



MEMORANDUM

TO: Mayor and Council Members
FROM: Rudy Garza, Assistant City Manager 
DATE: November 13, 2009
SUBJECT: Water Fluoridation Report

The following report was developed in response to concerns raised about the practice of water fluoridation during Citizen Communications at City Council meetings.

A team of multidisciplinary experts was enlisted to review the issues related to water fluoridation in Austin. The team was comprised of representation from the Austin Water Utility to explain fluoridation practices in the water treatment process, the City of Austin/Travis County Health and Human Services Department to assess health impacts, the Watershed Protection Department to assess environmental impacts, and the Law Department to define options following a public referendum.

The report findings show that the present level of fluoride in Austin's drinking water has no harmful impact to human health or adverse effect on aquatic life and provides a public benefit in preventing dental decay. The Austin Water Utility follows best practices established for water fluoridation. The state and federal government as well as many medical associations continue to endorse this practice. Lastly, the percentage of the U.S. population being served optimally fluoridated water is increasing with major cities participating.

Please let me know if you have any questions or require additional information.

cc: Marc A. Ott, City Manager
Greg Meszaros, Director, Austin Water Utility
Victoria Li, Director, Watershed Protection Department
David Lurie, Director, Health and Human Services Department
David Smith, City Attorney

Attachment: Water Fluoridation Report



WATER FLUORIDATION REPORT

November 13, 2009

EXECUTIVE SUMMARY

- In 1951, the U.S. Public Health Service began promoting water fluoridation as a public health initiative to reduce and prevent tooth loss and cavities.
 - Percentage of the population being served optimally fluoridated water has continued to grow from 62.1% in 1992 to 69.2% in 2006.
 - Since 2000, 16 additional communities in Texas have initiated water fluoridation.
 - Many major U.S. cities add fluoride to their drinking water, including: Boston, New York, Los Angeles, Chicago, Dallas, San Antonio and Phoenix.
- Today, the Center for Disease Control (CDC) continues to promote water fluoridation and has listed it as one of ten great public health achievements of the 20th century.
 - CDC recommended level of fluoridation is 0.7 – 1.2 mg/l.
- The Texas Department of State Health Services (TDSHS) supports water fluoridation.
- Many national medical associations continue to endorse water fluoridation, including: American Dental Association, American Medical Association, Academy of General Dentists, Surgeon General, American Academy of Family Physicians, and the American Public Health Association.
- The Medical Director of the Austin Travis County Health and Human Service Department concurs with the CDC and other major dental and health groups on supporting community water fluoridation: “Water fluoridation has undergone extensive scientific review to assess its public health benefits and risks. The CDC has also noted that the weight of the peer-reviewed scientific evidence does not support an association between water fluoridation and any adverse health effect or systemic disorder.”
- The City of Austin’s Watershed Protection Department has evaluated impacts of fluoridation on the environment and determined: “At the present levels of fluoride addition, there does not appear to be a strong potential for adverse aquatic life impacts. However, the fluoridation of drinking water does contribute additional fluoride to streams. The scientific evaluation of the need for continued fluoridation should be made on the basis of human health.”
- The Austin Water Utility (AWU) began adding fluoride to the water on February 2, 1973, per public referendum vote.
- AWU follows best practices established for fluoridation.
 - AWU control range is 0.6 – 0.9 mg/l with actual annual average of 0.75 mg/l, within CDC guidelines.
 - U.S. Environmental Protection Agency (EPA) maximum contaminant level to ensure no adverse health effects is 4.0 mg/l. EPA secondary standard for

- AWU inspected by Texas Fluoridation Project, part of TDSHS, for compliance with Engineering and Administrative Recommendation for Water Fluoridation established by CDC.
 - AWU utilizes hydrofluosilic complying with National Sanitation Foundation Standard 60 to ensure purity of product used.
- Fluoride costs have increased annually to a current level of \$7.25/Million Gallons water treated, or 7.9% of total chemical cost.
 - Cost is about 50¢ per person per year for fluoridation and actual cost of \$386,538.94 for 2009. National averages for large systems range from 50¢ to 90¢ per person per year.
 - Estimated dental health cost savings from water fluoridation is \$18.62 per person per year in large communities.
- If the City Council desires to change its decision on fluoridation, it can do so by a simple majority vote of at least 4.

