



### METAL TOXICITY

## New Grounds for Drinking Coffee

New information suggests that your morning cup of coffee may be a healthy part of a nutritious breakfast. Research by an international team of scientists published in the April 2000 issue of *Human and Ecological Risk Assessment* has shown that automatic drip coffee makers can remove up to 85% of both copper and lead in tap water. Team leader Herbert E. Allen, a professor of civil and environmental engineering at the University of Delaware in Newark, speculates that coffee grounds retain heavy metals through surface chelation, a chemical reaction in which metals form complexes with organic matter. After looking at ion exchange or adsorption as possible filtering mechanisms, Allen says that due to coffee's nature—coffee grounds having uncharged or negatively charged molecules—surface chelation most likely explains the large percentage of metals removed. Because dissolved heavy metals are positively charged,

the metal ions bind strongly to the coffee, he says.

The study was conducted by Allen, graduate student Christopher Impellitteri, Michael McLaughlin of the division of soils at the Commonwealth Scientific and Industrial Research Organisation in Adelaide, Australia, and Gustavo Lagos, a scientist at the Pontificia Universidad Católica de

Chile in Santiago. After attending a seminar about copper in the human diet presented by Lagos, the group speculated that the amount of copper in prepared coffee would be less than the amount present in the water used to make the coffee, and they decided to conduct a study to test their idea.

In order to simulate home coffee brewing as closely as possible, the team studied three commercial coffee brands using a coffee maker with a basket-type paper-lined filter and a 12-cup-capacity glass carafe. For the first batch of each brand, the team began with the standard amount of coffee recommended by the manufacturer (one teaspoon per cup) and then adjusted that amount to 30 grams of coffee per liter of water, a strength they agreed was satisfactory. From each first batch, four samples were taken for both metal and pH analysis to establish a

baseline value for the amount of copper and lead in an average pot of each brand of brewed coffee. The team prepared additional batches at different volumes (but maintaining the coffee-to-water ratio) and using different concentrations of coffee to produce stronger brews. They also ran normal and metal-spiked solutions through the coffee maker both with and without a paper filter to assess sorption by the coffee maker and the filter.

The results of the team's research suggest several reasons for the lead and copper removal. When increasingly stronger

batches of coffee were brewed, an increase in metal removal was observed, probably because of the increased contact time between the coffee and the water as it seeped through a thicker bed of grounds. People who prefer stronger coffee may be enjoying a greater decrease of the metals, the team says, since the stronger the coffee is brewed, the more metals may be removed. But after comparing the strongest batches and noting no additional removal of metals, they decided to continue the search for additional factors.

The team then varied the coffee grounds' consistency. They found that coarse coffee grounds removed 73% of the copper and 79% of the lead. In comparison, finely ground coffee powder removed 90% of copper and 91% of lead, suggesting that the increased surface area of the

smaller grounds enhances removal of the metals.

A moister bed of coffee also increased how much metal was adsorbed, as demonstrated by collecting samples of the coffee as it passed through the coffee bed and comparing their metal concentrations to those of the finished pot. Allen says that sorption of the metals may

also occur on interior surfaces of the coffee maker, paper filter, or glass carafe.

Although Allen says that the metal removal could actually be much higher worldwide for those who drink coffee, depending on cultural and personal tastes in coffee preparation, he says that the team's findings are important to current human exposure assessment estimates of copper and lead in tap water. Current estimates for metal exposure could be much higher than actual levels for people whose main tap water intake is through coffee.

—Lindsey A. Greene



## LEAD

## Studying Lead in Tijuana Tots

Researchers at the University of California at Irvine have recently completed a three-year project to assess lead exposure in more than 1,719 children in Tijuana, Mexico, and launch a lead prevention public health program there. Besides already producing positive effects in Tijuana, researchers say, the program could eventually lower the risk of lead poisoning among migrant children in the United States, since many of those children come from Tijuana.

