European Environment Agency

# 8th Environment Action Programme

## Premature deaths due to exposure to fine particulate matter in Europe

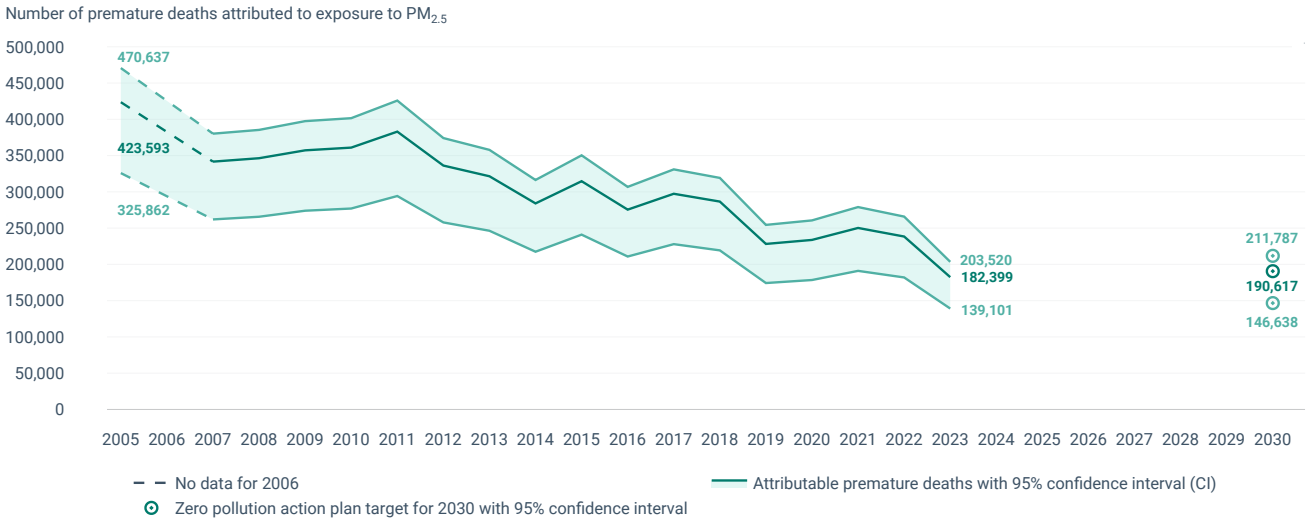
8TH EAP HEADLINE INDICATOR, 2025

# Premature deaths due to exposure to fine particulate matter in Europe

Published 30 Nov 2025

The European Commission's zero pollution action plan (ZPAP) sets a target to reduce the health impacts of air pollution by at least 55% by 2030, compared to 2005. Between 2005 and 2023, the number of premature deaths in the EU-27 Member States attributable to $PM_{2.5}$ concentrations above 5µg/m$^3$ fell by 57%, achieving the target for 2023. Despite ongoing improvements, there were still 182,000 premature deaths attributable to $PM_{2.5}$ in the EU-27 in 2023.

## Figure 1. Premature deaths attributable to exposure to fine particulate matter ($PM_{2.5}$), European Union




Between 2005 and 2023, **premature deaths** attributable to $PM_{2.5}$ exposure above the WHO air quality guideline level of 5µg/m$^3$ fell by 57% in the EU-27 (Figure 1), to an estimated number of 182,000. This was the result of implementing policies at different levels (international, EU, national and local) to improve air quality (e.g. the EU Ambient Air Quality Directives) and to reduce emissions of air pollutants (e.g. the National Emission Reduction Commitments Directive). Those policies have contributed to a decline in the total emissions of primary $PM_{2.5}$ (emitted directly into the atmosphere) by 38% between 2005 and 2023.

The population-weighted concentration of $PM_{2.5}$ (the concentration to which an average **inhabitant is exposed**) fell from 19.4µg/m$^3$ in 2005 to 10.2µg/m$^3$ in 2023 (a drop of 1.2µg/m$^3$ compared to 2022). It is still above the WHO guideline level of 5µg/m$^3$. In 2023, 94.4% of the urban population in the EU was exposed to $PM_{2.5}$ concentrations above the WHO guideline level.

