American Water Works Association

The Authoritative Resource on Safe Water℠

ANSI/AWWA B703-06
(Revision of ANSI/AWWA B703-00)

AWWA Standard

Fluorosilicic Acid

ANSI American National Standards Institute

Effective date: March 1, 2006.
First edition approved by AWWA Board of Directors July 30, 1954.
This edition approved Feb 12, 2006.
Approved by American National Standards Institute Oct. 19, 2005.

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American Water Works Association
ANSI/AWWA B703-89
(Revision of ANSI/AWWA B703-84)

AWWA STANDARD
FOR
HYDROFLUOSILICIC ACID

AMERICAN NATIONAL STANDARD

New standard B703-94 available from County Health Dept.

Effective date: July 1, 1989.
First edition approved by AWWA Board of Directors July 30, 1954.
This edition approved Jan. 29, 1989.
Approved by American National Standards Institute, Inc., June 26, 1989.

Published by
AMERICAN WATER WORKS ASSOCIATION

Foreword

This foreword is for information only and is not a part of AWWA B703.

I. History of Standard. This standard was first published in the November 1954 issue of *Journal AWWA* as tentative, having been approved on July 30, 1954, by the AWWA Board of Directors. The second, third, and fourth editions were approved on May 15, 1960; June 18, 1971; and Jan. 30, 1984, respectively. This edition was prepared by the AWWA Standards Committee on Fluorides.

II. Manufacture and Use of Hydrofluosilicic Acid. Hydrofluosilicic acid (fluosilicic acid) (H_2SiF_6) is one of several fluoride compounds presently being added to drinking water to reduce the incidence of dental caries. Since the first fluoridation installation during 1945 it has been repeatedly shown that dental decay can be reduced by 65 percent among children who have consumed fluoridated water since birth.

Hydrofluosilicic acid is an aqueous solution of H_2SiF_6, "water white" to "straw yellow" in color. It is a corrosive acid, irritating to the skin, and has a pungent odor. It is not known to exist in any anhydrous form. The boiling point increases with increasing acid content. At 25 percent acid content, a typical commercial strength, the boiling point is 222.5°F (105.8°C), and the freezing point is approximately + 4°F (–15.5°C). A 25 percent solution has a pH of 1.2 and weighs 10.1 lb/gal (1.20 kg/L). The molecular weight of H_2SiF_6 is 144.08.

Hydrofluosilicic acid is produced as a coproduct in the manufacture of wet-process phosphoric acid and other phosphate fertilizers. The raw material, phosphate rock, which contains fluoride and silica, is treated with sulfuric acid, which evolves the gases, silicon tetrafluoride and hydrogen fluoride. These gases are passed through scrubbers and react with water to form hydrofluosilicic acid. This acid is the principal raw material in the production of all silicofluoride salts. It is also used in the ceramic, brewing, paint, and metallurgical industries.

Hydrofluosilicic acid is added to water by means of various liquid-feeding devices and metering pumps. Hydrofluosilicic acid is normally fed directly into the water to produce the optimal fluoride concentration. Dilution of the acid before feeding is not recommended. If the acid is too concentrated for the solution feeder to handle, then solutions of other compounds are generally indicated—for instance, solutions of sodium fluoride or sodium silicofluoride. If the acid must be diluted, care should be taken to avoid the dilutions in the range of 10 to 1 and 20 to 1 (parts water to parts acid), which often result in the formation of an insoluble silica precipitate that can clog feeders, orifices, and other equipment. The use of softened or distilled water has no effect on the formation of this precipitate. However, the precipitate can be avoided by using dilutions outside of the critical range or by using acid that has been fortified with hydrogen fluoride (HF). The hydrofluoric acid content should not exceed 1.0 percent by weight of the total weight of the acid received.

III. Impurities. When a water treatment chemical is added to water, any impurity contained in the chemical is also added. Water treatment chemicals such as hydrofluosilicic acid must not contain soluble mineral or organic substances in quantities capable of producing deleterious or injurious effects upon the health of those consuming a water that has been properly treated with the chemical.

The AWWA Standards Committee on Fluorides recognizes that the establishment of health-related purity requirements for hydrofluosilicic acid depends on

the toxicity of the contaminant and the use pattern of the chemical. Interpretation of toxicological data is at times controversial and is dependent on an evolving science. The toxicological data base for water impurities is improving steadily. Therefore, it is important that purchasers and suppliers work together to ensure that water treatment chemical impurities be held at safe levels as new information concerning the presence and effects of impurities becomes available.

In the 1982 *Water Chemicals Codex*,* the codex committee considered a maximum dosage of 1.2 mg/L of fluoride ion. Commercially available 25 percent hydrofluosilicic acid (approximately 19.8 percent fluoride ion) may contain arsenic and lead, but at levels far below those that triggered the codex committee to list recommended maximum impurity content (RMIC) levels for treatment chemicals.

The presence of impurities in a water treatment chemical is greatly influenced by the method of manufacture and quality of raw material used. If other than recognized methods of manufacture are used, or if unusual raw materials are used, the potential may exist for impurities to be present that may be inconsistent with good water treatment practice.

Purchasers should consider making an inquiry of potential suppliers concerning the presence of impurities in the material to be supplied relative to the manufacturing process used. If a significant potential exists for impurities to be present that is inconsistent with good water treatment practice, purchasers may want to consider including specific impurity limits in their supplementary specifications. If additional impurity limits are required by the purchaser, then the purchaser must also state the analytical methods used to determine compliance with the limits. Refer to the *Water Chemicals Codex* for guidance regarding maximum allowable impurity content levels.

IV. Acceptance. Users of AWWA B703 should be aware that at the time AWWA B703-89 was published, general authority to accept direct additives for use in drinking water rested with individual states. States use various options to determine the acceptability of products, including a voluntary advisory program administered by the US Environmental Protection Agency (USEPA). This program provides unofficial listings of apparently acceptable drinking water additives. Indications are that USEPA will discontinue this advisory program April 7, 1990. Alternative information on additive acceptability is now being developed. AWWA intends to include definitive references on this subject in future editions of AWWA standards.

V. Storage, Handling, and Safety Precautions. Hydrofluosilicic acid must be handled carefully because it is corrosive. If the acid comes in contact with the skin, the affected parts should be immediately rinsed thoroughly with water. For information on safety refer to the material safety data sheets (MSDS) available from the chemical vendor or manufacturer. Protective safety gear should be worn when handling hydrofluosilicic acid. The following list of protective clothing and equipment should be the minimum available:

1. Gauntlet neoprene gloves (12-in. glove minimum length).
2. Full 8-in. face shield or acidproof-type safety goggles.
3. Heavy-duty acidproof-type neoprene aprons.
4. Safety shower and eye washer in easily accessible location.

*Available from National Academy Press, 2101 Constitution Ave. N.W., Washington, DC 20418.

Materials such as glass, ceramics, steel, concrete, and wood are not suitable for hydrofluosilicic acid containers and other equipment because they are attacked by the hydrofluoric acid (HF) formed at the surface of the hydrofluosilicic acid. Bulk storage tanks and other containers can be made of polyethylene, rubber-lined steel, or other appropriate materials. The polyethylene should be manufactured from high-density, cross-linked material (cross linking provides strength). The plastic should contain a minimum of 0.25 percent ultraviolet stabilizer to protect against sunlight. Steel tanks must always be lined. The linings are commonly made of natural rubber, neoprene, butyl rubber or equivalent, and should be at least 2.4 mm ($^3/_{32}$ in.) thick. Structural carbon, Hastelloy C, Durimet 20, or equivalent materials can be used for hardware. The rooms where the acid is stored and used should be thoroughly ventilated with a vent located near the ceiling. The acid fumes are lighter than air.

VI. Information Regarding Use of This Standard. This standard includes certain options that, if desired, must be specified by the purchaser. A number of items must be specified to describe completely the hydrofluosilicic acid required.

