

Options for revision of the EU Thematic Strategy on Air Pollution and Related Policies

Explanatory notes accompanying the public consultation

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1. INTRODUCTION

This note accompanies the public consultation on options for a revision of the EU thematic strategy on air pollution (TSAP) and its associated policies. It is meant to provide background information that may help contextualise the questions for potential respondents. The review and accompanying stakeholder consultations began in 2011 and is expected to be finalised by autumn 2013 at the latest. The note is not meant to be exhaustive, but rather a succinct overview of the wide range of issues involved in air pollution and air quality. It does not commit the Commission's services involved in its preparation, nor does it prejudge any future decision taken by the Commission.

Section 2 briefly explains the main causes and effects of air pollution, and Section 3 introduces the relevant EU policy framework. Section 4 summarizes the specific problems emerging from the present review, Section 5 elaborates on the drivers of those problems, and Section 6 sets out the general and specific objectives to which the options of the consultation questionnaire are related. More detailed information, including draft reports emerging from the review process, can be found at the Commission's webpage dedicated to the review (hereafter the *review website*): http://ec.europa.eu/environment/air/review_air_policy.htm.

2. CAUSES AND EFFECTS OF AIR POLLUTION

Emissions of air pollutants are closely linked to economic activity through the combustion and other processes which sustain that activity, and unless abated may cause serious damage to human health as well as to the environment. Over the past decades, a substantial knowledge base on the causes and effects of air pollution has been established and validated.

The pollutants of most concern for human health across Europe are airborne particulate matter (PM) and ground-level ozone (O₃). The most severe impact is the chronic effect (the shortening of life expectancy) associated with long-term exposure to fine particles (PM_{2,5}). However, short-term exposure to various PM fractions, and to ozone in high concentration episodes, leads to acute effects which are also significant. The main acute impact is increased mortality in sensitive population groups such as elderly citizens, or those suffering from respiratory ailments. In addition, the World Health Organisation (WHO) has also recently reported evidence for chronic effects of long term exposure to ozone and acute effects of direct exposure to NO₂. Air pollution is also associated to other negative health effects besides increased mortality, such as chronic bronchitis, asthma, and lower respiratory symptoms.

The pollutants of most concern for ecosystem damage are sulphur oxides (SO_x), nitrogen oxides (NO_x), ammonia (NH₃) and ground-level ozone (O₃). The main impacts are acidification (the deposition of acidifying substances such as SO_x, NO_x and NH₃ in excess of the carrying capacity of ecosystems), and eutrophication (excess deposition of nutrients such NO_x and NH₃). Direct damage to certain physiological functions of plants (including forest and food crops) also occurs as an effect of ozone.

More information, including on the present state of air quality and air pollution can be found in Annex A and on the air pollution website of the European Environment Agency (EEA).¹

¹ <http://www.eea.europa.eu/themes/air>

3. THE EU AIR QUALITY POLICY FRAMEWORK CURRENTLY UNDER REVIEW

Air pollution and air quality is a policy field with a relatively long tradition. The present EU air quality framework builds on an international dimension where the European Monitoring and Evaluation Programme (EMEP) and the Gothenburg Protocol under the UNECE Convention on Long Range Transboundary Air Pollution (CLRTAP) are particularly relevant. At EU level, there is an overarching policy framework and three main legislative pillars.

The overarching policy framework is the EU Thematic strategy on Air Pollution (TSAP), adopted by the Commission in 2005 and subsequently endorsed by the Council and European Parliament. It responded to the 6th Environment Action Programme's demand for a cost-effective policy framework to pursue the EU's long-term objective for air quality: to achieve "levels of air quality that do not give rise to significant negative impacts on and risks to human health and the environment". It sets an overall framework for assessing and managing air quality at the EU level for the period up to 2020, incorporating the multiple impacts, pollutants, sectors and sources concerned. Based on an integrated impact assessment and cost-benefit analysis, it identifies common "interim" health and environment objectives and associated pollution reduction targets, where appropriate differentiated by Member State and/or economic sector.²

The first legislative pillar comprises the Ambient Air Quality Directives (AAQD). The AAQD established in 1999-2000 limit values for PM, NO₂, and other pollutants which are not to be exceeded throughout the EU territory from 2010 onwards, thereby providing an equal minimum level of health protection for all EU citizens.³ The latest revision in 2008⁴ introduced the possibility for Member States to extend the attainment deadline for PM₁₀ and benzene until June 2011, and for NO₂ until December 2014, provided that certain conditions were met and verified by the Commission. New standards were also introduced for PM_{2.5}. The AAQD also sets out minimum standards for air quality and emission assessment and management, while leaving substantial discretion to Member States on their implementation.

