

Water fluoridation questions and answers



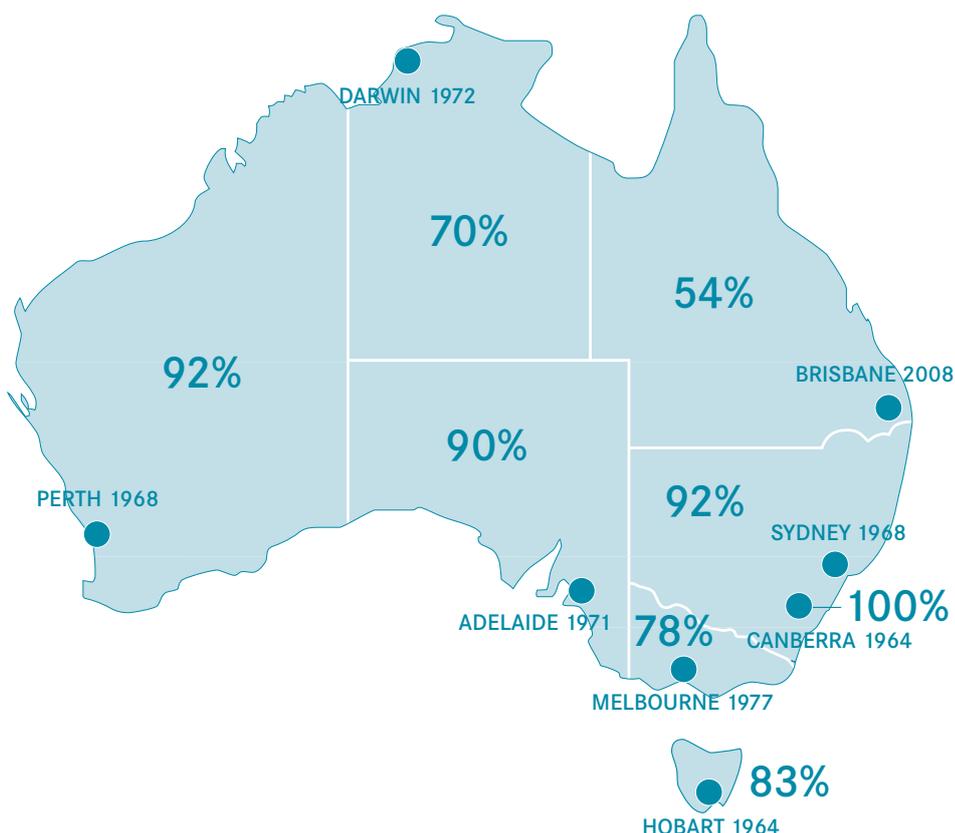
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1. Water fluoridation in Australia

1.1 What parts of Australia have water fluoridation?

Figure 1: Dates of introduction of water fluoridation to Australian capital cities with proportion of each state/territory population receiving fluoridated drinking water in January 2009



Adapted from National Health and Medical Research Council, 2007¹; Queensland Health, 2008².

- The first Australian water fluoridation program commenced in 1953 in Beaconsfield, Tasmania.³ Currently, more than 80 per cent of Australians have access to fluoridated drinking water.^{1,2,4}
- In late 2007, Queensland Health announced that water fluoridation would be rolled out in that state so that by end of 2009, approximately 80 per cent of Queenslanders will have fluoridated drinking water.⁵ Water fluoridation commenced in Brisbane in late 2008.²

1.2 Is my drinking water fluoridated?

Local water authorities can confirm if fluoride is added to a particular supply or visit the Victorian Department of Human Services Water Fluoridation website (<http://www.health.vic.gov.au/environment/fluoridation>) and check your location using the 'Fluoride by postcode' function.

1.3 Is water fluoridation part of Australia's National Oral Health Plan?

Australia has a National Oral Health Plan which has been endorsed by all state and territory governments and the Australian Government.⁶ The purpose of *Healthy Mouths Healthy Lives: Australia's National Oral Health Plan 2004–2013* is to improve health and wellbeing across the Australian population by improving oral health status and reducing the burden of oral disease.⁶ The Plan aims to help all Australians retain as many teeth as possible throughout their lives, have good oral health as part of good general health and have access to affordable and quality oral health services.⁶

One of the Plan's goals is the extension of fluoridation of public water supplies to communities across Australia with populations of 1000 or more.⁶

1.4 What is Victorian Government policy on water fluoridation?

As Victoria is one of the signatories to *Healthy Mouths Healthy Lives: Australia's National Oral Health Plan 2004–2013* (see section 1.3), it is Victorian Government policy to extend water fluoridation to those areas of rural and regional Victoria yet to benefit from this important public health initiative. Since 2004, the Victorian Government has provided \$16.7 million to extend water fluoridation.

A Fairer Victoria 2008, launched by Premier Brumby on 8 May 2008, is a whole of Government social policy action plan to address disadvantage and promote inclusion and participation.⁷ It continues the commitment to strong people and strong communities, investing over \$1 billion across a range of initiatives.⁷

As part of this plan, water fluoridation will be further extended to major rural and regional centres across Victoria to close a critical gap in the dental health of children living in regional and rural Victoria.⁷

The *Health (Fluoridation) Act 1973* provides the Secretary to the Department of Human Services with the power to direct water authorities to commence water fluoridation.⁸ The *Standard for Fluoridation of Public Water Supplies* (currently being updated) specifies requirements for water fluoridation plants to ensure the safe and effective addition of fluoride to drinking water supplies.⁹

2. Dental decay

2.1 What is dental decay?

Dental decay (also called dental caries) is a cavity (hole) in a tooth caused by bacterial acids.¹⁰ These acids are produced when bacteria in the mouth break down sugar-containing foods.¹⁰ The acid removes calcium and phosphates from the tooth structure, resulting in cavitation of the tooth.¹⁰

2.2 What does dental decay look like?

The following pictures show healthy teeth on the left and teeth with dental decay on the right; Deciduous ('primary', 'first', 'milk', or 'baby') teeth are shown in the upper two pictures, while permanent ('secondary' or 'adult') teeth are shown in the lower two pictures.

Figure 2: Comparison of healthy teeth and those affected by dental decay



Healthy deciduous teeth



Deciduous teeth with significant dental caries



Healthy permanent teeth



Permanent teeth with dental caries

Pictures provided by Prof M Morgan, The University of Melbourne.

2.3 How is dental decay measured?

The most commonly used measure of dental decay is called the DMFT/dmft index.¹ This is a measure of the number of **T**eeth which are **D**ecayed **M**issing or **F**illed.¹ Upper-case lettering refers to permanent ('secondary' or 'adult') teeth, while lower-case lettering refers to deciduous ('primary', 'first', 'milk', or 'baby') teeth.¹ The DMFT index ranges from zero to 32, which is the maximum number of teeth in the permanent dentition; the dmft index ranges from zero to 20.¹

(see section 4.5 for discussion of DMFT scores for Victorian and Australian 12-year olds)

2.4 Is dental decay really that serious?

Apart from being painful, dental decay can also extend into the nerve of the tooth where it can cause dental infections such as abscesses, facial swellings and other spreading infections.¹¹ These can have serious, potentially life-threatening consequences.¹¹

In 2007–08 across Victoria, there were more than 4,400 children under the age of 10, including 207 two-year olds and 835 four-year olds, who required a general anaesthetic for treatment of their dental decay.¹² In the same year, children under the age of ten in non-optimally fluoridated areas of Victoria were two times more likely to require a general anaesthetic in hospital for treatment of dental decay than in optimally-fluoridated areas.¹²