When purchasing hydrofluosilicic acid under this standard, the purchaser must provide supplementary specifications that include the following:

1. Standard used—that is, AWWA B703-89, Standard for Hydrofluosilicic Acid.
2. Whether an affidavit of compliance, or certified analyses, or both, are required (Sec. 1.3).
3. Concentration (strength of acid desired) (Sec. 2.2). Generally, the acid shall contain between 20 and 30 percent H_2SiF_6 by weight. Where variations in acid strength are acceptable, arrangements should be made between the purchaser and the vendor as to the method of payment, based on the aggregated acid content.
4. Quantity required.
5. Form of shipment—bulk or package (type) (Sec. 3.2.2).

VII. Major Revisions. Major changes made in this revision of the standard include the following:

1. Addition of a section on acceptance in the Foreword.
2. Additional information on impurities is provided in the Foreword and Sec. 2.3.
3. Additional information on safety is provided in the Foreword.
4. Updating of style and format to conform with current practice.
5. Sec. 4.4, Test Procedure for Heavy Metals, has been revised.
6. Appendix A on containment vessels is now included.

American Water Works Association
ANSI/AWWA B703-94
(Revision of ANSI/AWWA B703-89)

AWWA STANDARD
FOR
FLUOROSILICIC ACID

AMERICAN NATIONAL STANDARD

Available from County Health Dept.
Also, ask for the Specification Sheet

Effective date: Nov. 1, 1994.
First edition approved by AWWA Board of Directors July 30, 1954.
This edition approved Jan. 30, 1994.
Approved by American National Standards Institute Aug. 18, 1994.

AMERICAN WATER WORKS ASSOCIATION
6666 West Quincy Avenue, Denver, Colorado 80235

Foreword

This foreword is for information only and is not a part of AWWA B703.

I. Introduction

I.A. *Background.* Fluorosilicic acid (H_2SiF_6) is one of several fluoride compounds presently being added to drinking water to reduce the incidence of dental caries. Since the first fluoridation installation during 1945, studies have shown that dental decay can be reduced by 20 to 40 percent among children who have consumed fluoridated water since birth.

Fluorosilicic acid is an aqueous solution of H_2SiF_6, water white to straw yellow in color. It is a corrosive acid, irritating to the skin, and has a pungent odor. It is not known to exist in any anhydrous form. The boiling point increases with increasing acid content. At a typical commercial strength of 25 percent acid content, the boiling point is 105.8°C (222.5°F), and the freezing point is approximately –15.5°C (+4°F). A 25 percent solution has a pH of 1.2 and weighs 10.1 lb/gal (1.20 kg/L). The molecular weight of H_2SiF_6 is 144.08.

Fluorosilicic acid is produced as a coproduct in the manufacture of wet-process phosphoric acid and other phosphate fertilizers. The raw material, phosphate rock, which contains fluoride and silica, is treated with sulfuric acid, which evolves the gases silicon tetrafluoride (SiF_4) and hydrogen fluoride (HF). These gases are passed through scrubbers and react with water to form fluorosilicic acid. This acid is the principal raw material in the production of all silicofluoride salts. It is also used in the ceramic, brewing, paint, and metallurgical industries.

Fluorosilicic acid is added to water by means of various liquid-feeding devices and metering pumps. It is normally fed directly into the water to produce the optimal fluoride concentration. Dilution of the acid before feeding is not recommended. If the acid is too concentrated for the solution feeder to handle, then solutions of other compounds are generally indicated, for example, solutions of sodium fluoride or sodium fluorosilicate. If the acid must be diluted, care should be taken to avoid dilutions in the range of 10 to 1 and 20 to 1 (parts water to parts acid), which often result in the formation of an insoluble silica precipitate that can clog feeders, orifices, and other equipment. The use of softened or distilled water has no effect on the formation of this precipitate. However, the precipitate can be avoided by using dilutions outside of the critical range or by using acid that has been fortified with hydrogen fluoride (HF).

I.B. *History.* This standard was first published in the November 1954 issue of *Journal AWWA* as tentative, having been approved on July 30, 1954, by the AWWA Board of Directors. The second, third, fourth, and fifth editions were approved on May 15, 1960; June 18, 1971; Jan. 30, 1984; and Jan. 29, 1989, respectively. This edition was prepared by the AWWA Standards Committee on Fluorides.

I.C. *Acceptance.* In May 1985, the US Environmental Protection Agency (USEPA) entered into a cooperative agreement with a consortium led by NSF International (NSF) to develop voluntary third-party consensus standards and a certification program for all direct and indirect drinking water additives. Other members of the consortium included the American Water Works Association Research Foundation (AWWARF), the Conference of State Health and Environmental Managers (COSHEM), the American Water Works Association (AWWA), and the Association of State Drinking Water Administrators (ASDWA). The consortium is responsible for

AWWA Standard for Fluorosilicic Acid B703-89 (1989) new standard is B703-94

the cooperative effort of manufacturers, regulators, product users, and other interested parties that develop and maintain the NSF standards.

In the United States, authority to regulate products for use in, or in contact with, drinking water rests with individual states.* Local agencies may choose to impose requirements more stringent than those required by the state. To evaluate the health effects of products and drinking water additives from such products, state and local agencies may use various references, including:

1. An advisory program formerly administered by USEPA, Office of Drinking Water, discontinued on Apr. 7, 1990.
2. Specific policies of the state or local agency.
3. Two standards developed under the direction of NSF, ANSI†/NSF‡ 60, Drinking Water Treatment Chemicals — Health Effects, and ANSI/NSF 61, Drinking Water System Components — Health Effects.
4. Other references, including AWWA standards, *Food Chemicals Codex, Water Chemicals Codex,*§ and other standards considered appropriate by the state or local agency.

Various certification organizations may be involved in certifying products in accordance with ANSI/NSF 60. Individual states or local agencies have authority to accept or accredit certification organizations within their jurisdiction. Accreditation of certification organizations may vary from jurisdiction to jurisdiction.

Appendix A, "Toxicology Review and Evaluation Procedures," to ANSI/NSF 60 does not stipulate a maximum allowable level (MAL) of a contaminant for substances not regulated by a USEPA final maximum contaminant level (MCL). The MALs of an unspecified list of "unregulated contaminants" are based on toxicity testing guidelines (noncarcinogens) and risk characterization methodology (carcinogens). Use of Appendix A procedures may not always be identical, depending on the certifier.

AWWA B703-94 does not address additives requirements. Thus, users of this standard should consult the appropriate state or local agency having jurisdiction in order to

1. Determine additives requirements, including applicable standards.
2. Determine the status of certifications by all parties offering to certify products for contact with, or treatment of, drinking water.
3. Determine current information on product certification.

II. Special Issues.

II.A. *Storage, Handling, and Safety Precautions.* Fluorosilicic acid must be handled carefully because it is corrosive. If the acid comes in contact with the skin, the affected parts should be immediately rinsed thoroughly with water. For information on safety, refer to the material safety data sheets (MSDS) available from the chemical supplier or manufacturer. Protective safety gear should be worn when handling fluorosilicic acid. The following protective clothing and equipment should be the minimum available:

1. Gauntlet neoprene gloves (12-in. [300-mm] minimum glove length).
2. Full 8-in. (200-mm) face shield or acidproof-type safety goggles.
3. Heavy-duty, acidproof-type neoprene aprons.
4. Safety shower and eye wash in an easily accessible location.

