23. ETH-NPC, Zürich, June 2019
Focus - Event

White Spots

Suggestions for Improvement of Vehicle Emission Legislation post Euro 6

A.Mayer / VERT

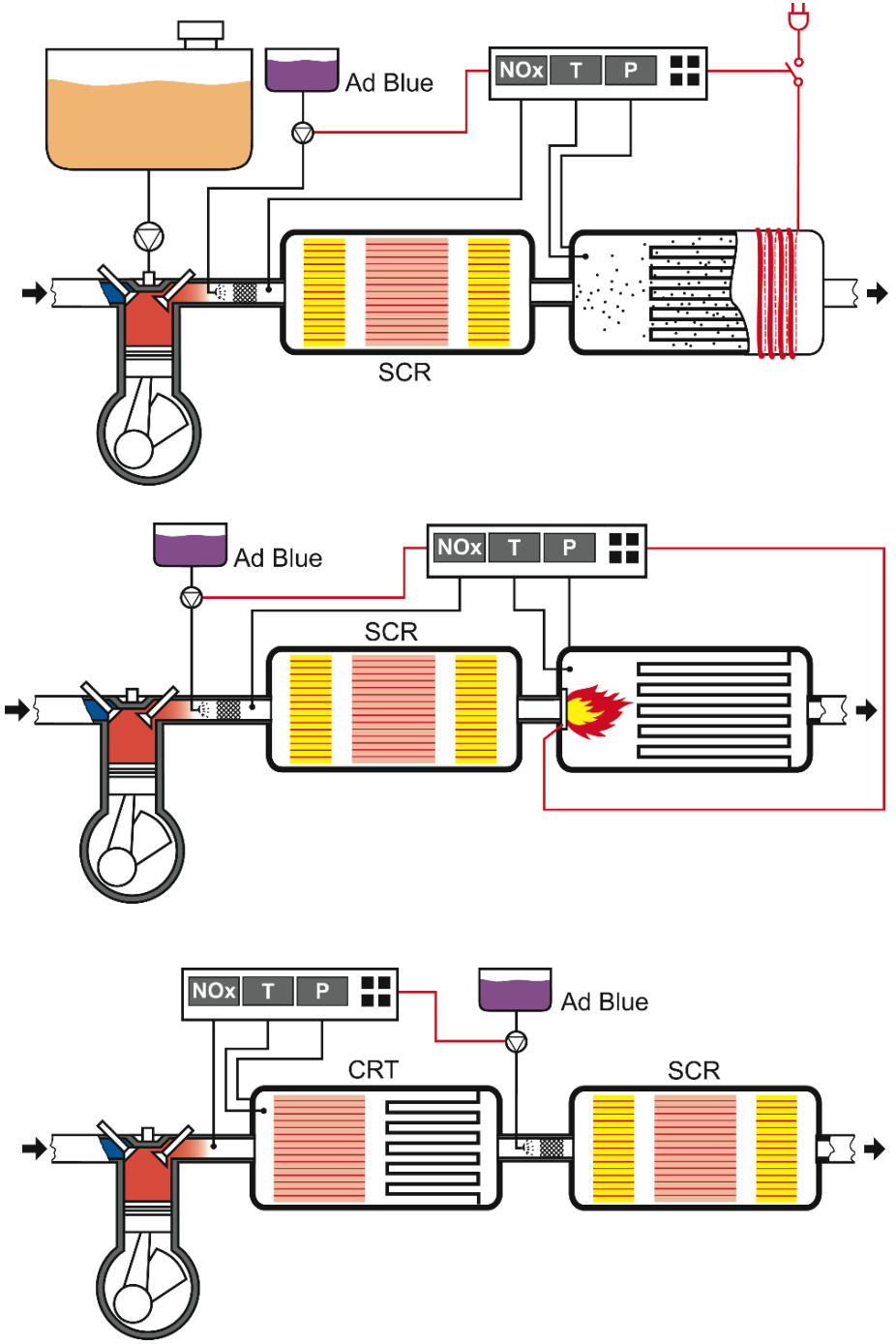
The following actions are urgently needed and the required technology is readily available

- **New PTI** to detect DPF & SCR failures and manipulations
- Strengthen PN criteria, also for NRMM
- Emission Upgrade for the in-use fleet by OEM
- Banning highly toxic secondary emissions and metals
- Unify metrics for exhaust and ambient pollution
- Address PN exposure in vehicle cabins
- Introduce alcylate (benzene free) fuel for handheld tools

Emission Control by aftertreatment is indispensable

- very efficient > 99%
- but depend on operation profile
- risk of wear, aging and poisoning, pollution
- risk of tampering and manipulation
- potential of intentional deterioration by defeat div.

→ Control is required



NOx Exceedences

due to Emission Fraud by European Manufacturers

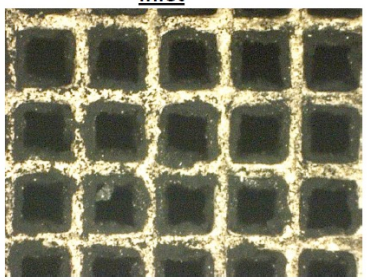
(defeat devices to limit emission technology to test cycle operation)

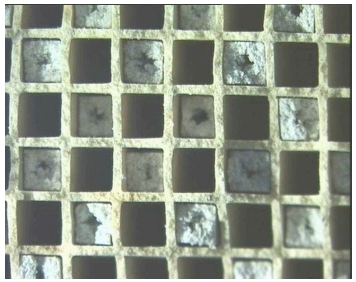
This only could happen since the European commission had resigned on IUC and PTI and «delegated» individual emission control to OBD

