

# Magee Scientific

Aerosol

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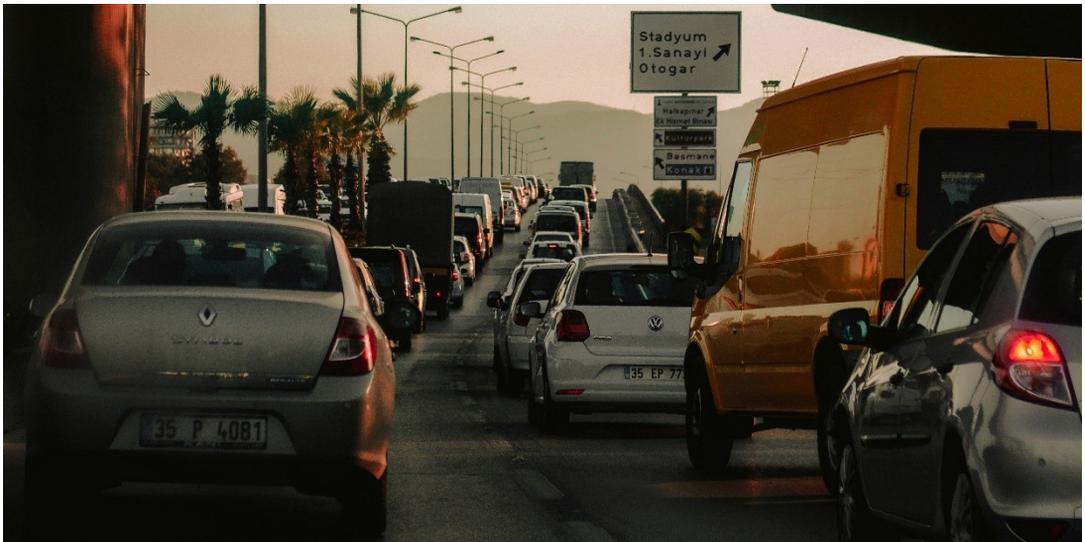
## SPIDer™ -

## Super Polluter IDentifier

**World's first measurement system for independent identification of vehicles that disproportionately contribute to vehicle fleet emissions**

**Real world vehicle emission factor measurements for Black Carbon (and NOx)**

**On-road chasing method**



### KEY FEATURES OF SPIDer™

- Real world measurements
- Methodology for monitoring emissions of the in-use vehicle fleet
- Simple instrumentation set-up
- Fleet and single vehicle measurements
- Contribution measurements based on vehicle type, age, fuel etc.
- Identification of super polluters

# Why is Black Carbon harmful

Black carbon is a global environmental problem that has negative implications for both human health and our climate. Black carbon from traffic is a major contributor to the fine particle (PM2.5) in urban environments and its negative effects on health have long been recognized and studied for decades. Inhalation of black carbon is associated with health problems including respiratory and cardiovascular disease, cancer, and birth defects<sup>1</sup>.

## Measuring emission factors vs. concentrations

Describing aggregate emissions from all road traffic is one way of measuring the impact of traffic on air pollution, but for a more fine-grained picture, measurements are needed per vehicle. One way of describing these emissions is by emission factors, which relate the quantity of emissions to the activity that generates them. Most emission factors are estimated by laboratory tests, which can only evaluate a limited number of vehicles and cannot replicate real driving conditions. To overcome these limitations, 'real-world' emission factor measurement techniques have been developed, which can measure emissions by following travelling vehicles (the chasing method). This method not only provides more realistic emissions estimates, it can also measure a large number of vehicles over a short period of time and capture a range of emission factors to measure a distribution, which is more representative than a single value.

## SPIDer™ provides means in addressing two key challenges

- How to reduce the problem of urban pollution, as painlessly as possible?
- How to quantify effectiveness of regulations addressing traffic pollution?
- Which part of traffic (vehicles) contribute to overall air pollution the most?

## Added value of SPIDer™

Measurement and interpretation system enables mobile measurements of Black Carbon emission factors for:

- Each individual vehicle and its contribution to pollution.
- Vehicle fleet and its contribution to pollution.

A fleet of vehicles can be an arbitrary grouping of vehicles based on their characteristics: manufacturer, engine type, age, vehicle type, EURO emission scale...

