The Honorable Kenneth Calvert  
Chairman, Subcommittee on  
Energy and Environment  
Committee on Science  
House of Representatives  
Washington, D.C. 20515-6301  

Dear Mr. Calvert:

Thank you for your letter requesting that the Centers for Disease Control and Prevention (CDC) respond to comments and questions regarding the use of fluoride and enamel fluorosis.

CDC has recognized community water fluoridation as one of the great public health achievements of the 20th century in its *Morbidity and Mortality Weekly Report (MMWR)* (copy enclosed). Fluoridation of community drinking water is a major factor responsible for the decline in dental caries (tooth decay) during the second half of the 20th century. Although other fluoride-containing products are available, water fluoridation remains the most equitable and cost-effective method of delivering fluoride to all members of most communities, regardless of age, educational attainment, or income level. The per capita cost of water fluoridation over an entire lifetime can be less than the cost of one dental filling; however, approximately 100 million American children and adults (38 percent of Americans served by public water systems) do not have access to water containing enough fluoride to protect their teeth.

Enclosed are CDC’s responses and copies of related publications, studies, and reports. We appreciate the opportunity to discuss the benefits of water fluoridation and hope this information is helpful.

Sincerely,

Jeffrey P. Koplan, M.D., M.P.H.  
Director

Enclosures
ENCLOSURES

Questions and Answers
*MMWR* Article - Ten Great Public Health Achievements—United States, 1900-1999
*MMWR* Article - Water Fluoridation and Costs of Medicaid Treatment for Dental Decay—
  Louisiana, 1995-1996

Reference List
At-A-Glance - Improving Oral Health: Preventing Unnecessary Disease Among All Americans
Community Water Fluoridation Pamphlet
Water Fluoridation - nature’s way to prevent tooth decay pamphlet
*MMWR* Article - Public Health Focus: Fluoridation of Community Water Systems
*MMWR* Article - Engineering and Administrative Recommendations for Water Fluoridation,
   1995
*MMWR* Article - Knowledge of the Purpose of Community Water Fluoridation – United States, 1990

*MMWR*: Article - Fluoridation of Drinking Water to Prevent Dental Caries
*National Fluoride Plan to Promote Oral Health*, June 1996
Fluoride: The Benefits Can Last a Lifetime
Papers Published by Thomas G. Reeves, M.S., P.E. (CDC Fluoridation Engineer)
*Water Fluoridation - A Manual for Water Plant Operators*
*Water Fluoridation - A Manual for engineers and Technicians*
*Fluoridation Census 1992*
Policy Statement on Community Water Fluoridation—July 22, 1992
Surgeon General Statement on Community Water Fluoridation—December 14, 1995
Correspondence Regarding Fluoride
Periodic Memoranda Over the Past 20 Years
Question 1

Given that normal, healthy teeth do not display fluorosis, does CDC consider the appearance of dental fluorosis in an individual as a sign of too much exposure to fluoride? If not, why not? If so, at what incidence level in the population would CDC consider that the population as a whole is receiving too much fluoride. If CDC does not consider dental fluorosis to be a sign of over exposure, would CDC be comfortable with a 100% incidence of dental fluorosis in America’s children?

Given that normal, healthy teeth do not display fluorosis, does CDC consider the appearance of dental fluorosis in an individual as a sign of too much exposure to fluoride? If not, why not?

Response 1

Yes, CDC considers the appearance of the moderate to severe forms of enamel fluorosis in an individual as a sign of too much exposure to fluoride during the time the enamel of these teeth had formed. Enamel fluorosis is the broad term applied to the range of certain visually detectable changes in opacity (white spots) determined to be areas of fluoride-related hypomineralization; many developmental opacities in enamel are not fluoride-related. This cosmetic condition can occur only during a relatively narrow period of childhood when young children ingest fluoride during susceptible periods of tooth enamel development.

Although the vast majority of enamel fluorosis today is of the mildest form that affects neither cosmetic function nor tooth function, its increased prevalence in both non-fluoridated and fluoridated areas suggests that during the first 6 to 8 years of life (the only time during which fluorosis can develop), the total intake of fluoride has increased since the United States began to use fluoride to prevent tooth decay. Since studies have demonstrated that fluoride intake from water and the diet by children in fluoridated areas has not increased since water fluoridation began in 1945, the increased intake by young children almost certainly derives from the ingestion of fluoride from fluoride dental products, including the inadvertent swallowing of toothpaste and inappropriate prescriptions of fluoride supplements.