During the project, led by Jon Ericson, a professor and interim chair of the Department of Environmental Analysis, and Dean Baker, director of the College of Medicine's Center for Occupational and Environmental Health, nearly 11% of the children were found to have unhealthily high concentrations of blood lead. Their exposure was traced primarily to lead-glazed pots fired at low temperatures, the cookware of choice throughout much of Mexico. Researchers identified other sources of exposure as well, including dust found inside homes, soil outside homes, and lead-based house paint. The mean blood lead concentration measured was 5.5 micrograms per deciliter. This concentration is not considered life-threatening, but it can affect IQ, attention span, and ability to learn, says Baker. "The children also may have more illnesses and become more belligerent and violent," he says.

The Tijuana children's blood lead concentrations were more than double those found in U.S. children in studies conducted in the past 5–10 years. Researchers found another cause for concern: In U.S. studies, blood lead concentrations decreased with age, while in Tijuana, they stayed the same or increased with the child's age, perhaps because of the continued use of lead-glazed pottery and the fact that Mexico only began phasing out leaded gasoline in 1992. Researchers also found that children whose families had little or no access to health care and whose mothers had less than a sixth-grade education and cooked with ceramic cooking pots were six times more likely to

have lead poisoning. After working with parents to identify sources of lead exposure and educate them about how to minimize those risks, however, the researchers saw blood lead concentrations fall in nearly all of the children who were part of the study's case management program.

Even though cooking pots are the primary culprit, Ericson cautions that lead in soil contributes to the problem in Tijuana as it does in the United States, although children in the Tijuana study typically were exposed to lower soil lead concentrations than U.S. children in some urban areas. But even in small amounts, lead from the soil can elevate blood lead concentrations in children.



**Lead in Mexico.** A new study of Tijuana children shows that nearly 11% have dangerously high blood lead concentrations due to exposure to lead-glazed cookware.

The research team worked with health care professionals in Tijuana to implement a sustainable system under which the city could continue to monitor lead levels, diagnose and treat lead poisoning, and educate citizens about prevention. "More than 1,000 public health professionals in Tijuana, including 205 physicians, nurses, and epidemiologists, have been trained in lead poisoning prevention," Ericson says. In addition, an analytical laboratory in Tijuana's General Hospital has been certified by the Centers for Disease Control and Prevention to perform blood lead screenings for anyone living in Tijuana.

Martha Vazquez, the binational coordinator with the Irvine team, believes that the percentage of children found to be exposed to lead is cause for real concern. "This means that the health sector in Tijuana needs to start working at the primary [care] level," she says.

She admits that it won't be an easy task. "We don't have a lot of money to promote health education," she explains. "During the study I was perfectly sure that 2,000 families and 500 doctors were educated [about lead]. But the population of Tijuana is over a million."

Vazquez believes that, once all the final data from the study are analyzed, the Mexican government will make the lead program a higher priority. "In Mexico," she says, "there are not enough human or economic resources for preventive medicine and educational programs, but at the primary level they can do a lot." —Jennifer Medlin

## Asbestos at Home

In February 2000, the U.S. EPA issued a warning for people to avoid disturbing any household insulation that may contain tremolite, a rare form of asbestos that easily penetrates lung tissue, where it can lead to severe dysfunction and cancer. Preliminary EPA testing found tremolite fibers in Zonolite brand household insulation, made from vermiculite ore—a volcanic mineral compound—as well as in other household and garden products. The EPA estimated in 1985 that the loose-fill insulation had been installed in 940,000 U.S. homes.

The EPA is concerned that consumers could be exposed to the dangerous mineral fibers when doing renovations, and is working to determine the extent of the threat to the public. A facility has been installed at the agency's Manchester, Washington, laboratory especially for testing vermiculite products. The EPA also advises that if insulation must be removed, those doing the removal should wear high-efficiency particle-arresting respirators, which prevent tremolite fibers from reaching the lungs.

