Emerging Issues for Drinking Water and Drinking Water Industry

by

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Six emerging drinking water issues will be discussed. They include:

1. Supply and infrastructure needs (repairs, replacement and expansion costs) for public water systems,

2. Widespread nutrient enrichment of surface water that is beginning to indirectly impact water quality and drinking water treatment costs,

3. New source water protection strategies, with emphasis on watershed-based land conservation practices versus enhanced water treatment technologies to protect drinking water quality,

4. Privatization of drinking water utilities with international marketing and commercialization of drinking water supplies,

5. Growing concern for chemicals that originate from water treatment processes, chemicals that leach from plumbing, chemicals from various fuel products, chemicals from health/personal care products for humans and animals, and ubiquitous chemicals coming from plastics, detergents and other widely used industrial and commercial products, and

6. Consumer needs for dealing with all the information and misinformation about drinking water quality, sources, properties, testing requirements, and treatment needs (some of this is nothing but scams).

NOTE: An issue related to all of the above could be the role that good science plays versus politics, ideology, environmental advocacy and maybe even human greed, in maintaining a cheap and plentiful supply of good quality drinking water for humans on earth.
Background Information
The earth is a water rich planet.
Most of earth’s water is salt water so active fresh water is becoming more limited and more valuable.
Desalination of seawater is the only source of fresh water in some places like Jubail, Saudi Arabia.
Typical drinking water system that uses surface water as its source.
Where do we get our drinking water?

- Public water systems
- Private water systems, mostly wells
- Packaged water, mostly bottled water
Public systems or private supplies?

Percentage of the U.S. Population on Public Water Systems

89.9%

10.1%

P.W.S. Population
Private Well Population
Where does bottled water come from?

Several different types of bottled water exist, including: artesian, mineral, spring, distilled, and sparkling—different types are distinguished by factors such as mineral content, carbonation, and source. Seventy-five percent of bottled water of U.S. origin comes from protected or uncontaminated wells and springs; while twenty-five percent originates from municipal water supplies.

Where does U.S. public tap water come from?

Different from state to state and system to system.

Public Water System (PWS) Types

Community Water System (CWS): Supplies water to the same population year-round (e.g. homes); at least 15 connections or 25 individuals

Non-Transient Non-Community Water System (NTNCWS): Regularly supplies water to 25+ of the same people at least 6 months of the year (e.g. schools, office buildings)

Transient Non-Community Water System (TNCWS): Provides water in a place where people only remain for short periods of time (e.g. gas stations, campgrounds)

How do we use water in the U.S.?

As of 1994, average daily water consumption per individual in the U.S. was 84.5 gallons.

Actual individual uses vary substantially based on geographic location and climate, type of dwelling, and other factors. Most (96%) of the treated water we receive from public water systems is used for non-drinking/cooking activities.

The U.S. and its territories need a $276.8 billion investment in drinking water infrastructure over the next 20 years just to ensure continued compliance with specific Safe Drinking Water Act regulations.

Wastewater infrastructure needs that would help protect drinking water for the same 20-yr period have been estimated by the American Society of Civil Engineers (ASCE) in 2005 to be around $390 billion. (http://www.asce.org/reportcard/2005/page.cfm?id=145)
Water utility infrastructure needs/costs for next 20 years in Connecticut ($1.36 billion)
How much will infrastructure repair and replacement cost for water systems of different sizes?

According to the American Water Works Association (AWWA), we are entering a period of unprecedented need for drinking water infrastructure repair and replacement. AWWA (2001) estimates that household impacts of infrastructure maintenance and replacement will be two to three times greater in smaller systems than in larger systems. Per-household impacts on certain small systems (i.e. American Indian and Alaska Native village systems) are estimated to be between eight and sixty-five times as great as in large systems.

Where will the greatest infrastructure needs be within the next 20 years?

