THE INVISIBLE KILLER

Air pollution in Europe

Clean Air for Health

Briefing

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About EPHA

EPHA is a change agent – Europe's leading NGO advocating for better health. We are a dynamic member-led organisation, made up of public health NGOs, patient groups, health professionals, and disease groups working together to improve health and strengthen the voice of public health in Europe. EPHA is a member of, among others, the Social Platform, the Health and Environment Alliance (HEAL) and the Better Regulation Watchdog.

Further reading

EPHA Clean Air 4 Health >> https://epha.org/clean-air/

Lancet Countdown & EPHA Policy Briefing I Tackling Climate Change and Air Pollution >> https://epha.org/lancet-countdown-epha-policy-briefing-i-tackling-climate-change-and-air-pollution/

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Source: European Respiratory Society (2010) Air Quality and Health. European Respiratory Journal. ERS 2010

Introduction

Air pollution remains the largest environmental health risk in Europe, despite increasing awareness of the health impacts of air pollution over decades and various policy initiatives at international, European, national and regional / city levels.

Breathing is the most basic human function to sustain life – the very process targeted by air pollution.

Air pollution is not a choice but an involuntary and inescapable exposure to this risk, affecting 100% of the population from cradle to grave. Diseases caused by pollution were responsible for an estimated 9 million premature deaths in 2015 – 16% of all deaths worldwide, three times more deaths than from AIDS, tuberculosis, and malaria combined and 15 times more than from all wars and other forms of violence. (The Lancet Commission 2017) Outdoor air pollution leads to significant reductions of life expectancy and productivity. (Brunekreef et al 2012)

The social health costs of air pollution

Air pollution is a factor in all major chronic disease groups – placing unacceptable cost burdens on European health systems. These diseases and costs are to a large extent preventable.

Travelling over long distances and across national boundaries, air pollution negatively impacts human health with heart disease and stroke the most common reasons for premature death attributable to air pollution, responsible for 80% of cases; followed by lung diseases and lung cancer. (WHO 2014a)

Exposure to air pollution is particularly harmful to children, even during gestation, impacting cognitive development as well as respiratory and cardiovascular health and causing allergies, with often lifelong consequences for health, quality of life and productivity. (EEA 2017a)

Recent studies by the WHO and the Royal College of Physicians, show emerging evidence that exposure to air pollution is associated with new-onset type 2 diabetes in adults, and it may be linked to obesity, systemic inflammation, ageing, Alzheimer's disease and dementia. (WHO 2016, RCP 2016)

The economic health costs of air pollution

According to WHO, the economic and human costs to Europe's cities and society are huge, at over €1tn per year. (WHO Europe 2015a)

The OECD projects that the market costs of air pollution (reduced productivity, additional health expenditure, crop losses, etc.) will increase to 2% of European GBP by 2060. However, this is estimated to be equivalent to just one tenth of the non-market costs, including those of illness, ecosystem damage and climate change. (OECD 2016)

The root causes of air pollution – the pollutants causing adverse health effects

Air pollutants can be classified as either primary or secondary, depending on how they are formed.

Primary pollutants are those emitted directly from process driven by humans, such as carbon monoxide emitted from motor vehicle exhausts, or sulphur dioxide released from factories.

Secondary pollutants are those that form when primary pollutants react or interact in the atmosphere, for example ground-level ozone (O3), which results from chemical reactions between primary pollutants and sunlight. Some pollutants, such as particulates of various sizes, may be both primary and secondary. (ERS 2010)

Sources of Air pollution

Pollutants can also be classified by source, such as road transport, stationary combustion sources and natural sources. The major source of air pollution, including traffic emissions is road transport. However, evaporative fuel emissions can also be important, especially from gasoline powered vehicles. Additional, related sources originate from the wear of

tyres or brake components and abrasion of road surface material. The burning of fossil fuels at industrial plants, refineries and power plants, and for domestic use such as heating and cooking, is also a major source of air pollution. It has to be noted that there are natural sources of pollution: trees and other vegetation can release biogenic VOCs. Ash is released from volcanic eruptions. Sea spray and wind-blown soil are also produced by natural processes. Dust storms can also cause increases in concentrations of particulate matter. (ERS 2010)

Primary pollutants

Air Pollutant	The Social and Economic health burden
Particulate matter (PM)	
Particulate matter (PM) refers to the mix of particles of various size and composition suspended in the air, including substances such as dust and soot, as well nitrates and sulphates. Natural sources of particulate matter include volcanoes, sea spray, pollen, fungal spores and soil particles. Man-made particles mainly result from fossil and biomass fuel combustion in power plants, industry, motor vehicles, off-road machinery and homes. Particles are also generated by construction work or friction from motor vehicles on road surfaces etc. PM10 and PM2.5, respectively refer to particles smaller than 10 and 2.5 micrometer, which can penetrate into the airways and lungs. (ECDA 2017)	According to the European Environment Agency, the health impacts attributable to exposure to air pollution indicate that PM2.5 concentrations were responsible for about 428 000 premature deaths originating from long-term exposure in Europe (41 countries), of which around 399,000 deaths in the EU28 (2014). Unfortunately, the EU level limits for PM are 2,5 higher than the level recommended by the World Health Organization. The current exposure to PM leads to an average loss of life expectancy in Europe, varying from 3 months in Finland to more than 13 months in Belgium. (Brunekreef et al 2012)
Sulphur Dioxide	
SO2 is a colourless gas, with a pungent, suffocating odour, produced by burning sulphur. Most SO2 comes from coal fired power plants and industries which burn fossil fuels such as petroleum refineries, cement and metal processing factories. (ECDA 2017)	A proportion of people with asthma experience changes in pulmonary function and respiratory symptoms after periods of exposure as short as 10 minutes to high SO2 peak concentrations. SO2 can affect the respiratory system and lung function, causing eye irritation and inflammation of the respiratory tract, in turn causing coughing, mucus secretion, aggravation of asthma, chronic obstructive pulmonary disease (COPD) and chronic bronchitis; and increases susceptibility to infections of the respiratory tract. Hospital admissions for cardiac disease increase on days with higher SO2 levels in the atmosphere. (WHO 2014b)
Nitrogen dioxide (NO2)	
NO2 is one of several nitrogen oxides – gases containing nitrogen and oxygen. Red/brown in colour with a sharp	The estimated impact of exposure to NO2 concentrations in 2014 is around 75,000 premature deaths per year

