Commentaries

Are the limit values proposed by the new European Directive 2008/50 for PM$_{2.5}$ safe for health?

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Directive 2008/50 CE of the European Parliament and Council of 21 May 2008 on ambient air quality and cleaner air for Europe was recently approved.$^1$ Annex XIV of the Directive establishes two stages for particulate matter having a diameter of under 2.5 micron (PM$_{2.5}$). Stage 1 indicates that the calendar year limit value for this pollutant is to be 25 $\mu$g/m$^3$ and that the date by which the limit value is to be attained is 1 January 2015. In Stage 2, the calendar year limit value is set at 20 $\mu$g/m$^3$ and is to be attained by 1 January 2020, though the Directive itself indicates that these indicative limit values will be reviewed by the Commission in 2013 in the light of further information on health and environmental effects, technical feasibility and experience of the target value (25 $\mu$g/m$^3$ at 1 January 2010) in Member States.

It is evident that PM$_{2.5}$ emission levels equal to zero are impossible to achieve in large cities, and that there must be a balance between desirable levels of protection of human health and feasible emission levels. Nevertheless, from the standpoint of their public health effects, the values proposed by this Directive appear to be inappropriate for a number of reasons. First, because in its 2006 guideline levels,$^2$ the World Health Organization (WHO) itself indicates that, as from an annual average PM$_{2.5}$ concentration of 10 $\mu$g/m$^3$, an increase in mortality due to cardiopulmonary causes is to be expected, establishing that this risk rises by 15% for annual average concentrations of 35 $\mu$g/m$^3$, whereas premature mortality falls by 6% for levels of 25 $\mu$g/m$^3$ vis-à-vis levels of 35 $\mu$g/m$^3$. Furthermore, based on studies undertaken in different US cities$^3$–$^5$ which associated cancer mortality with PM$_{2.5}$ levels for annual average concentrations of 18–20 $\mu$g/m$^3$, the United States Environmental Protection Agency$^6$ sets the permitted annual maximum concentration at 15 $\mu$g/m$^3$. Along these same lines are studies conducted in cities, such as Tokyo,$^7$ which indicate that annual average values of around 12 $\mu$g/m$^3$ would reduce annual mortality in this city by 8%.

Within the context of the APHEIS (Air Pollution and Health: A European Information System) network,$^8$ an assessment—based on different scenarios—was recently made of the long-term effects of annual averages of PM$_{2.5}$ concentrations on mortality in different European cities. This study concludes that overall mortality would be reduced in only 10 of the 27 cities targeted, if annual average PM$_{2.5}$ concentrations of 20 $\mu$g/m$^3$ were taken as limit values, due to the fact that these limit values are already being met at present. However, reducing this annual limit value to 15 $\mu$g/m$^3$ would result in health benefits in 19 of 27 cities, with reductions of up to 7.2% in mortality in the city of Cracow.

On the other hand, in a recent study undertaken to assess the short-term effects of PM$_{2.5}$ on morbidity and mortality in the city of Madrid (Spain), using a time-series design for the enhanced period, 1 January 2003 to 31 December 2005,$^9$ the limit for the daily mean value established by the WHO$^5$ (25 $\mu$g/m$^3$) was exceeded on 24% of the days of the study period. The results obtained indicate that the relationship between daily PM$_{2.5}$ concentrations and daily mortality and morbidity is linear, without a saturation threshold, so that any increase in daily PM$_{2.5}$ concentrations would entail related rises in daily morbidity and mortality. Hence, an increase of 25 $\mu$g/m$^3$ in the daily average concentration of PM$_{2.5}$ would entail an associated increase in daily all-cause admissions of 6.8%, with this figure being greater still in the group of subjects aged over 75 years, in which it would rise to as high as 8.8%. While the increase in total daily mortality would be 2.8%, specific causes would register increases in mortality of 7.7% for respiratory and 6.8% for circulatory causes, with the over 75 group once again being the group most affected by this pollutant.

On the basis of the evidence outlined here$^8$,$^9$ and in a recently published review on particulate matter and European policy,$^{10}$ it seems clear then, in the context of public health, the annual limit values set by the current Directive are not overly ambitious. This is reinforced by the expected demographic rise in the 75-year age group by the year 2020, i.e. the age group most affected by this pollutant.

Limits targeting annual average values could prove effective in reducing atmospheric concentrations of particles, as these may originate from sources that cannot be addressed on a day-to-day basis. Yet, the EU directive lacks a limit, like that set by the WHO$^2$ which would target daily mean values and specifically address the short-term effects of this pollutant. Such daily mean limit values would enable public health action measures to be adopted, e.g. activation of warning systems.

More scientific evidence may be needed to assess both the long- and short-term health effects of PM$_{2.5}$ concentrations in European cities. Such evidence would be essential in order for the annual limit value for 2020 to be revised downwards by the European Commission in 2013 ‘in the light of further information on the health effects of this primary pollutant’, as the Directive itself states, and for a daily mean limit value to be set.
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References


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