Kanton Zürich
AWEL Luft

21th ETH-Conference on Combustion Generated Nanoparticles –

Remote sensing of diesel and petrol NOx emissions over more than a decade

Gian-Marco Alt, Zurich, June 22nd, 2017

Agenda

- Remote Sensing (RSD) in Zurich: why / where / how
- Results
- Conclusions
- Q & A

RSD in Zurich: why / where / how

Background: air quality

Main source: road traffic, especially NOx (NO + NO2)

Problem «solves itself»? (Handbook of emission factors, HBEFA)

Retrospective always correction upwards

Main intention: use of RSD as a real-time monitoring instrument and for a better and immediate knowledge of trends

RSD in Zurich: why / where / how

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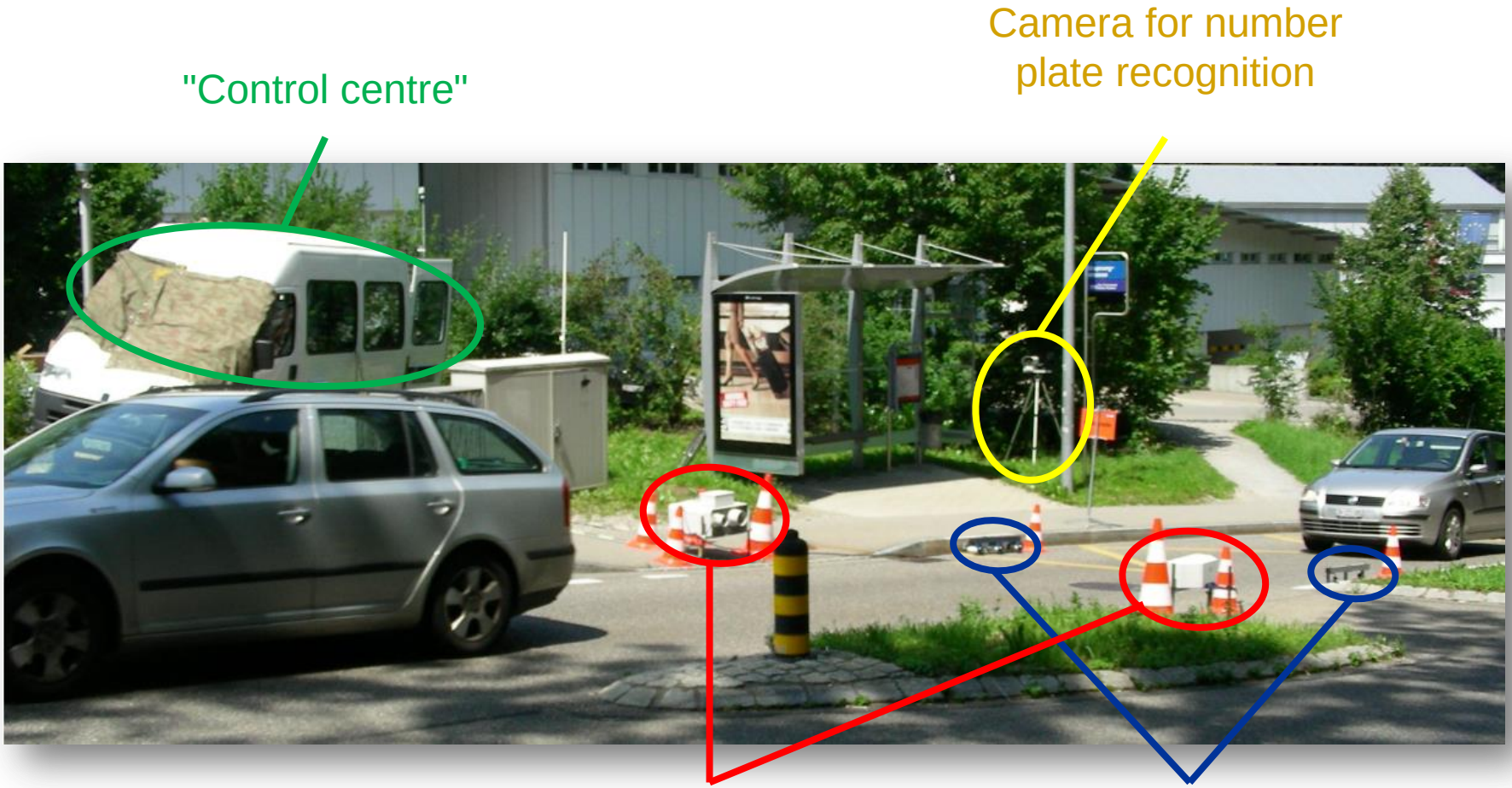

RSD in Zurich: why / where / how

Started in the late '90s (RSD 2000)

2016: First use of a RSD 5000 with NO2 channel

Focused on larger samples (N > 100)

regarding emission codes, fuel, manufacturer…

Vehicle categories

Passenger cars (PC) / light commercial vehicles (LCV)

During the last years we collected around 50'000 meas./a

In total ~ 500'000 useable measurements (2000 – 2016) in Zurich

2015: Comparison RSD / Portable Emission Measurement System (PEMS). Empa / AWEL, mandate from BAFU ➔ good correlation between RSD and PEMS

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between RSD and PEMS

Empa
Materials Science and Technology

Empa-Bericht Nr. 5214010202.01

Pilotprojekt Vergleichsmessungen
Remote Sensing - PEMS - Rollenprüfstand
im Auftrag des Bundesamts für Umwelt BAFU

Autor:

