What’s in our drinking-water?

What chemicals does the drinking water in my community contain?

Chemicals in drinking-water can come from:
- the water source used to supply our drinking-water,
- the treatment process water passes through to make it safe to drink, or
- the metal in our pipes and plumbing fittings

Raw water, or water in its natural state, contains a variety of chemicals, which it absorbs from the land that it flows over and through. Some of these chemicals can be harmful to humans if consumed at high levels. The levels of a variety of naturally occurring chemicals in water are monitored by water suppliers to ensure that your water will be safe to drink. Although the concentrations of chemicals in water are very small, some have the potential to cause health problems if consumed at higher than recommended levels over many years. Any potential new water source is screened for a number of possible naturally occurring chemicals (MOH 2008).

Methods to improve the taste and odour of drinking water were recorded as early as 4000 B.C. using treatment methods such as filtering through charcoal, straining and boiling. The Egyptians reportedly used the chemical alum as early as 1500 B.C. to remove particles from water. Filtration was commonly used in the 1700 and 1800s to make water appear less cloudy but it wasn’t until the mid to late 1800s that scientists began to understand the sources and effects of drinking water contaminants that were not visible to the naked eye, such as cholera, typhoid, and dysentery. By the 1900s disinfectants like chlorine played a large role in reducing water borne diseases. In recent history other contaminants have been identified such as industrial and agricultural sources, and treatment processes continue to be developed to improve water quality (EPA 2000).

Today, the type of treatment process used determines what may be added to the water. Some treatment plants may use ultra violet light, others use the addition of chemicals to achieve good quality drinking water and make it suitable to distribute. The type and quality of source water also determines what is added to the
water during the treatment process. If the water source is muddy or cloudy, has an offensive smell or taste, or has a lot of organic matter in it, it will be treated as any of these affect the water quality. There may be only a small addition of one or two chemicals such as lime or chlorine, or they may be several additions to the water depending on the amount of organic matter, and its look, taste, and smell.

Another factor in the treatment process is consideration of the metalwork used for plumbing. If the water source has a low pH, sometimes called ‘soft’ water, it can increase the likelihood of corrosion of metals in the water pipes. A substance can be added that balances the pH of water lessening the likelihood of metals in the drinking-water (MOH 2008).

Some common additions to water during the treatment process are (Humphreys 2011):

- **Lime**: Helps balance acidity (pH) to support the process which removes solids, bacteria viruses, and other organic compounds from water. Also helps control corrosion of water pipes and plumbing fittings.

- **Carbon dioxide**: Added to reduce the pH (measure of acidity) of water.

- **Poly aluminium chloride**: Used to clump bacteria, viruses, natural organic compounds and algae together, which can then be removed from water.

- **A long chain polymer**: Helps particles combine together so they can be removed

- **Powdered activated carbon**: used specifically to remove organic taste and odour that cause water to have a muddy smell and taste.

- **Chlorine**: Ensures that microbes are killed and there is no risk of illness for the community.

- **Fluoride**: Helps to remineralise tooth surfaces that have lost enamel due to acid from dental plaque metabolism\(^1\). Also helps to rebuild small holes that have already developed because it stays in the saliva for a period of time after fluoridated water is drunk (ISM 2012).

\(^1\) Bacteria in dental plaque use sugar that is eaten to produce acid that causes demineralisation of tooth enamel.
Why do we need to treat our drinking-water?

Water taken straight from rivers or underground sources may look clean, but it can contain microbiological contaminants – protozoans (single-celled organisms such as giardia), bacteria and viruses – which may cause illness and in extreme cases even death. In New Zealand, drinking water suppliers are required to maintain water to a certain standard, to regularly monitor it and to fix any problems. The details of these are contained in the publication Drinking-water Standards for New Zealand 2005 (Revised 2008) (DWSNZ) (MOH 2008).

The degree of treatment that raw water requires to make it to comply with the drinking-water standards depends on the level of substances contaminating the source water. Examples of these include faecal bacteria, protozoa, and various chemicals. Poor quality raw water requires a greater degree of treatment than good quality raw water. Several processes are used to protect the community from illness caused by contaminated raw water. These include removing substances that could make us sick, selecting a drinking-water source of the highest quality possible, to minimize the amount of treatment required, disinfecting the water to kill any microbes, and protecting the treated water from any further contamination.

What does contamination of the water look like – if there were problems what would I expect to see in my community?

There have been cases of contaminated water in New Zealand that cause people to become unwell. There could be a variety of causes, including microbial activity, overgrowth of organic matter such as algae, high levels of naturally occurring chemical elements in the source water, such as arsenic, or contaminated water sources from land based activities, such as dairy farming. If the contamination is found to be from the water source, the local Public Health doctor (Medical Officer of Health) works with the relevant council to issue warnings to protect the community from further ill-health.
The DWSNZ acknowledge that it is possible for chemical contamination to occur. This is why they have a method of measuring levels of chemicals in water against the set acceptable levels (the MAV\(^2\)). The most predominant source of contamination in New Zealand is microbial. It is recognized that there is naturally occurring arsenic in the Central Plateau so there is a program in place to monitor this.

References

Chris Nokes ESR (Personal Communication) Natural Fluoride in NZ waters. 15/12/11


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\(^2\) The maximum acceptable value (MAV) of a chemical is the concentration of that chemical which does not result in any significant risk to the health of a 70kg consumer over a lifetime of consumption of two litres of the water a day. The MAV, based on the latest WHO guidelines, provides a benchmark for the public health safety of the drinking-water to be assessed, i.e. if the chemical in the drinking-water occurs at concentrations less than its MAV, the water is considered safe.