

John Cooper
Director General

Urban Air Quality and Diesel Cars

Insights for meeting EU standards in our cities

Strasbourg, 6th February, 2018

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- About Concawe, and FuelsEurope
 - Understanding causes of Urban Air Quality non-compliance
 - Real driving emissions and latest regulation for cars
 - The emissions of each individual new car
 - The effect of new cars on urban air quality – two scenarios
 - Recommendations and best practice
 - Conclusions

One Association – two divisions

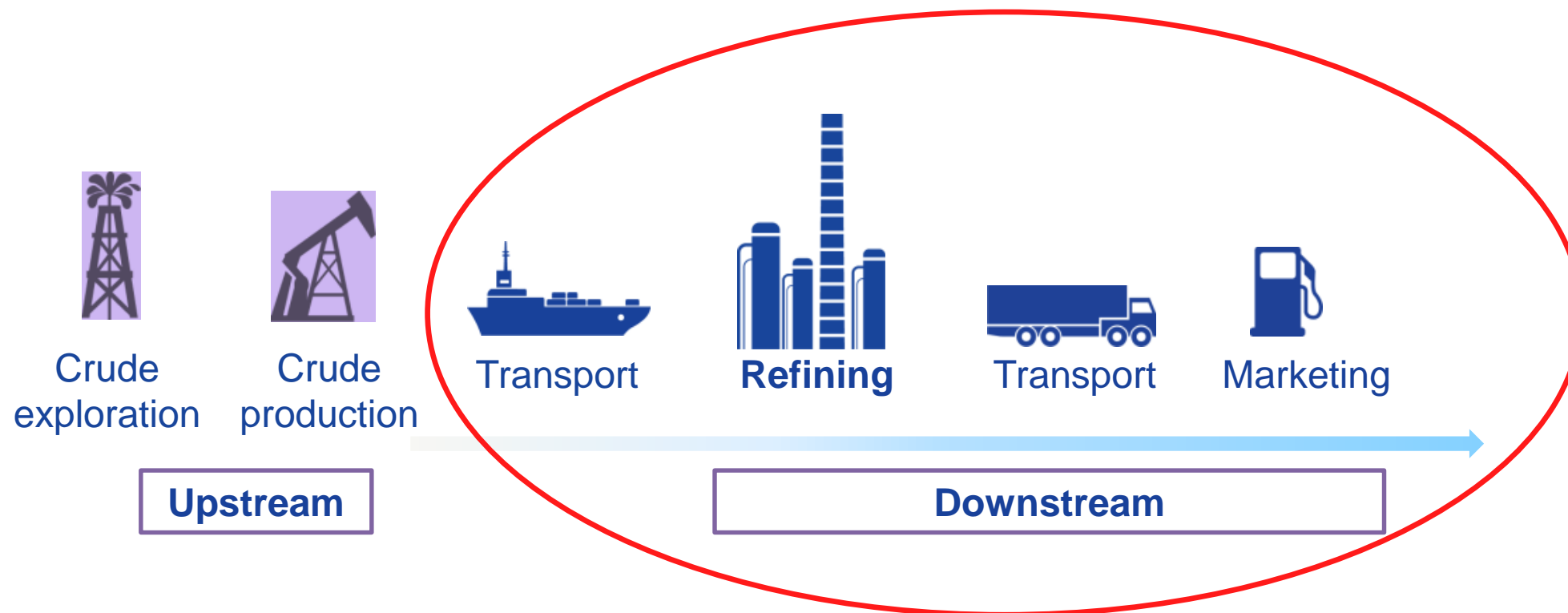


“REFINING PRODUCTS FOR OUR EVERYDAY LIFE”



“ENVIRONMENTAL SCIENCE FOR THE EUROPEAN REFINING INDUSTRY”

FuelsEurope represents the voice of the downstream sector of the EU oil industry



82 mainstream refineries with a primary capacity of 700 mln ton/y in EU28 + Norway and Switzerland.

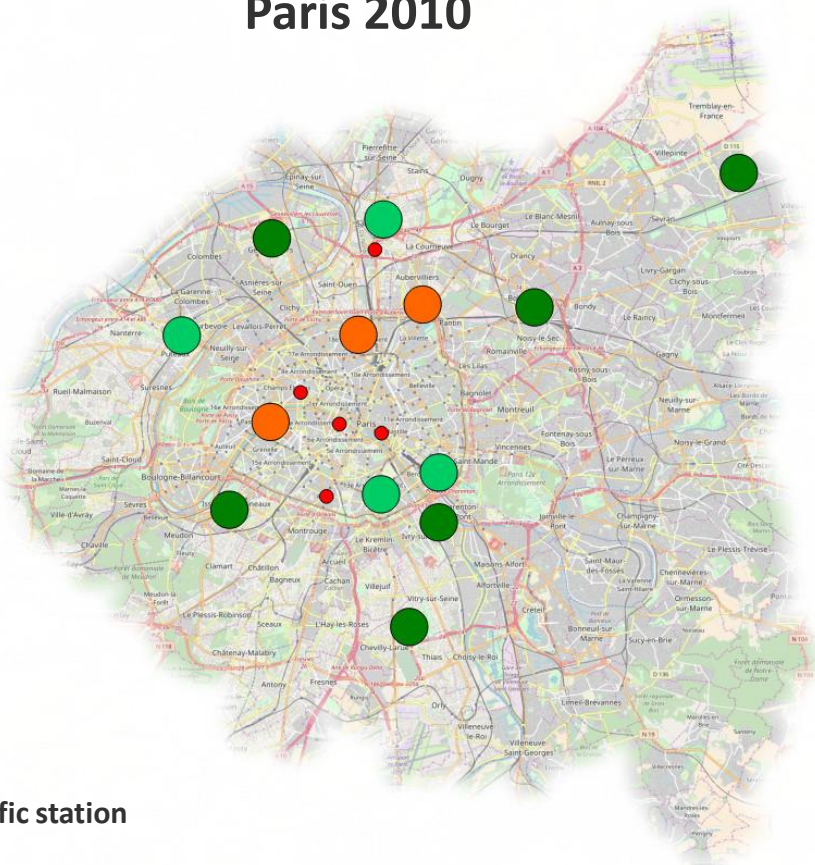
FuelsEurope represents 42 Member Companies ≈ 100% of EU Refining