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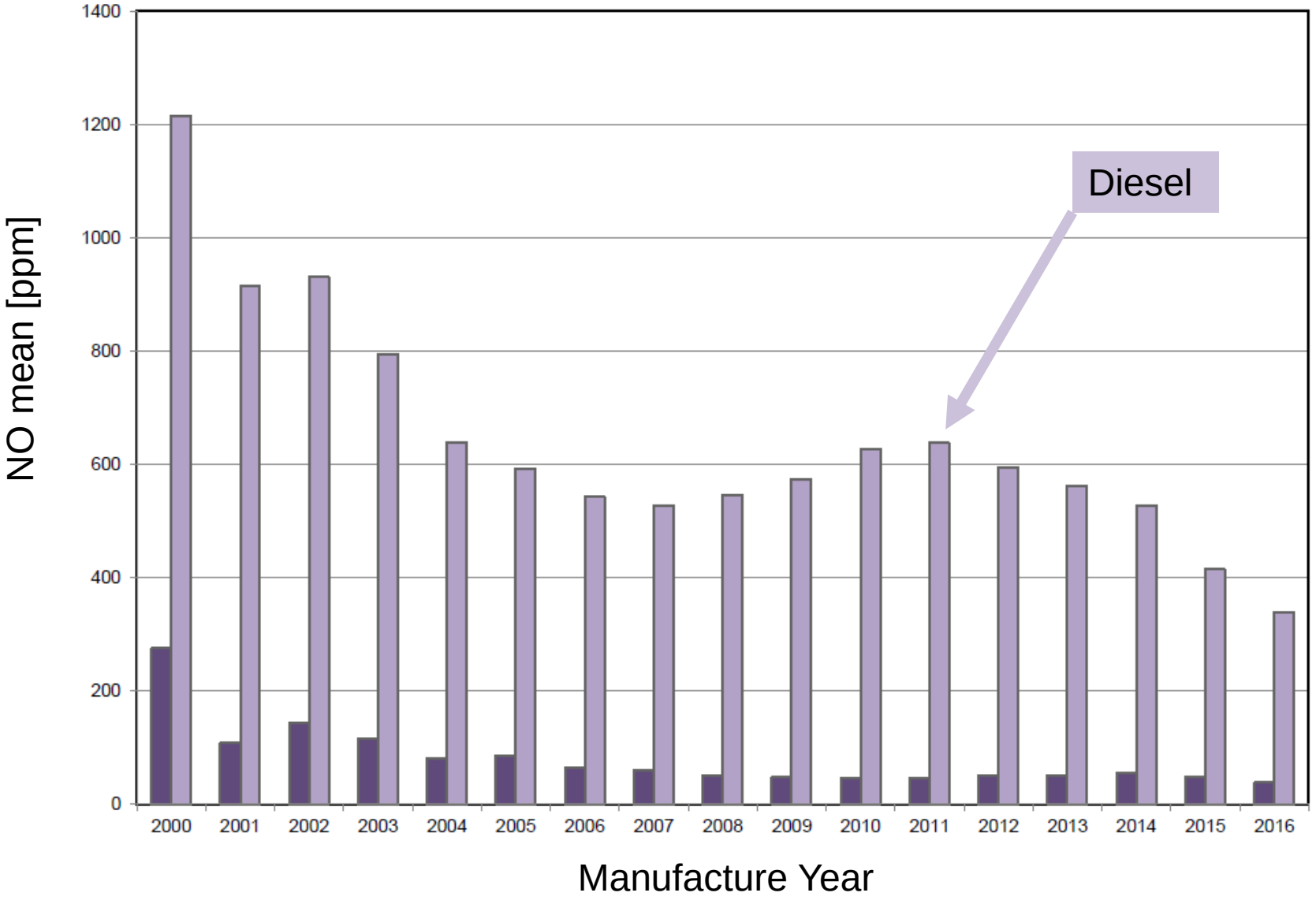
In Zusammenarbeit mit:

Michael Götsch und Felix Baum, AWEL Amt für Abfall, Wasser, Energie und Luft Zürich

