

Community Water Fluoridation

Community water fluoridation is the deliberate adjustment of the natural trace element fluoride to promote the public's health through the prevention of dental caries. Fluoride is found naturally in all soils and existing water supplies. It is also present in animal and plant food consumed by people.

Hailed as one of the ten greatest achievements in public health in the 20th century by former Surgeon General David Satcher, water fluoridation continues to be one of the safest, most cost effective prevention programs. It has the potential to benefit all age groups and all socioeconomic strata, including the lowest, which has the highest caries prevalence and is least able to afford preventive and restorative services. (1) Community water fluoridation is also the most cost-effective of all community-based caries preventive methods. An effective community water fluoridation program should be the cornerstone of all public oral health programs. The efficiency of drinking water fluoridation in reducing dental caries has been demonstrated in surveys conducted in the United States as well as several other countries for the past 50 years. Early water fluoridation studies reported caries reductions of approximately 40 to 60% for the permanent dentition and slightly lower reductions for deciduous teeth. Recent studies have found a smaller difference in the caries prevalence between optimally fluoridated and fluoride-deficient communities. (1) In American Indian/Alaska Native (AI/AN) populations the expected reductions in disease may be even greater, given the high caries rates.

History of Community Water Fluoridation

- 1908–Dr. Frederick McKay, Colorado Springs, CO discovered “brown stain”
- 1931–Alcoa Company chemist identifies fluoride in samples
- 1931–Trendley Dean starts at NIH as lone dentist, to investigate mottled enamel cases
- Mid-1930s–Dean reported inverse relationship between fluorosis and caries
- 21 Cities Study–IL, CO, OH, IN–established 1.0 ppm F threshold
- 1945–Grand Rapids–fluoridation first began

How Does Fluoride Work?

- It reduces the solubility of enamel in acid – fluorapatite
- It reduces ability of plaque organisms to produce acid
- It promotes remineralization or repair of enamel

Fluoridation Facts

- *All* water sources contain some fluoride.
- Optimal water fluoridation is 0.7 to 1.2 ppm (CDC WFRS 0.9-1.2).
- No difference in effectiveness between naturally occurring and “artificially added” fluoride.

- Fluoridation studies have shown a 44–60% reduction in caries prevalence in fluoridated communities.
- Fluoride not only protects children from caries, but also adults (including root caries).
- Cost effective.
 - Costs about 50 cents per person, per year to fluoridate
 - Cost savings—for every \$1 spent, \$38 saved
- “Nearly all tooth decay can be prevented when fluoridation is combined with dental sealants and other fluoride products, such as toothpaste” (from CDC).

Fluoridation Controversies

- “The overwhelming weight of scientific evidence indicates that fluoridation...is both safe and effective (ADA).
 - No association between fluoride and bone cancer
 - Fluoride does not affect human enzyme activity
 - No confirmed reports of fluoride allergies
 - No relationship between cancer rates and fluoride
 - No evidence linking fluoride exposure to AIDS
 - Fluoridated drinking water is not a genetic hazard
 - No relationship between fluoride and Down’s Syndrome
 - No association between fluoride and neurological problems
 - No link between fluoride and Alzheimer’s disease
 - Fluoridated water does not cause or worsen kidney disease
 - Drinking fluoridated water is not a risk factor for heart disease
 - Optimal fluoridation does not affect drinking water quality

Things You Can Do...

- Educate your community about the benefits of water fluoridation.
- Learn more about fluoridation—get the facts, so you can dispel the myths about fluoridation.

Additional Resources

http://www.ada.org/prof/resources/topics/topics_fluoridation_resources.pdf

http://www.ada.org/public/topics/fluoride/facts/fluoridation_facts.pdf

<http://www.ada.org/prof/resources/topics/fluoride.asp#statements>

History of Water Fluoridation in the IHS

In 1959, Public Law 86-121, the Indian Sanitation Facilities Act was passed. This piece of legislation was probably one of the most important documents for Indian people. The law provided for the installation of water systems for Native American communities upon Tribal request. Sanitary water facilities became a reality through this legislation.

