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Light Rail Commuters Exposed to Lowest Pollution Levels

Bicycle commuter with air pollution measuring backpack.

A study by California Air Resources Board (CARB),

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The mode of travel you take on your daily work commute can make a big difference in your exposure to air pollution, a new study finds.

The study, "Commuter exposure to PM2.5, BC, and UFP in six common transport micro-environments in Sacramento, California," conducted by researchers at the California Air Resources Board (CARB), was published recently in Atmospheric Environment, a prestigious scientific journal in the field of air pollution.

The researchers concluded that electricity-powered light rail trains offer the least polluted travel environment, while commute trips by older technology diesel-powered trains experienced the highest average air pollution levels in Sacramento.

Average concentrations of particulate matter and black carbon were statistically similar for cars, buses, and bicycle trips, and in between the levels found in the two types of train commutes. Since the average car and public transport trips are much faster than bicycle trips, they may offer shorter exposure durations; however, cycling has significant health benefits.

The study measured air pollution exposures to harmful traffic-related air pollutants during a variety of travel modes to and from CARB headquarters in downtown Sacramento. The researchers developed an innovative air pollution measurement backpack with state-of-the-science pollution sensors, and recruited volunteers to collect data during their daily commute trips.

The backpacks measure personal exposure to three air pollutants: particle pollution that can be inhaled deep into the lungs and then be absorbed into the bloodstream, including tiny particles measuring 2.5 micrometers or less (PM2.5) in diameter; and even smaller 'ultrafine' particles (UFP); and soot from diesel engines and other combustion sources, known as black carbon (BC). Commute modes included travel by car, bus, light rail, train, and bicycle.

Exposure to airborne particles is a serious public health concern. CARB calculates that PM2.5 exposure from all sources in California is associated with an estimated 7200 premature deaths, 1900 hospitalizations, and 5200 emergency room visits each year.

The study also compared air pollution exposure per mile for each mode, a useful metric for people to use when selecting a travel mode that offers the lowest air pollution exposure for their individual commute.

Light rail commutes had the lowest average exposure per mile for all measured pollutants, and car trips experienced marginally higher per mile exposure, whereas train commutes with older diesel technologies experienced the largest exposure per mile of all of the motorized transportation commute modes. The study also offers advice for reducing exposure to air pollution during commute trips:

Car travellers can reduce their personal exposure to PM2.5, ultrafine particles, and black carbon by up to 75 percent by operating the air conditioner on recirculate mode.

Bicycle commuters can reduce exposures by between 15 and 75 percent by choosing dedicated bicycle pathways away from traffic sources.

Older technology diesel-powered train commute trips where the locomotive engine was pushing the rail cars experienced up to 90 percent lower ultrafine particle concentrations than ones where the locomotive engine was pulling the cars.

The study took place from April 2014 to November 2015. Since then, the Capitol Corridor Joint Powers Authority has introduced California-built Siemens Charger Clean Diesel-Electric Locomotives on Sacramento's Capitol Corridor route and begun testing of cleaner-burning renewable diesel fuel. These new technologies reduce particle emissions by about 90 percent.

This transformation is part of a state-wide effort led by the California State Transportation Agency (CalSTA) to modernize California's intercity, commuter, and urban rail systems to improve services, increase safety, and reduce harmful pollutant emissions.

"The study has useful implications for our efforts to link transportation and land use planning to develop more sustainable communities.

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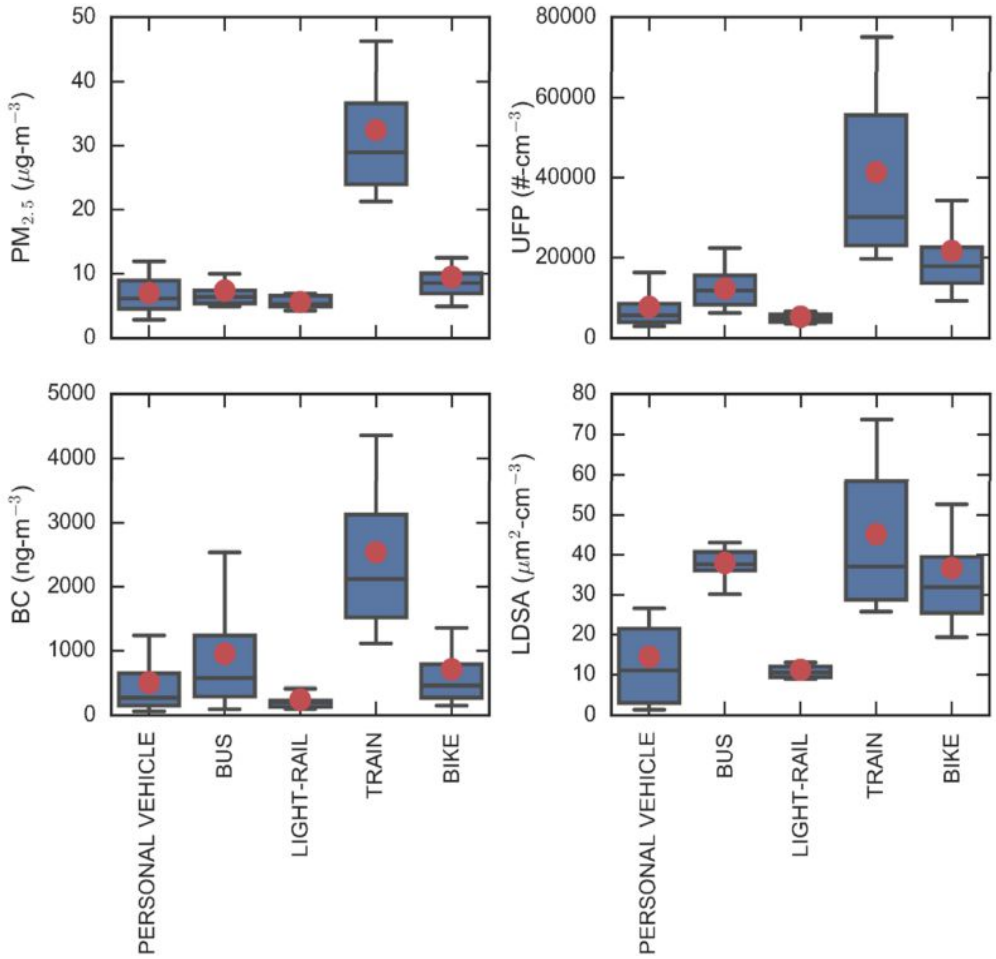

One important finding is the need for more light rail and dedicated bike paths, as well as cleaner locomotives," CARB Research Division Chief Bart Croes said.

"In addition, the portable technologies we employed to monitor air pollution levels in this project provide us with an important new tool for studying personal exposures and locating air pollution hotspots in disadvantaged communities and elsewhere.

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