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Engineering and Administrative Recommendations for Water Fluoridation, 1995

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April and September 1993

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Engineering and Administrative Recommendations for Water Fluoridation, 1995

Summary

In April and September 1993, CDC convened two advisory workshops to review and revise fluoridation recommendations. Since 1979, CDC has developed guidelines and/or recommendations for managers of fluoridated public water systems. This report summarizes the results of these two workshops and consolidates and updates CDC's previous recommendations. Implementation of these recommendations should contribute to the achievement of continuous levels of optimally fluoridated drinking water for the U.S. population, minimize potential fluoride overfeeds (i.e., any fluoride level that is greater than the recommended control range of the water system), and contribute to the safe operation of all fluoridated water systems. The report delineates specific recommendations related to the engineering aspects of water fluoridation, including administration, monitoring and surveillance, technical requirements, and safety procedures. The recommendations address water fluoridation for both community public water supply systems and school public water supply systems.

INTRODUCTION

Water fluoridation is the deliberate addition of the natural trace element fluorine (in the ionic form as fluoride) into drinking water in accordance with scientific and dental guidelines (*1–9*). Fluoride is present in small yet varying amounts in almost all soil, water supplies, plants, and animals and, thus, is a normal constituent of all diets (*10*). In mammals, the highest concentrations are found in the bones and teeth.

Since 1945, many studies have demonstrated the oral health benefits of fluorides and fluoridation. In 1945 and 1947, data from four studies (Grand Rapids, Michigan; Newburgh, New York; Brantford, Ontario [Canada]; and Evanston, Illinois) demonstrated the oral health benefits of fluoridated water in several communities and established water fluoridation as a practical, effective public health measure that would prevent dental caries (*11–14*). Data have consistently indicated that fluoridation is safe and is the most cost-effective and practical means for reducing the incidence of dental caries (tooth decay) in a community (*15–28*). However, additional studies have demonstrated that the oral health benefits are reduced if the optimal level of fluoride is not maintained (*29–30*). In the past, maintaining the optimal level without active monitoring/surveillance programs has been difficult. In the 1970s, approximately half of the systems presumed to be fluoridated were not consistently maintaining the optimal fluoride concentrations.

Since the late 1970s, CDC has developed technical and administrative guidelines and/or recommendations for correcting inconsistencies in fluoridated public water supply systems (CDC, unpublished data; *31–33*). In April and September of 1993, CDC convened two advisory workshops to review and revise fluoridation

guidelines. Participants included 11 technical experts from state agencies and the Indian Health Service. Additional comments were obtained from state dental officials, state drinking water personnel, and others (e.g., schools of public health, dental societies, and engineers from private industry). The intent of these recommendations is to provide guidance to federal, state, and local officials involved in the engineering or administrative aspects of water fluoridation, which should help ensure that fluoridated water systems are providing optimal fluoride levels.

This report provides information from earlier studies linking fluoridation with the reduction of dental caries, summarizes the conclusions of the workshops, provides recommendations for fluoridation of both community and school public water supplies, and consolidates previous recommendations. These recommendations are written with the assumption that the reader either has an engineering background or at least is familiar with basic water supply engineering principles. As an aid to readers, a glossary of technical terms is included.

BACKGROUND

History of Water Fluoridation

The capacity of waterborne fluoride to prevent tooth decay was recognized in the early 1900s in Colorado Springs, Colorado, when a dentist noted that many of his patients' teeth exhibited tooth discoloration (i.e., "Colorado Brown Stain"). Because that condition had not been described previously in the scientific literature, he initiated research about the condition and found that Colorado Brown Stain—now termed fluorosis (mottled enamel)—was prevalent throughout the surrounding El Paso County. The dentist described fluorosis and made recommendations on how to prevent its occurrence (*34,35*). Other dentists and researchers also had noted the occurrence of fluorosis and theorized that fluoride in the water might be associated with the condition. They also noted that persons who had fluorosis had almost no dental caries (*36*) The dentist in Colorado subsequently collaborated with the U.S. Public Health Service to determine if fluoride could be added to the drinking water to prevent cavities (*2,37*). Further studies were conducted that confirmed the cause-and-effect relation between fluoridation and the reduction of dental caries (*1,3,6,38,39*).

National, State, and Local Fluoride Guidelines

A public water system can be owned by the municipality that it serves, or it may be corporately owned. A public water system is not defined by its ownership. To be considered a public water system, the system must have ≥15 service connections or must regularly serve an average of ≥25 persons for ≥60 days per year. Public water systems do not necessarily follow city, county, or even state boundaries. For example, a large municipality may be served by one water system or by multiple water systems; a public water system may serve several municipalities. Individual states' regulations and/or guidelines for respective water systems range from specific to general. The recommendations and guidelines for water fluoridation must be sufficiently general to allow for individual states' variations in nomenclature and organization.

Schools that have individual water systems, which are considered public water systems, are subject to all the rules that apply to public water systems. However, because of limits on use and the size of these systems, they have been included in a subcategory of public water systems referred to as nontransient, noncommunity public water systems. Special recommendations and guidelines that apply to school public water systems are included in this report.

Although no national regulations or laws govern water fluoridation, many federal agencies concur that water fluoridation is beneficial to public health (M. Cook, personal communication; *40*). The Environmental Protection Agency (EPA), through the Safe Drinking Water Act of 1986, has established national requirements for public water systems but not for adjusted water fluoridation. EPA also has established a maximum concentration level for natural fluoride in drinking water. If the fluoride content in drinking water exceeds this level, it must be removed.*

RECOMMENDATIONS FOR FLUORIDATED COMMUNITY PUBLIC WATER SUPPLY SYSTEMS

I. Administration

A. Personnel

1. Each state should designate a state fluoridation administrator who will be responsible for a) managing the fluoridation program, b) promoting water fluoridation, and c) providing liaison with other state and federal agencies. This person should be selected from either the dental program or the drinking water program.

2. Each state should employ at least one full-time state fluoridation specialist, whose primary responsibilities will be to a) provide for site visits, b) provide for start-up visits, c) assist in the training of water plant operators, d) provide surveillance for all fluoridated water systems, and e) resolve problems. In larger states (e.g., Montana), this specialist should be responsible for no more than 75 fluoridated water systems and in smaller states (e.g., Massachusetts), for no more than 100.

3. The staff of both the state dental and state drinking water programs should maintain communication regarding all aspects of water fluoridation in the state.

