HIGHLIGHTS of the 12.VERT-Forum

CALAC+ 27.4.2022, A.Mayer, VERT-SC

MOVING TARGETS IN NANOPARTICLE ABATEMENT

12th VERT Forum, March 24th 2022

Registration

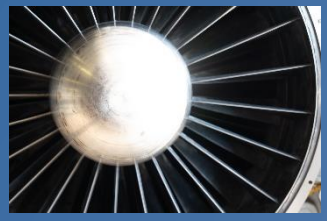
Registration Link VERT FORUM 2022

There is no participation fee (registration needed)
The conference will start at 9 am and end at 6 pm CEST.
Conference opens at 08:30 am

E-Conference venue

The conference will use Zoom Business Technology.
For registered participants exist the opportunity to chat with speakers and participants.



About the VERT® Forum

The annual VERT Forum this year as e-conference is a one-day conference in cooperation with EMPA, the Swiss Federal Laboratories for Materials Science and Technology and AFHB, Vehicle Emissions and Powertrain Systems Laboratories.

Scientists and practitioners discuss the latest trends of Best Available Technology to minimize health and climate impact of combustion engine exhaust.

Cordially invited are members of

- Environmental and municipal traffic authorities
- Indoor air cleaning community and HVAC
- Public and occupational health authorities
- Light and heavy duty vehicle manufacturers and operators
- Manufacturers, operators of vessels, locomotives and airplanes
- Public transport, harbor and airport management
- Emission regulatory authorities and research institutes
- Manufacturers of emission control technologies
- Manufacturers of emission measurement equipment.

The new format of the conference will leave lots of opportunities for discussions and questions.

What VERT® stands for

An association dedicated to the promotion of Best Available Technology for emission control.

The core objective of VERT® is the minimization of health burden caused by combustion engine emissions, especially the elimination of Ultra Fine Particles (UFP).

Members of VERT® are international manufacturers of engines, testing devices, DPF and SCR systems, as well as of substrate producers, chassis builders, among others.

VERT® stresses and recommends the application of particle number measurement against a pure particle mass metric. Very light Ultra Fine Particles (UFP) cause a major threat to health.

We set the highest quality standards for emission control technology by certifying emission control technologies (VERT® Label) and publishing the VERT® filter list.
VERT-Filter list

VERT® supports traffic pollution reduction programs all over the world, especially in megacities, occupational health and indoor.

Key Elements

- HEALTH RISKS OF ULTRA FINE PARTICLES
- NEW PARTICLE FILTERS FOR GASOLINE ENGINES
- NEW APPLICATIONS FOR NANOFILTERS
- PARTICLE EMISSION IN MARINE APPLICATIONS
- NPTI FOR DPF AND GPF VEHICLES
- TOXICITY OF ULTRAFINE PARTICLES WILL EURO 7 COVER IT
- NEW MARKETS AND APPLICATIONS

VERT Forum e-conference program abstracts

L. Larsen
VERT–Association
President

Moving targets

Things are changing. In the past couple of years, the VERT association has been working with a revised strategic approach to ensure the right focus in the future. Things are changing and we intend to keep following the vision of improving air quality by reducing negative impact of combustion technologies. A new CEO in 2022 will be given this challenge along with ongoing projects. NPTI will continue to be a key role, the marine industry is still in its infancy when it comes to emission control and VERTs participation in Horizon 22 project to eliminate particle emission from gasoline engines will keep us busy in the years to come. Further, is it the intention to investigate if conventional filter technology can apply to virus control and to look at alternative fuels and their environmental impact. VERT will be following the changes.

F.Cassee, Prof.;
RIVM
Netherlands

Health effect due to ultrafine solid particles of increasing concern ?

The adverse effects of air pollution on human health have been well documented and implemented in the recent update of the Global Air Quality Guidelines of the World Health Organization (WHO) established in a series of major observational studies. Interestingly, WHO also refers to ultrafine particles having a negative impact on human health but it was concluded that insufficient information is available to propose guideline values. Yet, more than two decades of toxicological research has increased our understanding on ultrafine particles may have a different effect on human health compared to the larger (microns) particles that we inhale. This presentation will present an overview on the evidence to support this hypothesis, which emphasis on particles dosimetry, biodistribution and toxic potential.

D.Rose;
CORNING
Germany

New generation gasoline particulate filters for noncatalyzed applications and lowest particulate emissions

Corning will report on a new generation of gasoline particulate filters for uncatalyzed applications. This new generation of filters has been developed to enable very high filtration efficiency, in most cases above 90%, even in the totally fresh state and over aggressive drive cycles. At the same time the associated pressure drop penalty of these new technologies is moderate and under many practical conditions comparable to Gen 1 technologies. The performance of the new filter technology will be discussed based on experimental data obtained on several vehicles and under different emission cycles. The robustness of the new technologies will be assessed based on data generated on engine bench and real world mileage accumulation on public roads.

New GPF for retrofit gasoline – a VERT-HORIZON project starting now

The EU-Commission set up a program for clean and competitive solutions for all transport modes including emission reduction for the in-use gasoline fleet. Retrofit emission reduction technology will therefore be required for cleaner, healthier air in urban centers. Within the frame of Horizon the EU commission has issued a call in September 2021 to develop solutions and demonstrate mature and commercially available GPF retrofit technology latest 2025. VERT as part of the consortium has passed the evaluation phase positively and will start this project in mid of 2022 with his partner companies and VERT members. With new Corning 2.0 substrates best available retrofit technology for uncatalyzed GPF will be demonstrated in 3-4 high mileage fleets, one of them in Israel. The project will also serve as a platform to continue research of the high emitter phenomena in general and demonstrate that new NPTI instruments are perfectly suited to eliminate the „dirty tail“ of the fleet. Both will be important contributions to systematically improve PN emission in megacities.

V. Hensel
VERT-Association
CEO

Brake wear particle emissions – Current state of play and future outlook

Particles emitted mainly due to brake, tire, and road wear – are expected to dominate traffic-related particulate matter emissions much earlier than 2030. Current braking systems are reported to be the most significant non-exhaust contributor of particulate matter to ambient air pollution. The scientific community, along with several regulatory bodies around the world, are investigating the topic of brake emissions from different perspectives. Despite the obvious research gaps – particularly in the field of possible adverse effects on human health – as well as various limitations mostly related to the lack of a standardized sampling and measurement method for characterizing brake particle emissions, there is a consensus that future regulation should limit particulate emissions from the foundation brakes. The United Nations Working Party on Pollution and Energy (UNECE GRPE) mandated PMP-IWG to develop a Global Technical Regulation (GTR) on brake emissions from Light-Duty Vehicles.

T.Grigoratos Dr. ;
EU-JRC;
Italy

Brake dust particle filter

Assessing PM10 fine dust emission of a vehicle on a holistic base, published data yields a contribution of non-exhaust emissions of about 85 %. Neglecting resuspension, the sources are brake wear, road wear and tire wear. Preferred would be reducing emissions by avoiding them. For break wear full regenerative braking is foreshadowing on the horizon, but still a long way to go. Today’s friction braking system is quite complex but highly optimized. Instead of changing e.g. materials and hence friction parameters, a filtering device capable for retrofitting would be preferred. Challenges of adapting, evaluating a filter will be discussed and solutions shown.
Authors: Martin J. Lehmann, Tobias Wörz, Lukas Bock

M.Lehmann Dr. ;
MANN+ HUMMEL
Germany

VERT Forum e-conference program abstracts

A.Mayer;
NCA
Switzerland

Filtration of bioaerosols

With DPF fand GPF we have learned to literally eliminate soot and ash particles of the exhaust gas in the lung penetrating size range 10-500 nm and VERT certifies such systems since 25 years. Why not use these successful filtration structures also for cleaning breathing air from virus and bacteria, which are in the same size range? But how to protect people indoors close to infected persons from virus infection? NanoCleanAir, a Swiss startup of the VERT network, together with Swiss universities has investigated filtration and de-activation of viruses in different filter matrices and has developed a complete ventilation system to eliminate viruses by 99.9999 %, reduce cross contamination risk by over 99 % and reduce half time to clean contaminated rooms to 8 minutes. A classroom installation is perfectly working since 8 month and applications in, hospitals, elevator cabins, public transport and even aircraft cabins are on the way.

K.Schrewe;
HJS
Germany

SMF® - Innovative thin metallic filter media for industrial filtration applications

The known advantages of the thin, pleatable SMF® material, such as sharp separation efficiency at 10µm or good cleanability, shall be used for new industrial applications, like hot gas and liquid filtration. SMF® material is a mechanically and thermally highly stable filter medium, which can be pleated similar to paper or synthetic filter media. The SMF® base material is industrially manufactured as quasi endless sheet that is wound on a coil. The material is further processed into typical filter modules for the named applications. The performance of the medium is described by qualifying it according the corresponding standards of both oil filtration, e. g. multi-pass acc. ISO16889 and gas filtration in accordance with ISO16890 and e. g. VDI3926. Filter cartridges with ø 130 or 160mm up to 3m length are currently being tested for hot gas filtration and further developed to enable up to ca. 9m length.

A.Friedrich Dr.;
DUH
Germany

Air pollution from ships in the Mediterranean sea

Emission from sea going ships create a massive air pollution problem in harbors and near land. Up to 300 km the impact of these pollutions can be detected. In the Mediterranean Sea the ship traffic is quite intensive. Therefore, it isn't surprising the measured values for particles and nitrogen oxide are high. But also the concentration of ozone due to the high emission level of the precursors is enormous. In the recent years, the impact of this emission came to the public knowledge and abatement measures started. Very recently the Barcelona convention adopted a Sulfur Emission Control Area for the Mediterranean Sea and submit the request the IMO to introduce the SECA from the 1st of January 2025. For a NECA the discussion started.

Diesel particulate filters in marine use – performance evaluation after three years of service"

Danish Technological Institute has evaluated the performance of closed wall particulate filters which were retrofitted to the main and auxiliary engines in a Danish ferry. The filters have now been in operation for three years. We present our measurements techniques and results. We will also present another more recent demonstration project with closed wall DPF and urea-based SCR in a combined modular design, which can be installed as retrofit. This aftertreatment system is designed to be used with up to 1000 ppm (0.1 %) sulfur, which is the limit in the SECA zones. The system is expected to reduce emissions of NOx below the IMO Tier II limit and PM/PN below EU Stage V.

T.D.Pedersen Dr.;
DTI ;
Denmark

A new membrane filter concept for HFO

Overall particulate emissions from ocean-going vessels are not much less than those from all land vehicles and are largely responsible for the melting of the polar ice caps. Because of the technical challenges, however, there have been no successful solutions so far and therefore no international regulations. A consortium under the leadership of VERT proposed a new technology with a ceramic membrane filter and pressure pulse cleaning, which should also be suitable for heavy fuel oil and for retrofitting. Test on engine benches with diesel oil and heavy fuel oil have shown that >99% filtration is achieved and periodic cleaning by compressed air is possible. The development however, was limited to a pilot test on a small scale and four-stroke engines. Because of its promising potential, this approach deserves broad further development and testing under real operational conditions, as there are still no alternatives in sight for this important environmental problem.

T.Lutz;
VERT
Switzerland

Number based periodic technical inspection to improve roadworthiness

In its Sustainable and Smart Mobility Strategy, the European Commission announced the revision of the EU rules on roadworthiness, in order to ensure lifetime compliance of vehicles with emission and safety standards. This is all the more necessary as a single faulty vehicle can pollute the air more than several thousand clean ones. The current methods for periodical emission testing are not sufficiently suited for modern vehicles which is why it is necessary to consider the use of more advanced test methods based on particle number and NOx measurements. Against this background and, more generally, to keep pace with the trend of technically ever more complex vehicles, major adaptations are needed to how vehicles are inspected, both periodically and during roadside checks. The presentation will give an overview of the revision process of the EU roadworthiness legislation and outline the main elements of this review.

P.Szatmari
EU-Commission
(DG MOVE)
Belgium

VERT Forum e-conference program abstracts

G.Kadijk;
ETS
The Netherlands

Accelerating the NPTI flywheel!