Source ICCT Sept 2016

and this is what we are sometimes finding - why

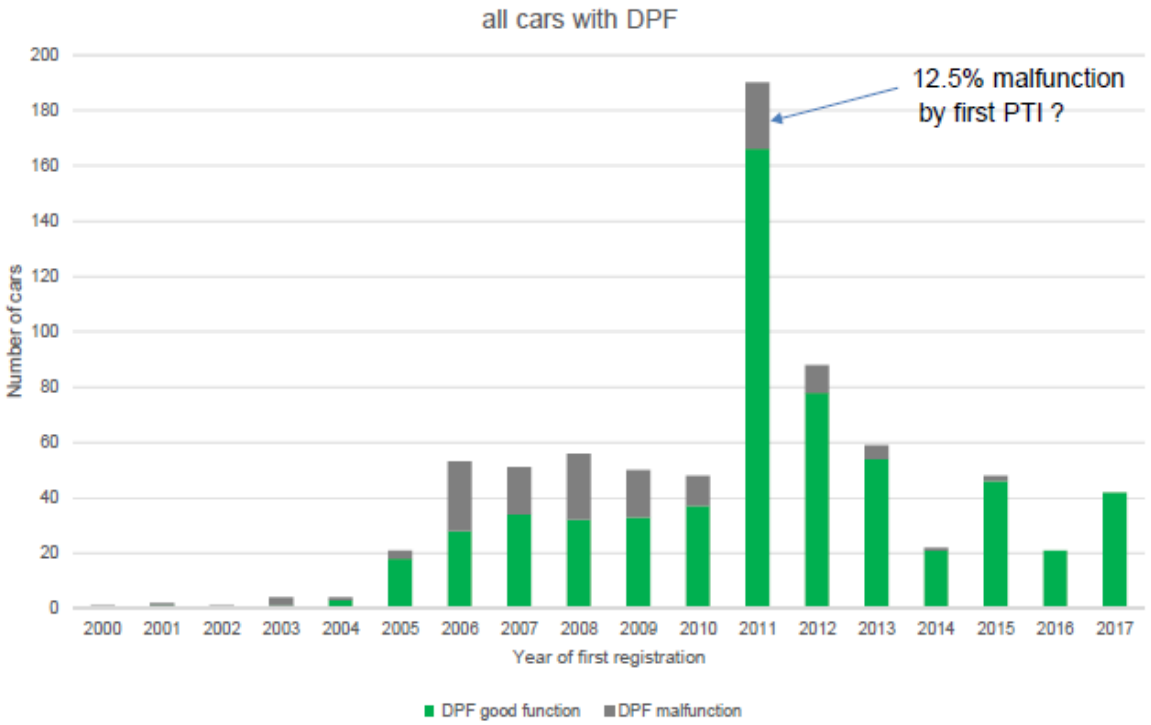
Inlet

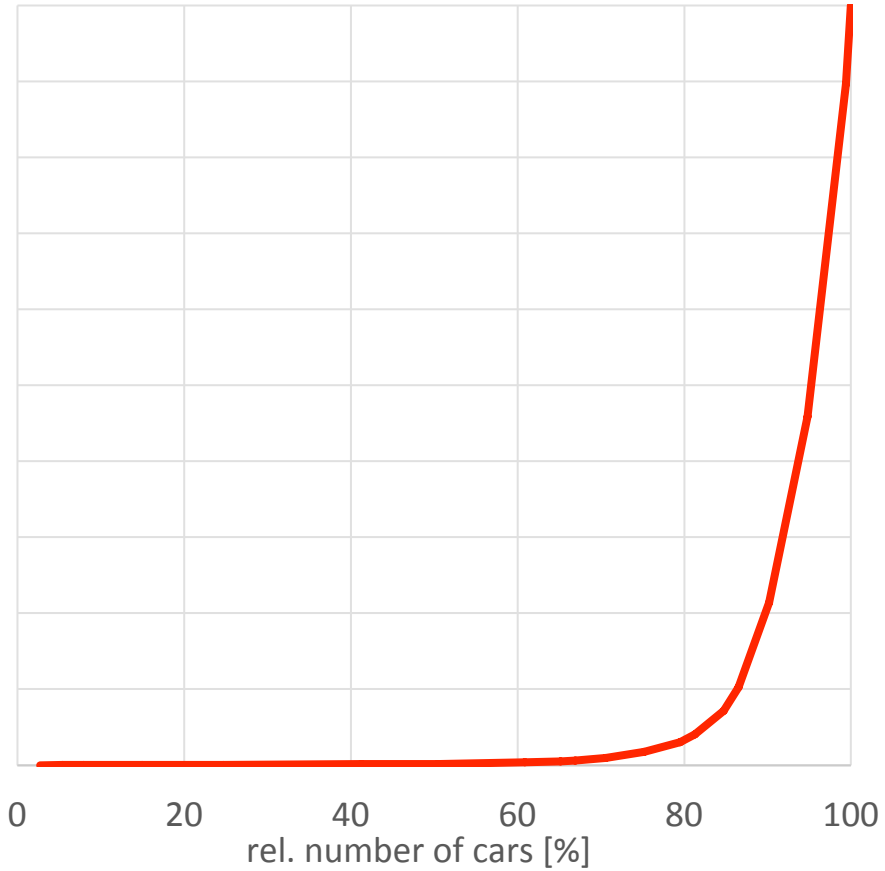




because they want to avoid cost for proper repair or cleaning

Cumulative Contribution of High Emittors at Zürich to Fleet Emission





H.Burtscher / FHNW
VERT-Forum March 2019

Eliminating 5% high polluters will improve the fleet average by a factor of >20

PTI – the Individual Emission Control

- EU-Directive 2014/45 (10) recommended to give up the periodic emission control for all vehicles with OBD (in CH from Jan 2013)
- This «sacrifice» was the real green light for Dieselgate and marketwide manipuliation since the authority declared officially but naively to give up control – except for some roadside checks

→ **This must be reversed and Emission PTI must become EU-Regulation**

and here is my recommendation to the German government 9/2016

Deutscher Bundestag
5. Untersuchungsausschuss
der 18. Wahlperiode

Ausschussdrucksache
18(31)38

Beitrag zur Sachverständigenanhörung des 5.PUA (18/8273, 8932)

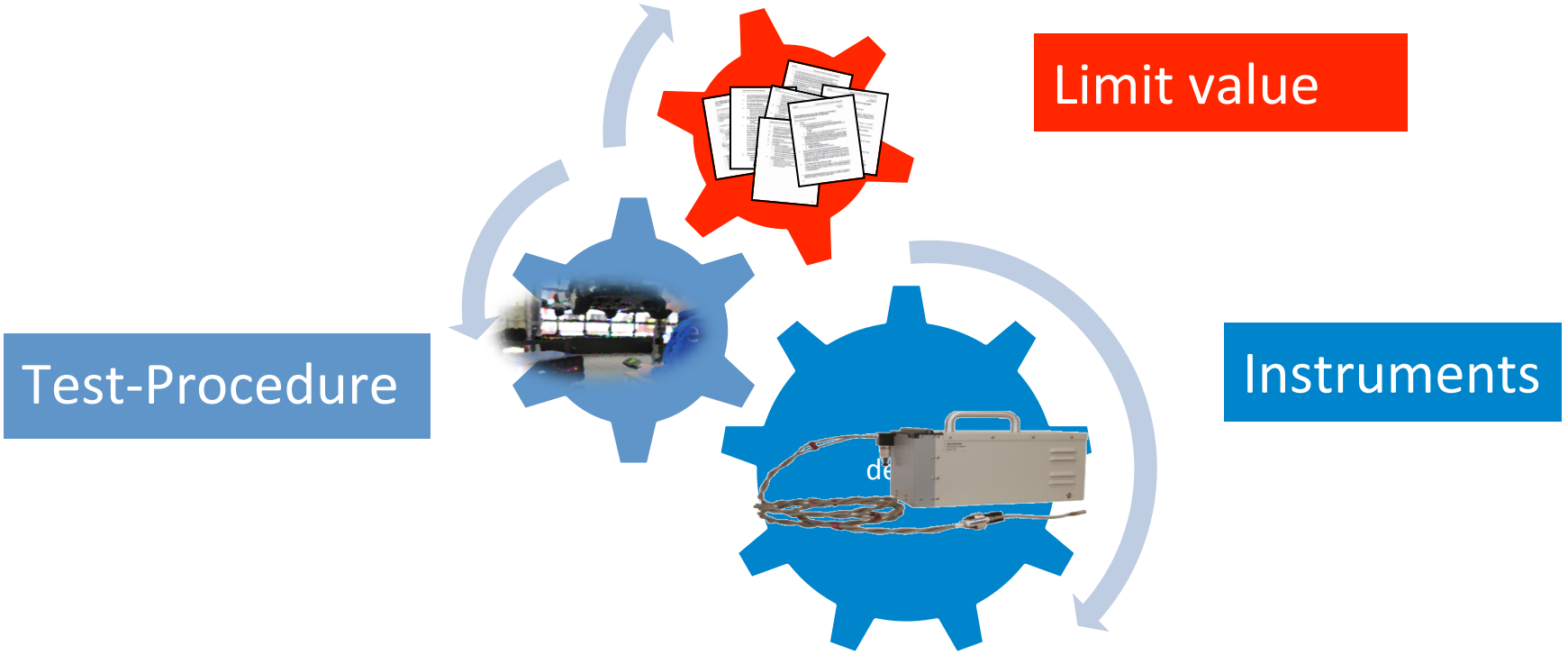
zur Frage erhöhter Schadstoffemissionen und Verbräuche von Fahrzeugmotoren durch Manipulation der elektronischen Motorsteuerung durch Hersteller und Betreiber, ungeeigneter Emissionsmessung, unzureichender Gesetzgebung und mangelhaften Vollzugs am 22.9.2016 in Berlin, Paul-Löbe-Haus, Sitzungssaal E 700

Emissionsstabilität von Fahrzeugmotoren

Der einzig sichere Weg zur Emissionsstabilität bestverfügbarer Abgastechnologie ist die flächendeckende unabhängige periodische Kontrolle nach einem neuen Testprotokoll

Germany re-introduced PTI Jan. 2017 - but simplified

TNO and VERT formed a Task Force with experts from NL, CH, DE, BE, UK and EU-JRC to elaborate a new procedure 2016-19 - will be enforced soon in NL



This must become an EU wide control mechanisme

The following actions are urgently needed and the required technology is readily available

- New PTI to detect DPF & SCR failures and manipulations
- **Strengthen PN criteria, also for NRMM**
- Emission upgrade for the in-use fleet by OEM
- Banning highly toxic secondary emissions and lube metals
- Unify metrics for exhaust and ambient pollution
- Address PN exposure in vehicle cabins

PM/PN limits at the exhaust and in ambient air are far too high and must be strengthened

