



Purchasing Department
140 Stonewall Avenue West, Ste 204
Fayetteville, GA 30214
Phone: 770-305-5420
www.fayettecountyga.gov

May 14, 2019

Subject: Invitation to Bid #1667-B: Water System Treatment Chemicals

Gentlemen/Ladies:

Fayette County, Georgia is seeking bids for an annual contract from qualified Suppliers for the purchase of various types of water treatment chemicals to be ordered as needed, in accordance with the information and specifications contained herein.

Questions concerning this invitation to bid should be addressed to Natasha Duggan, Contract Administrator in writing via email to nduggan@fayettecountyga.gov or fax to (770) 719-5534. Questions will be accepted until 3:00 pm, Thursday, May 30, 2019.

The Purchasing Department office hours are Monday through Friday 8:00am to 5:00pm excluding holidays. The office telephone number is (770) 305-5420.

Bids will be received at the address below until 3:00 pm, Friday, June 7, 2019 in the Purchasing Department, Suite 204. Bids will be opened at that time. Bids must be signed to be considered. Late bids will not be considered. Faxed or emailed bids will not be considered.

Fayette County Purchasing Department
140 Stonewall Avenue West, Suite 204
Fayetteville, Georgia 30214

Bid Number: 1667-B
Bid Name: Water System Treatment Chemicals

Your bid should be on the pricing sheet included herein. All prices shall be F.O.B. Destination, Fayette County. Be sure to include the **bid number** and **bid name** along with your company's name and address on the **sealed** envelope in which the bid is returned.

If you downloaded this Invitation to Bid from the county's website, it will be your responsibility to check the website for any addenda that might be issued for this solicitation. The county cannot not be responsible for a bidder not receiving information provided in any addenda.

Sincerely,

Ted L. Burgess
Director of Purchasing

TLB/nmd

GENERAL TERMS AND CONDITIONS

1. **Definitions:** The term “contractor” as used herein and elsewhere in these Terms and Conditions shall be used synonymously with the term “successful bidder.” The term “county” shall mean Fayette County, Georgia.
2. **Bid is Offer to Contract:** Each bid constitutes an offer to become legally bound to a contract with the county, incorporating the invitation to bid and the bidder’s bid. The binding offer includes compliance with all terms, conditions, special conditions, specifications, and requirements stated in the invitation to bid, except to the extent that a bidder takes written exception to such provisions. All such terms, conditions, special conditions, specifications, and requirements will form the basis of the contract. The bidder should take care to answer all questions and provide all requested information, and to note any exceptions in the bid submission. Failure to observe any of the instructions or conditions in this invitation to bid may result in rejection of the bid.
3. **Binding Offer:** Each bid shall constitute a firm offer that is binding for ninety (90) days from the date of the bid opening, unless the bidder takes exception to this provision in writing.
4. **Bidder’s Questions:** The Fayette County Purchasing Department must receive questions about this invitation to bid in writing at least six days before the scheduled bid opening, excluding Saturdays, Sundays, and holidays. The county will post answers to questions and/or other information concerning the invitation to bid in the form of an addendum on the county’s website at www.fayettecountyga.gov. It is the responsibility of the prospective bidder to check the website for any addenda issued for this invitation to bid.
5. **References:** Include with your bid a list of three (3) jobs that your company has done that are of the same or similar nature to the work described in this invitation to bid, on the form provided. Include all information as requested on the form.
6. **Bid Submission:** Submit your bid, along with any addenda issued by the county, in a sealed opaque envelope with the following information written on the outside of the envelope:
 - a. The bidder’s company name,
 - b. The bid number, which is #1667-B, and
 - c. The bid name, which is “Water System Treatment Chemicals”.

Mail or deliver one (1) original bid, signed in ink by a company official authorized to make a legal and binding offer to:

Fayette County Government
Purchasing Department
140 Stonewall Avenue West, Suite 204
Fayetteville, GA 30214

Attention: Contracts Administrator

You may submit bids in person, by U.S. mail, or by a commercial carrier. Do not submit bids by facsimile, e-mail, or other electronic means. Once submitted, all bids become the property of Fayette County.

7. **Bid Preparation Costs:** The bidder shall bear all costs associated with preparing the bid.
8. **Late Bids:** Bids not received by the time and date of the scheduled bid opening will not be considered, unless the delay is a result of action or inaction by the county.
9. **More than One Bid:** Do not submit alternate bids or options, unless requested or authorized by the county in the Invitation to Bid. If a responder submits more than one bid without being requested or authorized to do so, the county may disqualify the bids from that responder, at the county’s option.
10. **Bid Corrections or Withdrawals:** The bidder may correct a mistake, or withdraw a bid, before the bid opening by sending written notification to the Director of Purchasing. Bids may be withdrawn after the bid opening only with written authorization from the Director of Purchasing.

11. **Defects or Irregularities in Bids:** The county reserves the right to waive any defect or irregularity in any bid received. In case of an error in extension of prices or totals in the bid, the unit prices shall govern.
12. **Prices Held Firm:** Prices quoted shall be firm for the period of the contract, unless otherwise specified in the bid. All prices for commodities, supplies, equipment, or other products shall be quoted FOB Destination, Fayette County or job site.
13. **Quantities are Estimates:** Quantities listed herein are estimates for the period specified. This will be an indefinite-quantity type contract, with county requirements fulfilled on an "as ordered" basis. No guarantee to purchase the amounts shown is intended or implied. The county reserves the right to order larger or smaller quantities at the prices stated in the bid of the successful bidder.
14. **Brand Name:** If items in this invitation for bid have been identified, described or referenced by a brand name or trade name description, such identification is intended to be descriptive, but not restrictive and is to indicate the quality and characteristics of products that may be offered. Alternative products may be considered for award if clearly identified in the bid. Items offered must meet required specifications and must be of a quality which will adequately serve the use and purpose for which intended.
15. **Bidder Substitutions:** Bidders offering substitutions or deviations from specifications stated in the invitation to bid, shall list such substitutions or deviations on the "Exceptions to Specifications" sheet provided, or on a separate sheet to be submitted with the bid. The absence of such list shall indicate that the bidder has taken no exception to the specifications. The evaluation of bids and the determination as to equality and acceptability of products or services offered shall be the responsibility of the county.
16. **Samples:** When the county requires samples as part of the bid and vendor selection process, bidders must provide requested samples within the time allotted, and at no cost to the county unless otherwise specified. Any goods provided under contract shall conform to the sample submitted. The county will return samples only at the bidder's request, and at the bidder's expense, if they are not destroyed by testing.
17. **Non-Collusion:** By responding to this invitation to bid, the bidder represents that the bid is not made in connection with any competing bidder, supplier, or service provider submitting a separate response to this invitation to bid, and is in all respects fair and without collusion or fraud.
18. **Bid Evaluation:** Award will be made to the lowest responsive, responsible bidder, taking into consideration payment terms, vendor qualifications and experience, quality, references, any exceptions listed, and/or other factors deemed relevant in making the award. The county may make such investigation as it deems necessary to determine the ability of the bidder to perform, and the bidder shall furnish to the county all information and data for this purpose as the county may request. The county reserves the right to reject any bid item, any bid, or all bids, and to re-advertise for bids.
19. **Partial Award:** The county reserves the right to make award by item, by group of items, by any combination of items, or by lump sum award. The award will be made in the best interest of the county. Bidders may restrict their bids to consideration of a lump sum award or other restriction only by so indicating on the pricing sheet or the "Exceptions to Specifications" sheet included in the invitation to bid. Bidders who do not restrict consideration of their bids in this manner shall be expected to accept any portion of the bid awarded. The county reserves the right to award multiple contracts for the products or services sought by this invitation to bid.
20. **Payment Terms and Discounts:** The County's standard payment terms are Net 30. Any deviation from standard payment terms must be specified in the resulting contract, and both parties must agree on such deviation. Cash discounts offered will be a consideration in awarding the bid, but only if they give the county at least 15 days from receipt of invoice to pay. For taking discounts, time will be computed from the date of invoice acceptance by the County, or the date a correct invoice is received, whichever is the later date. Payment is deemed made, for the purpose of earning the discount, on the date of the check.

