



**NSAI**  
Standards

Irish Standard  
I.S. EN 16913:2017

Ambient air - Standard method for measurement of  $\text{NO}_3^-$ ,  $\text{SO}_4^{2-}$ ,  $\text{Cl}^-$ ,  $\text{NH}_4^+$ ,  $\text{Na}^+$ ,  $\text{K}^+$ ,  $\text{Mg}^{2+}$ ,  $\text{Ca}^{2+}$  in  $\text{PM}_{2,5}$  as deposited on filters

**I.S. EN 16913:2017**

*Incorporating amendments/corrigenda/National Annexes issued since publication:*

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NSAI  
1 Swift Square,  
Northwood, Santry  
Dublin 9

T +353 1 807 3800  
F +353 1 807 3838  
E standards@nsai.ie  
W NSAI.ie

Sales:  
T +353 1 857 6730  
F +353 1 857 6729  
W standards.ie

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## National Foreword

I.S. EN 16913:2017 is the adopted Irish version of the European Document EN 16913:2017, Ambient air- Standard method for measurement of  $\text{NO}_3^-$ ,  $\text{SO}_4^{2-}$ ,  $\text{Cl}^-$ ,  $\text{NH}_4^+$ ,  $\text{Na}^+$ ,  $\text{K}^+$ ,  $\text{Mg}^{2+}$ ,  $\text{Ca}^{2+}$  in  $\text{PM}_{2,5}$  as deposited on filters

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EUROPEAN STANDARD

EN 16913

NORME EUROPÉENNE

EUROPÄISCHE NORM

June 2017

ICS 13.040.20

English Version

**Ambient air - Standard method for measurement of  $\text{NO}_3^-$ ,  $\text{SO}_4^{2-}$ ,  $\text{Cl}^-$ ,  $\text{NH}_4^+$ ,  $\text{Na}^+$ ,  $\text{K}^+$ ,  $\text{Mg}^{2+}$ ,  $\text{Ca}^{2+}$  in PM<sub>2,5</sub> as deposited on filters**

Air ambiant - Méthode normalisée pour le mesurage de  $\text{NO}_3^-$ ,  $\text{SO}_4^{2-}$ ,  $\text{Cl}^-$ ,  $\text{NH}_4^+$ ,  $\text{Na}^+$ ,  $\text{K}^+$ ,  $\text{Mg}^{2+}$ ,  $\text{Ca}^{2+}$  dans la fraction PM<sub>2,5</sub> telle que déposée sur des filtres

Außenluft - Messverfahren zur Bestimmung von  $\text{NO}_3^-$ ,  $\text{SO}_4^{2-}$ ,  $\text{Cl}^-$ ,  $\text{NH}_4^+$ ,  $\text{Na}^+$ ,  $\text{K}^+$ ,  $\text{Mg}^{2+}$ ,  $\text{Ca}^{2+}$  in PM<sub>2,5</sub> nach Abscheidung auf Filtern

This European Standard was approved by CEN on 27 February 2017.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

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**CEN-CENELEC Management Centre: Avenue Marnix 17, B-1000 Brussels**

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## **EN 16913:2017 (E)**

### **European foreword**

This document (EN 16913:2017) has been prepared by Technical Committee CEN/TC 264 “Air quality”, the secretariat of which is held by DIN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by December 2017, and conflicting national standards shall be withdrawn at the latest by December 2017.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

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## Introduction

This European Standard describes how to measure a specified range of anions and cations in  $PM_{2,5}$  as deposited on filters.

The EU Air Quality Directive 2008/50/EC [1] on ambient air quality and cleaner air for Europe requests the measurements of concentrations of  $NO_3^-$ ,  $SO_4^{2-}$ ,  $Cl^-$ ,  $NH_4^+$ ,  $Na^+$ ,  $K^+$ ,  $Mg^{2+}$ ,  $Ca^{2+}$  in  $PM_{2,5}$  at rural background locations. In Annex IV of the Directive, guidance for these measurements is given.

