Irish Standard Recommendation
S.R. CEN/TR 16998:2016

Ambient air - Report on nitro- and oxy-PAHs - Origin, toxicity, concentrations and measurement methods

S.R. CEN/TR 16998:2016

Incorporating amendments/corrigenda/National Annexes issued since publication:

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This document is based on:	*Published:*
CEN/TR 16998:2016	2016-11-30

This document was published under the authority of the NSAI and comes into effect on:	ICS number:
2016-12-18	13.040.20
	NOTE: If blank see CEN/CENELEC cover page

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National Foreword

S.R. CEN/TR 16998:2016 is the adopted Irish version of the European Document CEN/TR 16998:2016, Ambient air - Report on nitro- and oxy-PAHs - Origin, toxicity, concentrations and measurement methods

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TECHNICAL REPORT

RAPPORT TECHNIQUE

TECHNISCHER BERICHT

CEN/TR 16998

November 2016

ICS 13.040.20

English Version

Ambient air - Report on nitro- and oxy-PAHs - Origin, toxicity, concentrations and measurement methods

Air ambiant - Rapport sur les nitro- et oxy-HAP - Origine, toxicité, concentrations et méthodes de mesure

Außenluft - Bericht über Nitro- und Oxy-PAHs - Herkunft, Toxizität, Konzentrationen und Messverfahren

This Technical Report was approved by CEN on 21 October 2016. It has been drawn up by the Technical Committee CEN/TC 264.

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Ref. No. CEN/TR 16998:2016 E

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European foreword

This document (CEN/TR 16998:2016) has been prepared by Technical Committee CEN/TC 264 “Air quality”, the secretariat of which is held by DIN.

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Introduction

Nitro-PAHs and oxy-PAHs are found in ambient air samples and there are strong indications that they are as harmful as PAHS. Several compounds are classified as probably carcinogenic for humans (see Table in Annex A) and nitro-PAHs are reported to be strongly mutagenic. Photooxidation of volatile PAHs gives rise to the formation of secondary aerosols (Chan et al. 2009, Kautzman et al. 2010, Shakya and Griffin, 2010).

1-Nitropyrene and 2-nitrofluorene are discussed as marker compounds for diesel exhaust and other combustion processes. 2-Nitropyrene and 2-nitrofluoranthene are good marker substances for the formation of nitro-PAHs by secondary reactions.

This Technical Report presents the state of the art of the oxy- and nitro-PAHS topics.

1 Scope

This Technical Report is focused on the presence of nitro- and oxy-PAHs in ambient air. It describes how nitro- and oxy-PAH are formed, what typical concentrations are found, what is known about their toxicity, and what sampling and measurement techniques are available.

The conclusions of this report are that nitro- and oxy-PAHs concentrations are present in the atmosphere in levels that are of concern regarding their high toxicity. Information on the presence of these compounds in ambient air is as relevant as information about PAHs. Validated techniques for the measurement of nitro- and oxy-PAHs are available.

2 Symbols and abbreviations

DNA	Deoxyribonucleic acid
EI	Electron ionization
CD	Chemiluminescence detection
FD	Fluorescence detection
GC-MS	Gas chromatography – mass spectrometry
GC-NICI-MS	Gas chromatography – negative ion chemical ionization – mass spectrometry
HPLC	High performance liquid chromatography
HPLC-FD	HPLC – fluorescence detection
HPLC-CD	HPLC – chemiluminescence detection
IARC	International Agency for Research on Cancer
LC	Liquid chromatography
MS	Mass spectrometry
NICI	Negative ion chemical ionization
Nitro-PAHs	Nitrated polycyclic aromatic hydrocarbons
Oxy-PAHs	Oxygenated polycyclic aromatic hydrocarbons
PAHs	Polycyclic aromatic hydrocarbons
SPE	Solid phase extraction
ToF-MS	Time of flight mass spectrometry

3 Literature overview

3.1 Nitro-PAHs

3.1.1 Sources

3.1.1.1 General

Nitro-PAHs in the atmosphere originate mainly from combustion sources and are produced from both gas and heterogeneous phase reactions of the parent PAHs with atmospheric oxidants such as NO_3, N_2O_5, O_3, OH and peroxide radicals (Arey et al., 1986; Atkinson et al., 1990; Keyte et al., 2013; Pitts et al., 1985; Pitts Jr et al., 1978) in the presence of nitrogen oxides.