

BOTTLED DRINKING WATER

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Summary

The bottled water industry is a huge business that involves many of the biggest food brands in the world and worth billions. It has grown dramatically in the last decade and today millions of people around the world, in developed and developing countries, consume bottled water regularly.

Bottled water competes with soft drinks and tap water. While it is healthier than most other soft drinks, studies indicate that it does not have a real benefit over tap water. In addition, in many places around the world bottled water is regarded as a food item, and as such is less regulated than tap water.

The production and consumption of bottled water entails various impacts on health, environment and society. The health risks are related not only to the quality of the water, but also to the quality of containers and to storage conditions. The environmental hazards are linked to the energy used and resources consumed in the processing, bottling and shipping of bottled water and to the huge amounts of bottle waste which is

not recycled. These, in turn, raise social, equity and justice questions, such as who is being exposed to the risks and who should pay for the damages.

The growing awareness to the negative impacts of bottled water on the environment and society has led to some improvement in the bottled water regulation. It also pushed the industry to improve its use of resources and waste management schemes. At the same time, in the last couple of years several local and regional governments have been taking various actions to reduce bottled water consumption. These actions include restrictions on the purchase of bottled water by public funds, banning bottled water in public events and taxes on bottled water.

1. Regulatory framework

Drinking water, or potable water, is water intended for human consumption with no other ingredients except that it may contain safe and suitable disinfectants. Drinking water is regulated at various levels. In the United States (US), for example, drinking water is regulated by the EPA (Environmental Protection Agency) under the Safe Drinking Water Act (SDWA). In the EU (European Union) the primary piece of legislation governing drinking water is the water framework directive and each member state is responsible for its implementation and inspection. Individual states in the US or countries in the EU can set themselves stricter drinking water regulation.

Bottled water is drinking water sealed in bottles with no added ingredients except that, like tap water, it may contain safe and suitable antimicrobial agents. Fluoride may be added within limitations set in the bottled water quality standards (this varies between countries).

The regulation of bottled water is complex. Four levels of regulation apply to the bottled water industry: international, national, local and trade associations standards. While seemingly heavily regulated, often bottled water may comply with only a few of these standards, while disregarding the others. In the US, for example, the FDA has a regulatory supervision only over products which are sold between states (“interstate commerce”). However, about 60-70% of all bottled water in the US is manufactured domestically, and never crosses any US state lines, hence subject only to the state regulations, which vary significantly between states.

In many places bottled water is considered a food item and regulated accordingly. In the US the FDA (Food and Drug Administration) regulates bottled water under the Federal Food, Drug, and Cosmetic Act (FFDCA) (For complete regulatory definitions, see 21 CFR 165.110(a)(2)). In the EU it is covered by the European Communities (Natural mineral waters, spring waters and other waters in bottles or containers) Regulations, 2007(S.I. No. 225 of 2007). This legislation covers the definitions of water types, their exploitation, treatment, microbiological criteria, chemical contaminants, sales description, labeling and packaging. Bottled water under the categories "spring waters" and “other waters” must also comply with European Communities (Drinking water, No. 2) Regulations, 2007 (S.I. No. 278 of 2007).

The FDA’s designated standard definitions for various types of bottled water are listed in the Glossary. These consist of: artesian water, mineral water, purified water, spring water and sparkling water.

While many people assume that water in bottles is mineral water, in reality bottled water comes from a variety of sources, underground as well as surface. About 40% of bottled water sold around the world is actually municipal water sealed in bottles, and may or may not be further treated.

2. History

The origin of the industry is in the early 1800s. Amongst the early sellers of bottled water are names that are still known today: Evian, San Pellegrino, Perrier, and Vittel, among others.

Regulation of the bottled water industry began in the mid-nineteenth century in Europe. In order to sell mineral water, a company had to prove that the mineral content of water was stable over two years. In the early 1900s clean water was not widely available everywhere and the bottled water industry thrived, both in the US and in Europe. Regulation of bottled water in the United States had begun in 1938, when bottled water was defined a packaged food under the FFDCA. .

When clean, safe and cheap drinking water was becoming widely available, the demand for bottled water decreased and the industry declined sharply. The bottled water industry struggled to survive until the 1970s, when the trend changed. Sales have been growing dramatically since then.

During the early 1990s controversies concerning bottled water quality began to emerge. Few occasions of water contamination (in particular: Perrier water contamination with high levels of benzene, and Natural Springs contamination with high levels of coliform bacteria) raised the quality of bottled water onto the agenda, and resulted in improved regulation.

Other controversies regarding bottled water have gained momentum lately. These include concerns over the energy and materials that are used for making bottles and shipping water around the globe and the implications for climate change; concerns regarding the amount of bottles which are not recycled and the harmful toxins that are released to the environment in the very long decomposing process in landfills; concerns about the privatization of a traditionally public good, as bottled water companies make huge profits by withdrawing water from public water sources and reselling it; and concerns regarding the impact of the industry on communities in areas in which spring water is over pumped and could run out, hence harming those who rely on this water for their livelihood.

3. Impact

3.1. Health Impact

Bottled water may be very useful and handy in times or places where tap water is unavailable or of bad quality. Yet in most developed countries, as well as many developing countries, tap water is readily available and is of good quality, thanks to strict water standards and regulation.

The quality of the water is, of course, the most immediate threat to the health of those who drink it. However, it should be noted that impacts on the environment may also affect human health, thus adding indirect risks which are not limited to the consumers of the bottled water themselves. Indirect health risks are not covered in this article.

