THINK OUTSIDE THE BOTTLE

RESPONSIBLE PURCHASING GUIDE

bottled water alternatives

UNIVERSITY EDITION

RPN
Responsible Purchasing Network
Center for a New American Dream

about this guide

The Responsible Purchasing Guide for Bottled Water Alternatives, University Edition is published by the Responsible Purchasing Network in print, as a PDF file, and on the web. Print and PDF copies are available to the public for purchase. The online edition includes additional resources available to members of the Responsible Purchasing Network, including: searchable product listings, multiple policy and specification samples, comparisons of standards, and related documents. Visit www.ResponsiblePurchasing.org to purchase a copy or to access the members-only web based edition of the Guide. Visit www.ResponsiblePurchasing.org to purchase a copy or to access the members-only web based edition of the Guide.

about the Responsible Purchasing Network

The Responsible Purchasing Network (RPN) was founded in 2005 as the first national network of procurement-related professionals dedicated to socially and environmentally responsible purchasing. RPN is a program of the Center for a New American Dream (www.newdream.org) and guided by a volunteer Steering Committee of leading procurement professionals and stakeholders from government, business, educational institutions, standards setting organizations, and non-profit advocacy organizations.

acknowledgements

The Responsible Purchasing Network (RPN) would like to thank the following people for assisting with the development of this Guide. Their expertise helped to ensure quality and accuracy, though RPN alone accepts responsibility for any errors or omissions. Affiliations listed below were current when input was provided to RPN and are listed for identification purposes only and do not imply organizational endorsement of this Guide.

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This Guide was developed thanks to the generous support of the Garfield Foundation, the Richard and Rhoda Goldman Fund, the Oram Foundation: The Fund for the Environment and Urban Life, the Park Foundation, and an anonymous donor.

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This Guide serves as an update to RPN's previous publication, "Think Outside the Bottle: Bottled Water Alternatives." In order to facilitate the efforts of educational institutions throughout the world that are seeking to reduce or eliminate purchases of bottled water, RPN has created an updated version of its bottled water alternatives guide, tailored specifically for universities and colleges. Most of the information in this Guide is applicable to any institutional purchaser, but a special effort was made to address the unique concerns of colleges and universities.

SOCIAL AND ENVIRONMENTAL ISSUES

Americans bought a total of 8.7 billion gallons of bottled water in 2008. According to one estimate, manufacturing bottled water in the United States required the energy equivalent of 32-54 million barrels of oil. Nearly 50 billion new polyethylene terephthalate (PET) plastic bottles were produced in 2005 from virgin rather than recycled materials, producing additional greenhouse gases and solid waste. In 2004, only 14.5 percent of non-carbonated beverage bottles made from PET in the United States were recycled. For each gallon of water that is bottled, an additional two gallons of water are used in purification and production. Furthermore, the entire process of manufacturing plastic bottles and transporting them to stores requires nearly 2,000 times the energy of supplying tap water. Many of these impacts can be avoided by encouraging students to consume water from municipal tap sources through filters, fountains and bottle-less coolers.

BEST PRACTICES

Though bottled water has become widespread in recent years, colleges and universities can shift to tap water with relative ease if they use a combination of careful planning, and the best practices outlined in this Guide, such as the following:

- Involve stakeholders in the process;
- Measure bottled water impacts and estimate cost and environmental savings from switching to alternatives;
- Upgrade potable water infrastructure such as water fountains;
- Cancel or amend bottled water contracts and identify, purchase, and implement alternatives such as filters, fountains, bottle-less coolers, and reusable containers; and
- After implementation, review the program's effectiveness, report the results and recognize the efforts of the people involved in the effort.

COST, QUALITY, AND SUPPLY

Colleges and universities can potentially achieve substantial savings by eliminating the purchase of bottled water. On average, the cost to treat, filter, and deliver water to residents in the United States is 0.2 cents per gallon – roughly 750-2,700 times cheaper than bottled water on a per gallon basis. For the most part, this water is also very safe for consumption. Over 90 percent of U.S. municipal water systems regularly meet or exceed the EPA's regulatory and monitoring requirements. However, a wide variety of cost-effective water filters are readily available to remove contaminants when they are present. Compared to bottled water, water fountains save money, especially when installed in easily accessible, highly visible areas such as main hallways, waiting areas, and cafeterias. Bottle-less water coolers are another smart option, drawing water from the tap and eliminating the expense of purchasing bulk bottled water. Reusable drinking water containers have low lifecycle costs and have lower human and environmental impacts than single-serve plastic bottles.

SPECIFICATIONS

This Guide includes a model specification, developed by the Responsible Purchasing Network, and several sample specifications.

STANDARDS

The Environmental Protection Agency (EPA) regulates tap water, while the Food and Drug Administration (FDA) regulates bottled water because it is considered a food product. The standards are different and are enforced differently. It is not uncommon for bottled water to be sold without ever having been tested by the FDA, especially if it is sold within the same state where it was produced.

The leading standards for water treatment units (e.g., filters, treatment systems, chemicals) are the National Sanitation Foundation/American National Standards Institute (NSF/ANSI) standards 42, 44, 53, 55, 58, 60, 61, and 62.

Colleges and universities can use standards from the Association for the Advancement of Sustainability in Higher Education's (AASHE) Sustainability Tracking, Assessing and Reporting System (STARS) program to document and report progress on sustainability initiatives.

POLICIES

Formal policies enacted by educational institutions should outline the underlying motivation for phasing out bottled water, communicate key messages to stakeholders, state goals, set a timetable, and mandate progress reports. Policies can be set in a variety of manners such as a mandate from the university administration or a referendum that is voted on by the student body. It is possible to forgo a formal policy with a dedicated initiative by a procurement official, but formal policies provide guidance and goals, ensure continuity in the case of personnel or administrative turnover, and encourage adherence to deadlines.

PRODUCTS

RPN's online product database includes over 2,000 water filters certified by NSF/ANSI 42, 44, 53, 55, 58, 60, 61, and 62 to remove various contaminants.

CALCULATOR

The Bottled Water Calculator developed by RPN, compares the cost and environmental impacts of bottled water with tap water.

CASE STUDIES

Washington University in St. Louis and The University of Winnipeg were the first American and Canadian schools, respectively, to end the purchase of bottled water for both administrative use and in retail operations. These initiatives are outlined in this section.

CONCLUSION

Bottled water is environmentally damaging and wasteful and fiscally unnecessary. Given the wide availability of safe, low-cost tap water, and the wide array of appropriate and cost-competitive filters and other drinking water dispensing equipment, switching to tap water saves consumers money and dramatically reduces environmental impacts, including greenhouse gas emissions, water consumption, and waste generation. A growing number of buyers, both public and private, are thinking outside the bottle and making the switch – providing models by which others can replicate their success. We hope this Guide will ease your university's transition to bottled water alternatives while cutting costs and lightening your environmental footprint.

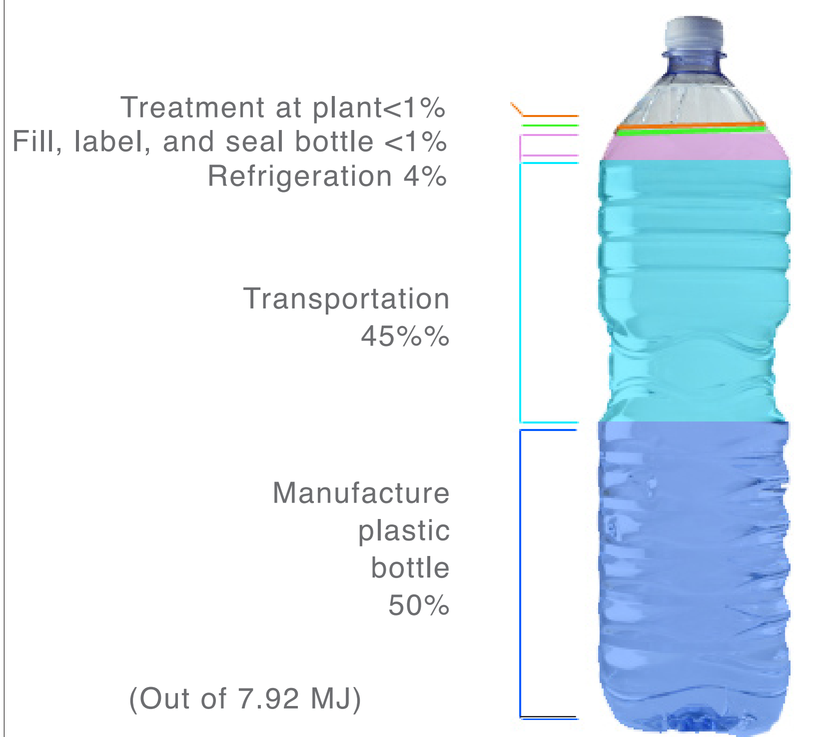
Americans bought a total of 8.7 billion gallons of bottled water in 2008, sold in a variety of containers from small single-serving bottles to multi-gallon water cooler bottles (BMC, 2009).

The increasing popularity of bottled drinking water has significant environmental and social impacts, from the energy used to produce the plastic containers and deliver filled bottles to consumers, to the concentrated water withdrawals near bottling facilities, to the plastic waste from discarded bottles. By choosing tap water over bottled water, universities can significantly reduce negative environmental impacts while also saving money.

ENERGY AND GREENHOUSE GAS EMISSIONS

Extraction, pumping, bottling, transporting, and chilling bottled water is less energy efficient than using the existing network of reservoirs, storage tanks, and pipes that furnish tap water to most homes and buildings in the U.S. (EPI, 2006). The vast majority of energy required in the manufacturing of bottled water occurs during the production of the plastic water bottles and transportation (Pacific Institute, 2009).

Figure 1: Energy Required to Make Bottled Water

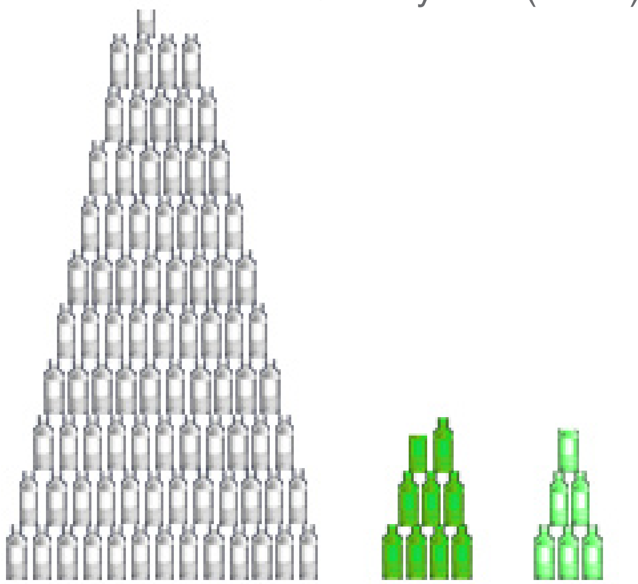


Pacific Institute, 2009

Most plastic water bottles are energy intensive to produce and derived from petroleum. Ninety-six percent of the bottled water sold in the U.S. in 2005 was sold in petroleum-based polyethylene terephthalate (PET) containers, most of which were single-serve sizes of one liter or less (CRI, 2007). In 2007, 1 million tons of PET was used to make bottles for U.S. consumption at a rate of approximately 100,000 MJ/ton of PET. Also, as the container volume increases, bottlers are more likely to use polycarbonate bottles instead of PET, which requires approximately 40% more energy to produce than single-serve PET bottles (Pacific Institute, 2009).

The transportation of bottled water accounts for a substantial amount of energy. Water, weighing one metric ton per cubic meter, requires a significant effort to ship. The distances and mode of transportation greatly affect the total amount of energy used. Evian water, which is sourced in France, is illustrative of some of the long-distance commutes bottled water takes from source to consumer. Evian is trucked from various sources to French ports, shipped to the United States across the Atlantic Ocean, transported by train and then distributed

Figure 2: Percentage of Plastic Bottles Recycled (2004)



Source: APC, 2005; EPI, 2006

locally by truck, accruing a combined energy cost of approximately 5.8 MJ/liter (Pacific Institute, 2009).

According to one estimate, the entire production of bottled water in the United States required the energy equivalent of approximately 32-54 million barrels of oil. The energy required to produce tap water, by comparison, requires 2,000 times less energy (Pacific Institute, 2009).

While PET is considered less toxic than many plastics, manufacturing PET resin does generate toxic air emissions in the form of nickel, ethylbenzene, ethylene oxide and benzene (EC, 1996). Furthermore, nearly 50 billion new PET plastic bottles were produced in 2005 from virgin rather than recycled materials, thus producing additional greenhouse gases (CRI, 2007).

The use of post consumer PET is very rare. Major beverage companies, such as Pepsi, have begun to incorporate post consumer PET in their plastic bottles, but recycled PET only accounts for 10 percent of material used in bottles.

If the percentage of post consumer PET used in plastic bottles across the county was 25 percent (in 2004), the energy equivalent of 4 million barrels of oil could have been saved (CRI, 2006).

END OF LIFE MANAGEMENT

Most plastic water bottles are discarded as trash. In 2004, only 14.5 percent of non-carbonated beverage bottles made from PET in the United States were recycled (see Figure 2), although this figure is increasing (APC, 2005). The recycling rate increased to approximately 23 % in 2006, although this still represented 633,000 – 999,000 tons of PET entering landfills annually (GAO, 2009). In 2004, almost 40 percent of the PET bottles for recycling in the U.S. were exported—often to China—requiring additional energy to transport (EPI, 2006). There are also concerns about lax environmental and worker safety standards of overseas recyclers, producing yet more pollution while endangering the health of workers (Vidal, 2004).

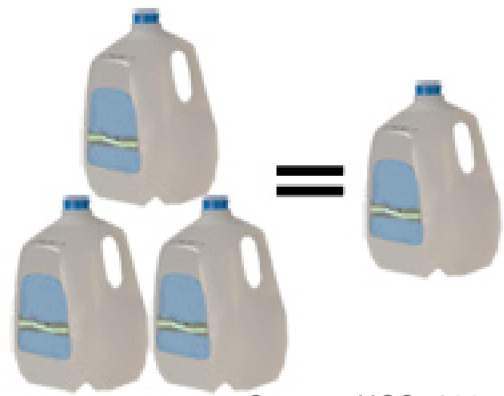
When bottles are burned in industrial incinerators, hazardous materials such as chlorine and dioxin can be released into the air (CRI, 2007). Though pollution control equipment at state of the art waste combustion facilities can help to minimize these hazardous emissions, doing so comes at a premium which further increases the net cost of bottled water.

WATER WASTE

Water resources on local, regional, national, and global scales are becoming even more precious due to increasing population and scarcity. Ironically, it takes substantially more than one gallon of water to produce and distribute one gallon of bottled water. Millions of gallons of water are used in the plastic-making process, and for each gallon that goes into the bottles, two additional gallons are used in the purification process. See Figure 3 (UCS, 2007).

Figure 3:

For each gallon that goes into bottles, two additional gallons are used in the purification process



Source: UCS, 2007

LOCAL WATER RIGHTS

Bottling plants can adversely affect local water supplies. Pumping large quantities of water can deplete underground aquifers that supply water to local communities and aquatic wildlife habitats (EPI, 2006). The appropriation of public water supplies by private entities raises social justice concerns when local users are displaced and public resources are commodified (EPI, 2006). These concerns are heightened in the case of imported water, where less affluent local populations may be deprived of vital water resources in order to provide "convenience" water to consumers elsewhere (IFG, 2001).

WATER QUALITY ISSUES

In the United States, tap water is more closely regulated than bottled water. Under the Safe Drinking Water Act, the Environmental Protection Agency (EPA) is responsible for tap water standards whereas bottled water is regulated by the Food and Drug Administration (FDA). The FDA standards are based on the EPA's tap water standards. However, ***FDA testing is less frequent and covers fewer contaminants***. Moreover, FDA rules do not apply to water packaged and sold within the same state (NRDC, 1999). Furthermore, the FDA does not require bottled water manufacturers to make test results available to the public, even when contaminants have been found (GAO, 2009). For more information, see **Standards**.

The Natural Resources Defense Council (NRDC) completed a four year study in 1999 and found that one-third of 103 brands of bottled water studied contained some levels of contamination, including traces of arsenic and E. coli. The study did not conclude that bottled water quality on the whole was inferior to that of tap water, but cautioned that the regulatory framework for bottled water is inadequate to assure consumers of either purity or safety (NRDC, 1999).

Moreover, bottled water is very often derived from municipal tap water sources. In 2006, approximately 44 percent of all bottled water in the United States originated from municipal tap water and was sold as "purified" water, with the remaining 56 percent coming from protected springs or groundwater (Pacific Institute, 2009).