In the former decade a dedicated test method for checking the PN emissions of diesel vehicles with a particulate filter (DPF) was developed. On the basis of these results the Dutch, Belgian and German governments decided to implement this particulate filter check (PFC) in 2022 and 2023. Meanwhile many developments and activities are on-going. More than 15 equipment manufacturers have developed low cost PN-counters and most of them are in the process of type approval. Furthermore UNECE prepares a revised Resolution R.E.6 on the administrative and technical provisions required for carrying out the technical inspections. Last year the European Commission investigated the performance of PTI particle counters. In a next step they will prepare a Recommendation for the particulate filter check. Currently detailed information of the PFC for policymakers, PTI-operators and emission professionals is available. Emission Training Services (ETS) recently published two books titled 'Roet in beeld' (Dutch) and 'Particles Matter' (English). More information is available on the webpage www.particlesmatter.com/book

M.Heuser;
SENSORS
Germany

Calibration of PN-PTI instruments

The implementation of Particle Number (PN) counting under the auspices of Periodical Technical Inspection (PTI) legislation for certain Diesel vehicles in different European countries results into an unparalleled quantity of PN counters in the field. This poses the challenge of safeguarding ongoing compliance with regards to metrological performance of the PN counters for the respective national regulations. Besides measurement instrument performance the traceable calibration chain to national standards and a low measurement uncertainty are key targets to maintain a high quality PTI system reducing false passes and false failures. This presentation will address the various existing applicable legislations for the verification/calibration of PN PTI devices and Sensors´ approach to comply with them.

N.Heeb Dr. ;
EMPA
Switzerland

Secondary emissions from emissions control devices and their impact

How to choose the right filter, this was a key question and motivation to develop the VERT protocols. The VERT filter test is a stepwise approach that includes testing of filtration efficiency at defined engine loads both, with new and exposed filters, after >2000 h field operation. Also included is the VERT secondary emission test (VSET), which investigates effects of filters on toxic exhaust constituents and hazardous compounds that may form during filter regeneration and combustion of accumulated soot. Obviously also the fuel chemistry affects exhaust toxicity and filter performance. A motivation to develop a secondary emission test was the general opinion of VERT, and in some cases legal requirements, that any catalytic converter technology should not produce new pollutants. But what are relevant pollutants that particle filters, DeNOx-systems or combinations thereof can produce? What should be tolerated if a filter should get VERT approval? These questions on secondary emissions generated in emission control devices and their impact on occupational health and safety will be addressed.

Emissions of handheld- and small engines 'HaSMaNet' <19k

The persons working with the machines <19 kW are mostly in the near exposure. The emission limits for this group of machines have remained unchanged for many years at a level that is significantly higher than what is technically feasible. In this presentation we recall various conclusions that have been worked out in the course of many meetings. We mention the most important technical solutions and we draw attention once again to this significant neglect of the legislative progress.

J.Czerwinski
VERT,
Switzerland

Particle emissions from mobile sources: Discussion of ultrafine particle emissions and definitions

At present there is no clear epidemiological evidence linking adverse human health effects to ultrafine particles (UFP), arguably because there is no universally agreed upon UFP definition. A commonly used definition is either particle number below 100 nm or total particle number, but without an agreed upon lower cut point. Another definition for UFP is total particle mass but without a commonly agreed upon aerodynamic diameter upper cut point. Yet another definition is lung deposited surface area weighted by lung deposition fraction, found mainly in the particle mobility diameter range from 20 to 400 nm. It is clear from these definitions that there are inconsistencies in the way UFP is used and defined in the literature. Sometimes these metrics are well correlated, sometimes not. For discussion, we suggest three new, metrics: UFP-N, UFP-M, and UFP-S, that we believe will add clarity. These metrics represent total number, mass, and surface area below 500 nm, respectively.

Kittelson D.
Prof.Dr. ;
Uni Minnesota,
USA

Why different approaches in the EU and the USA?

The evidence for concern [about ultrafine particle pollution] has grown substantially but falls short of being convincing to regulators for enacting general policies, especially at the national level." This statement is in the preface of Ambient Combustion Ultrafine Particles and Health and captures well the current state of affairs in the policy debate in the US. But things are changing rapidly. While national standards will continue to be based on the mass of PM present in ambient air, a new precedent has been set. The US has proposed new aircraft engine emission standards that include non-volatile PM mass (mg/kN) and number (nvPM#/kN) limits. Will this action spillover to other sectors like motor vehicles or heavy-duty engine standards? Will this step increase the chances of alignment between US and EU standards, especially considering the Euro 7 proposal?

A.Ayala Dr. ;
SMAQMD
USA

VERT Forum e-conference program abstracts

N.Levy;
Municipality
Jerusalem
Israel

UVAR in Jerusalem

The Jerusalem municipality's program to implement sustainable transportation via urban vehicles access regulations (UVAR) started in 2016 with a five- year program. The main step was promoting a Low Emission Zone (LEZ) for the entire city. The LEZ initiative involved a number of components: Our next UVAR step is initiating nonroad mechanical machinery (NRMM) legislation, which will be based on both the EU standards and the American standards. Our aim is to follow the same route as described for the LEZ. In this case the public campaign and negotiations will focus on the "Jerusalem Builders' Organization" which is the main construction union in the city. All the UVAR steps have been a result of excellent cooperation between the Jerusalem municipality, the ministry of environment in Israel, and the ReVeAL consortium.

A.Montalvo;
SWISSCONTACT
Peru

CALAC+ the climate and clean air program in Latin American cities

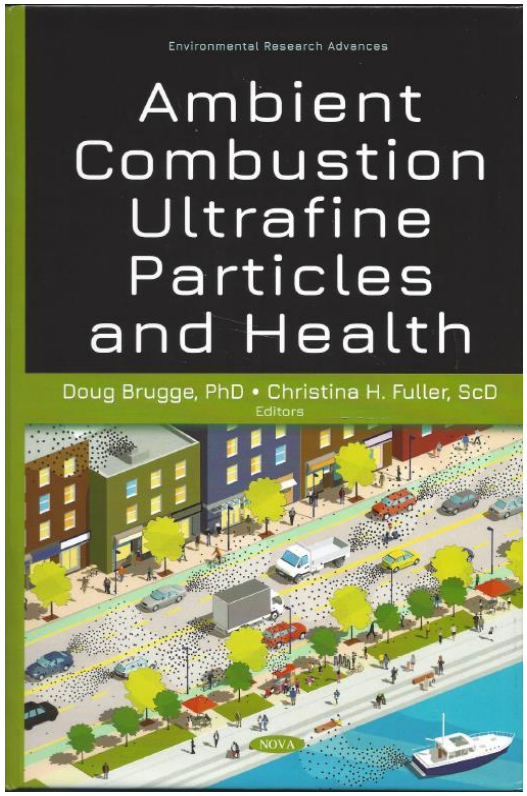
During its first phase, CALAC+ focused on providing technical assistance to promote enabling policies and regulatory conditions to reduce emissions from buses and nonroad mobile machinery (NRMM) in Bogotá, Mexico City, Lima and Santiago de Chile. Regarding buses emissions, CALAC+ contributed with studies related to the implementation and control of Euro 6/VI technologies, electromobility and vehicle environmental labelling strategies. The program also created a working group for Latin America in which three guidelines were issued for particle number measurements and inspections in buses equipped with diesel particulate filters (DPF). CALAC+ has played a key role in the region in raising awareness of NRMM emission problems, providing technical support for emission inventories calculations and the inclusion of regulatory pathways in government plans. CALAC+ conducted studies on the economic and environmental impacts of NRMM emissions reductions and developed 4 tools to transform technical information into practical inputs for policy writing.

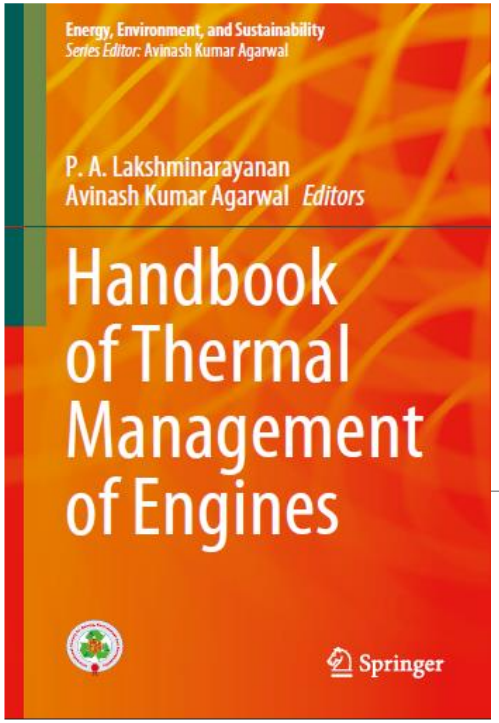
Low PN emission and BAT as well for engines > 560 kW

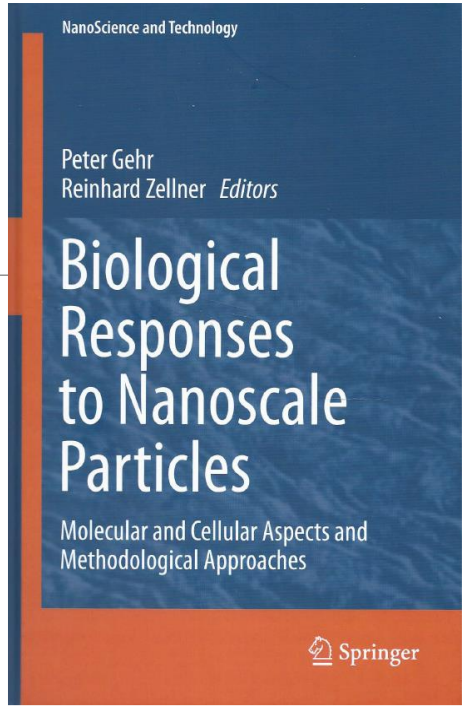
With emission standard “stage V” (2019) also emissions of diesel engines > 560 kW are now limited in Europe. However, the limit values for engines > 560 kW are higher than for engines < 560 kW and there is no particle number limit PN, which means that the gravimetric limit values can be achieved without the use of a wall flow DPF. The reasons, given for this decision were, that the fleet of construction machinery with engines > 560 kW in Europe is comparably small and these large machines usually do not operate in urban environments. Since 2019 however, new elements have been considered to also use best available technology for this high performance range: there are on one side reflections in Europe and also in the U.S.A. concerning the introduction of a follow up emission stage (Stage VI? / Tier5?) and on the other side the trend to introduce decentralized electric power stations powered by combustion engines to cover the risks of energy shortages during the difficult transition period to zero CO2 energy generation by solar and wind energy only. These plants will be close to consumers in urban areas, thus the question of BAT, in particular for exhaust gas particles, will gain importance.

