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Air pollution: a challenge for public health in Europe

Report[1]
Committee on Social Affairs, Health and Sustainable Development
Rapporteur: Mr Serhii KIRAL, Ukraine, European Conservatives Group

Summary

Across Europe, air pollution is the largest environmental risk to public health, causing disease and shortening lives. It is responsible for at least 753 000 deaths annually, and new evidence puts the death toll even higher: air pollution kills more people than tobacco smoking. Europeans living in cities are exposed to toxic air due to urban traffic, energy production, industry and residential heating that largely rely on fossil fuels. The rural population is more exposed to air pollution due to phytosanitary spraying in agriculture.

The report deems clean air to be a basic human right and pleads for more effective public regulatory policies to reduce air pollution, arguing that cleaner air would save lives, prevent illness, improve public health budgets and help implement the United Nations 2030 Agenda for Sustainable Development.

The report supports the World Health Organization's Geneva Action Agenda to Combat Air Pollution and urges the European Union to align its norms with the WHO Air quality guidelines. The report also asks member States to enhance their co-operation with the European Environment Agency, to boost air quality controls and better inform the public, to use green taxes, clean air zones and cleaner alternatives to fossil fuels.

1. Reference to committee: Doc. 14185, Reference 4265 of 23 January 2017.

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A. Draft resolution[2]

1. Across Europe, despite improvements over the last decade, air pollution remains the largest environmental risk to our health, causing disease and shortening lives. The World Health Organization (WHO) estimates that outdoor air pollution kills 4.2 million people worldwide every year. In Europe, air pollution is responsible for at least 753 000 deaths annually. However, the latest research evidence shows that the actual death toll is considerably higher, with air pollution killing more people than tobacco smoking. According to WHO, the global economic burden from premature deaths due to outdoor air pollution amounts to US $5.7 trillion in welfare losses, or up to 4.4% of the global gross domestic product (GDP).

2. Air pollution also cripples health by causing disorders that include respiratory diseases (particularly asthma), heart attacks, strokes and lung cancer. There is also a strong link with diabetes, obesity and dementia. At the beginning of life, air pollution leads to lower birth weight, alterations in immunity, impaired lung capacity, delayed neurocognitive development and reduced intelligence. Recent studies also link air pollution to mental health disorders in childhood. Although air pollutants are numerous, fine particulate matter, nitrogen dioxide (NO_2) and ozone are the most damaging to human health.

3. As three in four Europeans live in cities, they are highly exposed to toxic air due to urban traffic, energy production, industry and residential heating systems – largely as the result of fossil fuel combustion, notably diesel, but also from waste incineration. In rural areas, the agricultural sector contributes significantly to air pollution via the intensive use of phytosanitary spraying. No-one can escape air pollution, and because it crosses borders so easily, we need concerted policies and action across Europe.

4. The Parliamentary Assembly considers that clean air is a basic human right: wherever we live, we need air to be breathable and not to shorten or impair our lives. Public authorities bear direct responsibility for putting in place effective regulatory policies to reduce this pollution. The Assembly notes that while the current mandatory norms of the European Union on exposure to air pollutants are a helpful benchmark for its member States, they should be fully aligned with the more stringent WHO Air quality guidelines and must be better enforced. Non-European Union countries should follow the WHO guidelines and build them into national legislation so as to better protect public health.

5. The Assembly believes that multilateral action on cutting outdoor air pollution would not only save lives, prevent disease and improve public health budgets, but would also enable member States to contribute to reaching various targets under the United Nations 2030 Agenda for Sustainable Development, in particular Sustainable Development Goal 3 (healthy lives and well-being for all), Goal 7 (clean energy), Target 11.6 (air quality and waste management in cities), Target 11.2 (access to sustainable transport), and Goal 13 (climate change). Both present and future generations have the right to enjoy a healthy living environment.

6. The Assembly welcomes and supports the WHO action plan adopted in 2018 – the Geneva Action Agenda to Combat Air Pollution – aiming to mobilise global, national and local players to reduce the number of deaths from air pollution by two thirds by 2030. The Assembly also commends WHO's efforts to integrate new evidence on the toxicity of air pollution through policy advice to member States, based on its Air quality guidelines that are currently undergoing re-evaluation, with priority attention to fine particulate matter, ozone, NO_2, SO_2, carbon monoxide and benzene, as well as for certain heavy metals.

7. The Assembly deplores the fact that the consequences of chronic excessive exposure to air pollution are the worst for the most vulnerable population groups (children, pregnant women, people in poor health and certain categories of workers). It is moreover concerned that across Europe, social inequalities – within and between countries – tend to penalise the poorest populations in terms of disease and mortality from air pollution. Exposure levels are highest in eastern and south-eastern Europe, which is plagued by high poverty and unemployment rates, and within countries in the most socially deprived urban areas.

8. The Assembly urges member States to make action against air pollution a political priority on the grounds of the imperative to protect public health. It recommends that they:

8.1. enhance their co-operation with the European Environment Agency by participating fully – either as members or co-operating countries – in collecting data for the European Environment Information and Observation Network (Eionet), particularly as regards real-time air pollution levels;

8.2. ensure sufficient national capacity for air quality monitoring and inform the public about the current levels of air pollution in comparison with the WHO air quality norms;

2. Draft resolution adopted unanimously by the committee on 11 April 2019.

8.3. put in place new mechanisms for measuring ultra-fine particulate matter (less than 0.1 microns in size, or the so-called PM0.1 or less) in the air;

8.4. ensure that national legal provisions are in place to allow local authorities to enact green taxes and other relevant measures (such as traffic restrictions, pedestrian zones, sustainable urban planning, bans on burning biomass, air pollution alert units with monitoring and law-enforcement capacities) aimed at improving air quality locally;

