

**LEGISLATIVE ASSEMBLY FOR THE AUSTRALIAN CAPITAL TERRITORY**

**STANDING COMMITTEE ON  
SOCIAL POLICY**

**INQUIRY INTO WATER  
FLUORIDATION IN THE ACT**

**JANUARY 1991**



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## **PREFACE**

I thank my colleagues on the Committee for their dedication over a long period as we examined this matter. It has not been easy for there are strongly held views within the Committee as there are in the community.

Our major difficulty has been to separate fact from fiction. Indeed I sometimes wondered if fluoridation was being made the scapegoat for every ill, real or imagined.

Throughout the report we have sought to cite only those scientific and research references which we believe to be valid, except Chapter 6, which allowed an extensive review of the range of views opposed to fluoridation.

Great reliance has to be placed on the interim report of the Working Group on the Effectiveness of Water Fluoridation of Australia's premier scientific body, the National Health and Medical Research Council which rejected recent arguments questioning the value and safety of fluoridation.

Those who quote this report, or seek to use it as evidence one way or another, should note that the recommendation for a level of 0.5 ppm is based predominantly on the ground that with fluoride provided to ACT residents from more sources than in 1964, it simply may not be necessary to retain the former level to achieve the desired beneficial result on children's teeth.

I thank Dr Ann Scott and Ms Judith Henderson for their outstanding work and assistance to the Committee in the preparation on this report.

Bill Wood  
Presiding Member  
29 January 1991.



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## **PART I**

### **1 ESTABLISHMENT OF THE INQUIRY INTO WATER FLUORIDATION IN THE ACT**

1.1 The Standing Committee on Social Policy was created by the ACT Legislative Assembly on 23 August 1989.

1.2 On Wednesday 27 September 1989, the ACT Legislative Assembly passed the **Electricity and Water (Amendment) Act (No 2) 1989**, which banned the fluoridation of the ACT water supply for six years, to be followed by a referendum.

1.3 On Thursday 28 September 1989 the Legislative Assembly referred an inquiry into water fluoridation in the ACT to the Standing Committee on Social Policy, asking that:

- (1) the matter of fluoride in relation to public health be immediately referred to the Standing Committee on Social Policy;
- (2) the committee be asked to seek professional, technical and scientific advice on several matters including:
  - (a) the effect of fluoride on public health;
  - (b) the issue of mass medication and civil liberties; and
  - (c) other matters relating to the issue of fluoridation in the ACT which the committee considers should be drawn to the attention of the Assembly.

1.4 On Monday 9 October the ACT Electricity and Water Authority ceased adding fluoride to the ACT water supply, which supplies the ACT and the City of Queanbeyan.

1.5 On 18 October 1989 the Legislative Assembly passed a second bill, the **Water Supply (Chemical Treatment) Act 1989**, which permitted the continuation of water fluoridation in the ACT until 30 June 1990. It was also established that 31 May 1990 was the date by which the Social Policy Committee should table its report.

1.6 On 3 May 1990 a motion to postpone the reporting date to 29 November 1990 was passed by the Legislative Assembly. The purpose of this delay was to enable the Committee to take account of the findings of the National Health and Medical Research Council's Working Group on the Effectiveness of Water Fluoridation.

1.7 At the time of moving the motion, the Presiding Member of the Social Policy Committee, Mr Bill Wood, tabled a letter to the National Health and Medical Research Council seeking information on the Working Group's proposed reporting date.

1.8 On 6 June 1990 the Legislative Assembly passed the **Water Supply (Chemical Treatment ) (Amendment ) Act 1990** which extended the continuation of water fluoridation until 28 February 1991.

1.9 On 29 November 1990 a further motion postponing the reporting date to the first sitting day of 1991 was moved. The motion was passed with amendment by the ACT Legislative Assembly. The amendment stated:

and if the Standing Committee on Social Policy is unable to present a report by this date then the Committee be required to present a range of options for consideration by the Assembly to resolve these issues<sup>1</sup>.

1.10 In November 1990, the National Health and Medical Research Council Working Group issued an interim report. This interim report indicated that the full draft report was still being finalised and that it was planned that it would be completed and submitted to the Health Care Committee of the Council within three months.

1.11 The Social Policy Committee finalised its own report taking account of the Working Party's interim conclusions and recommendations.

1.12 The Committee acknowledges that as it is now 25 years since fluoride was added to Canberra's water supply it is an appropriate time to assess its efficacy and safety.

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<sup>1</sup> Legislative Assembly for the Australian Capital Territory **Minutes of Proceedings** No 88 item 20.

## **2 METHOD OF INQUIRY**

2.1 The Committee advertised the inquiry in both the local and national press in late October and early November 1989. The advertisement called for submissions to be received by 28 February 1990. As a result of the extension of the reporting date submissions were accepted until November 1990.

2.2 The Committee thanks all those who made submissions and gave evidence.

2.3 Appendix 1 lists all those who made submissions to the inquiry. The Committee received submissions from 160 individuals and organisations.

2.4 In addition, the Committee wrote to all embassies and high commissions in Canberra asking for information about water fluoridation policies in the countries concerned and seeking any other information which might assist it in its inquiry.

2.5 In response to this request, information was received from the following embassies:

- Chile
- Czechoslovak Socialist Republic
- Federal Republic of Germany
- Finland
- Greece
- Ireland
- Islamic Republic of Iran
- Italy
- Lebanon
- Norway
- Portugal
- Republic of Chile
- Republic of Korea
- South Africa
- Sweden
- Switzerland
- The Netherlands
- Turkey
- Union of Soviet Socialist Republics
- United States

2.6 Information was also received from the following high commissions:

- Britain
- Canada
- Malaysia
- Pakistan
- Republic of Cyprus
- Republic of Malta
- Singapore

2.7 The Committee is most grateful for assistance it received from the embassies and high commissions.

2.8 The Committee visited the Googong Water Treatment Plant and Pumping Station, one of the two points from which fluoride is added to the ACT water supply.

2.9 The Committee held a number of public hearings. A list of those who gave evidence is at Appendix 2.

2.10 The Committee also travelled to Brisbane and the Gold Coast to hold discussions with state and local government organisations and individuals.

## **GLOSSARY**

2.11 This report uses some abbreviations common to the fluoride debate:

ppm = parts per million

DMFT = decayed, missing or filled permanent teeth

dmft = decayed, missing or filled deciduous teeth

2.12 The terms "anti-fluoridationist" and "pro-fluoridationist" are used in this report to refer in general to those who either oppose or favour the fluoridation of public water supplies. No judgement or criticism is intended or applied in the use of these terms.

### **3 THE HISTORY OF THE WATER FLUORIDATION DEBATE**

#### **Introduction**

3.1 The debate over the fluoridation of public water supplies has a long history. It has, from the start, been characterised by a polarisation of views and mutual suspicion between the opponents and proponents of water fluoridation.

3.2 In February 1990 an article in *Newsweek* on the current debate in the United States concluded:

No-one can foresee how the fluoride debate will play out this time. But since the 1950s, the country's consciousness has been heightened. In the end, deciding whether or not to fluoridate turns less on science than on values. The sheer weight of good research may finally, after four decades, begin to inform those judgments and even overwhelm the unscientific rhetoric that has characterised both sides of the debate for far too long.<sup>1</sup>

3.3 In August 1986 an article in the *Atlantic Monthly*, again referring to the debate in the United States, concluded with the words:

Opinion on the issue of fluoridation is so thoroughly polarized that, as one social scientist has put it, 'only people with iron wills and blinders are willing to get involved'. Debates almost always end in deadlock. Proponents argue that fluoridation is a safe, effective way to protect Americans from costly and painful tooth decay. Opponents counter that fluoride has never been proved safe and that tests showing its effectiveness are inconclusive and biased. Proponents say that fluoridation is the only way to protect the teeth of people too poor to seek dental care. Opponents say that fluoridation interferes with their right to choose their own and their children's medications. No new epidemiologic or laboratory study seems to change the position of either side. This is because the fluoride debate was ushered out of the scientific and into the political arena more than thirty years ago, and it shows no signs of retracing its steps.<sup>2</sup>

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<sup>1</sup> Begley, S, "Don't Drink the Water?", *Newsweek*, 20.2.90, p 65.

<sup>2</sup> Shell, E O, "An Endless Debate", *Atlantic Monthly*, August 1986, p 31.

3.4 The **Journal of the American Dental Association**, a strong advocate of water fluoridation describes the tone of the early debates on fluoride in its criticism of the opposition:

Back in the late '40s and early '50s, everyone was worried about Communist plots, Communist infiltration of the government, and Communists under the bed. It was near hysteria for a while. And while people make jokes of it now, back then it was charged that fluoridation was a Communist plot to poison the American people. But at the same time it was just as real a scare as today when we have anti-fluoridationists charging that fluoridation causes AIDS, Alzheimer's disease, and cancer. Fluoridation gets tagged with whatever comes along.<sup>3</sup>

3.5 While the anti-fluoride case may sometimes have been characterised by far-fetched claims and deep suspicion of what has been seen as a conspiracy on the part of pro-fluoridation lobby, there are undoubtedly reasonable, valid arguments on both sides. Indeed, there has been a tendency for both sides to ignore or discredit the arguments of the other.

The political role of dentists has been emphasized throughout the history of fluoridation. In 1970, even after 25 years of fluoridation, John W Knutson, then professor at the University of California Medical Center, advised dentists that when they discussed fluoridation with the public, they must realize that "they are propagandizing, not simply educating". This attitude, widely shared by political proponents, led early advocates to treat fluoridation campaigns as debates to be won with dogmatic assertions and attacks on the credibility of the opposition. To promoters, the debate has never been seen as a scientific search for truth.

As a result, profluoridationists prepare booklets for the public that contain highly biased information. If scientific studies are cited, only those that support their side of the argument are mentioned. Those opposed to fluoridation counter with equally biased propaganda.<sup>4</sup>

3.6 Given the strength of feeling on both sides of the debate, it was with some trepidation that the Social Policy Committee approached this inquiry. However, as a cross-party committee it embarked on its examination of water fluoridation with great concern to make recommendations which were in the best interest of the ACT community.

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<sup>3</sup> **Journal of the American Dental Association**, vol 118, May 1989, p 529.

<sup>4</sup> Hileman, B, **Fluoridation of Water: Questions about health risks and benefits remain after more than 40 years**, Chemical and Engineering News, 1 August 1988, p 27.

## **History of water fluoridation in the United States**

3.7 There are numerous sources which describe the genesis and history of water fluoridation. It was in the United States of America that the possible causal relationship between fluoride levels in water supplies and the condition of teeth first emerged. In 1901, Dr Frederick McKay, a dentist who had recently moved to the area, observed an unusual brown stain on the teeth of inhabitants of Colorado Springs. He became sufficiently interested to investigate the phenomenon, which he discovered was not restricted to Colorado Springs but appeared in different communities dispersed around the United States. He became convinced that the stain was related to the source of drinking water.

3.8 He believed he had proved this connection in 1923. In 1908, residents of Oakley, Indiana, had built a pipeline to a spring about five miles away:

In time they began to notice brown stains on their children's teeth, while those who grew up there before 1908 and others in nearby towns showed no such discolouration.<sup>5</sup>

3.9 The connection with the level of fluoride in the water supply was made by chemists for the Aluminium Company of America (ALCOA) who analysed the drinking water of a company town, Bauxite, where residents' teeth tended to have the brown stain. They discovered that:

The water contained high trace elements of fluorine, a gaseous element that exists only when it's joined with another element and becomes a fluoride compound.

Fluorine is found in rocks, soil, and sand worldwide. But most of the conventional water analysis methods of the day failed to detect it.

Dr McKay arranged to have water samples from other towns where stained teeth were common sent to ALCOA's lab. Chemists saw that the samples from the communities contained levels of fluoride that ranged from 2 to 13 parts per million. And they concluded that fluoride had caused the stain.<sup>6</sup>

3.10 In the 1930s, the US Public Health Service investigated ways to help eliminate the brown stain. In the course of this investigation, one of the dental officers involved discovered that there was a correlation between instances of fewer caries among children and fluoridated drinking water. It was felt safe to establish that a fluoride concentration level of one part fluoride per million (ppm) of water helped prevent caries and at the same time held no threat of staining teeth.<sup>7</sup>

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<sup>5</sup> **Journal of the American Dental Association**, vol 118, May 1989, p 530.

<sup>6</sup> **Journal of the American Dental Association**, vol 118, May 1989, p 532.

<sup>7</sup> **Journal of the American Dental Association**, vol 118, May 1989, p 532.

3.11 During World War II, the United States government noted that the major cause of rejection for military service was missing teeth. This observation provided the impetus for President Truman to create the National Institute of Dental Research (NIDR) in 1948. The legislation establishing NIDR contained the mandate to conduct research and research training to improve oral health. NIDR's early research focused on eliminating dental caries. The research confirmed to NIDR scientists that fluoride was safe and effective in preventing tooth decay. This led to the United States embarking on a program to fluoridate community water supplies.<sup>8</sup>

3.12 The first addition of fluoride to a community water supply occurred slightly earlier, in Grand Rapids, Missouri. It has been claimed that since that time the steady growth of evidence drawn from surveys and other research has:

yielded unarguable conclusions on fluoride's benefits to oral health. Today, it is one of the country's most heralded public health measures. By 1988, 41 of the 50 largest cities in the United States were served by fluoridated water systems.<sup>9</sup>

3.13 Despite this apparent success, water fluoridation remains a subject of controversy. There are three primary areas of conflict. These relate to safety, efficacy and ethics. These controversies will be examined later in this report.

3.14 Both the proponents of fluoridation of public water supplies and its opponents often have fallen back on what could appear to be irrational arguments. However, the debate is certainly not completely irrational. The debate has become more complex over the years as the sources of fluoride have become more diverse (for example, through toothpastes, topical application by dentists, fluoride tablets and alternative water supplies). This complexity makes proof on either side more difficult to establish.

## **Water fluoridation in Australia**

3.15 The debate is worldwide. Indeed, the Social Policy Committee has received submissions from the United States, the United Kingdom, Canada, New Zealand and Sweden as well as solicited information from other countries, through their Canberra embassies or high commissions.

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<sup>8</sup> Sheridan, P G, "National Institute of Dental Research: Forty Years of Research Advances in Dental Health", *Public Health Report*, Sept–Oct 1988, 103(5), pp 493–9.

<sup>9</sup> Abstract, "Fluoride and oral health: a story of achievements and challenges", *Journal of the American Dental Association*, May 1989, 118(5): pp 529–40.



3.16 In Australia, the debate goes back to the 1950s and 1960s and has surfaced and resurfaced as the various State or local governments have contemplated adding fluoride to their water supplies.

3.17 The debate has always become highly politicised. Brian Head, in an analysis of a fluoridation controversy in Victoria, has written:

Wherever fluoridation has been proposed, opposition has developed to such a level that, what seemed at first to be a "technical" issue to be decided by Health Department experts, became a volatile political controversy marked by great fervour among active partisans on both sides. The emotional nature of the conflict has even led to violence.<sup>10</sup>

3.18 In an analysis of the fluoride debate, **Chemical and Engineering News** reported:

Ever since the Public Health Service (PHS) endorsed fluoridation in 1950, detractors have charged that PHS and the medical and dental establishment, such as the American Medical Association (AMA) and the American Dental Association (ADA), have suppressed adverse scientific information about its effects.

Some of those who generally support fluoridation make similar charges. For example, Zev Ramba, the Washington Bureau editor of **AGD Impact**, the monthly publication of the Academy of General Dentistry, wrote last year that supporters of fluoridation have had an "unwillingness to release any information that would cast fluorides in a negative light," and that organized dentistry has lost "its objectivity – the ability to consider varying viewpoints together with scientific data to reach a sensible conclusion."

