Name Your Poison: Toxicologists Meet

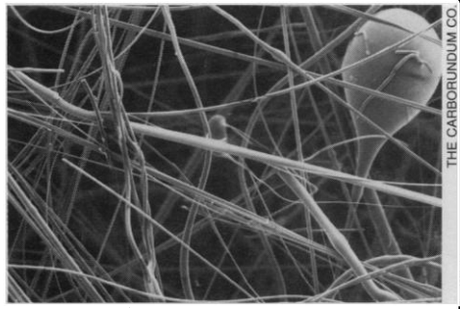
At the annual meeting of the Society of Toxicology in Seattle last month, a record-breaking 4000 toxicologists had their pick of sessions ranging from "free radicals in toxicology" to a debate between Bruce Ames and I. Bernard Weinstein over mechanisms of cancer causation. Some of the sessions that provoked the hottest debate were a pair on mercury and human health and on some manmade fibers that could be as dangerous as asbestos. And of topical interest were another pair—on toxic waste in eastern Europe and the aftereffects of the war in Kuwait.

Fiber Flap

Seattle—More risky than asbestos? Even as the debate continues to rage over just how dangerous asbestos is and what to do with the asbestos in the walls of our schools and other public buildings, officials at the Environmental Protection Agency (EPA) have identified something they think might be worse: refractory ceramic fibers (RCFs). These manmade fibers are used for insulation much as the now-forbidden asbestos was, and, according to the results of animal studies presented at last month's toxicology meeting here, RCFs could pose a higher risk of a specific type of asbestos-induced cancer than asbestos does. EPA officials, who launched a priority review of RCFs last November (see *Science*, 13 December 1991, p. 1575), are so concerned, they're dropping hints that the industry that makes insulation might need further regulation. Industry insiders, naturally, disagree.

The results that concern EPA arise from a series of studies begun in the 1980s by industry itself. Since 1953, RCFs have been used to insulate coke ovens, industrial furnaces, and the like (this stuff is *not* used in your average home). In the mid-1980s, researchers found that rats injected with RCFs developed lung fibrosis, lung cancer, and a rare cancer of the chest lining called mesothelioma, all hallmarks of asbestos exposure. Then in 1988, a team of industry toxicologists, headed by Richard Mast, chief toxicologist at the Carborundum Co. in Niagara Falls, New York, which has a large share of the $125 million-a-year domestic RCF industry, began a study in which rats and hamsters inhale aerosolized RCF fibers. Preliminary results from the inhalation study were disturbing enough to catch the eye of EPA scientists, says Jim Willis, deputy director of existing chemical assessment at EPA.

Mast and his team found that the rats that inhaled RCFs developed far more lung tumors than control animals did. Even more upsetting were the hamster results. While no animals developed lung cancer, 42% of hamsters exposed to RCFs developed mesothelioma, a rate that puts RCFs in a class with the most potent types of asbestos. Vanessa Vu, who heads the oncology branch of EPA's division of health and environment review, says: "Because of the greater risk of mesothelioma, RCFs may be more hazardous than chrysotile asbestos."



Hairy stuff. *Refractory ceramic fibers may pose cancer risks.*

Industry spokesmen don't buy that. In the same experiment, they note, hamsters in a control group were exposed to chrysotile asbestos, a proven human carcinogen—and none of them got cancer. Hence, they say, it could be misleading to base RCF risk assessment on the hamster study. Besides, they argue that the overall risk to the population is low, because RCF's are used in industrial equipment rather than in public buildings or homes, and therefore few people outside the industry are exposed to them.

On this point, the EPA concurs. According to agency figures, the total occupational exposure amounts to 800 people who manufacture and process RCFs and 31,500 who install RCF-containing products. In addition, Mast says, an industry study that's finishing up now will likely show that a threshold must be surpassed before RCF exposure causes tumors in rats. The predicted threshold, Mast says, far exceeds the levels of airborne RCF that workers in the industry inhale. So why are EPA officials so concerned that they're considering regulating the industry? "We have an obligation to the American public," says Willis. "There are a fair number of workers who manufacture and use RCFs. We've determined...that RCFs present or will present a significant [cancer] risk." A decision from EPA on how it plans to proceed is expected within several months. For now, the RCF industry will just have to hold its breath.