21. **Trade Secrets – Confidentiality:** If any person or entity submits a bid or proposal that contains trade secrets, an affidavit shall be included with the bid or proposal. The affidavit shall declare the specific included information which constitutes trade secrets. Any trade secrets must be either (1) placed in a separate envelope, clearly identified and marked as such, or (2) at a minimum, marked in the affidavit or an attached document explaining exactly where such information is, and otherwise marked, highlighted, or made plainly visible. See O.C.G.A. § 50-18-72 (A)(34).
22. **Trade Secrets – Internal Use:** In submitting a bid, the bidder agrees that the county may reveal any trade secret materials contained in the bid to all county staff and officials involved in the selection process, and to any outside consultant or other third parties who may assist in the selection process. The bidder agrees to hold harmless the county and each of its officers, employees, and agents from all costs, damages, and expenses incurred in connection with refusing to disclose any material which the bidder has designated as a trade secret.
23. **Ethics – Disclosure of Relationships:** Before a proposed contract in excess of \$10,000.00 is recommended for award to the Board of Commissioners or the County Administrator, or before the County renews, extends, or otherwise modifies a contract after it has been awarded, the contractor must disclose certain relationships with any County Commissioner or County Official, or their spouse, mother, father, grandparent, brother, sister, son or daughter related by blood, adoption, or marriage (including in-laws). A relationship that must be reported exists if any of these individuals is a director, officer, partner, or employee, or has a substantial financial interest in the business, as described in Fayette County Ordinance Chapter 2, Article IV, Division 3 (Code of Ethics).

If such relationship exists between your company and any individual mentioned above, relevant information must be presented in the form of a written letter to the Director of Purchasing. You must include the letter with any bid, proposal, or price quote you submit to the Purchasing Department.

In the event that a contractor fails to comply with this requirement, the County will take action as appropriate to the situation, which may include actions up to and including rejection of the bid or offer, cancellation of the contract in question, or debarment or suspension from award of a County contract for a period of up to three years.

24. **Contract Execution & Notice to Proceed:** After the Board of Commissioners makes an award, all required documents are received by the county, and the contract is fully executed with signature of both parties, the county will issue a written Notice to Proceed. The county shall not be liable for payment of any work done or any costs incurred by any bidder prior to the county issuing the Notice to Proceed.
25. **Term of Contract:** The term of this agreement shall begin July 1, 2019, and continue for a period of one year through June 30, 2020. Thereafter, this agreement may be renewed by the county for two additional one-year renewal terms (each a “Renewal Term” and together with the Initial Term, the “Term”), which renewal will be by letter or other written correspondence from the county to the contractor ninety (90) days prior to expiration of the Initial Term or the then-current Renewal Term. If the county fails to provide notice of renewal, this Agreement will terminate at the end of the Initial Term or the then-current Renewal Term. This agreement is subject to the multi-year contractual provisions of O.C.G.A. 36-60-13(a).
26. **Unavailability of Funds:** This contract will terminate immediately and absolutely at such time as appropriated and otherwise unobligated funds are no longer available to satisfy the obligations of the county under the contract.
27. **Unauthorized Performance:** The county will not compensate the contractor for work performed unless the work is authorized under the contract, as initially executed or as amended.
28. **Assignment of Contract:** Assignment of any contract resulting from this invitation to bid will not be authorized, except with express written authorization from the county.

29. **Insurance:** The successful bidder shall procure and maintain the following insurance, to be in effect throughout the term of the contract, in at least the amounts and limits as follows:

- a. **General Liability Insurance:** \$1,000,000 combined single limit per occurrence, including bodily and personal injury, destruction of property, and contractual liability.
- b. **Automobile Liability Insurance:** \$1,000,000 combined single limit each occurrence, including bodily injury and property damage liability.
- c. **Worker's Compensation & Employer's Liability Insurance:** Workers Compensation as required by Georgia statute.

Before a contract with the successful bidder is executed, the successful bidder shall provide Certificates of Insurance for all required coverage. The successful offeror can provide the Certificate of Insurance after award of the contract, but must be provided prior to execution of the contract document by both parties. The certificate shall list an additional insured as follows:

Fayette County, Georgia
140 Stonewall Avenue West
Fayetteville, GA 30214

30. **Indemnification:** The contractor shall defend, indemnify and save the county and all its officers, agents and employees harmless from all suits, actions, or other claims of any character, name and description brought for or on account of any damages, losses, or expenses to the extent caused by or resulting from the negligence, recklessness, or intentionally wrongful conduct of the contractor or other persons employed or utilized by the contractor in the performance of the contract. The contractor shall pay any judgment with cost which may be obtained against the county growing out of such damages, losses, or expenses.
31. **Severability:** The invalidity of one or more of the phrases, sentences, clauses or sections contained in the contract shall not affect the validity of the remaining portion of the contract. If any provision of the contract is held to be unenforceable, then both parties shall be relieved of all obligations arising under such provision to the extent that the provision is unenforceable. In such case, the contract shall be deemed amended to the extent necessary to make it enforceable while preserving its intent.
32. **Delivery Failures:** If the contractor fails to deliver contracted goods or services within the time specified in the contract, or fails to replace rejected items in a timely manner, the county shall have authority to make open-market purchases of comparable goods or services. The county shall have the right to invoice the contractor for any excess expenses incurred, or deduct such amount from monies owed the contractor. Such purchases shall be deducted from contracted quantities.
33. **Substitution of Contracted Items:** The contractor shall be obligated to deliver products awarded in this contract in accordance with terms and conditions specified herein. If a contractor is unable to deliver the products under the contract, it shall be the contractor's responsibility to obtain prior approval of the ordering agency to deliver an acceptable substitute at the same price quoted in the contractor's original bid. In the event any contractor consistently needs to substitute or refuses to substitute products, the County reserves the right to terminate the contract or invoke the "Delivery Failures" clause stated herein.
34. **Inspection and Acceptance of Deliveries:** The county reserves the right to inspect all goods and products delivered. The county will decide whether to accept or reject items delivered. The inspection shall be conclusive except with respect to latent defects, fraud, or such gross mistakes as shall amount to fraud. Final inspection resulting in acceptance or rejection of the products will be made as soon as practicable, but failure to inspect shall not be construed as a waiver by the county to claim reimbursement or damages for such products which are later found to be in non-conformance with specifications. Should public necessity demand it, the county reserves the right to use or consume articles delivered which are substandard in quality, subject to an adjustment in price to be determined by the Purchasing Director

35. **Termination for Cause:** The county may terminate the contract for cause by sending written notice to the contractor of the contractor's default in the performance of any term of this agreement. Termination shall be without prejudice to any of the county's rights or remedies by law.
36. **Termination for Convenience:** The county may terminate the contract for its convenience at any time with 10 days' written notice to the contractor. In the event of termination for convenience, the county will pay the contractor for services performed. The county will compensate partially completed performance based upon a signed statement of completion submitted by the contractor, which shall itemize each element of performance completed.
37. **Force Majeure:** Neither party shall be deemed to be in breach of the contract to the extent that performance of its obligations is delayed, restricted, or prevented by reason of any act of God, natural disaster, act of government, or any other act or condition beyond the reasonable control of the party in question.
38. **Governing Law:** This agreement shall be governed in accordance with the laws of the State of Georgia. The parties agree to submit to the jurisdiction in Georgia, and further agree that any cause of action arising under this agreement shall be required to be brought in the appropriate venue in Fayette County, Georgia.

Checklist of Required Documents

*(Be Sure to Return This Checklist and
the Required Documents in the order listed below)*

ITB #1667-B: Water System Treatment Chemicals

Company information – on the form provided _____

Pricing sheet _____

List of exceptions, if any – on the form provided _____

References – on form provided _____

Product Data Sheet for each chemical quoted _____

Addenda, if Any _____

COMPANY NAME: _____

ITB #1667-B: Water System Treatment Chemicals

INTRODUCTION

Fayette County, Georgia is seeking bids for an annual contract from qualified Suppliers for the purchase of various types of water treatment chemicals. The contract resulting from this invitation to bid will allow Fayette County Water System to purchase water treatment chemicals on an as-needed basis throughout the contract period.

SCOPE OF WORK

1. Fayette County will order chemicals according to the needs and storage capabilities, as per the unit size and amount.
2. Orders will be placed by a Fayette County Purchase Order.
3. Deliveries should be made within 1 to 3 days of receipt of order between the hours of 8am and 4pm, Monday through Friday excluding holidays.
4. Deliveries shall be made to two (2) locations:
 - A. Crosstown Water Treatment Plant
3500 TDK Blvd; Peachtree City, GA 30269
 - B. South Fayette Water Treatment Plant
880 Antioch Road; Fayetteville, GA 30215
5. Specifications for Liquid Alum are attached (Attachment A)
6. Alum will be delivered by tanker, 12 dry tons per load
7. Chemicals delivered by tanker truck shall provide insurance as per requirements outlined in Terms and Conditions #29.
8. Sodium Silicafluoride shall meet the AWWA Standard listed on the attached pricing sheet and meet NSF 60 Certifications
9. HTH Chlorine shall meet the AWWA Standard listed on the attached pricing sheet. Specifications are attached (Attachment B)
10. The responder shall provide a Product Data Sheet for each chemical quoted.
11. The driver shall be responsible for complete cleanup of any spill(s) originating from the unloading process.
12. The following information shall be provided on all invoices:
 - A. Purchase Order Number
 - B. Delivery Address
 - C. Chemical Shipped/Delivered
 - D. Quantity Shipped/Delivered
 - E. Unit Price
 - F. Total Invoice Amount

Invoices with incorrect and/or missing information shall be returned to the supplier for correction prior to payment. Fayette County will not pay late fees for invoices delayed due to incorrect or missing information.

PRICING SHEET
ITB #1667-B: WATER SYSTEM TREATMENT CHEMICALS

| Chemical | Unit Size | Estimated Annual Quantity | Unit Price | Extended Price |
|--|--------------------|---------------------------|------------------------------|----------------|
| Sodium Silicafluoride AWWA #B702-06 | 50 lb. bag, powder | 700 bags | \$ _____ per bag | |
| Cal-Flo Lime Slurry | liquid pounds | 2,866,950 | \$ _____ per liquid pound | |
| Sodium Hypchlorite | 15 gal. drum | 10 | \$ _____ per 15 gal drum | |
| Carasol 20 Permanganate | gallon | 10,000 | \$ _____ per gallon | |
| Liquid Alum AWWA #B403-03 | dry ton | 650 dry tons | \$ _____ per dry ton | |
| HTH Chlorine ANSI/AWWA B300-18 | 50 lb./pail | 20 Pails | \$ _____ per 50 lb. pail | |

NOTE: All applicable charges shall be included in your total unit price per chemical, e.g. chemical, delivery, and any other fees. No additional charges will be allowed after the bid opening.

STATE DELIVERY TIME AFTER RECEIPT OF ORDER _____ DAYS.

COMPANY NAME: _____

REFERENCES

ITB #1667-B: Water System Treatment Chemicals

Please list three (3) references for current or recent customers who can verify the quality of service your company provides. Projects of similar size and scope are preferable.

1. Government/Company Name _____

City & State _____

Work or Service Provided _____

Approximate Completion Date _____

Contact Person and Title _____

Phone _____ Email _____

2. Government/Company Name _____

City & State _____

Work or Service Provided _____

Approximate Completion Date _____

Contact Person and Title _____

Phone _____ Email _____

3. Government/Company Name _____

City & State _____

Work or Service Provided _____

Approximate Completion Date _____

Contact Person and Title _____

Phone _____ Email _____

COMPANY NAME _____

COMPANY INFORMATION
ITB #1667-B: Water System Treatment Chemicals

Company Name: _____

Physical Address: _____

Mailing Address (if different): _____

AUTHORIZED REPRESENTATIVE

Signature: _____

Printed or Typed Name: _____

Title: _____

Email Address: _____

Phone Number: _____ Fax Number: _____

PROJECT CONTACT PERSON

Name: _____

Title: _____

Office Number: _____ Cellular Number: _____

Email Address: _____

Contractor Affidavit under O.C.G.A. § 13-10-91(b)(1)

By executing this affidavit, the undersigned contractor verifies its compliance with O.C.G.A. § 13-10-91, stating affirmatively that the individual, firm or corporation which is engaged in the physical performance of services on behalf of Fayette County, Georgia has registered with, is authorized to use and uses the federal work authorization program commonly known as E-Verify, or any subsequent replacement program, in accordance with the applicable provisions and deadlines established in O.C.G.A. § 13-10-91. Furthermore, the undersigned contractor will continue to use the federal work authorization program throughout the contract period and the undersigned contractor will contract for the physical performance of services in satisfaction of such contract only with subcontractors who present an affidavit to the contractor with the information required by O.C.G.A. § 13-10-91(b). Contractor hereby attests that its federal work authorization user identification number and date of authorization are as follows:

Federal Work Authorization User Identification Number

Date of Authorization

Name of Contractor

#1667-B: Water System Treatment Chemicals

Name of Project

Fayette County Georgia

Name of Public Employer

I hereby declare under penalty of perjury that the foregoing is true and correct.

