



Indoor and Outdoor pollution - measurements of existing and emerging emissions

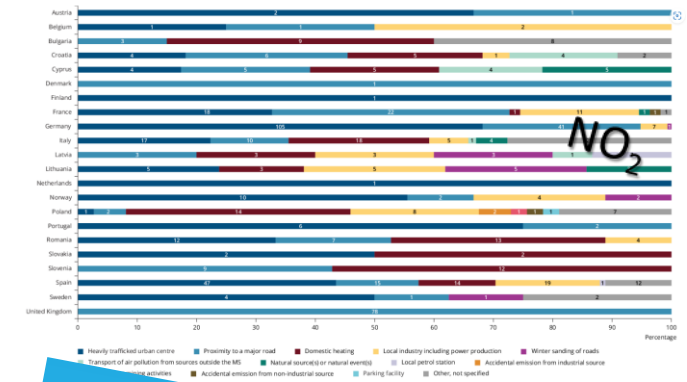
Metrology for Regulation

Open Public Consultation

[Panayot Petrov](#), Kieran O'Daly

Outdoor pollution and NO₂ emissions

- Poor air quality - a persistent problem in Europe, harming health
- Air quality plans focusing on reducing levels of nitrogen dioxide
- Road traffic – 64 % of NO₂ limits exceedance of air quality standards, and 100 % for some countries
- About 90 % of the NINC** is found in regions that meet the WHO guideline 40 µg m⁻³ for NO₂
- Undergoing revision of 1) Ambient Air Quality, 2) Industrial Emissions Directive and 3) **Introduction Euro 7 emission standards**
- Practical recommendations for real-driving emissions (RDE) tests with Portable Emissions Measurement Systems (PEMS)***, relevant for Euro 6 – One point + zero span calibration recommended



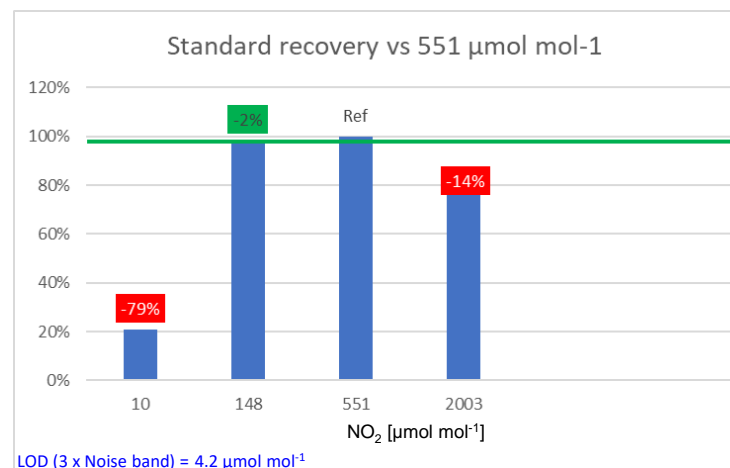
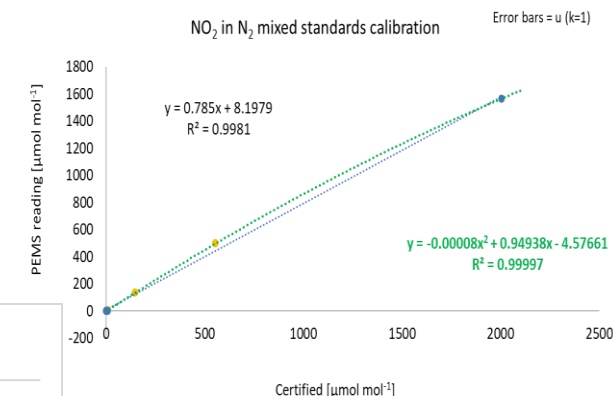
*[Managing air quality in Europe — European Environment Agency \(europa.eu\)](https://europeanenvironmentagency.europa.eu)