8.5. establish clean air zones around schools and other institutions ensuring full-time care of children, and ensure an adequate safety perimeter around agricultural areas that make intensive use of phytosanitary products;

8.6. consider special measures to limit the circulation of diesel-powered vehicles and make it mandatory for their owners to retrofit them with exhaust filters, as appropriate;

8.7. in the light of new evidence, reverse their policies favouring or tolerating diesel which have proven to be a failure from a climate change perspective and a disaster from a public health perspective, especially the air pollution angle;

8.8. set up alert mechanisms for systematically triggering air pollution control and reduction measures at local level whenever pollutant levels exceed WHO's guideline values;

8.9. where national clean air strategies promote greater use of electric vehicles:

8.9.1. boost recourse to sustainable and renewable energy sources for generating "clean" electricity;

8.9.2. ensure the traceability of the materials and processes used for making batteries, so that third countries involved do not use child labour in any part of the production chain;

8.10. enhance investment in clean technologies and fuels for industry (in particular transport and energy sectors), agriculture and households (notably for heating systems), and promote clean public transport systems and cycling.

9. The Assembly specifically calls on national parliaments to hold governments to account on domestic clean air policies, the enforcement of existing requirements on air quality and adherence to the relevant international legal instruments, in particular:

9.1. the Convention on Long-range Transboundary Air Pollution of the United Nations Economic Commission for Europe (UNECE) and its protocols, notably the Gothenburg Protocol (as amended in 2012);

9.2. the Stockholm Convention on Persistent Organic Pollutants, which obliges parties to eliminate dioxins;

9.3. the Minamata Convention on Mercury of the United Nations.

10. Finally, the Assembly urges the European Commission to upgrade the European Union norms on air quality through the current review of its air quality directives in order to align the European Union reference limits with WHO norms as soon as WHO's re-evaluation process is completed. By the same token, the Assembly calls on the European Parliament to monitor closely the review process regarding the European Union's air quality directives and norms. Where relevant, it also invites the European Commission to use the pre-accession instruments to support efforts to improve air quality in the neighbourhood countries.

B. Explanatory memorandum by Mr Serhii Kiral, rapporteur

1. Introduction: air pollution – a silent, invisible killer

1. According to the World Health Organization (WHO), air pollution is a major threat to global public health and a major cause of premature deaths. Of the 56 million deaths that occur annually, WHO estimates that 6 million are linked to smoking and 7 million to air pollution.[3] The latter are attributed to both outdoor and indoor air pollution; all in all, nine out of ten persons in the world breathe toxic air that exceeds WHO guideline limits. Indoor air pollution[4] is a major problem in developing countries, where homes and cooking devices are often unventilated. Outdoor air pollution – causing 4.2 million deaths out of the above-mentioned 7 million – occurs in developing and developed countries, particularly in industrial and urban areas. It is largely the result of fossil fuel combustion, such as in power stations (for energy production), industry and transport, or waste burning; domestic forms of heating (such as wood burners and coal fires) also contribute to outdoor air pollution levels. In Europe, traffic is the predominant source of outdoor air pollution in urban areas, whilst agricultural emissions are highly problematic in rural areas. There is no easy hideout from air pollution for many Europeans.

2. In 2018, the European Environment Agency (EEA) calculated that air pollution is responsible for 520 000 deaths annually in 41 European countries, at a cost of about €500 billion per year.[5] If we add the WHO data for the remaining European countries, the death toll rises to some 753 000 per year.[6] The three main pollutants that are damaging to human health are particulate matter (including particle-bound polycyclic hydrocarbons), nitrogen dioxide and ozone.[7] The health disorders most strongly associated with air pollution include respiratory diseases, particularly asthma, heart attacks, strokes and lung cancer. There is also a link with diabetes and obesity, as well as to dementia in the elderly.[8] At the beginning of life, air pollution is linked to lower birth weight, early alterations in immune development, impaired lung capacity and delayed neurocognitive development, including reduced IQ. More recent studies have linked air pollution to mental health disorders in childhood.[9]

3. Further to the motion for a resolution (Doc. 14185) tabled by Mr Geraint Davies and other members of the Parliamentary Assembly, this report will seek to evaluate European efforts towards improving outdoor air quality and will make policy recommendations for action in areas where improvements are urgently needed – bearing in mind public health imperatives and the need for a Europe-wide holistic approach to air pollution. As rapporteur appointed in succession to Mr Davies, who has left the Assembly, I will refer extensively to my predecessor's research, as well as the advice received from prominent experts in the field[10]. Moreover, in order to update the data used in this report and to obtain better insight into the latest trends, I carried out a fact-finding visit to the EEA on 17 July 2018[11] and took part in the First WHO Global Conference on Air Pollution and Health (held from 30 October to 1 November 2018 in Geneva).

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3. WHO (2014), WHO Methods and data sources for country-level causes of death 2000-2012, Global Health Estimates Technical Paper, WHO/HIS/HIS/GHE/2014.7, www.who.int/entity/healthinfo/global_burden_disease/GlobalCOD_method_2000_2012.pdf.
4. See the proceedings of the Parliamentary Conference "Environment and Health: Indoor Pollution and Multi-System Illnesses", held on 5 December 2008 in Strasbourg, available on the Parliamentary Assembly website.
5. EEA report on "Air quality in Europe", No. 12/2018 (data for 2015). WHO estimates that the global economic impact of premature deaths due to outdoor air pollution amounts to US$5.7 trillion in welfare losses, or 4.4% of the global gross domestic product (GDP) in 2016.
6. WHO data (http://apps.who.int/gho/data/node.main.BODAMBIENTAIRDTHS?lang=en) for 2016 relate to Armenia, Azerbaijan, Belarus, Georgia, the Republic of Moldova, the Russian Federation, Turkey and Ukraine, totalling 232 497 deaths.
7. In addition, combustion processes release other harmful pollutants such as sulphur dioxide (SO_2), benzene (C_6H_6), carbon monoxide (CO) and heavy metals (the most common ones are zinc (Zn), copper (Cu), nickel (Ni), lead (Pb), chromium (Cr), selenium (Se), arsenic (As), mercury (Hg), thallium (Tl) and cadmium (Cd)).
8. Joint Report by the Royal College of Physicians and the Royal College of Paediatrics and Child Health: "Every Breath We Take", February 2016.
9. Margolis A., Herbstam J., Davis K., Thomas V., Tang D., Wang Y. et al., Longitudinal effects of prenatal exposure to air pollutants on self-regulatory capacities and social competence, *Journal of Child Psychology and Psychiatry*, 2016, Vol. 57, pp. 851-60.
10. My special thanks go to Dr Robin Russell-Jones, a medical doctor with extensive activities in the field of environmental pollution and the way it harms public health.
11. My programme also included meetings with representatives of the Danish Ecological Council, the Healthy Cities Network, and Danida (Denmark's development co-operation body).