Executed on _____, _____, 2019 in (city) _____, (state) _____

Signature of Authorized Officer or Agent

Printed Name and Title of Authorized Officer or Agent

SUBSCRIBED AND SWORN BEFORE ME

ON THIS THE _____ DAY OF _____, 2019

NOTARY PUBLIC

My Commission Expires:

1.0 Product Name: Aluminum Sulfate (Liquid Alum)

2.0 Specification:

FEED COMPONENT AND CONCENTRATION RANGE

| Chemical Analysis | Specification | |
|---------------------------------------|----------------------------------|----------------------------|
| | | |
| Specific Gravity (SG) | 1.33 – 1.34 | |
| Density, lbs./gal, US | 11.09 – 11.17 | |
| Al ₂ O ₃ % wet | 8.10 – 8.40 | |
| Delivery Temperature | 80 – 130 degrees F | |
| | | |
| Appearance: | Clear (< 10 NTU) | NO SUSPENDED MATTER |
| Color: | Colorless to light yellow | |
| Odor: | Odorless, free from foreign odor | |
| | | |
| | | |
| Must meet NSF 60 certification | | |

3.0 Additional Requirements:

- 3.1 The supplier shall provide a Safety Data Sheet with each bid submittal.
- 3.2 The supplier shall provide a Certificate of Analysis (CoA) with each load delivered.
- 3.3 The product shall be delivered between 8:00 am and 4:00 pm Monday through Friday. The driver of each delivery will provide a bill of lading with stamped scale weight.
- 3.4 The driver shall be responsible for complete cleanup of any spill(s) originating from the unloading process.

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Attachment B



**American Water Works
Association**

Dedicated to the World's Most Important Resource®

ANSI/AWWA B300-18
(Revision of ANSI/AWWA B300-10)

AWWA Standard

Hypochlorites

Effective date: Sept. 1, 2018.

First edition approved by AWWA Board of Directors June 2, 1953.

This edition approved March 30, 2018.

Approved by American National Standards Institute April 24, 2018.



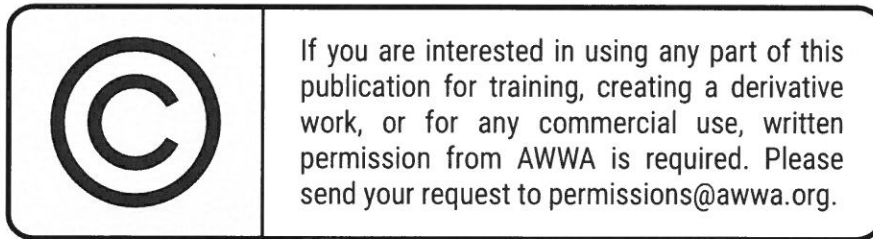
AWWA Standard

This document is an American Water Works Association (AWWA) standard. It is not a specification. AWWA standards describe minimum requirements and do not contain all of the engineering and administrative information normally contained in specifications. The AWWA standards usually contain options that must be evaluated by the user of the standard. Until each optional feature is specified by the user, the product or service is not fully defined. AWWA publication of a standard does not constitute endorsement of any product or product type, nor does AWWA test, certify, or approve any product. The use of AWWA standards is entirely voluntary. This standard does not supersede or take precedence over or displace any applicable law, regulation, or code of any governmental authority. AWWA standards are intended to represent a consensus of the water industry that the product described will provide satisfactory service. When AWWA revises or withdraws this standard, an official notice of action will be placed in the Official Notice section of *Journal AWWA*. The action becomes effective on the first day of the month following the month of *Journal AWWA* publication of the official notice.

American National Standard

An American National Standard implies a consensus of those substantially concerned with its scope and provisions. An American National Standard is intended as a guide to aid the manufacturer, the consumer, and the general public. The existence of an American National Standard does not in any respect preclude anyone, whether that person has approved the standard or not, from manufacturing, marketing, purchasing, or using products, processes, or procedures not conforming to the standard. American National Standards are subject to periodic review, and users are cautioned to obtain the latest editions. Producers of goods made in conformity with an American National Standard are encouraged to state on their own responsibility in advertising and promotional materials or on tags or labels that the goods are produced in conformity with particular American National Standards.

CAUTION NOTICE: The American National Standards Institute (ANSI) approval date on the front cover of this standard indicates completion of the ANSI approval process. This American National Standard may be revised or withdrawn at any time. ANSI procedures require that action be taken to reaffirm, revise, or withdraw this standard no later than five years from the date of ANSI approval. Purchasers of American National Standards may receive current information on all standards by calling or writing the American National Standards Institute, 25 West 43rd Street, Fourth Floor, New York, NY 10036; 212.642.4900; or e-mailing info@ansi.org.



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Committee Personnel

The AWWA Standards Committee on Disinfectants, which reviewed and approved this standard, had the following personnel at the time of approval:

K. Blake Stark, *Chair*

General Interest Members

K.-K. Au, FMC Global Peroxygens, Naperville, Ill.

N.J. Edman,* Standards Group Liaison, AWWA, Denver, Colo.

M.C. Graves, HDR Engineering, Austin, Tex.

R. Hampaul, Indigenous and Northern Affairs Canada, Vancouver, B.C.

G. Ramon,* Standards Council Liaison, Little Rock Wastewater, Little Rock, Ark.

M. Sivaganesan, USEPA, Cincinnati, Ohio

K.B. Stark, NSF International, Ann Arbor, Mich.

A. Waldron, CH2M, Englewood, Colo.

Producer Members

M.C. Gibson, American Chemistry Council, Washington, D.C.

R. Ness, Olin Chlor Alkali Products, Charleston, Tenn.

D.S. Weatherup, De Nora Water Technologies Inc., Colmar, Penn.

User Members

R.C. Lorenz, Westerville Water Plant, Westerville, Ohio

C.L. McLain, Consultant, Moorhead, Minn.

F. Noce, Lake County Department of Utilities, Painesville, Ohio

L. Olson, American Water, Voorhees, N.J.

P.R. Riendeau, New England Water Works Association, Holliston, Mass.

* Liaison, nonvoting

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Foreword

This foreword is for information only and is not a part of ANSI/AWWA B300.*

I. Introduction.

I.A. *Background.* “Hypochlorites” is used as an all-inclusive term for chlorinated lime, calcium hypochlorite, and sodium hypochlorite. A concise description of each chemical follows.

Chlorinated lime: 25 percent to 37 percent available chlorine. Other common names for chlorinated lime are bleaching powder and chloride of lime. Because it is an unstable material and is subject to deterioration from heat and moisture, it is not usually fed dry but as a 2 percent solution. Excess insolubles present in this solution must be separated by decantation before use. Storage in a cool, dry area, for no more than nine months, is advisable. Chlorinated lime is available in 100 lb (45.4 kg), 300 lb (136 kg), and 800 lb (363 kg) drums. Approximately 0.25 lb/gal (30 g/L) of chlorinated lime to water will produce a solution of approximately 1 percent available chlorine.