The dozen or so scientists C&EN was able to contact who have done research suggesting negative effects from fluoride agree on this aspect. They all say that fluoridation research is unusual in this respect.

If the lifeblood of science is open debate of evidence, scientific journals are the veins and arteries of the body scientific. Yet journal editors often have refused for political reasons to publish information that raises questions about fluoridation. A letter from Bernard P Tillis, editor of the **New York State Dental Journal**, written in February 1984 to Geoffrey E Smith, a dental surgeon from Melbourne, Australia, says: "Your paper ... was read here with interest," but it is not appropriate for publication at this time because "the opposition to fluoridation has become virulent again."

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<sup>10</sup> Head, B W, "The Fluoridation Controversy in Victoria: Public Policy and Group Politics", **Australian Journal of Public Administration**, vol XXXVII, No 3, September 1978, p 257.

The article continues:

Most authoritative scientific overviews of fluoridation have omitted negative information about it, even when the oversight is pointed out. Phillippe Grandjean, professor of environmental medicine at Odense University in Denmark, wrote to the Environmental Protection Agency in June 1985 about a World Health Organization study on fluorine and fluorides: "Information which could cast any doubt on the advantage of fluoride supplements was left out by the Task Group. Unless I had been present myself, I would have found it hard to believe." ...

According to Robert J Carton, an environmental scientist at EPA, the scientific assessment of fluoride's health risks written by the agency in 1985 "omits 90% of the literature on mutagenicity, most of which suggests fluoride is a mutagen."<sup>11</sup>

3.19 The League of Rights has been heavily involved in anti-fluoridation campaigns in Australia. As long ago as 1955 its **Intelligence Survey** carried the transcript of a radio talk by Eric Butler, "The Truth About Water Fluoridation" in which he talked of the "anti-Christian policy of mass medication".

3.20 A brochure<sup>12</sup> put out by the League of Rights encouraged people to oppose fluoridation because:

- **Rights** – A free people have a **RIGHT TO EXPECT THAT THEIR WATER SUPPLY** remains PURE. Those wanting Fluoride can buy tablets.
- **Force** – Nobody has the right to force others to consume that which they do not want.
- **Poison** – Sodium Fluoride is a cumulative poison.
- **Safe?** – Regular ingestion of Fluorides has NOT been proved harmless.
- **Mass Medication** – is contrary to sound medical practice.
- **Dosage** – Experience has shown that there is no guarantee that the "safe" dosage will not be exceeded.
- **Economics** – Why flush the sewers, streets – water parks and gardens with fluoride when only about 0.25% is used for drinking?

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<sup>11</sup> Hileman, B, "Fluoridation of Water : Questions about health risks and benefits remain after more than 40 years", **Chemical and Engineering News**, 1 August 1988, p 36.

<sup>12</sup> League of Rights brochure, undated.

3.21 Reflecting similar arguments in the United States at the time, another League of Rights brochure<sup>13</sup>, an article "Communism and Fluoridation" argued:

At first sight there may not appear to be any relationship between Communism and the fluoridation of public water supplies. But as Communist tactics support all policies which extend government control over the individual and weaken his sense of personal responsibility, it is not surprising that fluoridation has the endorsement of Communists.

This article concluded:

A community whose members cannot defend themselves against a policy of mass medication, irrespective of how the promoters of this policy describe themselves, has suffered a serious erosion of the very foundations of the free society. This erosion delights the Communists, who are experts in exploiting all developments which weaken a belief in freedom and personal responsibility.

3.22 The League ran a strong campaign in Victoria.

The League's involvement was highlighted by the publication of (Eric) Butler's lengthy pamphlet **Fluoridation or Freedom?** in 1960, and by the informal establishment of a Fluoridation Committee of the League under the chairmanship of Mr H H Gerrand. The Committee prepared and distributed anti-fluoride leaflets, and organized a great deal of letter-writing to newspapers throughout the State.<sup>14</sup>

3.23 In 1964 Hobart became the first Australian capital city to fluoridate its water supply. However, as a result of the contention over fluoridation the Tasmanian Government then established a Royal Commission into the Fluoridation of Public Water Supplies. The report supported fluoridation.

3.24 In common with the debates in the United States and elsewhere, the Australian inquiries were also characterised by conflict and mutual animosity. In 1968, the Tasmanian Commissioner reported:

There have been many excesses and some quite irresponsible things said and done in the course of public controversy even in this State. I am astonished and in fact dismayed by the vituperation and the unbridled arguments *ad hominem* employed by men who not only claim but in fact possess high scientific attainments.<sup>15</sup>

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<sup>13</sup> League of Rights brochure, undated.

<sup>14</sup> Head, B W, *op cit*, p 252.

<sup>15</sup> Report of the Royal Commissioner into the Fluoridation of Public Water Supplies, Hobart, 1968, p 4.

3.25 The Victorian Legislative Assembly established a Committee of Inquiry into the Fluoridation of Victorian Water Supplies, which reported in 1980. In common with the Tasmanian report, this report also supported fluoridation. Discussing public attitudes and the basis for decisions on fluoridation as a public health measure, the report said:

Much of the information available to the public is sensational, ill-informed, incomplete or misleading...

Members of the public, unless they have the basic scientific training which would enable them to examine critically the material put before them, tend to accept published or broadcast matter as factual and complete. The result is that debate on fluoridation becomes emotional and is not often guided by logical thought.

We have noted the "chain-effect" of adverse publicity. Local supply authorities have on occasions discontinued fluoridation because of fears generated in the public mind through publications that are not based on sound, scientific evidence. When one authority decides to abandon fluoridation, this is then quoted as further evidence against fluoridation and may then lead to cessation of fluoridation by another authority, and so on. The end result is that a number of communities are deprived of the benefits of fluoridation for reasons stemming from an original unsound hypothesis.<sup>16</sup>

3.26 The introduction of water fluoridation in the ACT in 1964 also took place after a sharply divided and acrimonious debate. At that time, governance of the ACT fell within the Commonwealth Government's responsibilities. After some months of dispute, the then Minister for the Interior curtailed debate by announcing that fluoride would be added to the ACT water supply. In 1989, twenty-five years later, the debate over fluoride, though never ceasing, was brought to a head. This Committee's inquiry is the result.

3.27 As a result of this long-term debate, the impact of fluoride on public health has been extensively researched. The Royal Commissioner into the Fluoridation of Public Water Supplies in Tasmania, the Honourable Justice Crisp, reported that by 1963 16,000 scientific papers were available on the subject. By 1989, the Australian Dental Association (Brisbane) reported that 30,000 papers had been written on fluoride.

3.28 Over the last few years numerous articles published in some of the world's leading scientific and research journals have questioned the scientific validity and methodology of findings on the efficacy and safety of fluoride. Among these researchers are Dr M Diesendorf and Dr P Sutton (Australia), Dr J Colquhoun (New Zealand) and Dr J Yiamouyiannis (United States).

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<sup>16</sup> Report of the Committee of Inquiry into the Fluoridation of Victorian Water Supplies for 1979-80, Government Printer, Melbourne, 1980, pp 202-203.

3.29 In 1985 the National Health and Medical Research Council (NHMRC) undertook a review of the literature to assess the efficacy and safety of water fluoridation, which it confirmed. Since then, the validity of the research findings have been further questioned. In 1989, in response to questions raised in a letter by Drs Diesendorf, Sutton and Colquhoun, the NHMRC established a Working Group with the following terms of reference:

What is the reasonable interpretation of the data provided by Diesendorf et al?

Given the estimated magnitude of any beneficial effect of water fluoridation, the likely dependence of such benefit upon the underlying dental caries rates, and the estimated benefits achievable via other contemporary sources of supplementary fluoride, is water fluoridation still a desirable public health policy in Australia.

Is there a special need for the ongoing monitoring of fluoridation, and if so, what form might it take?

3.30 This NHMRC inquiry, which has reviewed the literature on water fluoridation published since 1984, took place concurrently with the Social Policy Committee's inquiry into water fluoridation in the ACT. The Committee was concerned to monitor the outcome of the NHMRC inquiry. The NHMRC released two interim reports. The final report was not available before the Committee completed its inquiry.

3.31 This chapter has described some of the history and tone of the fluoride debate. Chapter 4, which follows, will describe the composition and action of fluoride. Chapter 5 will provide an overview of the arguments in favour of water fluoridation. Chapter 6 will provide an overview of the arguments against water fluoridation. These chapters will simply provide a review of the arguments. They should not, and cannot, necessarily be interpreted as this Committee's view. The Committee's comments will be contained in Part Two of the report.



## **4 FLUORIDE – ITS COMPOSITION AND ACTION**

4.1 The first problem facing the Committee in its inquiry into water fluoridation lay in establishing some basic facts about fluoride. While it had been required to seek professional, technical and scientific advice it soon discovered that no-one was seen as impartial, whatever their specialist background.

4.2 It was also obvious that the study of fluoridation could be (and had been) undertaken from many differing scientific and professional standpoints. For example, the dental profession might be able to discuss the effect of fluoride on teeth but not be qualified to talk about its effect on bone structures. Epidemiologists, allergists, medical practitioners and civil libertarians all view fluoridation from their own particular perspective.

4.3 The Committee wished to be given a basic briefing on the nature of fluoride and was at pains to be briefed by a specialist who had not at any time been involved in the fluoride debate. Professor Michael Irving, Dean of the Faculty of Applied Science, University of Canberra, generously offered to provide such a briefing. Professor Irving's field is clinical biochemistry, and he lectures in clinical biochemistry, clinical pharmacology and toxicology. Professor Irving emphasised that as he did not possess medical qualifications he was not in a position to make medical judgements.

4.4 In 1989, at the University of Canberra, students in clinical biochemistry measured fluoride levels in the ACT water supply from taps in homes in a number of suburbs. Professor Irving also described the results of these measurements (see Chapter 8).

4.5 Much of what follows here draws on Professor Irving's briefing. The chapter also draws on the technical sections of the Report of the Committee of Inquiry into the Fluoridation of the Victoria Water Supply.

### **The creation of sodium fluoride**

4.6 It is important, at the outset, to clarify what fluoride is, especially as there is considerable confusion about its relationship to other fluorine combinations in much of the literature on water fluoridation which has been received by the Committee.

4.7 Sodium silico-fluoride (fluoride) is the substance which is added to the ACT water supplies to achieve a concentration of approximately 1 part fluoride per million parts water (1 ppm).

4.8 Fluoride is normally obtained as a byproduct of heating cryolite with caustic soda. Cryolite contains fluorine, and it is this fluorine which, when combined with caustic soda, produces the salt, sodium fluoride.

4.9 Fluorine (not fluoride) is a member of a group of elements termed the "halogens". The term halogen is derived from the Greek words for "salt" and "to produce". Of the halogens, fluorine and chlorine are gases at room temperature, bromine is a liquid and iodine is a solid. All of these elements readily combine with metals to form salts. They are very reactive, particularly fluorine which is the most reactive of all.

Fluorine is an extremely reactive gas and in consequence was not isolated as such for many years after the chemistry of its compounds with other elements had been studied extensively and its existence as an element recognised. The fluorine atom is characterized by high electron affinity and an electronegativity which is the highest of all elements. Special methods were needed to isolate elemental fluorine ...

Since the second world war fluorine has been produced in large quantities commercially, since the compounds derived from it have found wide industrial, domestic and pharmaceutical application ...

It is important to realize that the properties, both physical and chemical, of the various compounds are quite different from those of elemental fluorine and from those of other fluorine compounds. The toxic properties of fluorine compounds range from extremely toxic to completely non-toxic ...

It can be accepted that the environmental occurrence of fluorine is exclusively as its inorganic fluorides, in which the fluorine atom occurs as the fluoride ion. Because of the added electron, which has come from another atom, the properties of the fluoride ion are quite different from those of the fluorine atom, the fluorine molecule, or any other fluorine-compound in which the fluorine atom is bonded covalently.<sup>1</sup>

4.10 While fluorine can react with carbon to form stable fluorocarbons which, in turn, can react with chlorine to form chlorofluorocarbons (CFCs), CFCs have totally different properties to fluoride. Sodium fluoride is a salt and has no effect on the ozone layer.

4.11 Waters with high fluoride content are usually found at the foot of high mountains and in areas with geological deposits of marine origin. Typical examples are the geographical belt from Syria through Jordan, Egypt, the Libyan Arab Jamahiriya, and Algeria to Morocco, and the Rift Valley through Sudan and Kenya. Another belt is the one stretching from Turkey through Iraq, the Islamic Republic of Iran, and Afghanistan to India, northern Thailand, and China. Similar areas can be found in the Americas and in Japan and China. The highest natural fluoride concentration ever found in water was recorded in Lake Nakuru in the Rift Valley in Kenya, namely 2800 mg/litre.<sup>2</sup>

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<sup>1</sup> Report of the Committee of Inquiry into the Fluoridation of Victorian Water Supplies for 1979-80, *op cit*, pp 23-25.

<sup>2</sup> Murray, J J (ed), *Appropriate Use of Fluorides for Human Health*, World Health Organisation, Geneva, 1986, pp 4-5.



## **Fluoride absorption in humans**

4.12 The absorption of ingested inorganic fluoride depends in the first place on its solubility. Fluoride is removed from the gastrointestinal tract by simple diffusion across the lining of the stomach and small intestine and then into the blood stream. Soluble fluorides are absorbed rapidly and almost completely. The less soluble fluorides are incompletely absorbed as the rate of absorption depends on the particle size, mode of intake, and various physical properties of the compounds concerned. Undissolved fluorides are excreted unchanged in the faeces.<sup>3</sup>

4.13 Fluoride salts are rapidly absorbed from the gastrointestinal tract in humans. Approximately half the fluoride absorbed is excreted in the urine with the remainder stored primarily in calcified tissues. The urinary excretion of fluoride increases with an increase in the dietary intake of fluoride.

4.14 There is considerable evidence that the concentration of fluoride progressively increases in bone and teeth with advancing age, provided a constant level of fluoride is ingested. However, individuals on long-term relatively constant fluoride intake reach an equilibrium between intake and retention, at which time the fluoride uptake by the skeletal tissue is reduced and the concentration of fluoride in the urine approximates that of drinking water.

4.15 Fluoride is absorbed in different ways by different parts of the body.

## **Fluoride in the plasma**

4.16 Fluoride is able to enter intracellular and extracellular fluid pools in the body. About 75 percent of total fluoride of blood is in the plasma, the remainder is associated with the erythrocytes and other cells in blood. The ionic concentration of fluoride in plasma has been reported to be 0.01–0.04 ppm which represents 15–70 percent of the total plasma fluoride.

4.17 It is important to note that the ionized (salt) form of fluorine, sodium fluoride, is the form that reacts with bone, dentine etc. Literature reports that cite the concentration of fluorine in blood, tissue or foodstuffs give the total concentration of fluorine, and thus greatly overestimate the "biologically active" amount of fluoride.

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<sup>3</sup> Report of the Committee of Inquiry into the Fluoridation of Victorian Water Supplies for 1979–80, op cit, p 35.

4.18 What is known is that the plasma fluoride levels are tightly regulated by skeletal and renal tissues, even when there is a variation of dietary intake of fluoride. Diseases of bone or kidneys and previous exposure to fluoride are the principal problems with this tight regulation of fluoride balance in the body.

