The Toxicity of Mercury

The metal mercury is famous for being subtly toxic. When I was in high school and college, it was fun to play with liquid mercury which seemed quite harmless. Some students would coat silver coins with mercury and even swallow drops. It was common for dentists to use a mercury amalgam for filling cavities. These actions are not where the real danger of mercury poisoning arises since our skin and intestinal lining are not very permeable to metallic mercury and dental amalgams tightly bond the mercury within them. Mercury vapor and mercury compounds, however, are quite dangerous.

For years, liquid mercury was regularly used in widely available thermometers, barometers, blood pressure manometers, and fluorescent lights, all made of glass. It was not unusual for one of these devices to break and spill their beautiful shiny liquid mercury onto the floor where it would break into droplets. In spite of efforts to clean up the mess, mercury would fall into cracks in the wooden floor where it would very slowly evaporate into the room over future decades. Occupants of the room would breath this mercury vapor which would enter their blood stream, replace sulfur in some amino acids and disrupt the function of proteins and enzymes made from those amino acids.

Organic mercury compounds like methylmercury, CH_3-Hg^+, ethylmercury, C_2H_5-Hg^+, and especially dimethylmercury, $(CH_3)_2$-Hg, are very toxic. Methylmercury dumped by a factory into Minamata Bay in Japan from 1932-1968 led the shellfish in the bay ingesting methylmercury and ultimately the villagers that ate the shellfish. As a result, the mercury damaged the nervous systems of over a thousand people with the effect continuing for 40 years after the dumping was halted. A similar, but smaller, disaster happened from methylmercury dumping into the Agano River in northwestern Japan.

Dimethylmercury is much more dangerous. It is a small, non-polar molecule that can quickly pass through normal protective gloves and through the skin. In a shocking case in 1996, a toxicology researcher at Darthmouth College, Prof. Karen Wetterhahn, who was taking all the precautions thought necessary for handling dimethylmercury, accidentally dropped a single drop on her gloved hand. Unknown to her, it passed through the glove and her skin within seconds and began damaging her nervous system. Five months later she started showing symptoms, then lapsed into a coma and was taken off of life support nine months after her exposure.

Mercury passes up the food chain, becoming concentrated as it reaches larger fish-eating fish and finally humans. Our bodies can gradually dispose of methylmercury, and eating fish gives us certain essential fatty acids, but too much of certain kinds of fish can be a problem. The optimum solution is to cease dumping mercury into the environment.