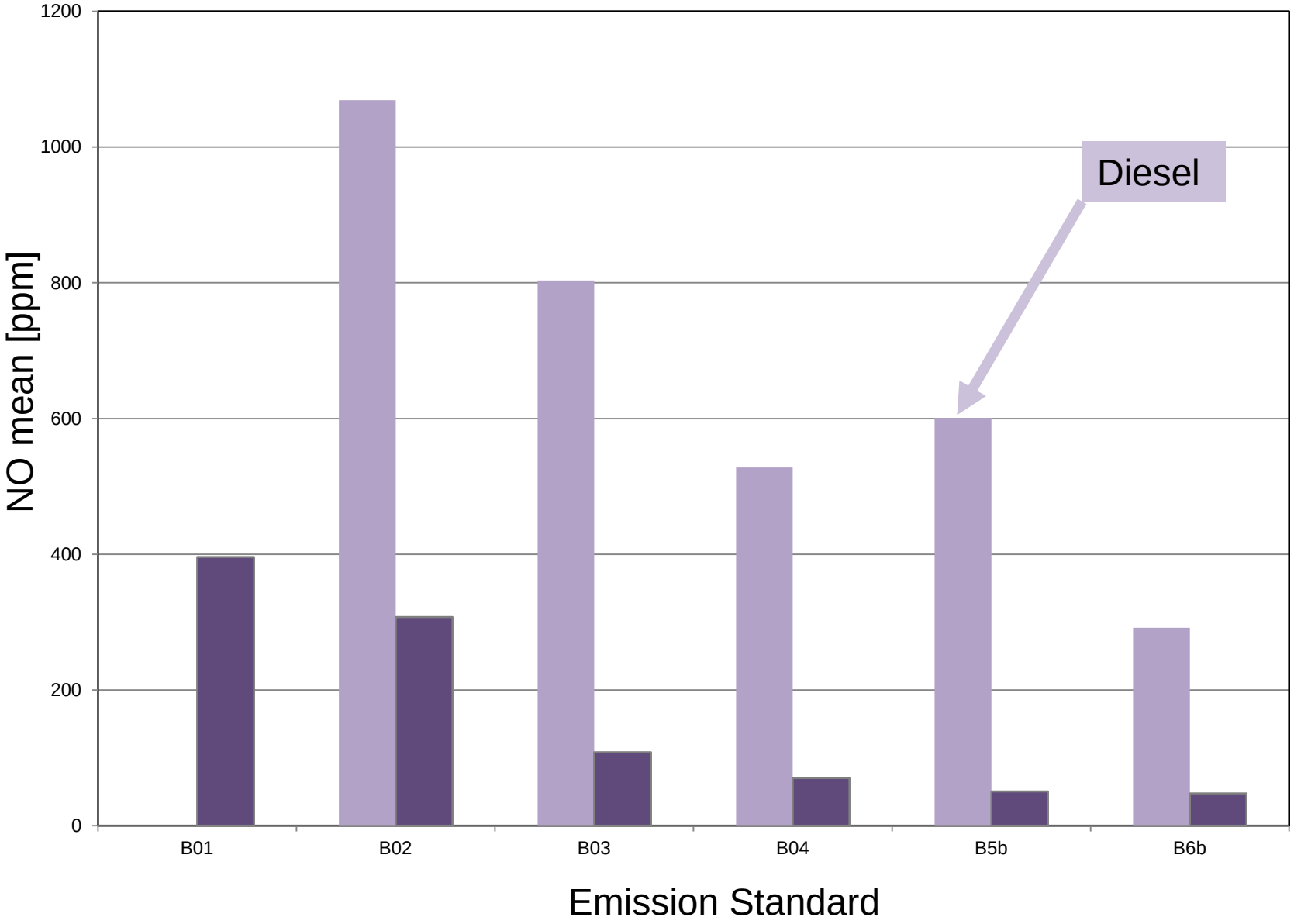
Dübendorf, den 28.10.2016

Results and their impacts

NO concentration PC diesel vs gasoline



NO concentration PC diesel vs gasoline



RSD ZH

Link to VW…

In 2012 we got a request from the International Institute for Applied Systems Analysis (IIASA, Austria) to use the data ➔ wider spread

Atmospheric Environment 101 (2015) 58–64

Contents lists available at ScienceDirect

Atmospheric Environment

journal homepage: www.elsevier.com/locate/atmosenv

New emission deterioration rates for gasoline cars – Results from long-term measurements

Jens Borken-Kleefeld [a, *], Yuche Chen [b]

[a] International Institute for Applied Systems Analysis (IIASA), Schlossplatz 1, 2361 Laxenburg, Austria
[b] Texas A&M Transportation Institute, Texas A&M University 3135, College Station, 77840 TX, USA

HIGHLIGHTS

- On-road measurements over 13 consecutive years in Zurich/CH.
- Lower deterioration rates for Euro 1 and 2 cars, but higher deterioration for Euro 3 and 4 than assumed so far.
- No evidence for high emitters.
- No evidence for effectiveness of idle emission inspection tests.

Atmospheric Environment 88 (2014) 157–164

Contents lists available at ScienceDirect

Atmospheric Environment

journal homepage: www.elsevier.com/locate/atmosenv

Real-driving emissions from cars and light commercial vehicles – Results from 13 years remote sensing at Zurich/CH

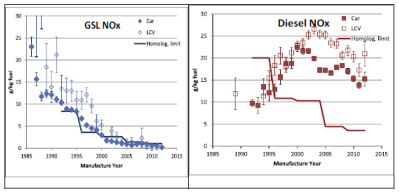
Yuche Chen [a], Jens Borken-Kleefeld [b,*]

[a] 2019 Ghausi Hall, Department of Civil and Environmental Engineering, University of California Davis, USA
[b] International Institute for Applied Systems Analysis (IIASA), Schlossplatz 1, 2361 Laxenburg, Austria

HIGHLIGHTS

- Real-driving emission factors from 13 years of on-road remote vehicle sensing.
- NO_x emissions from diesel cars and light commercial vehicles several times above limit value.
- Confirming HBEFA emission factors, but discrepancy with London remote sensing emissions.
- Significant uncertainty in primary NO_2 exhaust emissions.