Sourangsu Chowdhury *et al* 2021 *Environ. Res. Lett.* **16 035020

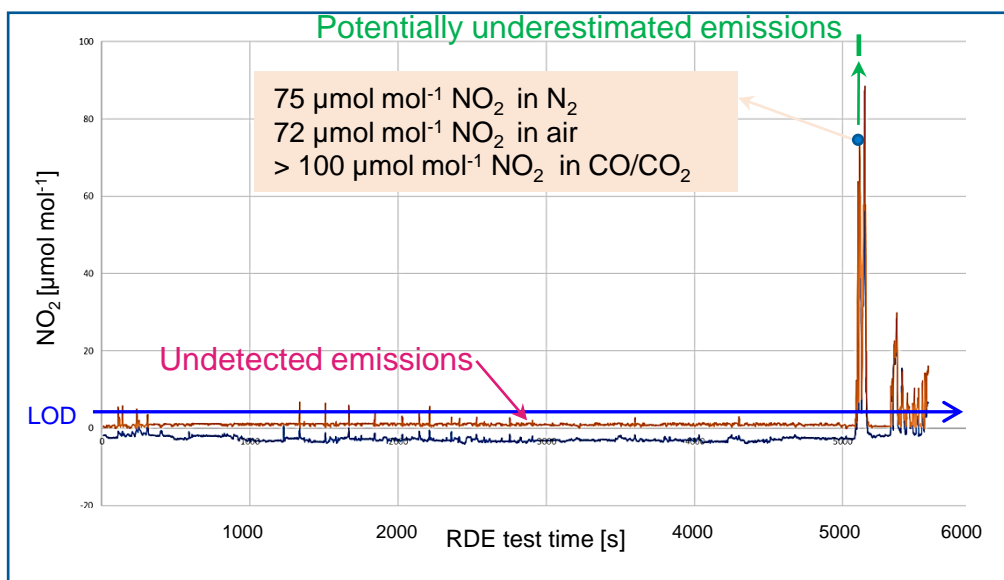
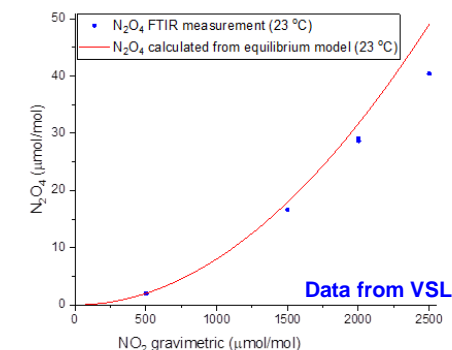
***Valverde Morales V and Bonnel P, On-road testing with Portable Emissions Measurement Systems (PEMS) - Guidance note for light-duty vehicles, EUR 29029 EN, Publications Office of the European Union, Luxembourg, 2018, ISBN 978-92-79-77345-7, doi:10.2760/08294, JRC109812

PEMS calibration and measurement accuracy

- PEMS calibration – one point, linear fit, blank and drift corrected, N_2O_4 corrected
- Normalised standards recovery vs. gravimetric value
- Data from RDE test by VTT (2023), using two different PEMS on one vehicle, calibrated with $625 \mu\text{mol mol}^{-1} \text{NO}_2$ in N_2



Effect of calibration gas matrix composition on reference standard recovery (values in cmol mol^{-1})	10 $\mu\text{mol mol}^{-1} \text{NO}_2$ relative recovery vs N_2 matrix
4.5 CO + 18 CO ₂	89 %
0.5 CO + 14 CO ₂	65 %
80 N ₂ + 20 O ₂	107 %



Emerging indoor air pollutants

NEWS

Science & Environment

'Forever chemicals' still in use in UK make-up

🕒 13 January

PFAS levels in ground and air could be higher than expected, research suggests

High levels of toxic 'forever chemicals' found in New Hampshire soil samples raise questions about food and water pollution

Toxic 'forever chemicals' contaminate indoor air at worrying levels, study finds

Food and water were thought to be the main ways humans are exposed to PFAS, but study points to risk of breathing them in

We're Breathing PFAS: Study Finds Harmful Forever Chemicals in Indoor Air

New measurement technique detected PFAS chemicals in the air of kindergarten classrooms, university offices, and a home

NEWS

Science & Environment

Experts call for tighter limits on 'forever chemicals' in water

🕒 13 hours ago · 💬 Comments

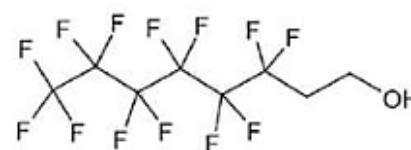
Emerging pollutants in indoor air – PFAS



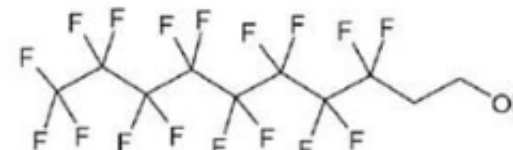
- Volatile PFAS - fluorotelomer alcohols, prevalent 6:2 FTOH and 8:2 FTOH and the biotransformed perfluorinated alkyl acids*
- Heavily environmentally persistent with large global warming potential, also bio-accumulative and potentially damaging to public health.
- Fluorinated compounds – Degradation products of higher PFAS, coolants, in dielectric fluids, propellants, and as refrigerants.
- Lack of available reference materials to take precise atmospheric measurements of these compounds.