Materials such as glass, ceramics, steel, concrete, and wood are not suitable for fluorosilicic acid containers and other equipment because they are attacked by the hydrofluoric acid (HF) formed at the surface of the fluorosilicic acid. Bulk storage tanks and other containers can be made of polyethylene, rubber-lined steel, or other appropriate materials. The polyethylene should be manufactured from high-density, cross-linked material (cross-linking provides strength). The polyethylene should contain a minimum of 0.25 percent ultraviolet stabilizer to protect against sunlight. Steel tanks must always be lined. The linings are commonly made of natural rubber, neoprene, butyl rubber or equivalent, and should be at least 2.4 mm (3⁄32 in.) thick. Structural carbon, Hastelloy C, Durimet 20, or equivalent materials can be used for hardware. The rooms where the acid is stored and used should be thoroughly ventilated with a vent located near the ceiling because acid fumes are lighter than air. Closed tanks should be vented to the outside.

III. Use of This Standard. It is the responsibility of the user of an AWWA standard to determine that the products described in that standard are suitable for use in the particular application being considered.

III.A. *Purchaser Options and Alternatives.* The following items should be covered in the purchaser's specifications:

1. Standard used — that is, AWWA B703, Standard for Fluorosilicic Acid, of latest revision.
2. Affidavit of compliance or certified analyses, or both, if required (Sec. 6.3).
3. Concentration (strength of acid desired) (Sec. 4.2). The acid shall contain between 20 and 30 percent H_2SiF_6 by weight. Where variations in acid strength are acceptable, arrangements should be made between the purchaser and the supplier as to the method of payment, based on the aggregated acid content.
4. Quantity required.
5. Form of shipment — bulk or package (type) (Sec. 6.2.2).

III.B. *Modification of Standard.* Any modification of the provisions, definitions, or terminology in this standard must be provided in the purchaser's specifications.

IV. Major Revisions. Major changes made in this revision of the standard include the following:

1. The format has been changed to current style for AWWA standards.
2. The acceptance clause (Sec. I.C) and the definitions of parties (Sec. 3) have been revised to approved wording.
3. Editorial revisions have been included throughout the standard.
4. The name of the compound which is the subject of the standard has been changed from hydrofluorosilicic acid to fluorosilicic acid, which is the internationally recognized name.
5. A statement regarding hydrofluoric acid content in fluorosilicic acid has been deleted from the foreword and added to Sec. 4.3.2, Impurities, in the standard.

V. Comments. If you have any comments or questions about this standard, please call the AWWA Standards Department, (303) 794-7711 ext. 2201, FAX (303) 795-1440, or write to the department at 6666 W. Quincy Ave., Denver, CO 80235.

*Persons in Canada, Mexico, and non-North American countries should contact the appropriate authority having jurisdiction.

†American National Standards Institute, 11 W. 42nd St., New York, NY 10036.

‡NSF International, 3475 Plymouth Rd., Ann Arbor, MI 48106.

§Both publications available from National Academy of Sciences, 2102 Constitution Ave. N.W., Washington, DC 20418.

Treatment Chemicals Contribute to Arsenic Levels

by Cheng-nan Weng, Darrell B. Smith, and Gary M. Huntley

Arsenic is an issue that water utilities no longer can avoid. The US Environmental Protection Agency is expected to propose a reduction in the federal drinking water standard on arsenic from 50 µg/L to 5 µg/L later this year, although USEPA is also considering setting the maximum contaminant level at 3 µg/L, 10 µg/L, and 20 µg/L. The final arsenic rule is due by Jan. 1, 2001.

Utilities should test their sources of water for arsenic and compare them with the proposed levels of 3, 5, and 10 µg/L. However, testing source water alone may not be sufficient to determine the arsenic load in finished water. Some treatment chemicals may also contain trace amounts of arsenic. Utilities should review and estimate the maximum possible arsenic concentrations contributed by the chemicals they use in drinking water treatment. Even trace amounts add up and may contribute a substantial portion—possibly up to 10 percent—of a 3 or 5 µg/L maximum contaminant level.

Connecticut Experience

The South Central Connecticut Regional Water Authority has three surface water treatment plants (SWTPs) and five wellfields. Recently, SCCRWA calculated the arsenic burden derived from chemicals routinely used to treat surface and groundwater at these facilities. Those chemicals are listed in Table 1.

To estimate the trace arsenic levels in the bulk treatment chemicals, data from the suppliers' analysis reports or product specifications were used. The resulting trace arsenic concentrations in the finished water that were contributed by the treatment chemicals were computed by one of the following two methods:

1. For those chemicals with dosages expressed as mg/L of product chemicals (such as polymer, sulfuric acid, bimetallic zinc metaphosphate, and potassium permanganate), the resulting trace arsenic concentration in the finished water was computed by multiplying the chemical dosage by the trace arsenic level in the bulk treatment chemical.

2. For other chemicals (such as alum, ferric chloride, caustic soda, and fluorosilicic acid), a dilution factor was determined by dividing the chemical concentration by the chemical dosage. The resulting trace arsenic concentration in the finished water was computed by dividing the trace arsenic level in the bulk treatment chemical by the dilution factor.

Information produced by several calculations is tabulated as follows:

- Table 2 shows the maximum possible arsenic concentrations contributed by treatment chemicals for one surface water treatment plant that uses alum (0.279 µg/L arsenic contributed).
- Table 3 shows the maximum possible arsenic concentrations contributed by treatment chemicals for the wellfield, which uses sodium hypochlorite for disinfection (0.249 µg/L arsenic contributed).

Treatment Chemical	# Surface Water Treatment Plants (3 total)	# Groundwater Treatment Facilities (5 total)
Sodium hydroxide	3	Not used
Sulfuric acid	1	Not used
Alum	2	Not used
Potassium permanganate	2	Not used
Ferric chloride	1	Not used
Synthetic polymer A	1	Not used
Synthetic polymer B	1	Not used
Chlorine	3	4
Sodium hypochlorite	Not used	1
Bimetallic zinc metaphosphate	3	5
Fluorosilicic acid	3	5

Table 1. Chemicals routinely used by the South Central Connecticut Regional Water Authority, and the number of facilities where they are used.

- Table 4 shows the range of maximum arsenic contribution by treatment chemicals for the SCCRWA (range of all compounds, 0.0002–0.245 µg/L).
- Table 5 compares in finished water the calculated amount of arsenic that is contributed by treatment chemicals with the analytical result (overall calculated range, 0.248–0.306 µg/L; analytical result <1 µg/L in all cases).

These data show that in finished water the theoretical arsenic concentrations attributable to normal dosages of water treatment chemicals are extremely low (Tables 2, 3, and 4). This conclusion is supported by the analytical data (Table 5), which show arsenic concentrations to be below 1.0 µg/L in all of the SCCRWA's surface and groundwater treatment facility finished waters.

Conclusion

If the standard were set at 3 µg/L, about 10 percent of the MCL would come from the treatment chemicals, hardly a minimal amount. It is also interesting to note that about 90 percent of the arsenic that would be contributed by treatment chemicals is attributable to fluoride addition.

If your processes include the addition of chemicals, ask your manufacturer for the amount of arsenic in each. If necessary, obtain conversion charts for diluted products, as well. Then calculate how much arsenic those chemicals will add to your finished water. If the total is close to the MCLs proposed by USEPA, you have reason for concern.

To find out more about the proposed arsenic rule, go to the agency's Web site, <www.epa.gov/safewater/arsenic.html>, or call the Safe Drinking Water Hotline at (800) 426-2791.

■ *Cheng-nan "Mike" Weng, PhD, DEE, is senior water quality engineer; Darrell B. Smith is vice president of water quality and research, and Gary M. Huntley is water treatment manager for South Central Connecticut Regional Water Authority, 90 Sargent Drive, New Haven, CT 06511; (203) 624-6671.*

CARGILL FERTILIZER, INC.

5613 Highway 41 South • Riverview, Florida 33569 • Telephone 813-677-9111 • TWX 810-875-0848 • Telex 52666 • FAX 813-671-6148

February 20, 1998

Mr. Tom Reeves
Center for Disease Control
4770 Buford Hwy.
Mailstop F-10
Chamblee, GA 30341

Dear Mr. Reeves,

Please find enclosed the analysis you requested regarding the radiological content of Cargill's Hydrofluosilicic Acid. As you can see, the results are very close to if not below the minimum detection limits of the instrumentation.

