



**American Water Works
Association**

The Authoritative Resource on Safe WaterSM

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

AWWA Standard

Fluorosilicic Acid



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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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.