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February 2012

Position paper on the ecological and  
economical supply of drinking water

# **Position paper on the ecological and economical supply of drinking water**

(February 2012)

The Austrian Federal Ministry of Health recommends drinking 1.5 l of fluids every day. Vienna's tap water is of a high quality, something which is rarely found in any other big city. The fresh spring water from Vienna's Spring Water Mains is inexpensive, is brought to all homes in an environmentally friendly way, is cool and does not produce any packaging waste. Due to its high quality, it is the premium choice when it comes to health. It originates in a well-protected area and is almost free from contamination from industry and business. At tastings, Vienna's tap water always stands out thanks to its cool temperature, high level of oxygen and its freshness. Drinking water can be taken from drinking fountains without any packaging.

A comparison of tap water, mineral water and water from a water dispenser clearly shows that tap water is by far the most inexpensive type of water at just EUR 0.0033 per litre. Regarding environmental-friendliness, tap water is also top since it is delivered ready to drink without any packaging, without transportation by HGVs and without any additional cooling required.

***From an ecological and economical point of view, tap water is therefore the most inexpensive type of drinking water.***

## **Position on the ecological and economical supply of drinking water:**

***Drinking water shall be supplied as tap water.***

**Recommendation:** The installation of a **drinking fountain directly connected to the mains water supply** is worth considering when large quantities of drinking water are needed. The best option are fountains which can be used with and without a glass.

# **Explanation of the position paper on the ecological and economical supply of drinking water**

On behalf of "ÖkoKauf Wien"

Working Group Food

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## 1. Introduction

The Austrian Federal Ministry of Health and the German Nutrition Society recommend drinking approx. 1.5 litres of fluids per day, preferably tap water or mineral water. The present position paper shows the ecological and economic differences of various types of water: tap water, mineral water and water from water dispensers.

## 2. Vienna's fresh spring water

Vienna's tap water from the Vienna Spring Water Mains I and II originates in the Lower-Austrian/Styrian Alps. The springs in the alpine region of the Schneeberg and Rax mountain, as well as in the the Hochschwab mountains are well protected, therefore the fresh spring water is virtually free from contamination from industry and business. The water runs towards the city through mountains in underground pipes without using a single pump, but by natural inclination alone. The gravitational energy along the course is actually used as an additional source of power production. Due to the type of bedrock (rugged karst mountain) and as a consequence of infiltration from the surface, the bacterial counts in the water can increase in times of water afflux such as during thawing periods and heavy rainfall. Disinfection therefore is vital and required by independent experts, which is currently carried out with chlorine and chlorine dioxide in Vienna<sup>1</sup>.

The City of Vienna is supplied with 100 percent spring water during normal operation. In times of extremely high demand for water and during maintenance works at the water mains, groundwater is additionally fed into the system. About 95 percent of spring water and approx. 5 percent of groundwater is fed into the system, as measured by annual consumption.

The inspection of Vienna's tap water is done in accordance with the Austrian Drinking Water Decree, which regulates the requirements concerning the quality of water intended for human consumption, Federal Law Gazette II No 304/2001 in the applicable version as amended by the Federal Law Gazette II No 254/2006), as well as in accordance with the specifications of chapter B1 of the Austrian Food Codex (Codex Alimentaris Austriacus). Both specifications are based on the Council Directive 98/83/EC of 3 November 1998 on the quality of water intended for human consumption. Drinking water is classified as a foodstuff and is therefore subject to the Food Law. Since the Austrian Food Code is not an official standard at the level of laws or ordinances, the "Ordinance on the quality of water intended for human consumption" was issued. The sanitary

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<sup>1</sup> <http://www.wien.gv.at/wienwasser/qualitaet/befundhoch.html> (only available in German)

inspections of Vienna's tap water are conducted by the Institute of Environmental Medicine (*Institut für Umweltmedizin*; part of Vienna's health care authorities). The current results of individual drinking water inspections can be downloaded from the Vienna Waterworks homepage ([www.wien.gv.at/wienwasser](http://www.wien.gv.at/wienwasser)).