## Leashing Leishmaniasis

German scientists have found a cure for the often fatal disease leishmaniasis. The disease, which is transmitted by blood-sucking sandflies, affects more than 12 million people worldwide, mainly in tropical and subtropical areas, with a growing number of cases in southern Europe. The new treatment—an oral form of a drug called miltefosine—has an efficacy rate of 98% for disease sufferers who take the medicine daily for four weeks. The treatment was reported in the 9 December 1999 issue of the *New England Journal of Medicine*.

Although the search for a vaccine was begun 30 years ago, until now treatment was limited to intravenous therapy with dangerously toxic compounds to which the disease was becoming increasingly resistant. Scientists are concerned that the spread of AIDS is influencing the spread of leishmaniasis, as some forms of the disease result in symptoms only in people with weakened immune systems. In Spain, 50% of leishmaniasis patients were also diagnosed with AIDS.

## Prawns and Ponds

The possible damaging effects of untreated prawn farm effluent are a growing environmental concern as large-scale prawn-growing operations are being built in a number of countries. However, marine scientists at Australia's Commonwealth Scientific and Industrial Research Organisation have developed an integrated nutrient removal process that, if implemented by prawn farmers, may eliminate most waste nutrients from the effluent.

The scientists discovered that using a combination of sedimentation ponds, treatment ponds containing beds of oysters and marine plants, and partial recirculation reduced the nutrient load in the discharge water by 75%. Increasing the size of the ponds would decrease the nutrient load even further.





## INNOVATIVE TECHNOLOGIES

## Global Language for Global Problems

Although—or perhaps because—environmental health concerns affect every person on the planet, scientists often suffer a modern-day Tower of Babel syndrome, using a diversity of terms in all different languages to describe the same ideas. So European, American, and international agencies have decided to collaborate on the development of a global multilingual environmental thesaurus to eliminate translation time and create easier communication between international parties. Representatives from the Consiglio Nazionale delle Ricerche (Italy's national research council), the European Environment Agency (EEA), the U.S. Environmental Protection Agency (EPA), and the United Nations Environment Programme (UNEP) met in January 2000

in an effort to begin breaking down linguistic barriers hampering environmental information exchange between nations. These agencies expect other partners to join in the creation of the global environmental language thesaurus.

The focus of this international initiative is to agree on a common vocabulary for indexing data contained in environmental information systems, Internet sites, databases, and other electronic resources according to a mutually agreed upon set of key words. A common vocabulary, according to the team, will assist in the development of environmental information systems and expedite the retrieval of such information from electronic resources through information searches and content cataloging by librarians, researchers, database developers, translators, policy developers, and the public. A common vocabulary may also help to expand international research partnerships in environmental health by facilitating communication. Domingo Jimenez-Beltran, executive director of the

EEA, said in a 7 February 2000 press release that this initiative “will increase access to timely, relevant, and reliable information on the environment by a wide range of language groups that are currently impeded by linguistic barriers.”

The consortium will begin the process by looking at *EnVoc: Multilingual Thesaurus of Environmental Terms*, which was published in 1997 by the EEA and UNEP. The group plans to combine this tool with the EEA's *Generalized Multilingual Environmental Thesaurus* and supplement the resulting document with terms from other sources such as the EPA's Terminology Reference System and the Asia-Pacific Economic Cooperation's thesaurus. Currently, the *Envoc* thesaurus uses 12 languages, and the new thesaurus is expected to incorporate even more. A plan for the global thesaurus, anticipated to be accessible on the Internet, on CD-ROM, and in print, is expected by September 2000. —**Lindsey A. Greene**

## NATURAL DISASTERS

## An Eruption of Silicosis

Volcanoes may pose long-term health hazards, according to an article in the 19 February 1999 issue of *Science* by researchers studying the aftermath of the 1997 eruption of the Soufriere Hills volcano in Montserrat. “Ash is an often neglected hazard, particularly the longer-term effects,” says coauthor Ray Dupree, a physicist at the University of Warwick in Coventry, United Kingdom. According to the researchers, certain types of eruptions—like that of Soufriere Hills—may be potentially more hazardous than others in terms of the ash produced.