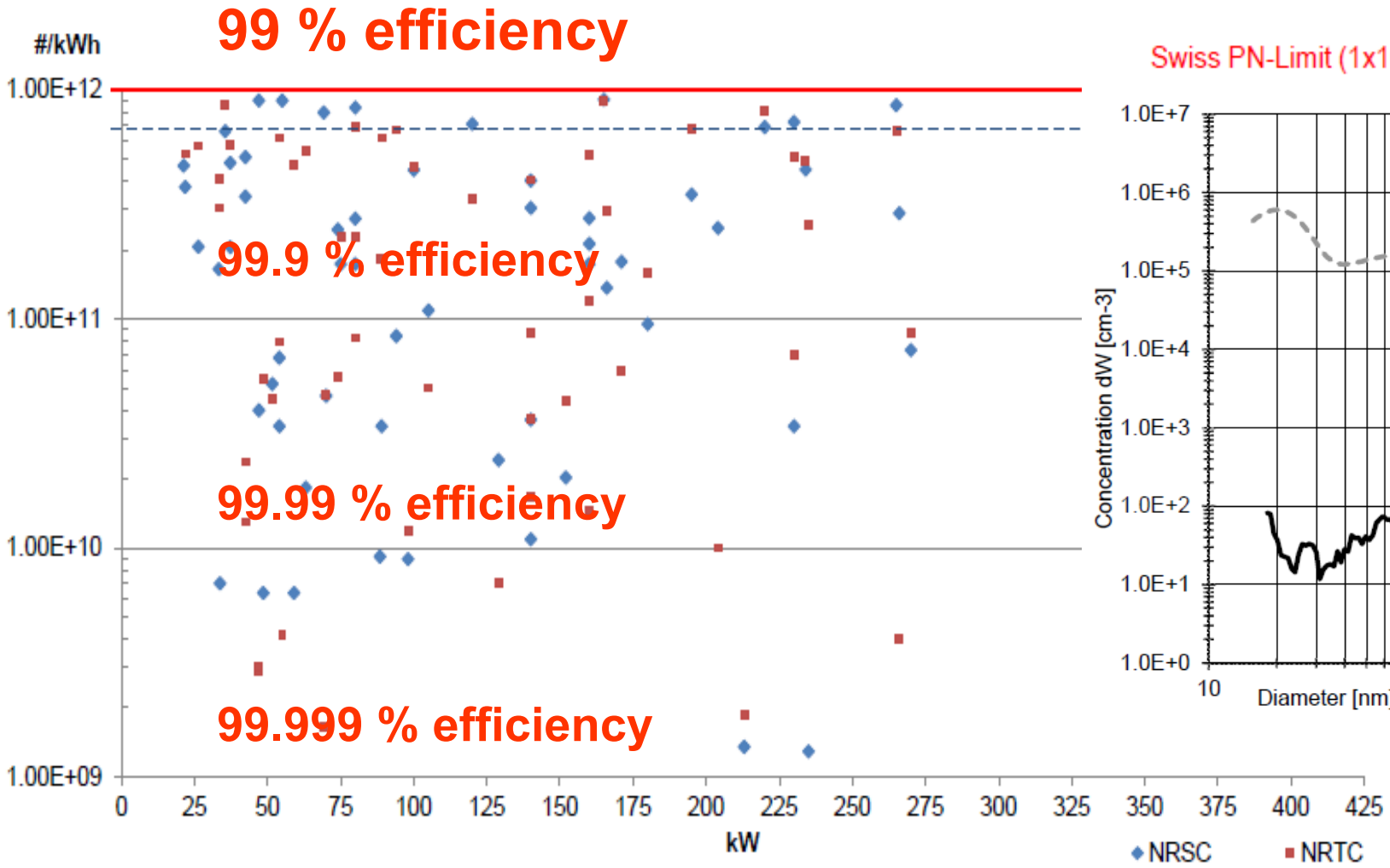
EC Particles are carcinogenic and the Miners Study 2011 found 180 lung cancer mortality cases within 16000 workers observed in 8 US metal mines. Based on this finding WHO in 2012 moved Diesel soot from class 3 to class 1 like Asbestos.
Using the usual number of max. 4 death within a population of 100'000 as acceptable guideline for a carcinogen in ambient air leads to a limit value of < 0.1 µg/m3 for EC as the **NL-official OCR study concluded on 26.Oct.2017**

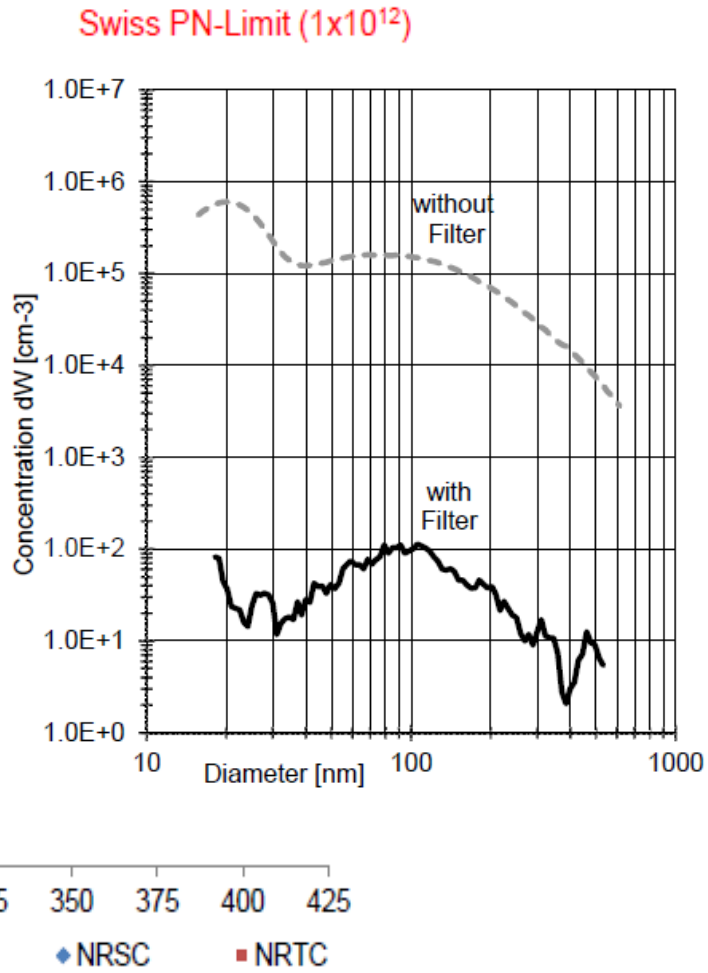
Limit values for particle exposure are far too high

- "No-effect level" does not exist with carcinogens
- **0.01 µg/m^3 lifelong creates a 4/100'000 cancer mortality risk probability**
- 1 µg/m^3 creates a 400/100'000 cancer mortality risk
- 100 µg/m^3 for Swiss tunneling (SUVA MAK) create a very high cancer risk
- 50 µg/m^3 for TRGS Germany from 2018 (MAK) is still far too high

In today's European policies and the understanding fo the public the health impact of solid ultrafine particles is by far under-estimated

DPF Technology permits limit strengthening by one order of magnitude





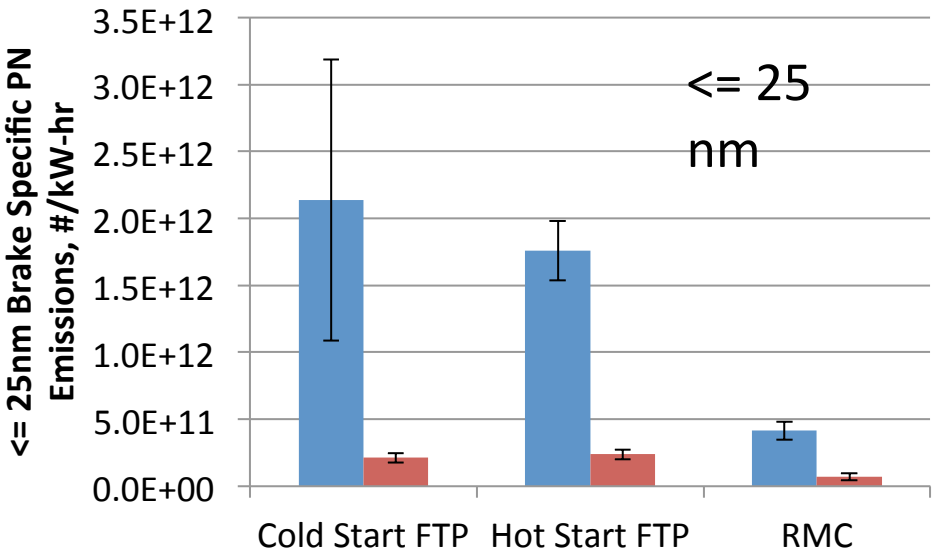
Swiss Statistics for Construction Machines with DPF