### **Benefits of Vienna's tap water**

- Low costs
- Unlimited availability
- No transportation with HGVs
- Excellent quality, guaranteed by regular inspections in accordance with the ordinance
- No supply expenditures, directly from the tap
- Minimal nitrate content
- Pesticide-free
- Well digestible
- No packaging waste
- Pleasantly and naturally cool
- Absorption of calcium, magnesium, fluoride and iron is almost identical for both drinking water and mineral water (Fröhler, 2010)

### **Disadvantages of Vienna's tap water**

- Often no customer-friendly availability (e.g. only available in bathrooms/toilets)
- Possible contamination with lead due to old pipes in the building

### **Lead content in drinking water**

Lead pipes were primarily used for domestic mains and domestic installations in buildings erected before 1938. Since 2007 all domestic mains are lead-free in Vienna. Where the pipes within a building are of the responsibility of the house owner there is still the possibility that they may not have been replaced. Stagnant water remaining in the plumbing system over night or for a longer period of time if the user is away, should not be used as drinking water or for cooking. In this case, lead concentration may increase beyond the permissible limit. The laboratory of the Municipal Department 39, the Research Centre, Laboratory and Certification Service of the City of Vienna offers to carry out lead analysis.

Further information regarding the measuring process and costs can be found here:

<http://www.wien.gv.at/amtshelfer/wirtschaft/zertifizierungsstelle/labor/trinkwasseruntersuchung.html>

(Anmerkung: diese Seite ist nicht mehr verfügbar)

### 3. Drinking fountains

Vienna has more than 900 drinking fountains, e.g. in parks, playgrounds and markets, as well as in public facilities. There is the possibility of renting mobile drinking fountains for events. The most cost-effective method is to mount a “fountain fitting” on existing water hydrants, turning them into drinking fountains for events in no time. If there is no water supply or hydrant on site at the event, there is also the possibility of renting water trucks at the Municipal Department 31. For information and ordering, e-mail to: [z6-kan@ma31.wien.gv.at](mailto:z6-kan@ma31.wien.gv.at).

Drinking hydrant



Photo: Wiener Wasserwerke

Drinking fountain



Photo: "die umweltberatung", J. Leutgöb

Mobile drinking fountain



Water truck



### **Benefits of drinking fountains**

- Low costs for continuing operation
- Unlimited availability
- No transportation with HGVs
- Excellent quality, guaranteed by regular inspections in accordance with the ordinance
- No supply expenditures, directly from the tap
- Minimal nitrate content
- Pesticide-free
- Well digestible
- No packaging waste
- Pleasantly and naturally cool

### **Disadvantages of drinking fountains:**

- Costs for erection

## **4. Mineral water**

Natural mineral water originates from an underground water source, protected from any contamination. Mineral water shall be of natural pureness and collected directly from the source and bottled at the source. Furthermore, it shall comply with the strict microbiological, chemical and physicochemical directives applicable in the entire European Union (EU). The legal requirements regarding the quality of natural mineral water are regulated in the Austrian Food Code, chapter 17: bottled water. Many types of mineral water contain carbon dioxide (CO<sub>2</sub>). Most mineral water bottlers have carbonated natural mineral water (“with gas”, i.e. approx. 5 g/l), mild (3 g/l) or still (“without gas”). The two latter ones are becoming increasingly popular. The type and quantities of the ingredients are stated on the labels by the bottlers. Iron, sulphur, manganese and arsenic are removed, carbon dioxide may be removed or added. The most important ingredients are calcium, magnesium, sodium, potassium and fluorine. A study by Niels Jungbluth shows that mineral water is only damaging to the environment when it involves cooling, packaging and transport.



## Benefits of mineral water

- There are types of water with special mineral compositions, e.g. for diets that are very low in sodium, baby food
- Promotes a “healthy” image

## Disadvantages of mineral water

- Mineral water usually contains much more sodium than drinking water (Azoulay et al., 2001)
- Migration of antimony in PET bottles
- High costs
- Supply expenditure and expenditure for return/disposal of packaging
- Needs to be transported (CO<sub>2</sub> emissions, environmental damage through pollutants and traffic)
- Packaging waste (lower damage to the environment with reusable packaging compared to disposable packaging)
- Energy expenditure for cooling
- Possible impact on taste due to long storage in PET bottles, e.g. acetaldehyde
- Lower tolerance for carbonated water for sensitive people

## 5. Water dispensers, water coolers

Water dispensers are used in big shopping malls, offices and doctor’s offices. A water cooler is a drinks machine directly powered by electricity, which dispenses spring, table or drinking water in cups. There are generally two types: bottle-fed water dispensers and mains-fed water dispensers. In 2010, a new, slightly changed bottle-fed system was launched where the bottle is mains-fed on site.



