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PATH-UTC 2007 Research Conference: "[Decadal Changes in On-Road Gasoline and Diesel Vehicle Emissions](#)," Robert Harley



Ooo-ooo, That Smell: An Overlooked Set of Pollutants Is Gaining Fast

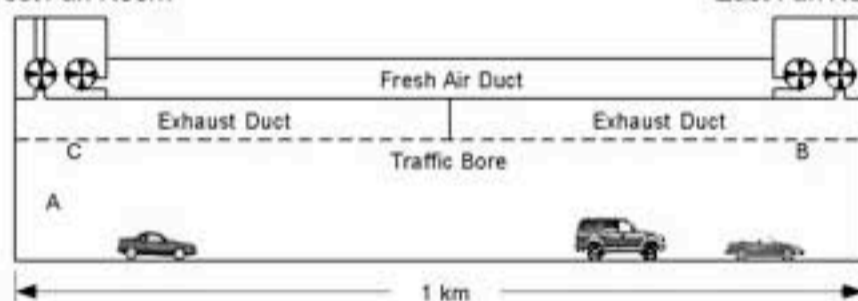
When Lee Schipper, visiting scholar at the [Center for Global Metropolitan Studies](#) and former Director of EMBARQ, made his introduction for the session on alternative fuels at the [PATH-UTC Conference](#), he commented on the stinky exhaust he was forced to inhale as he bicycled to the conference's Berkeley Marina site behind an AC Transit bus.

The source of the stench was a centerpiece of Robert Harley's presentation, the third in the session. Harley, a Professor of Civil and Environmental Engineering and the most recent [addition to the ITS Advisory Council](#), has been [measuring emissions in the East Bay's Caldecott Tunnel](#) for more than a decade. The reason for that smell swirling out diesel engine tailpipes?

Aldehydes.

Aldehydes are among a set of major air pollutants that have been overlooked with all the attention on passenger cars emissions and their role in air pollution problems, he explained.

West Fan Room



Over the years, Harley has used the unique research opportunities offered by the Caldecott's three tubes, which connect San Francisco's East Bay with the suburban bedroom communities further east, to compile a record of vehicle emissions. By extrapolating measures from the truck-free tube in the middle, he can better see the comparative pollution burdens of heavy versus light vehicles.

What Harley's figures and comparisons show is that there are questions being

overlooked in many discussions of the impacts of vehicle emissions.

"One is the question of **gross polluters**. Over time, as vehicles have become cleaner, what we're left with is not a uniformly distributed problem, but a few broken, malfunctioning, high-emitting vehicles that contribute a big proportion of pollutants.

"Historically we thought that **10 percent of the vehicles were responsible for half the emissions**. That distribution has gotten more skewed so that a small percentage of vehicles on the road are responsible for **three-quarters of all the pollutant emissions**."

Diesel emissions from freight traffic are also a big problem, he said, and they "have really been neglected in the past relative to the effort devoted to gasoline and passenger vehicles. Especially in areas where there are rapidly growing ports, the amount of increase in diesel truck traffic and the corresponding burden on surrounding communities are really unconscionable."

Another question is how this plays into current concerns about climate change, he said.

Beyond CO₂ there are other important pollutants that need to be accounted for: nitrogen oxides, which lead to urban smog as well as increases in global background ozone levels, and soot particles are two more examples of climate-forcing emissions from motor vehicles.

Because of improvements in fuel-efficiency and engine technologies, light-duty gasoline vehicle NO_x emissions have dropped steadily at the rate of about seven percent a year, enough to more than offset the increased amount of fuel burned over that time.

Not so for diesel. "The diesel shows a much lower slope over time. ...So that actual NO_x emissions from diesel are roughly unchanged."

Fine particles, or PM_{2.5}, a class of particulates that can be inhaled deeply into the lungs, is another concern. There has been some progress with those, as well.

Now, for that smell. It comes in part from aldehydes, a subset of a larger group of pollutants known as volatile organic compounds (VOCs).

"These include unburned fuel and partial oxidation products. We worry about these pollutants because they contribute to urban smog. If you look at the emission inventories, they say that gasoline engines dominate diesel as a VOC source."

So what did Lee Schipper smell?

"It's not the particles. We're finding large amounts of aldehydes in diesel emissions, and that is a concern." They are toxic and acrid-smelling. Furthermore, Harley added, they are not measured properly in federal regulatory measurements so that they are "largely invisible."

"Finally, diesels are a significant source of aldehydes, which are reactive, toxic and malodorous."

[PDF of article](#)