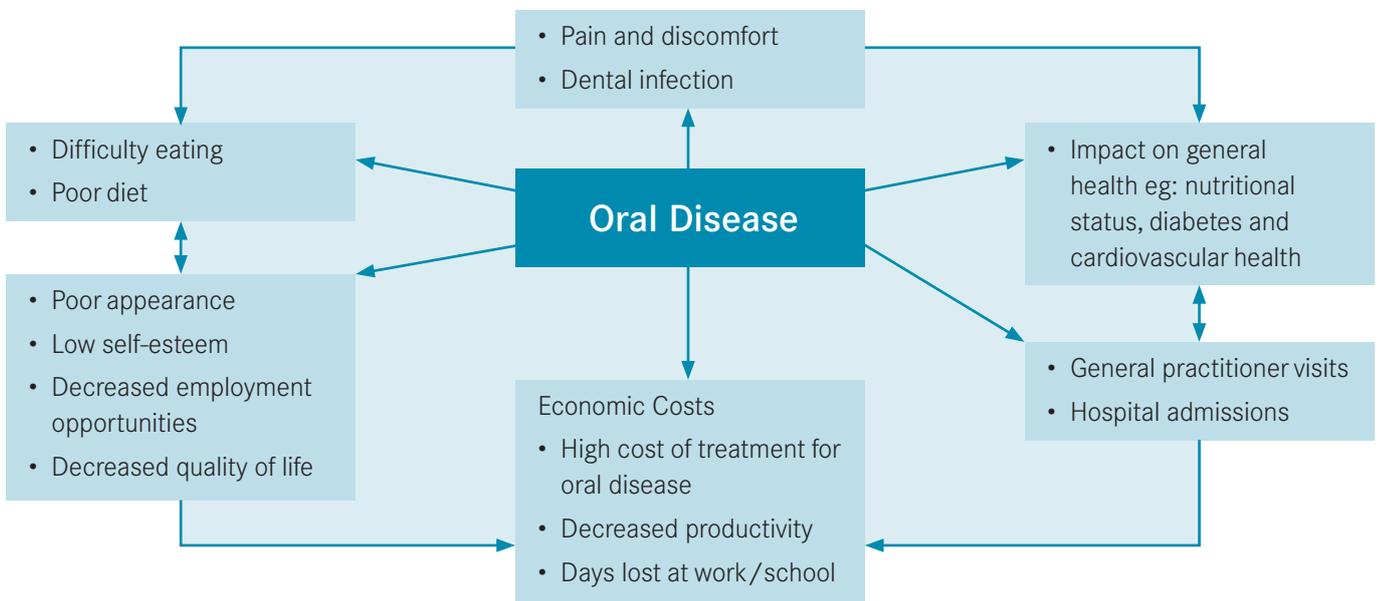
The consequences of dental decay are costly, in terms of time, money and personal pain and suffering.^{6,13} Once a tooth is filled, it becomes structurally weaker and may require further treatment in the future.¹⁴

2.5 Are oral health and general health related?

Oral health is fundamental to overall health, wellbeing and quality of life.⁶ A healthy mouth enables people to eat, speak and socialise without pain, discomfort or embarrassment.⁶

The diagram below shows links between oral health and general health, as well as some of the social and economic implications of oral disease.

Figure 3: The links between oral and general health and social/economic costs of oral disease



Adapted from Australian Health Ministers' Conference, 2004.⁶

Apart from being painful, dental decay can also extend into the nerve of the tooth where it can cause dental infections such as abscesses, facial swellings and other spreading infections.¹¹ These can have serious, potentially life-threatening consequences.¹¹

Dental infections and gum diseases have also been linked to other health problems such as atherosclerosis (thickening of blood vessel walls) and heart disease.⁶ Recent research suggests that poor gum health can make it harder for patients with diabetes to keep blood sugar levels stable—through as yet, unconfirmed pathways.^{15,16} Blood chemical changes occurring in gum disease may be responsible for this phenomena.^{15,16}

2.6 Are there other ways to protect teeth?

Having healthy teeth requires a combination of a healthy diet, good oral hygiene, appropriate use of fluoridated toothpaste and regular dental checkups.¹⁷ A fluoridated drinking water supply helps provide further protection against dental decay and is a safe and effective way of allowing everybody access to the benefits of fluoride.¹⁸

2.7 Are fluoride tablets recommended by dental professionals?

Whether water is fluoridated or not, fluoride tablets are not recommended for several reasons:^{18, 19, 20}

- They are most likely to be used by the people who need them least—children with good oral hygiene and healthy diets;
- People who brush teeth regularly with fluoridated toothpaste receive little (if any) additional benefit from fluoride tablets;
- People may not remember to take them, or may take too many; and
- They increase the risk of dental fluorosis (mottled teeth), without clear benefits. Animal experiments have shown that fluoride given once a day is more likely to cause dental fluorosis than the same amount of fluoride given intermittently throughout the day.

(see section 5.2 for discussion on dental fluorosis)

3. Technical information

3.1 What is fluoride?

Fluorides are abundant in the earth's crust and are therefore found in rocks and soils.²¹ The fluoride used for fluoridating drinking water is therefore obtained from fluoride-containing rock.²¹

As fluoride is found in rocks and soils, all water sources—both fresh and sea water—contain some fluoride.²² Sea water typically contains fluoride at approximately the same level as used in community fluoridation programs.²²

Naturally-occurring fluoride concentrations in drinking water depend on the type of soil and rock through which the water drains.²¹ Concentrations in surface water are generally low (<0.1–0.5mg/L), while water from deeper wells may have quite high concentrations (1–10mg/L) if the rock formations are fluoride-rich.²¹ Some soda lakes in Africa have fluoride concentrations up to 2,800 mg/L.²²

Virtually all foodstuffs contain traces of fluoride.^{19,21} High amounts can be found in dried tea leaves, for example, because of natural concentration by the tea plant.²¹

(see section 3.5 for discussion on optimal fluoride levels)

3.2 Does fluoride have other uses?

As well as helping prevent dental decay, fluoride can form a range of compounds, which have very different actions and uses. The most significant ones are:²¹

Calcium fluoride CaF_2 —the principal fluoride-containing mineral used industrially. It is used as a flux in steel, glass and enamel production and as the raw material for the production of hydrofluoric acid and hydrogen fluoride. It is also used as a molten electrolyte for the separation of oxygen and alumina in aluminium production.

Sodium fluoride NaF —one of the compounds used in water fluoridation, it also has a number of industrial uses, including glass and enamel production.

Hydrogen fluoride HF —an important industrial compound, manufactured from calcium fluoride and used mainly in the production of synthetic cryolite, aluminium fluoride (AlF_3), motor gasoline alkylates and chlorofluorocarbons. It is also used in etching semiconductor devices, cleaning and etching glass, cleaning brick and aluminium and tanning leather, as well as in petrochemical manufacturing processes.

Fluorapatite $\text{Ca}_5(\text{PO}_4)_3\text{F}$ —an important calcium-, fluoride- and phosphate-containing mineral used as a source of phosphates in the fertilizer industry.

When rocks and soils are crushed to make fertilizer, fluoride is extracted for other uses including water fluoridation.²³

3.3 Does fluoride come from the fertiliser industry?

Fluoride is found naturally in the environment in rocks, soil, air and water.²¹

Fluorapatite is an important mineral in rock, composed of calcium, fluoride and phosphate, commonly used as source material for the fertiliser industry.²¹ When phosphate is removed from rock, an extra step in the refining process may be taken to collect fluoride.²³ During this extraction process a fluoride gas is produced.²⁴ This gas can be converted into a liquid or powder form.²⁴ A piece of equipment called a scrubber is used for this conversion process.

Scrubbers can also be used to reduce atmospheric pollution by gases, leading some people to conclude that because a scrubber is used to extract fluoride from rocks, fluoride must be a pollutant, but this is not the case.²⁵

Fluoride is not a waste product of the fertiliser manufacturing process, but rather, a co-product.²³ If fluoride is not actively collected during the refining process for water fluoridation purposes, it remains in the phosphate fertiliser.²⁴ However, due to the widespread practice of water fluoridation in Australia, fluoride is commonly extracted during the refining process.²⁴

(see sections 3.1 and 3.2 for discussion on what fluoride is and other uses of fluoride)

3.4 What type of fluoride is added to community water supplies?

The National Health and Medical Research Council (NHMRC) recommends three compounds for fluoridating drinking water: sodium fluoride (NaF); sodium fluorosilicate (Na_2SiF_6); and fluorosilicic acid (H_2SiF_6).¹ Table 1 below summarises these compounds, their chemical formulae, alternative names and physical forms.

Table 1: Fluoride compounds used in water fluoridation programs

Compound name	Chemical formula	Alternative names	Physical form
Sodium fluoride	NaF		Powder
Sodium fluorosilicate	Na_2SiF_6	Sodium hexafluorosilicate Disodium hexafluorosilicate Sodium silicofluoride	Powder
Fluorosilicic acid	H_2SiF_6	Hexafluorosilicic acid Hydrofluorosilicic acid Fluosilicic acid	Aqueous solution

Adapted from American Water Works Association, 2006.^{26, 27, 28}

These fluoride compounds are added to water supplies in a controlled manner and dissociate in water to form fluoride ions (F^-), the same way that fluoride compounds such as calcium fluoride dissolve out of rocks as a result of water passing over them.²³

To be acceptable to the NHMRC, any chemical added to drinking water must not be toxic when ingested at the recommended maximum concentration in drinking water.²⁹

The NHMRC *Australian Drinking Water Guidelines* (the 'Guidelines') provide health-based guideline values for microbial, chemical and radiological quality of drinking water.²⁹ Health-related guideline values are based on World Health Organization recommendations and are designed to protect human health.²⁹

The Guidelines are available online at

<http://www.nhmrc.gov.au/publications/synopses/eh19syn.htm>.

3.5 What is the optimal fluoride level in water fluoridation programs?

The optimal fluoride level in water fluoridation programs has been determined by the National Health and Medical Research Council and is based on average maximum daily air temperature, and assumes fluoride intake from other sources such as foods, drinks, dental products and other environmental sources.^{1, 22} For Victoria, the optimal fluoride level is 1 mg/L (also known as 1 part per million).¹ For comparison, standard fluoride toothpaste contains fluoride at a concentration of 1000 mg/L—that is, fluoride at one thousand times the level used in water fluoridation programs.