All of Cargill's fluoride products are certified by the National Sanitation Foundation (NSF) Standard 60- Drinking Water Treatment Chemicals, Health Effects. The products go through an annual audit and testing by NSF to validate the certification and to insure all requirements are being met. The EPA has also established maximum contaminant levels for drinking water which all municipalities must meet.

The results attached represent the radiological content of 23% hydrofluosilicic acid. This will be diluted by approximately 180,000 times when added to fluoridate the water thus making the values well below any means of detection.

If you have any questions or need additional information, feel free to call me at (813)671-6154.

Sincerely,

Mike Wells
Lab Manager

cc: Gordon
Morris
File

WATER /ONSITE SEWAGE

02/25/2000 14:35 8509226959

THORNTON LABORATORIES, INC.
MARINE, ANALYTICAL AND ENVIRONMENTAL SERVICES
1145 EAST CASS STREET, TAMPA, FLORIDA 33602
P.O. BOX 2880, TAMPA, FLORIDA 33601-2880
CompQAS# 880124, HRS# 84147, 584100, E84324
TELEPHONE (813) 223-9702
FAX (813) 223-9332

13-Feb-1998

13-Feb-1998
Page 1

Report For: Cargill Fertilizer, Inc.
8813 Highway 41 South
Riverview, FL 33569

Sample Identification: Hydrofluosilicic Acid
Id: A

Attn: Mike Wells

Sampled by D.McNeil on 2/7/98

Date Received: 8-Jan-1998

CERTIFICATE OF ANALYSIS

Laboratory Number: 061400

Method	Parameter	Result	Units	Standard Detection Limit	Analysis Date	Analyst
	Uranium (U)	< 3	ppm		23-Jan-1998	Jean Emelsen
	Radium 226	0.01 +/- 0.03	pCi/g		26-Jan-1998	Jean Emelsen
	Radium 228	0.0 +/- 0.5	pCi/g		23-Jan-1998	Jean Emelsen

* Spike Recovery = 94%, RPD = 2%
** Spike Recovery = 105%, RPD = 1.5%
*** Spike Recovery = 93%, RPD = 0.0%

THORNTON LABORATORIES, INC.
Mr. M. Cliff Pearce

WATER /ONSITE SEWAGE 02/25/2000 14:35 8509226959

Lawton Chiles
Governor

FLORIDA DEPARTMENT OF HEALTH

James T. Howell, M.D., M.P.H.
Secretary

January 22, 1998

never followed through.

Mr. George C. Glasser
3016 23rd Street North
St. Petersburg, FL 33173

Dear Mr. Glasser:

Thank you for your December 18 letter expressing your concern about the radioactivity of the hydrofluorosilicic acid used for fluoridation of drinking water. Information provided to us by our local health departments and the Department of Environmental Protection shows that levels of radionuclides in systems providing fluoridation in Florida have consistently met state drinking water standards. At the typical rate used for fluoridation in Florida (0.7-1.2 mg/L), the hydrofluorosilicic acid would have to be very radioactive to exceed drinking water standards in the treated water.

Still, the possibility that the hydrofluorosilicic acid may be adding radioactive compounds to the drinking water is extremely significant to us. Following the receipt of your letter we contacted the Environmental Protection Agency and the National Sanitation Foundation. They have informed us that radionuclide testing of the hydrofluorosilicic acid has been initiated. The first results are expected within a week. Based on those results, we will coordinate any necessary action with the Department of Environmental Protection.

We thank you for bringing this important issue to our attention. If you have any questions or need additional information, please feel free to call Bart Bibler, P.E., Chief, Bureau of Water and Onsite Sewage Programs, at (850) 488-4070.

Sincerely,

James T. Howell, M.D., M.P.H.
Secretary

JTH/pm

CARGILL
FERTILIZER, INC.

8813 Highway 41 South - Riverview, Florida 33569 - Telephone 813-677-9111 - TWX 810-875-0648 - Telex 52666 - FAX 813-671-6145

February 20, 1998

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Center for Disease Control
4770 Buford Hwy
Mailstop F-10
Chamblee, GA 30341

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Sincerely,

Mike Wells
Lab Manager

cc: Gordon
Morrris
File

02/25/2000 14:35 8509226959 WATER /ONSITE SEWAGE PAGE 07

THORNTON LABORATORIES, INC.
MARINE, ANALYTICAL AND ENVIRONMENTAL SERVICES

1145 EAST CASS STREET, TAMPA, FLORIDA 33602
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FAX (813) 223-9332

11-Feb-1998
Page 1

Report For: Cargill Fertilizer, Inc.
9813 Highway 41 South
Riverview, FL 33569

Sample Identification:

Hydrofluosilicic Acid
Id: A
Sampled by D.McNeil on 1/7/98

Attn: Mike Wells

Date Received: 8-Jan-1998

Laboratory Number: 064400

CERTIFICATE OF ANALYSIS

Method	Parameter	Result	Standard Detection Limit Units	Analysis Date	Analyst
	Uranium (U) *	< 3	ppm	29-Jan-1998	Jean Encinosa
	Radium 226 **	0.08 +/- 0.03	pCi/g	26-Jan-1998	Jean Encinosa
	Radium 228 ***	0.0 +/- 0.5	pCi/g	28-Jan-1998	Jean Encinosa

* Spike Recovery = 94%, RPD = 24%
** Spike Recovery = 105%, RPD = 1.3%
*** Spike Recovery = 93%, RPD = 0.0%

THORNTON LABORATORIES, INC.
Ms. M. Cliff Pearce

AWWA Standard

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Contents

All AWWA standards follow the general format indicated subsequently. Some variations from this format may be found in a particular standard.

Foreword

This Foreword is for information only and is not a part of ANSI/AWWA B703.

I. Introduction.

I.A. *Background.* Fluorosilicic acid (H_2SiF_6) is one of several fluoride compounds presently being added to drinking water to reduce the incidence of dental caries. Since the first fluoridation installation during 1945, studies have shown that dental decay can be reduced by 20 to 40 percent among children who have consumed fluoridated water since birth.

Fluorosilicic acid is an aqueous solution of H_2SiF_6—water white to straw yellow in color. It is a corrosive acid, irritating to the skin, and has a pungent odor. It is not known to exist in any anhydrous form. The boiling point increases with increasing acid content. At a typical commercial strength of 25 percent acid content, the boiling point is 105.8°C (222.5°F), and the freezing point is approximately –15.5°C (4°F). A 25 percent solution has a pH of 1.2 and weighs 10.1 lb/gal (1.20 kg/L). The molecular weight of H_2SiF_6 is 144.08.

Fluorosilicic acid is produced as a co-product in the manufacture of wet-process phosphoric acid and other phosphate fertilizers. The raw material, phosphate rock, contains fluoride and silica and is treated with sulfuric acid, which evolves the gases silicon tetrafluoride (SiF_4) and hydrogen fluoride (HF). These gases are passed through scrubbers and react with water to form fluorosilicic acid. This acid is the principal raw material in the production of all silicofluoride salts. It is also used in the ceramic, brewing, paint, and metallurgical industries.

Fluorosilicic acid is added to water using various liquid-feeding devices and metering pumps. It is normally fed directly into the water to produce the optimal fluoride concentration. Dilution of the acid before feeding is not recommended. If the acid is too concentrated for the solution feeder to control, solutions of other compounds are generally indicated, for example, solutions of sodium fluoride or sodium fluorosilicate. If the acid must be diluted, dilutions in the range of 10 to 1 and 20 to 1 (parts water to parts acid) should be avoided, because they often result in the formation of an insoluble silica precipitate that can clog feeders, orifices, and other equipment. The use of softened or distilled water has no effect on the formation of this precipitate. However, the precipitate can be avoided by using dilutions outside the critical range (dilutions in the range of 200:1 to 100:1 are

known to work well), or by using acid that has been fortified with hydrogen fluoride (HF).