The second legislative pillar is the National Emission Ceilings Directive 2001/81/EC (NECD). The current NECD establishes for the year 2010 and beyond, aggregate ceilings for SO₂, NO_x, NH₃, and NMVOC, to limit the trans-boundary transport of air pollutants and so mitigate the resulting acidification, eutrophication, and ozone impacts.⁵

The ceilings and ambient standards are closely connected: one Member State's failure to comply with the ceilings can impact other Member States' ability to meet ambient limit values, because of the trans-boundary nature of pollution. Whilst there is an important level of "subsidiarity" embedded in the EU air quality policy framework as a whole, this is particularly the case for these

² The strategic analysis underpinning the TSAP established that no technical and economically viable scenario was available at the time to reach the EU's long-term objective by 2020. Hence, interim targets were established for that period.

³ The AAQD contains limit values for yearly averages as well as short-term limits not to be exceeded more than a fixed number of hours/days per year.

⁴ Directive 2008/50/EC merged the Air Quality Framework Directive and its first three "daughter directives". The *fourth daughter Directive* (2004/107/EC) had not been consolidated considering its recent entry into force and thus remains as a separate legislation. It establishes obligations for some heavy metals and persistent organic pollutants (POPs).

⁵ The TSAP announced a revision of the NECD to introduce a PM ceiling and to set new ceilings for 2020 for all pollutants consistent with the new TSAP objectives. Whilst the revision did not materialize as initially planned, the Commission has since confirmed it will present the revision as part of the 2013 review.

policy instruments: it is for Member States to identify the appropriate combination of controls at source to meet the ceilings or limit values.

However, there are sources which can only be regulated at EU level (e.g. products), or for which regulation at EU level is most effective. The third EU legislative pillar comprises this EU source-based legislation, regulating emissions from major sources such as industrial installations or vehicles (Annex B provides examples).

4. KEY PROBLEM CATEGORIES IDENTIFIED DURING THE REVIEW

Three main problem categories have emerged from the ongoing assessment of the current EU air policy framework. These are briefly described in the sections below; the key drivers of these problems are further discussed in the following section.

4.1. Widespread non-compliance with the current air policy framework

More than 10 years after agreeing the air quality limits, standards for PM₁₀, NO₂, and ozone are widely exceeded throughout Europe. As a result, a substantial part of the EU population and environment remains exposed to harmful levels of air pollution. A comprehensive overview of the state of air quality in the EU can be found in the EEA's Annual Air Quality Report for 2012.⁶ A preliminary assessment of the impacts suggests that, despite substantial improvements in air quality, about 420.000 premature deaths in the EU can be attributed to air pollution; eutrophication and ozone damage to the environment remain equally problematic.⁷ However, there are also some clear successes; the standards for CO, SO₂ and benzene are broadly met, and acidification is close to being resolved following the implementation of one the earliest EU air pollution strategies.

This implementation gap needs to be addressed as a matter of priority. Following the expiration of the time extension deadline in June 2011, the current enforcement focus is on PM₁₀, where infringement proceedings have been opened for 18 Member States. The enforcement strategy is set to be broadened once the infringement position on NO₂ becomes clear in 2013.⁸

Compliance with the NECD presents a more encouraging picture. Despite substantial problems observed over recent years, most of the 2010 ceilings are now expected to be respected, partly due to the economic downturn. Nevertheless, several Member States are likely to exceed the ceilings for NO_x. A comprehensive overview of the national emissions regulated by the NECD and their relation with the ceilings can be found in the EEA's Annual Reports related to the NECD and CLRTAP for 2012.⁹ Whilst the Commission has taken several "informal" enforcement actions to promote compliance with the NECD, the need for additional enforcement action and/or appropriate flexibility is being considered as part of the ongoing review.

4.2. Incoherence between European legislation and international air quality commitments

Following the recent completion of the revision of the CLRTAP's Gothenburg Protocol, current EU air quality legislation may no longer be sufficient to ensure fulfilment of the EU's new international

⁶ Available at <http://www.eea.europa.eu/publications/air-quality-in-europe-2012>.

⁷ For details, see the review website; address in section 1.

