Clean air in Europe: beyond the horizon?

Bert Brunekreef[1,2], Nino Künzli[3,4], Juha Pekkanen[5,6], Isabella Annesi-Maesano[7], Bertil Forsberg[8], Torben Sigsgaard[9], Menno Keuken[10], Francesco Forastiere[11], Maeve Barry[12], Xavier Querol[13] and Roy M. Harrison[14,15]

Affiliations: [1]Institute for Risk Assessment Sciences, Utrecht University, Utrecht, The Netherlands. [2]Julius Center for Health Sciences and Primary Care, University Medical Center, Utrecht, The Netherlands. [3]Swiss Tropical and Public Health Institute, Basel, Switzerland. [4]University of Basel, Basel, Switzerland. [5]Dept of Environmental Health, National Institute for Health and Welfare, Kuopio, Finland. [6]Dept of Public Health, University of Helsinki, Helsinki, Finland. [7]EPAR Department, INSERM, UMR_S 1136, Institute Pierre Louis of Epidemiology and Public Health, Paris, France. [8]Occupational and Environmental Medicine, Dept of Public Health and Clinical Medicine, Umea University, Umea, Sweden. [9]Section of Environment, Occupation and Health, Aarhus University, Aarhus, Denmark. [10]Netherlands Organization for Applied Research, Utrecht, The Netherlands. [11]Epidemiology Dept, Lazio Regional Health Service, Rome, Italy. [12]European Respiratory Society, European Affairs Dept, Brussels, Belgium. [13]Institute of Environmental Assessment and Water Research (IDAEA-CSIC), Barcelona, Spain. [14]National Centre for Atmospheric Science, School of Geography, Earth and Environmental Sciences, University of Birmingham, Birmingham, UK. [15]Dept of Environmental Sciences/Center of Excellence in Environmental Studies, King Abdulaziz University, Jeddah, Saudi Arabia.

Correspondence: Bert Brunekreef, Institute for Risk Assessment Sciences, Utrecht University, PO Box 80178, 3508 TD Utrecht, the Netherlands. E-mail: b.brunekreef@uu.nl

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The current EU limit values for $PM_{2.5}$ and PM_{10} are far too high
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When the European Union (EU) set its first Air Quality Limit Values for particulate matter in outdoor air (particulate matter <10 μm in diameter (PM_{10})) back in 1999, it promised to set a much stricter limit by 2010 [1]. The goal at the time was for an annual limit value of 20 $\mu g \cdot m^{-3}$, equivalent to the World Health Organization (WHO) Air Quality Guideline set in 2005 [2]. When it was time to do so, however, the new directive adopted in 2008 had no trace of it, and essentially preserved the limit values set in 1999, to which a rather unambitious limit value for fine particles ($PM_{2.5}$) was added [3]. The limit value for $PM_{2.5}$ is an annual average of 25 $\mu g \cdot m^{-3}$, to be reached by the year 2015: 2.5 times higher than the WHO guideline value (10 $\mu g \cdot m^{-3}$), based on the science available already in 2005 [2], and twice the current standard of 12 $\mu g \cdot m^{-3}$ in the USA. The 2008 directive, however, did introduce a voluntary exposure reduction scheme aiming for much lower levels of urban $PM_{2.5}$ up to 2020, with the intention of being made mandatory by 2013. In December 2013, at the end of the EU Year of Air, the Commission finally presented its new policy plan. This does not revise the limit values in the Air Quality Directive and does not make mandatory the voluntary exposure reduction targets, but now proposes introducing a medium-size combustion plant emissions directive and further reductions of the so-called National Emission Ceilings [4–6]. These reductions (as we will show here) are rather unambitious until 2020, but call for much stronger reductions in 2030, *i.e.* well over the horizon.

So there seems to be a pattern here: weak policies are proposed for the short to medium term, accompanied by nonbinding promises of truly clean air at some suitably distant point in the future, promises which then are not kept when that distant future becomes uncomfortably close to the messy present.

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Do we need to worry still about air pollution in Europe? The answer, unfortunately, is yes

WHO published two major reports recently, one reviewing the latest evidence in the context of a series of policy-relevant questions [7] and another defining concentration–response functions for a series of health effects of air pollution [8], to be used for Europe-wide health impact and cost–benefit assessments. Both of these reports summarise a wealth of recent studies, including many from Europe, that support that adverse effects of air pollution are now being observed at ever-lower concentrations of pollutants. Based on such evidence, the authoritative Global Burden of Disease reports, published in late 2012, document that in Europe, $PM_{2.5}$ in the air is clearly the most important environmental health concern among the major drivers of ill health and premature mortality in the population [9].

