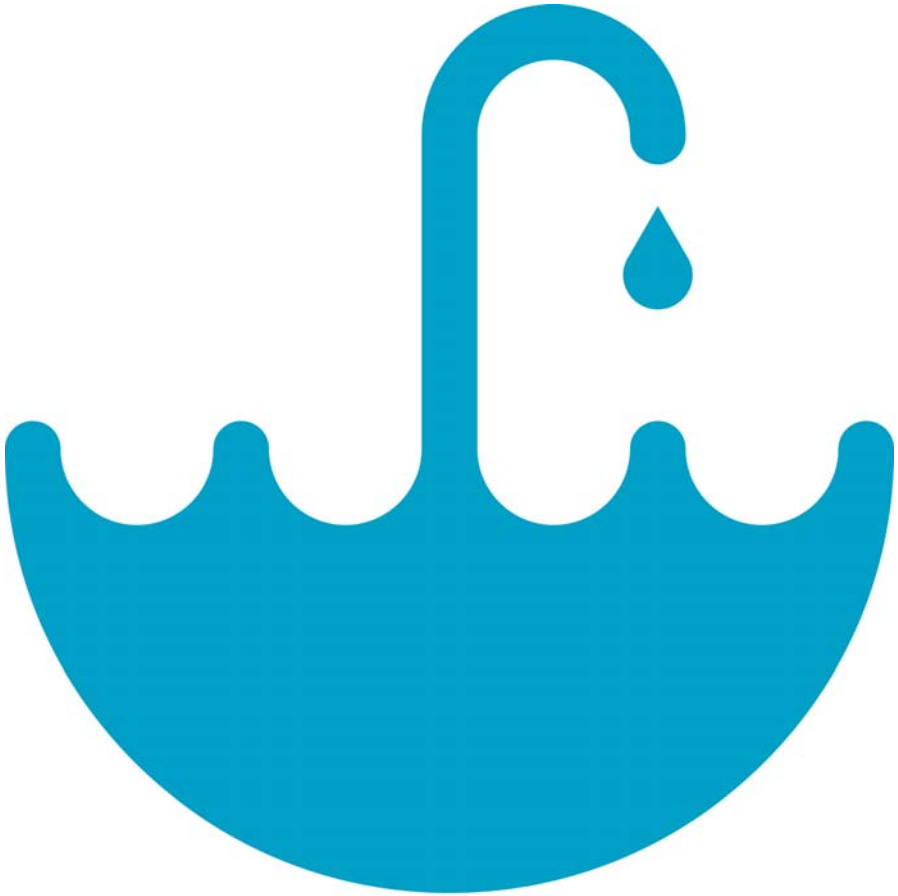

celebrate water

image courtesy of Massimo Bortolamiol

Thirst for Knowledge: Factors to Consider in Selecting a Reusable Water Bottle

William Shotyk
Elmvale Foundation


FIJI
local water from the tap ?
or water in a plastic bottle,
shipped halfway around the world ???

OUTLINE

➜ background

➜ arctic ice archives of global atmospheric metal pollution

➜ groundwaters in Springwater Township

➜ bottled waters: Pros and Cons

➜ reusable water bottles: Pros and Cons

REUSABLE WATER BOTTLES

➜ plastic

-Polycarbonate (BPA)

-Polypropylene (Enviroclear)

➜ stainless steel

➜ SIGG bottles

BOTTLED WATER:
FACTS AND MISCONCEPTIONS

- ➜ health benefits ?
- ➜ chemical composition of the water ?
- ➜ contamination from packaging
- ➜ direct environmental impacts
- ➜ indirect environmental impacts
- ➜ COSTS

BACKGROUND

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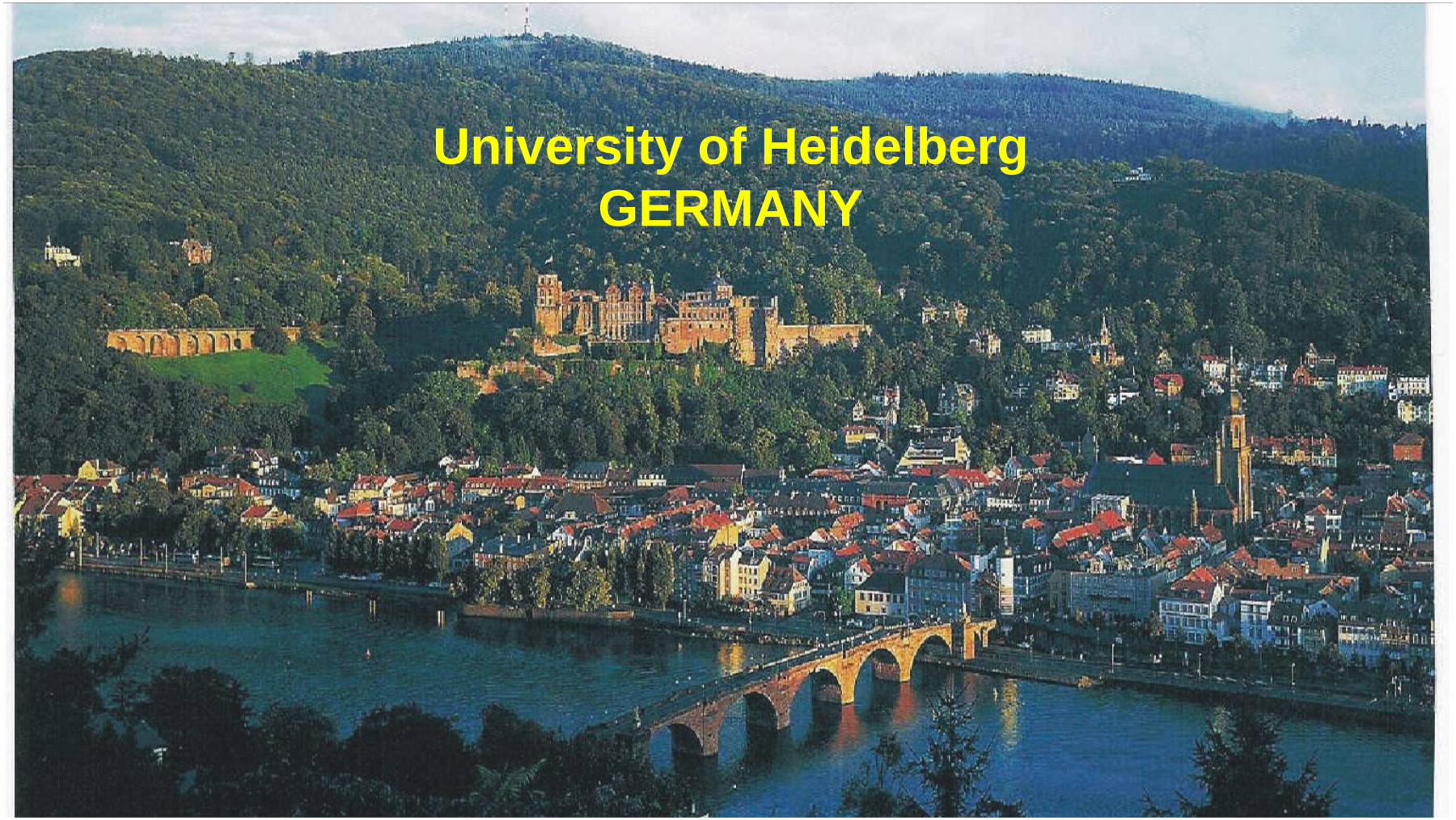
City of Toronto,
CANADA


University of Heidelberg
GERMANY

Lab for Trace Inorganic and Isotopic Analyses, University of Heidelberg

APEX high efficiency nebulizer

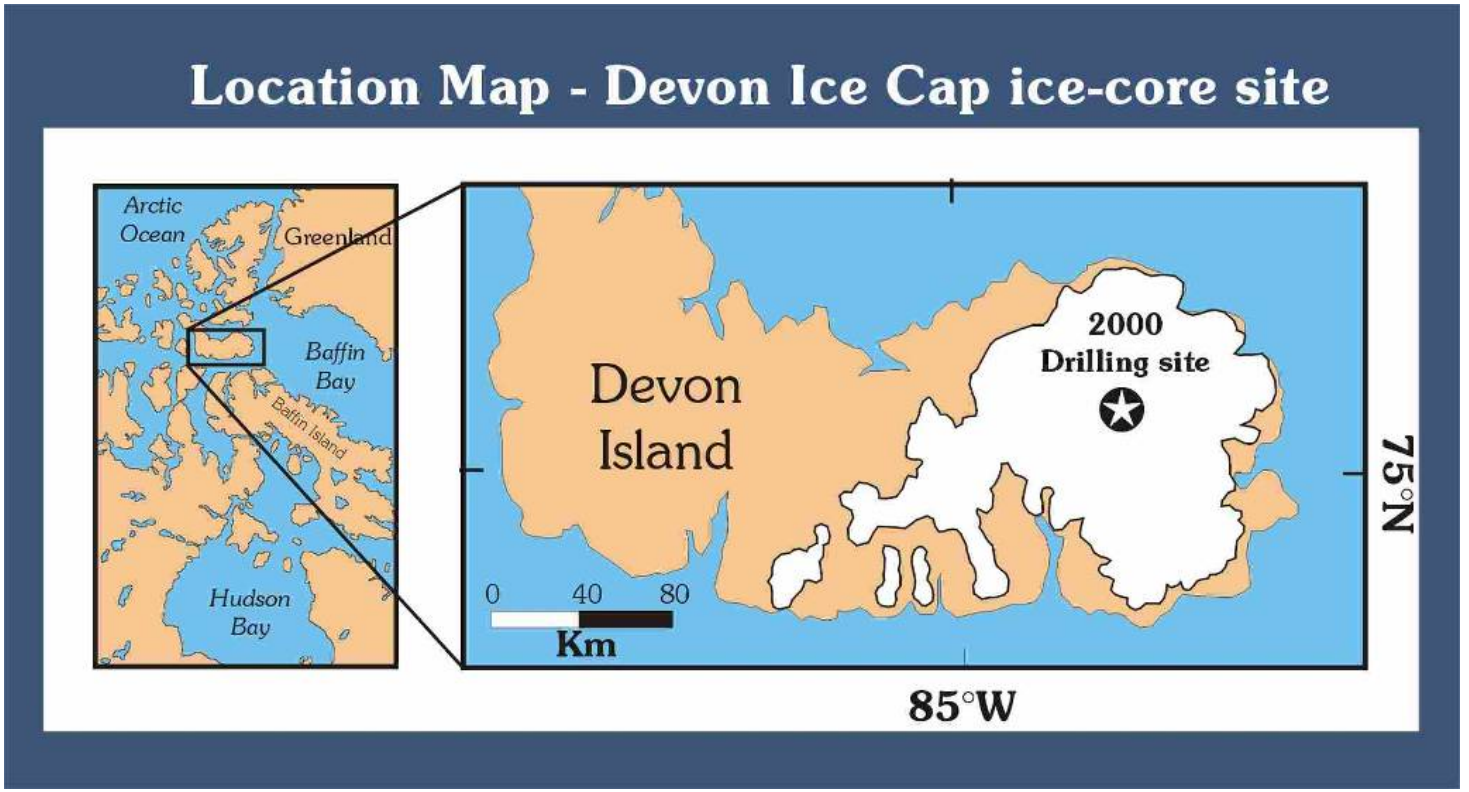
Dr. Michael Krachler

sub-boiling distillation of acids

Element2 Sector-field-ICP-MS

Natural Resources Canada | Ressources naturelles Canada

Dr. James Zheng



1/22/2009

Ice Cores – Archives of Environmental Change

natural concentration of lead (Pb)
in Arctic snow and ice ?

FIVE

PARTS PER TRILLION

in ice between 4,000 and 8,000 years old…..

what is a part per trillion ?

- volume of water in Lake Huron: approximately three trillion litres

- **adding one litre of water to Lake Huron, is like adding one part per trillion**

SPRINGWATER TOWNSHIP

flow at Old Johnson Farm

continuous flow, Parnell field

MEDIAN “background”

Pb = 5 ng/l

(Middle Holocene)

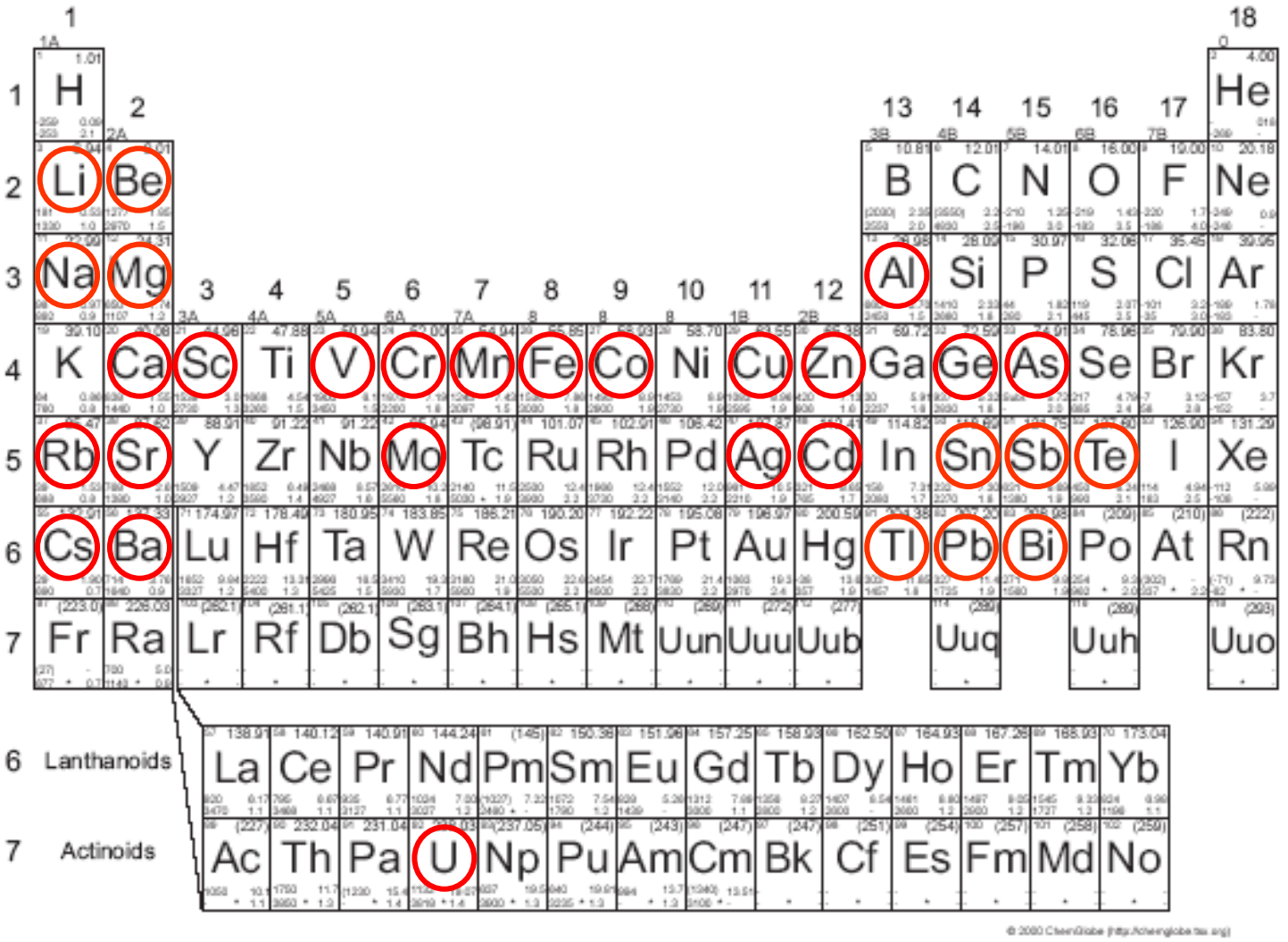
median concentration

Pb = 5 ng/l

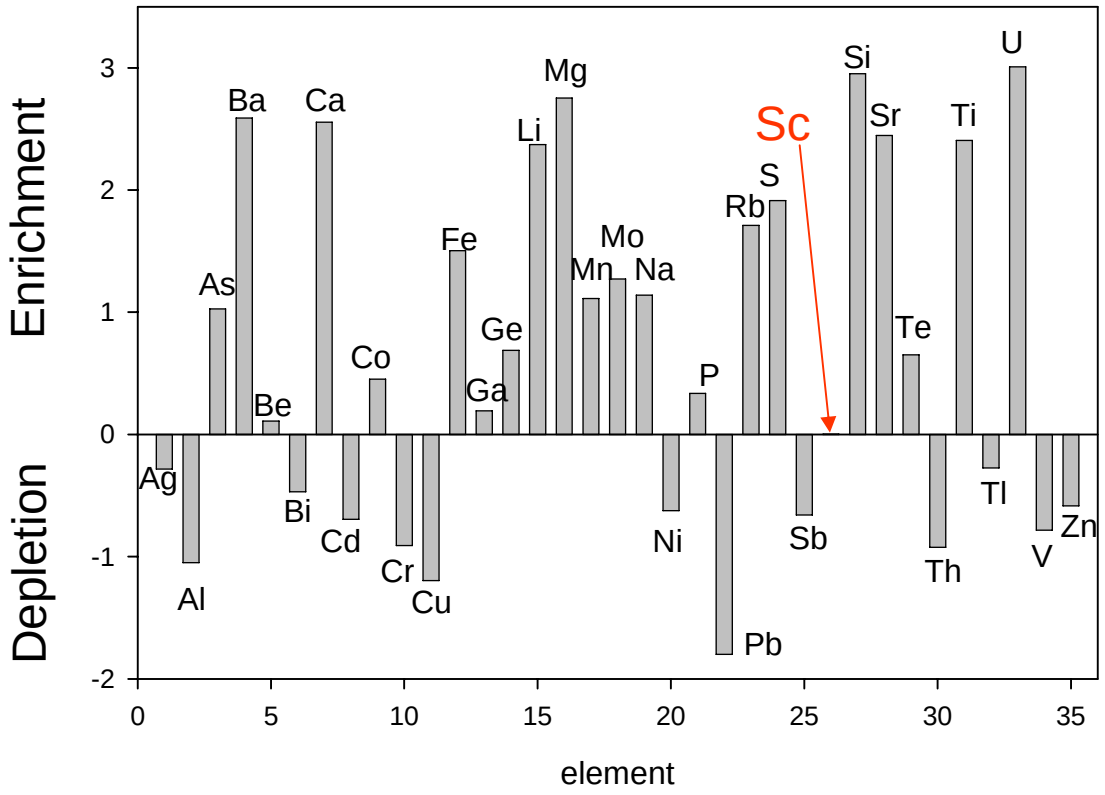
some samples

Pb < 1 ng/l

ie comparable to the lowest Pb concentrations ever measured…..



○ elements currently determined in groundwaters



Element Enrichments and Depletions in Groundwater (PARNELL) Relative to Snow

enrichments and depletions expressed as

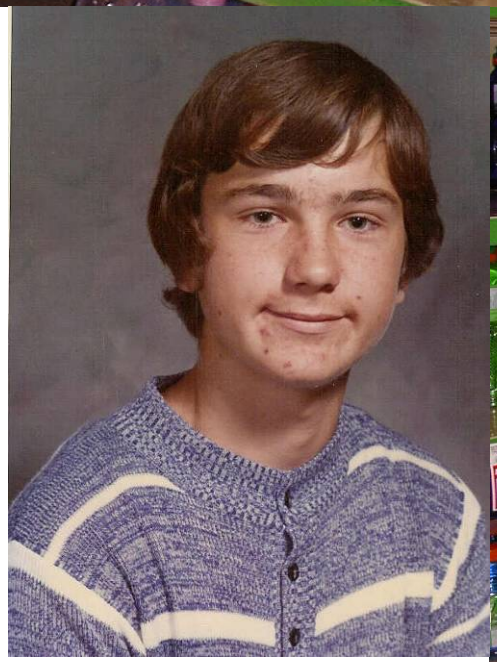
$\log [(M/Sc)]_{groundwater}/[(M/Sc)]_{snow}$

BOTTLED WATERS

elmvale


NUTRITION FACTS
Serving Size 8.45 fl oz. (250 ml)
Amount/Servings
Calories 0
Total fat 0 mg
Sat. Fat 0 mg
Cholest. 0 mg
Sodium 1.81 mg
Total carbohydrate 0g
Dietary Fiber 0 mg
Sugars 0 mg
Protein 0 mg
Vitamin A 0 %
04.04.2006


.99
1.79
1.25




Superstore
Gatorade
evian
DASANI
.99
.99

The United States-based Pacific Institute found that bottled water typically costs a thousand times more per litre than municipal tap water. Health Canada states that there is no evidence to support the notion that bottled water is safer than tap water and that, for health reasons,

Canadian drinks 61 litres of bottled water a year. The Beverage Marketing Corporation, an industry consulting firm, reports that $653 million was spent on bottled water in Canada in 2005, making it a more popular bottled beverage than wine.

