

Particulates Matter: why the EU must do more to tackle air pollution

European Chronic Disease Alliance position on the need for EU action to tackle air pollution

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Summary

Air pollution is an established cause of morbidity and mortality. Unlike other risk factors for chronic disease, exposure to air pollution has no element of choice. It is an involuntary environmental exposure affecting 100% of the entire EU population – from the womb until death.

Air pollution has become the world's **top environmental cause of premature mortality**, overtaking dirty water and lack of sanitation.¹

According to the WHO, **air pollution is a risk factor for heart disease, stroke, chronic obstructive pulmonary disease, asthma and cancer.**² **400,000 EU citizens die annually due to air pollution – 15 times more than the number of people killed in traffic accidents. In addition, the health related economic costs are enormous, amounting to between €330 and €940 billion for the year 2010 alone.**³

While some progress is being made, the reality remains that **the majority of EU citizens are exposed to air pollution levels which are actively harmful to their health.** Pre-existing chronic conditions are exacerbated and a large number of years of life are lost.

ECDA calls on the EU to do more to tackle air pollution and improve the lives of those suffering from chronic disease. In particular:

- President Juncker should see action on EU air quality as an opportunity to be “big on big things”,

¹ Global, regional, and national comparative risk assessment of 79 behavioural, environmental and occupational, and metabolic risks or clusters of risks in 188 countries, 1990–2013: a systematic analysis for the Global Burden of Disease Study 2013. The Lancet September 11, 2015. <http://www.thelancet.com/pdfs/journals/lancet/PIIS0140-6736%2815%2900128-2.pdf>

² WHO regional office for Europe. Air quality and health resolution adopted at the sixty-eighth World Health Assembly. 2015. <http://www.euro.who.int/en/health-topics/environment-and-health/air-quality/news/news/2015/05/air-quality-and-health-resolution-adopted-at-the-sixty-eighth-world-health-assembly>

³ European Commission. Commission Staff Working Document: Impact Assessment on National Emissions Ceiling (NEC Directive) http://ec.europa.eu/environment/archives/air/pdf/Impact_assessment_en.pdf

- The EU should adopt the WHO Air Quality Guideline values as Limit Values which for particulate matter smaller than 2.5 micrometer (PM2.5) means the Limit Value should be reduced from 25 to 10 $\mu\text{g}/\text{m}^3$,
- Clean air needs to be promoted and incentivised across all policy areas, in particular within the framework of a comprehensive EU strategy for the prevention and control of chronic disease,
- The EU must bring forward robust legislation tackling both emissions sources and ambient air concentrations to protect health, cut healthcare costs and save lives.
- EU Member States must fulfill their obligations and ensure compliance with EU legislation.

I. Something in the air?

Air pollution refers to the components of the atmosphere such as particulate matter, chemical substances or biological material that **cause adverse health effects to humans** or other living organisms or damage the environment. The WHO refers to the following as “classical pollutants”:

- **Particulate Matter (PM)**

Particulate matter (PM) refers to the mix of particles of various size and composition suspended in the air. It includes 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.

- **Sulphur dioxide (SO₂)**

SO₂ is a colourless gas, with a pungent, suffocating odour, produced by the burning of sulphur. Most SO₂, comes from coal fired power plants and industries that burn fossil fuels such as petroleum refineries, cement manufacturing and metal processing.

- **Ozone (O₃)**

In the stratosphere, ozone absorbs harmful ultraviolet radiation preventing it from reaching the earth. Near the ground, ozone becomes problematic – it is 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.

- **Nitrogen dioxide (NO₂)**

NO₂ is one of several nitrogen oxides – gases containing nitrogen and oxygen. It is one of the main nitrogen oxides present in the air, is of a red/brown colour, a sharp odour and is a major source of smog. The major sources of anthropogenic emissions of NO₂ are combustion processes such as heating, power generation, and engines in vehicles and ships.