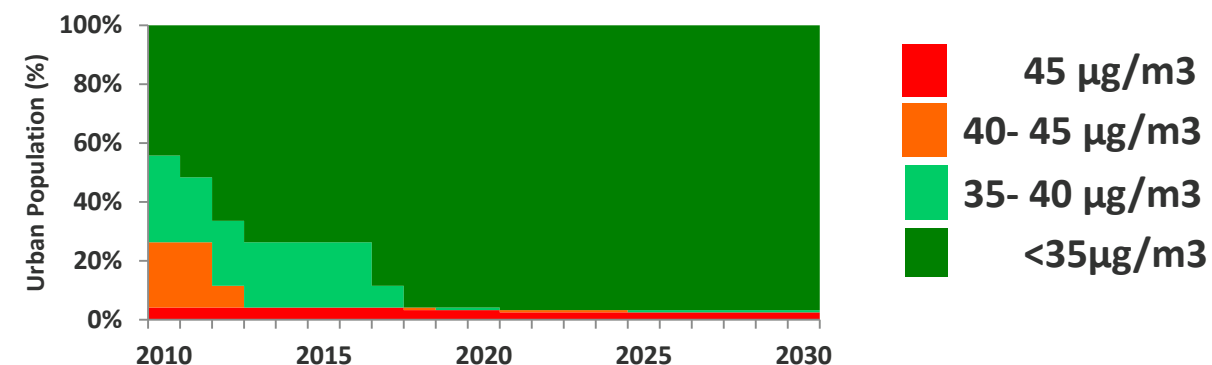
Understanding Air Quality Non-compliance

Data compiled from many monitoring stations in every city

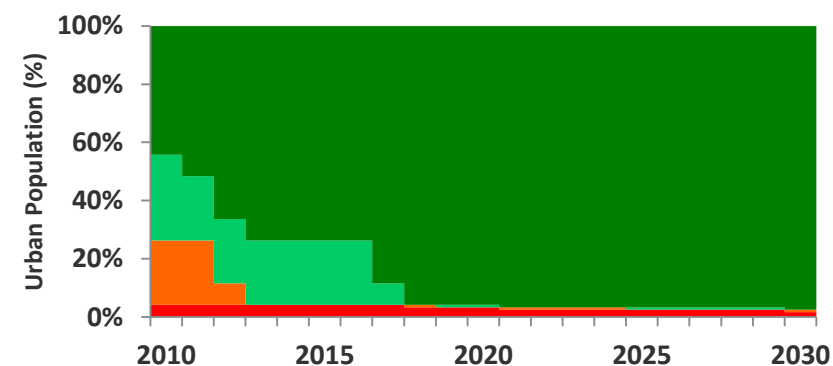
Paris 2010



Population Exposure to NO₂ in Paris
(Ricardo Median)

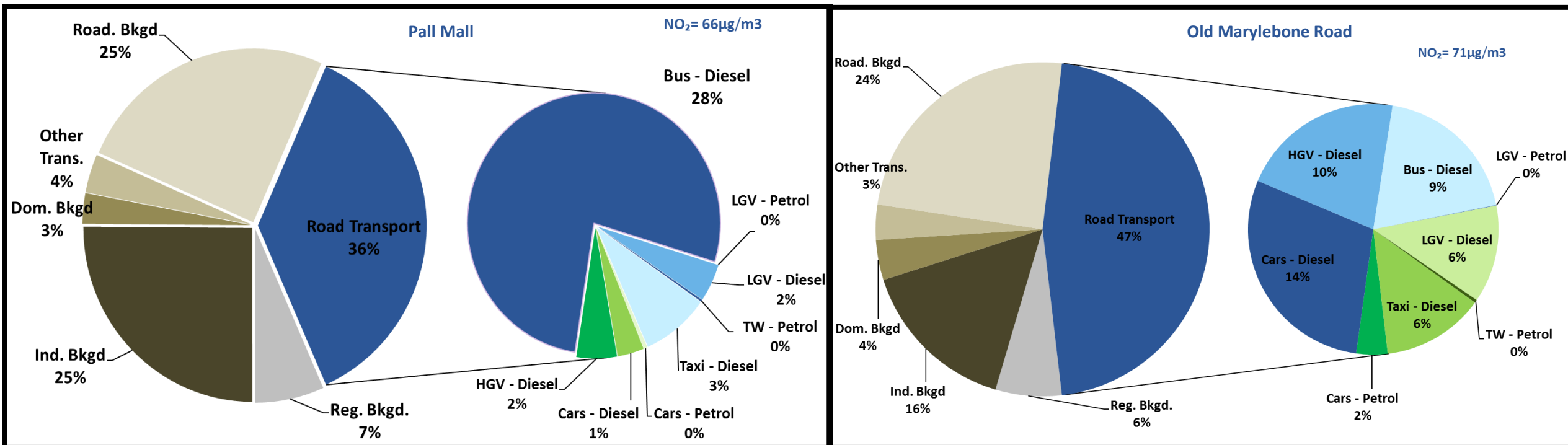


Population Exposure to NO₂ in Paris
(ZEV Scenario)



Example City: Source Attribution for London's Hot Spots (Samples for NO₂ from UK DEFRA)

