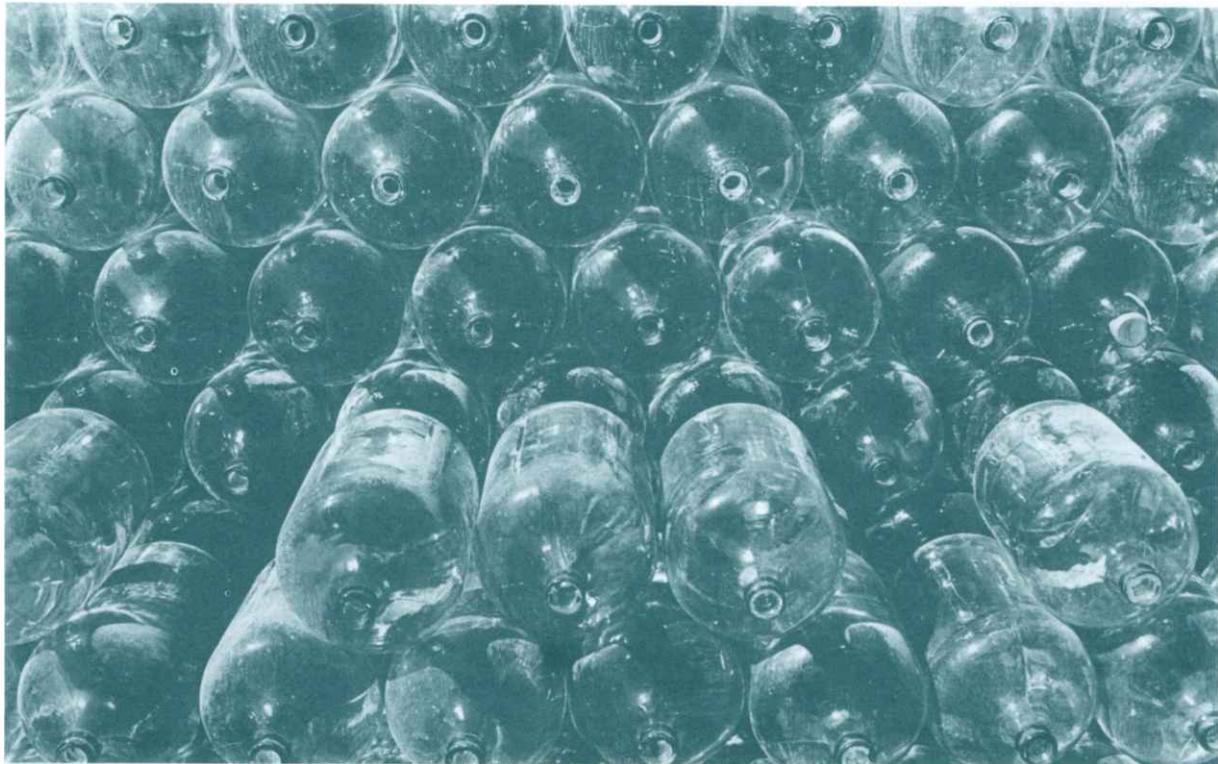


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Bottled water and more bottled water. The market for bottled water and home water treatment units is increasing in response to consumers' concerns about the quality of their tap water. (Photo: Arizona Daily Star photo file.)

Consumers Increasingly Use Bottled Water, Home Water Treatment Systems to Avoid Direct Tap Water

by Joe Gelt

Expecting safe, drinkable water to flow from household taps once was an unquestioned assumption. This assumption was founded upon various acts of faith—in progress, technology, and the local water utility. For many people, however, this comforting assumption no

longer holds true. We of little faith are becoming wary of tap water, questioning its quality and suspicious of its health effects.

As a result householders increasingly are turning to bottled water and home water treatment systems to ensure good quality water in their

homes. What this demonstrates is that many water consumers, for various reasons, prefer drinking an alternative to direct tap water and are willing to pay for it.

Drinking water, whether from tap or bottle, does not represent a vast quantity of water. Of Arizona's total

water supply, about 9 percent goes to household uses. Household members then drink about one half of one percent of their domestic water supply.

Is Tap Water Hazardous to Health?

Why is there a burgeoning use of bottled water and home treatment devices when U.S. citizens are enjoying some of the highest quality drinking water in the world? Might our concern appear excessive, even frivolous, considering the serious drinking water problems many countries face throughout the world. For example, the United Nations reports that 1.75 billion people in the world lack adequate drinking water and that more than 3 percent of all deaths in developing countries are directly related to contaminated drinking water.

The worldwide prevalence of such water quality problems whilst we, in the United States, expend much effort and expense to avoid drinking generally high quality U.S. tap water strikes some critics as incongruous. Some even consider the quest for more tasteful, purer, and healthier water as an unnecessary luxury or a consumer fad, unmotivated by any real need. But is this true?

People's consciousness about water quality was raised recently due to several widely reported incidents of public drinking water endangering health and even causing death. A 1993 outbreak of *cryptosporidium parvum* or crypto in Milwaukee sickened 403,000 Milwaukee residents, about half the city's population, and left more than 100 people dead.

In Las Vegas crypto contributed to the deaths of 19 AIDS patients in 1994, although the virus was never detected in the city's water supply. That AIDS patients on bottled water did not get the virus was a critical clue determining that crypto did, in

fact, come from drinking water.

Crypto is an elusive parasite that cattle and other animals excrete into watersheds and is found in up to 87 percent of untreated water supplies. Rain runoff carries the parasite to surface water supplies. Chuck Gerba of the University of Arizona's Department of Soil and Water Science estimates that crypto is in about one-third of the country's finished drinking water supplies.