Steps have been taken over the past 20 years to limit this condition while preserving the substantial caries preventive benefits for children and adults. In 1979, infant formula manufacturers reduced the amount of fluoride in infant formula. Since 1986, the Environmental Protection Agency regulations require that public water systems with natural fluoride concentrations over two parts per million (ppm) annually notify their customers about use of alternative water sources for children under age 8. In 1992, labels for toothpaste included directions to use a pea-sized amount of toothpaste for children under age 6. In 1994, the
American Dental Association, the American Academy of Pediatrics, and the American Academy of Pediatric Dentistry developed a revised schedule for fluoride supplements, which reduced the recommended amounts for children under age 6. In 1996, the Food and Drug Administration posted further guidance on toothpaste labels to guide parents on proper supervision of young children.

**Question 1A**

If so, at what incidence level in the population would CDC consider that the population as a whole is receiving too much fluoride.

**Response 1A**

The prevalence of moderate to severe enamel fluorosis is not necessarily an indication of the fluoride intake of the population as a whole. Factors that can affect fluoride intake in this young age group (less than age 6), such as inadvertent swallowing of toothpaste, can change with age and do not affect the teeth once they are formed. Early studies of fluoride by H.T. Dean established a “minimal threshold” (1.0 ppm) of fluoride in the water where there was maximal caries (tooth decay) prevention and enamel fluorosis that was “of no public health significance.” At 1.0 ppm there was approximately 10-15 percent prevalence of very mild and mild enamel fluorosis (barely noticeable) as well as a dramatic decrease in dental caries prevalence (greater than 50 percent) and, as a result, a dramatic increase in the number of normal, healthy teeth.

CDC analyzed data from the 1986-1987 National Institute of Dental Research (NIDR) National Survey of Oral Health, a survey designed to measure both the number of decayed, missing, and filled permanent teeth as well as the more exact number of tooth surfaces affected. The overall prevalence of very mild, mild, and moderate and severe forms of enamel fluorosis in U.S. school children was 23.5 percent, of which 18 percent was categorized as very mild, mild 4 percent, and moderate and severe 1.5 percent. This level, 23.5 percent, is considered below the level that would be of public health significance, using the Community Fluorosis Index developed by Dean (Dean 1942). In 2003, CDC expects to update data on enamel fluorosis prevalence and severity after the first phase of the National Health and Examination Survey IV (NHA~S IV).

**Question 1B**

If CDC does not consider dental fluorosis to be a sign of over exposure, would CDC be comfortable with a 100% incidence of dental fluorosis in America’s children?

**Response 1B**

CDC does not find 100 percent prevalence of any form of enamel fluorosis as acceptable. Since the time of the pioneering studies of fluoride in water in the 1920-1930s by Dean, McKay, and others, the existence of a low level of very mild and mild enamel fluorosis was, and still is,
regarded as far outweighed by the substantial reductions in tooth decay and its sequelae due to optimal concentrations of fluoride.

**Question 2**

What is the cost nationwide of repairing fluorosed teeth? If you do not have data, what is CDC’s estimate of the cost, and when will you have the data?

**Response 2**

CDC is unaware of local, State or national data on the cost of repairing fluorosed teeth. It is not currently possible to accurately estimate the cost of fluorosis-related treatment. Current insurance coding for dental procedures does not include the reason for restoration or procedure, and there are other causes of enamel opacities (white spots) that might prompt cosmetic treatment that are not fluoride-related. Also, information regarding the proportion of children with moderate or severe enamel fluorosis who seek elective treatment is not available.

**Question 3**

What is the basis for using the second most damaged tooth as the index for determining whether dental fluorosis is present and its severity? In other words, why must at least two teeth present with fluorosis before the diagnosis is made?

**Response 3**

Because enamel fluorosis typically occurs bilaterally and rarely occurs on only one tooth, one should expect to find similar changes on both sides of the mouth (e.g., both central incisors). Therefore, at least two teeth with opacities are considered when making a differential diagnosis. The scores from Dean’s Index are based on the most severe form recorded for at least two teeth (Dean 1942).

**Question 4**

What is CDC’s view regarding the value of the Precautionary Principle as a basis for public health protection?

**Response 4**

CDC encourages public health decisions that minimize disease and maximize good health. In doing so, CDC considers the accuracy and representativeness of scientific evidence regarding both established and hypothetical risks and benefits.

The precautionary principle focuses on risks for which scientific evidence is lacking. It is most useful for public health protection when confronting newly-identified risks and where the avoidance of risk poses no threat to health. The principle is less applicable when adequate
scientific information on risks has been used for making policy decisions. Also, it does not offer
guidance in situations where interventions to reduce a risk to health would increase another
health risk at the same time. In such situations, the weight of scientific evidence regarding risks
and benefits should be compared before a change is made in public health policy.

**Question 5**

Please provide specific citations for the studies that CDC regards as most persuasive in proving
that ingested fluoride reduces incidence of dental caries? If the 1986-1987 National Survey is
not included, why not? If it is included, please provide the rationale for that study using decayed
or filled surfaces, rather than decayed, missing or filled teeth, as the reported metric? If it is
included, how does CDC account for scatter among fluoridated, partially fluoridated and
non-fluoridated communities with respect to ranking for lowest caries incidence?