In 1981, the IHS established a surveillance system to monitor 325 systems that had fluoridation equipment. There was a two percent compliance rate at that time.

In 1985, Area and Service Unit Fluoridation Teams were established. These teams consisted of representatives from a variety of disciplines including: dental, environmental health and engineering, health education, pediatrics, public health nursing, pharmacy, and, of course, the water operator or water utility. A policy for the implementation and operation of the water fluoridation program was also developed at this time.

In May 1992, a fluoride overfeed occurred at the predominantly Native Alaskan village of Hooper Bay. An estimated 296 people became ill and one person died. (4) This incident had a profound effect on fluoridation throughout Indian Country. Many tribally-owned and operated water systems discontinued fluoridation.

In 1995, the Centers for Disease Control and Prevention (CDC), with input from IHS, developed a manual entitled, "Engineering and Administrative Recommendations for Water Fluoridation (EARWF)" (6). The EARWF is an excellent resource that emphasizes fluoridation safety and the recommendations can easily be adapted for use by tribal water utilities.

The current IHS fluoridation policy is Indian Health Service Circular No. 99-01, *Water Fluoridation Policy Issuance* and is available through the Area or Headquarters Dental or Office of Environmental Health and Engineering (OEHE) programs. It should be read by all dental care providers. (5)

Recommendations for Fluoridated Community Water Systems

Administration

The community or water system owner, with professional training and technical assistance, is primarily responsible for assuring the ongoing operation of fluoridation equipment and maintaining surveillance and records of operation. A reliable, frequent monitoring and surveillance process must be in place to maximize the benefit of water fluoridation. Training of water operators is also a critical element in assuring AI/AN communities the dental benefits of community water fluoridation.

Fluoridation teams should be established at each Service Unit or Tribal program and at the Area and Headquarters levels. Each team should include water plant operators, Tribal representatives, dental professionals, engineers, sanitarians and other community health workers involved in water fluoridation. Regular meetings of the fluoridation teams provide a good means of identifying problems in the fluoridation program and developing strategies to solve these problems.

Following is a list of activities in which the fluoridation team should be involved:

1. Review current water fluoridation system practices and identify any problem areas.
2. Work to improve fluoridation at problematic systems and delegate responsibilities to each team member.
3. Encourage and support training to increase both technical and public relations skills.
4. Educate the community and market the benefits of water fluoridation through:
 - a. Group presentations (Tribal health groups, PTA, Head Start, WIC)
 - b. Media (TV, radio, newspapers)
 - c. Posting the water fluoridation levels in public places (assuming the water utility approves)
 - d. Educating the medical staff
5. Maintain communication with the state dental and state drinking water programs regarding aspects of water fluoridation.

Fluoride Testing Requirements/Recommendations:

Most tribally-owned and operated public water systems (PWS) are regulated by the U.S. Environmental Protection Agency (EPA). The EPA does not require routine (i.e. daily) monitoring for fluoride. State-regulated PWSs have specific requirements for fluoride monitoring and many AI/AN people are served by state-regulated PWSs. IHS has no regulatory function but strongly recommends fluoridation practices that closely follow the EARWF guidelines. Those recommendations include:

1. Daily monitoring of the fluoride level from a representative sampling location in the distribution system.
2. Monthly split samples with a certified laboratory.
3. Performance of dosage calculations.
4. Annual raw water (i.e., water that has not been treated) sampling and testing for fluoride content. The analysis should be done by a certified laboratory.

IHS generally considers a water system optimally fluoridated if the following criteria are met:

1. The fluoride concentration is monitored daily.
2. The monthly average fluoride concentration falls within the control range.
3. At least 75% of daily water samples fall within the control range.
4. Split samples are submitted to a certified lab at least monthly.