2. A closer look at the situation in Europe

4. Across Europe – despite significant progress over the last decade – air pollution remains the largest environmental risk to our health, causing diseases and shortening lives. Far from being an abstract phenomenon, air pollution affects us all as it travels long distances beyond national borders. At a short range, it attacks the most vulnerable amongst us – children, pregnant women and all those in weaker health in general. WHO's emerging evidence suggests that the burden of death and disease from outdoor air pollution is still underestimated and is "expected to greatly increase", due to the persistent nature of mostly man-made pollution sources. Globally speaking, a number of air pollutants also contribute to climate change and vice versa.

5. According to the EEA, the transport sector, in particular road traffic, is a key contributor to poor air quality, notably in cities: traffic intensity is increasing, and diesel cars have invaded the public space. Already in 2012, there were over 1 billion vehicles on the road worldwide, of which approximately one quarter were in the United States. In 2014, the production of new cars reached 90 million worldwide, with China producing 24 million vehicles, the European Union 17 million and the US$11.5 million annually. Transport contributes approximately 15% of greenhouse gas emissions world-wide and 27% of the European Union's emissions; it is the only sector where emissions are rising. Any gains in vehicle fuel efficiency over the past two decades have been offset by the increasing number of cars on the road and increasing mileage.

6. Air pollution and climate change concerns in Europe are closely interlinked. Following the Kyoto Protocol, the European Union mandated reductions in CO_2 from transport during the 1990s. Because diesel is more fuel-efficient than petrol, car manufacturers in Europe persuaded governments that a change from petrol to diesel-powered vehicles would help achieve the necessary reductions in CO_2 emissions. Diesel's share of the new car market has therefore risen dramatically between 2000 and 2015 (in the United Kingdom, for example, from around 10% before 2000 to nearly 50% by 2015, while similar increases have been documented in Italy and Germany), with diesel vehicles accounting for 52% of new car registrations in the European Union in 2015, just before the Volkswagen "dieselgate" scandal broke out and reversed the trend. Because of court action penalising diesel pollution, diesel car sales in Germany fell by about 10% in one year by mid-2018, while in the European Union sales declined by 16% during the same period.

7. However, diesel is a dirty fuel in terms of air pollution.[12] Emissions of particulates from diesel are an order of magnitude greater than those from a petrol-driven engine, and emissions of nitrogen dioxide (NO_2) are three to four times higher. Because there is a trade-off between fuel economy and pollution control, the technology required to mitigate pollution from diesel vehicles tends to cancel out gains in fuel efficiency. In addition, diesel generates other pollutants with a greenhouse effect such as ozone, nitrous oxide (N_2O) and black carbon. Europe was the only bloc of nations to adopt diesel as a strategy to reduce CO_2 emissions; this has proven to be a failure from a climate change perspective and a disaster from a public health perspective.

8. Reference emission standards for new vehicles are set by the European Union, and the concentration of different pollutants in the air is controlled by the EU Air Quality Directive (2008/50/EC). The expectation within the European Union was that air quality in urban areas would improve with the introduction of tighter emission standards and increasingly efficient pollution control systems. However, these gains have failed to materialise, leading to several court actions against member States: in 2017, the European Court of Justice (ECJ) ruled against Bulgaria and Poland, and in May 2018 the European Commission referred France, Germany, Hungary, Italy, Romania and the United Kingdom to the ECJ over their persistent failure to introduce effective measures to improve air quality. The European Union has threatened legal action against several other countries.[13] Moreover, individual citizens and civil society organisations have also launched a series of lawsuits against State inaction to effectively curb outdoor air pollution and the related health problems and deaths.[14]

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12. Russell-Jones R. "Dirty Diesel" (Editorial). *BMJ* 2016; 335:i6726 DOI: 10.1136/bmj.i6726.

13. In terms of excess values for NO_2, Austria, Belgium, Czech Republic, Denmark, Luxembourg, Portugal and Spain are concerned; regarding particulate matter, Belgium, Czech Republic, Greece, Latvia, Portugal, Slovak Republic, Slovenia, Spain and Sweden have been singled out.

14. In the United Kingdom, the parents of a nine-year old girl Ella Kissi-Debra who died in February 2013 from a severe asthma attack during an air pollution peak are pursuing the State over its failure to cut the excessive air pollution. If the family's request is granted, this will be the first case in the United Kingdom when air pollution is officially stated as the cause of death. French citizens from Paris, Lyon, Lille and Strasbourg are suing France over air pollution effects on public health.

