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**The Industry of Emissions Controls and ...
the Ultrafine Particles**

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A new challenge for the Manufacturers of Exhausts Controls Equipments

The current situation is widely perturbing our industry which could (should ?) have to reassess its strategy without a clear definition of the problem.

During the last two decades the objectives were quite clear : reduction of the mass of identified pollutants : HC, CO, NOx and PM.

Every new step was more and more an emulating challenge due to some trade-off especially the one well known between NOx and PM in diesel exhausts.

But the target was well identified even if the methodology of measurements (driving cycles) was not identical in the different parts of the world.

A controversy has been growing up in the public opinion on the danger (?) associated with diesel exhaust leaving the candid observer with the feeling that this exhaust is dangerous because it is visible and stinks.

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A more serious controversy is now growing up inside the scientific community on the validity of the animal exposures and epidemiological studies leading to the classification of diesel exhaust as a potential carcinogen for humans.

The animal exposures are criticized as huge amounts of soot were inhaled by rats before they show any symptom and that other rodents were not showing a similar reactivity.

The epidemiology studies had shown some instantaneous effects on the morbidity and even mortality of persons at risks. This effect is apparently correlated with the amount of PM10 in atmosphere. None of the animal studies gave any indication of an acute effect.

The matter is serious enough to push the President of United States to take the head of a crusade against the fine particles. The warriors are now covered with the war paintings, but the enemy is not yet identified : as in a series B movie the Indians are dancing around in a perfect circle.

And the smoke signals are visible from far away ... but nobody know really what they mean ...

This circle could become vicious for related industries if the responsibilities are not better identified ...

Main questions to our industry : could you eliminate the nanoparticles from the exhausts ?

To answer this question we need to better define the key parameters and to rely on a reproducible metrology.

Key parameters : combustion type, engine type, fuel type, traffic conditions ...

is the emission of nanoparticles a consequence of special condition of combustion : burners, domestic heating, barbecue, engines ... ?

is the emission of nanoparticles specific of a given engine ?

spark ignition ?

internal combustion ?

turbine ?

is the emission of nanoparticles depending on the fuel type?

gasoline ?

diesel fuel ?

natural gas ?

LPG ?

is the emission of nanoparticles depending on the fuel composition ?

sulfur content ?

aromatics content ?

olefins content ?

presence of additives ?

is the emission of nanoparticles depending on the driving parameters ?

importance of the driving cycle ?

road/city real-world driving ?

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Reproducible metrology :

(reproducible is certainly not the right word, having a too narrow meaning ; what I mean is a metrology which allows a good communication and exchange of data between the environment scientists, the regulatory bodies and the related industries)

The metrology should help

- to assess the risk in terms of immissions data
- to quantify the various contributions (emissions data)
- to correlate these different data

The metrology should then (at a reasonable term)

- be considered as reliable by all the parties involved
- be applicable to all (or nearly all) the cases
- give an image of the real world conditions
- be easy (and low cost) to use as a reliable tool of
 - quantification of the problem
 - development of the solutions
 - certification of the commercial equipments
 - follow up of the results in the real world
- be accepted round the world

We are early enough in the development of this metrology to avoid a confusion similar to the one existing today in the fields of monitoring the ambient air, checking the emissions of vehicles and correlating the data.

Evidence of a health risk

All this work is useless if there is not a reasonably clear evidence that the nanoparticles represent a risk for the human health and the environment.

Today the airborne particles are suspected of representing a serious risk for the humans and specially the children and the elderly with respiratory and heart troubles.

The finest are designated by some scientists as the most dangerous and the US President decided to focus the regulation on the very fine particles. But there are still one or two order of magnitude to the particle size that we are discussing.

The plan of President Clinton will need a period of 10 years before being implemented. Monitoring will be completed in 2004.

The opponents have an easy argument in the fact that there is today no clear correlation between the size of the particles and the results of epidemiological studies :

- no reliable monitoring of ambient air quality (no speciation of sizes)
- no animal study at ambient air doses of exposures
- controversy in the medical world about the impacts of such an exposure

We need to have the question of quantifying biological impact of nanoparticles implemented in the general plan of monitoring the fine particles and the related effects.

We have to be in tight connection with the toxicologists and the physicians to establish as soon as possible a correlation between the immissions data and the biological effects. For that they have to develop new tools of investigation.