- At least 75% of monthly split samples taken by the PWS during the calendar year shall agree with the Lab results within the split sample tolerance of +/- 0.2 ppm.

The criteria for optimal fluoridation may differ across the IHS areas, and even within some areas. Optimal fluoridation criteria should be developed in consultation with tribes and their Tribal water utilities.

IHS personnel should encourage tribal water utilities to participate in the CDC Water Fluoridation Reporting System (WFRS). State-by-State statistics from WFRS can be found at <http://apps.nccd.cdc.gov/MWF/Index.asp>.

Colorimeter (SPADNS Method)

- The colorimetric method (SPADNS) of fluoride analysis is based on a reaction in which a deep color (from zirconium in dye) turns lighter in the presence of fluoride (fluoride removes zirconium). The colorimetric method can be used where no interference occurs or where the interferences are consistent (e.g., from iron, chloride, phosphate, sulfate or color). Consistent interferences can be accounted for by collecting a split sample and comparing the colorimetric results with results provided for by Lab personnel. State laboratory personnel, and the water plant operator can then make the appropriate adjustment.
- The colorimetric method (SPADNS) of fluoride analysis is applicable for daily testing of fluoride levels in the range 0.1 to 2.0 ppm. Beyond this range, dilutions must be made using deionized water to obtain accurate measures of the fluoride concentration.
- Colorimeters are easily transported and ideal for use in the field.

Specific Ion Meter (Electrode Method)

The electrode method is capable of measuring fluoride concentrations from 0.1 to 10 ppm and is not subject to the interferences associated with the colorimetric method. Specific ion meters are more difficult to use in a field setting than a colorimeter.

The fluoride level in water systems should be maintained as close to the recommended concentrations as possible. These values are based on annual average temperatures (Table 1).

Table 1: Recommended Optimal Fluoride Levels for Community Public Water Supply Systems (5)

Annual Average of Maximum Daily Temperatures F	Recommended Fluoride Conc. (ppm)	Recommended Control Range of Fluoride Conc. (ppm)
40.0 – 53.7	1.2	1.1–1.7
53.8 – 58.3	1.1	1.0–1.6
58.4 – 63.8	1.0	0.9–1.5
63.9 – 70.6	0.9	0.8–1.4
70.7 – 79.2	0.8	0.7–1.3

Annual Average of Maximum Daily Temperatures F	Recommended Fluoride Conc. (ppm)	Recommended Control Range of Fluoride Conc. (ppm)
79.3 – 90.5	0.7	0.6–1.2

Technical Assistance and Training

The IHS OEH&E Program provides technical assistance where surveillance reveals a problem and/or when it is requested by a tribe or the community. Ongoing training for the operators is also provided. The CDC also provides training for water system operators and others involved in the fluoridation programs. The CDC has developed manuals for operators as well as engineers and technicians. (7)

Safety of Community Water Fluoridation

Community water fluoridation is a safe and cost-effective method to ensure the oral health of all people. Technical requirements are outlined in the EARWF and they should be followed by all tribally-managed fluoridated water systems. These guidelines also establish recommended emergency procedures for fluoride overfeeds. Specific actions should be taken when equipment malfunctions or an adverse event occurs in a community public water supply system that causes a fluoride chemical overfeed (see Table 2).

TABLE 2: Recommended Fluoride Overfeed Actions for Community Water Systems (4)

Fluoride Level	Actions Recommended
0.1 mg/L above control range to 2.0 mg/L	Leave the fluoridation system on. Determine malfunction and repair.
2.1 mg/L to 4.0 mg/L	Leave the fluoridation system on. Determine malfunction and repair. Notify the water plant operator supervisor and report the incident to the appropriate regulatory agency.
4.1 mg/L to 10.0 mg/L	Determine malfunction and immediately attempt repair. If the problem is not found and corrected quickly, turn off the fluoridated system. Notify the water plant operator supervisor and report the incident to the appropriate regulatory agency. Take water samples at several points in the distribution system and test the fluoride content. Retest if results are still high. Determine malfunction and repair. Then, with supervisor's permission, restart the fluoridation system.
10.1 mg/L or greater	Turn off the fluoridation system immediately. Notify the water plant operator supervisor and report the incident immediately to the appropriate regulatory agency and follow their instructions.