II. Pollutants, adverse health effects and chronic disease

Air pollution is responsible for over 400,000 deaths in the EU – fifteen times more than from road traffic accidents.⁴ In addition to causing premature deaths, air pollution increases the incidence of a wide range of chronic diseases - respiratory, cardiovascular, and cancer, with both long and short-term health effects.⁵ The health related economic costs of air pollution are enormous, amounting to between €330 and €940 billion for the EU in the year 2010 alone.⁶ This includes €15 billion from lost workdays and €4 billion from healthcare costs. New evidence on the impacts of chronic exposure to ozone suggests that the overall cost figures would be higher.⁷ A 2013 assessment by the WHO International Agency for Research on Cancer (IARC) concluded that outdoor **air pollution is carcinogenic** to humans, with the particulate matter component of air pollution most closely associated with increased cancer incidence, especially cancer of the lung.⁸ Fine particulate matter (PM_{2.5}) and O₃ are among the pollutants of most concern. According to the WHO, exposure to particulate matter from anthropogenic sources leads to an **average loss of 8.6 months of life expectancy in Europe**. The Global Burden of Diseases reports note that in Europe, PM_{2.5} is the most important environmental health concern among the major drivers of ill health and premature mortality in the population.⁹ Exposure to air pollution can also make existing heart conditions worse and can cause cardiovascular events.¹⁰ *WHO estimates that some 80% of outdoor air pollution-related premature deaths were due to heart disease and strokes, while 14% of deaths were due to chronic obstructive pulmonary disease or acute lower respiratory infections; and 6% of deaths were due to lung cancer.*¹¹ New studies are emerging indicating **a role of ambient air pollution in the development of other chronic conditions such as diabetes and obesity**.¹² Air pollution is also an amplifying factor for health inequalities, as people living in less affluent areas are often more exposed to it.

Looking at pollutants in more detail in relation to chronic disease:

a) **PM**

- *The European Environment Agency estimates that PM_{2.5} alone was responsible for 430,000 deaths in 2011.*¹³

⁴ European Transport Safety Council. 9th Road Safety Performance Index Report. June 2015. http://etsec.eu/wp-content/uploads/ETSC-9th-PIN-Report_Final.pdf

⁵ European Environment Agency. Air Quality in Europe – 2014 report. 1977-8449. <http://www.eea.europa.eu/publications/air-quality-in-europe-2014>

⁶ European Commission. Commission Staff Working Document: Impact Assessment on National Emissions Ceiling (NEC Directive) http://ec.europa.eu/environment/archives/air/pdf/Impact_assessment_en.pdf

⁷ European Commission. Commission Staff Working Document: Impact Assessment on National Emissions Ceiling (NEC Directive) http://ec.europa.eu/environment/archives/air/pdf/Impact_assessment_en.pdf

⁸ International Agency for Research on Cancer. Press Release 221: Outdoor air pollution a leading environmental cause of cancer deaths. 17 October 2013. http://www.iarc.fr/en/media-centre/iarcnews/pdf/pr221_E.pdf

⁹ Lim S, Vos S T, et al. A comparative risk assessment of burden of disease and injury attributable to 67 risk factors and risk factor clusters in 21 regions, 1990-2010: a systematic analysis for the Global Burden of Disease Study 2010. *Lancet* 380(9859): 2224-2260.

¹⁰ British Heart Foundation. Policy Statement: Air pollution. https://www.bhf.org.uk/~media/files/publications/policy-documents/final_air_pollution_policy_statement_june14as_pdf.pdf

¹¹ World Health Organization. Fact sheet 313: Ambient (outdoor) air quality and health. March 2014. <http://www.who.int/mediacentre/factsheets/fs313/en/>

¹² Eze I C, Schaffner E, et al. Long-term air pollution exposure and diabetes in a population-based Swiss cohort. *Environ Int* 2014; 70: 95-105.

¹³ European Environment Agency. Air Quality in Europe – 2014 report. 1977-8449. <http://www.eea.europa.eu/publications/air-quality-in-europe-2014>

- Significant effects of fine particles have been found in recent European studies on low birth weight and head circumference at birth,¹⁴ lung function in school children¹⁵ and adults,¹⁶ incidence of coronary events,¹⁷ lung cancer incidence¹⁸ and all-cause mortality.¹⁹
- Relationships between fine particles and health outcomes remain significant even at low levels of exposure down to well below 20 or even 15 µg/m³ PM_{2.5}. This is far below the current limit value of 25 µg/m³ PM_{2.5}.²⁰
- There is no evidence of a safe level of exposure or a threshold below which no adverse health effects occur.²¹
- b) Sulphur dioxide (SO₂)**
 - A proportion of people with asthma experience changes in pulmonary function and respiratory symptoms after periods of exposure to high SO₂ peak concentrations as short as 10 minutes.
 - SO₂ can affect the respiratory system and the functions of the lungs, and causes irritation of the eyes, inflammation of the respiratory tract causes coughing, mucus secretion, aggravation of asthma, COPD and chronic bronchitis and makes people more prone to infections of the respiratory tract.
 - Hospital admissions for cardiac disease and mortality increase on days with higher SO₂ levels.²²
- c) Ozone (O₃)**
 - 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 US.²³
 - Ozone exposure results in airway inflammation, airway hyper responsiveness, and decrements in lung function in healthy and asthmatic adults.²⁴
- d) Nitrogen dioxide (NO₂)**
 - 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 defenses.²⁵
 - A new 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 attributed to PM_{2.5} independently.²⁶