WATER FLUORIDATION REPORT

Background:

In 1951, the U.S. Public Health Service began promoting water fluoridation as a public health initiative to reduce and prevent tooth loss and cavities. By 1960, water fluoridation had become widely used in the U.S.—reaching about 50 million people. The percentage of the population being served optimally fluoridated water has continued to grow from 62.1% of the population in 1992 to 65.0% in 2000 to 69.2% in 2006.

Major U.S. cities with optimally fluoridated water include:

- Boston, MA
- New York City, NY
- Baltimore, MD
- Washington, D.C.
- Atlanta, GA
- Chicago, IL
- Detroit, MI
- Tampa, Jacksonville and Miami, FL
- Austin, Dallas, Houston, and San Antonio, TX
- Phoenix, AZ
- San Diego, Los Angeles and San Francisco, CA
- Seattle, WA

The Center for Disease Control (CDC) identified water fluoridation as one of 10 great public health achievements of the 20th century. *Healthy People 2010*, is the plan that sets health goals for the nation for the year 2010. A *Healthy People 2010* objective is to achieve 75% of the U.S. population served optimally fluoridated water by community water systems. In 2007, Texas had 16.9 million people (78% of the population) being served adjusted or naturally fluoridated water in the optimal range:

- CDC defines optimally fluoridated as 0.7 – 1.2 mg/l of fluoride depending on the average maximum daily air temperature. (CDC, 1995)

TABLE 2. Recommended optimal fluoride levels for community public water supply systems (31,32)

Annual average of maximum daily air temperatures (8,9)		Recommended fluoride concentrations (mg/L)	Recommended control range (mg/L) 0.1-0.5	
F	C		Below	Above
50.0-53.7	10.0-12.0	1.2	1.1	1.7
53.8-58.3	12.1-14.6	1.1	1.0	1.6
58.4-63.8	14.7-17.7	1.0	0.9	1.5
63.9-70.6	17.8-21.4	0.9	0.8	1.4
70.7-79.2	21.5-26.2	0.8	0.7	1.3
79.3-90.5	26.3-32.5	0.7	0.6	1.2

* Based on temperature data obtained for a minimum of 5 years.

- The World Health Organization (WHO) has set a range of 0.5 to 1.0 mg/l.

The national and the state trends in water fluoridation are showing an increase in communities receiving fluoridated water. Since 2000, 16 additional communities in Texas have initiated water fluoridation including the Guadalupe-Blanco River Authority in San Marcos and the San Antonio Water System. (TDSHS, 2007)

The Texas Department of State Health Services (TDSHS) supports water fluoridation of the public water supply. Texas Health Steps Dental Program at TDSHS conducted a study to determine dental cost related to tooth decay and found that children from communities with the recommended levels of fluoride were shown to incur significantly lower Medicaid dental costs as compared to non-fluoridated systems. The average cost of Medicaid dental care per child declined \$24.00 per year in communities with optimally fluoridated water. (TDSHS, 2007)

The practice of water fluoridation to provide optimally fluoridated water is still endorsed by national health associations. Some of the associations endorsing water fluoridation include (endorsements attached):

- Center for Disease Control
- American Dental Association
- American Medical Association
- Academy of General Dentists
- Surgeon General
- American Academy of Family Physicians
- American Public Health Association
- American Water Works Association
- Texas Department of State Health Services

Water Fluoridation in Austin:

The City of Austin held a public referendum on fluoridation in 1972. The referendum passed with the support of the community resulting in Ordinance #720817-11. Austin Water Utility (AWU) began adding fluoride to the water on February 2, 1973. The ordinance requiring fluoridation of the water is still in place today.

The level of fluoride naturally occurring in the raw water supply for the City of Austin is 0.20 to 0.24 mg/l or parts per million, ppm. The Austin Water Utility adjusts the fluoride level to a range of 0.6 – 0.9 mg/l, averaging at about 0.75 mg/l. These values are well within the CDC guidelines for optimally fluoridated water as well as being within the recommended range from WHO.

Austin/Travis County Health and Human Services Perspective:

*Prepared by Philip Huang, M.D., M.P.H., Medical Director/Health Authority,
Austin/Travis County Health and Human Resources Department, November 2009.*

As Health Authority I fully concur with the CDC and other major dental and health groups on supporting community water fluoridation. The CDC has recognized community water fluoridation as one of 10 great public health achievements of the 20th century as fluoridation of community drinking water has been a major factor in the decline of tooth decay in the United States. For over five decades, the American Dental Association has continuously endorsed the fluoridation of community water supplies as a safe and effective measure for preventing tooth decay. Other organizations such as the American Medical Association and the World Health Organization are also strong advocates of fluoridation.