9. WHO sets stricter air quality limits than the European Union, but these are advisory and not legally binding. To limit the risk of potential harm to health, WHO's evidence-based guideline norms on particulate matter state that PM2.5 and PM10 levels should not exceed an annual mean of, respectively, 10 µg/m^3 and 20 µg/m^3. By comparison, the European Union's Air Quality Directive sets a mandatory 25 µg/m^3 as PM2.5 target and a 40 µg/m^3 objective for PM10; for NO_2 pollution, WHO and EU norms coincide at 40 µg/m^3. Ambitious countries and cities[15] may therefore voluntarily opt to pursue the tighter WHO air quality reference values, while the European Union should be encouraged to align its norms to those set by WHO.

10. There are several reasons why air quality has been so slow to improve. First, emissions standards for diesel vehicles are much less stringent than for petrol-driven vehicles, and diesel now represents a much larger share of the new car market. Second, emissions under real driving conditions bear little relation to the results in the laboratory. For example, nitrogen dioxide (NO_2) levels are typically 4 to 5 times higher on the road than under test conditions. This problem was highlighted by the Volkswagen scandal, when the company fitted defeat devices to switch off NO_2 pollution-control technology, resulting in real emissions that were 20 to 40 times higher than those measured under test conditions. Other car manufacturers have rigged the system by fitting pollution-control technology that only operates when the engine reaches a certain temperature, resulting in greatly increased pollution on cold winter days. In addition, vehicle owners themselves may illegally circumvent pollution control systems.[16]

11. Moreover, as the discussions in the Committee on Social Affairs, Health and Sustainable Development have shown, some member States' industrial policy choices have harmful side effects on air quality and ultimately also on public health, as well as in terms of greenhouse gas emissions. Germany, for instance, in a post-Fukushima context, decided to accelerate the phasing out of its nuclear power plants and embrace more renewable energy sources, mainly solar and wind. But the latter provide a more intermittent energy supply, they require back-up capacity, relying on enhanced use of coal- and gas-powered plants and thus leading to more air pollution. A healthy balance between economic priorities and sustainable development needs is often difficult to achieve.

12. Many non-EU countries in eastern and south-eastern parts of the continent are struggling with the air pollution phenomenon. Rapid economic expansion to catch up with the wealthier parts of Europe is seen as an immediate priority, well ahead of sustainable development concerns, and air quality is thus relegated to a secondary concern. Clean development based on new technologies is also more expensive; as the EU countries are hard-pressed to get rid of dirty cars and factories, these often end up being exported to the East. As we shall see in the next chapters, the population's exposure to certain pollutants is particularly pronounced in central and eastern Europe.

3. The culprits: air pollutants, their sources and impacts on our health

13. There are many sources of man-made air pollution with major associated effects on health. Here, I shall focus on the most noxious outdoor pollutants that affect our health most seriously and hence require the priority attention of policy makers and regulatory authorities: particulate matter, nitrogen dioxide, ozone and some others.

3.1. Particulate matter emissions (PM2.5, PM10 and others)

14. From a public health angle, the worst pollutant is particulate matter or particulates (the so-called PM2.5 and PM10):[17] the EEA attributes about 84% of deaths from air pollution to them and countless cases of heart attacks, cardiovascular disease, strokes and respiratory disorders.[18] Particulates originate mainly from fuel combustion in power plants, industry and vehicles, as well as waste incineration and domestic heating, but also from nature (e.g. pollen, bacteria) as primary pollutants; some are secondary pollutants floating in the air after interactions with other chemicals, especially in agriculture. If larger particulates may be visible as smoke,

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15. "London targets WHO air quality limits by 2030", www.airqualitynews.com/2017/08/11/london-targets-air-quality-limits-2030/.

16. NO_2 control technology can be expensive to replace and concerted attempts have been made by haulage companies to bypass the urea-based system used on lorries: either by fitting emulators which are hidden from MOT inspections, or software that is impossible to detect. Equally, particulate traps can be removed by drivers who wish to enhance fuel economy or avoid the cost of replacement.

17. Measuring less than 2.5 and 10 microns in diameter (respectively, PM2.5 and PM10). Particulate matter is very heterogeneous in terms of chemical composition, solid or liquid state and size.

18. A combination of natural particulates with other man-made particulates in the air has been shown to exacerbate respiratory allergies and asthma.

such as in car exhaust and forest fires, smaller particles are invisible. In fact, the smaller the particles, the worse their impacts on our health. Yet awareness about the dangerousness of ultra-fine particles less than 0.1 microns (PM0.1) is just emerging, and, unfortunately, such particles are neither routinely studied nor measured.[19]

15. A particularly worrying subset of particulates are polycyclic aromatic hydrocarbons (PAHs), with benzo(a)pyrene (BaP) being the only PAH routinely monitored throughout the European Union. They penetrate the lungs and increase the risk of lung cancer, according to the International Agency for Research on Cancer (IARC). WHO links 29% of deaths from lung cancer worldwide to air pollution, mainly due to various particulates. Of equal concern is new evidence that links exposure to PAHs during pregnancy with neurocognitive delay and mental health disorders during childhood,[20] including anxiety, depression and ADHD (attention deficit hyperactivity disorder). Given the largely unexplained surge in such problems in schoolchildren today, more research is needed in this area.

16. Diesel engines are the main source of particulates in urban areas. However, this may change with a new generation of petrol-powered engines, which use gasoline direct injection technology and emit even more particulates than diesel engines. Clearly, we need to phase out all fossil fuel-powered vehicles, and not just diesel engines. In the short term, emissions may be reduced by using pollution control devices such as particulate traps. These traps are effective when newly fitted but there are serious doubts about how effective they are over time, particularly in urban driving conditions. Their efficiency is not measured in standard vehicle-testing regimes which only employ a visual smoke detection test. Finally, diesel particulate filters are less effective at capturing the ultra-fine particles which may well be the most dangerous biologically.

