**Abstract**

The California PM emission standard for new heavy-duty engines was reduced from 0.1 g/bhp-hr to 0.01 g/bhp-hr in 2007. Similarly, the NOx emission standard will be reduced from last year's 2 g/bhp-hr to an eventual 0.2 g/bhp-hr limit in a stepwise fashion between 2007 and 2018. While diesel engine manufacturers have been able to meet previous emissions standards with engine design and combustion process improvements, the new very low emission limits will nearly universally require use of advanced aftertreatment. Some of these devices such as DPFs and SCR are currently being investigated in retrofit demonstrations. Many studies have shown these devices to be very effective at reducing the mass emissions of the targeted pollutants. There is, however, remaining interest regarding how these aftertreatment devices may affect the emissions of ultrafine particles (solid and semi-volatile) and, in particular, the formation of nanoparticles. Some research has suggested that emissions of the very small particles may, under certain conditions, increase even as PM mass is decreased with the use of these aftertreatment devices. The volatility of the particles is a determining parameter.

In this work, we present our preliminary findings with respect to the particle number and particle size distribution measured in the emissions from one test vehicle, a heavy-duty diesel truck equipped with a demonstration retrofit for PM and NOx control. The study is being conducted at the California Air Resources Boards Heavy Duty Vehicle Emissions Laboratory (HDVL) in Los Angeles. In our laboratory vehicles are exercised on a chassis dynamometer and emission samples are collected in accordance with the established protocols promulgated in the United States Code of Federal Regulations for emission certification.

**Project Overview**

This project seeks to investigate the physical and chemical characteristics of exhaust emissions of in-use heavy- and light-duty motor vehicles projected to have significant share of the population and VMT in California. This study is a 4-year collaborative project focused on emerging issues of relevance for air quality and the protection of health. These issues include ultraviolet emissions from advanced aftertreatment technology, measurement instrumentation and protocols, and the relative toxicity of PM components. The project builds on previous vehicle emissions research by CARB [1, 2]. The premise for the study is the retrofit systems of today being a glimpse into the production-ready OEM systems of the future. And with an eye toward 2010 emission standards, the project seeks to address the following:

**Hypothesis:** (a) Emerging, newer vehicle/engine systems will result in reduced emissions of physicochemical and toxicological relevance relative to existing, older systems

**Test fleets** Various types of retrofit systems for heavy-duty diesel (ULSD) applications are being investigated. These include two types of DPFs (passive, catalyst-based DPF and an active, plug-in, uncatalyzed system), two SCR catalysts (vanadium-based and zeolite-based). A diesel hybrid electric (ERG + DPF) was also tested. The results are compared to a baseline vehicle (uncontrolled diesel). Testing of heavy-duty vehicles has just been completed in August 2007.

For the light-duty fuel, various fuels types are anticipated. A clean diesel vehicle certified to California standards, a gasoline vehicle (ultralow and a high emitter), a CNG vehicle, an E85 vehicle, and a vehicle running on biodiesel are expected. This part of the project is planned for the 2008-2009 timeframe.

**References**


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