Illustration on the left:  
Mains-fed water dispenser.  
source: [www.waterpoint.at](http://www.waterpoint.at)

Illustration on the right:  
Bottle-fed water dispenser  
Source: [www.triple-a.at](http://www.triple-a.at)



These devices are available as space saving table-top devices or in free-

standing form. Businesses and plants usually use free-standing bottle-fed water dispensers, also called water coolers (with bottles of 18.9 litres).

Water is supplied as

- Still water, cooled
- Still water, hot
- Some models even have carbonated water

The legal regulations regarding the quality of bottled water for water coolers, as well as for natural mineral waters, is stated in chapter 17 of the Austrian Food Code. However, it only refers to the quality of the water in the bottles. The quality of the water at the dispensing point (office, plant, etc.) is not subject to any clearly defined legal regulation according to the Austrian Food Code.

### **Benefits of water dispensers**

- Quickly installed, no connection to the mains water supply necessary if it is a bottle-fed system
- Customer-friendly dispensing of drinking water due to the supply of cups
- “Cool” image, lifestyle product

### **Disadvantages of water dispensers**

- High costs
- Installation expenditure for mains-fed water dispensers
- Long distances for transportation (depending on the location of the bottling and production site)
- Energy expenditure for cooling and heating
- Cleaning expenditure
- Maintenance expenditure
- Possible germ contamination (Adler S., Eikenberg, M., Daschner F. 2004)
- Waste generated by disposable cups
- Bisphenol A can be transmitted to the water via bottles made of polycarbonate, as it is one of the source products used for the production of polycarbonate and is potentially hazardous to human health.

Despite bottled water systems, there are also systems operating with water from the mains supply, such as mains-fed water dispensers. The costs for the bottled water, as well as its transportation are eliminated, however the costs for service personnel for the installation and maintenance work still remain. With the exception of the self-filling system there must be a mains water supply close to the place where the water dispenser is to be installed, in order to make an installation even possible. Providers of such systems also charge a one-off installation charge. Energy, cleaning and maintenance expenses also remain.

Regarding the aforementioned systems, the tap water is usually cleaned by filter systems (micro filtration, activated carbon filters, UV filtration). The filters shall be properly serviced and replaced (min. 4 times a year), in order to guarantee sanitary requirements. In general these systems show better results from a sanitary point of view than bottled water dispensers.

### **Is water from water dispensers healthier?**

Although producers market their water dispensers using the health argument, inspections show that water dispensers that are not properly operated may cause health risks. In 2005 the German Federal Institute for Risk Assessment (*Deutsches Bundesinstitut für Risikobewertung* (BfR)) took 799 samples from water dispensers all over Germany. The analysis showed that 36.4 % of the samples were contaminated with germs.

Bottle-fed water dispensers in particular showed deficiencies in terms of hygiene. Critical issues are that the water stands too long, solar radiation, room temperature, lack of cleaning and disinfection of the unit. When water is taken from the bottle-fed systems, air bubbles rise within the bottle. The air comes from outside which means that germs from the surrounding air and via unclean dispensers can get into the water. Tubes made of plastic additionally favour the development of germs (biofilm). This is especially challenging at busy sites such as shopping malls or doctor's offices. Germs can multiply this way in the water, in the pipes and in the dispensing system and hence can become a risk to human health. Some producers have found a solution to this problem and started to install air filters and stainless steel pipes in their systems.

According to the BfR, water heated in a water dispenser is also not suitable for making herbal or fruit tea. The hot water in water dispensers only has a temperature between 80° and 85° C. This does not guarantee that potentially contained germs are killed.

