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(Revision of ANSI/AWWA B701-18)

AWWA Standard

Sodium Fluoride

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American Water Works
Association



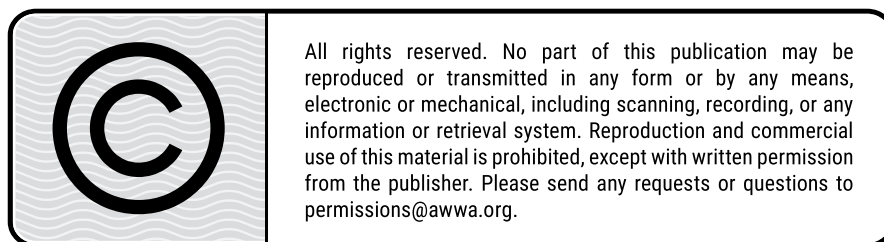
AWWA Standard

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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.

SEC.	PAGE	SEC.	PAGE
Foreword		4	Requirements
I	Introduction..... vii	4.1	Physical Requirements..... 3
I.A	Background..... vii	4.2	Chemical Requirements 3
I.B	History..... vii	4.3	Impurities..... 3
I.C	Acceptance viii	5	Verification
II	Special Issues ix	5.1	Sampling..... 6
II.A	Storage and Handling Precautions... ix	5.2	Test Procedures..... 7
II.B	Upflow-Type Saturator Operations x	5.3	Notice of Nonconformance..... 12
III	Use of This Standard xii	6	Delivery
III.A	Purchaser Options and Alternatives xii	6.1	Marking 13
III.B	Modification to Standard xiii	6.2	Packaging and Shipping 14
IV	Major Revisions..... xiii	6.3	Affidavit of Compliance or Certified Analysis 15
V	Comments xiii	Appendixes	
Standard		A	NaF: Contaminants..... 17
1	General	B	Test Procedure for Stirred/Settled Turbidity of NaF Solution (Provisional) 19
1.1	Scope..... 1	Tables	
1.2	Purpose 1	1	Maximum Allowed Concentrations of Impurities in NaF 5
1.3	Application..... 1	2	Impurity Analytical Methods..... 12
2	References 1	A.1	NaF: Contaminants..... 17
3	Definitions 2		

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Foreword

This foreword is for information only and is not a part of ANSI/AWWA B701.*

I. Introduction.

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

NaF is a white, odorless material available as a coarse crystalline material, as free-flowing crystals, or a combination of both. It is stable at temperatures up to and beyond its melting point (990°C or 1814°F), is nonflammable, and does not react with air or moisture. Its formula weight is 42.00, its specific gravity is 2.79, and its solubility is practically constant at 4 g/100 mL of water at the temperatures generally encountered in water treatment plants. The pure material produces solutions with pH values close to 7.0.

NaF is produced by neutralizing hydrofluoric acid with soda ash from the reaction between sodium fluorosilicate and caustic soda or soda ash or from the reaction between fluorosilicic acid and soda ash. The various particle sizes are obtained by grinding and screening the dried crystals.

NaF is proportionally added to the water being treated as a dry, coarse crystalline material or as a solution. Its constant solubility is particularly valuable in producing a saturated solution automatically and continuously in a tank or saturator specially designed for this purpose. This tank does require a water meter to measure the amount of water that is used to make up a solution of known strength.

Refer to AWWA Manual M4, *Water Fluoridation Principles and Practices*[†] for additional technical information concerning the use of NaF.

I.B. *History.* The AWWA Standard for Sodium Fluoride was tentatively approved by the AWWA Board of Directors on July 21, 1950. Subsequent revisions to ANSI/AWWA B701 were approved on May 15, 1960; Jan. 24, 1971; Jan. 28, 1978;

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

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

Jan. 30, 1984; Jan. 29, 1989; Jan. 30, 1994; June 20, 1999; Feb. 12, 2006; June 12, 2011, and March 30, 2018. This edition was approved on March 13, 2024.

I.C. *Acceptance.* Products that are covered by this standard should have certification in accordance with NSF/ANSI/CAN[‡] 60 and documentation on conformational testing to ANSI/AWWA B701 criteria.

Conformational testing to ANSI/AWWA B701 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.

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). The American Water Works Association (AWWA) and the Association of 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.[§] 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 60 and NSF/ANSI 61. Survey results from

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

[§] Persons outside the United States should contact the appropriate authority having jurisdiction.

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

2016 show adoption of NSF/ANSI 60 by 48 states and nine provinces/territories and adoption of NSF/ANSI 61 by 48 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 NSF/ANSI/CAN 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 B701 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 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 with 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 and Handling Precautions. NaF chemicals must be stored in a clean, dry location that is well ventilated. NaF has a tendency to compact or cake when exposed to moisture, when bags are stacked too high, or during long periods of storage. Bags of NaF should be stored on pallets in stacks not more than six bags high.