Examining specific primary $PM_{2.5}$ sources, reductions in their EU emissions from residential heating are particularly significant. Specifically, most regions with the **highest absolute reduction** in attributable mortality in 2023, compared to 2022, are located in countries with the highest reduction in emissions from the residential, commercial and institutional sector. This decline may partly stem from a warmer winter, as shown by the reduction in the number of heating degree days between both years as compiled by Eurostat.

Important decreases are also seen in regions where the reductions in emissions from road transport in cities may have contributed. The role of secondary $PM_{2.5}$ (**formed in the atmosphere**) seems more uncertain, partly due to the complexity of their chemical transformation processes. Out of the main precursors of secondary particles, sulphur dioxide and nitrogen oxides emissions have fallen by 84% and 53%, respectively, since 2005; emissions of ammonia have only reduced by 17%.

There is certain interannual variability in the number of estimated attributable deaths (Figure 1). Hence, long-term achievement of the ZPAP objective cannot be taken for granted. In 2023, the 95% confidence interval, which indicates the uncertainty associated with the concentration response function, is estimated at 139,000-204,000. This overlaps with the confidence

interval of the 2030 objective of 147,000-212,000. This confirms that measures to reduce the $PM_{2.5}$ emissions and concentrations need to be maintained and enhanced to ensure achievement of the **2030 target** and ultimately the long-term (2050) **zero pollution objective**. The revised air quality directive should help to maintain progress in the coming years.

Figure 2. Premature deaths normalised by population attributable to exposure to $PM_{2.5}$ at country level in 2005 and 2023, and percentage of change


The ZPAP target is set for the EU as a whole and there are significant differences in the change in mortality due to $PM_{2.5}$ exposure at **country level** between 2005 and 2023. Attributable mortality per capita has decreased in all Member States, and by more than 55% in 23 countries (Figure 2). The country level decreases range from 35.1% in Greece to 97.5% in Finland.

All non-EU countries **reduced** the number of premature deaths attributable to exposure to $PM_{2.5}$, with decreases ranging from 34.8% in Bosnia and Herzegovina to almost 100% in Iceland. The decrease was greater than 55% in eight countries.

For comparison of the impact of air pollution on human health across the different NUTS3 regions of Europe, this map shows the rate of premature deaths attributable to $PM_{2.5}$. The **highest rate** of attributable deaths in 2023 within the EU were in the regions of Plovdiv (Bulgaria), Padova (Italy) and Brodsko-posavska županija (Croatia). However, all Finnish regions except two, several Swedish regions and one region in Estonia and Portugal had very **low attributable death rates** (i.e. less than one).

The highest rate of attributable deaths for European countries outside the EU in 2023 were in the regions of Skopski (North Macedonia), Tiranë (Albania) and Nišavska oblast (Serbia). The lowest numbers were seen in the two Icelandic and three (out of eleven) Norwegian regions with a rate less than one.

## Supporting information

**Definition**

Air pollution is a major cause of disease and mortality and the so far largest single environmental health risk in Europe. The air pollutant with the strongest evidence for adverse health outcomes and also with the largest attributable burden is fine particulate matter ($PM_{2.5}$).

This indicator provides information on the number of premature deaths in the EU-27 attributable to long-term exposure to fine particulate matter ($PM_{2.5}$) since the year 2005.

It also shows a comparison in the mortality attributable to $PM_{2.5}$ between years 2005 and the most recent year with available data, at country level, for 40 European countries.

Furthermore, it provides European NUTS3 regional-level information on the number of premature deaths adjusted for the number of inhabitants aged above 30 years attributable to long-term exposure to $PM_{2.5}$ for the most recent year with available data. Nomenclature of territorial units for statistics, or NUTS classification, is a system for dividing up the European territory for the collection of regional statistics, where NUTS3 corresponds to small regions.

**Methodology**

The EEA has been estimating the mortality attributable to air pollution in the last years. Until year 2021 (when the mortality for year 2019 was estimated), it used the recommendations provided by the WHO Europe in its 2013 report. This methodology has been explained in several documents, among them:

· the EEA briefing 'Assessing the risks to health from air pollution';

· ETC/ATNI (2019, 2021).

After the publication of the new WHO global air quality guidelines in 2021, and to reflect the updated recommendations, there has been some changes in the data used in that methodology; those changes were implemented for the first time in 2022 (to estimate the mortality in year 2020):

· The relative risk has been updated from the previous 0.062 to 0.08; this implies that the risk of dying prematurely increases by 8% per each increase in 10µg/$m^3$ in the $PM_{2.5}$ concentrations (previously the increment in the risk was 6.2%).