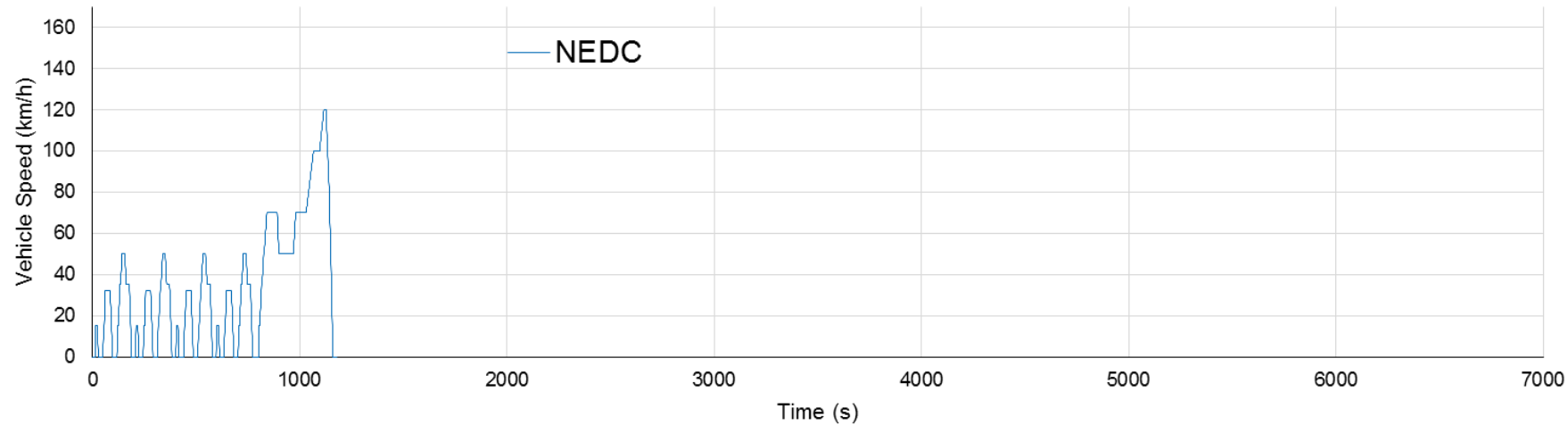
In two separate roads in London, the source attribution picture is quite different. Therefore, different measures may be needed to address the issue.



*Concawe project completed by Aeris Europe

The New European Drive Cycle (NEDC), used since the 1990s, requires relatively light load and low speed engine operating conditions

Drive cycles used for Euro 6 passenger cars

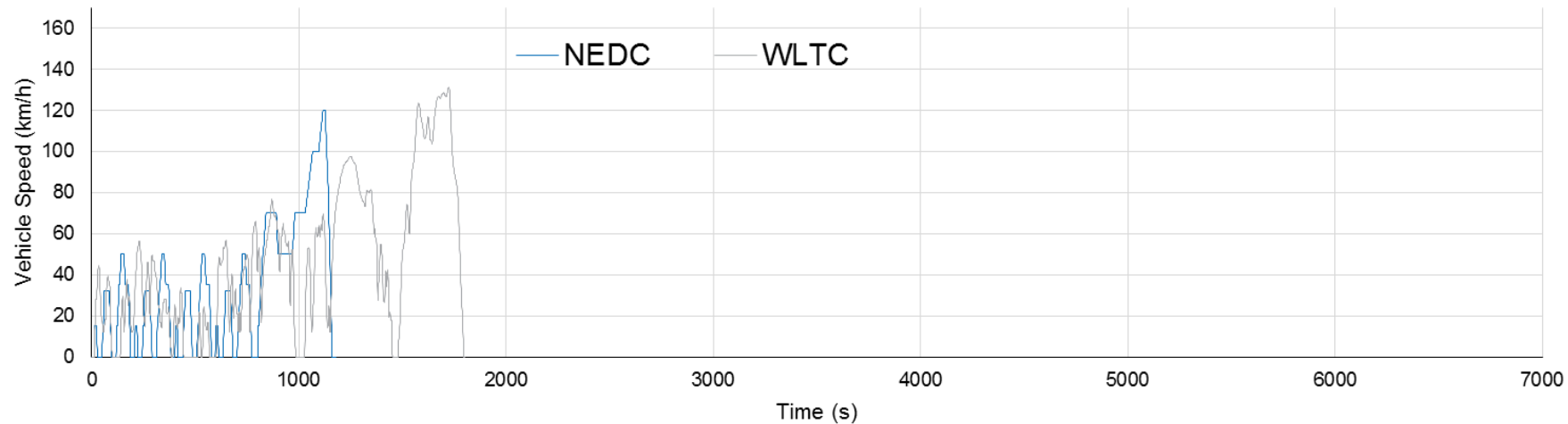


Drive Cycle	Duration (s)	Average Speed (km/h)	Maximum Speed (km/h)	Maximum Acceleration (m/s ²)
NEDC	1180	33.3	120.0	1.04

Source: EU Regulation, Ricardo

The Worldwide harmonized Light vehicles Test Cycle (WLTC) is more representative of real world driving conditions than NEDC

Drive cycles used for Euro 6 passenger cars

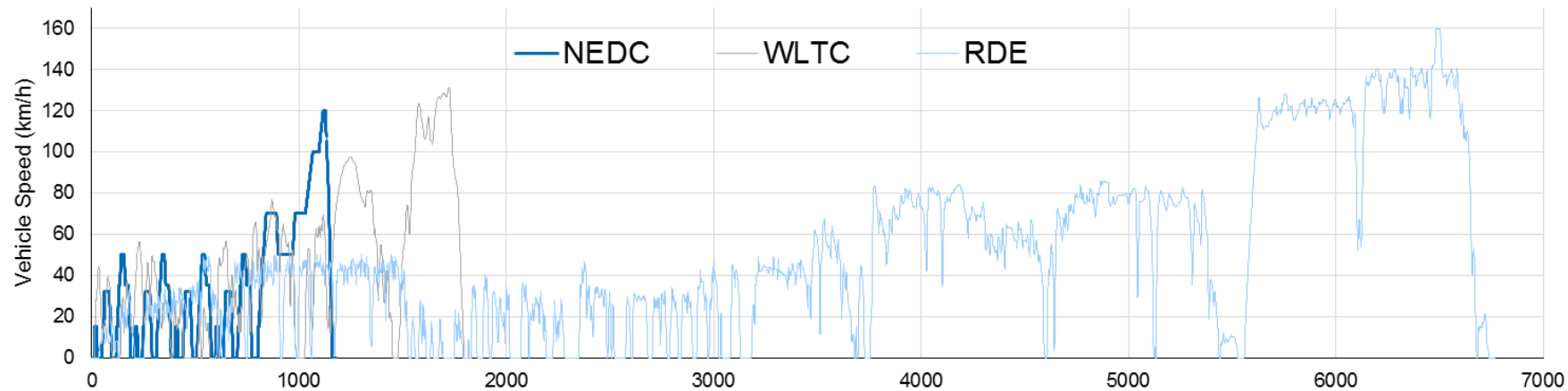


Drive Cycle	Duration (s)	Average Speed (km/h)	Maximum Speed (km/h)	Maximum Acceleration (m/s ²)
NEDC	1180	33.3	120.0	1.04
WLTC	1800	46.5	131.3	1.67