⁸ i.e. once the Member State requests for extension of the compliance deadline to 2015 have been processed.

⁹ Available at <http://www.eea.europa.eu/publications/nec-directive-status-report-2011>.

commitments. The amended Gothenburg Protocol establishes new emission reduction objectives for 2020 and introduces a new ceiling for primary PM emissions. It further includes flexibility provisions to address certain technical circumstances such as the emergence of previously unknown sources of emissions or the development of advanced emission inventory methods.¹⁰ . The new emission reduction objectives for 2020 are expressed as percentage reduction commitments, using the year 2005 as a base year, rather than absolute emission ceilings, and the EU framework should be updated for this also.

The EU chose to focus its negotiation objectives on broadening participation in the Gothenburg Protocol to European and Central Asian Countries, in order to promote the greening of the economy and a level playing field in the wider European area. Thus the negotiations focused to a large extent on ways and means to ensure that those countries could adopt the best available techniques standards reflected in the Protocol (and already contained in EU law). To avoid creating a further gap between those countries and existing Parties, including the EU and the US, negotiators settled for emission reduction obligations for 2020 which, while meaningful, do not tap the full cost-effective potential. The Commission and EU Parties agreed that consideration of further cost-effective reductions for the EU would be taken up during the present review.

The Commission is set to propose an amendment to the NECD where needed to align EU law with the Gothenburg Protocol, whilst also reviewing the need for further measures to ensure that the new obligations are met. The fact that several Member States have so far not ratified the existing Gothenburg Protocol must also be addressed.

4.3. The current EU air quality policy framework will not provide adequate protection of human health and the environment in the future.

The limit values of the AAQD are in many cases substantially weaker than the air quality guideline values recommended by the WHO, which it defines as "an acceptable and achievable objective to minimise health effects in the context of local constraints, capabilities and public health priorities". Some countries (e.g. the United States) already prescribe stricter limit values than the EU, especially for ambient PM concentrations (although provisions are not always readily comparable).

Medium and long term projections of EU air quality and associated impacts on human health and the environment are being updated as part of the review and made available on the review website¹¹, and recent methodological improvements have allowed us to forecast the extent of future compliance with limit values also. These projections take account of the range of different situations in the various Member States, including specific characteristics of the economy, the level of measures taken to date, and meteorological conditions.

These "baseline" projections suggest that even when broad compliance with existing legislation is achieved, air pollution impacts would still remain substantial, implying that the EU's overall long-term target for air quality (see above) would not be met.¹² Further cost-effective measures are available to narrow the gap, although even the application of all technically-available measures would not ensure full achievement of the long-term target by 2030.

¹⁰ The flexibility is to avoid the previous situation, where there was a disincentive to improve emission inventories, because compliance would thereby become more difficult (as the new (higher) inventory totals would be measured against the same ceiling).

¹¹ See address in section 1.

¹² In some cases the interim targets set in the 2005 TSAP would also be missed.

5. KEY DRIVERS OF THE MAIN PROBLEMS

The ongoing evaluation of the present air quality policy framework has identified a number of key drivers that are at the root of the previously described problem categories.

5.1. The subsidiarity approach has produced governance inefficiencies

An important part of the compliance problems with the AAQD can be attributed to governance inefficiencies. Whilst the AAQD requires Member States to designate zones or agglomerations (and accompanying competent authorities) for assessing and managing air quality, it leaves substantial discretion to Member States on the implementation of these minimum criteria. There is varied implementation of the provisions across the EU, and the scope for rationalisation to reduce the administrative burden on Member States should be examined.

A second point is that Member States have extensively delegated responsibilities to regional and/or local authorities, in many cases down to the city level, but the extent to which the delegated responsibilities come with means to execute those responsibilities varies substantially. Experience gained in recent years indicates that local and/or regional authorities often acted late in relation to the lead time necessary to bring air pollution down. When acting, they often faced substantial difficulties in meeting their responsibilities, notably with regard to lack of competence or means to control pollution from sources regulated at national or EU level, or from neighbouring regions. In some cases this has led to higher costs as more expensive measures are applied to the sources of pollution that *are* under the authorities' control. In other cases, promising air quality plans were altered without substituting abandoned measures with sufficiently good alternatives, leading to limited success in reaching limit values. In many cases, local and regional authorities lack the means and/or experience to develop, implement and monitor air quality plans, and the availability of adequate emission inventories, forecasting and impact assessments tools is also an issue. In some cases, available capabilities have been further reduced in the wake of the economic crisis, including at the national level. This again leads to difficulties in designing cost-effective and sustainable air quality plans at regional and urban level, as well as in organising efficient consultation and alignment across the national (and EU) governance levels. Local and regional authorities who claim that all has been tried to meet the limit values are often unaware of cost-effective options left untapped at the national level, or if they are aware, are not capable of influencing national decisions.¹³