### **Incorporation of fluoride into bone**

4.19 Bone can serve as a reservoir for elements such as fluoride, lead and strontium. For example, 90 percent of lead in the body is found in the skeleton. Skeletal uptake of these foreign materials occurs via an exchange mechanism with the hydroxyapatite crystals of bone mineral. Upon being transported to a crystal of bone by extracellular fluid, the toxicant enters the hydration shell of the crystal and penetrates the crystal surface. By virtue of similarities in size and shape, fluoride ions readily replace hydroxyl ions, whereas lead and strontium replace calcium in the hydroxyapatite crystal structure.

4.20 It is important to note that foreign elements incorporated into bone are not irreversibly trapped there. The cellular components of bone are continually being replaced by new ingested compounds. Furthermore the turnover of bone is also under hormonal control. Thus, although fluoride can replace hydroxyl ions in the hydroxyapatite crystal structure of bone, this is not an irreversible situation. This is an important consideration when reviewing claims concerning toxicity.

### **Incorporation of fluoride into teeth**

4.21 Similar processes are involved in the deposition of fluoride into dental tissues. However, there are some differences:

Dental tissues differ from bone in that the constant remodelling as described in bone does not occur. Mature enamel has no cellular activity and in addition mature dentine is almost impermeable. These various properties of mature dental tissues restrict ionic mobility which is not common to other human body structures.<sup>4</sup>

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<sup>4</sup> Report of the Committee of Inquiry into the Fluoridation of Victorian Water Supplies for 1979-80, op cit, p 44.

4.22 There are three broad phases in the fluoride deposition in teeth:

- (a) in the initial formation stage, fluoride ions are relatively uniformly taken up through developing dental tissues;
- (b) in the mineralization phase, the uptake of fluoride ions is largest in the areas of dental tissue where mineralization occurs;
- (c) in the last stage, when mineralization is complete and teeth are fully formed, the uptake of fluoride ions is almost entirely limited to the marginal regions of both the enamel and dentine.

4.23 The activity of fluoride on the mature teeth was described in the Victorian report:

The concentration of fluoride in mature teeth decreases from the enamel surface to the dentine–enamel junction and then increases from this junction to the pulp. The uptake of fluoride by erupted teeth is independent of cellular activity and its concentration in a fully formed tooth is greatest adjacent to the odontoblastic layer. Once enamel has been formed, its cellular activity ceases and the incorporation of fluoride depends entirely upon ion–exchange mechanisms and may be up to 10 times greater in the outer layers of enamel than in the deeper layers.<sup>5</sup>

### **Fluoride in the biological food chain**

4.24 There is always concern that toxins, for example mercury, can accumulate and concentrate in the food chain so that foods ingested by man may be heavily contaminated.

4.25 Fluorides are widely distributed in soils, fertilisers and as air pollutants. Although there is evidence of uptake of fluoride in plants, the ingestion of contaminated plants by animals poses little danger to humans. That is because 99 percent of fluoride retained in animals is stored in bone, and minimal changes occur in the concentration of fluoride in soft tissues at high levels of dietary fluoride intake. Milk from cows consuming high levels of fluoride show slight elevations of fluoride, indicating that the mammary gland is not a primary route for excretion.

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<sup>5</sup> Report of the Committee of Inquiry into the Fluoridation of Victorian Water Supplies for 1979–80, op cit, p 44.

4.26 Analysis<sup>6</sup> of the total fluorine content (not ionisable fluoride) of common foodstuffs shows fluorine levels to be for the most part very low, and in the case of milk products, which are mainly in the form of complexed insoluble calcium, fluoride levels are extremely low. There are two notable exceptions, namely tinned fish and tea. In Australia the small consumption of tinned fish does not present a problem. However, the high levels in tea may be of significance in those people who consume tea in copious quantities.

It is well known that tea leaves are high in fluoride (up to 400 mg/kg dry weight), but the tea infusion itself will have a fluoride concentration of only 0.5–1.5 mg/litre. The amount present in one cup of tea, however, will depend not only on the size of the cup, but also on the brand of tea, the amount used, the duration of the infusion, whether it is a dilution of a previous brew, and whether it was made with fluoridated water. In study of Duckworth and Duckworth<sup>7</sup>, the ingestion of fluoride by tea drinkers of all ages ranged from 0.04 mg to 2.7 mg per day. The fluoride was rapidly released from tea leaves and reached the highest concentration in the tea infusion after approximately 8 minutes. With various brands of tea leaves, there was up to a four-fold variation in the fluoride content of the tea infusions.<sup>8</sup>

4.27 A table showing the content of fluoride in various foods is given at Appendix 3.

## Conclusion

4.28 In this chapter, the composition and action of fluoride has been described as factually as is possible in a debate in which every fact appears to be subject to dispute.

4.29 The following chapter (chapter 5) will consider the arguments in favour of water fluoridation. Chapter 6 provides an overview of the case against water fluoridation.

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<sup>6</sup> For a table showing fluorine levels see Appendix 3.

<sup>7</sup> Duckworth, S C and Duckworth R, "The ingestion of fluoride in tea", *British Dental Journal*, 145:368 (1978).

<sup>8</sup> Murray, J J (ed), *op cit*, p 7.

## **5 ARGUMENTS FOR WATER FLUORIDATION**

**5.1 Dental caries has been described as a major dental disease affecting the lives of a large proportion of the inhabitants of this world:**

**It impairs the quality of life for many people by causing pain and sepsis and lack of treatment can aggravate other systemic diseases. In addition, it places a heavy financial burden on private and public health services.**

**Dental caries is a disease in which host, agent, and environmental factors interact to produce irreversible destruction of the hard tissues of the teeth – namely, enamel, dentine, and cementum (caries of root surfaces). Despite continuing efforts to develop methods of lowering the number of bacteria on teeth by mechanical means or of reducing the cariogenic activity with chemical agents, the proper use of fluorides remains our best defence against dental decay.<sup>1</sup>**

**5.2 The terms of reference for the current inquiry instruct the Committee to seek professional, technical and scientific advice in relation to its investigation into water fluoridation in the ACT.**

**5.3 It is therefore appropriate to give an overview of the case for water fluoridation based on the submissions from the Australian Dental Association (ADA) and the Association's ACT and Southern Tablelands Division (ACT Dental Group) as pertinent professional advice.**

**5.4 The ADA submission urged the Committee to recall the state of children's teeth about 25 years ago.**

**You are surrounded by a group of high-school children. What do you see of their teeth and smiles as they talk and laugh among themselves.**

**If their ages were, say, thirteen to sixteen, they would have an average, amongst them, of around twelve teeth that had already been affected by caries. Since this would be an average figure, there would be some in the group that would be worse-off, and some not so bad.**

**For those children from affluent families, few teeth would have been lost, but there would be many fillings, and their back teeth would be showing rows of amalgam restorations. Front teeth would show signs of repair, and for many this would be in the form of large gold fillings.**

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<sup>1</sup> Murray, J J (ed), **Appropriate Use of Fluorides for Human Health**, World Health Organisation, Geneva, 1986, p 1.

For those less affluent, you would see gaps resulting from extraction of permanent teeth, and there would certainly be some among the group with unrepaired large holes, brown to black with the evidence of active caries, visible in their smiles. If the group exceeded 25 in number, at least one regular member would be absent because of pain or infection or treatment needs attributable to dental disease (ABS statistics).

5.5 Evidence recorded in the Report of the Tasmanian Royal Commission of 1968 on the condition of Tasmanian children's teeth graphically describes the poor dental state of Tasmanians. Tasmania was notable for having the worst incidence of dental caries in Australia, and compared badly with other Western nations. One witness to the Royal Commission had qualified and practised in England:

As against his experience in England where to supply a child under 18 with full dentures would be an outstanding thing (in fact in 10 years of practice he could not remember a single case in a population of 17,000), he found it commonplace, as did other dental surgeons in Tasmania and he had to do clearances of either or both jaws for 21 school children in his first year.<sup>2</sup>

5.6 It is important to remember, especially when considering the perceived dangers of fluorosis (discolouration and staining), the extent of and distress caused by dental caries in children and young adults. Another Tasmanian witness, who had qualified in Sydney and practised both in Sydney and in the United Kingdom, had not experienced the necessity for full clearances in children under 18 until he arrived in Tasmania:

Most of them expect to have false teeth before they are married. I quite regularly get girls and boys who come in and see me in their late teens, early twenties – "I don't want any fillings done at the moment. Just take this one out because it is aching – because I am going to get them all out next year – because I'm being married". This is almost standard procedure; it is almost part of the dowry. They have not any future as far as keeping their teeth is concerned. The state of their teeth is so poor that you just are putting your finger in the hole in the dyke trying to patch them up until they are a bit older and they will have them out.<sup>3</sup>

5.7 The ADA submission to the Social Policy Committee moved on to describe the current condition of children's teeth.

A comparable group today would show an experience of caries about one-fifth to one-sixth of that of the earlier group of children. There would be almost no visible evidence of dental disease that a casual observer could detect – unless it was deduced from the number of children with orthodontic bands on their teeth. As caries experience has fallen, parents have found it increasingly worthwhile to have their children's teeth straightened, since there is, today, a reasonable prospect of life time use and benefit from one's dentition.

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<sup>2</sup> Report of the Royal Commissioner into the Fluoridation of Public Water Supplies, Hobart, 1968, p 47.

<sup>3</sup> Report of the Royal Commissioner into the Fluoridation of Public Water Supplies, Hobart, 1968, p 47.

ADA says, without any doubt or equivocation, that this vast change in dental disease experience has occurred wherever in the world fluoridation has been introduced, and it is primarily attributable to fluoridation. This view is based on a large volume of published investigations by respected scientists in many countries.

5.8 It was pointed out in evidence to the Committee that it was not just the young who benefited through a drop in dental caries, but that even the elderly, for whom good nutrition is vital, benefited if they had maintained their teeth throughout life and therefore found eating easier.

### **Fluoride and dental caries**

5.9 It is argued that fluoride ions in low concentrations lead to the formation and stabilisation of a well-crystallised mineral structure in the enamel of teeth. There is also evidence from experimental animal studies and from human epidemiological studies that fluorides may modify the shape of the teeth so that they are less likely to harbour food debris. Fluoride is incorporated into the tooth mineral as fluorapatite at the time of calcification and thus exerts a major effect in developing teeth.

5.10 Fluoride also plays a major role in the local environment outside the tooth where dental caries form. Dental caries form in enamel beneath a layer called dental plaque. The dental plaque consists of protein, bacteria and products of bacterial metabolism. These plaque bacteria also degrade carbohydrates from food to produce acidic end-products, and it is these acids that produce dental caries.

5.11 In the presence of fluoride either in surface enamel of teeth or in water or foodstuffs the acid produced by plaque bacteria releases fluoride which inhibits bacterial activity, and thus prevents caries. The use of topical fluoride in an acidic environment allows maximum uptake of fluoride into voids in tooth structure, and the use of insoluble salts such as calcium fluoride provide an additional surface film.

5.12 Levels of fluoride necessary to inhibit bacterial enzymes are usually of the order of 30 ppm. The outermost enamel of teeth contains fluoride levels of the order of 1500 ppm which can be temporarily increased by topical application of fluoride. Thus two to five percent of the fluoride in dental enamel needs to be mobilised as ions to inhibit bacterial enzymes. Considering the tight binding of fluoride to apatite in teeth, this would be a maximal figure and thus fluoride supplementation in drinking water would be required to assist this inhibition of dental caries.

5.13 The submission from the ACT Dental Group describes three main modes by which fluoride exercises its anti-caries effect:

First, by the incorporation of fluoride in the form of fluorapatite into the dental enamel during the years of pre-eruptive maturation, giving a fluoride-rich enamel which is resistant to attack, thus inhibiting the initial caries lesion.

Second, fluoride can help assist the remineralisation of porous enamel and the early carious lesion.

Third, the presence of fluoride ions at the tooth plaque interface reduces plaque colonisation and inhibits plaque acid production, thus reducing the intensity of the challenge.

5.14 Often, according to the ACT Dental Group submission, these effects are divided into either systemic/topical or pre-eruptive/post-eruptive categories, as determined by either the method of fluoride exposure or the actual timing of the event.

5.15 Fluoride, the ACT Dental Group argues, is widely distributed in the environment and in the body. Unsubstantiated claims of adverse effects of fluorides in the control of dental caries have, says the submission, been made for almost fifty years.

These claims have been based largely on speculation and supposition, and also on unwarranted assumptions concerning the application in the biological context of laboratory studies using extremely high concentrations of fluoride. Extensive investigations both in Australia and other countries have consistently shown that the levels of fluoride used in fluoridation programs were not a health hazard.

5.16 The ACT Dental Group argues that an inverse correlation between the fluoride content of drinking water and dental caries was shown almost 50 years ago in the USA. This investigation involved the examination of 7,257 children aged 12 to 14 years in 21 cities. Children using water with a natural fluoride content of 0.9 to 1.2 ppm fluoride had about half the amount of caries than children whose drinking water contained 0.2 ppm or less.

5.17 Subsequent studies showed that caries inhibition from water containing approximately 1.0 ppm fluoride continued into adult life.

5.18 In the period 1945 to 1946 four independent projects were begun in North America to assess the effect on dental caries of adding fluoride to fluoride-deficient water supplies. In each case a control city was selected in which the fluoride level of the water was very low. However, one of these cities was lost as a control when it started to fluoridate its water supply. After periods ranging from 10 to 17 years it was found that the children using fluoridated water had approximately 50 to 60 percent less teeth affected by dental caries than children who were not using fluoridated water.

5.19 According to the ACT Dental Group submission, a summary of published reports relating to 98 fluoridation projects in 20 countries, initiated between 1945 and 1972, found that the decayed, missing or filled (DMF) indices amongst children had been reduced by amounts ranging from 29 to 85 percent, with a mean of 55.6 percent.

5.20 A report of a carefully controlled survey in North Wales, using a non-fluoridated control group, showed that dental caries indices were reduced by 38, 43 and 55 percent for children aged 15, 12 and 5 years respectively.



5.21 In Australia, the ACT Dental Group points out, there have also been investigations into the effect on dental caries in children living in areas with fluoridated water. Other than Townsville, these were longitudinal studies. In the Townsville project, caries experience of children was compared with that of children in 16 low fluoride towns in Queensland. Results of these studies showed that after 10 years fluoridation the DMF indices of children declined by approximately 50 to 60 percent.

5.22 The ACT Dental Group submission drew attention to the National Oral Health Survey, undertaken in 1988, which showed that in a comparison between fluoridated Canberra and unfluoridated Brisbane, children in Brisbane aged between 5 and 9 years had a 59 % higher DMF rate than Canberra children, a 53 % higher DMF rate for the 10 to 14 years group and 40% higher DMF rate for the 15 to 19 years group.

5.23 In spite of such overwhelming evidence, the ACT Dental Group submission argues, some critics of fluoridation allege that it is ineffective in the control of dental caries, and that because of poor design fluoridation/caries studies are unacceptable.

5.24 The issue was raised at a major legal case in Scotland. The presiding judge, Lord Jauncey, ruled that:

allowing for the fact that in a perfect world each study might have been carried out in a more perfect manner in one or more details the message is nevertheless loud and clear from many different parts of the world. Water fluoridation to 1.0 ppm substantially reduces the incidence of caries.

5.25 The ACT Dental Group argues that the effect of fluoride on caries is probably greater than indicated in the many published reports which generally refer to the number of decayed, missing or filled teeth as a measure of caries. The size of the various lesions had not been taken into account in such studies because there is no severity index. However, an indication that the DMF index understates the benefits is shown in a summary of three studies. Amongst children in fluoridated areas the number of first permanent molar teeth which had to be extracted as 95, 75 and 85 percent respectively less than in low fluoride areas (0.1 ppm fluoride).