Fluoride Level	Actions Recommended
	Take water samples at several points in the distribution system and test the fluoride content. Retest if results are still high. Save part of each sample for the state laboratory to test. Determine malfunction and repair. Then, with supervisor's and the state's permission, restart the fluoridation system.

Most overfeeds do not pose an immediate health risk; however, some fluoride levels can be high enough to cause immediate health problems. All overfeeds should be corrected immediately because some have the potential to cause serious long-term health effects. (4)

When a fluoride test result is at or near the top end of the analyzer scale, the water sample must be diluted and retested to ensure that high fluoride levels are accurately measured.

CDC has also published recommendations for treatment if a person ingests dry fluoride chemicals (NaF and Na₂SiF₆) (see Table 3).

Table 3: Recommended Emergency Treatment for Persons Who Ingest Dry Fluoride Chemicals NaF and Na₂SiF₆ (4)

Milligrams Fluoride Ion (mg) Ingested Per Body Weight (kg)*	Treatment
<5.0 mg of fluoride ion/kg	Give calcium (milk) orally to relieve gastrointestinal symptoms. Observe for 2–4 hours. (A can of evaporated milk should be available at all times to use for emergency treatment.) Induced vomiting is not necessary.
>5.0 mg of fluoride ion/kg	Move the person away from any contact with fluoride and keep him or her warm. Call the Poison Control Center. If the person is conscious, induce vomiting by rubbing the back of the person's throat with either a spoon or your finger or giving the person syrup of ipecac. To prevent aspiration of vomitus, the person should be placed face down with the head lower than the body. Give the person a glass of milk or any source of soluble calcium (i.e., 5% calcium gluconate or calcium lactate solution). Take the person to the hospital as quickly as possible.
*Average age/weight: 0–2 years/0–15 kg; 3–5 years/15–20 kg; 6–8 years/20–23 kg; 9–15 years/23–45 kg; 15–21 years and higher/45–70 kg.	

Table 4: Recommended Emergency Treatment for Persons Who Ingest Fluorosilicic Acid (H₂SiF₆) (60)

Milligrams fluoride ion (mg) ingested per body weight (kg) *	Treatment
<5.0 mg fluoride/kg +	Give calcium (milk) orally to relieve gastrointestinal symptoms. Observe for 2–4 hours. (A can of evaporated milk should be available at all times to use for emergency treatment.) Induced vomiting is not necessary
>=5.0 mg fluoride/kg	Move the person away from any contact with fluoride and keep him or her warm. Call the Poison Control Center. If advised by the Poison Control Center and if the person is conscious, induce vomiting by rubbing the back of the person's throat with a spoon or your finger or use syrup of ipecac. To prevent aspiration of vomitus, the person should be placed face down with the head lower than the body. Give the person a glass of milk or any source of soluble calcium (i.e., 5% calcium gluconate or calcium lactate solution). Take the person to the hospital as quickly as possible. It is important that whoever takes the person to the hospital notify physicians that the person is at risk for pulmonary edema as late as 48 hours afterward.

* Average weight/age: 0-15 kg/0-2 years; 15-20 kg/3-5 years; 20-23 kg/6-8 years; 23-45 kg/9-15 years; 45-70 kg and higher/15-21 years and older.

+ 5 mg of fluoride (F) equals 27 mg of 23% fluorosilicic acid. Ingesting 5 mg F/kg is equivalent to a 154-lb (70 kg) person consuming 2 grams of fluorosilicic acid.