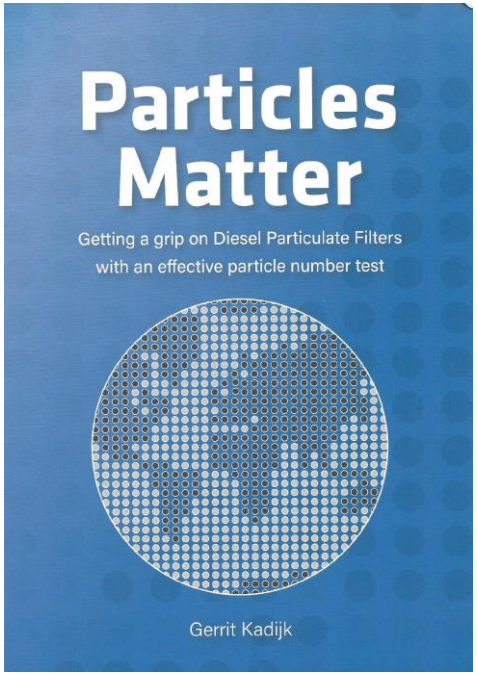
F.Jaussi;
LIEBHERR
Swirtzerland

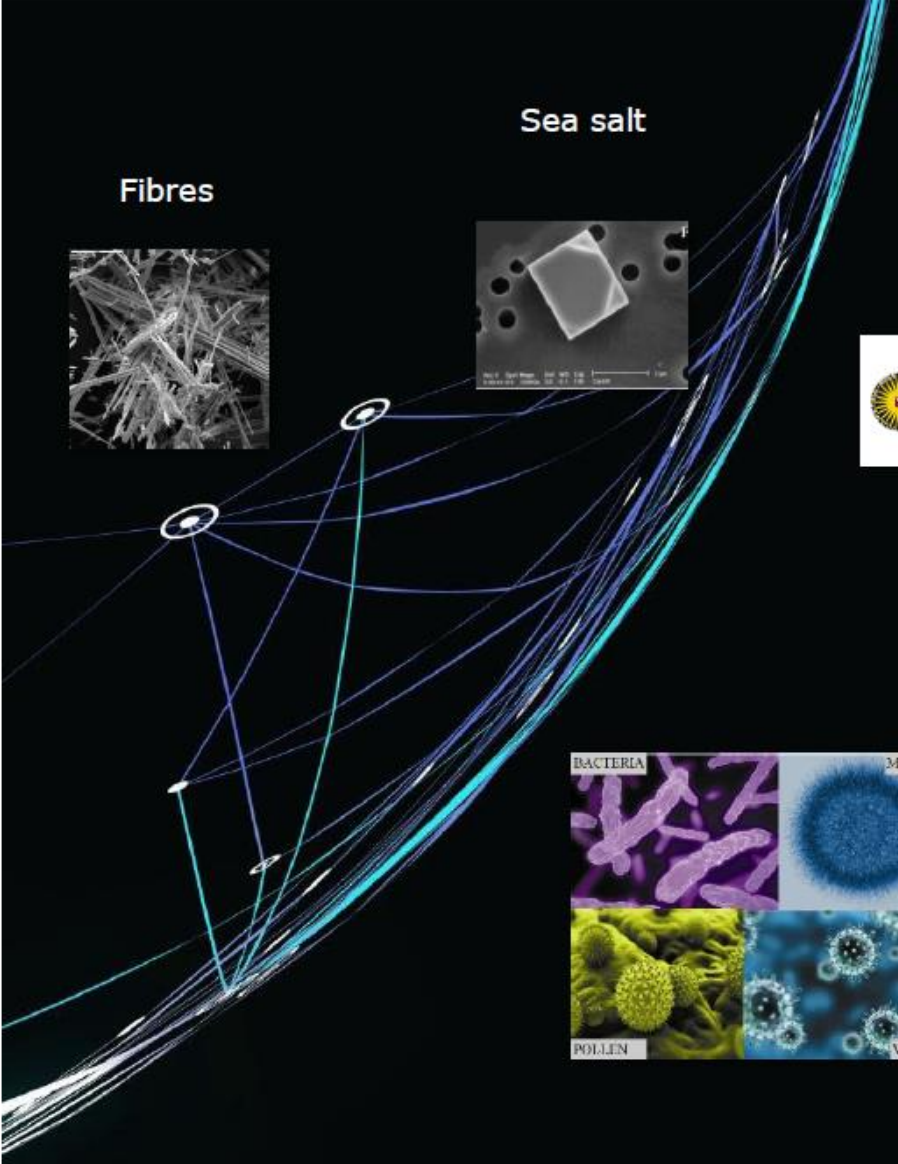
New Books by VERT associated authors appeared during the pandemic





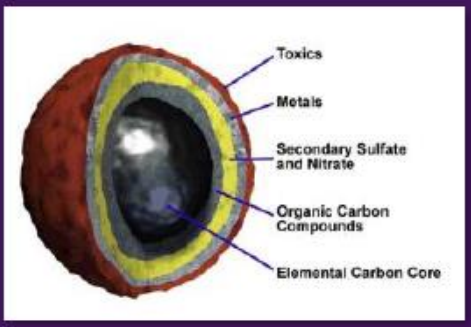






National Institute for Public Health and the Environment
Ministry of Health, Welfare and Sport

Utrecht University



Health effect due to ultrafine solid particles of increasing concern?

Flemming R. Cassee, PhD ERT

Conclusions ultrafine and health risks

- Differences in toxicity among sources
- Short-term exposure to high levels of UFP associated with decreased lung function and prolonged repolarization of the heart, oxidative stress as well as arterial stiffness directly after exposure in adults
- Risk is related to both the toxic potency and the level of exposure/dose
- Plausible that ultrafine particles can affect heart, brain and even cross the placenta after inhalation

World Health Organization

Offers new good practice statements on the management of e.g. black carbon/elemental carbon and ultrafine particles).

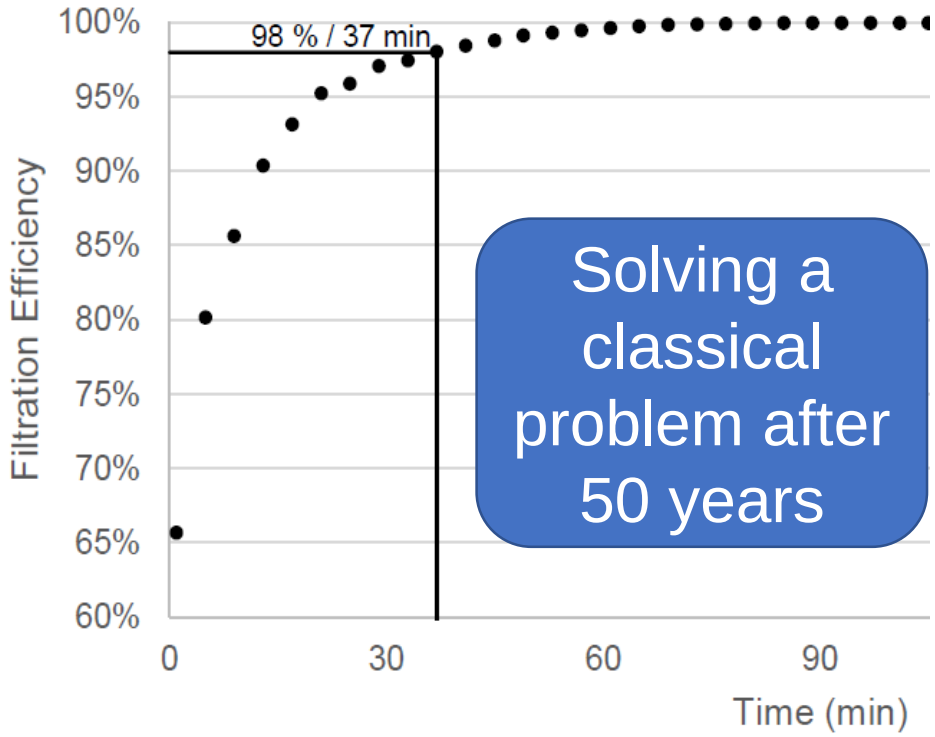
1. Quantify ambient UFP in terms of PNC for a size range with a lower limit of ≤ 10 nm and no restriction on the upper limit.
2. Expand the common air quality monitoring strategy by integrating UFP monitoring into the existing air quality monitoring. Include size-segregated real-time PNC measurements at selected air monitoring stations in addition to and simultaneously with other airborne pollutants and characteristics of PM.
3. Distinguish between low and high PNC to guide decisions on the priorities of UFP source emission control. Low PNC can be considered < 1 000 particles/cm³ (24-hour mean). High PNC can be considered > 10 000 particles/cm³ (24-hour mean) or 20 000 particles/cm³ (1-hour mean).
4. Utilize emerging science and technology to advance approaches to the assessment of exposure to UFP for their application in epidemiological studies and UFP management.

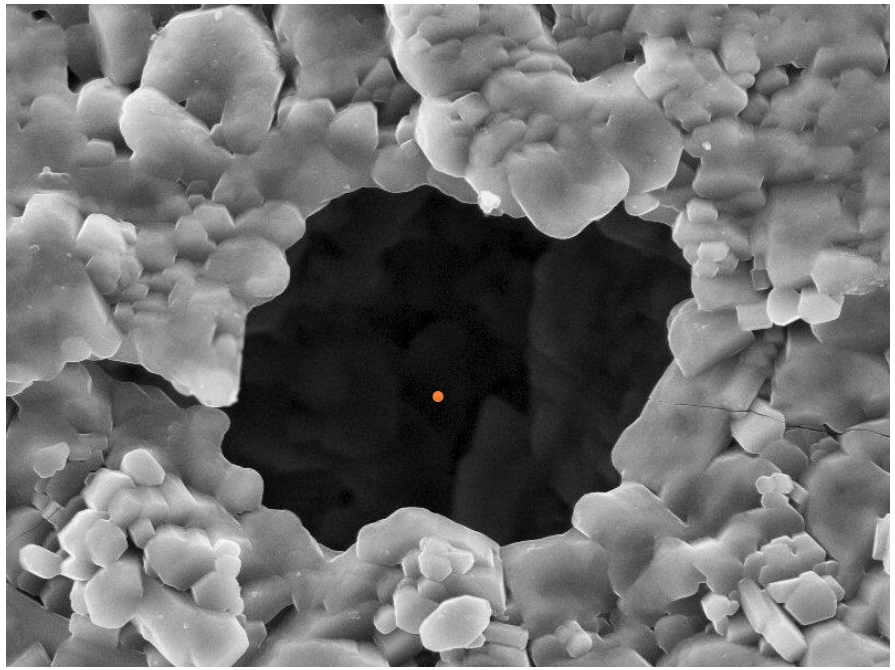
CORNING

New Generation Gasoline Particulate Filters for Uncatalyzed Applications and Lowest Particulate Emissions

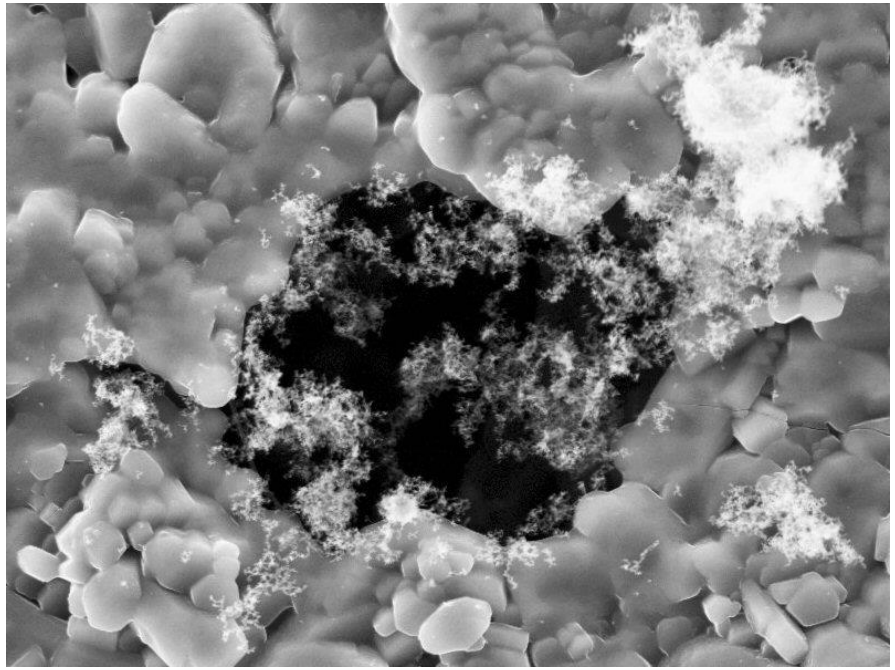
Dominik Rose, Thorsten Ogunwumi, Huiqing Wu and Thomas Glasson

