



# 8th Environment Action Programme

Premature deaths due to exposure to fine particulate matter in Europe

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

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The European Commission zero pollution action plan sets a target to reduce the health impacts of air pollution (estimated by the number of premature deaths attributable to fine particulate matter (PM<sub>2.5</sub>)) by at least 55% by 2030, compared to those in 2005. Between 2005 and 2021, the number of premature deaths in the EU attributable to PM<sub>2.5</sub> fell by 41%. Extrapolating the progress observed over the past ten years shows that the target will be overreached at the EU level. The European Commission also projected that the target will be overreached if the EU policies on air, climate and energy are adequately implemented. Despite the ongoing improvement, in 2021 the premature deaths attributable to PM<sub>2.5</sub> were 253,000 in the EU.

## Figure 1. Premature deaths attributable to exposure to fine particulate matter, EU



Source: EEA.

**Data used in the graph**

| <b>Year</b> | <b>Premature deaths</b> | <b>Zero Pollution Action Plan Target for 2030</b> |
|-------------|-------------------------|---|
| 2005        | 431114                  |   |
| 2006        |                         |   |
| 2007        | 349416                  |   |
| 2008        | 354207                  |   |
| 2009        | 362841                  |   |
| 2010        | 367732                  |   |
| 2011        | 392315                  |   |
| 2012        | 344027                  |   |
| 2013        | 328912                  |   |
| 2014        | 290933                  |   |
| 2015        | 321094                  |   |
| 2016        | 281995                  |   |
| 2017        | 303487                  |   |
| 2018        | 290716                  |   |
| 2019        | 231286                  |   |
| 2020        | 237715                  |   |
| 2021        | 253305                  |   |
| 2022        |                         |   |
| 2023        |                         |   |
| 2024        |                         |   |
| 2025        |                         |   |
| 2026        |                         |   |
| 2027        |                         |   |
| 2028        |                         |   |

| Year | Premature deaths | Zero Pollution Action Plan Target for 2030 |
|------|------------------|--|
| 2029 |                  |  |
| 2030 |                  | 194001                                     |



Air pollution is a major cause of mortality and disease in Europe and is the largest environmental health risk (WHO, 2023). The air pollutant deemed to cause the most severe impacts on human health is fine particulate matter (PM<sub>2.5</sub>).

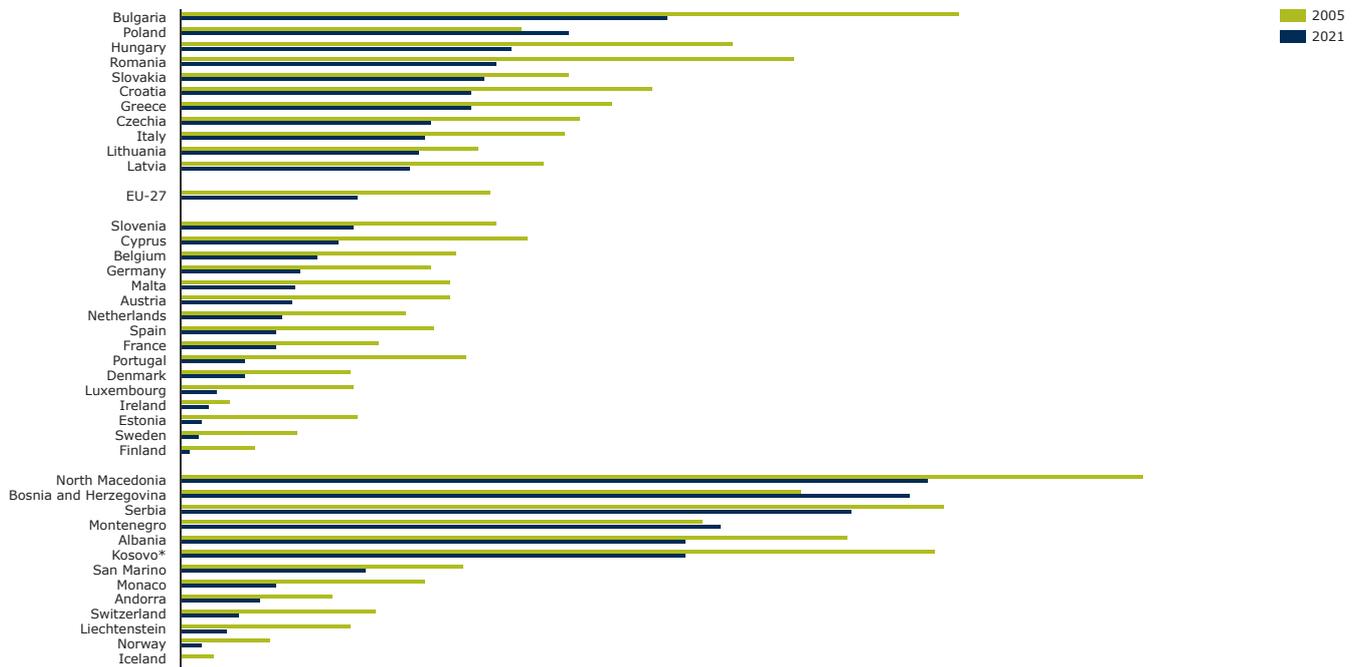
The European Green Deal called for a further improvement of air quality and to revise the EU's air quality standards, aligning them more closely with the latest World Health Organization (WHO) recommendations on air quality. The European Commission zero pollution action plan set the target of reducing the number of premature deaths caused by air pollution by 55% before 2030, relative to those in 2005 (specifying that this target will be measured considering only PM<sub>2.5</sub>). In October 2022, the European Commission also proposed a revision of the current EU Ambient Air Quality Directives, under negotiation during 2023 with the European Parliament and the European Council.