References

1. Ripa LW. A half century of community water fluoridation in the united states review and commentary. J Pub Health Dent 1993; 53(1):17-44.
2. The Oral Health of Native Americans. A Chart Book of Recent Findings, Trends and Regional Differences. 1994. (unpublished)
3. The 1999 Oral Health Survey Of American Indian And Alaska Native Dental Patients: *Findings, Regional Differences And National Comparisons*
4. Gessner, B.D., Beller M., Middaugh J.P., Whitford G.M., Acute Fluoride Poisoning from a Public Water System. New England Journal of Medicine, Vol. 330: 95-99, Jan. 13, 1994
5. Indian Health Service Circular No. 94-1, Water Fluoridation Policy Issuance, 1994.

6. Engineering and Administrative Recommendations for Water Fluoridation, 1995. Centers for Disease Control and Prevention. MMWR September 29, 1995/Vol. 4/No. RR -13. <http://www.cdc.gov/mmwr/preview/mmwrhtml/00039178.htm>
7. Water Fluoridation A Manual for Engineers and Technicians. US Department of Health and Human Services, Public Health Service, Centers for Disease Control and Prevention. <http://www.cdc.gov/fluoridation/engineering.htm>

CDC Water Fluoridation Web site: <http://www.cdc.gov/OralHealth/topics/fluoridation.htm>

FLUORIDATION SYSTEM DESIGN:

(from the CDC's EARWF)

Engineering Guidelines

1. The fluoride feed system must be installed so that it cannot operate unless raw water pumps are operating (interlocked). To assure this, the metering pump must be wired electrically in series with the main well pump or the service pump. If a gravity flow situation exists, a flow switch or pressure device should be installed.
2. When the fluoridation system is connected electrically to the well pump, the fluoride-metering pump cannot be plugged into any continuously active ("hot") electrical outlet. The fluoride metering pump must only be plugged into the circuit that contains the interlock protection (the interlock may not be necessary when water systems have an on-site water operator 24 hours a day.) One method of ensuring interlock protection is to install a special clearly labeled plug on the metering pump that is compatible with a special outlet on the appropriate electrical circuit. Another method of providing interlock protection is to wire the metering pump directly into the electrical circuit that is tied electrically to the well pump or service pump.
3. A secondary flow-based control device (e.g., a flow switch or a pressure switch) should be installed for back-up protection in water systems that serve populations of <500 persons.
4. The fluoride injection point should be located where all the water to be treated passes; however, fluoride should not be injected at sites where substantial losses of fluoride can occur (e.g., the rapid-mix chemical basin).
5. The fluoride injection point in a water line should be located in the lower one-third of the pipe, and the end of the injection line should extend into the pipe approximately one third of the pipe's diameter.
6. A corporation stop valve should be used in the line at the fluoride injection point when injecting fluoride under pressure. A safety chain must always be installed in the assembly at the fluoride injection point to protect the water plant operator if a corporation stop valve assembly is used.