24.3.2022





particles 10-100 nm
are 100 - 1000 x smaller
than pores 10-20 µm

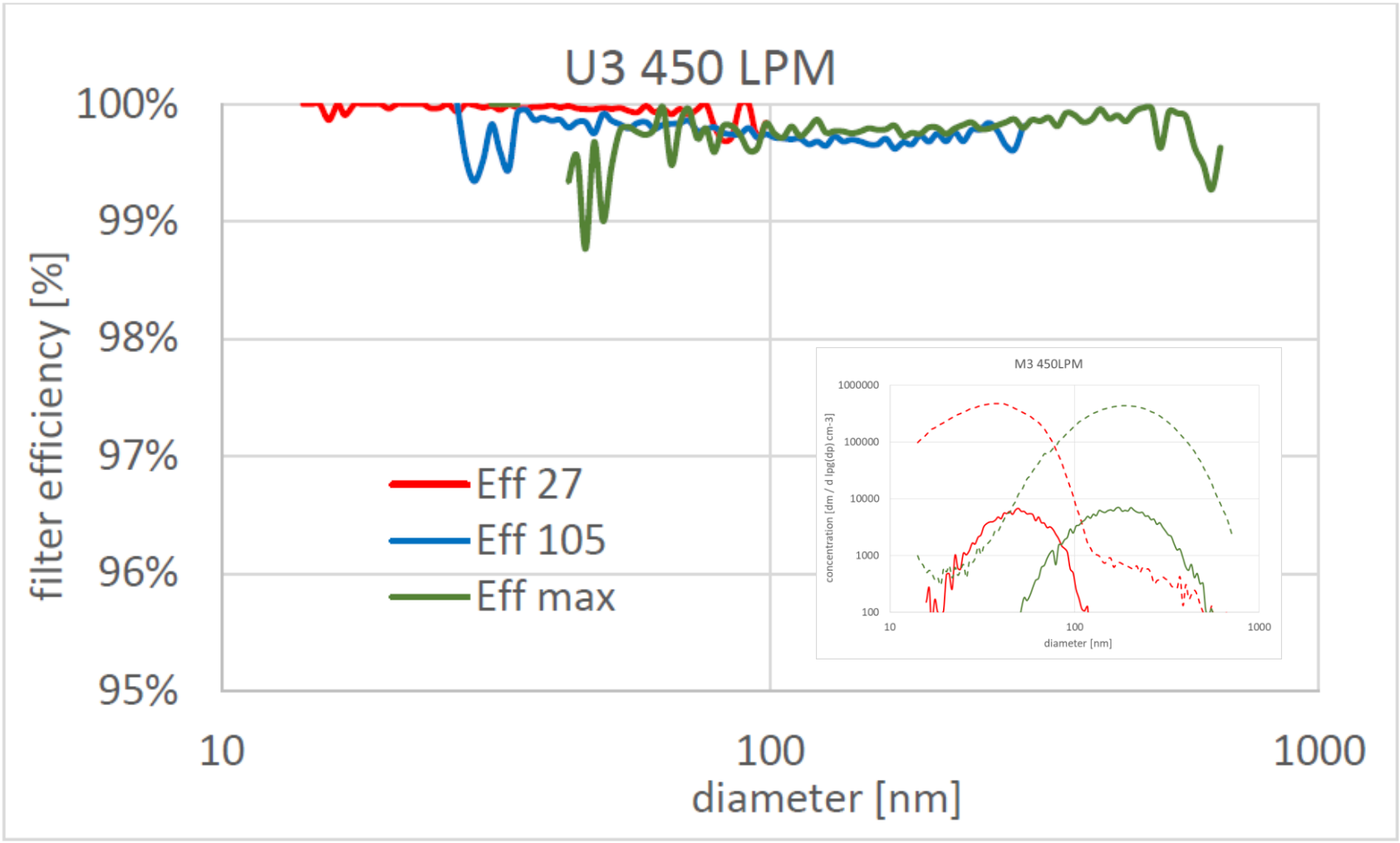


membrane like
formation of soot
particles to improve
filtration

Simon Payne, ETH-NPC 2012

New Technology for Petrol Engines
Efficiency brandnew

without deficits in the Alveoli critial size range (99.9 %)



EU-HORIZON – a VERT-Project

GPF-Retrofit

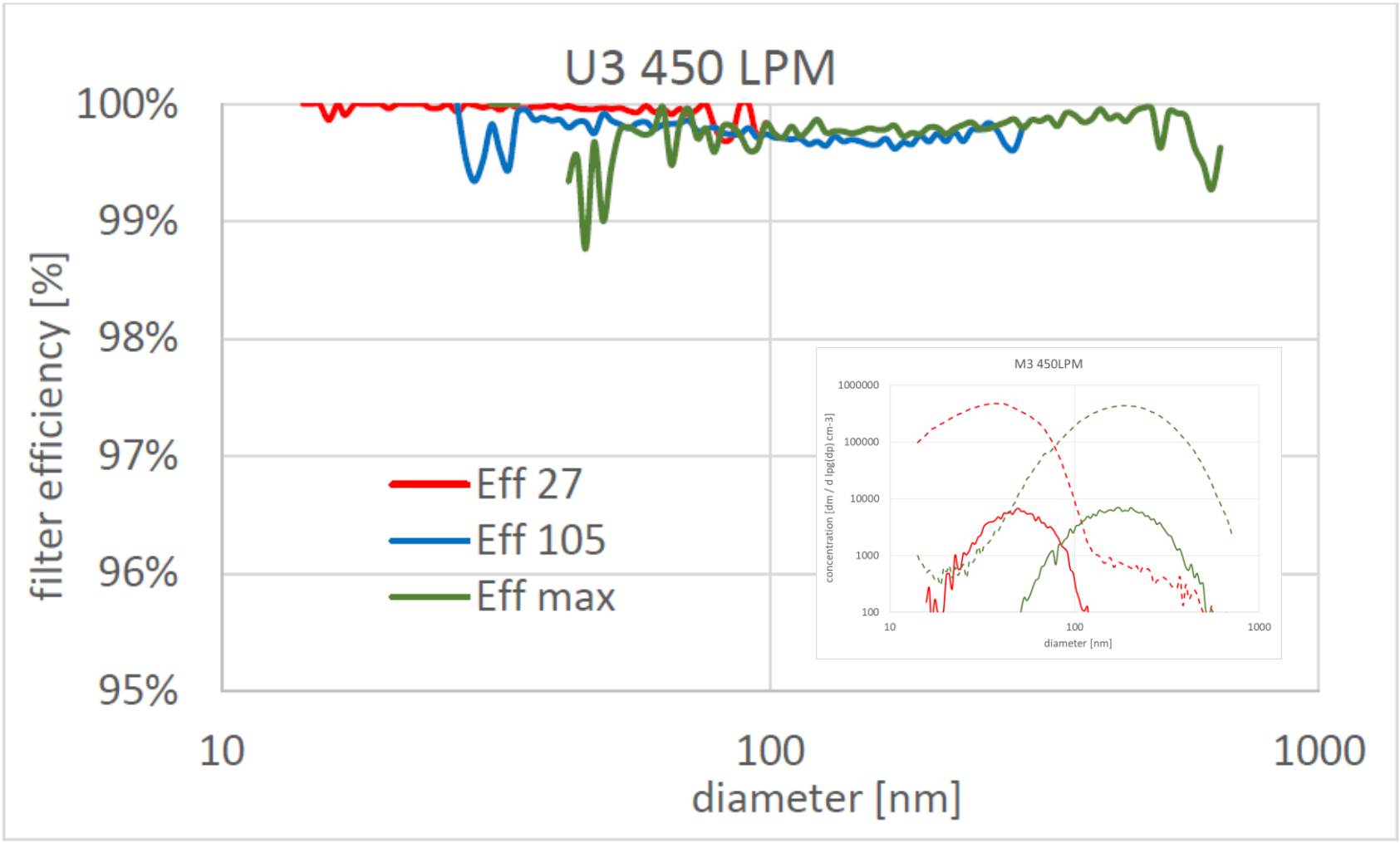
V.Hensel

Why will EU still invest in the combustion engine fleet?

- **Electrification is much slower than expected**
- **Combustion engines are expected to be used much longer than now**
- **Impact of transport** on air and water quality will continue to have **a very high share**
- **due to tailpipe emissions from older vehicles,** vehicles exceeding emissions limits in real driving conditions,
- THE EU commission considers that the current automobile fleet in Europe is **unlikely to be significantly renewed within the next 10 years**
- Special measures will be needed fot hot spots (emission zones)
- **For Diesel we have retrofit experience for gasoline not yet**

New Technology for Petrol Engines
Efficiency brandnew

without deficits in the Alveoli critial size range (99.9 %)



EU-HORIZON – a VERT-Project
GPF-Retrofit

The project target using new membrane like GPF

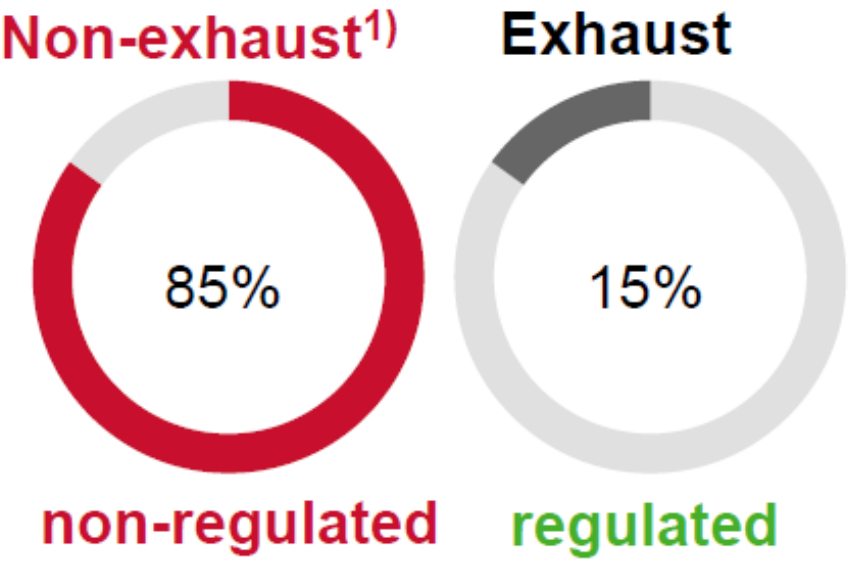
- Adapt and demonstrate an affordable high efficient gasoline particle filter
- Capable of reducing 95% of the exhaust particles – which is a challenge for gasoline engines having usually only 80%
- Cost efficient solution € 700 to € 1.000 depending on engine size and power rating
- Fast track to market by using an already proven technology in already high volume production
- Exploitation plan for retrofitting 5 million vehicles with the GPF by 2035

EU-HORIZON – a VERT+Mann&Hummel -Project

Brake Dust Filtration

M.Lehmann

- Brake Wear
- Tire Wear
- Road Abrasion
- (Resuspension)



Filtration at the Source,

- Brake Dust Particle Filter

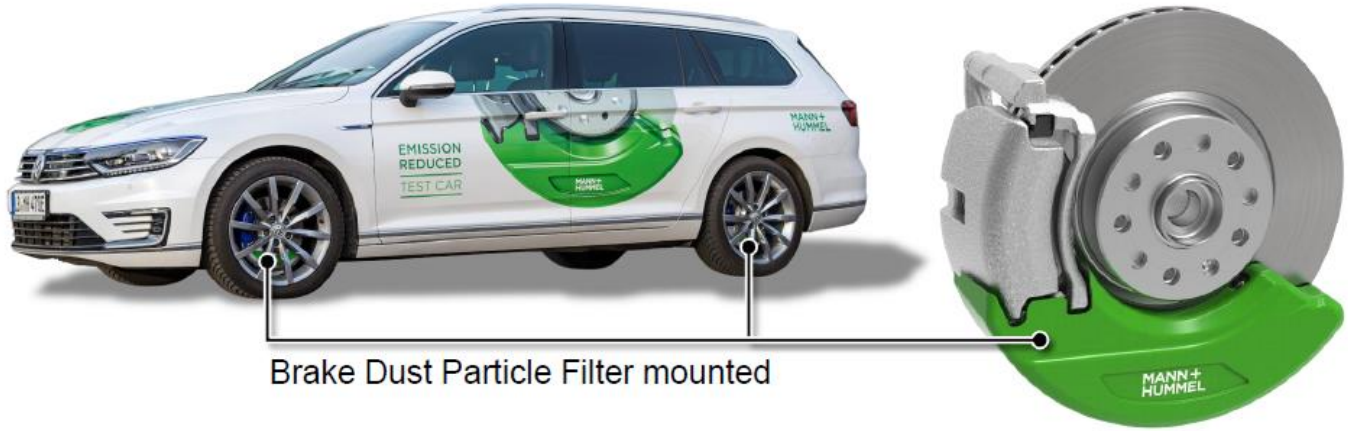
Brake Dust Particle Filter – Reducing Fine Dust at the Source
Our Plus for Clean Mobility – Status quo and aiming for more

Exhaust Emission PM_{10}

Average Emission EU[(1)] = **4 mg/km** (PM_{10})
Euro 5b-Euro 6c[(1)] = **2 mg/km** (PM_{10})
Euro 6d temp[(1)] = **1 mg/km** (PM_{10})

Brake Dust Particle Emission PM_{10}

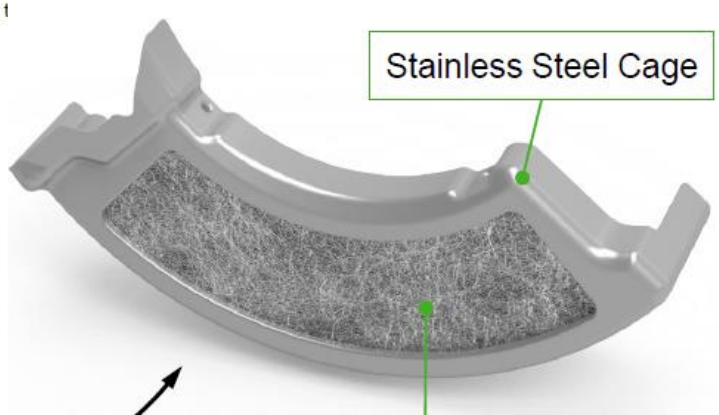
Average Emission[(2)] = **12.8 mg/km** (PM_{10})
Assumed distribution:
⅔ front brake ⅓ rear brake