4. A trained water plant operator (one who has received ≥6 hours of fluoridation training) should be responsible for each fluoridated water system.

*Safe Drinking Water Act, 42 U.S.C. §300f et seq, as amended in 1986.

B. System Reporting Requirements

Whenever the fluoride content of drinking water is adjusted, a person should be designated to report daily fluoride test results to the appropriate state agency. These reports should be submitted each month.

C. State Reporting Requirements

1. Each month, the state agency should report back to the respective operators the test results of monthly split or check samples taken from each fluoridated water system.

2. Each state should compile and maintain the following information on fluoridation:

   a. Names of all fluoridated water systems in the state;

   b. Names of all consecutive systems (i.e., a public water system that buys water from another public water system) that purchase water from fluoridated water systems; and

   c. Names of all communities served by each fluoridated water system and each consecutive water system.

3. Each state should supply CDC (National Center for Chronic Disease Prevention and Health Promotion, Division of Oral Health) with the preceding information at least yearly (*41*).

4. Each state should participate in the Association of State and Territorial Dental Directors (ASTDD) quarterly reporting system. Quarterly submission of data will assist states by providing national data against which to compare their quality and by providing a standard procedure for conducting quality assessments of their fluoridation systems. (See Exhibit A for ASTDD instructions.)

5. Each state should develop a system to notify health-care providers (i.e., dentists, pharmacists, and physicians) when a new fluoridation system is initiated and when one is discontinued.

D. Training

1. All state fluoridation specialists should attend CDC's basic fluoridation training course or a similar course at least once and CDC's advanced workshop or a similar workshop once every 3 years.

2. State personnel must provide training for all water plant operators for each new fluoridated water system before that system is started. This start-up training must address the following:

   a. Information specific to the water plant and equipment, including how to test water for fluoride, under the supervision of state personnel;

b. Reporting requirements to the state; and

c. Information on public health benefits of fluoride and the role of water plant personnel in providing those benefits.

3. Each state should integrate a minimum of 1 hour of precertification training in water fluoridation into the basic certification training course for water plant operators. This precertification training should include the following:

   a. Public health benefits of fluoridation and the operator's key role in preventing dental caries;

   b. The importance of maintaining the optimal fluoride level; and

   c. Technical requirements regarding the types of systems and the testing procedures.

4. Each state should provide an annual fluoridation training course for operators. This training should be a minimum of 6–8 hours and should address all aspects of water fluoridation, including fluoride analyses. The course may offer credit toward continuing education requirements for operator certification. In states where the operator turnover rate is low, training may be provided every other year.

E. Inspection

1. State personnel must provide a detailed, on-site inspection of each new fluoridation system before the system start-up to ensure that construction and installation are in accordance with state-approved plans and specifications. (See Exhibit B for fluoridation facility fact sheet to be completed for each facility inspected.)

2. State personnel should inspect individual water fluoridation systems at least once a year. (See Exhibit C for sample inspection form.) This comprehensive inspection should include, at a minimum, the following:

   a. An evaluation of the fluoride testing equipment;

   b. An inspection of the chemical (fluoride) storage area;

   c. An inspection of the operation and maintenance manuals;

   d. A check to ensure that only state-approved backflow preventers and antisiphon devices (as well as testing procedures for such equipment) are being used;

   e. An evaluation of the on-site emergency plans (stipulated actions in case of overfeed and public-notification procedures to be followed) (Table 1);

TABLE 1. Recommended fluoride overfeed actions for community water systems, United States (*31*)

Fluoride level	Actions recommended
0.1 mg/L above control range* to 2.0 mg/L	1. Leave the fluoridation system on. 2. Determine malfunction and repair.
2.1 mg/L to 4.0 mg/L	1. Leave the fluoridation system on. 2. Determine malfunction and repair. 3. Notify supervisor and report the incident to the appropriate county or state agencies.
4.1 mg/L to 10.0 mg/L	1. Determine malfunction and immediately attempt repair. 2. If the problem is not found and corrected quickly, turn off the fluoridation system. 3. Notify supervisor and report the incident to the appropriate county or state agencies. 4. Take water samples at several points in the distribution system and test the fluoride content. Retest if results are still high. 5. Determine malfunction and repair.Then, with supervisor's permission, restart the fluoridation system.
10.1 mg/L or greater†	1. Turn off the fluoridation system immediately. 2. Notify supervisor and report the incident immediately to the appropriate county or state agencies and follow their instructions. 3. 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. 4. Determine malfunction and repair. Then, with supervisor's and the state's permission, restart the fluoridation system.

*See control ranges in Table 2.
†The state might require public notification to prevent consumption of high levels of fluoridated water.

f. An inspection of the plant's security (e.g., placement of appropriate signs and fences and preventing entrance by unauthorized persons); and

g. An inspection of the on-site safety equipment available to the operator.

F. Actions in Case of Overfeed

State personnel must provide each water plant with procedures to follow in the event of an overfeed. These operating procedures should address the following:

1. Shutting down the equipment;
2. Notifying appropriate state personnel;
3. Flushing out the water lines containing the high (≥10 mg/L) fluoride concentration; and
4. Notifying the public to prevent consumption of drinking water with high fluoride concentration.

II. Monitoring and Surveillance

A. Water system personnel must monitor daily fluoride levels in the water distribution system. Samples that will reflect the actual level of fluoride in the water system should be taken at points throughout the water system. The sites where samples are taken should be rotated daily.

B. At least once each month, water system personnel should divide one sample and have one portion analyzed for fluoride by water system personnel and the other portion analyzed by either the state laboratory or a state-approved laboratory.

C. Each water system must send operational reports to the state at least monthly. The report must include:

1. The amount and type of chemicals fed and the total number of gallons of water treated per day;
2. The results of daily monitoring for fluoride in the water distribution system; and
3. The results of monthly split sample(s).

D. The calculated dosage should be cross-checked against the reported fluoride levels to spot chronic nonoptimal operation.

E. The system's raw water source (i.e., water that has not been treated) should be analyzed annually for fluoride by either the state laboratory or a state-approved laboratory, or in accordance with state regulations.

F. If the optimal fluoride level in a community public water supply system has not been set by the state, optimal fluoride levels should be established (Table 2). (State regulations supersede recommended optimal fluoride levels contained in this report.)

G. All state laboratories should participate in CDC's Fluoride Proficiency Testing Program to ensure the accuracy of their fluoride testing program.

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.