Scientists have long known that volcanic ash creates minor health problems such as eye irritation and exacerbates existing problems such as asthma. But the study, led by community medicine specialist Peter Baxter of the University of Cambridge, reveals that certain types of volcanic ash may create long-term problems such as silicosis, an irreversible scarring disease of the lungs that occurs over long periods of exposure. The study is the first to link a technical mechanism of eruption to a specific health hazard, and is also one of the most detailed studies to date to quantify and define the ratio of silica minerals in volcanic ash versus glass and other particles.

In the ash generated at Soufriere Hills by pyroclastic flows—mixtures of volcanic ash and gases that hug the ground and flow down valleys—the team found high levels of a form of crystalline silica called cristobalite, which is known to cause silicosis. After assaying the ash around the island, the team found that the majority of particles under 10 micrometers in diameter contained 10–24% crystalline silica, mainly cristobalite, by weight. Moreover, large amounts of the particles were less than 3 micrometers in diameter—small enough to penetrate deep into the lungs.

The team also found that the hazard is increased during long-lived eruptions, which spew ash over years or decades. Dome eruptions, in which a mass of magma builds up over the volcano's vent,

generating myriad pyroclastic flows and ash plumes, also increase the hazard because they produce more fine ash and more fine crystalline silica. “The amount of fine respirable ash generated in such eruptions and the content of crystalline silica in the ash are significantly increased by crushing processes and transport processes in the pyroclastic flows formed by dome [eruptions],” explains Bristol University geologist and volcanologist Steve Sparks, a study coauthor. In contrast, the 1980 eruption of Mount St. Helens in Washington State produced short-lived ashfalls with vastly fewer fine particles containing only 4% cristobalite by weight.



**Hazardous ash.** A less immediate but still hazardous effect of exposure to volcanic ash is the lung-scarring disease silicosis.

The team measured suspended particle concentrations in areas where there was human activity and found that such activity is an important factor in resuspending ash and increasing exposure of populations, Sparks says. Re-occupation of some of the devastated and evacuated areas was delayed because of the poor air quality conditions caused by the ash, which had to be removed before people were allowed back.

Laboratory experiments indicate that cristobalite can be more toxic than quartz, a known cause of silicosis in workers with long-term exposure to silica dusts, but the reason for cristobalite's

increased toxicity is not known, says Sparks. Cristobalite toxicity varies greatly according to the age of the stone, heating, and other treatments, he adds.

Although dome eruptions are fairly common worldwide, the study findings may not apply to domes of other volcanoes, especially those of different chemical compositions, which may produce different minerals in varying percentages. Plus, other hazards associated with the creation of volcanic clouds, including hydrochloric and hydrofluoric acid gases and sulfuric acid particles, are largely unstudied.

Indeed, much work remains to determine the specific long-term health risks volcanoes pose to humans. Even though follow-up studies such as a chest X ray survey of islanders most exposed to ash are being undertaken, getting hard data on human exposure and health effects may take years. “Conditions like silicosis take very long times to develop,” Sparks says. —**Julie Wakefield**



## Udall Center for Studies in Public Policy

Established in 1987, the Udall Center for Studies in Public Policy at the University of Arizona in Tucson specializes in several important program areas relating to the environment and public health, including environmental conflict resolution, environmental policy in the Southwest, the U.S.–Mexican border environment, and American Indian policy. To promote its mission in these areas, the Udall Center maintains a Web site at <http://udallcenter.arizona.edu/> that informs the public about its policy-related research and outreach activities.

The Publications link on each program area page leads the visitor to numerous citations for Udall Center working papers, scholarly articles (including some that have appeared in *EHP*), reports, issue papers, and other publications. A click on Related Links gives access to more than 300 environmental organizations in the Southwest. The Udall Center Library Online link allows the visitor to search the center's library collection, which houses more than 4,000 books, reports, and periodicals related to its mission.