Brake Dust Particle Filter mounted

Reduction of ~3 mg/km (PM_{10})
Compensation of 3 Passenger Cars
(Euro 6d temp)

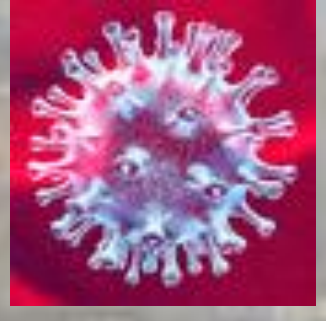
(1) HBEFA 3.3
(2) Average value from 41 sources (Literature, values from customer, own t

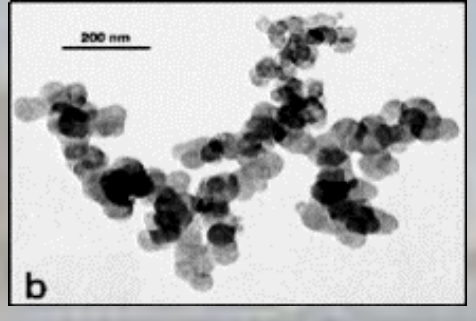


MANN+
HUMMEL

Transmission and Filtration of Bioaerosols

A new paradigma for cleaning air from indoor virus and from outdoor UFP contamination in one step

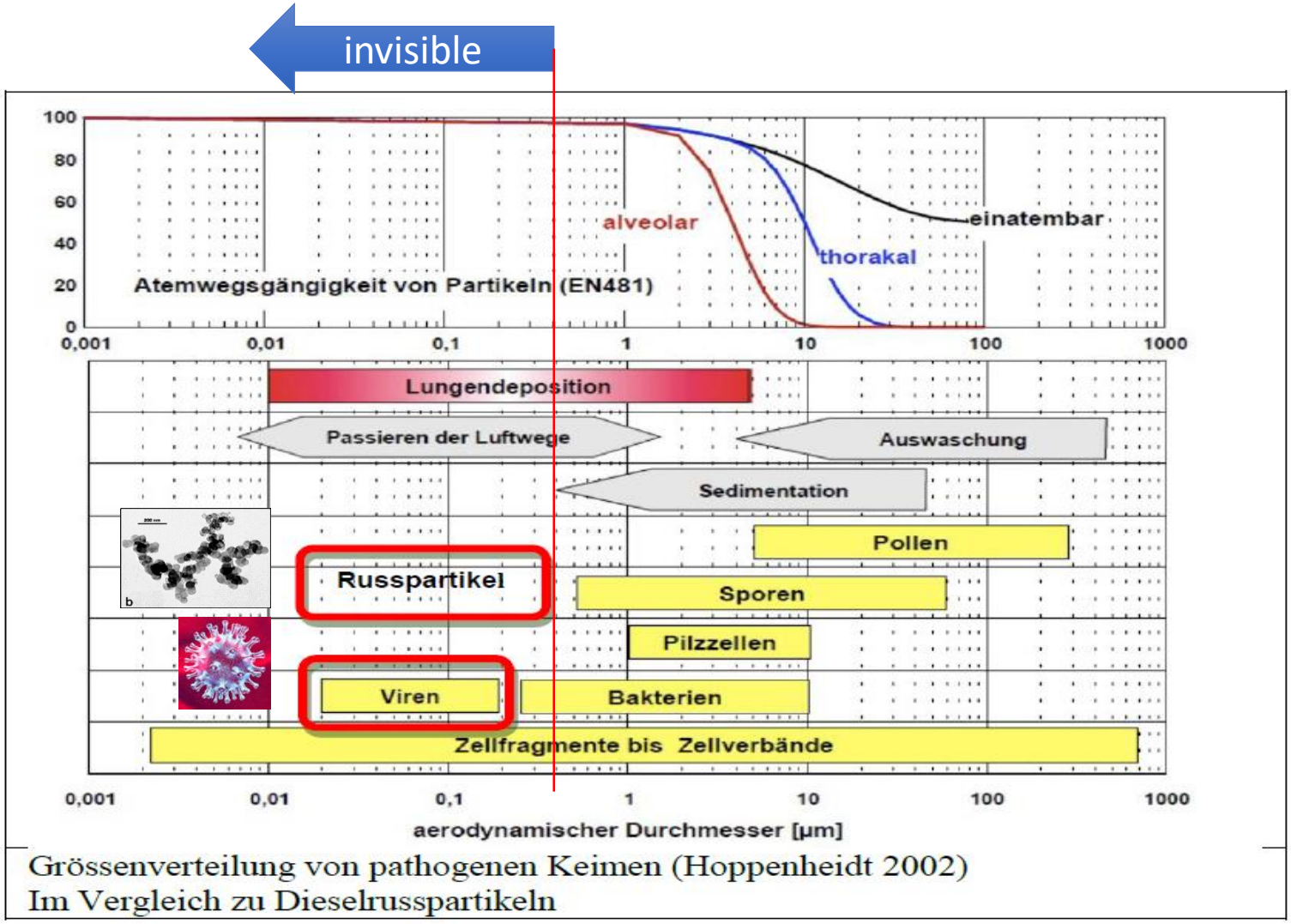




Andreas C.R.Mayer / NCA

Viruses are as small as diesel soot particles and form a similar very stable aerosol

if they behave like soot particles → why not filter them as soot

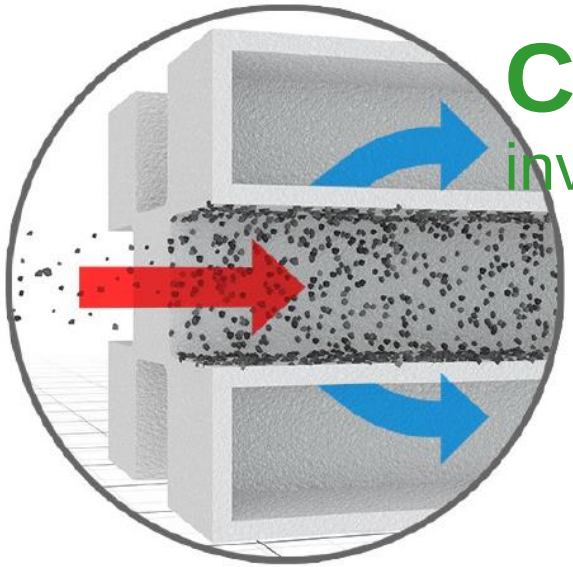


Grössenverteilung von pathogenen Keimen (Hoppenheidt 2002)
Im Vergleich zu Dieselrusspartikeln

New approach: the only safe place is overhad

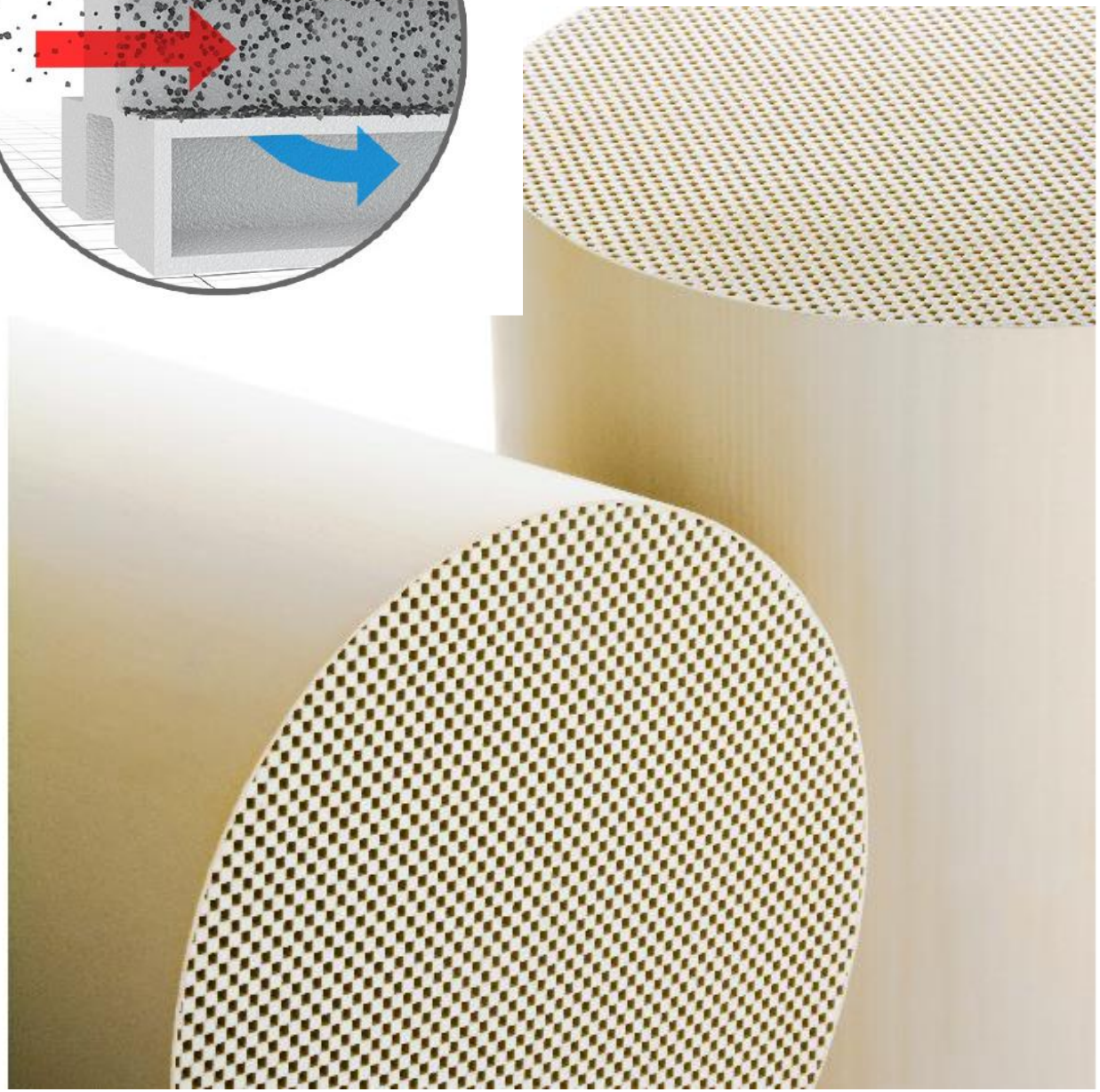
Perfect Solution in the KKL concert hall Lucerne

Vertical laminar flow – at a high flow setting



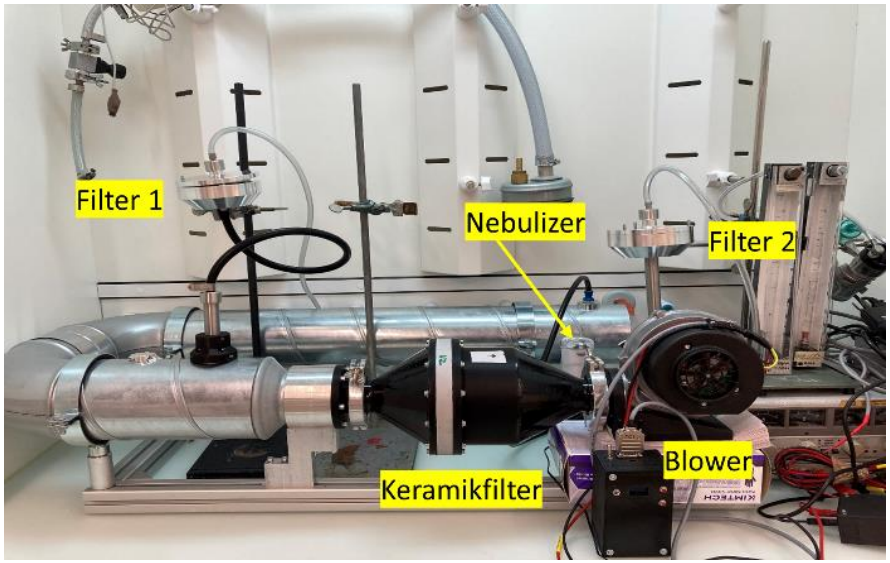
Ceramic wall flow multicell filter

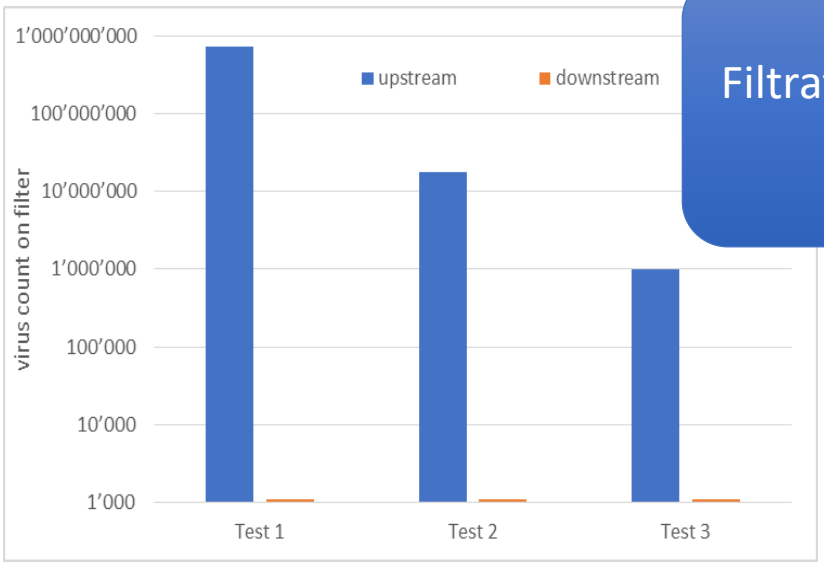
invented 1979, now > 200 Mio in Diesel cars



