

# Is Your Water Safe?

How Modern Water Sanitation Can Damage Your Health

**DR . M E R C O L A**



**Mercola.com**  
Take Control of Your Health

Mercola.com is the world's #1-ranked natural health website, with over one million subscribers to its free newsletter. Millions of people visit [www.Mercola.com](http://www.Mercola.com) each day to search for proven and practical solutions to their health and wellness concerns.

# Is Your Water Safe?

## How Modern Water Sanitation Can Damage Your Health

If you live in a typical urban or suburban area of the United States, the water you use every day is very likely loaded with chlorine, *and* something FAR more toxic; something you may have never even heard of. Disinfection byproducts (DBPs) are contaminants found in nearly every municipal water supply that adds chlorine, and they are over 100 times more toxic than chlorine.

That clear, clean-looking liquid you use every day – to quench your thirst, to bathe in, to wash your dishes and laundry – is far from the fresh, pure resource you might assume.



In fact, depending on where you live, the time of year, and your individual susceptibility, you could be exposed to dangerously high levels of DBPs in the chlorinated water you and your family use at home, at school or at work.

Chlorine is used to sanitize both public water supplies and swimming pools, and in the manufacture of bleached paper products. This potent chemical is also used to make plastics and pesticides.

It is important to understand that chlorine itself is relatively benign and breaks down to chloride in your body, which is not much different from the chloride ion in salt. The problem is that it reacts with organic material already dissolved in the water, forming these far more toxic DBPs.

Chlorination of public water systems began in the United States a century ago, in 1908, in Jersey City, New Jersey,<sup>1</sup> and is still one of the most common disinfection techniques used at water treatment facilities today.

The primary reason for adding chlorine to water is to make it safe to drink by killing or inactivating harmful microorganisms that cause diseases such as typhoid, cholera, dysentery, and giardiasis.<sup>2</sup>

Without question, chlorine does work to help keep us free from infectious diarrheas. We can be thankful that we don't get sick from our tap water like people in many underdeveloped countries do.

However, chlorine's effectiveness as a water sanitizer is due in part to its characteristic as a *persistent* chemical. In other words, it doesn't break down like other sanitizing agents. It is able to withstand hundreds of miles of travel, through centuries' old piping systems, to deliver water to your home that is free of waterborne contaminants.

That's the good news. The bad news?

Chemicals that are *persistent*, like DBPs, also tend to be very toxic.

Given the wide variety of applications for chlorine, many of which we are exposed to several times a day, every day, it's not surprising to learn that we are polluting our bodies and the world at an unprecedented rate.

The term *chlorine pollution* means Americans ingest from **300 to 600 times** what the Environmental Protection Agency considers a "safe" amount. And with devastating results.

The health effects from the DBPs created during water chlorination can be carcinogenic and/or have effects on reproduction and development. Large amounts of studies show there is a relation between chlorinated drinking water and bladder-, intestinal- and anal cancer.

According to the U.S. Council of Environmental Quality, the cancer risk to people who drink chlorinated water is **93 percent** higher than among those whose water does not contain chlorine.

**Chlorine Itself is Dangerous, But DBPs are 100X More Toxic !!!!**

Aside from ingesting residual chlorine, it is in fact the unintended byproducts of chlorine use that are the most toxic; many of which are considered mutagenic and/or carcinogenic.

These byproducts do not break down readily; they bio-accumulate,<sup>3</sup> meaning they are absorbed faster than they are broken down. Hence the byproducts of chlorine can accumulate in your system at a greater rate than your body can detoxify in order to maintain your good health. (The same toxic cumulative effect can also be seen in our environment.)

The two primary DBPs formed when chlorine is used are:

- trihalomethanes (THMs)
- haloacetic acids (HAAs)



Trihalomethanes include four different chemicals: chloroform, bromoform, bromodichloromethane, and dibromochloromethane.

Trihalomethanes (THMs) are a Cancer Group B carcinogen, meaning they've been shown to cause cancer in laboratory animals.

They've also been linked to reproductive problems in both animals and humans, and human studies suggest that lifetime consumption of chlorine-treated water can more than double the risk of bladder and rectal cancers in certain individuals.

These DBPs have also been linked to damaging effects to heart, lung, kidney and central nervous system.

Other dangerous byproducts of chlorine usage include PCBs, DDT, and dioxins.

But more than 600 different DBPs have been reported in the scientific literature since EPA scientists first discovered chloroform in chlorinated drinking water, back in 1974. Still, more than thirty years later, the EPA estimates that less than half of all chlorinated DBPs have been identified.

