

Made in China: Our Toxic, Imported Air Pollution

Mercury, sulfates, ozone, black carbon, flu-laced desert dust. Even as America □tightens emission standards, the □fast-growing economies of Asia □are filling the air with hazardous components that ▪ circumnavigate the globe.

by David Kirby

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Jaffe's monitors quickly captured evidence of carbon monoxide, nitrogen oxides, ozone, hydrocarbons, radon, and particulates. Since air from North America could not have contaminated Cheeka Peak with winds blowing from the west, the next step was identifying the true source of the pollutants. Jaffe found his answer in atmospheric circulation models, created with the help of data from Earth-imaging satellites, that allowed him to trace the pollutants' path backward in time. A paper he published two years later summarized his conclusions succinctly. The pollutants "were all statistically elevated . . . when the trajectory originated over Asia."

Officials at the U.S. Environmental Protection Agency took note, and by 1999 they were calling Jaffe to talk. They were not calling about aerosols or hydrocarbons, however, as concerning as those pollutants might be. Instead, they were interested in a pollutant that Jaffe had not looked for in his air samples: mercury.

Mercury is a common heavy metal, ubiquitous in solid material on the earth's surface. While it is trapped it is of little consequence to human health. But whenever metal is smelted or coal is burned, some mercury is released. It gets into the food chain and diffuses deep into the ocean. It eventually finds its way into fish, rice, vegetables, and fruit.

When inorganic mercury (whether from industry or nature) gets into wet soil or a waterway, sulfate-reducing bacteria begin incorporating it into an organic and far more absorbable compound called methylmercury. As microorganisms consume the methylmercury, the metal accumulates and migrates up the food chain; that is why the largest predator fish (sharks and swordfish, for example) typically have the highest concentrations. Nine-tenths of the mercury found in Americans' blood is the methyl form, and most comes from fish, especially Pacific fish. About 40 percent of all mercury exposure in the United States comes from Pacific tuna that has been touched by pollution.

In pregnant women, methylmercury can cross the placenta and negatively affect fetal brain development. Other pollutants that the fetus is exposed to can also cause toxic effects, "potentially leading to neurological, immunological, and other disorders," says Harvard epidemiologist Philippe Grandjean, a leading authority on the risks associated with chemical exposure during early development. Prenatal exposure to mercury and other pollutants can lead to lower iq in children—even at today's lower levels, achieved in the United States after lead paint and leaded gasoline were banned.

Among adults, University of California, Los Angeles, neuroscience researcher Dan Laks has identified an alarming rise in mercury exposure. He analyzed data on 6,000 American women collected by the Centers for Disease Control and Prevention and found that concentrations of mercury in the human population had increased over time. Especially notable, Laks detected inorganic mercury (the kind that doesn't come from seafood) in the blood of 30 percent of the women tested in 2005–2006, up from just 2 percent of women tested six years earlier. "Mercury's neurotoxicity is irrefutable, and there is strong evidence for an association with Alzheimer's and Parkinson's disease and amyotrophic lateral sclerosis," Laks adds.

He sent his spies into Chinese factories to □ determine how much mercury was entering the atmosphere. Usually they were turned away, but every so often a □ manager let them in with the promise of anonymity.

Circumstantial evidence strongly pointed to China as the primary origin of the mercury; the industrial processes that produce the kinds of pollutants Jaffe was seeing on Cheeka Peak should release mercury as well. Still, he could not prove it from his data. To confirm the China connection, and to understand the exact sources of the pollution, researchers had to get snapshots of what was happening inside that country.

One of the first scientists with feet on the ground in China was David Streets, a senior energy and environmental policy scientist at Argonne National Laboratory in Illinois. In the 1980s he was at the forefront of the study of acid rain, and in the 1990s he turned his attention to carbon dioxide and global warming as part of the Intergovernmental Panel on Climate Change. Streets began focusing on emissions from China about 15 years ago and has since become such a noted expert that he helped the Chinese government clean up the smoke-clogged skies over Beijing before the Olympics in 2008.

In 2004, spurred by increased attention to mercury in the atmosphere, Streets decided to create an inventory of China's mercury emissions. It was a formidable undertaking. Nobody had ever come up with a precise estimate, and the Chinese government was not □ exactly known for its transparency.

Nevertheless, Streets considered the endeavor important because China is full of the two biggest contributors to human-generated mercury, metal smelting and coal combustion. Smelting facilities heat metal ores to eliminate contaminants and extract the desired metal, such as zinc, lead, copper, or gold. Unfortunately, one of the consistent contaminants is mercury, and the heating process allows it to escape into the atmosphere in gaseous form. Similarly, coal contains trace amounts of mercury, which is set free during combustion at power plants.

Streets began by studying reports from China's National Bureau of Statistics. China's provinces provide the central government with detailed data on industrial production: how much coal they burn, how much zinc they produce, and so on. "China is very good at producing statistical data. It's not always 100 percent reliable, but at least it's a start,"

he says. Those statistics help the Chinese government monitor the economy, but for Streets they also quantified China's mercury-laden raw materials.

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