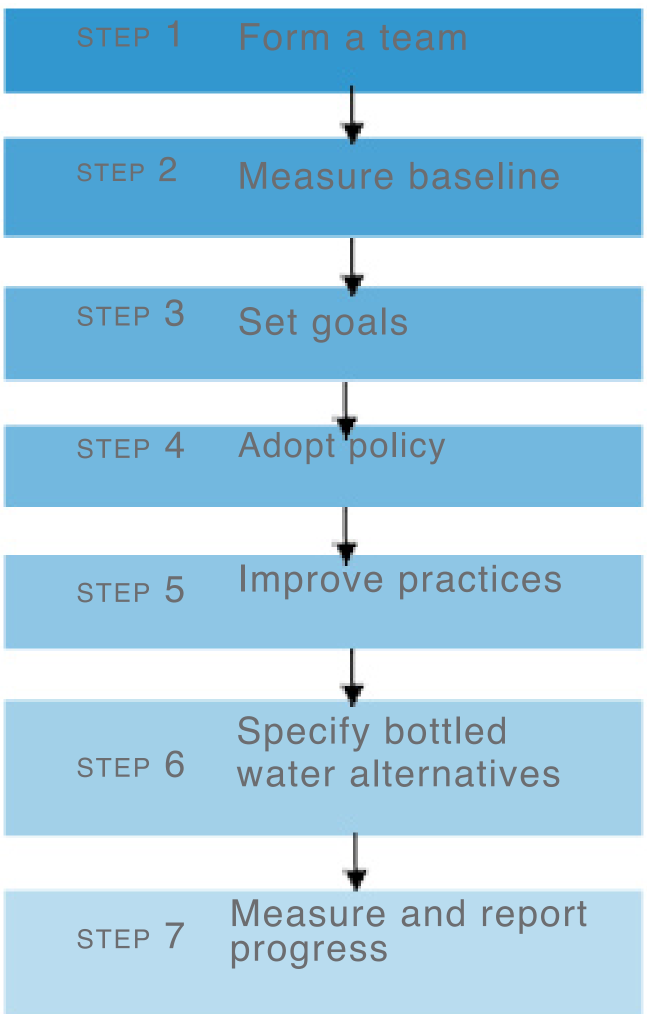
Chemical leaching from plastic bottles is an additional environmental and human health concern. Polyethylene terephthalate (PET, PETE, or #1), the plastic used for packaging most single-serving bottled waters, is not meant for repeated use, but consumers often do refill and reuse these bottles. PET plastic is considered more stable and less prone to leaching than other forms of plastic, but studies suggest that with repeated use PET containers may release di(2-ethylhexyl) phthalate (DEHP), an endocrine-disrupting compound and probable human carcinogen (Masterson, 2006). Another study found elevated levels of the chemical, antimony, in water bottled in PET bottles, and traced the source of contamination to the bottles themselves, although the concentration levels were below those currently considered safe for drinking water in the U.S. and Canada (SKC, 2006). Studies have also found that toxin concentrations increase the longer the water is in the bottle (Masterson, 2006). Considerable attention has been paid to the chemical leaching problems associated with Bisphenol A (BPA). Although the use of BPA raises health and safety issues, it is important to note that PET plastics do not contain BPA (PETRA, 2008). BPA and its use in polycarbonate bottles will be discussed in further detail in the "Reusable Containers" section of this Guide's **Cost, Quality, and Supply chapter.**

In many cases, simply switching from bottled water to tap water addresses these concerns. However, not all tap water is the same. The EPA reports that over 90 percent of U.S. public water systems meet its standards for safety (EPA, 2007). Even so, due to a combination of pollution and deteriorating equipment and pipes, some public water systems deliver drinking water that contains contaminant levels that exceed EPA limits (either legal limits or unenforced suggested limits) and may pose health risks to some residents. Addressing the problem of aging water infrastructure will require significant investments, but evidence suggests that this investment pays off in increased economic activity. Data from a joint U.S. Conference of Mayors and Cadmus Group study shows that "a $1 increase in local government spending on water and sewer infrastructure and operations and maintenance (O&M) increases total local economic activity by $2.62" (USCM, 2008).

In summary, quality concerns exist for both tap water and bottled water. Before implementing a new policy or practice prohibiting or limiting bottled water, check the EPA's online database of reports from local water quality districts: **www.epa.gov/safewater**. If the report you need is not in the database, your water district is required to produce and mail a report to customers upon request.

This section discusses best practices for phasing out bottled water and transitioning to alternative methods of dispensing water such as water filters, bottle-less water coolers, and fountains. We also discuss reusable water bottles.

Figure 4: Best Practices Flow Chart



Best practices include **forming a team dedicated to the task, establishing baseline data, setting goals, adopting a policy, improving current behaviors, specifying bottled water alternatives, and measuring** and **reporting progress** (see Figure 4).

1. FORM A TEAM

Form a Drinking Water Team of staff, students, and faculty representatives responsible for identifying and implementing bottled water alternatives (see Table 1). Smaller institutions may only need one person to spearhead such an effort. The Team's tasks should include:

- Developing a rationale for phasing out bottled water (e.g., cost savings, waste reduction, public pressure, etc.);
- Identifying the availability and feasibility of alternatives;
- Proposing a timeline to phaseout bottled water and switch to alternatives;
- Presenting an implementation plan to key decision makers; and
- Reporting on progress.

2. MEASURE BASELINE INVENTORY AND IMPACT

Gather the data needed to establish the costs, waste generation and other environmental impacts of current bottled water consumption as a basis for tracking progress.

Table 1: Drinking Water Team Staff & Responsibilities

Staff	**Responsibilities**
Executives & Senior Management	• Empower and support the program (see **Adopt a Policy**, below)
Sustainability Committee	• Quantify financial and environmental impacts of current bottled water consumption (also see **Measure Baseline Inventory and Impact**) • Estimate environmental and cost benefits of alternatives
Environmental Health & Safety	• Test water quality at building entry points and points-of-use and report results (see **Box 1,** below) • Determine whether water treatment is needed • If treatment is necessary, work with procurement team to identify the best products to meet water quality needs
Procurement	• Cancel/amend bottled water contract(s) (see **Improve Practices**) • Issue contracts for bottled water alternatives (see **Specify Bottled Water Alternatives**)
Facilities Management & Staff	• Replace water filters • Maintain, clean, and sanitize fountains and coolers
Events & Conferences, Catering & Dining, Retail & Other University Stores	• Replace bottled water with alternatives • Educate staff on reasons for the switch and availability and location of alternatives • Calculate the savings from eliminating complimentary bottled water at university sponsored events and administrative use and compare to bottled water sales in vending machines, campus stores, cafeterias, etc (see **Cost, Quality, and Supply**).
Students & Faculty	• Lead educational campaign on campus • Create and distribute signage and educational materials • Organize "Tap Water Challenge" events (For a comprehensive guide on how to organize a Tap Water Challenge event and other student resources, see **Related Documents**) • Issue press releases about the initiative

Include these data points in the inventory:

- Bottled Water Consumption
  - Volume, type, and cost of bottled water currently purchased.
  - Location where bottled water is being purchased (e.g., dining areas and cafeterias, catering services, vending machines, administrative offices, and on-campus retail stores). See "**Divergent systems for bottled water**" below.
  - Entity purchasing the bottled water and the reasons for their purchase.
  - Contractual requirements of beverage exclusivity contract, if applicable.
  - Revenue earned from bottled water sales in dining areas, on-campus retail stores, vending machines, etc.
  - Amount of waste generated from plastic water bottles and the associated cost of recycling and disposal. For single-stream recycling venues, calculations can be based on total waste, but results may be less accurate.
  - Electricity used and subsequent cost by any vending machines that exclusively sell bottled water, if applicable.
- Consumption of Other Bottled Beverages
  - Volume of other bottled beverages (e.g., soda and juice) purchased and amount of revenue earned through sales of those beverages.
  - Electricity used and subsequent cost by vending machines that sell mixed beverages.
- Tap Water
  - Tap water consumption by building, facility or department.
  - Results of tap water quality tests at building entry points, faucets, fountains, or water lines (see **Box 1**).

Box 1: Determine Water Quality

Prior to phasing out bottled water, find out if your water has contaminants. Obtain water quality information from a Consumer Confidence Report (CCR) from the local water utility company, and/or by testing your on-site water.

While water testing can be costly, many local health departments offer free or low-cost water testing kits. Call the Safe Drinking Water Hotline (800-426-4791) to find what is offered by local health departments.

A free water testing kit is available from **Everpure**.

Or use this **EPA list** to find a state-certified testing laboratory.

Companies such as National Testing Labs (www.ntllabs.com, 800-458-3330) can test for dozens of contaminants by mail. Consumer Reports found that low-cost test kits such as the Watersafe All-In-One Drinking Water Test Kit ($18) provide "quick, accurate results for chlorine, lead, nitrate, nitrite, two pesticides, pH, and total hardness" (CR, 2007a), though "results for bacteria were less reliable and required waiting 24 hours."

Water quality should be monitored on a regular basis and additional testing may be necessary for groups with higher health risks such as the very young, the elderly, pregnant women, and consumers with weakened immune systems (GG, 2007). These populations can be at risk even when contaminant levels are at or below legal standards.

- Number of water fountains currently in place, amount of water consumed from each, and condition and functionality.
- Number of bottle-less water coolers in use and the amount of water consumed from each.

► Identify Needs of Final Users

- List who drinks building tap water.
- Note any at-risk populations such as the young, elderly, pregnant, and immuno-suppressed that may be sensitive to certain water contaminants.
- Calculate quantities of water needed by these populations.

► Divergent systems for bottled water

- Recognize that the different types of delivery for bottled water affect consumption habits and have their own unique implications. For example, the logistics of supplying bottled water in vending machines may be different than the logistics of providing bottled water to Dining Services or Athletics. Other factors such as access to recycling bins in the vicinity of bottled water sales are also important to note.
- Though systems will vary by campus the list below gives some general systems to look at:
  - Vending machines
  - Catering
  - Events
  - Dining Services "to-go" meals (both retail dining and the growing trend of grab-n-go dining from dining halls)
  - Athletics (both use by athletes and retail at athletic events)
  - Retailers on campus (campus bookstores, etc.)
  - Bottled water use in offices

While compiling financial costs, be mindful of the possibility that new costs can be offset by savings in other areas. For example, eliminating the administrative use of bottled water from one office could pay for the installation of bottle-less coolers or upgraded fountains in another.

3. SET GOALS

Set goals and time frames for eliminating bottled water consumption, saving money, and reducing environmental impacts. Aim to reduce or eliminate bottled water procurement within 6-12 months. Use our **Calculator** to project cost savings and environmental benefits such as waste reduction and greenhouse gas emissions reductions, and establish these projections as goals.

The degree and pace of reduction or elimination depends partly on whether users embrace or reject the change. If resistance is expected, allow for a phase-out period while efforts are made to educate stakeholders. Be sure to research bottled water alternatives before implementing a ban so that replacements are ready to be substituted as soon as a ban is enacted. Analyze and factor in the staff, time, and money it will take to ensure

compliance with bottled water bans, especially in high-resistance situations.
Large colleges and universities might also find it useful to start with a pilot program that begins with a single operation or part of campus. If this is the case, the Drinking Water Team should focus its work on an agreed upon starting point, such as catering, dining services (as a whole or starting with a single cafeteria) or athletics, and create a timeline to expand the bottled water reduction or elimination more broadly.

4. ADOPT A POLICY

Adopt an official procurement policy outlining the general goals related to providing drinking water and establishing accountability. The policy can be a brief Executive Order from the university administration and/or can be incorporated into the institutional sustainability plan, procurement policies, and event and conference policies.

A drinking water policy should:

- State a rationale for reducing or eliminating bottled water;
- Establish a team for implementation;
- Identify preferred alternatives;
- Authorize funding;
- Address potential exceptions;
- Set a timeline for implementation; and
- Mandate tracking and reporting procedures.

Refer to the **Policies** section of this Guide for sample policies.

5. IMPROVE PRACTICES

Changing certain practices related to drinking water can help reduce wasted water and ease transition to bottled water alternatives. For example:

- **Maintain, renovate and/or upgrade existing drinking water dispensing infrastructure**. When practical and economical, retrofit fountains, filters, and bottle-less coolers. Locate fountains and coolers strategically, such as in high traffic areas and next to beverage vending machines. Train facilities staff to properly maintain existing fountains, filters and bottle-less coolers. Also, help to divert funds that would have been spent on bottled water for these upgrades, if necessary, to maintain the water infrastructure.
- **Replace bottled water at conferences and events**. Request that event venues provide adequate tap water and service containers, such as fountains, plumbed-in dispensers, mobile insulated water coolers (like those seen at sporting events), pitchers, glasses, or other reusable containers; and prohibit event caterers from selling or distributing bottled water. In event registration materials, encourage participants to bring reusable containers. Provide reusable bottles or glasses at events, either as a complimentary registration gift or for sale. If reusable containers cannot be supplied, use 100 percent compostable or recyclable cups and establish appropriate receptacles and collection methods. Note locations of watering stations during conferences, other university events and in venue maps.

  Large events such as commencement ceremonies and concerts present unique challenges. Participants need to stay hydrated and universities have a vested interest in the safety of their students. At large events where individuals might consume alcohol, this safety concern is heightened. Even in these instances, bottled water should be a last resort. A paramount concern should be to provide participants with easy access to clean water. This can be done with large, portable, coolers set up at water stations that are placed at scattered locations at the event venue. Many outdoor concerts already include basic amenities such as portable toilets and food services and these would also be ideal locations for water stations.

- **Switch to bottle-less coolers**. Bottle-less coolers filter, cool and/or heat water on demand, directly from taps. These plumbed-in coolers are cost competitive with bottled water coolers and most come with multi-year service contracts.
- **Switch to ENERGY STAR rated coolers**. If unable to switch to bottle-less coolers, switch remaining bottled water coolers to ENERGY STAR rated coolers. (Note: currently no bottle-less water coolers are registered as ENERGY STAR compliant.)
- **Eliminate disposable beverage containers**. Do not place disposable cups near coolers. Instead, where feasible, supply glasses or other reusable containers.
- **Plan for emergency situations**. Emergency preparedness requires advance planning. Make planning for tap water delivery a priority. Bulk purchase of bottled water should be a last resort.
- **Communicate changes**. Place signs near vending machines, kitchens, cafeterias, administrative offices, dormitories, etc., and send email updates explaining the bottled water phase-out and the alternatives that are being made available.
- **Engage students as much as possible.** In addition to having student representatives on the Drinking Water Team, allow students to have an active role in shaping the bottled water phase-out policy. Facilitate town-hall style meetings to encourage student input and address concerns. Also, establish a bottled water page within the university website to allow students to read about the changes, calculate their environmental impact with RPN's bottled water **Calculator**, read more about the environmental and social costs of bottled water and submit suggestions and comments.

SPECIAL CONSIDERATIONS FOR COLLEGES AND UNIVERSITIES

Beverage Exclusivity Contracts: Beverage exclusivity contracts (sometimes referred to as "pouring contracts") are agreements between colleges and universities and beverage companies such as Coca-Cola, PepsiCo, etc., which give these companies exclusive rights to sell and distribute their products at agreed upon venues at a school (Polaris, n.d.). Common contractual provisions include:

- Guaranteed exclusive market free of competitors
- Long term agreement (5, 10 years, etc.)
- Financial incentives such as scholarships or other contributions to the university
- Preferred pricing
- Minimum sales requirements
- Possible compensation if the university breaks its contract

Universities and colleges should work with contracted beverage providers to amend or cancel existing contracts that include bottled water (either single serve or bulk) for offices, events/conferences, on-campus retail or convenience stores, dining services, vending services, and cooler services. Contract language varies widely between schools, but many will allow purchasers to end the sale of bottled water so long as the school does not sell a different brand of bottled water.

For an example of common contractual provisions in a beverage exclusivity contract, see **Addendum I**.

6. SPECIFY BOTTLED WATER ALTERNATIVES

If necessary, identify, purchase and implement alternative methods of water dispensing such as **filters**, **fountains**, **bottle-less coolers**, and alternative methods of maintaining supply, such as **reusable containers**.

It is worth noting that water, available in single serve plastic pouches, has entered the marketplace as a potential alternative to water served in PET bottles. These pouches are claimed to use less energy to transport because they are lighter and also produce less waste (PFFC, 2005). Pouched water is also available for emergency preparations. However, water available in plastic pouches still poses many of the same problems as conventional bottled water, including the increased energy compared to tap water needed to transport the water and containers (although pouches might be lighter than PET bottles, the water itself is still heavy to transport) and manufacture the containers. Pouched water should therefore be considered a less effective alternative compared to filters, fountains, bottle-less coolers, and reusable containers.

Filters: Filters are commonly part of coolers, some fountains, and some reusable bottles but are not always necessary. Based on tap water testing (see Box 1, above), determine whether filters will be needed and, if so, which filters will best remove unwanted materials from the water (e.g., lead, chlorine, chloramine). Note that some water tests may not indicate whether chlorine or chloramine are in the water, but this information can be obtained from the local water utility.

Specify filters that meet NSF/ANSI standards and are certified to remove the contaminant(s) of concern (NRDC, 2005). See the Standards section of this Guide for more information on NSF/ANSI and **Addenda VII**, **VIII** & **IX** for detailed charts on water contaminants and filtration methods. Be aware that, in addition to contaminants, it could be beneficial to use filters designed to eliminate tastes and odors, if necessary. When possible, purchase filters from a manufacturer with a filter cartridge take-back or recycling program.

