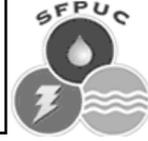




Fluoride: Updated Review of the Medical Literature 2000-2005



In 2000 the San Francisco Board of Supervisors [directed the Legislative Analyst](#) to report on research of the American Dental Association (ADA) and American Academy of Pediatrics (AAP) for fluoride supplementation in drinking water and to gather information on San Francisco's exposure to fluoride from all sources. At that time a literature review was prepared by the San Francisco Department of Public Health and, in 2001, testimony in front of the Board of supervisors was provided by the director of the Environmental Health Section of the San Francisco Department of Public Health (SFDPH). This current summary reviews the literature since the 2000 decision. There have been no new research findings in the past five years that would contradict the conclusions and decision of the Board of Supervisors in 2000. A bibliography table is available from the San Francisco Department of Public Health Environmental Health Section.

Water Fluoridation

We reviewed 13 studies of water fluoridation published in the peer-review medical literature since 2000, which supported the following conclusions:

- Water fluoridation provides dental health benefit;
- Water fluoridation is not associated with adverse effects such as decreased bone density, fracture, cancer, Down's syndrome, dementia or goiter;
- Water fluoridation with optimal fluoride concentration is associated with increases in the prevalence of dental fluorosis.

Fluorosis

We reviewed 39 abstracts of studies of drinking water fluoride concentration and fluorosis published since 2000. These studies have generally supported the conclusion that fluoride concentration in drinking water is associated with dental fluorosis. Many of these studies are based in areas with different water supplies (in some cases with very high natural fluoride concentrations) and hotter climates than the Bay Area and thus raise issues that are not directly applicable to local water fluoridation. Additionally dental fluorosis is classified into levels that range from mild to severe according to several different classification systems. A classification of "mild" dental fluorosis as evaluated by a dentist may not be aesthetically objectionable or noticeable to the lay person. Studies of fluorosis use varying criteria to classify subjects into those that do or do not have fluorosis. Therefore fluorosis is not always comparable across studies. These studies do not provide evidence that would contradict the decision of the 2000 Board of Supervisors to fluoridate SFPUC water.

Other studies of fluoride

We reviewed 59 additional manuscripts and/or abstracts that were published in the peer review medical literature. To our knowledge there have been no other studies published since 2000 that contradict the decision of the Board of Supervisors to fluoridate SFPUC water.

Water Fluoridation and Osteosarcoma

In June 2005, media attention was drawn to a doctoral thesis that had been completed in 2001 which included a chapter describing an epidemiologic study of the relationship between fluoride and osteosarcoma. The thesis concludes: "In view of our results, it now seems important that our findings be confirmed using data from other studies," acknowledging that if the conclusions hold up in peer review, they will add to the body of evidence about the relationship between osteosarcoma and fluoride, and that one study is not alone cause for reconsideration of support for water fluoridation. For more information about the current scientific evidence that water fluoridation is not associated with osteosarcoma, please see [our detailed fact sheet](#).

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October 2005



Fluoride: Updated Review of the Medical Literature 2006-2011



In 2000 the San Francisco Board of Supervisors [directed the Legislative Analyst](#) to report on research of the American Dental Association (ADA) and American Academy of Pediatrics (AAP) for fluoride supplementation in drinking water and to gather information on San Francisco's exposure to fluoride from all sources. At that time a literature review was prepared by the San Francisco Department of Public Health and, in 2001, testimony in front of the Board of supervisors was provided by the director of the Environmental Health Section of the San Francisco Department of Public Health (SFPDH). A subsequent [literature review was conducted by SFPDH in October 2005](#).

This current summary updates the previous work with a review of the literature published between 2006 and 2011. There have been no new research findings that would contradict the conclusions and decision of the Board of Supervisors in 2000. A bibliography table is available from the San Francisco Department of Public Health Environmental Health Section.

Community Water Fluoridation

We reviewed 53 abstracts on community water fluoridation published in the peer-review medical literature since 2006. Our review supports the following conclusions:

- Water fluoridation provides dental health benefits including:
 - Reduced dental caries and childhood tooth decay
 - Reduced adult tooth loss
 - Fewer missing teeth and higher number of intact roots.
- Community water fluoridation is a cost-effective solution to improve oral health, particularly among underserved populations.
- Community water fluoridation may be a tool to affect oral health inequities.
- Improved oral health habits and access to care are important, particularly among children, along with community water fluoridation to reduce dental concerns.

To our knowledge there have been no studies published since 2006 that contradict the decision of the Board of Supervisors to fluoridate SFPUC water.

Dental Fluorosis

We reviewed 28 abstracts of studies of drinking water fluoride concentration and fluorosis published since 2006. These studies have generally supported the conclusion that high fluoride concentration in drinking water is associated with dental fluorosis. A large proportion of these studies are based in areas with very high natural fluoride concentrations and hotter climates than the Bay Area, which raises issues that are not directly applicable to local water fluoridation. Additionally, dental fluorosis may also be impacted by sources of fluoride other than drinking water. Furthermore, dental fluorosis can range from mild to severe and classification systems are not uniform among research studies. A classification of "mild" dental fluorosis as evaluated by a dentist may not be aesthetically objectionable or noticeable to the lay person. Studies of fluorosis use varying criteria to classify subjects into those that do or do not have fluorosis. Therefore, fluorosis is not always comparable across studies.

These studies do not provide evidence that would contradict the decision of the 2000 Board of Supervisors to fluoridate SFPUC water.

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Current scientific evidence: Water fluoridation is not associated with osteosarcoma



Background

Osteosarcoma is a type of bone cancer that is relatively rare. According to the [American Cancer Society](#) and the [National Cancer Institute](#), each year, about 900 new cases of osteosarcoma are diagnosed in the United States. About 400 of the new cases diagnosed each year are in children and adolescents younger than 20 years old. The annual incidence of osteosarcoma in boys (5.2 per million) is somewhat higher than in girls (4.5 per million). The major risk factor for osteosarcoma is radiation to the bone: patients who have another type of cancer and receive radiation therapy are at risk of developing osteosarcoma.

Fluoride and Osteosarcoma

The current scientific literature does not support an association between osteosarcoma and drinking water fluoridation, even though in cellular studies, fluoride acts as a mitogen on osteoblasts, and this defines a biologically plausible pathway for it to play a role in the development of osteosarcoma. A search of the peer review medical literature on the key words "[\(fluoride AND osteosarcoma\) OR \(fluoridation AND bone neoplasms\)](#)" returned 64 manuscripts as of September 2005.[†] Of these 64 studies, our abstract review found that 37 were studies of cellular activity, diagnostic imaging techniques using radiolabelled fluoride, or were studies not related to water fluoridation; 11 were reviews, commentaries, or news reports, and seven were letters. Of the remaining nine, one was a genetic study (Ramesh et al. 2001) that showed p53 mutations in tissue of osteosarcoma are correlated with bone fluoride levels. One was a 2-year feeding study conducted in rodents (NTP 1990) in which no increases in osteosarcoma were observed in female rats or in male or female mice. In 130 male rats treated with either 100 ppm sodium fluoride or 175 ppm sodium fluoride, four developed osteosarcomas; the male rats treated with 25 ppm or 0 ppm sodium fluoride did not develop osteosarcoma. (Optimal fluoride

[†] Three studies frequently cited in the medical literature were not returned with this search strategy: Operskalski et al. (1997) found no relationship between fluoride and osteosarcoma, but was not specifically aimed at exploring fluoride exposure; a small case control study conducted by the New Jersey Department of Public Health (Cohn et al. 1991) reported a relationship between fluoride and osteosarcoma; a study by Hoover et al. (1991) is included as an appendix to the 1991 public health service report Review of Fluoride Benefits and Risks. The Hoover study was an ecological analysis of the relationship between cancer trends and fluoridation of drinking water supplies that concluded that temporal increases in osteosarcoma were not linked to the fluoridation of water supplies.

Current scientific evidence: Water fluoridation is not associated with osteosarcoma Page 2

levels in drinking water are approximately 1 ppm.) A total of seven epidemiologic studies were among the 64 in this search, none of which showed a relationship between fluoride exposure and osteosarcoma (Moss et al. 1995, Gelberg et al. 1995, Freni and Gaylor 1992, Grandjean et al. 1992, McGuire et al. 1991, Mahoney et al. 1991, Hrudey et al. 1990).

A bibliography list of the references annotated above is on Page 3.

Bassin Study

In June 2005, media attention was drawn to a doctoral thesis that had been completed in 2001 by Elise Bassin. The thesis included a chapter describing her epidemiologic study of the relationship between fluoride and osteosarcoma. The study appears to be well designed; it utilized a careful exposure assessment which is described in a [manuscript](#) that was subsequently published in 2004 (Bassin et al. 2004). The epidemiologic study has not been subject to peer review, and it is unclear what the author's intentions are for publication. There is one significant issue with the study analysis and presentation that presumably will be addressed through the peer review process. The data presentation does not permit the reader to determine how many cases and controls were included in each of the models that are presented in the figures and it is difficult to tell whether the authors appropriately excluded case-control sets who were younger than the age of exposure for each model, nor what, if any latency period(s) were considered.

The thesis concludes: "In view of our results, it now seems important that our findings be confirmed using data from other studies," acknowledging that if the conclusions hold up in peer review, they will add to the body of evidence about the relationship between osteosarcoma and fluoride, and that one study is not alone cause for reconsideration of support for water fluoridation.

For more information

Follow the links below for additional information on drinking water fluoridation:

- o [CDHS - Community Water System Fluoridation](#)
- o [CDHS – Public Water System Fluoridation](#)
- o [Centers for Disease Control and Prevention - Community Water Fluoridation](#)

References cited:

Bassin EB, Mittleman MA, Wypij D, Joshipura K, Douglass CW. Problems in exposure assessment of fluoride in drinking water. *J Public Health Dent.* 2004 Winter; 64(1):45-9.

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Operskalski EA, Preston-Martin S, Henderson BE, Visscher BR. A case-control study of osteosarcoma in young persons. *Am J Epidemiol.* 1987 Jul; 126(1):118-26.

Ramesh N, Vuayaraghavan AS, Desai BS, Natarajan M, Murthy PB, Pillai KS. Low levels of p53 mutations in Indian patients with osteosarcoma and the correlation with fluoride levels in bone. *J Environ Pathol Toxicol Oncol.* 2001; 20(3):237-43.

Note, for those reading a printed version of this fact sheet: the following link URLs are embedded on pages 1 and 2:

American Cancer Society: http://www.cancer.org/docroot/CRI/content/CRI_2_4_1X_What_are_the_key_statistics_for_osteosarcoma_52.asp?rnav=cri

National Cancer Institute: <http://seer.cancer.gov/publications/childhood/bone.pdf>

(fluoride AND osteosarcoma) OR (fluoridation AND bone neoplasms):

[http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=PureSearch&db=pubmed&details_term=\(\(\(fluoride AND osteosarcoma\) OR \(fluoridation AND bone neoplasms\)\) AND \("1900"\[EDAT\] : "2005/09/19"\[EDAT\]\)\)](http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=PureSearch&db=pubmed&details_term=(((fluoride AND osteosarcoma) OR (fluoridation AND bone neoplasms)) AND ()

Bassin et al. 2004 manuscript: http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=pubmed&dopt=Abstract&list_uids=15078061&query_hl=1

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October 2005

SAN FRANCISCO DEPARTMENT OF PUBLIC HEALTH

REPLY TO BOARD OF SUPERVISORS ON QUESTIONS ABOUT FLUORIDATION

July 26, 1985
David Werdegar, M.D., M.P.H.
Director, San Francisco
Department of Public Health

July 1985

This document was prepared at the request of the Board of Supervisors of the City and County of San Francisco in reply to their questions about Fluoridation.

Many health professionals contributed both their time and expertise. We would like to thank the following individuals for their help on this project.

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We hope that this document will assist other communities in their efforts to promote the public health.



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BOARD OF SUPERVISORS

CITY HALL, SAN FRANCISCO 94102 • Telephone 558-3184

July 15, 1985

File 278-05

David Werdegar, M.D.
Director of Public Health
101 Grove Street
San Francisco, CA. 94102

Dear Dr. Werdegar:

I am writing at the direction of the Board of Supervisors concerning fluoride.

At the initiative of Supervisor Quentin L. Kopp, the Board asks that you attend the August 5 meeting of the Board of Supervisors to answer questions of Board members concerning a proposal to submit to the voters a policy statement concerning fluoride in water.

The Board would appreciate receiving from you a written report by July 29, 1985 relative to the following items:

- 1) What is the Director's recommendation on whether the pending fluoride policy declaration should be presented to the voters of San Francisco? (see attached copy)
- 2) What is the Director's recommendation on whether the City should change its present practices relating to adding fluoride to water?
- 3) What are the Department's comments regarding the July 1, 1985 memorandum of Supervisor Richard D. Hongisto?
- 4) What is the Department's response to each study or report in the years since 1951 that Supervisor Nelder produced before the Rules and Legislation Committee?
- 5) What other studies and reports relate to the effects of fluoride in the water drinking supply of any city or other area in the world, showing that fluoride is safe for human consumption? Indicate also the amount of fluoride in each instance or study.

Sincerely,

John L. Taylor
Clerk of the Board

EXECUTIVE SUMMARY

Purpose

This report is in response to a July 15, 1985 request from the Board of Supervisors asking the views of the Department of Public Health on six questions relating to the fluoridation of the municipal water supply.

The staff of the Department have reviewed materials submitted to the Board of Supervisors by the Rules and Legislation Committee and the University of California. In addition, the staff have reviewed major reports and important studies relating to the effects of fluoride.

Expert consultation has been obtained from the University of California and other major universities, the California Department of Health Services and the National Institutes of Health.

Definition

Fluoridation is the controlled adjustment of the fluoride level in a water supply to an optimum concentration of 1 part fluoride to one million parts of water (1 ppm). Scientific evidence shows that at this concentration fluoride safely and effectively prevents tooth decay.

Fluoridation has been used in San Francisco for 34 years. The Board of Supervisors now asks if the practice should be continued.

The Department of Public Health strongly recommends that fluoridation be continued as a valuable public health measure.

Benefits

Dental decay is recognized as the most common chronic disease in man. It can produce pain, destroy body tissue, and cause serious infection throughout the body. In addition, tooth loss may result in disfigurement and disability. Decay can result in progressive dental problems throughout life, absence from school or work, and high costs for care.

Well-documented benefits of community water fluoridation include: a 60 percent decrease in tooth decay among children, fewer dental problems for adults, and improved personal appearance.

The greatest benefits are to poor, minority, immigrant children, and the developmentally disabled.

In communities where fluoridation was stopped, a rapid increase in tooth decay resulted.

Safety

The safety of community water fluoridation at a concentration of 1 ppm has been affirmed by responsible health agencies worldwide.

Most claims of adverse health effects deal with very high levels of fluoride. Many vitamins and minerals, such as calcium, magnesium, sodium, vitamins A, D, E, and K, are also toxic at high levels.

Other claims of adverse effects, at levels used in community water fluoridation, have not been substantiated in carefully conducted scientific studies.

Cost effectiveness

Water fluoridation saves money. Estimates suggest that for every \$1 spent on fluoridation, \$50 are saved in dental treatment costs alone.

Natural occurrence in environment

Fluoride is the 16th most common element on the earth's surface and is found everywhere. It occurs naturally in lakes, rivers, rocks, and soils. Fluoride is also found in all human blood, bone and teeth. Hence, fluoride is present in nearly all food and water supplies in minute amounts insufficient to prevent dental decay. Such fluoride has been present for generations. Many communities have water supplies with a high level of naturally occurring fluoride - four to eight times higher than the 1 ppm in San Francisco water.

Fluoride is found in all natural water supplies. The fluoride concentrations in U.S. water supplies vary from 0.05 ppm in the Northwest to 14 ppm in areas of the Southwest.

Community water fluoridation makes use of the element in a concentration that inhibits dental decay.

Conclusions

1. San Francisco should continue fluoridating its water.
2. There is no need to place the issue on the ballot.
3. The wording of the pending Declaration of Policy on fluoride could create confusion.
4. Scientific studies show fluoride is safe in San Francisco drinking water and benefits dental health.

RESPONSE TO QUESTIONS
FROM THE
BOARD OF SUPERVISORS

QUESTION 1

What is the Director's recommendation on whether the pending fluoride policy declaration should be presented to the voters of San Francisco?

RESPONSE

There is no reason to place this issue on the ballot.

The Director of Public Health recommends that the fluoridation policy which has been so successful and safe in promoting good dental health in San Francisco since 1951 should be continued. Our experience, as well as that of many others, has affirmed that fluoridation is an effective and economical way to protect our community's dental health.

In the Spring of 1951 the Board of Supervisors unanimously requested the Water Department to take steps to fluoridate San Francisco water. The Public Utilities Commission requested an enabling ordinance and appropriation of \$40,000 of Water Department funds. The Board approved the ordinance on first reading.

In the Fall of 1951 a declaration of policy regarding fluoridation was put before the voters. They voted to fluoridate the water.

The arguments in favor of this policy declaration in the official register in 1951 were as follows:

1. Extensive research since 1916 has conclusively proved that scientifically controlled fluoridation prevents up to 60 percent of the decay in children's teeth.
2. Twenty-one states are now carrying on a fluoridation program within their borders and eleven others have approved fluoridation and will start operations in the near future.
3. Fluoridation has no healing or curative powers. It is simply a preventative of dental cavities. Just as chlorine and other chemicals are injected into public water supplies as a sanitary measure to check and prevent waterborne diseases so fluoridation acts as an agent to check and reduce dental decay in children from birth until adult teeth are formed.
4. Fluoridation does not add taste, color, odor, or hardness to water nor has the use of fluoridated water had any known effects in industrial processes.
5. This Proposition deserves favorable treatment by voters at the polls. In all, introducing this safe chemical into drinking water results in no ill effects. Pain and expense are substantially reduced and dental health encouraged by the process. And the cost to the City of San Francisco is negligible—less than ten cents per person per year.
6. Among those strongly urging the adoption of water fluoridation, are these groups dedicated to the health and well-being of the community: San Francisco Dental Society, San Francisco Medical Society, San Francisco

Department of Public Health, California Department of Public Health, California State Dental Association, California State Medical Association, American Dental Association, American Medical Association, the United States Public Health Service and scores of other civic, fraternal, labor, business and community organizations. Your physician and dentist endorse this Proposition.

Hence, fluoridation was approved by both the Board of Supervisors and the people of San Francisco.

The six arguments in favor of fluoridation stated in 1951 are still valid today.

Over 34 years the experience in San Francisco has been that fluoridation has been a safe and highly effective community health practice. It prevents tooth decay for all and has special benefits for children of the poor, minorities and immigrants.

The Department continuously monitors literature on the public health consequences of fluoride. The San Francisco experience is consistent with all responsible health agencies in the United States and abroad. (See Appendix A)

The declaration of policy on fluoridation voted on by the people has served San Francisco well and continues to benefit the health of our community.

The Health Department discerns no need to bring the matter before the voters again.

QUESTION 2

What is the Director's recommendation on whether the City should change its present practices relating to adding fluoride to water?

RESPONSE

The Director of Public Health recommends no change to the City's present practices related to adding fluoride to the water.

As stated in answer to Question 1 the Department of Public Health concludes from 34 years of surveillance that fluoridation is an effective, economical, and safe preventive health care measure.

The same opinion is expressed by all major health agencies and professional societies in the nation.

The California Department of Health Services "believes that fluoridation of public water supplies is the safest, most economical, most effective, and most equitable means available to prevent tooth decay and to reduce personal and public expenditures for dental care" (California Department of Health Services, June 1985, Appendix X).

The Surgeon General of the United States Public Health Service "reaffirms its strong endorsement of fluoridating community water supplies...and stresses that this preventive measure is the single most important commitment that a community can make to the oral health of its children and its future generations" (Surgeon General Koop, 1983, Appendix K).

QUESTION 3

What are the Department's comments regarding the July 1, 1985 memorandum from Supervisor Richard D. Hongisto?

RESPONSE

The declaration of policy proposed by the Rules and Legislation Committee is as follows:

"Should fluoride or any other substance not necessary to water purification be added by the San Francisco Water Department to City drinking water?"

We agree with Supervisor Hongisto that the wording of this declaration is problematic and confusing. The phrase "or any other substance" could result in exclusion of factors not related to fluoridation. This could, in fact, result in putting the San Francisco Water Department in non-compliance with EPA standards. If the true intent is to ask the voters of San Francisco whether or not to stop adding fluoride to San Francisco drinking water, this point should be stated in a more straightforward way.

The term "water purification" is unclear since it is not defined and can include or exclude needed processes in water treatment. As the Supervisor states, "purification" has no definition within the water treatment industry or California law. It is not defined in the American Water Works Association textbook entitled "Water Quality and Treatment" or in any other books on water treatment since 1970.

The wording proposed in Supervisor Hongisto's memo of July 1, 1985 is:

"Shall the City and County of San Francisco cease to add fluoride or other elements to prevent or arrest dental decay, to the water furnished people in San Francisco by the San Francisco Water Department?"

would cause no confusion were it to be implemented.

QUESTION 4

What is the Department's response to each study or report in the years since 1951 that Supervisor Nelder produced before the Rules and Legislation Committee?

RESPONSE

Supervisor Nelder has forwarded to the Rules and Legislation Committee approximately 40 studies, articles and editorials on the subject of fluorides. A response to each will follow. Most of the papers dealt with the effects of fluoride at very high concentrations and do not apply to the use of fluoride in the extremely low concentrations used in community water fluoridation. Like many other nutrients, such as calcium, magnesium, sodium, chloride, vitamin A, D, E and K, fluoride can be toxic if taken in extremely high amounts.

A number of other papers were either editorials or articles from the journal, Fluoride. This is the journal which has published papers purporting to link water fluoridation with cancer and heart disease. The data presented in each case have been carefully reviewed and reanalyzed in professional journals of highest scientific repute and found to be inaccurate. Most contained serious methodological errors.

One paper in Science (Leverett) speculated that the amount of fluoride now in the food chain has changed since the time water fluoridation went into effect. There is evidence from more recent scientific studies to show that the level of fluoride intake among individuals in fluoridated communities has not changed over the last 20 years.

The EPA, in 1985, has proposed raising the level of fluoride permitted in the drinking water to 4 parts per million (ppm).

Indeed, Leverett, in a letter to the Department of Public Health dated July 17, 1985, stated "I have never, even for an instant, believed that we are receiving too much fluoride...I argue only...that we need to reassess our definition of 'optimal'. If I had to guess at the outcome, I would say that we would be most likely to adjust the optimal dosage upward."

In summary, none of the papers reviewed here should cause any change in the present water fluoridation policy of San Francisco. Another section of this document (answers to Question 5) will present more information on the safety of fluoride as used in community water fluoridation programs.

What follows is a review and comment on each of the articles and submissions from Supervisor Nelder.

Allen DO, Munshower J, Morris HP and Weber G. Regulation of adenyl cyclase in hepatomas of different growth rates. *Cancer Research*. 31 (5): 557-560. May 1971.

This report describes the regulation of the enzyme adenyl cyclase by glucagon and sodium fluoride in experimental animals at toxic levels of fluoride. Fluoride is known to stimulate adenyl cyclase activity in broken cell preparations at high levels. (See Steer 1975, review in this section.) Rat livers were homogenized and were exposed to a high concentration of a variety of chemicals. They were further exposed to crystalline glucagon and sodium fluoride at a concentration which is the equivalent of 190 mg per liter of sodium fluoride. This is equivalent to 190 ppm which is 190 times the concentration found in community water supplies with fluoride levels of 1 ppm. The active tissue concentration of fluoride resulting from fluoridation is the equivalent of from .01 to .02 ppm; therefore, the solution in this study is approximately 19,000 times the concentration found in the normal plasma of individuals living in fluoridated communities. (Taves, 1979)

This study was designed to analyze the effect of various chemical compounds on enzyme systems at levels much higher than those used in water fluoridation programs. An evaluation of the effects of fluoride in tissues at 19,000 times the concentration normally found in the tissues of adults living in fluoridated communities cannot be considered related to water fluoridation programs.

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Bayless JM, Tinanoff N. Diagnosis and treatment of acute fluoride toxicity. Journal of the American Dental Association. 1985: 209-211.

This paper provides a simplified approach to calculating the amount of fluoride swallowed and summarizes emergency treatment for fluoride overdoses. The paper discusses the importance of judicious use of topical fluorides containing concentrated solutions of fluoride for application on surfaces of teeth in order to prevent inadvertent swallowing of concentrated fluoride solutions, and utilizes the examples of the two children who expired as a result of inappropriate use of topical fluorides and the inappropriate storage of fluoride tablets. Fluoride is toxic and can cause death at high levels like many essential nutrients such as potassium, sodium, calcium, iron, phosphorous, vitamins A, D, K, and E, and others.

There is no reference in this article to optimally fluoridated community water supplies and in fact the author states "health professionals should be aware of the potential toxic effects of topically applied fluorides in addition to the well known caries preventive effect."

This article is one in a series which advises clinicians on appropriate use of concentrated topical fluorides and is appropriate for professional purposes. It in no way incriminates the use of fluorides judiciously used in community water supplies.

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Blasik LG and Spencer SK. Fluoroderma. Arch. Dermatol. 115 (11):1334-1335. November 1979.

This article describes a possible reaction to highly concentrated fluoride gel applied to the skin at the equivalent dose of 10,000 ppm. The report describes the experience of two patients: one a 59 year old woman, the second a 63-year-old woman, both of whom had head and neck cancer lesions which had been treated with radiation. Both of these patients had suppressed salivary function and blood circulation to the head and neck area common to post-radiation patients. Because of the severe reduction in salivary flow, post-radiation patients are highly susceptible to dental caries because of decreased salivary buffering, the salivary mineral exchange provided to the teeth, and decreased washing away of plaque acids. As a result, acceptable therapy for post-radiation patients is frequent application of concentrated topical fluoride preparations. The authors report that these two cases appeared to have a reaction to the application of an acidulated phosphate fluoride gel. This gel was used with the standard concentration of 1.23% acidulated phosphate fluoride. Although the authors acknowledge that "one can speculate that radiation may have contributed to the development of these clinical lesions," they note the similarity of the ectopic lesion to other halogen-stimulated allergic responses, or halogenodermas. This study reviews the reaction of two patients who have suppressed healing responses due to radiation and were exposed to a topical preparation of fluoride containing 10,000 ppm fluoride concentration. This concentration is 10,000 times that found in community water supplies. It is a preparation not intended for dietary consumption and is unrelated to dietary consumption of fluoride. The authors themselves acknowledge that the topical effect of a high concentration of fluoride is not uncommon in patients who have been subject to high radiation doses due to head and neck cancer.

The authors of this study do not make any reference to the use of lower concentrations of fluoride and are merely making a case observation of patients with suspected ectopic skin reaction to a particular acidulated phosphate fluoride gel preparation applied topically in much higher concentrations than those used in water fluoridation programs.

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Bundock JB, Burk D, Graham, JR, Morrin PJ; Fluorides, water fluoridation, cancer and genetic diseases. Science and Public Policy. February, 1985. pps. 36-85.

This is a review of the literature, the main conclusion of which is that "fluoridation of drinking water is associated with increased cancer mortality rates." In their review of epidemiological literature, the authors mainly cite the studies of Yiamouyiannis and Burk. The other contentions made in this review are that fluoride acts as a genotoxic agent and causes cellular mutations as well as other toxic reactions. These issues as well as the cancer claims of Yiamouyiannis and Burk have been reviewed elsewhere in this report. (A more complete review of the work of Yiamouyiannis and others will be found in the section of this report that examines the effect of fluoride on cancer rates. (See p. 5-22. See also discussion on mutagenesis p. 5-35.)

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Clark RA. Neutrophil iodination reaction induced by fluoride: implications for degranulation and metabolic activation. Blood. 57 (5):913-920. May 1981.

This study evaluated the effect of high concentrations of fluoride (20-30 mM which is the equivalent of 380-570 ppm) on the metabolic activation of white blood cells. The study found that in concentrations of 400 parts per million and above, fluoride had an effect of inhibiting certain cell functions. The normal concentration of fluoride found in the plasma of persons living in fluoridated communities is between .01 and .02 parts per million. Therefore, this study exposed cells to a much higher concentration of fluoride than found normally in people living even in high natural fluoride communities. The findings of this study are consistent with other studies that show that high concentrations of halogens such as bromine, chlorine, iodine, and fluorine have an effect on cell metabolism. Low concentrations of these elements have no negative effect on cell metabolism.

