ARB'S STUDY OF EMISSIONS FROM DIESEL AND CNG HEAVY-DUTY TRANSIT BUSES

Alberto Ayala, Norman Y. Kado, Robert A. Okamoto, Michael Gebel, and Paul Rieger
California Environmental Protection Agency

The identification of diesel particulate matter (PM) as a Toxic Air Contaminant (TAC) in California triggered the development of control strategies under the Diesel Risk Reduction Program (DRRP), which was recently approved by the California Air Resources Board (ARB). The DRRP aims to reduce PM emissions from diesel-fueled engines, and it includes numerous control measures to be phased in over the next several years. These measures are meant to substantially curtail emissions from new and existing on-road and off-road sources.

Approaches to reducing the risk of exposure to diesel PM include the use of alternative fuels, like compressed natural gas (CNG), and advanced aftertreatment control for existing and new diesel engines. Buses fueled by CNG or using diesel particulate filters (DPF) are two "green" alternatives to conventional diesels. These alternatives have been demonstrated to reduce PM emissions. However, additional information is needed on their effect on the
emissions profiles of non-regulated species, toxic and otherwise.

For this reason, the ARB embarked on a research effort to collect emissions data from two late-model, heavy-duty transit buses in three different configurations. These were: (1) a CNG bus equipped with a 2000 DDC Series 50G engine, (2) a diesel bus equipped with a 1998 DDC Series 50 engine and a catalyzed muffler, and (3) the same diesel vehicle retrofitted with a Johnson Matthey Continuously Regenerating Technology (CRT™) DPF in place of the muffler. The CNG bus in this study was certified for operation without oxidation catalyst. The diesel bus configurations ran on ARCO's (a BP company) Emission Control Diesel (EC-D 1) fuel with a measured sulfur content of 11 ppm.

The objectives of the study were: (1) to assess driving cycle effects, (2) to characterize the types and amounts of several toxic substances emitted for the various configurations, and (3) to investigate total PM and ultrafine (<100 nm) particle emissions. This study has shown that, in terms of PM mass, CNG and trap-equipped diesel buses are significantly superior to the conventional diesel bus. However, no single "green" technology is clearly superior to the other for every pollutant indicator measured. Measurable levels of toxic compounds in the exhaust suggest that neither the CNG nor the trap-equipped bus may be clearly superior to the other in all aspects. Most importantly, possible technology improvements were identified.