3.6 Must fluoride that is added to water be registered as a medicine?

The compounds recommended by the National Health and Medical Research Council (NHMRC) and used by water authorities throughout Australia are sodium fluoride (NaF), sodium fluorosilicate (Na₂SiF₆) and fluorosilicic acid (H₂SiF₆).¹

In Australia, the Therapeutic Goods Administration (TGA) is responsible for regulating therapeutic goods to ensure their quality, safety and efficacy.³⁰ The TGA does not require fluoride compounds (such as standard fluoride toothpaste and fluoride that is added to community drinking water supplies) to be registered as medicines if they:^{31, 32}

- are used for the prevention of dental decay; and
- are also not scheduled as a drug or poison in the *Standard for the Uniform Scheduling of Drugs and Poisons*.

In 2006, the NHMRC, Australian Government Department of Health and Ageing and New Zealand Ministry of Health included fluoride as a 'nutrient' in *Nutrient Reference Values for Australia and New Zealand including Recommended Dietary Intakes*.³³

This document states:

Because of its role in the prevention of dental caries [decay], fluoride has been classified as essential to human health.

3.7 How does fluoride help prevent dental decay?

There are three main modes of action in which fluoride acts to reduce dental decay. Each is described below, and summarised in table 2.

The first mode of action occurs when teeth are developing in the jaws before they come into the mouth (the ‘pre-eruptive phase’).¹⁰ When fluoride-containing foods/drinks are ingested, fluoride is absorbed from the gastrointestinal tract and redistributed into developing tooth structure.¹⁰ Such tooth structure is more resistant to acid attack, so when the tooth erupts into the mouth, it is better able to withstand the demineralisation that can occur when sugar-containing foods/drinks are ingested.¹⁰

The second mode of action occurs when fluoride-containing foods/drinks are ingested and fluoride is absorbed from the gastrointestinal tract and redistributed into salivary glands and then into saliva.³⁴ This fluoride-containing saliva then bathes the teeth over extended periods of time, again remineralising tooth structure which has commenced demineralisation.³⁴ This benefit also occurs topically, but does so after the fluoride has been ingested.³⁴

The third mode of action occurs when fluoride-containing foods/drinks wash over teeth during eating and drinking.¹⁰ The fluoride provides an instant benefit as it remineralises tooth structure which has commenced demineralisation.¹⁰ This is done topically.¹⁰

The second and third modes of action occur after the teeth have erupted into the mouth (the ‘post-eruptive phase’).

Table 2: Fluoride’s modes of action

Destination	Source	Main action	Pre/post eruption	Effect type
Incorporation into developing tooth structure	Absorption from gut	Structural alteration of mineral—tooth more resistant to acid attack	Pre-eruption	Structural
Redistribution into saliva	Absorption from gut	Fluoride repairs damage	Post-eruption	Topical
Washes over teeth during eating and drinking	Pre-absorption	Fluoride repairs damage	Post-eruption	Topical

Adapted from WHO, 1994 and 2002.^{19,21}

Dental decay develops when acid destroys part of the structure of the tooth.¹⁰ The acid is produced from sugar by bacteria in the mouth.¹⁰

Fluoride can limit the amount of acid produced, and can also repair damage before it becomes permanent.²³ A constant supply of a low level of fluoride in the mouth is best for this.²³ In this way, fluoride in the water supply acts like a constant ‘repair kit’ for teeth.¹⁷

3.8 Does fluoride affect the taste of water?

Optimal levels of fluoride have no taste or smell, so water fluoridation will not change the taste or smell of drinking water.³⁵

3.9 Do home water filters remove fluoride from water?

Many home water filtering systems do not significantly alter the fluoride content of the water, although reverse osmosis filters do remove most of the fluoride.²³

As the adjustment of fluoride in drinking water to around 1 mg/L is a safe and effective way to help protect teeth against decay, it is not necessary to use a water filter to remove the fluoride. It is therefore a personal choice to drink non-fluoridated water when the drinking water supply is fluoridated.

Some people choose to boil their drinking water. Boiling water will not significantly change the amount of fluoride.²³

3.10 How are fluoride levels in drinking water monitored?

Fluoride is added to the water at fluoridation plants especially designed to add carefully controlled amounts.³⁶ The fluoride levels in the water supplied to consumers are monitored every day at the plant.³⁶ Samples of water are also taken from households to check the fluoride concentration 'at the tap'.³⁶

The Victorian *Safe Drinking Water Act 2003* requires all drinking water to be safe.³⁷ Safe levels of chemicals are set out in the *Australian Drinking Water Guidelines* published by the National Health and Medical Research Council.²⁹

Safety is maintained by a risk management, multi-barrier approach.⁹ Equipment is designed to shut down if fluoride exceeds pre-determined levels at any point in the water treatment system.⁹ The Department has a *Standard for Fluoridation of Public Water Supplies* (currently being updated) which specifies requirements for water fluoridation plants to ensure the safe and effective addition of fluoride to drinking water supplies.⁹

(see section 3.4 for discussion on the *Australian Drinking Water Guidelines*)

3.11 Do fluoride compounds contain impurities?

The Victorian *Safe Drinking Water Act 2003* requires all drinking water to be safe.³⁷

Safe levels of chemicals are set out in the *Australian Drinking Water Guidelines* published by the National Health and Medical Research Council.²⁹ These guidelines stipulate the safe levels of chemicals, either naturally in or added to, drinking water.²⁹

All additives used to treat drinking water (including disinfectants, substances used to adjust pH and other products) usually contain small levels of impurities.²⁹ Drinking water additives must not contain amounts of these impurities which when added to water would result in the water not complying with *Australia Drinking Water Guidelines*.²⁹ Water authorities taking delivery of fluoride chemicals receive a Certificate of Analysis, which documents the number of chemical characteristics of the additive. Water authorities are required to ensure the amount and purity of any chemical added to drinking water (including residue and by-products) are always safe.²⁹

It is also important to note, that even water itself naturally contains dissolved or suspended impurities—hence the reliance upon the *Australia Drinking Water Guidelines*.^{29, 38}

Regarding arsenic (As) and lead (Pb) specifically:

A recent Certificate of Analysis for one of the chemicals used in water fluoridation, fluorosilicic acid (FSA), shows the following levels for arsenic and lead in the undiluted FSA:³⁹

Undiluted FSA:

Arsenic	5.2mg/L
Lead	<1mg/L

This FSA is then diluted into the water supply by approximately 6 parts per million to achieve a fluoride level of 1 mg/L.³⁹ Therefore, the levels of arsenic and lead are also diluted:

Diluted FSA:

Arsenic	0.00003mg/L
Lead	0.000006mg/L

These diluted levels of arsenic and lead are significantly lower than the levels in the *Australian Drinking Water Guidelines*.^{29, 39}

Arsenic	0.007mg/L
Lead	0.01mg/L

Therefore:

The addition of FSA contributes only trace levels of arsenic and lead to water.²⁹ The FSA contributes only 0.43% of the *Australian Drinking Water Guideline* level for arsenic and less than 0.06% of the Guideline level for lead.²⁹

4. Water fluoridation research

4.1 Has water fluoridation been properly researched?

In terms of the latest evidence about water fluoridation, the National Health and Medical Research Council (NHMRC) is Australia's peak health body for the achievement of the best possible standards for individual and public health.⁴⁰ In 2007, the NHMRC commissioned a review to evaluate scientific data on fluoridation.¹ The review affirms that water fluoridation remains the most effective and socially equitable means of achieving community wide exposure to the dental decay prevention effects of fluoride.¹

Water fluoridation has been practiced internationally for over 60 years, in Australia for over 55 years and in Victoria for over 46 years.^{3, 23} During this time, the safety and efficacy of water fluoridation has been re-evaluated many times.^{1, 18, 23, 34, 41, 42, 43, 44, 45}

(see sections 4.3 and 4.5 for discussion on scientific evidence and water fluoridation research)

4.2 Is all research the same?

The American Dental Association states the following regarding scientific research:²³

With the advent of the Information Age, a new type of 'pseudo-scientific literature' has developed. Scientific and technical information is often quoted in the press, printed in a letter to the editor or distributed via the internet. In these contexts, the information can appear as true simply because it is in print. Yet the information is not always based on research conducted according to the scientific method, and the conclusions drawn from research are not always scientifically justifiable. In the case of water fluoridation, an abundance of misinformation has been circulated. Such literature may be misleading, no matter how credible it seems. Therefore, scientific information from all print and electronic sources must be critically reviewed before conclusions can be drawn.

4.3 What is the best scientific evidence?

Because there are now many studies which have investigated water fluoridation, **systematic reviews** of the scientific literature have been conducted to collate and interpret the large amount of data on this subject.

Senior North American health researchers have discussed the usefulness of systematic reviews:⁴⁶

Systematic reviews can assist health practitioners and policy makers keep abreast of the latest health and medical research by summarising large amounts of evidence and helping to explain differences among studies on the same question. Systematic reviews are used increasingly to inform medical decision making, assist development of clinical guidelines, plan future research agendas and set policy directions. Systematic reviews may also strengthen the link between best research evidence and optimal health care.

In 2000, the United Kingdom's National Health Service Centre for Reviews and Dissemination released *A systematic review of public water fluoridation*, also known as 'The York Review.'⁴⁴

In 2007, Australia's National Health and Medical Research Council conducted a systematic review and released a public statement entitled *The Efficacy and Safety of Fluoridation 2007*.^{1, 47} The recommendation made by the NHMRC, after examining all of the studies on water fluoridation, states:⁴⁷

Fluoridation of drinking water remains the most effective and socially equitable means of achieving community wide exposure to the caries [decay] prevention effects of fluoride. It is recommended that water be fluoridated in the target range of 0.6 to 1.1mg/L, depending on climate, to balance reduction of dental caries and occurrence of dental fluorosis.

4.3 *Continued*

Leading health organisations also endorse the safety and effectiveness of water fluoridation. The Centers for Disease Control and Prevention, in the United States of America, has rated water fluoridation as one of the top ten public health achievements of the 20th Century, alongside motor vehicle safety, recognition of the dangers of tobacco and control of infectious diseases.⁴¹

In November 2006, researchers from the World Health Organization (WHO), the World Dental Federation and the International Association for Dental Research met at the Global Consultation on Oral Health Through Fluoride.⁴² The researchers stated:⁴²

Taking account of the scientific evidence, as well as several WHO World Health Assembly Resolutions and other technical reports, the experts reaffirmed the efficiency, cost-effectiveness and safety of the daily use of optimal fluoride.

In 2007, the WHO restated its support for fluoridation of drinking water in its *Global Policy for improvement of oral health*.⁴³

4.4 Does the Victorian Department of Human Services have the latest research on water fluoridation?

The Victorian Department of Human Services has a library of more than 500 water fluoridation articles. This library is updated as new studies are released—usually from peer-reviewed scientific journals. The library also contains public statements from researchers, academics, other health experts and peak health organisations, who have expertise in particular health issues and/or water fluoridation.

4.5 What research supports the benefits of water fluoridation in both children and adults?

The National Health and Medical Research Council (NHMRC) is Australia's peak health body for the achievement of the best possible standards for individual and public health.⁴⁰ In 2007, the NHMRC commissioned a review to evaluate scientific data on fluoridation and released a public statement on *The Efficacy and Safety of Fluoridation*, which reads:⁴⁷

Fluoridation of drinking water remains the most effective and socially equitable means of achieving community wide exposure to the caries [decay] prevention effects of fluoride. It is recommended that water be fluoridated in the target range of 0.6 to 1.1 mg/L, depending on climate, to balance reduction of dental caries and occurrence of dental fluorosis.

(see section 5.2 for discussion on dental fluorosis).

The Australian Research Centre for Population Oral Health, in 2008 presented study results which examined the effectiveness of water fluoridation on children's dental health across four Australian States: Queensland, Victoria, Tasmania and South Australia.⁴⁵ The study also considered a number of other factors: tooth brushing history, use of other fluoride products, water and food consumption, use of infant formula and socioeconomic status.⁴⁵ Over 16,800 children were examined including more than 4,000 Victorian children.⁴⁵ The study found:⁴⁵

- 5–6 year old children who had lived for more than half their lives in areas with optimal water fluoridation had 50 per cent less dental decay in their baby teeth than children who had lived in areas without optimal water fluoridation.
- 12–13 year old children who had lived for more than half their lives in areas with optimal water fluoridation had 38 per cent less dental decay in their adult teeth than children who had lived in areas without optimal water fluoridation.

Water fluoridation also helps protect against dental decay in adults, with studies demonstrating beneficial effects in young children and adults up to 75 years of age.^{18, 23, 41, 48, 49} The Australian Institute of Health and Welfare report, *Australia's dental*

4.5 Continued

generations: the National Survey of Adult Oral Health 2004–06, showed members of the fluoride generation (born after 1970) had about half the level of dental decay that their parents' generation had developed by the time they were young adults.¹³

In addition, adults are susceptible to dental decay in the root surfaces of their teeth, which can become exposed due to periodontal (gum) diseases.²³ Adults living in optimally-fluoridated areas have considerably less root surface dental decay than those living in areas without optimal water fluoridation.^{50, 51}

Water fluoridation gives additional protection against dental decay even if you already brush your teeth with fluoridated toothpaste.^{18, 23} Figure 4 demonstrates this point:

Figure 4: Dental decay experience in 12-year olds in Victoria and Australia, 1955–2005

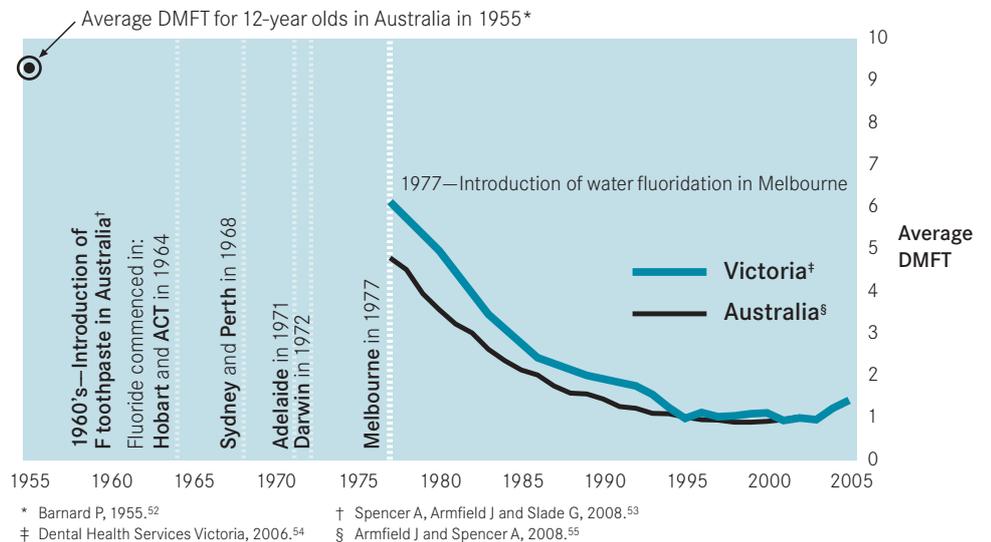


Figure 3 shows average **D**ecayed, **M**issing and **F**illed Teeth (DMFT) scores in Victorian 12-year olds when compared with the national average, following the introduction of fluoridated toothpastes and the commencement of water fluoridation in Australian capital cities. Victorian children had significantly higher average DMFT when water fluoridation commenced in Melbourne in 1977, compared to the national average.^{54, 55} Following the introduction of water fluoridation in Melbourne, the average Victorian DMFT fell to the national average by 1995.⁵⁴ Dental experts suggest the recent minor increases in dental decay across Australia are due to the same factors causing increased obesity—namely increased consumption of high sugar food and drinks.⁵⁵ (see section 2.3 for discussion on the DMFT index)

Water fluoridation is of particular benefit to communities of low socioeconomic status, which tend to have higher rates of dental decay and less access to dental treatment and other forms of fluoride exposure.^{18, 41, 56} Water fluoridation reduces the socioeconomic inequalities in dental decay experience, and remains the most socially equitable means of achieving community-wide exposure to the protective effects of fluoride.^{18, 34, 41, 47}

Water fluoridation is a good way to allow everybody in the community to have access to fluoride to help protect teeth against decay.^{1, 47, 56} One of the great advantages of water fluoridation is that it allows everybody to benefit from the protective effect of fluoride, without individuals having to make a conscious effort.¹⁸ It benefits people of all ages, regardless of education, income or access to dental care.^{18, 41, 56}

5. Health Concerns

5.1 Are there any health concerns associated with water fluoridation?

With the exception of dental fluorosis, scientific studies have not found any credible link between water fluoridation and adverse effects.^{41, 42, 43, 47} While the safety of water fluoridation has been confirmed by the World Health Organization and the National Health and Medical Research Council, some community members raise concerns about water fluoridation impacting upon general health.^{7, 8, 47} These are discussed in detail in the following sections, with reference to the findings of the systematic reviews conducted by the United Kingdom's National Health Service Centre for Reviews and Dissemination in 2000, also known as 'The York Review' and Australia's National Health and Medical Research Council in 2007.^{1, 44}

5.2 Dental fluorosis

Dental fluorosis is altered formation of tooth enamel resulting from excessive fluoride ingestion during the period of tooth development, usually from birth to approximately six to eight years of age.²¹

In its mildest (and most common) form it may manifest as barely noticeable whitish striations, while more severe forms involve confluent pitting and staining of the dental enamel.^{23, 57}

Determining the exact level of dental fluorosis within a community is difficult, as there are numerous other causes of enamel defects that may resemble dental fluorosis.^{23, 58, 59}

Points to note about dental fluorosis include:^{23, 57, 58, 59}

- It is usually barely noticeable, and appears as very fine pearly white lines or flecks on the teeth;
- It cannot develop after the teeth are fully formed;
- It also occurs in areas without water fluoridation;
- Mottled teeth should not be called dental fluorosis if fluoride is not the cause (other causes of mottled teeth include medications, injury to the teeth or childhood infections).