Like iodine which is essential to human nutrition, fluoride can also be harmful at extremely high doses, especially levels 4,000 to 10,000 times that recommended for consumption. The author of this study makes no mention of water fluoridation and in no part of his report extrapolates his findings to the use of water fluoridation.

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Colquhoun J. Fluoridation in New Zealand. New Evidence, Part 2. American Laboratory. June 1985. p. 98-109

This study by Colquhoun alleged that the incidence of dental fluorosis was much higher in the fluoridated areas of Auckland, New Zealand than in the non-fluoridated areas. He based his study on a group of children receiving clinical services through the health department in Auckland. This study suffers from a serious defect according to Peter Hunter, Principal Dental Officer for Research, Department of Health, Wellington, New Zealand (personal communication). The children in the fluoridated area were screened by a school nurse to select only those children with dental mottling or discoloration prior to examination by Colquhoun. All the children in the non-fluoridated areas were examined. Thus, the percentage of children with fluorosis in fluoridated areas would appear much higher. This methodological error invalidates all of these data and conclusions, and may explain why this researcher's findings are so different from the enormous body of literature which has been published recently on the beneficial effects of fluoride. (See reviews in Question 5.) The author also discusses changes in the incidence of fluorosis occurring in both fluoridated and non-fluoridated communities. Colquhoun cites a study in a Journal of the American Dental Association article 1983 by Driscoll et al. and misinterprets it to indicate that the incidence of fluorosis is increasing. In fact, the authors of that study, in Illinois, specifically state that no apparent change in the incidence of fluorosis can be detected from their study, which was conducted 38 years after the original studies made by Dean in those same communities in 1946.

In conclusion, this study has serious methodological defects that cast doubt on its findings.

Colquhoun J. Influence of social class and fluoridation on child dental health. Community Dent. Oral Epidemiology. 1985. 13:37-41.

Dr. Colquhoun's second article alleges that social class, more than anything else, is responsible for difference in dental caries incidence and that "this study also shows that dental treatment levels have continued to decline in both fluoridated and unfluoridated areas, and are related to social class factors rather than to the presence or absence of water fluoridation." He also states that "where socioeconomic level is controlled for child dental health appears to be better in unfluoridated areas." Again, his data differ with the published scientific literature. (See studies in Question 5 which show that fluoridation benefits the entire community.) This article suffers serious defects just as the initial article did. Dr. Colquhoun's evaluation of children, whom he states come from fluoridated and non-fluoridated communities, makes no attempt to assess residential histories of these children. He ignores crossover between children moving in and out of fluoridated and non-fluoridated communities. But most importantly, the author did not use accepted procedures when assigning social level. He assigned the level based on the average income of the area of the city where the child lived rather than family characteristics. (Peter Hunter, Principal Dental Officer for Research, Wellington, New Zealand, personal communication)

Dr. Colquhoun's findings are inconsistent with previous studies. The key variable under study, i.e., social class, was not assigned using accepted procedures. Many other studies have shown that dental problems are highest in non-fluoridated communities.

Compston JE, Chadha S and Merrett AL. Osteomalacia developing during treatment of osteoporosis with sodium fluoride and vitamin D. Brit. Med. Journal. 281 (6245):910-911. 4 October 1980.

This report reviews the clinical course of a 61-year-old woman who presented in 1978 "with a fifteen-year history of lower back pain which had rapidly increased over the previous 9 months." This patient was prescribed the accepted dosage of various therapeutic regimens to arrest the progress of her severe condition of osteoporosis. She was prescribed the following: sodium fluoride, 50 milligrams per day; vitamin D, 50,000 units weekly; and calcium gluconate, 600 milligrams twice daily — all by oral administration. The fluoride level consumed by the patient was at least 20 times the intake found in optimally fluoridated communities. This report showed the patient continuing to experience bone pain despite very high dosage levels of these therapeutic regimens. The authors cite two other papers that note that fluoride, in very high concentration, along with vitamin D and calcium, is an accepted therapeutic tool for physicians in the treatment of degenerative osteoporosis of the elderly. The authors state that fluoride at these doses sometimes causes osteomalacia. Vitamin D or calcium is sometimes thought to prevent these complications. In this particular case, it did not. This is not inconsistent with previous findings that high concentrations of fluoride used therapeutically can develop accumulations of unmineralized bone if other dietary elements are not present to assist fluoride in bone reformation.

This study evaluated fluoride at dosage levels used therapeutically in elderly patients with bone disease. It has no relationship to community water fluoridation programs.

DeChatelet LR, Campbell TL, Westrick MA and Shirley PS. Effects of fluoride on the oxidative metabolism of human neutrophils. *Biochem. Med.* 25 (1):106-113. February 1981.

This study evaluated the effect of various chemicals on the phagocytosis of human neutrophils. This laboratory study exposed cultures of cells to high concentrations of sodium fluoride. The concentration of fluoride to which these cells were exposed was at the level of 20 mM. (20 millimolar). 20mM. of fluoride is equivalent to a concentration of 380 parts per million fluoride. Normal plasma fluoride concentration in communities where the water supply contains 1 ppm is .01 parts per million; therefore, this study exposed cultured cells in a laboratory to 4,000 times the concentration of fluoride normally found in plasma (Taves, 1979).

The authors were investigating the usefulness of fluoride preparations in evaluating certain cell functions at extremely high levels. This study, again, has no relationship with the use of fluorides in community water supplies, their effect on overall health, nor their effect on the reduction of dental disease. The authors make no reference to the use of fluorides as used in community water supplies.

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Duffey PH and Tretbar HC. Giant cells in bone marrows of patients on high-dose fluoride treatment. *Ann. Intern. Med.* 75 (5):745-747. November 1971.

This report describes three patients under treatment for idiopathic

osteoporosis who were prescribed fluoride at therapeutic levels. The authors found atypical giant cells in these three patients who, it should be noted, were being treated with levels of fluoride much higher than the normal intake in fluoridated communities. Patient #1 was a 73-year-old woman with severe osteoporosis of the spine and multiple compression fractures and was on sodium fluoride therapy at a dose of 150 milligrams per day. Patient #2 was a 65-year-old woman with symptomatic osteoporosis and compression fractures of the thoracic spine and was also treated with sodium fluoride at 150 milligrams per day. Patient #3 was a 72-year-old woman taking sodium fluoride at a level of 16 milligrams per day, without medical supervision for three years. The researchers reported an apparent relationship between the consumption of high levels of sodium fluoride therapeutically in the treatment of these three patients' osteoporosis and the appearance of higher counts of giant cells in the blood. The authors also noted, "it is known that some patients with osteoporosis have an increase in mast cells in the bone marrow." In addition, the authors note that two of the three patients under study already had existing blood dyscrasias. One patient had classic iron deficiency anemia and the other patient had blood loss from benign gastric ulcers.

The authors of this study did not extrapolate their findings to the use of fluorides in community water supply, and their theoretical assertion that fluorides might be related to the giant cell formation in the blood by their own admission was nonconfirmatory and merely a report of an association.

This single report of cases with giant cells in bone marrow has not been duplicated since 1971 and is not relevant to community water fluoridation. There is evidence that this is related to fluoride at any dose.

Editorial: How fluoride might damage your health. New Scientist. 28 February 1985. p. 20.

This is an anonymous editorial. No original data or work is presented. This editorial alleges the following, "fluoride might begin the process (of cancer) by interfering with the hydrogen bonding of DNA." This unauthored editorial presents no original work, but interprets the results of a paper published in the Journal of Biological Chemistry.

The senior author of the original paper, Dr. Edwards, Professor of Chemistry at the University of California at San Diego, commented on this editorial in June 1983 in Industrial Chemical News. He said, "It is an almost total misunderstanding of our results...cytochrome C peroxidase is extracted from yeast mitochondria and is not found in animal tissue."

It should again be pointed out that the mutagenic and carcinogenic effects of fluoride have been thoroughly reviewed. The following statement is extracted from a prepared statement by the Chief of the Laboratory of Developmental Biology and Anomalies, Dental Institute of Health. The title of the statement is: "Fluoride shown to have no mutagenic effects in controlled animal experiments in microbiological assays." The conclusion is: "we conclude that fluoride does not alter chromosome structure and is not mutagenic according to the results of either the double-blind animal tests or the recognized system of bacterial mutagenesis assay." Therefore, according to the most recent and most comprehensive of mutagenic evaluations, no evidence exists to show that fluorides, even at high concentrations up to 100 parts per million given to laboratory animals by the Laboratory of Developmental Biology and Anomalies could produce any mutagenic effects.

This editorial makes no claim that any negative health effects have been observed, and its conclusions about another person's work have been contradicted by the original author of the paper which it interprets. Other attached reviews have not shown any relationship between cancer incidence and fluoridation or any association between fluoride and mutagenesis. (See sections on cancer and mutagenesis.)

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Fleisch JH and Hasich KD. Increase in antigen-induced release of slow reacting substance of anaphylaxis from guinea pig lung by sodium fluoride. *Biochem. Pharmacol.* 29 (12):1843-1847. 15 June 1980.

This study evaluated the release of mediators of anaphylaxis from passively sensitized guinea pig lung by various chemicals in high concentrations including sodium fluoride (NaF). Again, this highly technical report was for the purpose of identifying various laboratory agents that can be used in the evaluation of the metabolism of various cells. As the authors state, "the present experiments and those of Patcar support the notion that simple molecules like sodium fluoride might help elucidate the events responsible for elaboration of mediators of anaphylaxis." This study exposed cell cultures to plasma levels of fluoride at concentrations of 10mM, which is the equivalent of to 19mg/liter of the fluoride ion (F⁻). Therefore, 10mM equal 190 mg/liter.

This study is done at 190 times the concentration of fluoride found in fluoridated water supplies and up to 19,000 times the concentration found in the tissue of individuals in fluoridated communities. The study was not intended

to evaluate the health effects of fluoride but rather to evaluate the usefulness of sodium fluoride in analyzing certain metabolic functions of cells. The authors make no reference to water fluoridation.

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Greenberg SR. Leukocyte response in young mice chronically exposed to fluoride. Fluoride. 15 (3):119-123. July 1982.

This study appeared in the journal, Fluoride, which is described as "an official quarterly journal of the International Society for Fluoride Research." Dr. Greenberg's study evaluated the response of leukocytes (white blood cells) in young mice chronically exposed to elevated levels of fluoride in drinking water. He exposed laboratory mice to levels of fluoride at 11 parts per million and 22 parts per million. The mice were sacrificed after 12 weeks of continuous exposure to these high levels of fluoride, and bone marrow was sectioned to evaluate for cytoplasmic activity. This author found that alterations in cytoplasmic activity could be correlated with "elevated fluoride levels."

The author of this study makes no reference to his findings being extrapolated to the fluoridation of community water supplies at 1 part per million nor extrapolation to humans. The National Cancer Institute in evaluating this and other studies on an alleged relationship of carcinogenicity of fluoride has found no substance to this argument, and animal studies, according to the National Cancer Institute, do not indicate a relationship of fluoridation with cancer causation. (See discussion on cancer and mutagenesis.)

Grimbergen GW. A double blind test for determination of intolerance to fluoridated water: preliminary report. Fluoride. 7 (3):146-152. July 1974.

Grimbergen, in the journal, Fluoride, claimed 60 patients out of a group of 300 were "intolerant" to fluoride. These patients "reproducibly developed gastrointestinal symptoms, joint pains, polydipsia, headache, and visual disturbances." They gave patients three unmarked bottles and then followed them for symptoms. Two of the bottles had distilled water. One had a fluoride solution. The fluoride solution contained 2.2 mg. of sodium fluoride per tablespoon. This is an extremely concentrated solution containing 67 ppm of fluoride and must have had a distinctive taste. Thus, all the results could have been biased and subjects tasting the strange tasting solution would have been more likely to have symptoms. An evaluation of this study, among others, performed by the American Academy of Allergy in 1980, found that in fact the symptoms described by the author are not consistent with symptoms of intolerance and do not fall into the normal typing for allergic responses. The conclusion of the American Academy of Allergy in evaluating this particular study is that it is inconsistent with the objective evaluations of intolerance for allergy. Of particular significance was the lack of supervision by clinicians of total exposure to fluoride. In fact, "the patient is also instructed to avoid tea and other foods which are high in fluoride." This is an ineffective method of controlling other sources of fluoride for the controlled group and confounds the findings of the investigation. In addition, there have been no reports of similar studies in describing fluoride intolerance at low levels in peer reviewed journals. (See section on allergy and review of Shea, 1967, in this section.

Heifetz, SB and Horowitz HS. The amounts of fluoride in current fluoride therapies: safety considerations for children. J. Dent. Child., 51:257-269. 1984.

This article examines fluoride at extremely high levels during topical application. It is pointed out that fluoride, like many other nutrients, is toxic when ingested at these high levels. One of the authors of this article has recently sent a letter to the San Francisco Department of Public Health in which he remarks on the implication that this publication or a previous one, for which he is sole author, implies that the consumption of fluoridated drinking water is harmful and dangerous. (See Appendix E.)

"The two reports have no bearing on the safety of community water fluoridation, which has repeatedly been shown to be eminently safe and highly effective in reducing the prevalence of dental caries. Rather the articles address concerns and risk from the possible misuse of topically applied fluoride products."

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Holland RI. Cytotoxicity of fluoride. Acta Odontol. Scand. 38 (2):69-79. 1980.

This literature review is consistent with findings that fluorides in high concentrations have certain growth inhibition and enzyme inhibitory and cytotoxic effects. However, we find that the levels of fluorides referred to in this review are much higher than those found in community water supplies. For example, in his general summary, the author states "mouse fibroblasts in

suspension culture showed reduced growth rates in the presence of 1.3 mM of sodium fluoride." This would be equivalent to a level of fluoride ion of approximately 24 ppm which is toxic and does not occur in plasma. Normal fluoride plasma levels found in humans consuming fluoridated water range between .01 and .02 ppm (Taves, 1979). That means that the fluoride levels reviewed in this article are 1200 to 2400 times the normal plasma concentration in a community that drinks fluoridated water. Therefore, the findings of this review cannot be extrapolated to the experience of humans consuming fluoridated water.

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Holland RI. Fluoride inhibition of protein and DNA synthesis in cells in vitro. Acta Pharmacol. Toxicol. 45 (2):96-101. August 1979.

This article reviews fluoride inhibition of protein and DNA synthesis in cells in vitro and is one of the studies which was reviewed by the same author in the previously cited article. The author found that, at levels of 1.3 mM of sodium fluoride, certain enzymatic activity was inhibited. This level, as mentioned previously, represents many times the plasma level found in humans, even those humans residing in naturally high fluoride communities. It is important to point out that this author makes no reference to the use of fluorides in community water supplies nor does he suggest that his findings have any implications for the health of humans. Once again, this paper is an exploration of the biochemical issues related to high concentrations of sodium fluoride as in protein synthesis and enzymatic activity of cells.

doses, is toxic as are many other vitamins, minerals, and nutrients. (See Appendix E for author's letter.)

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Imai T, Niwa M and Ueda M. The effects of fluoride on cell growth of two human cell lines and on DNA and protein synthesis in HeLa cells. *Acta Pharmacol. Toxicol.* 52 (1):8-11. January 1982.

This article reports the findings of researchers who subjected cell cultures in vitro to solutions of .95 and 1.9 mM of sodium fluoride. These solutions are at 100 and 200 times that amount of fluoride normally found in plasma. These researchers found "a suppressive effect of sodium fluoride on protein synthesis" which would not be surprising in light of the extremely high concentrations of fluoride to which they were subjecting these laboratory cell cultures. It should be pointed out that the National Heart, Lung and Blood Institute did similar cell assays using varying concentrations of fluorides and although some enzymatic inhibition was observed by the NHLB, it was not to the extent found in this particular study. Once again, the researchers in this study make no reference to any extrapolation of their findings to humans nor do they relate their findings in any way to the low levels of fluorides provided in water fluoridation. It should be noted that numerous substances that are completely ineffective in altering cell metabolism at normal levels will alter cell metabolism at higher levels. Some of those substances include common table salt and other central trace minerals and elements required in human nutrition, such as, iron, manganese, and calcium.

Jankauskas J. Effects of fluoride on the kidney (A Review). Fluoride. 7 (2): 93-105. April 1974.

This is not a study, but rather a paper which reviews the current literature on fluorides and the effects on the kidney. It should be noted that this publication appeared in the journal, Fluoride. The author summarizes the findings of his review as follows: "Whereas, epidemiological statistics in the USA have not revealed any effect of fluoridated water (1 ppm) on the kidneys, in persons with kidney disease increased retention of fluoride in the blood has been recorded." This finding is not challenged and would appear to confirm the safety of fluoridation even to those patients with diagnosed kidney deficiencies. Since fluoride is eliminated through the kidney, it is consistent with earlier studies that greater retention of fluorides systemically occurs in patients with reduced kidney function. However, it is important to note that no toxicological or adverse physiological effects have been reported for patients in optimally fluoridated communities who have any level of kidney deficiency. This publication confirms this finding. The National Kidney Foundation and the US Heart, Lung and Blood Institute both endorse water fluoridation and recommend the use of distilled or deionized water during kidney dialysis. (For further discussion, see p. 5-30 section on renal disease and review of Spak in this section, and for comments by renal specialists from San Francisco on the lack of problems for patients, with compromised kidney function, drinking fluoridated water.)

Jansen I, Thomson HM. Heart death and fluoridation. Fluoride. 7 (1):52-57. January 1974.

This study again appears in the journal, Fluoride, discussed earlier.

The fluoride in the water in Antigo, Wisconsin, was removed in 1960 after concern was raised over the apparent increase in cardiac deaths in the years following fluoridation of the water supply. Isabel Jansen, a nurse and resident of Antigo, spent three years studying local death certificates as well as records from the US Public Health Service and Census Bureau. She reported a dramatic increase from 250 cardiovascular deaths per 100,000 in 1945 to about 550 in 1965. In contrast, the cardiac death rates for the United States as a whole rose gradually in these decades from just over 300 to 380. The National Fluoridation News (volume 18; July, 1972) reported that "this study should be vital concern to consumers of fluoridated water."

Age is essential to know in evaluating the Antigo experience. It is common knowledge that deaths from cardiac disease become more frequent as people grow older. Antigo's elderly population had doubled in a twenty-year period as young people left this small town. Thus, the proportion of residents in Antigo over age 75 increased from 1.5 times the state average in 1950 to 3.4 times in 1970 (Hodge, 1985). Older average age was responsible for the increased cardiovascular death rate. In 1965, after dental disease rose and it was proved that heart disease rates had not changed, fluoridation was reinstated in Antigo. No data are presented by Jansen other than two figures with linegraphs which purport to show "3 month moving average" of heart deaths. It is impossible to determine what methods were used when the claim is made that, "the number of heart deaths for Antigo residents age 65 and over was therefore

adjusted downwards." The attempt to control for age in this paper does not use accepted techniques. (See section on heart disease, p. 5-29 for further discussion of methodological limitations and other studies on water fluoridation and heart disease.)

Taves, in 1979, using accepted epidemiological methods examined the impact of fluoride on heart disease. He found that, "There is a 15 to 20 percent decrease in SMR deaths due to heart disease for each of the four groups over 1950 to 1970. This decrease in SMRs for the fluoridated cities is greater than the decrease for the controlled cities." Dr. Taves notes that while his findings suggest that fluoride might have some positive effect on the cardiovascular system, he cautions not to make that assumption in the absence of more specific data. He states, "Thus while the hypothesis (that fluoride reduces ischemic heart disease) at this point is only an intriguing possibility, it seems worthwhile to obtain the additional epidemiological and laboratory data needed to test the possibility."

This paper attempts to show a link between fluoride and heart disease in Antigo, Wisconsin. The authors do not use accepted methods and their results are contrary to many other studies that show no relationship between fluoridation and heart disease.

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Jolly SS, Sharma OP, Garg G and Sharma R. Kidney changes and kidney stones in endemic fluorosis. Fluoride. 13 (1):10-16. January 1980.

This study, again, appears in the journal, Fluoride. This study purports to

show that the level of fluoride in urinary tract calculi (kidney stones) is higher in areas of naturally high fluoride content, in this instance India, with levels as high as 16 parts per million on the average. It also purports to show a relationship between incidence of urinary tract calculi and levels of fluoride naturally occurring in the water supply. On the second claim, that is, the incidence of urinary tract calculi, the authors were careful to qualify their findings as follows: "This technique used in this study of calculating the incidence of urinary calculi, however, is approximate and cannot be considered accurate." Therefore, these investigators found only that the fluoride content of the stones from high fluoride areas was higher than that from the low fluoride areas, but that that mineral content had no demonstrable adverse effect on health since they were unable to show an association to the number with stones.

Once again, the authors make no reference to their findings in terms of extrapolating them to areas of optimal fluoridation at 1 part per million. Their findings relate only to areas with an average of 16 parts per million naturally occurring fluoride in India, and even in those areas this study was unable to disclose any adverse health effects with respect to the kidney and urinary tract. (See section on kidney disease, p. 5-30.)

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Juncos LI and Donadio JV. Renal failure and fluorosis. JAMA. 222 7:783-785. November 13, 1972.

This study reviews two case reports of patients who showed symptoms of fluorosis because they had a primary kidney disease that increased the fluid

intake in an area where the fluoride levels were naturally high. The first case was an 18-year-old boy who had had a usual daily water intake of about 5 to 6 liters since young childhood because of kidney disease. He lived in an area where the water supply was from an artesian well containing 2.6 parts per million of fluoride. The excessive water intake, 5 to 6 times that normally found in an adult male, was due to the severe renal failure which caused him to want to drink more water. The only systemic manifestation of excess fluoride intake from this boy who was drinking water 2.6 times the optimum level of fluoride, was fluorosis of the teeth and radiographic evidence of some bone changes. However, the bony changes observed in this patient were not manifested in any clinical symptoms of pain or dysfunction.

The second case is one of a 17-year-old girl who was referred to the Mayo Clinic because of kidney disease (azotemia). This patient, since infancy, had always drunk large amounts of water. The fluoride content of the sample of the patient's drinking water was 1.7 parts per million. Again, the only clinical manifestation of changes due to fluoride in the second patient was fluorosis of the teeth and some X-ray evidence of bony changes with no clinical symptoms of any pain or dysfunction. Neither of these two patients were analyzed for blood fluoride levels; therefore, no determinations of systemic fluoride intake could be made through these findings. The authors conclude "that chronic ingestion of fluoride containing water is unable to cause renal damage, per se, seems to be further supported by the marked efficiency of the normal kidney to clear the ion." They go on to say, "earlier reports of renal pathologic changes presumably due to chronic ingestion of fluoride have been nonspecific and could have represented preceding renal disease."

This study presents two case reports of patients with severely compromised kidneys who were, therefore, drinking excessive amounts of water containing fluoride at 2 to 3 times the level recommended for optimum tooth decay prevention. Although their fluoride intake was higher than optimum, they still did not suffer any serious health effects that were not already present.

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Leverett DH. Fluorides and the changing prevalence of dental caries.

Science. 217 (4554):26-30. 2 July 1982.

In this article, Dr. Leverett's central premise is that, while the prevalence of dental caries is clearly on a decline (it has declined some 30% among 5 to 17-year-olds over the last 10 years, according to the National Institute of Dental Research) public health researchers and scientists might wish to examine and reevaluate the current level of fluorides being prescribed for both dietary supplementation and for introduction into the community water supply.

Leverett recently sent the San Francisco Department of Public Health a letter in which he stated he thought research would ultimately indicate that the optimum dosage should be adjusted upwards. (See Appendix F.) "I have never, even for an instant, believed that we are receiving too much fluoride or that there is any danger to the health and welfare of our population, either in unfluoridated or fluoridated communities. I argue only, in light of these facts, that we need to reassess our definition of "optimal". If I had to guess at the outcome, I would say that we would be most likely to adjust the optimum dosage upward, in light of the fact that current practices

have resulted in a dramatic decline in the prevalence of dental caries, for the apparent price of a modest increase in the prevalence of mild and very mild dental fluorosis...On a more personal note, let me add that I conduct extensive clinical research in both fluoridated and non-fluoridated communities. Within this context, I examine thousands of children each year and continue to be overjoyed by the obviously superior dental health of children in fluoridated communities. I hope that San Francisco will soon join the ranks of beneficiaries of this unexcelled public health measure." As a possible indicator of fluoride intake, Leverett cites studies which purport to show an increasing prevalence of fluorosis. He is careful to point out, when he makes reference to fluorosis, that "I identify the increase in dental fluorosis only as an indicator of a change in the amount of fluoride in the environment. This dental fluorosis is not disfiguring and is not generally discernable to the lay person."

A recent article by Driscoll et al. in the June 1983 edition of the Journal of the American Dental Association attempted to assess that specific concern. Driscoll and coworkers returned to the same communities evaluated in the original fluoridation research done by H. Trendley Dean in 1945. Driscoll and coworkers found that the level of fluorosis in those communities has not changed appreciably since the early findings of Dean in 1945. Therefore, the most definitive studies done on fluorosis among individuals in fluoridated communities (and not evaluating individuals taking dietary fluoride supplements) show that there has been no significant change in the incidence of fluorosis. If, in fact, future studies indicate that the fluorosis incidence is increasing then public health investigators may, in fact, recommend a reduction in the level of fluoride in community water supplies. It should be reemphasized that the term "fluorosis" used in these discussions by Dr.

Leverett and others, are fluorosis of a very mild form and, in Dr. Leverett's words, "not generally discernable by the public but only discernable through close scrutiny by dentists."

Other data cited in the Leverett article that purport to show an increase in fluoride intake have been found to have had errors in calculations and methodology (Taves, 1979 and Singer, 1980). These more recent studies of food intake have shown no increase in fluoride intake during the past 20 years.

Another problem with Leverett's initial analysis was that he did not know that since the late 1970's, U.S. infant formula manufacturers reduced the concentration of fluoride in their products. Manufacturers of baby cereal and juices also took steps to control fluoride content (Horowitz, 1982).

Dr. Leverett makes no recommendation for, nor does he support, termination of fluoridation of community water supplies. He is an advocate of fluoridation of community water supplies and has indicated that in a number of his previous and current publications. He suggests in his letter that research may suggest a need to increase the optimal dosage. Recently the EPA has also considered raising the level of fluoride permitted in the drinking water to 4 ppm. (See Appendix G.) (In addition, see discussion on fluoride in the food chain, p. 5-40.)

McIvor M, Baltazar RF, Beltran J, Mower MM, Wenk R, Lustgarten J and Salomon J. Hyperkalemia and cardiac arrest from fluoride exposure during hemodialysis. American Journal of Cardiology. 51 901-902. March 1, 1983.

Approximately 1000 gallons of 22% hydrofluosilicic acid inadvertently spilled into the small community water supply. This raised the fluoride level to 30 parts per million and it took 7 days for the fluoride level to return to 1.6 parts per million. While the level was high it was used for kidney dialysis which further increased the fluoride to a potentially toxic level. This article reports a case history of a 63-year-old male who was dependent on hemodialysis and had virtually no normal kidney function. This patient was one of eight patients in a hemodialysis center which at that time did not provide distilled or deionized water for hemodialysis. Two days after the accidental spill, this patient reported symptoms of cardiac disturbances and went into cardiac arrest for a short period of time. The patient recovered after resuscitation and "four days later the arterial blood gases and serum electrolyte levels were normal." The exposure of this patient to fluoride was excessive. Estimates by the authors are that, "If over 100 gallons of tap water with normal fluoride levels of 1 ppm is used by a patient during dialysis, up to 36 mg of fluoride can be absorbed in a single run." Thus, according to the authors' figures, at the level of 30 parts per million, this exposure to the patient would have provided in a single dialysis use 1,080 milligrams of fluoride. This is a certain toxic dose even for healthy, normal human beings.

In this case, a patient with chronic renal failure was exposed to excessive amounts of fluoride due to kidney dialysis using non-distilled and non-

deionized water which had fluoride levels of 30 ppm as compared with 1 ppm found in water fluoridation programs. This case report emphasizes that kidney dialysis for patients with chronic renal failure must be done scrupulously and should adhere to the guidelines set by the National Kidney Foundation. Secondly, the administration of fluoride in community water supplies must also be done strictly according to standards established by the American Waterworks Association. This case report cannot be extrapolated to the population at large, and the authors make no reference with respect to the safety or efficacy of water fluoridation.

