Medical Xpress

Study sees little dust risk for subway workers

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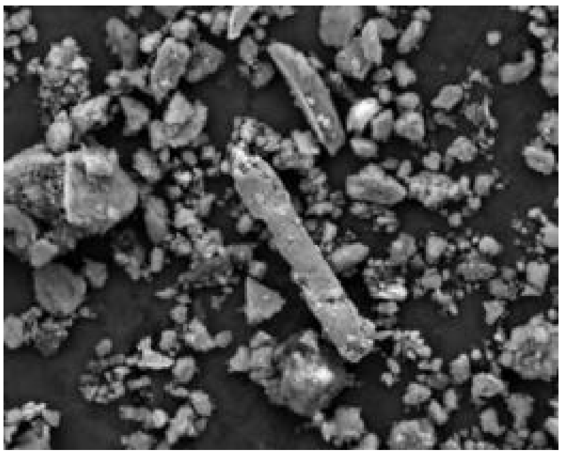

Thse are microscopic dust particles caught inside New York's Times Square subway station. Credit: Dee Breger

New York subway commuters may worry more about rats and rising fares than dust floating through the system, but for the workers who spend their whole shift below ground, air quality has long been a concern. Results from a new pilot study using miniaturized air samplers to look at steel dust exposure may help them breathe easier.

Steel dust, produced as thousands of train wheels roll through the tunnels each day, is a major source of pollution in one of the world's most extensive commuter rail systems. In the study, published this month in the journal *Environmental Research,* scientists tracked exposure in 39 subway workers and measured biological responses to three metals found in steel dust: iron, chromium and manganese. The study found no strong or consistent evidence of a biological response that might indicate elevated risk of dust-related disease. It also showed that workers were exposed to levels well below standards set by the U.S. Occupational Safety & Health Administration (OSHA).

"The results are good news, even though this was a small pilot study and not a comprehensive evaluation of potential subway-worker health risks from steel dust," said coauthor Steven Chillrud, a geochemist at Columbia University's Lamont-Doherty Earth Observatory.

Chillrud got interested in subway air when he coauthored a 2004 study aimed at understanding how and where teenagers were exposed to a variety of air pollutants. He and colleagues recruited high school students in Harlem to wear air-sampling backpacks to measure personal exposure. At the same time, fixed-site monitors ran inside and outside their homes and school. When the results came in, many students' backpacks showed much higher airborne levels of iron, manganese and chromium than the fixed-site samplers. These students shared one thing in common: they rode the subway.

To confirm that subways were the source of the metals, Chillrud had a Columbia student collect duplicate air samples while riding trains and sitting in stations. Signature ratios of metals were the same as those seen in the samples collected by the high-school students. Furthermore, the air-borne metal concentrations observed in stations and trains were more than a hundred times higher than above ground. It was lowest in cars, where dust gets trapped by air-conditioning filters, and highest in stations, where trains brake as they reach the platform.

This was not an immediate cause for alarm. Even in the stations, airborne levels of the three metals were 100 to 1,000 times lower than OSHA worker-safety limits. But, says Chillrud, the study showed that normal government air monitoring, usually done from rooftops, cannot predict human exposures to certain pollutants.

Lead researcher Steven Chillrud models a subway-friendly air sampler. Credit: Kim Martineau

Chillrud and Paul Brandt-Rauf, then a professor at Columbia's Mailman School of Public Health, designed the new study to look for evidence of oxidative stress, or DNA damage, at exposure levels lower than those set by OSHA. But backpack-size samplers seemed unsafe, because they would stick out and increase tunnel workers' chances of being hit by a passing train. So the researchers designed a lightweight device, conveniently tucked into a gun-holster shoulder harness. Under one arm, they inserted an air pump; under the other, a battery pack.

"Putting the sampler under the arms made sense," said David Grass, lead author of the study. But shrinking the air pump had one drawback: it now produced a high-pitched whine. The researchers partly dampened this with a tiny muffler. "Fortunately for the study, the subway is a noisy environment to begin with, so the sound didn't bother the subway workers," said Grass. "They could hardly hear it."

Each worker wore the sampler for up to three work shifts, and after the last shift, blood and urine samples were taken. The researchers also tracked where the workers had been; depending on job descriptions, whether cleaning stations or repairing tracks, they were exposed to widely different dust levels. The results were compared with two control groups: bus drivers and suburban office workers, none of whom rode the subway.

The scientists found no consistent link between steel dust exposure and markers of oxidative stress or DNA damage that might indicate a greater risk for disease. Specifically, they found no strong association between the amount of metal detected by the subway workers' air samplers and the levels of markers of DNA damage or oxidative stress in blood and urine samples. There was also no consistent pattern of the blood and urine markers being elevated for subway worker as compared to the office and bus drivers.

The researchers warn that the study has several limitations. A much larger study would have been better able to detect smaller effects. The study also did not include female subway workers, which may be important since men and women are known to regulate metal levels differently. There were no assessments of parameters like lung function, heart rate variations or direct metal uptake into the brain—measurements that could indicate other potential health impacts. Nor did the study consider the impact on the general public or susceptible subgroups such as children or the elderly.

The study also confirms earlier evidence that levels of particulate pollution in New York subways are far lower than in other city systems, including Toronto, London and Stockholm. A switch from friction to electrical braking in 1971 may have helped cut levels of steel dust in stations, and the relatively shallow depth of New York's subway lines appears to translate into higher ventilation rates.

Provided by The Earth Institute at Columbia University