As shown in Figure 1, between 2005 and 2021, premature deaths attributable to PM<sub>2.5</sub> exposure above the WHO air quality guideline level of 5µg/m<sup>3</sup> fell by 41% in the EU-27 (EEA, 2023). This decrease was caused by a decline in the concentrations of PM<sub>2.5</sub> and therefore a decrease in the exposure of the population to this air pollutant. Nevertheless, more than 70% of EU population live in urban areas and, according to a related EEA indicator, in 2021 97% of the urban population was still exposed to PM<sub>2.5</sub> concentrations above the new (2021) WHO air quality guideline level of 5µg/m<sup>3</sup>.

The decline in the premature mortality was the result of the implementation of EU, national and local policies to improve the quality of the air (e.g. the EU Ambient Air Quality Directives and the national, regional and local plans and measures derived from them) and to reduce emissions of air pollutants, including particulate matter (e.g. the National Emission Reduction Commitments Directive). These policies succeeded in reducing fine particulate matter emissions from domestic heating, their main source, as well as from other sources such as transport, industry and agriculture.

If the trend seen in the past ten years was to continue, the decline in the premature mortality attributable to PM<sub>2.5</sub> would reach 68% by 2030 (from 2005 levels), i.e., there will be an overachievement of the 55% zero pollution reduction target. In addition, according to the Third Clean Air Outlook, published by the European Commission, the target is expected to be overreached if the foreseen clean air measures, together with the climate and energy policies of the 'Fit for 55' package are implemented. The outlook foresees a reduction of 66% by 2030 if these conditions are met.

# Figure 2. Premature deaths attributable to exposure to PM<sub>2.5</sub> at country level in 2005 and 2021



Source: EEA.

## Data used in the graph

| <b>Country</b> | <b>2005</b> | <b>2021</b> |
|----------------|-------------|-------------|
| Bulgaria       | 251         | 157         |
| Poland         | 110         | 125         |
| Hungary        | 178         | 107         |
| Romania        | 198         | 102         |
| Slovakia       | 125         | 98          |
| Croatia        | 152         | 94          |
| Greece         | 139         | 94          |
| Czechia        | 129         | 81          |
| Italy          | 124         | 79          |
| Lithuania      | 96          | 77          |
| Latvia         | 117         | 74          |
|                |             |             |
| EU-27          | 100         | 57          |
|                |             |             |
| Slovenia       | 102         | 56          |
| Cyprus         | 112         | 51          |
| Belgium        | 89          | 44          |
| Germany        | 81          | 39          |
| Malta          | 87          | 37          |
| Austria        | 87          | 36          |
| Netherlands    | 73          | 33          |
| Spain          | 82          | 31          |
| France         | 64          | 31          |
| Portugal       | 92          | 21          |
| Denmark        | 55          | 21          |

| Country                | 2005 | 2021 |
|------------------------|------|------|
| Luxembourg             | 56   | 12   |
| Ireland                | 16   | 9    |
| Estonia                | 57   | 7    |
| Sweden                 | 38   | 6    |
| Finland                | 24   | 3    |
|                        |      |      |
| North Macedonia        | 310  | 241  |
| Bosnia and Herzegovina | 200  | 235  |
| Serbia                 | 246  | 216  |
| Montenegro             | 168  | 174  |
| Albania                | 215  | 163  |
| Kosovo*                | 243  | 163  |
| San Marino             | 91   | 60   |
| Monaco                 | 79   | 31   |
| Andorra                | 49   | 26   |
| Switzerland            | 63   | 19   |
| Liechtenstein          | 55   | 15   |
| Norway                 | 29   | 7    |
| Iceland                | 11   | 0    |



Although the Zero pollution action plan target is set at EU level, it is useful to have a look at the change in the mortality due to exposure to PM<sub>2.5</sub> at country level. Figure 2 depicts the estimated number of premature deaths per 100,000 inhabitants attributable to exposure to annual PM<sub>2.5</sub> concentrations above 5µg/m<sup>3</sup> in both 2005 and 2021.

