VERT Activities Worldwide on Reduction of Nanoparticle Emissions of Heavy-Duty Diesel Vehicles

3rd International Workshop Nanoparticle Emissions from Heavy-Duty Vehicles

DPF Retrofit Kick-off Meeting for Public Bus Fleets in Israel

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VERT: Created to eliminate particle emissions from internal combustion engines (ICE) by means of best available technology.
What does VERT stands for?

**VERT** = **V**erification of **E**mission **R**eduction **T**echnologies

**Key Know-how of VERT**
- Diesel particle filter testing procedure
- Certification of exhaust after treatment systems
- Field quality control system
- Acting as an advisor for emission legislation
- Support and project management for global retrofit programs

**VERT is a Trade Mark**
for Particle Filters based on **Best Available Technology**

**VERT is a global acting non-profit Association** of filter manufacturers, engine builders, chassis builders, technology providers and associates based in Switzerland
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Focused on Particle Number Measurements

Why?
- PM Measurement is a gravimetrical method. These method is due to the physical limits not able to detect carcinogenic small particles.
- Particles must be counted instead of weight

Characteristics very fine particles particles:
- Very small < 100 nm
- High surface > 100 m²/g
- Transporting toxics persistent in organism
- Carcinogenic
- Long life toxic aerosol (weeks to month)

 Diesel exhaust particles defined by WHO 1988 as probably carcinogenic
- Since 2012 as evidenced carcinogenic (class 1 like asbestos)

WHO = World Health Organization
VERT Swiss Activities

- **1990** 250 City-Buses Zürich and Geneva
- **1993-98** VERT to define BAT for tunneling + Particle Number
- **1998** DPF retrofit on public construction sites
- **2002** DPF mandatory on large construction sites
- **2007** bus retrofit mandatory for DPF
- **2007** ships mandatory
- **2010** locomotives mandatory
- **2012** DPF for trucks by road tax incentive LSVA

**Implementation**

More than 28,000 heavy duty machines and vehicles have been retrofitted
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VERT History of Activities

Switzerland
- PM Legislation for construction equipment

USA/California
- CARB Show Case
- New York City

Chile
- DPF regulation for Euro III buses

Euro 6
- EU adopted VERT principles for solid particle number - PMP-Protocol

Switzerland, Santiago de Chile, China, Bogotá, ...
- Demonstration of DPF efficiency, pilot tests, public authority support, guidelines for Air Quality

Present

Past
VERT Influences on International Legislation

- **2002**: CARB starts with support of VERT the retrofit show case in California with leads to a filter legislation
- **2005**: retrofit legislation for Euro1+2 buses in Santiago de Chile
- **2006**: EU adopted VERT principles for solid particle number - PMP-Protocol
- **2007**: EU introduces PN-Limit for LDV
- **2008**: retrofit Euro 3 buses in Santiago de Chile
- **2009**: EU introduces PN-Limit for HDV
- **2010**: UNECE-GRPE starts Working Group for on-road and off-road retrofit
- **2011**: EU parliament decides for PN for NRMM

**VERT ww recognition**

Switzerland: BAFU, SUVA, ASTRA | Austria: AUVA; Tyrol construction | Germany: BG Bau; UBA; TRGS 554 7 USA: MSHA; NY City | CARB partly | Netherlands: VROM | Italy: alto Adige | Canada: Mining | UK: London TFL and LEZ | Denmark: for all applications | Chile: Santiago Bus, Gensets | China: Hong Kong busses; Beijing | UNECE

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VERT activities Santiago de Chile

The **Santiago de Chile DPF Follow-Up Project [SFU]** is conceived as a continuation of earlier efforts with a successful DPF introduction (2004-2009). It addresses the enforcement scheme and environmental benefits of the ongoing DPF program and defines steps on future policies.

**Policy framework**
- **For in-use and new busses** DPF Regulation for EURO III busses

**DPF Retrofit Pilot Tests**
- Pilot bus fleet of 12 busses. Representative bus routes, data logging, installation and operation

**Implementation Phase**
- Approximately 3200 city buses operate in 2013 with DPF in the city
VERT activities in Bogotá DPF Project [BDPF]

The Bogotá DPF Project [BDPF] aims at the introduction of DPF applications in Colombia’s capital, supports the realization of DPF retrofit pilot tests, the introduction of a local approval scheme and the preparation and initiation of DPF implementation under the integrated system of public transport.