¹⁴ Pedersen M, Giorgis-Allemand L, et al. Ambient air pollution and low birth weight: a European cohort study (ESCAPE). *Lancet Respiratory Medicine* 2013; 1(9): 695-704.

¹⁵ Gehring U, Gruziova O, et al. Air Pollution Exposure and Lung Function in Children: The ESCAPE Project. *Environmental Health Perspectives* 2013; 121(11-12): 1357-1364.

¹⁶ Adam M, Schikowski T, et al. Adult lung function and long-term air pollution exposure. ESCAPE: a multicentre cohort study and meta-analysis. *European Respiratory Journal* 2015; 45: 38-50

¹⁷ Cesaroni G, Forastiere F, et al. Long term exposure to ambient air pollution and incidence of acute coronary events: prospective cohort study and meta-analysis in 11 European cohorts from the ESCAPE Project. *British Medical Journal* 2014; 348.

¹⁸ Raaschou-Nielsen O, Andersen Z J, et al. Air pollution and lung cancer incidence in 17 European cohorts: prospective analyses from the European Study of Cohorts for Air Pollution Effects (ESCAPE). *Lancet Oncology* 2013; 14(9): 813-822.

¹⁹ Beelen R, Raaschou-Nielsen O, et al. Effects of long-term exposure to air pollution on natural-cause mortality: an analysis of 22 European cohorts within the multicentre ESCAPE project. *Lancet* 2014; 383(9919): 785-795.

²⁰ Brunekreef B, et al. Clean Air in Europe. *European Respiratory Journal* 2015; 45: 7-10.

²¹ World Health Organization Regional Office for Europe. Review of evidence on health aspects of air pollution – REVIHAAP Project. 2013. http://www.euro.who.int/_data/assets/pdf_file/0004/193108/REVIHAAP-Final-technical-report-final-version.pdf

²² World Health Organization. Fact sheet 313: Ambient (outdoor) air quality and health. March 2014. <http://www.who.int/mediacentre/factsheets/fs313/en/>

²³ World Health Organization Regional Office for Europe. Review of evidence on health aspects of air pollution – REVIHAAP Project. 2013. http://www.euro.who.int/_data/assets/pdf_file/0004/193108/REVIHAAP-Final-technical-report-final-version.pdf

²⁴ Guarnieri M, Balmes J R. Outdoor Air pollution and Asthma. *Lancet* 2014; 383:1581-92

²⁵ European Respiratory Society. Air Quality and Health. 2010. ISBN 978-1-84984-008-8. <http://www.ersnet.org/images/stories/pdf/web-AQ2010-ENG.pdf>

²⁶ Transport for London and the Greater London Authority. Understanding the Health Impacts of Air Pollution in London. July 2015. www.london.gov.uk/sites/default/files/HIAinLondon_KingsReport_14072015_final_0.pdf

III. Clearing the air – what is the EU doing about it?

Among the EU policy instruments tackling these and other pollutants are two key directives:

- Directive 2008/50/EC on ambient air quality and cleaner air for Europe
- Directive 2001/81/EC on National Emission Ceilings for certain pollutants (NEC Directive)

There is considerable source-specific legislation focusing on industrial emissions, road and off-road vehicle emissions and fuel quality standards.

With regard to limits on *emissions* of pollutants, the NEC Directive sets national emission limits for sulphur dioxide (SO₂), nitrogen oxides (NO_x), non-methane volatile organic compounds (NMVOC) and ammonia (NH₃). Emissions of most air pollutants have decreased over the past decade, confirming the long-term downward trend in Europe since 1990. Despite this overall improvement, **many countries are still exceeding the agreed pollutant limits set to protect human health and the environment. Worryingly, preliminary data for 2013 show that eleven EU Member States exceeded one or more of their 2001 emission ceilings for NO_x, NH₃ and NMVOC.**²⁷