3.2. Nitrogen dioxide

17. Fuel burning results in air pollution with oxides of nitrogen (NOx) which include N_2O (nitrous oxide), NO (nitric oxide) and NO_2 (nitrogen dioxide). From a public health point of view, the latter is the most toxic, as it not only aggravates asthma, but also causes asthma in children and adults due to long-term exposure.[21] Traffic, especially with diesel cars, determines the level of both particulates and NO_2 pollution in urban areas, and because they are so closely linked, there has been much debate about their relative and combined effects on health. The picture is further complicated by the fact that oxides of nitrogen lead to the formation of ozone and secondary particulates. The EEA attributes at least 13% of deaths to NO_2,[22] and the estimated impact of Volkswagen defeat devices on cars is the loss of 13 000 life-years in Europe, mainly in Germany, over the 2008-2015 period due to higher levels of ozone and particulates generated by the extra NOx.[23]

3.3. Ozone

18. Ozone (O_3) is a major contributor to respiratory diseases and mortality: it causes about 16 000 of the premature deaths (3% of the total) from air pollution in 41 European countries. A secondary pollutant, ozone stems from photochemical reactions in the sunlight from precursors such as NOx and volatile organic compounds. Ozone levels, therefore, tend to be higher in the summer, and are often highest in the countryside, downwind of urban pollution.

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19. Miller M, Raftis J, Langrish J, McLean S, Samutrtai P, Connell S, Wilson S et al: "Inhaled nanoparticles accumulate at sites of vascular disease", *ACS Nano* 2017 DOI: 10.1021/acsnano.6b08551.
20. Joint Report by the Royal College of Physicians and the Royal College of Paediatrics and Child Health: "Every Breath We Take", February 2016. Margolis A, Herbstam J, Davis K, Thomas V, Tang D, Wang Y et al., "Longitudinal effects of prenatal exposure to air pollutants on self-regulatory capacities and social competence", *Journal of Child Psychology and Psychiatry* 2016; 57: 851-60. Perera F, Weiland K, Neidell M, Wang S, "Prenatal exposure to airborne polycyclic aromatic hydrocarbons and IQ: estimated benefit of pollution reduction", *Journal Public Health Policy,* 2014; 35: 327-36. Peterson B, Rauh V, Bansal R, Hao X, Toth Z, Nati G et al., "Effects of prenatal exposure to air pollutants (Polycyclic Aromatic Hydrocarbons) on the development of brain white matter, cognition, and behaviour in later childhood", *JAMA Psychiatry* 2015; 72: 531-40.
21. The EU Air Quality Directive sets an annual limit for NO_2 of 40 µg/m^3 of air, and a peak limit of 200 µg/m^3.
22. European Environment Agency report 28/2016.
23. Chossière G, Malina R, Ashok A, Dedoussi I, Eastham S, Speth R, Barrett S, "Public health impacts of excess NOx emissions from Volkswagen diesel passenger vehicles in Germany", *Environmental Research Letters*, March 2017, https://dspace.mit.edu/handle/1721.1/107400.

3.4. Other notable pollutants: sulphur dioxide, benzene, carbon monoxide and heavy metals

19. Sulphur dioxide (SO_2) emissions from fuels containing sulphur, although declining over the last few decades, still exceed WHO norms in many places in Europe, affecting 20% to 38% of the total urban population. They cause inflammation of the respiratory system and the formation of liquid particulate aerosols in the air, as well as the acidification of soil and water. Benzene (C_6H_6), which is still used as an additive in fuel across Europe, harms human cells and increases the risk of developing various cancers. About 80% of the benzene released in Europe comes from fuel consumption by the transport sector. The EEA reports that 15 European countries exceed WHO reference levels for this pollutant.[24] The highest carbon monoxide (CO) levels, which particularly affect people with some types of heart diseases, are detected in urban areas during rush-hour traffic and near large industrial plants. However, excess concentration (in relation to EU and WHO reference values) has been limited to four measuring sites in Albania and Germany.

20. Heavy metals – such as zinc (Zn), copper (Cu), nickel (Ni), lead (Pb), chromium (Cr), selenium (Se), arsenic (As), mercury (Hg), thallium (Tl) and cadmium (Cd) – are known to be directly toxic to biota through progressive accumulation in the body via air pollution and the food chain. Exposure to heavy metals has been linked to developmental retardation, immunological and reproductive effects, various cancers, kidney damage and deaths. Currently, the largest emission sources of heavy metals are energy, heat-producing and industrial facilities associated with fuel combustion. Municipal waste burning is another major source of heavy metal pollution, together with dioxins, a cancerogenic substance. However, data on the population's exposure to these pollutants is very sparse.

4. So where do we stand in terms of exposure?

21. Air pollution is not hitting headlines, but it should. As Dr Arvind Kumar pointed out at the First WHO Global Conference on Air Pollution and Health,[25] inhaling air polluted with 22 µg/m^3 of PM2.5 equals one cigarette a day, which means that all inhabitants become *de facto* smokers. In highly polluted countries, such as India, this means that everyone, including newborn babies, breathes in, on average, the equivalent of five to seven cigarettes a day. In these conditions, non-smokers' lungs turn black by the age of 15-20 years, and the average age of lung cancer is advanced to 30-40 years of age (compared to 50-60 years of age in 1988). Once lungs turn black, there is no way of cleaning them. This is truly a public health scandal and an emergency.

22. Across Europe, the population is trapped in toxic air and is poorly informed about its impacts on health. The table below shows the percentage of urban EU population exposed to different pollutants that affect human health according to EU or WHO norms. For PM2.5, the EU limit is 25 µg/m^3 of air, whereas the WHO level is only 10: this is a big gap when considering the share of the urban population exposed to unacceptable levels. Thus, while only 8% of the urban population is exposed to a level of PM2.5 pollution exceeding the EU limit, 85% are concerned with chronic exposure beyond the WHO limit. Using Dr Kumar's above-mentioned parallel, this means that 85% of the population breaths half-a-cigarette a day. About 40 million people living in the 115 largest EU cities are exposed to air that exceeds WHO reference values for at least one pollutant.