Since the mid 1990s, the prevalence of dental fluorosis in Australia has markedly reduced, mainly attributable to the use of low-fluoride toothpastes in young children, and awareness raising of appropriate toothpaste use by children.^{18, 60}

Reducing the risk of dental fluorosis, while at the same time reducing the risk of dental decay, can be accomplished by following these oral hygiene guidelines:⁶⁰

- discouraging ingestion of toothpaste by children
- cleaning children's teeth without toothpaste until the age of 18 months, unless otherwise recommended by a health professional
- using only a pea-size amount of low-fluoride toothpaste, smeared over the toothbrush, between 18 months and five years of age (inclusive), unless otherwise recommended by a health professional
- using fluoride mouth rinses in children six years of age and older
- spitting out and not swallowing toothpaste and not rinsing.
- ceasing the use of fluoride supplements, drops and tablets, whether the water supply is fluoridated or not (see section 2.7 for discussion on fluoride tablets).

Dental professionals will determine suitability for additional fluoride therapies.¹⁸

5.3 Allergy

The weight of scientific evidence indicates that optimal levels of fluoride in water fluoridation programs do not cause allergic reactions or allergy-like symptoms.^{1,41} Fluoride is an inevitable component of all diets due to its presence in common foods.^{21, 61} Individuals believing that allergy symptoms are related to fluoridated water are essentially claiming an effect from an incremental increase of fluoride, not its presence versus its absence.⁶²

According to medical specialists from the Department of Allergy, Immunology and Respiratory Medicine at the Alfred Hospital in Melbourne, no clinical or scientific evidence exists to confirm fluoride causes allergies or affects immunity at the optimal 1 mg/L.⁶³ Specifically, they state:⁶³

... during the last 25 years, whether in Melbourne or in the UK, we have never seen a patient with any respiratory symptoms nor any allergy-like symptoms that could be attributed to fluoride 1ppm [1mg/L] as in our fluoridated water.

5.4 Skeletal fluorosis

Skeletal fluorosis occurs in individuals with excessively high levels of fluoride exposure, and is endemic in several parts of the world including India, China, parts of the Middle East and Africa, where water supplies have fluoride levels higher than those recommended by the World Health Organization.²²

Skeletal fluorosis can also occur in workers with occupational exposure.²² It is a condition characterised by bone pain, joint stiffness and other arthritic symptoms, as a result of excessive incorporation of fluoride into bone.²²

While it is common in some developing countries, it is extremely rare in the developed world.⁴⁸

In the six-year period between 98–99 and 2004–05, only three cases of skeletal fluorosis were identified from hospital data in Australia.⁶⁴ From the Victorian Admitted Episodes Dataset for public hospitals in 2005–06, there were no cases of skeletal fluorosis out of more than 1.3 million hospital admissions.⁶⁵

5.5 Osteoporosis, arthritis and fractures

Fluoride has been used to treat osteoporosis.⁶⁶ However, studies specifically examining the effectiveness of water fluoridation on increasing bone mineral density or decreasing fractures have yielded conflicting results.³⁴

The National Health and Medical Research Council in 2007 concluded that there is no clear association between fluoridation and hip fractures or other fractures.¹

Optimal water fluoridation is safe in terms of any effect on bone mineral density and is endorsed by Osteoporosis Australia and Arthritis Australia, which states:^{67, 68}

There is no credible evidence, or even theory, to implicate water fluoridation in the cause of any type of arthritis.

5.6 Cancer

Bone cancer

There is no established link between water fluoridation and the risk of bone cancer.^{1, 44, 49}

The 2000 York Review found no clear association between water fluoridation and osteosarcoma and bone/joint cancers.⁴⁴

In 2007, the National Health and Medical Research Council (NHMRC) reviewed three new studies which had been published after the 2000 York Review.¹ One study by Takahashi et al, 2001, showed an association between bone cancer in males and water fluoridation, although the NHMRC Review stated: ‘given the low level of evidence in this study the results should be interpreted with extreme caution.’^{1, 69}

Another study by Yang et al, 2000, found no association between water fluoridation and bone cancer, although again, the level of evidence was low.⁷⁰

In April 2006, a paper by Elise Bassin et al, *Age-specific fluoride exposure in drinking water and osteosarcoma (United States)* was published in the journal *Cancer Causes Control*.⁷¹ The paper presented partial findings of a 15-year study of fluoride and osteosarcoma.⁷¹ Bassin et al concluded that their exploratory analysis found an association between osteosarcoma and fluoride in drinking water in males, but not in females.⁷¹ They also concluded that further studies were required to confirm or refute the findings.⁷¹

The senior researcher involved with the study, Professor Chester Douglass, advised readers to be cautious when interpreting the findings, noting that the full findings of the study (yet to be published) did not show an association between osteosarcoma and fluoride in drinking water.⁷² Other limitations of the study were also identified—these are summarised in the document *Osteosarcoma and fluoride* published by the Department of Human Services and The Cancer Council Victoria, available from the Department of Human Services’ water fluoridation website (details on page 35).⁷³

5.6 Continued

Other cancers

The published reviews have stated that there is no consistent evidence of an association between water fluoridation and morbidity or mortality due to cancer in general.^{1,44} The York Review concluded this after considering ten studies including separate analyses.⁴⁴

In 2007, the National Health and Medical Research Council (NHMRC) reviewed three new studies which had been published after the 2000 York Review.¹ These were ecologic studies which provide one of the weakest sources of evidence due to an inability to control for confounding factors.

One study by Yang et al (2000), demonstrated no association between water fluoridation and 11 different cancer types.⁷⁰ It did find an association between bladder cancer in women and water fluoridation, but stated:⁷⁰

...it seems implausible for fluoride to affect cancer rates for one sex only. Therefore, the possibility that this is a chance result should be considered...

A study by Takahashi et al (2001), found an association between fluoridation and increased cancer incidence in 23 of the 36 bodily sites investigated.⁶⁹ It also found decreased cancer incidence in four of the 36 bodily sites, and no association between water fluoridation and cancer incidence in nine of the 36 sites.⁶⁹

A study by Steiner (2002), found that fluoride concentration in drinking water was inversely correlated with cancer incidence—that is: the lower the fluoride, the higher the cancer incidence, yet again, the level of evidence was low.⁷⁴

The 2007 NHMRC Review concluded that the results of these three recent cancer studies should be interpreted with extreme caution or were subject to chance findings.¹

A more recent study by Stewart (2008), published after the NHMRC Review, conducted in developed countries found that there is a significant body of evidence demonstrating that the consumption of optimally fluoridated water is not associated with carcinogenic risk.⁷⁵

The Cancer Council Victoria endorses the water fluoridation program in Victoria.⁷⁶

5.7 Thyroid disease

Endocrinologists and Epidemiologists confirm there is no credible evidence of a link between water fluoridation and thyroid disease.^{77, 78} They state:⁷⁷

There is no scientifically acceptable evidence that fluoridation increases the incidence of thyroid disease.

(see also section 5.8 Iodine deficiency)

5.8 Iodine deficiency

A number of Australians are iodine deficient: a recent study reported that Australian children are mildly iodine deficient, and the authors attributed this to the phasing-out of iodophores in dairy disinfection, and a reduced use of iodised salt by the community.⁷⁹

In another paper prepared for the Australian Population Health Development Principal Committee of the Australian Health Ministers' Advisory Council, it is stated that:⁸⁰

- Median urinary iodine concentration in school-aged children suggests that, according to international criteria, Victoria, New South Wales and Tasmania (prior to implementation of the Tasmanian interim supplementation program) are areas of mild iodine deficiency.
- Western Australia and Queensland do not appear to be iodine deficient, while iodine status in South Australia is borderline.

Western Australia has a higher level of fluoridation coverage (92 per cent) compared to that in Victoria (78 per cent).¹ If water fluoridation at 1 mg/l was the cause of iodine deficiency, one would expect children in Western Australia to have greater levels of iodine deficiency than Victoria, yet this is not the case.