III. Technical Requirements

A. General

1. The fluoride feed system must be installed so that it cannot operate unless water is being produced (interlocked). For example, the metering pump must be wired electrically *in series* with the main well pump or the service pump. If a gravity flow situation exits, a flow switch or pressure device should be installed. The interlock might not be required for water systems that have an operator present 24 hours a day.

2. When the fluoridation system is connected electrically to the well pump, it must be made physically impossible to plug the fluoride metering pump into any continuously active ("hot") electrical outlet. The pump should be plugged *only* into the circuit containing the interlock protection. One method of ensuring interlock protection is to install on the metering pump a *special*, clearly labeled plug that is compatible only 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, so that such hard wiring can only be changed by deliberate action.

3. A secondary flow-based control device (e.g., a flow switch or a pressure switch) should be provided as 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). In a surface-water treatment plant, the ideal location for injecting fluoride is the rapid sand filter effluent line going into the clearwell.

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 (*31,32*).

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. 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 antisiphon 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.

8. All antisiphon 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. Vacuum testing for all antisiphon devices should be done semiannually. Operation of a fluoridation system without a functional antisiphon device can lead to an overfeed that exceeds 4 mg/L.

9. 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.

10. 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. Oversized metering pumps should not be used because serious overfeeds (i.e., an overfeed that exceeds 4 mg/L) can occur if they are set too high. Conversely, undersized metering pumps can cause erratic fluoride levels.

11. 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.

12. 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 ≤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.

13. 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%.

14. 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.

15. 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 (*42*).

16. Fluoride feed equipment, controls, safety equipment, accessory equipment, and other appurtenances must be inspected annually.

17. All hose connections within reach of the fluoride feed equipment should be provided with a hose bibb vacuum breaker.

18. 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 (*43–45*).

19. Storage should be provided for at least a 3-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; *46*).

20. Cross-connection controls that conform to state regulations must be provided.

B. Sodium Fluoride Saturator Systems

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 fluoride 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 2 gallons (7.6 L) per minute should be installed on all upflow 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 upflow saturator that is manually filled with water.

7. In an upflow 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.

C. Fluorosilicic Acid Systems

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 7-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 7-day supply must have a day tank. A day tank should only contain a small amount of acid, usually a 1- or 2-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.

D. Dry Fluoride Feed Systems

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 (*31*).
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.

E. Testing Equipment

1. Operators of surface water plants should use the ion electrode method of fluoride analysis because chemicals (e.g., alum) used in a surface water plant will cause fluctuating interferences in the colorimetric method (SPADNS) of fluoride analysis (*47*).
2. A magnetic stirrer should be used in conjunction with the ion electrode method of fluoride analysis.
3. The colorimetric method (SPADNS) of fluoride analysis can be used where no interference occurs or where the interferences are consistent (e.g., from iron, chloride, phosphate, sulfate, or color). The final fluoride test result can be adjusted for these interferences. State laboratory personnel, the state fluoridation specialist, and the water plant operator should reconcile the interferences and make the appropriate adjustment.
4. Distillation is not needed when the colorimetric method (SPADNS) of fluoride analysis is used for testing daily fluoride levels.

IV. Safety Procedures

Fluoride remains a safe compound when maintained at the optimal level in water supplied to the distribution system; however, an operator might be exposed to excessive levels if proper procedures are not followed or if equipment malfunctions. Thus, the use of personal protective equipment (PPE) is required when fluoride compounds are handled or when maintenance on fluoridation equipment is performed. The employer should develop a written program regarding the use of PPE. The water supply industry has a high incidence of unintentional injuries compared with other industries in the United States; therefore, safety procedures should be followed (*48*).

A. Operator Safety

1. Fluorosilicic acid

a. The operator should wear the following PPE:

- Gauntlet neoprene gloves with cuffs, which should be a minimum length of 12 inches (30.5 cm);
- Full face shield and splash-proof safety goggles; and
- Heavy-duty, acid-proof neoprene apron or acid-proof clothing and shoes.

b. A safety shower and an eye wash station must be available and easily accessible.

2. Sodium fluoride or sodium fluorosilicate

a. The operator should wear the following PPE:

- A National Institute for Occupational Safety and Health (NIOSH)/ Mine Safety and Health Administration (MSHA)-approved, N-series particulate respirator (i.e., chemical mask) with a soft rubber face-to-mask seal and replaceable cartridges (*49–51*);
- Splash-proof safety goggles;
- Gauntlet neoprene gloves, which should be a minimum length of 12 inches (30.5 cm); and
- Heavy-duty, acid-proof neoprene apron.

b. An eye wash station should be available and easily accessible.

3. Exposure to fluoride chemicals

If the operator gets either wet or dry chemicals on the skin, he or she should thoroughly wash the contaminated skin area immediately. If the operator's clothing is contaminated with a wet chemical, he or she should remove the wet contaminated clothing immediately. If the operator's clothing becomes contaminated with dry chemicals, he or she should change work clothing daily no later than the close of the work day (*51*).

B. Recommended Emergency Procedures For Fluoride Overfeeds

1. Fluoride overfeeds

a. When a community fluoridates its drinking water, a potential exists for a fluoride overfeed. 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 (*52–55*).

b. 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 (Table 1) (*33*).

c. 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.

2. Ingested fluoride overdose

Persons who ingest dry fluoride chemicals and fluorosilicic acid should receive emergency treatment (Tables 3 and 4) (*10,56–62*).

TABLE 3. Recommended emergency treatment for persons who ingest dry fluoride chemicals (NaF and Na_2SiF_6) (*60*)

Milligrams fluoride ion (mg) ingested per body weight (kg)*	Treatment
<5.0 mg of fluoride ion/kg†	1. 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.) 2. Induced vomiting is not necessary.
≥5.0 mg of fluoride ion/kg	1. Move the person away from any contact with fluoride and keep him or her warm. 2. Call the Poison Control Center. 3. 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. 4. Give the person a glass of milk or any source of soluble calcium (i.e., 5% calcium gluconate or calcium lactate solution). 5. Take the person to the hospital as quickly as possible.

*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 11 mg of sodium fluoride (8 mg of sodium fluorosilicate). Ingesting 5 mg F/kg is equivalent to a 154-lb. (70 kg) person consuming 0.8 grams of sodium fluoride (0.6 grams of sodium fluorosilicate).