The Directive on ambient air quality and cleaner air for Europe regulates *ambient air concentrations* of SO₂, nitrogen dioxide (NO₂) and other nitrogen oxides, particulate matter (PM) PM10 and PM2.5, and ozone (O₃) amongst others. It aims to prevent or reduce the harmful effects of air pollutants on human health and the environment by implementing limit or target values for ambient concentrations of air pollutants. However, compliance remains a serious issue. **When looking at PM alone, there are currently 16 ongoing infringement proceedings for PM10 at various stages.**²⁸ These actions are taken by the EU only when a Member State consistently fails to meet the limit values. Similarly for NO₂ infringement proceedings have already been opened against six Member States with others expected to follow.²⁹

There is a disconnect between slowly falling (albeit still too high) emissions and the continued exposure to pollutants in our ambient air. Transboundary air pollution is one explanation, where pollutants are emitted in one Member State yet affect the air quality of another.

As a means to tackle the problem, in 2013, the Commission presented its long awaited Clean Air Package. The package has a number of components, including the following:

- A new clean air programme for Europe, with measures to ensure that existing targets are met in the short term, and new air-quality objectives for the period up to 2030,
- A revised NEC Directive with stricter national emission ceilings for six main pollutants, and provisions for black carbon (BC), which also help to mitigate climate change,
- A proposal for a new directive to reduce pollution from medium-sized combustion plants.

If agreed and fully implemented by 2030, and compared to business as usual (i.e. implementation of current legislation), **the new Clean Air Policy Package is estimated to prevent 58,000 premature deaths and produce savings of healthcare costs amounting to between EUR 40 and 140 billion.** At present, the NEC Directive proposal in particular is provoking considerable push

²⁷ European Environment Agency. Air pollutant emissions declining, but still above limits. July 2015.

<http://www.eea.europa.eu/highlights/air-pollutant-emissions-declining-but>

²⁸ European Commission. Press Release: Commission refers Belgium and Bulgaria to Court and gives Sweden a final warning over poor air quality. June 2015. http://europa.eu/rapid/press-release_IP-15-5197_en.htm

²⁹ European Commission. Press Release: Commission refers Belgium and Bulgaria to Court and gives Sweden a final warning over poor air quality. June 2015. http://europa.eu/rapid/press-release_IP-15-5197_en.htm

back and resistance from sectors in society which would be requested to reduce emissions of pollutants they are producing.

The EU has a track record of acting on air pollution, but in health terms there is still a long way to go to meet its own targets for emissions and ambient air quality. What is even more worrying from a chronic disease perspective is that **the current and proposed targets are not even sufficient to protect health when compared with guidance given by the WHO already ten years ago.**

IV. Leading the way or lagging behind

The “European Environment and Health Process” sets the frame for WHO policy action in Europe. To date the most important outcome is the 2010 Parma Declaration – where 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.³⁰ More recently in early 2015, the 68th World Health Assembly adopted a resolution "Health and the environment: addressing the health impact of air pollution".³¹ Among the actions outlined in the adopted Resolution, WHO Member States are urged to:

- Raise awareness in the public and among stakeholders of the impacts of air pollution on health and opportunities to reduce or avoid exposure, and encourage and promote such measures,
- Meet the commitments made at the 2011 UN High level meeting on non-communicable diseases.

The ultimate goal is to propose a road map for an enhanced global response to the adverse health effects of air pollution. This comes at the same time as a new WHO report reveals that in the WHO European Region alone a staggering US\$ 1.6 trillion is the economic cost of the approximate 600 000 premature deaths and of the diseases caused by air pollution in 2010.³² (Note that the WHO European Region is larger than the EU, hence the larger number of deaths compared to the 400,000 occurring in the EU alone.)

Central to WHO efforts on air pollution are the **2005 WHO air quality guidelines (AQGs)** for PM2.5, PM10, O₃, NO₂ and SO₂, which offer guidance on reducing the health impacts of air pollution and are based on expert evaluation of the scientific evidence already available 10 years ago.³³ New