A large, multicentre study was recently completed in Europe, the European Study of Cohorts for Air Pollution Effects (ESCAPE) (www.escapeproject.eu). This study was funded, in part, because when the limit value for $PM_{2.5}$ was set in 2008, there were few European studies on long-term effects of $PM_{2.5}$. The ESCAPE study investigated health effects ranging from low birth weight to all-cause mortality. Significant effects of $PM_{2.5}$ were found on, for example, low birth weight and head circumference at birth [10], lung function in school children [11] and adults [12], incidence of coronary events [13], lung cancer incidence [14], and all-cause mortality [15]. These studies generally found that relationships between $PM_{2.5}$ and health outcomes remained significant even at low levels of exposure, down to well below 20 or even 15 $\mu g \cdot m^{-3}$ $PM_{2.5}$. This is far below the current limit value of 25 $\mu g \cdot m^{-3}$ $PM_{2.5}$. Moreover, new studies have emerged indicating a role of ambient air pollution in the development of very important chronic conditions such as diabetes and obesity [16]. Taken together, these recent findings and others discussed in the WHO documents result in the conclusion that the air pollution-related burden of disease must even be larger than considered in the past and argue for further strong reductions of the existing Air Quality Limit Values for PM_{10} and $PM_{2.5}$, and for strict implementation of the exposure reduction targets developed back in 2008. Moreover, there is consensus that air quality interventions not only reduce pollution but are indeed followed by improvements in public health [17].

The 2013 National Emission Ceilings Directive proposal

The European Commission published its Clean Air Policy Package in late 2013 [4–6]. While a revision of the Ambient Air Quality Directive is notably absent, the package does contain two main legislative proposals: firstly, a new directive to reduce pollution from medium-sized combustion installations; and secondly, a long-awaited proposal for a revised National Emission Ceilings Directive (NECD). In this plan, the European Commission argues that there are currently many breaches of air quality limit and target values (which are effectively air quality standards, often with some exceedances permitted). Therefore, air quality policy should be directed at reviewing specific emission standards and meeting the current air quality limit and target values rather than adopting even tighter air quality objectives as required implicitly by the WHO REVIHAAP (Review of Evidence on Health Aspects of Air Pollution) process [7]. The proposed extension of the NECD sets limits on emissions from individual countries for sulfur dioxide, nitrogen oxides, nonmethane volatile organic compounds, $PM_{2.5}$ and ammonia to be achieved by 2020, with considerably tougher limits to be achieved by 2030 (table 1). Regrettably, it leaves much room for improvement. Notably, the emission reductions proposed use the year 2005 emissions as baseline. As reported by the European Environment Agency (EEA) [18], emissions of all relevant components had already been reduced considerably by 2011 (table 1).

This makes the proposed Air Quality Policy rather unambitious relative to what has already been achieved in the past 6 years or so. Disconcertingly, another EEA report shows that over that same time period, reductions in ambient $PM_{2.5}$ concentrations in Europe were minimal [19], suggesting that the proposed

TABLE 1 National Emission Ceilings Directive emission reductions

	SO_2	NO_x	(NM)VOC	NH_3	$PM_{2.5}$
Proposed emission reductions by 2030 relative to baseline in 2005	81	69	50	27	50
Proposed emission reductions in by 2020 relative to baseline in 2005	59	42	28	6	22
Achieved emission reductions by 2011 relative to baseline emissions in 2005	42	24	20	5	13

Data are presented as %. SO_2: sulfur dioxide; NO_x: nitrogen oxides; NM: nonmethane; VOC: volatile organic compound; NH_3: ammonia; $PM_{2.5}$: particulate matter <2.5 μm in diameter.

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emission reductions may not translate into sizable reductions in $PM_{2.5}$ and associated health effects. This means that any real improvement over the current situation can only be expected with the next level of commitments, due to kick in only in 2030. This is far too distant given the urgent need for action if Europe is to attain "levels of air quality that do not give rise to significant negative impacts on, and risks to, human health and the environment" [20]. For a further critique of the proposal from an emissions and air quality modeling point of view, see the article by Harrison *et al.* [21].

Recommendations

It is imperative that we reach out to the public and policymakers, highlighting the importance of clean air. The theme of the first ever Healthy Lungs for Life campaign, led by the European Respiratory Society and European Lung Foundation, is "Breathe clean air". This far-reaching awareness campaign, launched in Munich, Germany, in September 2014, is a key method of highlighting the actions that everyone can take to tackle the health effects of indoor and outdoor air pollution. This includes calling on policymakers to tackle air pollution across the continent to improve the lives of European citizens (www.healthylungsforlife.org).

While air quality policy needs to be tailored to national and local conditions, setting ambient air quality standards is an essential element that provides clear targets and guidance to the authorities responsible for the management plans. Those 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. WHO was recently awarded the annual European Lung Foundation Award for introducing these outdoor air quality limits to protect the health of citizens across the world.

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. It is also needed to 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 as well, creating a win–win situation for climate change as well as air quality.

The current limit values for $PM_{2.5}$ and PM_{10} 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 $\mu g \cdot m^{-3}$. If the USA can do it, the EU should be able to as well.

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