GRAPHICAL ABSTRACT



Link to VW…

The New York Times | http://nyti.ms/1O1AUKk

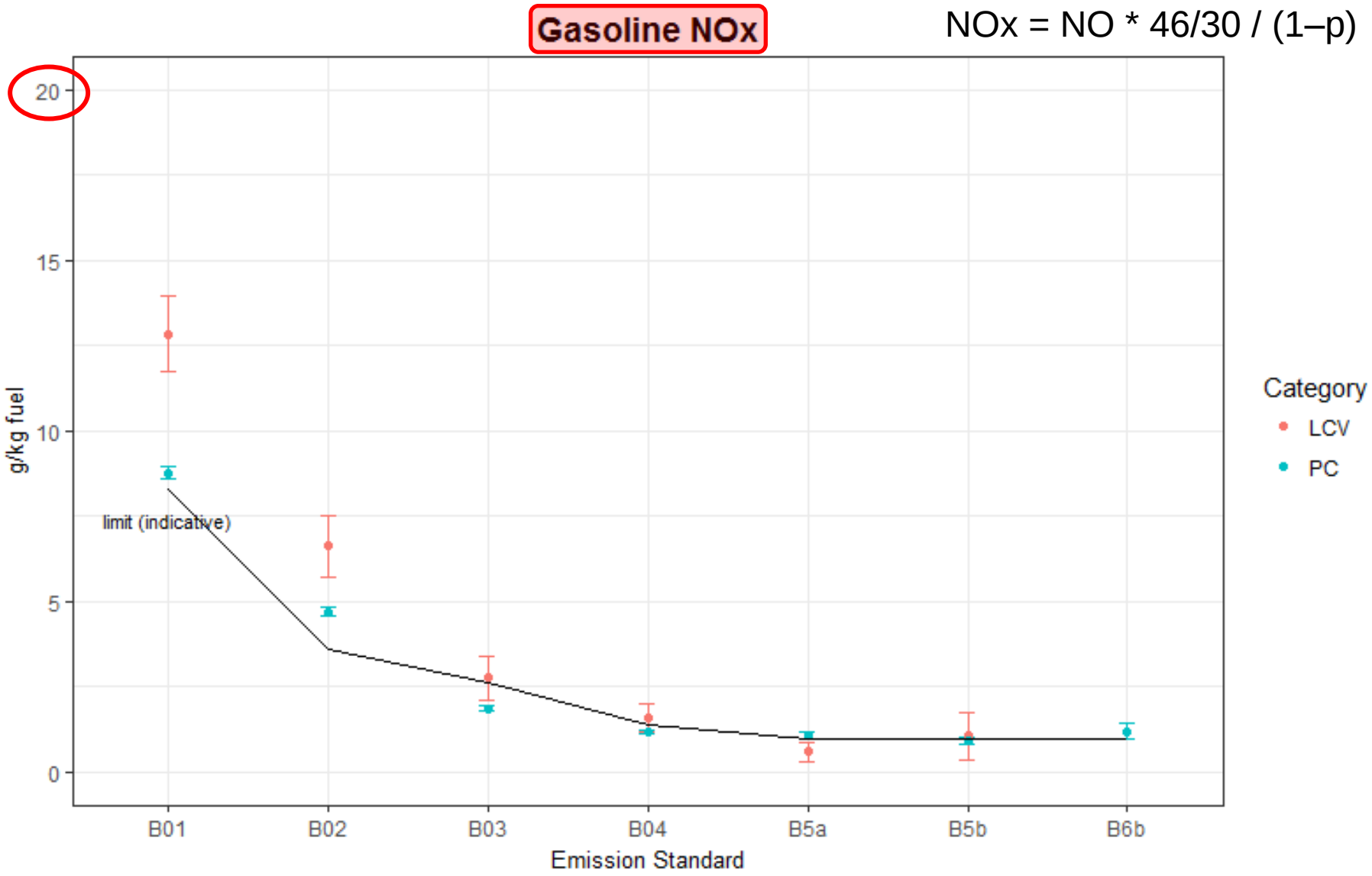
The Opinion Pages | OP-ED CONTRIBUTOR

Test Emissions Where Cars Pollute: On the Road

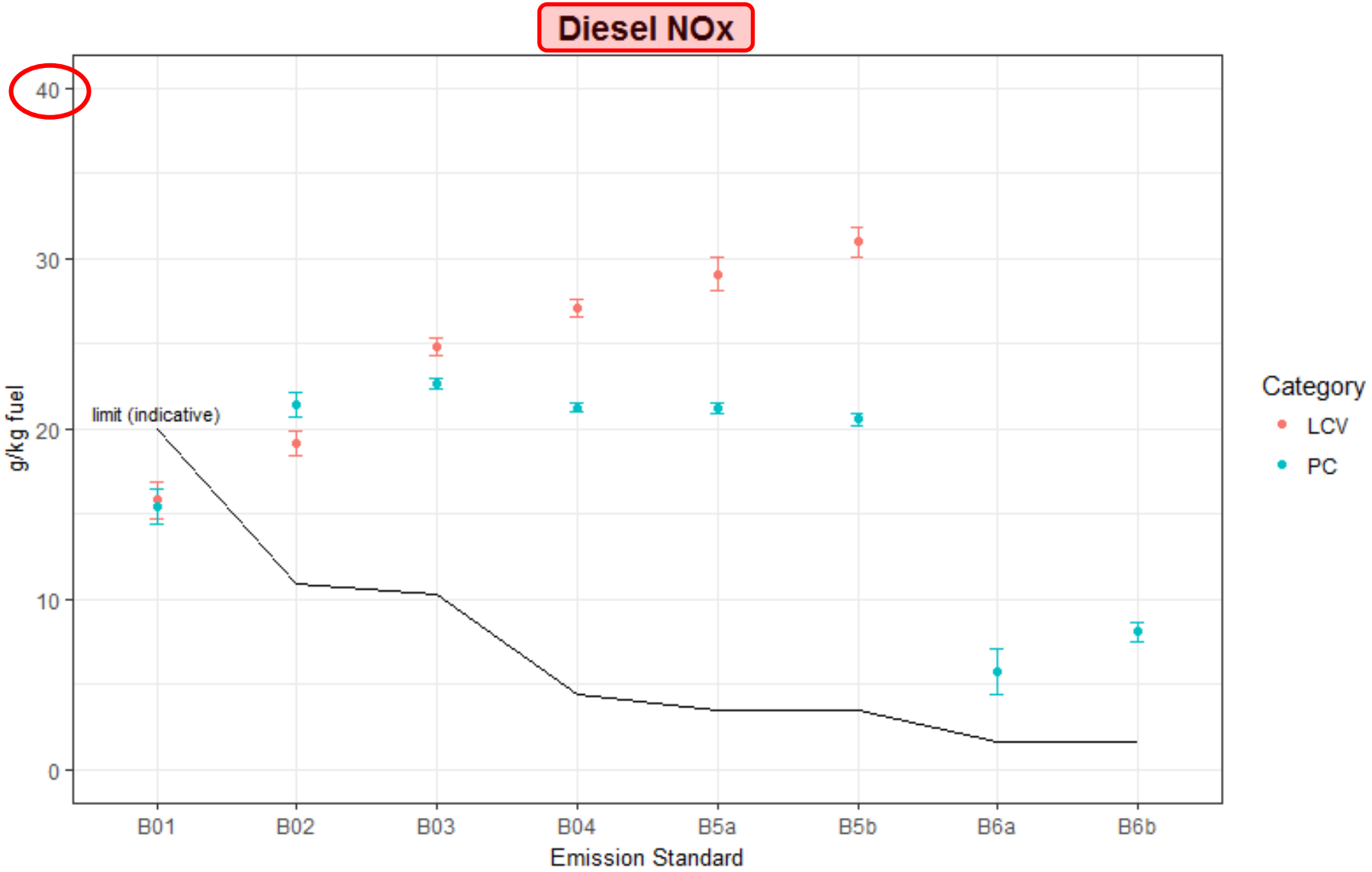
By PETER M. MCCLINTOCK SEPT. 30, 2015

The first hint came from a colleague in Europe who, looking