

UN/GRPE-PMP

Health Effect oriented Particle Emission Metrology for Type Approval of HD- and LD-Vehicles

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for SWISS EPA and DOT

PMP PROGRAMME OVERVIEW:

UN/GRPE PARTICLE MEASUREMENT PROGRAMME

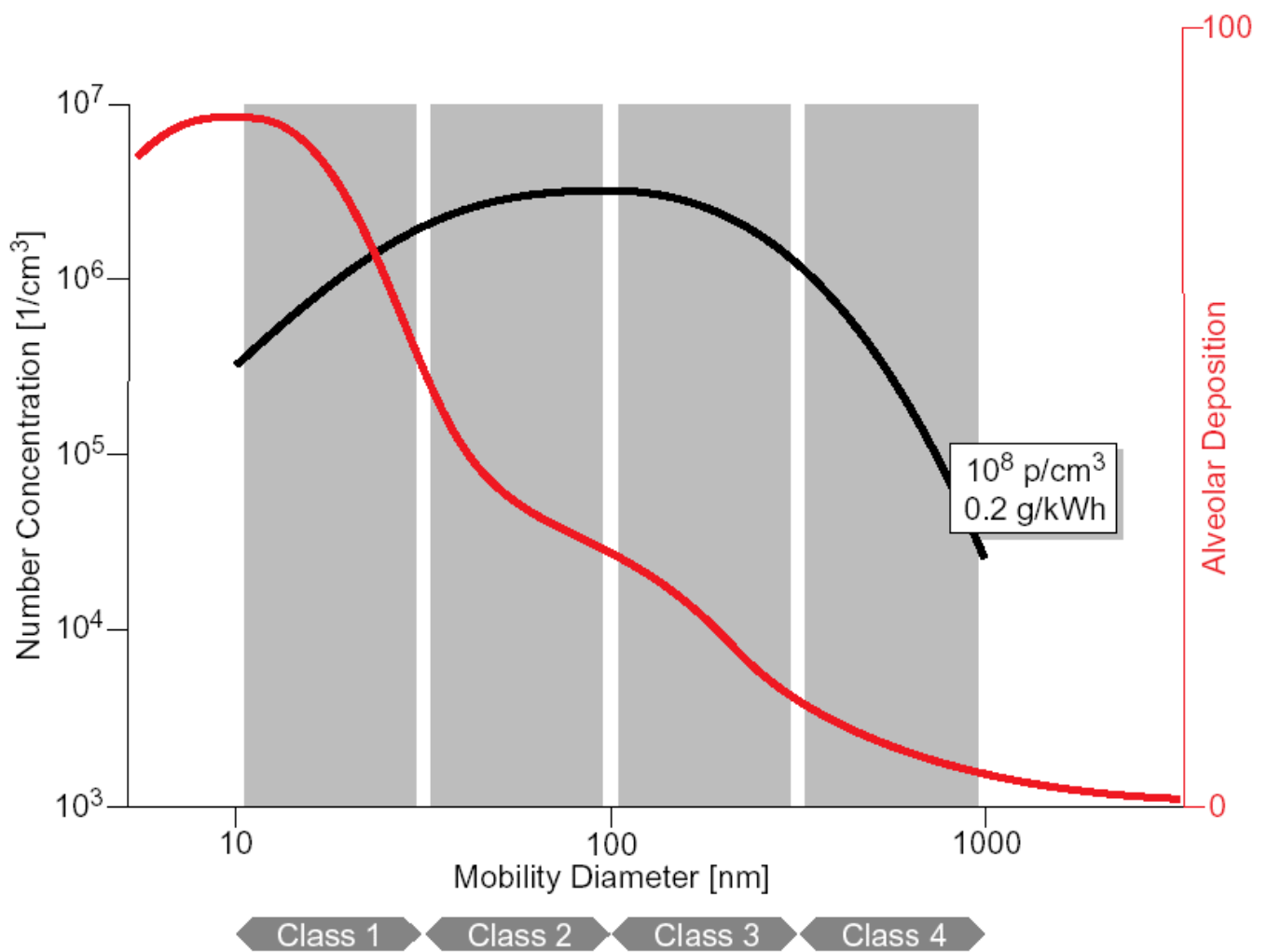
INTRODUCTION

Current medical evidence indicates that particle emissions, measured as PM10, are associated with increased mortality. However, a growing number of medical experts consider that nanometer size particles, that may be insignificant to the total mass of particulates, may be more significant in terms of health effects.

