Australian/New Zealand Standard™

Methods for sampling and analysis of ambient air

Method 12.1: Determination of light scattering—Integrating nephelometer method

PREFACE

This Standard was prepared by the Joint Standards Australia/Standards New Zealand Committee EV-007, Methods for Examination of Air, to supersede AS/NZS 3580.12.1:2001, *Methods for sampling an analysis of ambient air*, Method 12.1, *Determination of light scattering—Integrating nephelometer method*.

The objective of this Standard is to provide a method for the measurement of light scattering produced by fine particles.

Most light scattering is derived from particles less than 2.5 µm. These particles affect visibility and are of concern to health. Some common sources of such particles are combustion processes including motor vehicle emissions, incineration, and some industrial processes.

The term 'informative' has been used in this Standard to define the application of the appendix to which it applies. An 'informative' appendix is only for information and guidance.

FOREWORD

Objects become visible to an observer when light from the object is detected by the observer. A particular object is seen against its surroundings by virtue of the difference in either intensity or wavelength of the radiation emanating from it compared with that emanating from its surroundings.

Light is attenuated through scattering and absorption by both gases and particles in the atmosphere, with the result that objects viewed at a distance become less visible than when viewed close-up. A dark object appears lighter with increasing distance and a light coloured object appears darker. In either case a loss of contrast occurs between the object and its surroundings until at a sufficiently large distance the object merges into the background. It is generally held that an object can be no longer distinguished from its background once the contrast has been reduced to some two percent.

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METHOD

1 SCOPE

This Standard sets out a continuous, direct-reading, instrumental method for determining the light-scattering attributable to the presence of particulate matter in a sample of ambient air. The light scattering coefficient as measured by this Standard is an indicator of the perceived visual degradation caused by suspended particles in the air.

2 REFERENCED DOCUMENTS

AS/NZS
3580 Methods for sampling and analysis of ambient air
3580.1.1 Part 1.1: Guide to siting air monitoring equipment

ISO/IEC
Guide 98 Uncertainty of measurement
Guide 98-3 Part 3: Guide to the expression of uncertainty in measurement (GUM 1995)

3 DEFINITIONS

For the purpose of this Standard the definitions below apply.

3.1 Full scale (FS)

The nominated maximum value for which an instrument has been calibrated.

3.2 Range

Nominal minimum and maximum values that an instrument is capable of measuring.

NOTE: The nominal range is specified by the lower and upper range limits in measurement units, e.g. 0 to 2000 Mm^{-1}.

3.3 Rise time

The time interval, after a step increase in input, between initial instrument response and 90% of final instrument response.

3.4 U_{95}

A measurement of uncertainty at a confidence interval of 95% according to ISO/IEC Guide 98-3.

3.5 Zero drift

The change in instrument response to filtered air over a 1 h period of continuous unadjusted operation.

4 PRINCIPLE

Attenuation of light passing through the atmosphere may be represented by the Beer-Lambert law:

$$I = I_o e^{-bx}$$

where

I = intensity of light at the observer

I_o = initial light intensity

x = path length of light (i.e. the object to observer distance)

b = extinction coefficient (due to absorption and scattering)

= $b_{ag} + b_{sg} + b_{ap} + b_{sp}$ where b is the extinction coefficient and the subscripts, a, s, g and p refer to absorption, scattering, gases, and particles respectively