5.26 An individual dentist, in a submission to the Committee, argued that prevention of disease and abnormality is a fundamental principle in the achievement and maintenance of health:

It is an important part of our advancing society and contributes to reduction of costly treatment and health facilities. The community has increasingly embraced not only the concepts but the practice of prevention. These comments apply equally to the control of dental disease.

It would be a retrograde step to discontinue fluoridation which has been used successfully for so long in so many countries. It is now almost 50 years since the procedure was initiated in USA and Canada, 37 years since the first project in Australia, and 25 years since it was begun in Canberra. We are not dealing with a new procedure but one which has been consistently validated internationally, and which has survived the test of usage for half a century.

## **The conclusions of other inquiries**

5.27 One submission cited ten authoritative reports from official inquiries, all of which have come down in favour of fluoridation:

- . Commission of Inquiry in New Zealand (1957)
- . Commission of Inquiry in South Africa (1966)
- . Inquiry in the Republic of Ireland (mid-1960s)
- . Royal Commission, Hobart (1968)
- . Congressional Committee, United States of America (1977)
- . World Health Organisation (1969, 1975, 1978 and confirmed again in 1986)
- . Governor's Commission, Minnesota, USA (1979)
- . Victorian Committee of Inquiry, Australia (1981)
- . Lord Jauncey Report, Scotland (1983)
- . National Health and Medical Research Council, Australia (1979, 1985)

5.28 The Jauncey Report, while supporting fluoridation, did find that the Strathclyde Regional Council, against which legal action had been taken resulting in the Jauncey inquiry, did not have the power to add fluoride to the water supply. However, the British Parliament, after extensive investigation and discussion, passed the Water (Fluoridation) Act 1985 to overcome this legal problem, enacting that:

Where a health authority have applied in writing to a statutory water undertaker for the water supplied within an area specified in the application to be fluoridated, that undertaker may, while the application remains in force, increase the fluoride content of the water supplied by them within that area.<sup>4</sup>

5.29 The 1968 Hobart inquiry concluded that there was substantial and material benefit in Tasmania to dental health from the addition of fluoride to water supplied to the public having regard to the existing state of scientific knowledge and to experience with respect to water supplies containing fluorides, whether naturally or by addition, in other States of the Commonwealth and elsewhere.

5.30 The Commissioner responded to the question as to whether any detriment or other public disadvantage might result from the addition to 1 ppm fluoride to the public water supply. He replied that there was not, subject to two minor qualifications:

There is a risk of dental fluorosis occurring in some children. The number affected will not exceed 10 percent of the child population and may be less. The degree will be 'mild' (probably about 2 percent) and the remainder will be 'very mild' or 'questionable'. There is no reason to fear that it will in any case be disfiguring or even noticeable except to a clinical observer. In any case, over the child population as a whole it will be more than counter-balanced by the improved shape and appearance of the dentition and by an even greater reduction in mottling and staining of teeth from other causes.

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<sup>4</sup> Water (Fluoridation) Act 1985 – 1985 Chapter 63 – An Act to make provision with respect to the fluoridation of water supplies, 30 October 1985.

There is a possibility that some individuals will exhibit a hypersensitivity not shared by the rest of the population to fluoridated water. The possibility is extremely remote, so remote that I cannot quantify it statistically. The fact that such individuals do exist has not been clearly demonstrated but the possibility that they may exist cannot be dismissed. If they do exist the reaction to be expected is that of an abnormal toxic response to low dosages, not an allergic reaction in the strict sense. Hence in relation to water fluoridated at 1 ppm the reaction would be mild, easily relieved and prevented.<sup>5</sup>

#### 5.31 The Victorian inquiry concluded:

Various elements are essential for human and animal development and life. They may be required in nutrition in either relatively large (eg calcium and iron) or in low or trace quantities (eg iodine and copper). Fluorine has been ingested by humans and animals since life began. It is considered by most authorities as an essential trace element. The purpose of fluoridation of community water supplies is to adjust the fluoride content of such water to its optimal beneficial level for the population and geographical area served.

There is overwhelming evidence that the regular ingestion of water containing fluoride at its optimal concentration is an effective public health measure in reducing the incidence of dental caries, in the population served.<sup>6</sup>

5.32 The Jauncey inquiry was established because when the Strathclyde Regional Council decided, in 1978, to fluoridate its water supply, a citizen of Glasgow, Mrs McColl applied for an interdict to restrain implementation of the decision. The resulting court case was heard by Lord Jauncey. In an article published in 1985, Professor Stephen of the University of Glasgow Dental School, commented:

Thus, after 201 days' legal debate and at a cost of between 600,000 to 1,000,000 pounds, it has been proven that fluoride at a level of 1 ppm in the domestic water supply is a safe, effective, caries-inhibiting agent and the only disease it seems capable of producing is hysteria in the minds of misguided anti-fluoridationists.<sup>7</sup>

5.33 Quite clearly, scientific knowledge constantly extends as new research is undertaken. The conclusions of reports published in the 1960s or 1970s may well have been superseded by scientific discoveries in the intervening period. This possibility is the subject of the Social Policy Committee's assessment of the evidence in Part 2 of this report.

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<sup>5</sup> Report of the Royal Commissioner into the Fluoridation of Public Water Supplies, Hobart, 1968, p 7.

<sup>6</sup> Report of the Committee of Inquiry into the Fluoridation of Victorian Water Supplies for 1979-80, op cit, p 205.

<sup>7</sup> Stephen, K W, "Fluoridation Experience in the United Kingdom", The Journal of the Royal Society of Health, Vol 104, No 4, August 1985, pp 115-118.

5.34 Many studies of the effects of fluoridation have been undertaken and there has been general consensus in the mainstream scientific community that they demonstrate the effectiveness of water fluoridation. In Britain alone, these include the following:

A 1974 study by Jackson et al of decay experience of 5-year-olds and 15-year-olds living in fluoridated Anglesey. 5-year-old Anglesey children had 38 percent fewer "attacked" teeth than 5-year-olds living in a control (non-fluoridated) area. 15-year-olds in Anglesey had 44 percent fewer "attacked" teeth than 15-year-olds in the control area.

A 1979 survey by Whittle and Downer of the dental health and treatment needs of infant and secondary school entrants in fluoridated Birmingham and non-fluoridated Salford. 4-5-year-olds in Birmingham had 54 percent fewer decayed, missing or filled deciduous teeth (ie first teeth) than those in Salford. 11-12 year olds in Birmingham had 45 percent fewer decayed, missing or filled permanent teeth than those in Salford. Fluoridation began in Birmingham in 1964.

A 1979 study by Jackson et al of fluoridation in Leeds. Since 1968 the water supply to four districts of Leeds has been fluoridated. A comparison of 5-year-olds in these districts and in others revealed that 57 percent of children living in the fluoridated areas were free from dental decay compared to only 31 percent in non-fluoridated areas.

In 1979 two surveys were carried out in Wick by Stephen et al in 1979 following the cessation of fluoridation in 1977 on 106 5-year-old children and again in 1984 on 126 children. The two surveys showed that following the cessation of fluoridation there was a 27 percent increase in the incidence of decayed missing and filled teeth, a 60.9 percent increase in the number of tooth extractions and a 10 percent reduction in the number of caries free children, indication that the deterioration in dental health over the period was due to the cessation of fluoridation.<sup>8</sup>

In 1980 a study by Attwood and Blinkhorn of 10-year-old children in Stranraer (which had been fluoridated for 10 years) and those in Annan (which had a negligible amount of natural fluoride in the water) showed 100 percent greater prevalence of caries in non-fluoridated Annan than those in Stranraer.

A second study in 1986, following the cessation of fluoridation in Stranraer in 1983, showed that while dental health in Annan had improved by 19 percent compared with 1980, dental caries in Stranraer had deteriorated by 3 percent over the 1980 position although the dental health was still better in Stranraer compared to Annan.<sup>9</sup>

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<sup>8</sup> Stephen K W (and others), "Caries Prevalence in Northern Scotland Before, and 5 Years After, Water Defluoridation", *British Dental Journal*, 1987; 163, 324-326.

<sup>9</sup> Attwood D, Blinkhorn S, "A Reassessment of the Dental Health of Urban Scottish Schoolchildren Following the Cessation of Water Fluoridation", *Community Dental Health*, 1989, 6(3), 207-214.

These results are interpreted as showing that whilst the dental health in South West of Scotland had improved generally due to the effect of dental education and fluoride toothpaste etc, the effect of the withdrawal of fluoridation in Stranraer was to increase the incidence of dental caries.

A 1985 study by Duxbury et al of the dental health of samples of 5-year-old children in fluoridated Newcastle and non-fluoridated North Manchester. This showed that 5-year-olds in Newcastle had approximately 60 percent less decay than their counterparts in Manchester. The North Manchester children suffered more toothache and underwent more dental extractions.<sup>10</sup>

A 1987 study by Mitropoulos et al comparing samples of 14 year old children from fluoridated South Birmingham and non-fluoridated Bolton. The study showed that 32 percent of children in Birmingham were free of decay compared to only 19 percent in Bolton. 36 percent of the Bolton children had experienced high levels of dental caries, that is five or more decayed, missing or filled teeth, as against 15 percent of the Birmingham children.<sup>11</sup>

5.35 As will be seen, the anti-fluoridationists dispute the results of the above studies, generally claiming imperfections in the research design or in interpretation.

5.36 One of the problems in establishing what the effects of fluoride are lies in the fact that, as the Committee was told by an epidemiologist, epidemiology, which focuses on linking cause and effect in relation to population health, is essentially an inexact science. Epidemiology is the study of patterns, drawing evidence from a whole series of different sources, such as patterns of population over time, looking at dose/response relationships, biochemical mechanisms (whether they exist or not) and so on. With fluoride there are many components in the epidemiological judgement, including population movement, changes in incidence of dental caries, changes in the availability of fluoride, and topical versus systemic application.

5.37 Professor Douglas, Director of the National Centre for Epidemiology and Population Health and Past President of the Australasian Epidemiological Association and his research assistant, Ms Alison Hill, appeared before the Committee. They made the following statement:

There is no doubt at all that fluoride, when added to water supplies to the level of one part per million, has been demonstrated to have a beneficial effect on dental health in communities where fluoride levels were previously low. There is no doubt in our minds, on the basis of extensive

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<sup>10</sup> Duxbury J T, Lennon M A, Mitropoulos C M, and Worthington H V, "Differences in Caries Levels of 5-year-old Children in Newcastle and North Manchester in 1985", *British Dental Journal*, 1987, 162, 457.

<sup>11</sup> Mitropoulos C M, Langford J W, Robinson D J, "Differences in Dental Caries Experience in 14-year-old Children in Fluoridated South Birmingham and in Bolton", *British Dental Journal*, 1988, 164, 349.

evidence we reviewed, that even in the current environment where fluoride toothpastes are widely used communities which have fluoridated water supplies have some beneficial effects compared with those who do not.

Now, were fluoride to be removed from Canberra's water supply entirely, we believe it is likely there would be some deterioration in dental health but the extent of that deterioration cannot be predicted at this time on the basis of current evidence.<sup>12</sup>

5.38 However, despite what appears to be convincing evidence of the impact of fluoridated water on the teeth of children and young adults, some people still cast doubt on whether this is a clear case of cause and effect. This doubt, and other arguments, will be examined in Chapter 6 which looks at the case against water fluoridation.

5.39 This chapter has given an overview of the arguments put to the Committee by those who favour water fluoridation. It does not necessarily represent the Committee's view, nor does Chapter 6. The Committee's assessment is given in Part 2 of the report.

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<sup>12</sup> Transcripts of Proceedings, 14 March 1990, p103.

## **6 ARGUMENTS AGAINST WATER FLUORIDATION**

6.1 In the evidence received by the Committee a number of major arguments emerged against fluoridating public water supplies including:

- . that water fluoridation is a form of mass medication which infringes individual liberty;
- . that the benefits of fluoride have, in fact, never been conclusively proved because the research methodology has always been flawed;
- . that fluoride is dangerous and its long-term effects on other parts of the body have not been determined.

### **Mass medication and individual liberty**

6.2 This question was raised in many of the submissions from people opposed to water fluoridation. For example, the New York State Coalition Opposed to Fluoridation (USA) argued that:

A public water supply, which we all must share, is to provide safe, palatable water to all its citizens, not to serve as a vehicle for compulsory medication or treatment, for an entire populace, for a lifetime, for a non-contagious disease.

6.3 The Safe Water Coalition of Washington State (USA) argued that:

Not fluoridating the public water supply will not cancel anyone's opportunity to obtain fluorides from other sources if they so choose, but not fluoridating the public water supply will protect the rights of individuals who want to avoid fluorides.

6.4 Colin A Phillips of Queensland argued that:

Water fluoridation is a precedent in mass medicine. It is a breakdown in the doctor/patient relationship, where a waterworks employee dispenses medicine for a non contagious disease.

## **Absence of proof of benefits of fluoride**

6.5 Dr Diesendorf, a mathematician, has examined the research methodology and conclusions of studies which claim to demonstrate the efficacy of fluoride in reducing tooth decay. The summary of his conclusions is given below.

- 1 In the major cities of Australia and New Zealand, and in 84 locations in the USA, there is on average the same level of tooth decay, as measured by DMFT (the number of decayed, missing and filled permanent teeth per child), in both fluoridated and unfluoridated regions.

For example, in 1987, tooth decay in permanent teeth in unfluoridated Brisbane was approximately equal to that in fluoridated Adelaide and Perth, and was less than that in fluoridated Melbourne.

- 2 Over the past two to three decades, tooth decay has been declining by similar amounts in both fluoridated and unfluoridated regions of developed countries.

For example, from 1977 to 1987, DMFT declined by 65 percent in 10-year-olds in unfluoridated Brisbane. The corresponding declines in fluoridated Adelaide, Perth and Melbourne were 62, 54 and 72 percent respectively.

- 3 In several unfluoridated areas (eg Sydney, New Zealand and Gloucestershire), there were large declines in tooth decay in the 1960s. These occurred too early to have been caused by fluoride toothpaste and were too large to have been caused by fluoride tablets, and so non-fluoride factors must have been playing an important role. These factors include changes in diet (such as increased consumption of cheese and wholemeal bread) and possibly improved oral hygiene and improved immunity.

In the mid and late-1970s and in the early 1980s, the use of high-concentration topical fluorides, especially fluoride toothpaste became widespread, and could have made a significant contribution to the decline in tooth decay.

- 4 Recent scientific evidence suggests that, although there is benefit in applying fluoride to the surface of the teeth in high concentrations (eg 1000 ppm or more in toothpaste, mouth rinses and gels), there is negligible benefit in actually swallowing it. This greatly weakens the case for fluoridating drinking water.



- 5 The design of many of the classical surveys and quasi-experiments on human populations, which are supposed to prove enormous benefits from fluoridated drinking water, is so poor from a scientific viewpoint that these studies may be worthless. The conduct of and/or publicity from some of the trials (eg Tamworth NSW and Hastings New Zealand) even raises questions of possible fraud.

The benefits of fluoridating drinking water have been greatly exaggerated. Provided that schoolteachers are willing to supervise daily toothbrushing in primary schools, as in Brisbane, and provided that dietary improvements continue (eg through the reform of school canteens), there would be no increase in tooth decay following the general termination of water fluoridation. Indeed, it is likely that tooth decay would continue to decline, as is occurring in unfluoridated Brisbane and most of continental western Europe which is now almost entirely unfluoridated.<sup>1</sup>

- 6.6 In commenting on the Second Interim Report of the NHMRC Working Group on water fluoridation Dr Diesendorf stated:

it actually evades or obscures most of the scientific evidence we have put forward<sup>2</sup>

- 6.7 Dr Diesendorf does not contest that the topical application of fluoride may have some effect in reducing caries. He does dispute the benefits of ingesting fluoride and therefore opposes fluoridation of public water supplies.

