Whilst generic guidance on SEA Stage E is provided in *The Practical Guide*, some topic specific information of relevance to Stage A2 is provided below.

NB: many of the examples provided could be used not just when responding to adverse effects, but also to enhance the environmental outcomes of a plan from the outset.

E2: Responding to Adverse Effects

Plans can be used to deliver responses to adverse effects identified during SEA in a variety of ways. Specific examples of responses relevant to the air topic include:

- Make provision for, or improvements to, walking and cycling infrastructure;
- Increase provision of public transport services;
- Provide information regarding the use of alternatives to the car; timetables, details of service provision etc;
- Investigate the use of cleaner fuels in public transport and council fleet vehicles;
- Reducing the need to travel by setting the framework for meeting more needs locally and through better integration of land use and transport planning;
- Implement strong land use planning policies, where key services are within walking/cycling distances of residential areas;
- Encourage cleaner technology for power generation, heavy industry and transport;
- Include policies that resist development that would adversely affect air quality, especially by exacerbating existing air quality problems; and
- Take account of the National Air Quality Strategy.

References and Further Reading

SEA and Generic References:

- ODPM, Scottish Executive, Welsh Assembly Government and Department of the Environment in Northern Ireland (2005) *A Practical Guide to the Strategic Environmental Assessment Directive*, TSO, UK.
- NAW (2006) *Local Development Plan Manual*, National Assembly for Wales, UK.
- DfT (2004) *Strategic Environmental Assessment for Local Transport Plans*, TAG Unit 2.11, TSO, UK. Available at URL: www.webtag.org.uk/webdocuments/2_Project_Manager/11_SEA/
- ODPM (2005) *Sustainability Appraisal of Regional Spatial Strategies and Local Development Documents*, TSO, UK (Sustainability Appraisal includes SEA).
- Welsh Statutory Instrument 2004 No. 1656 (W.170): *The Environmental Assessment of Plans and Programmes (Wales) Regulations 2004*.
- Environment Agency (2007) *Web-based Advice on SEA and Good Practice*. Available at URL: http://www.environment-agency.gov.uk/aboutus/512398/1504325/1504417/?version=1&lang=_e
- Environment Agency Wales, Welsh Assembly Government, Cadw, and CCW (2005) *Strategic Environmental Assessment: Consultation Bodies' Services and Standards for Responsible Authorities in Wales*. Available at URL: <http://www.cadw.wales.gov.uk/upload/resourcepool/WalesS&Senglish6943.pdf>
- Countryside Agency, English Heritage, English Nature and Environment Agency (2005) *Environmental Quality in Spatial Planning*. Available at URL: http://www.english-heritage.org.uk/upload/pdf/Envir_Quality.pdf#search=%22environmental%20quality%20in%20spatial%20planning%22

Topic Specific References and Further Reading:

- APIS (2007) Air Pollution Information Service Website. Available at URL: <http://www.apis.ac.uk/>
- Cardiff International Airport (2006) *Master Plan 2006*. Available at URL: <http://info.cwifly.com/en/content.asp?area=4&id=274>
- CEH (2000) *Scoping Study for the Acid Waters in Wales Strategy*. Available at URL: http://www.ceh.ac.uk/sections/bef/documents/Executive_and_technical_summary.pdf
- Defra (2002a) *Integrated Pollution Prevention and Control*, HMSO, UK. Available at URL: <http://www.defra.gov.uk/environment/ppc/ippc.htm>
- Defra (2002b) *Ammonia in the UK*, HMSO, UK. Available at URL: http://www.defra.gov.uk/environment/airquality/ammonia/pdf/ammonia_uk.pdf
- Defra, Scottish Executive, Welsh Assembly Government and Department of the Environment in Northern Ireland (2007) *The Air Quality Strategy for England, Scotland, Wales and Northern Ireland*, Defra, UK. Available at URL: <http://www.defra.gov.uk/environment/airquality/strategy/index.htm>
- Defra (2004) e-Digest Statistics about Ozone Depletion. Available at URL: <http://www.defra.gov.uk/environment/statistics/ozone/ozdep.htm>
- Defra, Scottish Executive, Welsh Assembly Government and Department of the Environment in Northern Ireland (2005) *Air Quality and Climate Change: A UK Perspective*, Defra, UK. Available at URL: <http://www.defra.gov.uk/environment/airquality/panels/aeqg/publications/pdf/airqual-climatechange/title-contents.pdf> (due to be updated end March 2007)
- Defra, WAG, DOE, and Scottish Executive (2007) *The Air Quality Strategy for England, Scotland, Wales and Northern Ireland*, Defra, HMSO, UK. Available at URL: <http://www.defra.gov.uk/environment/airquality/strategy/index.htm>
- DETR (2000a) *Air Quality and Transport*, DETR, HMSO, UK
- DETR, Scottish Executive, National Assembly for Wales and Department of Environment (Northern Ireland) (2000b) *The Air Quality Strategy for England, Scotland, Wales and Northern Ireland: Working Together for Clean Air*, DETR, HMSO, UK
- EST (2006) *Transport*, Energy Saving Trust, UK.

- HA (2005) *Guidance for undertaking Environmental Assessment of Air Quality for Sensitive Ecosystems in Internationally Designated Nature Conservation Sites and CISS, Supplement to DMRB 11.3.1: Interim Advice Note 61/05*, Highways Agency, UK. Available at URL: http://www.highways.gov.uk/aboutus/documents/CRS_536611_IAN_61_05.pdf
- JNCC (2007) Air Pollution, Joint Nature Conservation Committee website. Available at URL: <http://www.jncc.gov.uk/page-1426>
- Morrissey, T., Ashmore, M.R., Emberson, L.D., Cinderby, S., Buker, P., (2007), *The impacts of ozone on nature conservation*, JNCC Report 403. Available at URL: http://www.jncc.gov.uk/pdf/jncc_403_web.pdf
- National Assembly for Wales - NAW (2006) *Key Environmental Statistics for Wales 2006*, National Assembly for Wales, UK.
- National Assembly for Wales, *Starting to Live Differently. The Sustainable Development Scheme of the National Assembly for Wales*, Available at URL: <http://new.wales.gov.uk/topics/sustainabledevelopment/?lang=en>
- Netcen (2006a) *What Causes Air Pollution?* The UK National Air Quality Information Archive, Defra, UK. Available at URL: http://www.airquality.co.uk/archive/what_causes.php
- Netcen (2006b) *Air Pollution Impacts, Air Quality in Wales*, UK. Available at URL: http://www.welshairquality.co.uk/moreinfo.php?n_action=impacts&t=2
- NETGAP (2001) *Transboundary Air Pollution: Acidification, Eutrophication and ground-level ozone in the UK*, National Expert Group on Transboundary Pollution, UK. Available at URL: <http://www.edinburgh.ceh.ac.uk/negtap/finalreport.htm>
- NRPB (2002). *Radon Atlas of England and Wales, NRPB-W26*. National Radiological Protection Board, 2002. Available at URL http://www.hpa.org.uk/radiation/publications/w_series_reports/2002/nrpb_w26.pdf
- Welsh Assembly Government (2006) *Environment Strategy for Wales*. Available at URL: <http://new.wales.gov.uk/topics/environmentcountryside/epq/Envstratforwales/?lang=en>
- Welsh Air Quality Forum (2005) *Air Pollution in Wales 2004*. Available at URL: http://www.welshairquality.co.uk/documents/reports/report_2004_v9b_final_screenres.pdf