The United States-based Pacific Institute found that bottled water typically costs a thousand times more per litre than municipal tap water. Health Canada states that there is no evidence to support the notion that bottled water is safer than tap water and that, for health reasons,

irreparably damage the surrounding ecosystem.

Nestlé paid

fee of $3,000 fo

Nestlé will be

water taken (o

water). While

is exported to

water bottling

bottled water is

JIM MACINNIS

irreparably damage the surrounding ecosystem.

Nestlé paid the Ontario government an application fee of $3,000 for access to the water. As of January 2009, Nestlé will be required to pay $3.71 per million litres of water taken (or $2,166.64 annually for 1.3 billion litres of water). While much of the water that Nestlé withdraws

How do rising gas prices compare to the cost of bottled water and other common household items? As of April 2008, the price of gas at Petro-Canada in Toronto was $1.17 per litre and a litre of bottled water was $2.01. Below is a random sampling of bottled products priced per litre – but only water can be had for free.

Ontario Nature, Summer 2008, p. 14
www.ontarionature.org

Bottled water 'is immoral'

Last Updated: 12:01am GMT 17/02/2008

Drinking bottled water should be made as unfashionable as smoking, according to a government adviser.

"We have to make people think that it's unfashionable just as we have with smoking. We need a similar campaign to convince people that this is wrong," said Tim Lang, the Government's naural resources commissioner.

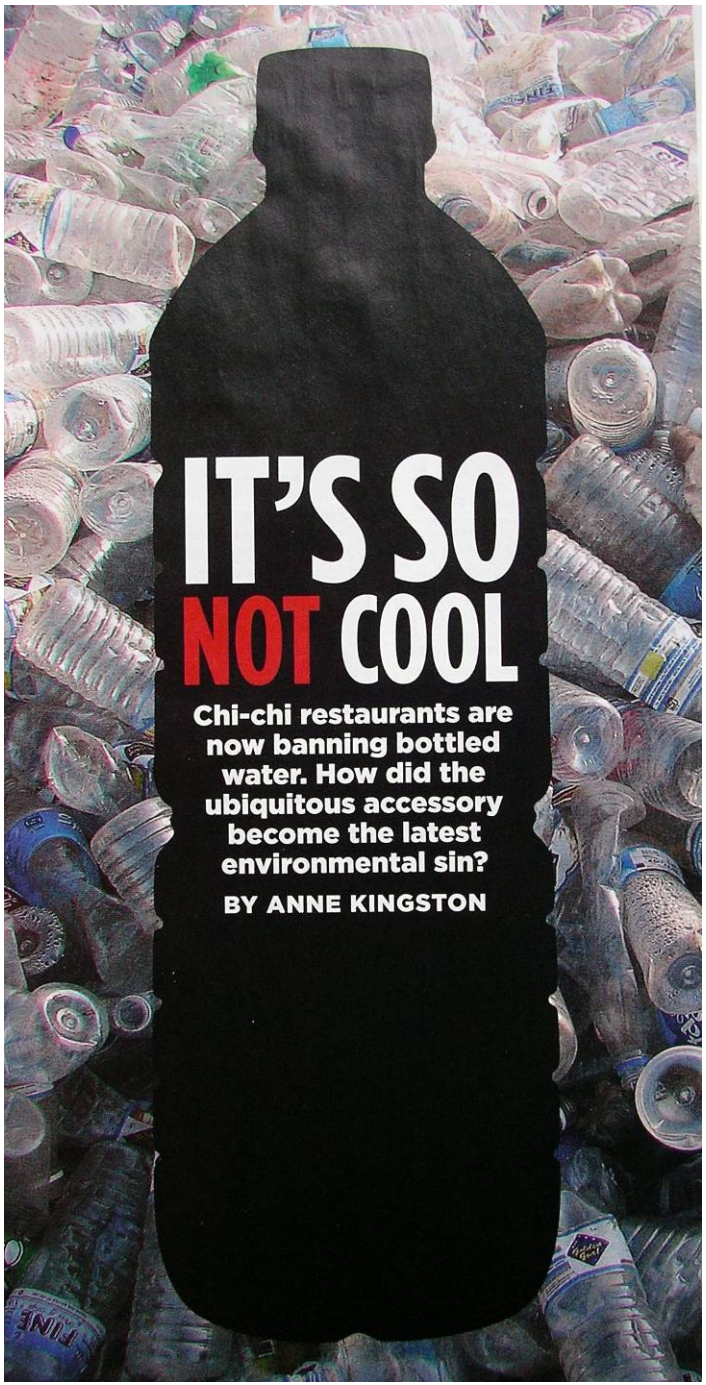
Phil Woolas, the environment minister, added that the amount of money spent on mineral water "borders on being morally unacceptable".

Their comments come as new research shows that drinking a bottle of water has the same impact on the environment as driving a car for a kilometre. Conservation groups and water providers have started a campaign against the £2 billion industry.

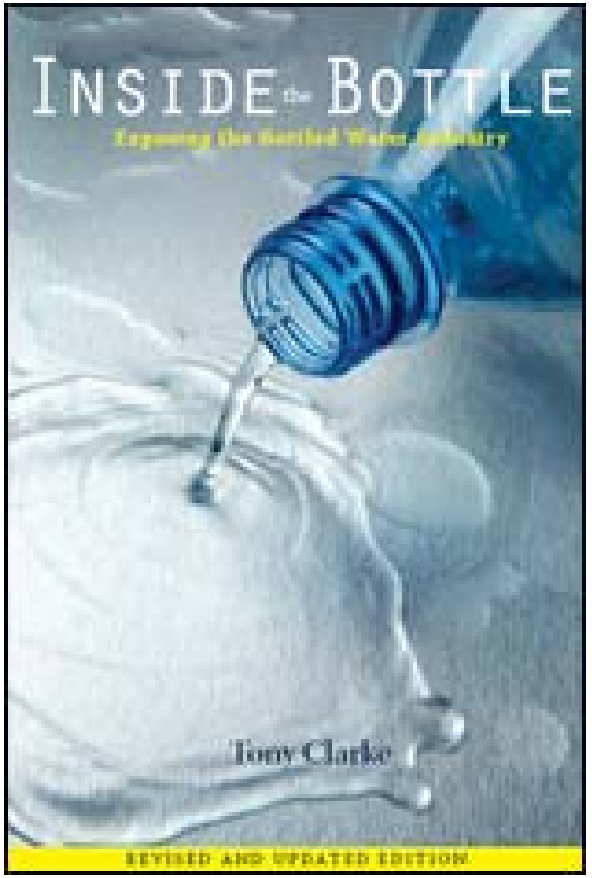
A BBC Panorama documentary, "Bottled Water: Who Needs It?", to be broadcast tomorrow says that in terms of production, a litre bottle of Evian or Volvic generates up to 600 times more CO2 than a litre of tap water.

Bottled water generates upto 600 times more CO2 than tap water


Teen Muslim fiction P.58
ON COPING P.14
Disney's racism mess P.62
China problem P.20
MACLEAN'S
CANADA'S MAGAZINE OF THE YEAR
MAY 14th 2007
www.macleans.ca
BOTTLED WATER IS THE LATEST ENVIRONMENTAL SIN
HOW MUCH TAP WATER ARE YOU WILLING TO DRINK TO SAVE
P.38
10100 003100 006 26 (E)
MME0107358848 38 13JUL09 83/05
DR NICOLE MANTHA
461 WATERLOO ST
LONDON ON N6B 2P4
AL GORE


IT'S SO NOT COOL
Chi-chi restaurants are now banning bottled water. How did the ubiquitous accessory become the latest environmental sin?
BY ANNE KINGSTON

Tony Clarke, Polaris Institute, Ottawa



Chemical Composition of Bottled Mineral Water

HERBERT E. ALLEN, Ph.D.
Environmental Studies Institute
Drexel University
Philadelphia, Pennsylvania
MARY ANN HALLEY-HENDE
Mobay Corporation
New Martinsville, West Virgi
CHARLES N. HASS, Ph.D.
Pritzker Department of Envir
Illinois Institute of Technolog
Chicago, Illinois

37 brands of bottled mineral water tested….
24 had one or more determinands
that were not in compliance
with the drinking water standards in the U.S.

ABSTRACT. Thirty-seven brands of domestic and imported mineral waters were analyzed for the following: alkalinity, aluminum, barium, beryllium, boron, cadmium, calcium, chloride, chromium, cobalt, copper, fluoride, iron, lead, lithium, magnesium, manganese, mercury, molybdenum, nickel, nitrate, pH, phosphate, potassium, silver, sodium, specific conductance, sulfate, tin, vanadium, and zinc. Of the waters examined in this study, 24 had one or more determinands that were not in compliance with the drinking water standards in the United States.

Archives of Environmental Health (1989)
March/April, Vol. 44, No. 2, pp. 102-116

World Health Organization

Fact sheet N°256
October 2000

Bottled drinking water

"Water, water everywhere, but not a drop to drink" from the Rhyme of the Ancient Mariner is perhaps a fittin
urban areas today who are increasingly looking toward bottled water as a means of meeting some or all of the
stretched to meet the demands of industry, agriculture and an ever-expanding population, the shortage of safe
challenge in many parts of the world. In the wake of several major outbreaks involving food and water, there
drinking-water. While bottled water is widely available in both industrialised and developing countries, it ma
may have various reasons for purchasing bottled drinking-water, such as taste, convenience or fashion, but fo
important considerations. Since such considerations are often not founded on facts, these will be specifically

The safety of bottled drinking water

While the term *bottled water* is widely used, the term *packaged water* is perhaps more accurate. Water sold in countries for consumption can come in cans, laminated boxes and even plastic bags. However, bottled water is most commonly sold in glass or disposable plastic bottles. Bottled water also comes in various sizes from single servings to large carbouys holding up to 80 litres. Depending on the climate, physical activity and culture, the drinking-water needs for individuals vary, but for high consumers it is estimated to be about two litres per day for a 60 kg person and one litre per day for a 10 kg child.

Drinking-water may be contaminated by a range of chemical, microbial and physical hazards that could pose risks to health if they are present at high levels. Examples of chemical hazards include lead, arsenic and benzene. Microbial hazards, include bacteria, viruses and parasites, such as *Vibrio cholerae*, *hepatitis A virus*, and *Cryptosporidium parvum*, respectively. Physical hazards include glass chips and metal fragments. Because of the large number of possible hazards in drinking-water, the

WHO has no scientific information on the health benefits or hazards of regularly consuming these types of bottled waters

The potential health benefits of bottled drinking water

In European and certain other countries, many consumers believe *that natural mineral waters* have medicinal properties or offer other health benefits. Such waters are typically of high mineral content and, in some cases, significantly above the concentrations normally accepted in drinking-water. Such waters have a long tradition of use and are often accepted on the basis that they are considered foods rather than drinking-water *per se*. Although certain mineral waters may be useful in providing essential micro-nutrients, such as calcium, WHO is unaware of any convincing evidence to support the beneficial effects of consuming such mineral waters. As a consequence, WHO *Guidelines for Drinking-water Quality* do not make recommendations regarding minimum concentrations of essential compounds.

On the other hand, in some countries, bottled waters with very low mineral content, such as distilled or demineralised waters, may be offered for sale. While a large number of people have traditionally consumed rainwater which is similarly low in minerals without apparent adverse health effects, WHO has no scientific information on the benefits or hazards of regularly consuming these types of bottled waters.

opened in their presence in restaurants and other food and beverage service establishments.

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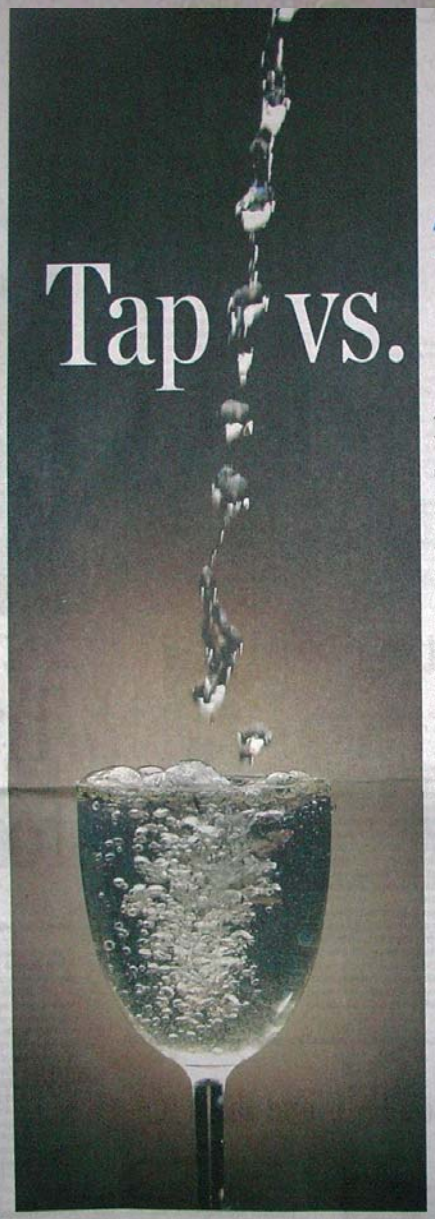
International standards for bottled drinking water

The intergovernmental body for the development of internationally recognized standards for food is the Codex Alimentarius Commission (CAC). WHO, one of the co-sponsors of the CAC, has advocated the use of the *Guidelines for Drinking-water Quality* as the basis for derivation of standards for all bottled waters.

SUNDAY, JULY 27, 2008 • TORONTO STAR • ID5



SCOTT GARDNER / TORSTAR NEWS SERVICES

ANNALS OF LIVING

Tap vs. bottled

American reporter's balanced probe into why we pay for water applies to Canada

D. GRANT BLACK

Ever wondered what's in that glass of water, or more likely these days, what's in that bottle of water?

Brooklyn-based journalist Elizabeth Royte not only wanted to find out what's in our drinking water, but where it comes from, its history, politics and, increasingly, who controls our shrinking fresh water resource.

In *Bottlemania: How Water Went on Sale and Why We Bought It*, Royte's reporting uncovers some disturbing water industry facts around the United States. Bottlemania is a watery *Fast Food Nation*, a treatise on H_2O that PR flacks would rather keep underground.

Bottlemania is thoroughly researched, fluid storytelling by a veteran investigative journalist who explains why water has made the leap from the tap in the last 20 years to a global industry worth $60 billion annually.

Royte, who also penned an exhaustive exposé on American trash, *Garbage Land: On the Secret Trail of Trash*, profoundly points out that the "outrageous success of bottled water, in a country where more than 89 per cent of tap water meets or exceeds federal health and safety regulations, regularly wins in blind taste tests against name-brand waters, and costs 240 to 10,000 times less than bottled water, is an unparalleled social phenomenon, one of the greatest marketing coups of the twentieth and twenty-first centuries."

She says the marketing of bottled water has been a huge success because it "plays into our ever-growing laziness and impatience." She says environmentalists decry the environmental impact of bottling spring water (draining aquifers, trucking and shipping, non-refundable plastic waste) given that we have a perfectly good source of drinking water right under our noses.

Nestlé, a Swiss-owned conglomerate and the largest food-processing company in the world, which controls 32 per cent of the U.S. bottled-water market and offers several brands around the U.S., brought in estimated 2006 profits of $7.46 billion. The other two biggest players are those old whores of a trendy drink, Coca-Cola and Pepsi.

Royte points out that sales of bottled water in the U.S.— more than 700 domestic and 75 imported brands — have already surpassed sales of beer and milk and by 2011 are expected to surpass soft drinks.

"They are ubiquitous where I live. You can't walk a block in New York City without seeing a bottle in someone's hand, their baby stroller, or bike cage, spilling from the corner litter baskets or crushed flat and gray, ratlike, in the gutters. Nationwide, we discard thirty to forty billion of these containers a year."

Those containers are manufactured from polyethylene terephthalate (PET), a polymer derived from oil with other ingredients for colour, strength and flexibility. Antimony, a catalyst in the manufacture of PET, leaches into bottled water.

BOTTLED continued on ID8

Bottlemania: How Water Went on Sale and Why We Bought It
by Elizabeth Royte
Bloomsbury,
248 pages, $27.95

Bottlemania: How Water Went on Sale and Why We Bought It
by Elizabeth Royte
Bloomsbury,
248 pages, $27.95

the "outrageous success of bottled water, in a country where more than 89 per cent of tap water meets or exceeds federal health and safety regulations, regularly wins in blind taste tests against name-brand waters, and costs 240 to 10,000 times less than bottled water, is an unparalleled social phenomenon, one of the greatest marketing coups of the twentieth and twenty-first centuries."

CONTAMINATION OF BOTTLED WATERS FROM LEACHING

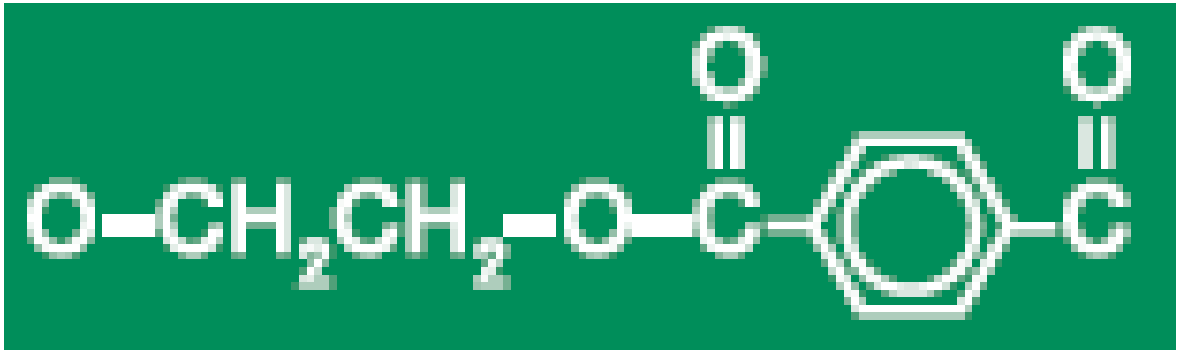
elmvale

UNIVERSITÄT HEIDELBERG

Thirst for Knowledge: Factors to Consider in Selecting a Reusable Water Bottle

Prof. Dr. William Shotyk

Institute of Environmental Geochemistry
University of Heidelberg, Germany



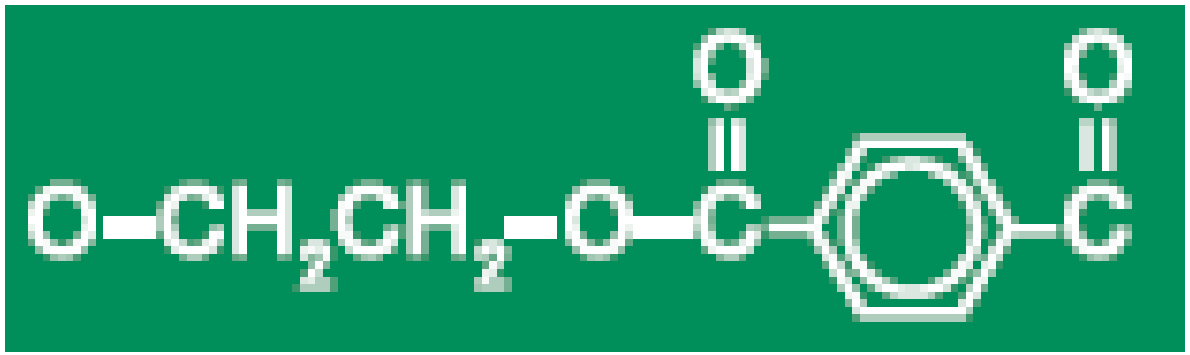
Polyethylene terephthalate (PET)