7. Operation of a fluoridation system without a functional anti-siphon device can lead to overfeed that exceeds 4 mg/L. Two diaphragm-type, antisiphon devices must be installed in the fluoride feed line when a metering pump is used. The antisiphon device should have a diaphragm that is spring-loaded in the closed position. These devices should be located at the fluoride injection point and at the metering pump head on the discharge side. The anti-siphon device on the head of the metering pump should be selected so that it will provide the necessary back pressure required by the manufacturer of the metering pump. Oversized metering pumps should not be used because serious overfeeds (i.e., overfeed that exceeds 4 mg/L) can occur if they are set too high. Conversely, undersized metering pumps can cause erratic fluoride levels.⁴
8. The fluoride metering pump should be located on a shelf not more than 4 feet (1.2 m) higher than the lowest normal level of liquid in the carboy, day tank, or solution container. A flooded suction line is not recommended in water fluoridation.
9. For greatest accuracy, metering pumps should be sized to feed fluoride near the midpoint of their range. Pumps should always operate between 30%–70% of capacity. Metering pumps that do not meet design specifications should not be installed.
10. The priming switch on the metering pump should be spring-loaded to prevent the pump from being started erroneously with the switch in the priming position.
11. In a surface-water treatment plant, the ideal location for injecting fluoride is the rapid sand filter effluent line going into the clear well.
12. Vacuum testing for all anti-siphon devices should be done semiannually. All anti-siphon devices must be dismantled and visually inspected at least once a year. Schedules of repairs or replacements should be based on the manufacturer's recommendations.
13. An in-line mixer or a small mixing tank should be installed in the finished water line exiting from the water plant if the first customer is less than or equal to 100 feet (30.5 m) from the fluoride injection point and if there is no storage tank located in the line before the water reaches the customer. The minimum distance is 100 feet, assuming there are typical valves and bends in the water line that allow for adequate mixing.
14. Flow meter-paced systems should not be installed unless the rate of water flow past the point of fluoride injection varies by more than 20%.
15. A master meter on the main water service line must be provided so that calculations can be made to confirm that the proper amounts of fluoride solution are being fed.

16. The fluoride feed line(s) should be either color coded, when practical, or clearly identified by some other means. Color coding helps prevent possible errors when taking samples or performing maintenance. The pipes for all fluoride feed lines should be painted light blue with red bands. The word “fluoride” and the direction of the flow should be printed on the pipe.
17. Fluoride feed equipment, controls, safety equipment, accessory equipment, and other appurtenances must be inspected annually.
18. All hose connections within reach of the fluoride feed equipment should be provided with a hose bibb vacuum breaker.
19. All fluoride chemicals must conform to the appropriate American Water Works Association (AWWA) standards (B-701, B-702, and B-703) to ensure that the drinking water will be safe and potable.
20. Storage should be provided for at least a three-month supply of fluoride chemical to minimize the effect of a possible fluoride chemical shortage. Shortages have occurred sporadically in the past (CDC, unpublished report, 1986).
21. Cross-connection controls that conform to state regulations must be provided.

Sodium Fluoride Saturator System Requirements

1. The minimum depth of sodium fluoride in a saturator should be 12 inches (30.5 cm). This depth should be marked on the outside of the saturator tank. The saturator should never be filled so high that the undissolved chemical is drawn into the pump suction line.
2. Only granular sodium fluoride should be used in saturators, because both powdered and very fine sodium fluorides tend to cause plugging in the saturator.
3. The water used for sodium fluoride saturators should be softened whenever the hardness exceeds 50 parts per million (ppm). Only the water used for solution preparation (i.e., the make-up water) needs to be softened.
4. A flow restrictor with a maximum flow of two gallons (7.6 L) per minute should be installed on all up-flow saturators.
5. In the event of a plant shutdown, the make-up water solenoid valve should be physically disconnected from the electrical service.
6. For systems that use < 10 gallons (< 38 L) of saturator solution per day, operators should consider using an up-flow saturator that is manually filled with water.
7. In an up-flow saturator, either an atmospheric vacuum breaker must be installed or a backflow prevention device must be provided in accordance with state or local requirements. The vacuum breaker must be installed according to the manufacturer’s recommendations.

8. A sediment filter (20 mesh) should be installed in the water make-up line going to the sodium fluoride saturators. The filter should be placed between the softener and the water meter.
9. A water meter must be provided on the make-up water line for the saturator so that calculations can be made to confirm that the proper amounts of fluoride solution are being fed. This meter and the master meter should be read daily and the results recorded.
10. Unsaturated (batch-mixed) sodium fluoride solution should not be used in water fluoridation.

