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(Revision of ANSI/AWWA B703-19)

AWWA Standard



Fluorosilicic Acid

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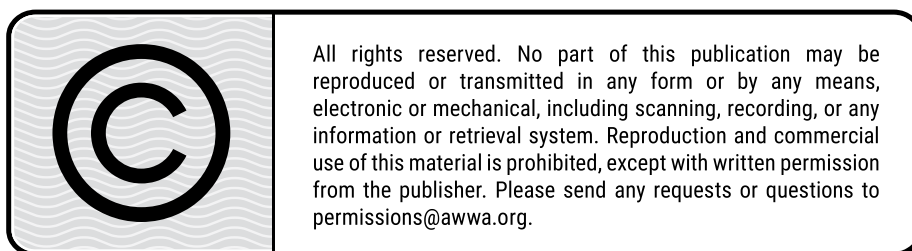
AWWA Standard

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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.* Community water fluoridation is an effective, safe, and relatively inexpensive way to prevent tooth decay. Since the first fluoridation installation during 1945, studies have shown that this method of fluoride delivery benefits Americans of all ages and every socioeconomic status. Dental decay can be reduced by 20 to 40 percent among children who have consumed fluoridated water since birth. Fluorosilicic acid (H_2SiF_6) is one of several fluoride compounds presently being added to drinking water to reduce the incidence of dental cavities.

Fluorosilicic acid is an aqueous solution of H_2SiF_6 —water white to amber in color. It is a corrosive acid that is 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.

Most 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. Fluorosilicic acid can also be produced by fluorspar (CaF_2) reacting with sulfuric acid, which evolves just hydrogen fluoride. The hydrogen fluoride is then reacted with quartz (silicon dioxide) and 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.

* American National Standards Institute, 1180 Avenue of the Americas, 10th Floor, New York, NY 10036.

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 on May 15, 1960; June 18, 1971; Jan. 30, 1984; Jan. 29, 1989; Jan. 30, 1994; Jan. 23, 2000; Feb. 12, 2006; and June 12, 2011. The last edition was prepared by the AWWA Standards Committee on Fluorides and approved on Apr. 19, 2019. This edition was approved on Oct. 14, 2024.

I.C. *Acceptance.* Products that are covered by this standard should have certification in accordance with NSF[‡]/ANSI/CAN[§] 60, Drinking Water Treatment Chemicals—Health Effects and documentation on conformational testing to ANSI/AWWA B703 criteria.

Conformational testing to ANSI/AWWA B703 should be provided by the supplier to the consumer with each lot delivered. It is recommended that the consumer also conduct independent validation testing to confirm the conformational testing by the producer.

Certification of product quality in accordance with NSF/ANSI/CAN 60 should be indicated for each lot delivered and provided to the consumer by the supplier in accordance with NSF/ANSI/CAN 60 requirements.

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 Water Research Foundation (formerly AwwaRF) and the Conference of State Health and Environmental Managers (COSHEM). AWWA and the Association of

[†] AWWA, 6666 West Quincy Avenue, Denver, CO 80235.

[‡] NSF International, 789 North Dixboro Road, Ann Arbor, MI 48105.

[§] Standards Council of Canada, 55 Metcalfe Street, Suite 600, Ottawa, ON K1P 6L5 Canada.

State Drinking Water Administrators (ASDWA) joined later. In April 1990, USEPA formally withdrew its list of acceptable drinking water additives, and regulatory oversight of direct and indirect drinking water additives passed to the process developed by the consortium under the leadership of NSF.

In the United States, authority to regulate products for use in or in contact with drinking water rests with individual states.⁴ 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 four standards developed under the direction of NSF: NSF/ANSI/CAN 60, Drinking Water Treatment Chemicals—Health Effects; NSF/ANSI/CAN 61, Drinking Water System Components—Health Effects; NSF/ANSI 372, Drinking Water System Components—Lead Content; and NSF/ANSI/CAN 600, Health Effects Evaluation and Criteria for Chemicals in Drinking Water. NSF, in cooperation with ASDWA, does a biennial survey of the US states and Canadian provinces/territories to determine which states and provinces/territories require, by legislation, regulations or policies that products and drinking water additives be evaluated by NSF/ANSI/CAN 60 and 61. Survey results from 2009 show adoption of NSF/ANSI/CAN 60 by 47 states and nine provinces/territories and adoption of NSF/ANSI/CAN 61 by 46 states and 11 provinces/territories.

Various certification organizations may be involved in certifying products in accordance with NSF/ANSI/CAN 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.

NSF/ANSI/CAN 600 (which formerly appeared in NSF/ANSI/CAN 60 and 61 as Annex A, “Toxicology Review and Evaluation Procedures”) 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 NSF/ANSI/CAN 600 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 to 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

⁴ Persons outside the United States should contact the appropriate authority having jurisdiction.

accredited certification organization in accordance with NSF/ANSI/CAN 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 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 for at least 15 min with water. Then apply 2.5 percent calcium gluconate gel liberally to areas suspected of fluorosilicic acid contact, paying particular attention to areas under the fingernails. It is recommended that a supply of the gel be kept on site wherever fluorosilicic acid is handled or stored. Prompt medical attention should follow. For information on safety, refer to the safety data sheets 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 and chemical splash-proof safety goggles,
3. heavy-duty, acid-proof-type neoprene aprons, and
4. safety shower and eyewash in an easily accessible location.

Bulk storage tanks and other containers can be made of polyethylene, rubber-lined steel, fiberglass-reinforced plastic (FRP), or other appropriate materials. Storage tanks for fluorosilicic acid shall also be placed in proper secondary containment made with appropriate lined materials.

FRP for fluorosilicic acid applications should be composed of an epoxy vinyl ester resin. The acid contact surfaces of the FRP should be provided with a single or double synthetic veil/liner. After an FRP tank is constructed, it should be cured using methyl ethyl ketone peroxide (MEKP).

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 SiF_4 formed at the surface of the fluorosilicic acid. Bulk storage tanks and other containers can be made of polyethylene, rubber-lined steel, fiberglass, or other appropriate materials. The polyethylene should be manufactured