Due to the size of the fluoride ion, inhibition of iodide uptake by the thyroid is not significant.⁸¹ Furthermore, fluoride is not expected to interfere with the enzymes responsible for iodide uptake in the thyroid.⁸¹

It is important to note that there is a difference between the halogens—fluorine F_2 or iodine I_2 —and the halides—fluoride F^- or iodide I^- .⁸¹ The issue of halogen displacement is relevant here: If fluorine gas (F_2) were to be pumped into an aqueous iodide solution (I^-) there would be a reaction, whereby the iodide would be converted to elemental iodine (I_2), and the fluorine converted to fluoride ion—which would be in accord with halogen displacement.⁸¹ However, when the iodide ion and the fluoride ion are present together, they do not react with each other under any conditions.⁸¹

Given these findings, optimal levels of fluoride used in water fluoridation programs do not pose any health risks for patients with iodine deficiency, nor do optimal levels of fluoride cause iodine deficiency.

5.9 Brain function

Studies have examined Intelligence Quotient (IQ) scores in children exposed to significantly higher fluoride levels than those used in Australia.

The 2006 United States of America National Research Council (NRC) report *Fluoride in Drinking Water (A scientific review of the EPA's Standards)* found three studies which examined the relationship between fluoride exposure at 2–4 mg/L and potential neurological effects compared with children from regions where the fluoride exposure was 0.4–1.0mg/L.⁸² All three studies were from China.⁸²

The studies reported that while modal IQ scores were unchanged between high fluoride and low fluoride regions, the average IQ scores were lower in the high fluoride exposed group.⁸²

The NRC, noted however:⁸²

While the studies lacked sufficient detail for the research committee to fully assess their quality and their relevance to US populations, the consistency of the collective results warrant additional research on the effects of fluoride on intelligence.

At 1 mg/L fluoride exposure, the York Review found two studies (also from China) which demonstrated a benefit of fluoridation for IQ.⁴⁴ The York Review, however, stated that both studies were susceptible to confounding factors, with insufficient evidence to reach an outcome.⁴⁴

5.10 Kidney disease

Kidney Health Australia (KHA) is Australia's leading organisation promoting kidney health through research, consumer participation, education and health service excellence.⁸³

KHA recommends water as the fluid to satisfy thirst and states that no evidence exists that consumption of optimally fluoridated drinking water poses any health risk for people with chronic kidney disease, although only limited relevant studies are available.^{84, 85}

There are two significant issues for patients with chronic kidney disease—neither of which relate to water fluoridation directly:⁸⁴

- The use of very high fluoride products which are used in dental clinics—some of which contain 23,000 mg/L fluoride. In relation to this, KHA states:⁸⁴

There is limited evidence that people with stage 4 or 5 chronic kidney disease [advanced kidney disease] who ingest substances with a high concentration of fluoride may be at risk of fluorosis.'

- In the case of dialysis, fluoride concentrations in the final feed water to the dialysis machine must comply with established drinking water guidelines, and be less than 0.2mg/L.⁸⁴ The dialysis water must be deionised (free of electrically charged particles) to ensure it is able to filter the dialysis patient's blood appropriately.⁸⁴ This issue relates to all electrically charged particles, not fluoride per se.

Importantly, KHA has not called for the cessation of water fluoridation programs.⁸⁴

5.11 Can fluoride accumulate in the body after consumption?

Most ingested fluoride is absorbed into the bloodstream, predominantly from the stomach and intestine.¹⁹ Minimal absorption occurs across the oral mucosa.¹⁹ Rapid distribution to the intra- and extracellular fluid of tissues occurs, with approximately 50 per cent of absorbed fluoride excreted and the remainder stored—almost all (99 per cent) of the stored fluoride is retained in teeth and bones, where it becomes incorporated into the mineral structure.¹⁹ Fluoride is also redistributed into saliva.²¹ Elimination from the body is primarily by urinary excretion.^{19, 21}

5.12 Can you consume too much fluoride from optimally-fluoridated water?

Many substances we use every day are beneficial in small amounts, but may be harmful in large amounts—examples include salt and even water itself.²³

To help protect teeth against dental decay, only very small amounts of fluoride are needed in water.²³

The optimal fluoride level in water fluoridation programs has been determined by the National Health and Medical Research Council (NHMRC) and is based on average maximum daily air temperature.¹ In Victoria, the optimal fluoride level is 1 mg/L (also known as 1 part per million).¹

This optimal level has been determined assuming fluoride intake from other sources such as foods, drinks, dental products and other environmental sources.²²

The NHMRC *Nutrient Reference Values for Australia and New Zealand (2006)*, identifies 10 litres/day as the upper limit for consumption of fluoridated water for an average sized adult over the long term.³³

While some population subgroups, such as athletes, outdoor workers and military personnel, may approach this level of consumption occasionally, it is highly unlikely that these levels of consumption would occur over the long term to put an individual at risk.⁸² The National Research Council (United States) has noted that the highest estimated average daily water ingestion, at the 99th percentile, is 5.8 litres/day.⁸²

5.13 Is it safe to reconstitute infant formula with fluoridated water?

Breastfeeding remains the preferred method of infant feeding and provides perfect nutrition to match an infant's needs.⁸⁶ Although breast milk is the best feeding choice for babies, infant formula is readily available and nutritionally adequate.⁸⁷ If infant formula is used, it is safe in Australia to reconstitute it using fluoridated water.¹⁸

In 2006, the Australian Research Centre for Population Oral Health published *The Use of Fluorides in Australia: guidelines*.¹⁸ These were developed by 35 experts from universities, health departments and health organisations.¹⁸ Guideline six states:¹⁸

Infant formula nowadays is safe for consumption by infants when reconstituted using fluoridated or non-fluoridated water.

On 8 November 2006, the American Dental Association issued interim advice based on a report from the United States of America National Research Council: *Fluoride in Drinking Water (A scientific review of the EPA's Standards)*.^{82, 88} This interim advice recommended that if infant formula was the predominant food source for infants, it should be reconstituted with non-fluoridated water, to minimise the risk of dental fluorosis.⁸⁸

It is important to note, however, that:^{82, 89}

- The US documents were written for a US audience: there are some water supplies in the US with naturally high levels of fluoride in the water (two to four times higher than recommended by the World Health Organization and practised across Australia).
- There are no low-fluoride children's toothpastes on the US market, unlike in Australia.

Following the American Dental Association interim advice, the US Centers for Disease Control advised that in the US reconstituting infant formula with water that is not optimally fluoridated should be weighed up with the increased risk of developing dental decay.^{88, 90}

Infant formulas sold in Australia generally have very low amounts of fluoride.¹⁸

Food Standards Australia New Zealand is an independent statutory authority that develops food standards to protect the health and safety of the public.⁹¹ Standard 2.9.1 of the *Australia New Zealand Food Standards Code* relates to infant formula products, and clause 19 refers specifically to dental fluorosis.⁹²

It states that infant formula containing more than 17 µg (micrograms) of fluoride per 100 kJ (kilojoules) powder prior to reconstitution must include a warning about dental fluorosis on the label.⁹² This figure assumed that fluoridated water was used to reconstitute infant formula.⁹²

5.14 Is it safe to drink fluoridated water while pregnant or breastfeeding?

It is safe to drink optimally-fluoridated water while pregnant or breastfeeding. No credible scientific study has linked drinking optimally-fluoridated water with birth defects or other reproductive effects.^{1, 21, 44, 49, 93}

Breast milk naturally contains about 5 to 10 µg (micrograms) of fluoride per litre of milk (optimally-fluoridated water contains 1000 micrograms per litre).²¹ The level of fluoride in breast milk remains steady when a nursing mother drinks fluoridated water.⁹⁴ Until six months of age babies only need breast milk or infant formula to grow and develop.⁹⁵ (see section 5.13 for discussion on reconstituting infant formula with fluoridated water)

6. Fluoride and the environment

6.1 Does water fluoridation pollute the environment?

Fluoride is naturally found in the environment in water, soil, rocks and air.²¹ The amount of fluoride naturally found in rocks and soil is about 300 to 700 times higher than fluoridated water.²¹

Fresh-water streams have natural levels of fluoride as a result of fluoride being leached from rocks.²¹ Five Victorian towns—Portland, Nhill, Port Fairy, Barnawartha and Kaniva—have naturally-occurring optimal amounts of fluoride in their water supplies.⁹⁶

The New Zealand Public Health Commission, in 1994 released a document *Water fluoridation in New Zealand*.⁹⁷ In this report, the impact of artificially fluoridated water upon the environment was examined.⁹⁷ The study found that:

Given the distribution of fluoride in most ecosystems, it would seem very unlikely that any hazard to the environment exists at a water fluoridation level of 1ppm [1 mg/L].

