

What's in Your Water Bottle? Or Where Does *Your* Water Come?

Case Study #1

Presented by: Erik Krogh, Sept. 18th, 2006

Materials Included In Reading Package:

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2. US Food and Drug Administration, 'Bottled Water: Better Than Tap?', by Anne Christiansen Bullers, www.fda.gov/fdac/features/2002/402_h2o.html accessed 9/13/06
3. Natural Resources Defense Council, 'Bottled Water: Pure Drink or Pure Hype?',
www.nrdc.org/water/drinking/nbw.asp
accessed 9/12/2006
4. E-Magazine, 'Message in a Bottle – Neither Cleaner or Greener than Tap Water' by Brian C. Howard, <http://www.emagazine.com/view/?1125>
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Further Resources:

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http://www.hc-sc.gc.ca/ewh-semt/water-eau/drink-potab/index_e.html

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'Bottled Water Blues', at [www.bottledwaterblues.com/Bottled Water Facts.cfm](http://www.bottledwaterblues.com/Bottled_Water_Facts.cfm)

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USA TODAY, 'Bottled water no safer than Tap'

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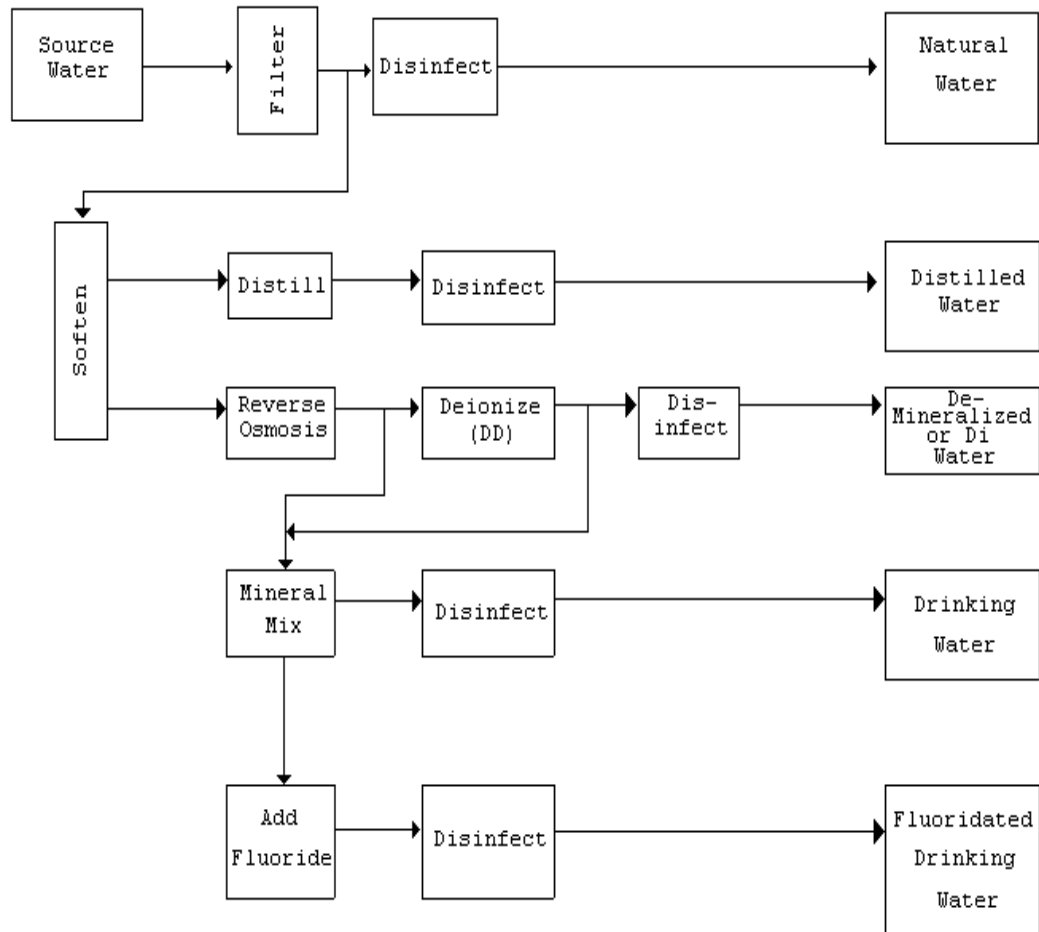
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Table 1. Bottled Water Definitions and Labels