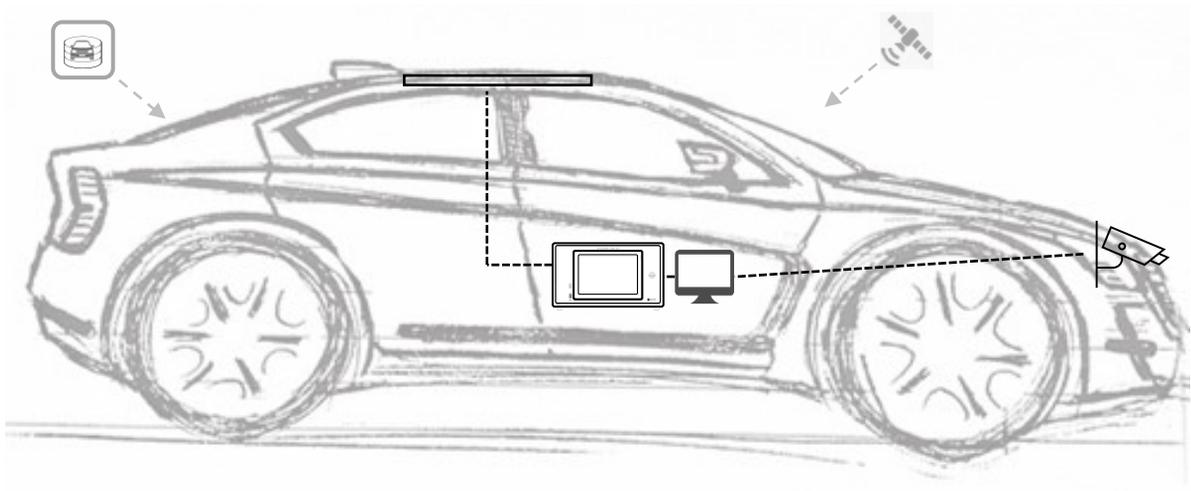
The measured and interpreted data provide a whole new insight into traffic pollution, as SPIDer™ is the first system to allow direct and real-world pollution measurements. This will give the users a tool to design corrective actions:

- Selective vehicle elimination - driving bans in the city centers for the selected vehicle type.
- Selective limitation for city center entry.
- Prohibition of entry into the country for major pollutants (Customs Administration - measurements at border crossings).
- Identification of vehicles using lower quality fuels (Customs Administration - use of fuel oil).
- Re-definition of environmental standards based on real, road-based emission data.

<sup>1</sup> Janssen, N., Ed.: Health effects of black carbon, World Health Organization, Regional Office for Europe, Copenhagen, 2012.

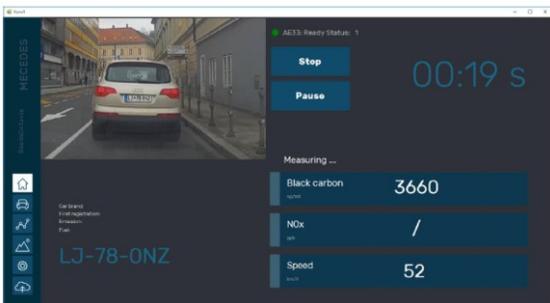
<sup>2</sup> European Commission DG Environment, Black carbon emissions of individual cars measured under real conditions, News Alert Service, 7 January 2016 Issue 441

# SPIDer™: Principle of operation



SPIDer™ set up: computer with SPIDer application, Magee Scientific Aethalometer® AE43, battery, CO2 sensor, cyclone, GPS, inlet, Smart-EYE.

SPIDer™ and on-road chasing method: measuring exhaust plume of a vehicle by chasing it on road. In the first stage a background concentrations for Black Carbon and CO2 are determined. Smart-EYE using machine vision recognizes the license plate and retrieves relevant vehicle information: vehicle type, engine type, age, displacement, fuel type or other. Measurements of Black Carbon and CO2 in exhaust plume start when right conditions are determined, automatically or manually. In the last stage emission factors are calculated and SPIDer™ determines whether vehicle is super polluter.



SPIDer™ application: during measurement Smart-EYE recognizes the license plate and retrieves relevant vehicle information (left). Real-time display of Black Carbon and CO2 concentration for emission factor determination.

## Super polluter

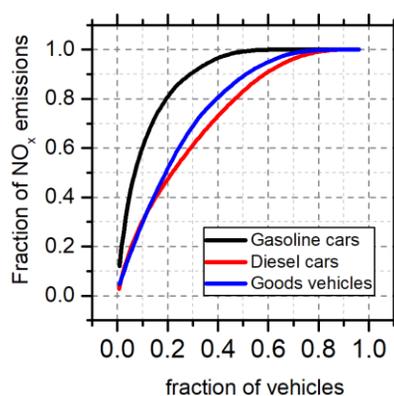
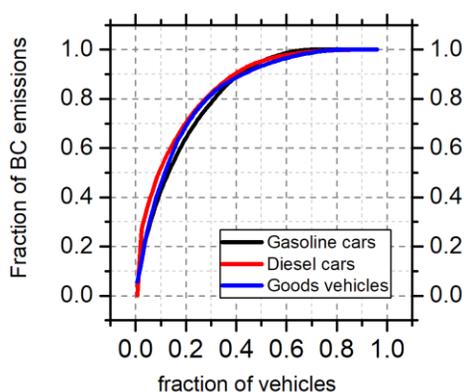


Vehicles that disproportionately contribute to total fleet emissions.

Not only old vehicles but also new vehicles that are not properly maintained.

Vehicles that were released to the market with fraudulent emission compliance tests (Dieselgate).

Example of 'super polluters' contribution in 2017 case study in Slovenia:



Contribution of super polluters: 25% of vehicles contribute from 53% to 85% to the total fleet emissions. 25% of highest emitting diesel cars contributed 76% of BC and 53% of NOx emissions.

## Eliminating super polluters would significantly reduce total vehicle fleet emissions.

*It is imperative to identify super polluters first.*



Scan the code for more info

### GENERAL INQUIRIES:

SPIDer™ is brought to you by Aerosol d.o.o. and Analitica d.o.o., Slovenia. Please contact Aerosol d.o.o. for more details.



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