6.8 Dr Colquhoun, who travelled from New Zealand to appear before the Committee, similarly contests the effectiveness of ingested fluoride in reducing dental caries. Dr Colquhoun had worked in private practice as a dentist in Auckland for 12 years and at that time had been a strong advocate of fluoridation. From 1967 to 1984 he was a member of the public service as a community dentist. It was during this period that he changed his view on fluoridation.

6.9 Dr Colquhoun argued that the prevalence of dental fluorosis amongst children in fluoridated areas was considerably higher than had been predicted when fluoride was introduced in New Zealand. He also argued that fluoride ingestion overall was likely to be at a toxic level, given all the fluoride sources in addition to fluoridated water.

6.10 Dr Colquhoun informed the Committee that when, as chairman of his department's Fluoridation Promotion Committee, he gathered statistics on the condition of children's teeth he discovered that more children were free of dental decay in unfluoridated parts of most health districts in New Zealand. He said that his colleagues were reluctant to accept his interpretation of the statistics and that since that time he (in common with Dr Diesendorf) had had difficulty in getting their research published in recognised dental journals.<sup>3</sup>

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<sup>1</sup> Diesendorf, M, "Have the benefits of water fluoridation been exaggerated?", part 1 of a submission to the Social Policy Committee of the ACT Legislative Assembly.

<sup>2</sup> Diesendorf M, "Comments on the Interim Report of the NH&MRC Working Group on Fluoridation, November 1990", unpublished paper, 1990.

<sup>3</sup> Transcripts of Proceedings, 17 May 1990, pp 433-436.

6.11 Drs Colquhoun and Diesendorf both argue that the statistics demonstrate that the decline in caries preceded fluoridation, was a phenomenon throughout the western world regardless of fluoridation, and continued to decline after the comparative effects could be attributed to fluoride. It is therefore necessary, they say, to look at alternative explanations for the dramatic decline in dental caries over the last twenty to thirty years. They suggest causes such as change in diet, natural immunity to caries developing, topical applications of fluoride, and alternative sources. But Dr Colquhoun differs from Dr Diesendorf in that he also questions the efficacy of the topical application of fluoride.

6.12 Both Drs Colquhoun and Diesendorf are sharply critical of the research methods used in the various studies which appear to prove the effectiveness of water fluoridation. Criticisms include the lack of properly established control groups, lack of blind or double-blind studies and lack of consistency in recording DMFT levels. They also suggest undue examiner bias in the case of dental examinations arguing that if someone was examining teeth of children in a fluoridated area they would be more likely to record low DMFT rates than they would in unfluoridated areas.

6.13 Dr Colquhoun also argued at the public hearings that doctors and other researchers using computer search tools such as Index Medicus were only able to access pro-fluoride articles because the index was controlled by the United States Public Health Service.

### **Fluoridation has led to increase in number of dentists**

6.14 A submission from the Freedom From Fluoridation Federation of Australia stated that:

It is recorded in the Government Census that between 1981 and 1986 Canberra experienced a 39 percent increase in practising dentists.

Canberra also has the highest number of dentists per population in Australia.

In the same recorded period each State of Australia had an increase of at least 10 percent dentists.

That is only a five-year period, so the real factor of increased dentists is our 86 percent artificially fluoridated country is quite contrary to the information promulgated by the Australian and State Governments and the Australian Dental Association, the NHMRC, the Health Departments and the controlled bureaucracy.

During October, Hansard 3/10/89 records a statement by the Minister of Health, Dr Blewett, that artificial fluoridation is taking away the livelihood of dentists.

Again and again you must ask yourself why artificial fluoridation is so adamantly promoted against the truth.

## Dangers of fluoride ingestion

6.15 A number of scientists and researchers have reported the health risks associated with the ingestion of fluoride.

### Total fluoride intake

6.16 Since the introduction of fluoridation of public water supplies there has been growing concern about the dangers of increasing levels of total fluoride intake. Individuals are now receiving fluoride from a large number of sources. Fluoride is contained in soft drinks, tea, processed foods, vegetables, toothpaste and even some medications. It is also added during the cooking process when fluoridated water is used eg in soups, sauces, rice and pasta.

6.17 In an article by Geoffrey Smith in *New Scientist* in May 1983, concerns are expressed about the dangers of individuals receiving fluoride from a number of sources.

During the past two years alone, reports in a series of highly respected scientific journals, including *The Journal of the American Chemical Society*, *Science*, and both *The British Medical Journal* and *The British Dental Journal*, have warned that individuals are receiving fluoride from a growing number of sources and that too much fluoride can be harmful. ...

The reasons for the present rethink about fluoridation are twofold. First, people are now ingesting fluoride from many more everyday sources, including water, food, dental health products, and medicines as well as pesticide, insecticide and fertiliser residues and even the air we breathe. Therefore the amount received by the individual cannot be controlled. Secondly, in 1976-77, scientists at Sweden's Karolinska Institute developed a simple and reliable way of measuring levels of ionic fluoride in the blood. They found that even very small dosages of fluoride may cause "normal" blood fluoride levels to surge to potentially harmful value

6.18 In discussing the fluoride content of food and beverages in a submission to the Committee Ms A Hill stated:

The effect of processing foods and beverages with fluoridated water produces an average daily fluoride intake in the range 1.0 to 2.0 mg. The mean fluoride content in communities with fluoridated water has been shown to be three times higher than those where water is not fluoridated (2.7 versus 0.9 mg/day). Spinach has the highest amount of fluoride amongst commonly consumed vegetables and gelatin, bone meal and fish protein are also potent sources of fluoride. The fluoride content of dried cereals is highly influenced by the fluoride content of the water in which they were processed. ... Ready-to-drink fruit juices increase the fluoride content by 5 to 20 times when fluoridated water is used.

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<sup>4</sup> Smith Geoffrey, "Fluoridation— are the dangers resolved?", *New Scientist*, 5 May 1990.

6.19 Dr Diesendorf has also raised the issue of total fluoride intake. He is concerned about the variation in dose levels particularly among high risk individuals of whom infants are a major group. He claims that:

Although the concentration of fluoride is controlled at about 1 ppm, the dose in mg per day varies substantially between individuals. High fluoride doses (compared with average doses) are ingested by the following groups, among others, in fluoridated areas:

- formula-fed babies;
- young children who drink mostly tapwater-based drinks;
- outdoor workers;
- long distance runners;
- people with diabetes insipidus.

In addition, people with malfunctioning kidneys store greater quantities of fluoride in their bones.

It is such high-risk groups which require protection from environmental chemicals such as fluoride, rather than just the "average person". Although the average daily fluoride dose to adults in fluoridated areas of the USA is about 2.5–3.0 milligrammes(mg), about 1 per cent of adults (excluding tea-drinkers and those who eat canned fish regularly) ingest about 5.5 to 7.5 mg of fluoride per day. Heavy tea-drinkers consume an additional 1.0 to 7.5 mg per day.

The fluoride dose in mg per kg of body mass per day generally increases with decreasing age, so that it is greatest for infants who drink powdered formula reconstituted with fluoridated water. The daily fluoride doses received by this group of infants are 4 to 6 times the doses from fluoride supplements currently recommended by the National Health and Medical Research Council for infants in unfluoridated areas.

The doses received by this high-risk group of infants are also 100 times the natural fluoride doses received by breastfed babies who do not take fluoride supplements. (The fluoride concentration of breastmilk is only about 0.01 ppm, whatever the fluoride intake of the mother). This group of infants with high fluoride intake contains prime candidates for dental fluorosis in permanent teeth, hypersensitivity reactions, and, if high fluoride intake continues through childhood and adulthood, skeletal fluorosis in middle and old age. There are also some grounds for concern that large fluoride doses during infancy may affect the developing immune system.<sup>5</sup>

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<sup>5</sup> Diesendorf Mark, "Fluoridation: Time for a Reassessment", *New Doctor*, Issue 52, Summer 1990, p12.

6.20 A number of other recent studies have started to question the level of fluoride added to water supplies, suggesting that it may lead to excessive intake and therefore stimulate detrimental dental and non-dental effects. For example, a recent American study, reported in the Journal of the American Dental Association concluded:

At twice the optimal fluoride concentration, the additional intake from extraneous sources of fluoride could be approaching a critical threshold for producing severe fluorosis. At 2 x optimal, 7.6 percent of the labial surfaces of maxillary anterior teeth of 13 to 15 year olds examined during the latest survey showed forms of severe fluorosis. It might be that the margin of safety between optimal water-fluoride concentrations and higher-than optimal water-fluoride concentrations, while always small, could have become even smaller. Further research is needed to corroborate the findings of this study.<sup>6</sup>

6.21 The Freedom From Fluoridation Federation of Australia also submitted that:

There is a serious pharmacological question on the dental "optimum" fluoride dose for children (and adults).

The belief of the fluoridation lobby is that children should ingest 1 mg of fluoride (F) each day of their lives in order to develop caries-free teeth.

The dose they state can be daily by either 1 mg/fluoride tablet or 1 litre of fluoridated water containing 1 mg/litre (1 ppm). How this works is not known, and the fluoridation literature for many years, (WHO, Royal College of Physicians etc etc) say the mechanism by which fluoridation works is unknown.

One may question the science of the "optimum" dose when they (the profluoridationists) do not know the mechanism by which fluoridation treats the teeth, let alone just how the fluoride arrives at the necessary point of treatment, then of course, how does the physiological change occur?

A hoax which is cleverly named optimal dose is drinking water supplies at 1 ppm (F) and all the disciples endorse it accordingly. It is a religion because it is a "belief" not a science, as the dose is uncontrollable, uncontrolled, unsubstantiated and relies completely upon the thirst of an individual, clearly demonstrating the lack of scientific basis for such a process.

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<sup>6</sup> Heifetz, S B, et al, "Prevalence of dental caries and dental fluorosis in areas with optimal and above-optimal water-fluoride concentrations: a 5-year follow-up survey", *Journal of the American Dental Association*, Vol 116, April 1988, p 495.

## **Dental fluorosis**

6.22 Dental fluorosis is the mottling of teeth as a result of fluoride ingestion. This condition ranges from fluorosis so mild that only dentists can identify it to severe mottling which is disfiguring. Severe mottling causes complete discolouration, pitting and possible tooth deformation with all enamel surfaces affected.

6.23 Mild dental fluorosis has been reported to occur at concentrations of fluoride above 0.6 ppm. Chronic intake of more than 6 mg per day of fluoride results in severe mottling of tooth enamel.

6.24 Anti-fluoridationists argue that:

Little concern has been shown for, or study made of, the reactions of children who have developed visible dental fluorosis as a result of ingesting the formerly-recommended dose of fluoride in tablets or through consuming fluoride in their drinking water. The mental stress, to both the child and its parents can be considerable, and stress can be a factor in the development of acute dental caries.<sup>7</sup>

6.25 Dr Colquhoun, as stated above, asserts that the level of fluorosis is considerably higher than predicted in areas which have been fluoridated. He contests the claim, made by some dentists, that it is hard to differentiate between mottling caused by fluorosis and other forms of mottling.

## **Non-dental effects of fluoride ingestion**

### **Interference with enzyme function – leading to birth defects**

6.26 The Nambucca Valley Association informed the Committee that:

In 1976 Swedish scientists developed simple and reliable ways of measuring blood levels of fluoride and found that even minute doses can cause 'normal' blood levels to 'peak' to potentially harmful ones. The free fluoride ion in the bloodstream has the ability to penetrate cell membranes and to interfere with enzyme function and mineral balance throughout the body and explains many disorders and pathological conditions arising from fluoridation. The health implications of enzyme changes are not fully known, but the possible damage is profound and diverse. For example, the oxygen carrying enzymes (called cytochrome C oxidase) in the blood are inhibited by fluoride. A deficiency in these enzymes causes oxygen starvation in the cells, which is acknowledged as one of the major causes of birth defects, infant mortality, Down's Syndrome and cot deaths.

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<sup>7</sup> Sutton, P R N, *Fluoridation, 1979: Scientific Criticisms and Fluoride Dangers*, a personal submission to the Committee of Inquiry into the Fluoridation of Victorian Water Supplies, August 1979, p 169.

. **Repetitive Strain Injury (RSI)**

6.27 Some people believe that there is a relationship between repetitive strain injury and fluoride ingestion. Indeed, one sufferer made a submission to the Committee to this effect.

. **Skeletal fluorosis**

6.28 A high level of fluoride ingestion over a protracted period can lead to the development of skeletal fluorosis. This condition was first reported in workers involved in the manufacture of aluminium from cryolite and was subsequently shown to result from the inhalation of airborne fluoride. The Committee of Inquiry into the Fluoridation of Victorian Water Supplies noted that endemic fluorosis was first reported in 1937:

The condition occurred among the inhabitants of certain villages in Madras, India. Some of the wells supplying the drinking water to those villages contained fluoride in concentrations in excess of 10 ppm. Shortly after, the condition was described in the Punjab and other areas of India, South Africa, China and several other countries with high fluoride contents in drinking water and soil.<sup>8</sup>

6.29 Skeletal fluorosis is endemic in tropical regions in which there is a high concentration of fluoride in the drinking water. Whether skeletal fluorosis can be attributed solely to fluoride in the water, or is complicated by malnutrition, is uncertain.

. **Cancer**

6.30 The Nambucca Valley Association, in its submission to the Committee, also claimed that:

A Canadian Government enquiry came to the conclusion that artificially fluoridated water contains mutagens. This was based on information from scientific studies demonstrated before the USA courts. These studies were done by Dr Dean Burk, a world leading biochemist with 50 years in cancer research including 35 years in the USA National Cancer Institute with many awards given for previous research, and his colleague Dr John Yiamouyiannis, a biochemist and Science Director of the National Health Federation of the USA.

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<sup>8</sup> Report of the Committee of Inquiry into the Fluoridation of Victorian Water Supplies for 1979-80, op cit, p 49.

Dr Burk and Dr Yiamouyiannis present one of the largest and most sophisticated epidemiological studies in modern science, covering the cancer/fluoridation experience derived from official government statistics, of 18 million Americans over 30 years. There were controls for known and unknown variables including geographic and environmental factors, double-blind design to avoid bias, and an objective and manageable index (vis cancer deaths), for the time trend studies, together with adjustments for age, race and sex by direct and indirect methods. It revealed that at least 10,000 more persons die of cancer each year in the USA due to fluoride ingestion.

Professor Ali Mohamed, of the University of Missouri, a noted cytogeneticist, did a series of experiments which showed the capacity of fluoride, even at low concentrations, to induce or accelerate genetic damage, tumours and cancer in experimental animals, plants and insects under controlled laboratory conditions. Further experiments by other researchers (T Tsutsui et al) as late as 1984, show that at least one type of mammalian cell grown in fluoride-treated culture, induces tumours when injected back into the living mammal. Untreated cells do not have this effect. While there are limitations in both laboratory experiments and epidemiological surveys, they are the two main methods used to help identify carcinogens. There is much more research to be done in the area of a cancer/fluoridation connection, but there is a definite risk, and so far the evidence is worrying.

6.31 The United States National Toxicology Program (NTP) was conducting a study of chronic toxicity and carcinogenicity of sodium fluoride in rats concurrently with the Social Policy Committee's inquiry. On January 22 1990, an interim "fact sheet" was made public. Pathology results were available, but not the interpretation and evaluation of the results. This fact sheet was submitted to the Committee from several sources.

6.32 The National Health and Medical Research Council deferred their Working Group report on fluoride, pending the results of the United States study. The findings of both will be considered in Part 2 of this report.