odour, it is one of the main nitrogen oxides present in the air and is a major source of smog. Anthropogenic emissions of NO2 are combustion processes such as heating, power generation, and engines in vehicles and ships, including diesel machines. (ECDA 2017) Real-world emissions of nitrogen dioxide from modern diesel engines are much higher than anticipated, potentially exposing many road users, and people living on busy roads, to short-term peak concentrations during rush hours and periods of stagnating weather that may impact on health. (Brunekreef et al 2012)

respectively in the EU28. (EEA 2017a) In asthmatic patients, nitrogen dioxide concentrations can enhance bronchoconstriction, the reaction to allergens and a range of responses with the lung suggestive of airway inflammation and alternation in lung immune defences. (Brunekreef et al 2015)

A recent health impact assessment for London has suggested that mortality impacts for traffic related pollution mixtures represented by NO2 may add a very large number of deaths to those already independently attributed to PM2.5. (Transport for London 2015)

Secondary pollutants

GROUND LEVEL OZONE (O3)

In the stratosphere, ozone absorbs harmful ultraviolet radiation preventing it from reaching the earth. Near the ground, ozone becomes problematic – formed by chemical reactions between the sun's rays and organic gases and oxides of nitrogen emitted by cars, power plants, industrial boilers, refineries, chemical plants and other sources, it causes crop losses and limits forest growth. (ECDA 2017)

The estimated impact of exposure to O3 concentrations in 2014 in the EU28 was around 13,600 premature deaths per year respectively. (EEA2017). Excessive ozone is associated with reduced lung function, exacerbation of chronic respiratory diseases such as COPD and increases in respiratory hospital admissions and mortality in Europe and the United States. (WHO Europe 2013) Ozone exposure results in airway inflammation, airway hyper-responsiveness, and decrements in lung function in healthy and asthmatic adults. (Guarnieri, Barnes 2014), (ERS 2010)

AMMONIA (NH3)

Ammonia emissions react in the atmosphere to form secondary particulate matter harmful to human health. 95% of ammonia emissions are caused by agriculture: from chemical fertilisers on the one hand, and manure and slurry from livestock on the other. Around 80% of EU ammonia emissions come from just 5% of farms. (IIASA 2016)

METHANE (CH4)

Methane is a greenhouse gas and air pollutant, contributing not onlyto climate change but also to the formation of ground level ozone (O3) (EEA 2014). it is estimated that around half of all methane emissions come from agriculture (mainly livestock farming), a third comes from waste (solid waste disposal and wastewater treatment) and around 14% comes from fuel extraction and distribution (coal mining and distribution of natural gas) in the EU. (European Commission 2013a)

There is currently no legislation which

specifically targets methane emissions in the EU. Instead, methane is one of the "basket of six" greenhouse gases covered by the Kyoto Protocol at international level and by the Effort Sharing Decision (ESD) at EU level (Official Journal 2009). Under the ESD, Member States are required to meet an overall reduction target for greenhouse gases, but not for methane. In practice, Member States could meet their ESD requirements only by reducing their CO2 emissions, doing nothing on methane. Methane emissions from agriculture account for 40% of the EU's total methane emissions. (Eurostat 2018)

There are various cost-effective ways of addressing both sources of methane produced by agriculture (from enteric fermentation and manure) without affecting meat/milk consumption such as manure management, changing feeding strategies and anaerobic digestion plants.

The OECD projects that the market costs of air pollution (reduced productivity, additional health expenditure, crop losses, etc.) will increase to 2% of European GBP by 2060.

CASE STUDY: THE HEALTH BURDEN OF DIESEL EMISSIONS

The rise of diesel power in Europe

In the 1990s, concerns over climate change created pressure on carmakers to improve the fuel-efficiency (and hence CO emissions) of the cars they sold. This worry was reflected in the voluntary agreement between the European Automobile Manufacturers' Association (ACEA) and the European Commission in 1998. The lower tax on diesel (and hence lower pump prices) provided an incentive to use diesel in high-mileage applications (diesel bonus), but some countries, such as France and Spain, went further, also offering lower vehicle taxes on diesel cars. The car industry itself was also quick to advocate a switch to diesels as an essential component of any strategy to cut CO2 emissions. As a result of this biased regulation, the share of new diesel registrations has increased from 15% in 1990 to 52% in 2015. This is in stark contrast to other global markets where in the absence of biased regulation, diesel's share is consistently below 5%; in the USA and China it is 1% and 2% respectively, in Turkey 2%, in South Korea 3% and in India 15%. Over a third of all cars on Europe's roads are now diesels. As a result, Europe became a global diesel island, accounting for 70% of world's sales of diesel cars and vans. There are currently 37 million diesel cars and vans on EU's roads. (Transport & Environment 2017)