Water fluoridation has undergone extensive scientific review to assess its public health benefits and risks. The CDC has also noted that the weight of the peer-reviewed scientific evidence does not support an association between water fluoridation and any adverse health effect or systemic disorder, including an increased risk for cancer, Down syndrome, heart disease, osteoporosis and bone fracture, immune disorders, low intelligence, renal disorders, Alzheimer disease, or allergic reactions

Adverse effects associated with ingestion of excessive amounts of fluoride are dental and skeletal fluorosis. Dental fluorosis occurs when people ingest more than 30 times the amount of fluoride typically found in fluoridated water. Skeletal Fluorosis occurs when people ingest more than 5 times the level of fluoride typically found in fluoridated water. These diseases occur only after long-term exposure to high levels of fluoride.

Austin Water Utility Water Fluoridation Practices:

Prepared by the Austin Water Utility, November 2009.

The Austin Water Utility (AWU) began fluoridating the public drinking water supply in February 1973 as a result of a public referendum. The issue of fluoridating water is a public health issue; therefore, AWU does not take a position on the practice of water fluoridation. The AWU, in fluoridating the water, follows industry best practices as well as CDC best practices.

Regulations:

Understanding the regulatory environment surrounding water fluoridation can be confusing. Though the CDC has established standards for what they define as optimally fluoridated to prevent dental loss and cavities, they do not have regulatory authority over the community water systems. Community water systems are regulated by the U.S. Environmental Protection Agency (EPA) on the federal level and, in the case of Texas, by the Texas Commission on Environmental Quality (TCEQ) at the state level. In other words, TCEQ is responsible for enforcing EPA Safe Drinking Water Act Regulations and may enforce more stringent regulations.

Where the CDC standard is established to promote a health benefit, the EPA and TCEQ standards are established to ensure no negative health impacts related to exposure over time. In the case of water fluoridation, the EPA has established a maximum contaminant level (MCL) of 4.0 mg/l for fluoride and a secondary standard of 2.0 mg/l. Science data has indicated that above 4.0 mg/l adverse health effects, such as bone fractures or skeletal fluorosis may occur. The secondary standard is based on aesthetic impacts such as dental fluorosis and is not an enforceable standard. EPA does not set a minimum standard. TCEQ requires that all chemicals used in the treatment of drinking water must be NSF/ANSI Standard 60 Certified. NSF/ANSI Standard 60 sets a single product allowable concentration (SPAC) for the fluoride ion in drinking water at 1.2 mg/l, less than one third of the EPA's MCL.

AWU has established a control range for fluoridation of 0.6 – 0.9 mg/l and averages 0.75 mg/l of fluoride in the tap water. AWU's practice is below the EPA's maximum contaminant level, the secondary standard and below the NSF SPAC, yet, within the CDC standard for optimally fluoridated water.

Product:

EPA and our state regulatory agency, Texas Commission on Environmental Quality, TCEQ, require that all chemical used in the production of drinking water meet NSF/ANSI Standard 60 Certification. This allows for a third-party review to ensure purity of products for the control of potential adverse human-health effects from products added directly to the water during treatment, storage and distribution. The fluoride product used by the AWU, hydrofluosilicic acid, meets NSF/ANSI Standard 60. The current vendor has also provided a Gold Seal Certificate from the Water Quality Association certifying that their product was independently tested and certified in accordance with NSF/ANSI Standard 60.

It should be noted that the NSF/ANSI Standard 60 sets a single product allowable concentration (SPAC) for the fluoride ion in drinking water at 1.2 mg/l, less than one third of the EPA’s MCL. (NSF, 2008) AWU is in compliance with this more stringent level.

Cost:

The cost for fluoride has been increasing annually since 2006. Though the cost per pound of product has increased by 226%, the percent of the overall chemical budget has only increased by 132%. Most of the chemical costs have increased faster than inflation over the past five years. The cost to maintain the fluoride system at the water treatment plants including labor and parts is \$1,500 per year per plant.