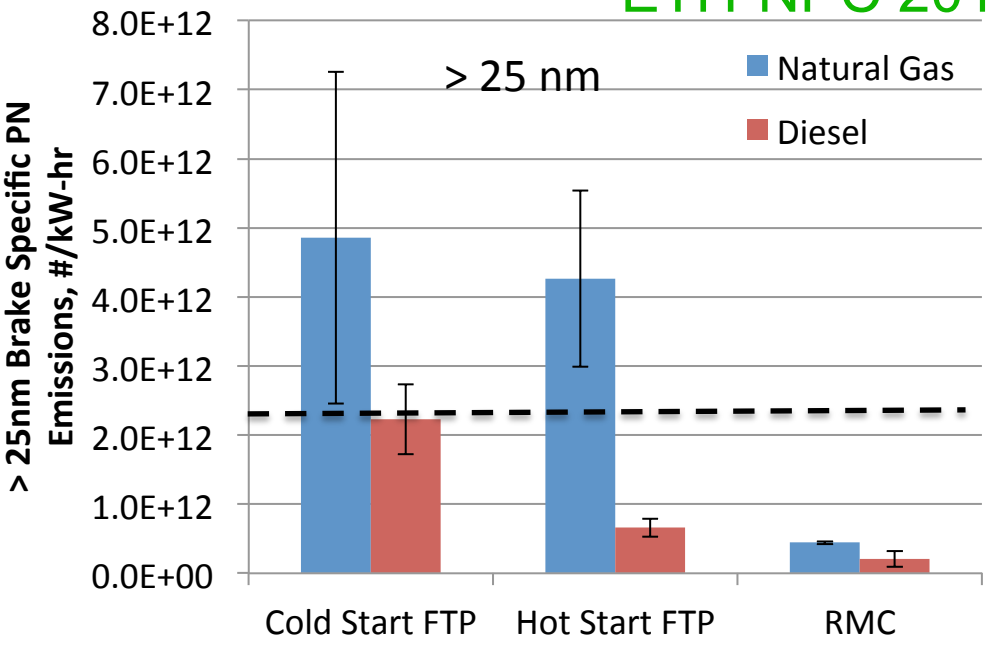
and not only with DIESELS

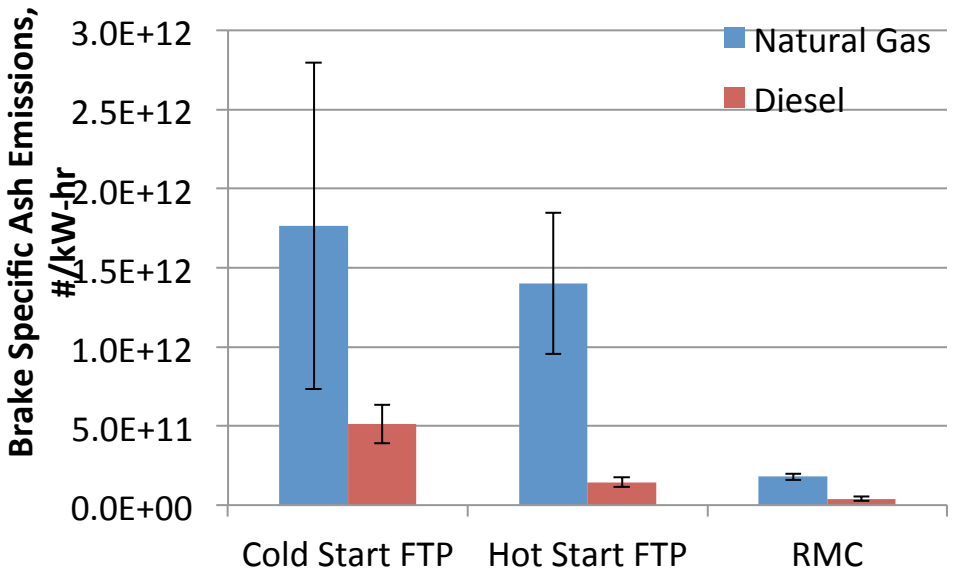
Modern PETROL car

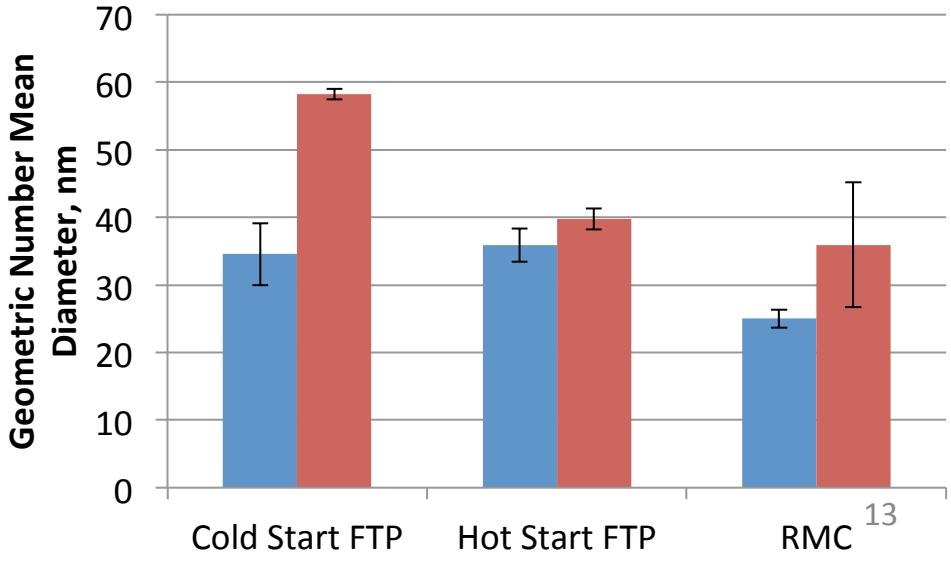
Modern Diesel car

And why are CNG-Engines promoted Khalek SWRI ETH-NPC 2017
and Tax exempted ?









The following actions are urgently needed and the required technology is readily available

- New PTI to detect DPF & SCR failures and manipulations
- Strengthen PN criteria also for NRMM
- **Emission upgrade options for the in-use fleet by OEM**
- Banning highly toxic secondary emissions and metals
- Unify metrics for exhaust and ambient pollution
- Address PN exposure in vehicle cabins

The following actions are urgently needed and the required technology is readily available

- New PTI to detect DPF & SCR failures and manipulations
- Strengthen PN criteria, also for NRMM
- Emission upgrade for the in-use fleet by OEM
- **Ban highly toxic secondary emissions**
- Unify metrics for exhaust and ambient pollution
- Address PN exposure in vehicle eabins

The following actions are urgently needed and the required technology is readily available

- New PTI to detect DPF & SCR failures and manipulations
- Strengthen PN criteria, also for NRMM
- Emission upgrade options for the in-use fleet by OEM
- Ban highly toxic secondary emission and lube metals
- **Unify metrics for emission and ambient pollution**
- Address PN exposure in vehicle cabins

and ambient Air Criteria?

Beijing 20.12.2012 9:00
day before predicted apocalypse

DISCmini: 90'000 P/cm³
(60 nm → 20 µg/m³ BC)

PM2.5 official: 182 µg/m³

(US-embassy: 320 µg/m³)

24h-mean value

Measurements in China:

20.12.2012 **90-120.000 PN/cm³**
at reported PM2.5 >300µg/m³ → unhealthy air

18.12.2013 **200.000-500.000 P/cm³**
at reported PM2.5 <50µg/m³ → healthy air ??

Apparent disconnect between PN number concentrations and PM concentrations in highly polluted atmospheres
Which metric characterizes health effects best?

The following actions are urgently needed and the required technology is readily available

- New PTI to detect DPF & SCR failures and manipulations
- Strengthen PN criteria also for NRMM
- Emission upgrade options for the in-use fleet by OEM
- Ban highly toxic secondary emission and lube metals
- Unify metrics for exhaust and ambient pollution
- **Address PN exposure in vehicle cabins**
- Introduce alcylate (benzene free) fuel for handheld tools