Measurements of anions and cations in PM are being performed by the EMEP programme, mainly by using a filterpack with limited particle size selectivity. The cooperative programme for monitoring and evaluation of long-range transmission of air pollutants in Europe (EMEP) was launched in 1977 as a response to the growing concern over the effects on the environment caused by acid deposition. EMEP was organized under the auspices of the United Nations Economic Commission for Europe (UNECE). Today EMEP is an integral component of the cooperation under the Convention on Long-range Transboundary Air Pollution.

Directive 2008/50/EC requires that measurements at rural sites, where appropriate, are coordinated with the monitoring strategy and measurement programme of EMEP. Although, there are different sampling procedures involved, a common approach is used for the analytical procedure.

In order to keep the agreement between existing EMEP data and data to be produced using this European Standard as close as possible, the EMEP protocol has been taken as starting point for this European Standard. This European Standard differs from the EMEP protocol in the sense that measurement of anions and cations are done in  $PM_{2,5}$ , and that a number of critical parameters (e.g. choice of filter material) are fixed.

Additional attention is given to harmonizing these critical parameters with elemental carbon/organic carbon (EC/OC) measurements and with  $PM_{2,5}$  measurements as well, as sampling is usually done simultaneously.

**EN 16913:2017 (E)****1 Scope**

This European Standard specifies a method for the determination of the mass concentration of water soluble  $\text{NO}_3^-$  (nitrate),  $\text{SO}_4^{2-}$  (sulphate),  $\text{Cl}^-$  (chloride),  $\text{NH}_4^+$  (ammonium),  $\text{Na}^+$  (sodium),  $\text{K}^+$  (potassium),  $\text{Mg}^{2+}$  (magnesium),  $\text{Ca}^{2+}$  (calcium) in  $\text{PM}_{2,5}$  as deposited on filters.

This European Standard describes the analytical procedures for determining anions and cations as part of the  $\text{PM}_{2,5}$  particulate phase, sample extraction and analysis of anions and cations by ion chromatography. Sampling onto filters will be done in accordance with EN 12341 for  $\text{PM}_{2,5}$ .

NOTE 1 Alternatively, cations, excluding ammonium, can be analysed by inductively coupled plasma optical emission spectrometry (ICP-OES). Ammonium can also be analysed by photometry or conductometry.

This European Standard can be used for the measurements of anions and cations as required by Directive 2008/50/EC. The method does not take into account the possible losses during sampling due to evaporation.

NOTE 2  $\text{NO}_3^-$ ,  $\text{Cl}^-$ ,  $\text{NH}_4^+$  are part of the volatile fraction of  $\text{PM}_{2,5}$ , and the concentrations determined using this standard can be used as minimum values for the concentrations of these ions in  $\text{PM}_{2,5}$ .  $\text{NO}_3^-$ ,  $\text{NH}_4^+$ ,  $\text{Cl}^-$  are usually up to 30 % underestimated due to evaporational losses from the filter during sampling.

This European Standard may be used at rural and urban background sites and road sites that are in accordance with the siting criteria of Directive 2008/50/EC.

This European Standard is applicable to the measurement of anion/cations in  $\text{PM}_{2,5}$  samples corresponding to  $\text{PM}_{2,5}$  mass concentrations between approximately  $1 \mu\text{g}/\text{m}^3$  (i.e. the limit of detection of the standard measurement method (EN 12341) expressed as its uncertainty) up to  $120 \mu\text{g}/\text{m}^3$ .

The validated range of the anion and cation concentrations based on the field validation measurements is presented in Table 1.

**Table 1 — Validated range of anions and cations**

Component	Minimum $\mu\text{g}/\text{m}^3$	Maximum $\mu\text{g}/\text{m}^3$
$\text{Cl}^-$	0,001	1,4
$\text{NO}_3^-$	0,002	29
$\text{SO}_4^{2-}$	0,05	13
$\text{Na}^+$	0,003	1,9
$\text{NH}_4^+$	0,04	11
$\text{K}^+$	0,003	0,49
$\text{Mg}^{2+}$	0,001	0,38
$\text{Ca}^{2+}$	0,002	0,72

See Annex A for the statistical analysis of the field validation measurements.

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