5.2. Transboundary pollution undermines the efforts of local and national authorities

Despite the obvious success stories of the present EU and international policy framework (see acidification above), compliance problems with the AAQD are still substantially attributable to the high levels of "background" pollution beyond the control of local or national competent authorities.

Depending on the situation this may suggest there are insufficient source controls at national, EU, and/or international level (discussed in the next section).¹⁴ For the share of background pollution arising from within the country, national policy coherence issues are often at stake. Background pollution emerging from beyond national borders requires a review of EU and international competences.

¹³ Examples include regulating PM and NO_x emissions from non-road mobile machinery, small scale combustion installations, emission control areas in territorial seas, etc. Member State positions at EU level are often also at odds with the needs expressed by national technical bodies and local authorities.

¹⁴ This is typically analysed through so called source attribution which is often not available as mentioned in the previous section. Weak source attribution capabilities may hamper targeting cost-effective measures.

The European Monitoring and Evaluation Programme (EMEP) estimates that for many countries less than 50% of the observed PM_{2,5} concentrations derive from emissions originating in the same country; for depositions of oxidised nitrogen this share drops to slightly more than one third albeit figures vary significantly country by country. Similarly, each country is not only a receiver but also a source of transboundary pollution, and the net balance between inflows and outflows of air pollution depends on a number of factors that – in addition to meteorological aspects – include the type, location, and density of economic activity and the stringency of pollution control in the respective countries.

Several drivers have been identified of the weaker than expected reductions in transboundary air pollution. First, there is the obvious impact resulting from the present non-compliance situation with the AAQD and NECD, i.e. the full effect of these measures has yet to take effect. While both the NECD and AAQD call on the Member States concerned to organise cross-border meetings to deal with transboundary pollution, and invite the Commission to attend, few such meetings have taken place. Second, following recent work of the CLRTAP Task Force on Hemispheric Transport, air pollution is now understood to travel longer distances and faster than previously assumed. The rise of the global economy, most notably the major developing economies in the northern hemisphere, could therefore be part of the explanation of the persisting high EU background concentrations, among a complex of other factors including climate change and meteorological variability. Long-range transport relates in particular to PM and ozone; global methane emissions become important when considering long-range transport of ozone.

5.3. Some source legislation is not delivering as needed

A third important driver for the present compliance problems is that some EU source legislation is not delivering the expected reductions. For NO_x emissions and NO₂ concentrations, sustained high levels are particularly attributed to traffic emissions that have not come down as much as expected. Since the nineties, type-approval emission standards for road vehicles have been tightened significantly, but while gasoline engines have largely delivered the intended emission reductions in real-world driving conditions, diesel engines (especially light-duty vehicles, LDV) have largely failed to reduce NO_x emissions. This problem has been linked to the poor representativeness of the standardised test cycle used for type approval in the EU¹⁵ and the weaknesses in compliance testing, meaning that an engine could meet the NEDC requirements but without substantially reducing emissions under normal driving conditions. However, the consequences of failing diesel LDV standards have been exacerbated by Member States' failure to control traffic volumes in urban areas.

5.4. Not all sectors have contributed equally to emission reductions in the past

Effective policies have been put in place over the years to control emissions from a number of sectors including the power sector, road transport, energy intensive industries and waste management; as a consequence, emissions of several pollutants from these sectors have been reduced substantially in the last two decades. The potential for further cost-effective reductions from these sectors is correspondingly lower, and significant further steps towards the resolution of air pollution problems will not be possible without the commitment of those sectors whose emission levels have not reduced.

¹⁵ The New European Driving Cycle (NEDC).

There is now also increasing consensus amongst experts from Member States' competent authorities that particulate matter concentrations are aggravated by emissions from small scale combustion installations in the range up to 50MW (including domestic heating), non-road mobile machinery (including rail, inland waterway vessels, construction equipment, and various smaller handheld devices), and agriculture (open burning of agricultural waste). Agriculture also accounts for 90% of EU emissions of ammonia, the major factor in the eutrophication problem in the EU. Accordingly, the EU air policy review analyses the further emission reduction potential from those sectors that are currently largely unregulated, including also the marine sector in countries that have not yet declared sulphur and/or NOx control areas.