- RDE and WLTC have:
 - Increased number & magnitude of accelerations
 - Higher maximum speeds

An RDE cycle is complementary to the WLTC, testing vehicles on real roads under realistic driving conditions

Drive cycles used for Euro 6 passenger cars



Drive Cycle	Duration (s)	Average Speed (km/h)	Maximum Speed (km/h)	Maximum Acceleration (m/s ²)
NEDC	1180	33.3	120.0	1.04
WLTC	1800	46.5	131.3	1.67
RDE	6769	49.7	159.6	4.17

Ricardo's RDE cycle is an example of a valid high speed and high dynamic RDE test

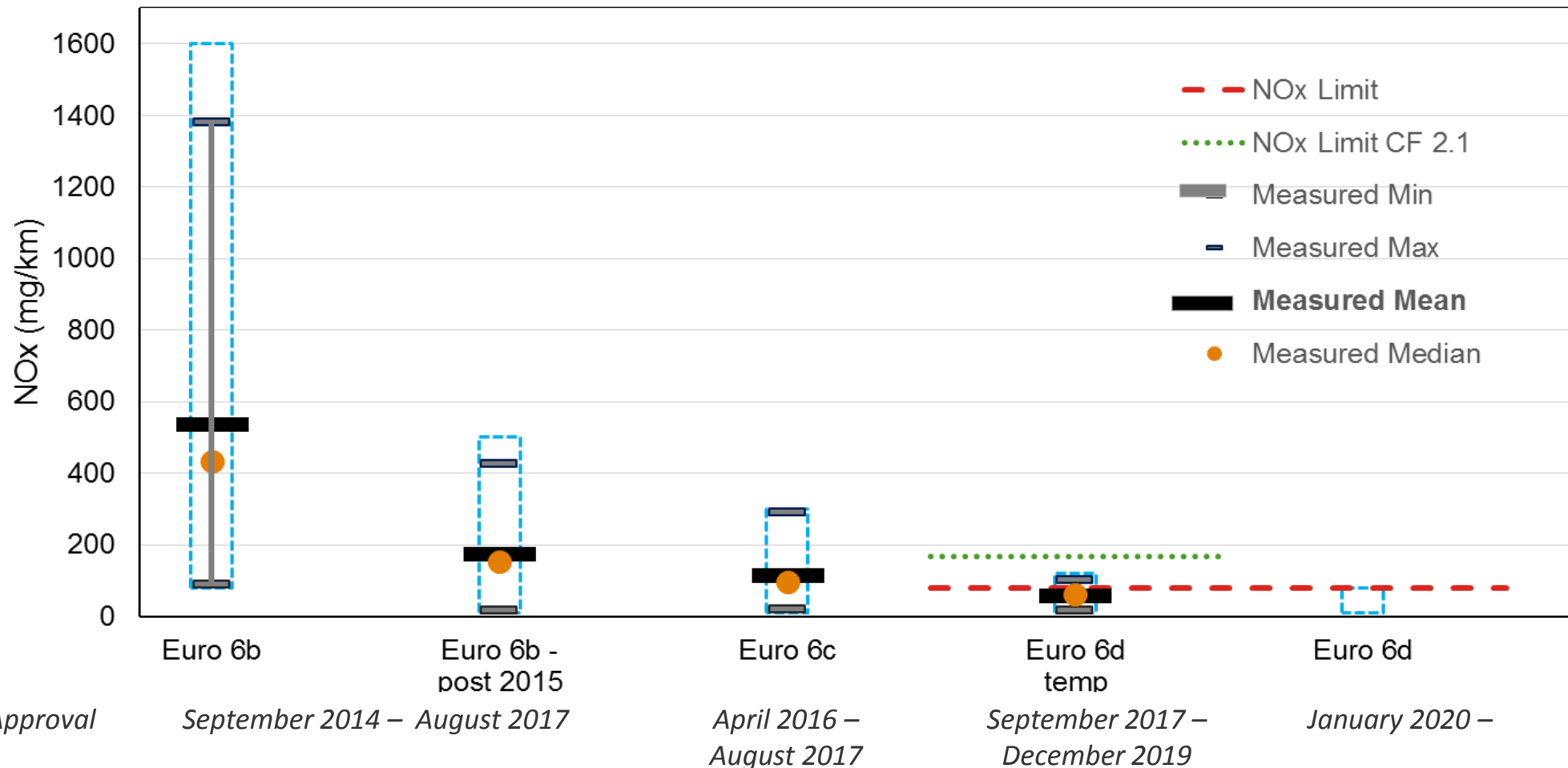
- **RDE and WLTC have**
 - Increased number & magnitude of accelerations
 - Higher maximum speeds

- **Environmental conditions**
 - “Moderate RDE” :
0°C to 30°C, 0 to 700m altitude
Representative of most normal driving
 - “Extended RDE” :
-7°C to 35°C and 1300m altitude

Source: EU Regulation, Ricardo

The stages of Euro 6 introduction show a progressive reduction in real world driving diesel NOx emissions

Fig.: Diesel NOx under real world test conditions (From Concawe Project completed by Ricardo)