at remote sensing data collected in Switzerland, had noticed high diesel nitrogen oxide emissions coming from passenger cars. At his suggestion, we examined thousands of measurements collected by Colorado's vehicle emissions program.

NOx emissions (2000 – 2016)

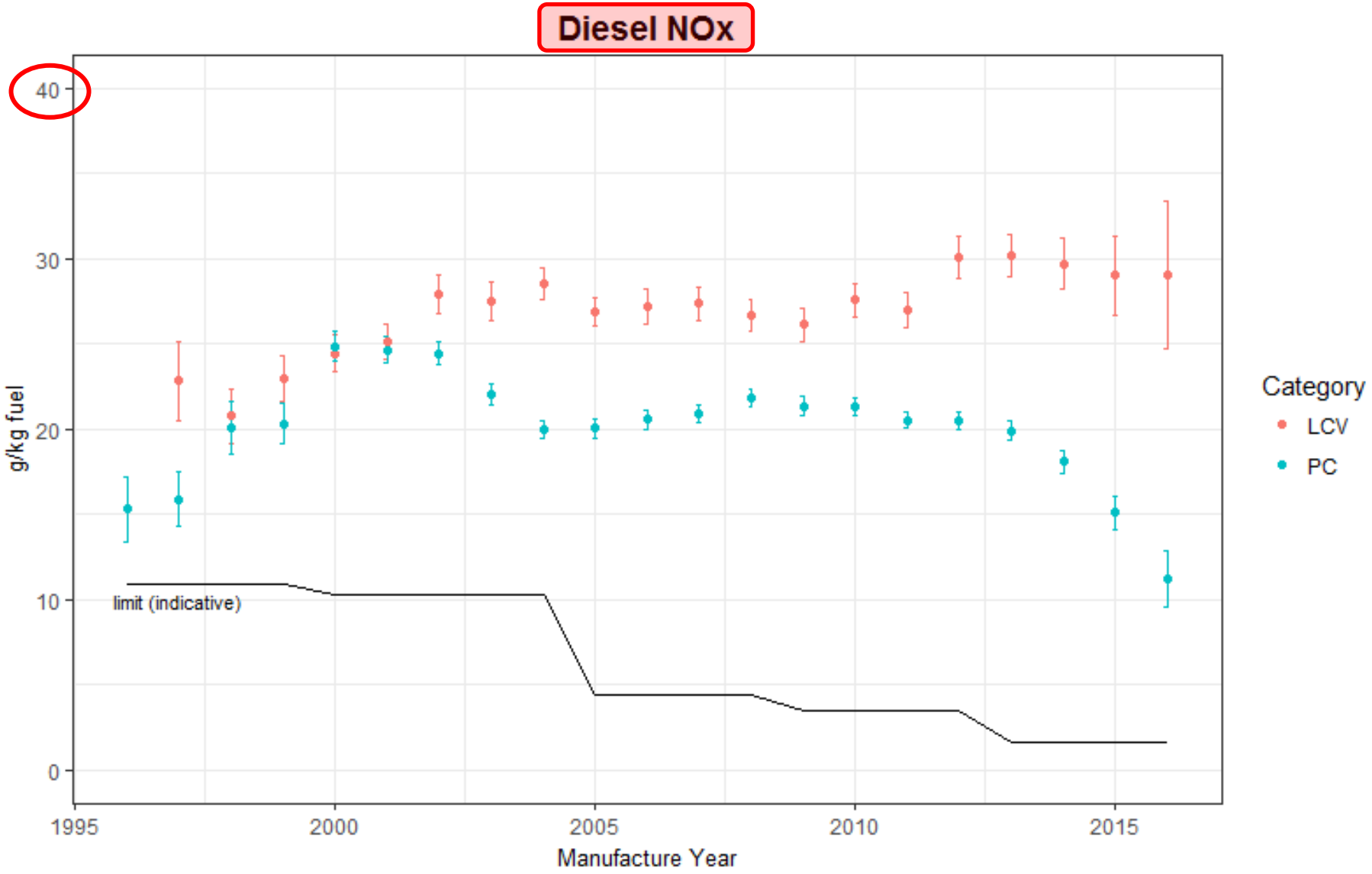


NOx emissions (2000 – 2016)