Year	Cost/lb F	Actual Cost	MG Treated	Cost/MG	Total Chemical Cost %
2006	\$0.1015	\$116,006.64	56,602	\$2.05	3.41%
2007	\$0.1540	\$146,605.69	45,868	\$3.20	4.22%
2008	\$0.2350	\$246,850.20	53,066	\$4.65	5.99%
2009	\$0.3310	\$386,538.94	53,331	\$7.25	7.90%

Austin serves a population of over 780,000—the cost to fluoridate equates to about 50¢ per person per year for fluoridation. National averages for large systems range from 68¢ to 90¢ per person per year (Surgeon General Report, 2000). The annual per person cost savings from fluoridation in large systems is estimated at \$18.62 per person per year. (Griffin, et. al., 2001)

Fluoride Feed System:

Tanker trucks deliver fluosilicic acid to the plants in bulk solutions as a 25% concentration of H₂SiF₆ (this equates to about a 20% fluoride-ion concentration). Tank padding is used to transfer the fluosilicic acid to two 6,800-gallon cross-linked polyethylene storage tanks in the fluoride storage area. An ultrasonic level-indicating transmitter monitors the level of each of the fluosilicic acid storage tanks. The plant’s control system records and trends each storage tank level for historical and inventory-control purposes. Two hydraulic diaphragm pumps (one operating, one standby) feed the acid directly from the storage tanks to the fluoride injection point. The metering pumps are variable speed, paced proportional to the water-flow meter reading. The chemical delivery area has dedicated storage-tank fill lines and an emergency-alarm system. Dilution water is added to the fluosilicic acid after the metering pumps.

The Texas Fluoridation Project is located in the Environmental and Injury Epidemiology and Toxicology Branch in the Epidemiology and Disease Surveillance Unit at the Texas Department of State Health Services. The Texas Fluoridation Project was created to meet the guidelines established by CDC for state community water fluoridation programs including site inspections of fluoridation facilities at public water systems. These inspections follow Texas’ best-practices guidance set forth in *the CDC Engineering and Administrative Recommendations for Water Fluoridation*. The inspections provide an

opportunity to identify design and operational problems; as well as, assess the safety and effectiveness of the operation. (TDSHS, 2007) The AWU fluoridation facilities have been inspected by the Texas Fluoridation Project of the TDSHS. AWU follows best practices in its fluoride feed systems.

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Pizzo G; Piscopo MR; Pizzo I; Giuliana G, 2007. “Community water fluoridation and caries prevention: a critical review”. *Clinical Oral Investigations* 11(3): 189-193.

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Environmental Impacts Developed by the City of Austin Watershed Protection Department:

Fluoride and aquatic environmental impacts in Austin

*Prepared by the City of Austin Watershed Protection Department
SR-09-05, October 2009*

Abstract

Adverse impacts to aquatic life in Austin streams and rivers from use of fluoride in drinking water treatment are evaluated using relevant effect levels versus measured and predicted instream concentrations. At the present levels of fluoride addition, there does not appear to be a strong potential for adverse aquatic life impacts. However, the fluoridation of drinking water does contribute additional fluoride to streams. The scientific evaluation of the need for continued fluoridation should be made on the basis of human health.

Introduction

Fluoride, though ubiquitous and naturally occurring in freshwater systems (ATSDR 1993), has been demonstrated to exert adverse impacts on aquatic life at elevated concentrations. This study compares the predicted and measured concentrations of fluoride in Austin's streams and rivers against relevant aquatic life effect levels. Mass balance modeling methods have been used to evaluate resulting instream concentrations of fluoride in local and regional scales (Osterman 1990). Health benefits and concerns from human consumption of fluoridated water must be considered separately by human health authorities.

Fluoridated drinking water may enter the aquatic environment primarily via potable water landscape irrigation, leaking drinking water supply infrastructure and through treated wastewater effluent discharge (Osterman 1990). Significant amounts of fluoride can be removed in secondary wastewater treatment processes (Masuda 1964). Fluoride is not expected to concentrate in groundwater, and is likely to be filtered out as water infiltrates through soils (Pescod 1992). Fluoride is not readily leached from soils, and due to low solubility in soils is typically less available to terrestrial plants (WHO 2002).

Fluoride may be permanently bioaccumulative in some tissues like bone and scales (Neuhold and Sigler 1960), although large-scale impacts of bio-magnification in aquatic food webs is unknown (ATSDR 1993). Fluoride toxicity varies inversely with calcium hardness (Smith et al 1985, WHO 2002) and temperature. Fluoride toxicity to aquatic organisms is highly species specific.