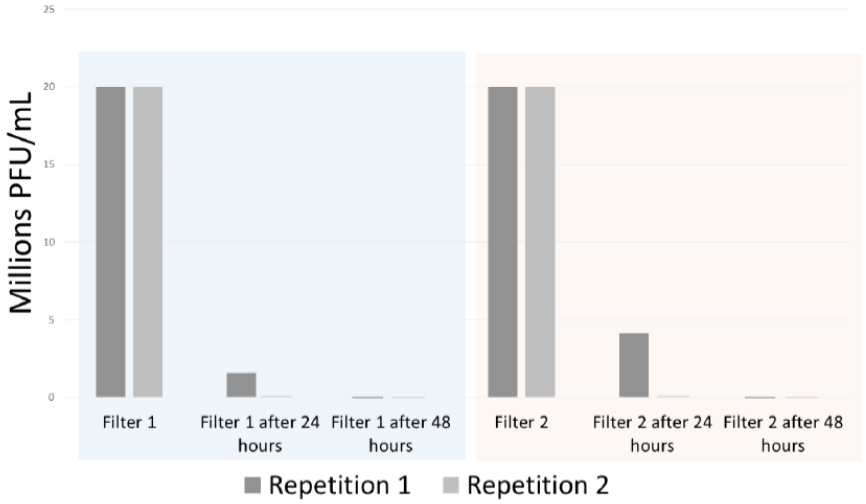
- pore size 10-20 µm
- porosity 45-65%
- 200 cpsi
- >1 m^2 per 1 ltr bulk volume
- High inflow speed but low face velocity some cm/s
- filtration efficiency >99%
- particle size 10 – 500 nm
- soot storage 10 g/ltr
- different materials
- any shape and size
- temperature > 1000°C
- no aging over vehicle life
- no vibration problem
- easy to clean
- Heating or coating to desinfect

Virus Filtration and De-Activation





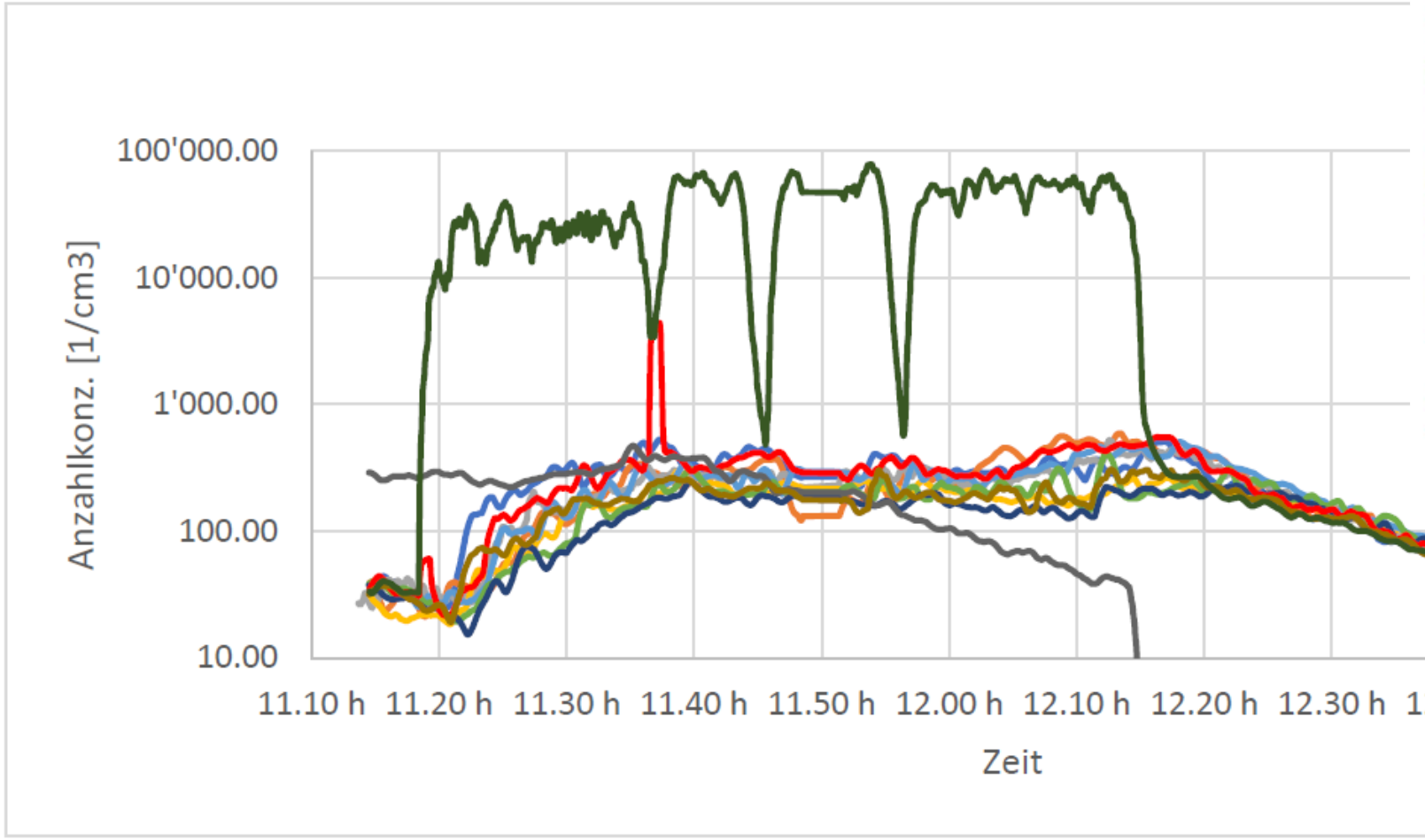
Filtration by number
> 99.99 %

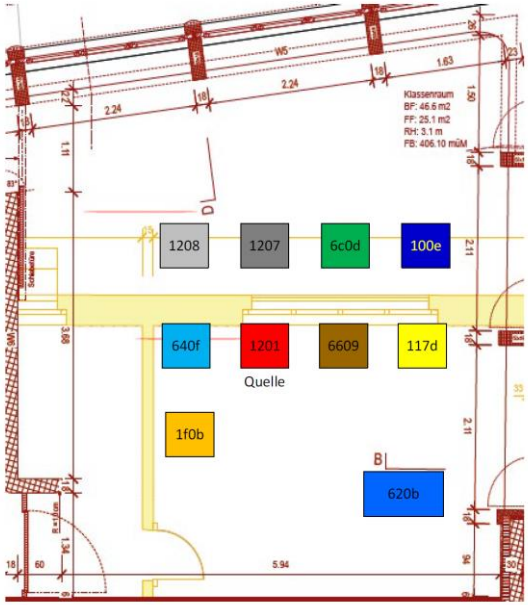


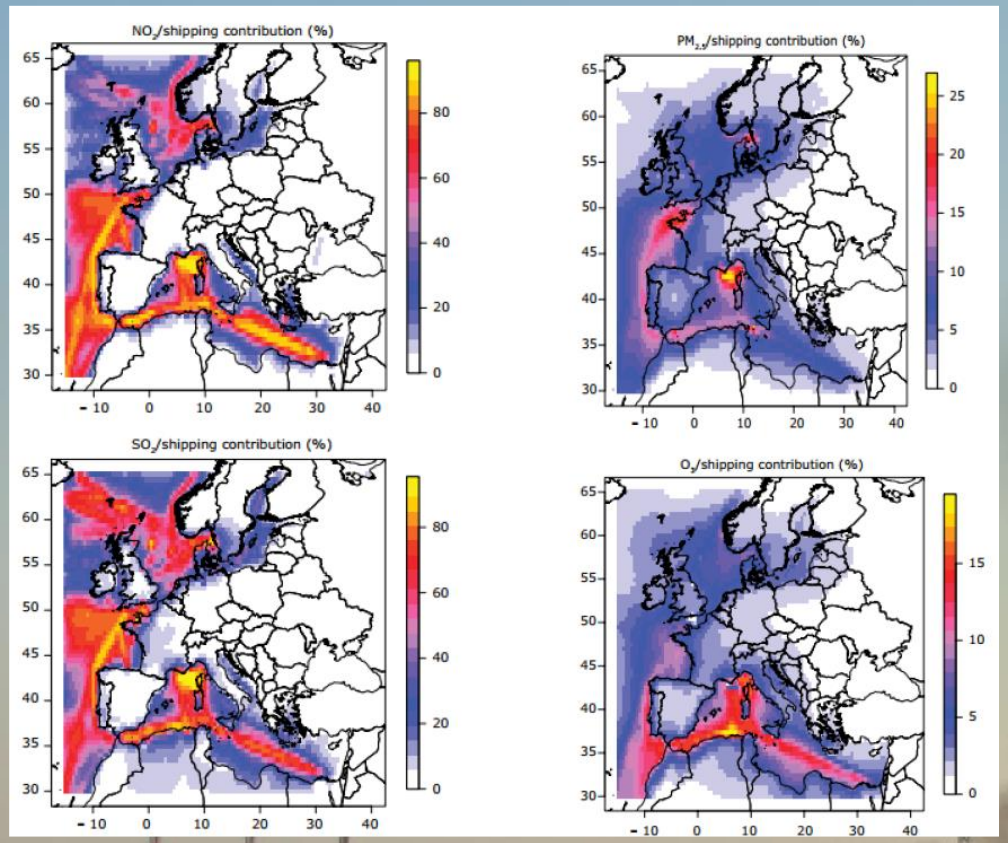
De-Activation
after 48 hrs
99%

Particle concentration at 10 desks
compared to the particle source (log scale)

two orders of magnitude risk reduction even in immediate vicinity of the infected person and homogeneous distribution in the room







Marine Emissions
NO PM/PN/EC-Limits yet

TEKNOLOGISK
INSTITUT

Diesel particulate filters in marine use – performance evaluation after three years of service