Demographic Changes: Population Has Grown Fastest in the West, Particularly in the “Public Land States”

Percent Change in Resident Population for the 48 States and the District of Columbia: 1990 to 2000

- Darker areas denote faster growth rates.
- Nevada (66%) and Arizona (40%) lead the nation.
- Intermountain states average about 30%.
2. Nutrient Enrichment Issues

Mississippi River Basin

Hypoxic Zone
Gulf of Mexico

This map is not to scale.
There are nitrate and nitrite standards for drinking water but increased levels of alga toxins, DOC and increased incidence of microbialis are emerging concerns for nutrient enrichment of fresh, surface water sources designated to supply drinking water.
Blue-green algae affects odor and taste of water but also produces highly potent toxins (hepatotoxins, neurotoxins, endotoxins and other non-specific toxins).
Nutrient enrichment and increased protozoa seem to be related. Cryptosporidium oocysts on the left and Giardia cysts on the right are hard to kill using conventional chlorine disinfection methods.
3. Source Water Protection Issues

Three-step Multi-barrier Approach to Protecting Public Drinking Water Supplies

1. Source water protection
2. Drinking water treatment
3. Maintaining and protecting distribution systems
Effective watershed management is the key element in maintaining a good supply of clean drinking water. Watershed-based pollution prevention is proving to be more cost effective than continuous upgrades to water treatment plants to meet drinking water quality needs.

Watersheds are considered to be the most practical unit for managing water since impacts are felt at the watershed level, rather than at the level of political boundaries, such as municipalities. As water flows downhill or seeps into groundwater, pollution discharged to the upstream segments impacts the downstream segments of the same river system. As water combines with pollution discharged from downstream sources, the effects are cumulative.
4. Water Marketing Issues

Spin and win win win!

Water and sanitation finance options:
- FRSC
- SWAP or death
- Double the donor money today
- 2% cost recovery
- Global joint loan
- MOGs or bust
- The same old game with a new spin.
Freshwater is predicted to be the oil of 21st century.
Commercialization and Anti-privatization Movement

Percent of water loans requiring privatization by year

*Data from Jan. 1, 2002 through Nov. 1, 2002
Source: World Bank and Center for Public Integrity analysis
Push for Privatization Continues Even with Failures

Water system main tank in Atlanta, Georgia, where a privatization contract was recently cancelled.

UNITE AGAINST PRIVATISATION OF WATER
NADI GHATI MORCHA
Some commercialization of drinking water is linked to packaged and bottled water industry.
How has bottled water consumption in the US changed over the past few decades?


Millions of Gallons

How much does bottled water cost?

Cost per Gallon of Selected Bottled Waters

Grocery Store Refill, Grocery Store Brands, Glenwood Inglewood Spring Water, Crystal Clear Spring Water, Mountain Valley Spring Water, Poland Spring Water, Deja Blue Purified Drinking Water, Aquafina Purified Drinking Water, Dasani Purified Drinking Water, Perrier Sparkling Water, Evian Natural Spring Water

Anytime water (ATW) and fill your own bottle machines.
5. Chemical Contaminant Issues:

There is a growing concern for certain types of chemical contaminants in our drinking water.
Chlorine and Chlorination
Byproducts
Pre-chlorination for removal of organics is being eliminated and carbon filtration being added.
Growing interest in non-chlorine based disinfection, even for private water systems.
A large variety of ozone systems are now available.
Even hand-held disinfection units are now on the market.
The Benefits and Hazards of Fluoridation

Percentage of U.S. Population on Public Water Systems Receiving Fluoridated Water

- Fluoridated: 65.8%
- Nonfluoridated: 34.2%
Strong Anti-Fluoridation Movement
Politics vs. Ideology vs. Science vs. Economics

Fluoride toothpaste ($1.25)

Fluoride-free toothpaste ($13.50)
Pharmaceuticals and Personal Care Products in the Environment
Scientific and Regulatory Issues

EDITED BY
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From outdoor privies to out of your site and out of your mind.
From toilet to sewer plant to a river and on to someone’s mouth.
Chemicals in wastewater may not be destroyed prior to stream discharge.
SKILCRAFT®