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Nanasuya A and Narasinga Rao BS. Hydroxyproline peptides of urine in fluorosis. Clinica Chemica Acta. 56 (1):121-123. October 15, 1974.

The purpose of this study was to determine the level of hydroxyproline peptides in the urine of patients with a clinical history of severe skeletal fluorosis. These subjects, therefore, must be assumed to have been in areas of endemic fluorosis in India, although this is not stated in the paper. The authors make no mention of the level of fluoride in the water supply or the source of fluoride exposure for the subjects with fluorosis. This study compared 5 individuals with fluorosis with 4 normal individuals. The findings of the study were that hydroxyproline excretion in the urine was different among the fluorotic individuals than it was in the normal individuals. The authors make no statement with respect to any health effects attributed to this difference. The authors make no statement with respect to the practice of water fluoridation. No mention is made of the fluoride levels, either in diets, in

the water or from other environmental sources. Fluoride is known to be high in certain endemic regions of India.

This paper has no relationship to the issue of water fluoridation at appropriate levels but rather is a case study of individuals with skeletal fluorosis in India which resulted from high intake of fluoride.

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Prchal J, Srivastava SK and Beutler E. Active transport of GSSG from reconstituted erythrocyte ghosts. *Blood*. 46 (1):111-117. July 1975.

The purpose of this study was to "evaluate the potential physiologic importance of the (oxidized glutathione) GSSG transport system in the turnover in vitro in (reduced glutathione) GSH in red cells." In the laboratory study, red blood cells were cultured and subjected to various media and their biochemical processes were evaluated. When a prepared culture of red blood cells was subjected to 30 mM of fluoride, which is equal to 570 milligrams per litre of fluoride (570 ppm), it was found that the transport of GSSG without the presence of ATP was lower than those with ATP. Transport in the presence of fluoride was approximately equal to an ATP-depleted environment. The use of fluoride in this study was for the purpose of analyzing certain biochemical activities of red blood cells, especially as it relates to oxidative mechanisms. The fluoride was used as a control at toxic levels to prevent certain cell functions. Since the level of fluoride in the serum of individuals in fluoridated communities is about .01 to .02 mg/L, these cells were subjected to over 28,000 times the amount of fluoride normally found in human serum.

The findings of this study are not related to fluoridation but rather are related to the biochemical transport action of red blood cells. The authors make no reference in the study to the practice of water fluoridation or the biochemical effect of fluoride on humans, nor was that the purpose of this study. High concentrations of fluoride, as well as high concentrations of a number of other essential trace elements for human nutrition, are known to disrupt cell processes in laboratory studies. This is not a significant finding with respect to the practice of water fluoridation and, therefore, is not germane to the discussion of the safety, efficacy or appropriateness of this community preventive health measure.

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Scott RE. Effects of prostaglandins, epinephrine, and NaF on human leukocyte, platelet and liver adenyl cyclase. *Blood*. 35 (4):514-516. April 1970.

This was a technical study of the stimulation of the enzyme ATP in vitro. Tissue homogenates were exposed to trisbuffer, caffeine, magnesium, ATP, and to high concentrations of sodium fluoride. The authors summarize their findings that "despite the limited scope of this study, the data show that epinephrine stimulates cyclic AMP production in liver and leukocyte homogenates and sodium fluoride shows a stimulatory effect in each tissue."

This study and evaluation was specific only to laboratory techniques to be utilized in the evaluation of various enzyme functions of cells. It does not relate in any way to water fluoridation. The findings cannot be extrapolated

to the use of water fluoridation and the authors make no reference to the practice of water fluoridation, dietary fluoride supplements, or dietary fluoride intake. The concentrations of sodium fluoride used in this study were $1 \times 10^{-2} M$. This is equivalent to 190 milligrams per liter of fluoride. This level of fluoride is equivalent to 10,000 to 20,000 times that found normally in blood serum in humans living in fluoridated communities.

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Shea JJ, Gillespie SM and Waldbott GL. Allergy to fluoride. Ann. Allergy. 25 (7):388-391. July 1967.

This is a case report of six children and one adult who allegedly exhibited various allergic reactions after the use of toothpaste and vitamin preparations containing fluoride. This report appeared in the Annals of Allergy in July 1967. In June 1971, the American Academy of Allergy published in the Journal of Allergy a response to this study as well as to other reports by Waldbott and others regarding alleged allergic responses to fluorides. Fluoride is a mineral nutrient. The academy stated, "there is no evidence of allergy or intolerance to fluoride as used in the fluoridation of community water supplies...the review of the reported allergic reactions showed no evidence that immunologically mediated reactions of the types I to IV had been presented. Secondly, the review of the cases reported demonstrated that there was insufficient clinical and laboratory evidence to state that true syndromes of fluoride allergy or intolerance exist." This statement by the American Academy of Allergy was reaffirmed most recently in 1982 after review of further studies submitted to them; therefore, there is at present no evidence to

support the contention that any true allergic responses have been reported as a result of consumption of fluoridated water.

In addition, Richmond points out that several thousand children received sodium fluoride in tablet form for several years and there was no report of allergic responses. The same is true about tea. It is a fluoride-rich beverage with billions of cups consumed around the world. No allergic response has been demonstrated (Richmond, 1985). Hodge recently pointed out that allergy to fluoride cannot exist (Hodge, 1985). "Allergy is a reaction to substances which the body recognizes as foreign -- whether generated from the host or introduced from the external environment. Fluoride, like other simple ions, e.g., calcium or magnesium, is not recognized by the body as foreign in an immunological sense. In fact, the smallest peptide that has been shown to be capable of acting as an antigen... (has) a molecular weight of 1,087 (versus fluoride ion at weight 19)."

(For further discussion of the absence of fluoride as a systemic allergen, see discussion of allergy in this report on p. 5-38.)

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Singer L, Armstrong WD, Zipkin I and Frazier PD. Chemical composition and of fluorotic bone. Clin. Orthopaed. Rel. Research. 99 :303-312. March/April 1974.

This is a case report of an individual from an area of India where there is endemic fluorosis. This study reported the findings of the chemical evaluation of a portion of the seventh rib of a 45-year-old Indian farmer, described as

being very poor and having a diet grossly deficient in essential nutrients. The water consumed by the patient was reported to contain 9.5 parts per million fluoride, almost 10 times the amount optimal for the prevention of dental caries. Persons in similar areas live where the temperature reaches 116°F during the long hot summers and "out of necessity, consume large quantities of water and their nutrient status is questionable." "The patient expired after 3 months observation as a result of urinary tract infection and secondary infection from extensive bed sores." "The physical examination of the patient revealed a very poorly nourished, emaciated person with grade three fluorosis." The authors state, "In contrast to the high bone fluoride concentrations reported here, the dry, fat-free ribs of individuals ingesting water containing less than 1 part per million fluoride contained about 0.04% fluoride and those persons using water with 4.0 parts per million fluoride had fluoride concentrations of 0.4%. The high fluoride content of the fluorosed bone from India is undoubtedly due to the large volume of high fluoride containing water ingested as a result of the extremely hot environment."

This evaluation of fluoride deposition in bone as a result of consumption of huge quantities of high-fluoride water, water naturally containing fluoride at nearly 10 times optimum over a period of 36 years, is consistent with other literature reporting similar findings. This is an analysis of a particular individual's rib exposed to highly excessive amounts of fluoride over a long period of time. The biological or biochemical pathway of fluoride is well known. The findings of this study are consistent with those of previous studies which show that large excesses of fluoride will be stored in both bones and teeth. Dr. Singer, senior author of this article, sits on the American Dental Association, National Fluoridation Advisory Committee, and has published

numerous articles on fluorides and takes a very strong favorable position on community water fluoridation.

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Singh M and Kanwar KC. Effect of fluoride on copper, manganese and zinc in bone and kidney. Bull. Environment. Contam. Toxicol. 26 (3):428-431. March 1981.

The introduction to this paper states "So far, there is no report discussing the effects of excessive fluoride ingestion on some essential metallic micro nutrients. The object of the present paper is to investigate changes in the levels of copper, manganese, and zinc in the kidney and bone (femur) of rats following fluoride toxicity." (emphasis added)

This article describes a laboratory study of 24 female albino rats which were fed varying levels of fluoride from 0 to 25 parts per million in their drinking water over a period of 10 months. The researchers then sacrificed the animals and evaluated the effect of fluoride on copper, manganese, and zinc in both bone and kidney. The findings of the study showed that the effect of fluoride on tissue levels was no different between the group of rats fed water with fluoride at 0 parts per million and those fed water with fluoride content as high as 10 parts per million. The only statistically significant difference in ionic levels in both bone and kidney were among the group of experimental animals fed 25 parts per million of fluoride over a 10 month period. That is 25 times the level recommended for the fluoridation of community water supplies. Although altered copper and zinc levels were found at the 25 part per million level, the authors state, "on the other hand, there is observed an

increase of 34% in zinc level of kidney and a decrease of 13% in zinc of bone in group 2 (that group subjected to 25 parts per million fluoride)." "With the data available, these changes are difficult to account for."

The authors observed no adverse health effects in any of the three groups and since, by their own admission, their experimental findings are "difficult to account for", the study itself must be subjected to close scrutiny and further evaluation and confirmatory findings of independently-conducted studies should be done.

The authors of this research say they are studying fluoride toxicity at doses thousands of times those found in human tissue even in fluoridated communities. They do not attempt nor do they recommend that their findings be extrapolated to the practice of water fluoridation at 1 part per million, nor do they make any claim or contention that water fluoridation is unsafe in any way. They are simply making a laboratory observation of apparent alteration in the mineral content of both bone and kidney at varying excessively high levels of fluoride intake in laboratory animals. These findings, incidentally, are not inconsistent with other studies that show an effect of high fluoride level on other mineral metabolism in bone.

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Spak CJ, Berg U, Ekstrand J. Renal clearance of fluoride in children and adolescents. Pediatrics. 1985. 75:575-579.

This article is clearly supportive of water fluoridation. In fact, the authors initiate their article with the following statement: "It is well documented

that 1 milligram of fluoride per liter in drinking water results in good protection against dental caries. Therefore, in fluoride deficient areas, fluoride supplementation is recommended in early childhood and often from shortly after birth. The aim of fluoride supplementation is to incorporate as much fluoride as possible in the developing enamel organ during a period of tooth formation in order to increase the resistance of the tooth to caries attack...The object of the present investigation was to study renal fluoride clearance in children and adolescents."

This study involved 38 children (29 girls and 9 boys). "In all children, renal function was tested because of suspected renal diseases or renal involvement associated with a systemic disorder such as diabetes." The age range of the children was 5 to 18 years. The researchers found that, "the results suggest that children have lower rates of renal fluoride clearance than adults, and indicate that a moderate impairment of renal function could lead to increased retention of fluoride." These findings are consistent with those of other researchers who have found that the biological pathway for fluoride indicates that fluoride is cleared through the urine and through the kidneys as well as through the bowel. These researchers made no observation of fluorosis in the entire group of 39 children even though many of these children had significantly impaired renal function. Secondly, although the researchers studied plasma and urine levels of fluoride, no evaluation was done of fecal fluoride levels. Further, these researchers observed no bone dysfunction in these patients; therefore, their observations that fluoride clearance is reduced when kidney function is reduced is consistent with previous studies and not surprising. Nevertheless, the lack of observation of any adverse health effect from the reduced clearance of fluoride suggests only that there is a great margin of safety for fluoride consumption even with patients with

partially compromised kidneys. Professor Donald Potter, Director of Childrens Renal Center, University of California, San Francisco, stated that in over 20 years experience in dealing with children with severely impaired renal function, he has never seen any case with any problem related to fluoride. (personal communication)

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Spencer H, Kramer L, Wiatrowski E and Osis D. Magnesium-fluoride inter-relationships in man. I. Effect of fluoride on magnesium metabolism. Amer. J. Physiol. 233 (3):E156-E169. September 1977.

This study examined the effect of high fluoride intake on magnesium balance in man. Metabolic balances of fluoride and magnesium were determined in control studies and during fluoride supplementation at various levels of calcium and phosphorous intake. Sodium fluoride doses of 10 to 45 mg per day were given.

The paper states, "the intake of about 10 milligrams of fluoride per day, given as sodium fluoride, resulted in a 2 to 3-fold increase of the urinary and fecal fluoride excretion. However, during the high fluoride intake, the urinary magnesium remained about the same. The fecal magnesium increased slightly and the magnesium balances did not differ significantly. This was the case where the fluoride was given during a low or high calcium intake in the absence or presence of added phosphorous. Similar results were obtained with large doses of fluoride, 40 to 45 milligrams per day given to patients with osteoporosis. The studies have shown that supplemental fluoride ranging from 10 to 45 milligrams per day did not effect the magnesium balance during calcium intake

that ranged from 200 to 2200 milligrams per day and during phosphorous intakes that ranged from 800 to 1400 milligrams per day."

Therefore, the findings of this study show that even with an increase of fluoride intake to up to 45 mg per day, there was no significant change in the excretion of magnesium or magnesium balance. An intake of 45 mg of fluoride per day would require drinking 45 liters of water which contained water fluoridated at 1 ppm.

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Steer ML. Adenyl cyclase. *Annals of Surg.* 182 (5):603-609. November 1975.

This article is a review of literature regarding adenyl cyclase activity and does not deal at all with the subject of water fluoridation or fluorides as used in community water supplies or as used therapeutically. Its purpose, as the author states, is as follows: "In this review of the characteristics of hormone receptors, the relationship between receptor occupancy and adenyl cyclase stimulation are discussed." The only mention of fluoride in the article is as follows: "The fluoride ion has been found to stimulate adenyl cyclase activity in broken cell preparations from a wide variety of tissues. For the most part, however, fluoride does not stimulate adenyl cyclase in intact cells. In broken cells, relatively high fluoride contents are required (1×10^{-2} M) for stimulation. The mechanism of this 'fluoride effect' is not known but it has been suggested that fluoride works by elementary pre-existing inhibitory forces which may be present." It must be emphasized that this is at extremely high levels. This level of fluoride is 190 times the amount found in water fluoridation and nearly 20,000 the times

found in normal tissue. Even at this level, its impact is on broken cells, not intact cells. This article is not relevant to the issue of water fluoridation.

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Teotia SPS and Teotia M. Secondary hyperparathyroidism in patients with endemic skeletal fluorosis. Brit. Med. J. 1 (5854):637-640. 17 March 1973.

This is a clinical series of "20 patients with skeletal fluorosis" of whom five had evidence of secondary hyperparathyroidism. These patients ranged in age from 42 to 68 years. "All belong to a low socioeconomic class and had lived since birth in an endemic fluorosis area of India...20 samples of water were analyzed from 4 wells located at different places in the endemic area and showed a fluoride concentration of 10.3 to 13.5 parts per million. The mean intake of fluoride from water alone by each patient was 25 milligrams per day and when it is realized that the same water had been used for processing and cooking the food, the intake becomes still larger." In evaluating these 20 patients, the investigators found 5 had "clear evidence of secondary hyperparathyroidism."

The authors offer a theoretical link between the excessively high fluoride intake of these patients and parathyroid changes. However, they state "further study of the parathyroid glands and of bone lesions in skeletal fluorosis is in progress." These authors never reported any further findings following their 1973 study. In addition, one must again recall that this is an evaluation of 20 patients who were consuming at least 25 times the amount of fluoride normally consumed in optimally fluoridated communities. They all had skeletal

fluorosis. This study's findings are equivocal and, even if accurate, could not be extrapolated to the fluoridation of community water supplies. The authors of this study make no recommendations with respect to the fluoridation of community water supplies. (For a further discussion of lack of association between fluoride intake and negative parathyroid effects, see Richmond, 1985.)

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Tsutsui T, Ide K and Maizumi H. Induction of unscheduled DNA synthesis in cultured human oral keratinocytes by sodium fluoride. *Mutat. Resch.* 140 (1):43-48. May 1984.

Tsutsui T, Suzuki N and Ohmori M. Sodium fluoride-induced morphological and neoplastic transformation, chromosome aberrations, sister chromatid exchanges, and unscheduled DNA synthesis in cultured syrian hamster embryo cells. *Cancer Research* 44, 938-941, March 1984.

In the first study, the authors evaluated DNA damage in human oral keratinocytes by culturing the cells in the laboratory and applying a range of high sodium fluoride concentrations to those cells. The range was between 100 to 300 micrograms per milliliter, equivalent to a range from 100 to 300 milligrams per liter. In the second study, the authors examined similar high doses, 75-125 micrograms/milliliter), on hamster embryo cells. These levels exceed the normal level found in human blood by thousands of times and exceed the amount found in community water supplies by 50 to 100 times.

Dr. George Martin, at a public hearing before the U.S. Environmental Protection Agency, June 1985, has reviewed this work. Dr. Martin is a cell biologist who

has done a study similar to the present one. These studies are cytogenic and mutagenic assays. He pointed out that Tsutsui has carried out a study where he directly exposed hamster embryo cells to various levels of fluoride and measured unscheduled DNA synthesis, measured the levels of chromosome aberrations and sister chromatid exchange rates. He reported fluoride to be active in each of these assays.

Martin pointed out that unscheduled DNA synthesis is believed to occur not as a replication of new DNA but rather as a repair of damaged DNA. Therefore, Martin went on to say that, "unscheduled DNA synthesis is a response to damaged DNA and represents repair rather than any new synthesis." Martin also criticized the methods of assay that Tsutsui used. He used an "indirect test which was carried out by exposing the cells to radioactive thymidine in the presence of an inhibitor of DNA synthesis and then washing out the thymidine and counting the thymidine that was associated with the cells." Tsutsui found that there was an increase in the amount of thymidine. "He did not directly examine DNA to see if there was some increase in unscheduled DNA synthesis."

Skare et al. (1985) has carried out similar studies except they have directly examined the DNA and separated the newly formed from the old DNA. Using a direct method, Skare and others have not been able to find an increase in unscheduled DNA synthesis.

In a memorandum dated December 24, 1984, Dr. Martin wrote, "Tsutsui reported that fluoride caused unscheduled DNA synthesis (UDS). He used an indirect method. Using direct assays, NIDR, Proctor and Gamble scientists and British scientists have not found an increase in UDS by exposing cells to sodium fluoride." Martin points out that there is an artifact involved because it is

known that fluoride will precipitate thymidine in the presence of magnesium and other salts. The method could cause a precipitation in the label, (Thymidine), used to determine the action rather than the direct affect on unscheduled DNA. Therefore, he thinks that Tsutsui's results on unscheduled DNA synthesis are not reliable.

Martin pointed out that he had previously reported studies on cells exposed to X-rays which do cause DNA damage. He found that fluoride at very high concentrations had no effect on the level of damage and did not effect the rate of repair. He concludes that there is no indication at this time that fluoride inhibits or causes damage in these DNA systems.

Commenting on the chromosome aberrations found by Tsutsui, Martin pointed out that extremely high levels of fluoride were added. These cause a toxic reaction in the protein normally associated with DNA. The results are not due to actual chromosomal aberrations but rather are due to a secondary effect on the protein normally associated with DNA.

Martin discussed his and other results regarding chromatid exchanges. He found there was no indication of any damage to DNA or chromosomes. "Direct exposure of cells to fluoride at very high levels caused considerable cytotoxicity. We believe there is the possibility of a variety of artifacts caused by such factors as increasing the ionic strength because sodium fluoride is the salt of a weak acid. We find that you can change the pH of the incubation and cause changes, and that the levels that are used in these direct exposures contain significant levels of impurities which in themselves have biological activities. So, we believe, in balance, that there is no indication that fluoride damages DNA and is not cytogenic or mutagenic."

Martin has pointed out that the levels of fluoride added to tissues by Tsutsui causes precipitation of the calcium that is needed for normal cell functioning. Therefore, the fluoride may act at these high levels by causing cells to die from lack of calcium or magnesium. The toxic effects of fluoride therefore explain some of the findings of Tsutsui because he used fluoride at extremely high doses.

In conclusion, Tsutsui has described changes in cells which include chromosome aberrations, sister chromatid exchanges and unscheduled DNA synthesis. Using direct methods a number of scientists have been unable to reproduce Tsutsui's results. Other findings can be explained by an artifact caused by the toxic effect of fluoride when used at extremely high concentrations.

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Villee, CA. Birth defects and glycolysis. Editorial. New England Journal of Medicine. 1984. 310: 254-255.

This is an editorial that discusses the interaction of birth defects with high levels of natural substances in the body, such as sugars. The reference to fluoride regards its effect of inhibiting certain enzymes. This has been reviewed in other papers in this section, where it has been pointed out that the toxic effects of fluoride occur at extremely high levels as is the case with many vitamins, minerals and nutrients.

Yiamouyiannis J, Burk D. Fluoridation and cancer age dependence of cancer mortality related to artificial fluoridation. Fluoride. 1977; 10:102-23. 1977.

This study purports to show a definitive link between the presence of water fluoridation and cancer mortality. The authors selected fluoridated and non-fluoridated cities and collected mortality information for cancer from these cities for the period 1952-1969. Their findings were that the incidence of cancer and mortality from cancer were much greater in the fluoridated communities than in the non-fluoridated communities. In fact, one of the authors, Dr. Burk, from his study stated that he estimates that over 35,000 deaths per year are caused by water fluoridation.

First, it should be noted that this study appeared in the journal, Fluoride, which is a publication of the International Society for Fluoride Research. Numerous reviews have been done of this particular paper by a number of research organizations including the National Cancer Institute.

One of the most complete critiques of this study was done by Smith in 1980. He pointed out that the Yiamouyiannis study divided the population into age groups of under 25, 25 to 44, 45 to 64, and 65 and over. He stated that the "statistical methods used in the Yiamouyiannis study are not those generally used for the examination of mortality rates in epidemiological studies and therefore, warrant careful scrutiny....The use of age bands, in 20-year widths, is not acceptable in cancer study since there is a dramatic increase in cancer mortality with age so that small differences in the age distribution of the two populations can lead to an apparently significant

difference in cancer mortality." This problem is compounded in this instance since there were noticeable changes in age composition, over time, in the two groups of cities.

There is no attempt by Yiamouyiannis to control for race. He simply stated that there was no significant correlation. This is not accepted procedure. "The percentage of non-whites in the fluoridated city increased over the study period and coupled with the fact that cancer mortality in the U.S. is higher among non-whites than among whites, means that this variable must be taken into account in any appropriate analysis."

No attempt was made by Yiamouyiannis to control for sex. Obviously, certain cancers occur predominantly in one sex or another. "There were noticeable changes in the sex composition of the two groups of cities over the time of the study. It is not clear if appropriate allowances were made for this in the Yiamouyiannis study." Yiamouyiannis simply stated that "the age sex corrected cancer death rate indicated 9 to 10 more cancer deaths per hundred thousand per year in the fluoridated cities." He did not explain how this correction was done.

Smith also states that it is "almost inconceivable that the diversions between the crude mortality figures for the two groups of cities... could be a consequence of fluoride in the drinking water being a cancer causing agent." According to Yiamouyiannis, the crude cancer rates begin to diverge immediately after the addition of the fluoride. Smith points out that the latency period, for most cancers, is usually over five years and for some on the order of 20 to 30 years.

Smith, in his paper, then does an analysis using the same figures that Yiamouyiannis uses. He found, once the cities were adjusted for age, race and sex, that no difference was found in cancer mortality rates.

In September 1977, Dr. Arthur Upton, then Director of the National Cancer Institute, made a statement before the Intergovernmental Relations and Human Resources Committee of the House Committee on Government Operations. His statements starts, "I can state with certainty from analysis and reviews of relevant data that no trends in cancer rates can be ascribed to consumption of water that is artificially or naturally fluoridated." Another statement was published by the Royal College of Physicians of the United Kingdom to the effect that there was no evidence that fluoride increases the incidence of mortality in cancer in any organ. Finally, we have read the recently published official report of the Royal Statistical Society which was requested by the Royal College of Physicians to give a formal opinion on the evidence. In an elegant exposition, this report examines the data of the National Health Federation (Yiamouyiannis and Burk) and the NCI analysis of the National Health Federation data and concludes that there is no evidence that fluoride increases cancer mortality.

In a recent paper in the journal, *Pediatrics*, Margolis and Cohen (1985) stated that the Yiamouyiannis studies have never been published in a refereed scientific journal, appearing only in the private journal, *Fluoride*, of which Yiamouyiannis is the co-editor.

A more complete review of this work of Yiamouyiannis and others will be found in the section of this report that examines the effect of fluoride on cancer in the answer to Question 5, p. 5-22.

The next three articles submitted by Supervisor Nelder are all anonymous. They are entitled Fluoride Cancer Controversy, which is an editorial published in the journal, Fluoride; the next is Fluoride in Kidney Stones, another anonymous editorial published in the journal, Fluoride; and the third is, and The Preskeletal Phase of Chronic Fluoride Intoxication, also published in Fluoride. These three anonymous articles do not purport to offer any original scientific research, but rather are editorial comments only.

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Anonymous. Fluoride and kidney stones. Editorial. Fluoride 13 (1):1-3.
January 1980.

This review briefly examines fluoride levels in kidney stones in high fluoride areas. No evidence is presented here or otherwise that there is any relationship between fluoride and the prevalence of kidney stones. Dr. Francis Kolb, an expert in metabolic stone diseases, the author of numerous articles and an endocrinologist leading the study of fluoride therapy in bone disease, has never seen fluoride renal stones. [Personal communication] "In fact, they do not exist in humans, only in non-human models to my knowledge." He has not heard of any renal problems secondary to community water fluoridation and says it is extremely rare to have any toxic symptoms with high dose sodium fluoride therapy; these are rapidly eliminated by decreasing the dose. Community water fluoridation has only positive effects."

Dr. Barry Kogan, Chief of Pediatric Urology at the University of California, San Francisco, has "never seen or heard of any fluoride stones and certainly

has not seen any patients with any complications of fluoridation." [Personal communication.]

(For further discussions on fluoride and kidney stones, see review of Jolly et al. 1980, and section on renal function in question 4, p. 5-30.)

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Anonymous. The Fluoride-cancer controversy; editorial. Fluoride. 10 (3):95-101.

This article reviews the epidemiological evidence of the Yiamouyiannis - Burk findings that there is a relationship between water fluoridation and cancer. These conclusions are extensively discussed elsewhere in this report. Essentially, this editorial ignores the findings of the Royal Statistical Society, the National Cancer Institute, and numerous other investigators around the world who have examined the same data using acceptable epidemiological methods and who have concluded that there is no relationship between cancer and fluoridation. They also ignore the major methodological defects cited by Smith in 1980. The anonymous author of this editorial also cites circumstantial evidence and other studies such as the Taylors' experiments in 1964 which have been extensively criticized. These issues are discussed further in the sections on cancer and mutagenesis.

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Anonymous. The pre-skeletal phase of chronic fluoride intoxication. Fluoride. 7 (3):118-122. July 1974.

This review of articles concludes that "fluorosis is a systemic disease liable to involve many or perhaps all organs of the system." They imply that many organs of the body can be involved with low doses of fluoride and cite the article by Grimburger (review above). Other evidence discussed is the toxicity of fluoride at high levels or chronic toxicity of other substances such as lead. Other studies cited concern convulsions, muscle fibrillation, etc. Reviews and articles presented elsewhere in this report refute these conclusions. There has been no evidence of chronic fluorosis at levels used for community water fluoridation in this country. The World Health Organization reviewed similar data in 1975 and concluded, "the only sign of physiological or pathological change in lifelong users of optimally fluoridated water supplies...is that they suffer less from tooth decay."

QUESTION 5

What other studies and reports relate to the effects of fluoride in the water drinking supply of any city or other area in the world, showing that fluoride is safe for human consumption? Indicate also the amount of fluoride in each instance or study.

Fluoridation has been one of the most extensively studied public health interventions since its initiation in 1945 in Grand Rapids, Michigan, and Newburgh, New York. Subsequent to these first community trials, more than 15,000 studies have been reported in the medical/public health literature. This tremendous body of knowledge is derived from in vitro and in vivo analyses of both animal and human systems. The resultant wealth of information thoroughly evaluates all aspects of fluoride biochemistry, toxicology, metabolism, therapy, and most importantly for us, community water fluoridation.