Refer to AWWA Manual M4, *Water Fluoridation Principles and Practices*,* for additional technical information concerning the application and use of fluorosilicic acid.

I.B. *History.* This standard was first published in the November 1954 issue of *Journal AWWA* as tentative, having been approved on July 30, 1954, by the AWWA Board of Directors. Subsequent revisions to ANSI/AWWA B703 were approved by the AWWA Board of Directors on May 15, 1960; June 18, 1971; Jan. 30, 1984; Jan. 29, 1989; Jan. 30, 1994; and Jan. 23, 2000. This eighth edition was prepared by the AWWA Standards Committee on Fluorides and approved by the AWWA Board of Directors on Feb. 12, 2006.

I.C. *Acceptance.* In May 1985, the US Environmental Protection Agency (USEPA) entered into a cooperative agreement with a consortium led by NSF International (NSF) to develop voluntary third-party consensus standards and a certification program for direct and indirect drinking water additives. Other members of the original consortium included the American Water Works Association Research Foundation (AwwaRF) and the Conference of State Health and Environmental Managers (COSHEM). The American Water Works Association (AWWA) and the Association of State Drinking Water Administrators (ASDWA) joined later.

In the United States, authority to regulate products for use in, or in contact with, drinking water rests with individual states.† Local agencies may choose to impose requirements more stringent than those required by the state. To evaluate the health effects of products and drinking water additives from such products, state and local agencies may use various references, including two standards developed under the direction of NSF, NSF‡/ANSI§ 60, Drinking Water Treatment Chemicals—Health Effects, and NSF/ANSI 61, Drinking Water System Components—Health Effects.

Various certification organizations may be involved in certifying products in accordance with NSF/ANSI 60. Individual states or local agencies have authority to

*AWWA Manual M4, *Water Fluoridation Principles and Practices*, AWWA, Denver, Colo.

†Persons outside of the United States should contact the appropriate authority having jurisdiction.

‡NSF International, 789 N. Dixboro Road, Ann Arbor, MI 48105.

§American National Standards Institute, 25 West 43rd Street, Fourth Floor, New York, NY 10036.

accept or accredit certification organizations within their jurisdiction. Accreditation of certification organizations may vary from jurisdiction to jurisdiction.

Annex A, "Toxicology Review and Evaluation Procedures," to NSF/ANSI 60 does not stipulate a single product allowable concentration (SPAC) value of a contaminant for substances not regulated by a USEPA final maximum contaminant level (MCL). The SPAC values of an unspecified list of "unregulated contaminants" are based on toxicity testing guidelines (noncarcinogens) and risk characterization methodology (carcinogens). Use of Annex A procedures may not always be identical, depending on the certifier.

ANSI/AWWA B703 addresses additives requirements in Sec. 4.3 of the standard. The transfer of contaminants from chemicals to processed water or the residual solids is becoming a problem of greater concern. The language in Sec. 4.3.3 is a recommendation only for direct additives used in the treatment of potable water to be certified by an accredited certification organization in accordance with NSF/ANSI 60, Drinking Water Treatment Chemicals—Health Effects. However, users of the standard may opt to make this certification a requirement for the product. Users of this standard should consult the appropriate state or local agency having jurisdiction in order to

1. Determine additives requirements, including applicable standards.
2. Determine the status of certifications by all parties offering to certify products for contact with, or treatment of, drinking water.
3. Determine current information on product certification.

II. Special Issues.

II.A. *Storage, Handling, and Safety Precautions.* Fluorosilicic acid must be handled carefully because it is corrosive. If the acid comes in contact with skin, the affected parts should be immediately rinsed thoroughly with water. For information on safety, refer to the material safety data sheets (MSDS) available from the chemical supplier or manufacturer. Protective safety gear should be worn when handling fluorosilicic acid. The following protective clothing and equipment should be the minimum available:

1. Gauntlet neoprene gloves (12-in. [300-mm] minimum glove length).
2. Full 8-in. (200-mm) face shield or acid-proof-type safety goggles.
3. Heavy-duty, acid-proof-type neoprene aprons.
4. Safety shower and eyewash in an easily accessible location.

Materials such as glass, ceramics, steel, concrete, and wood are not suitable for fluorosilicic acid containers and other equipment because they are attacked by the hydrofluoric acid (HF) and silicon tetrafluoride (SiF_4) formed at the surface of the fluorosilicic acid. Bulk storage tanks and other containers can be made of polyethylene, rubber-lined steel, or other appropriate materials. The polyethylene should be manufactured from high-density, cross-linked material (cross-linking provides strength). The polyethylene should contain a minimum of 0.25 percent ultraviolet stabilizer to protect against sunlight. Steel tanks must always be lined. The linings are commonly made of natural rubber, neoprene, butyl rubber, or equivalent and should be at least 2.4-mm (3/32-in.) thick. Structural carbon, Hastelloy C, Durimet 20, or equivalent materials can be used for hardware. The rooms where the acid is stored and used should be thoroughly ventilated with a vent located near the ceiling because acid fumes are lighter than air. Closed tanks should be vented to the outside. Additional information on materials compatibility appears in Appendix A.

III. Use of This Standard. It is the responsibility of the user of an AWWA standard to determine that the products described in that standard are suitable for use in the particular application being considered.

III.A. *Purchaser Options and Alternatives.* The following items should be provided by the purchaser:

1. Standard used—that is, ANSI/AWWA B703, Standard for Fluorosilicic Acid, of latest revision.
2. Whether compliance with NSF/ANSI 60, Drinking Water Treatment Chemicals—Health Effects, is required.
3. Quantity required.
4. If an analysis by a referee laboratory is required, the assignment of testing costs should be addressed.
5. Concentration (strength of acid desired) (Sec. 4.2). The acid shall contain between 20 and 30 percent H_2SiF_6 by weight. Where variations in acid strength are acceptable, arrangements should be made between the purchaser and the supplier as to the method of payment, based on the aggregated acid content.
6. Form of shipment—bulk or package (type) (Sec. 6.2.2).
7. Affidavit of compliance or certified analyses, or both, if required (Sec. 6.3).

III.B. *Modification to Standard.* Any modification to the provisions, definitions, or terminology in this standard must be specified by the purchaser.

IV. **Major Revisions.** Major changes made in this revision of the standard include the following:

1. Impurity requirements have been tied to the SPACs listed in NSF/ANSI 60, Drinking Water Treatment Chemical—Health Effects (Sec. 4.3.3).

2. Test procedures for impurities have been defined and referenced (Sec. 5.2.5 and Table 1).

3. A table showing SPACs for impurities regulated under NSF/ANSI 60, Drinking Water Treatment Chemical—Health Effects, has been added as an appendix (Appendix B).

V. **Comments.** If you have any comments or questions about this standard, please call the AWWA Volunteer & Technical Support group, 303.794.7711, FAX 303.795.7603, write to the group at 6666 West Quincy Avenue, Denver, CO 80235-3098, or e-mail at standards@awwa.org.

ANSI/AWWA B703-06
(Revision of ANSI/AWWA B703-00)

American Water Works Association

AWWA Standard

Fluorosilicic Acid

SECTION 1: GENERAL

Sec. 1.1 Scope

This standard describes fluorosilicic acid (H_2SiF_6) for water supply service application.

Sec. 1.2 Purpose

The purpose of this standard is to provide the minimum requirements for fluorosilicic acid, including physical, chemical, packaging, shipping, and testing requirements.

Sec. 1.3 Application

This standard can be referenced in specifications for purchasing and receiving fluorosilicic acid and can be used as a guide for testing the physical and chemical properties of fluorosilicic acid samples. The stipulations of this standard apply when this document has been referenced and only to fluorosilicic acid used in water supply service application.