The Austin Water Utility maintains fluoride concentrations in finished drinking water with a control range of 0.6 to 0.8 mg/L. Fluoride additions at drinking water plants account for existing fluoride inputs to insure fluoridation remains within acceptable control limits. For the purposes of this review, a conservative 0.8 mg/L will be used to represent finished drinking water fluoride concentrations that could be released to the aquatic environment through either leaking water supply infrastructure or irrigation in the aquatic environments upstream of Austin Water Utility wastewater effluent outfalls. Impacts of fluoride in Austin's wastewater effluent on the Colorado River are evaluated separately.

The Austin Water Utility is currently permitted by the Texas Commission on Environmental Quality to discharge approximately 150 mgd (232 ft³/s) of treated wastewater to the Colorado River. The permitted flow rates are greater than actual flow rates, although permitted flow rates are considered for conservative estimates. Although fluoride concentrations are likely to be reduced by existing wastewater treatment processes, fluoride concentrations are expected to be

higher in raw wastewater influents versus targeted drinking water concentrations. The Austin Water Utility does measure fluoride concentrations in treated effluent, and these measurements were included directly in this assessment. Ambient flows in the Colorado River downstream of Austin and upstream of any Austin municipal wastewater effluent outfall are represented by the United States Geological Survey gauge at the US 183 bridge (USGS 08158000).

Environmental Effect Levels

Aquatic life lethal concentration for 50% of test organisms (LC₅₀) and other effect levels for fluoride in published literature vary greatly, and experimental conditions may not mimic regional differences in covariates like hardness and temperature. Some of the lowest available relevant effect levels are summarized in Table 1. Trout and salmon are likely to be more sensitive than other fish and are not present in our warm-water river systems, but are included as a lower reference point.

Table 1. Selected lowest available relevant effect levels for freshwater aquatic organisms from literature.

Organism	Endpoint	Fluoride Conc. (mg/L)	Reference
<i>Rana pipiens</i> (leopard frog)	30-day LOEC	5	Kaplan et al 1964
<i>Rana pipiens</i> (leopard frog)	development effects	1.0*	Kuusisto and Telkka 1961
<i>Chlorella</i> (algae)	growth effects	2.0	Groth 1975
<i>Oncorhynchus mykiss</i> (rainbow trout)	20-day LC ₅₀	4.8	Angelovic et al 1961
<i>Musculium transversum</i> (fingernail clam)	8-wk LC ₅₀	2.8	WHO 2002
<i>Nitzschia palea</i> (diatom)	some growth enhancement	> 30	Joy and Balakrishnan 1990
<i>Hydropsyche bronta</i> (caddisfly)	96-hr LC ₅₀	17	Camargo et al 1992
<i>Mysidopsis bahia</i> (mysid shrimp)	96-hr LC ₅₀	10.5	LeBlanc 1984
<i>Pimephales promelas</i> (fathead minnow)	96-hr LC ₅₀	315	Smith et al 1985

*observed effects but no statistical verification

There are no State of Texas or U.S. Environmental Protection Agency (EPA) regulatory criteria for fluoride for the protection of aquatic organisms, although EPA human health drinking water maximum contaminant levels (MCL) are 4.0 mg/L with a secondary MCL of 2.0 mg/L. Lower recommended ambient fluoride levels (0.2 mg/L – 0.3 mg/L) for aquatic life have been established by the Government of British Columbia Ministry of Environment, although naturally occurring fluoride levels and water hardness are significantly lower in this area (EPD 1990). Aquatic organisms are likely to adapt to natural background fluoride concentrations, with brown trout found in the Madison River in Yellowstone National Park despite natural fluoride levels exceeding 12 mg/L (Neuhold and Sigler 1960).

Based on a review of available environmental effect levels for aquatic systems, it would appear that a lowest observed effect levels (LOEC) of 2.0 mg/L fluoride would be a reasonable screening

value and that a no observed adverse effect concentration (NOEC) of 1.0 mg/L would be highly conservative.

Monitoring Data

The City of Austin and the USGS have collected more than 3,455 measurements of fluoride in the Colorado River from Lake Travis downstream to Lady Bird Lake (upstream of Austin's wastewater effluent discharges) since 1967, primarily analyzed by SM 4500 (APHA 2005). Ambient levels of fluoride in aquatic systems vary greatly depending on regional-specific factors (ATSDR 1993). Analyses are mixed with fluoride measurements in both the dissolved and total fractions.

