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Introduction

Many recent studies have highlighted the severe medical dangers of nanoparticles as produced by vehicle exhausts, which can often reach 250,000/cc on busy roads for extended periods, with peak values of over 1,000,000/cc, compared to a 'clean' ambient level, experienced in remote woodland, of 5,000/cc or less. We demonstrate that existing vehicle ventilation systems mainly do not remove these, so that the nanoparticle concentration inside vehicles is similar to, or in some cases considerably higher than the levels experi-enced on the road outside the vehicle (Fig. 1).

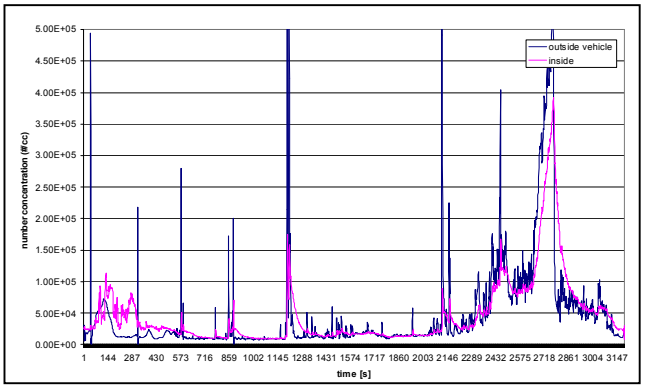

Fig.1: Particle number concentration inside and outside a passenger car w/o nanoparticle filter.

The nanoparticle filtration system

We have developed a range of retrofit filtration systems which reduce airborne nanoparticle concentrations inside vehicles to 'clean' ambient levels. These new filtration systems are compact and simple to construct, install and maintain, and it is expected that commercial versions will be available shortly. Systems for use in buildings are now under test.

Technology

The technology uses a small, high performance fan to draw air through a filter operated at low face velocity. External air from outside the vehicle is filtered in a single pass through first a pre-filter and then the novel nanoparticle filter. Prototype units, in round as well as in square form, have been constructed (Fig. 2).

Fig.2: Nanoparticle Filter system

Results

Numerous full-scale prototypes have been road-tested in a variety of makes of cars, school-buses, coaches and trucks under an extensive variety of environmental and traffic conditions, including high-exposure urban, traffic-jam and tunnel situations. These filtration systems can 'clean down' the internal cabin air within a few minutes, remove 95-99% of the nanoparticles from the incoming air, and allow a low level of nanoparticles, equivalent to 'clean' ambient levels, to be maintened whatever the external conditions (Fig. 3 and 4). They also remove viruses and other airborne pathogens. There have been no probems concerned with noise, clogging, CO_2 levels, or humidity. One prototype was successful tested in a tunnel (90 000 vehicles/day) during 1500 hours.

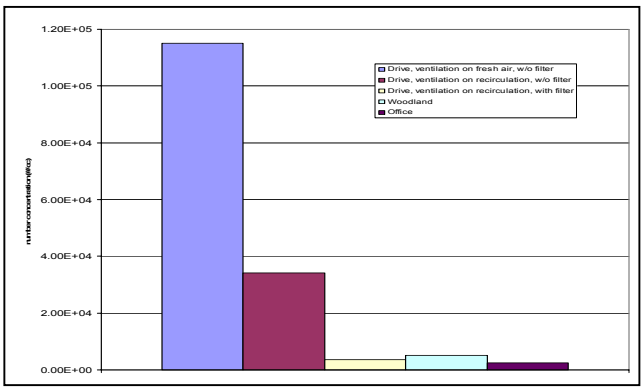

Fig.3: Particle concentration in a car (driving), at woodland

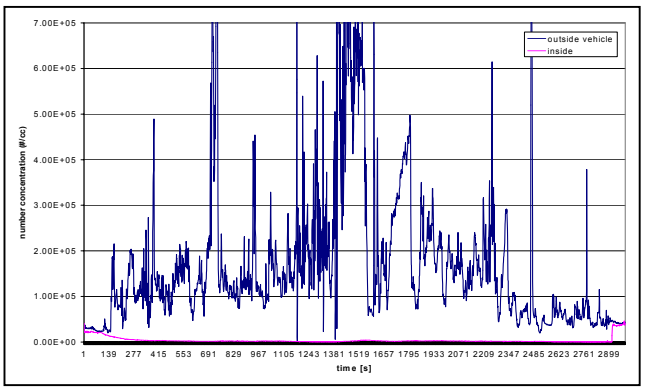

Fig.4: Particle concentration outside and inside a car