

Why you need a Nephelometer?

The Nephelometer is an important instrument in a variety of Air monitoring applications. Many organisations throughout the world including EPA's, Meteorological agencies, Universities, Airports, Federal, State and local governments use Nephelometers everyday in a variety of ways.



What is a Nephelometer?

An integrating nephelometer provides a real-time, direct measurement of the light scattered by dust pollution in the air.

What is light scattering?

Light scattering is the measurement of particulates (dust/aerosol) in the air by shining light through sample air and measuring the deflected light (scattering).

Why measure Light scattering?

Light scattering gives precise data on the amount of particulates/dust in the air.

Nephelometer's are able to use light scattering to measure:

- Visibility (how far you can see)
- Is a good indicator of mass particulate measurement (PM2.5 and lower)
- How aerosols affect Global warming.

Why measure visibility?

Visibility measurements are important as they indicate how much pollution is in the air. Visibility shows how much Haze, Smog or Fog is present, and therefore determine how much pollution is in the air.

A good indicator of PM2.5 mass measurement!

The Nephelometer is known through numerous studies to track closely with PM2.5 monitors. The Nephelometer can be correlated with a mass monitor and used accurately to measure masses of PM2.5 or lower.

Aerosols and Global warming

Investigations have provided much evidence that particles present in the air (aerosols) are affecting the radiation reaching the earth's surface. This has direct implications on global warming and the increase of Global temperatures.

Nephelometers measure light scattering and therefore is the perfect tool to study this aspect of global warming.

Wet V Dry sampling

Wet sampling is used for accurate Visibility monitoring, it does not heat sample air and thus all water vapour and fog components are included. Dry sampling heats the sample air removing water vapour and providing a more accurate assessment of Particulate mass.

Dry measurement

- Dry Mode has a strong correlation with PM2.5
- Set point of R.H. between 40% and 70% used
- This lowers the relative humidity and decreases particle scattering. The effect is greatest at high humidity (RH >80%) and becomes negligible at low humidity (RH <50%)

Wet measurement

- In wet mode the temperature rise in the measurement chamber is 0.5°C
- >60% RH, particles uptake of water and appear to grow this results in increase particle diameter
- Useful to detect fog and the affect of water in visibility.
- Provides more of a true visibility measurement

Sources of pollution

Pollution measured in the air is from 2 sources, Natural and Artificial.

- Natural Sources: forest fires, dust, pollen, chemicals emitted by plants/trees, sea salt, volcanic eruptions.
- Artificial (anthropogenic) Sources: automobile emissions, coal-burning power plants, intentional burning of forests and range lands, industrial and mining operations, dust from unpaved roads and agricultural fields.

Health implications

This pollution directly affects human health with lower visibility meaning more airborne pollution.

Health impacts from Haze/Smog

- Reduces the visible distance
- Increases respiratory diseases
- makes breathing difficult
- Fine particulate matter (PM2.5 and smaller) are generally composed with chemical and can penetrate deeply into lungs, enter blood and cause many other sicknesses

What different Nephelometers are there?

There are 3 types of Nephelometers Green, Red and Blue:

- Green: 520 nm – most sensitive for the human eye best measurement for smog, fog, haze
- Red: 700 nm - interacts strongly with large particulate matter (pollen, sea salt)
- Blue: 450 nm - interacts strongly with fine and ultrafine particulates (wood fires, automobiles)

Applications

The Nephelometer is used for a number of different applications including:

Visibility Haze/Smog monitoring

The Nephelometer gives accurate real-time measurements of visibility. The Nephelometer allows pollution to be reported in a simple and understandable way for the general population. Informing people of the visibility (distance they can see) gives people an accurate and easy to understand way to be informed of the current pollution.

Airport Visibility

Nephelometer's are ideal instruments for Airport Visibility. The Nephelometer is known as an accurate method of determining visibility and correlates strongly with human observations. Nephelometer use as a visibility monitor at airports reduces human error and keeps visibility measurement consistent, accurate and unbiased.

Dust storm/sandstorms monitoring

Nephelometer networks are used to monitor dust storms, determine their origin and are used as early warning systems for towns and cities, ideal for desert regions.

Wood fire monitoring

Nephelometers real-time measurement of visibility allow 24 hour monitoring of haze from wood fires and other pollution. This allows corrective actions to be designed specifically for the problem rather than broad ranged (blanket) actions that only partly solve the problem.

PM2.5 correlation studies

The Nephelometer has been used in multiple correlation studies with PM2.5 monitors such as the TEOM and FDMS. Nephelometers, after sufficient correlation studies have been performed, can be used as a PM2.5 monitor. The Nephelometer will have greatly reduced maintenance compared to other PM2.5 monitors and retains a high proportion of VOC's missed by other instruments.

Global warming studies

The 3 wavelength Nephelometer is used for comprehensive measurement of particulate light scattering. This monitoring provides vital information on how particulates are affecting solar radiation the heating of the planets atmosphere and surface.

Mobile pollution monitoring

The Nephelometer is easy to install and relocate. It is also able to monitor on the road and has been used in mobile laboratories and even in the back of a car. The Nephelometer does not measure particulate with vibration sensitive parts (such as a microbalance) and thus can monitor on the road and be used for pollution mapping.

Bushfire monitoring

Nephelometers are ideal for Bushfire monitoring and detection. The Aurora Nephelometer is a low power instrument that doesn't use filters. Not using filters allows Nephelometers to detect extremely high loads of particulates during bushfires.

User list

Australia

NSW EPA

Victorian EPA

CSIRO Atmospheric Science

Grain Board Bunbury

Worsley Alumina

Brazil

University of Sao Paulo

CNPq- Conselho Nacional de Des.
Cientifico e Tecno Brasilia**Canada**

Environment Canada

China

Chinese Meteorological Authority

Beijing University

Finland

Finnish Meteorological Institute.

France

LSCE Gif

Universite du Littoral Cote d'Opale

University TOULON-VAR

Université de Paris Val de Marne,

Laboratoire d'Aérodologie

University P. Sabatier

CNRS Orme Des Merisiers GIP Sur Yvette
Cedex**India**

The Energy and Resource Institute (TERI)

Hong Kong

H.K. International Airport

ItalyCNR-ISAC Istituto di Scienze
dell'Atmosfera e del Clima**Japan**

Japan Meteorological Service

SwedenNILU Sweden (Swedish Meteorological
Institute)**Switzerland**World Meteorological Organisation,
Geneva (for use in Indonesia & Malaysia)**Taiwan**

Le & Der Ltd Taipei Taiwan

U.S.A.

Maryland Department of the Environment

Desert Research Institute

Tejon Ranch Air Monitoring Station

Tucson Power

University of California

Colorado State University

SCRIPPS Institute San Diego and
Colorado State UniversityTexas Commission of Environmental
Quality

Puget Sound Clean Air Authority