Pollutant	**EU limit and exposure estimate in %**	**WHO limit and exposure estimate in %**
PM10	24 hours (50) 19%	Annual (20) 52%
PM2.5	Annual (25) 8%	Annual (10) 85%
BaP	Annual (1) 24%	Annual (0.12) 90%
NO_2	Annual (40) 8%	Annual (40) 8%
SO_2	24 hours (125) <1%	24 hours (20) 38%
O_3	8 hours (120) 30%	8 hours (100) 98%

Source: EEA; all pollutant levels (in brackets) are in µg (microgrammes)/m^3 of air apart from Benzo(a)pyrene (BaP) which is measured in ng (nanogrammes)/m^3. For exposure estimates, maximum values are retained.

23. It is more difficult to evaluate the situation concerning air quality in non-EU countries, especially those not covered by the EEA's measurements. The EEA's European Air Quality Index and the alternative Real-time Air Quality Index show the worst air pollution hotspots in eastern and south-eastern Europe, but both lack data

24. The countries concerned are: Albania, Austria, Bulgaria, Croatia, the Czech Republic, France, Germany, Hungary, Italy, Latvia, Norway, Poland, Romania, Slovak Republic and Spain.
25. See www.who.int/airpollution/events/conference/presentations/en/.

for Belarus, the Republic of Moldova, the Russian Federation, Ukraine, several Balkan countries, and the Caucasus region, and the EEA has few figures for Turkey. In terms of WHO data on premature deaths from air pollution, these countries' scores are very poor, comparable to the worst-performing countries of the European Union (Bulgaria, Poland, Slovak Republic, Greece and Italy for PM2.5, and Italy, Spain, Belgium, the Netherlands, Germany, Austria and the United Kingdom for NO_2). WHO's interactive map for ambient (outdoor) air pollution in non-EU countries in eastern and south-eastern Europe shows very few measuring stations, and the values provided indicate hugely excessive exposure to particulate matter (PM2.5 and PM10) in densely populated areas.

24. Consequences of excessive exposure to air pollution are the worst for the most vulnerable population groups (children, pregnant women, people in poor health and certain categories of workers). Children are particularly affected in unique ways, notably in the earliest stages of their lives (during foetal development and early childhood): they breathe faster than adults, inhale more air (including more pollutants), live closer to the ground where air pollutants are the most concentrated and spend more time outdoors running and playing (which intensifies breathing), while their lungs and brains are rapidly developing; in the womb, they have no escape from their mother's exposure to toxic air. The latter can lead to illness and poor health that will accompany them throughout their lives. According to WHO, among the total deaths from air pollution 9% are children; in Europe, child mortality from poor air quality is highest in lower- and middle-income countries.[26]

25. Across Europe, social inequalities – within and between countries – tend to penalise the poorest populations in terms of disease (asthma, heart problems, etc.) and mortality from air pollution. Thus, exposure to particulate matter (notably PM2.5) and ozone is highest in eastern and south-eastern Europe, regions which are plagued by high poverty and unemployment rates. Within countries, the most socially deprived urban areas also bear the brunt of air pollution and its impact on health. A recent study shows that, for instance, in and around London, nearly half of the most disadvantaged areas have the worst air quality as compared with a modest 2% of the wealthiest areas; similar trends have been observed in France, Germany, Malta, the Netherlands, some regions of the United Kingdom (Wales) and Belgium (Wallonia).[27]

26. If air pollution continues with "business as usual" attitudes, the right of present and future generations to a healthy living environment will be compromised. We can no longer be sure that our children would have better lives, because our inaction today is destroying their future. It is not surprising that children are taking their protest to the street as the wave of global children's movement on climate change has shown. The message is clear: we all need a cleaner planet – based on sustainable development for a healthy and prosperous future.

5. Legal tools and benchmarks for air pollution controls

5.1. Major European legal references for cleaner air

27. Along with a plethora of national regimes for air quality controls, European countries have a number of international tools at their disposal. The key reference instrument is the 1979 Convention on Long-range Transboundary Air Pollution of the United Nations Economic Commission for Europe (UNECE), as well as its protocols, among which the Gothenburg Protocol (1999, amended in 2012) is the most important one. Nearly all Council of Europe member States (except for Andorra and San Marino), as well as the European Union, are Parties to the Convention which covers a wide range of air pollutants. In addition, the Stockholm Convention on Persistent Organic Pollutants (2001) obliges European countries and the European Union to eliminate dioxins; Andorra, Italy[28] and San Marino are not Parties to this convention.

28. EU countries are all subject to the community clean air policy based on three pillars: 1) the Ambient Air Quality Directives (of 2004 and 2008) mandating the adoption of national air quality plans; 2) the National Emission Ceilings Directive (of 2016) prescribing national emission reduction targets and related control mechanisms;[29] 3) specific emission and energy efficiency standards for major sources of air pollution, from

26. WHO, "Air pollution and child health. Prescribing clean air", 2018. An estimated death rate from air pollution per 100 000 children under 5 years in European lower- and middle-income countries is 8.8, whilst in higher-income countries it is 0.3.

27. *The Guardian*, "Europe's most deprived areas 'hit hardest by air pollution'", 4 February 2019.

28. Italy has signed but not ratified the Stockholm Convention.

29. Ozone (as a secondary pollutant) levels are not controlled by the EU Air Quality Directive (2008/50/EC), but emissions of NOx and volatile organic compounds are controlled by the National Emissions Ceiling Directive (2001/81/EC) and by the Gothenburg Protocol under the UN Convention on Long-range Transboundary Air Pollution. As is the case for ozone levels, SO_2 emissions are covered by the EU National Emission Ceilings Directive and the Gothenburg protocol.

vehicles and fuels to products and industry. The Clean Air Programme for Europe published in 2013 obliges EU members to ensure full compliance with current legislation by 2020 and to keep improving air quality so as to half the number of premature deaths by 2030 compared with 2005. The European Commission is now reviewing its air quality directives and benchmarks, and should proceed to aligning its reference limits with WHO norms.

