

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 other institutions compared 250 workers exposed to benzene-laden glues in two shoe factories in China to 140 unexposed workers who sew clothes in other Chinese factories. The researchers carefully gauged benzene exposure by taking urine samples and testing air in the factories, as well as at each worker's home. After 16 months, they took blood samples from the workers.

As expected, workers exposed to benzene at levels of 1 ppm and higher had fewer white blood cells, such as granulocytes and B cells,

than did unexposed workers. But this also held true for the 109 workers exposed to less than 1 ppm benzene, even after controlling for smoking and other potential confounding factors. These workers had on average 15% to 18% fewer granulocytes and B cells than did unexposed workers—raising concerns about bone-marrow health, says Qing Lan of NCI.

Luoping Zhang of the University of California, Berkeley, and others in the research team also studied the effect of benzene on the



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

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

ScienceScope

No Meeting of Minds on NIH Honoraria Ban

Intramural scientists at the National Institutes of Health (NIH) remain upset about a proposed ban on university honoraria after meeting this week with NIH Director Elias Zerhouni. "This meeting did not really explain what the rules are," says Alexander Wlodawer, a cancer institute lab chief.

Zerhouni and his deputy Raynard King-ton held a closed-door meeting with lab chiefs and many institute directors after more than 170 senior scientists endorsed a letter protesting a proposed ban on honoraria from institutions receiving NIH grants (*Science*, 19 November, p. 1276). Participants said that NIH has yet to clarify its policies on matters such as teaching and whether speaking, even on official duty, could pose a conflict. But some were encouraged by Zerhouni's promise to carve out "exceptions" for some activities, such as bona fide awards, and to set up a "mechanism" for collecting staff input.

—JOCELYN KAISER

Salmon Plan Raises Hackles

PORTLAND, OREGON—The Bush Administration's plan to protect salmon on the Columbia and Snake rivers is a "step backwards," according to 250 fisheries scientists who have signed a last-ditch petition seeking changes in the court-ordered plan. A draft of that document became final on 30 November.

An earlier plan was dismissed by Federal District Judge James Redden, who will also review the new plan, for relying on questionable recovery actions. Critics say the current version sidesteps the problem by reinterpreting provisions of the Endangered Species Act, arguing that fisheries managers need only ensure the survival of species rather than their recovery. "The new analysis is an alarming sea change in approach with no supporting scientific justification," the petition concludes.

—ROBERT SERVICE

Swiss Endorse Stem Cell Law

BASEL—In the first-ever national referendum on the issue, Swiss voters have overwhelmingly approved the use of human stem cells for research. On 28 November, two out of three voters endorsed a law passed last December that allows scientists to use stem cells harvested from embryos no older than 7 days. The law bans therapeutic cloning and research on the embryos themselves and requires several layers of approval, including the consent of the donors. "This is incredibly encouraging for us," says Patrick Aebischer, president of the Swiss Federal Institute of Technology in Lausanne.

—GISELLE WEISS