Fact Sheet FS-216-95

Mercury Contamination of Aquatic Ecosystems

U.S. Department of the Interior–U.S. Geological Survey

Introduction

Mercury has been well known as an environmental pollutant for several decades. As early as the 1950's it was established that emissions of mercury to the environment could have serious effects on human health. These early studies demonstrated that fish and other wildlife from various ecosystems commonly attain mercury levels of toxicological concern when directly affected by mercury-containing emissions from human-related activities. Human health concerns arise when fish and wildlife from these ecosystems are consumed by humans.

During the past decade, a new trend has emerged with regard to mercury pollution. Investigations initiated in the late 1980's in the northern-tier states of the U.S., Canada, and Nordic countries found that fish, mainly from nutrient-poor lakes and often in very remote areas, commonly have high levels of mercury. More recent fish sampling surveys in other regions of the U.S. have shown widespread mercury contamination in streams, wet-lands, reservoirs, and lakes. To date, 33 states have issued fish consumption advisories because of mercury contamination (fig. 1). These continental to global scale occurrences of mercury contamination cannot be linked to individual emissions of mercury, but instead are due to widespread air pollution. When scientists measure mercury levels in air and surface water, however, the observed levels are extraordinarily low (fig. 2). In fact, scientists have to take extreme precautions to avoid direct contact with water samples or sample containers, to avert sample contamination (fig. 3). Herein lies an apparent discrepancy: Why do fish from some remote areas have elevated mercury concentrations, when contamination levels in the environment are so low?

How does mercury become a toxicological problem?

Like many environmental contaminants, mercury undergoes bioaccumulation. Bioaccumulation is the process by which organisms (including humans) can take up contaminants more rapidly than their bodies can eliminate them, thus the amount of mercury in their body accumulates over time. If for a period of time an organism does not ingest mercury, its body burden of mercury will decline. If, however, an organism continually ingests mercury, its body burden can reach toxic levels. The rate of increase or decline in body burden is specific to each organism. For humans, about half the body burden of mercury can be eliminated in 70 days if no mercury is ingested during that time. Biomagnification is the incremental increase in concentration of a contaminant at each level of a food chain (fig. 4). This phenomenon occurs because the food source for organisms higher on the food chain is progressively more concentrated in mercury and other contaminants, thus magnifying bioaccumulation rates at the top of the food chain. The bioaccumulation effect is generally compounded the longer an organism lives, so that larger predatory game fish will likely have the highest mercury levels. Adding to this problem is the fact that mercury concentrates in the muscle tissue of fish. So, unlike organic contaminants (for example PCBs and dioxins) which concentrate in the skin and fat, mercury cannot be filleted or cooked out of consumable game fish.

Figure 2. *The droplet of mercury shown in this slide is about 1 gram; the same amount that is in a standard mercury thermometer and the total amount that is deposited annually on a lake in northern Wisconsin with a surface area of 27 acres.*

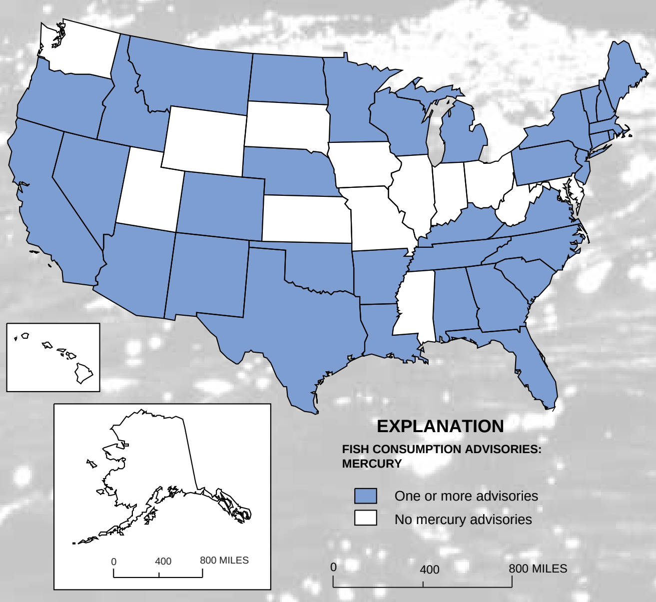

Figure 1. *States with at least one fish consumption advisory for mercury. Source: USEPA Fish Consumption Data Base*