Drinking water	Bottled water that is obtained from an approved source, meets all applicable federal and state standards, and has undergone a minimal treatment process consisting of filtration and some type of disinfection
Mineral water	Water that is collected and bottled directly at the point of emergence from a protected underground source without any treatment to alter its natural mineral composition (i.e., minerals cannot be added to this product). Mineral water contains at least 250 milligrams per liter (mg/L) of natural dissolved substances and is distinguished from other types of bottled water by its constant level and relative proportions of natural minerals and trace elements in the source water.
Well water	Water that is pumped or collected using some other mechanical means from a bored or drilled well that taps into a groundwater aquifer (a water-bearing rock or soil formation located underground)
Artesian water	Water that is collected from a bored or drilled well that taps into an aquifer trapped beneath a confining layer of impermeable clay or bedrock, which pressurizes the groundwater and allows it to rise up through the well to an elevation above the water table without mechanical pumping
Spring water	Water that is collected directly from an underground formation from which water flows naturally to the ground surface or from a bored hole that taps the source of the spring. Although spring water requires minimal treatment before it is bottled, it must retain the same physical properties and composition as the natural spring water.
Purified water	Water that has been produced by a suitable treatment process such as distillation, deionization, or reverse osmosis and meets the most recent definition of purified water in the United States Pharmacopeia
Distilled water	Water that has been produced by vaporizing and then condensing the water during the process of distillation. Distilled water must also meet the definition of purified water in the United States Pharmacopeia.
Sparkling water	Water that contains natural or added carbon dioxide in the same amount that it had at the point of emergence from its source. Sparkling water does not include soft drinks, such as carbonated, soda, seltzer, and tonic waters, which are regulated differently and may contain sugar and calories.

Taken from: 'Drinking Water Alternatives: Bottled Water' by Ariz R. Mehta at www.cce.cornell.edu/factsheets/wq-fact-sheets/bottled_water.htm

Figure 1. Water Treatment Processes.



This material is based upon work supported by the U.S. Department of Agriculture, Extension Service, under project number 89-EWQI-1-9168.

TABLE 2
Selected Contaminants of Potential Concern for Bottled Water

Contaminant	Health Concern with Excess Levels
Coliform Bacteria	Broad class of bacteria used as potential indicator of fecal contamination; may be harmless of themselves. Harmful types of coliform bacteria (such as certain fecal coliform bacteria or <i>E. coli</i>) can cause infections with vomiting, diarrhea, or serious illness in children, the elderly, and immunocompromised or other vulnerable people.
Heterotrophic Plate Count (HPC) Bacteria	Potential indicator of overall sanitation in bottling and source water; may be harmless of themselves. In some cases may indicate presence of infectious bacteria; data show sometimes linked to illnesses. Can interfere with detection of coliform bacteria or infectious bacteria. Unregulated by FDA.
<i>Pseudomonas aeruginosa</i> bacteria	Possible indicator of fecal contamination or unsanitary source water or bottling. Can cause opportunistic infections. Unregulated by FDA.
Arsenic	Known human carcinogen. Also can cause skin, nervous, and reproductive or developmental problems.
Nitrate	Causes "blue baby" syndrome in infants, due to interference with blood's ability to take up oxygen. Potential cancer risk.
Trihalomethanes (i.e., chloroform, bromodichloromethane, dibromochloromethane, and bromoform)	Cancer of the bladder, colorectal cancer, possibly pancreatic cancer. Also concerns about possible birth defects and spontaneous abortions.
Phthalate (DEHP)	Cancer; possible endocrine system disrupter. Unregulated by FDA.