SECTION 2: REFERENCES

This standard references the following documents. In their latest edition, they form a part of this standard to the extent specified in this standard. In any case of conflict, the requirements of this standard shall prevail.

NSF*/ANSI† 60, Drinking Water Treatment Chemicals—Health Effects.

Standard Methods for the Examination of Water and Wastewater. APHA,‡ AWWA, and WEF.§

SECTION 3: DEFINITIONS

The following definitions shall apply in this standard:

1. *Day:* A day is defined as a 24-hr period.
2. *Manufacturer:* The party that manufactures, fabricates, or produces materials or products.
3. *Purchaser:* The person, company, or organization that purchases any materials or work to be performed.
4. *Supplier:* The party that supplies materials or services. A supplier may or may not be the manufacturer.

SECTION 4: REQUIREMENTS

Sec. 4.1 Physical Requirements

4.1.1 *Suspended matter.* The fluorosilicic acid supplied according to this standard shall be clean and free of visible suspended matter.

4.1.2 *Color.* The fluorosilicic acid supplied according to this standard shall be white to straw yellow. Straw yellow shall be determined as material with a

*NSF International, 789 N. Dixboro Road, Ann Arbor, MI 48105.

†American National Standards Institute, 25 West 43rd Street, Fourth Floor, New York, NY 10036.

‡American Public Health Association, 800 I Street NW, Washington, DC 20001.

§Water Environment Federation, 601 Wythe Street, Alexandria, VA 22314.

maximum of 100 units in accordance with method 2120B, visual comparison method.*

Sec. 4.2 Chemical Requirements

The fluorosilicic acid shall contain between 20 and 30 percent fluorosilicic acid by weight unless specified otherwise by the purchaser.

Sec. 4.3 Impurities†

4.3.1 *General.* The fluorosilicic acid supplied according to this standard shall contain no mineral or organic substances in quantities capable of producing deleterious or injurious effects on the health of those consuming water that has been properly treated with fluorosilicic acid.

4.3.2 *Free acid content.* The fluorosilicic acid supplied according to this standard shall contain a maximum of 1 percent free acids (other than fluorosilicic acid), expressed as HF (hydrofluoric acid).

4.3.3 *Product certifications.* Fluorosilicic acid is a direct additive used in the treatment of potable water. This material should be certified as suitable for contact with or treatment of drinking water by an accredited certification organization in accordance with NSF/ANSI 60, Drinking Water Treatment Chemicals—Health Effects. Evaluation shall be accomplished in accordance with requirements that are no less restrictive than those listed in NSF/ANSI 60. Certification shall be accomplished by a certification organization accredited by the American National Standards Institute.

The fluorosilicic acid impurities regulated under NSF/ANSI 60, their drinking water regulatory levels, and their single product allowable concentration (SPAC) value are as provided in Appendix B. The SPAC values are to be compared to the concentration's values resulting from an applied fluorosilicic acid dose that results in a concentration of 1.2 mg/L fluoride in the treated water.

4.3.4 *Additional impurity limits.* Additional impurity limits may be specified by the purchaser to ensure that the material supplied is suitable for water treatment. If additional impurity limits are specified, the purchaser must state the test methodology to be used to determine compliance with the additional limits.

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* *Standard Methods for the Examination of Water and Wastewater.*

† See Sec. I.C of the Foreword.

SECTION 5: VERIFICATION

Sec. 5.1 Sampling and Laboratory Examination

Sampling shall be conducted in accordance with this section of the standard. The laboratory examination of the samples shall be completed within the following time limitations:

1. Bulk shipments—before unloading, unless the shipment is accompanied by a certified analysis from the manufacturer or supplier.

2. Drum shipments—within five days after receipt of the shipment.

5.1.1 *Sampling point.* Samples shall be taken at the point of destination.

5.1.2 *Amount of shipment to be sampled.* If the acid is supplied in drums, the number of drums sampled will be left to the discretion of the purchaser. In the case of bulk shipments, a composite sample should be taken from the tank truck or tank car.

5.1.3 *Sampling container.* Samples shall be collected in a clean, plastic or rubber container. Containers lined with acid-resistant plastic, wax, or rubber may also be used.

5.1.4 *Sampling method for drums.* When sampling from drums, the fluorosilicic acid in the containers to be sampled shall first be mixed by rolling or other suitable means. A portion shall be taken from each container to be sampled so that the total gross sample consists of at least 2 L.

5.1.5 *Sampling method for bulk material.* When sampling from a tank truck or tank car, at least five different 500-mL portions shall be taken from different places in the container (top, middle, and bottom) and combined to form a composite sample that is representative of the entire container.

5.1.6 *Sample handling.* After mixing of the gross sample, three 500-mL samples shall be sealed in airtight, moisture-proof, plastic or rubber containers. Each sample container shall be labeled to identify it, and the label shall be signed by the sampler.

5.1.7 *Sample retention.* Samples shall be held for 30 days before disposal.

Sec. 5.2 Test Procedures

Testing of fluorosilicic acid shall be conducted in accordance with the procedures presented in the following sections. Alternate procedures can be used only

on the written approval of the purchaser. In any case of conflict, the methods of this standard shall prevail.

5.2.1 *Test samples.* Test samples shall be obtained from the sealed material samples (Sec. 5.1.6) delivered to the laboratory. Material samples shall be unsealed only when it is necessary to remove quantities of the material for testing. Removal of material shall be performed quickly, and the material samples shall then be resealed for future reference.

5.2.2 *Determining fluorosilicic acid content.* Two methods are presented for determining the percentage of fluorosilicic acid content. The specific-gravity method will provide only a very rough approximation and should not be used for determining the exact amount of acid. If facilities are available, the hydrogen titration method is the preferred method for determining fluorosilicic acid content.

5.2.2.1 Hydrogen titration method.

1. Principle. Titration of ionizable hydrogen in a chilled solution from which the fluorosilicate ions have been precipitated as potassium fluorosilicate.

2. Reagents.

a. Deionized ice.

b. Potassium nitrate-saturated solution.

c. Standard sodium hydroxide solution, 0.5*N*.

d. Bromothymol blue, 0.2 percent solution.

3. Procedure.

a. Using a pipette bulb, pipette 25 mL of sample into a 500-mL volumetric flask. Dilute with deionized water to the mark and mix. If this suggested dilution produces a precipitate (Sec. I.A of the Foreword), pipette a smaller sample volume (in 5-mL increments) until no precipitate forms.

b. Place 100 to 150 mL of clean deionized ice into a 400-mL beaker, add 25 mL of potassium nitrate solution, and using a pipette bulb, pipette a 25-mL aliquot of the diluted sample solution into the beaker. Wash down the sides of the beaker with deionized water.

c. Stirring constantly, promptly titrate with standard sodium hydroxide, using bromothymol blue as the end-point indicator. The end point has been reached when the blue color persists for at least 30 sec. On standing longer, the indicator will turn yellow.

4. Calculation.*

$$\text{volume of sample taken, in milliliters } (D)\ C \times \frac{A}{B} \qquad \text{(Eq 1)}$$

$$\text{weight of sample, in grams} = D \times \text{specific gravity (at room temperature)} \qquad \text{(Eq 2)}$$

$$\text{percent } H_2SiF_6 = \frac{\text{mL NaOH} \times N \times 0.072 \times 100}{\text{weight of sample, in grams}} \qquad \text{(Eq 3)}$$

Where:

A = original sample volume, in milliliters (step 1)

B = diluted sample volume, in milliliters (generally 500 mL)

C = aliquot volume, in milliliters (step 2)

5.2.3 *Determining free acid.*

5.2.3.1 Procedure. The preceding method will include any free acid other than fluorosilicic acid that may be present. If it is necessary to distinguish between fluorosilicic acid and other acids, place the beaker, the contents of which have been titrated as above, on a hot plate and bring to a boil. Titrate the hot solution with standard sodium hydroxide to the neutral point of the bromothymol blue. This titration breaks down the fluorosilicate radical of the potassium fluorosilicate:

$$K_2SiF_6 + 4NaOH \rightarrow 2KF + 4NaF + SiO_2 + 2H_2O \qquad \text{(Eq 4)}$$

If the fluorosilicic acid is 100 percent pure, the milliliters of NaOH used in the cold titration will equal exactly half the milliliters of NaOH used in the hot titration. If free acid other than fluorosilicic is present, the cold titer will exceed half the hot titer. If the fluorosilicate salts are present, half the hot titer will exceed the cold titer.