This section of this document reviews the most important studies and reports—national and international—regarding the effects of community water fluoridation. For clarification—optimum water fluoridation is currently recommended by the Environmental Protection Agency to be 0.7 to 1.2 ppm of fluoride, while the maximal acceptable level is set at 1.4 to 2.4 ppm. For the purpose of this report, optimal concentration for community water fluoridation will be defined as the current standard of 0.7 to 1.2 ppm. Most communities are extremely close to the target of 1 ppm. Some communities with naturally fluoridated water supplies have much higher levels (up to 8 to 12 ppm). In June 1985, the EPA heard testimony regarding increasing this standard to 4 ppm (See Appendix G).

The scope of this review is large and complex, yet as will be presented, there is virtually unanimous consensus among independent scientific reports, organizations, health professionals and government-commissioned task forces, that fluoridation (1) is safe (in the recommended concentrations), (2) is beneficial to both child and adult health, and (3) is cost-effective.

Historical Perspective

Dr. Frederick McKay, a Colorado dentist, spent 30 years at the beginning of this century working to ascertain the cause of brown staining of the teeth that is common in Southwestern states. He discovered that patients with these mottled teeth had remarkable resistance to decay (McKay, 1929). In 1931, he, H.T. Dean, and Churchill established that fluoride was the substance in the water that was responsible for both the enamel discoloration and the decrease in dental decay (Churchill, 1931) (Dean, 1934, 1936, 1938). Dr. McKay's observations generated much interest and further research into the effects of fluoride on teeth. Chemical analyses of the water supplies in the area revealed naturally occurring fluoride concentrations of 2-10 ppm. No deleterious health effects, other than the cosmetic enamel staining, were found among a sample of three million people who had lived in those areas for a lifetime (Dean, 1934, 1936, 1938).

Dr. H.T. Dean, working for the US Public Health Service, led several research teams over a ten-year period in the epidemiologic examination of the effects of varying levels of natural fluoride in community water supplies. There were sixty percent fewer cavities in the teeth of those children whose water had a fluoride concentration of at least 1 ppm. (See Appendix R for Mechanism of Action.) Additionally, mottling of teeth in a small percentage of children was

not observed until the fluoride content was greater than 2-4 ppm (Dean, 1938, 1942; Mc Clure, 1970). [Mottling of the teeth or dental fluorosis is a cosmetic problem that has no health impact.]

United States

In 1945, the first long-term controlled community trials of fluoridation were begun. The New York State Department of Health proposed following matched groups of children in two neighboring towns (Newburgh and Kingston) which had similar demographic characteristics, environmental characteristics, and non-fluoridated water supplies (Ast, 1943). After comprehensive medical and dental exams were performed, 1500 children were enrolled in the study. Newburgh's water was fluoridated to 1 ppm (817 children) while Kingston (711 children) became the control town with no added fluoride. The study was designed to compare any differences between the bone development, growth rates, thyroid function, hearing, vision, dental exams, urine and blood chemistry of the two groups. Participation and followup during the 10 year study was very good. The results revealed no significant medical differences except that the Newburgh children had 60% fewer cavities (Hilleboe, 1956).

Also in 1945, the cities of Grand Rapids, MI, Muskegon, MI and Aurora IL joined with the Michigan Health Department, their local health departments, and the University of Michigan in a 15-year tri-city fluoridation study. Twenty-eight thousand children were (1) determined to be continuous residents of their respective cities and were enrolled, and (2) had baseline examinations performed (19,680 Grand Rapids, 4,219 Muskegon, 5,116 Aurora) (Arnold, F.A., 1962).

Annual examinations of selected age groups in all cities were performed. Grand Rapids had the fluoride content upwardly adjusted to 1 ppm from its previously unfluoridated level. Muskegon continued with its low level unfluoridated water while Aurora continued to use its naturally fluoridated water (1.2 ppm).

Within 6 years of initiation of fluoridation, the decay prevalence in Grand Rapids dropped well below the control level found in Muskegon, and almost equalled the level found in Aurora without evidence of any fluoride-related health problems. (Arnold, 1953) Public pressure forced the inception of a fluoridation program in Muskegon in 1951. Continued comparisons were made between cities and with pre-study baseline data for the three cities with each successive report, greater reductions in decay were observed (Arnold, 1956; Arnold, 1957; Arnold, 1962). After 15 years, dental cavities were reduced 50 - 63 percent in 12-14-year-olds. In addition, only 4 of 1,031 continuous resident children exhibited any evidence of fluorosis in the form of enamel mottling.

Brantford (Ontario, Canada), Sheboygan (Wisconsin), Evanston, (Illinois), Midland (Michigan), Lewiston (Idaho), and Marshall (Texas) all added fluoride to the water supply of their communities to the recommended levels by 1947. San Francisco, California, began adjusting the fluoride content in its drinking water in 1952 upon vote of the Board of Supervisors and public referendum.

Soon after, cities across the United States and around the world implemented community fluoridation and reported their successes in reduction of dental decay. Endorsement and approval of fluoridation from the American Association for the Advancement of Science came in 1954, the World Health Organization in 1958, and from nearly every major scientific and professional, public health,

and governmental agency. Appendix A reiterates those organizations that reaffirmed their support of fluoridation in 1984.

Fluoridation has been monitored in at least 110 communities in the U.S., with reports of its effectiveness being demonstrated repeatedly. In 1984, over 115 million Americans received fluoridated water (Fluoridation Census, 1984). Appendix B is a table listing the effectiveness of community fluoridation observed in more than 70 cities in the United States and around the world. The percent decrease in dental decay ranged from 26 to over 80 per cent when compared to their "equivalent" non-fluoridated community. The chart contained in Appendix C shows a dramatic increase in the numbers of persons drinking fluoridated water in the United States. The following discussion will highlight a few of the studies reviewed.

Winona, Minnesota reviewed its eleven-year experience with adding fluoride to its water. It surveyed 3300 school children prior to fluoridation and 3500 school children raised on fluoridated water. The conclusion was as follows:

Based on Winona's experience from 1965 to 1976, fluoridated water is a very effective public health measure. With continuous exposure during their developmental years to fluoridated water, school aged children 5 - 12 years will avoid 2 out of every 3 cavities (Minnesota Department of Public Health, 1977).

The New Haven, CT, Department of Health conducted a comprehensive survey to examine the effects of community fluoridation. A 76% reduction in decayed permanent teeth was found in all non-white students while white students had a

International

Canada has an equally long history of fluoridation, beginning in Brantford, Ontario, in 1945. Young adults, after 17 years of fluoridation, had a much lower prevalence (57%) of dental decay when compared to a matched group in the non-fluoridated city of Sarnia (Brown and Poplove, 1963). Fluoridation programs have been monitored throughout the cities and provinces (Connor Tharwood, 1963; Lewis, 1976). In Manitoba, a 41-74% decrease in caries was documented, while Toronto claimed a 35-56% reduction in decay in its 5 and 11-year-olds. The Canadian government affirmed its belief in the safety and benefits of fluoridation in its report, Fluoridation and Cancer (1977), after reviewing its success and other reports.

More than half the citizens of Canada drink fluoridated water and the government endorses and encourages adoption of fluoridation by local communities. In Quebec province, for instance, the Ministry of Social Affairs will subsidize the costs of purchase and installation of fluoridation equipment and chemicals.

Fluoridation is widely practiced in both Central and South America for those who receive piped water supplies. Ninety-six percent of the population of Puerto Ricans and 100% of those people in Paraguay who have access to piped water drink fluoridated water. (Guzman, 1961; WHO, 1969). Panama, Colombia, Nicaragua, Chile and Brazil all have extensive experience with fluoridation, and none of these countries have reported any adverse health effects (e.g., Viejas & Viejas 1974, Mejia 1976).

In Europe, the first well-documented experience with community fluoridation was in Tiel, Netherlands. A continuously followed group of 18-year-olds had a 53%

reduction in dental decay or an absolute difference of 19 cavities per person (Kwant, 1974). In Great Britain, fluoridation began in 1955 in Angsley. In 1974, its 15-year-olds had a forty-four percent reduction in cavities (Jackson, 1975), which was reconfirmed by continued monitoring in 1985 (Jackson). More recent reports of the effects of fluoridation on 5-year-old children have been reported from Leeds, where there was a 48-62% reduction in decayed teeth (Jackson, 1980); in Newcastle-upon-Tyne, a 57% reduction (Rugg-Gunn, 1977), and in Northumberland, a 67% reduction (Rugg-Gunn, 1977b). Such dramatic decreases were more recently reported in the urban centers—Leeds and Birmingham (Jackson, 1980 and Whittle, 1979). They concluded that "this opportunity for better dental health should not be withheld."

Sweden has never fluoridated its water supply except for one community (Norrköping, population 38,000) for nine years. This experiment ended in 1961 when an administrative ruling concluded that, because of technicalities in the water treatment laws, provision for the practice of fluoridation was not allowed. However, Uppsala, a city famous for its excellent university and educated populace (pop. 145,000), is fortunate in having had a natural source of optimally fluoridated water for more than one hundred years. Certainly, no official move has been made to enforce defluoridation of its water. Sweden has instituted a national program which includes fluoride tablets for children, fluoride mouthwashes for all who are caries-prone, and topical fluoride applications for all citizens. As with other Swedish government-funded programs (e.g., socialized medicine, child care), this program has wide acceptance.

The East Germans in Karl-Marx-Stadt, having begun fluoridating their water supply in 1959, have documented a 76% reduction in caries in the 5-year-olds

(Kunzel, 1968) and 66% in 12-year-olds (Kunzel, 1975).

In one of the most comprehensive Soviet studies, fluoridation effects have been monitored in Murmansk by the Central Research Institute of Stomatology and the World Health Organization. In 1978, those groups reported a 50% decrease in dental caries in the 10-year-olds in this Siberian city (Rybakor, 1978).

Little information on the effects of fluoridation on people in Asia is available. However, millions of people have been drinking fluoridated water in Singapore, Hong Kong and Taiwan. In Japan, water for millions of residents is naturally fluoridated at 1 ppm or greater.

In Australia, multiple long-term monitoring projects have occurred and are continuing, including those in Perth. Medcalf (1978) reported a decline in caries of 48% and 57% in 6 and 10-year-olds, respectively.

Reviews and Commission Reports

In 1971, the Kettering Foundation of the University of Cincinnati reviewed all previously-published articles on fluoride in an attempt to assess other aspects of the effects and safety of community fluoridation. This independent group could find no scientific evidence of any harmful effects of fluoridation and emphasized the overwhelming number of documents describing the benefits and safety of fluoridation.

Numerous commissions, boards, and task forces have exhaustively scrutinized the literature, their own fluoridation programs, and those of others.

The Royal Commissioner of Tasmania, in a thorough and eloquent treatise summarizes: "The evidence that fluoridation at optimum levels is only of benefit, is a claim for which the substantiating evidence is overwhelming and cannot be doubted." "As a public health measure, no alternative means of adding a fluoride supplement is as efficacious as fluoridation of water supplies. At a level of 1 ppm, fluoridation plainly constitutes no danger to normal individuals. Fluoride is not known to aggravate, dispose to, or be a cause of diabetes, kidney disease, cancer, goitre, diseases of the cardiovascular system, periodontal disease, enzymatic malfunction, teratogenesis and disorders of pregnancy or childbirth, mongolism, or ectopic calcification." (Report of the Royal Commissioner, 1968).

The International Workshop on Fluorides (University of Maryland, 1974) reached a consensus that no alternative "therapy approaches the degree of protection afforded by fluoridation of the public water supply" (p. 282).

In 1975, the California Task Force on Dental Health had, as its first recommendation, that "the state should act immediately to fluoridate all of its public water supplies as the most cost-effective step in reducing dental disease." The report reiterated the excellent safety (no known health effects) and economic arguments of this "essential nutrient." The California Department of Health Services reaffirmed its strong support of fluoridation in June of 1985 (see Appendices W and X).

The Canadian Department of Health and Welfare with the Canadian Public Health Association reviewed original research and "relevant scientific, technical and medical literature" in 1979. Their committee strongly recommended fluoridation of Canadian drinking water as it leads to a definite and substantial reduction

in caries. They concluded fluoridation was beneficial and safe. They also concluded fluoridation of drinking water does not produce renal disease, does not alter cardiovascular or thyroid function, nor is it carcinogenic. Hearing, vision, and the incidence of Down's syndrome births are not affected by fluoride in the water supply. (Drinking water standard for fluoride, 1979).

The Australian Committee of Inquiry (Victoria, 1980) found the "evidence overwhelming" that fluoridation is an effective public health measure to reduce the incidence of dental caries, both in children and adults. "Fluoridation is safe, economical, and effective" and there is no "sound, scientific evidence that implies fluoridation has any toxic, carcinogenic, mutagenic, teratogenic or allergenic effects on humans."

In Michigan, The Governor's Task Force on Fluoride and Human Health (Michigan, 1979) concluded that "current knowledge adequately establishes that fluoridation of public water is an effective public health measure." The impartial, highly academic panel examined fluoridation research experience and literature with special attention to public water fluoridation. They recommended fluoridation of the Michigan water supply as it is safe and effective while also suggesting that monitoring of community experience and relevant literature continue. At the same time, the Michigan Department of Public Health (1979) together with the Department of Agriculture conducted a year-long review of original investigations, recent scientific evidence and their own experience. On this basis, they recommended and encouraged continued fluoridation of the water supply as safe and efficacious. They found no "scientific evidence" of abnormal effects except for some mild mottling of teeth (fluorosis) at high concentrations of fluoride (e.g. using 8 ppm for 37 years).

The Governor's Commission on Fluoridation in Minnesota (1979) after reviewing the literature and hearing testimony, found no potential adverse effects could be associated with the ingestion of drinking water containing fluoride at 1 ppm (1 mg/liter). The Commission concluded "that claims that fluoride is allergenic, mutagenic, or carcinogenic are not supported by the preponderance of available scientific data."

Effect of discontinuation of fluoridation

There are a number of studies that have examined the impact of discontinuing fluoridation on the dental caries rates in communities in which it had previously been in effect. In Antigo, Wisconsin, fluoridation was discontinued after an erroneous report of increased heart disease rates following fluoridation (see p. 4-22).

A dental survey made shortly before fluoridation was discontinued showed decay rates were comparable to other fluoridated areas in the state. Four years after fluoridation was stopped, the decay rates were found to be greatly increased and approximately the same as in the non-fluoridated areas of Wisconsin (Lenke et al., 1970). With such a dramatic reconfirmation of fluoride's benefits, fluoridation was shortly reinstated in Antigo.

Another example of the impact of interruption of water fluoridation on caries prevalence was reported by Kunzel (1980). In Karl-Marx-Stadt, water had been fluoridated from 1960 to 1969. From 1970 to 1973, there was an interruption of optimal levels of fluoridation after which time fluoridation was reinstated. Health officials observed a dramatic increase in caries during the non-

fluoridated interval:

"The coincidence between the increase in caries prevalence in both the primary and the permanent dentitions, and the temporary reduction in fluoride levels, shows that the caries reduction in Karl-Marx-Stadt was genuinely due to the presence of fluoride in the drinking water and not an accidental consequence of other social or medical factors such as prenatal care, maternal and infant welfare, dental care, oral hygiene, etc."

Kunzel's paper shows dramatic evidence that fluoridation of the community water supply has an effective impact on dental health. It took years for the dental caries rate to return to its low level. He concluded that "only after 18 years of water fluoridation, however, will the situation be thoroughly restored."

Both Lenke and Kunzel give several other examples of cities where caries prevalence increased following discontinuation of community water fluoridation.

Fluoride for Children: Poor, Minority, and Disabled

The children in San Francisco, as those in other major cities in the United States, have much dental disease. A National Center for Health Services Research study (NCHSR, 1982) found 86.2% of children under 6 years of age had not visited a dentist and 49.1% of youth, 6 to 18 years, had not either. Other factors that had a strong negative correlation with dental care were minority background, low income (less than \$12,000 per year and \$12,000 to \$19,999), lack of a college education, and unemployment.

The National Dental Caries Prevalence Survey, 1979 to 1980, found that minority children in the age group 5 to 17 years old had 37.6% of their teeth decayed and 56.7% filled. The White children in this same age bracket had 16.3% of their teeth decayed, while 81.8% of those teeth with cavities were filled. Of the 40,000 school children in this sample (DHHS, 1981) 1 in every 2 minority children had a tooth extracted, while only 1 in 7 White children had a tooth extracted.

Considerably fewer Blacks and Hispanics visit a dentist than do Whites. 76.6% of Blacks and 70.1% of Hispanic people had not visited a dentist versus 53% of Whites (NCHSR, 1982). When a visit to a dentist was made, the average charge per visit was greater for Blacks (\$45) and Hispanics (\$46) than for Whites (\$42) and a much greater proportion of these visits were reimbursed with public funds (18%, 19% vs. 2% of White visits). This charge differential reflects the greater dental care need of minorities as mentioned above. To reiterate, White 17-year-olds had 10.8% of teeth decayed and 2.3% missing while minorities ("Blacks and others") had 34.7% decay and 10.0% missing (DHHS, 1981).

Of people with a family income of less than \$12,000, only 30% had made a visit to a dentist. This contrasts with greater than 50% in families with an income of more than \$20,000. It seems apparent that children, minorities and the poor have the greatest dental need and, therefore, these people would benefit most from community fluoridation.

San Francisco, a city with several traditionally large minority population groups, has recently had an influx of many immigrant and refugee children. A recent dental health survey was conducted on immigrant school children in San Francisco by Pollick and Echenberg of the Bay Area Human Nutrition Center

(1983). From December 1982 to December 1984, 1,156 children in newcomer's schools had dental screenings, and 942 were screened at least twice. 98% of these children were designated as either Filipino, Chinese, Southeast Asian (Cambodian and Vietnamese), or Hispanic (El Salvadorean, Guatemalan, Mexican, and Nicaraguan). Health questionnaires were also completed.

"The overall dental condition of the recent immigrant children who were screened in the newcomers schools was poor, with 1 in 3 children having serious dental conditions." A serious dental condition was defined as advanced dental caries that was likely to interfere with dental function. In comparison, fewer than 10% of children examined in the non-newcomers schools in San Francisco had serious dental conditions. In the same study, differences were found in the dental health findings according to the ethnicity of the children. Three out of four Filipino children had serious dental problems on arrival in the schools. Over time, there was improvement, yet the Filipino children still had the greatest proportion of serious conditions of all groups. These children had very low use of dental services as reported by their parents. All other ethnic groups had significantly higher levels of dental disease than the U.S. average, as is seen in Figures 1 and 2 (Pollick and Echenberg 1984).

In an informal review of over 70 dental records, Dr. Ronald Lee, a dentist at the San Francisco Department of Public Health's Health Center #4, found that the children exposed to fluoridated water, those growing up in San Francisco or Hong Kong, tended to have fewer dental problems (July 1985). Children who did not have the benefit of fluoridated water had a larger number of decayed teeth. Also, the cavities of the San Francisco children (those having had fluoridated water) tended to be smaller and much easier to restore. It is Dr. Lee's opinion that among families from Hong Kong, China, and

Southeast Asia, toothbrushing and flossing are not part of their culture.

Municipal fluoridation of the water system does reduce the prevalence of tooth decay among school children (Konick, 1979). Without fluoridation, the need and demand for dental services for children, especially poor children, will increase. Families who are knowledgeable and have the money will be able to protect their children with increased dental surveillance and fluoride applications.

Children with special health problems and handicaps have even greater need for dental health protection. These children suffer from a variety of physical illnesses for which a dental infection as a result of caries and its complications can have profound and possibly life-threatening consequences (Sweeney, 1974). Such instances involve prolonged and expensive courses of treatment. Dangerous situations arise when children with leukemia, hemophilia, diabetes, heart disease, or cystic fibrosis develop dental infections. Furthermore, a very large group of disabled children, such as those with cerebral palsy or other neurologic and orthopedic deficits, find it nearly impossible without fluoridation to maintain a minimally adequate state of oral hygiene (Sweeney, 1974). Harvard University's Childrens Hospital urges, therefore, "the use of fluoridation of public water supplies so that not only the well child can profit from its decay reduction but, more importantly, that a child with special needs may have a better chance for health" (Sweeney, 1974).

Hence, fluoridation appears to be the simplest and safest method to decrease the suffering by children secondary to dental decay. It is especially important in minorities and the poor where the disease is currently more prevalent and where access to dental care is less likely.

Cost-effectiveness

Fluoridation of community water supplies has been shown to be the most cost-effective method of preventing dental disease. (Newbrun, 1980; Klein et al., 1985; U.S. Government Accounting Office, 1979; Michigan Department of Public Health, 1980; Niessen and Douglass, 1984). The safety and dental benefits of community water fluoridation have been well documented, yet certainly in this current cost-conscious era, the low costs of fluoridation must also be considered a great benefit.

The estimated cost benefit ratio of fluoridation of the public water supply shows a ratio of about 1:50, such that every dollar invested in fluoridation saves \$50 dollars in dental bills. This is a conservative estimate using an expected caries reduction value of 50% and approximate cost per capita of \$.20 (Newbrun, 1978). Appendix I evaluates and compares community water fluoridation costs in San Francisco and other California communities. The Michigan Department of Public Health (1978) used its community experience with respect to dental decay as a basis for statistically extrapolating the savings in costs of dental care for its school children. The costs of fluoridation includes the costs of operation, equipment, and chemicals. Its estimate of this cost in 1978 was less than \$.10 per person.

Officials concluded: "To make this amount more realistic and understandable in terms of the individual and family, the following calculations have been made: at age 14, the savings in costs of dental care for the lifetime of the 14-year-old would amount to approximately \$207. If the figure of \$.10 per person were used for the annual cost, then a family of three, including the

father, mother, and the 14-year-old would have invested \$4.20 in the fluoridation during the lifetime of the child. The benefit to cost ratio, therefore, would be very close to the ratio of 50:1" (Michigan, 1980).

A prospective cost-benefit analysis study in Houston, Texas, was reported by Nelson and Swint (1976). They explicitly introduced and evaluated the effect of the time pattern (20 years) on the costs and benefits. Their results again reaffirm the positive benefit-to-cost ratio of community water fluoridation and "the results indicate an investment in a fluoridation program by Houston would be a socially profitable one."

In a paper entitled Theoretical considerations in applying benefit-cost and cost-effectiveness analyses to preventive dental programs, the authors (Niessen and Douglass of Harvard University, 1984) consider both the explicit and implicit costs of water fluoridation. After accounting for the effects of changes in caries rates, differential attack rates, and discount rates, "the analysis reveals that community water fluoridation yields the greatest net benefits and most favorable cost/benefit and cost-effectiveness ratios."

The U.S. Government Accounting Office, the audit arm of the U.S. Congress, released a 52-page report on fluoridation in 1979. The GAO report frequently made reference to the cost-effectiveness of fluoridation, specifically "because of the potential financial and health benefits."

In a most recent study (1985), Klein et al. studied the costs and effectiveness of preventive dental care. In comparing community water fluoridation with other preventive dental procedures, they reaffirm that communal water fluoridation is the most cost-effective means of reducing dental

disease in children.

While cost-benefit and cost-effectiveness analyses are extremely helpful in assessing the economic impact of programs, they suffer from the disadvantage that no monetary value can be placed on the benefit to an individual of freedom from pain, discomfort or inconvenience. No one can say what the "cost" is to a poor or immigrant school child of having decayed or infected teeth and little hope for appropriate dental care. Certainly, this is a hidden cost that must be considered. Water fluoridation involves a minimal financial expenditure for a tremendous saving in the cost of repairing and replacing decayed and missing teeth. In conclusion, it is one of the few bargains available in health care.

Adult benefits of fluoride

San Francisco, as well as the rest of the United States, has a growing population of older persons. Demographic trends suggest that the proportion of older persons will continue to grow. Hence, it is important to consider what benefits fluoridated water will contribute to the health of adults. There is little question that a person who has consumed optimal amounts of fluoride throughout life will have less caries-related dental disease as an adult. A study of 1800 adults between the ages of 18 and 59 who lived in a naturally fluoridated area (Aurora, Illinois) showed that they had less than half the number of decayed, missing, or filled teeth than those who lived in a non-fluoridated area (Rockford, Illinois) (Englander and Wallace, 1962). A study in Great Britain found that the 60 to 65-year-olds living in a fluoridated community had approximately the same number of carious teeth that the 20-year-olds of a non-fluoridated community had (Murray, 1971). Fluoride is especially

effective in the lifelong prevention of specific types of dental decay. In Stratford, Ontario (fluoride - 1.6 ppm) the adults had 66% fewer cavities in the maxillary incisors than in the non-fluoridated adults (Stamm and Banting, 1980). Certainly prevention of dental disease in adults and in the elderly is of great value to the individual and to the community.

With respect to heart disease, which is certainly present in the older population, there has been preliminary evidence suggesting that fluoridated water might actually be protective in decreasing the incidence of cardiovascular problems (Bernstein et al., 1966). As reviewed elsewhere in this document, there has been no substantiated evidence that fluoride causes an increased mortality from cardiovascular disease (discussed in heart disease section).

The use of large dosages of fluoride in the treatment of bone disorders such as osteoporosis (an affliction of the older population) has been reported to result in a more positive calcium balance and increased bone mineralization. Attention has also been paid to whether the fluoridation of community water supplies may result in a decrease in the incidence of bone disorders among the elderly. Bernstein et al., (1966) found that the incidence of osteoporosis, reduced bone density, and collapsed vertebrae was significantly lower in 300 persons over 45 years old in an area of relatively high fluoride concentrations. Another study (Shambaugh and Petrovic, 1968) also affirms the value of fluoride in preventing or slowing the loss of calcium from bones. There continues to be a need for more scientific evidence to document the actual benefit to adult bone strength. In a most definitive study, Dr. Lawrence Riggs of the Mayo Clinic examined fluoride in the treatment of osteoporosis. He compared calcium, vitamin D, fluoride, estrogen, and

combinations of these for effect on osteoporosis. The fracture rate over the twelve-year study period was reduced most when patients received calcium, estrogen, and fluoride (Riggs, 1982). It is abundantly clear that fluoride has important beneficial effects for adults that are gained from a lifetime consumption of fluoridated water.

In Yiamouyiannis's book Fluoride: The Aging Factor (1983), he cites a single case report of the considerable health problems in a small Turkish village as being directly associated with the naturally, highly fluoridated water (5.4 ppm). These villagers suffer from orthopedic problems: "more bone fractures in arms and legs than other Turks: upon falling, their bones shatter like glass," numerous spontaneous abortions, wrinkled facial skin, "aging before their time", and tooth loss.

Any reasonable individual should certainly be concerned by this and must ask what else is occurring here. Before accepting fluoride as the culprit, as proposed by Yiamouyiannis, critical information must be acquired. It is known that the diet is very low in protein. What else do these people eat? Or not eat? What are the causes of the bony problems, the dental problems, the abortions? What is the total fluoride intake, what other metals, minerals, or substances are in their water supply or in the local terrain? What behavioral, occupational, environmental, or genetic factors should be considered? Finally, is there scientific evidence from other locations that would corroborate this Turkish town's experience?

There have been numerous (more than 10,000) reports on the safety of community water fluoridation at the optimal levels (.7 to 1.2 ppm), with not a single case report of any of the clinical manifestations claimed in Yiamouyiannis'

book. A review of the health effects in high fluoride areas (Driscoll, 1983), over a period of 20 years, found only some mild brown staining of teeth and increased bone density. There have been no substantiated reports of fractured bones, tooth loss, wrinkled skin or premature aging associated in any way with fluoride.

Recently, claims of serious disorders have been attributed to community drinking water containing 1 ppm fluoride. A discussion of some of the issues and methods used in continuing the "controversy" appears in the current journal of the American Academy of Pediatrics (Margolis and Cohen, July 1985).

Appendices M-Q contain additional information on this issue.

Cancer

There have been allegations of a link between fluoridation and cancer. The few studies that have purported to show this link have been found to suffer from serious methodological defects.

Taylor and Taylor (1965) concluded that low concentrations of fluoride increased the rate of tumor growth in mouse mammary adenocarcinoma. This has been reviewed both by Hodge (1985) and the National Academy of Sciences' Safe Drinking Water Committee (1977). They point out that growth stimulation was independent of fluoride dose. Groups of mice receiving differing doses of sodium fluoride had increased weight of 25 to 39% while two groups receiving 500 times more fluoride had almost the same increased tumor weight as their respective controls. "To attribute these weight increases to fluoride is unthinkable; no such phenomenon has ever been reported." In addition, other works are cited that give the opposite result. [For further discussion on

fluoride regarding the lack of evidence associating fluoride with mutagenesis and cytotoxic effects, see the section on mutagenesis.]

