

# How Clean Is Your Water?

*This is a transcript of a talk given by John Archer, researcher and consumer advocate for the quality of our water. He is the author of many books including his latest title "Sydney On Tap" which explores the controversy surrounding the recent Sydney water contamination crisis.*

***"The highest benevolence is like water.  
The benevolence of water is to benefit all beings without strife." Lao Tsu***

Hello, I'm John Archer. I've been working with water now for ten years and during that time I've written four books on the subject. I'd like to share with you some of the understanding I've acquired about one particular aspect of water: the water we drink. Water is indispensable; without it nothing can survive.

Some of the properties of water may have been measured and documented, but the action of water within plants, animals and the animal body remains for the most part a mystery, a process about which little is known and even less is understood.

Water circulates through the body just as it travels through the earth, cleansing, invigorating, dissolving impurities, giving life and energy. Most of us take our drinking water for granted. We turn on the tap and there it is: abundant and reliable. Water is an essential part of our daily life. We drink it, we cook in it, we wash our bodies and our possessions in it, we swim in it for relaxation. We use it to nourish our gardens, to quench fires and to cool the buildings by humidifying air. But that's not all. We dump our wastes into clean water and then effortlessly flush them away with the press of a button or the lifting of a plug.

Water is the giver of life and comfort and an endless waste disposal system all rolled into one ... or so it might seem. But how much do we really know about this fluid

we drink with such confidence? Where does it come from and what happens to it between the time it falls as rain then magically gushes out of our taps? How pure is it ... how safe?

Water authorities, health officials and politicians regularly reassure us that our water is perfectly safe, but the truth is that they don't know whether it is safe or not. In fact no one knows what safe really means.

## **Lack of Purity Standards**

If you ask you will be told that drinking water is measured against strict guidelines for water quality set by the National Health and Medical Research Council, the NHMRC. This answer is meaningless. It gives the impression that there are compulsory standards that water authorities have to meet. Nothing could be farther from the truth.

There are three Australian versions of these guidelines published in 1988, 1987 and 1996. There are also the World Health Organisation guidelines. Water authorities are free to choose any one which suits them; some even make up their own. This doesn't really matter much because the business of having guidelines is a cosmetics exercise. There are no penalties for non-compliance, no compulsion to inform consumers when there is a health risk and in some instances the public has not

been told the truth at times when serious health risks existed.

Many people are surprised at learn that Australia has no standards for drinking water, no mandatory policy, no Safe Water Act. Until water quality requirements are mandated, water authorities will not be accountable to anyone for failure to apply to any guidelines. At the present time the buyer of a second-hand car has more legislative protection than a tap water consumer.

The truth is that the water most of us drink is contaminated to a greater or lesser degree in various ways. There are three basic sources of this contamination: the catchment, the treatment plant and the pipeline. Let's look at these one by one.

## **Sources of Drinking Water**

Drinking water comes from two sources: underground water stored deep beneath the earth and surface water which falls as rain and accumulates in creeks, rivers and lakes. With the exception of Perth, Australia's capital cities and most communities depend on surface water for their drinking supplies. Just as water is the major vehicle for moving nutrients in our bodies and removing salts and other water at the same time, so too it permeates and flushes out all plant and animal metabolisms. It also extracts from the earth a variety of minerals and salts. Many of these are not harmful to people and some are

beneficial, but unfortunately there remains a list of organisms and substances which threaten the quality of our drinking water and our health.

### **The Catchment**

Since our environment has become inundated with fertilisers, man-made chemicals, pesticides and human, animal and industrial wastes, it is inevitable that residues of some of these will find their way into the catchments providing our water supply. The catchment of your particular water supply should be of special interest to you because everything that happens in it will ultimately affect the quality of the water you drink. Every litre of pesticide, sewerage effluent, petrol or dog excrement that pollutes your catchment will end up in your water supply sooner or later. Only a portion of this is removed on its way to your tap. Living pathogens like hepatitis, cryptosporidium, giardia, shigella and salmonella may occur in raw or untreated water along with nitrates, cyno-bacteria from blue green algae and various pesticides and industrial residues.

### **The Protozoans**

High on the list of concerns are the protozoan parasites cryptosporidium and giardia. Protozoans are one celled organisms which are larger, more complex and more resistant to chlorine than bacteria. These were responsible for boiled water warnings in Melbourne's outer regions in 1993 and in the City of Sydney in 1998. Giardia was also found in Adelaide reservoirs in 1998. It is now generally agreed by the experts that cryptosporidium is found in most surface water supplies.

