

INDICATOR SHEET

1. Indicator name

PM10 concentration in the province of Girona
a) Average annual concentration of PM10
b) 90.4th percentile of PM10 per 24 hours (daily value)

Update date:	12-11-2024	Version:	v.2.
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2. Field

Main Area	Environment
Sub-Scope	Air quality

3. Definition

- a) Average annual concentration of PM10:**
The indicator shows the average annual concentration of suspended particles with a diameter of less than 10 micrometers (PM10) in micrograms per cubic meter ($\mu\text{g}/\text{m}^3$) in ambient air.
- b) 90.4 percentile of PM10 for an average period of 24 hours:**
This indicator shows the daily PM10 concentration value (average every 24 hours) of PM₁₀ concentration that has been exceeded only 9.6% of the time during the year. In other words, 90.4% of the days of the year, the concentration of PM10 has been below this value. This indicator is useful for identifying peaks in PM10 pollution which, despite being punctual, can have a significant impact on health.

4. Calculation formula

This is not the case, since the indicator is based on modelling data through the air quality forecast model of the CALIOPE system over Catalonia at 1 km horizontal resolution (<http://www.bsc.es/caliope/es>)

5. Reading

- a) Average annual concentration of PM10:**
This indicator makes it possible to compare PM10 levels between different municipalities or areas in the province of Girona. The information facilitates the analysis of temporal trends and the identification of areas with higher concentrations of PM10, which may represent a health risk.
In September 2021, the World Health Organization (WHO) published guidelines recommending that average annual PM10 levels should not exceed $15 \mu\text{g}/\text{m}^3$; while the annual limit value (VLA) established in current regulations for the concentration of PM10 microparticles is set at $40 \mu\text{g}/\text{m}^3$.

The annual PM10 average provides an overview of air quality throughout the year. However, it does not reflect the occasional variations in PM10 levels.

With the support of:

b) 90.4th percentile of PM10 per 24 hours (daily value):

The 90.4th percentile complements the information on the annual average, as it allows us to identify the peaks of pollution that may go unnoticed in the annual average.

The 90.4th percentile of PM10 per day is also known as the 36th highest daily value of the daily averages and represents the concentration of PM10 that has been exceeded by 35 days a year, given that if we consider that a year has 365 days, 9.6% of days a year is equivalent to 35 days (9.6/100).

The legislative reference values established by Directive 2008/50/EC and Royal Decree 102/2011 on PM10 indicate that the daily limit value (vld) – average value of each day – legislated is 50 µg/m³ of PM₁₀, which may not be exceeded more than 35 times per year for the protection of human health.

Therefore, the 90.4th percentile represents the concentration of PM10 that has been exceeded on 35 days of the year; that is, it represents the 36th highest daily value.

In conclusion:

The 90.4th percentile and the 36th highest daily value are two different ways of expressing the same concept: the concentration of PM10 that has been exceeded more than 35 times per year.

For a complete assessment of air quality in relation to PM10, it is recommended to analyze the annual average and the 90.4 percentile together

Example:

A municipality may have a low annual average of PM10, but a high 90.4th percentile. This indicates that, although air quality is generally good throughout the year, there are occasional pollution peaks that must be taken into account and appropriate measures taken.

6. Periodicity

Annual

7. Source

Department of Territory, Housing and Ecological Transition.

8. Limitations

Geographical	☐	Temporary	☐	Statistical secrecy	☐
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Description of limitations

- **Geographical:** Not applicable. The indicator covers the entire province of Girona.

- **Temporary:** Data are available for the years 2017 to 2022.
- **Statistical secrecy:** Not applicable.
- **Description of limitations:** The data are based on air quality prediction models, which may have a certain margin of uncertainty.

9. SDG

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
☐	☐	☒	☐	☐	☐	☒	☐	☐	☐	☒	☐	☒	☐	☒	☐	☐

SDG 3: Health and Well-being

PM10 particles affect respiratory health, especially in vulnerable populations, such as children, the elderly or people with chronic diseases. Exposure to high concentrations of PM10 can trigger asthma, bronchitis, and other respiratory and cardiovascular problems.

Target 3.9 of SDG 3 sets out to "substantially reduce the number of deaths and illnesses caused by hazardous chemicals, air pollution".

SDG 7: Affordable and Clean Energy

PM10 emissions are in many cases the result of polluting energy sources (e.g. coal and petroleum derivatives). Moving towards clean and sustainable energy, as set out in SDG 7, can directly contribute to reducing the concentration of PM210.

SDG 11: Sustainable Cities and Communities

The reduction of PM10 is essential to achieve healthier and more livable cities. PM10 emissions usually come from traffic, construction, industry and soil erosion, especially in urban areas.

Target 11.6 highlights the need to "reduce the negative environmental impact per capita in cities, with special attention to air quality".

SDG 13: Climate Action

The relationship between PM10 and climate change lies in the common origin of many emissions (e.g. motor traffic and industry). Many sources of PM10 are also sources of greenhouse gases. Reducing particulate emissions aligns with reducing emissions to combat climate change.

SDG 15: Life on Land

Although it is not a direct impact, PM10 particles affect biodiversity and soil quality in areas close to sources of pollution. This can compromise terrestrial and agricultural ecosystems, so maintaining low levels of PM10 is beneficial for the conservation of terrestrial life.

Therefore, the average concentration of PM10 is an indicator that can be directly related to public health (SDG 3), urban quality of life (SDG 11), and global environmental sustainability (SDGs 13, 7, and 15).

10. Comments and observations

Exposure to PM10 can have negative effects on health, especially on the respiratory and cardiovascular systems. These particles can penetrate deep into the lungs and cause respiratory problems, such as asthma, bronchitis, COPD (chronic obstructive pulmonary disease), pneumonia, and respiratory infections. In addition, recent studies have linked exposure to PM10 with an increased risk of:

- **Cardiovascular diseases:** Heart attacks, angina pectoris, arrhythmias, strokes and high blood pressure.
- **Lung cancer and other cancers:** An association has been observed between exposure to PM10 and an increased risk of developing lung cancer, as well as breast and bladder cancer.
- **Neurological problems:** Alzheimer's disease, Parkinson's disease and cognitive impairment.
- **Diabetes:** It has been suggested that exposure to PM10 may increase the risk of developing type 2 diabetes.
- **Premature mortality:** Several studies have shown that exposure to PM10 is associated with an increase in mortality from all causes, especially cardiovascular and respiratory causes.
- **Effects on children's health:** Children are especially vulnerable to the effects of air pollution, and exposure to PM10 has been linked to respiratory problems, asthma, allergies, low birth weight and neurodevelopmental problems.

It is important to note that the effects of exposure to PM10 can vary depending on the concentration of particles in the air, the duration of exposure and the individual vulnerability of each person.

Sources of information:

- World Health Organization (WHO):
- European Environment Agency (EEA)

As for the methodology, it should be taken into account that the forecast model used is the CALIOPE (CALidad del aire Operacional Para España), of the Department of Earth Sciences of the Barcelona Supercomputing Center (BSC), which offers the hourly forecast of air quality (24 hours and 48 hours) for Catalonia in 4x4 km and 1x1 km resolution.

These forecast models contain an emissions model that is carried out according to data provided by the Directorate General for Environmental Quality and Climate Change, among others.

https://mediambient.gencat.cat/ca/05_ambits_dactuacio/atmosfera/qualitat_de_laire/avaluacio/analisi-anual-dels-models-de-qualitat-de-laire/