Mains-fed water dispensers showed far better results, all samples were of drinking water quality. (BfR 2005)

Mains-fed water dispensers in hospitals, nursing homes and similar facilities with special sanitary requirements often use membrane filters and UV lamps, glass pipes and silver ion coatings on contact surfaces in order to counteract possible germs in the drinking water. When the device is serviced every 3 months, the filters and UV lamps are replaced. Heating is another common measure, however it causes calcification which again favours an increase of germs. For doctor's offices, water coolers with covered taps and a disposable plastic water pipe system are provided.

Water dispensers usually do not have any health advantages compared to tap water. If the water is in the bottle for a longer period of time, then this, along with poor hygiene can lead to a sanitary problem with the water dispensers. People with weak immune systems such as ill or elderly people or children are particularly at risk.

## 6. Comparison of costs

Table 6.1 Comparison of net costs of the different systems (average values according to the information given by the producers)

Costs in EUR	Mineral water	Bottle fed water cooler with 19l bottle	Mains fed water dispenser	Tap water <sup>2</sup>
	(price information ÖkoKauf Wien)	average (3 suppliers)	average (4 suppliers)	Municipal Department (MA 31)
<b>Installation costs</b>	0	0	0-186	0
<b>Monthly rent incl. maintenance, excl. water</b>	0	14.4	49	0
<b>Monthly costs (rent, maintenance, water) 100 l consumption</b>	25	53.05	49.31	0.33
<b>Monthly costs (rent, maintenance, water) 200 l consumption</b>	50	96.52	49.64	0.66
<b>per litre when ordering 100 l/month</b>	0.25	0.53	0.49	0.0033
<b>per litre when ordering 200 l/month</b>	0.25	0.48	0.25	0.0033

Table 6.1 compares the costs for mineral water, bottle-fed water cooler, mains-fed water dispensers and tap water. In order to be able to compare the overall costs, the costs for monthly rent and maintenance of the water dispensers were included. Non-recurring installation costs for

<sup>2</sup> Prices for Vienna's tap water incl. waste water management costs.

mains-fed water dispensers are not invoiced by all the suppliers and hence were not included in the calculations. Mineral and tap water do not have any such costs. **EUR 30 - 50 per 1,000 pieces of plastic cups** need to be added to the costs of water dispensers, although the use of disposable cups were not obligatory but usually common.

The costs were compared for ordering 100 l and 200 l per month. **Tap water is the most cost-effective alternative with EUR 0.0033 per litre** compared to all other types. Only when consumption per month goes beyond 200 litres does the use of a mains-fed water dispenser become cheaper than mineral water (the calculation includes rent and maintenance costs, but excludes non-recurring installation costs). However, what needs to be considered is the high energy consumption (see chapter 8). Price per litre is **EUR 0.25** - and hence is 75 times higher than tap water. The price per litre for bottle-fed **water coolers** with 19 l bottles is approx. **EUR 0.53** depending on how much is ordered per month.

## 7. Comparison of transport

Regarding the ecological balance, transporting bottled water to the consumer has a negative impact. The transport routes from the source to the consumer are long. Mineral water and bottles for water dispensers are partly transported over very long distances within Austria or are even imported from abroad. Furthermore, the purchase and transportation of bottled mineral water by means of HGVs or passenger cars have especially negative impacts.

In a study on behalf of the Swiss Federal Office for the Environment in 2009, it was calculated that tap water causes only about 1 % of environmental damage compared to mineral water and drinking water in bulk packs for water dispensers. Uncooled, still mineral water showed damage to the environment 90 to 1000 times higher than tap water due to the long transport routes and the means of transportation used (Jungbluth 2006). For example: A person drinking 2 litres of mineral water every day for a year could drive about 2,000 km by car with the energy needed for the production and transport of the mineral water. Compared to tap water: 2 litres per day over a year results in only 2 kilometres by car.

If in some cases mineral water needs to be bought, then origin and packaging should play a pivotal role in the decision due to ecological reasons. Mineral water coming from nearby sources – in the case of Vienna there are four sources within 100 km – is to be given preference. Returnable bottles are preferred to disposable bottles for ecological reasons. (Austrian Economic Chambers, WKO 2011).

No transport energy is needed for tap water coming from springs originating in the Schneeberg and Hochschwab mountains. The inclination of the First and Second Spring Water Mains brings the water into the high basins of Vienna.