Source: NRDC

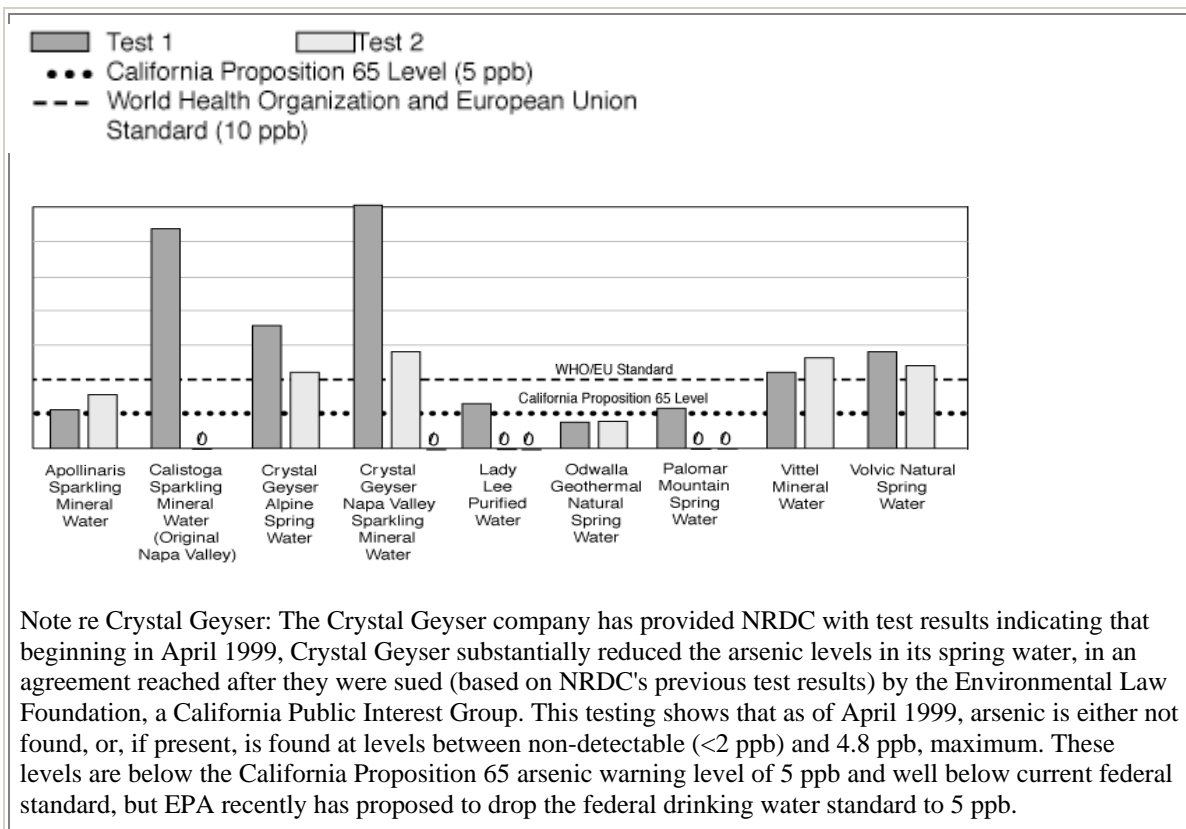


FIGURE 5: Arsenic in Selected Bottled Waters (Source: NRDC, 1997-1999)