5.5. Synergies between air pollution and other policies are not managed optimally

Especially during the 80s and 90s, the EU and other industrialized economies such as Norway, Switzerland, the US and Japan managed to decouple air pollution from economic growth, thereby lifting an important limiting factor on growth. Some of today's global challenges, however, were not present at the time. As climate change and energy security climbed rapidly on the political agenda, synergies between those policies and air policy may not have been managed optimally. Likewise, the environmental trade-offs of some energy/climate policies have not been effectively managed, adding to some of today's observed problems. For instance, further abatement measures for diesel engines were put off on the grounds that pollution abatement would come at the expense of energy efficiency gains, leading to a situation where diesel engines are amongst the largest sources of NOx in Europe while the WHO recently formally classified diesel exhaust as carcinogenic. Another example relates to biomass use, where the climate- and energy-related rise in its use has led to the sector becoming the dominant source of fine particles in Europe. Better regulation of PM and other pollutants from such combustion applications is needed to ensure that negative air quality impacts do not eventually hamper growth in these sectors.

There is also potential scope for synergy with indoor air quality: poor ambient air quality does not only affect people when outside, but also in their homes and workplaces. Research funded under the framework of the EU's Health Programme estimated that –despite the presence of additional pollutants that may affect indoor air quality (e.g. building material, heating, household products, cleaning agents)- fine particles from outdoor origin are the largest single contributor to the overall burden of disease from indoor air pollutants. Where relevant, options will be assessed also in relation to their coherence and potential to deliver additional benefits in other related areas, including reducing indoor exposure.

6. OBJECTIVES FOR THE PRESENT REVIEW AND VIABLE POLICY OPTIONS TO ACHIEVE THEM

The general long-term objective pursued by the present TSAP has been reconfirmed by the 7th Environmental Action Programme¹⁶ and will be maintained for the review, but a set of specific enabling and interim objectives have been formulated in relation to the problems identified in the previous section. Based also on the analysis of key drivers underlying the problems a number of questions have been formulated in the accompanying a public consultation to seek views on the range of policy options for moving forward. The range is exhaustive, and so includes standard impact assessment options entailing no policy change (or even policy relaxation) for comparison of their impacts with the options for reinforced action.

¹⁶ Available at: <http://www.cc.cec/dgintranet/env/d2/7EAP.htm>

6.1. Ensure Member State compliance with present air quality policies as soon as possible

The first priority of the review is to resolve the current situation of widespread breach of the existing legal obligations. Given the underlying drivers of the problem, pursuing this objective will likely entail options for 1) reducing transboundary background pollution that undermines efforts by local authorities to reach compliance with existing air quality standards at reasonable cost, ; and 2) removing inefficiencies in the policy framework whilst maintaining and possibly reinforcing effective enforcement.

6.2. Ensure coherence between the recently amended Gothenburg Protocol and the NECD

A second specific objective is to align EU legislation with the recently amended Gothenburg Protocol under the Convention on Long Range Transboundary Air Pollution, notably the newly agreed emission ceilings for 2020, including for PM10, and where appropriate, the new flexibility arrangements.

6.3. Further reduce the exposure of citizens and ecosystems to air pollution beyond 2020

The third specific objective is to make further progress towards the attainment of the EU's long term air quality objective, in the light of technical and scientific progress. This will entail setting new interim objectives for 2025 and/or 2030, taking into account the time needed for adequate planning and implementation over the investment cycle, as well as the need to drive effective decisions in the political and business contexts.

Pursuing these objectives should be done in a way that sets the EU on course to achieve the general objective by 2050. Maintaining the long-term vision should also help to further improve the overall coherence of EU policies and reduce unnecessary challenges for industry, by maximising the synergies with economic growth and the pursuit of an inclusive society backed by strong employment.

7. NEXT STEPS

The results of the on-line consultations will be fully integrated in the final stage of the EU air quality review. Feedback will be used, along with other expert and stakeholder inputs, to further develop, assess, and finally select the policy options that will be retained in the updated TSAP. The process will be conducted according to the guidelines for impact assessment applying to EU policy development and stakeholders will be kept informed on progress via the review website and dedicated stakeholder meetings. The review is due to be completed by September 2013.

