Meddlesome mercury

Last spring, Federal agencies, after discovering mercury in fish in Lake St. Clair and Lake Erie, thought they had a fair idea of where it came from: chlorine-alkali plants on the St. Clair and Detroit Rivers. The Federal Water Quality Administration moved to clean up the industrial effluents, and the Department of the Interior reported in September that mercury discharges had been cut by 86 percent. Use of mercury as a slimicide in paper and pulp plants—a use that made it practically impossible to clean up effluents—dropped from 296 flasks (a flask is 76 pounds) in the first quarter of 1970 to 6 flasks in the third quarter.

There is no doubt that large quantities of environmental mercury came from these direct industrial sources. But in recent weeks, there have been increasing numbers of reports of high mercury levels in marine organisms (SN: 11/7, p. 366), and it is almost impossible to learn where the mercury comes from. Scientists are now beginning to wonder if mercury in the environment is not an inescapable concomitant of increasing industrialization.

For example, says John West of the U.S. Bureau of Mines, there seems to be an association between trace amounts of mercury and bituminous coal. When the coal is burned, the mercury, which is volatile in its elemental form, enters the air. Likewise, says Dr. Edgar H. Bailey of the U.S. Geological Survey, mercury is sometimes associated with crude petroleum, and in one oil field—the Cymric Field in California's San Joaquin Valley—there is so much mercury in the oil that metallic mercury collects in pipelines. The source of the mercury there is probably nearby mercury deposits. But there seems to be a more general kind of association—not yet explained—between trace amounts of mercury and hydrocarbons. With energy consumption increasing at a prodigious rate, mercury discharges into the air from burning of fuels are bound to keep increasing.

Speculation that major amounts of environmental mercury may have a natural source probably has little basis in fact, says West, and Dr. Bailey agrees that such a source is unlikely. Most naturally occurring mercury is in the form of cinnabar, a sulfide of low solubility and volatility. "Any volatilization that takes place is extremely small," says Dr. Bailey. West adds that in the few instances where metallic mercury occurs naturally, it is in dry areas where conversion to soluble forms is unlikely.

The largest industrial use of mercury is in the chlorine-alkali plants, and losses to the environment from this use have largely been halted. But there is a wide range of other possible direct industrial sources. Industrial mercury consumption rose from an annual average of 48,147 flasks in 1949-53 to 79,104 flasks in 1969. Mercury is used in electrical appliances, for mildew-proofing compounds in paint, in dental amalgams, in industrial instruments, as a catalyst in plastics manufacture, in agricultural fungicides, in pharmaceuticals and for a number of laboratory purposes. Probably, says West, most of these uses involve loss of mercury to the environment. Control will sometimes be difficult.

Bureau of Commercial Fisheries

Tuna fishing: Selection of small species could help keep mercury levels low.

Whatever the source, the Food and Drug Administration now believes that human intake can be minimized through careful selection of fish, so far the only major foodstuff in which large amounts of mercury have been found. Mercury, like DDT and other persistent pesticides, concentrates in organisms up the food chain. Thus large predators generally have larger concentrations than smaller ones.

"All the data aren't in yet," says Richard Ronk of FDA's compliance branch, "but indications are strong that if fishermen will select smaller fish, then the mercury concentrations will be low." For example, the highest concentrations so far—up to 2.4 parts per million—have been found in large swordfish. But 6-to-12 pound skipjacks have virtually no mercury. Because canned tunafish actually comes from several different species of fish, it will be possible, says Ronk, to select the smaller species, especially where seining methods are replaced by hook-and-line fishing—the practice on Japanese fishing boats, the prime source of tuna. In the meantime, FDA is removing all contaminated fish from markets and is setting up machinery for future monitoring.

Although there have been a number of deaths in Japan in the past from mercury-contaminated fish caught near mercury-using industries, Ronk says FDA is fairly certain there has been no poisoning in the United States from contaminated fish. The FDA limit of 0.5 parts per million of mercury in foodstuffs has, he says, a 10-fold safety factor. Mercury is cumulative in human tissues from continual exposure, but its half-life in humans is about 70 days. Because Americans generally eat little fish, the mercury is excreted far faster than it can accumulate; this would be the case even if fish consumption were markedly increased.

And fish apparently is the only dietary source of mercury in the United States. FDA checks on chickens, bread, eggs, flour, dry milk and other foodstuffs tentatively show essentially no mercury contamination. Sampling of marine animals low on the food chain show negligible amounts. A few shrimp samples, for example, had mercury concentrations of 0.1 parts per million.

But there has been little research into the effects of low-level chronic doses of methyl mercury, and it is possible that even the lowest doses may have at least some toxic effect not now measurable. At least one synergism has been discovered through which methyl mercury's toxicity is greatly increased: combination with nitrolotriacetate (NTA) a substitute builder for phosphates in detergents (SN: 12/26, p. 475).

Far more research is needed, not only into the low-level toxicity of mercury compounds but also into the way the compounds are formed. The exact mechanisms through which elemental or inorganic mercury are converted into the much more toxic methyl mercury are still not clear. As with so many environmental by-products of industry, scientists have just begun to learn about the complex ramifications of mercury contamination. □