The population report alleging an association between fluoridation and increased cancer appeared in the work done by Yiamouyiannis in the mid-1970's in papers that appeared in the journal, Fluoride. Yiamouyiannis and Burk stated that they found a definite correlation between cancer and fluoride. Work published by Nixon and Carpenter at the same time (in 1974) showed no correlation. The work of Yiamouyiannis and Burk has been extensively criticized. Their study, which purported to show an increase in cancer rates, did not adequately adjust for age, sex or race. It is well known that all of these factors influence cancer rates. Many subsequent studies of the same data using accepted epidemiological techniques have found no association between fluoride and cancer. Smith in 1980 adjusted for age, sex, and race, and found no association between fluoridation and cancer in the exact same cities. (See detailed analyses of Yiamouyiannis and Burk, in Question 4, p.44.)

Oldham and Newell, in the Journal of Applied Statistics (1977), concluded that "the association claimed by Burk and Yiamouyiannis between fluoridation and cancer have not been substantiated."

Doll and Kinlen in 1977 also analyzed essentially the same data and concluded that "the ratio between observed cancer mortality and expected cancer mortality fell slightly in the cities with fluoridated water and did not change in the non-fluoridated cities." Arthur Upton, Director of the National Cancer Institute, testified before the House Committee on Government Operations in September 1977 on the lack of relationship between fluoridation in water and

the occurrence of cancer. He presented a study of the National Cancer Institute which analyzed the data produced by the National Health Federation and found no association.

Strassberg and Greenland (1979) in the Journal of Environmental Health also critiqued the methodology used by Yiamouyiannis. They state that during the recent ballot proposal in the Los Angeles area for fluoridating the water, a paper by Dr. Yiamouyiannis reporting to show a link between fluoride and cancer might have influenced the defeat of a fluoridation proposal in this election. "A number of politicians quoted freely from this paper and they felt that sufficient evidence was provided to incriminate fluoride as a carcinogenic agent." (The particular paper they reviewed was Yiamouyiannis JA, (National Health Federation); "A definite link between fluoridation and cancer death rate" March 25, 1975. 9 pgs.)

In his paper, Yiamouyiannis stated that 90% of increased cancer in fluoridated cities is due to cancer of the mouth, tongue, esophagus, stomach, large intestine, rectum, kidney, bladder, urinary organs, female breasts, ovary and fallopian tubes. He attributed this increase to the addition of fluoride in the water supply in these cities. Strassberg and Greenland used this paper to point out that many papers have recently been circulated in which objectivity has not always been a primary concern. They say that often the bias is very subtle and only experts can detect it easily. They then discuss the Yiamouyiannis paper for the purpose of pointing out pitfalls of data analysis which may occur. "On the surface, this paper claimed to have rallied impressive evidence linking cancer and fluoridation when it, in fact, provided no evidence capable of standing careful scrutiny." Hoover et al., (1976) also published a paper in the Journal of the National Cancer Institute in which

statistics for U.S. counties from 1950 to 1969 were examined relating to cancer mortality and fluoridation of water supplies. No trends in cancer mortality "could be ascribed to the consumption of water that is artificially or naturally fluoridated". The study indicated that well-known risk factors in cancer such as race, sex, socioeconomic and cultural characterizations, as well as industrialization and urbanization, explain the variations among fluoridated and non-fluoridated areas.

Taves (1977) also reviewed the data submitted by Yiamouyiannis. His analysis also showed, once again, that the available evidence does not suggest that fluoridation has increased or decreased cancer mortality rates. Newall (1979) also reanalyzed the data of Burk and Yiamouyiannis. He states that any differences could be explained on the basis of age, race, and sex structures of those cities and that "they ignore the scientific methods long established by epidemiologists, ...there is no substance to their claim that fluoridation causes cancer."

The Ministry of Health of Great Britain published a working paper on fluoridation and cancer (The Knox Report, 1985). In this report, it gives extensive reviews of the evidence that had been presented to the contrary and concludes that, "In view of the very large populations which have been observed, it can be concluded that in this respect, the fluoridation of drinking water is safe." It points out that 260 million people in the world receive water to which fluoride has been added. They also review the epidemiology in Australia, Austria, Canada, Italy, The Netherlands, New Zealand, Norway, South Africa, Sweden and the USSR.

The World Health Organization, International Agency for Research on Cancer,

evaluated the carcinogenic risk of inorganic fluorides used in drinking water and dental preparations in humans (WHO, 1982). After a complete review of the literature, the agency found that none of the studies reviewed provided any evidence that increased level of fluorides in water was associated with an increase in cancer mortality. This group included representatives from 16 nations and consisted of experts in pertinent specialities of oncology, epidemiology, biostatistics, genetics, toxicology, and others. In their comments on the studies by Burk and Yiamouyiannis, they state "standard epidemiological practice in the comparison of cancer rates is to make simultaneous adjustments for sex, race, and age in 5 or 10-year intervals. In these analyses, sex was ignored and the 20 year age groups were so broad as probably to provide insufficient control."

Oldham (1985) in the Journal of the Royal Statistical Society reviewed a recent case brought before the Scottish Courts regarding fluoridation. The judge took twelve months to consider the evidence. The arguments were made by Yiamouyiannis concerning the use of data on cancer deaths in 20 American cities. "The judge could not hold that the petitioner had established a balance of probabilities that cancer mortality in the 10 fluoridated cities had increased as a result of fluoridation...These included the rejections of crude, unstandardized death rates, of death rates calculated by means of interpolated population figures, and of death rates which ignore race...His judgment on the study of the U.S. cities concluded with a comment that the quality of evidence by the respondents' expert witnesses was different from that of the petitioners, being based on sound scientific principle uncolored by a priori views on fluoridation." Other evidence at the Scottish court was introduced by Dr. Burk, who said that fluoridation caused an increase in cancer death rates in Birmingham, but the judge concluded that there was "positive

evidence that it did not."

Kinlen and Doll (1981) once again reexamined the mortality rates presented by Yiamouyiannis and Burk and, again, concluded that once one controlled for age, sex, and race there was no association between cancer and fluoridation.

Goodall and Foster examined data in New Zealand in 1980. They concluded that "there was some evidence that the rate of increased cancer mortality over the 15 year period, 1961 to 1976, had been greater in unfluoridated areas than that occurring in areas with fluoridated water supplies."

In 1977, the Canadian government undertook a study to investigate the claims of the National Health Federation. The purpose of the investigation was to examine data for cancer mortality in Canada. In a retrospective study of 100 Canadian cities during the period 1954 to 1973, the government was unable to find any differences in death rates from all cancers of any specific tumor sites between fluoridated and non-fluoridated communities.

In conclusion, we can see that there is a great body of evidence to show that there is no relationship between cancer and water fluoridation programs. The main evidence presented by Yiamouyiannis has been reviewed by committees of the Royal Statistical Society and the National Cancer Institute. Analyzing the same data, using accepted epidemiological methodology, they have found no association. In addition, many other investigators have examined data from areas all over the world that have compared fluoridated and non-fluoridated communities and have found no association between fluoridation programs and cancer. We concur with the statement by the Royal College of Physicians in Fluoride Teeth and Health, "that there was no evidence that fluoride increases cancer mortality."

Fluoridation and Overall Mortality Rates

Although there has been much controversy regarding the possible adverse effects of fluoridation on human health, scientific evidence supports the conclusion that there is no relationship between fluoridated water supplies and increased mortality. The National Heart, Lung, and Blood Institute, in a comprehensive epidemiologic survey, examined mortality rates in 473 U.S. cities according to the fluoridation status of the water supply (Rogot et al., 1978). Findings show no relationship between mortality in general, or, specifically, cancer and cardiovascular mortality and fluoridation.

In a study reported in the New England Journal of Medicine, mortality rates in 24 fluoridated cities and 22 non-fluoridated cities were compared. Adjusting for age, sex and race caused the mortality rates for the two groups to be extremely close. Using an analysis of covariance for socioeconomic characteristics that influence mortality, the mortality rates for all causes in fluoridated communities was 1,123.9 per 100,000 person years and 1,137.1 in non-fluoridated communities. The author concluded that there was no evidence for a harmful effect of fluoridation (Erickson, 1978).

The Pennsylvania Department of Health undertook an epidemiologic investigation to determine whether fluoridation of the public water supplies was significantly associated with an increased risk of mortality in general and increased risk of mortality from certain chronic diseases (Tokuhata, 1978). It selected 12 communities each, fluoridated and non-fluoridated, determined the fluoride levels and computed age, sex and race-adjusted mortality rate. The department found no evidence to support the association of fluoridation with a generally increased mortality rate, nor was it associated with increased

mortality rates secondary to diabetes or cerebrovascular disease. Hence, there is no scientific evidence reported or reviewed in the literature that suggests that community water fluoridation is associated with an increased mortality rate.

Heart Disease

A study by the National Heart, Lung, and Blood Institute evaluated mortality trends from 1950 to 1970 in 473 cities according to fluoridation status of their water supplies (Rogot et al., 1978) and found no relationship between fluoridation and cardiovascular death rate trends.

Data from the National Center for Health Statistics were presented by Dr. Taves of the University of Rochester (1978) which are consistent with the hypothesis that the currently decreasing mortality rates due to ischemic heart disease are due to fluoridation. Fluoride may actually cause a reduction in ischemic heart disease by inhibiting calcification. He could find no evidence of fluoridation being associated with increasing cardiovascular mortality rates.

Taves, in 1979, examined the impact of fluoride in heart disease. He found that, "There is a 15 to 20 percent decrease in Standard Mortality Rate (SMR) deaths due to heart disease for each of the four groups over 1950 to 1970. This decrease in SMRs for the fluoridated cities is greater than the decrease for the controlled cities." Dr. Taves cautions that while his findings are that fluoride might have some positive effect on the cardiovascular system, one should not make that assumption in the absence of more specific data. He states, "Thus while the hypothesis (that fluoride reduces the ischemic heart

disease) at this point is only an intriguing possibility, it seems worthwhile to obtain the additional epidemiological and laboratory data needed to test the possibility."

Two population groups showed that excess amounts of fluoride in a water supply did not produce any cardiovascular effects. A town with a water supply naturally containing excessive fluoride was selected on the assumption that an association between exposure and physiology should manifest at a high fluoride concentration particularly after prolonged ingestion. Bartlett, Texas was selected because the town's water supply contained 8 ppm of fluoride. Cameron, Texas is a similar town with respect to geography, racial composition, and principal occupation yet its water supply contains .4 ppm of fluoride.

Leone, et al., in Public Health Reports (1954) found that 14.6% of Bartlett's adult population had cardiovascular problems while 21.2% of Cameron's population had such cardiovascular abnormalities, which were defined as atherosclerosis, diastolic murmurs, abnormal pulse pressure, aneurysms, heart block, or other. In summary, research findings show no relationship between fluoridation and increased cardiovascular morbidity or mortality.

See also review of Jansen paper in Question 4, p.22.

The effects of fluoride on the kidneys

The kidneys, as the major excretory organs of fluoride, were evaluated early with respect to any possible toxic effects. McClure and Kinser (1944) reported a renal study on approximately 1900 men and boys from regions with naturally low and high fluoridated water supplies (.5 to 5.0 ppm). After analyzing urine

samples they concluded that there was little hazard of cumulative toxicity to the kidneys from water containing up to 5.1 ppm of fluoride. McClure later reviewed the non-dental effects of fluoridation including the lack of renal damage and reemphasized the safety of 1 ppm fluoride in the drinking water (1970).

In the ten-year epidemiologic study in Bartlett, Texas, a community with 8.0 ppm of fluoride in its drinking water, Leone et al., (1954), having gathered clinical information including urinalysis on these residents, could find no evidence of renal dysfunction. Hodge and Smith, in the monograph on the biological properties of inorganic fluorides, summarized the renal effects from their experience and an extensive literature review. They concluded, "no kidney effects of any sort have ever been observed in men or animals consuming 1 ppm of fluoride in drinking water." (Hodge and Smith, 1965) Geever (1976) reviewed the pathologic findings of 334 autopsies performed on longterm residents of Colorado Springs, a naturally fluoridated area at the level of 2.5 ppm. He could find no increase in renal disease among the longterm residents of this community as compared with a non-fluoridated community. Further, he found no evidence that those afflicted with renal disease had decreased their life expectancy because of drinking fluoridated water for more than 20 years.

There has been much discussion on the effects of fluoride in the patient with compromised renal function (i.e., the person with severe renal disease or renal failure). However, there have been no reports of renal disease being caused or aggravated by drinking artificially fluoridated water. The physicians of patients undergoing hemodialysis must remain just as vigilant about the quantity of fluoride in the dialysate as they are about all the other constituents. It has been reported that with large volume exchanges, the

patient could receive a considerable amount of fluoride along with the large quantity of fluids. "In modern hemodialysis centers for treatment of renal failure, the level of fluoride in public drinking water is only one of many elements and components which are controlled. The dialyzing fluid is prepared as a prescription from the nephrologist and its composition is adjusted for the best interests of the patient." (Geever, 1976)

In San Francisco, there have been no reports of renal disease either being caused or aggravated by fluoride (personal communication with Dr. Donald Potter, Director of Children's Renal Center, U.C., San Francisco and Professor of Pediatrics and Nephrology). Dr. Frederick Kolb, an internist and an expert in metabolic renal stone disease, is also the author of numerous articles and an endocrinologist leading a current study of fluoride therapy in bone disease, has never seen fluoride renal calculi. "In fact, they do not exist in humans, only in non-human models to my knowledge." (personal communication, July 1985) He has not heard of any renal problems secondary to community water fluoridation and reports, "it is rare to have any toxic symptoms even with high doses of sodium fluoride therapy (40 to 60 milligrams of sodium fluoride per day). These side effects are rapidly eliminated by decreasing the dose." Dr. Barry Kogan, Chief of Pediatric Urology at U.C., San Francisco, has never seen any fluoride renal stones and certainly has never seen any patients with any complications that could be related to fluoridation of the community water supply (personal communication, July 1985). Hence, research evidence and the experience of experts affirm that community water fluoridation has no adverse effect on renal function. Dr. M. Humphries, Director of Nephrology at U.C., San Francisco and Chief of the Medical Staff at San Francisco General Hospital, stated that, in all his experience dealing with patients who had severely compromised kidney function, he has not seen a single case in which fluoride

caused any problem (personal communication July 1985).

The bone disease that sometimes accompanies renal failure, called renal osteodystrophy, appears to be related to the presence of aluminum in the bone. This trace metal must be carefully monitored both in the dialysate and in the medicines used by patients with impaired renal function. Fluoride is not implicated as being involved in this process (McClure and Smith, 1984, Potter personal communication).

Fluoridation and bone

Bones accumulate fluoride readily but there has been no evidence to suggest any harmful effects after the prolonged consumption of drinking water fluoridated at 1 ppm. Singh and Jolly (1970) reviewed their own original research and the world reports on osteoporosis. They stressed that extremely high fluoride intake along with other contributing factors such as poor nutrition, calcium deficiency, protein deficiency and hard manual labor could lead to osteoporosis. This skeletal fluorosis is characterized by increased bone density on radiographs and increased trabecular bone volume, new periosteal bone, porosity of cortical bone and other defects. In non-tropical countries, there have been no reported cases of skeletal fluorosis with clinical signs or symptoms of being related to drinking water containing fluoride at levels of less than 4 ppm (Victoria Committee, 1980). In the United States, studies have shown no signs or symptoms of osteofluorosis detected in areas where the fluoride levels were up to 6 ppm (McClure, 1946 and Leone et al., 1954). Geever and associates (1971) reviewed the effects of longterm fluoridation at the level of 1 ppm on skeletal structure and skeletal chemistry. They reviewed specimens from inhabitants of Grand Rapids and compared those to specimens from

inhabitants of New York City and Albany, New York. They could find no toxic bony effects related to the fluoridation status of the water. Thus, the effects of prolonged use of fluoridated drinking water have been extensively studied. Fluoridated drinking water at the level of 1 ppm, however, has been shown to have no adverse effects on skeletal tissues.

Recent studies have shown that high levels of fluoride may actually be beneficial in the treatment of osteoporosis (Riggs et al., 1982, Causse et al., 1980). Bone is constantly undergoing a remodeling process--resorption of older bone and formation of new bone as replacement. Osteoporosis is a disease where the new bone is not formed as rapidly as is needed and the bone becomes weaker, increasing its tendency to fracture. Fluoride appears to be the only available agent that can stimulate bone formation directly. Bernstein et al., (1966) found in their study that the incidence of osteoporosis was significantly lower in 300 persons living in an area of relatively high fluoride concentration (4 to 5.8 ppm) than in 715 persons residing in a low fluoride area (less than 3 ppm). Hence, sodium fluoride therapy in a dose of 40 to 60 milligrams per day causes a substantial increase in the bone mass of patients (Riggs et al., 1980 and Riggs et al., 1982). It has been found that with this high level of fluoride therapy some patients show some side effects, all of which are eliminated by a slight decrease in the dosage of fluoride. Experts in this field feel that community water fluoridation certainly has no harmful bony effects and certainly may add to the strength of the bone (personal communication with Kolb, 1985).

Liver (Gilbert's Disease) and Fluoride

Gilbert's Disease, "a quite common condition, is actually a non-disease, a

syndrome in which some people have slight elevation of their normal bilirubin levels." (Thaler, 1985) Such a condition is believed to be secondary to a relative deficiency of glucuronyl transferase. M. Michael Thaler, M.D., a liver specialist and Chief of Pediatric Gastroenterology at U.C., San Francisco, "has never seen any scientific report linking Gilbert's with fluoridation." (personal communication)

Rudi Schmidt, M.D., M.P.H., world reknowned hepatologist and Dean of U.C., San Francisco Medical School, relates "First, Gilbert's is not a disease, it is a slight variation on normal liver metabolism. Secondly, there is no evidence at all that fluoride either causes or aggravates this syndrome." (personal communication)

Mutagenesis

There have been many studies examining the possible effects of fluoride intake on chromosome damage. A summary of these studies appears in Appendix H. The National Academy of Sciences, Committee on Safe Drinking Water, has critically reviewed the findings in its monograph Drinking Water And Health (1977). They explained that the evidence "will not convince most scientists that fluoride is mutagenic for any species." George Martin's team at the Laboratory of Developmental Biology and Anomalies of the National Institutes of Health could find no evidence of increased chromosomal aberration in the bone marrow or testes cells of mice (mice with either a 50 ppm fluoride intake or 100 ppm intake compared to animals drinking distilled water). (Martin et al., 1979) Mohammed and Chandler (1976) suggested that sodium fluoride caused a significant increase in chromosomal aberrations in mice drinking water at concentrations of 1 ppm and above. Pram et al., (1978) attempted to

reproduce this finding and were unable to do so. At levels of 50 ppm fluoride they could not induce chromosomal changes or influence the cell replication rate. Additionally, they found fluoride not to be mutagenic when tested in microbial assays for mutagenicity using Salmonella and Saccharomyces. After a series of in vivo tests to look for the effects of fluoride on chromatid exchanges, the results of all these tests indicated that fluoride had no genotoxic effects (Martin et al., 1983). Hence, there is a lack of scientific evidence that fluoride is mutagenic. See further discussion and review of Tsutsui in Question 4, p.41.

It has been found in some studies that fluoride has a strong hydrogen bonding capability and there has been speculation that it could disrupt DNA. Hodge (1985) points out that these studies were done in a solution of formamide. When the experiments were repeated in an aqueous solution by Armstrong, the same results did not occur because water also forms hydrogen bond. In other words, fluoride did not form strong hydrogen bonds in the presence of water but only in a solution of formamide. The conclusions are that in a natural state, such as in the human body where water is ubiquitous, fluoride would not form these strong hydrogen bonds. Many studies have shown the lack of association of fluoride and cancer or congenital defects.

Down's Syndrome

There have been allegations that water fluoridation may be responsible for Down's Syndrome, previously called mongolism, yet there appears to be no conclusive scientific evidence to support this. In 1974, the New England Journal of Medicine presented results from a well-controlled, large-scale epidemiological study of the prevalence of Down's Syndrome. They examined the

incidence of Down's Syndrome births in the state of Massachusetts for the seventeen-year period from 1950 to 1966 with respect to the water fluoridation status of communities. No relationship between fluoridation status and incidence of Down's Syndrome could be documented. (Needleman et al., 1974)

The incidence of selected congenital malformations in areas with fluoridation of the public water supply was compared with the incidence in non-fluoridated areas (Erickson et al., 1976). In comparing the total incidence of several common birth defects in these areas there was no significant difference in the incidence rates in the different areas. In addition, the relative incidence rates for specific malformations were consistent for both sets of communities.

In 1980, a twenty-five-year review of the prevalence of congenital malformations in Birmingham, England was conducted (Knox et al., 1980). Although Birmingham initiated community fluoridation in 1964, there were no changes in the prevalence of anomalies. "There is no evidence of specific teratogenic or general toxic effects resulting from fluoridation."

Dementia (Alzheimer's Disease)

Primary degenerative dementia or Alzheimer's disease is estimated to affect 2% to 4% of the US population over age 65. Despite allegations that water fluoridation is the source of the continued increase in Alzheimer's disease, there has been no substantive evidence produced to support this. It has been generally accepted that aluminum has an important role in the causation of Alzheimer's (Adams and Victor, 1977; McDermott et al., 1979). Fluoride in the diet reduces absorption of aluminum and vice versa (Wills and Savory, 1983) hence, there is the possibility that higher concentrations of fluoride

in drinking water might actually be associated with a lower incidence of Alzheimer's-type dementia. In order to test this hypothesis, a case control study of primary degenerative dementia was conducted. Patients admitted to hospitals in three South Carolina counties having different levels of natural fluoride in their water supplies were studied (Still and Kelley, 1980). They found there was a significantly lower annual incidence of such dementia in the county that had naturally fluoridated water at greater than 1 ppm. (Incidence rates for dementia were: 3.6 per 100,000 people in fluoridated county vs. 17.1 and 20.8 per 100,000 people in the suboptimal fluoridated counties.) There were no significant differences found in other types of dementia (vascular, alcoholic, or other).

Prior to this study, the American Psychiatric Association, having reviewed the literature and research in this area, issued the following statement: "There is no available evidence that fluoridation of public water supplies in the recommended dosages has any injurious effect on mental functions." (APA, 1962)

Fluoride and Allergies

Allergy is a reaction to a substance which the body recognizes as foreign.

Fluoride, like other ions including calcium and magnesium, is not recognized by the body as foreign in an immunological sense. The smallest molecule to be recognized as such is vasopressin with a molecular weight of 1087 versus fluoride ions with weight 19 (Hodge, 1985). The American Academy of Allergy, having considerable expertise and having reviewed the case histories of purported allergy to fluoride, unanimously adopted the following statement: "There is no evidence of allergy or intolerance to fluorides as used in the

fluoridation of community water supplies" (Austin, et al., 1971). (See discussion of Shea et al. in Question 4, p.32.)

AIDS (Acquired Immune Deficiency Syndrome)

It has been suggested that there is a correlation between fluoridation and AIDS. There have been no scientific reports linking community water fluoridation and AIDS. The groups at high risk for AIDS are homosexual and bisexual men and their partners, hemophiliacs, Haitians, Central Africans, and intravenous drug abusers (MMWR, 1984). Large American cities tend to have a higher concentration of these high risk groups and, therefore, a greater number of potential sources of infection. Hence, the incidence of AIDS is in proportion to the percentage of the population in these risk groups, not to the presence or absence of water fluoridation.

The infectious agent responsible for AIDS has been identified as a retrovirus and designated as the Human T-cell Lymphotropic Virus Type III (HTLV-III). Several studies have suggested that AIDS is transmitted primarily through blood products, semen, and saliva. (MMWR, 1984). Hence, there is definitive evidence of the association between HTLV-III and AIDS and no evidence for an association with community water fluoridation. The Center for Disease Control (CDC) in a statement entitled The Fluoride/AIDS Allegation (January 1984) stated that, "The allegation that fluoride is the cause of AIDS is unfounded."

Food Chain

Fluoride is a natural component of the food chain. The National Research Council's Committee on Dietary Allowances, Food and Nutritional Board, in its

recommended dietary allowances, 1980, stated that fluoride is a constituent of all normal diets. A recent review in the American Journal of Clinical Nutrition stated, "unlike other elements for which food is the major source, water is the most practical, consistent and effective source of fluoride." (Richmond, 1985)

In the 1940s, during the initial studies of naturally fluoridated communities, it was determined that 1 ppm would be the level at which sufficient caries prevention occurred while at the same time preventing any appearance of dental fluorosis. Since that time many communities throughout the United States have increased the natural level of fluoride to 1 ppm. Recently, Leverett, in a paper in Science in 1982, speculated about a possible increase of fluoride in the food chain given the use of fluoridated water in food processing. He recommended reevaluation of optimum levels of fluoride in the community drinking water. If there is an increase in the food chain due to fluoridation of community water supplies, we would expect an increasing prevalence of fluorosis.

The most sensitive indicator of fluorosis in the community would be in children's teeth, where cosmetic changes are first to occur. A recent study by Driscoll et al., in 1983, reexamined communities that were originally surveyed in 1946 by Dean. Returning to these same Illinois communities 30 years later, Driscoll found, "in Illinois, today, the prevalence and severity of fluorosis at the optimal and higher than optimal fluoride concentrations are either similar to, or less than, that found by Dean at similar concentrations about 45 years ago. The data suggest that no important changes in the prevalence and severity of fluorosis have taken place between the two periods." Since the late 1970's, U.S. infant formula manufacturers have reduced the

concentration of fluoride in the products. In addition, manufacturers of baby cereal and juices also took steps to control fluoride content. (Horowitz, 1982)

Leverett also cites other studies that suggest that the intake of fluoride has increased in recent years, specifically in the study by Marier and Rose. Taves points out that the Marier and Rose study quoted by Leverett, gives a range of 1 to 2 milligrams per day intake of fluoride from food alone (1942). He states that the Marier and Rose study "requires the consumption of an intake of 1 kilogram of canned food per day." In addition, Leverett, and Marier and Rose quote Hodge and Smith (1965) data which give an intake range of fluoride from food of .5 to 1.5 milligrams per day. Taves points out that Hodge and Smith (1970) "lowered their estimate to 0.3 to 0.8 milligrams of fluoride per day."

Taves concludes that, "evidence of an increase in fluoride intake is based on a faulty analysis. Data obtained with reliable methods show no indication of an increase in food, bone, or urine concentration as compared to twenty or more years ago. The amount of increase in total intake [based on urine values] that might have occurred and yet have escaped detection with the available data, is less than ten percent."

Singer and Ophaug (1983) also review pertinent literature relating to the amount of fluoride that is ingested daily and present results from their own laboratory. Using market basket surveys, in 1981, they found that the diets of 16 to 19-year-old male adults in Baltimore, Maryland, where the water is fluoridated, was 2.5 milligrams of fluoride per day. This compared with a similar survey done in 1971 which found the diet to contain 2.0 to 2.3 milligrams of fluoride per day. These data indicated that intake in that city

had remained relatively constant throughout the years.

Singer and Ophaug also present documentation as to the unreliability of previous methodology used to analyze fluorides in food. "It has now been established that the determination of fluoride in diffusates of unashed plasma may be erroneously high." Colorimetric procedures on unashed samples can increase the fluoride content by 100%. The results of previous studies were biased by these techniques.

They conclude that, "the data obtained with reliable fluoride methods do not indicate any increase in fluoride consumption from food and beverages over the last 40 years."

In conclusion, there is no evidence that there is any significant increase in the level of fluoride in the food chain. In fact, Leverett has written to the San Francisco Department of Public Health suggesting that he guesses that the optimal levels of fluoride will be adjusted upwards (see Appendix F). The EPA has also recently proposed increasing the level of fluoride in drinking water to 4 ppm. (See Appendix G.) For further discussion of this issue, see review of Leverett paper in Question 4, p.26.