EU legislation

The Cars and CO2 Regulation agreed in 2008 and confirmed in 2013, required car manufacturers to reduce fleet average CO2 emissions from new cars to 130g/km by 2015 and 95g/km by 2021. (Eur-Lex 2009) While it is technology neutral, it indirectly discriminates in favour of diesel as tailpipe CO2 emissions from a diesel car are typically 15-20% lower than from an equivalent petrol car. (Transport & Environment 2017)

Euro air pollution standards for road transport

The legal framework consists of a series of directives, each amending the 1970 Directive 70/220/EEC Concerning Measures to be Taken Against Air Pollution by Emissions from Motor Vehicles, repealed by Regulation (EC) No 715/2007. (Eur-Lex 2007a) Air pollution emissions from cars and vans have been regulated through a sequence of tightening limit values, from Euro 1 beginning in 1991, through to Euro 6 which came into force for all models in 2015. These Euro standards limit all the main pollutants from vehicle exhausts - carbon monoxide, nitrogen oxides, particulates and volatile organic compounds.[1]

On NOx emissions specifically, the Commission has tightened the maximum NOx emissions limits for diesel passenger cars on

January 2000	January 2005	September 2009	September 2014
500 mg/km (Euro 3)	250 mg/km (Euro 4)	180 mg/km (Euro 5)	80 mg/km (Euro 6)

(European Commission 2017a)

1. The stages are typically referred to as Euro 1, Euro 2, Euro 3, Euro 4, Euro 5 and Euro 6 for Light Duty Vehicle standards. The corresponding series of standards for Heavy Duty Vehicles use Roman, rather than Arabic numerals (Euro I, Euro II, etc.).

several occasions:

Type Approval Framework Regulation (TAFR)

The European Commission tabled legislative proposals to ensure car manufacturers comply strictly with all EU safety, environmental and production requirements, proposing a major overhaul of the so-called EU type approval framework. Under current rules, national authorities are solely responsible for certifying that a vehicle to be placed on the market meets all requirements and for policing manufacturers' compliance with EU law. The proposals will make vehicle testing more independent and increase surveillance of cars already in circulation and compliments the Real Driving Emissions package. Once adopted, it will be directly applicable, repealing and replacing Directive 2007/46/EC (Eur-Lex 2007b), also known as the 'Framework Directive' (European Commission 2016a). The European Parliament, the Council and the Commission reached a political agreement on 7th December 2017. (European Commission 2017b)

The Dieselgate scandal

In 2013, emissions tests conducted on behalf of the International Council on Clean Transportation (ICCT) in the US found that some diesel-engine Volkswagen Group vehicles were emitting substantially more NOx pollution than in laboratory tests. The results were passed on to the California Air Resources Board and, subsequently, to the US Environmental Protection Agency (US EPA). After an investigation, the US EPA issued a Notice of Violation of the Clean Air Act to Volkswagen Group on 18 September 2015. Soon after, VW admitted that almost 500,000 of its vehicles in the US (including the VW-manufactured Audi A3, and some VW diesel versions of the Jetta, Beetle, Golf and Passat) were equipped with illegal emissions software ('defeat devices') designed to detect the regulatory test and lower emissions accordingly (while emitting up to 40 times the US NOx limits when on the road). The emissions scandal that erupted in the US quickly spread to Europe and the rest of the world, with the US revelation being a mere tip of the iceberg amid years of industry-wide circumvention of emissions tests. The original 500,000 VW vehicles in violation of US rules has grown to about 11 million cars worldwide, including 8.5 million in Europe, all fitted with the same test detection equipment. The use of such equipment is banned by EU law. (Eur-Lex 2007 Article 5.2)

In contrast to the action against VW by the US EPA (forcing the car manufacturers to buy back the faulty vehicles and pay penalties amounting to USD14.7 billion) no fines have been levied in Europe by any national approval authorities in charge of certifying vehicles for circulation. In the aftermath of the scandal in 2016/17 most diesel car manufacturers in Europe, including Daimler, Renault, Fiat, Audi, Opel and others offered a raft of often voluntary emission recalls and upgrade programmes. (Transport & Environment 2017)

Following the revelations in September 2015 (Dieselgate), the Commission invited all Member States, as the responsible authorities for market surveillance and enforcement of the type-approval legislation, to carry out the necessary investigations into the real emission

levels of vehicles on their territory, and to ensure compliance with EU law. The Commission supported their work by developing a common testing methodology to screen for defeat devices which altered the results of laboratory tests, ensuring consistency of the results of national investigations. It also published guidance to help Member States' authorities assess whether a car manufacturer is using defeat devices or other strategies that lead to higher vehicle emissions outside of the test cycle and analyse whether they are technically justified (European Commission 2017c). The Commission opened infringement procedures against eight Member States for breaching EU type approval legislation in December 2016 and May 2017. (European Commission 2017a)

Infringement procedures based on the EU vehicle type approval rules

As a follow up of the Dieselgate scandal, the Commission has been taking further steps in its infringement procedures against 4 Member States on the grounds that they have disregarded **EU vehicle type approval rules** on 17th May 2018. The Commission decided to issue additional letters of formal notice to **Germany, Italy, Luxembourg,** and the **United Kingdom**.

EU type-approval legislation requires Member States to have effective, proportionate and dissuasive penalty systems in place to deter car manufacturers from breaking the law. Where such a breach of law takes place, for example by using defeat devices to reduce the effectiveness of emission control systems, remedial measures – such as recalls – must be ordered and penalties must be applied (Articles 30 and 46 of Directive 2007/46 and Article 13 of Regulation 715/2007).

The Commission opened infringement proceedings against Germany, Luxembourg and the United Kingdom in December 2016 with regard to Volkswagen Group and sent complementary letters of formal notice in July 2017 requesting further clarifications.

