The Mounting Evidence Differentiating the Health Risks of New Technology Diesel Exhaust (NTDE) versus Traditional Diesel Exhaust (TDE)


Mills et al. (2011)1 reported evidence of vascular dysfunction, including reduced vasodilation in response to both endothelium-dependent and -independent agonists, among healthy men inhaling elevated diesel exhaust particulate (DEP) levels (350 microgram/m3) from an uncontrolled off-road engine. Highlighting the lack of similar responses for filtered diesel exhaust (DE) exposures (DEP concentration of 6 microgram/m3), the authors concluded that their findings provide a "rationale for testing environmental health interventions targeted at reducing traffic-derived particulate emissions."

Although the authors briefly allude to DE particle traps as one such intervention, they fail to note the evidence already available to support the public health benefits of particle traps and other DE aftertreatment components, including their own findings.2 We would like to briefly elaborate on this evidence, differentiating the potential health risks posed by post-2006 diesel engines with exhaust aftertreatment (termed New Technology Diesel Exhaust, or NTDE) versus exhaust from older engines without aftertreatment (termed Traditional Diesel Exhaust, or TDE). Namely, this same research group recently published the first human clinical study of diesel emissions representative of NTDE, reporting an absence of adverse vascular and prothrombotic effects among men inhaling DE from an engine equipped with a particle trap.2 Animal data are also supportive of the reduced health risks posed by NTDE compared to TDE3, with the ongoing Advanced Collaborative Emissions Study (ACES) to soon provide a suite of short-term and chronic rodent bioassay data for NTDE.

Moreover, in a recent review4, we demonstrated that particle traps and other DE aftertreatment not only reduce levels of DE emissions (e.g., particulate matter, hydrocarbons, formaldehyde, benzene, and PAHs), but also contribute to significant differences in the chemical and physical properties of DEP in NTDE compared to TDE. These emissions data further support differences in the health risk profile of NTDE versus TDE, especially given the Mills et al. suggestion that their findings support a key role of particle composition in DEP health risks.

Although Mills et al.1 reported subtle DE-induced changes potentially related to adverse vascular function, it is important to note that the responses were only observed at elevated DEP levels (350 microgram/m3) from an uncontrolled off-road engine. This is well above typical DEP exposure levels along urban roadsides or inside vehicles (average total PM2.5 levels of 20 to 42 microgram/m3).5 Furthermore, these investigators previously reported that elevated TDE exposures (300 microgram/m3) did not aggravate pre-existing vasomotor function among patients with coronary heart disease.6 Overall, the clinical significance of the observed responses is uncertain given that they are reversible and generally would not be considered life-threatening, as supported by the testing of heart disease patients by these investigators.

Additional health studies of NTDE are clearly needed, but this and other studies provide evidence that effects seen with TDE may have little relevance for NTDE. Overall, the accumulating data indicate that NTDE emissions are very different from TDE emissions, and this distinction will be crucial in the upcoming (June 2012) review of DE by the International Agency for Research on Cancer.
References:


4. Hesterberg TW, Long CM, Sax SN, Lapin CA, McClellan RO, Bunn WB, Valberg PA. Particulate matter in New Technology Diesel Exhaust (NTDE) is quantitatively and qualitatively very different from that found in Traditional Diesel Exhaust (TDE)." J. Air & Waste Manage. Assoc. 2011; In press.


Conflict of Interest:
Thomas Hesterberg and William Bunn are employed by Navistar, a major manufacturer of diesel engines and vehicles. Christopher Long and Peter Valberg of Gradient are consultants to Navistar. All authors declare no other financial interests in the subject matter of this letter.

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