

CARBON MONOXIDE AND THE FREEWAY COMMUTER

Carbon monoxide fumes inhaled by the daily freeway commuter can be of dangerous proportions. According to Arie J. Haagen-Smit, pioneer in smog research and professor of bio-organic chemistry at Caltech, "During rush hours, with heavy traffic, a buildup of slow-moving cars, and intermittent stopping, concentrations of carbon monoxide from exhausts can dull the alertness of drivers and could reach a more injurious level."

Data for this observation were obtained with a new carbon monoxide analyzer designed by Dr. Paul Hersch, senior scientist in the research department of Beckman Instruments, Inc. Prototypes of this instrument were installed on a sedan and a sports car which Dr. Haagen-Smit and a National Science Foundation student of his, Thomas W. Latham '64, drove in eight freeway trips, duplicating those taken by persons commuting between Pasadena and Los Angeles during peak traffic hours. The devices gave continuous records of the carbon monoxide levels of the drivers' environment.

Carbon monoxide is a poisonous gas produced by

incomplete combustion of gasoline. Because red blood corpuscles prefer it to oxygen, high concentrations of carbon monoxide in the atmosphere cause oxygen starvation in the cells. This reduces the flow of blood, and bodily functions are slowed down, resulting in drowsiness, fatigue, and delayed physical reactions.

Prolonged exposure to carbon monoxide can cause loss of judgment, muscular incoordination, increased difficulty in breathing, and, eventually, death from asphyxiation.

While "country" air is completely free from carbon monoxide fumes, normal Los Angeles air contains from 10 to 12 parts carbon monoxide per million parts (ppm) of air. The State Health Department has determined that 30 ppm is an "adverse" level and that 30 ppm for eight hours, or 120 ppm for one hour, is a "serious level of pollution." In the test trips made by Dr. Haagen-Smit and Tom Latham, the over-all average level of carbon monoxide measured was 37 ppm of air. In heavy traffic, moving at less than 20 miles an hour, the level rose to an

average of 54 ppm, with peaks up to 120 ppm. A short distance from the freeways and heavily-traveled streets, levels dropped rapidly, except at stop signals, where traffic again accumulated.

"If a commuter spends two hours at the higher exposure level found in the study," says Dr. Haagen-Smit, "the carbon monoxide level of his hemoglobin would be approximately that cited by the State Health Department for the 'serious' level."

A concentration of 30 ppm of the gas will inactivate 5 percent of a person's hemoglobin and 60 ppm will inactivate 10 percent of it. If a person is smoking, another 5 percent of his hemoglobin is inactivated.

The trips made on the Pasadena Freeway by Dr. Haagen-Smit and Tom Latham were between Caltech and the vicinity of Exposition Park in Los Angeles. Half the trips were made in the morning and half in the afternoon. They averaged 71 minutes duration, with the quickest one being 40 minutes long and the slowest taking one hour and 55 minutes.

To establish the effect of poor ventilation on carbon monoxide levels *inside* a car, and to determine whether or not leaks in its own exhaust system might contaminate a car's interior, the concentration of the toxic gas was measured inside two test cars with the windows closed and the engine running. The readings were 10 ppm above that of the outside atmosphere. A third car, evidently in poor

mechanical condition, showed an inside reading of between 100 to 200 ppm. And air-conditioning does not help, Dr. Haagen-Smit points out, because an air-conditioner does not filter out carbon monoxide.

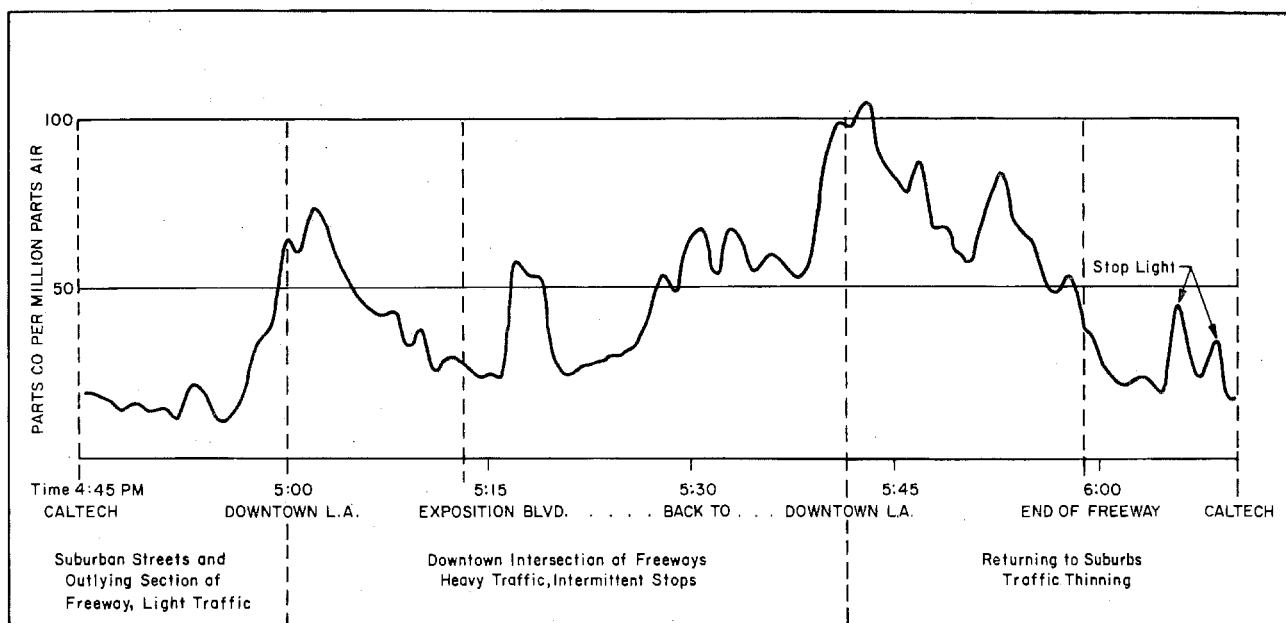
"Thorough study should be made of the effects of carbon monoxide levels on the alertness of motorists and on their ability to drive," Dr. Haagen-Smit recommends. "These investigations should include the respiratory cripples as well as the healthy drivers."

Dr. Haagen-Smit is a member of President Johnson's Environmental Pollution Panel and is a smog consultant for the state and Los Angeles County governments. He believes that automobile exhaust control is the answer not only for eye-irritating smog, but also for the reduction of the carbon monoxide level to which we are exposed.

"Some people," he comments, "still seem to think that all the smog comes from industry. However, practically the only uncontrolled source of carbon monoxide is the incomplete combustion of gasoline, which throws 9,000 tons per day of this respiratory poison into the Los Angeles area atmosphere.

"Fortunately, the cars coming out next September will be equipped with exhaust devices that will reduce the carbon monoxide concentration to perhaps one-third of its former level. Those who oppose controlling auto emissions should think of the wholesome effect this will have on the carbon monoxide level of our atmosphere."

Carbon Monoxide Concentration in City and Freeway Driving Routes



Amounts of carbon monoxide measured by Dr. A. J. Haagen-Smit along a route from Caltech to downtown Los Angeles and return, via the freeway system, during the hours of heaviest traffic. The run was made on June 26, 1964, an "average" day during which a late afternoon west wind dispersed existing smog.