The Commission is now sending additional letters of formal notice to request more information on the national investigations and legal proceedings related to these infringements. In addition, following the discovery of new cases of engine-management irregularities in several diesel cars (Porsche Cayenne, Volkswagen Touareg and several Audi A6 and A7 vehicles) the Commission asks Germany and Luxembourg, as the competent type-approval authorities, which remedial measures and penalties are envisaged. The Commission is also requesting clarifications from the United Kingdom on planned national legislation.

In May 2017, the Commission launched an infringement procedure against Italy for failure to fulfil its obligations under the EU vehicle type-approval legislation with regards to Fiat Chrysler cars. In the meantime, Italy took corrective measures by ordering the Fiat Chrysler Automobiles group to conduct a mandatory recall in the EU. Today, as part of the ongoing exchange, the Commission requests additional information on the concrete corrective measures taken and penalties applied.

An additional letter of formal notice constitutes

A study featured in The Lancet (January 2018) shows that diesel exhaust fumes from road traffic have immediate cardiovascular and respiratory impacts, as well as causing chronic diseases and long–term health damage.

an official request for information. The Member States have two months to respond to the arguments put forward by the Commission; otherwise, the Commission may decide to send a reasoned opinion.

New European Drive Cycle (NECD) versus Real-World Driving Emissions (RDE)

The earlier New European Drive Cycle (NEDC) testing methodology in place until September 2017 allowed diesel vehicles to emit significantly higher emissions in real life. As Dieselgate has shown, some cars on the road today passing the NECD test procedure do not respect these values under real driving conditions, meaning more pollutants are released into the air we breathe. Therefore, the European Commission modified Regulation C 715/2007 on 1st September 2017 and introduced the Real Driving Emissions test procedure (RDE) to further tighten the rules to check the emissions of NOx and ultrafine particles (Particle Number - PN) from road vehicles and reduce the current discrepancy between emissions measured in real driving and those measured in a laboratory. (European Commission 2017a)

In 2014, NOx emissions were typically 7-10 times higher on the road than in tests (ICCT 2014). This gap had fallen in 2015/16, as newer Euro 6 diesels entered the market. The most recent data by the ICCT shows the average gap is falling, but it is still 4.5 times above the legal limit. (ICCT 2017) The gross failure to meet limits on the road, combined with the dieselisation of the car fleet, has been the principal reason why EU ambient air pollution standards are not being met in urban areas. (Transport & Environment 2017)

Diesel pollution and nitrogen oxides

The levels of key pollutants such as nitrogen oxides (NOx) are significantly higher in the emissions from diesel vehicles than from equivalent gasoline vehicles. NOx is a combination of nitric oxide (NO) and nitrogen dioxide (NO2). In the air, NO is rapidly converted into NO2 adding to the NO2 directly emitted in diesel exhaust gases. However, a further problem is that diesel vehicles emit more of the NOx emissions than they produce as primary nitrogen dioxide (NO2). The EU Joint Research Centre (JRC)27 found that the share of NO in the total NOx emissions reached 60% for diesel vehicles but was substantially lower for gasoline vehicles (0-30%). NO2 is the toxic form of nitrogen oxides, and NO2 levels in streets with a high penetration of diesel vehicles are especially high. Indeed, concentrations of NO2 are above World Health Organisation (WHO) health guidelines across much of Europe, with 94% of exceedances observed at traffic stations.

As from 2017, Austria, Belgium, the Czech Republic, Denmark, France, Germany, Hungary, Italy, Poland, Portugal, Spain and the UK have been subject to EU infringement proceedings and face the threat of multi-billion fines for failing to meet the EU NO limit values. (Transport & Environment 2017)

The health costs of diesel emissions

Diesel emissions, particularly from road transport, are a major contributor to the health burden and cost of air pollution. (Thurston et al 2018)

A study featured in The Lancet (January 2018) shows that diesel exhaust fumes from road traffic have immediate cardiovascular and respiratory impacts, as well as causing chronic diseases and long–term health damage. (Sinharay et al 2018)

The European Environment Agency estimates 7% of EU urban citizens live in areas where NO2 pollution is damaging their health, causing 68.000 premature deaths annually. (EEA 2016)

Premature deaths from NO_2 exposure in Europe
Source: Transport & Environment Diesel – the true (dirty) story (2017)

More than 40% of nitrous oxides (NOx) come from road transport, of which around half is from diesel vehicles. (Anenberg 2017) Road transport is the second largest source of black carbon (EEA 2017a). Around 40% of particulate matter also comes from the transport sector. (EEA 2017b)
The International Agency for Research on Cancer (IARC) of the World Health Organisation (WHO) has classified diesel exhaust as a Group 1 carcinogen, as well as particulate matter as carcinogenic in its own right. (IARC 2012)

The excess emissions due to Dieselgate the international non-compliance with emissions standards (especially from heavy vehicles) totalling 4.6 million tons - has been associated with about 38,000 premature deaths (PM2.5- and ozone-related) globally in 2015, including about 10% of all ozone-related premature deaths in the EU-28. (Anenberg 2017) A study by IIASA found that roughly 10,000 premature deaths a year (EU28 plus Norway and Switzerland) can be attributed to NOx emissions from diesel cars, vans, and light commercial vehicles, of which approximately half are due to excessive NOx emissions. (IIASA 2017) Most health impact studies compare real world emissions concentrations to either regulatory standards or to equivalent petrol vehicles.

The adverse health impacts of diesel pollution show that the beneficial health effects of healthcare treatment and medication, or preventative activities such as moderate exercise, are immediately negated by even

brief exposure to diesel emissions. This, in turn, has serious implications for health services and budgets: action must be taken to curb diesel pollution to reduce diesel pollution-related healthcare spending.