Summary of the safety of water fluoridation

This review has found no evidence that water containing optimum concentrations (.7 to 1.2 ppm) of fluoride impairs general health. The safety of water fluoridation has been documented and reviewed by large commissions (reviewed elsewhere in this document) and numerous scientific experts (McClure, 1970; Newbrun, 1977; and Richmond, 1985). Fluoridation of the community water supply

has been shown to be the most effective public health measure for reducing caries. Fluoride stands with vitamin D and iodized salt as being both safe and effective.

The safety of fluoride was reaffirmed as official policy when the Surgeon General of the United States, C. Everett Koop, in January 1984, stated "fluoride, as currently found in U.S. drinking water supplies, does not constitute a hazard" (Appendix L).

The California Department of Health Services in June 1985 stated, "Fluoridation poses no known health risks to consumers" and strongly urged communities to fluoridate. The department's policy "stresses that this preventive measure is the single most important commitment a community can make to the oral health of its children and to future generations" (CA DHS, 1985) [see Appendix X].

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APPENDICES

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APPENDIX A

ORGANIZATIONS THAT HAVE ADOPTED
POLICIES FAVORABLE TO FLUORIDATION

October 1984

Health Related/United States

American Academy of Allergy
American Academy of Pediatrics
American Academy of Pedodontics
American Association for the Advancement of Science
American Association of Dental Schools
American Association of Public Health Dentists
American Cancer Society
American College of Dentists
American Council on Science & Health
American Dental Assistants Association
American Dental Association
American Dental Health Society
American Dental Hygienists Association
American Diabetes Association
American Heart Association
American Hospital Association
American Medical Association
American Nurses Association
American Osteopathic Association
American Pharmaceutical Association
American Psychiatric Association
American Public Health Association
American School Health Association
American Society of Clinical Pathologists
American Society of Dentistry for Children
American Veterinary Medical Association
Association of Public Health Veterinarians
Association of State and Territorial Dental Directors
Association of State and Territorial Health Officials
Federation of American Societies of Experimental Biology
Mayo Clinic
National Academy of Sciences
National Commission on Community Health Services
National Kidney Foundation

National Nutrition Consortium:

American Dietetic Association
American Institute of Nutrition
American Society for Clinical Nutrition
Institute of Food Technologists
Society for Nutrition Education
Food and Nutrition Board, National Academy of Sciences, National Research
Council

National Research Council

Society of Toxicology
U.S. Department of Agriculture
U.S. Environmental Protection Agency
U.S. Public Health Services (CDC, FDA, NIH, HRSA)

Non-Health Related/United States

American Federation of Labor and Congress of Industrial Organizations (AFL-CIO)
American Institute of Canning
American Institute of Packing
American Public Welfare Association
American Society of Brewing Chemists
American Water Works Association
Association of Casualty and Surety Companies
Child Study Association of America
Conference of State Sanitary Engineers
Consumer Federation of America
Health Insurance Association of America
National Education Association
National Institute for Municipal Law Officers
Office of Civil Defense
Travelers Insurance Company
U.S. College Foundation and Pan American Sanitary Bureau
U.S. Department of Defense
U.S. Jaycees

International (Partial Listing)

European Organization of Caries Research (ORCA)
European Organization for the Promotion of Fluoridation
Federation Dentaire Internationale
International Association of Dental Research
Pan-American Health Organization
World Health Organization (WHO)

Canada

Canadian Association of Accident and Sickness Insurance
Canadian Dental Association
Canadian Dental Hygienists Association
Canadian Medical Association
Canadian Nurses Association
Canadian Pharmaceutical Association
Canadian Public Health Association

APPENDIX A-3

Canadian Society of Dentistry for Children
Department of National Health and Welfare
The Health League of Canada

Great Britain

British Dental Association
British Medical Association
Great Britain Ministry of Health
Royal College of Physicians
Royal Health Service
Royal Society of Health

Results of Surveys into the Effectiveness of Public Water Fluoridation Schemes throughout the World

Country	Fluoridated community	Reference	Year fluoridation began	Year of study	Age of subjects (yrs)	Caries index	Non-fluoridated community caries experience	Per cent caries reduction
USA	Grand Rapids	Arnold et al. (1956)	1945	1951	5	def	5.3	57
	Grand Rapids	Arnold et al. (1962)	1945	1960	15	DMFT	12.4	50
	Newburgh	Ast et al. (1956)	1945	1955	6-9	DMFT	2.3	58
	Marshall	Taylor and Bertram (1965)	1945	1956	10	DMFT	4.3	67
	Sheboygan	Schreiber (1966)	1946	1950	5	dmft	4.8	45
	Evanston	Blayney and Hill (1967)	1946	1961	14	DMFT	11.7	49
	Lewiston	Young (1958)	1947	1957	10	DMFT	7.0	79
	Oshkosh	Steele (1977)	1948	1975	14	DMFT	9.1	50
	Charlotte	Szwejdja (1962)	1949	1961	6	def	5.3	51
	Charlotte	Szwejdja (1962)	1949	1961	11	DMFT	3.3	57
	Anigo	Lemke et al. (1970)	1949-1960	1966	5-6	def	5.3	53
	Newark	Musselman (1957)	1950	1955	6	DMFT	1.1	82
	New Britain	Erlenbach and Tracy (1961)	1950	1961	10	DMFT	3.9	48
	Milan	Trihart and Denney (1956)	1951	1956	6	def	6.9	42
	Louisville	Gernert (1958)	1951	1956	6	def	6.0	46
	Athens	Chrietberg and Lewis (1958)	1951	1957	6	DMFT	1.2	85
	Iowa	Iowa State DOH (1960)	1951	1958	5	def	5.1	44
	Tuscaloosa	Klymko (1959)	1951	1959	6	def	5.6	52
	Tuscaloosa	Klymko (1959)	1951	1959	8	DMFT	2.3	73
	Fort Wayne	Mollenkopf (1963)	1951	1962	10	DMFT	3.7	50
	Columbus	Trubman (1965)	1951	1962	10	DMFT	3.3	47
	Grand Junction	Reger et al. (1963)	1951	1962	6	def	5.3	50
	Grand Junction	Reger et al. (1963)	1951	1962	12	DMFT	5.9	68
	Norway	Garcelon (1956)	1952	1955	7	DMFT	2.1	71
	Antioch	Stadt et al. (1960)	1952	1957	5	def	4.1	42
	Orangeburg	Bunch (1959)	1952	1958	6	def	5.5	47
	Orangeburg	Bunch (1964)	1952	1963	10	DMFT	3.3	41
	Maryland	Russell and White (1961)	1952	1959	5	def	2.8	65
	Maryland	Russell and White (1961)	1952	1959	7	DMFT	1.1	77
	Baltimore	McCauley et al. (1961)	1952	1960	6	DMFT	1.2	68
	Easton	Sogaro (1964)	1952	1962	5	def	5.0	71
	Easton	Sogaro (1964)	1952	1962	10	DMFT	3.6	53
	Amery	Arra and Lemke (1964)	1952	1962	9	DMFT	3.8	39
	Roundup	Anon. (1962)	1952	1962	10	DMFT	4.0	60
	Washington, DC	Ostrow (1963)	1952	1962	10	DMFT	2.2	37
	Cleveland, Tenn.	Holmes (1963)	1952	1963	11	DMFT	7.6	63
	Hagerstown	Leonard (1963)	1952	1963	11	DMFT	4.2	62
	Rush City	Jordan (1964)	1952	1964	10	DMFT	5.0	50
	Providence	Yacovone and Parente (1974)	1952	1972	13	DMFT	8.4	63
	Richmond	Crooks and Konikoff (1972)	1952	1972	13	DMFT	7.2	50
	Monmouth	Ross et al. (1960)	1953	1959	6	DMFT	0.8	50
	Milwaukee	Schultz (1969)	1953	1959	5	def	3.6	35
	Milwaukee	Schultz (1969)	1953	1965	10	DMFT	3.6	56
	Boseman	Snyder (1964)	1953	1964	10	DMFT	5.0	50
	Mystic-Stonington	Erlenbach (1964)	1953	1964	11	DMFT	4.4	35
	Corvallis	Tank and Storvick (1964)	1953	c. 1962	5	def	6.0	45
	Puerto Rico	Guzman (1961)	1953	1958	6	DMFT	1.2	66
Salem	Anon (1971)	1953	1971	12	DMFT	6.9	67	
Philadelphia	Bronstein (1969)	1954	1967	5	def	3.2	50	
Philadelphia	Gordon (1975)	1954	1969-1970	15	DMFT	9.3	52	

Country	Fluoridated community	Reference	Year fluoridation began	Year of study	Age of subjects (yrs)	Caries index	Non-fluoridated community caries experience	Per cent caries reduction
	St Louis	Smith and Paquin (1962)	1955	1961	7	DMFT	0.8	50
	Kingsport	Bryan and Smith (1966)	1955	1965	10	DMFT	3.9	62
	Albert Lea	Jordan (1970)	1955	1969	6	def	5.7	42
	Albert Lea	Jordan (1970)	1955	1969	12	DMFT	6.2	53
	Cleveland	Healy (1963)	1956	1962	5-6	def	3.4	62
	Lebanon	Fishman and Collier (1965)	1956	1964	6	def	5.4	47
	Lebanon	Fishman and Collier (1965)	1956	1964	8	DMFT	2.4	68
	Chicago	Weinstein (1972)	1956	1972	14	DMFT	11.6	51
	Fayette	Moncrief (1970)	1957	1969	10	DMFT	5.1	63
	Mobile	Russell (1965)	1958	1965	6	def	5.6	32
	Mobile	Russell (1965)	1958	1965	7	DMFT	2.0	72
	Silver Bay	Jordan et al. (1969)	1958	1968	5	def	4.6	46
	Silver Bay	Jordan et al. (1969)	1958	1968	10	DMFT	3.6	45
	Kalamazoo	Margolis et al. (1975)	< 1964	1974	4-6	def	2.4	47
	Kalamazoo	Margolis et al. (1975)	< 1964	1974	7-10	DMFT	1.6	36
	Asheville	Dudney et al. (1977)	1965	1976	6	def	3.6	20
	Asheville	Dudney et al. (1977)	1965	1976	10	DMFT	3.3	59
	Winona	Flaven (1977)	1965	1976	5	def	4.0	74
	Winona	Flaven (1977)	1965	1976	10	DMFT	3.4	57
	Cudahy	Doherty and Krippene (1972)	1966	1971	5	def	3.9	56
	New Haven	Konick (1979)	1967	1977	10	DMFT	3.5	51
Canada	Brandon	Brown et al. (1960)	1945	1959	12-14	DMFT	7.5	57
	Brandon	Connor and Harwood (1963)	1955	1962	6-8	def	6.5	41
	Brandon	Connor and Harwood (1963)	1955	1962	6-8	DMFT	2.0	74
	Toronto	Lewis (1976)	1963	1975	5	def	3.9	56
	Toronto	Lewis (1976)	1963	1975	11	DMFT	3.6	35
	Prince George	Hann (1968)	1955	1968	12-14	DMFT	11.2	60
Brazil	Campinas	Viegas and Viegas (1974)	1962	1972	5	def	5.5	68
	Campinas	Viegas and Viegas (1974)	1962	1972	10	DMFT	5.1	55
Columbia	San Pedro	Mejia et al. (1976)	1965	1972	8	DMFT	3.8	78
UK	Anglesey	DHSS (1969)	1955	1965	5	def	4.8	40
	Anglesey	Jackson et al. (1975)	1956	1974	15	DMFT	11.4	44
	Watford	DHSS (1969)	1956	1967	5	def	2.8	43
	Watford	DHSS (1969)	1956	1967	10	DMFT	3.1	35
	Kilmarnock	DHSS (1969)	1956	1961	5	def	6.9	42
	Balsall Heath	Beal and James (1971)	1964	1970	5	def	5.2	62
	Northfield	Beal and James (1971)	1964	1970	5	def	4.9	50
	Birmingham	Whittle and Downer (1979)	1964	1977	5	def	3.6	54
	Birmingham	Whittle and Downer (1979)	1964	1977	12	DMFT	4.0	45
	Leeds	Jackson et al. (1980)	1968	1979	5	def	3.3	62
	Cumbria	Jackson et al. (1975)	1969	1975	5	def	4.4	46
	Newcastle upon Tyne	Rugg-Gunn et al. (1977)	1969	1975	5	def	6.1	57
	Northumberland	Rugg-Gunn et al. (1977)	1969	1975	5	def	6.1	67
Ireland	Dublin	O'Hickey (1976)	1964	1969	5	def	5.8	65
	Cork	Collins and O'Mullane (1970)	1965	1969	5	def	6.4	45

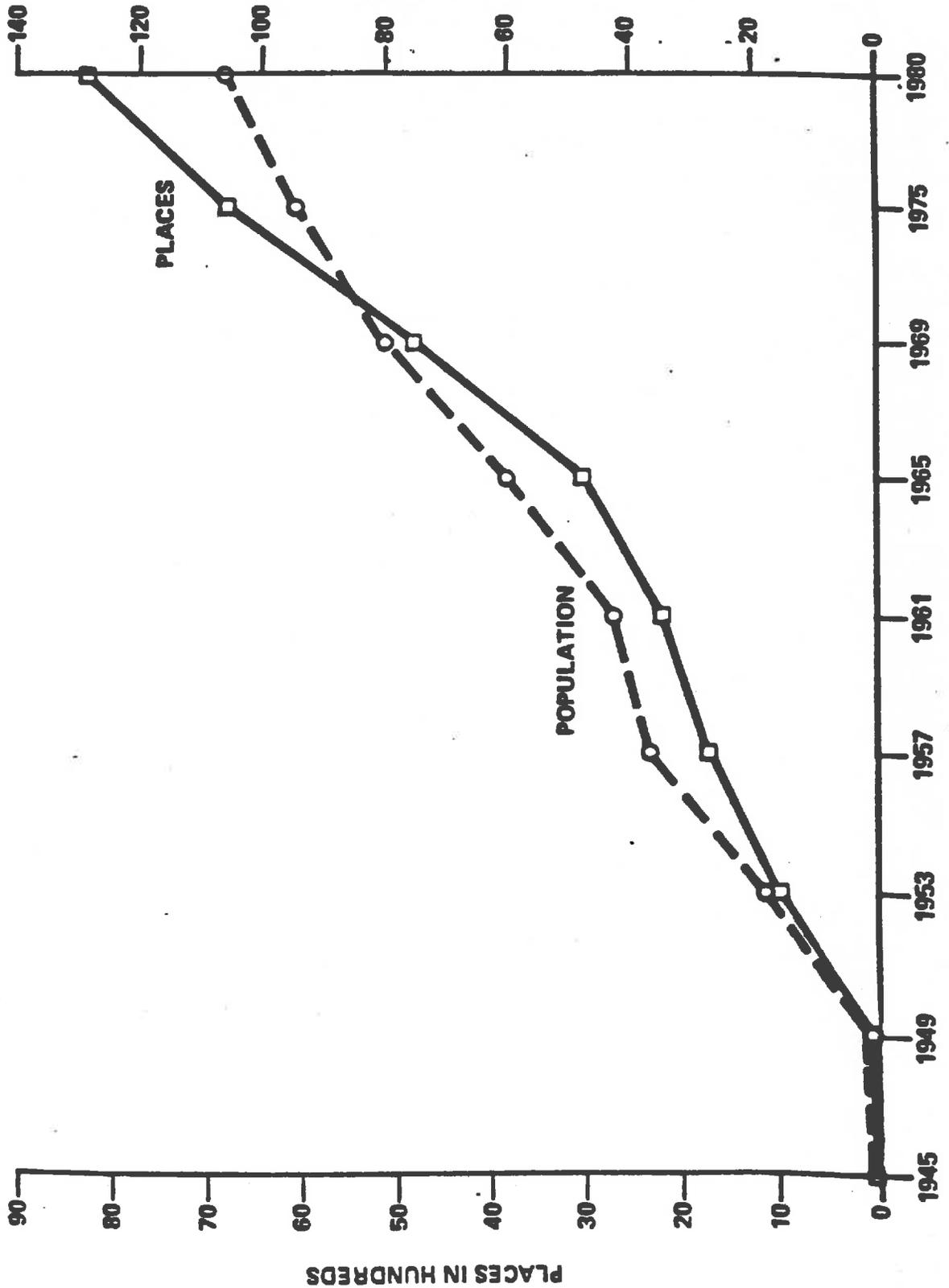
Appendix B.-3

Country	Fluoridated community	Reference	Year fluoridation began	Year of study	Age of subjects (yrs)	Caries index	Non-fluoridated community caries experience	Per cent caries reduction
Netherlands	Tiel	Kwant et al. (1973)	1953	1969	15	DMFT	13.9	51
Finland	Kuopio	Nordling and Tulikoura (1970)	1959	1968	7	DMFT	3.1	55
Switzerland	Basel	Gülzow and Maeglin (1979)	1962	1977	15	DMFT	7.2	59
DDR	Karl-Marx-Stadt	Künzel (1968)	1959	1966	5	def	2.9	76
	Karl-Marx-Stadt	Künzel (1976)	1959	1972	12	DMFT	4.1	66
Czechoslovakia	Tabor	Jirásková et al. (1969)	1958	1964	6-7	def	5.3	36
Poland	Wrocław	Wigdorowicz-M. et al. (1975)	1967	1972	5	def	5.5	38
	Wrocław	Wigdorowicz-M. et al. (1978)	1967	1975	8	DMFT	1.9	42
Romania	Tirgu-Mures	Csögör et al. (1968)	1960	1965	5	def	3.6	37
	Tirgu-Mures	Csögör et al. (1973)	1960	1971	10	DMFT	3.3	52
USSR	Murmansk	Rybakov et al. (1978)	1966	1976	10	DMFT	3.0	50
	Monchegorsk	Rybakov et al. (1976)	1966	1976	8	DMFT	2.7	54
	Ivan-Frankovsk	Gabovich et al. (1972)	1966	1970	8	DMFT	2.2	55
	Leningrad	Strelyukhina et al. (1976)	1969	1974	5	def	4.9	29
Singapore	Singapore	Wong et al. (1970)	1956	1968	7-9	def	10.7	31
	Singapore	Wong et al. (1970)	1956	1968	7-9	DMFT	2.9	31
Malaysia	Kluang	Awang (1973)	1966	1973	7	def	7.2	37
	Kluang	Awang (1973)	1966	1973	7	DMFT	2.3	75
Taiwan	Chung-Hsing	Hsieh et al. (1979)	1972	1978	5	def	8.5	26
Japan	Yamashina	Minoguchi (1964)	1952	1963	11	DMFT	3.6	33
Australia	Tamworth	Martin and Barnard (1970)	1963	1969	5	def	5.7	48
	Tamworth	Barnard (1980)	1963	1979	15	DMFT	12.3	76
	Canberra	Carr (1976)	1964	1974	5	def	5.0	71
	Canberra	Carr (1976)	1964	1974	10	DMFT	4.4	51
	Townville	Videroni et al. (1976)	1965	1975	6	def	5.3	57
	Townville	Videroni et al. (1976)	1965	1975	10	DMFT	4.8	54
	Kalgoorlie	Medcalf (1975)	1968	1973	6	def	6.3	40
	Perth	Medcalf (1978)	1968	1977	6	def	4.4	48
	Perth	Medcalf (1978)	1968	1977	10	DMFT	3.9	51
New Zealand	Hastings	Ludwig (1965)	1954	1964	5	def	8.4	52
	Hastings	Ludwig (1971)	1954	1970	15	DMFT	16.8	49
	Lower Hutt	Hollis and Knowsley (1970)	1959	1969	5	def	8.0	47
	Lower Hutt	Hollis and Knowsley (1970)	1959	1969	10	DMFT	6.2	42

Only surveys reporting deft or DMFT data have been included. In studies where results are given for several ages, for deciduous teeth age 5 years was preferred, and age 15 years for permanent teeth.

FLUORIDATION IN THE UNITED STATES

Figure 2
 Places and Population Served by Adjusted Fluoridation — 1945-1980
 POPULATION IN MILLIONS



SOURCE: FLUORIDATION CENSUS 1984

SUMMARY OF EFFECTS OF AMOUNTS, FORM AND FREQUENCY OF HUMAN INTAKE OF FLUORIDES

Amounts of Fluorides or Concentration in Water	Form and Frequency of Intake	Effect	Safety Factor or Remarks
Less than 0.7 parts per million in water	Drinking water	No reduction in tooth decay with trace amounts. Some reduction occurs up to 0.7 p.p.m. (Section V.-A.)	Supplementation of fluorides necessary through tablets or other means for the reduction of tooth decay.
0.7 - 1.2 parts per million in water	Drinking water daily during childhood from birth	Maximum reduction of tooth decay (Sections V-C & IX)	Only normal & routine ingestion of water is necessary with daily living. Optimum concentration will vary according to mean annual temperature.
About 2.5 parts per million or higher in temperate climates	Continual drinking of water daily before the ages of 8-12 years	Noticeable or objectionable dental mottling (See Sec. VII.)	Would require at least twice the normal daily intake of water fluoridated at one part per million
Eight parts per million in drinking water in the U.S.A.	Daily intake of drinking water	Nonsignificant skeletal fluorosis in 10% of adult population (Sec. VIII L.)	One would have to drink eight times the normal amount of water fluoridated at one part per million.
20-80 milligrams per day as in chronic industrial exposure	Daily intake for 15-20 years of water with very excessive amounts of fluoride or by long term chronic exposure to industrial materials and fumes	Skeletal fluorosis or Industrial fluorosis (See Section VIII L.)	Would require excessive daily intake of water with excessive amounts of fluoride for many years. Industrial exposure can occur in nonfluoridated area
250-500 milligrams	Raw chemical, instant dose (usually accidental)	Acute ill effects of nausea, vomiting and abdominal symptoms	Fluoridated water at one part per million would have to be ingested in the amount of over 60 gallons instantly. Not possible from usual food and drink
2500-5000 milligrams	Raw chemical, instant dose (usually accidental)	Acute effects leading to death	About 600 gallons or more of fluoridated water (one part per million of fluoride) would have to be ingested at one time. Impossible from usual food and drink.



DEPARTMENT OF HEALTH & HUMAN SERVICES

Public Health Service

National Institutes of Health
Bethesda, Maryland 20205
Building : Westwood
Room : 538
(301) 496-7032

July 12, 1985

RECEIVED
JUL 13 1985
DIRECTOR'S OFFICE

Dr. David Werdegar
Director, San Francisco City Health Department
101 Grove Street
San Francisco, California 94102

Dear Dr. Werdegar:

I have been informed that San Francisco Supervisor Wendy Nelder is using two publications that I either wrote or co-authored* to imply that the consumption of fluoridated drinking water is harmful and dangerous. The two reports have no bearing on the safety of community water fluoridation, which has repeatedly been shown to be eminently safe and highly effective in reducing the prevalence of dental caries. Rather, the articles address concerns of risk from the possible misuse of topically applied fluoride products.

I wish to disassociate myself totally with Supervisor Nelder's efforts to discontinue community water fluoridation in San Francisco, and urge you to do all that you can to retain this beneficial health procedure.

Sincerely yours,

Herschel S. Horowitz, DRS, MPH
Chief, Clinical Trials Section
Epidemiology & Oral Disease Prevention
Program
National Institute of Dental Research

* Horowitz, H.S. Misuse of topically applied fluoride. J. Amer. Soc. Prevent. Dent., 7:15-16, 1977.

Heifetz, S.B., and Horowitz, H.S. The amounts of fluoride in current fluoride therapies: safety considerations for children. J. Dent. Child., 51:257-269, 1984.



July 17, 1985

Dr. David Werdegar
Health Director
San Francisco Health Department
101 Grove Street
San Francisco, CA 94102

Dear Dr. Werdegar:

It has been brought to my attention that, in a recent public hearing relating to the fluoridation of San Francisco's water supply, certain opponents of fluoridation referred to one of my publications while attempting to substantiate their arguments in opposition to fluoridation.

Although I have not been apprised of the exact way in which my publication was exploited by those persons, this is not the first time that this has happened and I can guess that I was quoted out-of-context in such a way as to imply that I had reservations about the efficacy of community water fluoridation or about the safety of fluoride therapy, in general.

Nothing could be further from the truth. I have been a vigorous advocate of the use of fluorides for dental caries prevention for the past thirty years. Virtually all of my current research activity relates to various uses of fluoride modalities for the prevention of dental caries.

I have raised some questions, particularly in a recent article in SCIENCE (217:26-30, July 2, 1982), which relate to current widely accepted norms for fluoride administration. My point is that these norms were established during the early 1940's, when the only fluoride in the environment was that found in relatively few naturally fluoridated water systems. Now, with the much more wide-spread use of fluorides in community drinking water supplies, dentifrices, mouthrinses, foodstuffs, dietary supplements and professional topical applications, we need to reassess these norms. I have never, even for an instant, believed that we are receiving too much fluoride or that there is any danger to the health and welfare of our population, either in unfluoridated or fluoridated communities. I argue only, in light of these facts, that we need to reassess our definition of "optimal". If I had to guess at the outcome, I would say that we would be most likely to adjust the optimum dosage upward, in light of the fact that current practices have resulted in a dramatic decline in the prevalence of dental caries, for the apparent price of a modest increase in the prevalence of mild and very mild dental fluorosis. I see this as a very

Dr. David Werdegar
San Francisco Health Department
San Francisco, CA

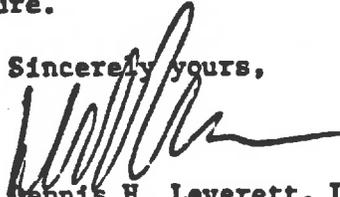
Page 2

July 17, 1985

small price to pay for the substantial benefits which we have derived from fluoride therapy.

Let me say, again, that I am not now, nor have I ever been, opposed to community water fluoridation or, for that matter, any other accepted mode of fluoride therapy. On a more personal note, let me add that I conduct extensive clinical research in both fluoridated and non-fluoridated communities. Within this context, I examine thousands of children each year and continue to be overjoyed by the obviously superior dental health of children in fluoridated communities. I hope that San Francisco will soon join the ranks of beneficiaries of this unexcelled public health measure.