### **Allergic reactions to fluoride**

6.33 The Nambucca Valley Association describes these:

In the USA particularly, large populations have been ingesting fluoride in their drinking water for decades. This gave scientists and others time to carry out tests and note the health statistics. A certain percentage of people are intolerant to fluoride (ie allergic) and the water has caused them to have serious health problems and even death. Some of the symptoms are: skin eruptions, gastric upsets, headaches, excessive thirst and urination, and exhaustion. If the allergic person does not drink fluoridated water for some weeks their symptoms disappear.



6.34 Dr G L Waldbott wrote a strong attack on water fluoridation, **Fluoride the Great Dilemma**, in which he documented many case histories of patients whose symptoms he attributed to the effects of fluoride, and especially fluoridated water. In it he listed the major symptoms (with the caveat that some of these symptoms could have other origins even in someone suffering from chronic fluoride poisoning):

Chronic fatigue not relieved by extra sleep or rest  
Headaches  
Dryness of the throat and excessive water consumption  
Frequent need to urinate  
Urinary tract irritation  
Aches and stiffness in muscles/bones (arthritic-like pain) – in lower back, jaws, neck area, arms, shoulders, legs  
Muscular weakness  
Muscle spasms (involuntary twitching)  
Tingling sensations in fingers (especially) and feet  
Gastrointestinal disturbances – abdominal pains, diarrhoea, constipation, blood in stools, bloated feeling (gas) tenderness in stomach area  
Feeling of nausea (flu-like symptoms)  
Pinkish-red or bluish-red spots (like bruises, but round or oval) on the skin that fade and clear up in 7–10 days  
Skin rash or itching, especially after showers or bathing  
Mouth sores (also from fluoridated toothpaste)  
Loss of mental acuity and ability to concentrate  
Depression  
Excessive nervousness  
Dizziness  
Tendency to lose balance  
Visual disturbances – temporary blind spots in field of vision, diminished ability to focus (possible retinal damage)

### **Kidney problems**

6.35 Several submissions referred to fluoride causing problems to people with kidney disease, and especially those on dialysis. A submission from Mr Walter Miller, of California, cited Dr Yiamouyiannis:

Dr Luis Juncos and James Donadio of the Mayo Clinic described a 17-year-old girl and an 18-year-old boy who had skeletal and dental fluorosis, accompanied by markedly reduced kidney function. The youths' primary source of drinking water contained 1.7 and 2.6 ppm fluoride, respectively. In regards to these two cases, Drs Juncos and Donadio concluded that either

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<sup>9</sup> Waldbott, G L, **Fluoridation: the Great Dilemma**, Coronado Press, Lawrence, Kansas, 1978, p 393.

fluoride was damaging the kidney or that fluoride was not being removed from the body because of an already damaged kidney. The possibility that fluoride damaged the kidneys is supported by evidence from the Yerkes Primate Research Center in Atlanta and Cornell University which show that 1 to 5 ppm fluoride causes interference with enzymes in the kidney and kidney damage to laboratory animals.<sup>10</sup>

### **Thyroid malfunction**

6.36 Some have also suggested that fluoride is harmful to the proper functioning of the thyroid gland. Dr Sutton cites a number of sources which claim that fluoride impairs the thyroid function. For example:

Professors T Gordonoff and W Minder stated, in 1960:

There is a true antagonism between fluorine and the amounts of iodine taken up by the thyroid. This may result in an approximately 20 to 30 percent reduction in function.<sup>11</sup>

### **Arthritis**

6.37 A number of submissions suggested that fluoride was a cause of arthritis. In his book **Fluoridation the Great Dilemma** George L. Waldbott refers to a number of studies linking fluoride to arthritis including Jolly (1973), Vischer (1969) and Cook (1971).<sup>12</sup> Dr Waldbott himself has linked arthritis and joint pains to the consumption of fluoridated water and claims to have brought about a reversal of the symptoms by eliminating fluoridated water from the diets of his patients. Dr Yiamouyiannis has reported a link between arthritic symptoms and exposure to air-borne fluoride in several countries.<sup>13</sup>

### **Fluoride toxicity**

6.38 Fluoride salts have and are widely used as insecticides and poisons for rodents. Sodium fluoride is widely used as a cockroach powder.

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<sup>10</sup> Yiamouyiannis, J, **Fluoride, the Aging Factor: How to Recognise and Avoid the Devastating Effects of Fluoride**, Health Action Press, 2nd edn, 1986, p 9.

<sup>11</sup> Sutton, P, op cit, p 193.

<sup>12</sup> Waldbott George L, op cit, pp 101, 132 and 199.

<sup>13</sup> Yiamouyiannis J, op cit, p 45.

6.39 These fluoride salts act as very potent inhibitors of enzymes in cells which produce the energy requirements for cells. It is this property of fluoride which kills insects and rodents and humans (at doses in excess of 2 grams), as well as (at much lower doses) bacteria in dental plaque.

6.40 Opponents of fluoridation argue that the fluoride salts used for fluoridation are toxic and therefore they should not be added to public water supplies.

### **Opposition on other grounds**

6.41 The Committee received as a submission from Mr Harley Dickinson, Member of the Victorian Legislative Assembly, a copy of **The Dickinson Statement** which suggests a broad conspiracy on the part of advocates of fluoridation. It cites a speech which Mr Dickinson made:

At the end of the second world war, the United States Government sent Charles Eliot Perkins, a research worker in chemistry, biochemistry, physiology and pathology, to take charge of the vast Farben chemical plants in Germany.

While there he was told by German chemists of a scheme which had been worked out by them during the war and adopted by the German General Staff.

This was to control the population in any given area through mass medication of drinking water. In this scheme sodium fluoride occupied a prominent place.

Repeated doses of infinitesimal amounts of fluoride will in time reduce an individual's power to resist domination by slowly poisoning and narcotizing a certain area of the brain and will thus make him submissive to the will of those who wish to govern him.

Both the Germans and the Russians added sodium fluoride to the drinking water of prisoners of war to make them stupid and docile.<sup>14</sup>

6.42 The author suggests that a fluoridation campaign in Northern Ireland, initiated by the British Government, was an attempt by Mrs Thatcher to "sedate the people and render them subservient to her autocratic dictates".<sup>15</sup> This claim was also repeated in the Committee's public hearings.

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<sup>14</sup> Stephens, I E, **The Dickinson Statement: A Mind Boggling Thesis**, published by author, October 1987, p 1.

<sup>15</sup> Stephens, I E, *op cit*, p 13.

6.43 Most of the major writers on fluoride who broadly fit under the description of anti-fluoridationist refer to the politics of the debate and the suppression of evidence of the anti-fluoride case. Dr P Sutton, for example, who made a submission to the Victorian inquiry, which he then published, described repressive actions which included the discouragement of discussion on fluoridation, repression and abuse of opponents of fluoridation, the suppression of published evidence against fluoridation and the difficulties in publishing new material which questions fluoridation.<sup>16</sup>

6.44 Ms Wendy Varney has written that:

Two recurring problems appear to have beset the fluoride question at governmental levels in this country. Firstly, there seems an inescapable conflict of interest within the existing structures. Those bodies and authorities whose task it is to promote fluoridation, such as the NHMRC at federal level, are precisely those which, either by their own monitoring, or through their own reports, or else by virtue of acceptance by "independent" committees that these bodies are the best equipped and most reliable experts to provide the necessary information, are the ultimate "regulators" of the measure. ...

Secondly, and interacting with the first problem, is that from the outset the burden of proof has been squarely placed on those who are uncertain of the safety of fluoridation, who, by and large, fall outside of the bureaucratic structures. Not only, therefore, is the state committed to fluoridation, through its promotional activities, but the resources of the state are directed singularly towards the reinforcement of the notion that fluoride is safe and effective.<sup>17</sup>

6.45 Varney identifies industry beneficiaries of artificial fluoridation which include: those which supply the by-product to the water supply authorities; food manufacturers whose products are conducive to tooth decay; and those companies which have entered the fluoride market with products such as fluoridated toothpastes, sold as harmless and effective prophylactic against dental decay.<sup>18</sup>

6.46 Varney expands on this concept of vested interest in describing the protagonists of fluoride.

While sections of industry have been the quiet beneficiaries from fluoridation, medical bodies such as the Australian Dental Association and the Australian Medical Association have been the vocal endorsers. Indeed,

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<sup>16</sup> Sutton, P R N, *Fluoridation, 1979: Scientific Criticisms and Fluoride Dangers*, August 1979.

<sup>17</sup> Varney, W, *Fluoride in Australia: A Case to Answer*, Hale and Iremonger, 1986, pp 124-125.

<sup>18</sup> Varney, *op cit*, p 53.

any proposal to fluoridate (or statement aimed at allaying fears about fluoride) are invariably prefaced with an assurance that 11 respected and competent bodies are unanimously satisfied as to the innocuousness of fluoridation.<sup>19</sup>

6.47 Indeed, Mr G Walker<sup>20</sup> at the Committee's hearings, went further by suggesting that because "every university in the world was funded directly and indirectly by the fluoridation lobby" it was difficult for scientists to begin discussing the possible drawbacks of fluoridation.

6.48 This chapter has provided an overview of the arguments against water fluoridation which have been put to the Social Policy Committee. As was the case with Chapter 5, they do not necessarily reflect the Committee's own view, which will be given in Part 2.

6.49 Chapter 7, which follows, will outline the responses the Committee received from embassies, high commissions and consulates on fluoridation policies in their respective countries.

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<sup>19</sup> Varney, op cit, p 79.

<sup>20</sup> Mr Glen Walker is author of **Fluoridation: Poison on Tap**, Glen Walker, Melbourne, 1982.



## **7 WATER FLUORIDATION OVERSEAS : RESPONSE TO COMMITTEE'S REQUEST FOR INFORMATION**

7.1 On behalf of the Social Policy Committee, the Presiding Member wrote to all embassies, high commissions and consulates in Canberra to seek information about policies on water fluoridation in their respective countries. A list of those who responded is given in Chapter 2.

7.2 This chapter provides an overview of these responses.

7.3 Great caution should be taken not to draw the wrong conclusions from responses of this kind. For example, natural fluoride levels in water supplies vary considerably. Should a response say that certain areas are not fluoridated, this could mean that the natural sources have a relatively high fluoride level in the first place.

7.4 The constitutional and legal position relating to water fluoridation also varies from country to country. An authority may wish to fluoridate but be subject to legal challenge if it does. In addition, the extent, locus or level of government responsibility for water supplies (national/state/local government and so on) varies from country to country.

7.5 The extent to which people have access to community water supplies also varies considerably, with many poorer or less-developed areas depending on well or bore water. In order to implement water fluoridation it is necessary to have both a reliable public water supply and grid electricity. Many countries lack these basic requirements. The decision here, therefore, may be not whether fluoridation is effective but whether it is possible.

7.6 What appears below, therefore, is an overview of the responses, with elaboration or illustration where this was provided.

7.7 Before looking at the country by country responses, the role of the World Health Organisation and the European Economic Community will be considered.

### **World Health Organisation**

7.8 In its report **Experience on water fluoridation in Europe** the World Health Organisation described the origins of its involvement in the fluoridation issue:

The World Health Organisation's interest in fluoridation of drinking water as a means of tackling the problem of dental caries goes back to the early 1950s when confronted with the first reliable proof that certain concentrations of fluoride in the water supply reduced the level of tooth decay, particularly amongst children.

At a WHO Dental Health Seminar held in New Zealand in 1954, it was concluded that the presence of fluoride in community water supplies of appropriate concentrations of 1 mg/l was associated with lowered incidence of dental caries, and that the adjustment of the fluoride content of community water supplies to an optimal level is a safe and effective health measure, and that particularly in those countries where dental caries is prevalent, fluoridation of water supplies should be undertaken. As one of the follow-ups to the 1954 meeting a WHO Expert Committee on Water Fluoridation met in Geneva in 1957. This committee again concluded that drinking water containing approximately 1 mg/l fluoride has a caries preventive action, and added that maximum benefits are derived if such water is consumed throughout life.

In 1969, the Twenty-Second World Health Assembly, in Resolution WHA 22.30, recommended that Member States introduce community water fluoridation and, where this would not be practicable, study alternative methods of using fluorides to protect dental health. In 1974, the Executive Board of the World Health Organisation requested that the Director-General develop a programme within WHO for the promotion of community water fluoridation and other approved methods of preventive dental caries.

Noting that no nation can expect to solve the problem of dental caries solely by the provision of curative services, the Twenty-Eighth World Health Assembly in 1975, in Resolution WHA 28.64 approved the programme proposed by the Director-General and stressed the importance of optimising the fluoride content of water supplies.

In 1978, the Thirty-First World Health Assembly, in Resolution 31.50, reaffirmed its support of fluoridation as safe, inexpensive, and effective, and urged Member States to consider fluoridation of public water supplies as part of their national plans for prevention and control of oral disease; and it suggested that, where community water fluoridation is not feasible, alternative methods of achieving optimum daily intake or application of fluorides should be envisaged.<sup>1</sup>

7.9 In 1982 there was a further endorsement from an FDI/WHO/KELLOGG Foundation Conference on fluorides in Vienna:

The International Conference on Fluorides reviewed the findings of recent experimental, clinical, and epidemiological research on the use of fluorides in promoting dental health. While welcoming the reports of declining caries experience in many developed countries, it was greatly concerned about the sharp increase in dental caries in some developing countries. As there is no possibility of treating so many decayed teeth with the dental resources at present available in the developing countries, the only hope is to contain the caries problem by preventive measures.

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<sup>1</sup> World Health Organisation, *Experience on water fluoridation in Europe*.



The Conference agreed that community water fluoridation is an ideal public health measure for the prevention of dental caries in countries with well developed, centralized public water supplies. It was in agreement with the view of the FDI, WHO, and the medical and dental professions throughout the world that community water fluoridation is an effective, safe, and inexpensive preventive measure, which has the virtue of requiring no active compliance on the part of the persons benefited. The Conference recommended that community water fluoridation be introduced and maintained wherever possible.<sup>2</sup>

7.10 In a letter to the Geelong and District Water Board the Western Pacific Regional Office of the World Health Organisation advised, in May 1986, that:

As you know, WHO through its General Assembly resolutions have advocated and supported fluoridation of drinking water supply in fluoride deficient areas.

But added the recommendation that:

To determine when it is appropriate to fluoridate is a matter that requires the prior determination of prevailing fluoride intake from all sources including drinking water, food and the general environment.

### **The European Economic Community**

7.11 The Council Directive of the European Economic Community, of 15 July 1980, provides guidelines on acceptable limits for the fluoride concentration in water for public consumption.

7.12 Article 8 states:

Member States shall take all the necessary measures to ensure that any substances used in the preparation of water for human consumption do not remain in concentrations higher than the maximum admissible concentration relating to these substances in water made available to the user and, that they do not, either directly or indirectly, constitute a public health hazard.

7.13 In its list of parameters, under the heading "Parameters concerning substances undesirable in excessive amounts", fluoride is given two upper limits, according to the temperature. If the temperature falls within 8–12 degrees centigrade, 1.5 ppm is the maximum. If the temperature falls within 25–30 degrees centigrade, 0.7 ppm is seen as the maximum concentration of fluoride.<sup>3</sup>

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<sup>2</sup> Murray, J J, *Appropriate use of fluorides for human health*, World Health Organization, Geneva, 1986, pp 127–178.

<sup>3</sup> *Official Journal of the European Communities*, No L 229/11, 30 August 1980.

## **Overview of responses from embassies and high commissions**

### **. Britain**

7.14 The British High Commission enclosed a copy of a letter from the British Department of Health which reported:

Evidence from around the world has proved conclusively that water fluoridation reduces dental decay. Although there has been a significant and welcome general decline in the prevalence of dental decay in the UK in recent years, studies which have been carried out contrasting comparable fluoridated and non-fluoridated areas have consistently shown that the reduction in dental decay is between one third and one half greater in the fluoridated areas than in non-fluoridated areas.