The European air quality policy framework

Ambient (outdoor) air pollution has become one of the most prevalent environmental public health risks. A key environmental policy area, clean-air policies are a very important tool to protect public health. There are significant opportunities for action at at international, European, national and regional / city level, adding value to actions undertaken by national governments.

The wider European context – WHO process on environment and health

The "**European Environment and Health Process**" sets the frame for policy action by the World Health Organization in Europe. To date, the most important outcome is the 2010 Parma Declaration (WHO Europe 2010) when the Governments of the 53 WHO European Member States set clear-cut targets to reduce the adverse health impact of environmental threats in the next decade. This was reinforced at global level in early 2015 when the 68th World Health Assembly adopted a WHA resolution "Health and the environment: addressing the health impact of air pollution" (WHO Europe 2015b)

Background information on pollutants and their effects on health can be found in the **Global Air Quality Guidelines (WHO AQG)** produced by the World Health Organization. The latest edition of WHO AQGs for ambient air pollutants was published in 2006 and included recommendations for the classical air pollutants: particulate matter (PM), ozone (O3), nitrogen dioxide (NO2) and sulphur dioxide (SO2). Since then, the evidence base for adverse health effects related to short- and long-term exposure to these pollutants has become much larger and broader. The WHA Resolution recognised the role of WHO AQGs for both ambient air quality and indoor air quality in providing guidance and recommendations for clean air that protect human health. In particular, it requested the WHO Director-General to strengthen organizational capacities in the field of air pollution and health through the development and regular update of WHO AQGs in order to facilitate decision making, and to provide support and guidance to WHO national governments in their efficient implementation.

As a result, in 2016 WHO has started the work towards the update of the WHO Air Quality Guidelines. It is expected to provide up-to-date recommendations for ways in which national governments can protect populations worldwide from the adverse health effects of ambient air pollution. (WHO Europe 2016)

The WHO has published new numbers on air pollution and the health toll worldwide on 2nd May 2018. (WHO 2018) The new data shows that air pollution levels remain dangerously high in many parts of the world, with 9 out of 10 people breathe air containing high levels of pollutants. WHO estimates that around 7 million people die every year from exposure to fine particles in polluted air that penetrate

deep into the lungs and cardiovascular system, causing diseases including stroke, heart disease, lung cancer, chronic obstructive pulmonary diseases and respiratory infections, including pneumonia.

In conjunction with the data launch, a new global communications campaign **BreatheLife** has been launched. It challenges citizens to take action to reduce air pollution. A partnership between WHO, UN Environment and the Climate and Clean Air Coalition to Reduce Short-lived Climate Pollutants, it aims to increase awareness and action on air pollution by governments and individuals and can be found at www.breathlife2030.org .

CLIMATE CHANGE AND AIR POLLUTION: HEALTH THREAT AND OPPORTUNITY

There is a huge opportunity for synergies that can be achieved from integrated prevention strategies, given that the drivers of both climate change and air pollution often overlap.

Particulate matter, responsible for many deaths also plays an important role in global warming because of its contribution to cloud formation

Ground-level ozone is itself a greenhouse gas because it inhibits the process by which plants contribute to carbon uptake from the atmosphere; carbon in the atmosphere contributes significantly to global warming

Methane, as a gas emitted from agriculture, energy and waste management activities also contributes to the formulation of ground level ozone.

Well-designed climate mitigation policies offer significant health and economic benefits. Policies that reduce greenhouse gas emissions, whilst also delivering cleaner air, increased physical activity, reduced road traffic accidents and better mental health, can deliver huge health and wellbeing benefits now and in the future. (ECDA 2017)

Tackling air pollution in the European Union

Air pollution has been one of the EU's main political concerns since the late 1970s. European Union policy on air quality aims to develop and implement appropriate instruments to improve air quality. Air pollution is a particularly urgent health threat in the European Union, where air-quality standards are far less stringent than WHO recommended levels.

1. Data on air pollution in the EU: air quality standards and the European Environment Agency (EEA)

As humans can be adversely affected by

Air pollution is a particularly urgent issue in the European Union, where air-quality standards are far less stringent than WHO recommended levels.

exposure to air pollutants in ambient air, the EU has developed an extensive body of legislation which establishes health-based standards and objectives for a number of pollutants present in the air. Information on other air pollution effects and data can be obtained from the EEA .

2. EU political commitments to limit air pollution

At the international level, the EU and its Member States are party to the Convention on Long-Range Transboundary Air Pollution and its Gothenburg Protocol. The Convention brings together the EU, Central and Eastern European countries, the United States and Canada. The 1999 Gothenburg Protocol was revised in 2012 to include 2020 emission reduction commitments which have been directly copied into EU law. (EEB 2017)

As a political commitment within the EU, the 7th Environmental Action Programme includes objectives for air quality for 2020, to ensure that air pollution and its impacts are further reduced with the long-term aim of not exceeding the air quality guidelines set by the World Health Organization (WHO) to protect health and the critical loads and levels for protection of plants and ecosystems. (European Commission 2016b)

On 18 December 2013, the European Commission adopted a Clean Air Policy Package based on an extensive review of EU air quality policy to that point and included a Clean Air Programme for Europe. (European Commission 2017d, 2013a)

On 17th May 2018, the European Commission issued a Communication 'A Europe that protects: Clean air for all' To address air pollutant emissions from traffic, the Commission committed further strengthen its work with national, regional and local authorities on a common integrated approach for urban vehicle access regulations, under the EU Urban Agenda. (European Commission 2018a)

3. The EU legal framework for air policy

In order to limit air pollution, the EU has policies in place limiting individual sources but also national totals of atmospheric emissions of the key pollutants. The Ambient (outdoor) Air Quality Directive **(Pillar I)** the National Emission Ceilings Directive (**Pillar II** and additional EU legislation regulating other sources (Pillar III) provide the legal framework for the EU's air policy.

