

Visibility-Reducing Particles & Health

CATEGORIES

Topics Health, Air Pollution

Programs Outdoor Air Quality Standards, Exposure

Type Information

CONTACT

Research Division

Email research@arb.ca.gov

Phone (916) 445-0753

What are visibility-reducing particles?

Particulate matter (PM) pollution impacts the environment by decreasing visibility (haze). These particles vary greatly in shape, size and chemical composition, and come from a variety of natural and manmade sources. Some haze-causing particles are directly emitted to the air such as windblown dust and soot. Others are formed in the air from the chemical transformation of gaseous pollutants (e.g., sulfates, nitrates, organic carbon particles) which are the major constituents of fine PM. These fine particles, caused largely by combustion of fuel, can travel hundreds of miles causing visibility impairment.

How do particles reduce visibility?

Visibility reduction is probably the most apparent symptom of air pollution. Visibility degradation is caused by the absorption and scattering of light by particles and gases in the atmosphere before it reaches the observer. As the number of fine particles increases, more light is absorbed and scattered, resulting in less clarity, color, and visual range. Light absorption by gases and particles is sometimes the cause of discolorations in the atmosphere but usually does not contribute very significantly to visibility degradation. Scattering by particulates impairs visibility much more readily. Particles that are the most effective at reducing visibility (per unit aerosol mass) have diameters in the range of 0.1-1.0 μm . Some types of particles such as sulfates scatter more light, particularly during humid conditions. Visibility standards are based on extinction coefficients, which is a measure of the light attenuation due to both absorption and scattering.

What are the health effects of visibility-reducing particles?

Haze not only impacts visibility, but some haze-causing pollutants have been linked to serious health problems and environmental damage as well. Exposure to particles up to 2.5 (PM_{2.5}) and 10 microns (PM₁₀) in diameter in the ambient air can contribute to a broad range of adverse health effects, including premature death, hospitalizations and emergency department visits for worsened heart and lung diseases. These effects are described in CARB's webpage for PM_{2.5} and PM₁₀.

What is the purpose of the Ambient Air Quality Standard for visibility-reducing particles?

The Ambient Air Quality Standard for visibility-reducing particles is intended to limit the frequency and severity of visibility impairment due to regional haze, which is largely caused by ambient particles. The visibility standard is unique among the California ambient air quality standards in that it is not based on health effects, but rather on what is termed a welfare effect. Welfare effects indirectly impact the public through effects that are not related to health, for example



reduced visibility, and damage to materials, plants, forests, and ecosystems. Haze also has economic consequences. Each year, millions of visitors travel to our national parks and wilderness areas. Haze affecting these areas obscures the spectacular views the public expects to experience. Over time, this could lead to fewer visitors or shorter visits.

What are the standards for visibility-reducing particles?

Secondary standards set limits to protect public welfare, including protection against decreased visibility. Originally, the State visibility standard was based on the distance a person could see, 10 miles in most of the State, and 30 miles at Lake Tahoe. In 1989, CARB converted both the general statewide 10-mile visibility standard and the Lake Tahoe 30-mile visibility standard to instrumental equivalents, which are "extinction of 0.23 per kilometer" and "extinction of 0.07 per kilometer" for the statewide and Lake Tahoe Air Basin standards, respectively.

Regional Haze Program

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(800) 242-4450 | helpline@arb.ca.gov
1001 I Street, Sacramento, CA 95814
P.O. Box 2815, Sacramento, CA 95812



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