Troels Dyhr Pedersen, PhD, senior consultant

Danish Technological Institute

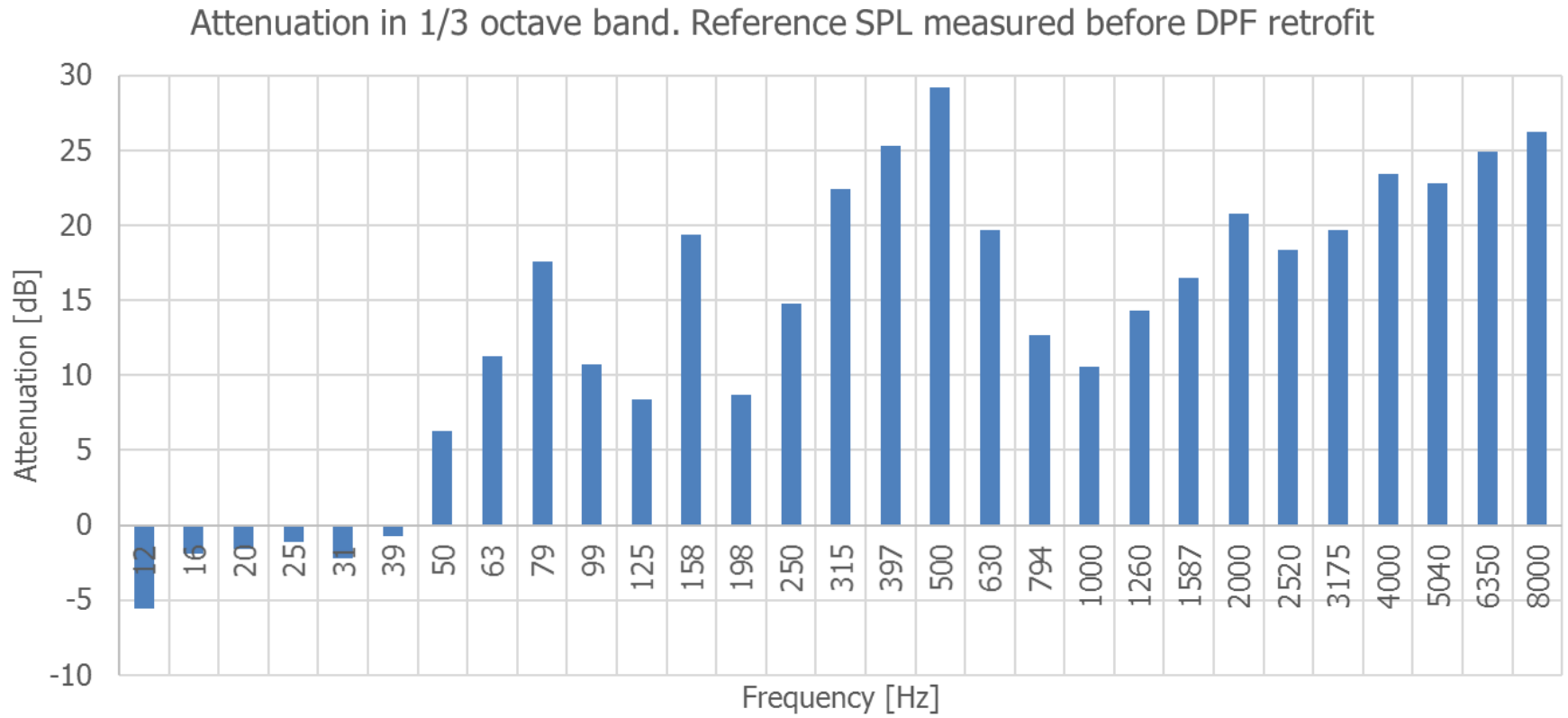
March 24.th 2022

Particulate number (PN

Year	Time in operation	Engine	DPF efficiency
2018	8 months	Main engine Aux. engine	99.6 % of PN 99.8 % of PN
2020	34 months	Main engine	97.3 % of PN

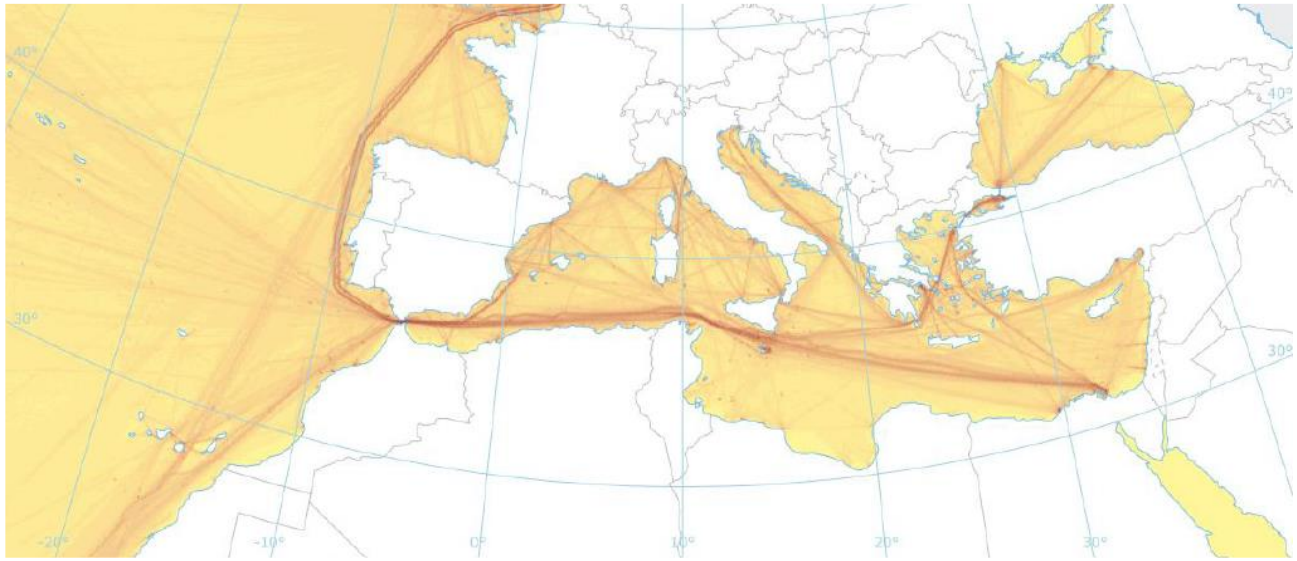
- Efficiency as expected for closed wall DPF in first measurement
- Second measurement indicates possible leakage in casing sealings, likely after DPF monoliths have been removed and reinstalled after ash removal
- Exhaust gas leakage through bypass valve has also been observed

Noise reduction



SECA for Sulfur
also needed
NECA for NOx
PECA for Particulate

A.Friedrich



Future SECA in the Mediterranean Sea

- An SECA is proposed by the contracting parties of the Barcelona Convention to the IMO for decision. It means from the 1st of January the maximum S- content in marine fuel will be 0.1 %
- The proposed area of application is identical to the geographic area described in Article 1.1 of the Barcelona Convention, which is hereinafter referred to as the Mediterranean Sea area. The waters of the proposed Med SOX ECA involve the twenty-two (22) Contracting Parties to the Barcelona Convention, namely Albania, Algeria, Bosnia and Herzegovina, Croatia, Cyprus, Egypt, France, Greece, Israel, Italy, Lebanon, Libya, Malta, Monaco, Montenegro, Morocco, Slovenia, Spain, the Syrian Arab Republic, Tunisia, Turkey, and the European Union.

NEW TECHNOLOGY needed
VERT Research on Membranes

12th VERT Forum, March 24th 2022

VERT PROJECT

PARTICLE FILTER CONCEPT
for
HFO ENGINES

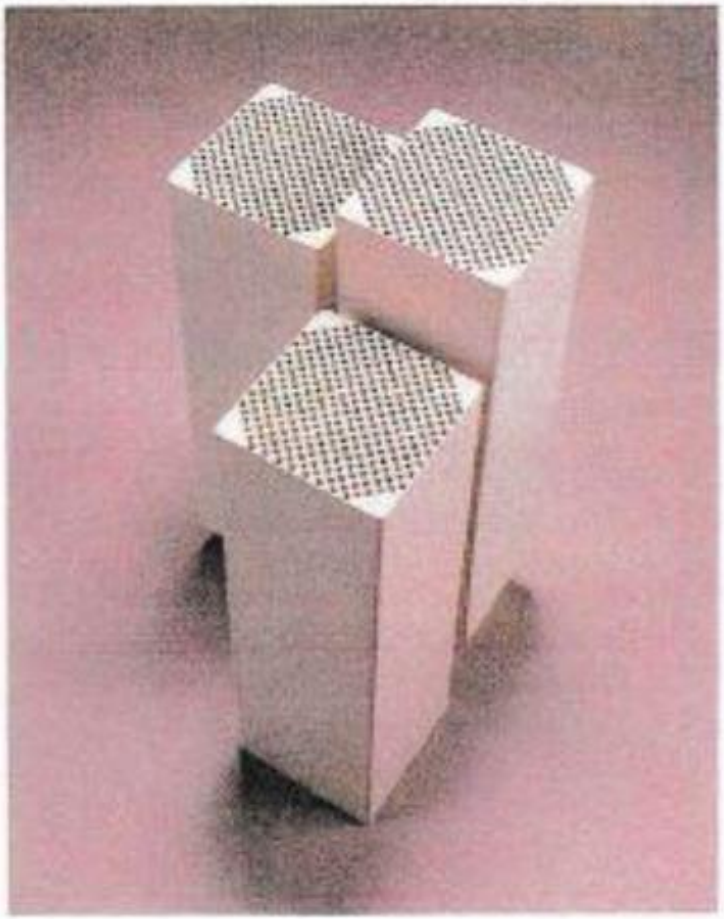
2019 - 2021

Thomas Lutz / A

© 2018, VERT

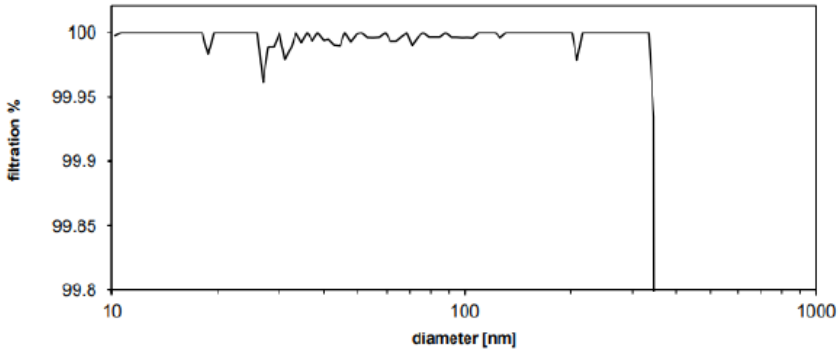
NGK MEMBRANE FILTER

Characteristics of ceramic filter



Material	Cordierite
Working temperature	Up to 900 °C
Dimensions	150□ × 500L
Cell pitch / Filtration area	4mm / 4.0m² 6mm / 2.6m²
Pore size (support layer) (coating layer)	Approx. 15μm Approx. 5μm
Porosity	45%
Coefficient of thermal expansion	1 × 10⁻⁶/°C

Filtration efficiency
(of new and unloaded filter)

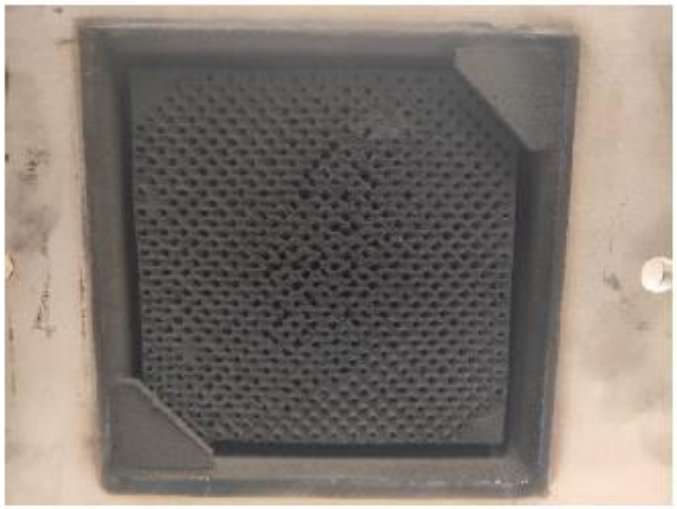


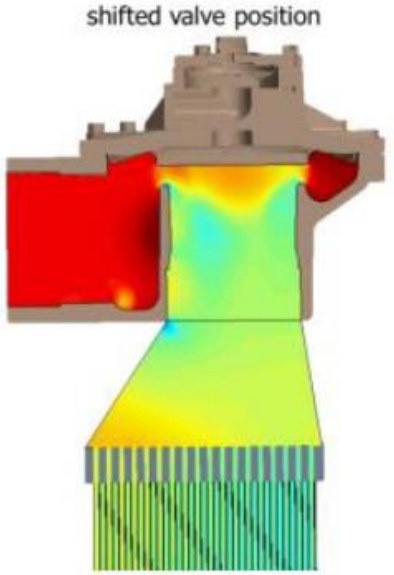
Loading by Marine heavy fuel oil soot on and blowing out inverse with compressed air pulses

after loading

outlet

inlet





21384.4	146.9	45.5%	**88.5%**	yes
20884.5	164.3	69.3%	**69.3%**	yes
20797.4	74	94.9%	**94.9%**	yes

VERT-NPTI Success

G.Kadijk

Country	Start date	Limit value	Euro Class
Netherlands	01-07-2022	1,000,000	3,4,5,6 and VI
Belgium	01-07-2022	1,000,000	5 and 6
Germany	01-01-2023	250,000	6 and VI
Switzerland	01-01-2023	100'000	5b, 6 and VI

18 suppliers
3 CPC and 15 DC types

7 Dutch type approvals (March 2022)
Price range: € 4,000 to € 5,250

Arex, Assemblad, **AVL-Ditest**, Bosch, Brainbee, **Capelec**, **Continental**, Dekati, Hella Gutmann, Maha, Mahle, Pegasor, **Saarloos**, Saxon-Junkalor, **TEN**, TEXA, **VLT**, WOW!.