The parasite causes severe diarrhea and nausea. Healthy individuals recover in about 10 days, but the virus can be deadly for children, the elderly, AIDS patients or anyone who is immunocompromised; i.e. who have a weak immune system. Even low level occurrences of crypto can pose health problems, although the effects may be difficult to trace. The disease's rather lengthy seven-day incubation period complicates accurate diagnoses. Most infected people assume their nausea and diarrhea resulted from something they ate the day before.

Some researchers believe that incidents of crypto are not isolated events. The incidents attracted notice in Milwaukee and Las Vegas only because a large number of people were affected, with deaths resulting. The subsequent news coverage might left the impression that a new water quality threat had surfaced. A number of researchers believe, however, that such water-borne illnesses are more prevalent than is presently realized.

A study by Pierre Payment of the University of Quebec suggests that about a third of reported "stomach flu" cases may be infections from tap-water systems in compliance with current law. Research continues to determine if the bacteria in the tap water comes from the distribution system or whether it is an organism able to pass through the treatment process. Either way, however, water consumers are alerted that possibly harmful bacteria could be in their tap water.

Realizing that crypto is an emerging health threat to be reckoned with, federal agencies took action. The Center for Disease Control and Prevention (CDC) and the Environmental Protection Agency (EPA) issued warnings last summer that immunocompromised people are at great risk drinking tap water. Such people were advised to boil their water, drink well-tested bottled water or install filters screening out particles as small as one micron, or a millionth of a meter.

A sizable segment of the U.S. population is at risk including those infected with HIV, cancer patients taking chemotherapy drugs, and organ-transplant recipients on immunosuppressive drugs. CDC estimates this includes about five million people. Because of all the publicity, even people in good health, who are unlikely to suffer infection from tap water, now are more concerned about their water quality. Many are considering bottled water and home water treatments options.

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Non-Health Reasons for Avoiding Tap Water

Although health and safety are foremost among water quality concerns, consumers' main reason for avoiding direct tap water is aesthetics; they object to the taste and smell of their tap water. EPA establishes primary and secondary standards: the former are to protect public health. Secondary standards are concerned with esthetics and include non-mandatory guidelines for taste, odor, turbidity, etc. Some people buy in-home treatment systems or bottled water when their tap water fails to meet these standards.

Water treated with chlorine, which is widely used as a disinfectant, often has a distinct smell, even if it is not in violation of EPA standards. Some people find this odor sufficiently onerous to seek alternatives to drinking chlorine treated tap water.

Also, many people believe an alternative to tap water ensures higher quality homemade beverages. They use such water when making tea, coffee and ice cubes. Along this line, Ben & Jerry's, a leading premium ice cream maker, will use Vermont Pure Spring Water as a food ingredient in its new line of sorbets scheduled to be introduced nationally in March-April. Also some people reach for bottled water as a healthy substitute for caffeinated or alcoholic beverages.

Along with health and aesthetic concerns, other factors also may help explain the growing popularity of bottled water and home water treatment systems; for example, a mistrust of government. Government agencies test, treat and monitor water supplies and mandate appropriate treatment. Meanwhile, a growing distrust of government causes some people to be wary of its effectiveness and even suspicious of its intent. As a result, various people have misgivings about trusting government to adequately

protect the water they drink.

Tucson's recent Proposition 200 was a reflection of this attitude. The initiative, which voters passed in November, prescribed the use of CAP water, in response to perceived mismanagement by Tucson Water officials. Seen as a current and emerging theme, this distrust of government actually has been around for a while, at least with regards to drinking water. "Troubled Waters," a Center for Investigative Reporting 1985 publication, is lengthily subtitled "The poisoning of America's drinking water—how government and industry allowed it to happen, and what you can do to ensure a safe supply in the home." If government is not to be trusted, then individual citizens must take charge of their water quality.

Perhaps a philosophical reason also might account for the use of bottled water and home treatment systems. It often is said that modern conveniences, by lessening our opportunities to provide for our own basic needs, deprive us of some fundamental human satisfactions. Hunting, gardening, even baking bread are efforts to regain some of the missing "handson" quality to life.

Water flowing from a tap clearly is a modern convenience. At a turn of a faucet, water flows, its source and route to the spout as unknown and mysterious to most people as is the flow of electricity to an outlet. Tap water is an abstraction.

In contrast, water purchased in bottles is a known quantity, readily visible and physically present. It is transported, stored, enshrined in a stand for use. And if bottled water allows people access to the physical reality of water, choosing and buying a home water treatment unit personally involves them in ensuring the purity of their drinking water. In other words, by using bottled water or a home treatment device, people take some direct charge of satisfying their basic need for water.

Home Water Treatment Systems

If, for whatever reasons, householders are dissatisfied with the water flowing from their taps, they can invest in a home water treatment unit. By installing such a unit, consumers extend the treatment process, from the water treatment plant to the actual point of delivery and consumption; i.e. their homes. With this one last step, consumers expect their domestic water quality is enhanced and more fit to drink.

Home water treatment units come in two basic types: point of use (POU) and point of entry (POE) devices. POU devices, which are the most common, usually are installed near the sink or faucet and treat only water used for drinking or cooking. POE devices treat all the water entering the house, regardless of its use.

The sale of such units is expanding. The purchase of home water treatment systems has increased, from about 3.4 million in 1991 to an expected sale of 4.7 million in 1996. Sales are expected to reach 5.5 million by 1999.

Home treatment units rely on various processes to purify water. Some of the processes have specialized functions and remove only certain constituents. Buyers need to study the advantages and disadvantages of each, to determine which process is best for their needs—or, indeed, if one is even needed—given the characteristics of their water and the desired results.