The word cryptosporidium means secret or hidden spore. It's a very appropriate name because there are many mysteries surrounding these strange parasites. They exist in the form of tiny, hard shelled, egg-like capsules or oocysts which are found in a variety of wild and domestic animal hosts, as well as in water supplies where they can survive in water or sediment for up to a year. There are several species but only one, *Cryptosporidium Parvum*, is known to infect mammals and humans.

Infection can occur by direct contact with a human carrier, by contact with infected farm animals or domestic pets or by drinking contaminated water containing the oocysts. It's thought that one oocyst can cause disease although some experts believe it may be as many as 50 to 100, depending on the type. Once ingested, the oocyst hatches in the stomach, releasing a parasitic worm-like organism called sporozoetes. These invade the living cells of the small intestine which asexually reproduce while feeding on the nutrients in the upper digestive tract.

Each minute oocyst produces more than a million replicas of itself during its four-day life cycle. The result is cryptosporidiosis: an explosive, acute and occasionally persistent gastroenteritis with symptoms which can include severe diarrhoea, weight loss, abdominal cramps, fever and vomiting. After a massive water-borne outbreak in Milwaukee USA, many people were so unwell they were unable to work for up to a fortnight. Although healthy people may recover within a week or two, the illness may be life-threatening for those

with depressed immune systems, particularly people who are HIV positive or those who have received organ transplants or are taking immune-suppressing drug treatments. There is no known treatment or cure for cryptosporidiosis.

Fluctuating levels of cryptosporidium and other parasites which cause gastroenteritis have been found in most major water supplies. While conventional treatment plants are not always successful at removing them, high quality domestic filtration has been shown to offer high levels of protection.

### **Blue Green Algae**

Another serious catchment contaminant is blue green algae. When nutrient laden water is exposed to heat, sunlight and sluggish flow due to drought or too much irrigation extraction, blue green algal blooms may occur. These discolour water, forming a blue green scum which smells vile and tastes worse. Bathing, showering or swimming in contaminated water can cause skin irritation and rashes, swollen lips, eye irritation, earache, sore throat and asthma. Drinking it can cause nausea, vomiting, diarrhoea, abdominal pain, liver complications, muscle weakness and paralysis. One of the algal toxins is a 1000 times more powerful than cyanide. These colourless toxins can remain potent for several weeks after the algae has disappeared. They are quite stable and cannot be destroyed by boiling water. Most water treatment plants cannot remove them because this requires expensive filtration through activated carbon. As a result every year many people drink such water without being aware of its harmful potential.

## **The Pseudo Oestrogens**

Another significant catchment problem arises from synthetic chemicals which mimic the effect of the female sex hormone oestrogen. These hormone disruptors, as they are called, have been linked to low sperm counts and consequent difficulty with conception, a doubling of testicular and prostate cancer in men and an increase in breast cancer in women. Synthetic oestrogen is produced by the action of chlorine compounds and pesticides in the aquatic environment. Water authorities around Australia are expected to be issued with guidelines and warnings in 1999.

## **The Treatment Plant**

Parasites, algal toxins and synthetic chemicals are just a few of the many catchment contaminants that find their way into reservoirs and dams. From there water flows into the treatment plants. At the treatment plant water is dosed with chemicals and filtered through beds of special sand. The Ph may be adjusted and fluoride may be added. Finally the water is disinfected with chlorine or chloramine, a mixture of chlorine and ammonia.

The idea that the best way to make water safe to drink is by adding highly poisonous chemicals has always seemed like a contradiction to me, yet many people accept it without question. What is not widely known is that the long-term safety of chlorination and chloramination has never been conclusively established. Although these substances have been used to disinfect water for 70 years there have been few systematic studies of their effects on humans; and the studies that have been

completed have raised more questions than they have answered. Most of us forget that chlorine was a poisonous gas used to kill people in World War One. It did dreadful things to them.

## **Chlorine By-Products**

The argument for adding poisonous chemicals like chlorine and ammonia to drinking water is that they kill bacteria and make the water safe. Chlorine has been used to disinfectant water supplies since 1904 because it was found to be very effective in killing the bugs that carried typhoid and cholera as well as a lot of other bacteria. It took scientists years to begin to realise that besides destroying these bacteria in water, chlorine produces dangerous bi-products. These compounds are created when water containing organic matter, such as decayed leaves, soil and other debris, is treated with chlorine and chloramine.

Chlorine bi-products include a family of chemicals called trihalomethanes, of which chloroform is the best known. Until recently trihalomethanes were thought to be the main cause of cancer and the genetic defects associated with tap water, but according to Dr Brenton Nicholson of the South Australian water laboratory, trihalomethanes are only the tip of the by-products iceberg. "The United States has identified so many bi-products of water purification, that working out the toxicity has become a nightmare," he said.