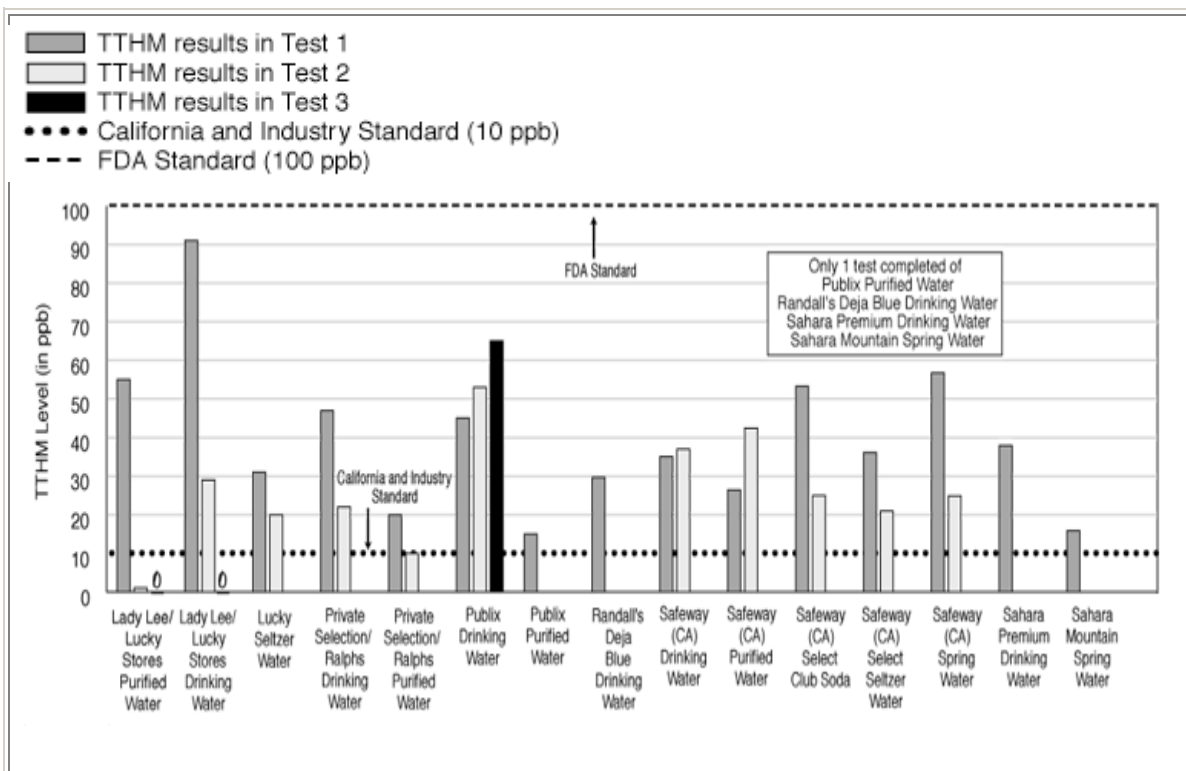


FIGURE 6: Significant Total Trihalomethane Levels in Bottled Water (Source: NRDC, 1997-1999)

Message in a Bottle:

Despite the Hype, Bottled Water is Neither CLEANER nor GREENER Than Tap Water

Whether a consumer is shopping in a supermarket or a health food store, working out in a fitness center, eating in a restaurant or grabbing some quick refreshment on the go, he or she will likely be tempted to buy bottled water. The product comes in an ever-growing variety of sizes and shapes, including one bottle that looks like a drop of water with a golden cap. Some fine hotels now offer the services of “water sommeliers” to advise diners on which water to drink with different courses.

A widening spectrum of bottled water types are crowding the market, including spring, mineral, purified, distilled, carbonated, oxygenated, caffeinated and vitamin-enriched, as well as flavors, such as lemon or strawberry, and specific brands aimed at children. Bottled water bars have sprung up in the hipper districts, from Paris to Los Angeles. The message is clear: Bottled water is “good” water, as opposed to that nasty, unsafe stuff that comes out of the tap. But in most cases tap water adheres to stricter purity standards than bottled water, whose source—far from a mountain spring—can be wells underneath industrial facilities. Indeed, 40 percent of bottled water began life as, well, tap water.

A 2001 World Wildlife Fund (WWF) study confirmed the widespread belief that consumers associate bottled water with social status and healthy living. Their perceptions trump their objectivity, because even some people who claim to have switched to bottled water “for the taste” can’t tell the difference: When Good Morning America conducted a taste test of its studio audience, New York City tap water was chosen as the heavy favorite over the oxygenated water O2, Poland Spring and Evian. Many of the “facts” that bottled water drinkers swear by are erroneous. Rachele Kuzma, a Rutgers student, says she drinks bottled water at school because “it’s healthier” and “doesn’t have fluoride,” although much of it does have fluoride. Bottled water is so ubiquitous that people can hardly ask for water anywhere without being handed a bottle. But what is the cost to society and the environment?