*Based on the following chemical equations:

$H_2Si_6 + 2KNO_3 \rightarrow K_2SiF_6 + 2HNO_3$

$HNO_3 + NaOH \rightarrow NaNO_3 + H_2O$

5.2.3.2 Calculation.

$$\frac{\left(\text{mL NaOH}^{*} - \frac{\text{mL NaOH}^{\dagger}}{2}\right) \times N \times 0.02 \times 100}{\text{weight of sample, in grams}}$$

= percent free acid other than H_2SiF_6, expressed as HF (Eq 5)

$$\frac{\frac{\text{mL NaOH}^{\dagger}}{2} \times N \times 0.072 \times 100}{\text{weight of sample, in grams}} = \text{percent } H_2SiF_6 \quad \text{(Eq 6)}$$

5.2.4 *Specific-gravity method.*

5.2.4.1 Apparatus.

1. Acid-resistant plastic or glass cylinder or dish with sufficient depth to float a hydrometer.

2. Glass hydrometer (long stem) capable of being read to three significant figures. (If the density of the solution varies over a wide range, a set of three or more hydrometers should be available to cover the range.)

5.2.4.2 Procedure.

1. Carefully transfer the fluorosilicic acid from the sample container to the cylinder and adjust the temperature to 17.5°C (63.5°F). Insert the hydrometer and measure the specific gravity.

2. Do not keep the hydrometer and other glassware in contact with the fluorosilicic acid solution longer than is necessary. Thoroughly rinse the hydrometer and other glassware in clear, cool, running water immediately after using.

3. Determine the approximate percentage of fluorosilicic acid from a table[‡] or graph that has been prepared from the analyses of a number of shipments from which both specific gravity and actual fluoride content have been determined.

5.2.5 *Test procedure for impurities.* When testing for impurities, the analytic methods provided for in *Standard Methods for the Examination of Water and Wastewater* shall be employed. Impurity-specific methods and additional methodologies that provide for automation and for multiple analyses to be determined at the same time are provided in Table 1. The aggregate methodologies are often more economical when the

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*Cold titer.

†Hot titer.

‡The use of a standard table from a handbook is not recommended. Because these tables are prepared from dilutions of cp-grade acid, distilled water may introduce errors of more than 10 percent. Experience in the field has shown that the specific gravity of commercial grades of fluorosilicic acid in concentrations from 20 to 30 percent varies considerably between different manufacturers (5 to 14 percent less than that given in the standard table).

Table 1 Impurity analytic methods

Impurity	*Standard Methods** Part	Aggregate Methodologies†
Regulated Metals		
Antimony	3500-Sb	AAS, ICP, ICP/MS
Arsenic	3500-As	AAS, ICP, ICP/MS
Barium	3500-Ba	AAS, ICP, ICP/MS
Beryllium	3500-Be	AAS, ICP, ICP/MS
Cadmium	3500-Cd	AAS, ICP, ICP/MS
Copper	3500-Cu	AAS, ICP, ICP/MS
Lead	3500-Pb	AAS, ICP, ICP/MS
Mercury (inorganic)	3500-Hg	AAS
Selenium	3500-Se	AAS, ICP, ICP/MS
Thallium	3500-T1	AAS, ICP, ICP/MS
Radionuclides		
Beta particle and photon activity	7110	—
Gross alpha particle activity	7110	—
Radium 226 and 228 (combined)	7500-Ra	—
Uranium	3500-U	ICP/MS

**Standard Methods for the Examination of Water and Wastewater.*

†Aggregate Methodologies

AAS—Atomic Absorption Spectrometry

ICP—Inductively Coupled Plasma (with spectrometer)

ICP/MS—Inductively Coupled Plasma/Mass Spectrometer

full spectrum of impurities are to be determined and are recommended. Producers are encouraged to maintain a database of impurity concentrations based on quarterly analysis of normal production product.

5.2.6 *Rejection.*

5.2.6.1 Notice of nonconformance. If the fluorosilicic acid delivered does not meet the requirements of this standard, a notice of nonconformance shall be provided by the purchaser to the supplier within 10 days after receipt of the shipment at the point of destination. The results of the purchaser's test shall prevail, unless the supplier notifies the purchaser within five days after receipt of the notice of

nonconformance that a retest is desired. On receipt of the request for a retest, the purchaser shall forward to the supplier one of the sealed samples taken in accordance with Sec. 5.1 of this standard. In the event that the results obtained by the supplier on retesting do not agree with the results obtained by the purchaser, the other sealed sample shall be forwarded, unopened, for analysis to a referee laboratory agreed on by both parties. The results of the referee analysis shall be accepted as final.

5.2.6.2 Material originating outside of North America. On request of the purchaser, the supplier shall inform the purchaser of the origin of the fluorosilicic acid to be provided. The purchaser may request from the supplier a written statement presenting the steps the supplier will take to ensure that the material to be supplied conforms to the requirements of this standard and NSF/ANSI 60.

SECTION 6: DELIVERY*

Sec. 6.1 Marking

6.1.1 *Required.*

6.1.1.1 Drum shipment labels. Each shipment shall contain clear identification of the material and a warning of potential danger in handling. Each drum shall have marked legibly on it the name of the acid, the net weight or volume of the contents, the percent strength of the acid, the name and address of the supplier or manufacturer, the lot number, and the brand name if any, and shall bear other markings as are required by applicable laws. The warning label should include suggestions for immediately rinsing away all acid coming in contact with the skin and the thorough dilution of acid accidentally spilled, including neutralization of the acid with lime.

6.1.1.2 Bulk shipment labels. On rail tank cars and tank truck shipments, the information listed under Sec. 6.1.1.1 shall accompany the bill of lading.

6.1.2 *Optional.* Packages may also bear the statement, "This material meets the requirements of ANSI/AWWA B703, Standard for Fluorosilicic Acid," provided that the requirements of this standard are met and the material is not of a different quality or strength by separate agreement between the supplier and purchaser.

*Governmental marking, packaging, and shipping references reflect US requirements. Users of ANSI/AWWA B703 outside the United States should verify applicable local and national regulatory requirements.

Sec. 6.2 Packaging and Shipping*

6.2.1 *Packaging.* Drums and any other nonbulk container used to package fluorosilicic acid shall comply to all applicable paragraphs of HM-181, part 178 of CFR 49.†

6.2.2 *Containers.*

6.2.2.1 General. Containers shall be rubber-lined steel, cross-linked polyethylene, or other structures suitably lined to prevent corrosion by the fluorosilicic acid. US Department of Transportation (USDOT) regulations should be consulted for additional options.

6.2.2.2 Structure. The container must be structurally sound and designed to withstand all hydrostatic pressures and other forces encountered. The specific gravity of fluorosilicic acid at 30 percent solution is 1.27.

6.2.3 *Net weight.* The net weight or net volume of the containers shall not be less than the recorded weight or volume, or more than 10 percent greater. If exception is taken to the weight or volume of the material received, it shall be based on the certified weight or volume of not less than 10 percent of the containers, selected at random from the entire shipment. Tank truck shipments shall be accompanied by certified weight tickets.