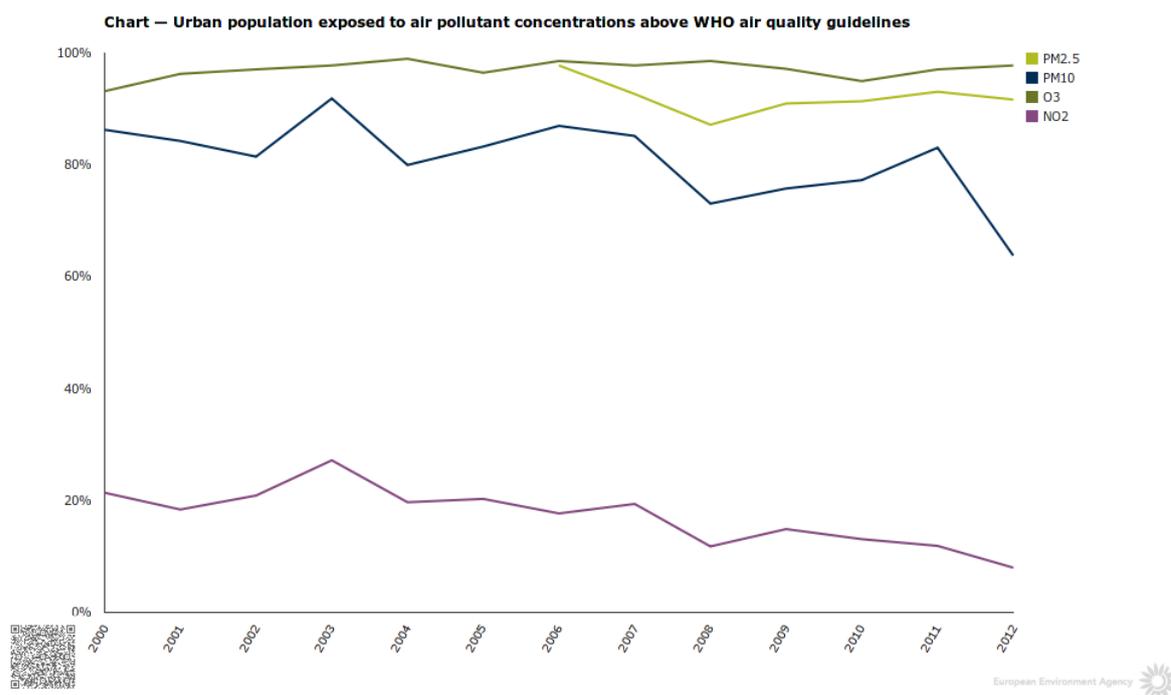
³⁰ World Health Organization Regional Office for Europe. European governments adopt comprehensive plan to reduce environmental risks to health by 2020. 2010. <http://www.euro.who.int/en/media-centre/sections/press-releases/2010/03/european-governments-adopt-comprehensive-plan-to-reduce-environmental-risks-to-health-by-2020>

³¹ World Health Organization Regional Office for Europe. Air quality and health resolution adopted at the sixty-eighth World Health Assembly. WHO regional office for Europe, May 2015. <http://www.euro.who.int/en/health-topics/environment-and-health/air-quality/news/news/2015/05/air-quality-and-health-resolution-adopted-at-the-sixty-eighth-world-health-assembly>

³² World Health Organization Regional Office for Europe. Air pollution costs European economies US\$ 1.6 trillion a year in diseases and deaths, new WHO study says. 2015. [http://www.euro.who.int/en/media-centre/sections/press-releases/2015/04/air-pollution-costs-european-economies-us\\$-1.6-trillion-a-year-in-diseases-and-deaths,-new-who-study-says](http://www.euro.who.int/en/media-centre/sections/press-releases/2015/04/air-pollution-costs-european-economies-us$-1.6-trillion-a-year-in-diseases-and-deaths,-new-who-study-says)

³³ World Health Organization. Fact sheet 313: Ambient (outdoor) air quality and health. March 2014. <http://www.who.int/mediacentre/factsheets/fs313/en/>

evidence reviewed by the WHO more recently^{34,35} suggests that it is time to revise the AQGs, and WHO has initiated a process to do so in the Autumn of 2015.



The EU’s ambient air quality directive explicitly states that the “emissions of harmful air pollutants should be avoided, prevented or reduced and appropriate objectives set for ambient air quality taking into account relevant World Health Organization standards, guidelines and programmes”. **Unfortunately the WHO AQGs are mostly not reflected in EU legislation.** For example, the Review of evidence on health aspects of air pollution – REVIHAAP technical report³⁶ noted the **current limit value for PM2.5 in the EU's Ambient Air Quality Directive is two and a half times as high as the WHO Air Quality Guideline.**

When we look at the adverse health effects, it is clear that this gap in protection is unacceptable. It is not only by comparison to WHO standards that the EU lags behind. The US for example reduced the annual average National Ambient Air Quality Standard for PM2.5 from 15 to 12 µg/m3. The comparative limit in the EU is 25 µg/m3.

