Northeast
Diesel Collaborative
www.northeastdiesel.org

Diesel Particulate Filters and Ultrafine Particles

The information below synthesizes the body of research on $PM_{2.5}$ (fine particulate matter ≤2.5 microns (µm) in diameter), ultrafine particles (<0.1 µm in diameter), and the effectiveness of diesel particulate filters in controlling both. The document represents the consensus of a group convened by the Northeast Diesel Collaborative, which consisted of representatives from the air agencies of the eight Northeastern states, U.S. EPA, environmental organizations, and the emission control industry.

Health Effects

- Fine particulate matter ($PM_{2.5}$) has well-documented harmful effects on human health, including decreased lung function, exacerbation of lung disease, respiratory and cardiac mortality, cancer, and immunological and developmental effects.
- Research has not determined which specific physical characteristics and chemical components of $PM_{2.5,}$ acting alone or in combination, are responsible for the adverse health effects. Therefore it is not reasonable to assume all adverse health effects result from just one constituent within the diverse mixture, such as ultrafine particles (UFPs).
- The potential health effects of UFPs are not yet fully studied, and although the literature suggests possible adverse effects, more research is needed before the evidence is as robust as that for the health impacts arising from the aggregate components of $PM_{2.5}$.

Control Technology

- Wall-flow diesel particulate filters (DPFs) remove more than 95 percent of the harmful solid particles larger than 0.02 µm.
- The DPF changes the interaction of the gases, particles, and volatiles emitted by the engine but does not add to the total ***mass*** emissions. The apparent increase in observed UFP ***number*** in some studies is in fact a redistribution, as uncondensed volatile material no longer has a solid particle on which to adhere and therefore passes through the filter.
- Recent field studies of exhaust from transit buses, school buses, and garbage trucks in major cities show a reduction in UFPs with the installation of DPFs.
- Other studies show an increase in the number of UFPs in vehicles fitted with an uncatalyzed DPF when high engine temperatures are reached; transit and school buses do not usually reach those temperatures.
- Research indicates that the observed UFP emissions are primarily sulfates and can be controlled in several ways, such as using low sulfur or synthetic lubricating oil and installing catalyzed filters (beginning in 2007 all DPFs are catalyzed). In addition, manufacturers are experimenting with sulfur traps.

Conclusions

- ***Currently available DPFs remove from diesel exhaust more than 95 percent of the particulate matter known to cause serious illnesses and therefore have clear benefits for public health.***
- The potential health effects of UFPs are not fully understood and require more study.
- The UFPs consist primarily of sulfates, and readily available mitigation measures can result in UFP levels indistinguishable from ambient levels even under high-temperature conditions.