## How Chlorine and DBPs Destroy Your Health

Unfortunately, in most cases science isn't even close to understanding the potential short-term and long-term impact of these chlorine-based

chemicals on your body and the environment. There are hundreds of them. And science isn't even close to understanding what levels of these chemicals can cause damage.

But we're not completely in the dark about the harm they can inflict.

Some of the serious health problems caused by DBPs include:

### **Heart Attacks**

Free radicals are linked to the presence of arterial plaque. The residents of a small town in Pennsylvania who ate diets rich in saturated animal fats and milk had no heart attacks – *until they switched from mountain spring water to chlorinated water.*

### **Immune System Injury**

Chlorine destroys acidophilus, a probiotic which helps build and maintain friendly bacteria in your colon. A healthy colon is necessary for a healthy immune system, since about 80 percent of your immune cells operate from your digestive tract. When your colon is overrun with unfriendly bacteria, your immune system is compromised, and your ability to fight disease is greatly reduced as well.

### **Cancer**

Scientists have linked worldwide pollution of rivers and oceans and chlorination of swimming pools to increased incidents of melanoma, the most dangerous form of skin cancer.<sup>4</sup>

Research from the University of Nijmegen in the Netherlands discovered that people who swam in chlorinated pools or polluted waters as children had 2.2 to 2.4 times the risk of developing melanoma compared to those who did not swim in chlorinated waters.

In the 1970's, researchers found that chlorinated water at levels at or below the EPA standard increased the risk of gastrointestinal cancer by 50 to 100 percent over a lifetime.

Additionally, -- as your bladder and rectum store waste products for periods of time – chlorinated water is associated with increased risk of bladder and rectal cancers.



A study published in 1998 by the National Cancer Institute found that male smokers who drank chlorinated tap water for more than 40 years had double the risk of bladder cancer as smoking males who drank non-chlorinated water.<sup>5</sup>

Another study<sup>6</sup> found that rates for rectal cancers for both sexes escalated with duration of consumption of chlorinated water. Individuals on low-fiber diets who also drank chlorinated water for over 40 years more than doubled their risk for rectal cancer, compared with lifetime drinkers of non-chlorinated water.

### **Reproductive Issues and Birth Defects**

Studies have also shown that chlorine found in human tissue and breast milk has caused a 50 percent drop in sperm counts in Denmark.<sup>7</sup>

And, research conducted in Europe indicated that women in their first trimester of pregnancy who drink five or more glasses of chlorinated tap water a day could be at a much higher risk of miscarriage.

A Norwegian study of 141,000 births over a three year period found the risk of spina bifida increased 14 percent in areas with chlorinated water.

### **Allergic Reactions**

Chlorine can cause allergic symptoms like skin rashes, headaches, gastrointestinal difficulties, and even arthritis.

In addition to the toxic byproducts and the health hazards mentioned above, chlorine also creates free radicals and oxysterols in water.



Excess free radicals in turn, can create toxins in your body that are linked to liver problems, compromised immune systems, pre-arteriosclerotic changes in arteries, and alterations in DNA.<sup>8</sup>

Chlorine also destroys the antioxidant vitamin E.

## You May Be Exposed to More Chlorine and DBPs Than You Ever Imagined

Please don't assume that because the water in your home seems okay, it's healthy. It's impossible to determine the safety of your water by the way it looks, tastes or smells. For example, tap water in some areas of the U.S. smells and tastes better than in other areas.

Don't be fooled.

Many of the contaminants in chlorinated water are so potent they are measured in parts per million (PPM) or parts per billion (PPB). Just a drop in a gallon of water can be very harmful.<sup>9</sup>

That's why a taste or sniff test of your tap water provides no real clue as to its safety with constant exposure.

And remember, your primary exposure to these chemicals isn't even from the water you drink. Most people aren't aware that when you shower, your exposure to DBPs is dramatically increased.

This is largely related to the volume of water you are exposed to, and the fact that the shower actually volatilizes these chemicals so you breathe them in, and absorb them through your lungs and your skin.

Warm water causes your skin to become like a sponge. Amazing as it sounds, you can absorb more chlorine and dangerous DBPs in a 10 minute shower than by drinking *eight full glasses* of the very same water.



Chlorine exposure in your daily shower can also irritate your eyes, your sinuses, and your throat. Chlorine gas is a respiratory irritant, so your lungs can also be affected.

Additionally, it is well known that chlorine dries your hair and scalp, and can damage your hair cuticles and cause, or worsen, dandruff.<sup>10</sup>

Likewise, when you open your dishwasher door after running a load of dishes, toxic volatilized chlorine and DBPs from detergent and tap water is released into the air, causing indoor pollution right in your home.