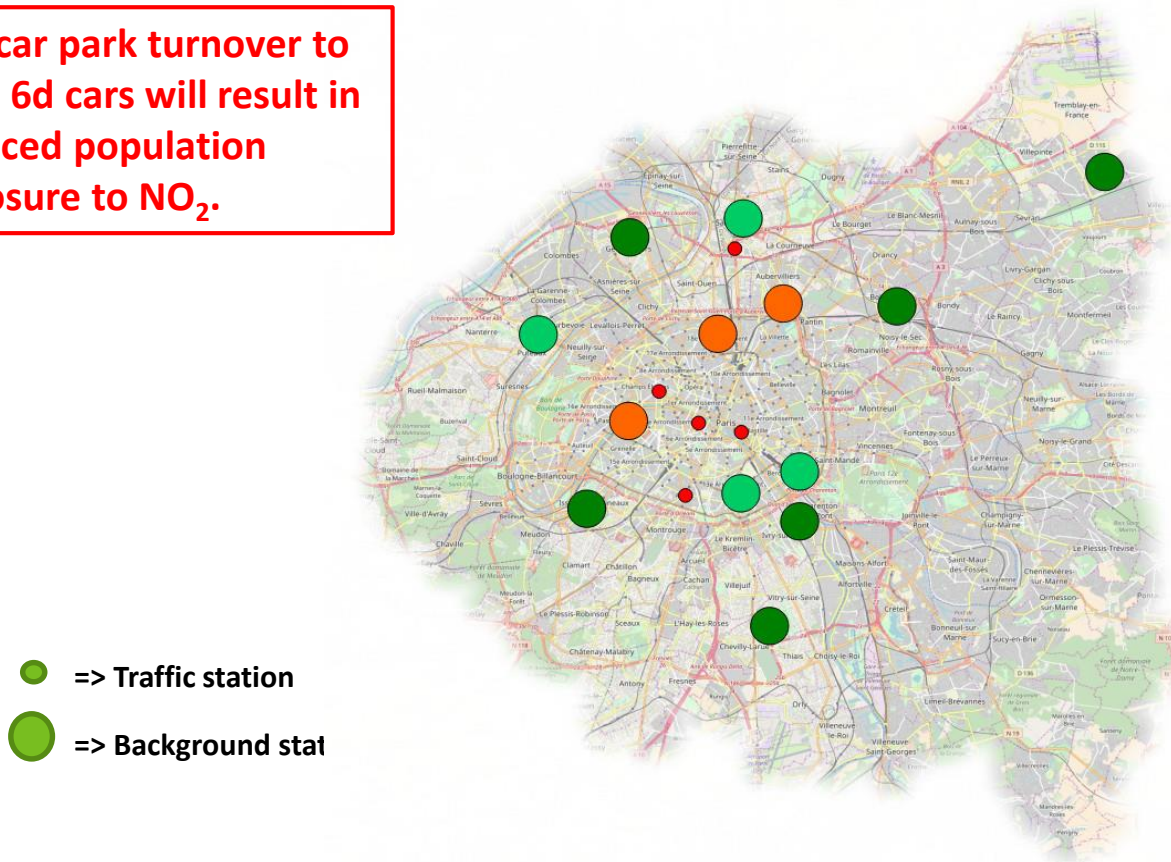


The introduction of Euro 6d cars results in compliance with the NOx limits for diesel cars **IN REAL LIFE**

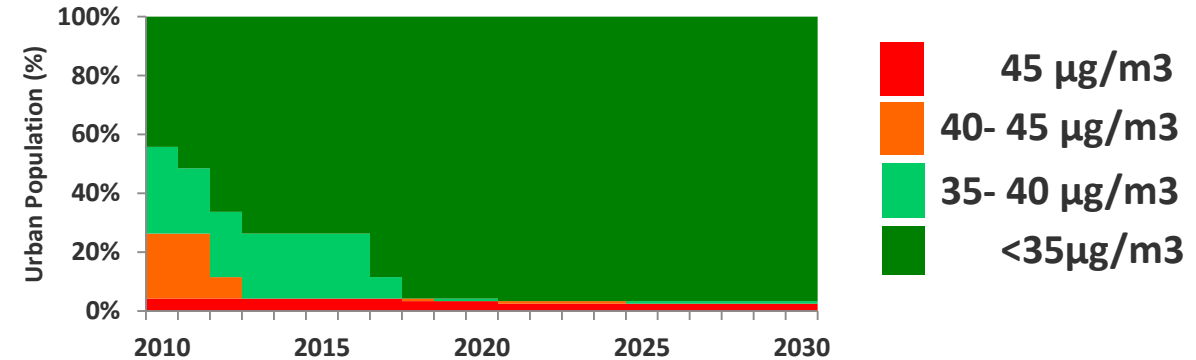
Population Exposure (NO₂) – EEA Methodology

Paris 2010

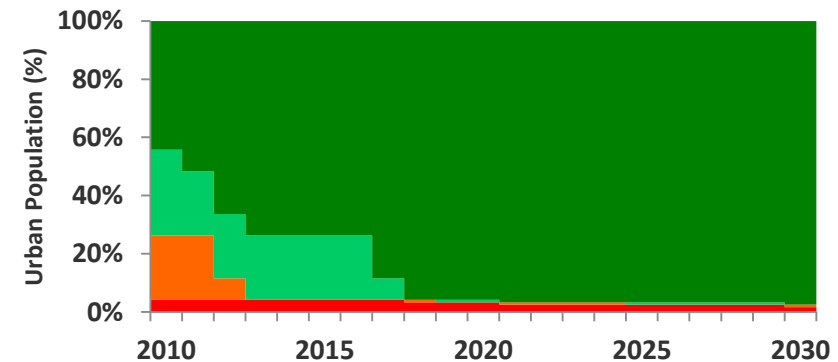
The car park turnover to Euro 6d cars will result in reduced population exposure to NO₂.



Population Exposure to NO₂ in Paris
(Ricardo Median)



Population Exposure to NO₂ in Paris
(ZEV Scenario)

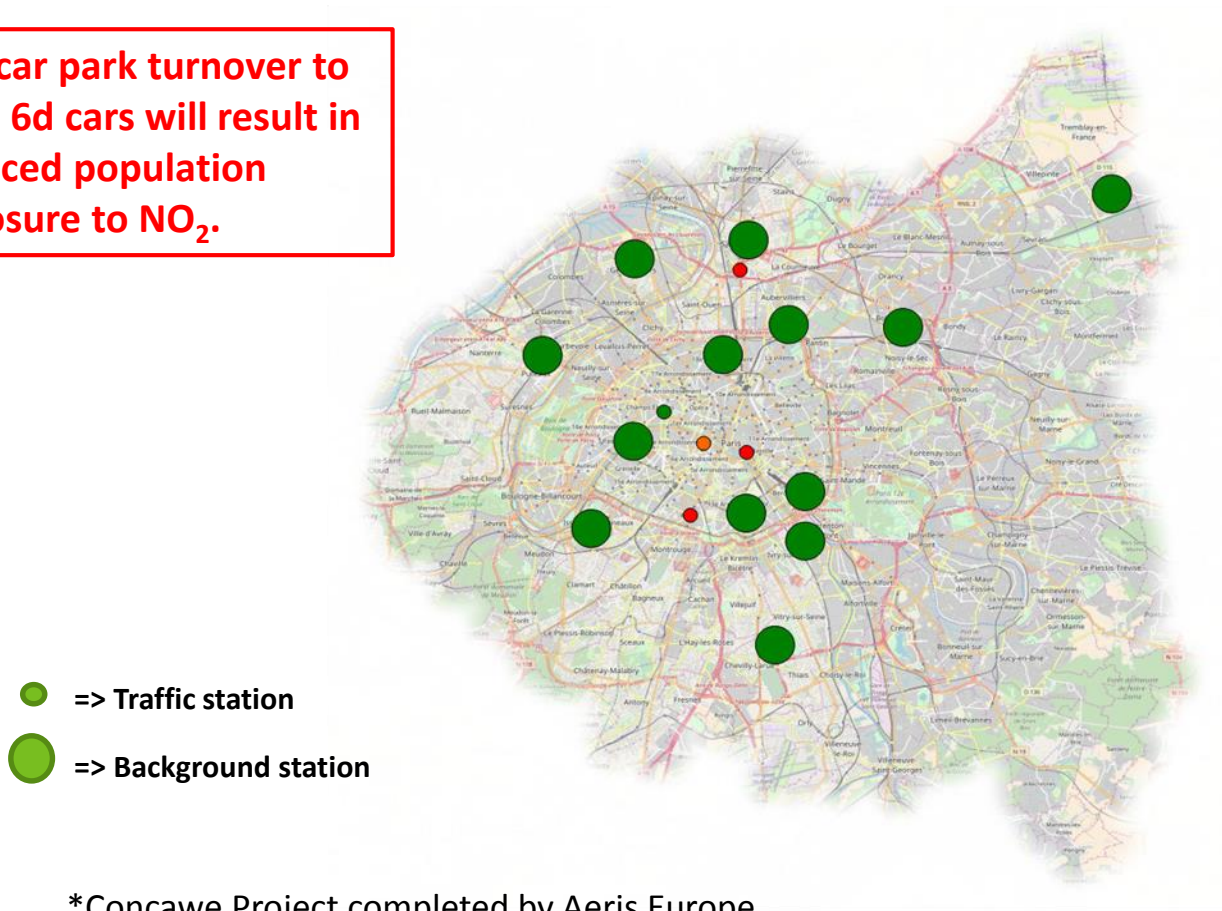


*Concawe Project completed by Aeris Europe

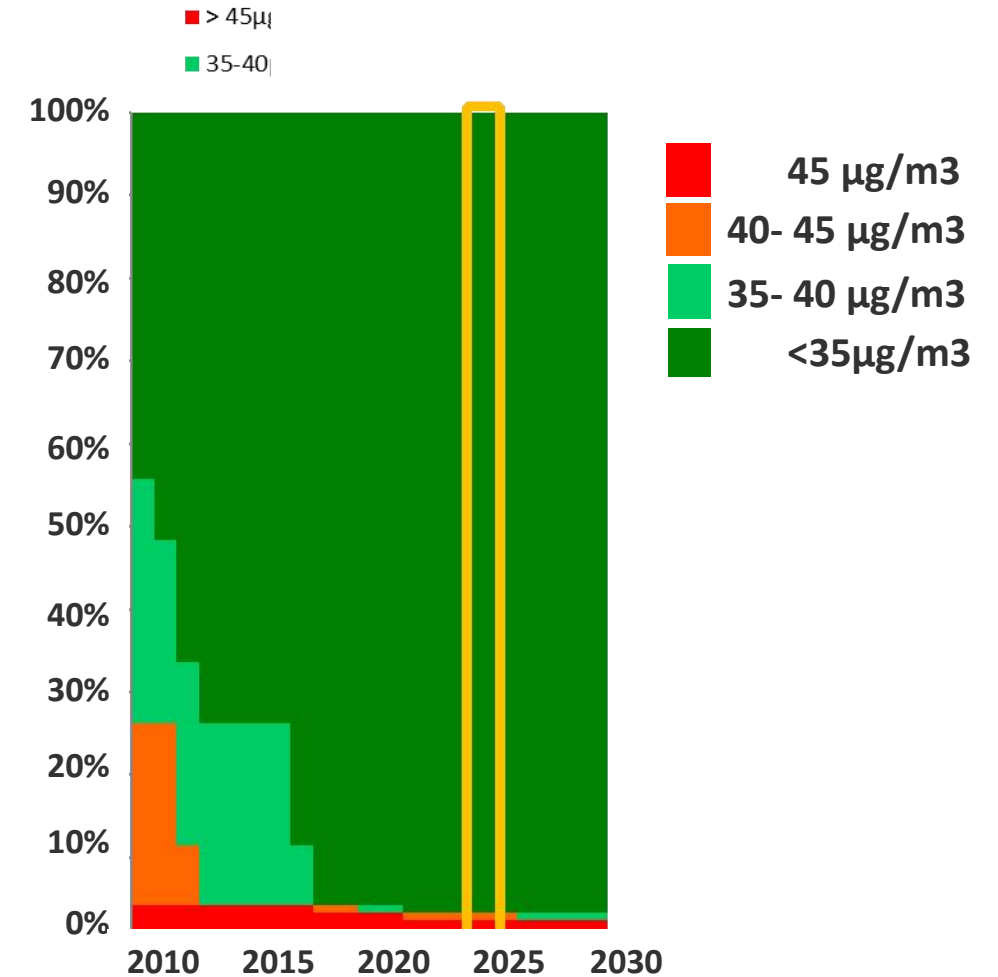
Population Exposure (NO₂) – EEA Methodology

Paris 2025

The car park turnover to Euro 6d cars will result in reduced population exposure to NO₂.