Maintain filters according to manufacturer instructions in order to ensure safe, continuous water filtration and to prevent old filters from releasing harmful materials into the water (NRDC, 2005). Maintenance may include regular filter cartridge or membrane changes or professional cleaning. For units without filter-life monitors, mark the filter-change dates on a calendar. The Centers for Disease Control recommend "wearing gloves and washing hands after changing the filter cartridge – a task to be avoided by people with weakened immune systems" (McEvoy, 2004). Some filter models offer service and maintenance contracts to keep the unit running at peak performance.

Fountains: Water fountains will play a principal role in the elimination of bottled water at a college or university because they can easily supply many people with drinking water. Also, since water fountains already exist in many buildings, they are an easy alternative. Even if newer buildings were built without water fountains, they can be easily installed and yield substantial cost savings compared to bottled water.

There are four basic types of drinking water fountains:

1. Box-shaped floor models that stand alone or are connected to a wall
2. Models with a pedestal base (also known as 'bubblers')
3. Wall-mounted units that do not touch the floor, allowing wheelchair access

4. Models built into and flush with the wall

Key features to seek when purchasing drinking fountains include:

- **Easy Installation**: Choose fountains that provide quick access to the inside of the unit. This makes installation and maintenance faster and less of a hassle. The height of the water stream should also be easy to adjust and should ideally be adjusted at the time of installation.
- **Durability**: Look for materials made to last such as painted metal or engineered plastic (Sorensen, 2004). Stainless steel is also a strong, easily maintained and aesthetically pleasing option
- **Easy to Clean**: Purchase fountains with "smooth surfaces and a minimal number of parts" (Sorensen, 2004).
- **Safe Design**: Blunt corners will help prevent injury.
- **Indoor vs. Outdoor**: Make sure the fountain purchased is designed for the environment in which it will be used. Most fountain models are for indoor use, but units do exist for outdoor and extreme temperature conditions.
- **Manufacturer Reputation**: Look for companies with a good reputation for providing superior customer service and products. Ask fountain companies to provide customer references.
- **Free Services**: Some companies offer free shipping, installation, or package deals. These can greatly reduce total costs.
- **Spigots**: These enable users to fill up large reusable bottles with fountain water. Existing fountains can be retrofitted to accommodate these bottles and such requirements should be written into building standards and specifications for new fountains. Spigots are also useful in that people can refill their reusable bottles without the common worry that the faucet has been touched by others' mouths.

This water fountain at the University of Winnipeg has been upgraded to include a spigot for reusable bottles.

<u>**Coolers**</u>. Consider these factors when evaluating bottle-less water coolers:

- **How much money is available for bottle-less water coolers**. Determine how much money can be invested in installing bottle-less coolers and how much is budgeted for monthly or annual fees for maintenance, repairs, etc. Filtered coolers typically can be either rented or purchased. Find out if there is money that is being spent on bottled water that could be reallocated to install and maintain bottle-less coolers.
- **The number of people needed to be served by coolers**. Calculate the total number of people who will need to access coolers, and the number of people each individual cooler must serve. Different size coolers may be better suited for different departments/areas based on their cold water production capabilities. Be sure to include staff as well as visitors.
- **Desired features for coolers**. Major health-focused features can include a filter or UV

disinfection light. Minor, more aesthetic or convenience-oriented features can include an LED readout screen; a monitor that tells when the dispenser's catch tray is full; an alert that tells when the UV light has burned out; or special leak protection hardware. Some coolers also have built-in meters that measure water use, a useful tool that can help an institution monitor how much their coolers are being used.

- **Quality of the institution's municipal water supply**. This will determine whether the cooler needs to have a filter, and if so, the appropriate type of filter. See **Box 1**, above, for information about determining water quality.
- Degree of required maintenance. Bottle-less coolers need routine water storage tank cleaning and sanitizing to prevent bio-film buildup in the tank. Coolers can be manually sanitized regularly or use a self-cleaning UV light technology. Determine the degree of maintenance that the Facilities department is willing or able to commit. For more information on bottle-less cooler maintenance, see **Cost, Quality and Supply**.

Reusable Bottles. Purchase bottles designed for reuse that can be filled with tap water. For maximum effectiveness, combine the use of reusable bottles with alternative methods of water dispensing such as filters, fountains, and bottle-less coolers. Consider selling and promoting reusable bottles in campus stores and special events. If possible, provide new students a complimentary reusable bottle at orientation and encourage them to use it properly and often. This tactic was employed at Smith College, which began providing incoming students with reusable bottles as part of a long term strategy to reduce bottled water consumption, and subsequently noticed a decline in the use of bottled water on campus. By distributing reusable water bottles, Smith College eliminated at least 130,000 bottles of water served to students at a savings of approximately $30,000 (Guzowski, 2009).

Buyers should consider the safety, recycled content and recyclability of bottle materials (such as metal, plastic, glass or ceramic), including materials used as inner linings. Benefits and drawbacks of reusable bottle options are discussed in the **Cost, Quality, and Supply** section of this Guide. It is important to note that PET bottles (#1 plastic) -- the ones used for packaging most bottled water -- are meant for one time use, not for reuse, so they should not be considered as a viable long-term reusable bottle option.

7. MEASURE & REPORT PROGRESS

Conduct regular reviews to determine effectiveness and maintain commitment to bottled water alternatives. Compare baseline data with current practices based on the timeline set out in the policy. Use RPN's **Bottled Water Calculator** to measure cost savings and environmental benefits achieved. Identify:

- Consumption of bottled water reduced,
- Money saved,
- Water conserved,
- Waste prevented, and
- Emissions reduced.

Identify whether there were obstacles to success and whether goals need to be reoriented. Publish and distribute periodic progress reports.

RELATED DOCUMENTS

Corporate Accountability International, **Student Organizing Kit**, n.d.
Corporate Accountability International, **Tap Water Challenge Organizing Kit**, n.d.
Polaris Institute, **Building a Bottled Water Free Campus Toolkit**, n.d.

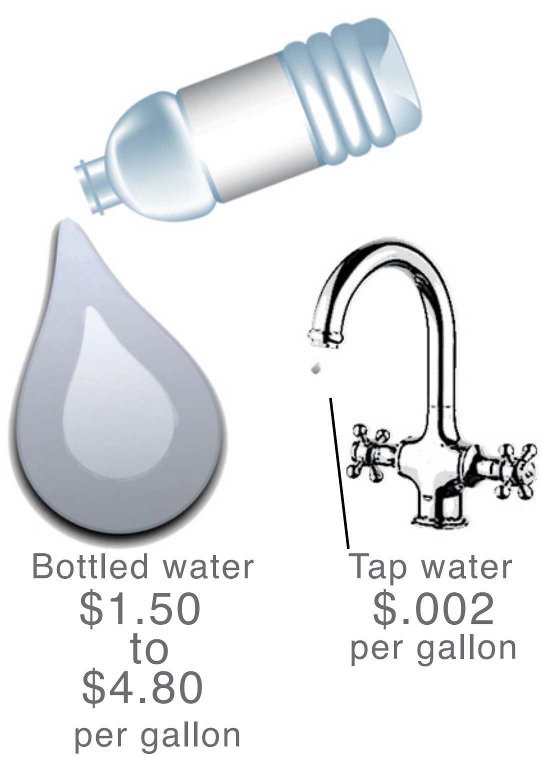
Americans enjoy one of the safest, most comprehensive and lowest cost public drinking water systems in the world.

Though contaminants can and do threaten the nation's water safety, a wide range of cost effective products are available to deliver clean tap water, and many municipalities are taking action to reduce risks associated with contamination.

In this section we discuss **tap water** and **wells** along with **water filters**, **water fountains, bottle-less water coolers,** and **reusable containers** (i.e., reusable metal and plastic bottles).

Banning bottled water does not necessarily result in a net loss of revenue for colleges and universities. Indeed, educational institutions can save money by eliminating or reducing complimentary bottled water at university-sponsored catered events and administrative functions. These bottled water giveaways could represent a substantial amount of cost savings. These savings should be compared to the revenue generated by bottled water purchases. Whether a university will save or lose money depends on a variety of factors such as the size and frequency of events where the university provides complimentary bottled water, the size of the student body and their consumption habits, and the scope of on-campus retail operations. These factors will obviously vary from school to school. If a net loss is predicted, specify whether the university will attempt to offset the cost through the sale of alternative beverages, reusable bottles, etc., or if it will accept and absorb the cost. Just remember to offset lost revenue by factoring in gains realized by eliminating the purchase and provision of free bottled water.

Figure 5:
Cost comparison of tap water versus bottled water



TAP WATER

On average, tap water costs 0.2 cents per gallon in the U.S. (EPA, 2004) – roughly 750-2,700 times cheaper than bottled water on a per gallon basis, although this cost varies regionally–see Figure 5. For instance, the City of Seattle determined that bottled water costs $8 per gallon while tap water costs 0.3 cents per gallon—nearly 2,700 times less (from Seattle's Executive Order Restricting Bottled Water; see **Policies**).

Over 90 percent of U.S. municipal water systems regularly meet or exceed the EPA's stringent regulatory and monitoring requirements (EPA, 2007). Federal law requires water utilities to issue annual Consumer Confidence Reports (CCRs), also called "right-to-know" reports, identifying the sources and quality of municipal water. Municipal water customers should receive a CCR in the mail by July 1 each year, although customers of systems serving fewer than 10,000 people may not receive reports via mail. Many CCRs are available online at **www.epa.gov/safewater/dwinfo.htm** and can be requested from the local water supplier or from the EPA's Safe Drinking Water Hotline (800-426-4791). Reported levels in CCRs are based on annual averages, but spikes can occur at certain times—for example, when spring rains raise nitrate levels (CR, 2007a).

These resources help consumers read and understand CCRs:

- Consumer Reports, "**Deciphering your water report**", May 2007
- **Campaign for Safe and Affordable Drinking Water**

Contaminants come from a variety of sources, including municipal and agricultural pollution, wells, faulty and aging pipes, flawed water treatment systems, and even from the natural environment (see **Addendum VII**). There are three types of contaminants: microbes, chemicals, and metals (CR, 2007a), all of which can cause serious health effects. Water contamination is of special concern to children, the elderly, pregnant women, and those with weakened immune systems. These populations may experience adverse health effects even if contaminants are at or below legal limits.

Although rare, the safety of a municipal water supply is sometimes so threatened, that a local agency will issue a "boil water advisory." These advise residents to boil water for several minutes to kill bacteria and viral agents prior to drinking. Boil water advisories often occur after a contamination has been detected. For a list of up-to-date advisories, visit **http://www.water.ca/US-bwa.asp**

Currently, approximately 69 percent of tap water in the United States receives added fluoride in their municipal water supply in a process known as "fluoridation". The process began in the 1940s as a way to combat tooth decay by exposing someone's teeth to fluoride throughout his life and is now very common (CDC, 2009). Although the CDC claims that fluoride treatment is safe, others are concerned that the levels might be too high as to cause health problems in infants which outweigh any benefits in oral hygiene (EWG, 2007). If desired, choose a filter that can remove fluoride from RPN's **Product database**.

While safety is legally regulated and monitored, "drinkability" is more subjective, including aesthetic characteristics such as odor, appearance, and taste. These subjective qualities, however, can be equally vital in ensuring a successful switch from bottled to tap water. Consumers may reject perfectly safe water if they consider its aesthetic qualities displeasing. Water tests and student polls may help a university identify and appropriately address any unpleasant non-health-related characteristics of its tap water supply.

WELLS

Private wells supply drinking water for over 40 million Americans. Well water is not regulated by the EPA and should therefore be tested annually by a state-certified laboratory. Contaminants of particular concern for well users include arsenic, nitrates, coliform bacteria, and total dissolved solids (TDS) (GG, 2007). Additionally, tests for radon and pesticides should also be conducted if they are known to exist in the area. Contact the state or local health department to find out which contaminants may be problematic in a particular region. For more information about wells and well water, contact the Water Systems Council at **www.wellcarehotline.org** or 888-395-1033.

For more information on common tap water contaminants and their health effects, see **Addendum VII** and **NRDC's Drinking Water Report**.

WATER FILTERS

Where safe, clean, aesthetically appealing tap water is available, filters are an unnecessary expense. However, it is important to use filters when water contains contaminants or has undesirable subjective qualities such as unpleasant taste or smell. Water filters range widely in cost, quality and supply. There are two general types of filters: point-of-entry (whole building) and point-of-use (counter top, carafes, faucet mount, under counter).

Water filtration can be accomplished through a variety of methods, including absorption, adsorption, filter membranes, distillation, and disinfection. **Addendum VIII** describes some of the most common filtration methods.

Filters come in a wide array of shapes, sizes, and styles to suit performance, convenience, and aesthetic needs. Enhanced features include LED readout screens, electronic touchpads, digital clocks, and monitors or alarms that indicate the need for cartridge replacement. **Addendum IX** describes some common filter styles.

Consider the following when choosing a water filter:

- **Contaminants**. Which contaminants need to be removed and which filtration method removes them? See Determine Water Quality (**Box 1**) and the **Tap Water** and **Wells** sections above for more information on how to determine tap water quality. See the **NSF International web site** for a database of drinking water treatment units certified to remove specific contaminants.
- **Location**. Where will filters be located (counter, cabinet, floor, refrigerator) and how much space is required and available?
- **Replacement**. How often do filter cartridges or membranes need to be replaced?
- **Installation**. Are the unit and filter easy to install, clean and change (GG, 2002)?
- **Performanc**e. Will the filtration unit maintain a steady flow rate throughout its lifespan (GG, 2002)?
- **Maintenance**. Who will maintain and clean the unit? When? Will training be required?
- **Resources**. How much energy and excess water does the unit use to filter water?
- **Price**. Factoring in all of the below, estimate cost per gallon of filtered water:
  - Filtration unit price
  - Annual filter and unit replacement costs
  - Cost of electricity required to operate the unit
  - Maintenance and cleaning costs, including cleaning products and staff time

Benefits of water filters include:

- **Low Cost and Wide Availability**. Filters are widely available and consistently cheaper than bottled water. One manufacturer claims that one pour-through filter can replace 300 standard bottles of water (16.9 oz.) (TBTF, n.d.).
- **Suitability to Wide Range of Needs**. Filters allow users to choose which substances are removed from their water (CR, 2007a). The type and quantity of contaminants removed depends on the filtration method, filter style, and manufacturer model. Rely on independent certifications to verify which contaminants are filtered (see **Standards**).
- **Removal of Contaminants in the Water System**. Filtration addresses pollutants that may have entered the water between the water treatment site or municipal pipes and the point-of-use at the faucet or fountain.

Despite these benefits, filters also present problems, including:

- **Less than 100% Effective**. No filter or filtration method removes one hundred percent of all types of contaminants. Combining filtration methods can come close, but even then there is debate over which substances are considered harmful and which are considered innocuous or even beneficial (i.e. certain minerals).

Box 2: Used Filter Take-Back and Recycling

Since 1992, the European branch of the BRITA company has been collecting filter cartridges to separate and recycle component materials (TBTF, n.d.). However, when Clorox bought BRITA North America (the most popular water filter system in the U.S.) (TBTF, n.d.), this practice was not extended to the U.S. until January 2009.

A few smaller filter manufacturers also offer refillable cartridges and/or filter takeback programs – such as TerraFlo and Abundant Earth.

Box 3: Filter Labeling Requirements

In California, Wisconsin, Massachusetts, and other states, manufacturers are required by law to disclose in product literature information such as filter replacement cost, filtration method and style, and contaminants removed.

- **Can be Costly**. Filtration can be expensive. In addition to the upfront purchase of the filtration unit (anywhere from $15 to $1500 for home units and much more for institutional units), there can be costs associated with installation, energy use, filter replacements, maintenance and cleaning.
- **Performance and Aesthetics**. Filters have a multitude of performance and aesthetic issues. For example, some units filter water very slowly, while others take up a large amount of counter or cabinet space. See **Addenda VIII** and **IX** for a comparison of the pros and cons of common filtration methods and filter styles.
- **Materials and End-of-Life Management**. A large majority of filters and filter components are manufactured using petroleum-derived plastic. Depending on the unit, disposable cartridges must be replaced anywhere from monthly to once every few years. Currently, most filter cartridges are not recyclable and most manufacturers do not offer filter take-back programs (See **Box 2**). Thus, most filter cartridges are disposed of in landfills. Compounding the waste problem is the fact that the contaminants trapped in the filters can easily leach into water and soil, or be released into the air if incinerated.

FOUNTAINS

Whether using existing drinking fountains or purchasing new ones, there are several practices that can help decrease costs, reduce energy usage, and improve equipment function.

In an average week, a refrigerated fountain uses 8.5 to 10.5 kWh of electricity (NC, 2004). While this number varies depending on frequency of use, air and water temperature, and unit size, this corresponds to a cost of $30-38 per fountain per year (based on average North Carolina electricity rates) (NC, 2004). There are several ways to reduce this electricity use and subsequent costs, including:

- **Increase the water temperature dispensed by the fountain**. Most cold-water fountains are set at 40-45 degrees Fahrenheit. Increasing this to 50 degrees will decrease the energy used for refrigeration while still protecting against bacterial growth.
- **Insulate the unit**, especially the piping, chiller, and storage tank, to save energy (DOE, 2001).
- **Disconnect the fountain** during nights, weekends, or other periods of non-use to stop the refrigeration unit from running. Note that disconnecting the fountain for extended periods can lead to bacterial growth inside the unit. Vendors recommend not leaving the fountain disconnected for more than 8 hours at a time. Consider the amount of effort involved in disconnecting the unit. Can the fountain just be unplugged? Will the fountain dispense without electricity? Will users react negatively to getting less chilled or unchilled water? Calculate the potential cost savings of unplugging your fountains **here**.

- ► **Use a timer** to switch the unit's refrigeration system off when not in use. Automatic timers are relatively cheap ($10) and easy to install for plug-in fountains. However, it is not always cost-effective to install a timer on fountains that are already wired into the building's electrical system (MEO, 2005). This cost can be avoided if fountains are wired into the building's light switch circuits at the time of installation or building construction. Again, vendors recommend not leaving the fountain disconnected for more than 8 hours at a time, as bacteria can proliferate much more quickly in water at room temperature.
- ► **Purchase unrefrigerated units** to avoid energy costs altogether. So called "direct feed" water fountains dispense water directly from the tap, similar to standard water faucets, but are designed for drinking. Water that comes directly from underground municipal pipes tends to be naturally cooler than room temperature.

While the cost of fountains can seem prohibitive, it is often less expensive over the long run to upgrade or install fountains than it is to purchase bottled water. The County of Santa Clara, California, analyzed the costs of switching from large, multi-serve bottled water coolers to tap water fountains (SCC, 2008). The county spends $131,151 per year on its bottled water contract. They found that installing one fountain would cost $10,000 (75 percent labor costs and 25 percent materials). This cost would double if the installation was considered 'difficult', meaning that hazardous materials or significant structural obstacles were present.

To convert from bottled coolers to fountains in all of its facilities, the County estimated that it would cost $369,000-539,000, with annual maintenance and service costs totaling $10,000-20,000 (assuming all simple installations). The County also noted that they would need to "divert existing staff from maintenance work or hire extra help" to service the fountains (SCC, 2008). It was estimated that after acquiring the necessary funds, it could take up to three years to make the switch.

Extrapolating these costs, the switch has a five-year return on investment. After the five-year mark, they would pay $10,000-20,000 per year for fountain maintenance, compared to $131,151 each year for their bottled water contract. All told, the County estimates savings of up to $500,000 over ten years (see **Table 2**). If bottled water prices increase during that time, savings on the switch could also increase.

Table 2: Long-term cost savings from water fountains

Cost of Bottled Water	Cost of Drinking Fountains	Savings over 5 Years
$655,755 (5 year contract)	$419,000 - $639,000 (Installation in year 1 and yearly maintenance costs for 4 years)	$16,755 - $236,755

Water fountains require regular maintenance to ensure sanitary conditions. Schedule regular maintenance for each fountain and order high-quality replacement parts. Ask fountain vendors to recommend reputable parts suppliers.

Be aware that proper cleaning and maintenance can be difficult with filtered drinking fountains. Typically, water dispensed from these units passes through a filter before reaching the water storage tanks. Because the filter usually removes chlorine – a sanitizing agent – the stored water is more susceptible to bacterial growth. This can lead to the development of a bacterial "biofilm" that coats the internal fountain components. When this happens, the fountain must be completely dismantled so the components can be manually scrubbed and sanitized. In most cases, it is impossible to access the inside of the water storage tank to manually sanitize this area (Doughty, 2008).

Install fountains in easily accessible, highly visible areas such as main hallways, waiting areas, cafeterias, and next to vending machines. This will increase their use and deliver a better return on investment. Create educational materials or signs that explain why bottled water is no longer available and encourage the use of tap water, fountains, and reusable bottles.

BOTTLE-LESS WATER COOLERS

Bottle-less water coolers are a great alternative to large bottled water dispensers. These plumbed-in coolers connect directly to a tap water line and are typically equipped with filtration systems. Bottle-less water coolers are very similar in construction to bulk bottled water units, except they draw water from the tap. Water flows from a building's tap through a filter inside the cooler and is then either chilled directly or piped to a stainless steel storage reservoir to be cooled before dispensing.

Factoring in the costs of cooler rentals, water delivery, and maintenance, the cost of bottle-less filtered water coolers is typically half the cost of delivered bottled water. Depending upon the usage, the cost savings can be as much as 80% when switching to bottle-less systems (Doughty, 2008). There are several costs to consider when purchasing a bottle-less cooler, including:

- Cost of the cooler unit
- Installation
- Filter replacement
- Maintenance and cleaning

Many vendors will bundle these costs into a monthly rate (ranging, generally, between $29 - $99 per month). Cost depends on the size, capacity and other features of the cooler. Multi-year contracts are ideal for institutions that do not want to handle ongoing cooler maintenance.

Bottle-less coolers save money, energy, labor time, and greenhouse gas emissions: A large national bank switched 7,000 bottled water coolers to bottle-less coolers and saved approximately $5 per month per cooler – approximately $420,000 over the course of a year in electricity savings alone (Doughty, 2008).

- Over an average week, a bottled water cooler uses approximately 3.5-4.5 kWh (NC, 2004), which, according to the average electricity rates in one state—North Carolina—costs $12-$17 per cooler per year. Bottle-less coolers use 30 - 50 percent less energy depending on the model and, based on the North Carolina case study, could save $4-$8 per cooler per week (Doughty, 2008).
- Spectrum Water Coolers claims that "switching out bottled water for…coolers reduces greenhouse gas emissions (GHGs) by 98 percent by eliminating the bottle manufacturing, bottling, storage, distribution, delivery, as well as the removal, recycling, or dumping of used bottles" (Spectrum, n.d.).
- Bottle-less coolers can also save money for other drinks such as juices and sodas in campus cafeterias. These coolers can promote the more efficient use of soda and juice concentrate, typically reducing the use of concentrate by 15 – 20 percent (Doughty, 2009).
- Basic filtered bottle-less coolers come with 2-4 liter chilling or heating tanks and are less energy efficient than direct chill coolers (see below). They also require constant cleaning and maintenance to prevent bacteria build-up from stagnant water. To solve the bacteria problem, some coolers use an internal ultraviolet light to prevent bacterial growth inside the cooler and tanks. Without proper cleaning or a UV light, bacteria can end up in the water.

Direct chill technology can eliminate the bacteria issue by chilling water instantly as it passes through the cooler's filter. Thus, water does not sit in a reservoir tank for any length of time. These coolers are energy efficient because the cooler does not have to constantly keep the water in its reservoirs cold or hot.

In some instances, installing bottle-less water coolers may be challenging. For instance, plumbing doesn't exist in some work locations, such as construction trailers. In such cases, the best solution is to purchase a few large reusable water containers, such as the mobile insulated coolers seen at sporting events, and have each construction crew fill their jug with tap water prior to going to the worksite. Another option is an ENERGY STAR rated bottled water cooler (NC, 2004). For locations where there is not access to a water line within 500 feet or running a water line would be too costly, Spectrum has developed a "Mobile Filtered Drinking Water Cooler Solution" that may be suitable. For more information, contact Spectrum directly at 301-362-9000.

Table 3: The pros and cons of bottle-less filtered water coolers.

Pros	Cons
• Decreased maintenance and cleaning (bottled coolers usually require monthly cleaning) • No plastic bottles • No need to transport the water hundreds or thousands of miles by truck or plane • Unlimited supply of water • Use much less energy than bottled coolers • Provide clean, safe filtered water • Save money	• Can be more difficult to clean the unit's complex internal structure • Majority of filter cartridges cannot be recycled (see **Cost, Quality, and Supply** section on filters for more information)

There are approximately 750,000 filtered bottle-less water coolers currently installed in the United States (compared to almost five million bottled water coolers) (Doughty, 2008). Bottle-less coolers are sold in a variety of sizes, for a range of applications, and with various optional features. Filtered bottle-less water coolers are growing at approximately two to three percent market share per year and currently make up 12 percent of the market (Doughty, 2008).

REUSABLE CONTAINERS

Reusable containers have lower lifecycle costs and are less harmful to humans and the environment than single-serve plastic bottles. Reusable containers are convenient to use and widely available in a variety of materials, sizes, and styles.

Many reusable containers, especially those made of metal, are lined with resins to prevent taste and odor contamination and corrosion. These resins may leach chemicals into the liquid inside. To avoid contamination, look for unlined bottles, bottles lined with water-based resins, or bottles that have been independently tested and proven not to leach chemicals. Choose bottle lids that provide a tight seal in a wide temperature range and are made of materials that can be recycled. Many manufacturers now offer several lid options in a variety of materials.

Reusable containers require proper use, care, and cleaning. Do not store full bottles in direct sun or other hot environments since this can promote bacterial growth and increase the leaching capability of some materials, especially plastics and resin linings. Use a mild soap or dishwasher detergent and warm water to clean reusable containers thoroughly but gently, including those that are deemed "dishwasher safe." For stainless steel bottles, do not use cleansers that contain chlorine, which corrodes steel. Use a bottle brush to clean bottles with narrow mouths. Don't forget to clean the bottle lids too, which can harbor bacteria.

Reusable bottles made of materials known to leach chemicals (such as polycarbonate plastic) should be washed by hand with warm water and mild soap in order to prevent the need for disposal and replacement. High heat

dishwashers, strong detergents, and repeated washing can abrade plastic and intensify leaching. Scratches and cracks (sometimes indicated by cloudy spots) also encourage leaching, so damaged bottles should be replaced. For more advice on reusable bottles, visit this **Consumer Reports website**.

Metal Bottles. Stainless steel and aluminum are popular options for reusable containers. The most commonly used bottles weigh around 5-8 ounces (stainless steel is heavier), can hold a liter of liquid, and cost about $15-$30. Metal bottles are strong and durable, but can be prone to dents and will lose shape if frozen. They retain temperature well but single-walled models should not be used for hot beverages.

Metal bottles generally will not corrode or leach chemicals even when used for hot, cold, or acidic beverages. However, the interior surface of metal bottles is often coated with a food-grade resin lining. This lining can help prevent odors and metallic aftertastes. However, since many of these resins are chemically derived, they have the potential to leach toxins into any liquid they contact. Some reusable containers are lined with water-based epoxies that have been found not to leach chemicals, according to independent tests (Breum, 2001).

Some bottles are dishwasher safe, but most need to be cleaned by hand. This can prove difficult for bottles with small openings, but effective cleaning can be achieved by using a bottle brush and warm, soapy water. For dishwasher-safe stainless steel bottles, use a chlorine-free detergent since chlorine corrodes this material (Karlstrom, 2007). Depending on location and waste hauler/recycler, metal and plastic bottles and bottle caps may be recyclable.

Glass and Ceramic Bottles. These materials are also a relatively safe, low cost option for reusable containers. Glass and ceramic bottles can be repurposed from used jars and containers, thereby preventing waste. As a result, they also save energy, money, and materials because they displace the manufacturing of new bottles. Glass and ceramic bottles can also be recycled an infinite number of times and do not leach chemicals or toxins.

However, glass and ceramic both have some serious drawbacks. The first and most obvious is that they are breakable. Aside from being inconvenient, a broken bottle can pose a safety hazard. To partially address this concern, cover or wrap glass or ceramic bottles with fabric or another material that will contain the shards if broken. Glass and ceramic bottles are also heavier than metal and plastic alternatives.

Plastic Bottles. Reusable plastic water bottles cost between $3 and $50, depending on features, but most are in the $5-$10 range. Plastic bottles come in an array of shapes, sizes, colors, and styles. Some include special caps, covers, built-in filters, and even LED lights.

Polyethylene terephthalate (PET, PETE, or #1) is the plastic used for packaging most single-serving bottled waters. While it is one of the safer plastics, PET is not meant for repeated use. Bottles made from this porous plastic are difficult to clean and can harbor bacteria, especially if reused multiple times. Additionally, studies suggest that with repeated use, PET containers may release di (2-ethylhexyl) phthalate (DEHP), an endocrine-disrupting compound and probable human carcinogen, as well as antimony, an eye, skin and lung irritant at high doses (Masterson, 2006). Studies also found that toxin concentrations increase the longer the water is in the bottle (Masterson, 2006). Number 1 plastic is recyclable, but the quality degrades with each cycle so PET is typically "down-cycled" into products such as fleece apparel, carpet fiber and plastic strapping.

Certain plastics should be avoided in reusable drinking bottles, including polyvinyl chloride (PVC or #3 plastic), polystyrene (#6), and hard, transparent polycarbonate plastic (#7 and/or PC). These plastics are known to leach chemicals. Polycarbonate, in particular, has been found to leach bisphenol-A (BPA) – an endocrine disruptor, and phthalate compounds, which interfere with reproductive hormones; though it is important to note that #7 plastic is an "other" designation for plastic containers that includes polycarbonate as well as compostable bio-plastics that do not contain bisphenol-A. It also appears likely that BPA leaches at a dramatically increased rate when boiling water is used in polycarbonate containers when compared to temperate or cool water (SD, 2008).

Several studies have found that BPA can have an adverse effect on human health. The chemical has been associated with liver damage and hormone disruption. Moreover, traces of BPA have been detected in approximately 90 percent of the population. A recent article in the Journal of the American Medical Association also discovered "higher urinary concentrations of BPA were associated with an increased prevalence of cardiovascular disease, diabetes and liver-enzyme disease (JAMA, 2008)."

While some studies indicate a link between extremely low BPA doses and harmful health effects, others suggest otherwise. The FDA maintains that plastics with BPA are safe, stating "products containing BPA currently on the market are safe and that exposure levels to BPA from food contact materials, including for infants and children, are below those that may cause health effects (FDA, 2009)." The FDA, while maintaining this position, is still reviewing additional research and information as they become available.

By contrast, the Canadian government, in 2008, decided to ban the importation, sale and advertisement of polycarbonate baby bottles that contain BPA. Infants are exposed to BPA primarily through the use of polycarbonate baby bottles and although exposure levels were below acceptable limits, the government decided to enhance protections. The ban made note that only infants up to 18 months of age were likely affected and the general population was not at risk (HC, 2008).

However, despite the FDA's assessment that BPA is innocuous, some major companies, such as Nalgene, are voluntarily removing products with BPA from their inventory. Nalgene insists that its polycarbonate bottles with BPA are safe for intended use, but is transitioning to BPA-free bottles because of "consumer requests for alternative materials (Nalgene, n.d.)."

Some safer plastics include high-density polyethylene (HDPE or #2), low-density polyethylene (LDPE or #4), and polypropylene (PP or #5). Of these, #2 plastic is preferred for its durability and wide-ranging recyclability. LDPE and PP are harder to recycle, but polypropylene is frequently used in many reusable containers.

Choose plastic bottles that are recyclable in your area and, regardless of the plastic type, minimize chemical leaching by avoiding hot liquids, harsh cleaning detergents, and heating the bottles in microwaves. Once a polycarbonate bottle becomes unsafe for drinking, it can be repurposed as a lantern or flashlight. A few companies offer plastic caps with built-in LED lights that fit on several popular brands of bottles. These "light caps" replace the bottle's old cap. SolLight makes one model that is solar-powered, eliminating the need for batteries or other external power source.

Many organizations are shifting their purchases away from bottled water and toward alternatives such as filters, bottle-less water coolers, fountains, and reusable bottles.

MODEL SPECIFICATION

RPN, Model Bid Specification Guidance, 2008

RPN created this model guidance document on developing bid and contract specifications for bottled water alternatives. Guidance is provided on filters, fountains, bottle-less coolers, reusable bottles, and events and catering. For the complete specification, see **Addendum V**.

MORE SAMPLE SPECIFICATIONS

EDUCATIONAL INSTITUTIONS

Michigan State University, Drinking Fountain and Water Cooler Bid Solicitation, 2009

This bid solicitation seeks drinking water fountains that comply with various standards for quality assurance. For the complete specification, see **Addendum VI**.

STATE

State of Maryland, Department of Health and Mental Hygiene, Bottle-less Water Cooler Bid Solicitation, 2007

This bid solicitation states health reasons for the discontinuation of five-gallon water bottles and requires bottle-less coolers that provide hot, warm, and cold drinking water. A four-stage filtration system is required and the cooler must be hooked up to the facility's water supply. The dispenser area must be large enough to refill reusable bottles and carafes. Bidder is required to install the bottle-less coolers.

CITY

Minneapolis, MN, RFP for Outreach on City Water Supply Quality, 2008

Seeks contractors to create a public outreach campaign to educate city residents about tap water quality and encourage its use over bottled water.

Santa Monica, CA, RFP for Bottle-less Coolers, 2009

This bid solicitation is seeking 44 bottle-less coolers and specifies delivery and maintenance requirements that vendors must meet.

City of Rock Hill, SC, RFP for Drinking Fountain Maintenance, 2009

This RFP seeks vendors to perform regular maintenance on the drinking fountains in the Galleria Mall.

