DOE'S GASOLINE/DIESEL PARTICULATE MATTER (PM) SPLIT STUDY – CHARACTERIZATIONS OF THE VARIATIONS IN CHEMICAL COMPOSITION OF $PM_{2.5}$ IN THE SOUTH COAST AIR BASIN

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ABSTRACT

DOE's Gasoline/Diesel Particulate Matter (PM) Split Study is being conducted to quantify the relative contributions of tailpipe emissions from gasoline-powered motor vehicles and diesel-powered motor vehicles to the ambient concentrations of fine particulate matter ($PM_{2.5}$) in the urbanized region of Southern California using an organic compound-based chemical mass balance model (CMB). This study involves several groups working cooperatively on sample collection and quality assurance aspects of the study, but working independently, at least initially, on chemical analysis and data analysis. Groups participating in the study include California's Bureau of Automotive Repair, the South Coast Air Quality Management District, the U.S. Environmental Protection Agency, Ralph's Groceries, the Clean Air Vehicle Technology Center, the West Virginia University, the University of Wisconsin at Madison (UWM), and the Desert Research Institute (DRI).

Source testing of 59 light-duty vehicles (including 2 diesel vehicles) was completed in June 2001; ambient measurements were performed in July; and the testing of 34 heavy-duty vehicles was completed in September. DRI used sample collection and chemical analysis methods consistent with those employed during the Northern Front Range Air Quality Study. Parallel samples were collected by UWM using methods consistent with previous PM studies in Los Angeles. This paper describes the variations in the chemical composition of the ambient samples collected by DRI.

Twenty-four hour samples were collected on Teflon and quartz filters and Teflon-impregnated glass fiber (TIGF) filters followed by polyurethane foam (PUF) plugs and XAD-4 resin cartridges for 28 consecutive days at air-monitoring stations in downtown Los Angeles and Azusa. Teflon filters were analyzed for gravimetric mass, elements, and ions, and quartz filters were analyzed for organic and elemental carbon by thermal optical reflectance (TOR) and thermal optical transmittance (TOT) using both IMPROVE and NIOSH protocols. The TIGF/PUF/XAD samples were combined and extracted together by day of the week, and analyzed for polycyclic aromatic hydrocarbons, hopanes, steranes, alkanes, methoxyphenols, lactones, sterols, and polar organic compounds.

A third set of ambient samples was collected from a mobile sampling van at several regionally representative sites and at locations with expected higher proportions of PM emissions from diesel trucks (e.g., Terminal Island, truck stop, highway truck routes) and from gasoline vehicles (e.g., congested freeways during commuter rush hours, surface streets during weekends, and a parking lot at major sporting events). Black carbon and total PM were monitored continuously by photoacoustic and DustTrak instruments. As a prelude to the CMB analysis, we examined the variations in relative abundances of key marker compounds in the source-dominated ambient samples relative to corresponding variations in the samples from regional air-quality monitoring sites by day of the week. This work was supported by the DOE's Office of FreedomCAR and Vehicle Technologies through the National Renewable Energy Laboratory.