Factory Study Shows Low Levels of Benzene Reduce Blood Cell Counts

There's no doubt that benzene, a widely used industrial chemical, can be harmful. Workers highly exposed to benzene fumes, for example, run an increased risk of leukemia and bone-marrow toxicity. But the risk from smaller exposures is unclear. Now a tightly controlled study in Chinese factories, reported on page 1774, provides reason for concern: Workers who inhaled less than 1 part per million (ppm) of benzene—an exposure considered safe under U.S. occupational guidelines—had fewer white blood cells than did unexposed workers.

Although the workers weren't sick, the results hint that low doses of benzene may alter the bone marrow and could lead to health problems, some experts say. The study also provides the first direct evidence in humans that benzene harms the progenitor cells that give rise to blood cells. “It really breaks new ground on the potential effects of low levels,” says toxicologist Bernard Goldstein of the University of Pittsburgh's School of Public Health.

Benzene is ubiquitous. People are commonly exposed to it from secondhand cigarette smoke, gasoline vapors, and air pollution, although typically only on the order of parts per billion. Studies of the chemical's health effects in industrial settings, where benzene is used as a solvent and in chemical manufacturing, led the United States in 1987 to regulate the maximum allowable workplace exposure at 1 ppm of benzene averaged over 8 hours.

To determine whether blood cells are affected at even smaller exposures, a group of researchers from the U.S. National Cancer Institute (NCI) in Bethesda, Maryland, the Chinese Center for Disease Control and Prevention in Beijing, the University of California, Berkeley, and others in the research team also studied the effect of benzene on the progenitor cells that give rise to blood cells. They found that the ability of progenitor cells to grow and multiply declined with higher exposures. “The key point is that high levels of benzene had a more toxic effect on the progenitor cells than on mature cells,” says study co-author Nathaniel Rothman of NCI. “That may suggest we’re underestimating the effects of benzene by just studying mature cells.”

But Richard Irons of the University of Colorado Health Sciences Center in Denver and Fudan University in Shanghai suggests that counting progenitor cells from blood samples probably does not accurately reflect what's happening to such cells in bone marrow. Irons, who leads a $20 million industry-funded study of benzene effects in Shanghai, also says it's possible that the low-dose changes seen in the Science paper stem from exposure to other chemicals or factors such as nutrition. “Because the magnitude of the changes are so small, it becomes difficult to discriminate between transient effects and benzene toxicity,” he says.

Still, the findings may lead to demands for lowering the benzene exposure standard, says geneticist Gilbert Omenn of the University of Michigan Medical School in Ann Arbor: “This paper should cause a stir in occupational and environmental health circles.”

---ERIK STOKSTAD

Hazard? A study of shoe workers in China suggests that even low doses of benzene affect blood cells.