29. WHO's Air quality guidelines (2000 and 2005 editions) are used as a worldwide reference, although in Europe, EU member States are bound by the softer community norms. In 2015, in light of the new evidence of the toxicity of air pollution, WHO launched the re-evaluation of its guidelines and estimated that existing norms should be reassessed as a matter of priority as regards particulate matter (including PAHs and notably benzo(a)pyrene), ozone, NO_2, SO_2, carbon monoxide and benzene, as well as for certain heavy metals (such as cadmium, chromium, lead, nickel and arsenic).[30]

30. Concerning mercury concentrations in the air, the European Union and several of its member States ratified the Minamata Convention on Mercury (United Nations, 2013), in May 2017 which has enabled this convention's entry into force. It is hoped that this step will lead to more careful measurements of mercury emissions and exposure.

5.2. Geneva Action Plan – Europe in the global context

31. From a global perspective, tackling outdoor air pollution to prevent diseases and deaths would also contribute to reaching targets under the 2030 Agenda for Sustainable Development, in particular the Sustainable Development Goal 3 (on health), Goal 7 (clean energy), Target 11.6 (air quality in cities), Target 11.2 (access to sustainable transport), and Goal 13 (on climate change). Already in 2016, the World Health Assembly had put forward the "Road map for an enhanced global response to the health effects of air pollution". Then, in 2018, WHO rolled out an ambitious action plan – the Geneva Action Agenda to Combat Air Pollution – aiming to mobilise global, national and local players to reduce the number of deaths from air pollution by two thirds by 2030,[31] which is a much more ambitious goal than the European Union's target.

32. In its grand lines, the WHO plan thus foresees the scaling up of efforts worldwide under the BreatheLife campaign, a massive reduction of fossil fuel and biomass burning, a push for circular economies and clean cities, the enhanced protection of the most vulnerable populations (notably children), a boost for partnerships to obtain climate, air and health co-benefits under the SDGs, harmonised air pollution monitoring, and awareness raising on air pollution as a key factor for improving health and quality of life. The nitty-gritty of implementation steps is now in the hands of multi-sector stakeholders, many of whom took part in the First WHO Global Conference on Air Pollution and Health, and made voluntary commitments on air quality targets.

5.3. European Healthy Cities Network: sharing good practice for cleaner air

33. Improving air quality across Europe is unthinkable without strong involvement, political vision and wisdom of local actors. Some 1 400 European municipalities work together under the WHO European Healthy Cities Network for the strategic engagement of local government institutions in piloting changes, capacity building, partnership-based planning and innovation around the quality of life and well-being in cities. The Network's vision for the future advocates inclusive societies and shared prosperity through sustainable development which covers clean air imperatives.

34. Examples of good practice at European cities' level speak loudest about the positive changes on the ground. Perhaps the most radical measure is a ban on polluting cars (notably diesel cars): in 2018, several large cities (Oslo, Madrid, Hamburg, Stuttgart, Copenhagen, Helsinki, Paris, London, Brussels, Rome, to mention just a few) announced more or less extensive bans, mainly as of 2019-2020 or later. The extension of pedestrian zones in central districts, increases in congestion and "old car" charges, the introduction of "zero and low emissions" zones, and the promotion of cycling and clean public transport are among the measures which have been put in place.[32] Many German cities have been ordered by local administrative courts to enact bans or extensive restrictions on diesel cars (such as Aachen, Berlin, Bonn, Cologne, Essen, Frankfurt, Gelsenkirchen, Mainz).[33]

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30. WHO Expert Consultation: Available evidence for the future update of the WHO Global Air Quality Guidelines, meeting report, Bonn (Germany), 29 September-1 October 2015. See www.euro.who.int/__data/assets/pdf_file/0013/301720/Evidence-future-update-AQGs-mtg-report-Bonn-sept-oct-15.pdf.

31. See "Clean air for health: Geneva Action Agenda", summary report of the First WHO Global Conference on Air Pollution and Health, www.who.int/phe/news/clean-air-for-health/en/.

32. *Business Insider France*, "13 cities that are starting to ban cars", 1 June 2018.

35. In parallel, electric and hybrid vehicles are gaining ground, as municipalities expand recharge networks and national or local measures penalise dirty cars with "green taxes". In "virtuous" cities such as Copenhagen, about 40% of trips within the town are by bicycle and some 75% of the city's inhabitants use bicycles daily. Various forms of green taxation appear to be one of the most effective means to implement the "polluter pays" principle and thereby reduce air pollution. These taxes can be introduced at national or local level and tax proceeds thus gathered can serve to finance public infrastructure for cleaner mobility, renovation of municipal waste processing facilities or maintenance of urban green spaces. At the same time, national policy makers need to be attentive to the greater sourcing of electricity from renewable energy sources and to ensure the traceability of the materials and processes used for making batteries for electric vehicles, so that third countries involved do not use child labour in any part of the production chain.

5.4. Gaps in national legislation and practice?

36. A parliamentary survey of national laws, regulations and norms on air quality (including sanctions for infringements) carried out by the European Centre for Parliamentary Research and Documentation (ECPRD) in 2017 across Council of Europe member States provides valuable insights into the situation in 24 countries, mainly those belonging to the European Union.[34] All of these countries have a comprehensive legislative basis for air quality protection. However, half of European countries (notably those in eastern and south-eastern Europe with the worst air quality situation) failed to reply to the questionnaire. Domestic legal obligations for air quality monitoring and assessment are therefore not clear for this region.

