



POSITIVE IMPACTS ON PUBLIC HEALTH FROM DIESEL FUEL FILTRATION

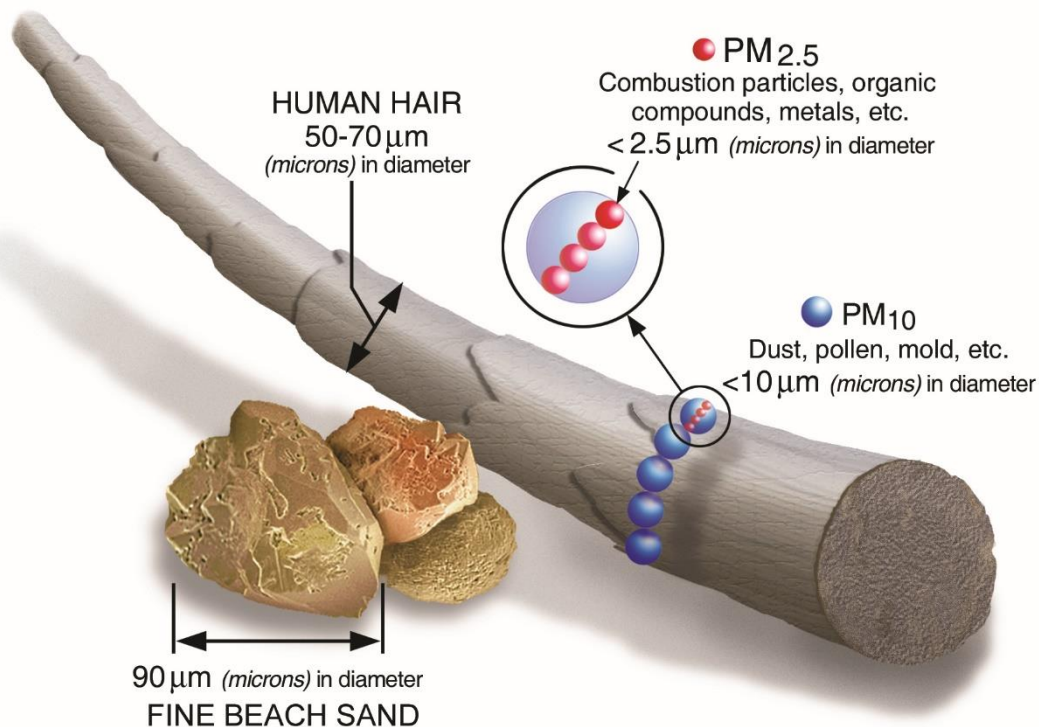
What is PM particle contamination?

PM (particulate matter) pollution is the term used for the mixture of particles that are suspended in the air, such as dust, dirt, soot, or smoke. The PM particles that come from human activity are the most abundant and the ones we should be most concerned about. Their most important source is that produced by incomplete combustion (soot) of thermal engines in transportation and industry, **mainly from diesel engines (DPM)**.

Explanatory video (Harvard): <https://youtu.be/wl3BkTE4TEc>

The US Environmental Protection Agency (EPA) groups particle contamination into two size categories. These particles are so small that they are measured in micrometers. A micrometer, or micron (μm), is one millionth of a meter: $1 / 1'000,000 \text{ m}$.

- **PM₁₀**: inhalable particles, with diameters that are generally $10 \mu\text{m}$ and smaller.
- **PM_{2.5}**: fine inhalable particles, with $2.5 \mu\text{m}$ and smaller diameters, mainly come from the combustion of **contaminated** (dirty) **diesel**: DPM size $< 1 \mu\text{m}$.



For comparison, fine beach sand is approximately 90 microns in diameter. A human hair is between 50 and 70 microns in diameter.



How do PM affect public health?

Several adverse health impacts have been associated with exposure to PMs. For PM_{2.5}, short-term exposures (up to 24-hours) have been associated with premature mortality, increased hospital admissions for heart or lung causes, acute and chronic bronchitis, asthma attacks, emergency respiratory symptoms, and restricted activity days. These adverse health effects have been reported primarily in infants, children, and older adults with preexisting heart or lung diseases. PM_{2.5} is associated with the greatest proportion of adverse health effects related to air pollution, both in the US and world-wide based on the World Health Organization's Global Burden of Disease Project. Short-term exposures to PM₁₀ are associated primarily with worsening of respiratory diseases, including asthma and chronic obstructive pulmonary disease (COPD).