Officials warn that some home treatment systems, if not maintained properly, can create their own water quality problems. Users failing to change filters as often as needed is a common problem. Proper maintenance takes time and money.

Also, the technology of treatment units is rapidly changing. For example, a new product recently has

been introduced to help resolve the problem of consumers not knowing when to change their water filters. This device provides the user a constant indication that the filter is functioning and will shut off automatically when it needs changing.

The most common home treatment method, granular activated carbon (GAC) takes advantage of carbon's capacity to absorb impurities. Carbon's water purifying ability long has been known. For centuries, sailing ships used carbon for storing drinking water during long voyages. The approximately 50 acres of surface area contained in a pound of carbon can absorb many chemicals. Adding a slight electro-positive charge to activate carbon increases its attraction to chemicals and impurities.

The appeal of GAC is its low cost, general availability, ease of installation, and capabilities. GAC filters can reduce, but not totally eliminate, pesticides, volatile organic chemicals (VOCs), synthetic organic compounds (SOCs), some radiological constituents, fluoride and a few metals.

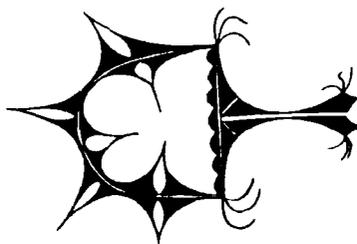
A disadvantage is that GAC filters can contribute microbiological contaminants to water by collecting organisms in the filter. As water passes through the GAC, some bacteria get trapped in the substrate where they can multiply prolifically because of the warm, moist oxygen-containing environment. The filter also concentrates organic matter that feeds the bacteria. As a result, filtered water flowing from the tap could contain bacteria, especially in the first flow in the morning.

The microbiological contaminants produced by GAC filters are not pathogens for most people and are unlikely to infect healthy individuals, although immuno-compromised people may be at risk. Epidemiological studies of healthy people using GAC filtration devices showed no cor-

relation between their use and illness. Chuck Gerba is working with the Water Quality Association to assess the risk of using GAC filters.

GAC filters can become saturated through normal household use, resulting in a rapid decrease in effectiveness. The carbon therefore must be replaced regularly. The life of the unit is determined by the amount of carbon it contains, the quality of incoming water, and the quantity of water passing through the filter.

Some home water treatment devices rely on a reverse osmosis



San Ildefonso water jar design

(RO) process. This involves forcing water through a semi-permeable membrane capable of blocking 90 percent of almost all constituents. Some RO systems include a GAC filter installed at the end of the process to capture any impurities that make it through the membrane. RO units are recommended for water with a high mineral content. Further, RO's effectiveness at removing nitrates makes them very useful in some agricultural areas.

Up until fairly recently RO devices were criticized for the limited amount of water they produced and their high water use. Only a portion of the water RO devices used is actually processed for consumption. Literature from 1993 stated that RO devices used from three to ten gallons to produce one gallon of purified water. It is an

indication of how the technology is changing that a Tucson water market recently reported its RO filtering system can produce 7,000 gallons daily, with 1.9 gallons needed to produce each gallon of treated water.

A concern associated with RO systems is that their reservoir can be a breeding ground for pseudomonas bacteria. This bacteria grows well in low nutrient or ultra pure water which is produced by RO and water distillation systems. It is an opportunistic pathogen, relatively harmless to healthy individuals, but a possible threat to people who are immuno-compromised.

Pierre Payment of Quebec University compared incidents of diarrhea in households using RO filtrated water with other households that drank straight tap water. He found that, although diarrhea occurred much less frequently in households with RO systems, some incidents still occurred and these he related to bacteria growth in the RO filter.

RO membranes last much longer than GAC filters. RO membranes can last from one to eight years depending upon incoming water quality and quantity of flow.

Ultraviolet light (UV) also is used to disinfect water. This process involves water passing through a clear cylinder, with a UV lamp shining on the water to disinfect it. The effectiveness of this method depends upon exposure time, light intensity, and type of microorganisms in the water.

UV exposure effectively rids water of most bacteria and viruses. It does not kill giardia and chryptosporidia, however, nor does it remove chemicals, lead or asbestos. UV disinfection is less effective in water with iron or high turbidity, i.e. suspended particles causing cloudiness. UV bulbs should be replaced every year.

Distillation is another water purification process. It involves boiling water, then condensing the steam into a liquid to remove all dissolved

minerals. Distillation effectively removes all nonmetallic inorganics, metals, microbiological contaminants, physical contaminants, synthetic organic compounds, most pesticides, and radiological contaminants. Distillation is the most effective method for removing the largest number of chemical constituents.

A disadvantage to distillation is the high energy cost. A great amount of electricity or natural gas is consumed to produce usually a small quantity of water each day. The process also is time-consuming, taking about eight hours to produce several gallons of drinking water. The life span of the unit varies with the type of water treated, about 10 years with soft water and from three to four years with hard water.

Water softeners or conditioners are used to treat water with excessive mineral content; i.e., hard water. Most conditioners on the market rely on an ion exchange process, with sodium exchanged for the calcium and magnesium that causes water hardness. The chemical makeup of the water is thereby changed. Water softeners also remove some metals. Salt or sodium chloride is used to regenerate the treatment unit.

Excessively hard water can be a problem, causing mineral scale on sinks, water pipes, and other household appliances. The mineral build up can reduce the energy efficiency of water heaters as well as reduce the life of various appliances, including water treatment systems. Also soaps and detergents are less effective in hard water.