Airparif study

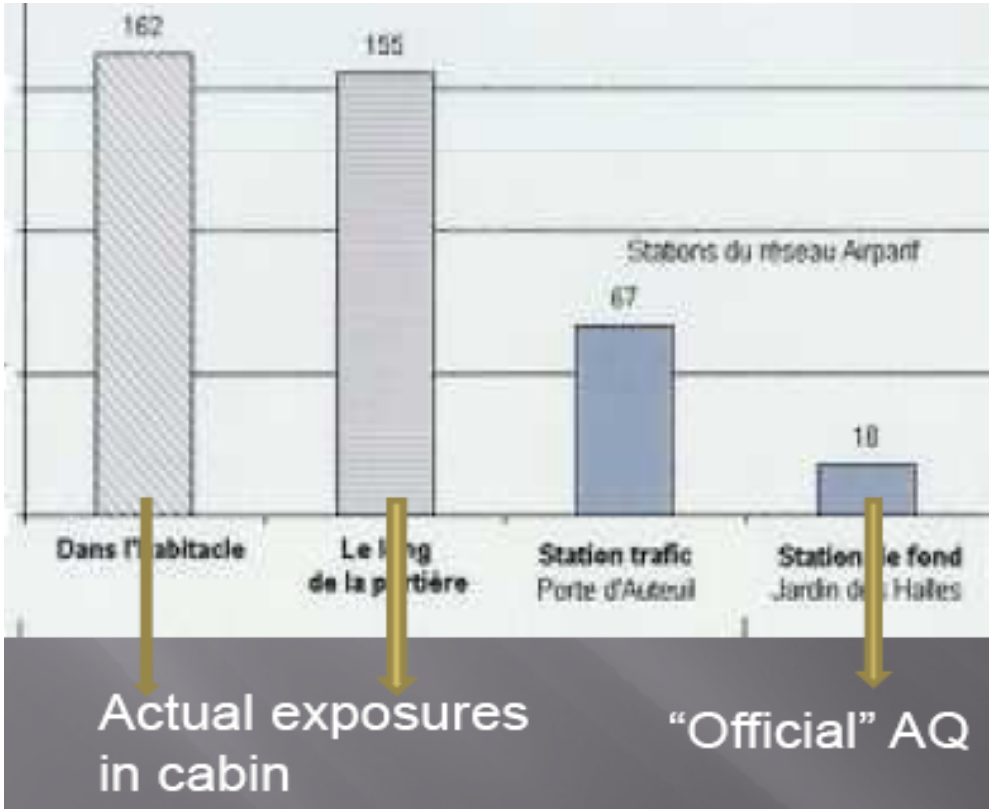
This study was published on the internet site of Auto-Moto and is accessible by link

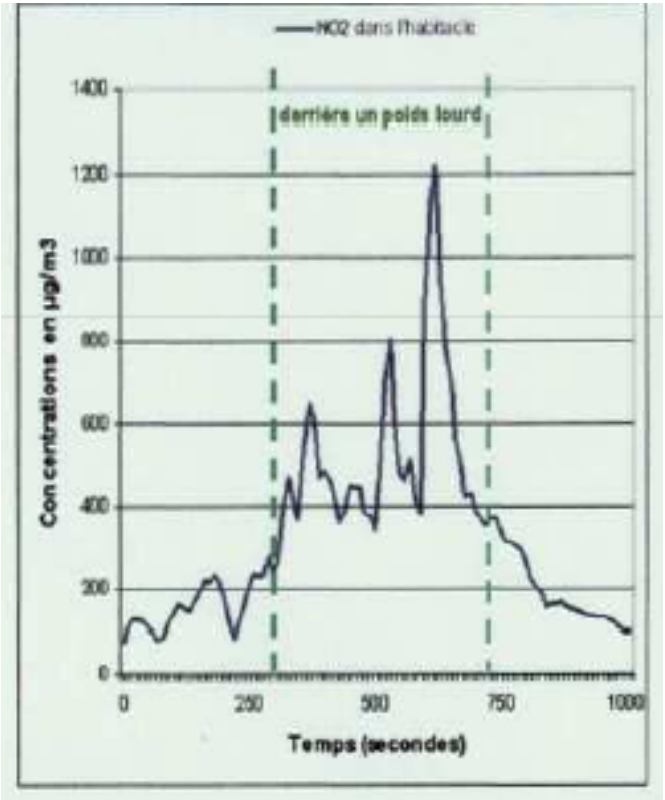
http://www.auto-moto.com/sommaire/article.php?id=4624 or

http://www.airparif.fr/airparif/pdf/mesures_embarquees_synthese.pdf

Figure 1 : Emplacements des prélèvements d'air dans l'habitacle et le long de la portière du véhicule test.

Results from Airparif 2007

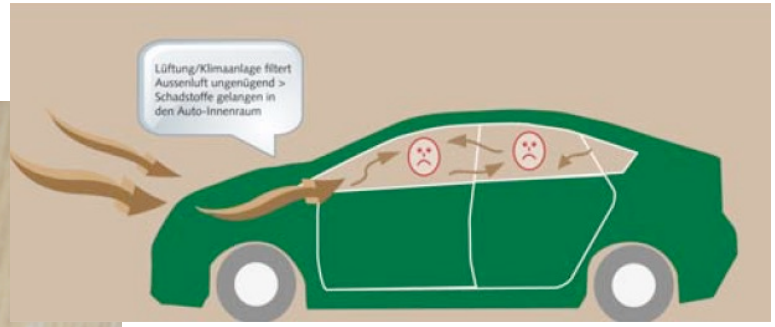


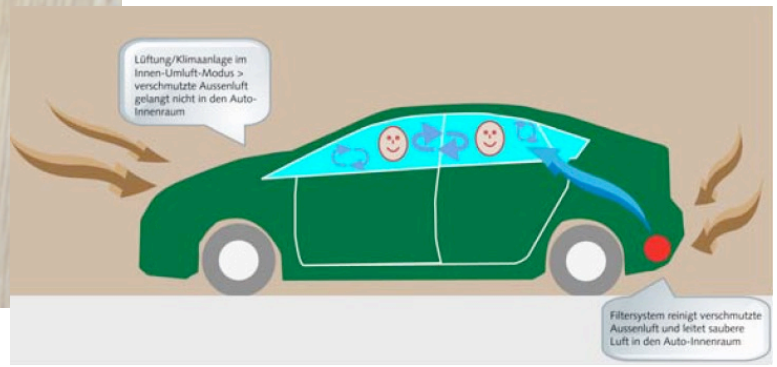


In Cabin compared to Curbside [µg/m^3]

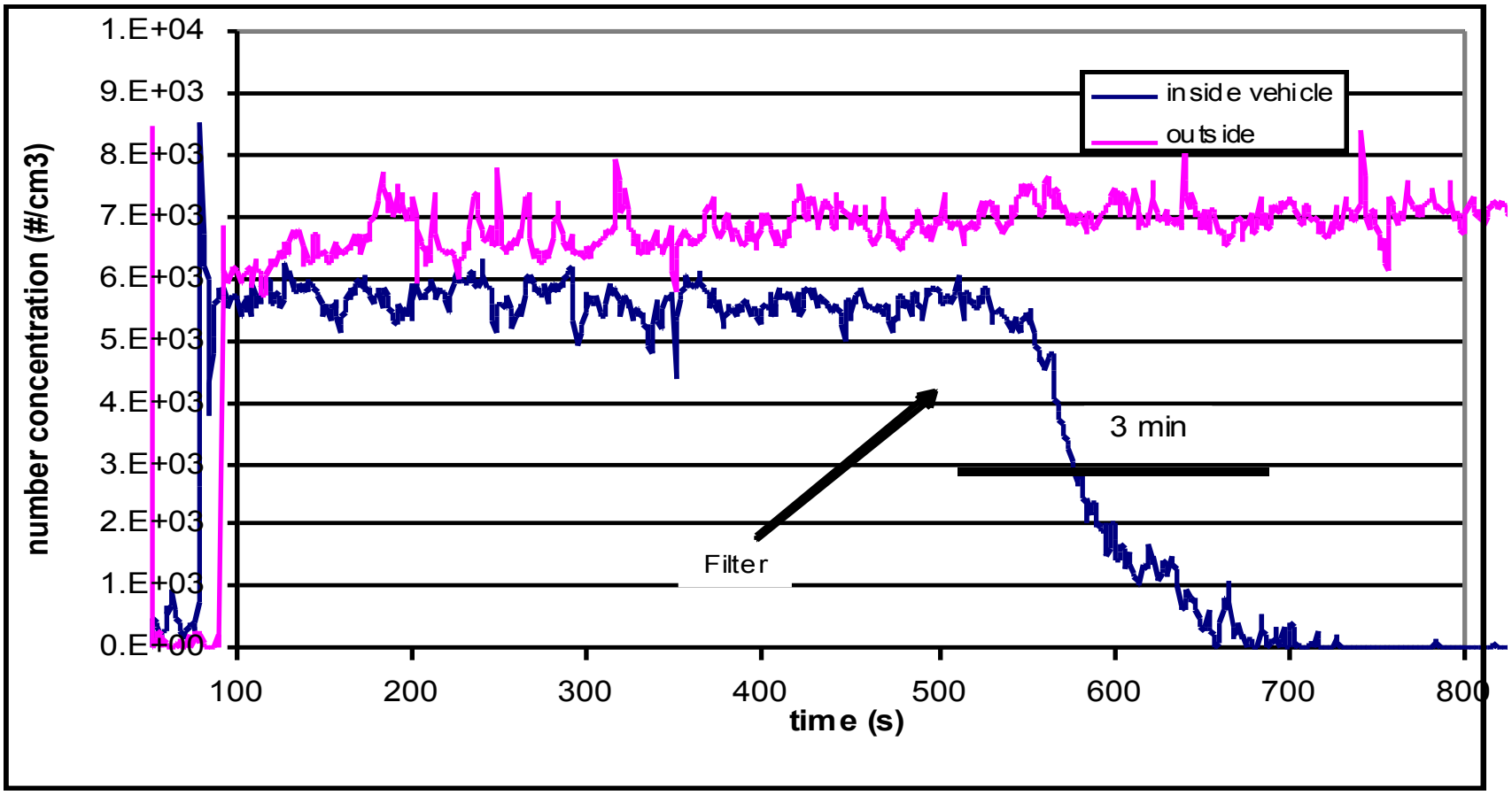
Behind a Truck

Cabin Filter: "NanoCleaner“ available





Doors shut, Filter ON...