As you can see, toxic chlorine exposure in your home comes from many sources beyond drinking unfiltered water from your sink. You and your family are exposed to a toxic cocktail of chemicals every time you:

- shower or take a bath
- wash your hands
- run a load of laundry
- wash dishes, glasses and utensils
- rinse fruits, vegetables or other foods

## The Little Known Dangers of Swimming Pools

If you have a swimming pool and use chlorine as a sanitizer – or if you and your family swim in a chlorinated pool regularly -- you'll want to pay particular attention to the following information.

The chlorine byproduct trihalomethanes (THMs) abound in swimming pools, forming when chlorine reacts with organic matter like skin and hair.

Pool chlorine and DPBs are rapidly absorbed through your skin and can disrupt your biochemistry. In fact, ***you can absorb more chlorine and DBPs in one hour in your pool than from a week of drinking tap water.***





So, just how bad is that?

Worse than you'd think, actually. A recent study published in the *Journal of Environmental Sciences*<sup>11</sup> found that swimming in a chlorinated pool presented ***an unacceptable cancer risk***.

They concluded that the cancer risk of trihalomethanes from various routes in descending order was:

1. skin exposure while swimming
2. gastro-intestinal exposure from tap water intake
3. skin exposure to tap water
4. gastro-intestinal exposure while swimming

But the cancer risk from skin exposure while swimming was **94 percent of the total cancer risk** resulting from being exposed to THMs!

THMs formed in chlorinated swimming pools have also been linked to spontaneous abortion, stillbirths and congenital malformations, even at lower levels.

This information clearly demonstrates just how much more dangerous it can be to immerse yourself in a chlorinated body of water.

But the toxic dangers of swimming pools don't end there.

The chlorine in your swimming pool also reacts with organic matter such as blood, feces and urine, sweat, and skin cells to form another dangerous byproduct: *chloroform* (also called trichloromethane).

In scientific experiments conducted on laboratory animals, results indicate that the health effects of chloroform are similar whether you inhale or ingest it. These effects include damage to the liver, kidneys, and the central nervous system of rats.

Moderate amounts (300,000 parts per billion) have been found to affect reproduction.<sup>12</sup>



Similar health effects are seen in humans. In large amounts, chloroform may damage your central nervous system, liver and kidneys. Breathing high levels in the air (900,000 ppb) – such as in an indoor pool area – even for a short time, can cause tiredness, dizziness, or headaches.

After just one hour in a chlorinated pool, chloroform concentrations in your blood can range anywhere from 100 to 1,093 parts per billion (ppb). Indoor pools expose you to 70 to 240 times greater amounts of chloroform than outdoor pools.<sup>13</sup>

This is an important point to remember, especially if you or your children suffer from asthma or other breathing difficulties.

Asthma has increased 50 percent in developing countries in the last 25 years. It is thought that the chlorine byproducts in the air around indoor pools could be a contributing factor in the rapidly escalating increase in cases of childhood asthma.<sup>14</sup>

It's interesting to note that the Environmental Protection Agency (EPA) used to have a maximum contaminant level goal (MCLG) of zero for chloroform in drinking water due to its potential toxicity. They list it as a "probable human carcinogen," and the U.S. Department of Health and Human Services has determined that chloroform may reasonably be anticipated to be a carcinogen.

However, the EPA was forced to remove the zero standard -- effective as of May 30, 2000 -- after the MCLG was successfully challenged in court by the Chlorine Chemistry Council and the Chemical Manufacturers Association.<sup>15</sup>

## **Other Sources of Chlorine and DBPs You Should Be Concerned About**

As stated in the beginning, chlorine is also used to make a wide variety of bleached paper products.

Dioxin is yet another chemical byproduct of chlorine, created in the manufacture of chlorine bleached paper, and is ***the single most carcinogenic chemical known to man.***



According to the EPA, dioxin is 300,000 times more potent as a carcinogen than DDT, and has been linked to:

- diabetes
- neurotoxicity
- immune system impairment
- reproductive dysfunction in men and women
- decreased fertility
- endometriosis
- birth defects

In your home, you'll find dioxin in bleached coffee filters, paper milk cartons, disposable diapers, paper towels, bathroom tissue and feminine hygiene products.

Few ever think about this, but the cancer causing chemicals in chlorine bleached paper products are readily absorbed through your skin.

Feminine hygiene products present a significant risk, since they are typically worn close to warm, moist areas of a woman's body (or in the case of tampons, inside the body) for extended periods of time.

Bleached coffee filters are also cause for concern, since 40 to 70 percent of dioxin in the filters can leach into your coffee.