Calcium hypochlorite: 65 percent to 70 percent available chlorine. This material is unstable but more stable than the grade with 35 percent available chlorine. It is best fed as a solution. Its theoretical solubility is approximately 22 g/100 mL of water (18 percent) at room temperature; however, its practical solubility use is closer to 3 percent. Decantation is advisable before use because of the excess insolubles present. Storage in a cool, dry area is advisable, but storage periods should not exceed one year. Calcium hypochlorite can lose 3–10 percent available chlorine in one year. It is available in 3 lb to 5 lb (1.4 kg to 2.3 kg) cans, 2 lb to 9 lb (0.9 kg to 4.1 kg) plastic containers, and 100 lb (45.4 kg) steel drums, and in granular powder, granule, and tablet form. Solubility tests that determine both rate and percentage should be conducted with particular emphasis on testing the tablets. Approximately 0.125 lb/gal (15 g/L) of calcium hypochlorite to water produces a solution of approximately 1 percent available chlorine.

Sodium hypochlorite: 12 percent to 20 percent available chlorine. Other common names for sodium hypochlorite are bleach, liquor, chlorine water, and Javelle water. Sodium hypochlorite will undergo some decomposition over time. There are numerous parameters that affect the rate of decomposition (see The Chlorine Institute[†] Pamphlet 96, *Sodium Hypochlorite Manual*).

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

[†] The Chlorine Institute Inc., 1300 Wilson Blvd., Suite 525, Arlington, VA 22209.

Table F.1 Chlorine available in sodium hypochlorite

| Available Chlorine <i>g/L</i> | Trade % Available Chlorine | Chlorine Equivalent <i>lb/gal</i> | Chlorine Equivalent <i>kg/L</i> | Gallons to Obtain 1 lb Chlorine | Liters to Obtain 1 kg Chlorine |
|----------------------------------|----------------------------|--------------------------------------|------------------------------------|------------------------------------|-----------------------------------|
| 200 | 20.0 | 1.630 | 0.200 | 0.610 | 5.000 |
| 160 | 16.0 | 1.333 | 0.160 | 0.752 | 6.250 |
| 150 | 15.0 | 1.200 | 0.150 | 0.800 | 6.667 |
| 120 | 12.0 | 1.000 | 0.120 | 1.000 | 8.333 |
| 50 | 5.0 | 0.417 | 0.050 | 2.400 | 20.000 |
| 10 | 1.0 | 0.083 | 0.010 | 12.000 | 100.000 |

Sample calculation:

12 trade percent available chlorine = 120 grams per liter (g/L) available chlorine

$120 \text{ g/L} \times 3.785 \text{ L/gal} \times 2.205 \text{ lb/1,000 g} = 1 \text{ lb/gal available chlorine}$

Sodium hypochlorite is miscible in any proportion with water. It should be stored in a dark area where the temperature does not exceed 80°F (27°C). A 12 percent to 20 percent solution is still liquid at 0°F (-17.8°C) but is a slush at -20°F (-28.9°C). It is available in 5 gal and 13 gal (19 L and 49 L) carboys (glass or polyethylene), 30 gal (113.6 L) drums, and approximately 5,000 gal (18,926 L) tank trucks. The available chlorine content is as indicated in Table F.1.

I.B. *History.* The original AWWA Standard for Hypochlorites, prepared for the AWWA Water Purification Division, was approved by the Executive Committee of the Water Purification Division and by the Water Works Practice Committee and received approval by the AWWA Board of Directors on June 2, 1953. It was designated ANSI/AWWA B300-53T.

The initial document was reaffirmed without revision on June 17, 1955, and the designation was changed from ANSI/AWWA B300-53T to ANSI/AWWA B300-55. Subsequent revisions were adopted on June 5, 1964; Jan. 26, 1975; June 15, 1980; and June 14, 1987. This standard was revised by the AWWA Standards Committee on Disinfectants, and ANSI/AWWA B300-99 was approved by the AWWA Board of Directors on June 20, 1999. Subsequent revisions were adopted on June 13, 2004 and Jan. 17, 2010. This edition was approved on March 30, 2018.

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 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 the United States, all hypochlorites used in water disinfection are required to be registered with USEPA under the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA). Individual states* and local agencies may choose to impose requirements more stringent than those required by USEPA. 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 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 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 Annex A procedures may not always be identical, depending on the certifier.

ANSI/AWWA B300 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 great concern. The language in Sec. 4.3.2 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 also 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.

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

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

II. Special Issues.

II.A. *Storage and Handling Precautions.* Light, heat, organic matter, and certain heavy-metal cations, such as copper, nickel, and cobalt, accelerate the decomposition of hypochlorites. Dampness appreciably decreases the life of metal containers in which the powdered forms are shipped. Hypochlorites should be stored in a cool, dry place, preferably in the dark or out of direct sunlight. They are very active chemically and should be stored in a manner that prevents any possible contact with other materials that are flammable, such as oil, grease, glycerine, or printed matter. When removing hypochlorite from a drum, never use a scoop or vessel that is contaminated with organic matter.

All hypochlorite solutions are corrosive to some degree and will affect the skin and eyes on contact. Any affected areas should be washed with copious amounts of water. Personnel are advised to use caution and to wear protective clothing (i.e., gloves, apron, goggles, and a suitable vapor mask) when handling the solutions. Personnel should refer to the manufacturer's safety data sheets (SDSs) for recommendations regarding personal protective equipment.

Because chlorine gas can be released, never acidify a hypochlorite solution.

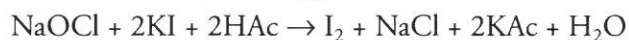
Hypochlorite solutions can add chlorate/chlorite ions to potable water. There is some concern about the health effects of chlorate/chlorite. Utilities using these products are advised to analyze for the chlorate/chlorite ion in their water supply.

Perchlorate is another possible contaminant in hypochlorites.

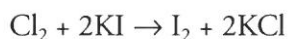
II.B. *Strength of Solutions.* There are several common ways that the concentration of sodium hypochlorite may be expressed. These are listed subsequently with explanations.

1. Available chlorine. The term *available chlorine* came into usage as a means of comparing oxidizers in different applications.

Because chlorine was among the first widely used oxidizers, it became the standard against which other oxidizers were measured. As shown in the following equations, sodium hypochlorite can oxidize the same amount of iodide ion as the chlorine (Cl₂) that it takes to manufacture the sodium hypochlorite.



This may be compared with the reaction of chlorine with potassium iodide:



One molecule of hypochlorite ion has the equivalent oxidizing power of two atoms (one molecule) of chlorine. Therefore, sodium hypochlorite behaves as if all the chlorine consumed in making it is *available* for oxidizing purposes, even though half of that chlorine is in the chloride form.

Available chlorine refers to the amount of chlorine equivalent to hypochlorite in terms of oxidizing power. It is a measure of strength and bleaching power and, in one or another of its related units of measurement, denotes the concentration of the bleach solution.

2. Grams per liter (g/L) available chlorine. The weight of available chlorine in grams contained in 1 L of sodium hypochlorite solution.

3. Trade percent available chlorine. Commonly used to denote the strength of commercial sodium hypochlorite solutions, it is similar to g/L except that the unit of volume is 100 mL instead of 1 L. Its value is therefore $\frac{1}{10}$ of the g/L.

$$\text{trade percent available chlorine} = \frac{\text{g/L available chlorine}}{10} \quad (\text{Eq 1})$$

4. Weight percent available chlorine. Dividing trade percent by the specific gravity of the sodium hypochlorite solution gives weight percent or percent available chlorine by weight.

$$\text{wt \% available chlorine} = \frac{\text{g/L available chlorine}}{10 \times (\text{specific gravity of solution})} \quad (\text{Eq 2})$$

$$\text{wt \% available chlorine} = \frac{\text{trade percent available chlorine}}{(\text{specific gravity of solution})} \quad (\text{Eq 3})$$

II.C. *Sodium Hypochlorite.* To facilitate a variety of calculations and operations in different chemical processes, it is often important to know the concentration of the actual chemical species, NaOCl, in sodium hypochlorite solutions. In addition, *weight percent sodium hypochlorite* must be displayed on pesticide products registered under the US Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA).

Weight percent of sodium hypochlorite is defined as the weight of sodium hypochlorite per 100 parts weight of bleach solution. It can be calculated by converting weight percent of available chlorine into its equivalent as sodium hypochlorite; that is, multiplying by the ratio of their respective molecular weights as follows:

$$\frac{\text{molecular wt NaOCl}}{\text{molecular wt Cl}_2} = \frac{74.44}{70.91} = 1.05 \quad (\text{Eq 4})$$

$$\text{wt \% NaOCl} = (\text{wt \% available Cl}_2) \times \frac{\text{molecular wt NaOCl}}{\text{molecular wt Cl}_2} \quad (\text{Eq 5})$$

or

$$\text{wt \% NaOCl} = \text{wt \% available chlorine} \times 1.05 \quad (\text{Eq 6})$$

$$\begin{aligned} \text{wt \% NaOCl} &= \frac{\text{g/L available chlorine}}{10 \times (\text{specific gravity})} \times 1.05 \quad (\text{Eq 7}) \\ &= \text{wt \% available chlorine} \times 1.05 \end{aligned}$$

or

$$\text{wt \% NaOCl} = \frac{\text{trade \% available chlorine}}{(\text{specific gravity})} \times 1.05 \quad (\text{Eq 8})$$

Generally, sodium hypochlorite solutions are produced at strengths up to 20 percent by weight sodium hypochlorite. As strength increases, stability generally decreases. Frequently, manufacturers provide a range of strengths depending on customer requirements. Bleach solutions with a strength of less than 7.0 weight percent sodium hypochlorite are typically used in household bleach applications.

II.D. *Bromate in Sodium Hypochlorite.* Stage 1 of the USEPA Disinfectants and Disinfection Byproducts Rule requires potable water plants to meet a bromate MCL of 10 ppb in their effluent. Water plants that use ozone in their treatment process are required to test monthly for bromate. Water plants that do not use ozone but use sodium hypochlorite solutions do not need to test for bromate but are required to use sodium hypochlorite solutions that are certified under NSF/ANSI 60.

Sodium hypochlorite solutions certified to meet NSF/ANSI 60 will allow water plants to meet the bromate MCL. Each facility must make certain that the sodium hypochlorite it purchases is certified for its maximum anticipated dosage. Certification to NSF/ANSI 60 may be accomplished at a lower Maximum Use Level (MUL) than the standard MUL of 10 ppm (as chlorine). In some cases, a product could be certified to an MUL as low as 2.0 ppm (as chlorine). If a water plant does not expect to exceed this value, such a product is suitable for that site.

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 information should be provided by the purchaser:

1. Standard used—that is, ANSI/AWWA B300, Hypochlorites, of latest revision.
2. Quantity required.
3. Whether compliance with NSF/ANSI 60, Drinking Water Treatment Chemicals—Health Effects, is required.
4. Details of other federal, state or provincial, and local requirements (Sec. 4).
5. Type and grade of material wanted or required (Secs. 4.1, 4.2, and 4.3).
6. Whether the purchaser will reject product from containers or packaging with missing or damaged seals. The purchaser may reject product from bulk containers or packages with missing or damaged seals unless the purchaser's tests of representative samples, conducted in accordance with Sec. 5.2, demonstrates that the product meets the standard. Failure to meet the standard or the absence of, or irregularities in, seals may be sufficient cause to reject the shipment.
7. Whether alternative security measures have been adopted to replace or augment the security measures set out in Secs. 6.2.5 and 6.2.6.
8. Form of shipment—bulk or package, and the type and size of container (Sec. 6.2).
9. Affidavit of compliance, if required (Sec. 6.3).

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

IV. Major Revisions. Major changes made to the standard in this edition include the following:

1. Changes/additions to *Sample Handling* (Sec. 5.1.3)
2. Revision to the Notice of Nonconformance (Sec. 5.3).
3. Inclusion of new language in the Affidavit of Compliance (Sec. 6.3).

V. Comments. If you have any comments or questions about this standard, please call AWWA Engineering and Technical Services at 303.794.7711, FAX at 303.795.7603, write to the department at 6666 West Quincy Avenue, Denver, CO 80235-3098, or email at standards@awwa.org.

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**American Water Works
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ANSI/AWWA B300-18
(Revision of ANSI/AWWA B300-10)

AWWA Standard

Hypochlorites

SECTION 1: GENERAL

Sec. 1.1 Scope

This standard describes chlorinated lime, calcium hypochlorite, and sodium hypochlorite for use in water, wastewater, and reclaimed water treatment.

Sec. 1.2 Purpose

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

Sec. 1.3 Application

This standard can be referenced in documents for purchasing and receiving hypochlorites and can be used as a guide for testing the physical and chemical properties of hypochlorite samples. The stipulations of this standard apply when this document has been referenced and then only to hypochlorites used in water supply service, wastewater treatment, and reclaimed water treatment applications.

SECTION 2: REFERENCES

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

APHA,* AWWA, and WEF.† *Standard Methods for the Examination of Water and Wastewater* (latest edition).

NSF‡/ANSI§ 60—Drinking Water Treatment Chemicals—Health Effects.

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. *Potable water*: Water that is safe and satisfactory for drinking and cooking.
4. *Purchaser*: The person, company, or organization that purchases any materials or work to be performed.
5. *Reclaimed water*: Wastewater that becomes suitable for beneficial use as a result of treatment.
6. *Supplier*: The party that supplies materials or services. A supplier may or may not be the manufacturer.
7. *Tamper-evident packaging*: Packaging having one or more indicators or barriers to entry which, if breached or missing, can reasonably be expected to provide visible evidence to the purchaser that tampering has occurred. The tamper-evident features of the packaging shall be designed to, and shall remain, intact when handled in a reasonable manner during manufacture, storage, shipment, and delivery to the purchaser. Properly constructed, labeled, and closed sheet-iron drums and plastic containers constitute effective forms of tamper-evident packaging.

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

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

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

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

8. *Wastewater:* A combination of the liquid and water-carried waste from residences, commercial buildings, industrial plants, and institutions, together with any groundwater, surface water, and stormwater that may be present.