Fluorosilicic Acid System Requirements

1. To reduce the hazard to the water plant operator, fluorosilicic acid (hydrofluosilicic acid) must not be diluted. Small metering pumps are available that will permit the use of fluorosilicic acid for water plants of any size.
2. No more than a seven-day supply of fluorosilicic acid should be connected at any time to the suction side of the chemical feed pump. All bulk storage tanks with more than a seven-day supply must have a day tank. A day tank should only contain a small amount of acid, usually a one- or two-day supply.
3. Day tanks or direct acid-feed carboys/drums should be located on scales; daily weights should be measured and recorded. Volumetric measurements, such as marking the side of the day tank, are not adequate for monitoring acid feed systems.
4. Carboys, day tanks, or inside bulk storage tanks containing fluorosilicic acid must be completely sealed and vented to the outside.
5. Fluorosilicic acid should be stored in bulk, if economically feasible.
6. Bulk storage tanks must be provided with secondary containment (i.e., berms) in accordance with state/local codes or ordinances.

Fluoride Dry Feed System Requirements

1. A solution tank that has a dry feeder (both volumetric and gravimetric) must be provided.
2. Solution tanks should be sized according to CDC guidelines.
3. A mechanical mixer should be used in every solution tank of a dry feeder when sodium fluorosilicate (i.e., silicofluoride) is used.
4. Scales must be provided for weighing the amount of chemicals used in the dry feeder.

Safety And Reporting

Water Operator Safety

1. The water supply industry has a high incidence of unintentional injuries as compared with other industries in the United States; with proper safety procedures injuries can be avoided.
2. Water operator should follow proper safety procedures to avoid injuries and overexposure to chemicals. Water plant personnel should regularly receive safety training on all chemicals, including fluoride. Exposure hazards and first aid should be reviewed and emergency spill procedures should be established and explained to workers.

Protective Equipment

1. The use of personal protective equipment (PPE) is required when handling fluoride chemicals or when maintenance on fluoridation equipment is performed.
2. Required PPE for handling sodium fluoride or sodium fluorosilicate includes:
 - a. NIOSH approved high efficiency dust respirator (chemical mask) with soft rubber face-to-mask seal and replaceable cartridges.
 - b. Gauntlet neoprene gloves (12" glove minimum length)
 - c. Heavy duty neoprene aprons.
3. Required PPE for handling fluorosilicic acid includes:
 - a. Gauntlet neoprene gloves (12" glove minimum length)
 - b. Heavy duty neoprene aprons.
 - c. Full 8" face shield or acid type safety goggles
 - d. Safety shower/eye washer in easily accessible location (or pint-size bottle of eyewash solution).

Chemical Storage

1. Do not allow unauthorized personnel, especially small children, in areas where fluoride chemicals are fed or stored. Do not eat or keep food in areas where fluoride is stored.
2. Store dry fluoride on pallets, in stacks preferably not more than six bags high. If fiber drums are used, keep the tops closed to prevent moisture contamination.
3. Vapors from fluorosilicic acid are corrosive; containers should be kept tightly closed, vented to the outdoors, and stored away from hot temperature areas. Bulk storage tanks can be made of fiberglass polyethylene or rubber-lined steel.

Glossary of Technical Terms

Adjusted fluoridated water system: A community public water system that adjusts the fluoride concentration in the drinking water to the optimal level for consumption (or within the recommended control range).

Calculated dosage: The calculated amount of fluoride (mg/L) that has been added to an adjusted fluoridated water system. The calculation is based on the total amount of fluoride (weight) that was added to the water system and the total amount of water (volume) that was produced.

Centers for Disease Control and Prevention (CDC): An agency of the U.S. Department of Health and Human Services charged with promoting health and quality of life by preventing and controlling disease, injury, and disability.

Census designated place: A populated place, not within the limits of an incorporated place, that has been delimited for census purposes by the U.S. Bureau of the Census.

Certified Waterworks Operator: A water operator who meets the minimal criteria set by the State Department of Health Division of Water Supply for certification as evident by passing a written examination.

Check sample: A distribution water sample forwarded to either the state laboratory or to a state-approved laboratory for analysis.