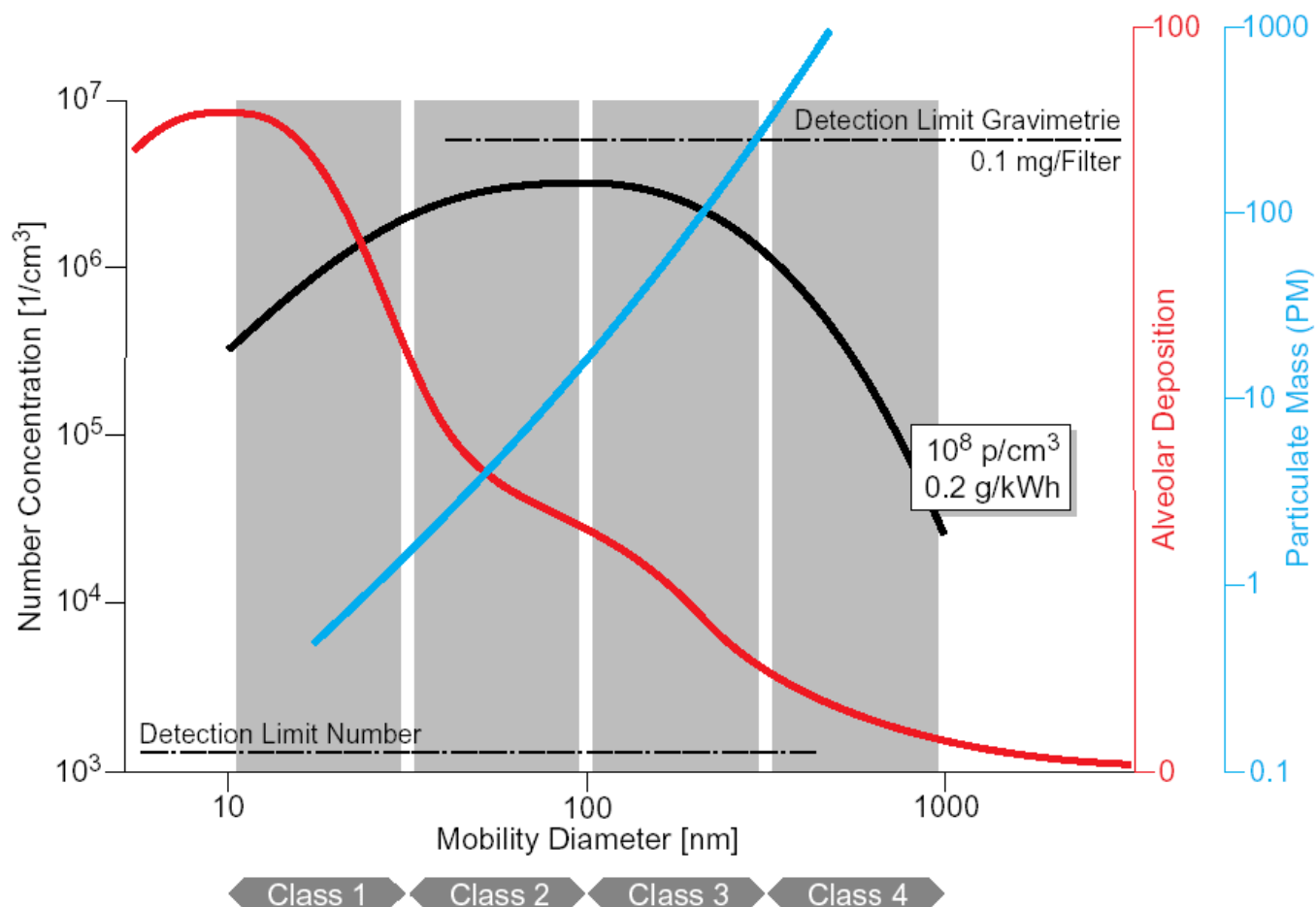
HEALTH EFFECTS

The metric used to measure particle emissions in vehicle emission control legislation should be either directly or indirectly related to the effects on air quality and human health. Current opinion suggests that particle size and number may be important criteria with respect to health effects.