Yet hard water has its benefits. People who drink hard water are less prone to heart disease. Hard water also seems to help develop stronger teeth and bones. Further, the mineral buildup within pipes caused by hard water coats solder joints thereby preventing any lead that may be in the joints from getting into the drinking water. Also people on low-sodium

diets should avoid softened water since the process adds sodium to the water.

Home Water Treatment Systems Regulations

Consumers are likely to be confused by the array of water treatment devices and brands on the market. Their confusion may turn to wariness, even suspicion when pressured by sales people warning them of the dire consequences of drinking straight tap water and extolling the inestimable worth of their products. To guide and protect consumers, the National Sanitation Foundation (NSF) International, an independent, not-for-profit testing organization, tests and evaluates drinking water treatment units. NSF tests for aesthetic and health concerns. Drinking water aesthetics involves taste, odor or color, characteristics that may not be harmful to health, but are undesirable in water. Testing for aesthetics effects involves ratings for reduction of particulates, iron, taste, odor and chlorine, total dissolved solids and turbidity.

NSF rating for health effects of water filtration devices includes testing for reduction of asbestos, herbicides and pesticides, total trihalomethanes (TTHMs), volatile organic chemicals (VOCs), cysts (giardia, cryptosporidia), turbidity, lead, asbestos, and radon.

The five basic requirements to be met for a system to be NSF Certified are: contaminant reduction claims are true; the system is not adding anything harmful to the water; the system is structurally sound; advertising, literature and labeling are not misleading; and the materials and manufacturing process don't change. A product advertising "Tested to NSF Standards" instead of "NSF Certified" doesn't ensure that any of the above standards were, in fact, met,

but merely referred to.

A system having received an NSF classification is subject to unannounced inspections of its manufacturing facilities. This is to ensure that standards are maintained after the original NSF testing.

NSF certification occurs in lieu of federal regulation, with manufacturers voluntarily submitting their products to NSF for testing and evaluation. NSF has certified 82 manufacturers of treatment units, representing over 1600 products. Another 56 manufacturers are working toward certification. An estimated 290 companies are producing home water treatment devices. Most reputable companies do not spare expense to achieve respectable NSF ratings.

Various states use NSF ratings when regulating home treatment devices. For example, California requires that all filters sold in the state must include the filter's NSF rating on the unit, the packaging, and all related literature related to the filter. Arizona does not have regulations pertaining to home treatment devices.

By referring to NSF testing results, householders should be able to identify the best system for their needs. Free consumer information is available by contacting: NSF International, P.O. Box 130140, Ann Arbor, Michigan 48113-0141; 1-800-NSF-MARK.

Consumers Reach for Bottled Water

Barrel water appeared in Arizona history prior to bottled water. Before piped water was available in some areas a horse-drawn wagon delivered water by filling water barrels located in front of homes, businesses and even tents. A white flag was a signal to fill up the water barrel. In Flagstaff during the 1890s a barrel of water ranged from 25 cents to \$1

depending on availability. A profound difference between barrel water and bottled water is that barrel water represented a prime source, a way of obtaining water before tap water was available, whereas bottled water is a strategy to avoid tap water. Such is historical progress.

Bottled water as a consumer item conveys two distinct images. Some critics view it as a luxury item for the privileged few who are able to squander good money for what is readily available at the turn of a faucet. Such people are said to purchase bottled water to flaunt their privileged status, in a strained effort to demonstrate distinction and discrimination. The existence of "water boutiques" bears out this impression. One Dutch water boutique carries 70 different kinds of bottled water.

Bottled water as an amenity for the elite was a theme in a recent piece of political theater. A public health group faulted some Washington lawmakers for purchasing at taxpayers' expense bottled water for their district offices, while voting against water quality standards to protect the domestic supplies of their constituents. The Physicians for Social Responsibility in its report titled "Bottle Watergate" called these legislators "water hypocrites." (Gone are the kingly days when the accused could have loftily dismissed such allegations by declaring "Let them drink tap water.")

Befitting its image as a consumer frill, bottled water is offered with commercial allure. For example, various styles of dispensers are sold, to display and serve bottled water to best effect. Sparkletts advertises "Deluxe Designer Dispensers" that are "designed to fit both your decorating schemes and your space requirements." Made of handpainted fashion ceramics, these dispensers come in various designs: Tuscany Rose, Luz Floral, Desert Mirage, and Classic Floral.

But there is more to bottled water than its image as a beverage for the privileged. Some people drink bottled water because they are wary of the quality of their tap water. For example, because of water quality concerns along the border, the use of bottled water is high in Nogales, Arizona, and its use is a necessity for some in Nogales, Sonora. Many Tucson residents turned to bottled water in response to the delivery, or threatened delivery of CAP water. In such situations, the use of bottled water demonstrated a real concern about health and well being.

In fact, the EPA is considering mandating that small water utilities supply bottled water to replace supplies with elevated nitrate and sulfate levels. Some small towns in Texas already distribute bottled water to pregnant women and infants after high nitrate levels were discovered in the town's water wells. Turkey, a town in the Texas Panhandle, distributes vouchers redeemable at local grocery stores for six to eight gallons of bottled water.

But whatever the image, the sale of bottled water is a booming business. The International Bottled Water Association (IBWA), the trade association representing the bottled water industry, says the sales of bottled water have increased by five-fold over the last decade, and consumption per capita has increased 15 fold, with approximately 1 in 15 households using bottled drinking water. About 700 brands are sold in the United States, with consumers spending about \$2.7 billion on bottled water per year.

