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Diesel-driven vehicles

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The number of diesel cars among new registrations has more than doubled in recent years, reaching a percent share in Germany of nearly 40%. The trend for particulate emissions indicates that by 2020 the sharp rise in diesel cars will lead to an increase in road traffic particulate emissions by a factor of 2.3, and therefore to an increase of total particulate emissions by a factor of 1.6 compared with earlier assumptions. There are no discernible reductions of particulate concentrations at roadside emissions monitoring sites that correspond to any reductions in waste gas limit values established to date. The proportion of ultrafine particles emitted by diesel vehicles has even increased. The particulate emissions from diesel engines in passenger cars and commercial vehicles have already been considerably reduced in recent years by changes in engine design, i.e. by improving combustion. Any real measures to reduce particulate matter according to best available technology can only be achieved by after-treatment of waste gas, i.e. by a particle filter. The reduction rates proven for a series of different particle filter systems are well over 90% for particulate mass and over 99.99% for number of particles.

Modern diesel cars also have a decided disadvantage compared to petrol-run cars with regard to NO_x emissions: they emit eight to ten times more nitrogen oxides, and they are partly responsible for the formation of summer smog, which is hazardous to health. The EURO IV limit value for NO_x in diesel cars is nearly three times higher than the cap for petrol-run cars. The actual reduction of NO_x emissions in trucks as foreseen by EURO II and EURO III emission standards is not as high as assumed. Electronic fuel injection systems in heavy-duty commercial vehicles, introduced as of 2000 with the EURO II standard, allow different fuel injection strategies to be used in the various ranges of the engine's characteristic curves. More recent studies have shown that EURO II engines are deliberately optimized outside of the range of characteristic curves run in the type approval testing cycle in order to improve specific fuel consumption. As a result, NO_x emissions from heavy-duty commercial vehicles for 2003 and for 2010 will be about 40% and 50% higher, respectively, than previously assumed.

A total of approx. 800,000 people die every year in Germany (all causes of death). According to a current survey by Prof. Wichmann of the National Research Center for Environment and Health in Neuherberg (GSF), about 10,000-19,000 of those deaths can be classified as premature deaths due to exhaust emissions from diesel engine vehicles. Reducing particulate emissions, i.e. by particle filters, would prevent most of these premature deaths.

The Federal Environment Agency (UBA) believes that the impact of particulate matter and NOx emissions on health and the environment necessitate a tangible reduction of limit values. Technical reduction measures for making this progress are already available. The costs of reduction per vehicle/engine are low and reasonable in relation to the effects.

As of June 2003 in Germany, there was a total of 14 French and Italian car models on the market fitted with a particulate filter. The introduction of particulate filters is set for the autumn of 2003 or early 2004 in 20 other car models, including those of German manufacture.

Particulate filter technology is also available for commercial vehicles. Seven different systems, some with reduction rates of over 90%, were already tested successfully in the early 1990s on 1,100 urban buses as part of a large-scale soot trap test by the German Federal Environment Ministry. Today there are more than 5,000 urban buses on Germany's roads and more than 50,000 commercial vehicles worldwide that are fitted with particulate filter systems. A sum of $100 million in funding has been approved to install these systems in 900,000 diesel-run vehicles in California.

Demands are being made at the national and international levels to adjust the emission

limit values for cars and (light-duty) commercial vehicles. The World Health Organization, the EU Commission, as well as the National Research Council and the US Environmental Protection Agency (EPA) have made particulates, including diesel particulate matter, one of the priority issues of environmental hygiene in Europe and the USA today. The USA and Japan are already working on implementation plans. The Federal Environment Agency is also calling for further reductions of waste gas limit values in diesel engine vehicles. An adjustment of the NO_x and particulate matter limit values valid as of 2005 - EURO IV for cars and EURO IV/V for commercial vehicles- is necessary to avert jeopardizing health and the environment, and it is technically feasible.

A further reduction in mass-based particle limit values by a factor of 10 is sufficient to achieve the goal of protecting human health if effective particulate filters or comparable technologies with a high rate of reduction over the entire size range of the particles, including ultrafine particles, are also used. To avoid ill-guided efforts such as technical developments aimed primarily at reducing mass, a limitation of the particulate count must be an accompanying measure.

The UBA recommendation is as follows: a particulate limit value in EURO V for cars of .0025 g/km should correspond to a 90% emissions reduction over the EURO IV limit value. The NO_x limit value of .08 g/km for diesel cars should correspond to that of petrol cars valid as of 2005 in the EURO 4 standard.

An adaptation of EURO V exhaust gas limits for heavy-duty engines also requires a further reduction of particulate emissions by 90% all the way to the level of the particulate filter. This means a limit value of .002 g/kWh in the stationary test cycle and .003 g/kWh in the dynamic test cycle. With regard to NO_x emissions, the NO_x limit value in EURO V should be readjusted from 2.0 to 1.0 g/kWh, followed by a further decrease to .5 g/kWh as of 2010.

The additional costs for EURO V designs in diesel cars plus an appropriate combination of measures to comply with the aforementioned limit values are estimated to range between 200€ and 400€ per vehicle compared with EURO IV technology. In the case of commercial vehicle engines, additional costs for emission control that go beyond the approved EURO V stage and the exhaust after-treatment systems they require, which are essentially an optimization of the systems needed for EURO V, are negligible. Total costs compared to a EURO III engine will range between 1,500€ and 3,000€ depending on engine size. Some technical configurations even make it possible to have these additional costs pay themselves off by facilitating a concurrent reduction in fuel consumption.

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