SECTION 4: REQUIREMENTS

Materials shall comply with the requirements of the Safe Drinking Water Act and other federal regulations for potable water, wastewater systems, and reclaimed water as applicable. All hypochlorites used in water disinfection are required to be registered with the US Environmental Protection Agency (USEPA) under the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA).*

Sec. 4.1 Physical Requirements

4.1.1 *Chlorinated lime.* Chlorinated lime (bleaching powder, chloride of lime) is a fine, yellowish-white, hygroscopic powder of about 38–53 lb/ft³ (0.61–0.85 g/cc)[†] bulk density, containing from 25 percent to 37 percent available chlorine by weight. It is manufactured by the action of chlorine on selected slaked lime. The material contains some free lime. The exact formula is a matter of controversy. One of the more generally accepted formulas is CaO·2CaOCl₂·3H₂O.

4.1.1.1 Chlorinated lime shall be substantially free of lumps. It shall not contain any dirt or foreign material.

4.1.2 *Calcium hypochlorite.* Calcium hypochlorite [Ca(OCl)₂] is a white or yellowish-white granular powder, granule, or tablet containing from 65 percent to 70 percent available chlorine by weight. The bulk density of the granular powder is about 32–50 lb/ft³ (0.51–0.8 g/cc), and the bulk density of the granules is approximately 68–80 lb/ft³ (1.1–1.3 g/cc). It can be manufactured by adding chlorine to a milk of lime slurry, which can be prepared by mixing hydrated lime with water or by slaking quicklime with water.

4.1.2.1 Calcium hypochlorite granular powder or granules shall be substantially free of lumps. Not more than 10 percent of the powder shall pass a 100-mesh screen. It shall not contain any dirt or other foreign material.

* Government packaging and marking references reflect US requirements. Users of ANSI/AWWA B300 outside the United States should verify applicable local, provincial, and national regulatory requirements. Because of 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.

[†] Metric conversions given in this standard are direct conversions of US customary units and are not those specified in International Organization for Standardization (ISO) standards.

4.1.2.2 Calcium hypochlorite tablets shall be uniform in shape. The weight of the tablets shall not vary by more than 5 percent from the average value stated on the label. Not more than 2 percent of the tablets shall be broken.

4.1.3 *Sodium hypochlorite.* Sodium hypochlorite solution (NaOCl) is a clear, light-yellow liquid containing up to 200 g/L available chlorine (20 trade percent). Passing chlorine into a caustic soda solution or into a caustic soda/soda ash mix is one method of manufacturing.

Another method of manufacturing is the use of an electrochemical generator. This method utilizes a sodium chloride feed to an electrochemical cell where the salt is converted to sodium hypochlorite using electricity.

4.1.3.1 Sodium hypochlorite solution shall be a clear liquid containing not more than 0.15 percent insoluble matter by weight.

Sec. 4.2 Chemical Requirements

4.2.1 *Chlorinated lime.* Chlorinated lime shall contain not less than 25 percent available chlorine by weight.

4.2.2 *Calcium hypochlorite.* Calcium hypochlorite shall contain not less than 65 percent available chlorine by weight when shipped.

4.2.3 *Sodium hypochlorite.* Sodium hypochlorite shall contain not less than 100 g/L available chlorine (10 trade percent; see Sec. II.B.3 in the foreword).

4.2.3.1 The total free alkali (expressed as NaOH) in sodium hypochlorite shall not exceed 1.5 percent by weight.

Sec. 4.3 Impurities*

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

4.3.2 *Product certifications.* Hypochlorites are direct additives used in the treatment of potable water and wastewater. 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 performed by a certification organization accredited by ANSI.

* See Sec. I.C of the foreword.

SECTION 5: VERIFICATION

Sec. 5.1 Sampling

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

5.1.2 *Sampling procedures.*

5.1.2.1 Not less than 5 percent of the packages or containers shall be sampled. No sample shall be taken from a broken package or container.

5.1.2.2 The powdered and granule forms of hypochlorite shall be sampled by means of a sampling tube that is at least $\frac{3}{4}$ in. (20 mm) in diameter. Tablets shall be selected at random from each container sampled.

5.1.2.3 The total gross sample of the solid forms of hypochlorite, weighing at least 16 lb (7.3 kg), shall be mixed thoroughly and divided to provide three 1 lb (0.45 kg) samples. The samples shall be sealed in airtight, moisture-proof glass containers. Each sample shall be labeled for identification, and the label shall be dated and signed by the sampler. This should be done rapidly and carefully to avoid loss of chlorine.

5.1.2.4 Sodium hypochlorite shall be mixed thoroughly by rolling containers or by other suitable means before sampling. The gross sample, collected in a clean earthenware or glass container, shall contain at least 10 qt (9.5 L). The gross sample shall be mixed thoroughly and three 1 pint (0.47 L) samples provided. These shall be sealed in airtight, moisture-proof glass or plastic containers. Each sample container shall be labeled to identify it, and the label shall be dated and signed by the sampler.

5.1.3 *Sample handling.*

5.1.3.1 The samples of chlorinated lime and calcium hypochlorite shall be divided carefully and rapidly to create one sample weighing approximately 100 g. After thorough mixing, the 100 g sample shall be stored in an airtight glass container and kept in a dark, cool, and dry place. The container shall be kept closed to avoid loss of available chlorine, except when portions of it are being weighed.

5.1.3.2 The laboratory examination of the sample shall be completed within five days after receipt of the shipment. Samples shall be stored for at least 30 days from the date of receipt of a shipment before disposal.

5.1.3.3 Sodium hypochlorite solution shall be sampled from the shipping container at receipt of the shipment for analysis. If stored, the moisture-proof glass or plastic sample bottle shall be kept in a dark, cool, and dry place and kept perfectly sealed after the sample is withdrawn.

5.1.3.4 The time the sample can be stored before the laboratory evaluation will depend on the purpose of the sample's analysis.

5.1.3.4.1 If the sample is to be evaluated for chlorates or perchlorates, the sample must be quenched immediately to preserve the chlorate concentration at the time the sample was taken. Quenching guidelines can be obtained from organizations involved in certifying products in accordance with NSF/ANSI Standard 60 or the product supplier.

5.1.3.4.2 If the sample is to be evaluated for assay (sodium hypochlorite or available chlorine concentration), the analysis must be completed within 24 hours of the receipt of shipment and the sample must be stored correctly prior to analysis.

5.1.3.4.3 Laboratory evaluation for other compounds must be conducted within five days after receipt of the shipment.

5.1.3.4.4 Samples should be stored for at least 30 days from the date of the receipt of a shipment before disposal; however, these samples will not be representative of the product received for assay (sodium hypochlorite or available chlorine), chlorate, and perchlorate.

Sec. 5.2 Test Procedures

5.2.1 *Testing for available chlorine in chlorinated lime and calcium hypochlorite.*

5.2.1.1 Reagents.

1. Crystalline potassium iodide (iodate-free).
2. 0.1 N sodium thiosulfate.
3. Glacial acetic acid.
4. Starch indicator solution.

5.2.1.2 Procedure.

1. Place 5 g of chlorinated lime or calcium hypochlorite into a nonmetallic mortar, moisten with distilled water, and grind into a fine paste. Transfer to a 1 L flask. Rinse the mortar with distilled water and add to 1 L flask. Make up to 1 L with distilled water and mix.