ANTIBACTERIAL
HAND SOAP

Liquid soap in pouches
Cleans effectively
For use in wall mounted dispensers

27 FL OZ (800 ml)
AFOs
Animal Feeding Operations
To boost the growth of closely confined swine, U.S. farmers buy feed containing subtherapeutic doses of any of 21 antibiotics.
Is arsenic in poultry litter reaching surface water sources?
Tainted water Areas with arsenic above the EPA-proposed safe level.
Endocrine disrupting chemicals can have impacts at very low concentrations.
Plastics, plastics everywhere and many are potential sources of endocrine disrupting chemicals. (50 million tons produced in U.S. in 2003)

Many PVC plasticisers are esters of "phthalic acid"

1,2-benzenedicarboxylic acid (phthalic acid)

Leaching of Bisphenol-A from Polycarbonate Nursing Bottles
Polyvinyl chloride is used everywhere, even in water distribution and home plumbing systems.
From Copper to Plastic and Back to Copper
Groundwater and Fuel Product Contaminants

- Perchlorate anion (K, Na, Ca, Mg, or NH\textsubscript{4}ClO\textsubscript{4})
- Methyl Tertiary Butyl Ether (MTBE)

Ammonium Perchlorate - A National Technical Asset Integral to Strategic Defense and Space Systems

MTBE Contamination
Perchlorate: what is its potential health effect?

Perchlorate acts as an endocrine disruptor

In the human body, perchlorate inhibits production of thyroid hormones, essential to normal organ development in babies, especially brain development.

Membrane of the thyroid gland

1. Iodide from foods, such as salt, enters the body.
2. Iodide is transported into the thyroid by the sodium/iodide symporter (NIS) as sodium is transported out. The iodide is then used to produce thyroid hormones.
3. If perchlorate is ingested, it blocks the symporter, disrupting the uptake of iodide.

Sources: Environmental Protection Agency; Environmental Working Group
MTBE is in water everywhere but groundwater contamination is the primary concern.
State Drinking Water Regulations and Guidelines for MTBE (ug/L)
U.S. EPA, February 2001
This individual was just told his drinking water contains halogenated organics.
Fear and stress cause health problems too, so understanding chemical exposure risk is important.
6. Consumer Drinking Water Scams
Many Scams Now Internet-Based
Radiation is natural so exposure was once considered beneficial to one’s health.

For that healthy glow drink radiation was once a very popular slogan.
From Hot-Springs Therapy to Radium and Radon Water
Radon or Radium Water Treatment Devices
Radium Water from Pills
Radon Water from Liquid Concentrate
The first bottled water scam may have been water sold to be radioactive that was not. (half-life of radon is just 3.8 days)
Modern Day Drinking Water Scams

- Associated with bottled water
- Associate with health quackery nonsense
- Associated with water treatment
- Associated with water testing
- Associated with water supply
Types of Bottled Water Scams

- All bottled water is not a scam
- Fraudulent vendor claims are scams
- Deception by sales persons are scams
- Special formulations are often scams
Bottled Water—the Good

- It is convenient and portable
- It is a good diet drink
- Healthier than many drinks containing sugar, caffeine and other additives
- Fits special niches (some are scams)
Bottled Water—the Bad

- Very expensive in comparison to tap water
- Does not necessarily taste better than most tap water
- Not necessarily safer than most tap water
- Some niche uses are scams
- Associated with health quackery scams
- Associated with marketing scams
The GREAT AMERICAN Water Taste Test
National Rural Water Association
Water and Health Quackery

Bottled water is tied to many health quackery scams

- Structure-altered or clustered water
- Special oxygenated forms of water
- Specialized mineral waters
- Alkaline, ionic or ionized water
- Special energized forms of water
  - Treated with magnetism
  - Treated with some form of light
  - Treated with sound waves
  - Treated with electricity in some way
  - Treated with a special catalyst
  - Naturally occurring (some remote area)
Bottled Water Health Quackery