BUSINESS

AquaPure, Standard Specification Guidance for Bottle-less Water Coolers, 2008

Contains recommendations for bottle-less water cooler contracts.

Tap and bottled water are evaluated using similar quality standards, but tap water is tested more frequently and has more independent oversight by state and federal environmental authorities (e.g., U.S. EPA and state Departments of Environmental Protection).

The FDA regulates bottled water quality, but often lacks the capacity to adequately regulate bottled water and largely relies on bottled water corporations to police themselves. Also, the FDA has little jurisdiction over the roughly 60 percent of bottled water that is bottled and consumed in the same state (Gleick, 2005; NRDC, 1999).

A recent report by the Government Accountability Office (GAO) found that FDA's regulation of bottled water, particularly when compared with EPA's regulation of tap water, reveal key differences in the agencies' statutory authorities. Of particular note, "FDA does not have the specific statutory authority to require bottlers to use certified laboratories for water quality tests or to report test results, even if violations of the standards are found (GAO, 2009)."

There are several NSF/ANSI standards for drinking water treatment units (e.g., water filters).

Universities can use standards from the Association for the Advancement of Sustainability in Higher Education's (AASHE) Sustainability Tracking, Assessing and Reporting System (STARS) program to document and report progress on sustainability initiatives.

TAP WATER

United States Environmental Protection Agency, Safe Drinking Water Act, 1974 (Amended in 1986 and 1996).

This law gives the EPA power to set monitoring, treatment, and contaminant standards for the drinking water sources and supply of all U.S. public water systems. Maximum contaminant levels (MCLs) are set for over 90 naturally occurring as well as man-made contaminants. However, many contaminants are not covered. State standards must meet or exceed the legal limits set by the EPA and both the EPA and the States are responsible for enforcing compliance with these standards. Water systems are tested regularly and randomly at various points in the distribution path. Water suppliers are required to report all violations and remedial actions in Consumer Confidence Reports (see the **Cost, Quality, and Supply** section of this Guide for more on these reports).

BOTTLED WATER

United States Food and Drug Administration, Federal Food, Drug, and Cosmetic Act, 1938 (FFDCA).

Under the FFDCA, bottled water transported across state lines is regulated as a packaged food product. Bottled water processed, packaged and sold within a single state is regulated by that state. Standards applicable to bottled water can be found in the Code of Federal Regulations (CFR). Title 21 of the CFR defines the various types of bottled water; sets limits for certain contaminants; lists labeling requirements; and establishes processing and bottling regulations under the Current Good Manufacturing Practice. The FDA is required to adopt standards for bottled water that are no less stringent than the EPA's standards for tap water. However, it is the responsibility of the bottler to make sure its water can pass FDA tests and inspections.

However, since "bottled water plants generally are assigned low priority for inspection," inspectors tend to focus primarily on plants that have received several complaints or have a previous history of violations (Posnick and Kim, 2002). There is no mandated reporting for bottled water companies, and consumers do not have a guaranteed right to know the contaminants found in bottled water. Furthermore, the FFDCA does not authorize the FDA to require bottles to post test results, even if contaminants have been found. Instead, inspectors review testing records at bottling facilities; by contrast, the EPA must notify the public within 24 hours of detecting violations in tap water (GAO, 2009).

DRINKING WATER TREATMENT UNITS

A variety of standards are available for verifying the filtration functions of treatment units. After determining which (if any) contaminants need to be removed from drinking water, choose drinking water treatment units (DWTU) certified to remove those contaminants. The following independent, third-party organizations set standards for drinking water treatment units and certify units that are verified as meeting the standards.

NSF is a non-profit organization that "conducts safety testing for the food and water industries" (Rysavy, 2007). "Through a comprehensive consensus process, the NSF Joint Committee on Drinking Water Treatment Units (DWTUs) has developed key standards for evaluation and certification of drinking water treatment units" (NSF, 2004). DWTUs that meet NSF safety standards and remove 93 percent or more of a particular contaminant are eligible to receive NSF certification for that contaminant. NSF also has standards for particular water treatment methods. A listing of NSF-certified drinking water treatment units is available at **http://www.nsf.org/Certified/dwtu** or 877-867-3435.

NSF standards for DWTUs include:

- **NSF/ANSI Standard 42: Drinking Water Treatment Units - Aesthetic Effects**
  "This standard covers point-of-use (POU) and point-of-entry (POE) systems designed to reduce specific aesthetic or non-health-related contaminants (chlorine, taste and odor, and particulates) that may be present in public or private drinking water." (NSF, 2004) This includes commonly-used carbon adsorption filters.

- **NSF/ANSI Standard 53: Drinking Water Treatment Units - Health Effects**
  "Standard 53 addresses point-of-use (POU) and point-of-entry (POE) systems designed to reduce specific health-related contaminants, such as Cryptosporidium, Giardia, lead, volatile organic chemicals (VOCs), and MTBE (methyl tertiary-butyl ether), that may be present in public or private drinking water." (NSF, 2004) This includes commonly-used carbon adsorption filters.

- **NSF/ANSI Standard 58: Reverse Osmosis Drinking Water Treatment Systems**
  "This standard was developed for point-of-use (POU) reverse osmosis (RO) treatment systems. These systems typically consist of a pre-filter, RO membrane, and post-filter. Standard 58 includes contaminant reduction claims commonly treated using RO, including fluoride, hexavalent and trivalent chromium, total dissolved solids, nitrates, etc. that may be present in public or private drinking water." (NSF, 2004)

- **NSF/ANSI Standard 44: Cation Exchange Water Softeners**
  "This standard covers residential cation exchange water softeners designed to reduce hardness from public or private water supplies. Additionally, this standard can verify the system's ability to reduce radium or barium" (NSF, 2004).

- **NSF/ANSI Standard 55: Ultraviolet Microbiological Water Treatment Systems**
  "This standard establishes requirements for point-of-use (POU) and point-of-entry (POE) ultraviolet systems and includes two optional classifications. Class A systems (40,000 uwsec/cm2) are designed to disinfect and/or remove microorganisms from contaminated water, including bacteria and viruses,

to a safe level. Class B systems (16,000 uwsec/cm2) are designed for supplemental bactericidal treatment of public drinking water or other drinking water, which has been deemed acceptable by a local health agency." (NSF, 2004)

- **NSF/ANSI Standard 62: Drinking Water Distillation Systems**
  "Standard 62 covers distillation systems designed to reduce specific contaminants, including total arsenic, chromium, mercury, nitrate/nitrite, and microorganisms from public and private water supplies." (NSF, 2004)

For more info on above standards, click **here**.

- **NSF/ANSI Standard 60: Drinking Water Treatment Chemicals – Health Effects**

  "The nationally recognized health effects standard for chemicals which are used to treat drinking water." (NSF, 2004a)

- **NSF/ANSI Standard 61: Drinking Water System Components – Health Effects**
  "The nationally recognized health effects standard for all devices, components and materials which contact drinking water" (NSF, 2004a). Section 9 of this standard "regulates the levels of contaminants that can leach from drinking water devices into potable water" (Sorensen, 2004). While the U.S. federal government only requires compliance for lead levels, the 2003 International Plumbing Code (IPC) requires that products comply with all sections of this standard.

For more info on the above standards click **here**.

Underwriters Laboratories
The Underwriters Laboratories certifies filters with their **Water Quality mark**, which is based on, but is not verified precisely to, NSF standards.

Water Quality Association (WQA)
The WQA certifies filters with their **Gold Seal**, which is based on, but is not verified precisely to, NSF standards.

State Department of Health Certificate of Claims
Some states (such as California, Wisconsin, and Massachusetts) require certification of performance claims and promotional literature for water treatment devices. Companies earn this certification by providing extensive laboratory test data for each contaminant removal claim. The Certificate also means the company's literature, website, and packaging have been reviewed to contain no false or exaggerated claims (WFC, n.d.).

ENERGY STAR for Bottled Water Coolers
Energy Star has not created a testing protocol for bottle-less coolers, but many bottled coolers are Energy Star compliant. These coolers use less standby energy (the required energy to maintain cold and/or hot water at appropriate dispensing temperatures) (EPA, n.d.). To earn the Energy Star label, the cold-only and cook-and-cold (i.e., room temperature and chilled) units must use less than or equal to 0.16 kWh per day. Hot-and-cold units must use less than or equal to 1.20 kWh per day. Note that while Europe has regulations requiring that water coolers be sanitized on a quarterly basis, no such standards exist in the United States.

ADA and IPC/UPC Standards for Fountains .
Fountains are affected by two additional standards: model plumbing codes and the Americans with Disabilities Act (ADA). Model plumbing codes, such as the International and Uniform Plumbing Codes (IPC and UPC), specify the number of drinking fountains required in public buildings and spaces. The ADA addresses design features of fountains, requiring them to be accessible to wheelchair-bound or disabled persons. Fountains must

have a certain amount of knee and toe clearance and limits are set on how high the fountain stream can be set.

OTHER ORGANIZATIONS

Association for the Advancement of Sustainability in Higher Education (AASHE), Sustainability Tracking, Assessment and Rating System (STARS)

The STARS program is a voluntary self-assessment undertaken by many colleges and universities to track relative progress toward sustainability. Universities receive "credits" based on their performance in three categories: Education and Research, Operations, and Planning, Administration and Engagement.

While there are no specific categories pertaining to bottled water in STARS, such an initiative could help earn existing Operations credits. For example, Operations Credit 17: Waste Reduction recognizes the reduction "of the use of materials in the first place...and the total amount of materials discarded… (AASHE, 2009)." The reduced waste resulting from a bottled water ban can be included in this category. Colleges and universities can receive a maximum of five points from this credit by reducing waste by 50 percent or more relative to their 2005 baseline. For reductions under 50 percent, a formula, which measures waste reduction by campus users, is used to award points (to calculate the amount of waste reduced by eliminating bottled water in terms of plastic, energy, water and oil saved, use RPN's **Bottled Water Calculator**).

In addition to receiving credits from other related categories, colleges and universities can earn an "Innovation Credit" for "new, extraordinary, unique, ground-breaking, or uncommon outcomes, policies, and practices (AASHE, 2009)" that greatly exceed the criteria of a STARS credit or is not covered elsewhere in STARS. The elimination of bottled water could possibly earn a credit in this category as well.

For more information on the STARS program and how your college or university can become involved, visit **http://www.aashe.org/**.

Formal policies which eliminate the purchase of bottled water can be beneficial for educational institutions by clearly outlining the underlying motivation for phasing out bottled water and communicating any exceptions to stakeholders, stating goals, setting a timetable and providing a guideline to evaluate success by tracking and reporting progress.

Universities can choose to do this with a written declaration from the chancellor or other administrator or by having students enact policy, such is the case from the University of Winnipeg. Of course, it is possible to change purchasing practices without a policy, but formal policy helps ensure timely action, accountability, and continuity in the event of personnel or administrative turnover. For a comprehensive list of educational institutions in the United States and Canada with bottled water bans, "bottled water free zones" and use reduction campaigns, see **Addendum II**.

MODEL POLICY

Developed by the Responsible Purchasing Network, this model policy incorporates the recommended "best practices" in phasing bottled water out of universities. See **Addendum III** for the complete policy.

EDUCATIONAL INSTITUTIONS WITH ENACTED POLICIES

Belmont University, Nashville, Tennessee, April 2009
Belmont University announced during its Earth Week fair in 2009 that it was going to eliminate the sale of bottled water at all stores and vending machines. Several water fountains were added and filters were also installed.

Johns Hopkins University, Baltimore, Maryland, April 2008
President William Brody issued an order, as a symbolic gesture, to rid the President's office of bottled water in addition to reverting to reusable glassware, dishes and utensils.

Memorial University of Newfoundland, St. John's, Newfoundland and Labrador, Canada, September 2009
President pro tempore, Dr. Chris Loomis signed policy that made Memorial University of Newfoundland (MUN) the second Canadian university to progressively phase out bottled water. The announcement was made at a new student orientation that provided incoming students with reusable bottles. Thirteen water-fill stations were installed, with more upgrades planned for the future.

Smith College, Northampton Massachusetts, Summer 2009
A policy was announced to eliminate bottled water in residential dining and limit the sale of bottled water in the Campus Center Café and vending machines to those brands sourced from within a 500-mile radius. Bottled water was replaced in all catering operations with bulk water except for box lunches intended to be carried elsewhere (e.g. alumnae weekends).

Washington University in St. Louis, St. Louis, Missouri, January 2009
Washington University in St. Louis was the first college in the United States to expel bottled water from its

campus. Through a largely administration-driven initiative, bottled water was eliminated from all campus stores and vending machines and many water fountains were upgraded or repaired.

The University of Winnipeg, Winnipeg, Manitoba, Canada, March 2009
The University of Winnipeg was the first Canadian university to end the purchase of bottled water. A student led movement brought the issue to a school referendum, which passed overwhelmingly and ended the school's contract with Trainor Artesian Water. For the proposed referendum and ballot question, see **Addendum IV**.

CITIES WITH ENACTED POLICIES

Ann Arbor, MI, Council Announcement, June 2007
Banned the city government purchase of commercial bottled water for city-sponsored events and functions.

Bundanoon, Australia, July 2009.
Banned the sale of bottled water at all venues, both private and public, within the town precinct. Bundanoon was the first city in Australia to completely eliminate bottled water and possibly the world's first city to take such a large municipal-level action.

Chicago, IL, Chicago Bottled Water Tax Ordinance, 2008
Imposed a 5 cent per bottle retail tax on every bottle of water sold in the City of Chicago, with the money going to Chicago's corporate fund.

Davis, CA, Bottled Water Resolution, 2007
Banned use of public funds for bottled water purchases, except for emergency personnel, and encourages residents and businesses to stop using bottled water.

Morrow Bay, CA, Resolution Regarding Bottled Water, 2008
Prohibited the spending of public funds on bottled water.

Federation of Canadian Municipalities, March 2009
Urged all municipalities to phase out the purchase and sale of bottled water and develop awareness campaigns about the benefits of municipal tap water.

San Francisco City and County, CA, Permanent Phase-Out of Bottled Water Purchases by San Francisco City and County Government, June 2007
Signed by Mayor Gavin Newsom in June of 2007, this Executive Directive set three distinct deadlines for eliminating the purchase of bottled water by the city and county. First, the purchase of single-serving bottled water was prohibited by city departments and agencies. Three months later, these same agencies were required to study the feasibility of replacing bottled water coolers with plumbed-in, bottle-less dispensers. The final step, called for two months after the audit, mandated that "all city departments and agencies occupying city or rental properties must switch to bottle-less dispensers that connect to main local tap water lines.'' By using this system, San Francisco addressed two of the most common types of bottled water, half-liter bottles and larger, multiple-gallon containers.

San Jose, CA, Prohibition of Purchase of Single-Serving Bottled Water, 2008
Policy prohibited the use of public funds to purchase single-serving bottled water, with an exception for emergency responders.

Seattle, WA, Executive Order Restricting Bottled Water, 2008
This E.O. restricted the purchase of single-serving and large-volume bottled water for City facilities and events. The Seattle Public Utilities company was directed to inspect water quality at City facilities upon request. An education program was required to inform City employees about the reasons for the policy and the

availability of tap water.

Toronto, Ontario, Canada, City Council Announcement, December 2008
Banned the sale of bottled water immediately at Civic Centers and authorized staff to implement a program to ban the sale and distribution of bottled water at all remaining city facilities by the end of 2011 and improve access to tap water.

U.S. Conference on Mayors, June 2008
The US Conference of Mayors encouraged cities to phase out, where feasible, government use of bottled water and promote the importance of municipal water.

STATES WITH ENACTED POLICIES

New York, Executive Order restricting the use of bottled water, May 2009
Governor David Paterson directed the state to implement a plan for eliminating bottled water within a year at all executive agencies, citing financial and environmental costs.

RPN's online product database includes over 2,000 water filters certified by NSF/ANSI 42, 44, 53, 55, 58, and 62 to remove various contaminants (see Standards), including filters for point-of-use and point-of-entry.

These listings were last updated on September 9, 2009; please check directly with certifying agencies to verify current product certification status.

The Bottled Water Calculator developed by RPN, compares the cost and environmental impacts of 16.9 oz. bottles of water with tap water.

Results are expressed in gallons of water, mega joules of energy, gallons of oil, pounds of CO_2e, and dollars saved. The calculator may be found at **http://www.responsiblepurchasing.org/purchasing_guides/bottled_water/calculator/**.

Washington University in St. Louis

In early 2009, Washington University in St. Louis (WUSTL) became the first college in the United States to end the sale of bottled water. The administration began and implemented the initiative, but also worked in conjunction with a student led educational campaign.

- University officials mapped all drinking fountains and about 70 were upgraded or fixed.
- Contract with Coca-Cola allowed for the discontinued sales of bottled water without alteration.
- Bottled water was pulled from all dining locations in January of 2009 and on-campus stores two months later.
- Bottled water in vending machines was substituted with other drinks.
- Student-led "Tap It" campaign showcased the safety and quality of tap water in St. Louis with several tap water challenge events.