The following actions are urgently needed and the required technology is readily available

- New PTI to detect DPF & SCR failures and manipulations
- Strengthen PN criteria also for NRMM
- Emission upgrade options for the in-use fleet by OEM
- Ban highly toxic secondary emission and lube metals
- Unify metrics for exhaust and ambient pollution
- Address PN exposure in vehicle cabins
- **Introduce alcylate (benzene free) fuel for handheld tools**

How to avoid breathing benzene at this exposure?

this man cannot protect himself against lung cancer
nor is he protected by the manufacturer
nor by his employer
nor by the law
→ cancer, accidents

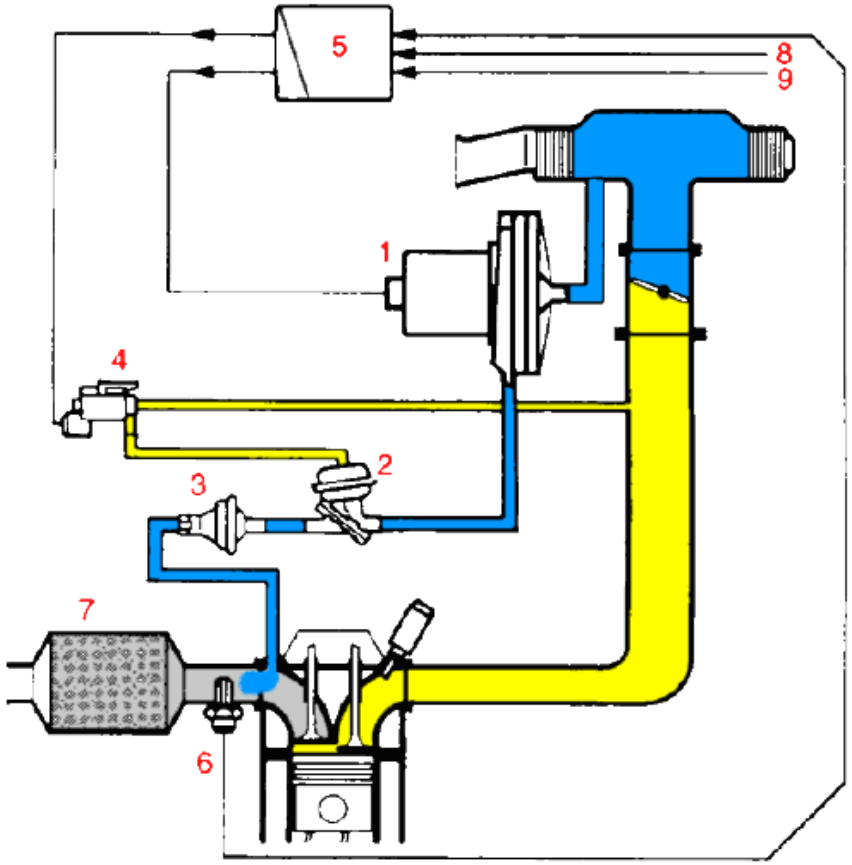
Limit Values for handheld Petrol NRSh acc. to the newest EU-NRMM-Regulation

Emissions stufe	Motorenunterklasse	Leistungsbereich	Art der Motorzündung	CO	HC + NO_x
		kW		g/kWh	g/kWh
Stufe V	NRSh-v-1a	0<P<19	FZ	805	50
Stufe V	NRSh-v-1b			603	72

PM/PN and PAH not even mentioned

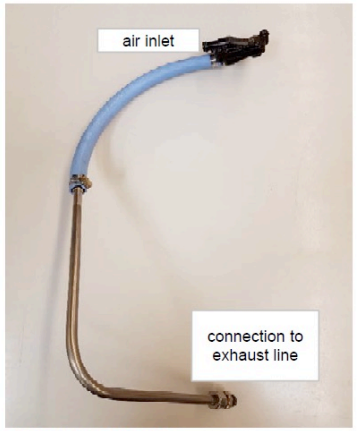
Meanwhile we are used to milligramms/kWh but here we are in the order of magnitude of ***Kilogramms***

New Approach
Effects of PulsAir (B507)
(Catalysts by BUCK, BAUMOT and UMICORE)