More information: www.particlesmatter.com/particle-counters

EU Move

P.Szatmary

European Commission

Revision of the Roadworthiness legislation

Updating EU rules on roadworthiness tests, technical roadside inspection, and registration documents of vehicles (Directives 2014/45/EU, 2014/46/EU, 2014/47/EU)

12th International VERT FORUM, March 24 2022

Emissions of Handheld- and Small Machines HaSMa <19kW

contribution to the occupational health protection

J. Czerwinski, A. Mayer / VERT

12th VERT Forum, EMPA/Web, March 24th 2022

Limit Values for handheld Petrol NRSh

Emissionsstufe	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 **(Kilo)gramms***

NRMM Directive is unsufficient for NRS

→Meeting VERT with EU-Commission

VERT extends the work for emission reduction to all engines < 56 kW

→ introduce Alkylate Fuel worldwide to eliminate cancer and accident risks
→ introduce Oxidation Catalyst with Sec.Air, as the first step to oxidize CO and HC
→ demonstrate feasibility of EAC for < 56 kW
→ Standardization for Alkylat Fuels and Lube Oils
→ increase awareness of lube oil toxicity
→ increase awareness for PTI for small engines
→ Inspection and Maintenance (I&M) rules

Low PN emission and BAT as well for engines > 560 kW?

12th VERT Forum 2022

François Jaussi

24.03.2022

LIEBHERR

Low PN emission and BAT as well for engines > 560 kW ?

risk of electricity shortages →need for decentralized Diesel Power Stations

THE HINDU

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KERALA

Power shortage: KSEB to operate diesel plant

Tiki Rajwi

THIRUVANANTHAPURAM: OCTOBER 18, 2021 18:13 IST
UPDATED: OCTOBER 18, 2021 18:15 IST

SHARE ARTICLE PRINT A A A

128-MW KDPP at Nallalam last saw operations in February this year

The Kerala State Electricity Board (KSEB) has given the go-ahead for operating its Kozhikode Diesel Power Plant (KDPP) as part of the efforts to overcome the power shortage triggered by a coal crisis.

The 128-MW KDPP at Nallalam last saw commercial operation between December 2020 and February this year.

According to the KSEB, running the plant on light diesel oil (LDO) will be less expensive than purchasing power from the open market where per unit prices had touched ₹20.

FINANCIAL TIMES

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China power crisis sparks rush for generators from factories

SWI swissinfo.ch

#NOTHING TO HIDE

Swiss Politics

Swiss perspectives in 10 languages

Swiss companies told to brace for electricity shortages

Should we expect more power cuts in future?

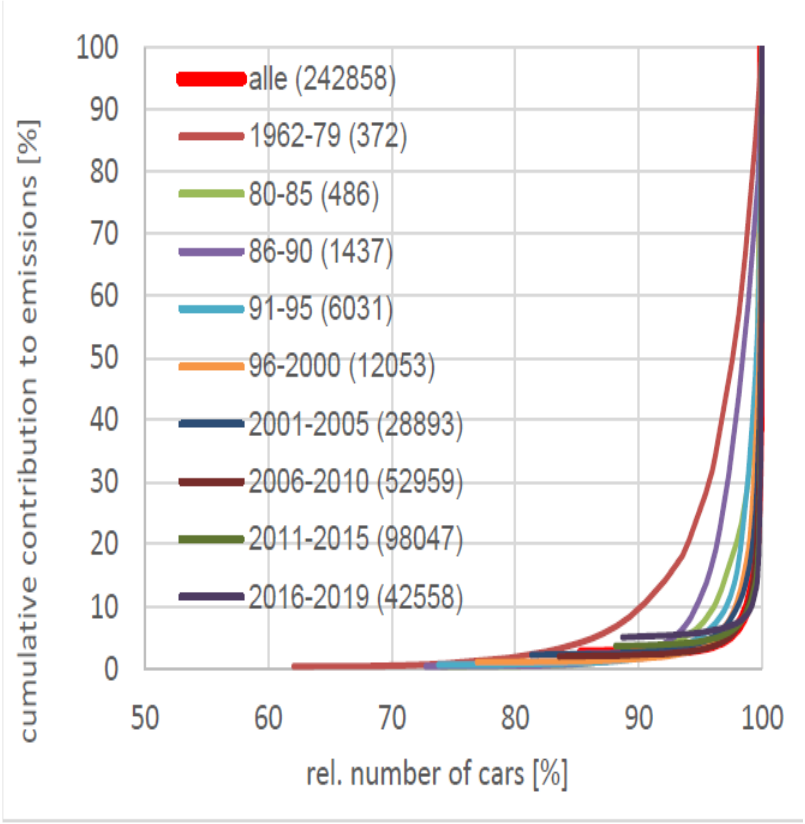
BBC NEWS

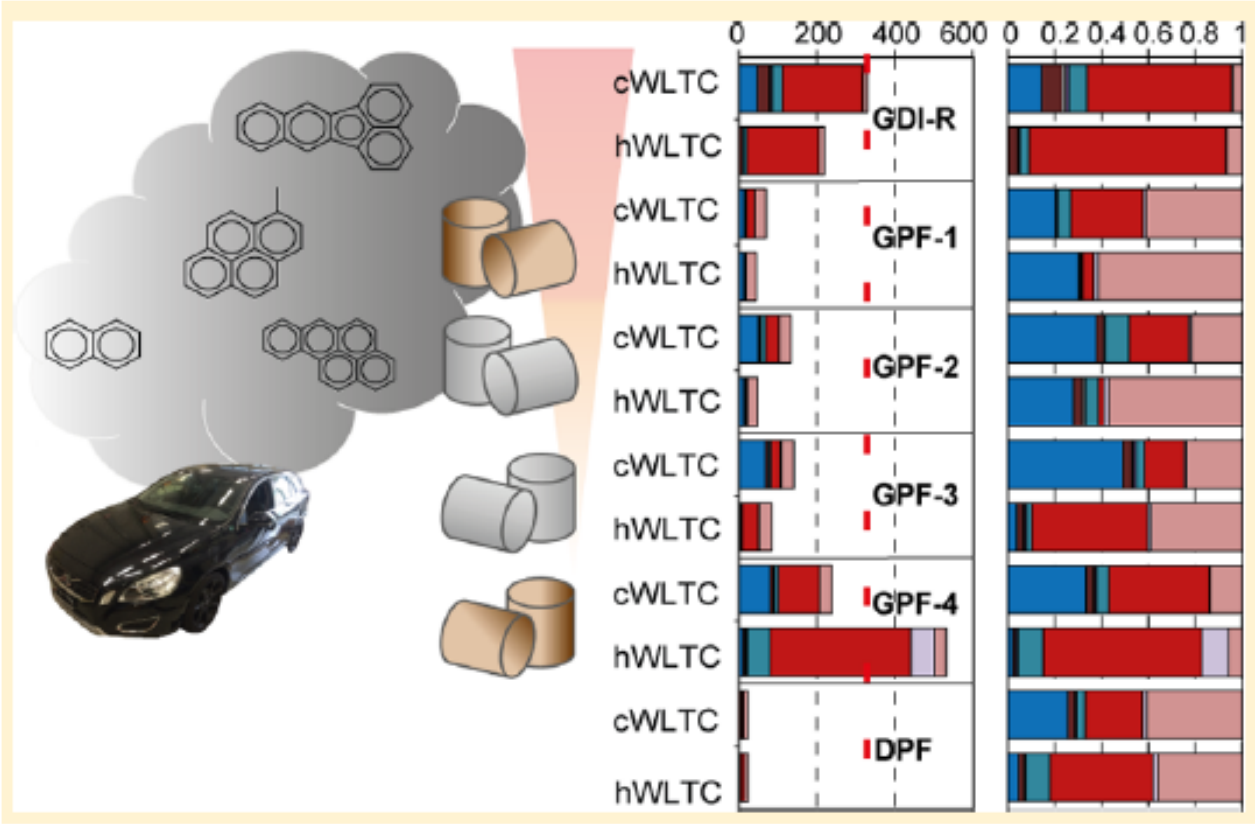
By Douglas Fraser
Business and economy editor, Scotland

1 February 2022

LIEBHERR

Large Problem with Gasoline High Emitters





Soot nanoparticles – Trojan horses for genotoxic compounds

Non-treated exhausts of combustion engines, containing nanoparticles, are toxic cocktails

This includes exhausts of:
- diesel engines,
- GDI-vehicles,
- jet engines,
- non-road machinery,
- ships,

etc.

Do not inhale them!

DPF Retrofit for 35 % of all NRMM 37-560 kW in Jerusalem

NRMM

A Real Highlight: US agreed to particle number limit für civil aircraft turbo engines

A.Ayala; a Swiss initiative 2014, BAZL Rindlisbacher

Is there a brewing inconsistency in federal policy?

- EPA proposed aircraft PM standards
- Dec 2021 - adoption of ICAO standards
- Visibility (mass concentration)
- Mass
- Number
- Effective date Jan 1, 2021

EPA United States Environmental Protection Agency

CALAC
Programa Clima y Aire limpio
en Ciudades de América Latina

Climate and Clean Air in Latin American Cities – Plus (CALAC+)

Adrián Montalvo

Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Agencia Suiza para el Desarrollo y la Cooperación COSUDE

swisscontact

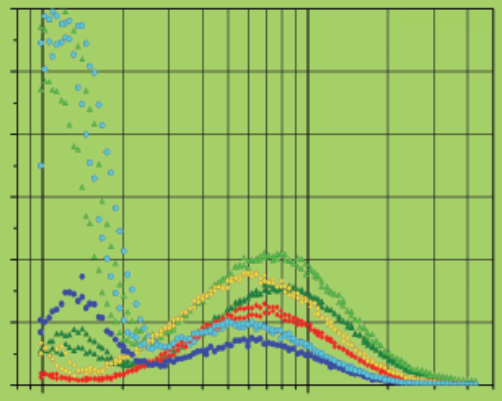
25.ETH Nanoparticle Conference June 21.- 23. 2022 online

Online Conference

Invitation and call for e-papers to the

25th ETH-Conference on Combustion Generated Nanoparticles

Focus Event:
New legislation to guide the world



June 21 – 23, 2022
ETH Zürich, Switzerland – online
www.nanoparticles.ch
@ethnpc

No conference fee, sponsors welcome

Under the auspices of
FOEN, SCS and ETH

SCS
Swiss Chemical Society

25th ETH-Conference on Combustion Generated Nanoparticles

The ETH Conference on Combustion-Generated Nanoparticles in 2022 is again organized as an online conference under the auspice of the Swiss Chemical Society. It serves as an interdisciplinary platform for expert discussions on all aspects of nanoparticles, freshly emitted from various sources, aged in ambient air, technical mitigation aspects, impact of particles on health, environment and climate and particle legislation. The conference brings together representatives from research, industry and legislation.

Conference Topics

- Aircraft, marine and other non-road sources
- Ambient air particles, secondary pollutants
- Biomass-, biofuel- and synfuel combustion
- Brake- and tyre-wear, non-combustion emissions
- Emission control of combustion engines
- Emission upgrade and PTI for in-use vehicles
- Environmental and health effects
- Exhaust aftertreatment systems
- Future legislation and enforcement
- Impact on climate
- Nanoparticle formation and transformation
- Nanoparticle metrology and chemical characterization
- Nanoparticle chemistry and toxicology
- Occupational exposure and prevention

Focus Event: New legislation to guide the world

The World Health Organization air quality guidelines, European vehicle and engine legislation, National clean air acts, and periodic technical inspection (PTI) legislation have become key elements of international and national clean air policy. With no doubt, the implementation of catalytic converter technologies and better fuels, compatible with such technologies, were major steps to reduce emissions of combustion engines.
The 2022 focus event will discuss the next legislative steps to take and the challenges to tackle with new fuels and new engine and vehicle technologies, to further reduce the impact of air pollution on health and global warming.

Health Session

The health session will provide new experimental and epidemiological results and evidence about health consequences of combustion emissions and other emissions.