Environmental Benefit

Using figures provided by WUSTL and RPN's bottled water calculator, WUSTL's ban will save 331,992 bottles of water annually, which accounts for:

- 103,074 gallons of water just for production and purification = water used by 35 people in a month
- 62, 249 lbs. of CO_2 to make plastic bottles = 5 cars off the road for a year
- 8, 231 gallons of oil to produce plastic bottles = one 18-wheeler tanker
- 33, 296 megajoules of energy = one household for a year

University of Winnipeg

In March of 2009, The University of Winnipeg (UW) became the first Canadian school to ban the sale and provision of bottled water through a student referendum.

- Canadian Federation of Students (CFS), a national student union, declared water a major campaign priority.
- A broad coalition of local groups in Winnipeg and on-campus environmental organizations was formed.
- The campaign received support from the Campus Sustainability Office and President of UW, Dr. Lloyd Axworthy.
- Students passed a referendum in March 2009 to terminate its beverage contract and the university announced a progressive phase out of bottled water, which paralleled upgrades in water infrastructure.

Example of a water fountain at UW that has been upgraded to include a spigot for use with reusable bottles.
Photo courtesy of David Jacks.

- There are approximately 14.4 million undergraduate and 3.1 million graduate students currently enrolled in the U.S. (Census, 2003)
- Americans bought 8.7 billion gallons of bottled water in 2008 (BMC, 2009).
- Producing PET bottles uses the equivalent of more than 17 million barrels of oil and produces over 2.5 million tons of carbon dioxide (Pacific Institute, n.d.) - the same amount of carbon dioxide that would be emitted by over 400,000 passenger vehicles in one year (EPA, 2007a).
- On average, the cost to treat, filter, and deliver water to ratepayers in the United States is 0.2 cents per gallon in the U.S. (EPA, 2004) – roughly 750-2,700 times cheaper than bottled water on a per gallon basis, although this cost varies regionally.
- Over 90 percent of U.S. municipal water systems regularly meet or exceed the EPA's regulatory and monitoring requirements. (EPA, 2007).
- According to 1999 government and industry estimates, about 25-40% of bottled water is actually bottled tap water, sometimes with additional treatment, sometimes not (NRDC, 1999).
- In 2005, 96% of bottled water sold in the U.S. was packaged in PET containers, most of which were single-serve sizes of one liter or less (CRI, 2007).
- In 2004, only 14.5 percent of non-carbonated beverage bottles made from PET were recycled (APC, 2005).
- For each gallon of water that is bottled, an additional two gallons of water are used in processing (UCS, 2007).
- A $1 increase in local government spending on water and sewer infrastructure and operations and maintenance (O&M) increases total local economic activity by $2.62 (USCM, 2008).
- In an average week, a refrigerated fountain uses 8.5 to 10.5 kWh of electricity (NC, 2004).
- While this number varies depending on frequency of use, air and water temperature, and unit size, this corresponds to a cost of $30-$38 per fountain per year (based on average North Carolina electricity rates) (NC, 2004).
- Over an average week, a bottled water cooler uses approximately 3.5-4.5 kWh, which, according to the average electricity rates in one state, North Carolina, costs $12-$17 per cooler per year (NC, 2004).
- Bottle-less coolers often use 30 to 50 percent less energy depending on the model and, based on the North Carolina case study and could save $4-$8 per cooler per week (Doughty, 2008).

DEFINITIONS

Absorption	A process in which one substance, such as a liquid or solid, permeates another; a fluid permeates or is dissolved by a liquid or solid. Some water filters absorb contaminants in this manner.
Adsorption	The process by which molecules of a substance, such as a gas or a liquid, collect on the surface of another substance, such as a solid. The molecules are attracted to the surface but do not enter the solid's minute spaces as in absorption. Some drinking water filters consist of carbon cartridges that adsorb contaminants.
Aesthetic contaminants	Non-health-related contaminants that affect the odor, appearance, and/or taste of water. These can include chlorine, minerals, and particulates, among others.
Antimony	A potentially toxic trace element that is an eye, skin, and lung irritant at high doses and has chemical properties similar to those of arsenic. It has been found to leach from bottles made of PET plastic.
Arsenic	A highly poisonous metallic element sometimes present in trace amounts in bottled water, municipal water, and well water.
At-risk populations	Groups of people (such as the very young, elderly, pregnant, and those with weakened immune systems) who are particularly susceptible to toxins and contaminants found in bottled and tap water. These populations may experience adverse health effects even when exposed to contaminant levels that meet or fall below legal standards.
Benzene	A toxic substance that can cause drowsiness, dizziness, and unconsciousness. Long-term exposure can cause anemia, leukemia, and bone marrow problems. Sometimes emitted when PET resin is manufactured into plastic bottles.
Beverage exclusivity contract	Agreements between many colleges and universities and beverage providers (i.e. Coca-Cola, Pepsi Co., etc.) that guarantee beverages from the provider's competitors will not be sold or distributed. These contracts vary widely between schools.
Bioaccumulate	A process whereby harmful substances accumulate as they move up the food chain.
Biofilm	A slime-like layer of bacterial growth that can coat the internal components of coolers, fountains, and filters. This film can develop when drinking units are not properly cleaned and maintained and when water is allowed to sit in storage tanks for extended periods of time.

Bottle bill	A legislative bill that requires the charging of a refundable deposit on certain beverage bottles and cans, to encourage the return of these containers for recycling and litter reduction.
Bottled water	Drinking water that is put into bottles and offered for sale.
Bottled water cooler	A cooler that dispenses cold, hot, or room-temperature water from a large multi-gallon jug of bottled water.
Bottle-less water dispenser	A dispenser that connects directly to a main municipal water supply line and dispenses tap water as opposed to bottled water (this includes water fountains and coolers, as well as other dispensers with built-in tanks that hold pre-chilled or pre-heated water).
Bulk bottle	Bottles that contain multiple gallons of water (the most common is a 5-gallon bottle).
Chloramine	A chlorine-ammonia compound used as a disinfectant in 29% of U.S. water utilities. Can cause asthma, rashes, and fainting (GG, 2007).
Chlorine	A chemical used effectively as a disinfectant for municipal water treatment systems. When emitted as a gas – such as when plastic bottles are incinerated – it can be highly irritating to respiratory organs. May also be present in tap water in trace amounts, though in a different chemical form than that which leaches from PET and other plastic bottles.
Coliform bacteria	Presence of these bacteria in water can indicate presence of Cryptosporidium and other dangerous microbes. Coliform bacteria are not harmful in themselves (GG, 2007).
Community water system	Public water system that serves at least 15 service connections used by year-round residents or regularly serves at least 25 year-round residents (EPA, 2006; EPA, 2007b).
Consumer Confidence Report (CCR)	An annual “right-to-know” report of an area’s drinking water quality that the EPA requires water suppliers to send to customers.
Current Good Manufacturing Practice (CGMP)	Part of the Federal Food, Drug, and Cosmetic Act which establishes processing and bottling regulations for beverages.

Dioxins	A particular class of chlorine-containing chemical compounds classified as persistent, bioaccumulative, and toxic (PBT) by the EPA. Not all PBTs are dioxins. See PBT for more information on other persistent, bioaccumulative, and toxic chemicals.
Direct chill coolers	These coolers chill water instantly as it passes through the cooler's filter. Bacterial growth is avoided because water does not sit in storage tanks and, as a result, direct chill coolers also tend to use less energy.
Direct feed fountain	A water fountain that dispenses water directly from the tap, without using refrigeration or storage tanks. These fountains take advantage of the naturally cooler temperature of water that comes from underground municipal pipes.
Distillation	A water purification process by which water is boiled and the steam is recondensed, leaving behind certain contaminants. Typically combined with other filtration methods (such as carbon adsorption) to remove any remaining contaminants.
Downcycled	The process by which recycled materials "lose viability or value in the process of recycling. They can then only be used in a degraded form for components other than their original use" (Sustainability Dictionary, n.d.). PET (#1) plastic can only be fully recycled into new plastic water bottles a few times before it is downcycled into products such as carpet fiber and plastic lumber.
Drinking Water Treatment Unit (DWTU)	A device which reduces or removes aesthetic and/or health-related contaminants from water. DWTUs can include filters, fountains, and bottle-less water coolers.
E. Coli	A bacterium sometimes found in bottled, municipal, and well water which can be pathogenic and threaten food safety.
End-of-life management	Process by which products are reused, recycled, remanufactured, or disposed of after their term of useful service expires.
Environmentally preferable	Products and services that have either a more positive or a less negative effect on human health and the environment when compared to other products and services that serve the same purpose.

Ethylbenzene	A toxic substance that can cause drowsiness, fatigue, headache, and mild eye and respiratory irritation with short term exposure. Long term exposure is linked to damage to the liver, kidneys, central nervous system and eyes. Ethylbenzene is emitted when PET resin is manufactured into plastic bottles.
Ethylene oxide	A toxic substance that, with acute exposures, can cause respiratory irritation and lung injury, headache, nausea, vomiting, diarrhea, shortness of breath, and cyanosis. Chronic exposure has been associated with the occurrence of cancer, reproductive effects, mutagenic changes, neurotoxicity, and sensitization. Emitted when PET resin is manufactured into plastic bottles.
Fluoridation	The process of adding fluoride into municipal tap water as a way to combat tooth decay. The process began in the 1940s but has recently received increased scrutiny.
Greenhouse gas	Heat-trapping gas in the Earth's atmosphere responsible for global warming; category includes water vapor, carbon dioxide, methane, ozone, CFCs, and nitrogen oxides.
Hazardous substance	1. Material posing a threat to human health and/or the environment, that can be toxic, corrosive, ignitable, explosive, or chemically reactive, 2. Substance that must be reported to the EPA if released into the environment.
Hazardous waste	Hazardous by-products that can pose a hazard to human health or the environment when improperly managed.
Health-related contaminants	Contaminants that can cause specific negative health effects as a result of short- or long-term exposure. These can include Cryptosporidium, Giardia, lead, volatile organic chemicals (VOCs), and MTBE (methyl tertiary-butyl ether), among many others.
Heavy metals	Metallic elements with high atomic weights; (e.g. mercury, chromium, cadmium, arsenic, and lead) that can damage living things at low concentrations and tend to accumulate in the food chain (EPA, 2007b). When plastic bottles are incinerated, heavy metals can be deposited in the ash. Heavy metals may also leach into water from pipes and can be found in trace amounts in soil, water supplies, and elsewhere.

Lead	Metal used in older plumbing infrastructure (i.e. pipes) that can contaminate water supplies and cause blood and brain disorders as well as damage to the nervous system.
Maximum Contaminant Level (MCL)	The highest level of a naturally-occurring or man-made contaminant the EPA allows in drinking water.
Metric Tons of Carbon Equivalent (MTCE)	The international standard for expressing greenhouse gases in carbon dioxide (CO_2) equivalents.
Multi-serve bottle	Large, multi-gallon jug (or carboy) of water. Usually holds 5 gallons and weighs around 50 pounds.
Nickel	A toxic substance that can cause dermatitis, respiratory irritation, and lung and nasal cancer. Nickel is emitted when PET resin is manufactured into plastic bottles.
Nitrates	Compounds containing nitrogen that can exist as a dissolved gas in water and can have harmful effects on humans. A plant nutrient and inorganic fertilizer, nitrate is found in septic systems, animal feed lots, agricultural fertilizers, manure, industrial waste waters, sanitary landfills, and garbage dumps (EPA, 2007b)
PBTs	Persistent, bioaccumulative, and toxic (PBT) chemicals that remain in the environment for long periods of time, are not readily destroyed, and build up or accumulate in body tissue.
Plumbed-in water dispenser	A dispenser that connects directly to a main municipal water supply line and dispenses tap water as opposed to bottled water (this includes water fountains as well as dispensers with built-in tanks that hold pre-chilled or pre-heated water).
Point-of-entry site	The location where tap water enters a home or building.
Point-of-use site	The location where tap water directly reaches a consumer, such as a faucet or water fountain.
Polycarbonate plastic	Plastic used in baby bottles, food can liners, and sport water bottles. Tends to be hard, transparent, and shatter-proof. Labeled number 7, which is a catchall category for plastics that do not fit into one of the other six categories. Studies have found that polycarbonate bottles leach Bisphenol-A (BPA), an endocrine disruptor, into the beverages they hold.

Polyethylene terephthalate (PET or PETE, #1 plastic)	Plastic labeled number 1, used in making synthetic fibers, beverage bottles, liquid containers, and carpet. This plastic is a type of polyester.
Post-consumer recycled content	Material recovered from a consumer product at the end of its life, diverted from waste destined for disposal.
Public (or municipal) water system	A system that provides piped water for human consumption to at least 15 service connections or regularly serves 25 individuals (EPA, 2007b).
Safe Drinking Water Act (SDWA)	Regulates the U.S. municipal drinking water supply; enforced by the EPA.
Safe Drinking Water Information System (SDWIS)	A database which contains information about public water systems and their violations of EPA's drinking water regulations (EPA, 2006a).
Single-serving bottle	Bottle intended for one-time use and disposal; usually containing half-liter (16.9 oz) of water or less.
Take-back	"A 'producer responsibility' approach to facilitating reuse or recycling whereby consumers return used products back to the company that produced them" (Sustainability Dictionary, n.d.). Some filter companies offer take-back of used filter cartridges, but many do not.
Tap water	Municipal water drawn directly from a tap, faucet, or other direct local water supply line.
Toxic substance	A chemical or chemicals that may present an unreasonable risk of injury to health or the environment.
Ultraviolet (UV) disinfection	A water treatment process, incorporated into many bottle-less water coolers, which uses a 60 watt ultraviolet bulb to irradiate water as it flows through the cooler. UV disinfection systems kill most bacteria and viruses found in water.
Water distribution system (drinking water infrastructure)	An underground network of pipes that delivers drinking water to homes and businesses. Small systems may be relatively simple, while large metropolitan systems can be extremely complex, sometimes consisting of thousands of miles of pipes serving millions of people.

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Sample Beverage Exclusivity Contract

Beverage exclusivity contracts are far too large to provide in this Guide in their entirety. However, the document below exemplifies many common contractual provisions by summarizing the details of Virginia Tech's contract with Coca-Cola.

The University and Virginia Tech Services, Inc. have entered into exclusive sponsorship contracts with the Coca-Cola Company. This is a ten year agreement. The agreement specifies that the university will purchase beverages exclusively from Coca-Cola and not from competing brands. Coke has exclusive advertising and sampling rights on campus. As a result of this agreement, you will also see Coke products co-branded with VT logos on beverage products in the commercial marketplace.

As a result of our agreement, Coca-Cola will be providing the university with financial support, marketing support and preferential pricing on their products.

There are some exceptions to the exclusivity of Coke products. Culinary services will still be able to sell some specific brands of soda such as Pepsi and Dr. Pepper. VT Services' Bookstore and convenience stores will also be able to sell other brands of soda, teas, and specialty waters, etc. Further, this contract applies to the Blacksburg campus only. It does not apply to off-campus locations, even though these locations are a part of the university.

The important thing to know is that if your campus organization is purchasing sodas to be used for any purpose on campus, such as for a reception or meeting, or is seeking sponsorship in the form of donations or support for any on-campus event, you must deal exclusively with Coke and must not work with any other beverage supplier.

Universities with Bottled Water Policies

American Bottled Water Bans and Use Reduction Campaigns

The following list, provided by AASHE, consists of institutions that have banned bottled water from campus or have active campaigns to reduce their sale and consumption. Click on a school for more information on its initiative.

Campus-Wide Bans

- Belmont University
- Gonzaga University
- Oberlin College
- University of Winnipeg
- Upstate Medical University
- Washington University in St. Louis

Area, School and Department Specific Bans

- Barnard College
- Harvard Kennedy School
- Harvard School of Public Health
- Ohio University College of Osteopathic Medicine
- Smith College
- University of Ottawa
- Stanford University
- Stony Brook University
- University of Maryland
- University of Minnesota

Student Campaigns to Ban Bottled Water

- Colgate University
- Evergreen State College
- Gonzaga University
- Northeastern University
- Ohio University
- Pennsylvania State University

Awareness and Reduction Campaigns

- Boston College
- Brandeis University
- Case Western Reserve University
- Dartmouth College
- Davidson College
- DePauw University
- Drexel University
- Duke University
- Flemming College
- Georgia Institute of Technology
- Harvard Law School
- Kalamazoo College
- The Meredith College
- Montana State University
- Monterey Institute of International Studies
- Portland State University
- Rider University

- Saint Joseph's College of Maine
- St. Olaf College
- State University of New York, Cortland
- University of Arkansas
- University of California
- University of Colorado at Boulder
- University of Hawai'i
- University of Idaho
- University of Montana
- University of Vermont
- Utah State University

Canadian Universities & Colleges with "Bottled Water Free Zones."

"Bottled Water Free Zones" are spaces where bottled water is not purchased or provided. Alternatives such as glasses, pitchers and reusable stainless steel containers for tap water are promoted and provided, and beverage exclusivity contracts are challenged. The following list, provided by Polaris Institute, consists of Canadian universities and colleges that have a designated "Bottled Water Free Zone."