Dioxin and other chlorine byproducts accumulate in your fatty tissues and can disrupt your hormonal milieu. Your body is simply not equipped to efficiently metabolize this poisonous load. These toxins accumulate and build up in your body, even at very low rates of exposure.

The wastewater from paper manufacturing processes is also a major culprit in destroying a vital food supply: fish. Animals who sustain themselves on fish ingest and accumulate these toxins in their tissues as well, and needless to say, this includes you, at the end of the food chain.

## What You Can Do to Protect Yourself and the Environment

It's important to recognize that organizations like the Chlorine Institute and the Chemical Manufacturers Association have a serious and well-funded interest in maintaining the status quo. In other words, don't count on any help from the chemical lobbies to clean up your water source or your environment.

Scientific advances have allowed dramatic improvement in the ability to reduce your exposure to these toxic chemicals. Due to these technical advances, you no longer *need* to use harmful substances like chlorine in your water supply.

There are safer, less costly water sanitizing agents, among them hydrogen peroxide and ozone. However, these treatments generate no disposal profits for the big chemical companies.

In addition, water companies incur high costs to remove disinfection byproducts from the water, so they lobby to keep EPA limits on the high side.

The ultimate solution to the challenge of safely sanitizing public water supplies could be home-based water filtration/sanitizing systems. This would eliminate the need to disinfect water at the source with chemicals so strong and persistent that the water remains uncontaminated through hundreds of miles of pipes installed hundreds of years ago.

However, there are also many smaller steps you can take that will make a big difference to your health and the environment.

The following is a list of nine planet-friendly steps you can take to dramatically reduce your risk of exposure to chlorine and its toxic byproducts:

1. Get your water tested. If you pay for your water from a water purveyor, they are required by law to regularly test their water



and you can simply request a free copy of this report. Ideally the THMs concentration should be below 10 parts per billion (ppb)

2. Filter your own water at home with a high quality reverse-osmosis system. This is clearly the best option as not only will it remove DBPs and fluoride, but also drugs that may have made their way into the local water supply.
3. Open a window in your bathroom to ventilate and remove the chloroform when you shower.
4. Request and purchase processed chlorine-free paper (writing paper, paper towels, napkins, tissue, toilet paper, etc.).
5. Request and purchase non-chlorinated, non-toxic household cleaning products.
6. Support product manufacturers who use chlorine alternatives like ozone gas, hydrogen peroxide and ultraviolet light.

Keep in mind that not all chlorine alternatives are safe. Chloramines, a mixture of chlorine and ammonia, are being used as a chlorine alternative and are proving to contain **much greater** toxins than those of chlorine!

7. Buy locally grown, organic fruits and vegetables.
8. Avoid Sucralose, a chlorinated table sugar which may have many of the same risks associated with chlorine.
9. If you have a swimming pool, use ozone instead of chlorine as a sanitizer. Make sure everyone entering the pool has cleaned themselves. This will reduce the level of THMs in chlorinated pools.

## A Word About Bottled Water

You might have noticed that conspicuously absent from the above list is any mention of substituting commercially bottled water for tap water as a way to reduce your exposure to chlorine and disinfection byproducts. Here's why.

***About 40 percent of bottled water is regular tap water.***

And if the thought of paying a premium for something you already have on tap isn't disturbing enough, you should know that while the EPA requires a rigorous contaminant testing schedule for public water supplies, the FDA requirements for private bottlers are considerably less demanding.

While large public water suppliers must test for contaminants up to several times a day, private bottlers need only test for contaminants once a week, once a year, or once every four years, depending on the contaminant.

Contaminants testing on over a hundred different bottled waters have turned up chemicals like arsenic and carcinogenic compounds, fluoride (a dangerous bone poison), the toxic metal antimony, disinfection byproducts like THMs, and pharmaceutical drugs.

Adding insult to injury, the chemicals that leach out of bottled water's plastic packaging are also highly toxic.

Last but not least – our landfills are overflowing with plastic bottles that do not biodegrade.



## **Chlorine is Risky Business...**

... to your health, and the health of our planet.

It's time for each of us to exercise our purchase power and every available option to reduce and ultimately eliminate exposure to this deadly chemical and its toxic byproducts. Your and your children's future depends on it.