37. In terms of national compliance with international obligations on air quality control as enshrined in the Convention on Long-range Transboundary Air Pollution and its eight protocols, EU member States have so far engaged much more strongly than countries in eastern and south-eastern Europe; the latter have barely embraced the convention's protocols which constitute the most powerful regulatory framework. Overall, progress among participating States is lacking on ground-level ozone, particulate matter and heavy metals, as well as more generally with regard to persistent organic pollutants. Moreover, economic concerns have led many States to water down their commitments on air quality improvements by 2020, and experts note that the general level of ambition is largely insufficient to adequately protect both our health and the environment.[35]

38. Importantly, the 1999 Gothenburg Protocol contains specific provisions on public access to information on air quality, such as national annual emissions, pollution levels, and the health and environmental effects of air pollutants. These obligations are further amplified through the enhanced transparency regime embodied by the 1998 Aarhus Convention on Access to Information, Public Participation in Decision-making and Access to Justice in Environmental Matters. Making adequate information on air quality available to the public is crucial for reasons of transparency and democratic control, particularly in the more polluted countries that escape the European Union's scrutiny and are not covered by the EEA's air data collection network.

39. The situation in my own country (Ukraine) is critical in many aspects in relation to air quality challenges. This concerns the institutional set-up for air quality controls, technical problems due to aging air monitoring equipment, and compliance with the best international practice, including relevant provisions of EU directives. Currently, competences and responsibilities of governmental institutions participating in the air monitoring system are not clear, major air pollutants (PM2.5, PM10, ozone) are not subject to monitoring, and methodology is outdated. Moreover, information on air quality is not disseminated to the public, and sampling frequency is not in line with EU and WHO requirements. However, many essential changes are underway in light of the EU–Ukraine Association Agreement. For instance, the Government of Ukraine has developed draft legislation on a new system of air monitoring and management based on EU standards. This legislation, currently going through the public stakeholders' consultation process, will streamline a national system of collecting, analysing and disseminating air quality information, and more importantly, lay a basis for effective improvements in air quality.[36]

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33. Reuters, "Factbox: German cities ban older diesel cars", 15 November 2018; *Deutsche Welle*, "Stuttgart to introduce diesel driving ban in 2019", 11 July 2018.
34. ECPRD Request No. 3305 of 18 January 2017, launched by the Romanian Parliament.
35. "The 1979 Convention on Long-range Transboundary Air Pollution: Assessing its Effectiveness as a Multilateral Environmental Regime after 35 Years", Adam Byrne, published on 13 February 2015 in *Transnational Environmental Law*, Volume 4, Issue 1, pp. 37-67.
36. The assessment reports show that modernising the air quality monitoring network and strengthening institutional capacity require substantial investment and time. There is also a need to set up a national laboratory to ensure that the air quality monitoring data is both reliable and comparable.

40. Whilst some European countries are taking effective measures to rein in air pollution, many are struggling with the implementation of existing requirements and the death toll keeps rising. Data comparisons based on the EEA's air quality reports for 2018 and 2017 show that Nordic countries (Denmark, Estonia, Finland, Sweden and partly Norway), Belgium, Poland and the United Kingdom have managed to reduce deaths from air pollution, whereas the situation deteriorated in the remaining countries covered. Some countries achieved positive results in lowering PM2.5 and NO_2 pollution (Czech Republic and the Netherlands), just PM2.5 pollution (Albania, Germany, Lithuania, North Macedonia, Switzerland), or only NO_2 pollution (Bulgaria, Romania).

41. National ozone reduction strategies do not seem to work, and ozone levels remain problematic all over Europe, in particular in the Mediterranean region. This is mainly due to a combination of traffic plus industry emissions and climate warming trends, with only 4% of measuring sites meeting WHO recommended values.

6. Arresting air pollution: the need for strong and concerted action

42. Clean air is our basic human right: when we are born, the first thing we do is take a gulp of air. Wherever we live, we need air to be breathable and not to shorten or impair our lives. Because air pollution crosses borders so easily, we need concerted action across Europe. The current EU norms are a helpful benchmark for its member States, but they need to be fully aligned with the more stringent WHO Air quality guidelines and must be better enforced. Non-EU States should follow WHO guidelines, which could be built into national legislation on the grounds of protecting the public health of citizens.

43. Council of Europe member States need to work harder to reduce air pollution, both in the short and long term. Depending on the specificity of a national situation in terms of key pollutants and sources of pollution, measures deployed or strengthened could include improvements in emissions testing methods, comprehensive real-time monitoring of air quality and information to the public, fiscal incentives and penalties, sustainable urban planning[37] (such as clean air zones with traffic restrictions, the expanded use of public transport and cleaner fuels, the promotion of cycling) and enhanced investment in clean technologies for industry (in particular transport and energy sectors), agriculture and households (notably for heating systems and personal mobility). Where laws and norms for regulating air quality are not comprehensive enough at national level, parliamentary action should help rectify the situation.

44. Importantly, we must see the problem of air pollution as part of a broader picture: the massive degradation of our living space has far-reaching harmful effects on present and future generations. We are literally cutting the branch upon which we are perched. Alarm bells are ringing about environmental risks (regarding natural capital, climate, biodiversity, chemical leaching), interactions and tipping points that are driving our society into developmental breakdown with major social, economic and political disruptions in sight.[38] By tackling air pollution through multisectoral efforts, we can build upon existing synergies and undo the harm to our health, our well-being and the planet.

37. Additional relevant proposals for improving the quality of life in urban areas are included in the Assembly report on "Sustainable urban development fostering social inclusion", Doc. 14887 (rapporteur: Ms Sybille Benning, Germany, EPP/CD).

38. Study by the Institute for Public Policy Research, "This is a crisis: Facing up to the age of environmental breakdown", 12 February 2019, www.ippr.org/research/publications/age-of-environmental-breakdown.