Contaminant	Indoor air concentration /pg m ⁻³	Outdoor air concentration /pg m ⁻³
PCBs	9000 (n = 20, homes and offices)	310 (n = 25)
PBDEs	110 (n = 67, homes and offices)	21 (n = 6)
Hexabromocyclodecane (HBCDD)	250 (n = 33, homes)	37 (n = 5)
Perfluorooctane sulfonate (PFOS)	38 (n = 20, homes)	2.3 (n = 10)
Perfluorooctanesulfonic acid (PFOA)	52 (n = 20, homes)	3.5 (n = 10)

DEFRA 2022



6:2 FTOH



8:2 FTOH

Properties of F-gases

Chemical Formulas:

HFCs, PFCs, NF₃, SF₆

Lifetime in Atmosphere:

HFCs: up to 270 years

PFCs: 2,600–50,000 years

NF₃: 740 years

SF₆: 3,200 years

Global Warming Potential (100-year):¹

HFCs: up to 12,400

PFCs: up to 11,100

NF₃: 16,100

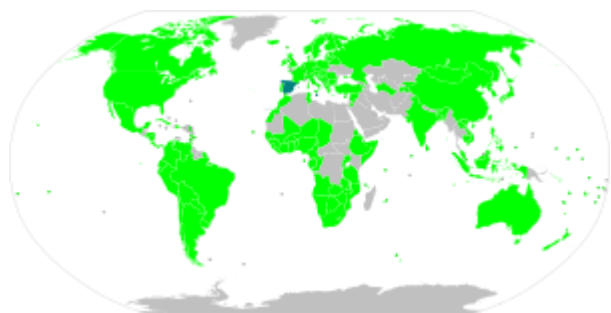
SF₆: 23,500

*"The Air That We Breathe: Neutral and Volatile PFAS in Indoor Air", Environ. Sci. Technol. Lett. 2021, 8, 10, 897–902

FOSE - perfluorooctane sulfonamido ethanol, FOSA - perfluorooctane sulfonamide, FTOH - fluorotelomer alcohol, PFAA - perfluorinated alkyl acids

PFAS & HFC's – current regulatory status

- The Montreal Protocol – 1987
- Kigali Amendment to the Montreal Protocol is an international agreement to gradually reduce the consumption and production of hydrofluorocarbons (HFCs). It is a legally binding agreement designed to create rights and obligations in international law



HFC agreed phase out from 2020 to 2050

ECHA publishes PFAS restriction proposal

ECHA/NR/23/04

The details of the proposed restriction of around 10 000 per- and polyfluoroalkyl substances (PFASs) are now available on ECHA's website. ECHA's scientific committees will now start evaluating the proposal in terms of the risks to people and the environment, and the impacts on society.

Helsinki, 7 February 2023 – The proposal was prepared by authorities in Denmark, Germany, the Netherlands, Norway and Sweden and submitted to ECHA on 13 January 2023. It aims to reduce PFAS emissions into the environment and make products and processes safer for people.



ECHA receives more than 5 600 comments on PFAS restriction proposal

26/09/2023

More than 4 400 organisations, companies and individuals submitted comments and information on the proposal to restrict per- and polyfluoroalkyl substances (PFAS) in the European Economic Area.

Priorities for the 2022 to 2023 UK REACH work programme

1. Per- and polyfluoroalkyl substances (PFAS)

Description of proposal

A proposal to investigate the risks of per- and polyfluoroalkyl substances (PFAS) and consider how best to manage any identified risks.

Acknowledgment

The authors are grateful to the NPL colleagues David R. Worton, Sivan Van Aswegen, Calum Bavin, Yoana Hristova, Nana Akuffo, and to VSL and VTT colleagues Evtim Efremov and Pettinen Rasmus for the performed experiments and provided data and figures, used in this presentation. The presented data, related to outdoor air pollution was generated for the 19ENV09 project “Improved vehicle exhaust quantification by portable emission measurement systems metrology”. This project (MetroPEMS,19ENV09) has received funding from the EMPIR programme co-financed by the Participating States and from the European Union's Horizon 2020 research and innovation programme.



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