Sincerely yours,



Dennis H. Leverett, D.D.S., M.P.H.
Chairman
Department of Community Dentistry

DHL/mf

cc: Dr. Howard Pollick
Dr. Dean Echenberg



Press Advisory

For the week of: April 29, 1985

Following are some agency developments which may interest you. If you need more information on any of these subjects, call the appropriate contact:

TOPIC

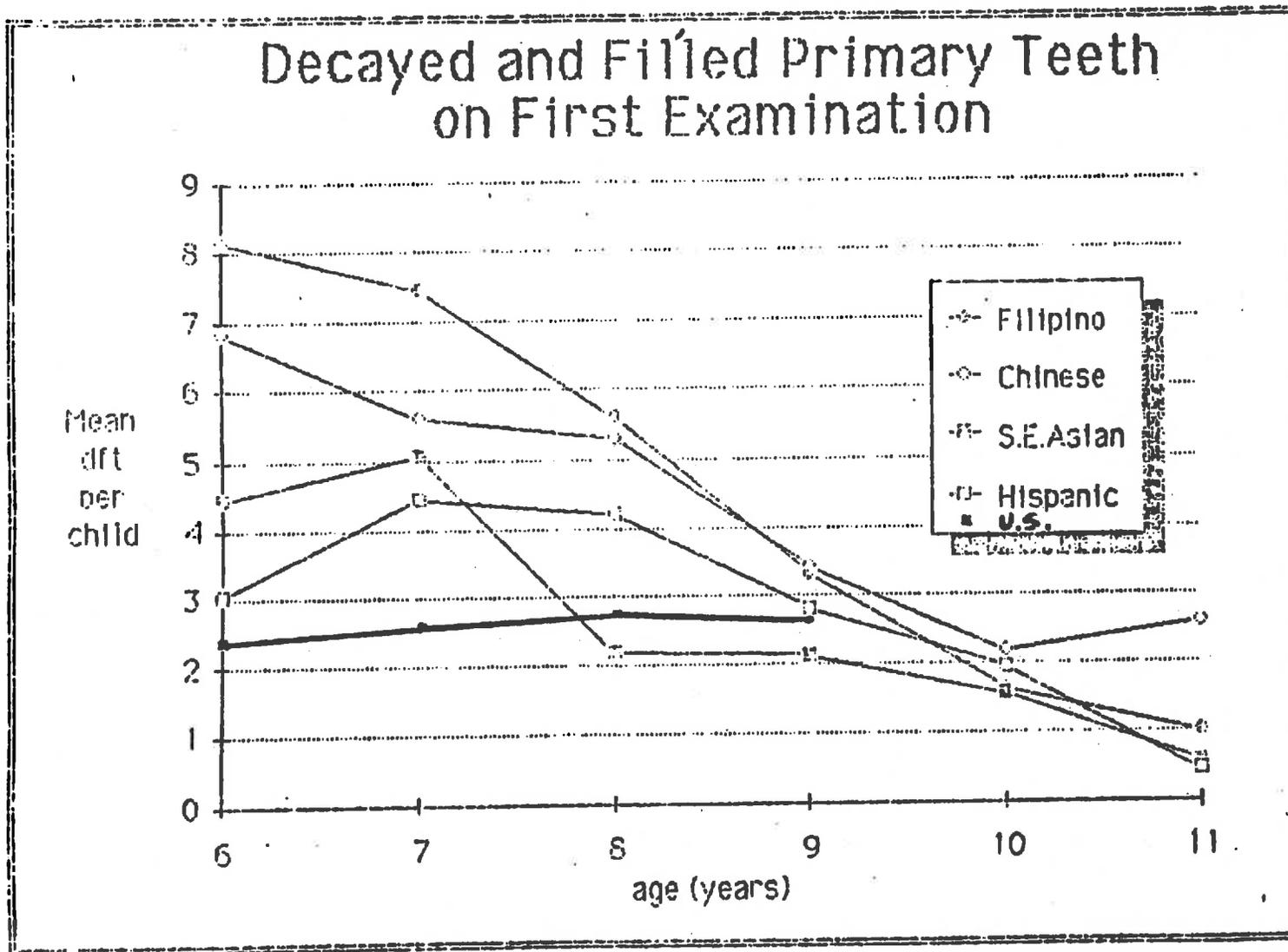
CONTACT

EPA has proposed raising the level of fluoride permitted in drinking water to 4 milligrams per liter (mg/l). The agency believes the proposed level is sufficient to prevent the occurrence of skeletal effects of fluoride. EPA plans to propose a Secondary Maximum Contaminant Level to advise the public of the risks of dental fluorosis and its cosmetic effects. In 1975, the agency had set the Maximum Contaminant Level at 1.4 to 2.4 mg/l for protection against dental fluorosis, which can cause discoloration of teeth. In a 1982 report, the U.S. Surgeon General did not consider dental fluorosis to be an adverse health effect. The latest action will satisfy a consent decree involving a legal challenge brought by South Carolina contending that dental fluorosis should not be considered an adverse health effect but merely a cosmetic one. Fluoride occurs naturally at elevated levels in drinking water in a number of states. At levels of 1 to 2 mg/l it helps protect against cavities. Above this range it also causes dental fluorosis, and at 5 mg/l and above it can cause non-clinical changes in bone density. At 10 mg/l long-term exposures cause skeletal disorders similar to arthritis. EPA will hold hearings on the proposed standard in Washington, D.C., June 17 and 18 beginning at 10 a.m. in Room 2126 at EPA Headquarters, 401 M St., S.W. Written comments may be submitted to: Comment Clerk, Criteria and Standards Division, Office of Drinking Water (WH-550), U.S. Environmental Protection Agency, Washington, D.C. 20460. The agency will accept comments until June 29. Details will soon appear in the Federal Register. EPA expects action on the proposal to be completed by October. EPA is obligated by law to periodically review the Safe Drinking Water Act requirements.

Truman Temple
202-382-5590

FIGURE 1

SAN FRANCISCO NEWCOMER DENTAL HEALTH



- Figure 1

Source: Pollick, Rice and Echenberg 1984

FIGURE 2

SAN FRANCISCO NEWCOMER DENTAL HEALTH

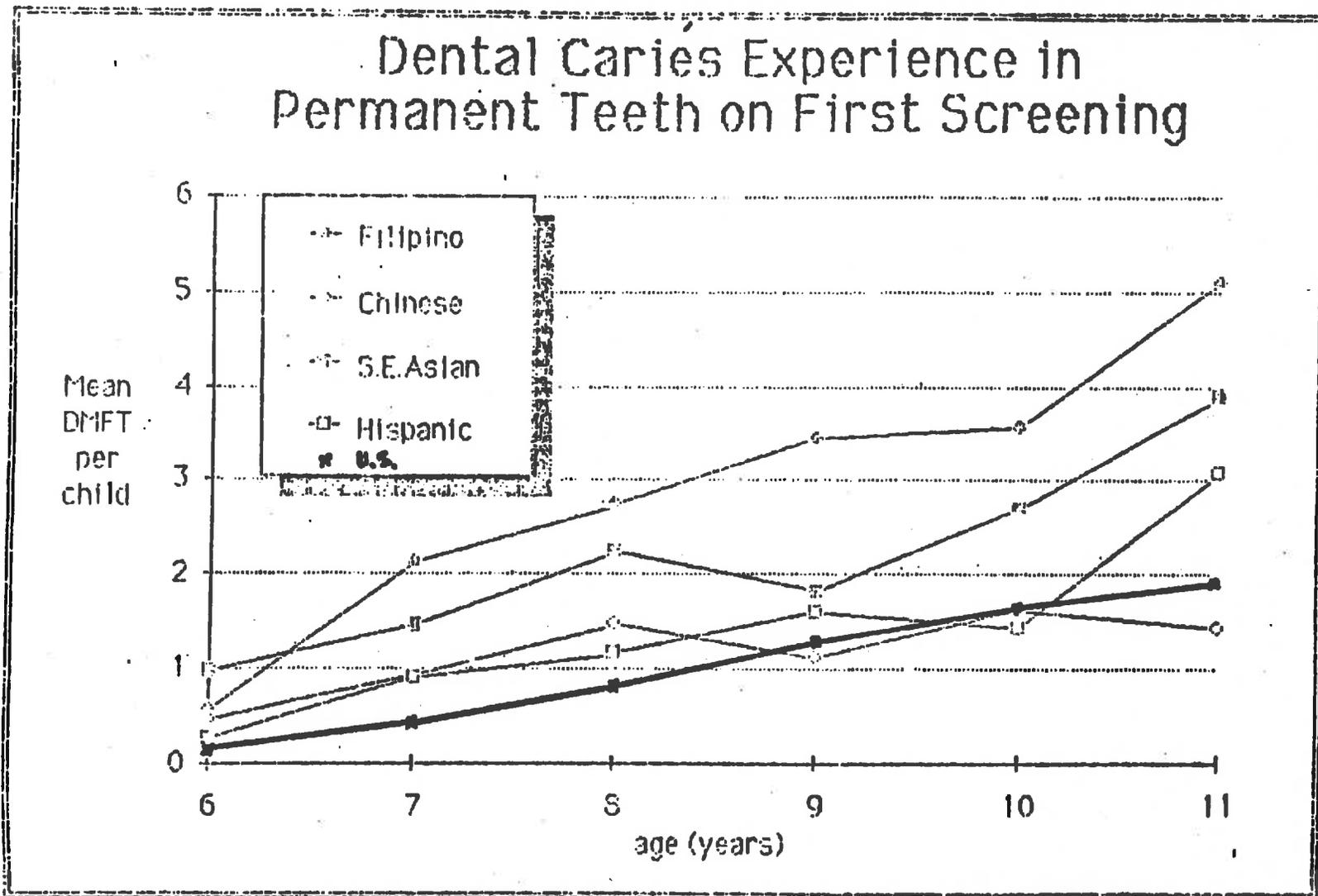


Figure 2

Source: Pollick, Rice and Echenberg 1984

Appendix H

SUMMARY OF MUTAGENIC STUDIES

<u>Study</u>	<u>Organism Studied</u>	<u>Parameter Studied</u>	<u>Effect Observed</u>	<u>Fluoride Levels</u>
Mukherjee & Sobels (1968)	Fruit Flies	Lethal Mutations	None Increased effect of x-rays	19 ppm F 19 ppm F
Boigel (1973)	Fruit Flies (Oocytes)	Hatchability of eggs	Decrease (Mature Eggs) None (Immature Eggs)	46,228,456 ppm F 46-456 ppm
		X-Chromosome Loss	None	228 ppm F
		Trenimon-Induced Mutations	Decreased	228 ppm F (Sparing Action)
Ube-Slacik-Erben (1973)	Human Cells	Chromosomal Changes	None Decreased Mutations From Other Agents	19 ppm F 19 ppm F
Tagiello & Bin (1974)	Mouse, Sheep, Cow (Oocytes)	Chromosomal Changes	None Increased	4.5 ppm F 90-180 ppm
	In Vivo, Mice	Cytologic Changes	None	<500 ug/mouse (given IV; 0.5 mg F)
Mohammed &andler (1976)	Mice (Marrow & Spermatocytes)	Chromosomal Changes	Increased	0.45-45 ppm F (in drinking water)
Arum, et al (1978)	Mice (Marrow)	Chromosomal Changes	None	50 ppm F (in drinking water)
Martin, et al (1979)	Mice (Marrow & Spermatocytes)	Chromosomal Changes	None None	50 ppm F (in drinking water) 1-100 ppm F (in drinking water)
	Microorganisms (Salmonella & Saccharomyces)	Mutagenicity	None	0.1-500 ug per culture

Table 1: Communal water fluoridation cost data¹

<u>Community</u>	<u>Population served</u>	<u>Capital costs (Dollars)</u>	<u>Amorization (Years)</u>	<u>Annual operating costs (Dollars)</u>	<u>Annual cost per capita (Cents)</u>
San Francisco San Mateo Burlingame Hillsborough	1,100,000	200,000	50 ²	110,000	14
East Bay Municipal Utility District	1,093,000	500,000	15	168,116	18
Marin Municipal Water District	182,000	85,000	10	20,000	16
Los Angeles (projected)	2,858,000	175,000	25	205,000 ³ 410,000 ⁴	13 20

1. Data or cost estimates, 1974

2. Amortization over 50 years because major cost item was new building

3. Projected operating cost using H₂SiF₆ or Na₂SiF₆

4. Projected operating cost using NaF

Source: Water engineers from each community, personal communication, 1974

While controlling the fluoride feed dosage, the naturally occurring fluoride concentration of approximately 0.05 ppm in the water is taken into consideration to maintain the correct residual concentration.

Monitoring and Control

The fluoride feed rate is manually set. The residual fluoride concentration is continuously monitored. If for any reason (e.g. change in rate of flow of water, malfunction of feed equipment, or other) the residual fluoride concentration rises above 1.0 ppm, the fluoride feed equipment will automatically stop. A complete overhauling and rehabilitation of the Polhemus Road fluoride station was initiated in January 1984 and is in the final stage of completion. The characteristics of the current operational controls are as follows:

1. Residual fluoride is monitored automatically and continuously recorded on charts in both the stations. If the residual concentration exceeds 1.0 ppm, the feed system will automatically shut down. Appendix 3 is an original of the residual fluoride concentration recorded from May 11 to May 13, 1984. A copy of the chart, although not as easily interpreted as the original, is enclosed for your files. Please return the original to the Water Department at your earliest convenience so that we may return it to our records.
2. Any possibility of overfeeding of fluoride, due to back siphonage, at the unmanned Polhemus Road fluoride station has been eliminated by providing negative suction head. These modifications were completed in August 1984.
3. An alarm system is being installed to sense any ground spill or leak of acid from the hydrofluosilicic acid tank in the Polhemus Road station. The alarm will automatically relay a message to the Millbrae radio operator.
4. Pertinent operational data, including water flow rate, fluoride feed and residual fluoride concentration are monitored continuously on automatic recorders in each station.
5. Once any plant is shut off due to any alarm function, the restart can be done only manually. If the residual fluoride concentration exceeds 1.0 ppm, the fluoride feed equipment is shut down.
6. A confinement area will be constructed around the tanks at the Polhemus Road fluoride station, under the current capital improvements program. This confinement area will retain any acid spill resulting from natural disasters (e.g. earthquake), to avoid any potential hazard to the adjacent communities.

In addition to the operational controls in the fluoride feed stations, the concentration of fluoride is measured daily by the laboratory in approximately 35 locations within the distribution system. This sampling program is for the purpose of quality control and quality assurance. Appendices 1 and 2 reflect

WATER FLUORIDATION

One of the avowed aims of medicine throughout history has been to develop curative and preventive measures which will reduce human suffering and improve the quality of life for all people. Over the past several years, remarkable progress has been made in developing preventive capabilities that are now readily available to improve health and reduce the cost of health care for countless millions of people. Fluoridation of community water supplies to reduce dental disease is an excellent example of a highly effective and efficient preventive method which offers a potential benefit to nearly everyone.

Tooth decay is one of this Nation's greatest health problems in terms of the number of people affected and its persistence. Children are most vulnerable. Years of research and community demonstrations have shown that the fluoridation of drinking water supplies is the most effective and least costly public health measure available to prevent tooth decay. Between half and two thirds of the dental decay that children would have if unprotected is prevented if they drink fluoridated water from birth. Many children who drink fluoridated water are decay free. Although this safe and effective preventive measure is easily provided, only about half of the Nation's people drink optimally fluoridated water.

The United States Public Health Service reaffirms its strong endorsement for fluoridating community water supplies to an optimum level wherever the natural level is less than optimum, and stresses that this preventive measure is the single most important commitment that a community can make to the oral health of its children and to future generations. I urge all health officials and concerned citizens to join me in supporting this commitment and in the task of achieving water fluoridation for all community drinking water supplies which lack the fluoride content needed for the prevention of dental caries.

February 8, 1983



C. Everett Koop, M.D.
Surgeon General

DEPARTMENT OF HEALTH & HUMAN SERVICES

The Surgeon General of the
Public Health Service
Rockville MD 20857

JAN 23 1984

Mr. William D. Ruckelshaus
Administrator
Environmental Protection Agency
401 M Street, S.W.
Washington, D.C. 20460

Dear Mr. Ruckelshaus:

On July 30, 1982, I responded to a request from the Environmental Protection Agency (EPA) to review the scientific aspects of epidemiological studies relating to the effects of fluoride ingested through drinking water and to provide advice on the validity and significance of the findings relative to dental fluorosis. My summary conclusion, based on the lack of sufficient scientific evidence to the contrary, was that dental fluorosis, while not a desirable condition, was nevertheless not an adverse health effect. Thus, from an oral health standpoint, fluoride, as currently found in U.S. drinking water supplies, does not constitute a hazard. A copy of that response is enclosed (Tab A).

This letter is in response to a January 19, 1983 EPA request that "the Public Health Service (PHS) review medical and epidemiologic literature on fluoride and non-dental (underlining added) health effects." Specifically, the PHS was requested "to make recommendations on the significance of that data relative to drinking water fluoride concentrations."

I convened an expert committee to review the scientific literature and to assess the continued validity of past findings in terms of ongoing research. A copy of the committee report is enclosed (Tab B). My conclusions and recommendations are made in consideration of the ad hoc committee's report and subsequent considerations by the committee chairman, other consultants and PHS authorities.

Adverse health effects were defined by the committee as death (poisoning), gastrointestinal hemorrhage, gastrointestinal irritation, arthralgias, and crippling fluorosis. No record exists of poisoning death from fluorides consumed in drinking water. There are no scientifically credible reports of gastrointestinal effects at levels found in drinking water. Clinical experience suggests that arthralgias are not likely to occur in patients who are on therapeutic regimens of less than 20 milligrams (mg) per day. Crippling fluorosis has been detected in some people who have consumed 20 mg or more of fluoride per day from all sources for twenty or more years. Such a situation does not exist in the U.S. today.

**REPORT TO THE SURGEON GENERAL BY THE AD HOC COMMITTEE ON THE
NON-DENTAL HEALTH EFFECTS OF FLUORIDE IN DRINKING WATER**

In February 1982, the Environmental Protection Agency (EPA), in the process of re-examining the health effects of fluoride in drinking water, requested a scientific review by the Public Health Service of the relationship of fluoride in drinking water to dental fluorosis.

An ad hoc PHS committee on dental fluorosis, reviewing the scientific aspects of epidemiologic studies related to fluoride in drinking water, subsequently reported (July 1982), in effect, that twice optimum (1.4-2.4 mg/l) is a conservative standard for a maximum recommended concentration in natural drinking water supplies. They concluded that two times the optimum concentration be used as a guide as to which communities should consider fluoride removal, since there is evidence that dental health benefits do not significantly improve above that point." Following this report the Surgeon General (July 30, 1982) agreed that a) "No sound evidence exists which shows that drinking water with the various concentrations of fluoride found naturally in public drinking water has any adverse effect on general health," and b) that "to minimize the occurrence of undesirable cosmetic effects it is prudent to maintain the upper limit of fluoride in drinking water at two times the recommended optimum concentration." These statements were contained in the ad hoc PHS committee report.

In January 1983, EPA requested that the PHS conduct a review to determine the level at which adverse non-dental (medical) health effects may result as a consequence of fluoride in natural drinking water supplies and the margin of safety that would be appropriate. This review was to be directed at general health effects of fluoride, to determine if the safety margin falls within the concentration of fluoride found in some U.S. drinking water supplies.

Specifically, five issues identified by the EPA were:

1. Could fluoride have any adverse or potential adverse effect on health, specifically with reference to potential non-dental toxicity?
2. Do the levels of fluoride in drinking water meet the criteria of the Safe Drinking Water Act, e.g., "have any known or anticipated adverse effect on the health of persons"? What, if any, are those potential adverse health effects?
3. What would be the "highest no observed adverse effect exposure level" and/or the "lowest observed effect level?"
4. Which persons in the general population would be considered most sensitive and for what reason; age, severe disease, high water intake, etc?
5. What margin of safety would be appropriate to assure that the "no-known or anticipated adverse effect level" had been determined?

Reprinted by
U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
PUBLIC HEALTH SERVICE
CENTER FOR DISEASE CONTROL
Bureau of State Services
Dental Disease Prevention Activity
Atlanta, Georgia 30333

U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE

Public Health Service

National Institutes of Health

Refer: PPB-34
February 1972

\$100,000 REWARD OFFER -- A GIMMICK

For years a reward offer has been circulated by opponents of fluoridation. The fact that the reward has not been collected has been used by them as substantiating their claims. A flyer has appeared in which the reward has been increased. The offer has been very carefully worded. For example:

- (1) The wording asks proof that fluoridation "will cause no future body harms." This would require proof of events which will take place in the future, which is impossible.
- (2) The wording asks that, using PHS recommended fluoride levels (approx. 1 ppm), proof be given that "poisonous" fluorides are safe. Fluorides at PHS recommended levels are not poisonous, and proof of effectiveness and safety at such levels would be irrelevant to use at the much higher levels at which fluoride could be termed "poisonous."
- (3) The reward offer is ambiguous, with no indication of what would be considered a "controlled" experiment, what proof would be considered acceptable, or who would make the decision as to whether the proof was acceptable.
- (4) The flyer requires the posting of a bond by anyone attempting to collect the reward to cover any costs which the offerors of the reward might incur if the proof is deemed invalid; this condition would be extremely difficult to comply with, for the amount of such possible costs would appear to be impossible to determine in advance. Moreover, in view of the difficulties and ambiguities in the nature and wording of the offer which are pointed out above, a person seeking to collect the reward could easily be placed in an impossible economic position.
- (5) Posting of the bond, above, could make payment of the reward unenforceable, because the entire offer might be considered a wager, and the courts will not enforce the collection of a gambling debt.

The reward serves to confuse and deter action on a proven public health measure. The fact is that the drinking of fluoridated water adjusted to Public Health Service recommended levels has been demonstrated for more than 27 years and no bad or harmful effects have ever been clinically substantiated.

Division of Dental Health
Preventive Practicer Branch
9000 Rockville Pike
Bethesda, Maryland 20014

Member
Board of Supervisors
City and County of San Francisco



WENDY NELDER

DID YOU KNOW ????????

1

All of the other industrialized countries throughout the world which have experimented with fluoride in drinking water have now stopped using it.

2

Japan fluoridated a portion of its drinking water and noted that the death rate from heart disease and cancer in the fluoridated areas was excessively high; the fluoridation was stopped, and the excessive death rate went back down to the average.

3

Sweden fluoridated drinking water for nearly 20 years; then research showed the cancer death rate was extraordinarily high and stopped fluoridation, stating the increased health risk was too high a price to be paid for any potential benefit to teeth.

4

Canada used to have mandatory fluoridation but now does not because in the 1970's the doctors at the head of the agency which is the equivalent of the United States Environmental Protection Agency became concerned that fluoride, which was not present naturally in the food chain--or available in toothpaste, gels, and tablets--50 years ago is now prevalent in the food chain; the doctors noted that 35 years ago (in the 1950's) it was arbitrarily (without testing) decided one part per million (1 ppm) fluoride was the optimal amount that could be added to drinking water; "optimal" means at less than 1 ppm the body probably receives no benefit from fluoride and at more than 1 ppm the body probably is damaged by it; the Canadian Doctors examined fruit and vegetables watered with fluoride and found they were "fluoridated vegetables"; they examined cows eating fluoridated hay which turned into "fluoridated steaks"; they found cereals and soft drinks made or bottled in fluoridated counties had a high fluoride content; they added it all up and found that your daily diet probably gives you between 6 and 12 ppm fluoride a day and said it should not be in the drinking water because no one has ever claimed that fluoride will not do harm at such excessive levels.

5

West Germany added fluoride to drinking water as an experiment for about 20 years, but then removed it because the death rate from cancer and heart disease was excessive and the government decided that in light of the health risks involved, each individual has to be given the right to decide whether to use fluoride or not.

6

There is no way to calculate or control the amount of fluoride a person consumes from fluoridated water; 1 ppm is intended to equate to 1 milligram per human being (remembering that beyond that "optimal" level it is admittedly toxic); but that assumes every person must consume no more and no less than four

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glasses of water per day--that has to include all the jello, diluted concentrated juice, rice, pasta, or vegetables boiled in water, soups made with water, coffee or tea (or low cal hot chocolate or cider) made with water! It's likely everyone exceeds that "optimal" level and people with exceptional problems involving water consumption (those with a kidney problem, diabetes, pregnant women, laborers or athletes, or even children who play hard and work up a thirst) who drink more water have severe problems clearing the fluoride from their kidneys; since there are sometimes "spills", mistaken additions to the water of more than 1 ppm, the danger of over-consumption is higher for those of the higher consumption level.

7
Fluoride is, quite literally, toxic waste created during phosphate fertilizer manufacturing and aluminum manufacturing processes; if it is not sold to counties to add to drinking water, or sold to poison rats and cockroaches, it has been disposed of by putting it on a ship and dropping it into the ocean--because if it is disposed of on land it kills everything; there is a place in Canada where it has been allowed to be emitted during manufacturing procedures and for 50 miles in all directions, everything is dead (it is called the "death zone" by people around the area). Fluoride has never been the subject of a study to show that at 1 ppm it is safe (for human consumption); not by the U.S. Government; not by the American Medical Association; not by the American Dental Association; it is defined as toxic--poisonous--at all levels to humans in virtually any Toxicology of Pharmaceutical Textbook.

8
Poor children, poor people generally, and seniors have a greater number of adverse health responses to fluoridated drinking water because of their tendency to be malnourished; certain elements, for example, calcium, present in an adequate diet will bind fluoride which is otherwise free to cause problems in the body.

9
Only 25% of California's population fluoridates water; Los Angeles for example does not and it has a substantially lower cancer death rate.

10
Fluoride has been the subject of thousands of studies reported in books and respected, peer reviewed medical and scientific journals; those studies show:

- a) Fluoride has a significant correlation with increased death rates from heart and cancer disease.
- b) Fluoride has a significantly adverse effect on the thyroid and kidneys.

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c) Fluoridated drinking water has a significant correlation with an increase of mongoloid births and births involving other defects.

d) Fluoride attacks and can damage and even destroy the body's immune defense system by inhibiting the production of enzymes essential to body functions and by inhibiting the production of DNA, the body's natural blueprint for repair; this activity accounts for the much higher death rates in fluoridated-water counties from any diseases which may be active at a given time, including flu or pneumonia. (Although it has been reported otherwise, I have never said, "Fluoride causes AIDS," but I have explained the phenomenon described in this subparagraph.

11 There has never been a study which proves adding 1 ppm Fluoride to the drinking water can prevent tooth decay, but generally those who claim it does so admit it is unlikely that fluoridated water can help you if you have permanent teeth; in other words, fluoridated drinking water is only intended to help children without permanent teeth or below about 14 years old; more than 90% of San Francisco's population can therefore receive no possible benefits from adding fluoride to our water supply.

12 Fluoride is easily available for private consumption; that is the policy followed for almost the entire population of the industrial world. If you wish to use or consume more than you already take in for your fluoridated toothpaste or gel, tablets are available by prescription (which shows that even at 1 ppm pharmacological practices recognize its toxicity).

13 Fluoride costs the City large amounts of money every year; The Water Department spends approximately \$175,000 to purchase the chemical itself, but fluoride is extremely corrosive (your favorite toothpaste tube you'll find is rubberized so the fluoride can't eat through it), and while the City spent \$430,000 on water main repair for the year prior to fluoridation (1951 - 1952) we spent \$3.4 million last year and that exceeds the natural inflation rate by nearly one million dollars. The pipe corrosion/repair problem is one that occurs in every water delivery system where fluoride has been added.

14 DON'T BE CONNED!

Dr. Albert Schatz, the doctor who discovered streptomycin, said the success of the aluminum and phosphate fertilizer manufacturing industry convincing dentists and public health officials and the public that the toxic waste they produce should be added to water to fight tooth decay--when no test has ever shown it has any such effect--and where no test has ever

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shown it to be safe for human consumption--is a "scientific fraud." "It is the most dangerous medical hoax not only of the past century, but of all time." Dr. Schatz called Fluoridation "a perversion and a prostitution of science."

15 He referred in part to the grant monies so generously doled out by the producers of fluoride to the doctors and dentists who write (even to editors of large, small, and even neighborhood newspapers) and speak at the drop of a hat in favor of the poison.

16 The doctors, dentists, and public health officials who have been selling it to us for years are themselves victims of the con. If you have read this article you now know more about the subject than most doctors or dentists you will ever meet--but that won't prevent them from asserting that fluoride is fine. Ask them if they know Gilbert's Syndrome, a malaise that affected 1 in 4000 persons 30 years ago when we started fluoridating drinking water supplies, now affects 1 in every 200 people, and it has been found to be cured by eliminating fluoridated water from the diet. Ask them if they know that many eczemas and facial dermatological problems can be cured by eliminating fluoridated toothpaste. Ask them if they know that studies have shown that at 1 ppm fluoride causes rats and mice to develop "inexplicable" tumors. Ask them if they know that until we fluoridated, San Francisco was at or below the national average for cancer deaths but that since we began fluoridation we share with other fluoridated water cities the distinction of having a 22% higher number of deaths than the national average. We are the only major California City to fluoridate so long, and we are the only major California City on the high cancer list. Ask them if they know Dr. Dean Burk who was at the National Cancer Institute for 35 years and the head of the Cytochemistry section, told the United States Congress that ending fluoridation in this country would save 35,000 lives a year.

17 Shortly after I first asked for information on the incidence of diseases associated in the literature with fluoride consumption, a dentist who was president of the San Francisco Dental Society and a doctor who was the head of the Public Health Department for the University of California asked for an appointment "to set Nelder straight on fluoride." After a meeting that lasted for more than one hour they both said they knew nothing about fluoride. We agreed to set another date when they would be represented by "fluoride experts." They would never again respond to the request to meet or produce experts and if you read the newspapers carefully, (you'll note with some question in your mind about the sincerity) the pro-fluoridation doctors and dentists will be quoted saying, "Nelder never talked to the experts," and then shortly thereafter you'll read "the experts refuse to talk to Supervisor Nelder because she wants a confrontation."

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18 You'll read that "fluoride is absolutely safe according to many studies;" ask for the name of one and submit it to the group of doctors who have posted a \$100,000 reward for the last 30 years for such a study--the offer still stands because no such study exists.