· The concentration from which the effect of exposure to $PM_{2.5}$ is considered has changed from 0µg/$m^3$ to 5µg/$m^3$; in this way the EEA estimates the mortality attributable to not reaching the air quality guideline level recommended by WHO, and considers in this way the concentrations for which the form of the concentration-response function is linear and for which this function is more certain. Nevertheless, it should be considered that there is no evidence of a threshold below which air pollution does not impact on health. (Please see additional information at the EEA's briefing *Health impacts of air pollution in Europe, 2025*).

Finally, since the 2024 update, the mortality per number of inhabitants has been calculated considering only the population aged above 30 years, since this is the population for which the total mortality is calculated, following the concentration-response functions recommended by WHO.

Mortality calculations for all years back from 2005 have been recalculated using this updated methodology.

The aggregations are either at European, EU, country or at NUTS3 level.

**Policy/environmental relevance**

The zero pollution action plan, adopted in the context of the European Green Deal, has, among other things, set the goal to reduce by 2030 the number of premature deaths in the EU caused by air pollution by at least 55%, relative to 2005 levels and specified that this will be monitored via the premature deaths attributed to $PM_{2.5}$. The plan also identifies the long-term ambition, by 2050, of air pollution being reduced to levels no longer harmful to health.

The European Green Deal's call for revising the EU's air quality standards and aligning them more closely with the World Health Organization (WHO) recommendations on air quality was achieved with the revised EU Ambient Air Quality Directive. This Directive, adopted in October 2024, introduces stricter and new standards to be attained by 2030. In line with the WHO recommendations, it also introduces an obligation to monitor additional pollutants such as ultrafine particles and ammonia.

This indicator is a headline indicator for monitoring progress towards the 8th Environment Action Programme. It mainly contributes to monitoring aspects of the 8th EAP priority objective Article 2.2.d that shall be met by 2030: 'pursuing zero pollution, including in relation to harmful chemicals, in order to achieve a toxic-free environment, including for air, water and soil, as well as in relation to light and noise pollution, and protecting the health and wellbeing of people, animals and ecosystems from environment-related risks and negative impacts', (European Union Decision on the 8th EAP). In line with the zero pollution action plan, the European Commission's Communication on the 8th EAP monitoring framework specifies that this indicator monitors progress towards reducing 'premature deaths from air pollution by 55% (from 2005 levels) by 2030', (European Commission Communication on the 8th EAP monitoring framework).

**Accuracy and uncertainties**

The main uncertainties are those derived from the health risk calculations. They are described at the EEA briefing 'Assessing the risks to health from air pollution'.

**Data sources and providers**

- Burden of disease of air pollution (Countries & NUTS), European Environment Agency (EEA)

## Metadata

**DPSIR**

Impact

**Topics**

# Environmental health impacts # Air pollution # Pollution

**Tags**

# mortality by exposure to PM2.5 # health impacts # Zero pollution # 8th EAP # Particulate matter # PM2.5 # AIR007 # environmental burden of disease

**Temporal coverage**

2005-2023

**Geographic coverage**

Albania
Austria
Belgium
Bosnia and Herzegovina
Bulgaria
Croatia
Cyprus
Czechia
Denmark
Estonia
Finland
France
Germany
Greece
Hungary
Iceland
Ireland
Italy
Kosovo (UNSCR 1244/99)
Latvia
Liechtenstein
Lithuania
Luxembourg
Malta
Montenegro
Netherlands
North Macedonia
Norway

Poland
Principality of Andorra
Repubblica di San Marino
Serbia
Slovenia
Sweden
Türkiye
Portugal
Principality of Monaco
Romania
Slovakia
Spain
Switzerland

**Typology**

Descriptive indicator (Type A - What is happening to the environment and to humans?)

**UN SDGs**

SDG11: Sustainable cities and communities

**Unit of measure**

FIG1: Number of premature deaths attributed to exposure to PM2.5

FIG2: Attributable deaths per 100,000 inhabitants and percentage of change 2023 vs. 2005

**Frequency of dissemination**

Once a year

## References and footnotes