Diesel Particle Emission versus Alveolar Deposition



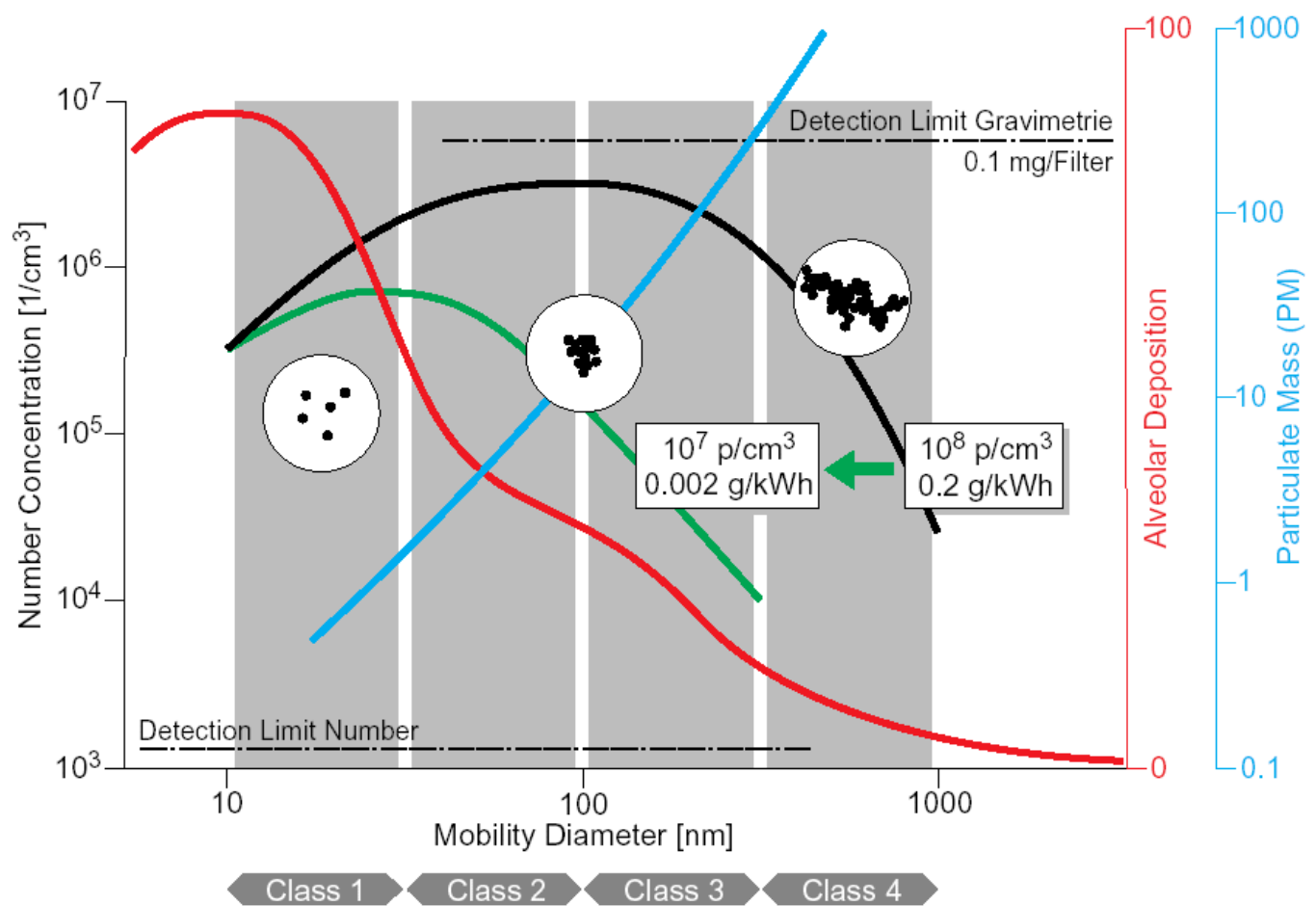
**Particle Mass is extremely low where Alveolar Deposition reaches maximum
→ Gravimetric Detection not possible**