Largely Self-Regulated The bottled water industry has exploded in recent years, and enjoys annual sales of more than \$35 billion worldwide. In 2002, almost six billion gallons of bottled water were sold in the U.S., representing an increase of nearly 11 percent over 2001. Americans paid \$7.7 billion for bottled water in 2002, according to the consulting and research firm Beverage Marketing Corporation. Bottled water is the fastest-growing segment of the beverage industry, and the product is expected to pass both coffee and milk to become the second-most-consumed beverage (behind soft drinks) by 2004. According to the Natural Resources Defense Council (NRDC), “More than half of all Americans drink bottled water; about a third of the public consumes it regularly.” While most people would argue that bottled water is healthier than convenient alternatives like sugared sodas or artificially flavored drinks, are the third of bottled water consumers who claim they are motivated by promises of purity (according to a 2000 survey) getting what they pay for?

While the Environmental Protection Agency (EPA) regulates the quality of public water supplies, the agency has no authority over bottled water. Bottled water that crosses state lines is considered a food product and is overseen by the Food and Drug Administration (FDA), which does mandate that it be bottled in sanitary conditions using food-grade equipment. According to the influential International Bottled Water Association (IBWA), “By law, the FDA Standard of Quality for bottled water must be as stringent as the EPA’s standards for public drinking water.”

A 1997 United Nations report concluded that bottled water has no nutritional advantage over tap water, so why do so many people think otherwise?

However, the FDA is allowed to interpret the EPA's regulations and apply them selectively to bottled water. As Senior Attorney Erik Olson of the NRDC explains, "Although the FDA has adopted some of the EPA's regulatory standards, it has decided not to adopt others and has not even ruled on some points after several years of inaction." In a 1999 report, the NRDC concludes that bottled water quality is probably not inferior to average tap water, but Olson (the report's principal author) says that gaps in the weak regulatory framework may allow careless or unscrupulous bottlers to market substandard products. He says that may be of particular concern to those with compromised immune systems.

The IBWA urges consumers to trust bottled water in part because the FDA requires water sources to be "inspected, sampled, analyzed and approved." However, the NRDC argues that the FDA provides no specific requirements—such as proximity to industrial facilities, underground storage tanks or dumps—for bottled water sources. That's looser monitoring than occurs at the EPA, which requires more specific assessments of tap water sources. Olson says one brand of "spring water," which had a graphic of mountains and a lake on the label, was actually taken from a well in Massachusetts in the parking lot of an industrial facility. The well, which is no longer used for bottled water, was near hazardous waste and had experienced contamination by industrial chemicals. According to Olson, the FDA has no official procedure for rejecting bottled water sources once they become contaminated. He also says a 1990 government audit revealed that 25 percent of water bottlers had no record of source approval. Further, in contrast to the EPA, which employs hundreds of staffers to protect the nation's tap water systems, the FDA doesn't have even one full-time regulator in charge of bottled water.

Scott Hooper of the Kansas Rural Water Association says that although municipal system managers have to pay a certified lab to test samples weekly, monthly and quarterly for a long list of contaminants, water bottlers can use any lab they choose to perform tests as infrequently as once a year. Unlike utilities, which must publish their lab results in a public record, bottlers don't have to notify anyone of their findings, including consumers who inquire. The FDA has the authority to ask for a company's data, although test results can be destroyed after two years. Olson adds, "Unlike tap water violations, which are directly enforceable, if a company exceeds bottled water standards, it is not necessarily a violation—they can just say so on the label, and may be insulated from enforcement." Further, while EPA rules specify that no confirmed *E. coli* or fecal coliform (bacteria that indicate possible contamination by fecal matter) contamination is allowed in tap water, the FDA merely set a minimum level for *E. coli* and fecal coliform presence in bottled water. Tap water from a surface source must be tested for cryptosporidium, giardia and viruses, unlike bottled water, and must also be disinfected, unlike bottled water. Hooper also notes that food products such as "carbonated water," "soda water" and "seltzer water"—in addition to most flavored waters—are held to even looser standards than "true" bottled water.