V. ECDA Recommendations

The EU has a clear mandate and means to act on air pollution. Currently there are a number of opportunities to step up efforts and protect health and reposition Europe as a leader in tackling air pollution.

³⁴ World Health Organization Regional Office for Europe. Review of evidence on health aspects of air pollution – REVIHAAP Project. 2013. http://www.euro.who.int/_data/assets/pdf_file/0004/193108/REVIHAAP-Final-technical-report-final-version.pdf

³⁵ World Health Organization Regional Office for Europe. Health risks of air pollution in Europe – HRAPIE Project. 2013. http://www.euro.who.int/_data/assets/pdf_file/0017/234026/e96933.pdf?ua=1

³⁶ World Health Organization Regional Office for Europe. Review of evidence on health aspects of air pollution – REVIHAAP Project. 2013. http://www.euro.who.int/_data/assets/pdf_file/0004/193108/REVIHAAP-Final-technical-report-final-version.pdf

NEC: President Juncker outlined that he wants “a European Union that is bigger and more ambitious on big things, and smaller and more modest on small things”. The clean air package and the National Emissions Ceiling directive are a great opportunity to prove his commitment. To effectively tackle air pollution in Europe the final agreement should:

- include binding emission ceilings for 2025,
- include lower emission ceilings especially for ammonia,
- introduce more ambitious emission ceilings for all pollutants to match ambitions related to achieving climate and energy targets.

The air quality package and NEC Directive will not only save lives, improve health and tackle health inequalities; it will be a positive driver for innovation in industry, for climate change actions and for energy policy targets. It will contribute to the EU’s role as a leader in green growth, innovation and environmental protection at the international level. Cleaner air is better regulation.

Air quality: air quality standards must be science-based and set to protect the health of the citizens. The WHO Air Quality Guidelines, set in 2005, are based on the research available at that time. Recent European investigations, funded by the EU, fully support those guideline values. The European Commission should not ignore this science but should strive to adopt the WHO Air Quality Guideline values as Limit Values in the near future. This is needed to support the national and local agencies responsible for improving air quality. The EU Ambient Air directive must be revised to meet WHO Air Quality Guidelines and provide effective protection for health.

In particular: concerning *particulate matter*. The current Limit Values for PM_{2.5} and PM₁₀ are far too high and provide no incentive for the implementation of those national and local strategies needed to achieve more ambitious goals. In 2012, the US Environmental Protection Agency reduced the annual average National Ambient Air Quality Standard for PM_{2.5} from 15 to 12 µg/m³. If the US can do it, the EU should be able to do so as well.

Air in all policies: Clean air needs to be promoted and incentivised across all policy areas. The EU should stimulate development of low- or zero-emission technologies in transportation, energy production, agriculture, industry and other major sources of air pollution. Such technologies are urgently needed also to achieve major reductions in greenhouse gas emissions, creating a win-win situation for climate change as well as air quality. Incentives should be put in place to reward those who implement such measures. Measures to tackle indoor air pollution should be taken where the EU has means to act – stronger Ecodesign standards for domestic biomass burners for example would greatly reduce PM levels in the many areas of Europe where domestic biomass burning is widespread.

Member States must take obligations seriously and put in place the national/regional/local measures needed to comply with EU legislation. It remains important to stress that the monetarized health benefits far outweigh the abatement cost of even very ambitious pollution reduction scenarios.³⁷

³⁷ International Institute for Applied Systems Analysis (IIASA). Adjusted historic emission data, projections and optimized emission reduction targets for 2030 – A comparison with COM data 2013 (TSAP Report #16A). January 2015.
http://www.iiasa.ac.at/web/home/research/researchPrograms/MitigationofAirPollutionandGreenhousegases/TSAP_16a.pdf

Environmental factors such as air pollution must be included as a risk factor in discussions on how to tackle non-communicable disease. In doing so, Member States will be making progress both towards meeting the **WHO NCD commitments** made at the 2011 UN High level meeting on non-communicable diseases and the promotion of a comprehensive EU strategy for the prevention and control of chronic disease.

About the European Chronic Disease Alliance (ECDA) www.alliancechronicdiseases.org

The European Chronic Disease Alliance (ECDA) is a coalition of 11 European health organisations sharing the same interests in combating preventable chronic diseases through European policies that impact health. ECDA represents millions of chronic disease patients and over 200 000 health professionals.

ECDA's mission is to reverse the alarming rise in chronic diseases by providing leadership and policy recommendations based on contemporary evidence.