The IBWA defines bottled water as water sealed in a sanitary container, to be sold for human consumption. The varied types of bottled water include artesian water, mineral water, sparkling water, spring water, well water and purified water. Bottled water can be carbonated, either naturally or artificially, and it can be flavored, but flavoring must comprise

less than one percent by weight of the final product; otherwise it is a soft drink. Further, bottled water is without sweeteners or additives.

Approximately 75 percent of bottled water is obtained from protected sources such as springs, artesian wells, and drilled wells. The other 25 percent is derived from municipal water systems that meet federal and state requirements set by the 1974 Safe Drinking Water Act. That the source of some bottled water is public water supplies prompts suspicion among some consumers. Yet, bottled water from a municipal source is doubly protected, by the EPA and the U.S. Food and Drug Administration.

Various processing techniques are used to produce a distinct type and brand of bottled water. Bottled water usually is filtered to remove impurities and treated with ozone before bottling to kill any bacteria that may be present. Both mechanical and activated carbon filtration likely are used on chlorinated source water to remove residual chlorine and organic materials. The use of distillation, demineralization or reverse osmosis produces mineral-free water, such as distilled water. Or a bottler may add selected minerals and mineral salts to create the desired flavor for a specific type of drinking water.

Regulation of Bottled Water

Bottled water, unlike tap water provided by a utility, is considered a food, at least for regularity purposes. The U.S. Food and Drug Administration regulates bottled water, with EPA responsible for the safety of drinking water from public water systems.

The 1974 Safe Drinking Water Act required that FDA adopt bottled water standards compatible with EPA's national drinking water standards. Assisted by the American Bot-

tled Water Association, the FDA developed standards for quality and good manufacturing practices. Such standards require that bottled water meet certain bacteriological, chemical and physical standards. Tolerances also were set for certain substances, including arsenic, fluoride, lead, nitrate, zinc and total dissolved solids.

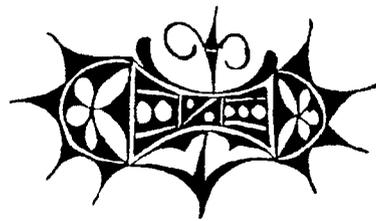
As EPA revises its drinking water regulations, FDA must make similar revisions in its bottled water regulations or publish why it didn't in the *Federal Register*. For example, in 1981 FDA set a level for trihalomethanes, a suspected carcinogenic formed when water is chlorinated, following EPA's action to regulate the substance in tap water. At that time FDA also adjusted its good manufacturing practices to provide for annual analytical testing. FDA requires that bottled water products are clean and safe for human consumption, are processed and distributed under sanitary conditions, and are produced in compliance with FDA good manufacturing practices. Regulations also require that the public be notified if the microbiological, physical, chemical, or radiological quality of bottled water falls below standard.

Further, domestic bottled water producers engaged in interstate commerce, i.e. selling their products in states other than the site of production, are subject to periodic, unannounced FDA inspections. The inspections are to ensure the producers are in compliance with all aspects of bottled water standards, the Fair Packaging and Labeling Act, and all other applicable regulations incorporated in the FDA quality standards.

Since bottled water lacks readily apparent product characteristics to differentiate between its various types, establishing standard definitions is important to build consumer trust. Without such definitions, advertising is likely to exaggerate, or be used to create added value for bottled

water to pique consumers' interest. This, in fact, was occurring, with the extravagant claims made by some water bottlers getting out of hand.

For example, Crystal Geysir Natural Alpine Spring Water was depicted as a very tempting elixir, indeed, from its claim to be "nature's perfect beverage" which "begins as the pure snow and rain that falls on 12,000-foot Olancha Peak in the towering Sierra. This pristine water is naturally filtered through the



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mountain's bedrock." No confusing this veritable nectar with mere tap water.

In response to such extravagant advertising, the North Carolina Agriculture Department in 1993 ordered Crystal Geysir and seven other bottled waters, including the popular Naya and Poland Springs brands, taken from store shelves in the state. The agency claimed "false and deceptive labeling" saying companies actually drilled underground wells to pump water to the surface for bottling.

Other states also took action to regulate the industry's water quality and labeling standards. For example, Georgia requires documented proof of a company's source of water, and Vermont requires bottlers to disclose any amounts of lead, arsenic and nitrate in their beverages.

Prior to the above state actions the

federal government already had faulted FDA for a neglect of its regulatory duties. A 1991 U.S. House Energy and Commerce Committee investigation of the bottled water industry found that 25 percent of the higher priced bottled water, including such brand names as Great Bear and Glacier Springs, comes from the same sources as ordinary tap water; another 25 percent of the bottlers were unable to document their sources of water; and 31 percent exceeded allowable limits of microbiological contamination. The committee faulted FDA's "inexcusably negligent" regulatory oversight.

In response to this situation, FDA recently published rules to promote honesty and fair dealing in the marketplace by establishing definitions for the various types of bottled water. Definitions were set for artesian water, groundwater, mineral water, purified water, sparkling bottled water, sterile water and well water. FDA's final rules defining bottled water types were announced in November 1995, to go into effect in May 1996.

The rules include specification of mineral content of water sold as mineral water. Mineral water previously was exempt from standards applying to other bottled water. Also water coming from a municipal supply now must be labeled to indicate its origin.

Defining spring water provoked controversy within the industry. Spring water is a highly desirable designation commanding higher prices. The International Bottled Water Association therefore wanted it broadly defined to include water captured through a borehole from an underground aquifer. More of a purist, the National Spring Water Association claimed spring water is limited to water flowing naturally to the earth's surface. FDA sided with IBWA.

Along with federal regulations,

domestic bottled water producers also are subject to inspection by state health officials and must comply with all applicable state laws and regulations. Some states, e.g., California, Pennsylvania and Florida, have adopted regulations that are stricter than federal requirements. Arizona does not have any laws regulating bottled water.