TABLE 4. Recommended emergency treatment for persons who ingest fluorosilicic acid (H_2SiF_6) (*60*)

Milligrams fluoride ion (mg) ingested per body weight (kg)*	Treatment
<5.0 mg of fluoride/kg†	1. 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.) 2. Induced vomiting is not necessary.
≥5.0 mg of fluoride/kg	1. Move the person away fron any contact with fluoride and keep him or her warm. 2. Call the Poison Control Center. 3. 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. 4. Give the person a glass of milk or any source of soluble calcium (i.e., 5% calcium gluconate or calcium lactate solution). 5. 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.

RECOMMENDATIONS FOR FLUORIDATED SCHOOL PUBLIC WATER SUPPLY SYSTEMS

I. Administration

School water fluoridation is recommended only when the school has its own source of water and is not connected to a community water system. Each state is responsible for determining whether school water fluoridation is desirable and for effecting a written agreement between the state and appropriate school officials. A school water fluoridation program must not be started unless resources are available at the state level to undertake operational and maintenance responsibilities. For example, one full-time school technician should be assigned to every 25–30 schools. The following recommendations should be implemented for a school water fluoridation program:

A. The state must take the primary responsibility for operating and maintaining school fluoridation equipment. School personnel should be responsible only

for monitoring fluoride levels and minimal operation and maintenance of equipment.

B. For each school being considered for water fluoridation, appropriate state personnel should evaluate and prioritize the following criteria:

1. Number of students who will benefit;
2. Natural fluoride level in the school's drinking water;
3. Recommended fluoride level of the community water systems in the geographic area where the students live;
4. Whether the water system for the entire school system (the elementary, middle, and/or the high school) will be fluoridated;
5. Technical feasibility of fluoridating the school's water system; and
6. Evaluation of the fluoride content of water drunk at home by students attending a school being considered for fluoridation. That evaluation must occur before school is selected. In general, if >25% of the children attending the school already receive optimally fluoridated water at home, the school's water should not be fluoridated (*31*). None of the existing research on school water fluoridation covers prekindergarten children (*63–68*).

C. At a minimum, state personnel should visit annually each school system and provide a thorough inspection and overhaul of the equipment (usually during summer recess or when school is not in session).

D. The state must provide school administrative officials with operating procedures to follow should an overfeed occur. These operating procedures should address the following:

1. Shutting down the equipment;
2. Preventing the consumption of high fluoride concentrations (>10 mg/L) in the drinking water;
3. Notifying appropriate state personnel; and
4. Other emergency procedures.

II. Monitoring and Surveillance

A. For each school that has a fluoridated water system, a sample of the drinking water must be taken and analyzed for fluoride content before the beginning of each school day. Samples may be taken by appropriate school personnel.

This sampling will not prevent fluoride overfeeds but will prevent consumption of high levels of fluoride.

B. School personnel must divide at least one sample per week, with one portion analyzed for fluoride at the school and the other portion analyzed at the state laboratory. The weekly state test results should be compared with test results obtained at the school to ensure that school personnel are using the proper analytic techniques and that their daily samples are being tested accurately for fluoride.

C. Optimal fluoride levels in a school water system should be established by the state (Table 5). (State regulations supersede recommendations provided in this report.)

III. Technical Requirements

A. General

1. School water fluoridation systems should be installed only where the water is supplied by a well pump with a uniform flow because varying flow rates can cause problems in consistently maintaining optimal fluoride levels (*31*).

2. All school water fluoridation systems should be built with a bypass arrangement so that the fluoridation equipment can be isolated during service and inspection periods without shutting off the school water supply. Most states use a pipe loop, with gate valves isolating such devices as the injection point, meters, strainers, check valves, make-up water, and take-off fittings.

3. Fluoridation equipment should be placed in an area that is secure from tampering and vandalism.

TABLE 5. Recommended optimal fluoride levels for school 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)	
F	C		20% Below	20% Above
50.0–53.7	10.0–12.0	5.4	4.3	6.5
53.8–58.3	12.1–14.6	5.0	4.0	6.0
58.4–63.8	14.7–17.7	4.5	3.6	5.4
63.9–70.6	17.8–21.4	4.1	3.3	4.9
70.7–79.2	21.5–26.2	3.6	2.9	4.3
79.3–90.5	26.3–32.5	3.2	2.6	3.8

*Based on temperature data obtained for a minimum of 5 years.
†Based on 4.5 times the optimal fluoride level for communities.

4. A routine maintenance schedule should be established. Items to be checked include pump diaphragm, check valve, Y-strainers or sediment filters, injection points (for clogging), flow switch contacts and paddles, saturator tank (for cleaning), pressure switch, solenoid valve, float switch, and foot valve.

5. All hose connections within reach of the fluoride feed equipment should be provided with a hose bibb vacuum breaker.

6. Cross-connection control, in conformance with state regulations, must be provided.

7. State personnel should keep records on the amount of fluoride used at each school.

B. Sodium Fluoride Saturator Systems

1. Manually filled saturators should be used in all school fluoridation systems. Upflow saturators generally are recommended because less maintenance is required. Make-up water (i.e., replacement water for the saturator) should be added manually for the following reasons:

   a. Greater protection from an overfeed will be provided because only a finite amount of solution is available and no continuously active (i.e., "hot") electrical outlet will be necessary; and

   b. Potential problems with sticking solenoid valves are eliminated.

2. The metering pump must be installed so that it cannot operate unless water is being produced (interlocked). For example, the metering pump must be wired electrically *in series* with the flow switch and the main well pump.

3. The metering pump must be plugged only into the circuit containing the overfeed protection; it must be physically impossible to plug the fluoride metering pump into any continuously active ("hot") electrical outlet. The pump should be plugged *only* into the circuit containing the interlock protection. One method of ensuring interlock protection is to provide on the metering pump a *special*, clearly labeled plug that is compatible only 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, so that such hard wiring can be changed only by deliberate action. These methods are especially important with an upflow saturator installation because a solenoid valve requires the continuously active ("hot") electrical connection.

4. A flow switch, which is normally in the open position, must be installed *in series* with the metering pump and the well pump so that the switch must

close to activate the metering pump. Flow switches should be properly sized and installed to operate in the flow range encountered at the school. It should be installed upstream from the fluoride injection point.

5. Metering pumps should be sized to feed fluoride near the midpoint of their range for greatest accuracy. Pumps should always operate between 30%–70% of capacity. Metering pumps that do not meet design specifications should not be installed in schools. Oversized metering pumps should not be used because serious overfeeds can occur if settings on the pump are too high. Conversely, undersized metering pumps can cause erratic fluoride levels.