19 One of every three children in fluoridated areas is afflicted with dental fluorosis--that is pitting, staining, or white markings on his or her teeth; if you're looking for it it shows first on the tips of teeth and generally matches on both sides of the mouth. The important thing to remember is that fluorosis in the mouth indicates a toxic effect throughout the body. Some people react more acutely to fluoride than others might. Fluoride is known to decalcify bones and to mineralize soft tissue, but if you already have your teeth, there is no outward insignia to show your reaction; it's all happening inside the body. The skin eruptions, gastro-intestinal disorders, weakness, skeletal pain, neurologic disorders, allergies and early senility which may be the result of fluoride consumption are unlikely to be correctly diagnosed by a doctor who has been taught that fluoride is safe simply because it has been around so long. The average pro-fluoridation doctor or dentist will probably never tell you that at least 6 dentists have been so unknowledgeable that they allowed small children to die because they thought that symptoms (e.g. convulsions) could not be a reaction to fluoride treatment. Sadly, simply administering milk would have resulted in binding the fluoride and would probably have saved those children's lives. Even more sadly, they won't tell you not because they are bad or duplicitous, but because they don't know.

20 In addition to all of the above information, it may be helpful to you to know that there is no test or study showing that fluoridated water prevents tooth decay. Studies frequently cited by pro-fluoride authorities are misrepresented. In fact, tooth decay is going down all over the world, even in countries without fluoridation; obviously diet and hygiene are the most effective tools to prevent tooth decay.

21 I have asked my colleagues on the Board of Supervisors to put the Fluoridation question on the ballot in November. I think you have a right to choose what medications you take and what risks you are willing to run.



DEPARTMENT OF HEALTH & HUMAN SERVICES

Public Health Service

July 19, 1985

Dr. John C. Greene
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Dear Dr. Greene:

As you and Dr. Isman requested, I have technically reviewed "Did You Know" ("DYK"), using the documentary resources available here at the Institutes and at the National Library of Medicine, also located here in Bethesda. For your convenience in reference, I have numbered in the margin each paragraph in "DYK" (see enclosed marked copy), and will refer to those paragraph numbers as the comments on the content of "DYK" are presented in this letter. Although I would have preferred to prepare a numbered reference list of the accompanying documentation and place reference numbers appropriately in the text of the comments, there was just not time to do that, and I have instead only marked the documents on the front with the number of the "DYK" paragraphs to which they have relevance. There are some minor comments for which I have not supplied documentary back-up, judging that the facts involved are well established and known to health professionals. If questions are raised about any of these, certainly documentation can be provided from either the University's resources or from ours, if necessary.

I have not applied a scale of importance to the points presented in "DYK", but it seems the the best start is to deal with the information offered in "DYK" paragraph 13 about the San Francisco water supply system, and the aside on toothpaste tubes. The facts are readily available locally, so are undocumented.

This paragraph opens with a wholly accurate statement!-- the city does indeed spend about \$175,000 a year to purchase the chemical compound used for fluoridation of the water supply. That means that for every one million gallons of water treated, the cost for fluoridation is two dollars and forty-three cents, or, for each resident of San Francisco, about seventeen cents a year for fluoridation.

The information about the costs of maintenance for the water distribution piping in San Francisco is certainly a matter of public interest, and therefore it is well to point out that the records show that fluoridation has no effect on pipe maintenance costs. The corrosion problem that Mother Nature imposed upon San Franciscans in the form of naturally acidic water from Hetchy-Hetch is neatly resolved at the water plant by the addition of a calcium compound that raises the pH from acidic to slightly alkaline. The condition of the water is frequently checked to maintain the pH at about 9.0 or slightly higher. The effectiveness of the anticorrosive treatment is evidenced by the essential absence of heavy metals from water samples taken from the system and analyzed in more than 300 testings during 1984-85. Using these results, one can definitely say that there is no detectable corrosive action in the distributed water. In summary, nature makes the water corrosive, the water plant operators make it slightly alkaline, there is little detectable pipe corrosion happening, and fluoride is not a significant factor in the pipe protection process.

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Moving on to the budget for water main repair and replacement, and accepting the figures as given, we note that the San Francisco water system now has about two-hundred more miles of pipe than it had in the early 1950's. Also, in the past few years, there has been a sustained effort to replace about four miles of the oldest piping every year, at an approximate annual cost of about one million dollars. That effort could account for the cited annual cost difference that is said to exist, in addition to inflation, between the less ambitious maintenance programs of the 1950's and the present effort to improve water service by the replacement of mains having inadequate carrying capacity. The management of the San Francisco water supply system anticipates that the pipes being installed under this replacement program will remain in service for as long as one-hundred-and-fifty years, which seems to indicate, as does the official record, that when it comes to naturally corrosive water, one can fool Mother Nature.

While on the subject of water supply, I would like to comment on the misconceptions about the nature and purposes of fluoridation that are expressed in paragraph 6 of "DYK". When the fluoride concentration in drinking water is optimal (near one part per million), it is not intended that anyone should calculate or control the quantity that a person drinks. Fluoridation of the water supply is not an effort to give everyone (or anyone) one milligram of fluoride daily or any other specific amount. Rather, the objective is to replicate a naturally occurring quality of water that provides some degree of protection against tooth decay to those who use it regularly. The fluoride ion concentration that is used matches that found in naturally fluoridated areas where people as a group using the water for all the normal purposes (drinking, cooking, bottling, food processing, etc.) showed substantial dental health benefits as they matured. In temperate climate areas with one part per million of fluoride ion in the water, some people showed more benefit than others (perhaps those who drank more), but all benefitted to some degree, and none were harmed by the one part per million fluoride. The average benefit measured across the child population group was a reduction of 50% or more in the prevalence of tooth decay and loss. Much of the benefits so gained extend well into the adult years when the use of fluoridated water is continuous. To restate the principle, fluoridation is not based on a dosage, but on an observed natural environmental condition that provides important benefits to dental health. The study of the effects of fluoride in water came first-- the one-milligram of fluoride that is provided by tablets is an attempt to approximate the average child's fluoride intake in an optimally fluoridated community. For several reasons, water fluoridation is more effective, safer, and costs less.

As to comment on the parenthetical phrase about toothpaste tubes in "DYK" paragraph 13, it is safe to say that "rubberized" toothpaste tubes (if they ever existed) are no longer in style, as nearly all of the toothpaste tubes since about 1980 have been made of plastic (polymers). Beyond that, we should note that the fluoride compounds used in toothpaste are not corrosive; the acidity of some toothpastes results from other ingredients, some of which are added to enhance the absorption of the fluorides. When these toothpastes were packaged in the metal tubes that were once commonly in use, the products that tended to be acidic were packaged in tubes with a paraffin-based lining to

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avoid the potential uptake of lead from the metal tube into the acidic toothpastes during long storage. The toxic potential of lead uptake, which was always slight in this situation, is now wholly avoided. The relevance of the construction and safety of toothpaste tubes to the consideration of the fluoridation of water in San Francisco is clearly close to zero.

The "DYK" statement about Sweden, paragraph 3, contains no factual information. Swedish government records show that water was fluoridated in only one Swedish community, Norrkoping (pop. 38,000), for nine years, from 1952 until 1961. Fluoridation was halted by a judgement of the Supreme Administrative Court in December 1961 that dealt not with any intimation of cancer risk, but with technicalities of the water treatment laws, which the Court concluded did not provide for the practice of water fluoridation. The Swedish national legislature (the Riksdag) passed new legislation in 1962 enabling fluoridation to be practiced by communities upon application to and individual approval by the national government. Under this restrictive arrangement, no communities in Sweden got full technical approval to begin fluoridation, and so there has been no fluoridation there since Norrkoping stopped in 1961. The enabling legislation, unused and thought by many local authorities to be so stringent as to be unworkable, was repealed by the Riksdag in 1971 in a close vote following a strong campaign by Swedish opponents of fluoridation. One man's view of the nature of the debate in Sweden at that time was expressed in the Medical Journal by Dr. Lennart Hamberg, a consultant to the city of Stockholm's child care program--- "Another circumstance that tells against fluoridation of water is the unease felt by many people about this kind of caries prophylaxis. This unease is psychological and is fed by a flora of quasi-scientific articles, in which, with the usual cocksureness of ignorance, the fateful consequences of water fluoridation are depicted."

To the citizens of Uppsala, Sweden (population 145,000), the questions may seem already answered-- they, like the citizens of Jacksonville, Florida, have been using water from sources that have been optimally fluoridated by nature for about one-hundred years. So far, neither the Riksdag, the courts, nor the opponents of adjusted fluoridation have made any protest to the water authorities at Uppsala. For the better dental health of their other citizens for whom nature has not so provided, the Swedish national and county governments have instituted programs that include fluoride mouth-rinsing in the schools, fluoride tablets for young children, topical applications of fluoride for those especially prone to caries, and the encouragement of the use of fluoridated dentifrices. These programs have had good public acceptance in Sweden-- however, the earlier success of fluoridation opponents in the Riksdag has removed any possibility that a Swedish community might exercise any freedom of choice about water fluoridation.

"DYK"'s paragraph 4 on fluoridation in Canada is similarly deficient in accuracy. The Canadian government has never had a mandatory requirement for fluoridation. Almost half the people of Canada who are on public water supplies are provided with fluoridated water, and the Department of Health and Welfare of the national government endorses and promotes the adoption of fluoridation by local option. In Quebec province, where the city of Quebec

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began fluoridating in 1978, the Ministry of Social Affairs offers subsidies to municipalities to cover the cost of the purchase and installation of fluoridation systems and for the purchase of initial supplies of fluoridation chemicals. In 1977, the Environmental Health Directorate of National Health and Welfare, which in Canada is the equivalent of the U. S. Environmental Protection Agency, issued a report on a national statistical survey of seventy-nine groups of Canadian municipalities that indicated there were no significant differences in death rates from cancer between fluoridated and nonfluoridated places. We were not able to find in any document published by the Environmental Health Directorate a reference to "fluoridated vegetables" or "fluoridated steaks", which are rather odd terms, given what is known about fluoride uptake by crop plants and by animals. Other than tea, we know of no food crop that accumulates fluoride in significant amounts through watering, even when watered with irrigation waters having naturally excessive fluoride concentrations. Similarly, the meat of animals that have been affected by skeletal fluorosis even to the point of physical impairment does not contain concentrations of fluoride that would be of any concern, because ingested fluoride is selectively taken up by calcified tissues (bones and teeth). The increases in soft tissue fluoride concentrations that occur immediately after ingestion of fluoride are in the circulating fluids and are transient. It seems unlikely to me, from past experience with the reported work of Canadian researchers and veterinary specialists, that these terms and interpretations are from a Directorate report. I would in fact appreciate having a copy of or a full reference for the Directorate's document. It would be well to note here that the cases of skeletal fluorosis in dairy and meat cattle that have occurred in the U. S. have not been caused by waterborne fluorides.

Facts are also scarce in the "DYK" paragraph 5 statement about fluoridation in West Germany. West Germany added fluoride to the drinking water supply for a part of the population (about 6000 persons) in the city of Kassel, beginning in 1952. This demonstration project was continued to completion several years later. No other West German community has adopted fluoridation because the water treatment laws of the Federal Republic have never provided for fluoridation (an exception was made for the Kassel project). There is no fluoridation, although it is endorsed by various dental and health organizations there, because there has been no legislative initiative to make the necessary changes in the water laws. We could find no record of a survey of cancer and heart disease rate changes in connection with fluoridation at Kassel. Even had such a statistical analysis been attempted, the mortality statistics from such a small adult population group could not have produced meaningful results.

The growing length of this letter demonstrates the validity of our rule-of-thumb which says that it requires at least ten sentences of facts to effectively offset each sentence of calculated disinformation. Lest this information become unwieldy, I am going to treat only one more item in much detail, and then move to a summary line or two, with reference documentation, on some of the lesser items in "DYK". This is not to say that the neglected remainder of "DYK" is necessarily accurate, but only that time and space for analysis are limited.

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In paragraph 7, in paragraph 11, in paragraph 18, and in paragraph 20, there are statements concerning the absence of tests, and the availability of a \$100,000 reward if you can supply one, to show that one part per million of fluoride ion in water is safe and will reduce tooth decay. We have had considerable correspondence over the years with the author of the reward offer. What this offer calls for is a laboratory experiment using water with one ppm fluoride that will prove that use of it will cause no "future bodily harm". The most obvious problem is that no one can design an experiment that will "prove" future happenings-- in science, one can only assess probabilities. The next most evident problem is that the reward offer calls for a laboratory experiment, which implies the use of laboratory animals in whatever experiment might be planned. Because of their more rapid tooth development, laboratory animals must be provided with fluoride at concentrations several times higher than those to which humans react in order to get comparable effects in caries prevention. Hence, there cannot be any meaningful experiments in laboratory animals with fluoride in water at one ppm. Submitting a claim for this reward, should one be able to somehow overcome the scientific impossibilities that are imposed, involves posting a bond to cover the expenses of the people involved in evaluating the submission. Given that the evaluating persons are not defined in the offer, and may well be the author and co-makers of the reward offer, the chances for success seem slim and the risks of loss rather high. There are of course numerous reports on laboratory research with animals getting the appropriate concentrations of 5 to 10 ppm fluoride. Unfortunately, for them no reward is offered. For the above reasons, the \$100,000 dollars is as safe from removal as if it were in Fort Knox, and so the offer will probably remain with us forever as an eye-catching public relations gimmick for the wonderment of the uninformed. It may be of some interest that the contact for information on this reward offer is the New Jersey-based "Americans United to Combat Fluoridation".

Now, more quickly--

Concerning paragraph 1 of "DYK", thirty countries practice adjusted optimal water fluoridation as a public health measure. Only one country that had fluoridation on a large scale, the Netherlands, has stopped fluoridating. The halt in the Netherlands resulted, again, from a court ruling action holding that the water laws as written did not provide for fluoridation, and the ensuing lack of any legislative action to amend the water laws so as to permit the continuation of fluoridation.

In 1984, Canadian agricultural and environmental authorities of the national government and of some provincial governments in agricultural regions responded to a USPHS inquiry concerning the prevalence of fluorosis and fluoride pollution problems in Canada. In contrast to the information in "DYK" paragraph 7, government and university specialists reported almost no problems of that nature; strangely, none of the them reported on a "death zone", which, if it met the "DYK" description of a one-hundred mile diameter, should have been easily detectable. If you can narrow down the geography, we can check further and report.

PAGE 6

Fluoridation chemicals are not byproducts of aluminum manufacturing. Aluminum smelting in fact consumes the greater part of the fluoride compounds produced in the U. S. In case someone shows up with the fluoride ad from page 118 of "The Aging Factor", know that the cited ad was last published 34 years ago (1951) when one aluminum company owned a fluoride manufacturing plant that made fluoride for their use and also sold some for a few years. They sold the plant about 1952. Contrary to the implications in "DYK" paragraphs 7 and 14, there is only one connection between aluminum production and fluoridation; they compete in the marketplace for the same chemical products.

Dr. Albert Schatz, quoted in "DYK" paragraph 14, apparently is also confused about aluminum, and caries research, and the income sources of doctors and dentists, and even their supposed ready availability to promote fluoridation. He has for several years been presenting the same rather extravagantly expressed opinions about the propriety of fluoridation promotion in his home territory of Philadelphia, fluoridated for 30 years, without much effect.

Dr. Dean Burk, who retired from the National Cancer Institute in 1974, did tell the U. S. Congress about those 35,000 lives mentioned in paragraph 16. His opinion appeared not only in the Congressional Record, which accepts and prints whatever is proffered through a Member, but also was published in The National Enquirer. Also, a more developed presentation of Dr. Dean's presentation was published in the journal "Fluoride" with co-author Dr. John Yiamouyiannis of Delaware, Ohio. Co-editors of the journal at that time were Dr. Albert Burgstahler of the University of Kansas and Dr. John Yiamouyiannis of Delaware, Ohio. Review publications were included in an earlier packet to you.

"DYK"'s paragraph 10 would take a small treatise to fully discuss, but I would just point out that the issue heart disease and fluoridation, popular some years ago, has been little brought lately, presumably because of the steep and continuing decline in cardiovascular mortality in the U. S. that has taken place over the last two decades. In this material, we see again the equating of "fluoride" and "fluoridation" when biological effects are discussed. A comment on this fallacy might be provided by Dr. Newbrun.

I have to end my review here; you may wish to cover other points in "DYK".

As you know from our long association, I have, when responding to requests for comments on information pieces about fluoridation, usually limited my notes to matters of documented or demonstrable facts. I have generally left the discussion of the political, ethical, and sociological implications to those whose fields of work encompass the broader picture. I have, however, largely through circumstance, also become something of a historian of what the The Mison Quarterly recently referred to as "America's Longest War". For that reason, as a historical note, I am including this personal observation concerning "Did You Know?".

You have probably recognized many of statements critiqued above, since much of the content of "Did You Know?" is already familiar to persons who have kept up with the public flow of statements concerning fluoridation. I have many

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times seen the older stories in letters to newspapers or in fliers and pamphlets produced by opponents of fluoridation for local campaigning. Most of them have also been included in the several books "exposing" water fluoridation. The letters have come mainly from private persons-- a journalism student in New York, an ex-mayor in Georgia, an oil well equipment dealer in the West, homemakers in many places, and individuals from the whole spectrum of working Americans. The similarities among their published statements arise because nearly all of the writers have over the years drawn on the same sources. Given the pre-existence of the inaccurate and often fictional material that abounds in the antifuoridation literature sources, and given that the resources available to individuals for evaluating their source material may in some localities be very limited, the spreading ripples of disinformation that we are see in the public media are not surprising and certainly are not unique to San Francisco. Rather, the confusion that is caused by the publicizing of factual information on effects of fluorides that have no relevance to fluoridation, and of claims that appear to be relevant but that have no basis in fact, is pretty typical of any community's discussion of fluoridation via the public media.

In most large communities, the process is continued as the technical information resources of the local government are put to work to review incoming information, to obtain necessary evaluations, and to determine which information is factual and relevant.

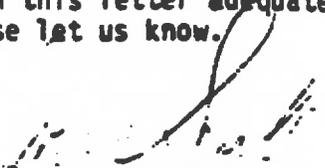
It is here, in "DYK", that we can discern a historical departure, in San Francisco, from what has been the usual practice and process for a local government's consideration of fluoridation as a public health measure. Here we see the to-be-expected presentation of technical inaccuracies, largely fictional accounts of events in faraway places, scarey irrelavancies, and the other misleading statements coming not from an individual citizen's letter, and not from a street-corner pamphleteer, but from an upper level of the local government. It is, within my 20-year experience, the first time that a major municipal government body has provided this quality of "information" for citizens who must necessarily rely on their offical bodies for some guidance on the complex subject of fluoridation.

Failures of local governments to meet this need for accurate information can result in losses of valuable programs if the citizen is moved to vote against the programs to "play it safe" because they are uninformed or, worse, are misinformed. The precedent that is here noted for the historic record, if it becomes common practice, does not bode well for decision-making on health matters through either our representative form of government or through our occasional practice of direct participative democracy. Neither can function effectively for the common welfare unless there is an accurately informed citizenry.

Having gone this far, I will now proceed with a rare lapse into personal opinion to say that it seems to me that the provision of an information piece of the quality of "Did You Know" under the imprimatur of the Board of Supervisors is a disservice both to the Board and to the citizens of San Francisco.

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I hope you find the factual information included in this letter adequate to your needs. If we may be of further service, please let us know.



John S. Small
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APPENDIX R
Mechanism of Action

The precise mechanism by which fluoridation acts to prevent decay and strengthen bone has been, and continues to be, studied extensively (Fejerskor et al 1981, Sanders, 1980, DePadra and Kasket 1983, Eanes, 1983).

Fluoride acts to promote hardness of tooth enamel and bone by increasing the ratio of fluoroapatite to hydroxyapatite. Fluoroapatite is less soluble than hydroxyapatite. The resultant crystalline structure is larger with fewer imperfections thus creating a smaller surface area to volume ratio, and thereby reducing solubility. Fluoroapatite is formed when fluoride ions (F-) replace hydroxyl ions (OH-) in the apatite crystal structure. This transformation is limited by the presence of fluoride and hydroxyfluoride (Sogannes, 1965).

Fluoride prevents dental decay by promoting remineralization of enamel by precipitation of calcium phosphate and apatite. It also influences tooth shape to a more decay resistant pattern of rounder cusp and shallower tissues (ORCA, 1977).

APPENDIX S

Date: July 1, 1985
To: My Fellow Board Members
From: Supervisor Richard Hongisto
Subject: Fluoridation Ballot Measure (Nelder)

The current proposed wording of the fluoridation measure adopted by the Rules and Legislation Committee, is expressed in such a way that could create considerable confusion were it to be implemented. The phrase "or any other substance not necessary for water purification" is inaccurate and inconsistent because:

1. According to the American Water Works Association and the California Department of Health, Sanitary Engineering Section, the term "water purification" has no definition within the water treatment industry or in California law.
2. Preliminary interpretation by the State Department of Health is that this phrase, if implemented, could put the San Francisco Water Department in a position of non-compliance with E.P.A. standards by disallowing current water treatment procedures such as:
 - oxidation
 - softening
 - erosion control
 - iron removal
 - PH balance

Since Supervisor Nelder, who originally brought this issue to your Board has not raised objections to any water treatment process other than fluoridation, the issue should be put before the voters in the most clear, concise, straightforward and accurate manner possible. This approach, in addition, would avoid the likelihood of future legal challenges.

Therefore, I recommend that proposition wording consistent with the wording of the original fluoridation proposition "M" passed by the San Francisco voters on November 6, 1951 be adopted. That wording is:

"Shall the City and County of San Francisco cease to add fluoride or other elements to prevent or arrest dental decay, to the water furnished people in San Francisco by the San Francisco Water Department?"

The Association
of
STATE AND TERRITORIAL DENTAL DIRECTORS

RECEIVED

June 28, 1985

DIRECTOR'S OFFICE

10619 Jousting Lane
Richmond, VA 23235

Mr. John L. Molinari
President, Board of Supervisors
City and County of San Francisco
Room 235, City Hall
San Francisco, CA 94102

Dear Mr. Molinari:

It is our understanding that the Board of Supervisors is considering, for referendum, the issue of the addition of fluoride to the public water supply for the prevention of dental caries.

Fluoridation, which has been in practice in this country since 1946, has been proven over and over again to be the most effective and efficient means of preventing dental caries. The safety of this measure is without parallel in the annals of public health because it is simply a duplication of nature's ways.

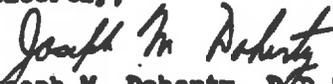
After careful examination of all the facts the City of San Antonio, the third largest city in the United States without optimal fluoride, has just approved fluoridation and will soon provide its citizens with this most beneficial health measure.

We hope the City of San Francisco, which has for so long benefitted from the addition of fluoride, carefully considers any measure that would place this health practice in jeopardy.

If this Association may be of any assistance, please do not hesitate to call us.

Best wishes!

Sincerely,


Joseph M. Doherty, D.D.S., M.P.H.
President

JMD/pb

cc: David Werdagar, M.D.

MYRON ALLUKIAN
46 LOUDERS LN
BOSTON MA 02130 28AM

Western Union Mailgram

4-0468678179 06/28/85 ICS IPMTZZ CSP SFOS
6174244717 MGMB TDMT BOSTON MA 169 06-28 0447P EST

DR DAVID WERDAGER, DIRECTOR
DEPARTMENT OF HEALTH
CITY OF SAN FRANCISCO
ROOM 306
SAN FRANCISCO CA 94102

RECEIVED
JUN 28 1985

DIRECTOR'S OFFICE

THIS IS A COPY OF MAILGRAM SENT TO: MR JOHN MOLINARI, PRESIDENT BOARD OF SUPERVISORS, CITY AND COUNTY OF SAN FRANCISCO, ROOM 235 CITY HALL, SAN FRANCISCO, CA 94102 ON FRIDAY JUNE 28, 1985.

ON BEHALF OF THE AMERICAN ASSOCIATION OF PUBLIC HEALTH DENTISTRY I STRONGLY RECOMMEND THAT YOU SUPPORT THE CONTINUATION OF FLUORIDATION IN SAN FRANCISCO AND NOT ALLOW A WELL ESTABLISHED PUBLIC HEALTH MEASURE TO BE PUT ON THE BALLOT. IN 1952 SAN FRANCISCO TOOK A LEADERSHIP ROLE IN BECOMING ONE OF THE FIRST MAJOR CITIES IN THE UNITED STATES TO BECOME FLUORIDATED AND NOW OVER 120 MILLION AMERICANS LIVE IN FLUORIDATED COMMUNITIES. I URGE YOU TO TAKE A RESPONSIBLE LEADERSHIP ROLE IN CONTINUING TO PROVIDE THE HEALTH AND ECONOMIC BENEFITS OF THIS HIGHLY COST EFFECTIVE PREVENTIVE MEASURE TO YOUR RESIDENTS.

THANK YOU,

CC DR DAVID WERDAGER, DIRECTOR
DEPARTMENT OF HEALTH

MYRON ALLUKIAN DDS MPH
PRESIDENT, AMERICAN ASSOCIATION
PUBLIC HEALTH DENTISTRY

16:48 EST

MGMCMP

AMERICAN PUBLIC HEALTH ASSN BY K
1015 15 ST NORTHWEST
WASHINGTON DC 20005 28AM

Western Union Mailgram

4-0256048179 06/28/85 ICB 2PHMTZZ CSP BPOB
2027895651 MGMB TDMT WASHINGTON DC 67 06-28 0100P EST

DAVID WERDAGAR MD MPH
DIRECTOR DEPT OF PUBLIC HEALTH
CITY OF SAN FRANCISCO
101 GROVE ST ROOM 306
SAN FRANCISCO CA 94104

RECEIVED

DIRECTOR'S OFFICE

THE AMERICAN PUBLIC HEALTH ASSOCIATION STRONGLY SUPPORTS FLUORIDATION
OF ALL PUBLIC WATER SUPPLIES AS A COST EFFECTIVE MEASURE FOR
PREVENTING TOOTH DECAY. URGE YOU TO STAND FIRM AGAINST ATTEMPTS TO
STOP THE FLUORIDATION OF SAN FRANCISCO'S DRINKING WATER.
WILLIAM H MCBEATH MD MPH
EXECUTIVE DIRECTOR

13:01 EST

MGMCMP

DEPARTMENT OF HEALTH SERVICES

714/744 P STREET
SACRAMENTO, CA 95814
(916) 445-1248



June 27, 1985

RECEIVED
JUN 29 1985

David Werdegar, M.D.
Acting Health Officer
San Francisco City and County Health Department
101 Grove Street
San Francisco, CA 94102

DIRECTOR'S OFFICE

Dear Doctor Werdegar:

As part of the Department of Health Services' ongoing program of reviewing and revising departmental policies to keep them relevant to current health issues, I am pleased to announce a revision in the Department's policy on the fluoridation of community water supplies. A copy of the new policy is enclosed for your information.

As noted in the policy, the Department believes that fluoridation represents the single most important commitment a community can make to the oral health of its children and to future generations. It is our hope that communities that are not currently fluoridated will consider this measure as a high priority public health issue, and that fluoridated communities will note the importance of continuing to reinforce to the public the considerable preventive benefits of fluoridation.

If you are interested in further information on fluoridation, please contact Robert Isman, D.D.S., M.P.H., Chief, Dental Health Section, 714 P Street, Room 440, Sacramento, CA 95814, (916) 322-4933.

Sincerely,

for Kenneth W. Kizer, M.D., M.P.H.
Director

Enclosure

DEPARTMENT OF HEALTH SERVICES

714,744 P STREET
SACRAMENTO, CA 95814

CALIFORNIA DEPARTMENT OF HEALTH SERVICES

POLICY ON FLUORIDATION OF COMMUNITY WATER SUPPLIES

Tooth decay is one of California's greatest health problems, affecting 95 percent of the population. Almost nine out of every ten of our children have experienced this disease by age 17. Unfortunately, though the means to prevent up to 65 percent of tooth decay is available to communities in the form of community water fluoridation, most California communities remain unfluoridated.

The Department of Health Services believes that fluoridation of public water supplies is the safest, most economical, most effective, and most equitable means available to a community to prevent tooth decay and to reduce both personal and public expenditures for dental care. Almost forty years of research and extensive community experience have demonstrated beyond a reasonable doubt that:

- o Fluoridation reduces tooth decay by as much as 65 percent
- o Fluoridation can reduce the cost of dental care by as much as 50 percent
- o Fluoridation benefits the entire community, regardless of ability to pay for dental care
- o Fluoridation poses no known health risks to consumers

The Department of Health Services strongly supports the fluoridation of community water supplies to optimal levels wherever the natural level is less than optimal, and stresses that this preventive measure is the single most important commitment a community can make to the oral health of its children and to future generations.