It shows that in all EU Member States, except Poland, mortality per capita has decreased, more than halving in 14 of them.

A decrease in mortality can also be seen in the rest of the European countries considered, with the exception of Bosnia and Herzegovina and Montenegro. In these non-EU countries, five of them have at least halved their number of premature deaths attributable to exposure to PM<sub>2.5</sub>.

This reduction at country level partly reflects the reduction in PM<sub>2.5</sub> concentrations over the years (see, for instance, the [Air quality in Europe – 2020 report](#)). The increasing results found in the three countries mentioned above happened in spite of the decreasing concentrations between 2005 and 2021. This may be due to an increase in total and/or relative mortality between the two years. Specifically, 2021 saw an increase in total mortality due to the impact of COVID-19.

Finally, to allow comparison of the impact of air pollution on human health across the different NUTS3 regions of Europe ([NUTS](#): Nomenclature of territorial units for statistics), [this map](#) shows the number of premature deaths attributable to PM<sub>2.5</sub> expressed per 100,000 inhabitants. Out of the EU regions, the highest relative number of attributable deaths in 2021 were in several regions of Bulgaria (Vidin, Plovdiv and others) and Poland (Miasto Kraków, Katowicki, Sosnowiecki and others). In contrast, within the EU, several Finnish and Swedish regions and one Portuguese region had very low attributable deaths (i.e., less than one per 100,000 inhabitants).

Outside of the EU, the highest number of relative attributable deaths in 2021 were in several regions of North Macedonia (Skopski, Vardarski and others) and of Serbia (Podunavska oblast, Pomoravska oblast, City of Belgrade and others). Regarding the lowest numbers, all the Icelandic regions and a couple of Norwegian regions had less than one attributable death per 100,000 inhabitants.

The high relative numbers of premature deaths attributable to PM<sub>2.5</sub> in the above-mentioned regions are the result of burning solid fuels for domestic heating and industry. And all the regions (both inside and outside EU) with the lowest relative mortality have population-averaged concentrations below 5µg/m<sup>3</sup>.

## ▼ Supporting information

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### Definition

This indicator provides information on the number of premature deaths in the EU-27 attributable to long-term exposure to fine particulate matter (PM<sub>2.5</sub>) since the year 2005.

It also shows a comparison in the mortality attributable to PM<sub>2.5</sub> 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 attributable to long-term exposure to PM<sub>2.5</sub> 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  $10\mu\text{g}/\text{m}^3$  in the  $\text{PM}_{2.5}$  concentrations (previously the increment in the risk was 6.2%).
- The concentration from which the effect of exposure to  $\text{PM}_{2.5}$  is considered has changed from  $0\mu\text{g}/\text{m}^3$  to  $5\mu\text{g}/\text{m}^3$ ; in this way the EEA estimates the mortality attributable to not reaching the air quality guideline level recommended by the 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, 2022*).

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  $\text{PM}_{2.5}$ .

This indicator is a headline indicator for monitoring progress towards the 8<sup>th</sup> Environment Action Programme. It mainly contributes to monitoring aspects of the 8<sup>th</sup> 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 8<sup>th</sup> EAP](#)). In line with the zero pollution action plan, the [European Commission's](#)

Communication on the 8<sup>th</sup> 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 8<sup>th</sup> 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

- Premature deaths due to exposure to fine particulate matter PM2.5 (2005-2021), EU SDG 11\_52, European Environment Agency (EEA)

## ▼ Metadata

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### 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

2005-2021

### Geographic coverage

Albania

Belgium

Bulgaria

Cyprus

Denmark

Finland

Germany

Hungary

Ireland

Kosovo (UNSCR 1244/99)

Austria

Bosnia and Herzegovina

Croatia

Czechia

Estonia

France

Greece

Iceland

Italy

Latvia

Liechtenstein  
Luxembourg  
Montenegro  
North Macedonia  
Poland  
Romania  
Slovakia  
Spain  
Switzerland

Lithuania  
Malta  
Netherlands  
Norway  
Portugal  
Serbia  
Slovenia  
Sweden

### **Typology**

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

### **UN SDGs**

Sustainable cities and communities

### **Unit of measure**

Number of premature deaths.

Number of premature deaths per 100,000 inhabitants.

### **Frequency of dissemination**

Once a year

### **Contact**

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