Please provide specific citations for the studies that CDC regards as most persuasive in proving
that ingested fluoride reduces incidence of dental caries?

Response ~

Dean HT, Arnold FA, Jay P, Knutson JW. Studies on mass control of dental caries through

Arnold FA Jr., Likins RC, Russell AL, Scott DB. Fifteenth year of the Grand Rapids fluoridation


Hutton WL, Linscott BW, Williams DB. Final report of local studies on water fluoridation in

Dean HT, Jay P, Arnold FA Jr., Elvove E. Domestic water and dental caries II. A study of 2,832
white children ages 12-14 years of eight suburban Chicago communities, including L.

Dean HT, Arnold FA Jr., Elvove E. Domestic water and dental caries. Additional studies of the
relation of fluoride in domestic waters to dental caries experience in 4,425 white children, ages

Health Service papers on dental fluorosis and dental caries; physiological effects, analysis, and


**Question 5A**

If the 1986-1987 National Survey is not included, why not? If it is included, please provide the rationale for that study using decayed or filled surfaces, rather than decayed, missing or filled teeth, as the reported metric?

**Response 5A**

The NIDR’s 1986-1987 National Survey is included in the list provided in Response 5 (Brunelle 1990). The survey was designed to measure both the number of decayed, missing, and filled permanent teeth (DMFT) and the more exact number of tooth surfaces affected (DMFT versus DMPS). This additional level of precision allows for more accurate assessment of effect and analysis by surface type. Because the surface-specific analysis was used, we learned that almost 90 percent of the remaining decay is found in the pits and fissures (chewing surfaces) of children’s teeth; those surfaces that are not as affected by the protective benefit of fluoride.

**Question 5B**

If it is included, how does CDC account for scatter among fluoridated, partially fluoridated and non-fluoridated communities with respect to ranking for lowest caries incidence?

**Response 5B**

CDC continues to analyze the data that indicate a significant “diffusion effect” for non-fluoridated communities. Non-fluoridated communities in regions with a significant number of
fluoridated communities have lower decay rates than non-fluoridated communities in regions with only a few fluoridated cities. This indicates that non-fluoridated communities are also deriving decay-preventive benefits from community water fluoridation by eating foods and drinking beverages prepared and bottled in fluoridated communities. This may account in part for the declining decay rates even in partially fluoridated and non-fluoridated communities.

**Question 6**

Does CDC subscribe to the recommendations of the American Dental Association (ADA) and the American Medical Association (AMA) that children under six months of age should receive no fluoride? If not, why not? If so, what measures does CDC recommend for families living in communities with fluoridated water to prevent infant exposure to fluoride?

**Response 6**

The American Dental Association (ADA) and the American Medical Association (AMA) have not made recommendations stating that children under 6 months should receive “no fluoride.” The ADA, the American Academy of Pediatrics (AAP), and the American Academy of Pediatric Dentistry (AAPD) recommend that children living in non-fluoridated areas receive fluoride supplements beginning at six months of age, but do not restrict intake of fluoride from other sources such as foods, beverages, and water.

**Question 6A**

If so, what measures does CDC recommend for families living in communities with fluoridated water to prevent infant exposure to fluoride?

**Response 6A**

CDC recommends that clinicians follow the ADA, AAP, and AAPD supplement guidelines for children in non-fluoridated areas. In communities with fluoridated water below the 2 ppm level, CDC does not recommend any measures to restrict intake from water.

**Question 7**

How many individuals in the Nation (CDC estimates) fall into the category called “unusually susceptible” in the Toxicological Profile for Fluorides, Hydrogen Fluoride, and Fluoride, published by the Agency for Toxic Substances and Disease Registry (ATSDR)? What measures does CDC recommend for unusually susceptible individuals who live in fluoridated communities?

**Response 7A**

The Toxicological Profile for Fluorides, Hydrogen Fluoride, and Fluorine states that “some subsets of the population may be unusually susceptible to the toxic effects of fluoride and its
compounds. These populations include the elderly; people with deficiencies of calcium, magnesium, and/or vitamin C; and people with cardiovascular and kidney problems.” These populations are hypothesized to be more susceptible because they may have decreased kidney function that affects the clearance of fluoride from the body. Because there are no data available concerning humans, these hypotheses are based on studies conducted on animals. This possible susceptibility is attributed to fluoride at levels greater than that used to fluoridate water (0.7 to 1.2 ppm), or greater than the maximal natural levels allowed by the Environmental Protection Agency (4ppm) for drinking water. CDC cannot estimate the number of people who may be unusually susceptible because we do not know the number of people in the United States who have naturally occurring fluoride in their water at a level greater than 4 ppm.