Almost all PET is manufactured using Sb_2O_3, Antimony Trioxide

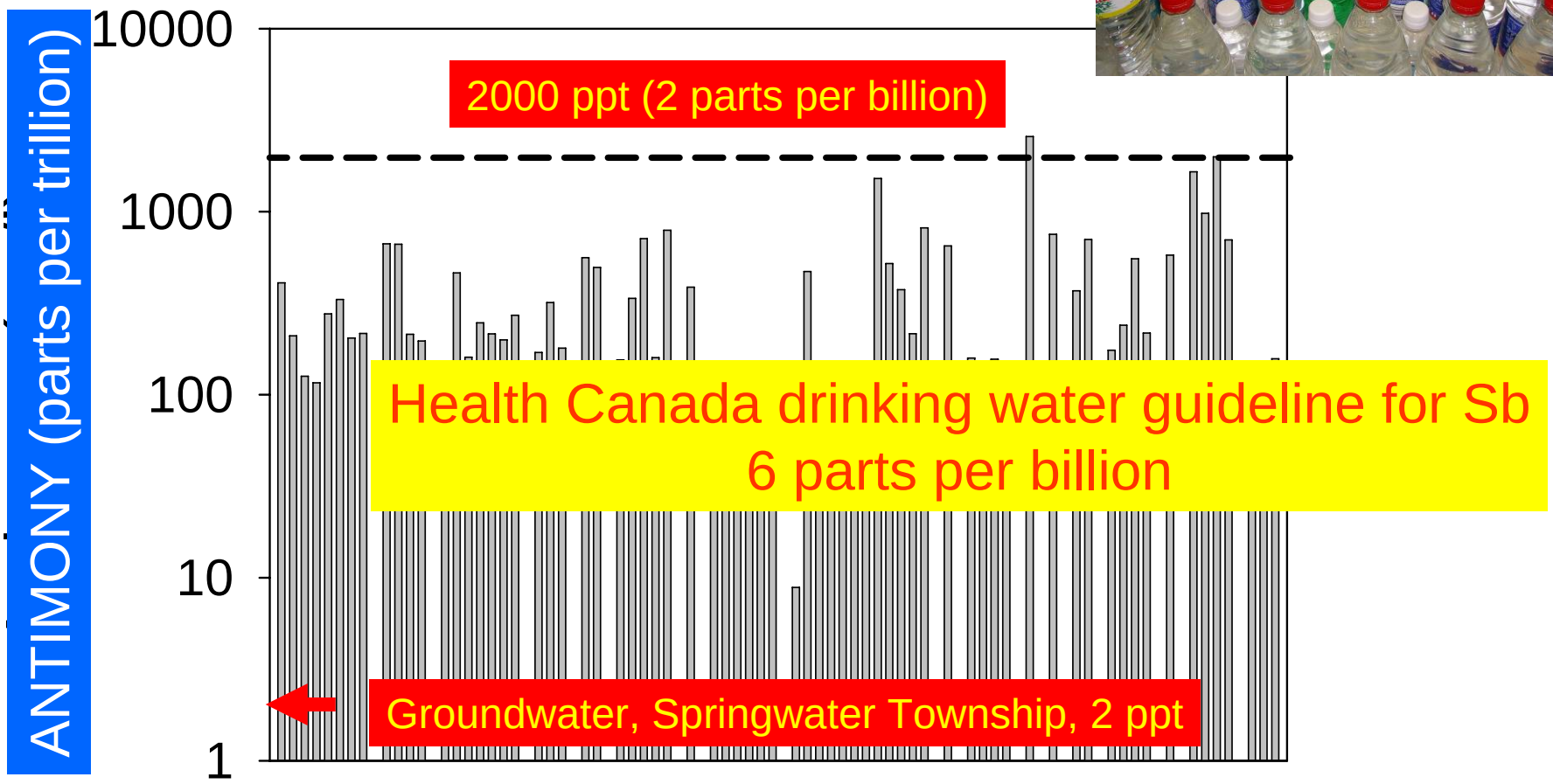
PET bottles contain several hundred parts per million of Sb

Sb, a potentially toxic trace metal, leaches into the water

Bottled waters contain Sb at concentrations hundreds to thousands of times above natural levels



Polyethylene terephthalate (PET)



Measurements to date: 132 brands of bottled water from 28 countries

Mineralwasser aus PET-Flaschen ist mit Antimon verunreinigt

Schadstoffe im Mineralwasser

PET-Flaschen
Mineralwasser mit Antimon verunreinigt

Schweres Wasser - Antimon in PET-Flaschen

Hoher Antimongehalt in PET-Flaschen?

Messung von Antimonspuren in Mineralwasser

Aus PET-Flaschen freigesetzte Menge liegt weit unter den empfohlenen Grenzwerten

Mineral mit Schwermetall

Ein Geist zu viel in der Plastikflasche

Das Schwermetall Antimon in Mineralwasser aus PET-Gefäßen gibt Wissenschaftlern zu denken

In PET-Flaschen abgefülltes Mineralwasser ist mit dem Schwermetall Antimon verunreinigt. Die Werte sind zwar sehr niedrig, so dass Gesundheitsschäden durch Trinken

The Mail on Sunday

The Courier-Mail

News
THE POISON LURKING IN YOUR PLASTIC WATER BOTTLE
504 words
12 March 2006
The Mail on Sunday

The Daily Telegraph

Daily Mirror

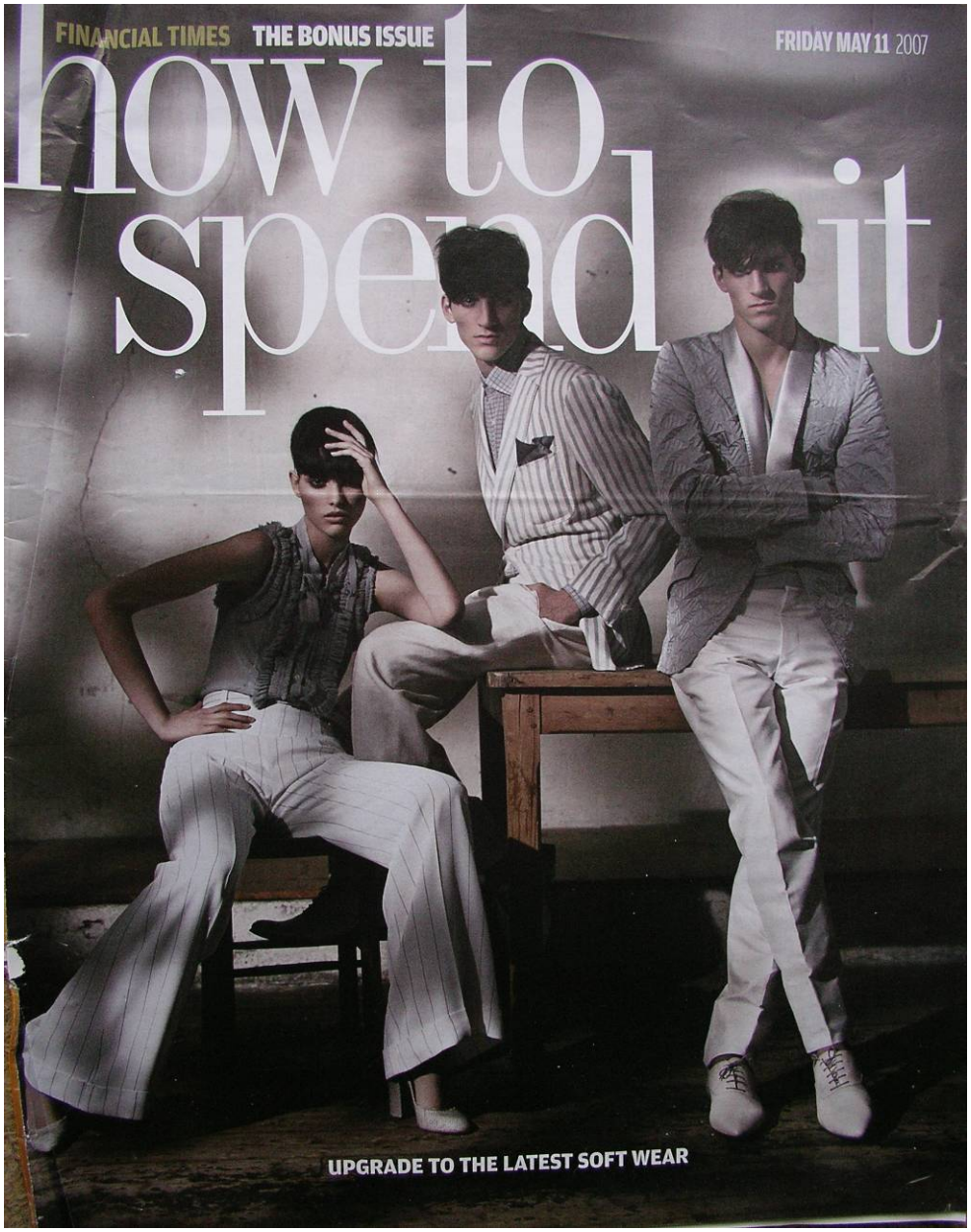
DAILY EXPRESS

The Sun

Toxins that are lurking in your bottle of water
By Jo Willey

The Mercury (AUSTRALIA)

HindustanTimes.com (INDIA)


FINANCIAL TIMES
THE BONUS ISSUE
FRIDAY MAY 11 2007
how to spend it
UPGRADE TO THE LATEST SOFT WEAR


HILDON
Delightfully Still
AN ENGLISH
NATURAL MINERAL WATER
OF EXCEPTIONAL TASTE
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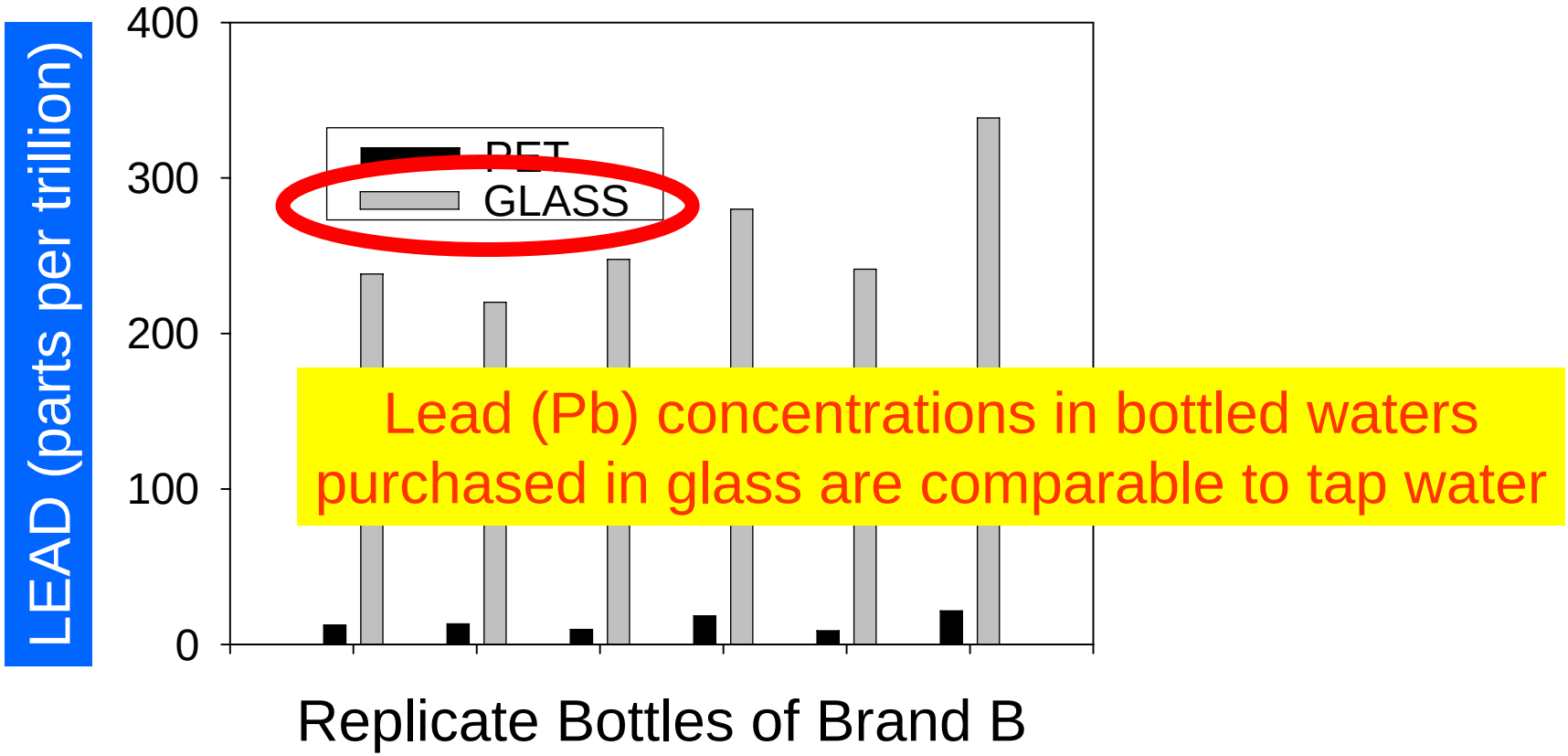
Hildon Ltd, Broughton, Hampshire SO20 8DQ
www.hildon.com ☎+44 (0) 1794 301 747

Contamination of Bottled Waters by Pb leaching from glass



Shotyk, W., and Krachler, M. (2007) Lead in bottled waters: comparison with pristine groundwaters and contamination from glass. *Environmental Science and Technology* (published on the web April 7, 2007).

VARIABLE CHEMICAL COMPOSITION OF BOTTLED WATERS

elmvale

Table 1 – Summary statistics of trace (μg/L) and major (mg/L) element data in 132 brands of bottled water from 28 countries

Element	Min	Max	Median	Spread	Guidelines WHO [a]	EPA [b]
Major elements (mg/L)						
Ca	0.03	508	62.8	16,500		
Mg	0.007	96.1	13.4	14,200		
Na	0.03	1370	9.17	51,100		
Sr	0.001	10.7	0.17	17,400		
Trace elements (μg/L)						
Ag	0.0004	2.20	0.002	5200		100
Al	0.19	108	1.60	560		50–200
Ba	0.02	557	21.0	32,000	700	2000
Be	0.00004	31.0	0.005	801,000		4
Cd	0.0006	0.265	0.008	470	3	5
Co	0.0009	2.99	0.024	3370		1300
Cr	0.006	1.72	0.082	307	50	
Cu	0.025	19.0	0.17	770	2000	1000
Fe	0.070	104	0.75	1480		300
Ge	<0.001	119	0.015	119,000		
Li	0.057	5460	4.80	96,200		
Mn	0.025	310	0.15	125,000	400	50
Mo	0.006	12.4	0.30	2090	70	
Pb*	<0.001	0.76	0.009	760	10	15
Rb	0.005	840	0.87	162,000		
Sb#	0.001	2.57	0.33	1850	20	6
Sc	0.0005	0.36	0.002	690		
Te	0.0006	0.18	0.004	280		
Tl	0.00004	0.30	0.002	7840		2
Th	0.00002	0.26	0.0002	11,550		
U	0.0002	27.5	0.23	147,700	15	30
V	0.0006	93.1	0.126	164,700		
Zn	0.043	442	0.64	10,270		5000

*This study does not include glass bottles which may leach Pb (Shotyk and Krachler, 2007b).

#Natural value perhaps 1% of this value, due to leaching of Sb from PET containers (Shotyk and Krachler, 2007a).

[a] Refers to drinking water.

[b] Refers to drinking and ground water.

URANIUM

Uranium: Minimum and maximum concentrations of U varied ~150 000-times in the investigated bottled waters yielding a median of 0.23 µg/L. While the majority of waters possessed U concentrations below the present WHO (WHO 2004) threshold limit of 15 µg/L, one bottled water from Finland (27.5 µg/L) exceeds this value and one water from Spain (15.1 µg/L) reaches this value. It should be noted, however, that the WHO guideline limit of 15 µg/L is a provisional value, as there is evidence of a hazard, but the available information on health effects are limited. A guideline value of 2 µg/L was recommended by WHO in 1998 (WHO 1998). A Croatian study reported maximum U concentrations of 1.53 µg/L (Fiket et al. 2007) in bottled water, while a survey of 56 European bottled waters revealed a maximum value of 9.45 µg/L (Misund et al. 1999). In a German study U concentrations as high as 10.6 µg/L were reported (Schnug et al. 2005). The highest U concentration (72 µg/L), however, was reported from a survey of bottled waters available on the Swedish market (Rosborg et al. 2005).

LITHIUM

Lithium: Lithium concentrations in the investigated waters varied over five orders of magnitude, reflecting the geology of the source region (Table 1). The highest concentration of 5.5 mg/L Li was found in a bottled water from France that also contained the highest Be concentration of all investigated waters. The bottled waters containing the greatest Be concentrations (in excess of the EPA threshold level of 4 µg/L Be) also had the highest Li concentrations (Germany (1.4 mg/L), Yugoslavia (1.3 mg/L) pointing to a natural source of both elements. Although no guideline level for Li in drinking water exists, it is worth mentioning that the Li blood plasma level of patients treated with Li-containing drugs against manic depression is adjusted to 3.5 to 8 mg/L (Emsley 2001). A blood plasma level of 10 mg/L is considered as mild Li poisoning, while levels exceeding 20 mg/L may cause death. While similar maximum Li concentrations of 5.1 mg/L (Allen et al. 1989), 3.1 mg/L (Misund et al. 1999) and 3.2 mg/L (Fiket et al. 2007) have been determined in bottled waters, a Li value of as high as 8.71 mg/L has been reported for a spring in the Baden-Baden area, Germany (LaMoreaux and Tanner 2001). Regular consumption of such waters might increase the body Li burden to relevant levels for health concerns. As a consequence, such a Li intake

BERYLIUM

Beryllium: By far the largest spread between lowest and highest concentrations (~10^6) was found for Be (median: 5 ng/L). Both the lowest and the highest Be concentration (0.04 ng/L and 31 µg/L in bottled waters from Hongkong and France, respectively) are beyond the range of values reported previously (Allen et al. 1989; Misund et al. 1999; Rosborg et al. 2005). While the median Be concentration of all bottled waters (5 ng/L) is far below the guideline value set by EPA (2003), one of each bottled waters from France (31 µg/L), Germany (8.1 µg/L) and Yugoslavia (11 µg/L) exceeded the EPA threshold level of 4 µg/L. Applying the much stricter Russian guideline level of 0.2 µg/L (Kirjukhin et al. 1993), however, only two additional bottled waters exceed this limit. Most tap waters around the world have < 0.1 µg/L Be (Vaessen and Szteke 2000), while certain geological settings might increase groundwater Be levels in Norway up to 6.6 µg/L (Frengstad et al. 2000).

TEST

Heikle Stoffe im

Test: Kohlensäu

Im K-Tipp Test schneiden 6 d
Mineralwässer gut ab. Drei G
enthalten viel radioaktives Ur
die von der Pet-Flasche stam

Vollmundig verspre-
chen die Hersteller
des Cristalp-Mineral-
wassers: «Seine ausgewoge-
ne Mineralisierung trägt zur
Regeneration Ihrer Zellen
und zur Reinigung des Or-
ganismus bei.» Im K-Tipp-
Test schnei
aber nur
Schuld sind
gehalt und
stammende
Der K-T
sen, wie vi
säurehaltige
enthalten. Dazu schickte er
15 in- und ausländische
Mineralwässer ins Labor.
Die Fachleute
die Wässer au
dehyd und d

An
wu
Sto
Fla
Ace
nen unangenehmen Beige-
schmack geben.
Sechs Mineralwässer sind

gabs für diese drei Produkte
ein «ungenügend». Laut
Hersteller sollte Heidiland

Abwertungspunkte
0 Sel
0,5 bis 1 Gut
1,5 bis 2 Ge
2,5 und mehr Un

Marke				
Bezeichnung				
Eingekauft bei				
Ebenfalls erhältlich bei	–	Coop	Volg, Landi, Globus, Spar, Manor	–
Preis pro Liter	–.20	–.50	–.80	–.20
Antimongehalt [1]	0,3	0,3	0,2	0,3
Uran (Mikrogramm/l) [2]	Weniger als 1	Weniger als 1	1,3	Weni
Acetaldehyd (Mikrogramm/l) [3]	13	14	15	16
Abwertung um ... Punkt(e)*	**0,5**	**0,5**	**0,5**	**1**
Gesamturteil [5]	**Gut**	**Gut**	**Gut**	**Gut**

[1] Mehr als 1 Mikrogramm pro Liter: Abwertung um 1 Punkt [2] Mehr als 2 Mikro
gramm pro Liter: Abwertung um 1 Punkt [4] 0,5-Liter-Flasche [5] Laut Herst

FOTOS: DOMINIQUE SCHÖTZ

Mineralwasser: Bei vielen Pet-Flaschen lösen sich die Schadstoffe Antimon und Acetaldehyd – und landen im Wasser

Im K-Tipp Test schneiden 6 der 15 getesteten Mineralwässer gut ab. Drei Getränke jedoch enthalten viel radioaktives Uran und Substanzen, die von der Pet-Flasche stammen.