Pillar I – Ambient (Outdoor) Air Quality Directives (AQD)

As part of the 2005 Thematic Strategy on Air Pollution, the Commission proposed to consolidate various EU legislations on air quality into a single Ambient Air Quality Directive, adopted as 2008/50/EC (Eur-Lex 2008). Together with the fourth daughter Directive 2004/107/EC, the Ambient Air Quality Directives provide the current framework for the control of ambient concentrations of air pollution in the EU.

The Ambient Air Quality Directives have certain aims and principles, including the control of emissions from mobile sources, improving fuel quality and promoting and integrating

environmental protection requirements into the transport and energy sector. Member States divide their territory into a number of Air Quality zones and agglomerations, where they should undertake assessments of air pollution levels using measurements, modelling and other empirical techniques – and report accordingly this air quality data to the European Commission. (European Commission 2017e, 2017f) Where levels are higher than the limits or target values air quality standards' targets, Member States should prepare an air quality plan or programme to address the sources responsible and ensure compliance with the limit value before the date when the limit value formally enters into force. In addition, information on air quality should be circulated to the public.

Many Member States are in breach of one of more limits set in the AQD. By November 2016, the European Commission had opened infringement proceedings against 19 EU national governments.

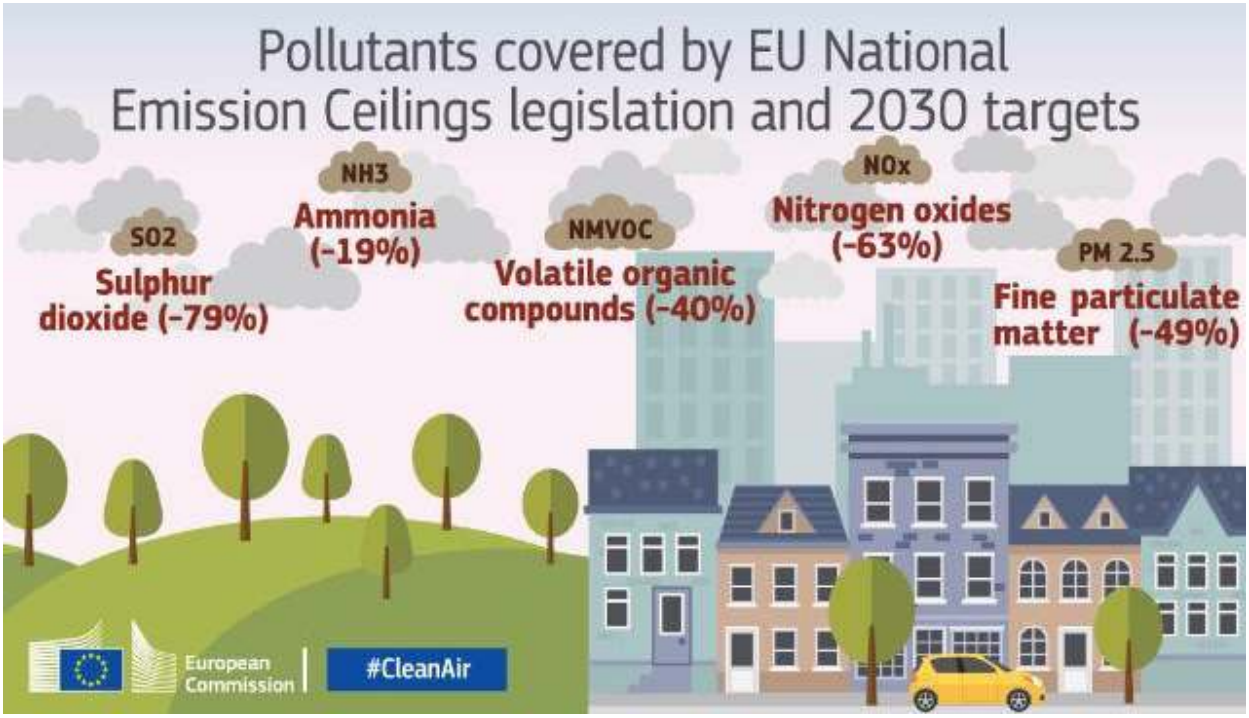
Revision of the EU legislation on ambient (outdoor) pollution in 2017-2019

As significant compliance gaps for some key pollutants still prevailed – most noteworthy exceptions are for particulate matter, nitrogen oxide and to a certain extent the ozone target values, the European Commission decided to launch a revision or 'fitness check' in 2017 to look at the performance of the two complementary EU Ambient Air Quality (AAQ) Directives (Directives 2008/50/EC and 2004/107/EC). The findings of the fitness check will be used to inform further reflections on whether the AAQ Directives are fit for purpose and continue to provide the appropriate legislative framework to ensure protection from adverse impacts on, and risks to, human health and the environment. (European Commission 2017g)

Pillar II – National Emissions Ceiling (NEC) Directive

The National Emissions Ceilings Directive (NEC Directive) the main legislative instrument to achieve the 2030 objectives of the Clean Air Programme - entered into force on 31 December 2016. (Eur-Lex 2016)

