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Bottled antimony

Once drinking water is encased in plastic bottles, its levels of antimony tend to rise; researchers suspect that the toxic element is leaching out of the bottles.

Consumers who drink bottled water could be getting more than they bargained for in the form of a surprising amount of antimony, a potentially toxic trace element with chemical properties similar to those of arsenic. Fortunately, concentrations reported to date are too low to trigger health alerts.



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Bottled waters in PET containers were found to be contaminated with antimony, a potentially toxic heavy metal with no known physiological function.

Acting on a hunch, researchers at the [University of Heidelberg](http://www.uni-heidelberg.de) (Germany) Institute of Environmental

Geochemistry measured the abundance of this heavy metal in 15 brands of Canadian bottled water and 48 European brands. In findings published in February (*J. Environ. Monit.* **2006**, 8, [288–292](#)), they reported concentrations of more than 100 times the average level of antimony in uncontaminated groundwater, which is 2 parts per trillion (ppt).

The researchers weren't initially looking for antimony in bottled waters. "We were just interested in characterizing a pristine groundwater and got to wondering why a number of analyses in the literature were reporting much higher values of antimony in bottled waters than what we were finding," says William Shotyk, the study's lead author.

Most commercially available bottled water is now sold in polyethylene terephthalate (PET) containers, according to Mike Neal, chairman of the PET Health, Safety, and Environment Committee of [Plastics Europe](#), an association of European plastics manufacturers. Antimony trioxide is used as a catalyst in the manufacture of PET, which typically contains several hundred milligrams per kilogram (mg/kg) of antimony. By comparison, the natural abundance of antimony in rocks and soils is less than 1 mg/kg.

Global consumption of bottled water more than doubled over the past 5 years, to 41 billion gallons (gal), according to the [latest statistics](#) from the International Bottled Water Association (IBWA), a trade group. People throughout the globe consumed an average of 6.4 gal of bottled water per person in 2004, according to IBWA. In 2005, revenues for the U.S. market alone, which is the largest consumer of bottled water, topped \$9.8 billion.

Shotyk and his colleagues found that waters bottled in PET containers contained as much as 550 ppt of antimony. Even highly purified deionized waters contained in PET bottles had antimony concentrations up to 160 ppt. Moreover, "the longer the water's in the bottle, the more antimony it's going to have," Shotyk notes.

Just to be sure that the antimony was leaching from the PET bottles, Shotyk and his colleagues collected source water from a German bottling company and measured 4 ppt of antimony. However, in the same brand of water purchased from a local supermarket, "I got 360 ppt," Shotyk says, "and that same brand of water, but purchased 3 months earlier and sitting in my office, contains 630 ppt."

Neal points out that these concentrations are far lower than drinking-water standards, which range from 2 parts per billion (ppb) in Japan to 5 ppb in Europe and 6 ppb in the U.S. and Canada. Under World Health Organization guidelines, up to 20 ppb is considered safe. Additionally, he notes that "all packaging materials migrate different amounts of materials into foodstuffs, and PET is one of the polymers that migrates the least of its contents."

But Shotyk wonders about the wider environmental implications. "That's a lot of antimony in the plastic," Shotyk notes, and "the question is, where does it end up?" Unlike other heavy metals, such as lead, mercury, cadmium, and arsenic, very little research has been done to date on the environmental fate of antimony. The U.S. EPA lists the metal as a possible carcinogen and priority pollutant. Previous

studies by Shotyk and his colleagues on ice cores from the Canadian Arctic show that antimony enrichment from aerosols migrating there is 50% higher today than it was 30 years ago.

Although antimony has been used since ancient times, consumption has risen dramatically since the early 1970s with the advent of flame retardants, says James Carlin, a commodity specialist with the [U.S. Geological Survey](#) (USGS). China now produces 85% of the world total. The mining and processing of antimony ores is a primary source of antimony to the environment, according to a [toxicological profile](#) by the U.S. Agency for Toxic Substances and Disease Registry. Smaller amounts are also released by waste incinerators and coal-burning power plants.

More than half of the antimony goes into flame retardants. The rest is used mainly in glass for television picture tubes and computer monitors, pigments, stabilizers and catalysts for plastics, ammunition, friction bearings, lead-acid batteries, and solders, USGS statistics show. —[KRIS CHRISTEN](#)