

What is PM_{2.5}?

Fine Particulate Matter

PM_{2.5}, also known as fine particulate matter, refers to particles or droplets in the air that are 2.5 microns or less in width.

Although it is invisible to the naked human eye as individual particles, PM_{2.5} can reduce visibility and cause the air to appear hazy when PM_{2.5} levels are elevated.

40+ PM_{2.5} particles = the smallest particle visible to human eye

20 PM_{2.5} particles = 1 fog particle

4 PM_{2.5} particles = 1 PM₁₀ particle

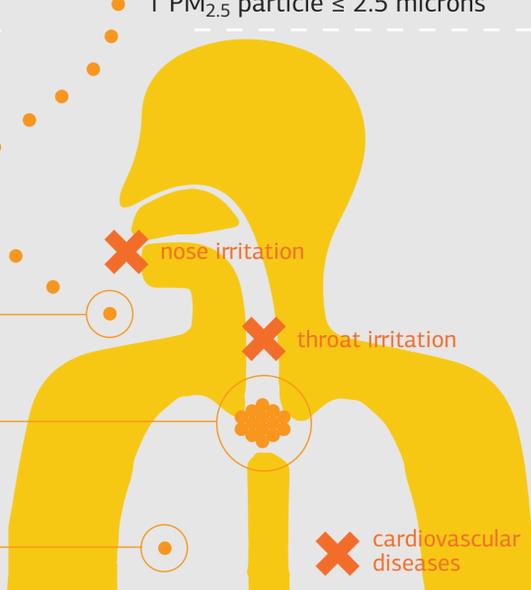
1 PM_{2.5} particle ≤ 2.5 microns

Human Effects

Enter through nose and mouth.

Larger particles such as PM₁₀ are eliminated through coughing, sneezing, and swallowing.

Smaller particles such as PM_{2.5} can travel deep into lungs, causing lung and heart problems.



Vulnerable Populations



Unlike other pollutants in the air, PM_{2.5} can go deep into the lungs and bloodstream, leading to health problems. Young children, pregnant women, and the elderly are especially vulnerable.

Sources



Agriculture



Power Plants & Factories



Motor Vehicles



Burning of wood, oil, grass, etc.

How do we know?

We use satellite-derived estimates that develop a consistent measure for each country, many of which do not yet measure ground-based PM_{2.5}.

Satellite vs. Ground

SATELLITE



PROS

- Consistent measure for all countries (important for cross-country comparisons)
- Global data coverage for all countries

GROUND

- Measured typically at the ground level where populations are exposed, which is the most accurate for local exposure to PM_{2.5}

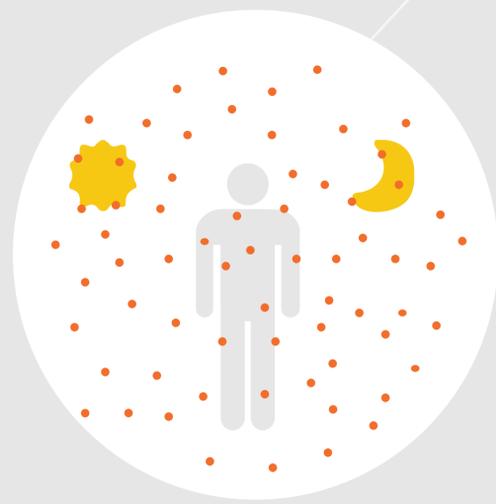
VS

CONS

- Uses scientific models to estimate ground-based measures
- Uses multi-year averages, so could mute effects of high-pollution events

- Many countries don't have resources to measure PM_{2.5}
- Inconsistent spatial coverage
- Comparisons between countries difficult, due to measurement and reporting differences

Average Exposure to PM_{2.5} - A 'Typical' Air Pollution Day



Average exposure is calculated by multiplying the PM_{2.5} concentration by the population exposed. It reflects a 'typical' air pollution day a person would experience in a country.

The 2014 EPI includes two ways of looking at exposure: 1) the average exposure to PM_{2.5} at a national scale; 2) an average of the percentage of the population exposed to PM_{2.5} levels at the World Health Organization's different air quality guidelines (10, 15, 25, and 35 µg/m³).

10 µg/m³

WHO
(World Health Organization)
Recommendation

U.S. Air Quality Index & Concentration Values

Air Quality Index (AQI)	Levels of Health Concern	Concentration Values (µg/m ³)
0 - 50	good	0 - 12
51 - 100	moderate	12.1 - 35.4
101 - 150	unhealthy for sensitive groups	35.5 - 55.4
151 - 200	unhealthy	55.5 - 150.4
201 - 300	very unhealthy	150.5 - 250.4
301 - 500	hazardous	250.5 - 500.4

References

- WHO air quality guidelines for particulate matter, ozone, nitrogen dioxide and sulfur dioxide, Global Update 2005, Summary of Risk Assessment", World Health Organization (WHO): http://whqlibdoc.who.int/hq/2006/WHO_SDE_PHE_OEH_06.02_eng.pdf
- "Air Quality Index (AQI) - A Guide to Air Quality and Your Health", Air Now: <http://airnow.gov/index.cfm?action=aqibasics.aqi>
- "Particulate Matter (PM)", United States Environmental Protection Agency (EPA): <http://www.epa.gov/pm/basic.html>