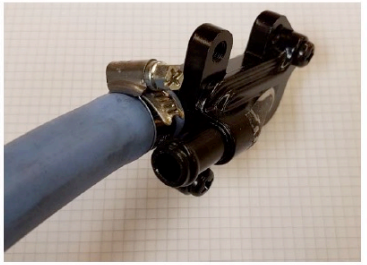


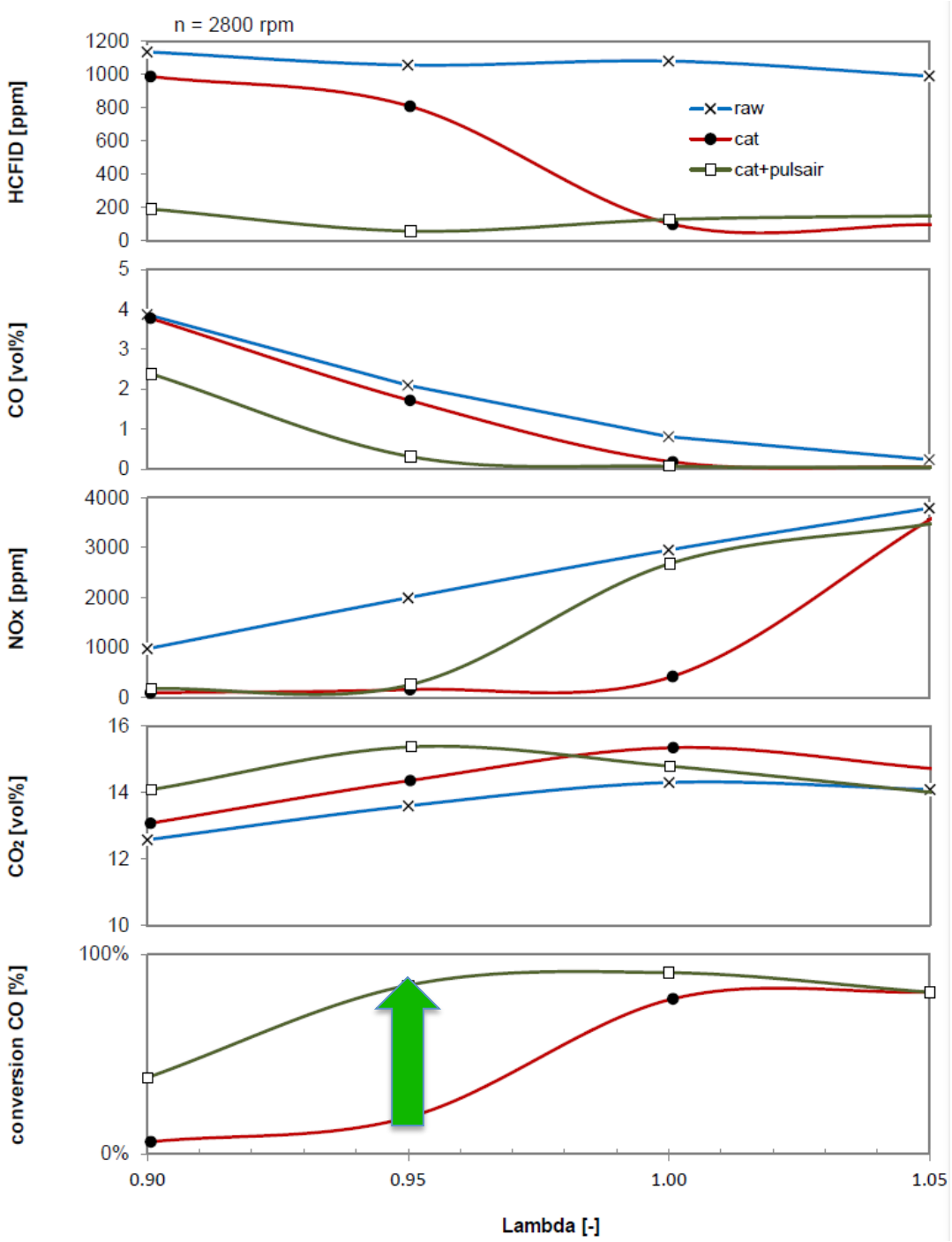
Cat. 1 - LO-TECH METAL


Cat. 2 - Buck wire-mesh



Pulsair connecting pipe


Pulsair valve



Potential of Oxicat with Pulsair,

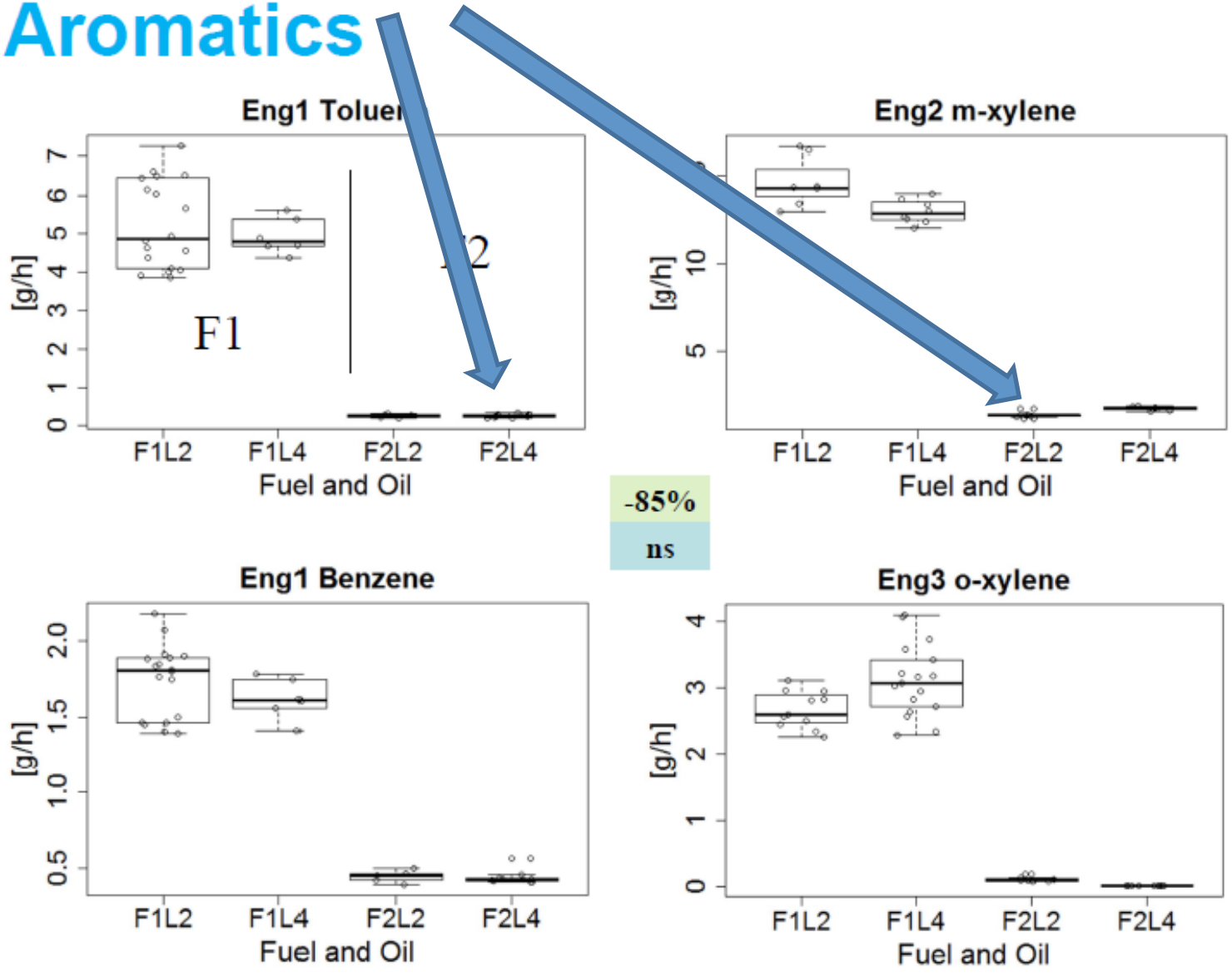
Lambda variation

Lombardini LGW523; Gasoline;
cat2, pulsair; serie wire mesh
α_Z = variable @ α^{zopt};
λ = 1.05/1.0/0.95/0.9;
Throttle = const = 30%

JRC Test Results 2016 (JRC, Zardini)

F1: normal fuel; F2: Alkylate

Aromatics



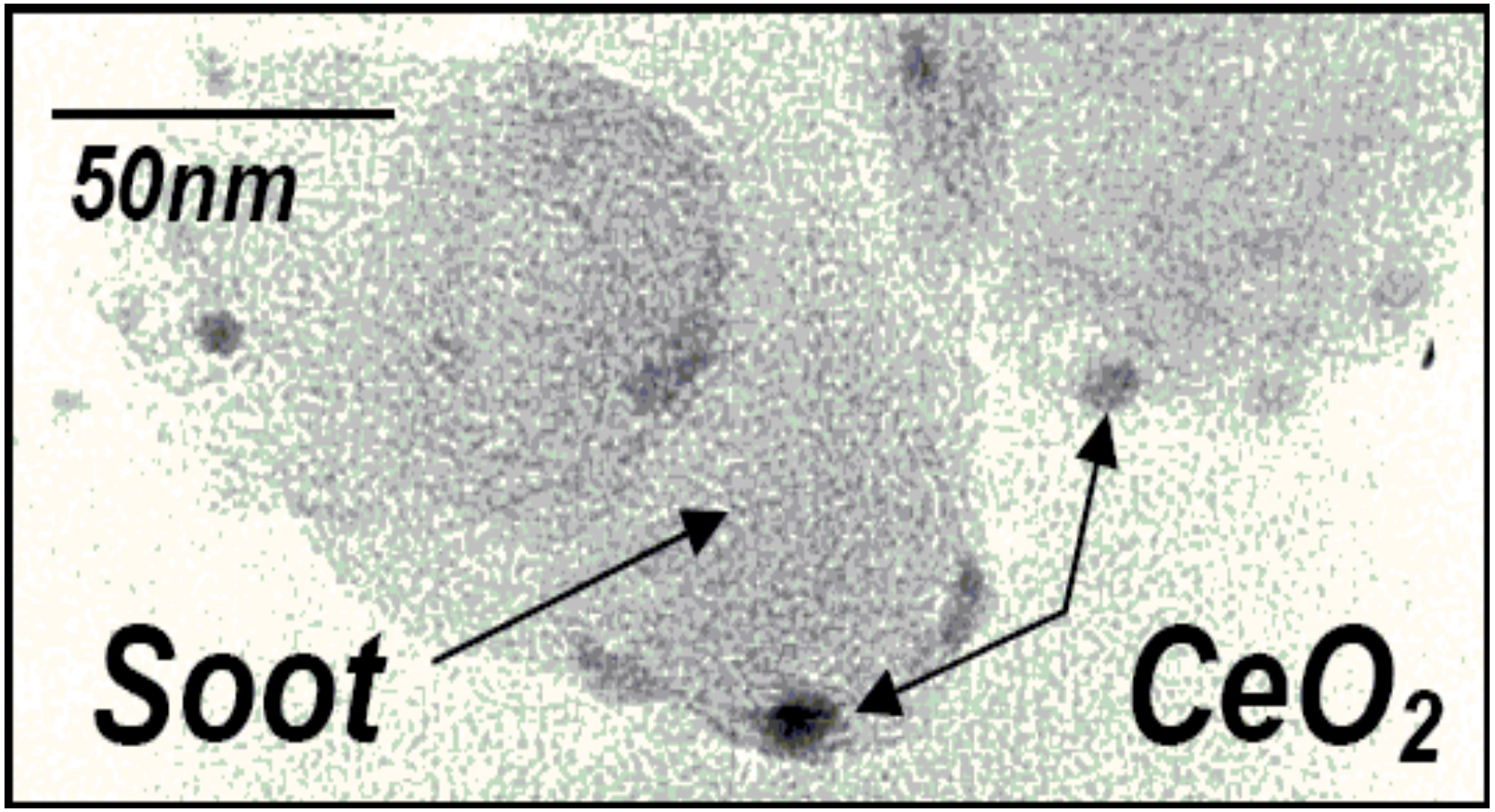
The following actions are urgently needed and the required technology is readily available

- New PTI to detect DPF & SCR failures and manipulations
- Strengthen PN criteria also for NRMM
- Emission upgrade options for the in-use fleet by OEM
- Ban highly toxic secondary emission and lube metals
- Unify metrics for exhaust and ambient pollution
- Address PN exposure in vehicle cabins
- **Reduce Metals – Create Standards for Lubrication Oils**