Table 7.1 Transport routes of the different systems

	<b>Mineral water</b>  (company example.: Edelstal, Bgld)	<b>Bottle fed water cooler with 19l bottle</b>  (company example: Thalheim, Styria)	<b>Water dispenser (mains fed)</b>  (company example: Mauthausen, Upper Austria)	<b>Tap water</b>
<b>Transport route from bottling plant to Vienna</b>	approx. 65 km	Per delivery (incl. maintenance) approx. 210 km (min. 4x/year)	For maintenance approx. 370 km/year	0 km

As table 7.1 shows, tap water does not require any transportation, it gets into the building by means of the tap water network. Mains-fed water dispensers only require servicing trips, increased consumption usually does not require further servicing trips. However, for mineral water and bottle-fed water dispensers the quantity of transport routes increases with an increase in consumption.

## 8. Energy consumption

Both types of units, bottle-fed and mains-fed water coolers, are connected to the electricity network in order to cool and heat the drinking water. In order to be able to compare the different types of units, the highest values given by the producers were taken. A refrigerator of 170 l volume, efficiency class “A” was presumed for calculating the cooling of mineral water.

Table 8.1. Annual energy consumption of the different systems

consumption	<b>Mineral water</b> Presumption: excl. Cooling of mineral water	<b>Bottle-fed water cooler with 19l bottles</b> depending on quantity taken, highest values <sup>1</sup>	<b>Mains-fed water dispenser</b> depending on quantity taken, highest values <sup>3</sup>	<b>Tap water</b>
<b>Cooled water</b>				
Capacity of device (Wh)	32	55	42	No energy consumption
Energy consumption/year (kWh)	281	482	365	
CO <sub>2</sub> emissions (kg) due to energy consumption for cooling/year <sup>4</sup>	166	284	215	No CO <sub>2</sub> emissions
Electricity costs for cooling (€) (13-17 Cent/kWh) <sup>5</sup>	36.50 – 47.80	62.70 – 81.94	47.50 – 62.10	0
<b>Hot water</b>				
Capacity of device (Wh)	Usually no heating function	110	110	-
Energy consumption/year (kWh)		964	964	3,000 W device: 0.125 kWh for 1 l boiling water. With the annual energy consumption of a water dispenser 7,700 l water can be boiled
CO <sub>2</sub> emissions (kg) due to energy consumption for heating/year		569	569	
Electricity costs for heating (€) (13-17 Cent/kWh)		125.30 – 163.90	125.30 – 163.90	Depending on the amount of water to be boiled

A comparison of primary energy consumption for the production of the different water types is difficult, and there are no values available regarding the energy consumption (grey energy) for the production of water dispensers and water coolers. The aforementioned comparison is therefore limited to the energy consumption for cooling and heating of water. Furthermore, the producers were not able to state the average consumption of the unit, therefore the highest values were taken for the calculations. Measurement of energy consumption conducted by "die umweltberatung" on a

<sup>1</sup> Consumption data according to producers

<sup>3</sup> Consumption data according to producers

<sup>4</sup> CO<sub>2</sub> calculation: Internationales Wirtschaftsforum Regenerative Energien (IWR, a German based Renewable Energy Industry Institute): [www.iwr.de/re/eu/co2/co2.html](http://www.iwr.de/re/eu/co2/co2.html)

<sup>5</sup> <http://www.wienenergie.at>

bottle-fed water dispenser over a period of six days showed that the daily energy consumption was 1.51 kWh; this is 551 kWh when projected for a whole year.

For tap water, no energy is needed because it is delivered at drinking temperature.

Energy is also needed for tap water when heating water for hot drinks. Approx. 7,700 l water could be heated in an electric kettle using the same amount of energy needed for water dispensers with a hot water function over a year (max. 964 kWh). In comparison, a 3 person private household in Austria uses on average 3,420 – 4,310 kWh electricity per year.

## 9. Packaging

Reusable glass bottles for mineral water are refilled up to 40 x, PET mineral water bottles up to 20 times ([www.mehrweg.at](http://www.mehrweg.at); only available in German). However, the share of reusable bottles for mineral water is sinking while the share of disposable bottles is increasing, which is the most unfavourable alternative from an ecological point of view. Since the year 2000, the share of reusable bottles for mineral water has fallen from 64.6 % to 16.3 % (Austrian Economic Chambers, WKO 2011).