Based on available monitoring data, the average background fluoride concentrations in the Colorado River through Austin is 0.21 mg/L (stdev = 0.04). The 99th percentile of fluoride measurements in the Colorado River through Austin is 0.31 mg/L, with a maximum recorded value (Lady Bird Lake at Longhorn Dam, 19 Jan 1988) of 0.7 mg/L. Flow patterns through the Colorado River change drastically based on downstream agricultural demands, with summer release periods yielding flows typically an order of magnitude higher than winter non-release periods. There is no statistically significant difference in mean fluoride concentrations in the Colorado River through Austin between the high flow release (0.21 mg/L±0.03, n=2196) and low flow non-release period (0.21 mg/L±0.04, n=1259), suggesting that even with minimal dilution finished drinking water releases are not altering fluoride concentrations in source waters.

In addition to ambient fluoride measurements in the Colorado River, there are 1,334 fluoride measurements in surface waters from 1968 to present at 69 different locations throughout Austin. As in Austin's drinking water sources, the median fluoride concentration is 0.2 mg/L with more than 97% of all measurements less than the 1.0 mg/L NOEC. There are 31 measurements with fluoride values above 1.0 mg/L, and all but 2 of these 31 measurements were historical values from the mouth of Walnut Creek downstream of the Walnut Creek wastewater treatment facility discharge (and prior to the relocation of that outfall directly to the Colorado River). For larger watersheds that transition longitudinally from lesser developed headwaters to more urban lower reaches (e.g. Barton Creek, Bull Creek and Onion Creek), there are no differences in fluoride concentrations with increasing development. Lawn irrigation and drinking water supply line leaks or breaks are expected to increase with density and age of development. Background concentrations of fluoride in lesser developed creeks are consistent with mean values in the Colorado River through Austin (0.2 mg/L).

Approximately 1,370 measurements of fluoride in 137 groundwater springs across Austin were assessed. Fluoride in springs is generally consistent with background levels measured in surface waters (mean=0.22 mg/L±0.15), with no measurements greater than 2.0 mg/L and 99% of all measurements less than 0.8 mg/L. Although ion concentrations in groundwater springs have been demonstrated to increase with development (Herrington et al 2007), this is not necessarily indicative of fluoridated drinking water impacts to groundwater. Fluoride concentrations in some rural springs (e.g., Holman Hollow, n=21, mean=0.2 mg/L ± 0.05) are not significantly different from fluoride in some springs in older urban areas (e.g., Stillhouse Hollow, n=29, mean=0.16 mg/L ± 0.1). However, fluoride concentrations may be slightly elevated in springs strongly influenced by irrigation in the contributing zones with treated wastewater effluent (e.g., Driving Range Spring, n=22, mean=0.31 mg/L ± 0.11). Fluoride concentrations may be increasing over time in Barton Springs (Hiers and Herrington 2008), although the maximum concentrations measured to date (n=257) is 0.65 mg/L and less than the NOEC.

Fluoride measurements in 125 different groundwater wells in Austin (n=834, mean=0.44 mg/L \pm 0.62) in general yield higher concentrations than observed in groundwater springs, with some wells influenced by the Trinity Aquifer yielding fluoride values above the drinking water MCL of 4.0 mg/L. The majority of the measured values (96%), however, were below the secondary drinking water MCL of 2.0 mg/L. Geologic variations must be accounted for via multivariate analyses like Piper plotting and examination of the formation in which the groundwater is being evaluated to fully investigate differences in groundwater source contributions. A review of fluoride in groundwater previously conducted (Hauwert and Vickers 1994) identified the strong influences of interactions with minerals naturally occurring in Glen Rose limestone or leakage from the Trinity Aquifer on background fluoride levels in groundwater. Despite this variation, the general consistency of spring fluoride samples in Edwards limestone at concentrations less than the NOEC again suggest low potential for adverse environmental impacts. Measurements in cave drips, or surface waters that have infiltrated through the overlaying soil/rock matrix to underground conduits, appear to confirm the reduction of water column fluoride by interactions with soils as measured concentrations (n=49, mean=0.05 mg/L \pm 0.03) are less than surface background levels.

Colorado River flows estimated from USGS gauge 08158000 from 1992 to 2009 (to reflect current water management policies) yield median values of 1,050 ft³/s and seven-day average low flows with 2-year return intervals (7Q2) of 146 ft³/s. The full permitted volume of wastewater discharge from the City of Austin of 150 mgd (232 ft³/s) is approximately equivalent to the 16th percentile of flow. Thus, less than 16% of the period of record would yield a dilution factor of less than 1:1. These low flow periods typically occur during dry rainfall years in the winter months when demand from downstream agricultural uses is lower. There have been approximately 40 measurements of fluoride in Austin's wastewater effluent (prior to discharge) from the two major treatment plants which discharge directly to the Colorado River since 2001. The mean fluoride concentration in the treated effluent from the major plants was approximately 2.10 (\pm 0.61) mg/L (non-detect values taken at detection limits for conservative estimate). With dilution at 7Q2 flow values, the resulting instream concentration is predicted by mass balance to be 1.37 mg/L, and at median flows the fluoride concentration is predicted to be 0.55 mg/L. More than 75% of the year fluoride concentrations from Austin's wastewater effluent are predicted to be diluted to 1.0 mg/L or less, and Colorado River flows would have to be less than 13 ft³/s for the resulting instream concentrations to be 2.0 mg/L or higher after mixing. Daily average flow in the Colorado River has only been less than 13 ft³/s on 18 days since 1900, and only one day since the current flow management policy was instituted in 1992 (representing less than 0.02% of the record). Based on average fluoride concentrations in the effluent and dilution, wastewater effluent impacts from fluoride on the Colorado River again do not appear to have a strong potential for negative aquatic life impacts.

As an additional assessment of fluoride concentrations in the Colorado River downstream of Austin's wastewater discharges, the USGS historically measured fluoride upstream of Bastrop (USGS site 08159200), with 171 measurements of dissolved fluoride from 1968 to 1994. The average value was 0.35 mg/L (\pm 0.15), although the time period is clearly not reflective of the most current conditions. The maximum value was 0.9 mg/L (10 Dec 1968), and 99% of all values were less than 0.83 mg/L. Although wastewater effluent may be slightly increasing the concentration of fluoride in the Colorado River, values are still expected to be below the LOEC of 2.0 mg/L for all nominal conditions.

In comparison to the 0.8 mg/L targeted fluoridation concentration of drinking water, ambient monitoring data particularly in surface waters yield lower background concentrations. Although the release of finished drinking water to aquatic environments could increase the concentration of

fluoride in Austin streams (and would definitely increase the mass loading of fluoride), there is no clear indication that ambient fluoride concentrations are being noticeably increased. By mass balance there would be less than or equal to 0.8 mg/L fluoride as any existing ambient flows (which would have lower background concentrations of fluoride) would dilute the drinking water fluoride. Comparison of the maximum predicted 0.8 mg/L fluoride concentrations in receiving streams as well as ambient monitoring data to the effects levels reviewed and the suggested NOEC of 1.0 mg/L fluoride clearly demonstrates the low potential for adverse environmental impacts to aquatic systems in the Austin area.

Discussion

Fluoride increases in ambient water is not likely to have adverse impact in Austin streams at current levels. The finding of a lack of obvious potential for environmental degradation is consistent with other national reviews (Osterman 1990; Pollick 2004). However, it is likely that some mass loading increase of fluoride would occur as a result finished drinking water releases to aquatic environments. Minimization of anthropogenic sources of contamination to aquatic systems is environmentally preferable as in-situ cumulative and synergistic impacts may not always be fully understood. Additionally, the processing and transport of fluoride may have additional indirect environmental effects. Thus, from a purely environmental protection standpoint there is no reason to fluoridate drinking water. The decision to fluoridate drinking water should be based on the comparison of human health benefits from reduced dental cavities versus any potential human health risks (Kumar 2008).

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Legal Issues:

Prepared by the City of Austin Law Department, November 2009

On August 8, 1972, the City Council passed a resolution to hold an election on the proposition of “fluoridation of the public water supply of the City of Austin.” The election was held on September 9, 1972, and the results were “for” fluoridation 16,964, and “against” fluoridation 12,287 (approximately a 58%-42% split for and against). As a result, Council directed that the City begin to fluoridate the City’s public water supply.

This election was not conducted in response to a petition under the City Charter, Article IV, section 2, and fluoridation was approved by Council resolution. Therefore, if the City Council desires to change its decision on fluoridation, it can do so by a simple majority vote of at least 4.