Community: A geographical entity that includes all incorporated places as well as all census-designated places as defined by the U.S. Bureau of the Census.

Community water system (CWS): Any water system serving piped water for human consumption to 15 or more individual service connections used year-round by consumers or regularly serving 25 or more individual consumers year-round, including, but not limited to, any collection, pretreatment, treatment, storage and/or distribution facilities or equipment used primarily as part of, or in connection with such system, regardless of whether or not such components are under the ownership or control of the operator of such system.

Connection: Generally speaking, water service into an individual housing unit or dwelling.

Consecutive water system: A public water system that buys water from another public water system. For purposes of water fluoridation record keeping, the consecutive water system should purchase at least 80% of its water from a fluoridated water system.

Distribution sample: A water sample taken from the distribution lines of the public water system that is representative of the water quality in the water system.

Dry Fluoride Feed System: A fluoridation system that uses a dry chemical compound (usually sodium fluorosilicate) as the means to fluoridate a PWS.

Fluorosilicic Acid System: A fluoridation system that uses fluorosilicic acid as the means to fluoridate a PWS.

Fluorosis: A clinical condition of the teeth where whitish to brownish staining occurs due to excessively high levels of fluoride exposure during tooth development.

Incorporated place: A populated place possessing legally defined boundaries and legally constituted government functions.

MG/L: Milligrams per liter; also, ppm.

Monitoring, fluoride: The regular analysis and recording by water system personnel of the fluoride ion content in the drinking water.

Must: See Shall.

Natural fluoride level: The concentration of fluoride (mg/L) that is present in the water source from naturally occurring fluoride sources.

Naturally fluoridated water system: A public water system that supplies water which contains naturally occurring fluoride at levels that is beneficial to dental health.

Operator: The certified waterworks operator who directly supervises and is personally responsible for the daily operation and maintenance of a community or non-transient non-community public water system.

Optimal Control Range: A range within which adjusted fluoridated water systems shall operate to maintain optimal fluoride levels. the range is 0.7–1.3 parts per million.

Optimal Fluoride Level: The fluoride concentration (mg/L, which is the same as ppm) based on the annual average of the maximum daily air temperature in the geographical area of the fluoridated water system.

Optimally Fluoridated Water System: A public water system that has consistent optimal levels of fluoride for oral health from either naturally occurring sources, or by adjusting the fluoride level to optimal concentrations.

Overfeed, fluoride: Any fluoride analytical result above the recommended control range of the water system. Different levels of response are expected from the operator depending on the extent of the overfeed.

PPM: parts per million. See also, mg/L.

Public water supply/system (PWS):

Required Water Samples: Required samples include a minimum of three (3) routine fluoride samples which shall be taken on different days each week and submitted monthly, and submission of a monthly split water sample to the laboratory for testing.

Shall: Indicates that which is mandatory; a requirement.

Sodium Fluoride Saturator System: A fluoridation system that uses a saturated solution of sodium fluoride as the means to fluoridate a PWS.

Split sample: A distribution water sample taken by the water plant operator, who analyzes a portion of the sample and records the results on the monthly operating report to the state. The operator then forwards the remainder of the sample to the laboratory for analysis.

Split sample tolerance: The amount of variance allowed between the portion of the split sample tested by the water system operator and the Lab. the split sample tolerance is 0.2 ppm.

State fluoridation administrator: The employee who is responsible for the administration of the fluoridation program.

Surveillance, fluoride: The regular review of monitored data and split sample or check sample results to ensure that fluoride levels are maintained by the community water systems in a specific geographic area.

Uniform flow: When the rate of flow of the water past a point varies by less than 20%.

Upstream: In a water line, a point closer to the source of water.

Water, make-up: Water that is used to replace the saturated solution from a sodium fluoride saturator; this saturated solution is pumped into the distribution lines.

Water fluoridation: The act of adjusting the fluoride concentration in the drinking water of a water system to the optimal level.