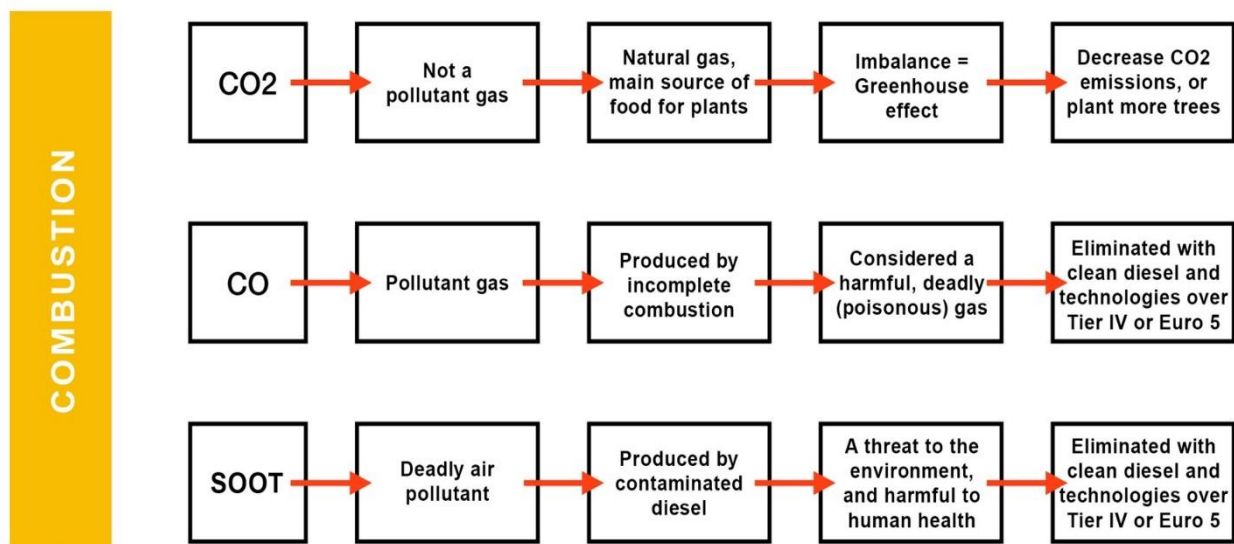
Long-term (months to years) exposure to PM_{2.5} has been linked to premature death, particularly in people who have chronic heart or lung diseases, and reduced lung function growth in children. The effects of long-term exposure to PM₁₀ are less clear, although several studies link long-term PM₁₀ exposure and respiratory mortality. The International Agency for Research on Cancer (IARC) published a review in 2015 that concluded that particulate matter in outdoor air pollution causes lung cancer and may contribute to the incidence and aggravation of respiratory diseases, including COVID-19.

According to [WHO](#), ambient air pollution, both in cities and rural areas, was responsible for 4.2 million premature deaths worldwide per year; due to exposure to PM_{2.5} particles which cause cancer, respiratory and cardiovascular diseases.

Source: <https://ww2.arb.ca.gov/resources/overview-diesel-exhaust-and-health>

Video 1: <https://youtu.be/mAjDvBwKFWE> Video 2: <https://youtu.be/0811kyRS2GI>

Emissions from an internal combustion diesel engine





Environmental damage produced by diesel particulate matter (DPM)

Particulate contamination in diesel fuels is defined by the international cleanliness standard ISO 4406, and is the primary parameter for determining the highest rate of DPM that an engine will expel into the environment:

For every 10,000 diesel gallons with particulate contamination ISO 4406 code 22/21/18, 473 grams of particulate matter are emitted in the exhaust gases. **This means that for every 1 million gallons of diesel per year there is a total of 47,300 grams of particulate contamination (DPM) expelled into the environment, with serious impacts on the quality of air, water, soil and, even worse, in the lungs of citizens.**

DPM particles can be transported by wind over long distances and can then settle on the ground or in water. Depending on the chemical composition, the effects of this deposition can result in:

- estuaries, rivers and reservoirs becoming acidic
- change in the nutrient balance of coastal waters and river basins
- reduction of soil nutrients
- damage to sensitive forests and agricultural crops
- detrimental effects on ecosystem diversity
- contribution to the effects of acid rain

DPM's role in climate change

A large proportion of DPM is composed of black carbon (BC). Recent studies cited in the Intergovernmental Panel on Climate Change report estimate that emissions of BC are the **second largest contributor to global warming**, after carbon dioxide emissions. Warming occurs when BC particles absorb sunlight, convert it into infrared (heat) radiation, and emit that radiation to the surrounding air. A recent study showed that the darkening of snow and ice by BC deposition is a major factor in the rapid disappearance of mountain snowpacks. **Melting of the snowpacks is one of the contributing factors to the serious decline in water supply.**

Video: <https://youtu.be/kIOABRCb79w>

Contamination produced by lubricating oils

By maintaining clean combustion through the consumption of a diesel at optimum cleanliness parameters (ISO 4406: 11/8/7) and a clean engine (ISO 4406: 15/13/10), less contamination (soot) is generated; therefore, the lubricant remains cleaner and oil changes are more efficient, **extending its useful life by double** and, as a consequence, the amount of waste lubricating oil is reduced by half, a substance with a very high environmental impact on soil, surface water and groundwater.



FMS Solution: Doubly Green

FMS provides expert solutions that achieve ultra-clean diesel fuels, in optimal ISO 4406 parameters, reducing the generation of emission gases:

- CO₂ (carbon dioxide): respirable, greenhouse gas (global warming)
- CO (carbon monoxide): causes heart diseases
- PM (soot microparticles): affects respiration, enhances allergies, promotes cancer
- HC (unburned hydrocarbons): affects respiration and promotes cancer
- NO_x (nitrogen oxides): irritates mucous membranes, affects breathing, promotes cancer

All transportation and industrial operations with diesel engines should be certified with ISO 4406 controls for particle contamination. This will lead to a reduction in the volume of emissions, an improvement in the quality of emissions to the environment and a halving of the amount of contaminating waste oils.

Optimal diesel cleanliness (code 11/8/7 or better) results in very high technical and economic benefits for the engine owner by significantly reducing friction and internal temperature, increasing power, consuming less fuel (huge savings), reducing wear in moving parts and injection systems (great savings in repairs and spare parts), reducing maintenance services downtime (improving productivity), extending the useful life of lubricating oil and fuel/oil OEM on-board filters (great savings), among many others.

The technical and economic benefits of FMS Premium Diesel (ultra-clean and ultra-dry) also mean very important social, health and environmental benefits.