- Acadia University, Wolfville, Nova Scotia
- Brock, St. Catharines, Ontario
- Carleton University, Ottawa, Ontario
- Concordia University, Montreal, Québec
- Dalhousie University, Halifax, Nova Scotia
- George Brown College, Toronto, Ontario
- Guelph University, Guelph, Ontario
- Humber College, Toronto, Ontario
- John Abbott College, Montreal, Québec
- Lakehead University, Thunder Bay, Ontario
- Langara College, Vancouver, British Columbia
- McGill University, Montreal, Québec
- Memorial University, St. Johns, Newfoundland & Labrador
- Mount Saint Vincent University, Halifax, Nova Scotia
- Queen's University, Kingston, Ontario
- Ryerson University, Toronto, Ontario
- Saint Mary's University, Halifax, Nova Scotia
- Simon Fraser University, Vancouver, British Columbia
- Sir Sandford Fleming College, Peterborough, Ontario
- Thompson River University, Kamloops, British Columbia
- Trent University, Peterborough, Ontario
- UBC Okanagan, Kelowana, British Columbia
- Université Sainte-Anne, Church Point, Nova Scotia
- University of King's College, Halifax, Nova Scotia
- University of Manitoba, Winnipeg, Manitoba
- University of Ontario Institute of Technology (UOIT), Oshawa, Ontario
- University of Ottawa, Ottawa, Ontario
- University of PEI, Charlottetown, Prince Edward Island
- University of Toronto, Toronto, Ontario
- University of Winnipeg, Winnipeg, Manitoba
- Waterloo University, Waterloo, Ontario
- York University, Toronto, Ontario

RPN Model Policy

This model policy, developed by the Responsible Purchasing Network, is a basic template to clearly lay out a policy initiative from a university administration that will progressively phase out the purchase and sale of bottled water by using best practices.

To the students, faculty and administrators of [UNIVERSITY],

In an effort to further strengthen [UNIVERSITY]'s ongoing commitment to sustainability, the [office, department or administrator] has decided to reevaluate and gradually reduce the role of bottled water on campus.

The production of bottled water accounts for needless use of plastics and energy in addition to the extra expense of transporting cases of water from factories to campus. It can take up to two gallons of water to produce a single gallon of bottled water. Additionally, bottled water is often not any cleaner than tap water. We are often consuming a more expensive and environmentally harmful product when tap water is readily available.

[UNIVERSITY] will take the following steps to phase out bottled water purchases in the next X months:

- A committee comprised of students, faculty and administrators has been established to measure the baseline costs, both financial and environmental, of bottled water sales on campus and set goals for reduction. This committee will also oversee and monitor the initiative and its progress.
- By X [DATE], the committee will review and inspect the drinking facilities and municipal water on campus and where appropriate, order upgrades to provide safe, accessible, and clean tap water. Facility upgrades will also include the installation of new drinking fountains equipped to refill reusable bottles and bottle-less coolers with filtered water. All future on-campus buildings will incorporate, to the greatest extent possible, tap water delivery for students, faculty and administrators in high-traffic areas.
- By X [DATE], the sale of bottled water on campus will be discontinued. This includes bottled water sold at all university stores and cafeterias, vending machines, catering and other university events, and administrative use.

While the sale of bottled water will be discontinued at all university venues, it is important to note that exceptions will be integrated into this policy where the committee finds it appropriate. These exceptions will include emergency preparedness and other procedures vital to safety on campus.

The ban applies only to the purchase and sale of bottled water on campus; students, faculty and staff are by no means prohibited from using bottled water, although we are encouraging the use of reusable bottles in its place. We can each do our part to reduce the collective impact of [UNIVERSITY]'s environmental footprint. By using a reusable water bottle, we can reduce countless bottles of water from entering landfills and prevent carbon dioxide emissions.

For questions or concerns, please contact [appropriate party] at XXX-XXX-XXXX

Policy Sample

The University of Winnipeg

MOTION TO TERMINATE UWSA WATER COOLER CONTRACT

Whereas the University of Winnipeg Student's Association is committed to and directed by bylaws and policies that declare sustainability as a priority and;

Whereas the UWSA has embraced a campaign to eliminate the sale of bottled water on campus to lead by example by encouraging the use of clean, safe and free tap water;

Be it resolved that the UWSA terminate its current water cooler contract with Trainor Artesian Water.

UNIVERSITY OF WINNIPEG STUDENT'S ASSOCIATION GENERAL ELECTION: REFERENDUM QUESTION

Would you be willing to support an initiative led by the University of Winnipeg and the UWSA to gradually eliminate sales of bottled water on campus with increased access to clean and free drinking water?

Yes/No

RPN, Model Bid Specification Guidance, 2008

Bottled Water Alternatives

Model Bid Specification Guidance

This document provides tips on developing bid specifications for Filters, Fountains, Bottle-less Coolers, Reusable Bottles, and Events & Catering. We recommend items that should be specified in a bid request document and information that should be requested from bidders.

I. Filters

a. Specify:

i. The contaminant(s) you want to filter from your water

ii. Whether you seek a point of entry or point of use filter

1. If point of entry:

a. Specify the location where you will place the filter

i. If you're unsure where to locate the filter, ask bidder to provide on-site assessment

2. If point of use:

a. Specify the type of fixture(s) that you will be using to filter water (e.g., faucet, pitcher, bottle-less water cooler, refrigerator, etc.)

b. Provide detailed specifications of these fixtures so vendors can correctly match their filter to your needs

iii. Whether you seek a full service/maintenance contract, or just a contract for the filters

iv. Whether you seek advanced features on filters such as filter replacement indicator lights/alarms

a. Require bidders to:

i. Provide evidence that their filter will remove the desired contaminant(s) from the drinking water and the percentage of the particular contaminant(s) that will actually be removed

ii. Provide evidence of compliance with NSF/ANSI standards

iii. Provide evidence that their filter will serve your point of entry or point of use application

iv. Explain filter installation, maintenance, and replacement requirements

v. Describe how much space the filter requires

vi. Estimate total volume of water filtered before filter needs replacing, and associated cost of the filter per gallon of water (show all assumptions)

vii. If applicable, estimate the amount of electricity required to operate the filter and the total amount of electricity per gallon of water filtered (show all assumptions)

viii. Identify the filtration method used (e.g., adsorption, filter membranes, distillation, or disinfection)

ix. Describe end of life management services that are available to keep waste cartridges and other filter equipment out of landfills

II. **Fountains**

a. Specify:

i. What type of fountain you're looking for (e.g., box-shaped floor model, pedestal base model, wall-mounted unit, models built into and flush with wall)

ii. Where the fountain will be located (e.g., indoor, outdoor)

iii. Whether the contract includes the fountain, installation, and cleaning/maintenance, or some combination

iv. Whether the fountain needs special features such as taller spigots for the refilling of large reusable bottles

v. Whether refrigeration is required

b. Require bidders to:

i. Describe installation requirements

ii. Describe maintenance procedures

iii. Describe the durability, maintenance, and aesthetic characteristics of materials the fountain is made of

iv. Describe design features of the fountain including:

1. How the design accommodates cleaning and maintenance

2. How the design ensures user safety (e.g., no sharp corners)

3. How the stream of water can be adjusted

v. Provide references from previous clients

vi. Explain, if refrigeration is required,:

1. Types and environmental impacts of refrigerants used

2. Whether there is an adjustable thermostat on the fountain

3. Whether the fountain is insulated to conserve energy

vii. Identify warranties for parts and reputable suppliers of replacement parts

viii. Estimate the cost of a delivered gallon of water including costs for fountain purchase, maintenance, and refrigeration (show all assumptions)

ix. Provide evidence of compliance with ADA and IPC/UPC standards

x. For filtered units, provide evidence of compliance with NSF/ANSI standards

III. **Bottle-less Coolers**

a. Specify:

i. Whether cold or heated (hot and/or warm) water is desired

ii. Total volume of water desired, in terms of gallons per day or number of employees served

iii. Type of fixture to which the cooler will be installed (e.g., a building's cold water line)

iv. Whether a filtration system is desired and, if so, the specifications of that filter (see Filters, above)

v. Whether you seek a full service/maintenance contract, which could include scheduled filter replacement

vi. Whether you seek to lease or purchase the bottle-less water cooler

b. Require bidders to:

i. Describe the features of their bottle-less water cooler, including:

1. Whether it uses direct chill technology, or

2. If there is a tank reservoir, and if so, what it is made of, it's volume, the temperature at which it stores water, and sanitation devices (e.g., ultraviolet light) included in the tank

3. Whether there is a filter and, if so, what type; which contaminants it removes and the percentage it removes; the filter replacement schedule and cost

4. Amount of energy required to operate the unit

ii. Describe installation and maintenance requirements

iii. Estimate cost of the bottle-less water cooler (including filters, if applicable) per gallon of water dispensed (show all assumptions)

iv. For filtered units, provide evidence of compliance with NSF/ANSI standards

IV. **Reusable Bottles**

a. Specify:

i. The size of the bottle(s) requested

ii. The preferred bottle material(s)

iii. Whether the bottles should be designed for hot and/or cold liquids

b. Request bidders to:

i. Indicate specifications of the bottle(s):

1. Capacity

2. Material it is made of (if plastic, the type of plastic) and any recycled content

3. Indicate whether their bottles are lined with resins and if so:

a. What type of resin is used

b. Propensity of this resin to leach chemicals into the bottle's contents

ii. Indicate whether the bottles are recyclable

iii. Indicate materials used in the bottle lids, including recycled content, and recyclability

iv. Describe recommended cleaning procedures

v. Describe cleaning procedures that should be avoided

V. Events & Catering

a. Specify:

i. The number of event attendees

ii. The time and duration of the event

iii. The desired method for water delivery (e.g., water pitchers, bottle-less coolers, fountains)

iv. Whether vendor will be required to provide drinking vessels, and if so, what type (e.g., glasses, reusable bottles)

b. Request bidders to:

i. Describe the bottle-less water alternatives available through their location/service

ii. Describe the proximity of bottle-less water to event participants

iii. Describe the types of drinking vessels that can be provided

iv. Estimate the total gallons of water needed for the specified number of participants and duration of the event

v. Estimate the cost per gallon of water

Sample Specification

This specification, taken from Michigan State University, is an RFP for drinking fountains and water coolers.

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following drinking fountains and water coolers and related components:

1. Drinking Fountains.
2. Water coolers.

A. Fixture supports.

1.3 DEFINITIONS

A. Accessible Drinking Fountain or Water Cooler: Fixture that can be approached and used by people with disabilities.

B. Drinking Fountain: Fixture with nozzle for delivering stream of water for drinking.

C. Fitting: Device that controls flow of water into or out of fixture.

D. Fixture: Drinking fountain or water cooler unless one is specifically indicated.

E. Remote Water Cooler: Electrically powered equipment for generating cooled drinking water.

F. Water Cooler: Electrically powered fixture for generating and delivering cooled drinking water.

1.4 SUBMITTALS

A. Product Data: For each fixture indicated. Include rated capacities, furnished specialties, and accessories.

B. Shop Drawings: Diagram power, signal, and control wiring.

C. Field quality-control test reports.

D. Operation and Maintenance Data: For fixtures to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

A. A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Regulatory Requirements: Comply with requirements in ICC A117.1, "Accessible and Usable Buildings and Facilities"; Public Law 90-480, "Architectural Barriers Act" ; and Public Law 101-336, "Americans with Disabilities Act" ; for fixtures for people with disabilities.

C. NSF Standard: Comply with NSF 61, "Drinking Water System Components--Health Effects," for fixture materials that will be in contact with potable water.

D. ARI Standard: Comply with ARI 1010, "Self-Contained, Mechanically Refrigerated Drinking-Water Coolers," for water coolers and with ARI's "Directory of Certified Drinking Water Coolers" for type and style classifications.

E. ASHRAE Standard: Comply with ASHRAE 34, "Designation and Safety Classification of Refrigerants," for water coolers. Provide HFC 134a (tetrafluoroethane) refrigerant, unless otherwise indicated.

PART 2 - PRODUCTS

2.1 DRINKING FOUNTAINS

A. Wall-Mounted Drinking Fountains:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Filtrine Manufacturing Company; Drinking Water Division.

   b. Halsey Taylor.

   c. Haws Corporation; Model 1119.

   d. Oasis Corporation.

2. Description: Accessible, Hi-Lo wall-mounted.

   a. Material: Type 304, 18 gauge Stainless steel with satin finish.

   b. Receptor Shape: Rectangular.

   c. Back Panel: Stainless-steel satin finish wall plate behind drinking fountain.

   d. Bubblers: Polished chrome-plated brass vandal-resistant bubbler heads.

   e. Control: Push button.

   f. Supply: NPS 3/8 with ball, gate, or globe valve.

   g. Drain: Grid with NPS 1-1/4 minimum horizontal waste and trap complying with ASME A112.18.2.

   h. Support: Hi-LO universal mounting plate.

2.2 WATER COOLERS

A. Electric Water Coolers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Elkay Manufacturing Co.

b. Halsey Taylor.

c. Haws Corporation; Model HWBFA8L.VRC

d. Oasis Corporation.

2. Description: Hi-Lo, barrier-free, vandal-resistant wall-mounted.

a. Cabinet: All stainless steel.

b. Bubbler: One, with adjustable stream regulator, located on deck.

c. Control: Push button.

d. Supply: NPS 3/8 with ball, gate, or globe valve.

e. Filter: One or more water filters complying with NSF 42 and NSF 53 for cyst and lead reduction to below EPA standards; with capacity sized for unit peak flow rate.

f. Drain: Grid with NPS 1-1/4 minimum horizontal waste and trap complying with ASME A112.18.2.

g. Cooling System: Electric, with hermetically sealed compressor, cooling coil, air-cooled condensing unit, corrosion-resistant tubing, HFC refrigerant, corrosion-resistant-metal storage tank, and adjustable thermostat.

h. Capacity: 8 gph of 50 deg F cooled water from 80 deg F inlet water and 90 deg F ambient air temperature.

i. Electrical Characteristics: 120-V ac; single phase; 60 Hz.

2.3 FIXTURE SUPPORTS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Josam Co.
2. MIFAB Manufacturing, Inc.
3. Smith, Jay R. Mfg. Co.
4. Tyler Pipe; Wade Div.
5. Watts Drainage Products Inc.; a div. of Watts Industries, Inc.
6. Zurn Plumbing Products Group; Specification Drainage Operation.

B. Description: ASME A112.6.1M, water cooler carriers. Include vertical, steel uprights with feet and tie rods and bearing plates with mounting studs matching fixture to be supported.

1. Type I: Hanger-type carrier with two vertical uprights.
2. Type II: Bi-level, hanger-type carrier with three vertical uprights.
3. Supports for Accessible Fixtures: Include rectangular, vertical, steel uprights instead of steel pipe uprights.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in for water and waste piping systems to verify actual locations of piping connections before fixture installation. Verify that sizes and locations of piping and types of supports match those indicated.

B. Examine walls and floors for suitable conditions where fixtures are to be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLICATIONS

A. Use carrier off-floor supports for wall-mounting fixtures, unless otherwise indicated.

B. Use mounting frames for recessed water coolers, unless otherwise indicated.

C. Set freestanding and pedestal drinking fountains on floor.

D. Set remote water coolers on floor, unless otherwise indicated.

E. Use chrome-plated brass or copper tube, fittings, and valves in locations exposed to view. Plain copper tube, fittings, and valves may be used in concealed locations.

3.3 INSTALLATION

A. Install off-floor supports affixed to building substrate and attach wall-mounting fixtures, unless otherwise indicated.

B. Install mounting frames affixed to building construction and attach recessed water coolers to mounting frames, unless otherwise indicated.

C. Install fixtures level and plumb. For fixtures indicated for children, install at height required by authorities having jurisdiction

D. Install water-supply piping with shutoff valve on supply to each fixture to be connected to water distribution piping. Use ball valves. Install valves in locations where they can be easily reached for operation. Valves are specified in Division 22 Section “General-Duty Valves for Plumbing Piping.”

E. Install trap and waste piping on drain outlet of each fixture to be connected to sanitary drainage system.

F. Install pipe escutcheons at wall penetrations in exposed, finished locations. Use deep-pattern escutcheons where required to conceal protruding pipe fittings. Escutcheons are specified in Division 22 Section “Common Work Results for Plumbing.”

G. Seal joints between fixtures and walls and floors using sanitary-type, one-part, mildew-resistant, silicone sealant. Match sealant color to fixture color. Sealants are specified in Division 07 Section “Joint Sealants.”

3.4 CONNECTIONS

A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.

C. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

D. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.5 FIELD QUALITY CONTROL

A. Water Cooler Testing: After electrical circuitry has been energized, test for compliance with requirements. Test and adjust controls and safeties.

1. Remove and replace malfunctioning units and retest as specified above.

2. Report test results in writing.

3.6 ADJUSTING

A. Adjust fixture flow regulators for proper flow and stream height.

B. Adjust water cooler temperature settings.

3.7 CLEANING

A. After completing fixture installation, inspect unit. Remove paint splatters and other spots, dirt, and debris. Repair damaged finish to match original finish.