6. 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 saturator. Many manufacturers recommend that metering pump be located lower than the liquid level being pumped (i.e., flooded suction). However, a flooded suction line is not recommended in water fluoridation.

7. 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.

8. 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 antisiphon 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.

9. All antisiphon devices must be dismantled and visually inspected at least once a year. Repair or replacement schedules should follow the manufacturer's recommendations. All antisiphon devices should be vacuum tested semiannually. Operation of a fluoridation system without a functional antisiphon device can lead to a serious overfeed.

10. Sediment filters (20 mesh) should be installed in the water make-up line going to the sodium fluoride saturators, between the softener and the water meter.

11. A flow restrictor with a maximum flow of 2 gallons (7.6 L) per minute should be installed on all upflow saturators.

12. In an upflow saturator, either an atmospheric vacuum breaker must be installed or a backflow preventor must be provided in accordance with state or local requirements for cross-connection control. The vacuum breaker must be installed according to the manufacturer's recommendations.

13. A master meter on the school water service line and a make-up water meter on the saturator water line are required so that calculations can be made to confirm that the proper amounts of fluoride solution are being fed. These meters should be read daily and the results recorded.

14. A check valve should be installed in the main water line near the wellhead (in addition to any check valve included in the submersible pump installation). The check valve should be tested at least annually for leakage.

15. The water used for sodium fluoride saturators should be softened whenever the hardness exceeds 50 ppm (or even less if clearing stoppages or removing scale becomes labor intensive). Only the water used for solution preparation (i.e., the make-up water) needs to be softened.

16. Unsaturated (i.e., batch-mixed) sodium fluoride solution should not be used in water fluoridation.

17. Only granular sodium fluoride should be used in saturators because both powdered and very fine sodium fluoride can cause plugging in the saturator.

18. The minimum depth of sodium fluoride in a saturator should be 12 inches (30.5 cm). This depth should be externally marked on the saturator tank. The saturator should never be filled so high that the undissolved chemical is drawn into the pump suction line.

19. All sodium fluoride chemicals must conform to the AWWA standard (B-701) to ensure that the drinking water will be safe and potable (*43*).

C. Testing Equipment

1. The colorimetric method (SPADNS) of fluoride analysis is recommended for daily testing in school water fluoridation. If interferences are consistent (e.g., from iron, chloride, phosphate, sulfate, or color), the final fluoride test result can be adjusted for these interferences. State laboratory personnel and the state school technician should reconcile the interference and make the appropriate adjustment.

2. Distillation is not needed when the colorimetric method (SPADNS) of fluoride analysis is used for testing daily fluoride levels.

IV. Safety Procedures

Fluoride remains a safe compound when maintained at the optimal level in the water supplied to a school water system; however, the school technician could be exposed to excessive levels if proper procedures are not followed or if equipment malfunctions. Thus, the use of PPE is required when fluoride compounds

are handled or when maintenance is performed on fluoridation equipment. The state should develop a written program for schools regarding the use of PPE.

A. Operator Safety

1. The state school technician should wear the following PPE:

   a. A NIOSH/MSHA-approved, N-series particulate respirator (i.e., chemical mask) with soft rubber face-to-mask seal and replaceable cartridges (*49–51*);

   b. Gauntlet neoprene gloves with cuffs, which should be a minimum of 12 inches (30.5 cm) long;

   c. Splash-proof safety goggles; and

   d. Heavy-duty, acid-proof neoprene apron.

2. An eye wash solution should be readily available and easily accessible.

3. Exposure to fluoride chemicals

   If the operator gets dry chemicals on the skin, he or she should thoroughly wash the contaminated skin area immediately and should change work clothing daily no later than the close of the work day (*51*).

B. Recommended Emergency Procedures for Fluoride Overfeeds

1. Fluoride overfeeds

   When a school system fluoridates its drinking water, a potential exists for a fluoride overfeed. Most overfeeds do not pose an immediate health risk; however, some can be high enough to cause immediate health problems. All overfeeds should be corrected immediately because some can cause long-term health effects (*52–55*).

   a. Specific actions should be taken when equipment malfunctions or an adverse event occurs that causes a fluoride chemical overfeed in a school public water supply system (Table 6).

   b. 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.

2. Ingested fluoride overdose

   Persons who ingest dry fluoride chemicals should receive emergency treatment (Table 3) (*10,56–62*).

TABLE 6. Recommended fluoride overfeed actions for school public water supply systems (*31*)

Fluoride level	Actions recommended
0.1 mg/L above recommended control range* to 10.0 mg/L	1. Turn off the fluoridation system immediately. 2. Notify state technician. 3. Notify supervisor. 4. Take water samples at several points in the school and hold the samples for the state technician. 5. Follow advice of the state technician.
10.1 mg/L or higher	1. Turn off the fluoridation system immediately. 2. Notify state technician. 3. Notify supervisor. 4. Take water samples at several points in the distribution system and hold samples for the state technician. 5. Prevent the consumption of high levels of fluoridated water. 6. Follow advice of the state technician.

*See Table 5 for the recommended control range.

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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.

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.

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 public water system (CWS): A public water system that serves at least 15 service connections used by year-round residents or that regularly serves at least 25 year-round residents.

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.

Fluoridated water system: A public water system that produces water that has fluoride from either naturally occurring sources at levels that provide maximum dental benefits, or by adjusting the fluoride level to optimal concentrations.

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

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

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 produces water that has fluoride from naturally occurring sources at levels that provide maximum dental benefits.

Nontransient, noncommunity water system (NTNCWS): A public water system that is not a community water system and that regularly serves at least 25 of the same persons more than 6 months per year.

Optimal fluoride level: The recommended fluoride concentration (mg/L) based on the annual average of the maximum daily air temperature in the geographical area of the fluoridated water system.

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 (Tables 1 and 6).

Public water system (PWS): A system that provides piped water to the public for human consumption. To qualify as a public water system, a system must have 15 or more service connections or must regularly serve an average of at least 25 individuals 60 or more days per year.

Recommended control range: A range within which adjusted fluoridated water systems should operate to maintain optimal fluoride levels. This range is usually set by state regulation.

School technician: A state employee (usually from either the dental or drinking water program) whose primary responsibility is to provide for site visits, assist in the training of school fluoridation monitors, provide surveillance of all fluoridated school water systems, and resolve problems. This person functions as the water plant operator for a school fluoridation system and may be either an engineer or a technician.