6.2.4 *Shipping regulations.* Packaging and shipping of all fluorosilicic acid solutions shall conform to all applicable local, state, provincial, and federal regulations (including USDOT regulations and applicable interstate regulations).

Sec. 6.3 Affidavit of Compliance or Certified Analyses

The purchaser may require (1) an affidavit from the manufacturer or supplier that the fluorosilicic acid provided in the purchaser's documents complies with all applicable requirements of this standard; (2) certified analyses of the fluorosilicic acid, provided by the manufacturer or supplier, covering items as required; or (3) both.

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*Because of the frequent changes in these regulations, all parties should remain informed of possible revisions. Provisions of the purchaser's documents should not preclude compliance with applicable regulations.

† *Code of Federal Regulations,* Title 49, part 178 (Transportation). Superintendent of Documents, US Government Printing Office, Washington, DC 20402.

APPENDIX A

Materials Compatibility

This appendix is for information only and is not a part of ANSI/AWWA B703.

All tanks and containers must be manufactured from or lined with materials that are highly resistant to fluorosilicic acid. General materials in use include the following:

1. Fiberglass coated with resistant resin.
2. Polyethylene manufactured from high-density, cross-linked material that contains a minimum of 0.25 percent ultraviolet stabilizer.
3. Steel tanks lined with a minimum 2.4-mm (3/32-in.) thickness of natural rubber, butyl rubber, or neoprene and secured to the metal surface with proper adhesive.

References to specific materials commonly in use include, but are not limited to, the following: polyvinyl chloride (PVC), type 1, grade 1; polyvinylidene fluoride (PVDF); ethylene propylene dienemonomer (EPDM); ethylene chlorotrifluoroethylene (E-CTFE); Saran; Vinyl; Hypalon; Carpenter 20; and Hastelloy C.

When purchasing storage tanks or other appurtenances used to handle fluorosilicic acid, the purchaser may request certification from the materials manufacturer verifying the tested resistance of the particular material for use in contact with fluorosilicic acid. Bulk storage tanks should be provided with a certification plate containing (at minimum) the following:

1. Name of tank manufacturer.
2. Date of manufacture.
3. Chemical (chemicals) to be stored.
4. Mechanical properties of the structure.*
5. Mechanical properties of the lining.†

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*For example, high-density, cross-linked polyethylene.

†For example, 2.4-mm (3/32-in.) thick butyl rubber.

APPENDIX B

Fluorosilicic Acid—Contaminants

This appendix is for information only and is not a part of ANSI/AWWA B703.

Table B.1 Fluorosilicic acid—contaminants

Contaminant*	Regulation	Drinking Water Maximum Contaminant Level/Maximum Allowable Concentration (MCL/MAC) *mg/L*	Single Product Allowable Concentration (SPAC) *mg/L*
Antimony	(40 CFR § 141.60, § 141.62)	0.006	0.0006
Arsenic	(effective date: 01/23/06)	0.010	0.001
Barium	(40 CFR § 141.60, § 141.62)	2	0.2
Beryllium	(40 CFR § 141.60, § 141.62)	0.004	0.0004
Cadmium	(40 CFR § 141.60, § 141.62)	0.005	0.0005
Copper (at tap)	(40 CFR § 141.80, 65 FR 1950)	TT† (action level 1.3 mg/L)	0.13
Lead (at tap)	(40 CFR § 141.80, 65 FR 1950)	TT† (action level 0.015 mg/L)	0.0015
Mercury (inorganic)	(40 CFR § 141.60, § 141.62)	0.002	0.0002
Selenium	(40 CFR § 141.60, § 141.62)	0.05	0.005
Thallium	(40 CFR § 141.60, § 141.62)	0.002	0.0002
Radionuclides			
Beta particle and photon activity	(40 CFR § 141.16)	4 mrem/y	0.4 mrem/y
Gross alpha particle activity	(40 CFR § 141.15)	15 pCi/L	1.5 pCi/L
Radium 226 and 228 (combined)	(40 CFR § 141.15)	5 pCi/L	0.5 pCi/L
Uranium	(40 CFR § 141.66)	30 µg/L	3.0 µg/L

*The references for criteria based on US primary drinking water regulations are from the US Code of Federal Regulations, Title 40 (Protection of Environment), revised as of July 1, 1999. This document is available online at www.access.gpo.gov/cgi-bin/cfrassemble.cgi. Issue dates are given for criteria based on Health Canada guidelines. Additional information on the guidelines for these chemicals is available at www.hc-sc.gc.ca/water quality.

†TT—Treatment technique

Somehow....
Anita managed
to receive this.

standard + specification sheet

Called Mr Wyatt
538-7277 ext 111
Requested update of
Mar. 2, 1995 -
Received Sat.
Mar. 4th, 1995
Anita N. Knight

LCI LTD
(904) 241-1200
P.O. Box 49000
Jacksonville Beach, FL 32240-9000

FOR REFERENCE ONLY - DO NOT SEND OUT

October, 1990

ROUTING AND TRANSMITTAL SLIP

1 TO (NAME, OFFICE SYMBOL OR LOCATION) 2
Anita Knight
3014 23rd Street North
3 St. Petersburg, Fla. 33713

ACTION

☑ Information	☐ For Approval	☐ Signature
☐ Approval Your Signature	☐ Copy to me	☐ Approval My Signature
☐ Please See Me	☐ Comment	☐ Necessary Action
☐ Note and Return	☐ Note and Pass On	☐ For Concurrence
☑ For Request	☐ Coordination	☐ File

REMARKS (USE REVERSE SIDE IF NECESSARY)

Fluoride Specifications utilized in City of St. Petersburg Public Drinking Water System per your request.

Pinellas County Health Dept.
D. WAYNE WYATT, Assistant Director
Environmental Engineering

FROM (NAME, OFFICE SYMBOL OR LOCATION) D. Wayne Wyatt
DATE 7/19/94
PHONE

STD. NO. 115

HYDROFLUOSILICIC ACID SPECIFICATIONS

H_2SiF_6

COMMERCIAL GRADE

	GUARANTEED	TYPICAL
H_2SiF_6 (MOL. WT. 144.06)	25% +/- 3% by weight	24%
Fluorine	19% +/- 3% by weight	18.5%
Heavy Metals, as lead, Pb.	0.020% MX.	0.0002%
Phosphorus		0.100%
HF		1.0%
Arsenic		0.0035%
Barium		< 0.0002%
Cadmium		0.0004%
Chromium		< 0.00003%
Iron		0.100%
Iodine		0.0015%
Lead		< 0.00005%
Mercury		< 0.0000001%
Selenium		< 0.000003%
Silver		0.0004%
Specific Gravity, at 25%, at 60°F		1.224
Boiling Point for 25%		222.5°F
Freezing Point for 25%		-4.0°F
Weight per Gallon for 25%		10.2 lbs/gal
pH 1% Solution		1.2

Material meets AWWA Standard B703-89

Water white to straw yellow in color - transparent aqueous solution - acid liquid.

Clean and free of visible suspended matter.

Highly corrosive, pungent odor - store in structural carbon, Hastelloy C, Durimer 20 and approved rubber or plastic lined containers.

FOR REFERENCE ONLY - DO NOT SEND OUT

Telex 752638 LCI LTD JAX
FAX 904-241-1220

1-800-726-5524 (new Engla
Lucier Chemical Industry
agent Jack Ammann
Jacksonville Beach, FL

Every little bit helps

Tampa Tribune 8/2/92
(Editorial ad lib)

One part per million, a ppm, doesn't sound like much. It accounts for only one minute in two years. But one ppm is the minimum daily requirement of vitamin C for a 132-pound person. A part per billion, or ppb, sounds even less consequential — about one second in 32 years. But without a daily ppb of vitamin B-12, people get sick. So the next time you hear about ppms or ppbs of harmful chemicals in our food, water or air, pay heed — even tiny bits can affect our health.

Source: Knight-Ridder Newspapers