QUARTERLY REVIEW

Tyre Insights

STATE OF THE SCIENCE

EMISSIONS ANALYTICS

Tyre Insights is the quickest way of distilling cutting edge tyre science to essential facts, empowering your business strategically to plan products that meet the needs and regulations of tomorrow.

Overview

Emissions Analytics' new Tyre Insights publications will be a quarterly report offering an accessible synopsis of the latest developments in tyre emissions and sustainability research. In the last five years, the volume of research on in-use, manufacturing and end-of-life tyre impacts has grown rapidly. Much of this is in the academic literature and not easy to access or understand how it sits within the wider state of the science.

Research methods

Experts at Emissions Analytics and top international universities are tracking the latest research so that Tyre Insights can offer a regular analysis of the content and implications of this fast-moving field. The report will help to highlight where the science is still solidifying and where there may be ambiguous or conflicting data.

Any relevant peer-reviewed academic paper within the scope of this report is studied, assessed and summarised, making a critical judgement on the quality, importance and relevance of the material. Themes cutting across multiple reports will be brought out.

The findings will be put in the context of the latest findings from Emissions Analytics' own proprietary research, to give additional depth and analysis. If deeper insight it required, Emissions Analytics offers complementary emissions databases, test methods and consultancy.

SCOPE

Tyre particle characterisation
- "Microplastics"
- Size distribution
- Chemical composition

Environmental measurement
- Methods and uncertainties
- Tracers – organic and inorganic
- Ultimate fate

Human health effects
- Inhalation
- Ingestion
- In vivo, in vitro

Marine effects
- 6PPD and 6PPD-quinone
- Leachate
- Sediment

Soil and roadside effects
- Road dust and roadside snow
- Effects on animals, plants
- Indirect effects on food chain

Air quality effects
- Modelling concentrations
- Characterising airborne particles
- Estimating exposures

Emissions rates and source measurement
- On-vehicle and laboratory sampling methods
- Variables affecting emissions rates – speed, acceleration, vehicle weight, weather
- Interferences from road wear, brake wear and resuspension

Mitigations
- Wastewater treatment, sludge
- Wear reduction at source
- Particle sinks – SUDs, porous pavements

Human health effects

Tyre Wear Particles (TWPs) are respirable and will deposit in the lower airway, possibly exacerbating lung cancer and COPD risk.

TWPs tend to induce a negative cellular response, with inflammation increasing with dosage.

More research is required to distinguish the health impacts of TWPs from other Non-Exhaust Emissions.

The health effects of a particle are highly dependent on its physicochemical characteristics[1] and in this domain, Tyre Wear Particles (TWPs) are no different. It is well known that exposure to PM2.5, the size fraction of PM defined as respirable, can reach the lower airway. PM2.5 exacerbates asthma and chronic obstructive pulmonary disease (COPD), as well as causing death through lung cancer and other cardiovascular diseases[2]. These problems are exacerbated by the presence of Ultrafine particles (UFPs) where dp ‹100 nm a major component of TWPs are particularly worrisome as they reach and deposit efficiently in the alveolar region and cross cellular membranes[3].

There are few epidemiological studies, which are the golden standard of toxicological research on the health effects of TWPs, our literature search for these studies led to few results and it is worth noting that these studies can't differentiate effectively between all types of Non-Exhaust Emissions (NEEs) and most studies focus specifically on tracers of NEEs Cu, Fe, Zn and S. Lipfert et al 2006[4], used a cohort of 70,000 male US veterans, found that there have been modest changes in the health outcomes, specifically mortality risks, even with a reduction in tailpipe emissions, hinting that NEEs may be the primary driver of these mortality risks. The authors also admit that there are limitations in their monitoring data.

Read more

References

1. Baensch-Baltruschat, B., Kocher, B., Stock, F. & Reifferscheid, G. *Tyre and road wear particles (TRWP) – A review of generation, properties, emissions, human health risk, ecotoxicity, and fate in the environment.* Science of the Total Environment vol. 733 137823 (2020).
2. Karlsson, H. L., Holgersson, Å. & Möller, L. *Mechanisms related to the genotoxicity of particles in the subway and from other sources.* Chem. Res. Toxicol. 21, 726–731 (2008).
3. Geiser, M. et al. *Ultrafine Particles Cross Cellular Membranes by Nonphagocytic Mechanisms in Lungs and in Cultured Cells.* Environ. Health Perspect. 113, 1555–1560 (2005).
4. Lipfert, F. W., Wyzga, R. E., Baty, J. D. & Miller, J. P. *Traffic density as a surrogate measure of environmental exposures in studies of air pollution health effects: Long-term mortality in a cohort of US veterans.* Atmos. Environ. 40, 154–169 (2006).

CONTENT HIGHLIGHTS

— New edition every three months
— Issue 1 will contain an overview on all main topics, to give a solid foundation
— Subsequent issues will typically cover two or three areas of current interest in greater detail
— Introduction from Emissions Analytics on high-level trends, including latest regulatory and media activity
— Around 50 pages of condensed insight, compiled critically
— Researched by experts from universities including Imperial College London, the University of Cambridge, and many others

ACCESS

— Five user logins per corporate subscription
— Email alerts when new editions published
— Access to previous issues
— Unique access to select presentations from Emissions Analytics' Tyre Emissions & Sustainability conferences

How to order

Contact our sales team on
+44 (0)20 7193 0489

Or email
insights@emissionsanalytics.com

About Emissions Analytics

Emissions Analytics is proud to run testing projects globally. Headquartered near Oxford, in the United Kingdom, we have bases in North America and Europe, giving us the ability to test a multitude of applications in a wide range of locations.

Unencumbered by vested interests, and technology agnostic, Emissions Analytics compiles large databases of independent test data to give unrivalled market insights, and delivers unbiased test results on real-world product performance.

Emissions Analytics Ltd
Unit 2 CR Bates Industrial Estate
Stokenchurch
High Wycombe
Buckinghamshire HP14 3PD
United Kingdom