The British Government believes fluoridation to be safe. This is the view not only of the eminent independent medical and scientific experts who advise the Government on fluoridation, but also that of the overwhelming weight of medical and scientific opinion throughout the world. ...

Whilst fluoridation is not widespread in Western Europe, the reasons for this have been mainly due to technical feasibility or legality. In this country, some 6.5 million people receive artificially fluoridated water whilst in Eire fluoridation of water supplies is mandatory on a national basis. ...

On the question of freedom of choice, the Government does not believe that the supplementing of fluoride levels in water to a level which occurs naturally in a number of areas in the United Kingdom can be described as mass medication. Fluoride is already present at varying concentrations in all domestic water supplies. Water fluoridation does not introduce any alien substance into the water supply but rather adjusts the level of fluoride to the optimal concentration for dental health of 1 ppm.

However, the Government is also fully aware of the sensitivities surrounding this subject and recognises that local opinion on the need for this measure may differ. The Water (Fluoridation) Act therefore ensures that the final decisions on this matter are taken only at a local level. The results of professional opinion polls have consistently shown public support in this country for fluoridation running at about 70 percent.

. **Canada**

7.15 The Minister of National Health and Welfare wrote:

The year 1989 marked the forty-fourth years since the first city in Canada, Brantford, Ontario, adjusted the fluoride level in its water supply to improve the dental health of its citizens. Yet, only 39.2 percent of Canadians who have the possibility of receiving this benefit are presently able to do so.

Tooth decay is still a widespread and costly disease. Fluoridation, in concert with good oral hygiene, proper diet, and parental counselling, is the most effective and inexpensive method of combating this disease.

Questions concerning the safety of present-day water fluoridation practices have been thoroughly checked many times, and my Department is satisfied that there is no human health hazard from this public health measure.

It is my earnest hope that fluoridation of public water supplies will soon be implemented throughout Canada.

. **Chile**

7.16 The Embassy wrote:

Drinking water is currently being fluoridated in the Province of Valparaiso urban services. It is planned to extend fluoridation to all urban centres in the country.

. **Cyprus**

7.17 Cyprus does not fluoridate its water supplies, giving the ethics of mass medication as its rationale. The Director of Dental Services in the Ministry of Health indicated that water fluoridation would be difficult because of the diversity of water sources (which have a range from .01 to 2.15 ppm natural fluoride concentration).

7.18 The Dental Health Services have a program of topical application and fluoride tablets for children.

. **Czechoslovakia**

7.19 The Scientific Council of the Ministry of Health recommended the introduction of fluoridation of drinking water wherever possible. The methodological instruction for fluoridation was issued by the General Health Officer in 1967.

Development of fluoridation of drinking water: in 25 years it was introduced in 567 localities in the Czech Socialist Republic, supplying about 33 percent of population. The extent of water fluoridation in the Slovak Socialist Republic is very limited due to unfavourable water resources.

After 12 years of fluoridation of drinking water a representative sample of population aged 6–14 was examined. When compared with the results of basic research in 1975 the examination showed a reduction in cariogenicity of 38 percent in the temporary dentition and 39 percent in the permanent dentition.

Children aged 12 living since birth in Prague where water was fluoridated for their entire lives had in 1987 on average 1.8 Decayed, Filled or Missing Teeth. This figure is 44 percent lower when compared with average cariogenicity of 12-year old children in the Czech Socialist Republic and 53 percent lower than in children in Slovakia.

Fluoridation of drinking water in Prague stopped on 30 September for technical reasons and has not been resumed to date.

In connection with the interruption of fluoridation of drinking water in Prague some doubts were expressed in the media (press and television) about the effects of fluoridation on human health and its preventative value. The arguments against the preventative effects were based on the information in foreign countries (Diesendorf, Colquhoun and Ziegelbecker).

Despite the clearly proved effectiveness of fluoridation of drinking water in Czechoslovakia and the continued support for it by the World Health Organisation, the present campaign against it could affect public opinion to such a degree that the water fluoridation could be interrupted or even abandoned at a number of locations.

#### **Federal Republic of Germany (formerly)**

##### **7.20 The Embassy responded that:**

The adding of fluoride to drinking water is not allowed in the Federal Republic of Germany. Section 37 of the Food and Commodities Act gives the state authorities however the possibility exists to grant exemptions from this general rule. So far this provision has not been used.

## **Finland**

7.21 The following was included in the Embassy's response:

Finland has only limited experience on water fluoridation in practice. In the whole country only one city, Kuopio, fluoridates its piped water supply. The paucity of the fluoridated water systems is not a consequence of an adequate supply of natural fluorides among the population. With the exception of a few uniform high fluoride areas in the southeastern and southwestern parts of the country, the natural fluoride content in the drinking waters of Finland tend to be low. The majority (78 percent) of the population (that totals about 5 million) are residing in low fluoride areas with fluoride concentrations of the drinking water being less than 0.5 mg/l. Twelve percent are using water containing 0.5 to 1.5 mg fluoride per litre, and for 10 percent of the population the concentration exceeds 1.5 mg/l.

No legal constraints impede the implementation of water fluoridation programmes in Finland. In contrast, water fluoridation has, especially in the 1970s, been strongly encouraged by the state health authorities. In the Finnish system, however, each commune (in all over 400) may decide quite independently whether it fluoridates its drinking water or not. At present, a permission by the National Board of Health is required before the implementation of any water fluoridation programme in Finland. The state authorities do not have the power, however, to force unwilling communes to introduce such programmes.

Fluoride tablets (0.25 F) are used in young age groups. The total sale in 1988 was 143.5 million tablets. Fluoride tablets can be purchased at pharmacies without prescription and are free of charge to children from the age of 6 months up to the age of 16 years.

At schools 0.2 percent sodium fluoride mouthrinses were common in the 1970s. Recently fluoride dentifrices and topical applications in dental clinics have replaced most of the school-based rinsing programmes.

Fluoride pastes, gels, varnishes, etc (up to 2 percent F) are applied topically on caries risk groups by dental assistants and dentists.

Fluoride dentifrices are freely available all over the country, and some 99 percent of all dentifrice sold in Finland in 1988 contained fluoride. Consumption of dentifrices has gradually increased. In 1988 an average Finn used approximately 172 ml dentifrice.

Sugar fluoridation:

The first research reports on sugar fluoridation were published in Finland in 1979. Today there are serious attempts to introduce sugar fluoridation in candy production. A field trial on large scale fluoridation of certain candy products is under preparation.

. **Greece**

7.22 The Embassy wrote that fluoride was not added to the community water supply in Athens and, as far as the Embassy knew, this was also the case in other Greek cities. The Embassy indicated that the relevant Greek authorities had provided the following reasons for not supporting water fluoridation:

. Fluoride is a toxic substance and, as such, is included in a list of undesirable elements which should not be contained in drinking water according to directive No 80/778 of the European Community. It should be noticed that this is especially important for Greece, where a large quantity of the water supplied is actually drunk by the population because of the warm climate.

. Consumer groups have repeatedly expressed their opposition to water fluoridation.

. It is considered better to prevent tooth decay through dental care instead of installing expensive plants to fluoride water.

. **Iran**

7.23 The Embassy responded:

I would like to inform you that fluoride is added to the drinking water of my country and it is considered as a very useful element in tooth enamelling especially during the period of childhood.

. **Ireland**

7.24 The Embassy wrote:

Arising from a belief in the 1960s that water fluoridation was beneficial to dental health an Act was passed in 1960, the Health Fluoridation of Water Supplies Act, 1960. The constitutionality of the Act was contested in the Supreme Court and it was not until 1964 that fluoridation began with fluoridation of supplies in Dublin and Cork.

Every suitable supply has since been fluoridated, the criteria being feasibility on engineering grounds and that the population using the supply must be at least 1,000 to 1,500. Sixty-five percent of the population now receive fluoridated water.

Baseline studies were carried out in the 1960s and following on these, a report issued in 1984 found that children who were lifetime dwellers in fluoridated areas benefited from improved dental health.

. **Italy**

7.25 The Ministry of Health provided the following information:

Considering that in Italy a specific legislation on water fluoridation does not exist, we would like to inform that we follow the Superior Council of Health (consultative body of the Ministry of Health) in favour of fluoridation of the water-works, as a method of karyoprophylaxis.

Such method, found to be the most efficient among many other international bodies and major dentistry organizations, appears to be harmless if correctly applied and has an actual cost inferior to that of fluoroprophylaxis and prevention in general.

The Embassy cited EEC Directive 80/778 in support of this policy decision.

. **Korea**

7.26 Korean water supplies are not artificially fluoridated. Two reasons were given: that the less additives to water supplies the better; and that there was a danger of side-effects on young teeth.

. **Lebanon**

7.27 The Embassy responded:

The public water supply in Lebanon is not fluoridated. However, fluoride tablets are available from pharmacies and fluoride toothpaste is widely used and recommended by dentists.

. **Malaysia**

7.28 The Ministry of Health Malaysia wrote:

Upon approval by the Government the National Fluoridation Programme was implemented in this country in phases, beginning in 1975. Today, all the major water treatment plants have been installed with fluoride feeders, supplying fluoridated water to more than 60 percent of the population...

The programme is quite well implemented and the reduction in caries prevalence among the school children in this country is becoming evident. In 1971 (pre-fluoridation survey) the DMF status for 12-year-old children was 3.7. In 1989 (post-fluoridation survey) the DMF of this group was 2.4. ... The six-year-old showed the greatest decline of about 50 percent as compared to the previous survey. The reduction for the 12-year-old group was about 36 percent and the 16-year-old group was about 9 percent.

## **Malta**

7.29 The High Commissioner wrote:

The Medical and Health Department in Malta have no official policy on the fluoridation of water, it being considered that the compounds found naturally in the water supply in Malta do not need any special treatment.

## **Netherlands**

7.30 The Netherlands does not fluoridate. The Embassy provided the following account, "Fluoridation of Drinking Water in the Netherlands":

### Fluoridation of drinking water: the beginning

In 1942 the results of an epidemiological study were published, which has been carried out on children between 12 and 14 years old in 21 cities in the United States. The results showed a link between the fluoride naturally present in drinking water and the incidence of dental caries. At a concentration of 1 mg fluoride per litre of drinking water, the incidence of caries was reduced by half, while there was little risk of fluorosis, the discoloration of the teeth due to a high concentration of fluoride.

These results led to high expectations within the world of dentistry. The addition of fluoride to drinking water would provide a simple, cheap method of controlling the extremely common disorder of dental caries. In 1945, in the American Grand Rapids, the first water fluoridation project was set up.

### Pilot drinking water fluoridation project in Tiel, The Netherlands

The Dutch were among those whose attention was attracted by the American studies into the results of drinking water fluoridation, and plans were drawn up for the implementation of fluoridation in the Netherlands. For safety's sake, an experiment was to be set up to see whether the effects under Dutch conditions were comparable with those in the United State. The experiment started in 1952 in the town of Tiel, where the fluoride concentration was increased from 0.15 mg to 1.1 mg per litre. The results were compared with those from the municipality of Culemborg, where no fluoridation of the water was carried out.

In 1952 and 1953, the incidence of caries in children was the same for both communities. In 1957, however, 4 to 5 years after the introduction of fluoridation, the results were very favourable.

Depending on age, children in Tiel had 50 to 70 percent less caries than their contemporaries in Culemborg.



### Implementation of drinking water fluoridation

The experiment in Tiel and Culemborg was scheduled to continue for 15 years, but as early as 1955 the Dutch Minister of Health and Social Services sought advice from the Health Council concerning the desirability of fluoridation with a view to caries prevention. The Health Council, partly on the basis of the results from Tiel, recommended the fluoridation of water in the Netherlands at a concentration of 1 – 1.2 mg per litre.

The Minister accepted the Health Council's advice, but left the decision as to whether or not to fluoridate to the water companies, which in most cases meant the local councils. A large number of councils implemented fluoridation between 1962 and 1967, and by the end of 1972 almost four million Dutch citizens were drinking fluoridated water supplied by 18 water companies.

### The resistance

Despite all the public information about fluoridation – for which a special government commission was set up in 1960 – more and more objections were made to the addition of fluoride to drinking water. The main objection concerned the infringement of personal liberty. Fluoride was being added to drinking water as a preventive health measure; the fact that everyone was to be forced to take this 'medicine' was an attack on the rights of the individual. In addition, many dangers to health were cited – often in a highly emotional way.

The resistance became organised in 1962 with the formation of the Association for the Protection of Drinking Water (Vereniging tot bescherming van het drinkwater), followed in 1968 by the Drinking Water Guardian Foundation (Stichting waakzaamheid drinkwater).

The first local action committee was formed in the town of Bussum in 1966. The number of anti-fluoride groups was estimated at around 30, which meant that wherever fluoridation was implemented or there was a threat of fluoridation, there was an action committee present.

### 1970: pronouncement by the Crown

In 1968, opponents of water fluoridation resorted to legal weapons. Shortly after the Central Netherlands Water Company had been granted permission to begin fluoridation, an appeal was lodged with the Crown, and this example was followed by opponents in other municipalities.

In 1970 the Crown made a pronouncement. A condition ought to have been imposed on the water companies, the objectors must be given the opportunity to obtain non-fluoridated drinking water.

This meant that the Association of Water Companies in The Netherlands (Vereniging van Exploitanten van waterleidingmaatschappijen in Nederland – VEWIN) was faced with the task of supplying both fluoridated and non-fluoridated water. As long as the number of objectors was small, it was sometimes possible to meet the demand for non-fluoridated water. In Amsterdam, for example, there were just five supply points where water without fluoride could be drawn. When, thanks to the activities of the Pure Drinking Water action committee, more than a thousand requests for non-fluoridated water were received in Tiel, the water company was forced to end fluoridation in the town.

Legal proceedings sometimes led to the end of water fluoridation, as happened after a judgement by the Dutch High Court in Arnhem, for example. The result of all this was that from 1968 onwards, progress in the drinking water fluoridation programme virtually came to a standstill.

#### 1973 pronouncement by the Supreme Court

##### Drinking Water Fluoridation Bill

In 1973 the Supreme Court of The Netherlands reached the conclusion that drinking water fluoridation could not be included under the independent authority of the municipalities, but that a statutory basis was required for the measure. In the same year, a bill of the 'Amendment of the water company law with respect to the fluoridation of drinking water' was introduced.

When the bill was put through in the Dutch Lower House of Parliament in 1976, the criticism was so great that the Minister first asked for an adjournment of the debate, and later withdrew the bill, thus signifying the end of drinking water fluoridation in The Netherlands.

##### Consequences of the rejection of drinking water fluoridation

As a reaction to the rejection of drinking water fluoridation, attention was focused more strongly on alternative methods of supplying fluoride: fluoride tablets, fluoride toothpaste, and local application of fluoride preparations

Fluoride tablets and local application were included in the services offered by the Dutch Health Service. In school dentistry, several regions switched to the application of fluoride in the form of local application or rinsing with a fluoride solution. There was also a great increase in the use of fluoride toothpaste.

Professor Backer Dirks – then Professor of Preventive Dentistry at the State University of Utrecht and a great champion of drinking water fluoridation, and who also, for example, began the study into the effects of fluoride in Tiel – recently announced that there is no longer a need for water fluoridation for the majority of the population in The Netherlands.