RSD ZH

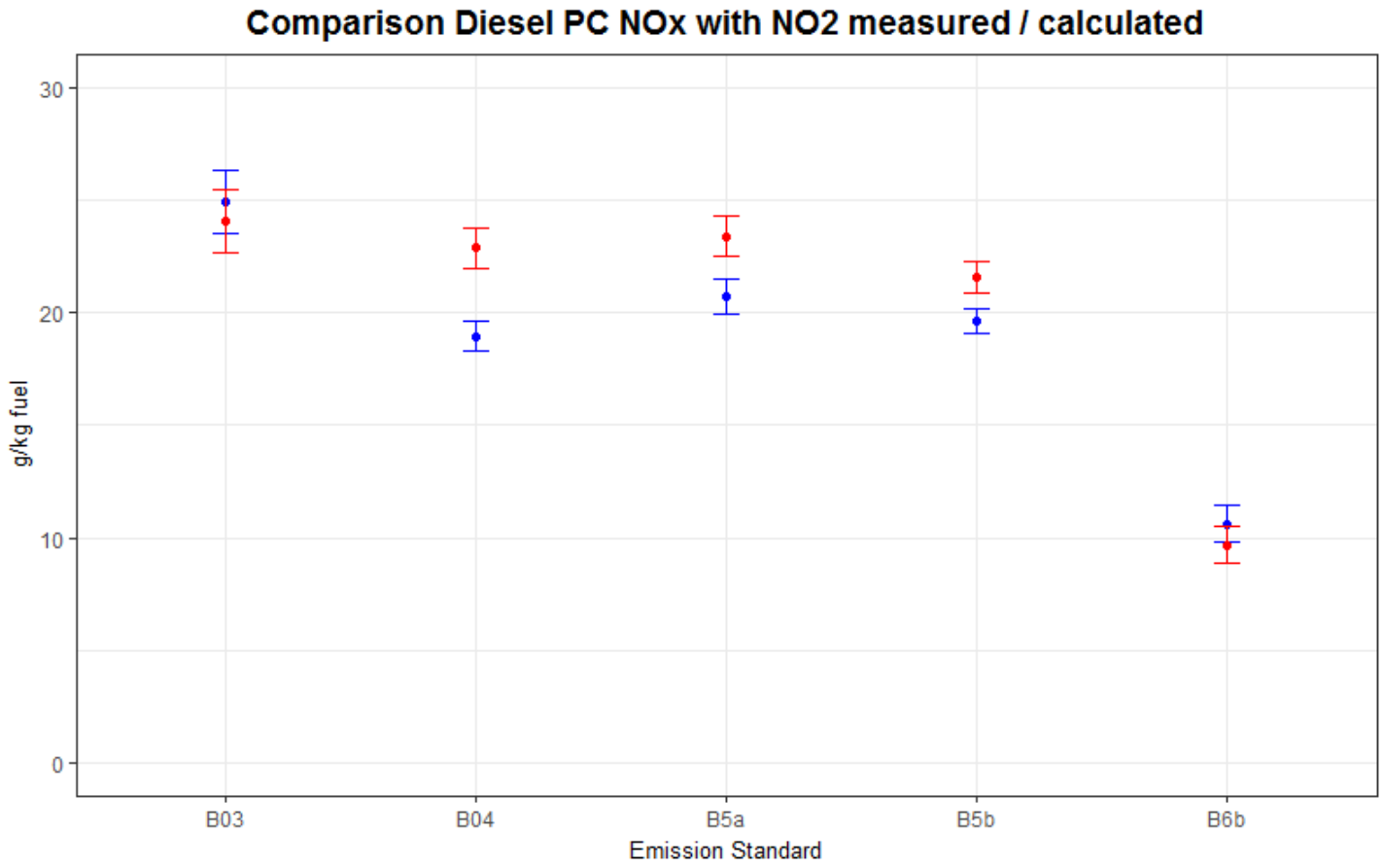
NOx emissions (2000 – 2016)