School water system: A nontransient, noncommunity water system that serves only a school.

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 state laboratory or to a state-approved laboratory for analysis.

State: This term includes the 50 contiguous states and U.S. territories.

State fluoridation administrator: A state employee (usually from either the dental or drinking water program) who is responsible for the administration of the fluoridation program.

State fluoridation specialist: A state employee (usually from either the dental or drinking water program) whose primary responsibility is to provide for site visits, assist in the training of water plant operators, provide surveillance of all fluoridated water

systems, and resolve problems. This person may be either an engineer or a technician.

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. The review is conducted by a source independent of the water system.

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.

Exhibit A

The Association of State and Territorial Dental Directors

Instructions for Completing Fluoridation Quarterly Report for Community and School Water Systems

Introduction

The purpose of this report is to provide data in summary form to describe the quality of fluoridation in each state as determined by the ability of fluoridating systems to conduct monitoring and maintain optimal fluoride levels.

General Instructions

1. All community water systems in the state that adjust the fluoride concentrations of their drinking water supply should be included in this report.

2. The optimal fluoride level for a particular system is to be based on the annual average of maximum daily air temperature for the geographic area over a 5-year period.

Instructions for Completing Form

Item 1. Record the state name.

Item 2. Enter the quarter covered by the report. The reporting period is the 3-month quarter beginning in January, April, July, or October. Reports are requested within 60 days after the end of reporting period.

Item 3. Provide an update on the following:

A. Record previous quarter's total systems and population.

B. The names of systems that began fluoridating during the quarter, date started, and the total population served.

C. The names of systems that discontinued fluoridating during the quarter, date discontinued, and the population that was served.

NOTE: This does not include systems with temporary interruption of service. These fall into Item 4 or Item 5.

D. The total number of fluoridated systems at the end of the quarter and the total population served.

Item 4. Report the total number of systems and population served that did not report required sampling in any month of the reporting period as determined by either or both of the following criteria:

Exhibit A — Continued

a. Split/check Samples (check samples are acceptable if split samples are not available) should be included on the report if every quarterly or monthly split sample was not submitted.

b. Monitoring Reports - For systems required to monitor daily by the state, monitoring results were reported for less than 75 percent of days water was pumped; or for systems required to monitor less frequently, at least one monitoring result per week was not reported.

Item 5. Report the total number of systems and population served that failed to maintain optimal fluoride levels because of either of the following:

a. The mean of all fluoride verification samples, for each system, was more than 0.1 ppm below or 0.5 ppm above the optimal fluoride level for the system.

b. More than 25 percent of the monitoring samples, for each system, were more than 0.1 ppm below or 0.5 ppm above the optimal level (outliers). Report the number of systems and the population in this category.

NOTE: Systems that fail to maintain optimal levels should only be in Item 4 or Item 5--NOT BOTH.

Item 6. Report total number of systems and population served that have maintained optimal levels for all 3 months in the quarter. Do not include systems falling into Item 4 or Item 5 above.

Note: Items 4, 5, and 6 must equal End of Quarter total Item 3D.

Item 7. Report total number of systems and population served that had more than one-third of the split/check samples taken in the quarter deviating by more than plus or minus 0.2 ppm from the corresponding monitoring results.

Note: Systems included in this item may also be included in Items 4, 5, and 6.

Revised 1985

Exhibit A — Continued

FLUORIDATION QUARTERLY REPORT
COMMUNITY WATER SYSTEMS

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1. STATE: _____2. REPORTING PERIOD: _____

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3. END OF QUARTER STATISTICS:

A: Last Quarter Total Systems:_____ Population:_____

B: Began During Quarter (one line)

NAMES	DATE STARTED	POPULATION SERVED

C: Discontinued During Quarter

NAMES	DATE DISCONT.	POPULATION SERVED

D: Total Systems Fluoridating

End of Quarter Total Systems:_____ Population:_____

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4. SUMMARY OF SYSTEMS WITH INCOMPLETE DATA

Number of Systems: _____ Population Served: _____

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5. SUMMARY OF SYSTEMS NOT MEETING OPTIMAL LEVELS

Number of Systems: _____ Population Served: _____

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6. SUMMARY OF SYSTEMS MEETING OPTIMAL LEVELS

Number of Systems: _____ Population Served: _____

---

7. SYSTEMS WITH INADEQUATE CORRELATION BETWEEN CHECK SAMPLES AND MONITORING RESULTS

Number of Systems: _____ Population Served: _____

Person Completing Form:_____Telephone_____

Revised 1985

Exhibit A — Continued

Introduction

The purpose of this report is to provide data in summary form to describe the quality of fluoridation in each state as determined by the ability of fluoridating schools to conduct monitoring and maintain optimal fluoride levels.

General Instructions

1. All school water systems in the state that adjust the fluoride concentrations of their drinking water supply should be included in this report.

2. The optimal fluoride level for a particular system is to be based on the annual average of maximum daily air temperature for the geographic area over a 5-year period. This optimal fluoride level is the community optimal level multiplied by 4.5 for use in schools.

Instructions for Completing Form

Item 1. Record the state name.

Item 2. Enter the quarter covered by the report. The reporting period is the 3-month quarter beginning in October, January, and April. Reports are requested within 60 days after the end of reporting period.

Item 3. Provide an update on the following:

A. Record previous quarter's total schools and population.

B. The names of schools that began fluoridating during the quarter, date started, and the total population served.

C. The names of schools that discontinued fluoridating during the quarter, date discontinued, and the population that was served.

NOTE: This does not include schools with temporary interruption of service. These fall into Item 4 or Item 5.

D. The total number of fluoridated schools at the end of the quarter and the total population served.

Item 4. Report the total number of schools and population served that did not report required sampling in any month of the reporting period as determined by either or both of the following criteria:

Exhibit A — Continued

a. Verification Sample - a school should be included on the report if every weekly verification sample was not submitted.

b. Monitoring Reports - For systems required to monitor daily by the state, monitoring results were reported for less than 75 percent of days water was pumped; or for systems required to monitor less frequently, at least one monitoring result per week was not reported.

Item 5. Report the total number of systems and population served that failed to maintain optimal fluoride levels because of either of the following:

a. The mean of all fluoride verification samples, for each school, was more than 0.5 ppm below or 1.5 ppm above the optimal fluoride level for the system.

b. More than 25 percent of the monitoring samples, for each school, were more than 0.5 ppm below or 1.5 ppm above the optimal level (outliers). Report the number of systems and the population in this category.