3.1.1. Minerals

According to the World Health Organization (WHO), drinking water is generally not a significant contributor to daily dietary nutrition, but could be important in cases of dietary insufficiency. Nonetheless, some drinking water minerals have been shown to have favorable effects.

In particular, calcium (Ca^{2+}) and magnesium (Mg^{2+}), which are abundant in “hard” water, have been shown to be associated with reduced ischemic cardiac mortality in hard water areas. Ca^{2+} -and Mg^{2+} -rich mineral water could provide a significant amount of the recommended dietary mineral intake of adults, in a biologically available form. While many of the bottled mineral water brands contain high levels of both minerals, distilled bottled water (water which is deficient in all dissolved substances) contain none, and if consumed regularly, might lead to mineral deficiencies.

Drinking-water may be important as a source of skeletal fluoride. It has been suggested that there is a minimum level of fluoride in water, below which net loss of fluoride from the skeleton may occur. In many countries public water is being fluoridised in order to reduce tooth decay and prevent cavities. Tooth decay (dental caries) is one of the most prevalent chronic diseases worldwide. In countries where the public water is not enriched with fluoride, consumption of fluorides in bottled water is preferred by some people, as it is a source for this mineral. On the other hand, in countries where public water is enriched with fluoride, moral, ethical, and safety controversies regarding water fluoridation brought people to prefer bottled water with no added fluoride over enriched tap water.

3.1.2. Monitoring of contamination

Unlike tap water quality, which is subject to strict governmental regulatory standards, in most countries bottled water is regarded as a food product and regulated as such. Commercial foodstuff is subject to less restricting regulations and enforcement methods. Emphasize is mostly put on truthful labeling, sanitary processing and transport conditions.

In the US, for example, the EPA regulates tap water, while the FDA regulates bottled water. EPA's Office of Ground Water and Drinking Water has issued extensive regulations on the production, distribution and quality of drinking water, including regulations on source water protection, operation of drinking water systems, contaminant levels and reporting requirements. The FDA monitors and inspects bottled water products and processing plants under its general food safety program, rather than a specific bottled water program. Because the FDA's experience over the years has shown that bottled water has a good safety record, bottled water plants generally are assigned low priority for inspection.

For example, while municipal water suppliers in the US are required to test for harmful microbiological content in water several times a day, bottled water companies need to test for these microbes only once a week. Similarly, public water systems are required to test for chemical water contaminants four times as often as bottled water companies. However, bottled water regulation has been improving in the last decade, and in general is of a good quality.

Bottled water could be contaminated in different stages. It may contain contaminants originating in the source waters, as well as substances which may have entered the water in the treatment plant or the bottling process. Contamination could also result from the continuous contact with the containers the water is stored in. Since many bottles contain water derived from tap water, contaminants could be the same ones found in the public water system. A few exceptions are the metal contaminants which may be present in tap water due to its exposure to household plumbing pipes and are therefore less likely to be found in bottled water.

A fundamental difference between incidents of tap and bottled-water contamination is the speed in which consumers are informed about it, either by risk communication or a recall of bottles. The key reason is that whereas tap water is consumed in a well defined geographical area and therefore the public can be informed by local agencies and local media, bottled water is manufactured and distributed in various areas or continents and consumers are geographically spread. This poses a challenge to risk communication for both bottled water manufacturers and distributors. Indeed, often consumers are not informed about contamination occasions. As a result, the public's ability to protect itself from events of bottled water contamination is limited.

Every year there are a few incidents of recalls of contaminated water bottles. Causes for recalls over the years included contaminants such as: benzene, sodium hydroxide, kerosene, styrene, yeast, tetrahydrofuran, sand, fecal coliforms, elevated chlorine, glass particles and others. Between 2003 and 2008, in the US alone, there were at least 27 such incidents. Not all events included notification to the public, as some contaminations were identified before the product reached the markets. Causes for the 2003-2008 recalls included occasions where the following substances were found in water: diluted cleaning solution, mold, bromate in levels up to 39.7µg/L (four times the maximal federal limit), excessive arsenic, algae, coliforms and/or other bacteria, excessive sodium polyphosphate. Other recalls were due to water with foul odor and/or taste or bottles which were prepared, packed or held under unsanitary conditions.

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Biographical Sketches

Dr. Yael Parag is a senior researcher at the Lower Carbon Futures team in the Environmental Change Institute, Oxford University School of Geography and the Environment.

Yael is a policy scientist and is interested in the theory of the policy process and the roles that policy actors' networks play at the different policy stages. She studies environmental policies, and in particular those related to energy, climate change and water.

In her current research she is looking at agents that could mobilize change from the 'middle-out' (as oppose to 'top-down' and 'bottom-up'). In that instance she focuses on the roles that different communities and social networks play at governing energy policies and practices in the UK. Previously she researched personal carbon trading, the politics of bottled water, drinking water governance, and industrial emissions to the air.

Tamar Opher, MSc, is a research assistant and a PhD student at the Department of Environmental, Water & Agricultural Engineering in the Faculty of Civil and Environmental Engineering, Technion – Israel Institute of Technology.

Tamar has two bachelor's degrees: in biology and computer science and a master's degree in environmental engineering. In recent years she has been involved in research projects concerning various aspects of water quality modeling, such as biofouling in water pipelines, cyanobacterial blooms in lakes and water reservoirs and effects of multiannual climatic trends on lake water characteristics.

She is interested in water reuse, sustainable water management and in computerized tools which may facilitate sustainable planning and management of natural resources.

Currently she is working towards a PhD diploma, developing a multi-criteria LCA-based model of wastewater reuse in the urban sector.