Population Exposure - Paris



*Concawe Project completed by Aeris Europe

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Highest Measuring Station shows ~zero response to ZEV scenario (NO₂)

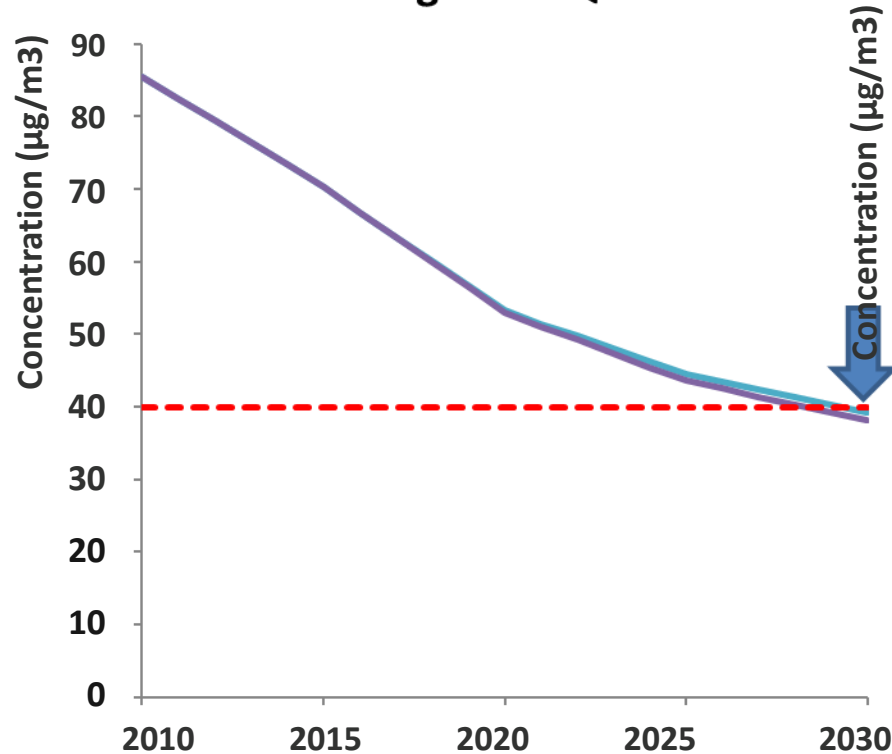
— Ricardo Median

— ZEV Scenario

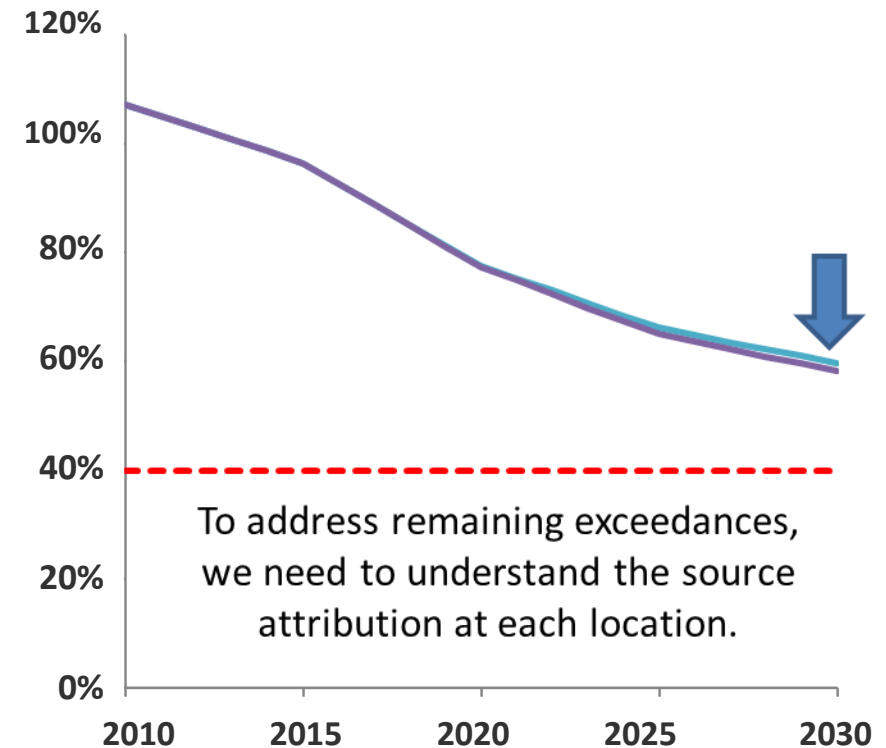
- - - AQLV

The car park turnover to Euro 6d cars will give practically the same result as for turnover to ZEV

