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Gasoline Components in Blood After Refueling: Part A: Fairbanks

Due to the unfavorable Alaska experience with methyl-tert-butyl-ether (MTBE) during the winter of 1992-1993, use of the oxygenate was suspended in Alaska. An alternative oxygenated fuel, a fuel containing 10% ethanol (E-10), was introduced in Anchorage during the winter of 1994-1995 to reduce carbon monoxide levels. Because the E-10 fuel had not been adequately tested under extreme cold conditions, Fairbanks was not required to use E-10. Instead, a drivability study was conducted in Fairbanks by the Alaska Department of Environmental Conservation (DEC). The drivability study was designed to compare car performance of volunteers using regular unleaded and E-10 fuel. Study participants were not informed of the type of fuel they were using and were instructed to always refuel from either Tank A or B at the same gas station. The drivability study in Fairbanks provided an opportunity to compare gasoline exposures prior to and after pumping regular and E-10 fuel. A total of 30 individuals using regular unleaded and 30 using E-10 were recruited from the drivability study. Only non-smokers and individuals not occupationally exposed to volatile organic compounds (VOCs) were eligible for the Fairbanks Gasoline Exposure Study. Nonsmoking status was verified by measuring levels of 2,5,-dimethylfuran (a marker for smoking) in the blood samples. Blood samples and environmental air samples were analyzed for VOCs typical of gasoline exposure.

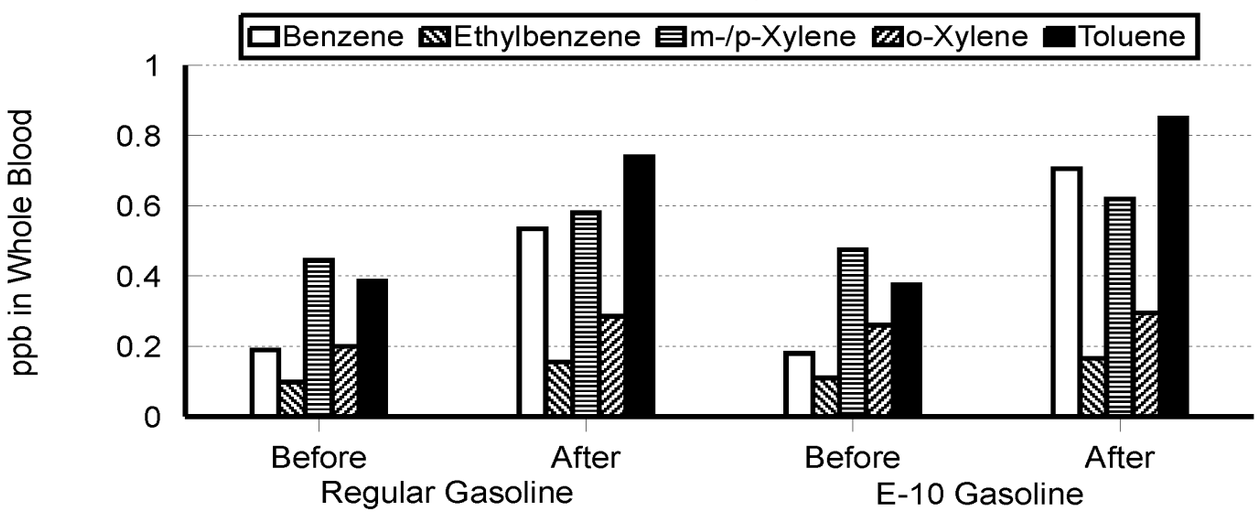
Laboratory results verified that all study participants were nonsmokers. Both fuel groups showed significant increases in concentrations of gasoline components in their blood after refueling (Figure). Although the increase in blood benzene, m-/p-xylene and toluene was slightly greater for the E-10 group than the regular gasoline group, the differences were not statistically significant. The E-10 group, on average, pumped a statistically significantly greater number of gallons of fuel compared to those who pumped regular gasoline (median number of gallons pumped was 13 and 8.8 gallons respectively). Median personal breathing zone exposures with an average duration of 3 minutes were also comparable for those pumping regular and E-10 fuel: 352 vs. 246 part per billion (ppb) for benzene, 49 vs. 45 ppb for ethylbenzene, 111 vs 92 ppb for m-/p-xylene, 55 vs. 51 ppb for o-xylene and 391 vs. 332 ppb for toluene

Limited data are available from which to draw comparisons to other study populations. The pre-pumping blood VOC concentrations observed in this study are comparable to those observed among commuters in Fairbanks in December 1992 and February 1993 (1). Median blood benzene levels were 0.2 ppb among 7 commuters in Fairbanks in December 1992. In February 1993,blood VOC levels were 0.3 ppb for benzene; 0.1 ppb for ethylbenzene; 0.6 ppb for m-/p-xylene; 0.2 ppb for o-xylene; and 0.5 ppb for toluene. Post-pumping blood VOCs were lower than those observed for mechanics in Fairbanks: the median post-shift blood benzene levels was 1.3 ppb for 4 mechanics in December 1992 and 1.9 ppb for 9 mechanics in February 1993 (1).

The level of gasoline components in the blood of the Fairbanks study participants prior to pumping gasoline may reflect exposures occurring at home, while driving in an enclosed vehicle with the heater drawing in air containing auto exhaust, and exposures at the gas station prior to providing the first blood sample. VOC levels in the blood decrease considerably and quickly after exposure stops. Thus, the levels reported immediately after commuting to the gas station and after refueling do not reflect typical day-long concentrations of blood VOCs. The level of blood VOCs are low, falling for the most part below 1 ppb. Also, the data indicate that exposures to gasoline components are similar whether refueling with regular or E-10 fuel.

References: 1 Moolinaar, Unpublished Data, CDC, 1995.

Median Blood VOC Concentrations
Before and After Pumping Gasoline
Fairbanks, Alaska, February 1995



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