The introduction of water fluoridation does not impact on the ability of organic producers to obtain or retain organic certification for their produce.⁹⁸ The Australian Organic Standards Committee of Biological Farmers of Australia has a water policy which states that potable water is acceptable for use within organic production and processing systems.⁹⁸ This may include added substances such as fluoride.⁹⁸

Some residents in Queensland have expressed concern about water fluoridation having a negative impact upon the Great Barrier Reef.⁹⁹ Prof Russell Reichelt from the Great Barrier Reef Marine Park Authority responded:⁹⁹

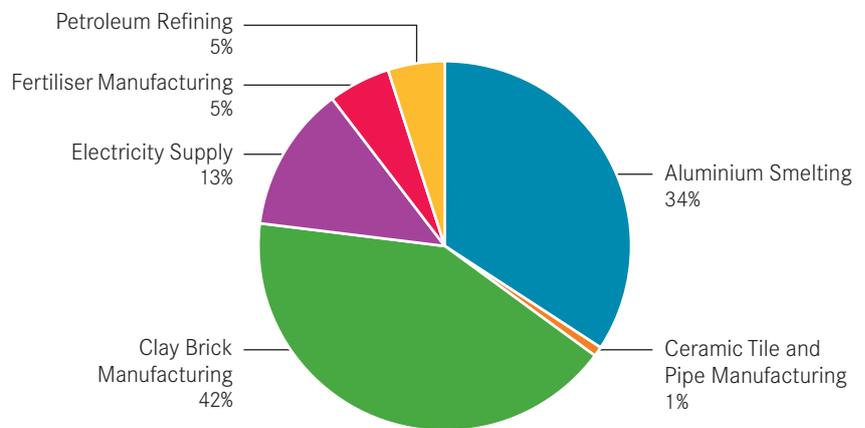
The levels [in seawater] are similar or even higher than is found in treated drinking water. In any case, the water from urban use entering the ocean is relatively very small and rapidly diluted by the ocean water.

6.2 Are air-borne fluoride emissions considered in water fluoridation policy?

The optimal fluoride level in water fluoridation programs has been determined by the National Health and Medical Research Council and is based on average maximum daily air temperature.¹ For Victoria, the optimal fluoride level is 1 mg/L (also known as 1 part per million).¹ This level has been determined assuming fluoride intake from other sources such as foods, drinks, dental products and other environmental sources.²²

The National Pollutant Inventory (NPI) provides information on the major emitters of fluoride in Victoria.¹⁰⁰ The following graph is based on NPI data for the 2005–06 NPI reporting year.¹⁰⁰

Figure 5: Fluoride emissions to air in Victoria 2005–06



Adapted from the Department of the Environment, Water, Heritage and the Arts (formerly the Department of the Environment and Water Resources), 2007.¹⁰⁰

The main sources of fluoride emissions are clay brick manufacturing, aluminium smelting and electricity production.¹⁰⁰

Environment Protection Authority (EPA) Victoria administers the *State Environment Protection Policy (Air Quality Management) 2001*, the framework for managing emissions to the air environment.¹⁰¹ This policy framework contains criteria that are applied in the design phase of an industrial facility to ensure that air emissions do not impact on the environment or human health.¹⁰¹

Vegetation and grazing animals are more sensitive to fluoride exposure than humans.^{102, 103, 104, 105, 106} Limits on industrial fluoride emissions are therefore set to protect vegetation and grazing animals.¹⁰¹ Meeting these limits also means that human health is protected.¹⁰¹

Fluoride is monitored by a number of industrial facilities in Victoria. Each facility has an EPA Licence outlining emission limits for fluoride. These limits are set to ensure that the design criteria are met where people may be exposed. Fluoride is measured inside the facility's emission points (or stacks) and reported annually to EPA Victoria.

7. Fluoride around the world

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- 7.1 What other countries fluoridate drinking water?** More than 400 million people around the world benefit from water fluoridation programs—at least 350 million as part of community water fluoridation and at least 50 million as part of naturally optimally-fluoridated water.⁴⁸ Countries with widespread water fluoridation schemes include New Zealand, the United States of America, Canada, the United Kingdom, Ireland, Spain, Israel, Brazil, Chile, Argentina, Columbia, Hong Kong, South Korea, Singapore and Malaysia.⁴⁸
-
- 7.2 Does the United States fluoridate drinking water?** The United States was the first country to introduce water fluoridation in 1945.¹⁰⁷ In 2006, 69.2 per cent of the U.S. population served by community water systems received optimally fluoridated water—an increase from 62.1 per cent in 1992 and from 65.0 per cent in 2000.¹⁰⁸ Overall, approximately 184 million people served by community water systems receive fluoridated water; of that number, approximately 8 million people received water with sufficient naturally-occurring fluoride concentrations.¹⁰⁸ 46 of the 50 largest US cities are fluoridated.¹⁰⁸
- In September 2007, water fluoridation was extended to an additional 18 million people in southern California.¹⁰⁹ The US continues to extend fluoridation and in recent years fluoridation schemes have been introduced for several million more US citizens in major cities including San Antonio, Los Angeles and Las Vegas.¹¹⁰
-
- 7.3 Does the United Kingdom fluoridate drinking water?** In the United Kingdom, ten per cent of the population—approximately 6 million people—have fluoridated water, with almost all of these living in England.⁴⁸ In February 2008, England’s Department of Health provided £42 million to increase water fluoridation coverage from the current ten per cent to approximately 30 per cent of England’s population.^{111, 112}
-
- 7.4 What other kinds of fluoridation schemes exist?** Many European countries, including Switzerland, France, Austria, Germany, Hungary, Slovakia and Belarus, use fluoridated salt widely.⁴⁸ In many parts of Central and South America the use of fluoridated salt is also widespread.⁴⁸
- Milk fluoridation schemes exist in several countries, including Chile, China, Peru, Thailand and the United Kingdom.^{1, 23}
-
- 7.5 Has water fluoridation been banned in Europe?** Europe has not banned water fluoridation.⁴⁸ There has been no directive or legislation banning water fluoridation.⁴⁸ In some European countries, water fluoridation is not practical because of very complex water systems without a single central point to add fluoride.⁴⁸ Some fluoride plants in Eastern and Central Europe were not given adequate attention during the political turmoil in the late 1980s, and closed through neglect.⁴⁸
- Sometimes fluoride is added to salt (which is then used in numerous products such as bread) or milk, to ensure that the community can still benefit from fluoride.⁴⁸
- Some European countries have ceased water fluoridation against Health Department advice.⁴⁸
-

7.6 Why was water fluoridation stopped in Basle, Switzerland?

Water fluoridation was introduced to the Swiss Canton of Basle in 1962 and was successfully maintained for 41 years.⁴⁸ It was eventually ceased in view of widespread salt fluoridation in Switzerland.⁴⁸

Having fluoridated salt and fluoridated water in different parts of Switzerland was not seen as a problem until new federal laws were passed in 1995 which removed the restriction on the sale of fluoridated salt in the Canton of Basle.¹¹³ This meant that residents of Basle were then receiving fluoride from both salt and water, and it was decided to stop the water fluoridation program despite its many advantages.¹¹³ It appears that there was also considerable political pressure from the water company of Basle, who wanted to sell surplus water to surrounding communities but could not do so while it was fluoridated due to the existence of salt fluoridation in surrounding areas.¹¹⁴

The success of the Basle water fluoridation program was repeatedly confirmed by surveys published in scientific journals.¹¹³ Despite this, opponents regularly challenged the water fluoridation policy of Basle during the 41 year period it was in place.¹¹³ Researchers investigating the case have stated:¹¹³

The allegations used as arguments against it were all regarded as unfounded by Cantonal Parliament, and this opinion was upheld in the official document leading to the cessation of water fluoridation. The document also re-stated that the Swiss Federal Court had decided that water fluoridation was constitutional, that it had been introduced through correct legal procedure, that it was in the public interest, and that personal freedom was limited only marginally.

Concern has also been expressed about the potential consequences of the loss of water fluoridation, particularly regarding the dental health of particular subgroups within the community.¹¹³