NaF is hazardous if swallowed or inhaled in large amounts. Ingestion of 4–5 g of fluoride ion (F^-) per 150 lb (68 kg) body weight may be fatal. The inhalation of NaF dust should be avoided. Protective safety gear should be worn when handling NaF. The following protective clothing and equipment should be the minimum available:

1. A high-efficiency dust respirator (chemical mask) with a soft rubber face-to-mask seal and replaceable cartridges approved by the National Institute for Occupational Safety and Health/Mine Safety Health Administration (NIOSH/MSHA).**

2. Gauntlet neoprene gloves (12-in. [305-mm] minimum glove length).

3. Heavy-duty neoprene aprons.

4. Splash-proof goggles.

Spills should be cleaned up immediately. Personnel should wash thoroughly after handling fluoride chemicals. For additional safety aspects, refer to safety data sheets available from the chemical supplier or manufacturer.

II.B. *Upflow-Type Saturator Operations.* The only fluoride product suitable for use in a saturator is NaF.

1. NaF will dissolve to saturation within a 5-min contact period with water having hardness content of less than 50–75 mg/L as CaCO₃ (3.0–4.5 g/gal) if a flow restrictor with a maximum flow of 2 gal/min is installed. Water with a total hardness of greater than 50–75 mg/L as CaCO₃ should be softened to reduce the hardness.

2. The pressure of the incoming makeup water should be reduced to a range of 20–80 psi during the fill cycle. A small water meter must be provided on the makeup 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 should be read daily and the results recorded.

3. The NaF bed should be maintained at a sufficient depth, and the water should be limited to a rise rate that provides a minimum of 5 min contact before it emerges out of the bed into the saturator bulk-saturated solution. The minimum depth of the NaF bed upon solution erosion should be 12 in. to maintain a sufficient bed depth to provide sufficient contact through the bed to achieve a saturated flow. The maximum bed depth should be 18–24 in. to avoid compaction and flow constrictions through the bed. Marking the outside of the translucent thermoplastic saturator tank with fill and refill markings and turning on the inside saturator lamp momentarily will help the operator maintain the proper depth. The NaF should be replenished in the bed on a daily basis. A larger volume saturator should be considered if high usage rate erodes the bed depth within a few hours and frequent additions of NaF are necessary.

** NIOSH/MSHA approval is given to various masks. Each brand is evaluated by NIOSH/MSHA for the proposed use and conditions. Available from the National Institute for Occupational Safety and Health, 4676 Columbia Parkway, Cincinnati, OH 45226 or Mine Safety Health Administration, 201 Twelfth Street South, Suite 401, Arlington, VA 22202-5450.

4. Fresh NaF should be added to the bed in a uniform pattern and not added only at one side of the saturator. After the fresh NaF is added, a 5-ft-long, $\frac{3}{4}$ -in.-dia. PVC schedule 80 pipe-stick with a glued-on cap, pole, or paddle implement should be used to gently stir the bed contents to a uniform character and height.

5. Allow the saturator solution to settle (for a couple of minutes) so that excessive colloidal solids and particles are not suspended when pumping is resumed. If possible, adding the NaF when the water source is offline is preferable.

6. It is natural for some colloidal solids and particles to be suspended in the saturated solution and drawn into the feed tube. To prevent plugging and operational problems in the system, a filter or strainer should be included on the suction end of the feed tube to the pump. This filter or strainer should be checked and cleaned regularly to prevent air binding. Using dual-pump pickup strainers on saturator top covers will reduce the maintenance downtime spent on cleaning the strainers.

7. Since the NaF salts will continue to dissolve, the insoluble fraction of the product will accumulate in the bed. Experience has found that as much as 2 percent of the product can be anticipated to become residual cinders and other insolubles that need to be cleaned out periodically. With a recommended minimum bed depth of 12 in. before routine additive replenishment, there should not be more than 3 in. of cinders and other insolubles or there may be difficulty in maintaining sufficient bed depth to ensure saturation of the flow. This results in an approximate cycle of standard 55-gal saturator cleanout according to the following schedule (may vary by season):

- One 50-lb bag or less added per week requires an annual cleanout cycle to allow for annual inspection of installation.
- Two 50-lb bags added per week require an annual cleanout cycle to allow for annual inspection of installation.
- Four 50-lb bags added per week require a six-month cleanout cycle.
- One 50-lb bag added per day requires a four-month cleanout cycle.
- Two 50-lb bags added per day require a two-month cleanout cycle.

8. Many facilities have found that using a 12-in. minimum bed depth, presuming potentially 3 in. of residual cinders and other insolubles at the end of the cleanout cycle, with a full bed depth of 18 in., provides desirable operating results without bed compaction. If higher demand rates are experienced or if a saturator can achieve satisfactory operation with up to a 24-in.-deep bed, consideration may be made to not let the saturator deplete to less than 18 in., and then a 6-in. accumulation of residual cinders and other insolubles may be tolerated. If that is practiced, the facilities