The bottles for water coolers could be refilled up to 80 x, which depends on the degree of contamination<sup>6</sup>. From an ecological point of view, tap water is ideal, because it does not need any packaging. Mains fed water dispensers or devices which refill their bottles with tap water also do not cause any packaging waste.

Table 9.1 Generation of packaging material in different systems

	Mineral water	Bottle-fed water cooler with 19l bottles	Mains-fed water dispenser	Tap water
<b>Packaging material</b>	Disposable bottles / reusable glass bottle, 40 x refillable on average	Bottles made of plastics, refillable up to 80 times	-	-

## 10. Possible health implications of PET bottles and polycarbonate bottles.

<sup>6</sup> Company information triple A



A study on behalf of the Vienna Chamber of Labour (*Kammer für Arbeiter und Angestellte für Wien*), Department for Transport and Environmental Policy, of the Department for Environmental Protection and the Vienna Ombuds Office for Environmental Protection investigated the health implications of drinks packaging in 2011.

The study shows that drinks packaging can contain endocrine disruptors, which are transmitted to the contents through migration processes. Endocrine disruptors are substances which influence the hormonal system of the human (and animal) body and hence may have a harmful impact on the health of organisms. For example, they have an impact on hormone regulation, bind to hormone receptors or influence hormone syntheses, transport or metabolism. Among the endocrine disruptors is the hormone active substance **Bisphenol A**, which is a component in the production of **polycarbonate**. Polycarbonate is a material which is inter alia used for the bottles in water dispensers; a migration of Bisphenol A into the water cannot be excluded. An urgent need for research exists on the investigation of food packaging and its hormone-like effects. In any case, the intake of potentially endocrine effective substances should be kept as low as possible, since there is no minimum threshold for their effects.

Mineral water is bottled in reusable glass bottles and increasingly in disposable PET bottles. **PET production** uses **antimony trioxide** as a catalyst. According to the International Agency for Research on Cancer (IARC), antimony trioxide is rated as a substance with a possible carcinogenic risk for humans (Federal Office of Public Health, 2007). Content of antimony increases with the duration of storage (Shotyk William, Michael Krachler, Bin Chen, 2006). According to the study by the Vienna Chamber of Labour (*Kammer für Arbeiter und Angestellte für Wien*), Department for Transport and Environmental Policy, the incorporated quantity of antimony is very low, even when consuming large quantities of water containing antimony, it accounts for max. 2 % of the daily tolerable dose. Nevertheless, intake should be avoided if possible, because even low amounts may contribute to the sum total of carcinogenic or hormone-effective substances (Chamber of Labour 2011).

## 11. Conclusion

Mineral water needs to meet strict legal requirements, just like tap water. Regarding health implications, mineral water is not better than Vienna's tap water; with costs of **EUR 0.25 per litre** on average, it is however 75 times more expensive. It needs a lot of energy for packaging, transportation and cooling. The increasing bottling of it using disposable instead of reusable bottles additionally increases the resource demand.

The use of water dispensers is to be critically assessed for the same reasons. Bottle-fed water dispensers cause the biggest environmental damages, since the bottles are transported over long distances throughout Austria. Additionally, they cause a high energy consumption of up to 964 kWh per year for the heating and cooling of the water. Furthermore, germ contamination due to improper use and maintenance cannot be excluded. From an economical point of view, the bottle-fed water dispensers also occupy the last place with an average price of **EUR 0.53 per litre**. Mains-fed water dispensers do not require transportation of water and are significantly more cost-effective with an average price of **EUR 0.25 per litre** (at a consumption rate of 200 litres/month). The units, however, have an almost equally high energy consumption. Proper maintenance is also indispensable for this unit. An ecological alternative are drinking fountains, since water can be accessed without incurring expenses for packaging and energy.

Vienna's tap water is a strictly examined foodstuff and suitable for life-long daily consumption. The two Vienna Spring Water Mains supply Vienna with excellent drinking water. Tap water does not cause any energy consumption for filling, storage and transportation. For ecological reasons, it is by far superior to mineral water and water dispensers and is the most cost-effective water with a price of **EUR 0.0033 per litre**.

## 12. Literature

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