The EPA concludes, "Some bottled water is treated more than tap water, while some is treated less or not at all." Henry Kim, consumer safety officer for the FDA, asserts, "We want bottled water to have a comparable quality to that of tap water"—which, of course, runs counter to the widely held public belief that bottled water is better. The situation is similar in the European Union and in Canada, where there are more regulations on tap than bottled water. That New York restroom attendant would be surprised to learn that her city's tap water was tested some 560,000 times in 2002. Environmentalists also point out that if a brand of bottled water is wholly packaged and sold within the same state, it is technically not regulated by the FDA, and is therefore only legally subject to state standards, which tend to vary widely in scope and vigor. Co-op America reports that 43 states have one or fewer staff members dedicated to bottled water regulation. On the other hand, California enforces strict regulations on bottled water contaminants, and Fort Collins, Colorado tests bottled water sold in town and posts the results online. The NRDC estimates that 60 to 70 percent of bottled water brands sold in the U.S. are single-state operations. Stephen Kay, vice president of communications of the IBWA, says he doubts the percentage is that high.

Kay is adamant that “no bottled water escapes regulation,” and he points out that all members of the IBWA (which are responsible for 80 percent of U.S. bottled water sales) must also adhere to the organization’s mandatory Model Code. This code does close some of the FDA’s regulatory gaps, including setting a zero tolerance for coliform contamination, and it requires members to follow certain standards and undergo an annual, unannounced plant inspection. However, Olson stresses that, except in a few states, this Model Code is not legally binding or enforceable. Members of the much smaller National Spring Water Association follow their own guidelines, and must get their water from free-flowing springs. One result of such Byzantine bottled water standards has been the widespread use of disinfection to reduce possible contaminants. Although the FDA does not require it, disinfection is mandatory in several states, including New York, California and Texas. However, chemicals commonly used to disinfect water, including chlorine and ozone gas, may react unpredictably, forming potentially carcinogenic byproducts. Opponents also argue that disinfection destroys naturally beneficial bacteria, creating a blank slate. Further, Mark Johnson of bottler Trinity Springs—which taps a spring in Idaho so pure it doesn’t need any treatment—concludes, “If you don’t disinfect, you must protect the source and increase environmental awareness so the source stays protected.”

What’s Really in that Bottle? Even with widespread disinfection, consumer groups have raised numerous warnings about a host of different microorganisms and chemicals that have been found in bottled water. In a four-year scientific study, the NRDC tested more than 1,000 bottles of 103 brands of bottled water. The group concluded, “Although most bottled water tested was of good quality, some brands’ quality was spotty.” A third of the tested brands were found to contain contaminants such as arsenic and carcinogenic compounds in at least some samples at levels exceeding state or industry standards. An earlier NRDC-commissioned study tested for hundreds of different chemicals in 38 brands of California bottled water. Two samples had arsenic contamination, six had chemical byproducts of chlorination, and six had measurable levels of the toxic chemical toluene. Several samples violated California’s bottled water standards. In a study published in the Archives of Family Medicine, researchers at Case Western Reserve University and Ohio State University compared 57 samples of bottled water to Cleveland’s tap water. While 39 of the bottled water samples were purer than the tap water, 15 of the bottles had significantly higher bacteria levels. The scientists concluded that although all of the water they tested was safe to drink, “use of bottled water on the assumption of purity can be misguided.”

Another area of potential concern is the fact that no agency calls for testing of bottled water after it leaves its initial packaging plant, leaving some to wonder what happens during months of storage and transport. To begin to examine this question, the Kansas Department of Health and Environment tested 80 samples of bottled water from retail stores and manufacturers. All 80 of the samples had detectable levels of chlorine, fluoride and sodium. Seventy-eight of the 80 contained some nitrate (which can cause methemoglobinemia, or blue-baby syndrome, in higher doses), 12 had nitrite, 53 had chloroform, 33 contained bromodichloro-methane, 25 had arsenic and 15 tested positive for lead. Forty-six of the samples contained traces of some form of the carcinogen (and hormone disrupter) phthalate, while 12 of those exceeded federal safety levels for that chemical. According to Olson, phthalates may leach out of some plastic bottles into water. “Phthalates are not legally regulated in bottled water because of intense industry pressure,” says Olson. Although Co-op America concludes that there is little evidence of a link between phthalate exposure from bottled water and any health problems, the group suggests using glass over plastic bottles as a precaution. Similarly, if your office cooler is made of polycarbonate, it may be releasing small amounts of the potential hormone disrupter bisphenol A into the water.