This Directive sets national reduction commitments for the five pollutants (**Sulphur Dioxide (SO2), Nitrogen Oxides (SOx), Non-Methane Volatile Organic Compounds (NMVOCs), Ammonia (NH3) and Fine Particulate Matter (PM2.5)**) responsible for acidification, eutrophication and ground-level ozone pollution which leads to significant negative impacts on human health and the environment. By nationally reducing overall emissions, the NEC Directive helps national, regional and local authorities to comply with the air quality requirements of the AQD (see Pillar I) (EEB 2017). However, due to the limited ambition of the final NEC directive, it is still expected that air pollution due to PM2.5 exposure will cause more than 300,000 premature deaths in the EU in the year 2020. The annual health costs of air pollution are expected to amount to €243-€775 billion and two thirds of EU air quality zones would still breach the WHO recommended level for PM2.5. (European Commission 2013c)



Reduction of National Emissions
Source: European Commission

Emission reduction targets for 2020 and 2030

The NEC Directive sets targets known as National Emissions Reduction Commitments (NERCs) to be reached for the five pollutants by both 2020 and 2030. There are 280 NERCs in total (28 Member States x 5 pollutants x 2 target years) and are all listed in the Directive's Annex II. However, Member States are allowed to use "flexibilities' to justify if they are not meeting the set targets. These include

- adjustment of national emission inventories;
- calculate their emissions in a 3-year average in case of exceptionally cold winter or an exceptionally dry summer;
- exceed certain NERCS for certain pollutants if they set more stringent level for other pollutants; as well as
- unforeseeable events leading to a sudden and exceptional interruption of the power and/or heat supply or production system

There are no binding limits for 2025 – Member States shall only indicate which levels they expect to meet in 2025. Members States can adjust their emission inventories to ensure compliance with their NERCs in an informative inventory report to be submitted by 15 March of the reporting year and made available to the public. After receiving the report, the Commission has nine months to oppose the use of flexibility, which is possible in three cases:

1. The breach is due to emissions from a new source which was not known at the time the NERC was set; or
2. The breach is due to a significantly different emission factor used for determining emissions from a given source; or

3. The breach is due to different methodologies used for determining emissions from a given source.

Member States must develop and adopt so-called "National Air Pollution Control Programmes" (NAPCPs). The Directive contains a new set of minimum binding requirements for the content of NAPCPs, in particular:

- Member States must detail the policy options considered for attaining their 2020 and 2030 NERCs as well as their 2025 trajectory but also to "further improve the air quality" beyond their NERCs.
- Member States must assess how the selected measures will ensure coherence with other relevant programmes, such as those taken to meet the Ambient Air Quality Directive's standards for human health.
- The authority responsible for the implementation of the programme must be designated.
- A timetable for implementation and review of the selected measures must be detailed.

The new NEC Directive provides an explicit obligation for Member States to consult the public when drawing up and adopting the NAPCPs. (EEB 2017)

Enforcement

If a Member State breaches its 2030 NERC, the Commission could start legal proceedings only after 2032 result in a possible court judgment not earlier than 2036. Members of the public can assist the Commission by providing information and making official complaints where there has been a breach of the Directive and enforce compliance with the national rules by taking legal action before their national courts. (EEB 2017)

Revision

The European Commission is obliged to review the Directive by the end of 2025, with a view to bringing the EU closer to the Directive's objectives set in Article 1 of the 7th Environmental Action Programme. These objectives include meeting air quality levels in line with the World Health Organisation (WHO) guidelines. The European Commission will also have to look into the possible inclusion of mercury, a highly transboundary pollutant with significant adverse impacts on human health. Based on its assessment, the European Commission can decide whether to propose new policies to further address air pollution in the EU. (EEB 2017)

Pillar III - Tackling other specific sources of air pollution

The EU also sets emission standards for specific sources of pollution in different sectors.

- **Road Transport** - Regulation (EC) No 715/2007. Emissions from road transport are regulated through 'Euro' standards for cars, vans and heavy duty vehicles. EU type approval rules were updated on 1st September 2017 and "Real Driving Emissions Test Procedures" (RDE) were being developed to better reflect on-the-road emissions. (Eur-Lex 2007a)
- **Industrial Emissions Directive (IED)**. Directive 2010/75/EU on industrial emissions aims to achieve a high level of protection of human health and the

Policies that result in sustained reductions in concentrations have a greater potential to lead to larger public health benefits than "emergency policies" aiming to prevent a few extreme air pollution peaks.

environment taken as a whole by reducing harmful industrial emissions across the EU, in particular through better application of Best Available Techniques (BAT). Energy generation, the production of metals, minerals and chemicals and waste management, as well as large poultry and pig facilities are regulated through the IED. (European Commission 2016c)

- **Non-Road Mobile Machineries(NRMM)** - Regulation (EU) 2016/1628 aims to progressively reduce the pollutant emissions and to phase out equipment with the most polluting engines. The NRMM addresses emissions from combustion engines installed in construction machines, railcars, locomotives, and inland waterway vessels, as well as defining emission limits and laying down the procedures engine manufacturers have to follow to be allowed to sell their engines in the EU market. (European Commission 2018b)
- **The Medium Combustion Plant (MCP) Directive** (EU) 2015/2193 addresses boilers, heaters, engines and turbines used for electricity generation, residential heating and cooling, and heating and steam for industrial processes. Medium combustion plants are an important source of emissions of sulphur dioxide (SO2), nitrogen oxides (NOx) and dust. (European Commission 2016d)
- **The Paints Directive** 2004/42/EC sets emission limits for paints and varnishes. Products containing solvents such as paints, varnishes, deodorants and nail polish are responsible for emissions of volatile organic compounds (VOC) which are precursors of ground-level ozone. (European Commission 2017h)
- **International shipping** While standards to limit the sulphur content of marine fuel in the EU do exist, the EU largely relies heavily on standards adopted by the International Maritime Organisation (IMO). (EEB Undated)

Enforcement of EU law on air quality

The Aarhus Convention

The United Nations Economic Commission for Europe (UNECE) Convention on Access to Information, Public Participation in Decision-Making and Access to Justice in Environmental Matters was adopted on 25 June 1998 in the Danish city of Aarhus (Århus) at the Fourth Ministerial Conference as part of the "Environment for Europe" process. It entered into force on 30 October 2001.