Mercurial Debate

If you thought the mercury worry had been eclipsed by greater public health issues, you were misled by the press: The field of toxicology remains sharply polarized over whether the mercury in dental fillings poses a hazard to health.

A growing body of data indicates that mercury, to which human beings are exposed by eating seafood and by the gases released from "silver" amalgam fillings—can have subtle, damaging effects on the body, from kidney to brain. But the amount of mercury vapor that escapes from a typical filling is very small, and the toxicology community is at loggerheads over whether the fillings pose a health threat. Last year, expert panels at the Food and Drug Administration and the National Institutes of Health concluded amalgams are at least as safe as the available alternative materials, but at the Seattle meeting, two controversial studies showing effects of mercury on reproductive health provided, if not a smoking gun, at least some additional ammunition for those who believe amalgams may be harmful.

One presentation that had amalgam advocates grinding their teeth was made by epidemiologist Andrew Rowland of the National Institute of Environmental Health Sciences (NIEHS). Rowland's team sent questionnaires to 7000 registered dental assistants in California and culled from the responses a study group composed of married woman who had intentionally become pregnant within the past 4 years and who had worked full time in the 6 months prior to conception. After taking into account a woman's age, her race, the frequency of intercourse, exposure to nitrous oxide, and incidence of pelvic inflammatory disease, Rowland found that women who prepared more than 30 amalgams per week and practiced varying degrees of "poor mercury hygiene" took longer to get pregnant. Indeed, those women's likelihood of conceiving during a particular menstrual cycle was only about half that of dental assistants who didn't prepare amalgams.

Rowland draws a cautious conclusion: "Even though there are some inconsistencies in our data, we consider the suggestion of reduced fertility in our highest exposed

women worth further investigation and concern." Medical physiologist Fritz Lorscheider of the University of Calgary, a critic of the use of amalgams whose work was featured in a 1990 "60 Minutes" report on amalgam safety, was more forceful. Rowland's study, Lorscheider says, "shows very clearly a trend toward impairment of fertility."

But while some toxicologists and physiologists are voicing doubts about mercury, many dentists remain skeptical. The American Dental Association (ADA) contends that amalgams are safe, and a dental researcher to whom ADA officials referred *Science* agrees: "I don't think [Rowland's findings have] any relevance to amalgam fillings," says Terence Donovan, director of restorative dental research at the University of Southern California.

Donovan homes in on Rowland's "inconsistencies"—to wit, the other women in the study (who prepared less than 30 amalgams per week and handled mercury safely) were actually more fertile than the controls. "It's absurd," Donovan says, "but you could just as easily make the case for small amounts of mercury vapor enhancing fertility."

Rowland's study wasn't the only one on mercury that raised hackles in Seattle. Only slightly less contentious were results presented by Mats Berlin, director of the Institute of Environmental Medicine at the University of Lund in Sweden. Collaborating with researchers at Sweden's University of Uppsala, Berlin's team exposed pregnant squirrel monkeys in a sealed chamber for several hours a day to amounts of mercury vapor ranging from 50 to 200 micrograms per cubic meter of space in the chamber. Berlin says his group observed early abortions, premature births, low birth weights, and perinatal deaths in a number of the monkeys. The Uppsala group exposed pregnant rats to similar amounts of vapor and noted learning problems in the offspring. Berlin's group currently is conducting behavioral studies on the monkey offspring.

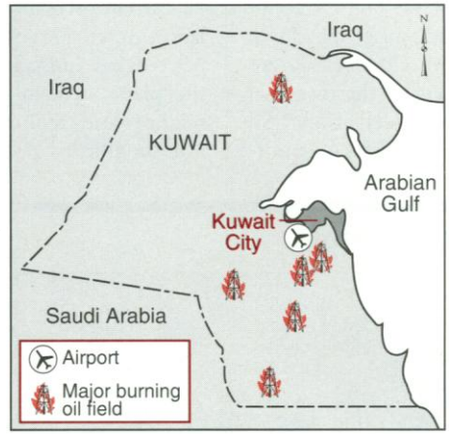
Not surprisingly, those results also don't pass muster with Donovan. The amount of mercury vapor released by fillings isn't easy to measure, of course, and Donovan contends that the levels of mercury vapor the monkeys and rats had been exposed to "were way above the worst-case scenario for mercury fillings." Lorscheider, on the other hand, argues that the vapor level in the experiment is comparable to that released by dental amalgams.

