

Levels of fluoride in our drinking-water

Why does the natural level of fluoride in water vary from place to place?

The fluoride content of water depends on the type of water (surface or groundwater) and the types of rocks and minerals with which it has been in contact. Volcanic rocks and soils, and geothermal fluids appear to be an important source of fluoride in New Zealand's natural waters. Groundwaters (wells, bores and springs) tend to contain higher naturally-occurring fluoride concentrations than surface waters (rivers, streams and lakes). This is because groundwater is in longer and more intimate contact with the surrounding rocks than surface waters.

How high do natural levels of fluoride get in New Zealand?

In 2007, the Ministry for the Environment released a report on the quality of groundwaters in New Zealand. It shows that 95% of the 279 monitoring sites had fluoride concentrations of 0.56 mg/L or lower. This concentration is a little lower than the range of concentrations recommended for fluoridating drinking-water (0.7–1.0 mg/L). Most of water that came from bores with fluoride concentrations higher than 0.56 mg/L, were in regions with a history of volcanic activity, namely, Auckland, Bay of Plenty, Northland, Waikato. Occasional naturally occurring fluoride levels higher than the MAV have been recorded in raw water such as in geothermal water, but these water sources are not used to supply drinking-water.

What symptoms do you see in areas where drinking-water sources have high levels of fluoride?

Globally, waters with high fluoride concentrations occur in broad geographical belts associated with the type of rock and sediment. The most well-known and documented area associated with volcanic activity follows the East African Rift system from the Jordan valley down through Sudan, Ethiopia, Uganda, Kenya and Tanzania. Levels of between 12mg/litre and up to 690mg/litre have been found in some drinking water sources in



Tanzania and Kenya. High concentrations of fluoride in groundwater associated with certain types of rock (granites and gneisses) have been reported from India, Pakistan, West Africa, Thailand, China, Sri Lanka, and Southern Africa. In India various states are documented with having naturally occurring fluoride levels between 0.2mg/litre and 20mg/litre.

Excessive exposure to high naturally occurring levels of fluoride in drinking-water, or in combination with exposure to fluoride from other sources, can give rise to a number of adverse effects. These range from mild to severe dental fluorosis (staining or pitting of the teeth) to skeletal fluorosis (the accumulation of fluoride in the bone) as the level and period of exposure increases. The early symptoms of skeletal fluorosis, include stiffness and pain in the joints. In severe cases, the bone structure may change and ligaments may calcify, with resulting impairment of muscles and pain.

These adverse effects are commonly reported in areas where there are naturally high concentrations of fluoride in drinking-water sources, such as in the above examples of Tanzania and India. Some of these areas have treatment processes to lower the level of fluoride in the drinking-water. Fluoride may not be the only cause of dental enamel defects. Enamel opacities similar to dental fluorosis are associated with other conditions, such as malnutrition with deficiency of vitamins D and A or a low protein-energy diet. Intake of fluoride after six years of age will not cause dental fluorosis.

In contrast, New Zealand has low levels of naturally occurring fluoride and moderate to severe dental fluorosis and skeletal fluorosis is unknown here.

How closely are my water fluoride levels managed/ measured?

Registered¹ community drinking-water supplies where fluoride is added are owned by a territorial local authority (TLA) such as a district or city council. They extract the source water, run it through the treatment plant to remove risks or contaminants, and pipe the water to your door. Under the Drinking-water Standards for New Zealand (2008), produced by the Ministry of Health, the TLA or a company contracted by the TLA is expected to test the water regularly to demonstrate that it is safe. The District Health Board in that area is

¹ The register is a list of community drinking-water supplies in New Zealand published by the Ministry of Health, with all their details.



expected to oversee the TLA and ensure that the TLA maintains appropriate water quality. To comply with the Drinking-water Standards, fluoridated drinking water supplies must be sampled at least weekly to monitor levels where the drinking-water leaves the treatment plant, using appropriate procedures and analytical laboratories.

What happens if the levels are exceeded?

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.

If the MAV is exceeded the water supplier must advise the local Drinking Water Assessor immediately, investigate the cause of the sample exceeding the MAV and take appropriate action. Every time the concentration is above the MAV it must be recorded, including monitoring results, actions taken and outcomes. The aim of this is to protect public health and to reduce the likelihood of this happening again.

The Ministry of Health publishes the Annual Review of Drinking Water Quality in New Zealand at the end of every year. The report covers the assessment of microbiological and chemical quality of registered drinking water supplies using the Drinking-Water Standards and includes performance against the standards. The most recent report can be accessed on the following website:

<http://www.health.govt.nz/publication/annual-review-drinking-water-quality-new-zealand-2010-2011>

References

Chris Nokes ESR, personal communication, Natural Fluoride in NZ waters 15/12/11.

MOH (2008) Drinking-water Standards for New Zealand 2005 (Revised 2008).

WHO (2006) Fluoride in Drinking-water