Particles are coated by PAH and decorated by metal oxides

(D.Kittelson)

The Trojan Horse Effect



Ash Emission high at idle

Diesel

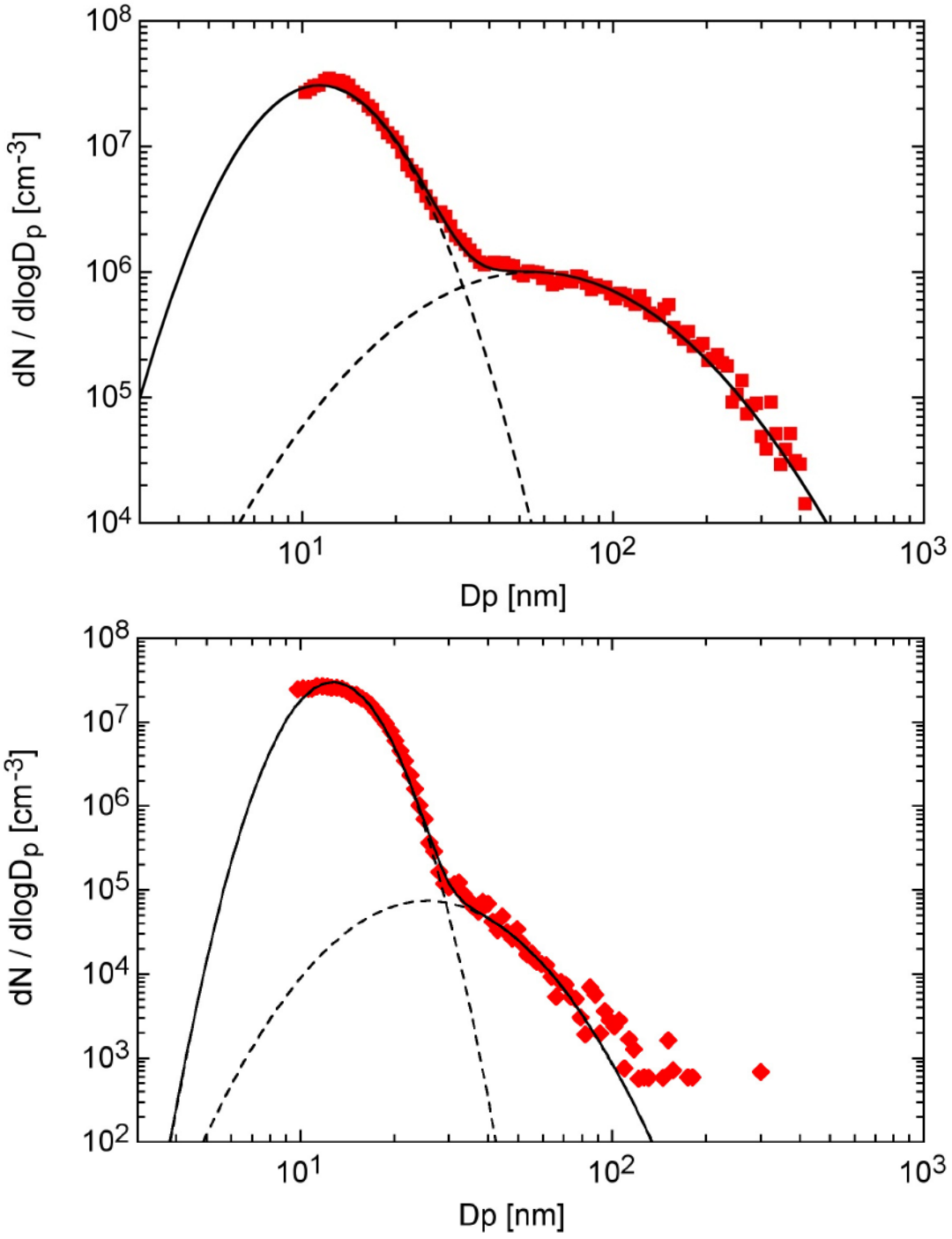
Sootpeak: 80 nm; 10^6 P/cc

Ashpeak: 10 nm; 10^7 P/cc

Petrol

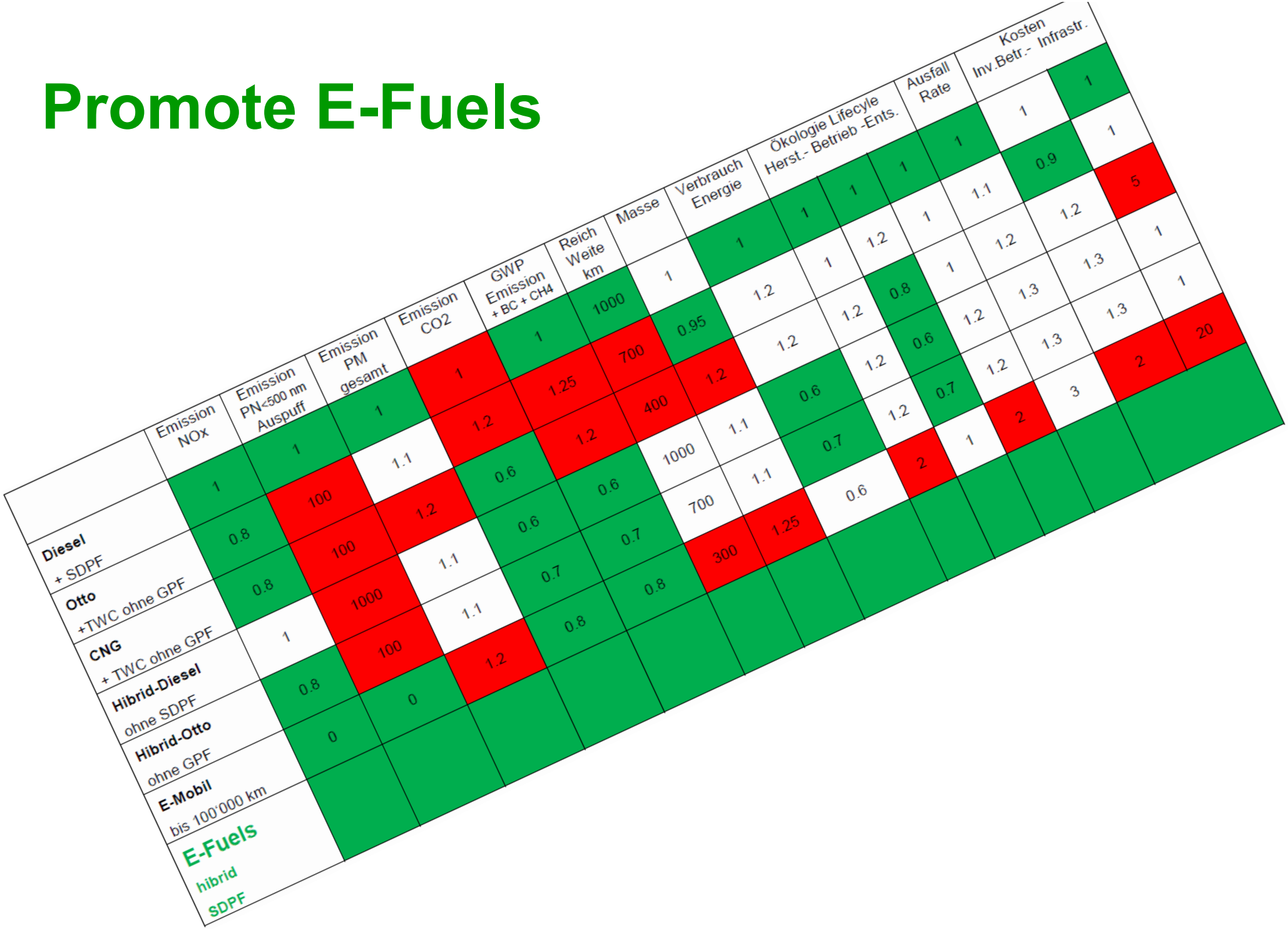
Sootpeak: 40 nm; 10^5 P/cc

Ashpeak: 10 nm; 10^7 P/cc




Lubrication Oils
must be regulated with
respect to toxic ingredients

Promote E-Fuels



based on

EUROPEAN COURT OF AUDITORS

A VERT Contribution to EU Court of Auditors Workshop on «EU-Response to Dieselgate»

Luxembourg 2.Oct.2018 – Report published Feb.2019

EU-Actions needed

to introduce, enforce and preserve
Best Available Technology
for Elimination of Toxic Air Contaminants
Emitted by Internal Combustion Engines