Of 15 brands of mineral water tested, 6 were ranked “good”

Six were ranked only “adequate” and “three inadequate”, based on the concentrations of uranium and acetaldehyde

K-Tipp, Nr. 10, May 21, 2008

n Mineralwasser

ner mit unerwünschtem Beigeschmack

Drinking water guideline for uranium
20 parts per billion

www.ktipp.ch

Archiv im Netz
Unter **www.ktipp.ch** finden Sie alle Tests seit Januar 2000. Der Bezug eines Tests im PDF-Format (inkl. Tabellen) ist für Abonnenten gratis.

Die gute Nachricht: Alle im Test gemessenen Werte liegen unter den offiziellen Grenzwerten. Bloss: In der japanischen Pet-Produktion wird laut Michael Krachler von der Universität in Heidelberg (D) weitgehend auf Antimon verzichtet, denn: «Je länger das Wasser in der Pet-Flasche lagert, desto höher der Antimongehalt. Licht und Wärme beschleunigen den Vorgang. Eine unnötige Verunreinigung.» Für die Gesundheit haben Mengen, wie sie im Heidiland-Wasser festgestellt wurden, keine Folgen, so das deutsche Bundesamt für Risikobewertung (BfR).

Ähnlich verhält es sich beim Acetaldehyd: Es entsteht bei der Pet-Produktion und geht – ebenfalls durch Licht und Wärme beschleunigt – ins Wasser über. Laut BfR ist auch dieser Stoff in den vom Labor festgestellten Mengen unbedenklich. Aber die Substanz verändert schon in kleinsten Mengen den Geschmack des Wassers. Wer seinen Durst ohne diese Stoffe löschen will, kauft Mineral in der Glasflasche.

Uran: «2 Mikrogramm pro Liter akzeptabel»

Uran gelangt durchs Gestein ins Mineralwasser. Die Herkunft bestimmt also den Urangehalt. Das zeigt auch ein Vergleich der Resultate des K-Tipp-Tests mit jenen des Gesundheitstipp (Ausgabe 6/06): Aproz, San Pellegrino und M-Budget hatten ähnlich hohe Uranwerte. Der deutsche Experte Ewald Schnug hält 2 Mikrogramm Uran pro Liter Wasser für gerade noch akzeptabel – im aktuellen Test haben allerdings 9 von 15 Produkten diesen Wert überschritten.

Die Hersteller verweisen auf Richt- und Grenzwerte, die eingehalten würden. Nestlé und Migros schreiben, die Urankonzentration im San Pellegrino bzw. Aproz sei nicht gesundheitsgefährdend. Die Migros behandelt deshalb das Wasser auch nicht speziell.

Beat Camenzind

Ktipp

So wurde getestet

Das Labor Simec in Zofingen AG hat die kohlensäurehaltigen Mineralwässer auf folgende Substanzen untersucht:

- **Uran:** Das radioaktive Schwermetall reichert sich im Körper an, kann Krebs, Organ- und Erbgutschäden verursachen und gelangt vom Gestein ins Quellwasser. Ein Grenzwert existiert in der Schweiz nicht. Das deutsche Umweltbundesamt publizierte einen «Leitwert» von 10 Mikrogramm pro Liter Wasser. Laut Experten sind aber auch bei Wässern mit niedrigerem Urangehalt gesundheitliche Schäden möglich.
- **Acetaldehyd:** Die Substanz entsteht bei der Pet-Herstellung, kommt aber auch in der Natur vor. Je nach Inhalt, Produktionsmethode und Lagerung der Flasche geht Acetaldehyd ins Wasser über. Laut Gesetz darf die Verpackung das Lebensmittel geschmacklich nicht verändern. Ab 15 Mikrogramm ist Acetaldehyd im Mineralwasser geschmacklich spürbar. Sensoriker schmecken es auch bei tieferen Werten.
- **Antimon:** Das Halbmetall wird bei der Pet-Herstellung eingesetzt. Der Toleranzwert in der Schweiz liegt bei 5 Mikrogramm pro Liter Wasser. Die Substanz geht ebenfalls vom Pet ins Wasser über.

Guideline for acetaldehyde is
15 parts per billion
(beyond that it affects the taste of the water)

15 Mineralwässer im Test: Nur 6 von 15 sind

Prix Garantie Mineralwasser	Denner	Valser Classic	Fontelaura	Perrier	M-Budget						
Coop	Denner	Coop	Denner	Globus	Migros						
–	–	Denner, Landi, Manor, Spar, Volg	–	Manor	–					Globus	
–.20	–.40	–.80	–.20	3.40 [4]	–.20	–.30	–.60	–.70	–.60	–.80	2.50 [4]
0,3	0,3	0,4	0,4	0,7	0,3	0,3	0,4	0,6	0,2	0,3	1,4
Weniger als 1	1,7	1,6	2,5	4	7,6	3,4	4,8	2,5	8,7	6,1	4,8
16	18	26	11	11	10	36	21	27	39	18	30
1	**1**	**1**	**1,5**	**1,5**	**2**	**2**	**2**	**2**	**2,5**	**2,5**	**3**
Gut	Gut	Gut	Genügend	Genügend	Genügend	Genügend	Genügend	Genügend	Ungenügend	Ungenügend	Ungenügend

DOMINIQUE SCHÜTZ

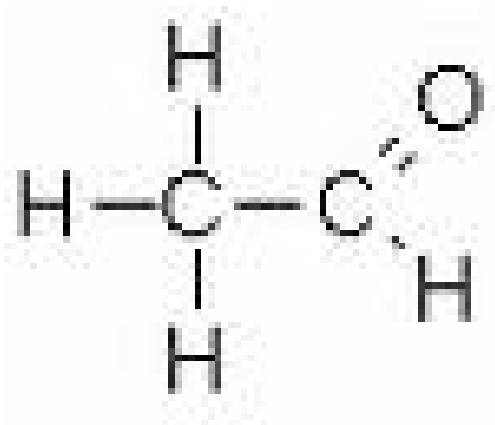
Mikrogramm pro Liter: Abwertung um 1 Punkt, mehr als 5 Mikrogramm pro Liter: Abwertung um 1,5 Punkte [3] 10 bis 15 Mikrogramm pro Liter: Abwertung um 0,5 Punkte, mehr als 15 Mikro-
Hersteller sollte das Produkt nicht mehr erhältlich sein [6] Bei gleich vielen Abwertungspunkten Rangierung nach Preis

Abwertungspunkte *:
0 Sehr gut
0,5 bis 1 Gut
1,5 bis 2 Genügend
2,5 und mehr Ungenügend

Marke	Sancarlo Mineral	Eptinger	Henniez	Prix Mine
Bezeichnung			Rot	
Eingekauft bei	Spar	Denner	Coop	Coop
Ebenfalls erhältlich bei	–	Coop	Volg, Landi, Globus, Spar, Manor	–
Preis pro Liter	–.20	–.50	–.80	–.20
Antimongehalt [1]	0,3	0,3	0,2	0,3
Uran (Mikrogramm/l) [2]	Weniger als 1	Weniger als 1	1,3	Weni
Acetaldeh				
Abwertur				
Gesamtu				

[1] Mehr al
gramm p

- occurs naturally in ripe fruit, coffee, and fresh bread
- produced by plants as normal part of their metabolism
- known as the chemical that causes hangovers



acetaldehyde

15 Mineralwässer im Test: Nur 6 von 15 sind «gut»

Prix Garantie Mineralwasser	Denner	Valser	Fontelaura	Perrier	M-Budget	Cristalp	Swiss Alpina	Rhäzünser	Aproz Classic	San Pellegrino	Heidiland O_2 [5]
		Classic					blau		blau		
Coop	Denner	Coop	Denner	Globus	Migros	Carrefour	Coop	Spar	Migros	Coop	Globus
–	–	Denner, Landi, Manor, Spar, Volg	–	Manor	–	Coop, Manor, Spar	–	Coop, Landi, Volg	–	Migros, Manor, Spar, Denner, Globus	Reformhaus Müller
–.20	–.40	–.80	–.20	3.40 [4]	–.20	–.30	–.60	–.70	–.60	–.80	2.50 [4]
0,3	0,3	0,4	0,4	0,7	0,3	0,3	0,4	0,6	0,2	0,3	1,4
Weniger als 1	1,7	1,6	2,5	4	7,6	3,4	4,8	2,5	8,7	6,1	4,6
16	18	26	11	11	10	36	21	27	39	18	30
1	**1**	**1**	**1,5**	**1,5**	**2**	**2**	**2**	**2**	**2,5**	**2,5**	**3**
Gut	**Gut**	**Gut**	**Genügend**	**Genügend**	**Genügend**	**Genügend**	**Genügend**	**Genügend**	**Ungenügend**	**Ungenügend**	**Ungenügend**

DOMINIQUE SCHÄTZ

Mikrogramm pro Liter: Abwertung um 1 Punkt, mehr als 5 Mikrogramm pro Liter: Abwertung um 1,5 Punkte [3] 10 bis 15 Mikrogramm pro Liter: Abwertung um 0,5 Punkte, mehr als 15 Mikro-
Hersteller sollte das Produkt nicht mehr erhältlich sein [6] Bei gleich vielen Abwertungspunkten Rangierung nach Preis

health

EDITOR: WING SZE TANG

Plastic rap

It's one of the most used materials on earth, but could our plastic-packaged world pose a serious health hazard? As we swig our bottled water, scientists are raising the alarm. By WING SZE TANG

PHOTOGRAPHY BY TETRA IMAGES/JUPITER IMAGES

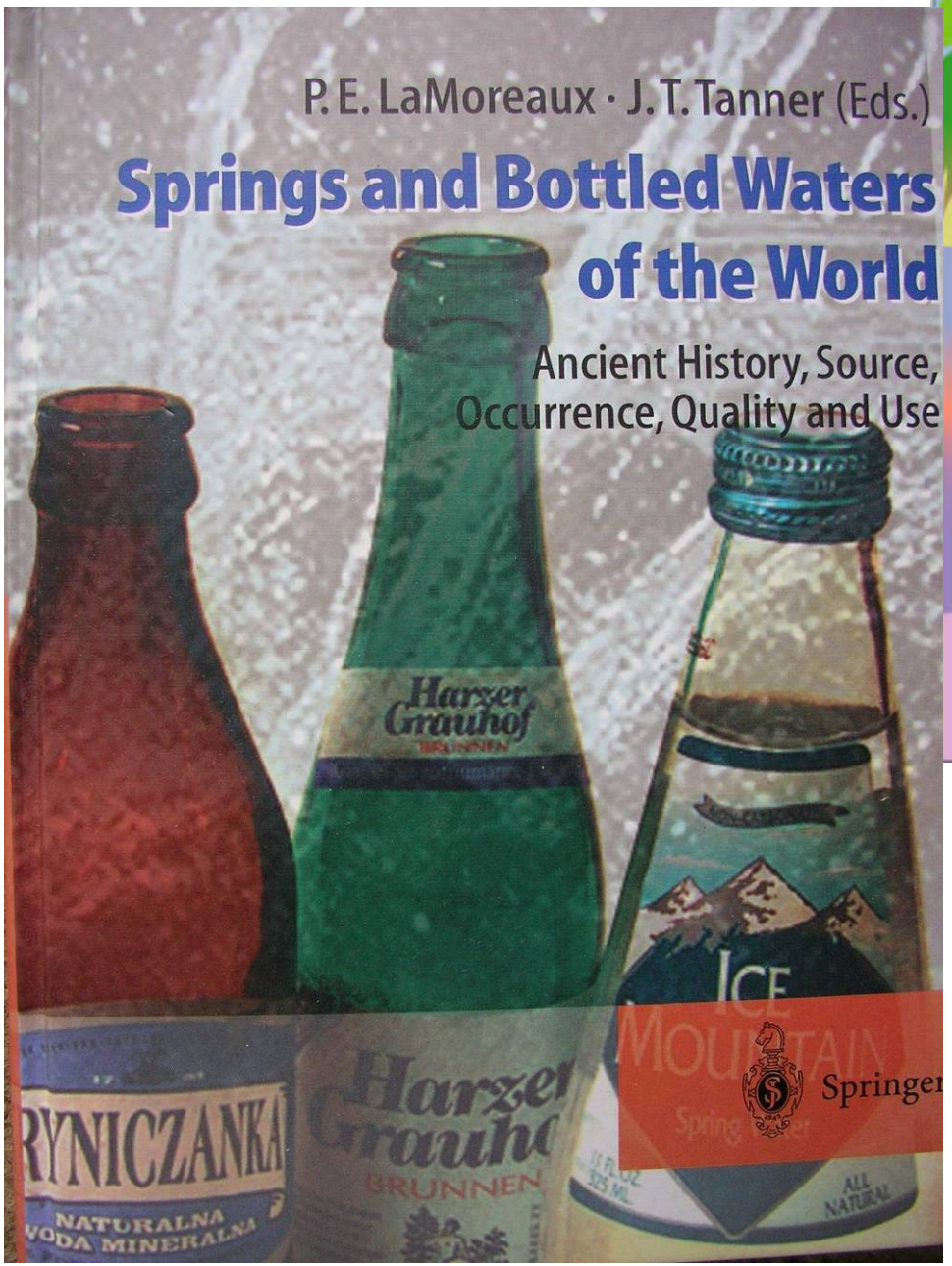
Flat or fizzy, sourced from the French Alps or Fiji, perhaps even pumped up with vitamins and minerals, bottled water exudes purity and good health. But in my e-mail sits a dire warning: "Dioxins are highly poisonous to the cells of our bodies. Don't freeze your plastic bottles with water in them as this releases dioxins from the plastic." The ominous message, which has been spamming inboxes far and wide for years, has been firmly debunked as an urban legend (plastic water bottles don't have any dioxin), but the anxieties remain: Could something as ordinary and ubiquitous as a water bottle be leaching harmful chemicals into our bodies?

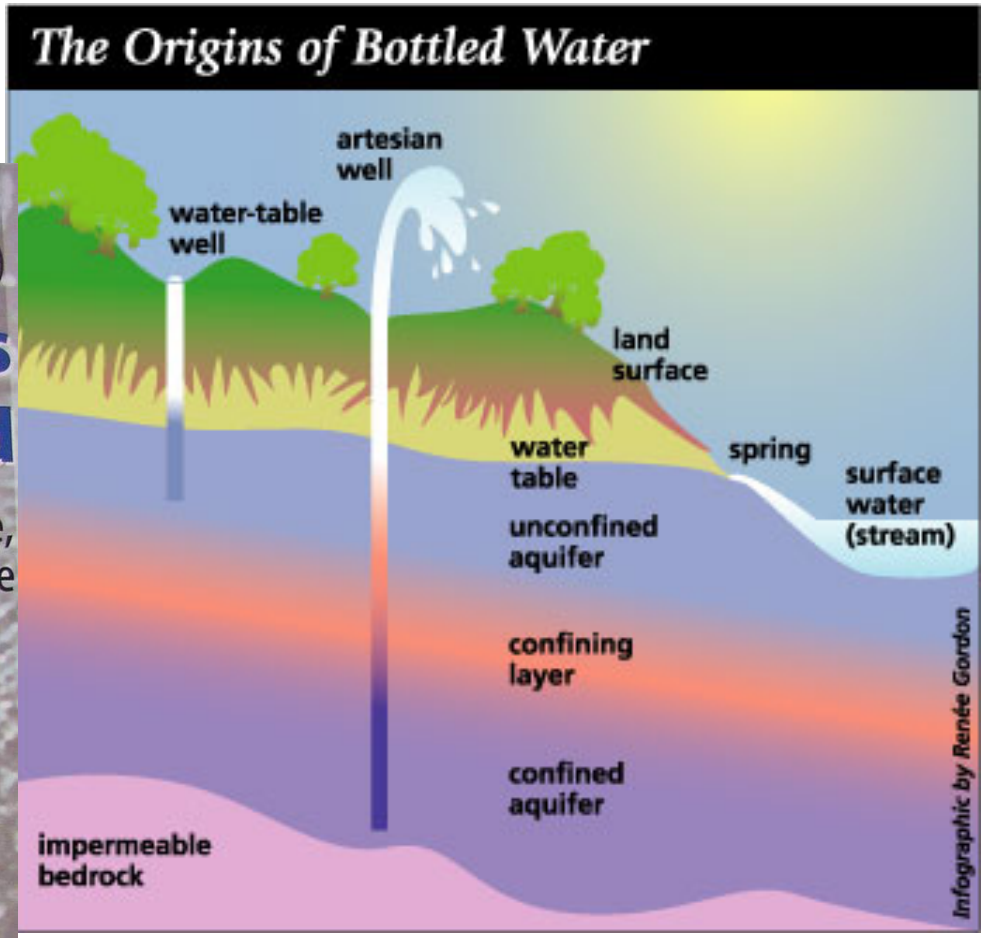
The fears have been stoked by recent headlines on bisphenol A (BPA), a hotly debated, potentially toxic manmade substance »

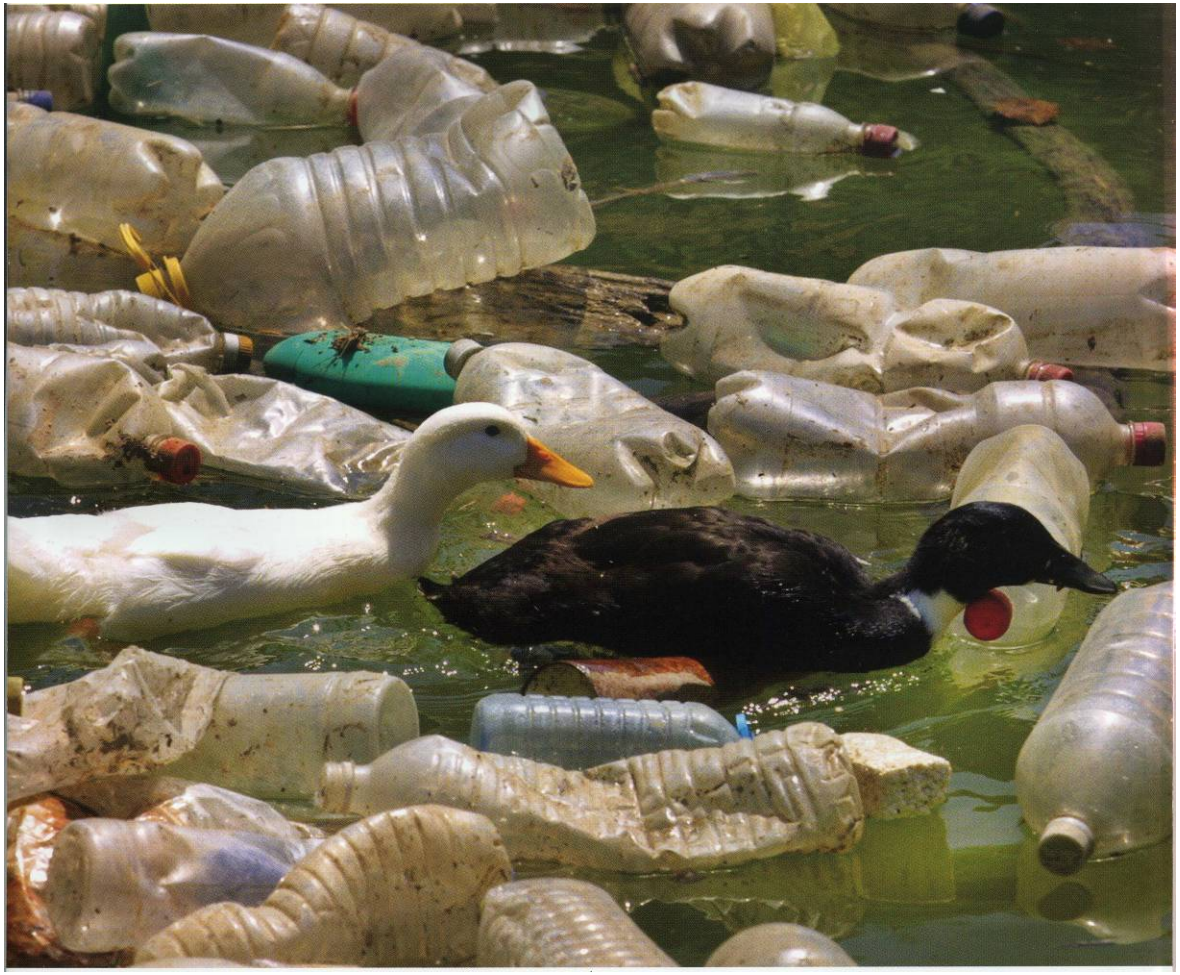
Dr. Michael Kramer,
Canadian Institutes of Health Research:
"We know what's in tap water. And depending on what the source of the bottled water is and what leaches from the plastic containers, I think we sometimes know less about what's in bottled water"

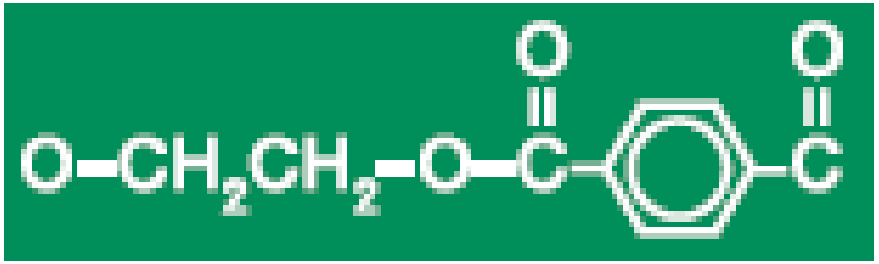
DIRECT ENVIRONMENTAL IMPACTS OF BOTTLED WATER

elmvale


P. E. LaMoreaux · J. T. Tanner (Eds.)
Springs and Bottled Waters of the World
Ancient History, Source, Occurrence, Quality and Use
Harzer Grauhof
BRUNNEN
ICE MOUNTAIN
ALL NATURAL
RYNICZANKA
NATURALNA WODA MINERALNA
Springer


The Origins of Bottled Water
artesian well
water-table well
land surface
water table
spring
surface water (stream)
unconfined aquifer
confining layer
confined aquifer
impermeable bedrock
Infographic by Renée Gordon





Polyethylene terephthalate (PET)

celebrate water

INDIRECT ENVIRONMENTAL IMPACTS OF BOTTLED WATER

elmvale

BOTTLED WATER AND ENERGY
A PACIFIC INSTITUTE FACT SHEET

PACIFIC INSTITUTE
ESTABLISHED 1987

The growing consumption of bottled water raises questions about the product's economic and environmental costs. Among the most significant concerns are the resources required to produce the plastic bottles and to deliver filled bottles to consumers, including both energy and water.