IBWA also has established a program of self-regulation. This includes unannounced National Sanitation Foundation inspections of bottled water producers who are IBWA members. NSF, the same organization that certifies home treatment devices, evaluates bottled water producers on their compliance with both the association's performance requirements and the FDA regulations pertaining to the production and sale of bottled water.

There is a movement underway for NSF also to provide national certification for bottled water. At present only 65 bottlers out of the many hundreds now operating participate in the NSF certification program, but the number is growing.

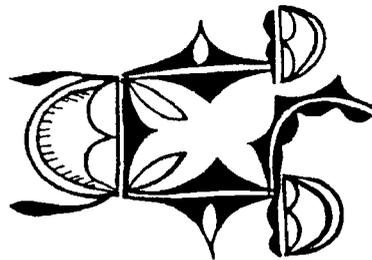
Tourists are advised that other countries do not necessarily regulate bottled water quality as carefully as the United States. For example, water bottled in Nogales, Mexico was found to contain industrial solvents. Also, UA water quality expert Chuck Gerba tells of purchasing bottled water in Greece with fecal coliform bacteria in it.

Flagstaff Peaks Bottled Water

If they were not often public entities, water utilities might be in a good position to profit from the increasing popularity and sale of bottled water. Utilities already are in the business of selling water, and the sale of bottled water would be merely adding to the established product line,

possibly like Ben and Jerry's coming up with another ice cream flavor.

The Flagstaff public water utility is attempting to break into the bottled water market with its Flagstaff Peaks water. The utility is marketing water from the caldera or inner basin of the San Francisco Peaks, the highest point in the state. The water, which is melted snowpack, comes from a secured, pristine U.S. Forest Service area, from three shallow wells and a number of springs and is the highest quality water available to the utility. This water source originally was developed at the turn of the century to provide water to Flagstaff. The utility believes Flagstaff Peaks is a unique and quality product.



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Processing the water has proven to be rather complicated thus far. The water has been trucked to Phoenix from Flagstaff for processing since no such suitable operation is available in Flagstaff to do the job. The water is chlorinated for transport. The Phoenix plant then carbon filters the water to remove the chlorine and further filters the water through a micro filter and treats it with ozone for further disinfection.

The water then is bottled, labeled and transported back to Flagstaff for distribution and sale. Negotiations are underway to involve a Flagstaff company in the processing and bottling of the water. The plan is to in-

volve mostly local firms in the operation.

The Flagstaff water utility went into the water bottling business to raise additional operating revenues. Sufficient earnings could delay future rate increases. Flagstaff already has steep water rates due to the high cost of drilling wells in a mountainous terrain and an uncertain surface water supply. Profits also could be used for needed structural improvements, such as replacing old water lines.

Other motives also prompted the city to vend its water. The City Council anticipated that bottling and selling city water would increase Flagstaff's tourist appeal, especially if the water were sold throughout Arizona and in other states. Flagstaff Peaks also is viewed as a possible souvenir item to be sold in gift shops. Along these lines, a considered marketing strategy was to include a small map of the Grand Canyon with bottles of Flagstaff Peaks. The water currently is available at the Flagstaff visitors center, as well as the local Safeway and Target stores.

A public water utility is at an obvious disadvantage in establishing this kind of operation which is more likely a private sector initiative. The city's role however is limited to supplying the water, with the private sector processing, bottling and distributing the product. The city collects a royalty of 75 cents a case.

The idea of distributing and selling Flagstaff water far and wide has not met with universal approval among some city residents. Some residents feel chauvinistic and protective about their water, claiming that Flagstaff water is too good to ship to Phoenix and other distant cities. They argue that Flagstaff should reserve its good water for its residents. Others are concerned that bottling and selling Flagstaff water might deplete local reserves and create a shortage.

Flagstaff Peaks has not yet lived up to initial expectations. Sales in

Flagstaff have been fairly good, but introducing the product beyond the city has not gone smoothly. The bottled water business is highly competitive and therefore difficult to break into. Despite difficulties, city officials remain hopeful as efforts continue to expand Flagstaff Peaks distribution and sales area.

Water Vending Machines

Neither fitting bottled water nor home treatment categories, water vending machines are a source of drinking water for many households. Such machines are conveniently located, often outside supermarkets. Customers bring their own containers, position them under a spout, insert a coin, usually a quarter, and receive a gallon of what they expect to be high quality water.

FDA considers water vending machines as a food vendor and regulates them accordingly, applying its 1978 Vending of Food and Beverage Model Ordinance. This ordinance does not involve water quality testing, but instead ensures that the machine meets design standards specified in the model ordinance; for example, that toxic materials were not used in its construction.

Since water for vending machines must come from an approved municipal source, the assumption is that the water meets EPA standards. Whatever the effectiveness of the machines' treatment process, therefore, dispensed water is unlikely to be of lesser quality than tap water and should be better because of the additional treatment provided.

The National Automatic Merchandising Association (NAMA) has been certifying water vending machines since 1985. Manufacturers voluntarily submit their products to NAMA for certification. NAMA certification involves water quality testing, with standards set for turbidity, total dis-

solved solids, total coliform, pH, chloride, sulfate and lead.

NAMA's samples water prior to entering the machine, then at the dispenser nozzle, and again at the nozzle after a flow of 250 gallons. NAMA has certified about 30 manufacturers of water vending machines.

NAMA is negotiating to involve NSF International in the certification of water vending machines. NSF, an independent testing organization that certifies drinking water treatment units, is highly respected in the water industry. Water quality standards acceptable to both organizations need to be worked out. Manufacturers could then decide whether to seek certification with NSF or NAMA.