Plastic water bottles can take 1,000 years to biodegrade. Nine out of 10 water bottles end up as garbage or litter, and that means 30 million per day. A small percentage goes into recycling bins like the one below.

Idaho's Pure Health Solutions, a water purification company, also conducted its own study that concluded certain bacteria grow significantly in bottled water over a 12-day period. Bacteria will normally grow in tap water within a few days if it is kept bottled up at room temperature. Most municipal water managers leave a residual amount of chlorine in tap water after treatment specifically to inhibit the growth of bacteria as the water runs through pipes and sits in tanks.

The IBWA argues that the presence of benign bacteria in bottled water has no bearing on public health, since the treatment processes used by manufacturers ensure the death of any potentially harmful organisms. The group's website claims that there have been no confirmed cases of illness in the U.S. as a result of bottled water. The IBWA does mention an instance in 1994 in the Northern Mariana Islands, in which bottled well water was linked to a disease outbreak. The NRDC argues that no U.S. government agency actively searches for incidents of illness from bottled water.

Misleading Labels Another complaint commonly levied against the bottled water industry is that many of the myriad product labels are misleading. Not long ago, New York-based artist Nancy Drew began collecting water bottles for a project. She concluded, "In a culture so inundated with images solely designed for promotion and profit, water is the most absurd element to see being used in this context." Drew's subsequent art views water labels' ubiquitous depictions of pristine landscapes as a stark contrast to the "gluttonous consumption and sense of status that they represent."

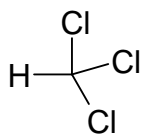
The IBWA states, "The labeling requirements ensure that the source and purity of the bottled water are identified and that, if the label is false or misleading, the supplier is subject to civil or criminal sanctions." Even so, the FDA technically requires that bottled water labels disclose only three variables: the class of water (such as spring or mineral), the manufacturer, and the volume. That brand of Massachusetts "spring water" exposed by NRDC was so-named because the source occasionally bubbled up to the surface in the industrial parking lot. As ABC News put it, "Ad campaigns touting spring-fed or glacier-born H₂O are winning over a population increasingly skeptical of taps and willing to shell out big bucks for what they consider a purer, tastier and safer drink." Water bottlers use product names such as More Precious Than Gold, Ice Mountain, Desert Quench, Pure American, Utopia and Crystal Springs. The Environmental Law Foundation has sued eight bottlers on the basis that they used words like "pure" to market water containing bacteria, arsenic and chlorine breakdown products.

Co-op America advises consumers "to be wary of words like 'pure,' 'pristine,' 'glacial,' 'premium,' 'natural' or 'healthy.' They're basically meaningless words added to labels to emphasize the alleged purity of bottled water over tap water." The group points out that, in one case, bottled water labeled as "Alaska Premium Glacier Drinking Water: Pure Glacier Water from the Last Unpolluted Frontier" was actually drawn from Public Water System #111241 in Juneau. The FDA now requires this bottler to add "from a municipal source" on the label. According to Co-op America, "as much as 40 percent of bottled water is actually bottled tap water, sometimes with additional treatment, sometimes not." So-called purified water can be drawn from any source as long as it is subsequently treated, which leaves some to wonder how that differs from good old tap water. The number one (Aquafina) and two (Dasani) top-selling brands of bottled water in the U.S. both fall in the category of purified water. Dasani is sold by Coca-Cola, while Aquafina is a Pepsi product. As U.S. News & World Report explains, "Aquafina is municipal water from spots like Wichita, Kansas." The newsmagazine continues, "Coke's Dasani (with minerals added) is taken from the taps of Queens, New York, Jacksonville, Florida, and elsewhere." Everest bottled water originates from southern Texas, while Yosemite brand is drawn from the Los Angeles suburbs.

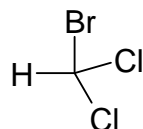
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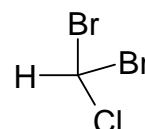
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chloroform

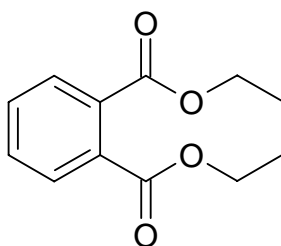


BDCM



DBCM

Phthalate



Bisphenol-A