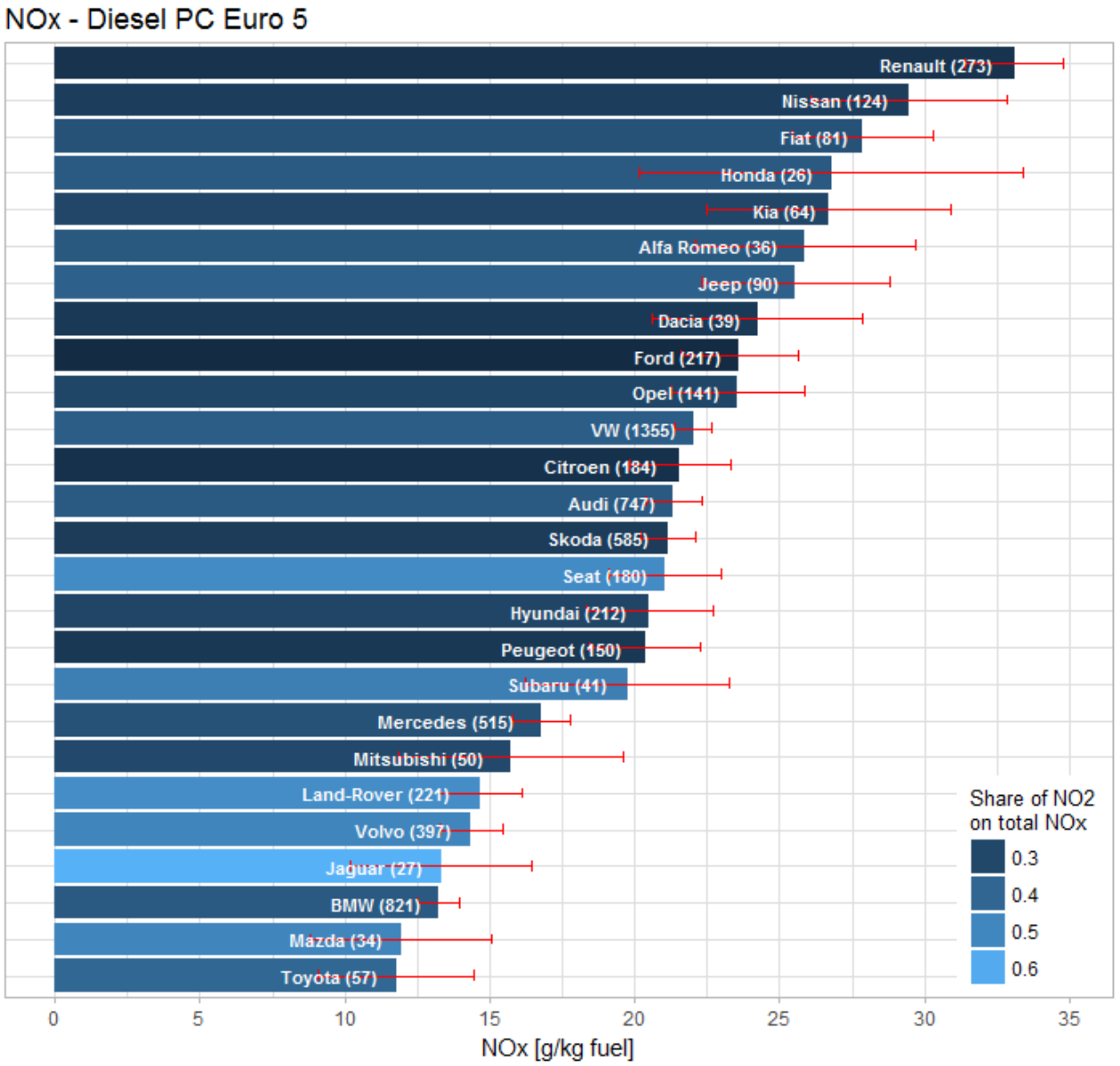
Results 2016 (RSD 5000 / NO2)

NO2 measured

NO2 share from HBEFA



Results 2016 (RSD 5000 / NO2)