8. Ethics

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- 8.1 Why doesn't the Department of Human Services participate in debates about water fluoridation?**
- The Department of Human Services, along with key partners, including the Australian Dental Association and Dental Health Services Victoria, are unanimously of the view that public debates about water fluoridation, including debates about the relative scientific merits of particular pieces of research, provide little or no value to members of the public with a genuine interest in learning more about water fluoridation. The Department does, however, conduct community information sessions to provide members of the public with opportunities to ask questions about water fluoridation.
-
- 8.2 Why don't the public get to vote on water fluoridation?**
- In Australia, public health initiatives are generally not put to a public vote. For example, seatbelt, tobacco and drink driving legislation have not been voted upon by the general public.
- The Victorian Government is committed to improving the oral health of all Victorians, particularly those most in need.⁷ The extension of water fluoridation to those areas of rural and regional Victoria currently without this important public health measure is an essential component of this commitment.⁷
-
- 8.3 Shouldn't water fluoridation be an individual choice?**
- Governments and health professionals have a responsibility to make decisions that balance the best possible community health outcomes with individual choices. In 2004, all Australian Health Ministers endorsed water fluoridation as a national oral health initiative—a key action in *Healthy Mouths Healthy Lives: Australia's National Oral Health Plan 2004–2013*.⁶
- Preventing problems before they occur is vital to good health. Adding fluoride to water to prevent dental decay can be compared to current practices of adding Vitamin D to margarine to maintain healthy bones, folic acid to breakfast cereals to reduce the risk of babies being born with neural tube defects or iodine into salt for thyroid health, and public health measures such as smoking restrictions, compulsory seat belts and immunisation.
- (see section 1.3 for discussion on Australia's National Oral Health Plan and section 8.6 for discussion on the Victorian *Charter of Human Rights and Responsibilities*)
-
- 8.4 Is water fluoridation mass medication?**
- Fluoridation is not mass medication as it is not a drug or medicine.³¹ It is an element that occurs naturally in water supplies—from very small amounts to levels far above those used in water fluoridation programs.²²
- In Australia, the Therapeutic Goods Administration does not require fluoride compounds (such as standard fluoride toothpaste and fluoride that is added to community drinking water supplies) to be registered as medicines if they:^{31, 32}
- are used for the prevention of dental decay; and
 - are also not scheduled as a drug or poison in the *Standard for the Uniform Scheduling of Drugs and Poisons*.
- In 2006, the National Health and Medical Research Council, Australian Government Department of Health and Ageing and New Zealand Ministry of Health included fluoride as a 'nutrient' in the *Nutrient Reference Values for Australia and New Zealand including Recommended Dietary Intakes*.³³
-

8.5 Is water fluoridation unconstitutional?

The Australian Constitution gives the Australian Government the power to legislate for medical and dental services.¹¹⁵ It does not preclude a State government from passing legislation to protect and enhance public health.¹¹⁵ The restriction placed on the Commonwealth so that it cannot legislate in a way that authorises civil conscription (section 51 xxiiiA) is in recognition of the importance of the right to professional independence of health practitioners and the right to exercise choice in doctor-patient relations.¹¹⁵ This does not relate to, nor restrict, the capacity of the Victorian Government to make laws which ensure that all Victorians have access to the best standards of community health, by way of water fluoridation.¹¹⁵

8.6 Is water fluoridation consistent with the Victorian *Charter of Human Rights and Responsibilities*?

The Victorian *Charter of Human Rights and Responsibilities* is a law that protects the human rights of all people in Victoria.¹¹⁶ It commenced on 1 January 2007.¹¹⁶ The rights in the charter may be subject to reasonable limitation.¹¹⁶ Reasonable limitation involves balancing the rights of the individual with the need for government to protect the broader public interest, such as public safety, health and order.¹¹⁶ Because of the public health importance of water fluoridation in reducing dental decay, the practice of fluoridating drinking water supplies is consistent with the Charter.¹¹⁷

8.7 Is water fluoridation protected by law?

The effect of section 4 of the *Health (Fluoridation) Act* 1973, is that a person does not have any right of legal action against:⁸

- a water supply authority;
- a member of a water supply authority;
- a person acting under the direction of a water supply authority; or
- a person acting on behalf of a water supply authority under a contract made between that authority and the person, in respect of anything done in regard to the fluoridation of a public water supply that is in accordance with the Act. The Act further provides that the Supreme Court of Victoria does not have the power to consider an action of this kind.

Section 4 of the Act was amended by the *Health and Community Services (Further Amendment) Act* 1993.¹¹⁸ The then Minister for Health explained in Parliament the rationale for placing this restriction on the jurisdiction of the Supreme Court:¹¹⁸

Fluoridation of the public water supply is so important in the interests of public health that bodies performing this function in accordance with the Health (Fluoridation) Act 1973 should not be prevented from doing so by actions before the court.

8.8 Is water fluoridation ethical?

According to Professor John Harris, from the Centre for Social Ethics and Policy, University of Manchester:¹¹⁹

In considering the ethics of fluoridation...we should ask not are we entitled to impose fluoridation on unwilling people, but are the unwilling people entitled to impose the risks, damage and costs of failure to fluoridate on the community at large.

9. Costs

9.1 Is water fluoridation cost effective?

The amount of fluoridated water used for drinking is enough to reduce dental decay in the community.^{1, 18} The World Health Organization concludes that water fluoridation is a safe and cost-effective way to prevent dental decay.^{42, 43} A study assessing the cost savings resulting from water fluoridation found that the reduction in costs of restorative treatment due to averted dental decay exceeded the cost of water fluoridation in communities of any size.¹²⁰ Likewise, another study concluded that fluoridation is highly cost-effective, especially for communities with high proportions of children, indigenous people or people of low socioeconomic status.¹²¹

An economic study conducted in 2003 found that in the 25 year period following its introduction, water fluoridation had saved the Victorian community about \$1 billion through avoided dental costs through avoided dental costs, days away from work/school and associated costs.¹²²

9.2 Is water fluoridation done just to save money on dental treatment, without any consideration for the wellbeing of people?

Water fluoridation is not done for commercial gain, but rather to improve the health of the community.^{1, 18, 23} People of all ages benefit by having less dental decay and its complications.^{1, 18, 23} This reduces pain and suffering, and results in less time spent away from school and work.¹²² It also saves money for individuals, families and the community.¹²²

9.3 Why isn't money directed toward addressing causes of poor dental health such as poor diet and oral hygiene?

Dental decay has a significant impact on health and wellbeing, and results in high personal and community costs.^{6, 122} It is largely preventable, and therefore there is high priority on oral health promotion within Victoria.⁷ Water fluoridation is one of many ways to prevent dental decay.¹⁷

Other ways supported within Victoria include:

- Improving access to dental care;
- Promoting healthy food and water policies in children's services and schools
- Increasing awareness about the importance of tooth brushing, appropriate use of fluoridated toothpaste and regular dental check-ups.

In May 2004 the Victorian Government increased public dental funding by a record \$97.2 million, over a four-year period, to reduce waiting lists and improve access to dental care.

The Victorian Government also funds a number of programs which focus on healthy eating. The Smiles 4 Miles program introduces water policies into kindergartens, child care centres, day care and schools, which aims to limit sugary drinks and encourage children to drink plenty of tap water—most children only require plain water to satisfy thirst.¹²³

Other initiatives which focus on healthy diet, such as the Kids Go For Your Life! campaign, have also been funded.¹²⁴ Recently, it was announced that chocolates, confectionary and other sugar-rich foods would no longer be sold from Victorian Government School canteens from 2009.¹²⁵

Oral hygiene instruction is just one of the preventive dentistry items funded by the Government in all Victorian public dental clinics.

Fluoridation is just one element of the Government's commitment to improving Victoria's oral health, with \$16.7 million being allocated to extending water fluoridation to communities in regional and rural Victoria since 2004.

9.4 If water fluoridation is effective, why are we still training so many dentists?

Water fluoridation helps protect teeth against decay.^{1, 18} No single measure can fully protect against dental decay, so even if the water is fluoridated people still need to look after teeth through regular brushing, appropriate use of fluoridated toothpaste, healthy diet and regular dental check-ups.¹⁷ Also, there are many reasons other than dental decay why people need to see a dental professional including routine check-ups, gum disease, repair of broken fillings and dentures and treatment of trauma. Furthermore, older people are retaining more teeth than in previous decades which means dental professionals are required to help care for these teeth.^{23, 41, 48}

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Further information

On the web

Department of Human Services

www.health.vic.gov.au/environment/fluoridation

www.health.vic.gov.au/dentistry/

National Health and Medical Research Council

www.nhmrc.gov.au

Australian Dental Association

www.ada.org.au

Dental Health Services Victoria

www.dhsv.org.au

Better Health Channel

www.betterhealth.vic.gov.au

World Health Organization

www.who.int/water_sanitation_health/oralhealth

American Dental Association (includes a 56-page booklet Fluoridation Facts)

www.ada.org/public/topics/fluoride/facts/

British Fluoridation Society

www.bfsweb.org

Telephone

Water fluoridation information line, Department of Human Services

Tel: 1800 651 723

Endorsing organisations

The following organisations endorse the fluoridation of drinking water supplies:

- The World Health Organization^{42, 43}
- Australia's National Health and Medical Research Council⁴⁷
- The Australian Dental Association¹²⁶
- The Australian Medical Association (Victorian Branch)¹²⁷
- The Public Health Association of Australia¹²⁸
- The Australian Academy of Science¹²⁹
- General Practice Victoria¹³⁰
- The Pharmacy Guild of Australia (Victorian Branch)¹³¹
- The Australian Centre for Human Health Risk Assessment¹³²
- Osteoporosis Australia⁶⁷
- Arthritis Australia⁶⁸
- The Cancer Council Victoria⁷⁶
- VicHealth¹³³
- Dental Health Services Victoria¹³⁴
- The Victorian Dental & Oral Health Therapist Association¹³⁵
- Melbourne Dental School at The University of Melbourne¹³⁶
- La Trobe University School of Dentistry and Oral Health¹³⁷
- The Royal Children's Hospital Department of Dentistry¹³⁸

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