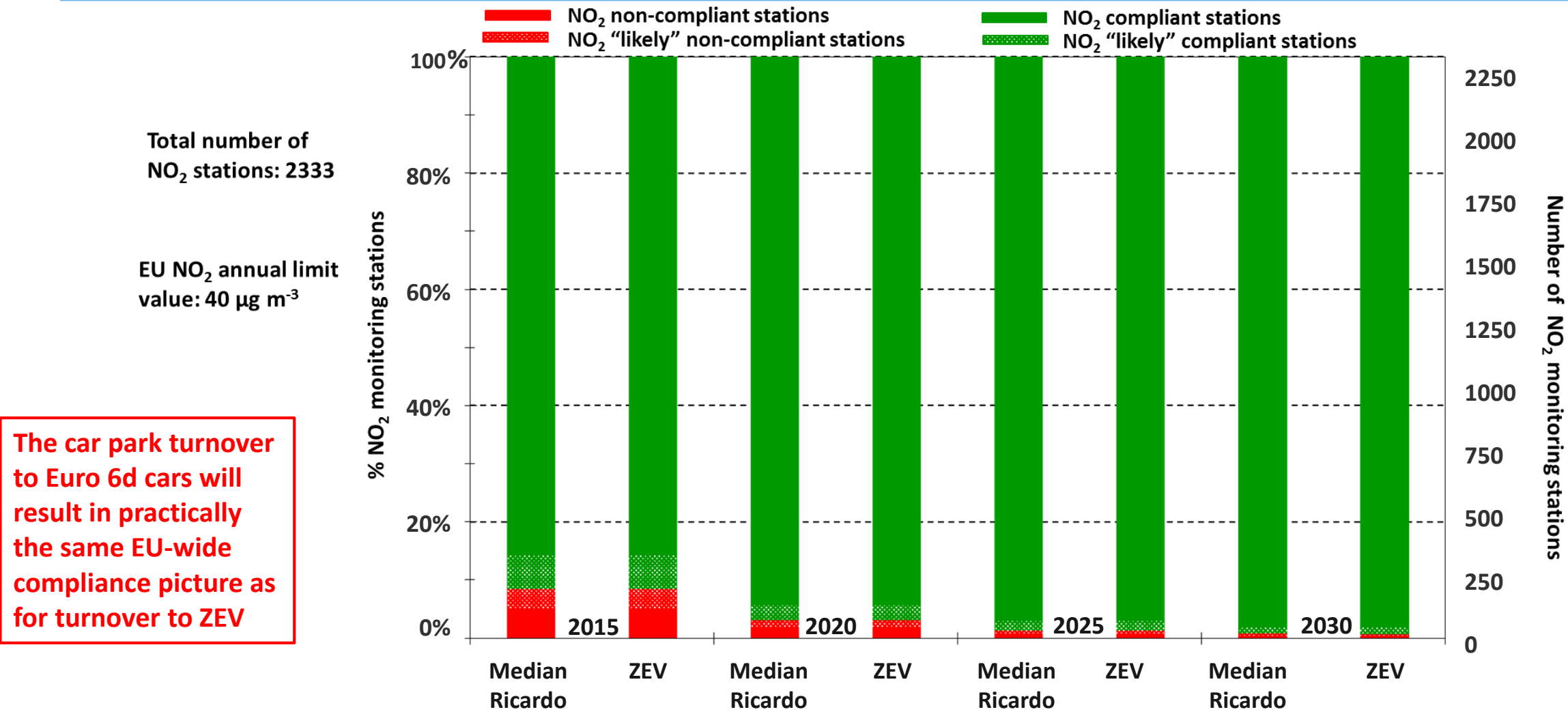
Munich - Highest AQ Station



Paris - Highest AQ Station



Compliant and Non-Compliant NO₂ Measuring Stations (Median Ricardo vs ZEV Scenarios)



Recommendations – Antwerp Low Emissions Zone

Targeted measures for passenger cars

Diesel	From 1/02/2017 onwards	From 1/01/2020 onwards	From 1/01/2025 onwards
Euro 6	admitted	admitted	admitted
Euro 5	admitted	admitted	admitted with fee
Euro 4	admitted	admitted with fee	only with day-pass
Euro 3 with part. filter	admitted	only with day-pass	only with day-pass
Euro 3 without part. filter	admitted with fee	only with day-pass	only with day-pass
Euro 2	only with day-pass	only with day-pass	only with day-pass
Euro 1	only with day-pass	only with day-pass	only with day-pass
Pre-Euro	only with day-pass	only with day-pass	only with day-pass



Reference: EU Refining Forum Presentation by Filip Lenders (City of Antwerp (Dec 2017)

Recommendations – London

Targeted measures for Buses

Putney air pollution plummets

Published: Friday 19th January 18



Air pollution levels in Putney High Street have fallen sharply over the past year, new figures show.



Data from a council's air monitoring station on the façade of a building in Putney High Street show that in 2017 levels of nitrogen dioxide in the air were breached eight times. This means a target of not breaching them more than 18 times in a year has easily been beaten.

In comparison, in 2016 they were breached 403 times. In 2012 there were 1726 breaches – meaning that since then there has been a 99 per cent reduction in breaches. Mean levels of nitrogen dioxide recorded at a kerbside monitoring station show a reduction from 98 in 2016 to 60 in 2017

The fall in pollution coincides with the introduction of cleaner buses along the street and the introduction last year of a Low Emission Bus Zone. More than 100 buses an hour use Putney High Street, but in 2012 a [unique research project](#) by Wandsworth Council exposed the bus fleet as responsible for over 80 per cent of nitrogen dioxide build ups.

Reference:

http://www.wandsworth.gov.uk/news/article/14330/putney_air_pollution_plummets

Recommendations

Recommendations for effective measures:

- Gradual restriction of use of older passenger cars
- Replacement or retrofitting of urban buses
- Measures to ensure vehicles maintain “as new” emissions performance
 - Prevent tampering with vehicle calibration
 - Prevent/prohibit removal of exhaust after-treatment equipment

Summary

Based on Ricardo's estimates for EURO 6d emission levels under RDE conditions, compliance with current air quality regulated emission limits will be largely achieved by 2025/30

- For NO₂, in 2020 approx. 4% of monitoring stations are assessed to be non-compliant, and by 2025 this reduces to 2%.
- By 2030 1% of the stations remain uncompliant, in both scenarios (Ricardo Median & ZEV).
- Diesel PM exhaust is a diminishingly small contributor to Urban Air Quality.
- Brake & tyre wear dominates primary PM emissions from passenger cars regardless of the powertrain technology.

Summary

- AERIS modelling shows that by 2030 there is no difference in population exposure between the ZEV scenario and the Ricardo Median scenario.
- Using London as a case study, extensive modelling work by DEFRA highlights the importance of 'source attribution' in designing effective local responses to address the remaining 'hotspots'.

Conclusions:

- *AERIS modelling shows that, from 2020 onwards, replacing all new diesel vehicles by zero emission vehicles (tailpipe) will offer little improvement to the compliance outlook compared with the Ricardo Median Euro6d scenario.*
- *We should now focus on measures to improve or restrict use of older vehicles, including trucks and buses, and improving non-transport sources of emissions*

THANK YOU FOR YOUR ATTENTION

This document was presented by:

John Cooper, Director General
John.Cooper@fuelseurope.eu

FuelsEurope
165, Boulevard du Souverain
1160 Brussels - Belgium
T: +32 2 566 91 00



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