B. Clean fixtures, on completion of installation, according to manufacturer's written instructions.

END OF SECTION 224700

Common Contaminants in Tap Water

Contaminant	Source	Health Effects	Common Location	Available Filters
2, 4-D	• Widely-used herbicide	• Possible endocrine disruptor		
Arsenic	• Heavy metal that leaches into water from pollution (agricultural or industrial) and natural soil deposits (GG, 2007)	• Linked to bladder, lung, kidney, prostate and skin cancer in animal tests (GG, 2007) • Neurological and cardiovascular damage • Skin irritation • Endocrine disruptor	• High concentrations in Southwest U.S. but common nationwide	• Pentavalent arsenic: NSF-certified carbon or reverse osmosis filters (McEvoy, 2004) • Trivalent arsenic: use distillation (McEvoy, 2004)
Atrazine	• Corn herbicide • Common pesticide	• Short-term: lung, kidney and heart congestion (GG, 2007) • Long-term: cardiovascular disease (GG, 2007) • Possible endocrine disruptor • "Cancer, weight loss, muscular degeneration" (McEvoy, 2004)	• "Most common in Mississippi River Basin during spring runoff" (McEvoy, 2004) • Common nationwide	• NSF-certified carbon filters or filters certified to reduce VOCs (McEvoy, 2004)
Chloramine	• Chlorine-ammonia compound used as a disinfectant in 29% of U.S. water utilities (GG, 2007)	• Asthma, rashes and fainting (GG, 2007)		
Chlorine	• Used by water treatment facilities to disinfect water	• Eye and nose irritation • Stomach discomfort	• Municipal tap water that has been treated using chlorine	• NSF-certified carbon filters
Coliform bacteria	• Indicators of Cryptosporidium and other dangerous microbes (GG, 2007)	• Not harmful in themselves (GG, 2007)		

E.coli	• Fecal coliform bacteria (GG, 2007)	• Gastrointestinal illness (GG, 2007) • 2-7% of E. coli infections lead to kidney failure (GG, 2007)		
Lead	• Decaying pipes and taps in homes, buildings and public water mains (GG, 2002; GG, 2007)	• Damage to brain and nervous system • Developmental problems in children (McEvoy, 2004) • Damage to blood pressure, kidneys and red blood cells (McEvoy, 2004)	• Exceeded the national standard in Boston*, Newark* and Seattle* (McEvoy, 2004) • Of high concern in Baltimore*, Los Angeles*, Manchester*, Philadelphia* and Washington D.C.* (McEvoy, 2004)	• NSF-certified carbon filters, reverse osmosis or distillation (McEvoy, 2004)
Lindane	• Insecticide • Found in prescription medications for head and body lice (GG, 2007)	• Endocrine disruptor	• Runoff from farmland, homes, and gardens where the insecticide was applied	
Mercury	• Heavy metal	• Brain and kidney damage	• Most comes from the chemical industries, as well as fossil fuel combustion, landfills, and industrial manufacturing and waste	
Methyl Tertiary-Butyl Ether (MTBE)	• Gasoline additive • Leaks into groundwater from underground fuel storage, spills and storm-water runoff (GG, 2007)	• Potential carcinogen	• Banned in many but not all states (GG, 2007)	• NSF-certified carbon filters (McEvoy, 2004)

Misc. Heavy Metals	• Copper, lead, mercury, etc.	• Chromium: carcinogen; upset stomach, ulcers, kidney and liver damage; death (GG, 2007) • Selenium, cadmium, copper (short-term): nausea, vomiting and diarrhea (GG, 2007) • Cadmium and copper (long-term): kidney disease (GG, 2007)	• Naturally occurring in soil; can leach into groundwater • Other sources include landfills, corroding and leaching pipes, mining, and industrial waste	
Nitrates	• Animal waste on cattle farms, feedlots and dairies (GG, 2007)	• Can cause 'blue-baby syndrome', which prevents blood from holding oxygen (GG, 2007)	• More common in rural areas (McEvoy, 2004) • High concern in Fresno* and Phoenix* (McEvoy, 2004)	• Reverse osmosis
Pathogens (aka Cysts)	• Microorganisms carried by animal and human waste (GG, 2007) • Ex: E.coli, giardia, and Cryptosporidium	• Linked to gastrointestinal illness (GG, 2007) • Life-threatening for those with weakened immune systems, especially Crypto (GG, 2007; McEvoy, 2004)	• High concern in Boston*, Detroit*, Houston*, Philadelphia*, Seattle* and Washington D.C.* (McEvoy, 2004)	• Use carbon filters that are NSF certified for cyst reduction; reverse osmosis or ultraviolet light systems (class A) (McEvoy, 2004)
Perchlorate	• Rocket fuel ingredient	• Thyroid damage • Potential carcinogen	• Leakage from a Kerr-McGee plant in NV has reportedly contaminated the Colorado River – drinking water impacted in Los Angeles*, San Diego*, Phoenix*, and other areas (McEvoy, 2004)	• Reverse osmosis or distillation

Perchloroethylene (PERC) – aka Tetrachloroethylene	• Main solvent used in most dry-cleaning processes (GG, 2007)	• Known carcinogen (GG, 2007) • Neurological, kidney, liver effects (GG, 2007) • Associated with reproductive effects such as spontaneous abortion (GG, 2007)	• Can leach into groundwater when improperly disposed of	
Simazine	• Widely-used pesticide	• Long-term exposure may lead to liver and kidney damage (GG, 2007)		
Trihalomethanes (THMs)	• Water disinfection by-products • Formed when chlorine reacts with organic matter, such as animal waste, treated sewage or leaves and soil (GG, 2007)	• Increased risk of cancer (GG, 2007) • Liver, kidney, and neurological damage • Increased rates of miscarriage and birth defects (GG, 2007)	• Highest concern in Boston*, Houston*, Los Angeles*, Manchester*, Newark*, Philadelphia*, Phoenix*, San Diego*, San Francisco*, Seattle* and Washington D.C.* (McEvoy, 2004)	• NSF-certified carbon filters (McEvoy, 2004)
Total Dissolved Solids (TDS)	• Inorganic salts, such as calcium, sodium and sulfates, and small amounts of organic matter that are dissolved in water (GG, 2007)	• Not a health hazard but can cause water to be corrosive or salty in taste and may lead to mineral build-up (GG, 2007)		
Toxaphene	• Insecticide	• Likely carcinogen • Kidney, lung, and neurological damage at high levels	• Usage is banned but it “breaks down slowly in the environment” (GG, 2007)	

Volatile Organic Compounds (VOCs)	• Includes benzene and toulene among others	• Benzene: cancer, birth defects • Toulene: nausea, weakness, confusion, hearing and vision loss (GG, 2007)	• VOCs that are improperly disposed of can pass through soil easily and end up in groundwater • Not typically found in drinking supplies sourced from surface waters since VOCs evaporate into the air	

* The cities cited in this Addendum come from a National Geographic Green Guide article from 2004. Since the publication of this article, these cities may have taken action to clean up contaminants in their respective water supplies. For the most up-to-date information on a city's water quality, contact the local water utility company, visit the EPA's online database of Consumer Confidence Reports at www.epa.gov/safewater, or call the EPA's Safe Drinking Water Hotline at 800-426-4791.

Filtration Methods

Method	Description	Benefits	Drawbacks	Styles
Adsorption (General)	• Water is filtered through "an adsorbent medium – like carbon, charcoal, KDF (a copper-zinc formulation), and ceramic – to which liquids, gases, and dissolved or suspended matter will adhere" (Rysavy, 2007)	• Removes organic contaminants, chlorine, and other substances that affect taste and odor (Rysavy, 2007) • Uses gravity, not energy, to filter water • Inexpensive	• Does not remove nitrates, heavy metals, fluoride (Rysavy, 2007) • Filter can harbor bacteria unless changed frequently	• Carafe • Faucet Mount • Counter Top • Under Counter • Whole House (POE) • Portable • Refrigerator • Multi-stage
Carbon Adsorption	• Charged carbon attracts and traps contaminants within its porous structure	• Least expensive filter type (GG, 2002) • Removes tastes, odors, chlorine • Adsorp lead, chlorine by-products, certain parasites, radon, solvents, some pesticides and herbicides, and some organic chemicals as well as odor and bad tastes (GG, 2007) • If NSF-53 certified, can reduce heavy metals such as copper, lead and mercury; disinfection by-products; parasites such as Giardia and Cryptosporidium; pesticides; radon; and VOCs such as MTBE, dichlorobenzene and trichloroethylene (TCE) (NRDC, 2005)	• Won't remove heavy metals, arsenic, nitrites, bacteria, microbes, (GG, 2007), viruses, parasites, and sodium (Ruddy, 2006)	• Carafe • Faucet Mount • Counter Top • Under Counter • Whole House (POE) • Portable • Refrigerator • Multi-stage

Distillation	• Water is boiled and steam recondenses, leaving behind certain contaminants • Frequently combined with a carbon filter (NRDC, 2005) to remove any remaining contaminants	• Removes heavy metals such as cadmium, chromium, copper, lead and mercury, as well as arsenic, barium, fluoride, selenium and sodium (NRDC, 2005) • High temperature kills some microbes • Best at removing inorganic contaminants (Rysavy, 2007) • Removes nitrates, hardness (calcium and magnesium)	• Can cost between $200 and $1500 • De-mineralizes water, making its pH more acidic (BW Blues, 2008) • Does not remove chlorine and VOCs (a carbon filter will do this if present) • Does not remove small synthetic organic chemicals which vaporize at lower temperatures than water (BW Blues, 2008) • Does not remove chloramines • Uses significant energy – "it takes 1 kWh to produce one liter of distilled water" (GG, 2007) • Creates significant heat • Requires regular cleaning (McEvoy, 2004) • Can taste 'flat' because it "contains less dissolved oxygen" (GG, 2007)	• Counter Top • Whole House (POE) • Multi-stage
Filter Membranes (General)	• Water passes through a membrane(s) that traps particles above a certain size • Many times combined with other filtration methods like UV	• A 1 micron filter will remove particulates and most bacteria, Cryptosporidia, and viruses (Rysavy, 2007)	• Membranes can only filter out particles that are bigger than the holes in the membrane • Membranes need to be replaced periodically and require proper disposal	• Faucet Mount • Counter Top • Under Counter • Whole House (POE) • Multi-stage

Reverse Osmosis	• Water is pushed through a semi-permeable membrane, separating out contaminants and flushing them away with waste water • Typically combined with UV or carbon filters	• Removes many contaminants, including: parasites such as Cryptospo-ridium and Giardia; heavy metals such as cadmium, copper, lead and mercury; and other pollutants, including arsenic, barium, nitrate/nitrite, perchlorate and selenium (NRDC, 2005) • Removes total dis-solved solids • Only filter certified to remove arsenic (CR, 2007) • The only filter that removes nitrates and perchlorate (GG, 2007) • Removes industrial chemicals, chlorine by-products, asbes-tos • Best for removing bacteria (Rysavy, 2007) • Removes virtually all pharmaceutical contaminants (Donn, 2008) • Wastewater can be reused as greywater • Good option for institutions with sensitive populations such as the elderly, immuno-suppressed, pregnant, and children • Good option for areas known to have pharmaceutical contamination • New technology allows waste water to be captured through a central drain and collection system and reused for irrigation, janitorial uses, etc.	• Large amount of water waste (3-9 gallons waste water for every filtered gallon, depending on the system) • In the future, certain regions may impose water consumption restrictions or regulations which may penalize or charge users of reverse osmosis systems due to the large amount of water waste • Requires ad-equate drainage infrastructure • Flushes contaminants back into the water supply • Requires plumbing modifications • Hard to install • Must be cleaned thoroughly and frequently • Membrane lasts 2-3 years • Slow • Takes up space • Very expensive for large-scale use (Donn, 2008), costs between $160 to $450 for the system • Does not re-move radon or some pesticides (GG, 2007)	• Under Counter • Whole House (POE) • Multi-stage

Ceramic	• Ceramic acts as a filter membrane with openings as small as 0.2 microns • Frequently combined with carbon filters and other filters	• Removes bacteria, parasites/cysts, asbestos and sediments (GG, 2007)	• Requires regular cleaning to prevent clogs and slow water flow • Contaminants go down the drain	• Counter Top • Under Counter • Multi-stage
Ultraviolet Disinfection	• Used in areas where there is a history of bacteria outbreaks in the water supply (i.e. many wells) • Uses a 60-watt ultraviolet bulb that stays lit continuously. Water is irradiated as it flows around the lamp. • An alarm system should be included to signal when the bulb burns out • Should be used in combination with another filtration method like carbon filters • Class A systems remove bacteria and viruses like Cryptosporidium, E. coli and Giardia • Class B systems make non-disease-causing bacteria inactive (NRDC, 2005)	• Kills 99.9% of harmful bacteria in point-of-use filter systems (Peterson, 2008) • Kills microorganisms and parasites • These are the only systems NSF-certified to remove Giardia, E. coli, and Cryptosporidium • FDA approved to disinfect filtered water • More energy efficient than distillers, despite bulb being lit 24/7	• Expensive: $700+ for NSF-certified models • Not certified to remove pathogens uncommon to North America such as toxoplasma and entamoeba (GG, 2007) • Will not remove chemical pollutants (Rysavy, 2007) • Water treatment units that include UV disinfection consume more energy than those that do not	• Under Counter • Whole House (POE) • Multi-stage
Selective Filtration	• Said to be able to distinguish between contaminants and trace minerals such as calcium, magnesium and potassium (BW Blues, 2008)			

Cation Exchange Softener	• Softens hard water by trading minerals with a strong positive charge for one with less of a charge (NRDC, 2005)	• Removes calcium and magnesium, which form mineral deposits in plumbing and fixtures (NRDC, 2005) • Removes barium and other ions which have adverse health effects		• Counter Top • Whole House (POE)

Filter Styles

Filter Style	Description	Benefits	Drawbacks	Price Range
Carafe	• Plastic pour-through pitcher • Most use a carbon filter • Best for filtering small quantities of drinking water (CR, 2007)	• Inexpensive • Simple to use • Portable • No installation	• Some models tend to clog easily and filter slowly • Requires frequent filter changes (usually every 1-3 months) • Most filter cartridges cannot be recycled in the U.S.	$15 to $60
Faucet Mount	• Attaches directly to a faucet or tap (i.e. point-of-use) • Most use a carbon filter • Best for filtering drinking and cooking water (CR, 2007)	• Filters faster than carafes • Minimal installation effort (CR, 2007) • Can filter both drinking and cooking water • Easy to switch between filtered and unfiltered water (CR, 2007)	• Slows water flow • Does not fit on all faucets • Requires frequent filter changes (usually every 3 months) • Most filter cartridges cannot be recycled in the U.S.	$20 to $60
Counter Top	• Either manual-fill units, or filled via a tube connected to a faucet (GG, 2007) • Typically use carbon filters or distillation • Best for filtering large quantities of water without plumbing modification (CR, 2007)	• Less likely to clog than carafes or faucet mounts (CR, 2007) • Some manual-fill units can fit on a refrigerator shelf for continuous chilled water	• Take up counter top space • Does not fit on all faucets • Most filter cartridges cannot be recycled in the U.S.	$50 to $300

Under Counter	• Attaches to water pipes under sink and provides hot or cold filtered water through existing tap or separate faucet (GG, 2007) • Best for filtering lots of water without modifying the existing faucet or cluttering the counter (CR, 2007)	• Better water flow compared to faucet mount filters • Infrequent filter changes (about 2 times a year)	• Takes up space under the counter • Requires plumbing modifications (CR, 2007) • Typically needs permanent connection to existing pipe (McEvoy, 2004) • Installation can be expensive, especially if the unit needs a separate faucet – "a hole must be drilled through the sink and/or counter top for the dispenser" (CR, 2007) • Most filter cartridges cannot be recycled in the U.S.	$55 to $350
Whole House (aka Point-of-Entry or POE)	• Filters water at the point-of-entry to a house or building • Best for inexpensively removing sediment, rust, and for some, chlorine, from household water (CR, 2007) • Installed outside or in a basement	• Can prolong the life of major appliances when sediment in water is a problem (GG, 2007) • Long cartridge lifetime (CR, 2007)	• Ineffective at removing lead, chloroform, pesticides, and bacteria (GG, 2007) • Ineffective at removing most contaminants, including pathogens, heavy metals, and VOCs (CR, 2007) • Requires professional installation (CR, 2007) • Most filter cartridges cannot be recycled in the U.S.	$35 to $80

Portable	• Typically found inside reusable water bottles or as screw-on mouthpieces for single-serving bottled water	• Most remove chlorine, bad tastes and odors, heavy metals including lead, mercury, and copper (GG, 2007) • Portable and convenient • Filters water from any source	• Short filter lifespan • Most filter cartridges cannot be recycled in the U.S.	$5 to $50
Refrigerator	• Built into the inside or door of a refrigerator • Filters water at point-of-use	• Convenient, continuous water supply • Chilled water on-demand	• Most filter cartridges cannot be recycled in the U.S.	Refrigerators with filtration units typically cost more than those without
Multi-Stage	• Combine two or more methods of filtration	• Can filter a wide variety of contaminants		Varies.