The Aarhus Convention establishes a number of rights of the public (individuals and their associations) with regard to the environment. The Parties to the Convention are required to make the necessary provisions so that public authorities (at national, regional or local level) will contribute to these rights to become effective. The Convention provides for:

- **the right of everyone to receive environmental information** that is held by public authorities (**"access to environmental information"**). This can include information on the state of the environment, but also on policies or measures taken, or on the state of human health and safety where this can be affected by the state of the environment. Applicants are entitled to obtain this information within one month of the

request and without having to say why they require it. In addition, public authorities are obliged, under the Convention, to actively disseminate environmental information in their possession;

- **the right to participate in environmental decision-making**. Arrangements are to be made by public authorities to enable the public affected and environmental non-governmental organisations to comment on, for example, proposals for projects affecting the environment, or plans and programmes relating to the environment, these comments to be taken into due account in decision-making, and information to be provided on the final decisions and the reasons for it ("**public participation in environmental decision-making**");
- **the right to review procedures to challenge public decisions** that have been made without respecting the two aforementioned rights or environmental law in general ("**access to justice**"). (European Commission 2017i)

European Case Law in the field of litigation on air quality

There is European case law in the area of air quality litigation against Member States. Landmark cases are as follows:

Case C-237/07, Dieter Janecek vs. Freistaat Bayern – 25th July 2008

In this landmark ruling, the CJCE stated that where there is a risk that the alert thresholds or limit values may be exceeded, persons directly concerned must be in a position to require the competent national authorities t**o draw up an action plan**, even though, under national law, those persons may have other courses of action available to them for requiring the competent authorities to take measures to combat atmospheric pollution.

With regard to the **content of the action plans**, the Court notes that the Member States are not obliged to take measures to ensure that the limit values or alert thresholds are never exceeded. They are obliged, subject to judicial review by the national courts, only to take such measures in the short term in an action plan as are capable of reducing to a minimum the risk that the limit values or alert thresholds may be exceeded and of ensuring a gradual return to a level below those values, taking into account the factual circumstances and all opposing interests. (InfoCuria 2008)

Case C-404/13, ClientEarth vs. United Kingdom – 19th November 2014

According to the ruling the UK plans should have aimed at compliance by 1 January 2015 at the latest and UK courts must order the government to produce a plan which achieves nitrogen dioxide limits "as soon as possible" Limit values impose an obligation of result, but there is no guidance about the interpretation of "asap" and Member States' margin of discretion is "heavily circumscribed. It must be added that protection of health takes priority. (InfoCuria 2014)

European legal actions: new approach to infringement cases

The Commission infringement procedure comprises several informal and formal steps:

1. **Letter of formal notice** – a first written warning, setting out the grounds on which the commission thinks the member state is failing to comply with EU law and requiring a formal response (usually within two months)
2. **Reasoned opinion** – a final written warning, typically giving the member state two months to take steps to rectify the breach
3. **Referral to the CJEU** (under TFEU article 258)
4. **First CJEU judgment** – if the Court agrees with the commission it will make a declaration that the member state has failed to comply with the EU law. The member state must then take the necessary measures to comply with the court's judgment.
5. **Second referral to the CJEU** – if the Commission thinks that the member state has failed to take the necessary measures to comply with the first court judgment, it must then initiate a second round of infringement action and make a second referral to the CJEU with a recommendation for a fine (under article 260)
6. **Second CJEU judgment** – if the CJEU rules that the member state has failed to comply with its first judgment, it can issue either or both a daily and lump sum fine. (Clean Air Europe undated)

Infrigement procedures based on the ambient (outdoor) air quality

The European Court of Justice (ECJ) has recently condemned Bulgaria and Poland for breaching these limits. The cases are in phase 4 – first CJCEU judgment.

- Case C-488/15, European Commission vs. Bulgaria – 5th April 2017 (InfoCuria 2017)
- Case C-336/16, European Commission vs. Poland – 22nd February 2018 (HEAL 2018)

On 17th May 2018 the European Commission referred **France, Germany, Hungary, Italy, Romania and the United Kingdom** to the Court of Justice of the EU for failing to respect agreed air quality limit values and for failing to take appropriate measures to keep exceedance periods as short as possible. These referrals concern exceedances of air quality standards.

Conclusion – ultimately tackling the invisible killer

Systematic EU policy action on air pollution is urgently needed.

Air pollution is an invisible killer. While the relative risks associated with current levels of ambient air pollution are usually quite small, the overall impact of air pollution on public health is substantial, and thus the benefit of clean air policies can be huge.

Current air quality standards focus on minimising the number of days with high peak concentrations of air pollution. The few days with very high air pollutant concentrations usually receive great media attention, while the public is often less aware of the regular long periods of somewhat lower but still unhealthy concentrations of pollutants in the atmosphere. Policies that result in sustained reductions in concentrations have a greater potential to lead to larger public health benefits than "emergency policies" aiming to prevent a

few extreme air pollution peaks. The benefits of such policies far outweigh the costs. (ERS 2010) •

Systematic EU policy action on air pollution is urgently needed.

Air pollution is an invisible killer. The overall impact of air pollution on public health is substantial, and the benefit of clean air policies can be huge.

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