The Pacific Institute estimates that in 2006:

- Producing bottles for American consumption required the equivalent of more than **17 million barrels of oil**, not including energy for transportation.
- Bottling water produced more than **2.5 million tons of carbon dioxide**
- It took **3 liters of water** to produce 1 liter of bottled water

Total U.S. Consumption of Bottled Water in 2006

According to the Beverage Marketing Corporation,[1] Americans bought a total of 31.2 billion liters of water in 2006, sold in bottles ranging from the 8-ounce aquapods popular in school lunches to the multi-gallon bottles found in family refrigerators and office water coolers. Most of this water was sold in polyethylene terephthalate (PET) bottles, requiring nearly 900,000 tons of the plastic. PET is produced from fossil fuels – typically natural gas and petroleum.

Energy Required to Make PET Plastic

According to the plastics manufacturing industry, it takes around 3.4 megajoules of energy to make a typical one-liter plastic bottle, cap, and packaging.[2] Making enough plastic to bottle 31.2 billion liters of water required more than 106 billion megajoules of energy. Because a barrel of oil contains

Transporting and Recycling Bottled Water

More energy is needed to fill the bottles with water at the factory, move it by truck, train, ship, or air freight to the user, cool it in grocery stores or home refrigerators, and recover, recycle, or throw away the empty bottles. The Pacific Institute estimates that the total amount of energy required for every bottle is equivalent, on average, **to filling a plastic bottle ¼ full with oil.**

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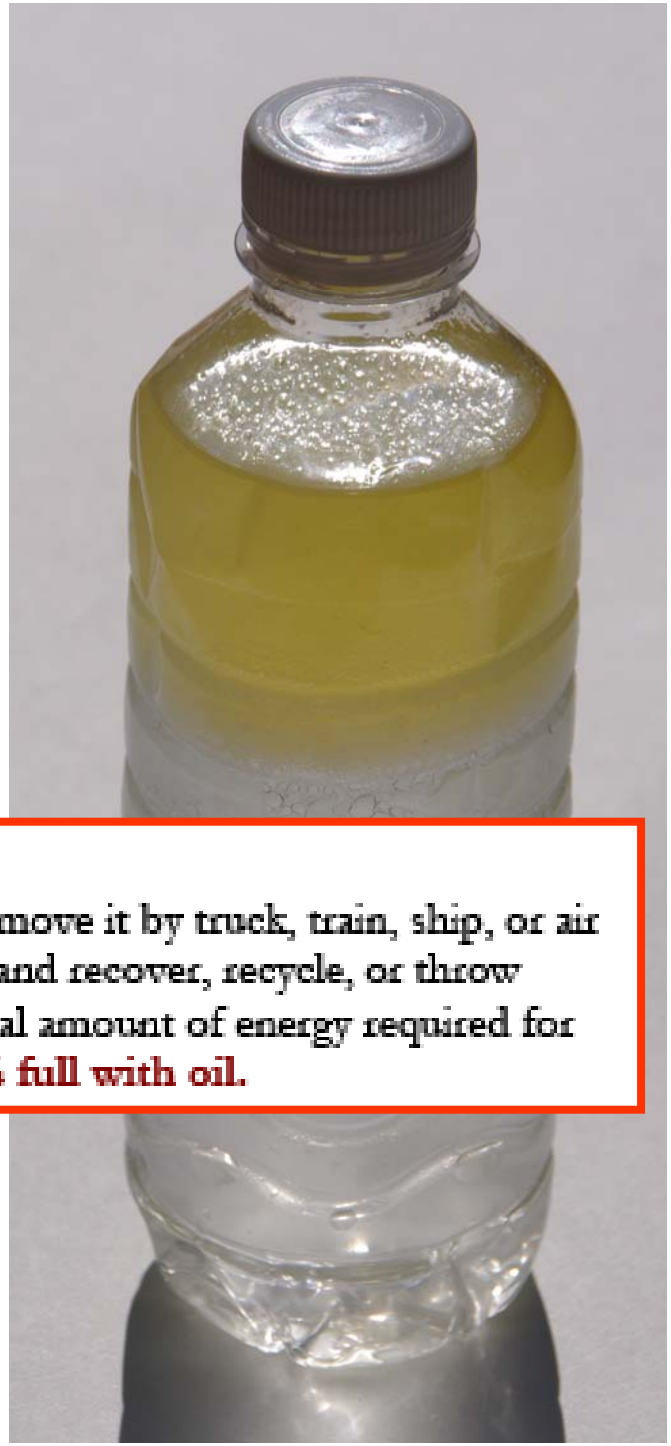
[1] Beverage Marketing Corporation estimate for 2006.
[2] Plastics Europe. http://lca.plasticseurope.org/perb5.htm
[3] I. Bousted. 2005. Eco-profiles of the European Plastics Industry: Polyethylene Terephthalate (PET), (Bottle grade).

Pacific Institute · 654 13th Street, Preservation Park, Oakland, California · 510.251.1600 · info@pacinst.org · www.pacinst.org



CARBON EMISSIONS
-global climate change
-acidfication of the oceans

NITROGEN OXIDE EMISSIONS
-acid rain
-photochemical smog

EMISSIONS OF PARTICULATE MATTER
-PM10, PM 2.5

HEAVY METALS
- Pt, Pd, Rh from catalytic converters
-Pb from tire weights
-Zn from tires
-Sb from brake pads

-etc etc

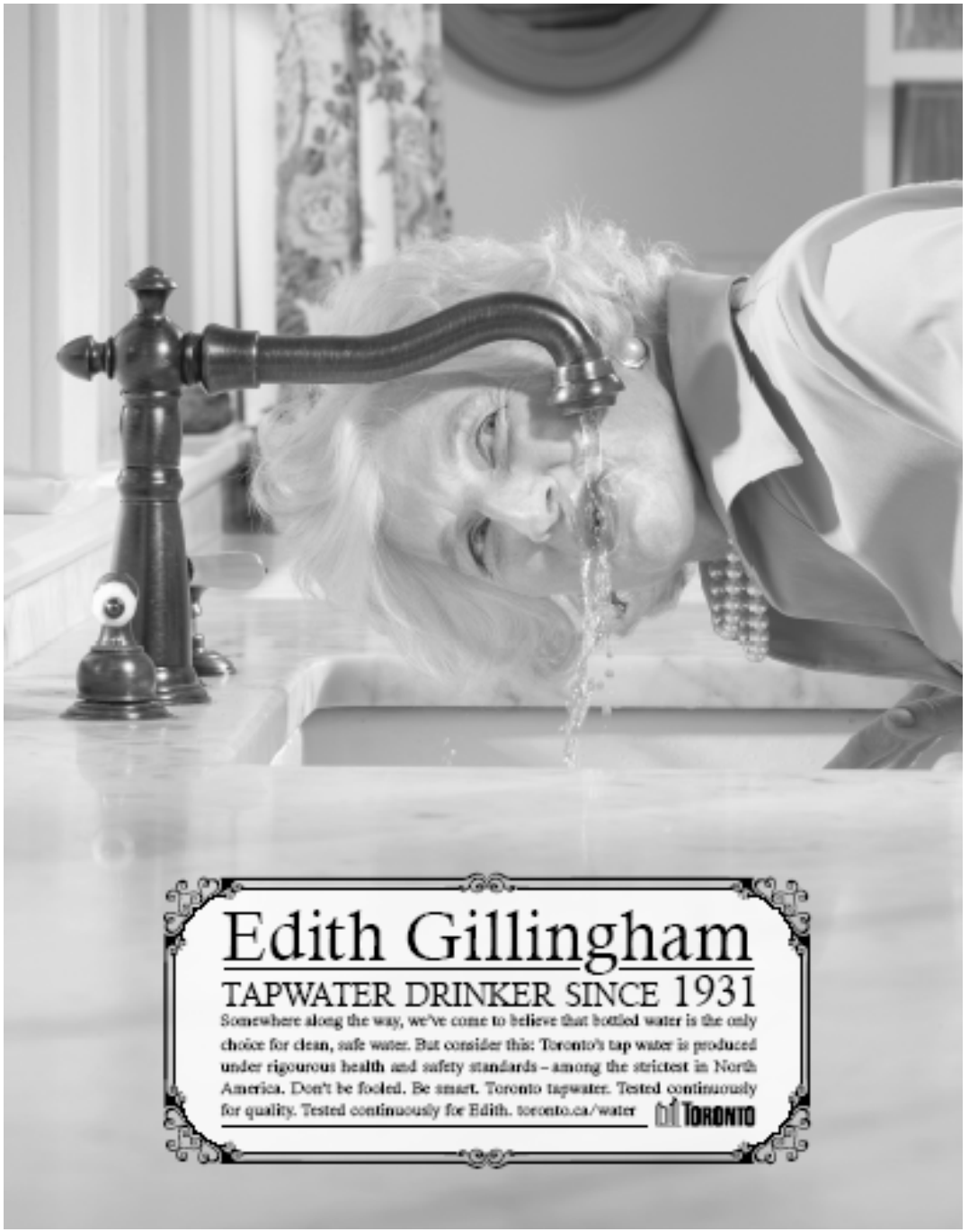
SUMMARY,
BOTTLED WATER CONS

-Expensive for us to buy, but cheap for bottling companies
-Not healthier than tap water
-Direct environmental impacts of groundwater removal
-Indirect environmental impacts
(fossil fuels for packaging and transportation
= global climate change + acid rain + airborne particulate matter + heavy metals)
-Variable chemical composition
(e.g. natural variations in Li, U, and As in groundwaters)
-Leaching of Sb from PET bottles
-Leaching of Pb from glass bottles
-Leaching of acetaldehyde from PET bottles

Prince Edward Island, summer 2007

TAP WATER

elmvale


Edith Gillingham
TAPWATER DRINKER SINCE 1931
Somewhere along the way, we've come to believe that bottled water is the only choice for clean, safe water. But consider this: Toronto's tap water is produced under rigourous health and safety standards – among the strictest in North America. Don't be fooled. Be smart. Toronto tapwater. Tested continuously for quality. Tested continuously for Edith. toronto.ca/water
TORONTO

EDITORIAL

In Praise of Tap Water

Published: August 1, 2007

On the streets of New York or Denver or San Mateo this summer, it seems the telltale cap of a water bottle is sticking out of every other satchel. Americans are increasingly thirsty for what is billed as the healthiest, and often most expensive, water on the grocery shelf. But this country has some of the best public water supplies in the world. Instead of consuming four billion gallons of water a year in individual-sized bottles, we need to start thinking about what all those bottles are doing to the planet's health.

Here are the hard, dry facts: Yes, drinking water is a good thing, far better than buying soft drinks, or liquid candy, as nutritionists like to call it. And almost all municipal water in America is so good that nobody needs to import a single bottle from Italy or France or the Fiji Islands. Meanwhile, if you choose to get your recommended eight glasses a day from bottled water, you could spend up to $1,400 annually. The same amount of tap water would cost about 49 cents.

Next, there's the environment. Water bottles, like other containers, are made from natural gas and petroleum. The Earth Policy Institute in Washington has estimated that it takes about 1.5 million barrels of oil to make the water bottles Americans use each year. That could fuel 100,000 cars a year instead. And, only about 23 percent of those bottles are recycled, in part because water bottles are often not included in local redemption plans that accept beer and soda cans. Add in the substantial amount of fuel used in transporting water, which is extremely heavy, and the impact on the environment is anything but refreshing.

More Articles in Opinion »

EPA National Primary Drinking Water Standards

	Contaminant	MCL or TT[1] (mg/L)[2]	Potential health effects from exposure above the MCL	Common sources of contaminant in drinking water	Public Health Goal
OC	Acrylamide	TT[8]	Nervous system or blood problems;	Added to water during sewage/wastewater increased risk of cancer treatment	zero
OC	Alachlor	0.002	Eye, liver, kidney or spleen problems; anemia; increased risk of cancer	Runoff from herbicide used on row crops	zero
R	Alpha particles	15 picocuries per Liter (pCi/L)	Increased risk of cancer	Erosion of natural deposits of certain minerals that are radioactive and may emit a form of radiation known as alpha radiation	zero
IOC	Antimony	0.006	Increase in blood cholesterol; decrease in blood sugar	Discharge from petroleum refineries; fire retardants; ceramics; electronics; solder	0.006
IOC	Arsenic	0.010 as of 1/23/06	Skin damage or problems with circulatory systems, and may have increased risk of getting cancer	Erosion of natural deposits; runoff from orchards, runoff from glass & electronics production wastes	0
IOC	Asbestos (fibers >10 micrometers)	7 million fibers per Liter (MFL)	Increased risk of developing benign intestinal polyps	Decay of asbestos cement in water mains; erosion of natural deposits	7 MFL
OC	Atrazine	0.003	Cardiovascular system or reproductive problems	Runoff from herbicide used on row crops	0.003
IOC	Barium	2	Increase in blood pressure	Discharge of drilling wastes; discharge from metal refineries; erosion of natural deposits	2
OC	Benzene	0.005	Anemia; decrease in blood platelets; increased risk of cancer	Discharge from factories; leaching from gas storage tanks and landfills	zero
OC	Benzo(a)pyrene (PAHs)	0.0002	Reproductive difficulties; increased risk of cancer	Leaching from linings of water storage tanks and distribution lines	zero
IOC	Beryllium	0.004	Intestinal lesions	Discharge from metal refineries and coal-burning factories; discharge from electrical, aerospace, and defense industries	0.004
R	Beta particles and photon emitters	4 millirems per year	Increased risk of cancer	Decay of natural and man-made deposits of certain minerals that are radioactive and may emit forms of radiation known as photons and beta radiation	zero
DBP	Bromate	0.010	Increased risk of cancer	Byproduct of drinking water disinfection	zero
IOC	Cadmium	0.005	Kidney damage	Corrosion of galvanized pipes; erosion of natural deposits; discharge from metal refineries; runoff from waste batteries and paints	0.005
OC	Carbofuran	0.04	Problems with blood, nervous system, or reproductive system	Leaching of soil fumigant used on rice and alfalfa	0.04
OC	Carbon tetrachloride	0.005	Liver problems; increased risk of cancer	Discharge from chemical plants and other industrial activities	zero
D	Chloramines (as Cl2)	MRDL=4.0[1]	Eye/nose irritation; stomach discomfort, anemia	Water additive used to control microbes	MRDLG=4[1]

LEGEND

D Disinfectant | IOC Inorganic Chemical | OC Organic Chemical

DBP Disinfection Byproduct | M Microorganism | R Radionuclides

	Contaminant	MCL or TT[1] (mg/L)[2]	Potential health effects from exposure above the MCL	Common sources of contaminant in drinking water	Public Health Goal
OC	Chlordane	0.002	Liver or nervous system problems; increased risk of cancer	Residue of banned termiticide	zero
D	Chlorine (as Cl_2)	MRDL=4.0[1]	Eye/nose irritation; stomach discomfort	Water additive used to control microbes	MRDLG=4[1]
D	Chlorine dioxide (as ClO_2)	MRDL=0.8[1]	Anemia; infants & young children: nervous system effects	Water additive used to control microbes	MRDLG=0.8[1]
DBP	Chlorite	1.0	Anemia; infants & young children: nervous system effects	Byproduct of drinking water disinfection	0.8
OC	Chlorobenzene	0.1	Liver or kidney problems	Discharge from chemical and agricultural chemical factories	0.1
IOC	Chromium (total)	0.1	Allergic dermatitis	Discharge from steel and pulp mills; erosion of natural deposits	0.1
IOC	Copper	TT[7]; Action Level = 1.3	Short term exposure: Gastrointestinal distress. Long term exposure: Liver or kidney damage. People with Wilson's Disease should consult their personal doctor if the amount of copper in their water exceeds the action level	Corrosion of household plumbing systems; erosion of natural deposits	1.3
M	*Cryptosporidium*	TT[3]	Gastrointestinal illness (e.g., diarrhea, vomiting, cramps)	Human and animal fecal waste	zero
IOC	Cyanide (as free cyanide)	0.2	Nerve damage or thyroid problems	Discharge from steel/metal factories; discharge from plastic and fertilizer factories	0.2
OC	2,4-D	0.07	Kidney, liver, or adrenal gland problems	Runoff from herbicide used on row crops	0.07
OC	Dalapon	0.2	Minor kidney changes	Runoff from herbicide used on rights of way	0.2
OC	1,2-Dibromo-3-chloropropane (DBCP)	0.0002	Reproductive difficulties; increased risk of cancer	Runoff/leaching from soil fumigant used on soybeans, cotton, pineapples, and orchards	zero
OC	o-Dichlorobenzene	0.6	Liver, kidney, or circulatory system problems	Discharge from industrial chemical factories	0.6
OC	p-Dichlorobenzene	0.075	Anemia; liver, kidney or spleen damage; changes in blood	Discharge from industrial chemical factories	0.075
OC	1,2-Dichloroethane	0.005	Increased risk of cancer	Discharge from industrial chemical factories	zero
OC	1,1-Dichloroethylene	0.007	Liver problems	Discharge from industrial chemical factories	0.007
OC	cis-1,2-Dichloroethylene	0.07	Liver problems	Discharge from industrial chemical factories	0.07
OC	trans-1,2-Dichloroethylene	0.1	Liver problems	Discharge from industrial chemical factories	0.1
OC	Dichloromethane	0.005	Liver problems; increased risk of cancer	Discharge from drug and chemical factories	zero
OC	1,2-Dichloropropane	0.005	Increased risk of cancer	Discharge from industrial chemical factories	zero
OC	Di(2-ethylhexyl) adipate	0.4	Weight loss, live problems, or possible reproductive difficulties	Discharge from chemical factories	0.4
OC	Di(2-ethylhexyl) phthalate	0.006	Reproductive difficulties; liver problems; increased risk of cancer	Discharge from rubber and chemical factories	zero
OC	Dinoseb	0.007	Reproductive difficulties	Runoff from herbicide used on soybeans and vegetables	0.007
OC	Dioxin (2,3,7,8-TCDD)	0.00000003	Reproductive difficulties; increased risk of cancer	Emissions from waste incineration and other combustion; discharge from chemical factories	zero
OC	Diquat	0.02	Cataracts	Runoff from herbicide use	0.02
OC	Endothall	0.1	Stomach and intestinal problems	Runoff from herbicide use	0.1

LEGEND

D Disinfectant | IOC Inorganic Chemical | OC Organic Chemical

DBP Disinfection Byproduct | M Microorganism | R Radionuclides

	Contaminant	MCL or TT[1] (mg/L)[2]	Potential health effects from exposure above the MCL	Common sources of contaminant in drinking water	Public Health Goal
OC	Endrin	0.002	Liver problems	Residue of banned insecticide	0.002
OC	Epichlorohydrin	TT8	Increased cancer risk, and over a long period of time, stomach problems	Discharge from industrial chemical factories; an impurity of some water treatment chemicals	zero
OC	Ethylbenzene	0.7	Liver or kidneys problems	Discharge from petroleum refineries	0.7
OC	Ethylene dibromide	0.00005	Problems with liver, stomach, reproductive system, or kidneys; increased risk of cancer	Discharge from petroleum refineries	zero
IOC	Fluoride	4.0	Bone disease (pain and tenderness of the bones); Children may get mottled teeth	Water additive which promotes strong teeth; erosion of natural deposits; discharge from fertilizer and aluminum factories	4.0
M	*Giardia lamblia*	TT3	Gastrointestinal illness (e.g., diarrhea, vomiting, cramps)	Human and animal fecal waste	zero
OC	Glyphosate	0.7	Kidney problems; reproductive difficulties	Runoff from herbicide use	0.7
DBP	Haloacetic acids (HAA5)	0.060	Increased risk of cancer	Byproduct of drinking water disinfection	n/a6
OC	Heptachlor	0.0004	Liver damage; increased risk of cancer	Residue of banned termiticide	zero
OC	Heptachlor epoxide	0.0002	Liver damage; increased risk of cancer	Breakdown of heptachlor	zero
M	Heterotrophic plate count (HPC)	TT3	HPC has no health effects; it is an analytic method used to measure the variety of bacteria that are common in water. The lower the concentration of bacteria in drinking water, the better maintained the water system is.	HPC measures a range of bacteria that are naturally present in the environment	n/a
OC	Hexachlorobenzene	0.001	Liver or kidney problems; reproductive difficulties; increased risk of cancer	Discharge from metal refineries and agricultural chemical factories	zero
OC	Hexachlorocyclopentadiene	0.05	Kidney or stomach problems	Discharge from chemical factories	0.05
IOC	Lead	TT7; Action Level = 0.015	Infants and children: Delays in physical or mental development; children could show slight deficits in attention span and learning abilities; Adults: Kidney problems; high blood pressure	Corrosion of household plumbing systems; erosion of natural deposits	zero
M	*Legionella*	TT3	Legionnaire's Disease, a type of pneumonia	Found naturally in water; multiplies in heating systems	zero
OC	Lindane	0.0002	Liver or kidney problems	Runoff/leaching from insecticide used on cattle, lumber, gardens	0.0002
IOC	Mercury (inorganic)	0.002	Kidney damage	Erosion of natural deposits; discharge from refineries and factories; runoff from landfills and croplands	0.002
OC	Methoxychlor	0.04	Reproductive difficulties	Runoff/leaching from insecticide used on fruits, vegetables, alfalfa, livestock	0.04
IOC	Nitrate (measured as Nitrogen)	10	Infants below the age of six months who drink water containing nitrate in excess of the MCL could become seriously ill and, if untreated, may die. Symptoms include shortness of breath and blue-baby syndrome.	Runoff from fertilizer use; leaching from septic tanks, sewage; erosion of natural deposits	10
IOC	Nitrite (measured as Nitrogen)	1	Infants below the age of six months who drink water containing nitrite in excess of the MCL could become seriously ill and, if untreated, may die. Symptoms include shortness of breath and blue-baby syndrome.	Runoff from fertilizer use; leaching from septic tanks, sewage; erosion of natural deposits	1

LEGEND

D Disinfectant | IOC Inorganic Chemical | OC Organic Chemical

DBP Disinfection Byproduct | M Microorganism | R Radionuclides

	Contaminant	MCL or TT[1] (mg/L)[2]	Potential health effects from exposure above the MCL	Common sources of contaminant in drinking water	Public Health Goal
OC	Oxamyl (Vydate)	0.2	Slight nervous system effects	Runoff/leaching from insecticide used on apples, potatoes, and tomatoes	0.2
OC	Pentachlorophenol	0.001	Liver or kidney problems; increased cancer risk	Discharge from wood preserving factories	zero
OC	Picloram	0.5	Liver problems	Herbicide runoff	0.5
OC	Polychlorinated biphenyls (PCBs)	0.0005	Skin changes; thymus gland problems; immune deficiencies; reproductive or nervous system difficulties; increased risk of cancer	Runoff from landfills; discharge of waste chemicals	zero
R	Radium 226 and Radium 228 (combined)	5 pCi/L	Increased risk of cancer	Erosion of natural deposits	zero
IOC	Selenium	0.05	Hair or fingernail loss; numbness in fingers or toes; circulatory problems	Discharge from petroleum refineries; erosion of natural deposits; discharge from mines	0.05
OC	Simazine	0.004	Problems with blood	Herbicide runoff	0.004
OC	Styrene	0.1	Liver, kidney, or circulatory system problems	Discharge from rubber and plastic factories; leaching from landfills	0.1
OC	Tetrachloroethylene	0.005	Liver problems; increased risk of cancer	Discharge from factories and dry cleaners	zero
IOC	Thallium	0.002	Hair loss; changes in blood; kidney, intestine, or liver problems	Leaching from ore-processing sites; discharge from electronics, glass, and drug factories	0.0005
OC	Toluene	1	Nervous system, kidney, or liver problems	Discharge from petroleum factories	1
M	Total Coliforms (including fecal coliform and *E. coli*)	5.0%4	Not a health threat in itself; it is used to indicate whether other potentially harmful bacteria may be present5	Coliforms are naturally present in the environment as well as feces; fecal coliforms and *E. coli* only come from human and animal fecal waste.	zero
DBP	Total Trihalomethanes (TTHMs)	0.10 0.080 after 12/31/03	Liver, kidney or central nervous system problems; increased risk of cancer	Byproduct of drinking water disinfection	n/a6
OC	Toxaphene	0.003	Kidney, liver, or thyroid problems; increased risk of cancer	Runoff/leaching from insecticide used on cotton and cattle	zero
OC	2,4,5-TP (Silvex)	0.05	Liver problems	Residue of banned herbicide	0.05
OC	1,2,4-Trichlorobenzene	0.07	Changes in adrenal glands	Discharge from textile finishing factories	0.07
OC	1,1,1-Trichloroethane	0.2	Liver, nervous system, or circulatory problems	Discharge from metal degreasing sites and other factories	0.20
OC	1,1,2-Trichloroethane	0.005	Liver, kidney, or immune system problems	Discharge from industrial chemical factories	0.003
OC	Trichloroethylene	0.005	Liver problems; increased risk of cancer	Discharge from metal degreasing sites and other factories	zero
M	Turbidity	TT3	Turbidity is a measure of the cloudiness of water. It is used to indicate water quality and filtration effectiveness (e.g., whether disease-causing organisms are present). Higher turbidity levels are often associated with higher levels of disease-causing micro-organisms such as viruses, parasites and some bacteria. These organisms can cause symptoms such as nausea, cramps, diarrhea, and associated headaches.	Soil runoff	n/a
R	Uranium	30 ug/L as of 12/08/03	Increased risk of cancer, kidney toxicity	Erosion of natural deposits	zero

LEGEND

D Disinfectant | IOC Inorganic Chemical | OC Organic Chemical

DBP Disinfection Byproduct | M Microorganism | R Radionuclides

	Contaminant	MCL or TT[1] (mg/L)[2]	Potential health effects from exposure above the MCL	Common sources of contaminant in drinking water	Public Health Goal
OC	Vinyl chloride	0.002	Increased risk of cancer	Leaching from PVC pipes; discharge from plastic factories	zero
M	Viruses (enteric)	TT[3]	Gastrointestinal illness (e.g., diarrhea, vomiting, cramps)	Human and animal fecal waste	zero
OC	Xylenes (total)	10	Nervous system damage	Discharge from petroleum factories; discharge from chemical factories	10

NOTES

1 Definitions

- Maximum Contaminant Level Goal (MCLG)—The level of a contaminant in drinking water below which there is no known or expected risk to health. MCLGs allow for a margin of safety and are non-enforceable public health goals.
- Maximum Contaminant Level (MCL)—The highest level of a contaminant that is allowed in drinking water. MCLs are set as close to MCLGs as feasible using the best available treatment technology and taking cost into consideration. MCLs are enforceable standards.
- Maximum Residual Disinfectant Level Goal (MRDLG)—The level of a drinking water disinfectant below which there is no known or expected risk to health. MRDLGs do not reflect the benefits of the use of disinfectants to control microbial contaminants.
- Maximum Residual Disinfectant Level (MRDL)—The highest level of a disinfectant allowed in drinking water. There is convincing evidence that addition of a disinfectant is necessary for control of microbial contaminants.
- Treatment Technique (TT)—A required process intended to reduce the level of a contaminant in drinking water.

2 Units are in milligrams per liter (mg/L) unless otherwise noted. Milligrams per liter are equivalent to parts per million (ppm).

3 EPA's surface water treatment rules require systems using surface water or ground water under the direct influence of surface water to (1) disinfect their water, and (2) filter their water or meet criteria for avoiding filtration so that the following contaminants are controlled at the following levels:

- Cryptosporidium (as of 1/1/02 for systems serving >10,000 and 1/1/2005 for systems serving <10,000) 99% removal.
- Giardia lamblia: 99.9% removal/inactivation
- Viruses: 99.99% removal/inactivation
- *Legionella*: No limit, but EPA believes that if Giardia and viruses are removed/inactivated, *Legionella* will also be controlled.
- Turbidity: At no time can turbidity (cloudiness of water) go above 5 nephelometric turbidity units (NTU); systems that filter must ensure that the turbidity go no higher than 1 NTU (0.5 NTU for conventional or direct filtration) in at least 95% of the daily samples in any month. As of January 1, 2002, for systems servising >10,000, and January 14, 2005, for systems servising <10,000, turbidity may never exceed 1 NTU, and must not exceed 0.3 NTU in 95% of daily samples in any month.
- HPC: No more than 500 bacterial colonies per milliliter
- Long Term 1 Enhanced Surface Water Treatment (Effective Date: January 14, 2005); Surface water systems or (GWUDI) systems serving fewer than 10,000 people must comply with the applicable Long Term 1 Enhanced Surface Water Treatment Rule provisions (e.g. turbidity standards, individual filter monitoring, Cryptosporidium removal requirements, updated watershed control requirements for unfiltered systems).
- Filter Backwash Recycling: The Filter Backwash Recycling Rule requires systems that recycle to return specific recycle flows through all processes of the system's existing conventional or direct filtration system or at an alternate location approved by the state.

4 No more than 5.0% samples total coliform-positive in a month. (For water systems that collect fewer than 40 routine samples per month, no more than one sample can be total coliform-positive per month.) Every sample that has total coliform must be analyzed for either fecal coliforms or *E. coli* if two consecutive TC-positive samples, and one is also positive for *E. coli* fecal coliforms, system has an acute MCL violation.

5 Fecal coliform and *E. coli* are bacteria whose presence indicates that the water may be contaminated with human or animal wastes. Disease-causing microbes (pathogens) in these wastes can cause diarrhea, cramps, nausea, headaches, or other symptoms. These pathogens may pose a special health risk for infants, young children, and people with severely compromised immune systems.

6 Although there is no collective MCLG for this contaminant group, there are individual MCLGs for some of the individual contaminants:

- Haloacetic acids: dichloroacetic acid (zero); trichloroacetic acid (0.3 mg/L)
- Trihalomethanes: bromodichloromethane (zero); bromoform (zero); dibromochloromethane (0.06 mg/L)

7 Lead and copper are regulated by a Treatment Technique that requires systems to control the corrosiveness of their water. If more than 10% of tap water samples exceed the action level, water systems must take additional steps. For copper, the action level is 1.3 mg/L, and for lead is 0.015 mg/L.

8 Each water system must certify, in writing, to the state (using third-party or manufacturer certification) that when it uses acrylamide and/or epichlorohydrin to treat water, the combination (or product) of dose and monomer level does not exceed the levels specified, as follows: Acrylamide = 0.05% dosed at 1 mg/L (or equivalent); Epichlorohydrin = 0.01% dosed at 20 mg/L (or equivalent).

LEGEND

D	Disinfectant	IOC	Inorganic Chemical	OC	Organic Chemical
DBP	Disinfection Byproduct	M	Microorganism	R	Radionuclides

Health Canada Santé Canada

Guidelines for Canadian Drinking Water Quality

Summary Table

Prepared by the
Federal-Provincial-Territorial Committee on Drinking Water
of the
Federal-Provincial-Territorial Committee
on Health and the Environment

March 2006

The *Guidelines for Canadian Drinking Water Quality* are published by Health Canada on behalf of the Federal-Provincial-Territorial Committee on Drinking Water (CDW). This summary table is updated regularly and published on Health Canada's web site (www.healthcanada..gc.ca/waterquality). It supersedes all previous versions, as well as the published booklet of the *Sixth Edition of the Guidelines for Canadian Drinking Water Quality*.

These guidelines are based on current, published scientific research related to health effects, aesthetic effects, and operational considerations. Health-based guidelines are established on the basis of comprehensive review of the known health effects associated with each contaminant, on exposure levels and on the availability of treatment and analytical technologies. Aesthetic effects (e.g., taste, odour) are taken into account when these play a role in determining whether consumers will consider the water drinkable. Operational considerations are factored in when the presence of a substance may interfere with or impair a treatment process or technology (e.g., turbidity interfering with chlorination or UV disinfection) or adversely affect drinking water infrastructure (e.g., corrosion of pipes).

In general, the highest priority guidelines are those dealing with microbiological contaminants, such as bacteria, protozoa and viruses. Any measure taken to reduce concentrations of chemical contaminants should not compromise the effectiveness of disinfection.

Inquiries can be directed to: water_eau@hc-sc.gc.ca

Canada

water_eau@hc-sc.gc.ca

Toronto Water

Drinking Water Analysis SUMMARY

Drinking Water Analysis Summary for all plants and distribution for January 1 to December 31, 2006

	Units	AO/OG	MAC/ IMAC	Sampling Date	Number of Samples	Method Detection Limit	Number of Detectable Results	Max	Min	Avg
Microbiological Parameters										
EColi	CFU/100 mL		0	1/01 - 12/31	11453		0	0	0	0
Heterotrophic Plate Count	CFU/mL		500	1/01 - 12/31	11125		1259	5000	0	0.12
Total Coliform	CFU/100 mL		0	1/01 - 12/31	11458		29	65	0	0.0021
Total Coliform Background	CFU/100 mL		200	1/01 - 12/31	11453		168	10000	0	0.019
Operational Parameters										
Aluminum	mg/L	0.1		1/01 - 12/31	1728	0.002	1728	0.837	0.025	0.079
Fluoride	mg/L		1.5	1/01 - 12/31	5332	0.05	5332	0.90	0.12	0.55
Total Chlorine (Distribution only)	mg/L		3.0	1/03 - 12/29	5320	0.04	5320	1.59	0.17	1.05
Turbidity (Distribution only)	NTU	5.0		1/03 - 12/29	1376	0.02	1376	4.06	0.02	0.18
General Chemical and Physical Parameters										
Alkalinity	mg/L	30-500		1/17 - 9/19	70	6.5	70	90	80	84
Colour	T.C.U.	5		1/17 - 10/24	537		537	10	1	1
Conductivity	µmhos/cm			1/17 - 10/24	69	1	69	352	280	312
Hardness (as CaCO3)	mg/L	80-100		1/17 - 11/14	79	0.45	79	126	122	124
NTA	mg/L		0.4	3/07 - 8/22	15	0.05	0	0	0	0
pH		6.5-8.5		1/03 - 12/29	1464		1464	7.8	7.2	7.5
Total Organic Carbon	mg/L	5		1/17 - 11/14	79	0.6	79	3.0	2.2	2.5
Total Solids	mg/L	500		3/07 - 11/14	16	30	16	199	180	191
Inorganic Parameters										
Antimony	mg/L		0.006	3/07 - 11/14	25	0.001	2	0.0020	0.0000	0.0001
Arsenic	mg/L		0.025	3/07 - 11/14	25	0.001	0	0.000	0.000	0.000
Barium	mg/L		1	3/07 - 11/14	25	0.005	25	0.024	0.021	0.023
Beryllium	mg/L			3/07 - 11/14	25	0.0005	0	0.0000	0.0000	0.0000
Bismuth	mg/L			3/07 - 11/14	25	0.001	0	0.000	0.000	0.000
Boron	mg/L		5	3/07 - 11/14	25	0.005	25	0.027	0.021	0.024
Cadmium	mg/L		0.005	3/07 - 11/14	25	.0001	0	0.000	0.000	0.000
Calcium	mg/L			3/07 - 11/14	25	0.5	25	41.0	34.0	37.5
Chloride	mg/L	250		1/17 - 12/12	75	0.25	75	36.7	24.5	27.5

	Units	AO/OG	MAC/ IMAC	Sampling Date	Number of Samples	Method Detection Limit	Number of Detectable Results	Max	Min	Avg
Chromium	mg/L		0.05	3/07 - 11/14	25	0.006	0	0.000	0.000	0.000
Cobalt	mg/L			3/07 - 11/14	25	0.0005	0	0.0000	0.0000	0.0000
Copper	mg/L	1		3/07 - 11/14	25	0.001	12	0.028	0.000	0.002
Iron	mg/L	0.3		1/02 - 10/02	131	0.001	106	0.105	0.000	0.008
Lead	mg/L		0.01	3/07 - 11/14	25	0.0005	1	0.0010	0.0000	0.00003
Lead (end of line)	mg/L		0.01	3/07 - 11/14	4	0.0005	1	0.0010	0.0000	0.0003
Lithium	mg/L			3/07 - 11/14	25	0.005	0	0.0000	0.0000	0.0000
Magnesium	mg/L			3/07 - 11/14	25	0.05	25	10.0	8.0	9.5
Manganese	mg/L	0.05		3/07 - 11/14	25	0.002	0	0.000	0.000	0.000
Mercury	mg/L		0.001	3/07 - 11/14	19	0.0001	0	0.0000	0.0000	0.0000
Molybdenum	mg/L			3/07 - 11/14	25	0.001	25	0.002	0.001	0.001
Nickel	mg/L			3/07 - 11/14	25	0.001	3	0.0050	0.0000	0.0003
Nitrate	mg/L		10	1/17 - 12/12	75	0.01	75	0.54	0.28	0.45
Nitrate + Nitrite	mg/L		10	1/17 - 12/12	75	0.01	75	0.54	0.28	0.45
Nitrite	mg/L		1	1/17 - 12/12	75	0.002	0	0.0000	0.0000	0.0000
Phosphorus	mg/L			3/07 - 11/14	25	0.05	0	0.000	0.000	0.000
Potassium	mg/L			3/07 - 11/14	25	0.1	25	2.2	1.5	1.7
Selenium	mg/L		0.01	3/07 - 11/14	25	.002	0	0.0000	0.0000	0.0000
Silicon	mg/L			3/07 - 11/14	25	.05	25	0.74	0.28	0.47
Silver	mg/L			3/07 - 11/14	25	0.0001	2	0.0001	0.0000	0.00001
Sodium	mg/L	200		1/05 - 9/19	74	0.1	74	19.6	11.4	14.5
Strontium	mg/L			3/07 - 11/14	25	0.001	25	0.200	0.160	0.177
Sulphate	mg/L	500		1/17 - 12/12	75	0.1	75	35.7	27.1	31.0
Tellerium	mg/L			3/07 - 11/14	23	0.001	0	0.000	0.000	0.000
Thallium	mg/L			3/07 - 11/14	25	0.0001	0	0.0000	0.0000	0.0000
Thorium	mg/L			3/07 - 11/14	23	0.001	0	0.000	0.000	0.000
Tin	mg/L			3/07 - 11/14	25	0.001	0	0.000	0.000	0.000
Titanium	mg/L			3/07 - 11/14	25	0.005	0	0.000	0.000	0.000
Total Cyanide	mg/L		0.2	3/07 - 11/14	19	0.005	0	0.000	0.000	0.000
Tungsten	mg/L			3/07 - 11/14	25	0.001	0	0.000	0.000	0.000
Uranium	mg/L		0.02	3/07 - 11/14	25	0.0001	25	0.0004	0.0002	0.0003
Vanadium	mg/L			3/07 - 11/14	25	0.001	0	0.000	0.000	0.000
Zinc	mg/L	5		3/07 - 11/14	25	0.005	1	0.0170	0.0000	0.0004
Zirconium	mg/L			3/07 - 11/14	25	0.001	0	0.000	0.000	0.000
Disinfection Byproducts- Trihalomethanes										
Bromodichloromethane	µg/L			1/09 - 11/20	50	0.4	50	6.7	1.8	3.8
Bromoform	µg/L			1/09 - 11/20	50	0.9	0	0.0	0.0	0.0
Chloroform	µg/L			1/09 - 11/20	50	0.4	50	8.9	2.6	4.8
Dibromochloromethane	µg/L			1/09 - 11/20	50	0.6	50	4.9	1.1	2.9
THM (total)	µg/L		100	1/09 - 11/20	36	0.9	36	20.5	5.5	10.5
THM (total - end of line)	µg/L		100	1/09 - 11/20	18	0.9	18	18.8	9.9	12.9

REUSABLE BOTTLES

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GREEN GUIDE
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#7 PC reusable water bottle

Cracking the Code

Picking the Best Plastics for Storing Your Food and Drink

Many plastics are made with chemicals you don't want near your leftover soup or cottage cheese. How do you know which to use? Turn over your plastic container and look for the number in the recycling arrows. This code provides the vital clues: what type of plastic it is, if it can be recycled and, most important, whether it includes chemicals that may harm your health (or the environment). Read on, and it won't be a mystery anymore.

By **Danielle Masterson** • Photographs by **Davies + Starr**

#4 LDPE
food wrap

4

LDPE *(low-density polyethylene)*
Safe
Recyclable: accepted at Whole Foods Market, Wal-Mart and plastic-bag recycling centers

5

PP *(polypropylene)*
Safe
Recyclable: check with your local curbside-recycling program

6

PS *(polystyrene)*
Avoid
Can leach styrene, a possible human carcinogen.
Recyclable: check with your local curbside-recycling program

7

(miscellaneous) includes varieties listed below:
PC *(polycarbonate)* **pictured p. 48**
Questionable
Composed of hormone-disrupting bisphenol A.
Not recyclable

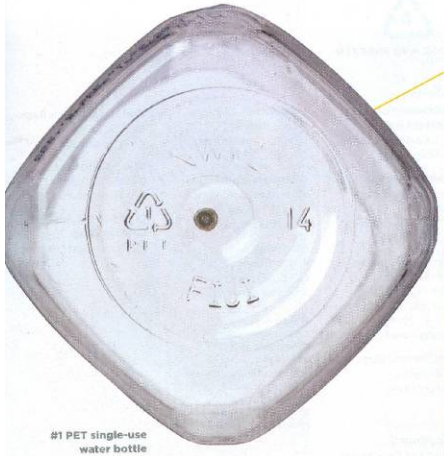
PLA *(polylactide,* made from renewable plant resources*)*
Safe
Not recyclable: can be composted

Plastics Are Forever

Made from oil and natural gas, plastics don't decompose in the environment. Instead, they accumulate in ever greater amounts on land and in water. The results can be overwhelming: In the North Pacific, currents have swept together a floating island of plastic twice the size of Texas and composed of tires, toys and other plastic waste. Rather than dispersing, it has doubled in size in the last six years, trapping animals in lost plastic nets and shopping bags.

#5 PP food-storage container

#6 PS bowl



#1 PET single-use
water bottle

1

PET or PETE *(polyethylene terephthalate)*
Safe
Avoid reusing single-use bottles
Recyclable

2

HDPE *(high-density polyethylene)*
Safe
Recyclable

3

Vinyl or PVC *(polyvinyl chloride)*
Avoid
Some products can leach hormone-disrupting phthalate plasticizers and lead into foods.
Not recyclable

#2 HDPE
milk bottle

#3 PVC
lunch bag

GREEN GUIDE

Smart Shopper's Card

When you're at the market, buying green can turn into a memory test: Which fish is safe? Which conventionally grown fruit are okay to buy, and which tend to have pesticides? Tear out this *Green Guide* Smart Shopper's Card and carry it in your wallet to pull out when you need it. There will be one in every issue of the *Green Guide*, or you can go online at thegreenguide.com, download any of the cards we've already created, and print your own—for free.

Plastic Picks

Decipher the code and choose the safest, easiest-to-recycle plastic food-storage containers.

GREEN GUIDE Smart Shopper's Card Plastic Picks

1 PET or PETE (polyethylene terephthalate)
☑ Safe
☑ Recyclable

2 HDPE (high-density polyethylene)
☑ Safe
☑ Recyclable

3 VINYL OR PVC (polyvinyl chloride)
☒ Avoid
☒ Not recyclable

4 LDPE (low-density polyethylene)
☑ Safe
☑ Recyclable: accepted at plastic bag recycling centers

5 PP (polypropylene)
☑ Safe
☑ Recyclable: check with your local curbside-recycling program

6 PS (polystyrene)
☒ Avoid
☑ Recyclable: check with your local curbside-recycling program

7 (miscellaneous) includes varieties listed below:
PC
☒ Questionable
☒ Not recyclable

PLA (polyactide, made from renewable plant resources)
☑ Safe
☒ Not recyclable: can be composted

FOLD CARD IN HALF HERE

GREEN GUIDE Smart Shopper's Card Plastic Picks

1 PET or PETE (polyethylene terephthalate)
☑ Safe
☑ Recyclable

2 HDPE (high-density polyethylene)
☑ Safe
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☑ Safe
☒ Not recyclable: can be composted

POLYCARBONATE

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Polycarbonate

Bisphenol A Is Released from Used Polycarbonate Animal Cages into Water at Room Temperature

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Bisphenol A (BPA) is a monomer with estrogenic activity that is used in the production of food packaging, dental sealants, polycarbonate plastic, and many other products. The monomer has previously been reported to hydrolyze and leach from these products under high heat and alkaline conditions, and the amount of leaching increases as a function of use. We examined whether new and used polycarbonate animal cages passively release bioactive levels of BPA into water at room temperature and neutral pH. Purified water was incubated at room temperature in new polycarbonate and polysulfone cages and used (discolored) polycarbonate cages, as well as control (glass and used polypropylene) containers. The resulting water samples were characterized with gas chromatography/mass spectrometry (GC/MS) and tested for estrogenic activity using an MCF-7 human breast cancer cell proliferation assay. Significant estrogenic activity, identifiable as BPA by GC/MS (up to 310 μg/L), was released from used polycarbonate animal cages. Detectable levels of BPA were released from new polycarbonate cages (up to 0.3 μg/L) as well as new polysulfone cages (1.5 μg/L), whereas no BPA was detected in water incubated in glass and used polypropylene cages. Finally, BPA exposure as a result of being housed in used polycarbonate cages produced a 16% increase in uterine weight in prepubertal female mice relative to females housed in used polypropylene cages, although the difference was not statistically significant. Our findings suggest that laboratory animals maintained in polycarbonate and polysulfone cages are exposed to BPA via leaching, with exposure reaching the highest levels in old cages. *Key words:* animal caging, bisphenol A, endocrine disruptor, estrogen, leaching, polycarbonate, polysulfone. *Environ Health Perspect* 111:1180–1187 (2003). doi:10.1289/ehp.5993 available via *http://dx.doi.org/* [Online 5 February 2003]

Markey et al. 2001a; Nagel et al. 1997; Palanza et al. 2002; Rubin et al. 2001; Sakaue et al. 2001; Schönfelder et al. 2002a; Steinmetz et al. 1998; vom Saal et al. 1998)

We also evaluated new polycarbonate cages as well as new polysulfone cages, another type of plastic manufactured from BPA. Polysulfone is marketed as having a higher temperature and chemical tolerance than polycarbonate cages and thus may be less likely to leach BPA. The bioactivity of the cage water samples was tested in an *in vitro* cell proliferation assay using estrogen-sensitive MCF-7 human breast cancer cells to determine whether the BPA measured by gas chromatography/mass spectrometry (GC/MS) was sufficient to elicit a biological response in human breast cancer cells. Finally, the *in vivo* estrogenic bioactivity of the used polycarbonate cages was tested by measuring the uterine wet weight of prepubertal female mice housed in the cages.

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ES&T News

Plastics chemical alters female brains

A chemical that leaches out of plastics has been discovered to modify the developing brains of female mice, who later behave much more like their brethren. This latest study builds on a growing body of literature about the toxicity of bisphenol A (BPA) and raises questions about its effects in humans.

Photodisc

From the 8th day of pregnancy until the 16th day of nursing, tiny pumps in female mice released doses of BPA into the mothers' bloodstreams.

In 1936, researchers found that BPA acts much like the hormone estrogen. Scientists now estimate that >6 billion lb of the chemical are manufactured for use in products such as polycarbonate plastic, the resin lining food cans, and dental sealants.

BISPHENOL A CALLED MOSTLY SAFE

CHEMICALS: Draft report sees some concern for infants, children

THE NATIONAL Toxicology Program (NTP) released its draft report on the health effects of bisphenol A (BPA) on April 14. The report concludes that there is "some concern" that BPA may cause neural and behavioral changes in infants and children at current exposure levels and that there is "negligible concern" that current exposures cause any negative effects in pregnant women and their unborn children or in other adults.

These conclusions on BPA safety are the same as those announced in August 2007 in a controversial draft report by the NTP Center for the Evaluation of Risks to Human Reproduction (C&EN, Sept. 3, 2007, page 31), located in Research Triangle Park, N.C. Last year, concerns raised by two government-convened groups of experts over the objectivity of the contractor facilitating the CERHR review had forced the panel to reexamine the literature. The results of that study formed the basis for the new NTP draft.

BPA is a high-volume chemical used to make polycarbonate and epoxy resins. Most human exposure stems from its use as a liner in food containers and drinking from polycarbonate bottles, including baby bottles.

The possibility that BPA can harm infants and children has led some scientists and consumer groups to call for a ban on its use, especially where it comes into contact with food. But the chemical industry has its own studies indicating no danger from low BPA exposures.

NTP's precautionary tone was taken as supporting both sides. "The findings in NTP's draft report provide reassurance that consumers can continue to use products made from bisphenol A," said Steven G. Hentges of the American Chemistry Council's Polycarbonate/BPA Global Group. ACC, the chemical industry's most visible lobbying group, said the report affirms that there are no serious or high-level concerns for adverse effects of BPA on human reproduction or development.

But Congress is using the same report to prod FDA into reconsidering the safety of BPA. Rep. John D. Dingell (D-Mich.), chairman of the House Energy & Commerce Committee, is investigating the use of BPA in the lining of infant formula cans. "The NTP findings fly in the face of FDA's determination that BPA is safe," Dingell said. "I hope FDA will reconsider its position on BPA for the safety of our infants and children."—DAVID HANSON

Chemical and Engineering News,
American Chemical Society
April 2, 2008

MOMENTUM BUILDS AGAINST BISPHENOL A

TOXICOLOGY: Move to eliminate chemical from some products begins

CANADA MOVED last week to become the world's first country to set exposure limits on bisphenol A (BPA), a high-volume chemical used to make polycarbonate and epoxy resins. U.S. politicians proposed similar measures, and a leading supplier of plastic drinking bottles announced that it will stop manufacturing products that contain the chemical.

Bowing to public concern over the health effects of BPA, bottle maker Nalgene said it will drop the use of polycarbonate. In addition, Wal-Mart, the world's largest retailer, announced it will stop stocking baby products containing the chemical immediately in Canada and early next year in the U.S. Toy store chain Toys 'R' Us has also announced a BPA phaseout for these products.

Scrutiny of BPA increased earlier this month with the release of a draft report by the U.S. National Toxicology Program (NTP) on the health effects of the chemical. The report concluded that although BPA is generally safe, there is "some concern" that it may cause neural and behavioral changes in infants and children at current exposure levels (C&EN, April 21, page 11).

The proposed ban in Canada targets polycarbonate baby bottles. Canadian Minister of Health Anthony P. Clement frames it as proactive. "Although our science tells us exposure levels to newborns and infants are below the levels that cause effects, it is better to be safe than sorry," he said, announcing the action. Barring any compelling information brought to light during a comment period that started on April 19, he added, the ban will take effect in mid-June.

Canada's decision is based on its risk assessment of the chemical. The study found that BPA is not a concern for adults but may pose a risk for newborns and infants.

Meanwhile, members of Congress are citing the NTP study in pushing for limits on BPA. Sen. Charles E. Schumer (D-N.Y.) announced plans to introduce legislation to ban BPA in all children's products and "food contact" containers, such as water bottles. On the House side, the Energy & Commerce Committee, led by Reps. John D. Dingell (D-Mich.) and Bart Stupak (D-Mich.), is investigating the safety of products as part of its oversight of FDA.

Manufacturers eliminating the chem are taking action even in the absence of evidence of serious health risks. "Based able scientific evidence, we continue to Nalgene products containing BPA are s intended use," says Steven Silverman, of Nalgene's Outdoor line of polycarbo ers. "However, our customers indicate BPA-free alternatives." Last week, a Ca filed a lawsuit against Nalgene claiming knew that BPA could leach from its bot

Nalgene recently introduced a new manufactured with an Eastman Chem ester called Tritan. CamelBak, anothe polycarbonate bottles, is also switchin material. Last month, Eastman annou will expand capacity for the copolyest Kingsport, Tenn.

In the infant care market, Playtex an week that it will phase out BPA-contain by the end of the year. It is also distribu samples of a baby bottle product that e able polyethylene bag inserts.

Polycarbonate resins account for roughly three-quarters of U.S. demand for BPA; epoxy resins for high-performance coatings make up nearly all the rest. Most uses of these products—including automotive parts, compact discs, flooring products, and electronics—are not affected by the BPA initiatives.

According to Mark Walton, communications leader for chemical and health issues at Dow Chemical, the number two U.S. producer of BPA, the impacted markets are "specialty" areas. "Our products tend not to be in the primary markets affected by the action in Canada," Walton says. "We are still trying to understand what kind of impacts current events could have on Dow's business."—RICK MULLIN AND SUSAN MORRISSEY

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copolyester.

EASTMAN CHEMICAL

Chemical and Engineering News,
American Chemical Society
April 28, 2008

BRITT ERICKSON/C&EN

ALL SALES FINAL Polycarbonate Nalgene water bottles can be found on clearance racks in many sporting goods stores, following the company's announcement in April to phase out BPA from its products.

BISPHENOL A UNDER SCRUTINY

Congress, media **CALL INTO QUESTION** safety of widely used plastics chemical

BRITT E. ERICKSON, C&EN WASHINGTON

CONSUMER PRODUCTS containing bisphenol A (BPA), a high-production-volume chemical used to manufacture polycarbonate plastic and epoxy-based resins, have been on the market for more than 50 years. The chemical industry and federal regulatory agencies around the world insist that, on the basis of the available science, those products are safe when used as directed. But in the wake of a media firestorm and a congressional investigation centered on the use of BPA in baby bottles, infant formula cans, and everyday consumer goods, many retailers are bowing to consumer pressure and voluntarily pulling BPA-containing products off their shelves.

More than 2 billion lb of BPA is used annually in the U.S., according to ICIS Chemical Business. Most of that demand is for polycarbonate resins, which represents 75% of the market, followed by epoxy resins, which makes up 20% of the market. The rest goes into making miscellaneous products such as flame retardants.

BPA is found in numerous consumer products, from compact discs to bicycle helmets to automotive parts. But it's the food, beverage, and dental applications of BPA that have some researchers and activist groups riled up because those uses are thought to be the primary routes of human exposure. Almost all food and beverage cans are lined with epoxy resins made with BPA; dental sealants painted on children's teeth contain BPA; and many reusable plastic water bottles and food containers, including baby bottles, are made from BPA-containing polycarbonate plastic.

BPA was first synthesized in 1891, and its estrogenic properties were revealed in the 1930s. "We are only just now getting around to studying this chemical sufficiently to recognize its hazards after decades of widespread use in applications that clearly hold significant potential for exposure," says Richard Denison, a senior scientist with the nonprofit organization Environmental Defense Fund.

Those who want to see BPA—a known endocrine disrupter—banned from consumer products point to hundreds of studies published during the past decade that link low-level exposure with increased rates of prostate and breast cancer, reproductive abnormalities, decreased sperm count, accelerated puberty in females, neurological effects similar to attention deficit hyperactivity disorder, diabetes, and obesity in laboratory animals (C&EN, Aug. 6, 2007, page 8).

The Environmental Protection Agency—the federal agency that regulates BPA—considers 50 mg per kg of body weight per day to be the lowest exposure level at which adverse effects can be discerned. After applying a safety factor, EPA has set an oral reference dose for BPA at 50 µg/kg/day. Anything below that is considered safe. That safety standard, which went into effect in 1988, is the same standard that the Food & Drug Administration uses today to regulate how much BPA can migrate from food packaging.

"Back in the 1930s, the mantra was 'The dose makes the poison,'" says Mary Bachran, a research associate with the Endocrine Disruption Exchange. TEDX is a nonprofit group that aims to disseminate information about the effects of chemicals on the developing embryo and fetus. Bachran adds that earlier last century, regulators "didn't have a clue" about nonmonotomic responses; that is, as the dose goes down, the response goes up. The first "low dose" effects of BPA were reported in 1997, she says. Today, TEDX lists more than 300 such studies on its website.

But not everyone is buying the low-dose hypothesis. "Many of the studies investigating endocrine-modulating activity are essentially screening tests, and many employ experimental protocols that have not been validated. This information in conjunction with the known extensive metabolism of BPA to nonestrogenic metabolites provides a scientific basis for the lack of toxicological effects at low doses," says Steven G. Hentges, executive director of the American Chemistry Council's (ACC) Polycarbonate/BPA Global Group, which represents the plastics industry.

In August 2007, two government-convened groups came to nearly opposite conclusions regarding the health risks of low-level exposure to BPA (C&EN, Sept. 3, 2007, page 31). One group, made up of 38 scientists who had attended a workshop in November 2006 sponsored by the National Institutes of Health's National Institute of Environmental Health Sciences (NIEHS), reported that human exposure to BPA is within the range that causes adverse effects in laboratory animals.

"There is more than 40 years of science surrounding bisphenol A."

The other group, established by the National Toxicology Program's (NTP) Center for the Evaluation of Risks to Human Reproduction (CERHR), an interagency group located on the NIEHS campus, expressed "some concern" regarding potential neurological effects from prenatal and early childhood exposures to BPA. However, they downplayed all other risks to adults, pregnant women, and unborn children.

Because of mounting allegations of industry influence on the CERHR panel and on the contractor facilitating the CERHR review, the panel reexamined the literature, including several low-dose studies it had omitted in its initial review. On April 14, NTP released its draft report on the health risks of BPA (C&EN, April 21, page 11), making essentially the same conclusions it did in August 2007. What was different this time was how various groups interpreted the phrase "some concern," which the report did not clearly quantify.

The chemical industry said the CERHR finding provided reassurance that BPA in consumer products is safe. "The NTP report did not say BPA is bad; it said there is some concern. You can make that statement about anything. That gives us confidence in the safety of BPA in all its multiple uses," says Jack N. Gerard, chief executive officer of ACC.

ENVIRONMENTAL GROUPS, Congress, and the media, however, took the finding to mean the opposite and emphasized the report's concerns about prenatal and early childhood exposures to BPA. The Environmental Working Group, a nonprofit group that has been trying to have BPA banned from children's products for years, said on its website that the NTP report "raised concerns that exposure to BPA during pregnancy and childhood could impact the developing breast and prostate, hasten puberty, and affect behavior in American children."

Following closely on the heels of the NTP draft report, Health Canada, the Canadian counterpart to FDA, released its draft assessment of BPA on April 18. This assessment concluded that "early development is sensitive to the effects of BPA." Canadian Minister of Health Anthony P. Clement acknowledged that although BPA "exposure levels to newborns and infants are below the levels that cause effects," he had decided it's "better to be safe than sorry" (C&EN, April 28, page 11). As a result, Health Canada announced plans to ban polycarbonate baby bottles and set limits on how much BPA can migrate from infant formula cans.

Meanwhile, because of a flurry of media reports in the U.S. about the health risks of BPA, the House of Representatives Committee on Energy & Commerce, led by Reps. John D. Dingell (D-Mich.) and Bart Stupak (D-Mich.), launched an investigation in January 2008 into the use of BPA in baby bottles and other products intended for infants and children. As part of that investigation, Congress learned that FDA based its determination that BPA is safe on two industry-funded studies, one of which is unpublished. In light of the findings and concerns raised by the NTP draft report and the Canadian risk assessment, the committee has asked FDA to re-

Chemical and Engineering News, American Chemical Society, June 2, 2008

Chemical and Engineering News,
American Chemical Society,
June 16, 2008

FDA'S SCIENCE BOARD TO REVIEW BISPHENOL A

At the request of FDA's chief scientist, Frank M. Torti, the agency's Science Board has established a new subcommittee to review the safety of the plastics chemical bisphenol A (BPA), a known endocrine disrupter. In April, because of an ongoing congressional investigation and a media firestorm focusing on the use of BPA in consumer products such as baby bottles and infant formula containers, FDA Commissioner Andrew C. von Eschenbach formed an agency-wide task force to review the safety of BPA in all FDA-regulated products. The new Science Board subcommittee will review a report this fall from that task force and hold a public meeting on the topic later this year, FDA Associate Commissioner for Science Norris E. Alderson said at a House Energy & Commerce subcommittee hearing on June 10. Alderson chairs FDA's BPA Task Force.

POLYPROPYLENE

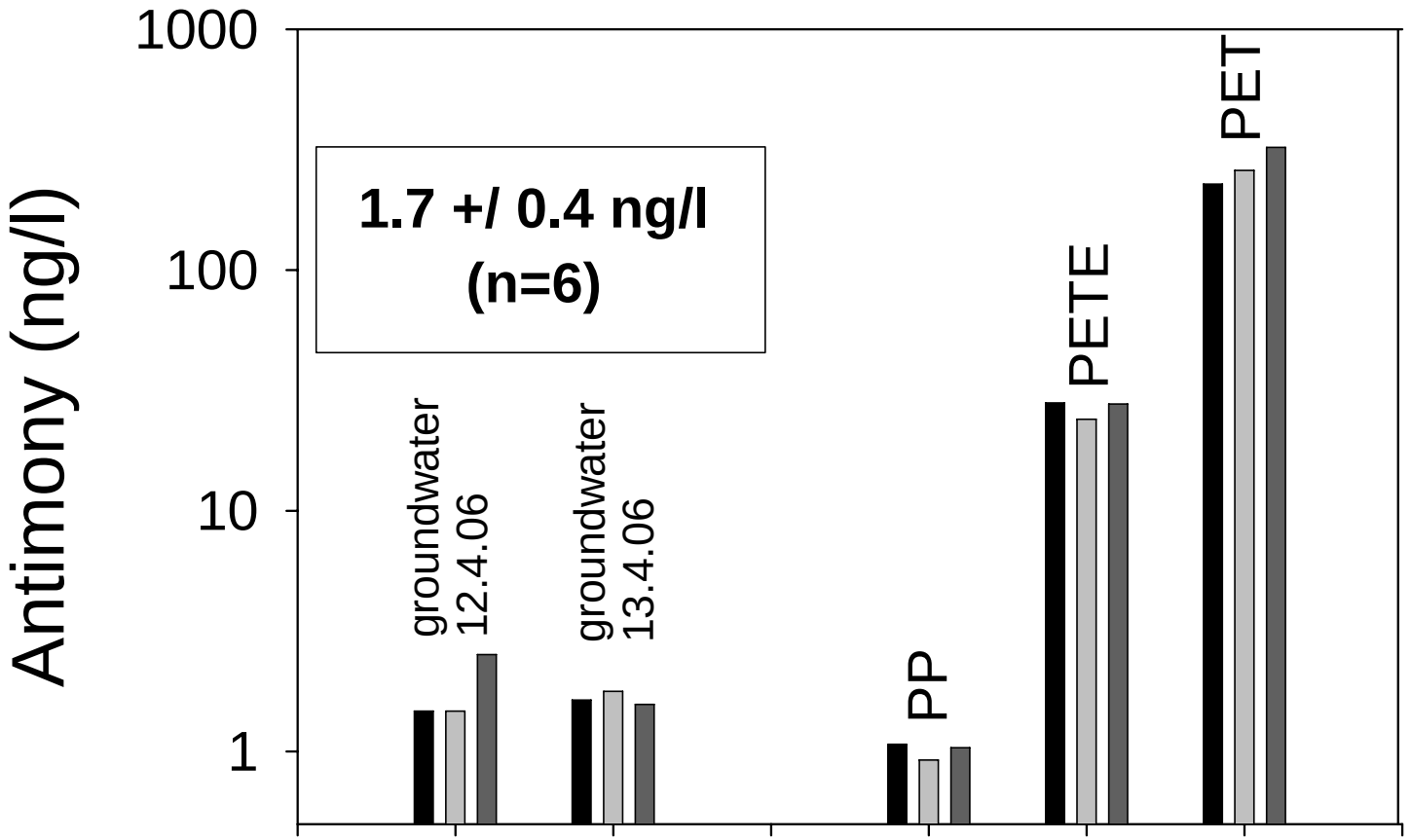
elmvale

Enviroclear bottles, Container Corporation, Richmond Hill

Non-toxic (no BPA)
Dishwasher safe
Recyclable

Polypropylene

Increasing Sb concentrations in groundwaters stored in PET plastic bottles



Shotyk, W., and Krachler, M. (2007) Contamination of bottled waters with antimony leaching from PET increases with storage. *Environmental Science and Technology* **41**:1560-1563.

STAINLESS STEEL

elmvale

SIGG BOTTLES

elmvale

RESULTS OF 13 DAY LEACH TEST, DEIONIZED WATER

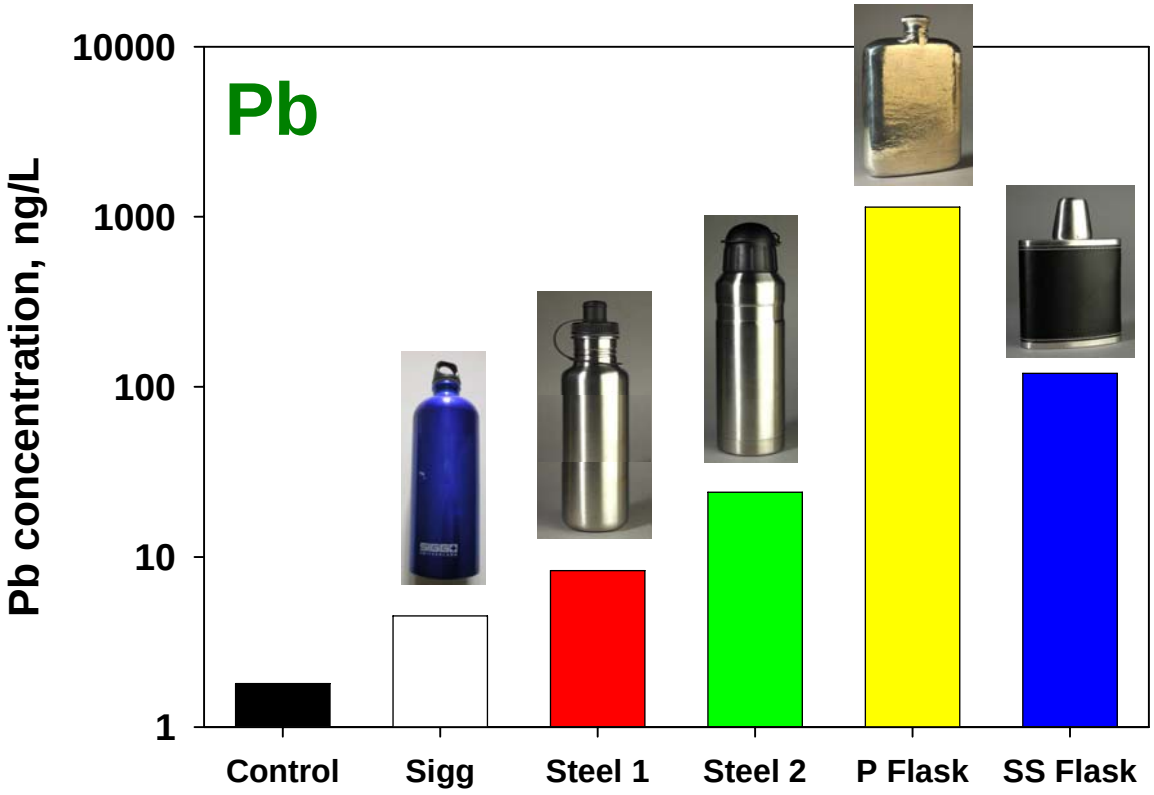
elmvale

Stainless steel,
Brand 1,
Made in China

Stainless steel,
Brand 2,
Made in China

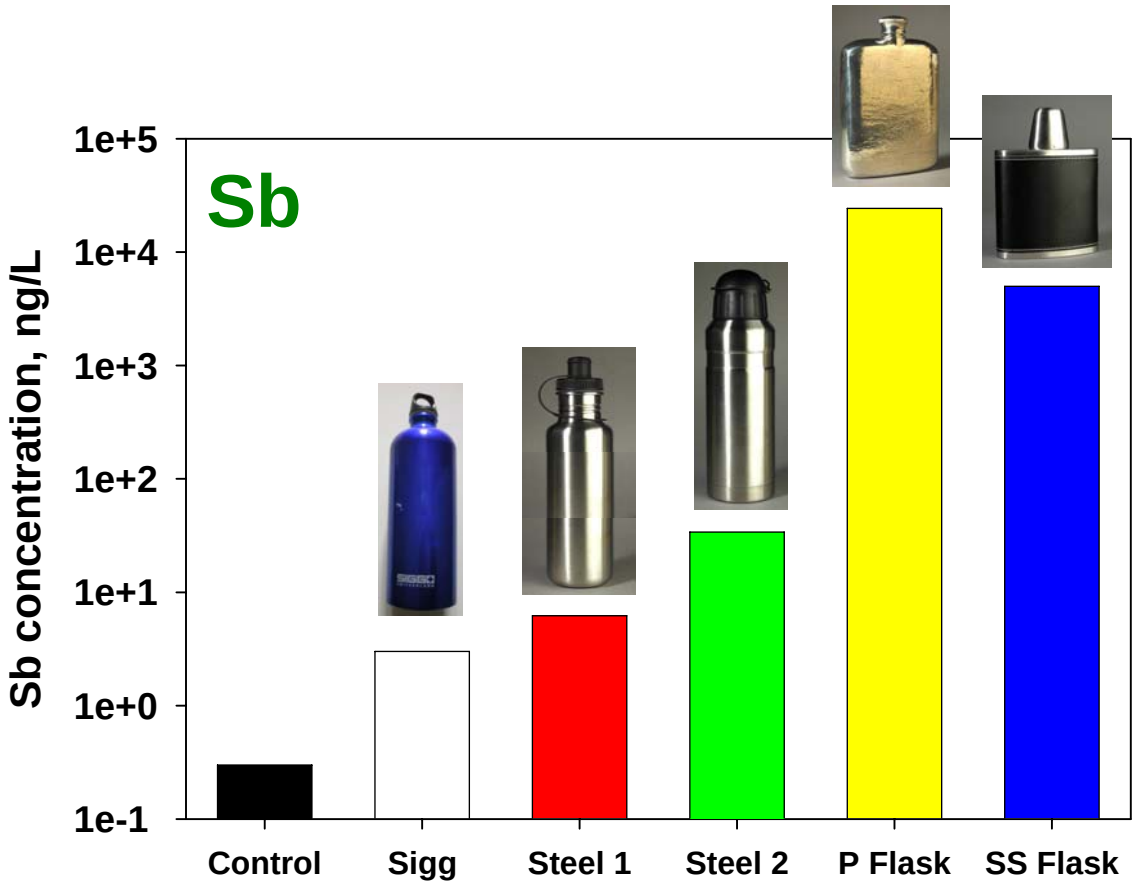
SIGG
Aluminum with
proprietary liner
Made in Switzerland

celebrate water



elmvale

celebrate water



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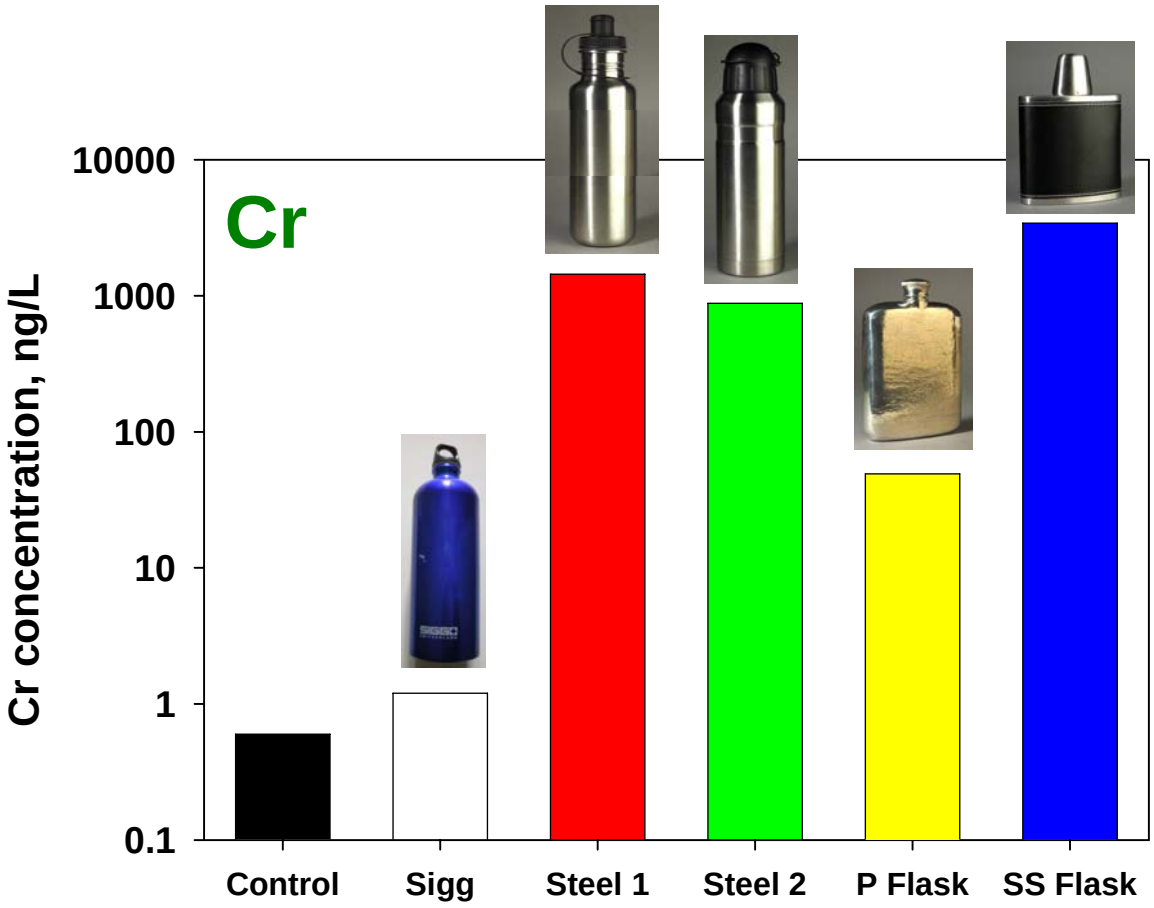
celebrate water



elmvale

Jet Set
design

Eau Couture

Forget disposable bottles – thirst quenching now comes with benefits.

Histoire d'eau

Oubliez les bouteilles jetables ; se désaltérer a aussi du bon.

1 The Light
La lumineuse

Perk This lid for wide-mouth water bottles contains a battery-operated LED light with adjustable brightness that creates a watery, glowing lantern. **Perfect for** Injecting romance into a camping trip. **Atout** Ce couvercle pour bouteilles à large ouverture comprend une DEL à piles et à luminosité réglable qui crée un effet de lanterne d'eau. **Parfait pour** Mettre du piquant dans votre excursion de camping.

Guyot Designs Firefly, $18 / 18 $, guyotdesigns.com

2 The Sheath
La gainée

Perk Like a sporty jacket, the insulating sleeve keeps its contents hot or cold and has room for your iPod too (what doesn't these days?). **Perfect for** Multitasking music lovers. **Atout** Tel un thermos, son étui isolant garde vos boissons froides ou chaudes, en plus d'avoir une pochette pour iPod (y a-t-il un objet qui n'en ait pas ?). **Parfait pour** Les mélomanes sportifs.

Nathan Hydration MP3 Thermal Quickdraw, $28 / 28 $ nathansports.com

3 The Sippy Cup
La munie d'un bec

Perk A rugged, dishwasher-safe alternative to plastic, this stainless steel kid-size cup can be customized with sippy adaptor and spout. **Perfect for** Hiking trips with the wee ones. **Atout** Robuste et résistant au lave-vaisselle, cette bouteille en inox petit format peut être munie d'une tétine ou d'un bec verseur. **Parfait pour** Les randonnées avec bambins et marmots.

Klean Kanteen Sippy Cup, $18 / Bouteille pour enfants, 18 $ kleankanteen.com

4 The Purifier
La purificatrice

Perk It could literally save your life by removing all sorts of water-borne nasties with its built-in, chemical-free filtration system. **Perfect for** When the water at hand is cloudy at best. **Atout** Pourrait vous sauver la vie en purgeant votre eau de parasites et autres bactéries indésirables grâce à son système de filtration sans produits chimiques. **Parfait pour** Les moments où l'eau disponible n'a rien de limpide.

Lifesaver 4000UF, $380 / 380 $, lifesaversystems.com

5 The Classic
La classique

Perk Sturdy enough for the Swiss army (for whom it was designed in 1941), it's got a timeless look and an integrated cup that's great for sharing. **Perfect for** Fans of retro design who also like to portage. **Atout** Assez robuste pour l'armée suisse (pour qui elle a été conçue en 1941), avec un look indémodable et une tasse qui permet de partager. **Parfait pour** Les amateurs de rétro qui aiment aussi portager.

Sigg 1941 Swiss Army Field Bottle, $30 / Gourde de l'armée suisse de 1941, 30 $ sigg.com

6 The Two-in-One
La deux-en-un

Perk Serious exercisers can target-hydrate by alternating sips of water and energy drink or vitamin water and protein shake. **Perfect for** Triathletes and other fitness fiends in training. **Atout** Ceux qui s'entraînent fort peuvent alterner gorgées d'eau et de boisson énergisante, ou d'eau vitaminée et de lait fouetté aux protéines. **Parfait pour** Les triathlètes et autres mordus de gym.

Swigz Dual Hydration System, $15 / 15 $, swigz.com

According to the manufacturers, none of the products featured contains bisphenol A.
Selon les manufacturiers, aucun des produits dont nous faisons la description ne contient de bisphénol A.

Water bottles: which one should you use? - Green Living Online http://www

greenliving

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Water bottles: which one should you use?

(Mar 17, 2008) Commercially bottled water is a big eco no-no, but the big question is, what reusabl

Air Canada, EnRoute, June 2008

SUMMARY

Polypropylene

-non-toxic

(does not leach BPA or metals)

-dishwasher safe

-easily recycled

-inexpensive

SUMMARY

Stainless steel

-non-toxic

(leaching of metals extremely low)

-robust

-dishwasher safe

-more expensive

SUMMARY

SIGG

-non-toxic
(no leaching of metals)
-no BPA
-robust
-dishwasher safe
-more expensive

The 3 R's
REDUCE
REUSE
RECYCLE

more R's
"re-usable"
"rinse"
"re-fill"
"refresh"


THANKS
for your attention
Allenwood Beach, Springwater Township, Ontario


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