Vending machines evaluated by NAMA have a service mark stating "NAMA listed." The service mark however may be within the machine and not visible to the consumer. Some states, including California, require water vending machines to be certified. Arizona has no such requirement.

Arizona county governments may have health codes with regulations pertaining to water vending machines. For example, Maricopa County's health code includes a provision for periodic sampling of water vending machines. Unsatisfactory lab results could result in the shutdown of the machine. Health officials generally admit, however, even in counties with such regulations on the books, the testing of water vending machines does not attract priority attention, unless a specific complaint is received.

Few studies have been done on the bacteriological quality of water vending machines. One such study was done recently by University of Arizona graduate students Cristobal Chaidez-Quiroz of the Department of Nutritional Sciences, and Pat Rusin and Jaime Naranjo of the Department of Soil, Water, and Environmental Science and Chuck Gerba. The researchers conducted bacteriological

analyses on water samples taken from 30 water vending machines in the Tucson area.

The researchers found *Pseudomonas aeruginosa* in 23 percent of the samples. *Pseudomonas aeruginosa* is an opportunistic pathogen that possibly is harmful to sensitive populations, such as the elderly, very young children and the immuno-compromised. It has the potential to contaminate food and multiply very rapidly.

The researchers also found total coliform in 20 percent of the samples, and heterotrophic plate count (HPC) bacteria in all the samples, with 73 percent of the HPC samples having greater than 500 organisms per ml. EPA regulations require that HPC bacteria not exceed 500 cfu per ml in drinking water. Not much is actually known about the effects of HPC bacteria on human health, although some members of this group are considered opportunistic pathogens, such as *Aeromonas* and *Flavobacterium*.

Swab testing on the nozzle of the water dispensers and the drains found that contamination of these sites may affect the bacteriological quality of the dispensed water. Most of the samples had drains contaminated with both total coliform and fecal coliform. The researchers suggest that improper cleaning of the vending machines may cause the high levels of bacterial contamination.

The researchers suggest that improved cleaning of water vending machines may reduce the bacterial concentrations. They also recommend that since the vending machines rely on point-of-use and point-of-entry treatment processes, the machines may be appropriately evaluated by the established procedures for certifying microbiological purifiers. Consumers then would have the assurance that the vending machine is dispensing high quality water.

Increasing Consumers' Water Awareness

People have become more aware of their water quality because recent government regulations require utilities to notify their customers if certain problems arise; e.g., if crypto or fecal coliform is detected in their water supplies. Receiving such a notice would likely raise consumers' water quality awareness and may encourage them to check into alternatives to tap water, if not actually go out and purchase such alternatives.

The water quality awareness of older people is increasing. Infections that have no affect on youth could prove fatal to older people, especially if they have certain preexisting health conditions. As more older people live longer concern about water quality therefore broadens in society. Also, medical treatments are available to prolong the lives of people who subsequently need to be very cautious about the water they drink. As result, citizens' water quality awareness has increased, with many investigating home treatment options.

Just as people must choose among various options when assembling a stereo or a computer system, they also face various decisions when working out a domestic water quality strategy. First, they must decide whether they, in fact, need to take special precautions. Presumably this decision is made based upon a sound understanding of their own domestic water quality. They then can decide what actions, if any, to take to improve their water.

People connected to a public water system should be able to get water quality information from the serving utility, or from state or local health officials. The water supplier can provide a listing of what it has monitored in the drinking water. Help with interpreting the data can be obtained from utility personnel,

state or local health officials, or by calling the Safe Drinking Water Hotline at 800-426-4791.

Some householders may want to contract a private lab to test their water supplies, either because they are wary of information provided by a utility or because they suspect contaminants may be entering their water supply through their domestic delivery system. For example, lead may have been used in their home plumbing systems and may be entering their water. Also, people on private wells need to have their water tested for various contaminants. The Arizona Department of Health Services (602-255-3454) provides a list of labs in Arizona certified to test water.

A private water lab will perform a basic test for bacteria for about \$25. A test for the primary contaminants listed by the Safe Drinking Water Act including arsenic, barium, cadmium, chromium, lead, and mercury costs about \$100.

A person saves money if requesting a test for a specific contaminant, e.g. nitrate or lead, rather than having tests conducted for a range of contaminants. Advice about which tests should be done can be obtained from local health officials or by calling the Safe Drinking Water Hotline.

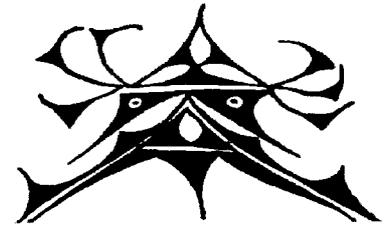
Consumers are advised to carefully research their water quality and their treatment options and not rely on advice proffered by salespeople with a home water treatment device to sell. Such salespeople have been known to misrepresent water quality information, not to mention the efficacy of their products.

Caution Advised for Certain Water Users

People receiving their water from large municipal water providers should feel confident that their water has been thoroughly treated and meets all established water quality

standards. A small utility or private water company in a rural area, however, lacking the resources of a large organization, may be unable to consistently maintain established water quality standards.

For example, water with a high nitrate level was found in areas near Quartzite. High nitrate, which is a



San Ildefonso water jar design

concern to pregnant woman and children, often comes from fertilizers. Also, the drinking water provided to the residents of the Mountain View subdivision in St. John's has been found to contain an excess amount of radium. Because of such occurrences, some officials suggest that people served by small utilities in rural areas install home water treatment systems. This advice also is applicable to people with private wells.

