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Contributions of Carbonaceous (Nano) Particulate and Non-Particulate Components to Health Hazards of Engine Emissions

The FreedomCar and Vehicle Technology Program partners with other government and non-government sponsors of the National Environmental Respiratory Center to conduct research to determine which components of engine and other combustion emissions drive the different health hazards associated with air pollution by epidemiology studies. Among other benefits, the results of this research help inform emission control strategies by determining which regulated and unregulated emissions present the greatest health hazards. We will report results from a series of studies that characterize the pulmonary and cardiovascular toxicity associated with specific components of diesel and gasoline engine emissions.

Diesel emissions were generated by a single cylinder diesel generator operated with Number 2 Certification diesel fuel and 40w motor oil. Engines were operated at a constant load imparted by a load bank of 500 watt lights. To generate emissions of varying composition, the emissions were studied at both high and low engine loads, and in some cases with a ceramic (non-catalyzed) particle filter in place to examine the role of particles on toxicity. For gasoline emissions, 4.3 L GM engines were operated on a California Unified Driving Cycle. In all cases, animals were exposed 6 hours/day to diluted exhaust. The dilutions yielded particle concentrations ranging from 5-3500 $\mu\text{g}/\text{m}^3$, or an equivalent dilution with the gas phase only. We will report on several animal species/strain/age/gender "models" used to characterize pulmonary inflammation, systemic immunity, and cardiopulmonary toxicity. We will present the preferential role of elemental carbon on pulmonary inflammation, particles in systemic immunity, and the gas phase for cardiopulmonary effects.