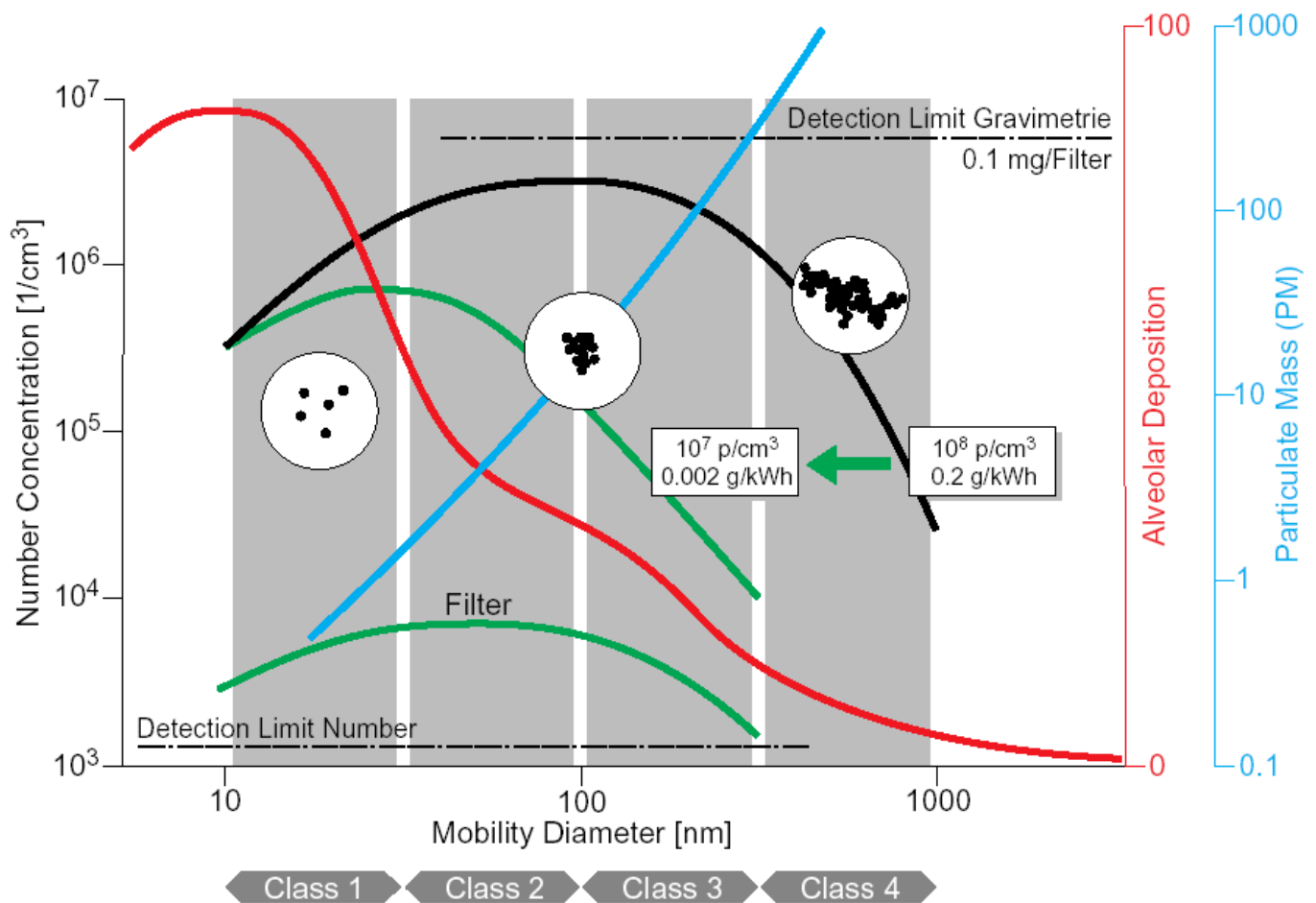
Engine Development reduces large Particles first

➔ Particle Mass reduced

➔ Particle Number?



Particle Filtration is extremely efficient. Control of Filter Technology requires very low Detection Limit.



Swiss Statement Brussels 5.Feb.2002

Status of research on the health impact of ultrafine particles

- The finer the particles, the deeper the pulmonary penetration. Most of the inhaled ultrafine particles are deposited in the lung (bronchia and alveoli). A study showed that children living in the proximity of streets have significantly more ultrafine particles in their alveoli than children living farther away. (US EPA 2001, Smith et. al. 2001).
- The finer the particles, the greater their propensity to trigger inflammatory processes. Particles of various chemical composition (Carbon black [soot without PAH], TiO₂, polystyrol, etc.) exhibit this detrimental response. Particles of diameters 20-50 nm (0.02-0.05µ m) have almost twice the inflammatory potency compared to particles of 200-500 nm (0.2-0.5µ m) diameter. New studies indicate that the inflammatory impact correlates closely with the particle surface area. (Ferin et. al. 1992, Li et. al 1997, Oberdörster et. al. 1997, Brown et. al. 2001).
- Inflammatory processes in the bronchia and alveoli release secretions, which increase subsequently the susceptibility to blood coagulation and, hence, the risk of cardial infarction. Consequently, inhaled ultrafine particles are hypothesized as exacerbating respiratory and cardiovascular diseases. (Wilson and Spengler 1996, Pope 2000, US EPA 2001).
- Several studies indicate that higher levels of ultrafine (< 0.1 µ m) particles restrict the pulmonary function of adult asthmatics and can increase their short-term mortality.
(Peters et al. 1997, Wichmann et al. 2000, Penttinen et al. 2001).

Swiss Position

From the public health perspective, it is important to measure not only the mass but also the concentration count and the surface area of the ultrafine particles, in the size range of 20 – 300 nanometer. These emissions must be controlled and curtailed using appropriate methods.