NOTE: Schools that fail to maintain optimal levels should only be in Item 4 or Item 5- -NOT BOTH.

Item 6. Report total number of schools and population served that have maintained optimal levels for all 3 months in the quarter.

Do not include schools falling into Item 4 or Item 5 above.

Note: Items 4, 5, and 6 must equal End of Quarter total Item 3D.

Developed March 1988

Exhibit A — Continued

FLUORIDATION QUARTERLY REPORT
SCHOOL WATER SYSTEMS

---

1. STATE: _____2. REPORTING PERIOD: _____

---

3. END OF QUARTER STATISTICS:

A: Last Quarter Total Schools:_____ Population:_____

B: Began During Quarter (one line)

NAMES	DATE STARTED	POPULATION SERVED

C: Discontinued During Quarter

NAMES	DATE DISCONT.	POPULATION SERVED

D: Total Schools Fluoridating

End of Quarter Total Schools:_____ Population:_____

---

4. SUMMARY OF SCHOOLS WITH INCOMPLETE DATA

Number of Schools: _____ Population Served: _____

---

5. SUMMARY OF SCHOOLS NOT MEETING OPTIMAL LEVELS

Number of Schools: _____ Population Served: _____

---

6. SUMMARY OF SCHOOLS MEETING OPTIMAL LEVELS

Number of Schools: _____ Population Served: _____

Person Completing Form:_____Telephone_____

Developed March 1988

Exhibit B

Fluoridation Facility Fact Sheet

FLUORIDATION FACILITY FACT SHEET

Date:_____ **Completed By:**_____

SYSTEM INFORMATION

Water System Name:	
Water System ID Number:	
Water System Address:	
Water System Phone Number:	
Water System Manager:	
Manager Phone Number:	
County Water System Located In:	
Number of Water Sources	

POPULATION SERVED DIRECTLY BY WATER SYSTEM

Residential Customers:	
Commercial Customers:	
Total Population Served:	

CONSECUTIVE SYSTEMS

System Name	System PWS ID #	Population Served

Exhibit B — Continued

FLUORIDE FACILITY FACT SHEET **PAGE_____**
PWSID#_____ **SOURCE # _____**

WATER SUPPLY

TYPE OF WATER SYSTEM							
Surface		Purchased Surface		Ground		Purchased Ground	
WATER PRODUCTION (GALLONS/DAY)							
Maximum Flow		Average Flow		Minimum Flow		Operating Pressure	
IS FLOW METER-PACED SYSTEM NEEDED				Yes		No	

FLUORIDE

TYPE OF CHEMICAL USED					
Sodium Fluoride		Sodium Fluorosilicate		Fluorosilicic Acid	
DOES CHEMICAL MEET AWWA STANDARDS			Yes	No	
NATURAL FLUORIDE LEVEL (milligrams/liter)					
Normal		High		Low	
CALCULATED FLUORIDE FEED RATE					
Maximum Flow		Average Flow		Minimum Flow	
IS FEEDER CAPACITY NO MORE THAN TWICE AVERAGE FLOW FEED RATE					
Yes		No		Maximum Capacity	
EMERGENCY TREATMENT SHEET INGESTION POSTED			Yes	No	
MATERIAL DATA REFERENCE SHEET AVAILABLE			Yes	No	

RECORD KEEPING & MONITORING

MONITORING	Yes	No
ARE FLUORIDE CHEMICALS FED RECORDED DAILY		
ARE FLUORIDE ANALYTICAL RESULTS RECORDED DAILY		
ARE REFILLS OF FLUORIDE CHEMICALS RECORDED		
ARE FLUORIDE DOSAGE CALCULATIONS PERFORMED		

LABORATORY INSTRUMENTATION

Analyzer Brand Name:		Model Number:			
Method of Fluoride Analysis MAGNETIC STIRRER WITH ELECTRODE		Ion Electrode:		SPADNS:	
Age of Analyzer:					
Last Manufacturer's Calibration:					

Exhibit B — Continued

FLUORIDE FACILITY FACT SHEET **PAGE_____**
PWSID#_____ **SOURCE # _____**

FLUORIDATION FEED EQUIPMENT INTERLOCK

Plant Power		Flow Meter		Control Valve	
High Lift Pumps		Raw Water Pumps		Flow Switch	

FEEDER - SPECIAL PLUG TO INTERLOCK	Yes		No	
FEEDER - HARDWIRED TO INTERLOCK	Yes		No	

SECONDARY FLOW CONTROL DEVICE

Flow Switch		Pressure Device	

POINT OF INJECTION

Location		Pressure	

CORPORATION STOP VALVE AT INJECTION	Yes		No	
SAFETY CHAIN ON CORP. STOP VALVE	Yes		No	
1ST CUSTOMER <100 FT FROM INJECTION	Yes		No	
IN-LINE MIXER INSTALLED	Yes		No	
FLUORIDE FEED LINES COLOR CODED	Yes		No	

FEED ROOM HOSE CONNECTIONS

HOSE BIBB VACUUM BREAKERS ALL HOSE CONNECTIONS	Yes		No	

OPERATOR CERTIFICATION

Operator Name	Certification Level	Certification Number

OPERATOR FLUORIDATION TRAINING

ALL OPERATORS RECEIVED START-UP TRAINING	Yes		No	
ALL OPERATORS RECEIVED IN-DEPTH TRAINING	Yes		No	

PLANT EMERGENCY PLAN

DOES PLANT HAVE ON-SITE EMERGENCY PLAN	Yes		No	
DOES PLAN COVER ACCIDENTAL CHEMICAL SPILLS	Yes		No	
DOES PLAN COVER FLUORIDE OVERFEEDS	Yes		No	
DOES PLAN PROVIDE FOR PUBLIC NOTIFICATION	Yes		No	
DOES PLAN ADDRESS ACTS OF NATURE	Yes		No	

PLANT SECURITY

NECESSARY SECURITY MEASURES IN PLACE	Yes		No	

Exhibit B — Continued

FLUORIDE FACILITY FACT SHEET **PAGE_____**
PWSID#_____ **SOURCE # _____**

ACID FEED SYSTEM

Metering Pump

Stroke Length		Stroke Frequency	
Motor Size		Pump Pulley Size	
PUMP PRIMING SWITCH SPRING LOADED		Yes	No
PUMP MOUNTED <4 FEET HIGHER THAN LIQUID		Yes	No