- **Policy framework** introduction of 10-year plan of air pollution per decree. **Control emission systems (DPF) for buses**

- **DPF Retrofit Pilot Tests**
  Know-how & technology transfer, leverage the participation of main DPF manufacturers

- **Implementation Phase**
  Stage 1 – 18 busses, stage 2 – 300 busses until June 2015

Pictures: Secretaría Distrital de Ambiente Bogota-Colombia
VERT China Activities Background

- By the end of 2012, the total population of vehicles in China reached 223.83 million; the trend is still strongly increasing.
- Vehicle emission pollutants:
  - PM: 622,000 tons in 2012
- In mega cities the industry had to shut down due to the over exceeding pollution levels.
- Starting from 2011 and supported by Swiss Gouvernement, VERT and MEP of China; a program has implemented to retrofit in-use heavy duty vehicles.

Pictures: Vehicle Emission Control Center (VECC) of MEP, China
VERT China Activities (VERT SINO Project)

China and Switzerland authorities supported by VERT started the Sino-Swiss program Black Carbon Emission of Mobile Sources (BCEMS) with VERT certified DPFs. Based on these experiences a national diesel vehicle aftertreatment guideline is drafted.

- **Policy framework for in-use heavy duty**
  National diesel vehicle after treatment guideline is drafted

- **DPF Retrofit Pilot Tests**
  10 coaches in Nanjing, 10 city buses in Xiamen, 11 construction machines in Beijing

- **Implementation Phase**
  About 10,000 diesel vehicles In Beijing are already retrofitted and got the green labels
VERT Berlin Activities (Construction Machines)

After cleaning the bus fleets in Berlin with diesel particulate filters the government of Berlin recognized the construction sites within the city as major source for health effects. Berlin has decided to use for future tenders only machineries with newest emission standards or retrofitted with diesel particle filters.

Policy framework from July 2015
machines ≥ 19 kW have to fulfill newest EU emission standards or retrofitted with DPF

DPF Retrofit Pilot Tests retrofit of 17 construction machines different size, age and type. Check of reliability, safety and cost.

Implementation Phase
From July 2015 several thousands of construction machines have to equipped with DPF
**More global Experience with Heavy Duty Diesel Particulate Filters**

- **USA:** Construction machines in Boston “big dig”, DPF for diesels engines in all metal mines, California retrofit program for in-use heavy duty on-road vehicles, since 2007 all new Heavy duty with DPF New York, New Jersey; many activities in cities under local law, large funds for school buses and transit buses > 60,000 DPF

- **UK:** London Low Emission Zone 3 phases –total > 100,000 retrofits, DPF for Construction Machines in London cross rail

- **Italy:** DPF for LDV and DPF for Construction Machines in public construction in Südtirol, Low Emission Zones in Lombardia and Emilia Romana, „Decreto“ for retrofit of HDV retrofits in the Milan and Turino area > 15,000 retrofits

- **Netherlands:** Low Emission Zones in all major cities, starting with on-road HDV, off-road vehicles following

- **Denmark:** retrofit in Copenhagen, LEZ in all major cities > 4,000 retrofits

- **Japan and Korea:** retrofit activity starting bus and truck in Seoul and Tokyo, 2008 intensified, some are pDPF > 150,000 retrofits

- And much more...

*DPF= Diesel Particulate Filter pDPF= partial Diesel Particulate Filter; HDV= Heavy Duty Vehicles, LEZ= Low Emission Zone*
Conclusion

- **Diesel Particulate Filter for retrofit** of in use Heavy Duty vehicles is a proofed, reliable technology with decades of worldwide experiences.

- **VERT** as non profit organization is an experienced partner for successful implementation of retrofit programs and has 21 years of experience.

- **Mega cities** all over the world start actions to reduce air pollution to increase health-related quality of life and choose retrofit as best option.

- Diesel engines are modern and future orientated technologies BUT DON’T USE THEM WITHOUT A FILTER.