EFFECTS OF CITY DRIVING ON PARTICLE NUMBER AND SIZE DISTRIBUTIONS FROM HYBRID-ELECTRIC AND CONVENTIONAL LIGHT-DUTY GASOLINE VEHICLES

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Particle number emissions from combustion engines have been an area of increasing concern in recent years. This is due to acute and chronic health effects that can result from exposure to air with high particulate concentrations. Of greatest concern are particles classified as ultrafine and nanoparticles. Previous studies have focused on diesel vehicles because they emit much higher particle concentrations compared to gasoline vehicles. Increased interest in particles emitted from gasoline engines has been growing, however, because gasoline engines make up the majority of the vehicle fleet. New hybrid technology has further complicated understanding of engine emissions and little particulate emissions data exist for hybrid cars. Current air quality regulations are based solely on particle mass, but studies have shown that total particle mass and particle number have little, if any, correlation. This is significant because while nanoparticles constitute over 90 percent of the particle number, they comprise 1-20 percent of the total particle mass (Kittelson 1998). Consequently, a rapid response measurement system has been developed to collect on-road, second-by-second tailpipe particle number emissions data along a specified route for both conventional and hybrid gasoline vehicles. An Engine Exhaust Particle Sizer™ Spectrometer (TSI, Inc. Model 3090) was used to measure particle number concentrations over 32 size channels ranging from 5.6 to 560 nanometers. A Condensation Particle Counter (TSI, Inc. Model 302A) was also used to record total concentrations. The data was analyzed as a function of various operating parameters to identify conditions influencing particle number and size distribution during city driving in Burlington, Vermont. Spatial emissions patterns, such as emissions at stop signs and traffic lights, were also analyzed.

Kittelson, D. B. (1998). Engines and Nanoparticles: A Review. *Journal of Aerosol Science, 29*(5/6), 575-588.