GLOSSARY

BAT	Best Available Techniques
CAFE	Clean Air For Europe Programme
CH ₄	Methane
CLRTAP	Convention on Long-range Transboundary Air Pollution
CO ₂	Carbon dioxide
EC4MACS	European Consortium for Modelling Air Pollution and Climate Strategies
EEA	European Environment Agency
EMEP	European Monitoring and Evaluation Programme
GHG	Greenhouse gases
HDV	Heavy Duty Vehicles (heavy trucks and buses)
IED	Industrial Emissions Directive
IPPC	Integrated Pollution Prevention and Control (directive)
kW	kilo Watt (1000 Watts, measure for power and power capacity)
LCP	Large Combustion Plants (directive)
LDV	Light Duty Vehicles (passenger cars and small trucks)
MARPOL	International Convention on the Prevention of Pollution from Ships
MW	Mega Watt (1 million Watts, measure for power and power capacity)
NEC	National Emission Ceilings (directive)
NH ₃	Ammonia
NMVOC	Non-methane volatile organic compounds
NRMM	Non-Road Mobile Machinery (include diverse products ranging from hand-held power tools to large construction and agricultural machines)
NO _x	Nitrogen oxides (NO and NO ₂)
O ₃	Ozone
PM	Particulate Matter of any size
PM10	Particles with an aerodynamic diameter of less than 10 µm
PM2.5	Fine particles with an aerodynamic diameter of less than 2.5 µm
SO ₂	Sulphur dioxide
SO _x	Sulphur oxides (including SO ₂ , SO ₃)
TSAP	Thematic Strategy on Air Pollution
VOC	Volatile organic compounds
WHO	World Health Organisation

ANNEX A: FURTHER INFORMATION ON CAUSES AND EFFECTS OF AIR POLLUTION

Observed **Particulate Matter (PM)** concentrations in the atmosphere are the sum of a number of components which originate from different sources. The most relevant of which are:

- Primary PM from combustion sources as well as some non-combustion and also natural processes. Sectors and activities of particular importance are
 - Traffic, mainly through the exhaust from diesel engines albeit new generation gasoline direct injection (GDI) vehicles and non-exhaust particles from traffic (tyre and break wear, re-suspension) also contribute to such pollution (especially to coarser PM fractions). Traffic emissions enter the atmosphere in or close to densely populated areas and thus contribute to significant exposure of the population.
 - Off-road vehicles and machinery (including construction machinery, diesel trains, tractors, small hand-held engines, etc), which are currently regulated in a less stringent way compared to road transport.
 - Small scale combustion installations up to 50 MW (including residential heating), especially related to combustion of biomass (wood and pellets), solid fuels (coal, coal briquettes), and certain liquid fuels.
 - Open burning of agricultural waste, which is banned in some of the Member States but is nevertheless a significant source of PM emissions.
- Secondary PM in the form of inorganic aerosols formed in the atmosphere by atmospheric reactions between SO_x, NO_x and NH₃, and organic aerosols formed by reactions involving VOCs and oxidants.

Ozone (O₃) is not emitted directly to air but is formed in the atmosphere through a number of chemical reactions between so-called ozone precursors. During the last decade, despite the fact that emissions of ozone precursors in Europe has decreased substantially, the expected reduction of ozone concentrations has not taken place. One of the explanations is that background concentrations in the northern hemisphere have increased, due to long-range transport of O₃ from regions outside Europe. The most important ozone precursors are:

- VOCs, emitted through a large range of processes and applications such as energy use and supply systems, road and other transport systems (petrol vapour), industrial and domestic solvent use, agriculture and natural sources (trees).
- NO_x, emitted by traffic, especially diesel engines (also from off-road machinery); the power sector and industrial combustion sources, including small-scale combustion installations (SCI); boilers and heating appliances fired by liquid fuels and natural gas; and international transport (air and marine).
- CO, which is the product of incomplete combustion. CO emissions have decreased substantially over the years following introduction of EURO standards for vehicles (oxidation catalyst) and improvements in residential heating devices.
- Methane (CH₄), which, because of its long atmospheric lifetime, plays a much more significant role in the generation of hemispherically-transported O₃ than in locally-produced episodic O₃ which has been the focus of control up until now.