Since the spring of 1996, the Udall Center has undertaken several activities that have furthered its objective of establishing a national program in environmental conflict resolution. These activities, described on the Environmental Conflict Resolution page, include the funding of interdisciplinary research projects at the University of Arizona, designing and implementing two simulated conflict exercises, and the development of a database of graduate programs in environmental conflict resolution. Projects include the Upper San Pedro River Initiative, which focuses on water resource management in the river basin, and the Arizona Common Ground Roundtable, a statewide policy dialogue among ranchers, environmentalists, government officials, and others.

The Environmental Policy in the Southwest page includes information about projects and events pertaining to climate change, environmental health, and water policy.

According to the U.S.–Mexico Border Environment page, the center has, during the past decade, "established a presence as a neutral, respected observer and commentator on border environmental policy." As the page shows, the center's research agenda in this area has been full and has included studies of transboundary urban water management and the evolution and functioning of environmental institutions such as the Border Environment Cooperation Commission and the North American Commission for Environmental Cooperation, created to address issues related to trade and the environment.

The American Indian Policy page reveals that the center spends much time analyzing and researching Indian health and environmental and natural resource issues. The program emphasizes providing tribal, state, and federal policy makers with education and policy analysis in areas including the tribal management of natural resources and environmental issues.

Environmental health specialists can keep up with the work of the Udall Center by periodically checking out the Newsletter: *Update* link. Although irregularly published, the Udall Center *Update* contains a wealth of information about events and activities at the center and the acquisitions by the center library. —Ron Chepesiuk

## Baking the Bugs Out

University of South Florida scientists sampled 19 store-purchased wheat flours, processed wheat mixes, and corn meals, and found that the cockroach allergen Bla g2 is prevalent in these products and could cause episodes of baker's asthma. The scientists say exposure to the allergen could also possibly result in sensitization to it. Baker's asthma, a common occupational disease that is also one of the oldest, is also known to be brought on by exposure to flour beetle allergens.

The study, presented last March at the annual meeting of the American Academy of Allergy, Asthma, and Immunology, determined that heating the baking products for 30 minutes at 350°F (standard baking temperature and time) greatly reduces the allergen levels. They also stated that the products are most likely not contaminated at the grocery store, as allergen levels in all of the samples, which were purchased from four different retailers, were comparable.

## Tobacco Dangers Start on the Farm

A study in the March 2000 issue of the *American Journal of Industrial Medicine* finds that commercialization and consolidation of tobacco farms may be causing a rise in green tobacco sickness, a form of acute nicotine poisoning that occurs after brushing against wet tobacco leaves. Wake Forest University School of Medicine epidemiologist Sara A. Quandt and colleagues found that 41% of the tobacco workers in the study—mostly Hispanic seasonal and migrant workers—reported symptoms of the illness at least once during the summer.

According to Quandt, Hispanic migrant workers are much shorter than the white and African-American workers who formerly worked family farms. This brings them in closer physical contact with tobacco plants, as does the closer planting of tobacco rows to increase output. "These workers are exposed to the risks of tobacco work for longer, more intensive periods of time than was ever the case for farming families," says Quandt.

The researchers state that green tobacco sickness is an environmental justice issue and call for studies of the economic impact of the disease and of the long-term effects of prolonged dermal exposure to tobacco plants, as well as for development of interventions to prevent or treat the illness.

## The Color of Cancer

A genetic test has been developed that helps detect the skin cancer malignant melanoma before the cancer can spread to other areas of the body. The test, presented at the March 2000 meeting of the International Society of Dermatopathology, was developed by staining normal and cancerous skin cells with fluorescent dye to identify a common set of chromosomal abnormalities to which pathologists can refer.

The test allows dermatologists to make more certain diagnoses and, by showing where cancer cells stop and healthy cell growth begins, will help them remove only the cells that are cancerous. A simplified version of the test is expected to be available to pathology laboratories within a year.