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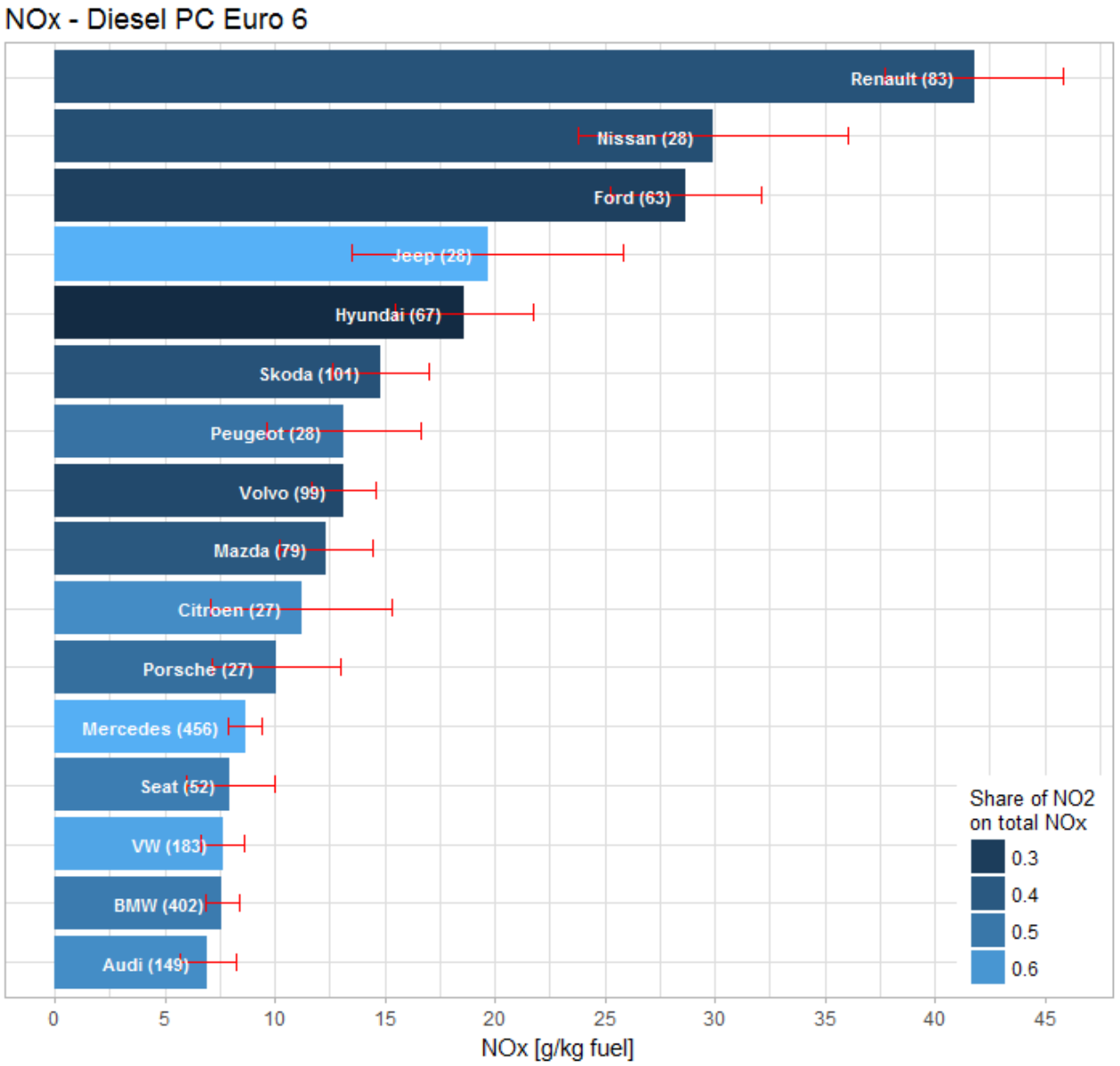
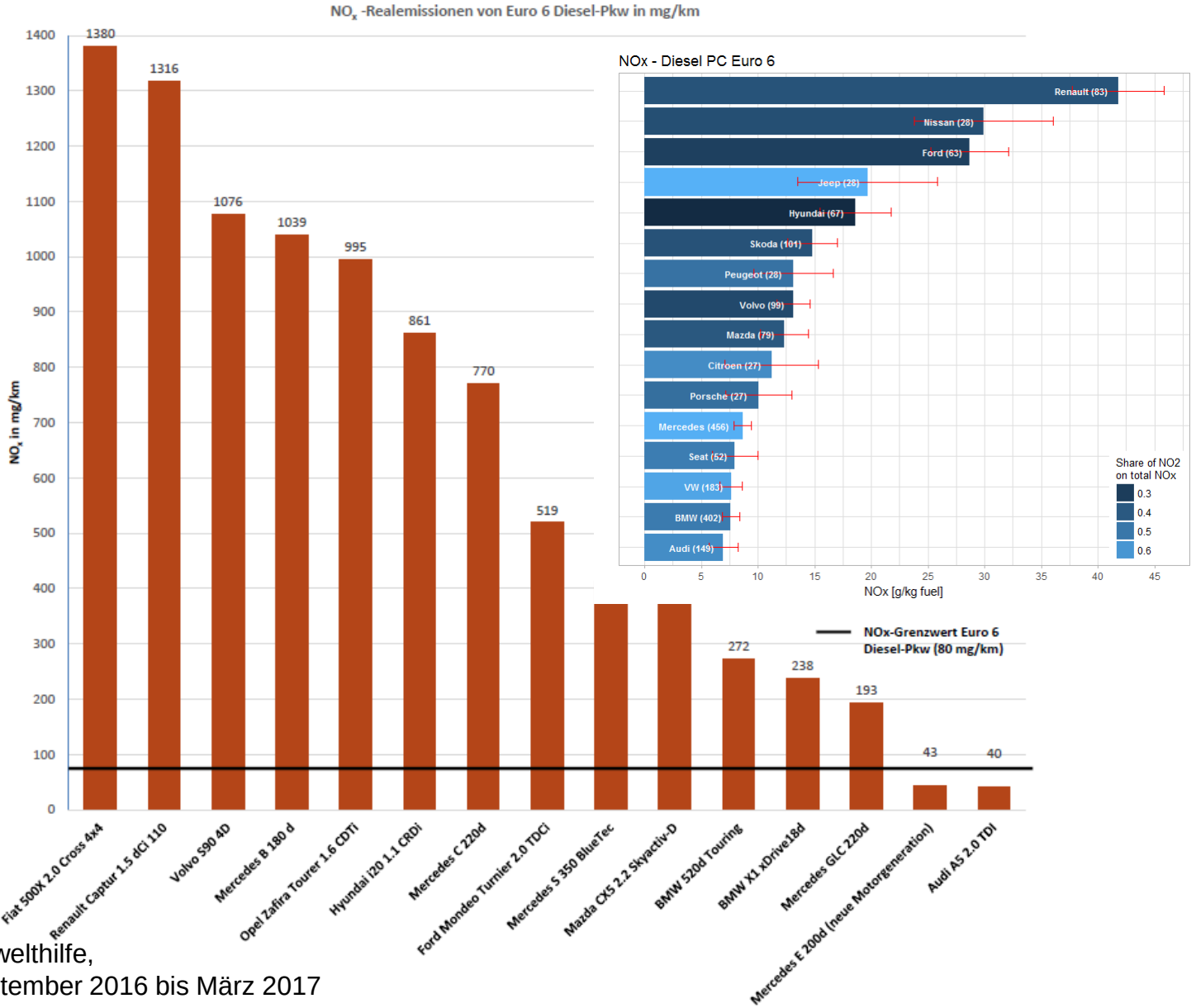


RSD ZH

Results 2016 (PEMS vs. RSD)

PEMS



Source: Deutsche Umwelthilfe,
Wintermessungen September 2016 bis März 2017

RSD ZH

Fleet development – passenger cars

Newly released passenger cars by fuel type per year – Canton of Zurich

Conclusion

Main intention: use of RSD as a real-time monitoring instrument for real driving emissions and for a better and immediate knowledge of trends ➔ fulfilled

Validation of emission factors

- deterioration
- shares of NO_2 on total NOx
- function of temperatur…

Improvement for the latest Euro 6 Diesel PC, but still clearly too high NOx emissions, also higher spread between different makes

Q & A

More information

www.luft.zh.ch ➔ Verkehr ➔ RSD (only german)

Thanks to:

- our team at AWEL

- Jens Borken-Kleefeld (IIASA)

- Åke Sjödin (IVL, Sverige)