The pollutants of most concern for ecosystem protection are thus sulphur oxides (SO_x), nitrogen oxides (NO_x), ammonia (NH₃) and ozone (O₃):

- SO_x are in particular emitted by energy intensive industrial processes and power generation. Over the last 20 years, SO_x emissions have substantially decreased thanks e.g. to effective

implementation of EU emission controls at source of large combustion installations (regulated under the Large Combustion Plants Directive). Smaller industrial and commercial sources (below 50 MWth) are currently outside the scope of this legislation, which adds to NO_x, PM and other emissions as well as SO_x. Another large source of SO_x emissions is international shipping, which has traditionally relied on unabated high sulphur content residual fuel oil. Formerly, such emissions have been considered of lower significance because they occur at sea rather than on land, but with the reduction of land-based emissions following the progressive introduction of effective legislation on industrial emissions, seaborne SO_x emissions now account for a progressively larger share of total emissions. A recent amendment of Directive 1999/32/EC integrates the latest MARPOL provisions to stepwise reduce the sulphur content of marine fuels into EU legislation.

- The vast majority (more than 90%) of NH₃ is produced by agricultural activities through emissions from manure application and storage, animal housing facilities and fertiliser application. For some activities, such as large intensive pig rearing and chicken farming, the application of best available techniques (BAT) is required through the Integrated Pollution Prevention and Control Directive and, in the future, the Industrial Emissions Directive, but many large contributors, in particular cattle farms, are not subject to EU legislation. Low-emission manure spreading techniques exist but are applied unevenly in different Member States. Overall, NH₃ emissions have been stable in the last decade and are, in the absence of further measures, not projected to decrease in future.

More information, including on the present state of air quality and air pollution can be found on the air pollution website of the European Environment Agency.¹⁷

¹⁷ <http://www.eea.europa.eu/themes/air>

ANNEX B: EXAMPLES OF EU SOURCE-BASED AIR POLLUTION INSTRUMENTS

Emissions from Industrial Activities

- The Industrial Emissions Directive (2010/75/EU)
 - Titanium Dioxide Directives (78/176/EEC, 82/883/EEC, 92/112/EEC)
 - The Solvents Directive (1999/13/EC)
 - The Waste Incineration Directive (2000/76/EC)
 - The Large Combustion Plants Directive (2001/80/EC)
 - The Integrated Pollution Prevention and Control Directive(2008/1/EC)
- The Best Available Techniques (BAT) Reference Documents (BREF) and BAT Conclusions (being established over time as required by the new industrial emissions directive)
 - See: <http://eippcb.jrc.es/>
- Other EU legislation reducing air pollutant emissions from industrial activities
 - The Sulphur Content of Certain Liquid Fuels (w.r.t. stationary sources) (Dir 1999/32/EC)
 - The VOC Stage I Directive (Dir 94/63/EC)
 - The Paints Directive (Dir 2004/42/EC)
 - The VOC Stage II Directive (Dir 2009/126/EC)
 - The regulation on storage and banning and of exports of metallic mercury (1102/2008)
 - The Major industrial accidents hazards Directive (Dir 1996/82/EC and 2012/18/EU)
 - Other (incl. ETS and non-regulatory measures)

Road Transport Emissions

- Passenger Cars Type Approval Standards
- Light Duty Vehicles Type Approval Standards
- Heavy Duty Vehicles Type Approval Standards
- Motorcycle (L-Type) Type Approval Standards)
- Electric & hybrid vehicles Type Approval Standards
- Quality of Road Transport Fuels (CLIMA)
- Roadworthiness Testing
- Other road transport policies (incl. infrastructure, retrofit, and non-technical measures)
- ...

Maritime Transport Emissions

- Fuel Quality –Marine (and other liquid) fuels (IMO, Directive 1999/32/EC)
- Environmental Control Areas (IMO, Directive 1999/32/EC)
- Type approval standards for international shipping (IMO)
- Other maritime transport policies (incl. infrastructure and non-technical measures)
- ...

Non Road Mobile Machinery Emissions

- Inland Water Way Vessels –Type Approval Standards
- Rail Traction Engines –Type Approval Standards
- Small Spark Ignition Engines –Type Approval Standards

- Recreational crafts, Tractors, Excavators
- ...

Emissions from Small Scale Installations

- Ecodesign Directives
- The Industrial Emissions Directive (for directly associated activities)
- ...

Emissions from agriculture

- The Industrial Emissions Directive and the Integrated Pollution Prevention and Control Directive (for certain activities only)
- The Nitrates Directive
- The Common Agriculture Policies (CAP)
- ...