**Uncover the truth about  
Chlorine Dangers by  
searching for "chlorine" at  
[www.Mercola.com](http://www.Mercola.com)**



**Mercola.com is the world's #1-ranked  
natural health website with over one  
million subscribers to its free newsletter.**

**Millions of people visit Mercola.com to  
search for proven and practical solutions  
to their health and wellness concerns.**

## Footnotes

---

<sup>1</sup> Mercola.com, The Dirty Little Secret Behind the Chlorine in Your Water,  
<http://articles.mercola.com/sites/articles/archive/2005/03/19/chlorine-water.aspx>,  
(Accessed 11/22/08)

<sup>2</sup> Mercola.com, Bottled Water Not So Pure,  
<http://articles.mercola.com/sites/articles/archive/2008/11/08/bottled-water-not-so-pure.aspx>, (Accessed 11/18/08)

<sup>3</sup> Mercola.com, The Dangers of Chlorine and Issues With Sucralose,  
<http://articles.mercola.com/sites/articles/archive/2001/06/23/chlorine-part-two.aspx>,  
(Accessed 11/20/08)

- 
- <sup>4</sup> The Perils of Progress, p. 228, John Ashton, Ronald S. Laura, [http://books.google.com/books?id=OZ39-KD7HDAC&pg=PA228&lpg=PA228&dq=chlorinated+poools+melanoma&source=web&ots=KXXRdw3Tx8&sig=F2\\_K2B\\_JPa12stwbeyALsLK5DDE&hl=en&sa=X&oi=book\\_result&resnum=6&ct=result](http://books.google.com/books?id=OZ39-KD7HDAC&pg=PA228&lpg=PA228&dq=chlorinated+poools+melanoma&source=web&ots=KXXRdw3Tx8&sig=F2_K2B_JPa12stwbeyALsLK5DDE&hl=en&sa=X&oi=book_result&resnum=6&ct=result) (Accessed December 4, 2008)
- <sup>5</sup> Epidemiology 1998;9(1):21-28, 29-35
- <sup>6</sup> Epidemiology 1998;9(1):21-28, 29-35
- <sup>7</sup> Mercola.com, Chlorine in Your Tap Water and In Your Diet Cola, <http://articles.mercola.com/sites/articles/archive/2004/11/13/chlorine-water-cola.aspx>. (Accessed 11/23/08)
- <sup>8</sup> Mercola.com, Poisoning by Chlorinated Water, <http://articles.mercola.com/sites/articles/archive/2001/01/07/chlorinated-water.aspx>, (Accessed 11/19/08)
- <sup>9</sup> Mercola.com, Chlorine Alternative Makes Tap Water More Deadly, <http://articles.mercola.com/sites/articles/archive/2004/10/06/chlorine-alternative.aspx>, (Accessed 11/22/08)
- <sup>10</sup> Mercola.com, The Negative Health Effects of Chlorine, <http://articles.mercola.com/sites/articles/archive/2001/02/28/chlorine.aspx>, (Accessed 11/19/08)
- <sup>11</sup> PubMed.gov, Journal of Environmental Sciences, 2008;20(3): 372-8, Panyakapo M, Soontornchai S, Paopuree P, Cancer Risk Assessment from Exposure to Trihalomethanes in Tap Water and in Swimming Pool Water, [http://www.ncbi.nlm.nih.gov/pubmed/18595407?ordinalpos=7&itool=EntrezSystem2.PEntrez.Pubmed.Pubmed\\_ResultsPanel.Pubmed\\_DefaultReportPanel.Pubmed\\_RVDocSum](http://www.ncbi.nlm.nih.gov/pubmed/18595407?ordinalpos=7&itool=EntrezSystem2.PEntrez.Pubmed.Pubmed_ResultsPanel.Pubmed_DefaultReportPanel.Pubmed_RVDocSum), (Accessed 11/23/08)
- <sup>12</sup> MMR.org, Chemical Fact Sheet: Chloroform, July 2001, <http://www.mmr.org/irp/genprog/riskinfo/chlorofr.htm> (Accessed December 4, 2008)
- <sup>13</sup> Mercola.com, The Negative Health Effects of Chlorine, <http://articles.mercola.com/sites/articles/archive/2001/02/28/chlorine.aspx>, (Accessed 11/19/08)
- <sup>14</sup> Mercola.com, Chlorinated Swimming Pools Jump Start Asthma, <http://articles.mercola.com/sites/articles/archive/2006/08/03/chlorinated-swimming-pools-jump-start-asthma.aspx>, (Accessed 11/24/08)
- <sup>15</sup> Environmental Protection Agency, Removal of the Maximum Contaminant Level Goal for Chloroform From the National Primary Drinking Water Regulations, Federal Register: May 30, 2000 (Volume 65, Number 104), <http://www.epa.gov/EPA-WATER/2000/May/Day-30/w13202.htm> (Accessed December 4, 2008)