Oxygenated water nonsense
Fluoridated water for babies: Is it a scam?
Homeopathy: Water to Cure Every Disease

More health quackery nonsense—catalyst altered or special memory water.
Two Categories of Home Water Treatment Scams

1. Those convincing consumers to purchase treatment devices that do not work
2. Those convincing consumers to purchase treatment devices they do not need

NOTE: There are scams associated with remedying both health and nuisance problems.
Chart 1:
Residential Water Treatment Equipment Market: Revenue Forecast (US), 2003-2008

Source: Frost & Sullivan
Home Treatment Health Quackery Devices

- Devices that produce oxygenated, super-oxygenated or antioxidant water
- Devices that produce special structure-altered or special clustered water
- Devices that produce alkaline or ionic forms of water
- Devices that produce water with some special form of energy or other magical properties
Oxy-Plus Water Treatment Devices
Devices for producing water with micro-clusters
Ion Bunk H₂O dot com

"Ionized" and alkaline water: snake oil on tap
Ionizer for the Faucet

![Diagram of an ionizer for a faucet showing the carbon filter, electrolysis chamber with positive and negative electrodes, and acidic and alkaline water streams.](image-url)
There are several opinions as to just what bio-water is. The main thing is that it is a scam.
The magic of magnetism

Catalyst altered water
Magnetic Nonsense
Specially Energized Water

The PX ENERGY MUG and the LIFE FORCE or BOVIS SCALE

Most Drinking and Bottled Water is Between 2000 - 5000 Bovis

The PX Home System Brings All Water in Your Home to 7,000 - 30,000 Bovis.

The PX Energy Mug Brings Drinks to 18,000 - 40,000 Bovis Depending on Original Liquid.

Life Force Enhanced Water for Use by Health Practitioners

Neutral Point for Human Life

Above 10,000, toxins begin reversing spin, allowing them to be more easily eliminated without harm to the body.

Energy-Balancing Water with Life Force Restoration

850,000
Scare Tactics: A way to sell home water filtration systems.

Be Wary of Water Testing Scams

1. On-site demonstration tricks
2. Misinterpretation of lab test results
3. Fake lab test results
Softening requires removal or reduction of divalent cations in solution. Water conditioning is not water softening.
Water conditioners are not water softeners, just magnetic magic.
Many home water treatment devices work fine but are often not needed and require regular maintenance.

Filtration through some media or multi-media and more recently, through porous membranes with or without added pressure, is the technique most used now in removing contaminants from water.
New techniques are not necessarily scams.
Supply-Related Water Scams

- Water locating scams
- Rain making scams
- Well drilling scams
- Water privatization scams
Does dowsing to find ground water really work?
Can rain dancing and rockets fired into clouds produce rain?
Cloud seeding is based on science but conditions must be right.
National and state certification programs now prevent most well drilling scams.
Glossary of over 8000 words and phrases related to water and water quality.

Over 200 articles, over 5000 questions and answers, and over 2000 web links by nine primary topics and 105 subtopics.

Over 50 links on scams and Internet fraud related to drinking water (subject code = 138).

All databases are searchable on the web site by key word (s).
How do the costs of various water protection and supply options compare?

<table>
<thead>
<tr>
<th>Option</th>
<th>Cost Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Public Water Supply</td>
<td>$0.01 - $1.10</td>
</tr>
<tr>
<td>Point-of-Entry</td>
<td>$0.69 - $1.12</td>
</tr>
<tr>
<td>Point of Use (as sole treatment)</td>
<td>$47.00 - $94.00</td>
</tr>
<tr>
<td>Watershed Protection</td>
<td>$0.73 - $5.48</td>
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<tr>
<td>Point-of-Use as Supplement</td>
<td>$13.00 - $118.00</td>
</tr>
<tr>
<td>Bottled Water</td>
<td>$295.00 - $1,095.00</td>
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</tbody>
</table>

Assumes 2 quarts per person per day.

Sources: