

# APPENDIX A-1

## Fort Collins Fluoride Technical Study Group Reference List

### “TIER ONE”

Reviews by widely recognized national and international public health agencies

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### **Materials Submitted by Members of the Public**

These were reviewed by at least 3 members of the FTSG. Some submissions (including published and peer-reviewed journal articles) are included above. This list represents a best-possible representation of submitted materials. In some cases proper referencing information was lacking and this list does not conform to the APA Publication Manual guidelines.

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## APPENDIX A-2

### Fluoride Mass Balance Calculations

#### City of Fort Collins Water Treatment Facility

#### **Background**

The amount (pounds/day) of fluorosilicic acid (HFS) added at the Water Treatment Facility is continuously measured and controlled by the HFS chemical feed system in order to ensure the proper dosing of fluoride to the finished water. The concentration (mg/L) of fluoride ion in the raw and finished water is measured by the Water Treatment Facility Process Control Lab in order to verify the dosing of fluoride to the finished water. The question being addressed here is:

Does the concentration of fluoride ion measured by the Process Control Lab agree with the quantity of HFS that is dosed to the finished water?

This question is answered using process data for the month of February 2003. Note that the Process Control Lab uses an ion-selective electrode to determine the concentration of fluoride ions (F<sup>-</sup>) in water samples (Standard Method 4500-F<sup>-</sup> C).

#### **Fluorosilicic Acid (HFS) Properties**

- Commercial Purity = 24.4% (the commercial product is 24.4% H<sub>2</sub>SiF<sub>6</sub> and 75.6% water)
- Fluoride Ion Purity = 79.2% (pure H<sub>2</sub>SiF<sub>6</sub> is 79.2% F by weight)

#### **Water Treatment Facility Process Data for February 2003**

- Total finished water produced during the month = 434.6 million gallons (MG)
- Total HFS added during the month = 15,381 pounds
- Measured fluoride ion in raw water = 0.20 mg/L (monthly avg., measured by Process Control Lab)
- Measured fluoride ion in the finished water = 1.00 mg/L (monthly avg. at Sample Station 2, measured by Process Control Lab)
- Concentration (mg/L) of added fluoride ions (from Process Control Lab measurements)
  - = Fluoride in Finished Water – Fluoride in Raw Water
  - = 1.00 mg/L - 0.20 mg/L
  - = 0.80 mg/L

#### **Concentration of added fluoride ions determined from known quantity of added HFS**

$$\begin{aligned}
 \text{Mass of F}^- \text{ added} &= (\text{pounds of HFS added}) \times (\text{Commercial Purity}) \times (\text{Fluoride Ion Purity}) \\
 &= (15,381 \text{ pounds}) \times (0.244) \times (0.792) \\
 &= 2,972 \text{ pounds of fluoride added during the month of Feb. 2003}
 \end{aligned}$$

$$\begin{aligned}
 \text{Concentration of added F}^- \text{ in the finished water (mg/L)} &= \frac{(\text{pounds of added F}) \times (1 \text{ mg/L})}{(\text{Volume of Finished Water, MG}) \times (8.34 \text{ lb/MG})} \\
 &= \frac{(2,972 \text{ lb})}{[(434.6 \text{ MG}) \times (8.34 \text{ lb L/MG mg})]} \\
 &= 0.82 \text{ mg/L}
 \end{aligned}$$

**Compare concentration of fluoride ion measured by the Process Control Lab to the concentration determined using the known quantity of HFS dosed to the finished water**

Concentration determined by Process Control Lab = 0.80 mg/L  
Concentration determined from known quantity of added HFS = 0.82 mg/L

The two values differ by less than 3 percent, which is a very acceptable margin of error. These values show that the fluoride ion concentration detected by the lab agrees with the quantity of HFS that is dosed to the finished water. The data further indicate that the hydrolysis of HFS to form fluoride ions is essentially 100% complete before water leaves the Water Treatment Facility.