Epidemiological research among young people has shown that the incidence of tooth decay has begun to fall. Moreover, this fall has continued since 1985 and is now also gradually becoming apparent among the young adult population. This leads to the conclusion that, without interference from the authorities, the population itself, by the adoption of a healthier lifestyle - including the use of fluoride – is successfully bringing the dental caries problem under control.

Professor Backer Dirks' view on this subject is that "the problem of dental caries has shifted from being an insoluble problem for the majority to a problem for special population groups, such as: the lower income groups and many immigrant children. Water fluoridation would be helpful for these groups, but they are too small to justify this".

Water fluoridation remains an important measure for many countries with a high incidence of caries, low dental awareness, few dentists and a relatively low income.

In The Netherlands, health is something which in the first place is the responsibility of the individual, and our relatively high level of knowledge enables us to put this into practice.

## **Norway**

7.31 Norway does not fluoridate. The Embassy wrote:

A committee on fluoridation appointed by the Ministry of Health and Social Affairs submitted its report in 1969. The committee unanimously endorsed water fluoridation, considering it as a safe and effective dental public health measure, and recommended that the local authorities be given jurisdiction to pass bylaws for the fluoridation of public water supplies in communities with waterplants meeting defined technical standards.

So far, no fluoridation bill has been presented to Parliament.

There has been and still is an organized and strong opposition to the measure.

The Director-General of the Directorate of Health has for many years recommended water fluoridation as a safe and most effective public health measure.

7.32 The use of fluoride toothpastes, fluoride tablets etc appears to have markedly improved the dental health of the Norwegian population.

. **Pakistan**

7.33 Pakistan does not fluoridate any community water supplies.

. **Portugal**

7.34 Portugal does not fluoridate its water supplies.

. **Singapore**

7.35 Singapore's water supply has been fluoridated since 1957. This has been found to be an effective method for the prevention of dental caries. It is also cost effective. According to the Ministry of Health, in Singapore, in 1984, children about 12 years of age have an average of 2.47 Decayed, Missing or Filled Teeth each. The target recommended by the World Health Organisation is a DMFT of 3.0 by the year 2000.

The fluoride level maintained in our drinking water is between 0.6 and 0.8 milligrams per litre and is within the WHO Guidelines for Drinking Water Quality (1984). Dentists in Singapore are aware that a high intake of fluoride in early childhood does cause fluorosis and some of them are carrying out studies on the prevalence of enamel mottling. The Ministry of Health is also keeping close watch on similar studies in neighbouring countries.

. **South Africa**

7.36 Fluoride is not added to any South African water supplies. The Chief Medical Officer of Johannesburg was cited in the letter from the South African Embassy:

Johannesburg does not add any fluoride to its drinking water, a practice followed in all of South Africa. Although the McKenzie Commission of Inquiry on Fluoridation recommended the fluoridation of drinking water in 1966, it was never proposed into legislation. Due to the fact that fluoridation is such a controversial issue, local authorities were not prepared to take the risks of possible litigation in the absence of an enabling Act.

. **Sweden**

7.37 The Swedish Embassy responded:

The result of the Government Official Report, SOU 1981:32, on fluoridation of drinking water was that Parliament turned down the proposal. The reasons were not scientific but ethical. The majority was against "forced medication".

7.38 An accompanying report of the Swedish Fluoride Commission contained the following conclusions:

The Commission has noted that caries is a disease which can be prevented. The basic cause of caries is the consumption above all of sweet foods. The repeated consumption of sugar and sugar containing products between meals is particularly liable to cause caries. Thus the prevention of caries must be based on dietary and mealtime habits.

7.39 The Commission was satisfied that fluoride has a preventive effect on caries and did not query the existing forms of fluoride treatments. However, it stated:

As regards to fluoridation of drinking water, the Commission is opposed to legislation making it possible for municipal authorities to add fluoride to drinking water supplies. The various measures taken so far have led to a steep decline in the incidence of caries in recent years, and the Commission feels that further preventive effects can be obtained on a voluntary basis. This should be engineered by means of intensified efforts to improve popular dietary habits and oral hygiene and also by means of efficient individual fluoride treatment

To many people, the fluoridation of water supplies represents an encroachment on the individual's freedom of choice. This gives the Commission a further reason against recommending a measure like the fluoridation of drinking water for which it may be difficult to secure public confidence. The combined and long-term environmental effects of fluoride are insufficiently known, which is yet another reason for rejecting fluoridation of water.

#### Switzerland

7.40 The following information was provided by the Embassy:

The Cantons (States) of the Swiss Confederation are legally authorised to add for medically prophylactic reasons any substance to food that is necessary or has physiologically favourable effects. Of all the Cantons, it is only the Canton of Basle-City which avails itself of this legal right as far as the addition of fluoride to drinking water is concerned.

The waterworks of the City of Basle regulate the fluoride content of drinking water to be 0.9 ppm in summer and 1 ppm in winter.

In all the other Cantons table salt containing 250 mg of fluoride per kg is being sold. However, the consumer has a choice, since there is also table salt available, which does not contain fluoride. About 80 percent of table salt sold contains fluoride.

. **Turkey**

7.41 The Embassy responded:

Fluoride is not added to community water supplies in Turkey. However, water supplied for home consumption in rural areas, 1.5 mg/lit of fluoride is added. This quantity is in accordance with World Health Organisation standards.

. **Union of Soviet Socialist Republics**

7.42 The USSR Ministry of Public Health, through its embassy, informed the Committee that in accordance with the Soviet standard recommended level of fluoride in the community water may be from 0.7 ml per litre to 1.5 ml per litre. The level depends on the climatic zone.

**Conclusion**

7.43 The Social Policy Committee is grateful for the trouble Canberra's high commissions, embassies and consulates took in preparing and/or supplying information for this fluoride inquiry and has found the different responses particularly interesting. This is why a whole chapter has been devoted to this overview.

7.44 Having looked at some overseas experiences with water fluoridation, the report will now provide an explanation of the mechanics of fluoridating the ACT water supply.

## **8 FLUORIDATION OF AUSTRALIAN WATER SUPPLIES**

8.1 This chapter will give a brief overview of fluoridation in Australia and then describe the water fluoridation process currently practised by the ACT Electricity and Water Authority (ACTEW) in fluoridating the ACT water supply which provides water to the ACT and the City of Queanbeyan.

### **Fluoridation of Australian water supplies**

8.2 Water fluoridation was gradually introduced in Australia through the 1960s and 1970s. The table below gives the dates when the capital cities became fluoridated.

#### **FLUORIDATION OF WATER SUPPLIES OF AUSTRALIAN CAPITAL CITIES**

HOBART	1964
CANBERRA	1964
SYDNEY	1968
PERTH	1968
ADELAIDE	1971
DARWIN	1972
MELBOURNE	1977

8.3 By 1984 nearly 66 percent of the Australian population were served by fluoridated water supplies. It was estimated that 0.9 percent of the population were served by naturally fluoridated water at 0.5 ppm or above. Most striking of these was the Northern Territory, where 9.2 percent had naturally fluoridated water.<sup>1</sup>

### **Fluoride in the ACT water supply**

8.4 Since 1964, fluoride has been added to the ACT water supply. Officers from ACTEW informed the Committee that the ACT currently obtains its water from two primary sources, the Cotter River system (Corin, Bendora and Cotter Dams) and the Queanbeyan River (Googong Dam).

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<sup>1</sup> See Appendix 5.

8.5 The Cotter River supply originates from mountainous catchments which are, to a large extent, closed to the general public. The water from these catchments requires only minimal treatment at the Mt Stromlo Treatment Plant (to meet guidelines established by the Nation Health and Medical Research Council).

8.6 The Googong Reservoir receives its supply from basically uncontrolled rural, agricultural and pastoral land with some eucalypt forests. It requires extensive treatment to deal with bacteria, colour and turbidity in the catchment before it can safely be consumed.

8.7 Googong water is currently only used during the summer high demand period (typically November to March) and for two to three weeks in July to enable maintenance on the Cotter system. The Committee inspected the water treatment plant at Googong while it was in operation in March 1990. The Cotter supply, with the exception of this maintenance period, is used throughout the year.

8.8 Within a typical year, ACT and Queanbeyan residents currently consume in the order of 70,000 MI of water (approximately 85 percent of which will be supplied through the Cotter system). Maximum summer demands are of the order of 500 MI per day whilst winter demands are of the order of 120 or 140 MI per day.

#### **Naturally occurring fluoride levels**

8.9 Fluoride occurs naturally within both catchments but in such small quantities that it requires identification and measurement by special trace element analysis.

8.10 Natural levels of fluoride have been determined to be of the following order:

Cotter : 0.05 ppm  
Googong : 0.10 ppm

8.11 ACTEW informed the Committee that regular monitoring carried out at the water treatment plant inlets over many years has determined that fluoride levels remain fairly constant with the variation range being reasonably insignificant.

8.12 Sodium silicofluoride is added at both the Stromlo and Googong plants to increase the fluoride levels to the final concentration of 1 mg per litre. The operational limits set for the water treatment operators are 0.90 – 1.10 mg per litre. These dosage rates are in accordance with Section 6 of the NHMRC guidelines. ACTEW indicated that operators had no difficulties in maintaining concentration within these limits.



## **Monitoring**

8.13 ACTEW monitors fluoride concentrations measured at Googong water treatment plant continuously, by automatic analysers, supplemented by a minimum of two manual tests during each eight-hour shift.

8.14 Stromlo has older equipment which does not incorporate automatic analysers; and four manual checks are carried out each shift.

8.15 In addition, a daily cross-check is carried out by ACTEW's Water Quality and Investigation Laboratory, located at Lower Molonglo, on samples sent from both plants. A further six samples are taken for analysis each week at various points throughout the City's reticulation system.

8.16 ACTEW indicated that the final safeguards in the system were the balance storage tanks located at each treatment plant and the dilution offered by the 900 ML of stored water in the reticulation system. In the unlikely event of an accidental overdose that escaped all of the other safeguards, monitoring would quickly identify this while all the overdosed water was still contained in the balance tank on site. Any small amounts that might have escaped would be diluted so much by the volume of water that the effects would be negligible.

8.17 ACTEW told the Committee that when fluoride was reinstated in the water supply (after being "turned off" between 9 and 19 October 1989) it took nearly three weeks before fluoride levels rose to the normal operation range as a result of the dilution offered by the unfluoridated water in the reticulation system.

## **Grade and source of ACT fluoride supply**

8.18 The fluoride which is added to the ACT water supply is obtained from Redox Chemicals Pty Ltd of Sydney, under contract. The supply contract is a Department of Territories contract originally let in 1987 and has subsequently been taken over by ACTEW. The technical specification for the supply of sodium silicofluoride incorporated within the contract is based upon the American Water Works Association (AWWA) Standard for sodium silicofluoride (the major exception is the sieve sizing which is based upon British sieve sizes which relate to the dosing equipment installed at the Stromlo and Googong treatment plants).

8.19 Redox was one of five companies that tendered for the supply of the fluoride. The contract required a sample of the proposed sodium silicofluoride to be submitted for analysis before letting the contract. Two companies provided samples. Redox was preferred as it was less expensive.

8.20 The fluoride originates from Gdansk, Poland. Redox also supply this fluoride to:

- . the Melbourne Board of Works;
- . the Sydney Water Board;
- . the Western Australian Water Authority;
- . the Power and Water Authority of the Northern Territory;
- . several New South Wales local governments.

### **Cost of fluoridation**

8.21 The cost of fluoridating the ACT water supply is at present (1990) \$150,000 per year (this figure includes chemicals, labour and power). The cost of monitoring fluoride levels is an additional \$10,000 per year.

8.22 ACTEW bills the Queanbeyan City Council monthly for the water it receives. This charge is on the basis of a bulk rate at a standard charge per kilolitre and covers the total cost of treatment as well as the provision and maintenance of the infrastructure necessary to supply Queanbeyan. The cost of fluoridating water provided to the City of Queanbeyan is not isolated.

### **Water treatment process**

8.23 Water is treated so that efficient disinfection is possible as well as meeting aesthetically acceptable levels. At Googong the process is as follows:

#### **1 Coagulation**

Chemicals are added to the water to assist in the removal of colour and turbidity by the formation of floc particles. The two chemicals used in the flocculation component of the ACT's water treatment processes are Aluminium Sulphate and Polyelectrolyte (Lt 22).

#### **2 Clarification**

Removal of the floc particles from the water, by a process of settlement, thus leaving "clear water".

#### **3 Filtration**

Final treatment to remove any particles carried over from clarifiers. Water would contain negligible levels of colour and turbidity after this process.

#### **4 Disinfection**

The filtered water is then chlorinated to ensure safe disinfection.

#### **5 pH adjustment**

Disinfection often makes the water more acidic and so the pH has to be adjusted by adding lime, to protect the reticulation system from corrosion.

#### **6 Fluoridation**

Finally, fluoride is added.

8.24 Water is not treated to the same extent at the Stromlo water treatment plant as the water is of such high quality. The process is limited to disinfection, pH adjustment and fluoridation.

### **Chemicals used in water treatment**

8.25 The chemicals used to treat the water are chlorine (as a disinfectant), lime (to adjust the pH of the water), aluminium sulphate (as a coagulant to assist in flocculation and clarification) and polyelectrolytes (coagulant aids).

### **Regulation of the amount of fluoride in water**

8.26 Sampling of fluoride levels is carried out by ACTEW at outlets to each of the reticulation reservoirs. Within a normal week, some six to seven of the reservoirs are sampled and this is rotated on a scheduled basis so that each reservoir is sampled at least every seven weeks.

8.27 However, Professor Irving, in his evidence, raised some doubts about the extent to which the level of fluoride in the water supply could be accurately regulated. He cited the Health (Fluoridation) Act of Victoria, which decrees that the level to which fluorides are to be built up is to a maximum "average optimum concentration" of 1 ppm fluoride. No permissible range of concentration is stated, nor the period over which the average is to be determined. The "maximum concentration determined by the (Health) Commission" is not stated.

8.28 Professor Irving commented that when the Act was passed, the considerable difficulty in carrying out that instruction appeared not to have been appreciated. This difficulty was pointed out by the German Association of Gas and Water Experts (1974), who said:

Certainly it is technically possible to adhere to such a dosage in larger works, but the maintenance of the optimal concentration of fluoride throughout the network of pipes to the ultimate consumer cannot be guaranteed.

They added that:

The impossibility of regulating the total quantity of fluorides ingested by any individual makes nonsense of the demand for very precise dosage added at the waterworks.

8.29 This difficulty in the distribution of fluorides in reticulated water also occurs in "naturally fluoridated" water supplies. Professor Irving drew the Committee's attention to a particular trial whose authors reported that:

In some instances reporting communities have indicated that the fluorine content of the water, when drawn from its source, differed from the fluorine content of the same water when it was collected at some point in the distribution system.

8.30 Professor J B Polya, of the University of Tasmania, said that:

Since all but the most expensive materials for the reticulation of fluoridated water (rubberised pipes or Monel metal) react with fluorides, the concentration of fluoride at delivery points may differ greatly from concentrations at the mixing point.

8.31 Professor Irving reported that failure to obtain the specified concentration of fluoride at the taps of the consumer has been reported many times from the United States. He confirmed this finding through a study undertaken by final year students of Clinical Biochemistry at the University of Canberra before and during the removal of fluoride from Canberra in October 1989. Two different analytical procedures were used.

8.32 Within the different regions of Canberra no significant difference was found in the mean fluoride concentrations within each region. Tuggeranong had the lowest mean value of 1.09 ppm and Woden the highest mean value of 1.13 ppm.

8.33 There was, however, a significant difference between the individual suburbs – from 1.20 ppm at O'Connor to 1.06 ppm at Deakin. Of the 23 suburbs analysed, the water of 8 had significantly different fluoride levels from the other suburbs.