Critics and defenders of amalgam do agree on one point, though: More research will be needed to settle the question of how damaging silver fillings really are. Says mercury expert Thomas W. Clarkson of the University of Rochester School of Medicine, "There's really been very little research done on mercury amalgams. We've been groping around in the dark." But dawn may be slow in breaking. At the moment, NIH's National Institute of Dental Research is funding only two extramural studies on the health effects of mercury amalgams, for a total of $287,000, just 0.3% of their annual budget.

SOURCE: TRC ENVIRONMENTAL CONSULTANTS INC. ILLUSTRATION: J. CHERRY

Kuwait Quits Smoking

The plume of smoke in Kuwait, left behind by Saddam Hussein's troops, may not have been the environmental disaster some predicted—partly because the fires were put out ahead of schedule. But that doesn't mean the burning oil wells had no effect. A study by a consulting firm for a confidential U.S. client shows that if you are young and healthy and living in Kuwait City, your risks are an elevated chance of getting cancer and perhaps "mild, reversible" lung problems. For those with existing lung problems, however, the health damage could be worse, as it could for those living outside the capital.



Smoke gets in your eyes. *Winds largely spared Kuwait City from oily smoke.*

Although prevailing winds usually spared Kuwait City, at times the capital's air contained carcinogens such as benzene in quantities two to four times higher than prewar levels. Toxicologists from TRC Environmental Consultants Inc. analyzed data on air quality and found that residents of Kuwait City had between a 1 in 100,000 and 1 in 1,000,000 chance of developing cancer after breathing Kuwait City's air several hours a day. This translates into a 50% increase in cancer risk, says TRC toxicologist Gary Ginsberg, who headed the study.

There was also a transient five-fold increase in smoke particles, which can induce coughs and colds in healthy children. People with prior lung problems and those living in the sparsely peopled regions south of the capital might fare worse, says Ginsberg. But their fate is unknown, since the study focused on the capital—at the request of the firm's client, which TRC toxicologist Wendy Koch would describe only as a U.S. organization that "employs a lot of people in Kuwait City."

Czech-ing out Toxic Wastes

Envision the already bleak eastern European landscape littered with a thousand Pandora's boxes, buried during the last decades by communist regimes. Last year, Czech and U.S. environmental engineers began opening one of those boxes: the Chabarovice waste site in northwestern Czechoslovakia. Out came a fearsome witches' brew of toxic chemicals. At the toxicology meeting, researchers from the two countries described the health risks posed by those post-Communist chemical demons. The depictions could make your eyes burn—and they don't apply just to Chabarovice: They preview the massive cleanup all of eastern Europe faces.

Last year Aquatest, a Prague-based hydrogeological engineering firm, and CH2M Hill International, a Denver-based environmental engineering company, teamed up and waded into the Chabarovice waste pits, located 20 kilometers from the German border. Their job was to make a rough assessment of health risks for the Czech government, and at the Seattle meeting, toxicologist Robin D. Smith, now of Denver-based Woodward-Clyde Consultants but formerly of CH2M Hill, presented preliminary results.

For decades, industrial firms dumped relatively benign glass and textile ash at Chabarovice. But in the 1970s, Spolchemie, a Czech chemical company, began dumping something worse—and they haven't stopped to this day. Among dozens of chemical contaminants analyzed at the site were high levels of carcinogens such as arsenic and benzene and lower but still "troubling" amounts of mercury, toluene, and derivatives of phenol.

The dump threatens not merely landfill workers but, says Smith, possibly also nearby residents. Smith calculated that the dump's workers face roughly a 1 in 100 chance of developing cancer due to vapors they inhale at Chabarovice. That's about 10,000 times greater than the excess cancer risk that the Environmental Protection Agency (EPA) allows for newly licensed chemicals, and at least a thousand-fold greater than the level of risk at which EPA mandates the cleanup of Superfund sites, Smith says. And now that the hazards have been documented, the Czech government has asked the World Bank for funds to clean up the site. As for CH2M Hill, the next stop on its itinerary is a group of abandoned Soviet military sites in Hungary. ■ RICHARD STONE