## **Mutagen X**

In the early 1990s a new sinister compound was identified, one which authorities believe is responsible for many of the health problems associated

with tap water. Scientists have christened it Mutagen X or MX. Among the disturbing properties of MX are its potency and its mutagenicity, that is, its ability to cause genetic changes in testes and ovaries, changes which will only be revealed in subsequent generations of children. In effect MX is a time-bomb of unknown power.

By 1993 experts had learnt to test for MX more effectively and had expanded their understanding of its effect. They wrote "Chlorinated drinking water was found to be mutagenic and a number of compounds responsible were identified. One of these, MX, has been shown to account for 30 to 60 per cent of the mutagenic activity detected in drinking water. The target organs appear to be the bladder, urinary tract and the gastro-intestinal tract."

## **Chemical Cocktail**

The Australian drinking water guidelines set safety limits for only nine of the 130 chlorine bi-products known to exist. About MX, the substance thought to be responsible for up to 60 per cent of the total threat, they simply say "insufficient data available". Professor Harry Rescher from the University of New England, disagrees. He warns that adding chemicals to our drinking water will lead to the same sort of cancer epidemics in Australia as they have in the US.

There is a growing view among environmental scientists that high cancer rates in certain cities relates to the fact that they've been drinking a chemical cocktail for the past few decades. The cocktail concept highlights the failure of the guidelines to consider the effect of chemical combinations. The values for

individual chemicals were calculated, we are told, without specific consideration for the potential for each chemical to interact with others in the water, even though there's a high probability of these synergistic reactions taking place.

### **A Thousand Toxic Chemicals**

It's important to remember that almost all municipal treatment facilities in Australia were designed for the purpose of disinfecting water, not purifying it. To purify all the water that is treated would cost billions of dollars. As a result, water authorities focus on achieving an acceptable level of bacteriological safety. This was once an appropriate health safeguard in a relatively unpolluted environment but it is hardly adequate today.

In the USA, Ralph Nader's Centre for Responsive Law found that more than 1000 toxic chemicals in drinking water of which less than 30 are tested for or monitored. Most of these substances, including pseudo-oestrogens, blue green algal toxins and cryptosporidium, are not removed or inactivated by conventional treatment. Instead, what results is a cocktail of many chemicals including of course the fluoride, chlorine and/or chloramine added at the treatment plant. The result could hardly be described as pure, healthy water.

### **Volatile Gases**

If drinking such a chemical mixture is a hazard, bathing or showering presents an even greater threat because some of the chlorine bi-products are volatile organic gases. Conservative calculations indicate that taking a shower exposes you to the equivalent of consuming an additional

two litres of chlorinated water each day. It takes a pleasure out of the long hot shower when you discover that chloroform and volatile organic gas levels are four times greater after a ten minute shower than one lasting five minutes.

### **Skin Absorption**

Skin absorption is another possibility. A 1984 study calculated that a person taking a 15 minute bath in which he or she was 80 per cent submerged absorbed significant quantities of the volatile organics in the water. This also applies, of course, to spa and swimming pool users. Many allergic skin reactions to chlorinated water have been reported. Most disappeared when a shower filter or a whole house filter was fitted. It's worth remembering too that an infant's consumption of water per kilo of body weight is far greater than that of adults and so too is their relative exposure to volatile organics, both via breathing and via absorption through the skin. So you can see that the sort of chemical treatment used to disinfect drinking water may kill some of the bacteria and remove some contaminants, but the result could hardly be described as pure water.

### **The Pipeline**

However, just suppose for argument sake that our treatment plants could deliver pristine water. How would we get it? Our water travels through many kilometres of mains pipes before we drink it. Some of these pipelines are more than a century old and many are decaying. This makes the water's journey a perilous one which can add bacteria, heavy metals and other contaminants to a

previously clean supply.

One of the most difficult problems for water authorities is the reappearance of significant quantities of pathogenic bacteria in the water distribution system. These live and multiply in the pipelines, finding shelter and nutrients in the build up of slime which takes place over time. When there is a considerable thickness of slime and sediment, a bio-film coating develops. This bio-film seals off its contents from the disinfecting action of chlorine with the result that bacteria can grow and multiply in a protective and nutrient rich environment. When there is a sudden or violent flow of water, or any other disturbance to the surface of the bio-film, bacteria and other organisms are released into the water supply where they may cause isolated clusters of illness or gastroenteritis.

The regrowth of bacteria is a significant factor in the deteriorating quality of our tap water. It's a problem common to many large articulating systems in Australia.

