

THE WEEKEND OZONE EFFECT - THE WEEKLY AMBIENT EMISSIONS CONTROL EXPERIMENT

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ABSTRACT

Since the mid-1970s, ozone concentrations in California's South Coast Air Basin (SoCAB) have been higher on weekends than on weekdays. Despite significantly lower ozone precursor levels on weekends, 20 of all 78 southern California sites show statistically significant higher mean ozone levels on Sundays than on weekdays ($p < 0.01$); 49 of the remaining 50 sites show no significant differences between mean weekday and Sunday peak ozone levels. The weekend effect has generated strong interest because of its implications for development of air-quality control strategies.

To investigate the possible causes of higher weekend ozone compared to weekday ozone in the SoCAB, the National Renewable Energy Laboratory (NREL), with support from DOE's Office of FreedomCAR and Vehicle Technologies, and the Coordinating Research Council (CRC) sponsored a multi-phase effort beginning in 1999 to collect and analyze weekday and weekend air-quality, emissions, and meteorological data to formulate hypotheses likely to explain the causes of elevated weekend ozone in the SoCAB.

As part of the field study, on-road mobile source emissions activity data were collected in close proximity to each ambient air-quality monitoring site.

These emissions-activity data include daily diurnal vehicle count figures for selected surface streets and Caltrans Weigh-in-Motion data collected on major freeways. Surveys also were conducted to acquire data about business and residential activities on weekdays and weekends.

The ambient air-quality field program was conducted during September and October 2000. Measurements were used to attribute weekday/weekend changes in the temporal and spatial patterns of volatile organic compounds (VOC's) and NO_x concentrations to major sources of ozone precursor emissions. While exhaust emissions from on-road gasoline and diesel vehicles are the primary sources of interest, detailed speciation of VOC's also allowed for attribution of other sources of volatile organic compounds.

Air-quality simulation modeling explained the observed weekend ozone effect very well. Changes to the mass of motor vehicle emissions were the main contributor to ozone differences rather than changes to the timing of motor vehicle emissions. Ozone increases on weekends are caused by lower NO_x emissions because ozone formation is strongly VOC-limited throughout most of the Los Angeles area. Carryover of precursors and/or ozone is not an important factor in explaining the relationships between emission changes and ozone effects.