Anti-siphon Protection

ON PUMP DISCHARGE	Yes		No		Brand/Type	
TESTED	Yes		No		Last Maintenance	
AT INJECTION POINT	Yes		No		Brand/Type	
TESTED	Yes		No		Last Maintenance	

Acid Strength

Full		Dilute(Not Recommended)	
IF DILUTE ACID IS USED, IS THERE A MIXER		Yes	No

Day Tank

PROVIDED	Yes		No		Capacity	
Days Storage		SEALED AND VENTED		Yes	No	

Scale

PROVIDED	Yes		No	Brand/Model	
Last Date Certified					

Floor Drain

FLOOR DRAIN IN CHEMICAL STORAGE ROOM	Yes		No
Where does floor drain discharge to			
FLOOR DRAIN IN CHEMICAL FEED ROOM	Yes		No
Where does floor drain discharge to			

Bulk Storage

SEALED AND VENTED	Yes		No		Capacity	
Reorder level(gallons)				Days available at reorder		
BERM OR DIKE	Yes		No		Containment capacity	

Carboy Storage

SEALED AND VENTED	Yes		No		# Carboys	
Reorder level(carboys)				Days available at reorder		

Operator Safety Equipment

Safety Shower			Operational		
Eye Wash Station			Operational		
Apron		Gloves		Boots	
Goggles		Face Shield		Vapor Mask	

Exhibit B — Continued

FLUORIDE FACILITY FACT SHEET **PAGE_____**
PWSID#_____ **SOURCE # _____**

SATURATOR FEED SYSTEM

Saturator

Upflow		Downflow(No longer produced)					
FLOW RESTRICTOR(2 GAllONS/minute)			Yes		No		
Daily Chemical Usage (GALLONS)							
MANUAL FILL OF MAKE UP WATER			Yes		No		
Chemical Bed Height(inches)							

Metering Pump

Stroke Length		Stroke Frequency					
Motor Size		Pump Pulley Size					
PUMP PRIMING SWITCH SPRING LOADED			Yes		No		
PUMP MOUNTED <4 FEET HIGHER THAN LIQUID			Yes		No		

Anti-siphon Protection

ON PUMP DISCHARGE	Yes		No		Brand/Type		
TESTED	Yes		No		Last Maintenance		
AT INJECTION POINT	Yes		No		Brand/Type		
TESTED	Yes		No		Last Maintenance		

Makeup Water Line

AIR GAP MAINTAINED AT SATURATOR	Yes		No	
BACKFLOW PROTECTION PROVIDED MAKE-UP WATER	Yes		No	
Type of backflow protection				
SEDIMENT FILTER BETWEEN SOFTENER AND METER	Yes		No	

Water Softener

Make-up water hardness(ppm hardness)				
MAKE-UP WATER SOFTENER	Yes		No	
Water softener regeneration frequency(days)				
Type/Brand Water Softener				

Floor Drain

FLOOR DRAIN IN CHEMICAL STORAGE ROOM	Yes		No	
Where does floor drain discharge to				
FLOOR DRAIN IN CHEMICAL FEED ROOM	Yes		No	
Where does floor drain discharge to				

Bag Storage(do not stack over 6 bags high)

Maximum # Bags		Reorder point (Bags)				
Days of Chemical Available at Reorder Point						
Bag Size	100#		50#		Other	

Operator Safety Equipment

Safety Shower		Operational			
Eye Wash Station		Operational			
Apron		Gloves		Boots	
Goggles		Face Shield		Dust Mask	

Exhibit B — Continued

FLUORIDE FACILITY FACT SHEET **PAGE____**
PWSID#_____ **SOURCE # _____**

DRY FEED SYSTEM

Dry Feeder

Volumetric Dry Feeder									
Screw		Roller		Pan		Disk		Other	
Gravimetric Dry Feeder									
Loss-of-Weight		Belt Type				Other			

Makeup Water Line

AIR GAP PROVIDED AT MIXING TANK	Yes		No	
BACKFLOW PROTECTION FOR MAKE-UP WATER	Yes		No	
Type of backflow protection				

Mixing Tank

PROVIDED	Yes		No		Capacity		
CHEMICALS COMPLETELY DISSOLVED IN TANK?			Yes		No		
MIXER	Mechanical		Baffles		Water Jets	Other	

Feeder Settings

Motor Size		Pump Pulley Size	
Frequency		Screw Size	

Scale

PROVIDED	Yes		No		Brand/Model	
Last Date Certified						

Floor Drain

FLOOR DRAIN IN CHEMICAL STORAGE ROOM	Yes		No	
Where does floor drain discharge to				
FLOOR DRAIN IN CHEMICAL FEED ROOM	Yes		No	
Where does floor drain discharge to				

Hopper Storage

Capacity		BAG LOADER	Yes		No	
DUST CONTAINMENT FOR BULK STORAGE HOPPER			Yes		No	

Bag Storage(do not stack over 6 bags high)

Maximum # Bags			Reorder point (Bags)			
Days of Chemical Available at Reorder Point						
Bag Size	100#		50#		Other	

Operator Safety Equipment

Safety Shower			Operational		
Eye Wash Station			Operational		
Apron		Gloves		Boots	
Goggles		Face Shield		Dust Mask	

Exhibit C

Fluoridation Facility Inspection Report

FLUORIDATION FACILITY INSPECTION REPORT

				SATISFACTORY	UNSATISFACTORY
WATER SYSTEM NAME					
WATER PLANT NAME					
OPERATOR ON DUTY					
DATE OF INSPECTION					
OTHER TREATMENT CHEMICALS					
Chlorine		Polyphosphates			
Alum		Water Softeners			
Caustic		Ammonia			
Soda Ash		$KMnO_4$			
Lime		Other:			
Flocculent Aid		Other:			
LABORATORY CONTROL					
Frequency of Fluoride Analysis			/day		
Fluoride Concentration at inspection			mg/L		
Location of Sample Point					
MONITORING REPORTS					
CHEMICAL FEED EQUIPMENT CONDITION					
INJECTION POINT					
CHEMICAL STORAGE					
DUST REMOVAL					
FLUORIDE CHEMICAL MEETS AWWA SPECIFICATIONS					
FACILITY FACT SHEET CURRENT					
OVERALL FLUORIDATION PROGRAM EVALUATION					

COMMENTS:

WATER PLANT OPERATOR_____

INSPECTOR_____

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