### **Metal Poisoning**

Metal poisoning is another. Studies in Sydney in 1994 and Perth in 1995 found unacceptably high levels of lead, cadmium and copper in tap water in many homes. The lead was found to be leaching from common brass taps and fittings used in the plumbing of new houses, in PVC piping or from other connections where lead solder was used. The use of lead solder is now prohibited, of course, but plumbing systems installed before 1989 may contain lead soldered joints.

Copper leeches from copper pipe used in household

plumbing at levels which vary in relation to the quality of the water and how long it's been sitting in the pipes. Even overnight contact may result in elevated levels of copper in your tap water but you can usually taste it. Research has found that first flush tap water, the water that comes out as soon as you turn on the tap, is potentially a major source of lead and copper contamination.

### **Increased Risk for Babies**

It is a particular concern in the case of bottle fed babies, whose formula is made up of tap water, and pregnant women who can accumulate lead in their bones and pass it on to their unborn child. Lead poisoning can cause impotence and sterility in men and accelerated bone loss in post menopausal women. Symptoms of lead poisoning included pains in the stomach and abdomen, nausea, vomiting and constipation.

### **Lead Build Up in Stagnant Water**

You can reduce the amount of metal contamination in tap water by flushing about 10 litres through your tap each morning, or you can use an appropriate water purifier. Always check the device's capabilities and documented performance in reducing lead; and set up an effective and practical maintenance programme to make sure that the system is maintained as recommended by the manufacturer.

High rise offices and apartment buildings have long and complex plumbing systems which are particularly susceptible to copper and lead contamination of water retained in pipelines during weekends and holidays. The highest lead and copper levels

found during the Perth study were recorded in the drinking water in high-rise buildings. There is no simple solution to this problem. Unlike households supplies the volume of water necessary to flush all the polluted water through the pipelines of buildings 15 or 20 storeys high makes flushing impractical. Point of use purification is the only practical alternative.

### **Accumulated Intake**

We live in an era where food, water and even air present potential health hazards, particularly in large cities. Each contaminant may be present in minute quantities which, when considered individually, may not present a serious problem, except of course in the case of parasites such as cryptosporidium and giardia. But the real issue is our accumulated intake, the sum total of the daily dose of poisons, chemicals, metals, pesticides, herbicides and poison gases from whatever source. This toxic load has a greater impact on babies, small children, the aged, people who are ill or undergoing treatment with immuno-suppressive drugs. All of these are more susceptible and vulnerable than are healthy adults.

### **The Human Filter**

It is in our own interest to make sure that the food we eat, the air we breathe and the water we drink contains as few toxic impurities as possible. Looked at that way, any efforts toward improving the quality of our water is not a waste of time. Whatever impurities exist in our water when we drink it, most will remain in our bodies because we have our own sophisticated filtering devices: the skin, the kidneys and the

liver. Humans are, after all, the final filter.

### **Adequate Hydration**

If the water you drink tastes good you and your family will be more inclined to treat it. This practice alone has significant health benefits. The correct balance of water in the human body is vital in order to maintain an optimal level of physical and mental performance. The normal healthy body attempts to maintain a constant water level by a number of mechanisms. The one we are most familiar with is the sensation of thirst. In order to satisfy this need we go to the tap, but if the water tastes or smells even slightly offensive we tend to put off drinking it and opt for something more palatable. Worse still, we may become conditioned to ignore this early warning signal of physiological distress.

However thirst is not always a good indicator of the body's need for water. In order to maintain adequate hydration adults require at least one-and-a-half to two litres of water every day. That's about six to eight big glasses. That sounds simple enough to achieve but because of the deteriorating quality of our tap water, voluntary dehydration has become a widespread condition and one which may have serious, long-term medical consequences.

According to medical experts, loss of the thirst sensation in humans can lead to many things including rheumatoid joint pain, angina pain, hypertension, asthma, allergies, raised cholesterol levels, chronic fatigue syndrome and diabetes, particularly in the elderly. Much of this is unnecessary. It has been suggested that

depression and stress can themselves be a product of dehydration as well as exacerbating it. Don't forget that you're brain is 85 per cent water and if deprived of even a small amount of its fluid requirements, thought processes and emotional stability are the first to be affected.

Although alcohol, coffee, milk and flavoured drinks contain water they don't

adequately supply the body's needs. Don't count on them as part of your daily water intake or you will be short changing yourself. On the other hand if you increase your water intake you'll probably decrease your consumption of other less vital fluids. Children are particularly at risk from dehydration so it's important to encourage them to drink plenty of water. This simple practice may enhance

their school performance and general behaviour.

The more I become acquainted with the mysteries of water, the more convinced I am that the quality of the water we drink is a significant factor in maintaining our personal domestic harmony as well as our health. We are, after all, the water we drink.

***It's your choice: buy a filter or be a filter!***

John Archer