Immuno-compromised people are advised to avoid tap water if its source is surface water, even if supplied by a large urban utility. Surface water is likely to contain more impurities, including crypto, than groundwater and is subject to rapid changes in water quality. Flagstaff and Phoenix both include surface water in their water supplies.

The above represent general conditions that prompt citizens to avoid direct tap water. Sometimes special situations occur that also cause people to adopt tap water alternatives. For example, last summer some Flagstaff residents received brown water from their taps. The condition

was due to a chemical reaction in the treatment process and lasted for several days. During Tucson's ill-fated introduction of CAP water, some residents received discolored tap water. Despite health officials' claim that the water was safe to drink, many residents sought options to drinking it.

Gary Woodard of the UA's Water Resources Research Center conducted a study of the purchase of bottled water and home treatment systems by Tucson residents during the CAP affair. He found that households that were switched to CAP water were increasing their purchase of bottled water at an annual rate of 2.8 percent before receiving CAP water, and after the introduction of CAP water the figure jumped to 30.4 percent, a ten-fold increase.

But even those households remaining on groundwater increased their consumption of bottled water. Before the introduction of CAP water, such households were increasing their purchase of bottled water at an annual rate of 3.3 percent, with the figure rising to 10.6 percent after CAP water was delivered to other sections of town, a three-fold increase. This group's increased bottled water use is mainly explained by aggressive advertising and the increased availability of bottled water.

This pattern did not hold, however, with the purchase of home water treatment devices. Households that were not switched to CAP water were increasing their purchase of home treatment devices 2 percent per year both before and after CAP water came on line.

On the other hand, households that were switched to CAP water were increasing their purchase of home treatment systems at an annual rate of 2 percent before receiving CAP water. After the introduction of CAP water the figure jumped to 12 percent, a six-fold increase. Home water treatment devices are not

marketed through the same advertising strategies as bottled water.

Conclusion

Most U.S. citizens share a belief in progress. Underlying this belief is a presumption of our country's technological superiority and its political and cultural preeminence. Our much vaunted civilization, with its sterling accomplishments and wondrous effects, suddenly seems tarnished when doubts arise about a service as basic as the delivery of quality drinking water. Cynics then might remark with some justification, "We can put a man on the moon, but we cannot be sure we are getting safe drinking water."

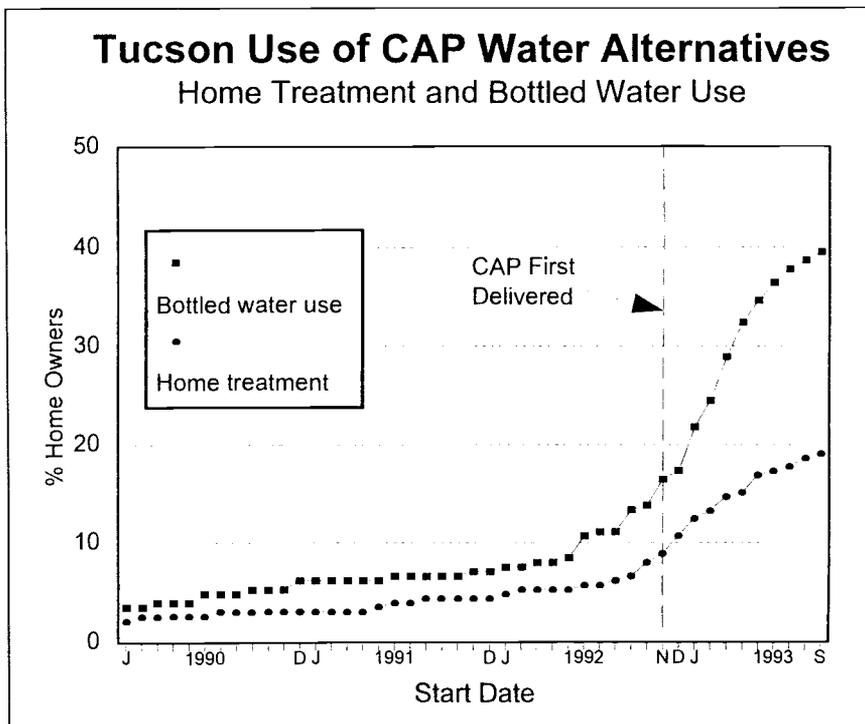
Things may not be getting any better. With Congress in the grip of an anti-regulatory fervor critics fear that existing water quality standards, which many already find wanting, may be further slackened. Fewer services and fewer regulations seem to be the emerging cut and fashion of government.

Will ensuring drinking water quality attract less government atten-

tion? The ultimate privatization of a government service is for the individual, private citizen to take over. In this regard, customers who purchase bottled water and home treatment systems have privatized a previously-performed government service. This could involve an equity issue.

The Rocky Mountain Institute conducted a planning exercise titled "The Future of Municipal Water Services" for the EPA. To prompt discussion RMI offered a future scenario of financially strapped government agencies and water utilities unable to ensure safe drinking water. With reports of waterborne illnesses a common occurrence, the wealthier folks invest in home treatment units. The less privileged rely on minimal water service, with universal water quality no longer assured.

It is an extreme scenario meant to provoke discussion, but does make a valid point. Since water is a basic necessity of life, all citizens should be able to expect a safe and available supply for their needs. That we should have to purchase water over



and above what flows from our faucets, or further treat it to achieve acceptable drinking water quality seems patently unjust. If this becomes necessary, the wealthy would have an unfair advantage in obtaining safe drinking water.

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The ideas and opinions expressed in the newsletter do not necessarily reflect the views of any of the above people or organizations.

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