2. Measure 25 mL of the solution from the 1 L flask into a 250 mL Erlenmeyer flask; add approximately 1 g of crystalline potassium iodide; and make acid with approximately 4 mL of glacial acetic acid. Titrate* with 0.1 N sodium thiosulfate until the yellow color of the iodine is nearly destroyed. Add approximately 1 mL of

* Moist samples of hypochlorite partially decompose in storage and result in the formation of chlorite. In acetic acid medium, ClO_2 reacts with I^- very slowly to release iodine. Therefore, if chlorite is present in the sample, a sharp end point in iodometric titration may not be attained.

soluble starch solution and continue to titrate until the blue (blackish-blue) color disappears entirely.

5.2.1.3 Calculation.

$$\begin{aligned} \text{sodium thiosulfate, in milliliters} \times \text{normality} \times \frac{40 \times 0.03545 \times 100}{\text{grams of sample}} \\ = \text{percent available chlorine by weight} \end{aligned} \quad (\text{Eq 1})$$

(That is, milliliters of sodium thiosulfate \times normality \times 28.37 = percentage available chlorine by weight when a 5 g sample is analyzed.)

5.2.2 *Testing for available chlorine in sodium hypochlorite.*

5.2.2.1 Reagents.

1. Crystalline potassium iodide (iodate-free).
2. 0.1 N sodium thiosulfate.*
3. Glacial acetic acid.
4. Starch indicator solution.

5.2.2.2 Procedure.

1. Measure accurately 20 mL of the sample, transfer it to a 1 L volumetric flask, and make up to volume with distilled water.

2. Measure 25 mL of the solution from the 1 L flask into a 250 mL Erlenmeyer flask; add approximately 1 g of crystalline potassium iodide; and make acid with approximately 4 mL of glacial acetic acid. Titrate with 0.1 N sodium thiosulfate until the yellow color of the iodine is nearly destroyed. Add about 1 mL of soluble starch solution and continue to titrate until the blue (blackish-blue) color disappears entirely.

5.2.2.3 Calculations. When volumes of sample and aliquot, as stated in Sec. 5.2.2.2, are used:

$$\begin{aligned} \text{sodium thiosulfate, in milliliters} \times \text{normality} \times \frac{40 \times 50 \times 0.03545}{10} \\ = \text{volume or trade percent} \end{aligned} \quad (\text{Eq 2})$$

or

sodium thiosulfate, in milliliters \times normality \times 7.092 = volume or trade percent.

* Nominal; see *Standard Methods for the Examination of Water and Wastewater* (APHA, AWWA, and WEF; latest edition), 4500-Cl B, for comparable standardization.

5.2.3 *Testing for free alkali in sodium hypochlorite.*

5.2.3.1 Reagents.

1. 0.1 N hydrochloric acid.
2. Hydrogen peroxide solution, 3 percent.
3. Methyl orange indicator.

5.2.3.2 Procedure.

1. Weigh accurately 10 g of sodium hypochlorite into a tall-form, 200 mL, heat-resistant glass beaker and add hydrogen peroxide until the action ceases. Record the exact amount of hydrogen peroxide addition. Boil for 2 min and then cool.

2. Titrate with 0.1 N hydrochloric acid, using methyl orange as an indicator.

3. Measure the same amount of hydrogen peroxide solution into a beaker as was added to the sample in Sec. 5.2.3.2(1). Next, titrate with 0.1 N hydrochloric acid using methyl orange indicator. Subtract this amount from the titration method in Sec. 5.2.3.2(2).

5.2.3.3 Calculation.

$$\frac{\text{net mL HCl} \times \text{normality} \times 0.04 \times 100}{10 \text{ grams (weight of sample)}} = \text{net mL HCl} \times \text{normality} \times 0.4$$

$$= \text{percentage free alkali, as NaOH} \quad (\text{Eq 3})$$

5.2.4 *Testing for insoluble matter in sodium hypochlorite.*

5.2.4.1 Procedure.

Pour approximately 100 mL of the sodium hypochlorite solution into a tared 400 mL beaker placed on a laboratory platform balance and weigh to the nearest 0.1 g. Add 100 mL of distilled water and mix thoroughly. Filter through a tared Gooch crucible. Wash the beaker and crucible with distilled water. Dry the crucible to a constant weight at 212–221°F (100–105°C).

5.2.4.2 Calculation.

$$\frac{\text{grams of residue}}{\text{grams of sample}} \times 100 = \% \text{ insoluble matter} \quad (\text{Eq 4})$$

Sec. 5.3 Notice of Nonconformance

If the hypochlorite delivered to the purchaser does not meet the chemical, physical, safety, or security requirements of this standard, the purchaser shall provide a written notice of nonconformance to the supplier within 10 days after receipt of the shipment at the point of destination, except for sodium hypochlorite assay, which should be reported within 24 hours. The results of the purchaser's test shall prevail, unless the supplier notifies the purchaser within five working days after receipt of the notice of complaint 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. If the results obtained by the supplier on retesting do not agree with the test results obtained by the purchaser, the other sealed sample shall be forwarded, unopened, to a referee laboratory agreed on by both parties for analysis. The decomposition characteristics of sodium hypochlorite solutions must be considered when shipping and storing samples if concerns of nonconformance include sodium hypochlorite concentration, perchlorate, or chlorate. The results of the referee's analysis shall be accepted as final.

Material not complying with the requirements of this standard and the purchaser's documents may be rejected. Replacement and retesting shall be accomplished in accordance with the purchaser's documents.

Because the exact concentrations of the active ingredient in specific shipments of some materials can vary within an acceptable range (thereby conforming to the standard), the purchase documents between purchaser and supplier should address treatment of concentration variation.

SECTION 6: DELIVERY

Sec. 6.1 Marking*

6.1.1 *Required.* Hypochlorites are oxidizing materials generally used by water utilities as a disinfectant. Hypochlorites used for disinfection shall be registered, labeled, and marked as prescribed by FIFRA. Labels should serve as a warning that the material is a strong oxidizing agent and that contact with heat, acids, or organic or combustible materials could cause fire. Shipments shall also

* Governmental packaging and marking references reflect US requirements. Users of this standard outside the United States should verify applicable local and national requirements. Because of 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.

bear warning labels as specified by US Department of Transportation regulations. Each package shall bear a legible statement identifying the active ingredient and content, the net weight of the contents, the name of the manufacturer or distributor, the lot number, and the brand name, if any, and other markings as required by applicable laws and regulations. Each package must bear a USEPA registration number as well as the USEPA establishment number indicating where the product was manufactured or last repackaged. For calcium hypochlorite tablets, each label shall also show either the weight of each tablet or the number of tablets per unit weight.

6.1.2 *Optional.* Each package may also bear the statement “Guaranteed by (name of manufacturer) to meet ANSI/AWWA B300, Standard for Hypochlorites, for (type of hypochlorite contained in the package)” provided that the requirements of this standard are met.

Sec. 6.2 Packaging and Shipping

Packaging and shipping of all hypochlorites shall conform to the current federal, state or provincial, and local regulations.

6.2.1 *Chlorinated lime.* Chlorinated lime may be shipped in 100 lb or 300 lb (45 kg or 136 kg) sheet-iron drums. The containers should be tight enough so that the material will not sift through cracks or openings but should not be airtight. Sealing compound shall not be used at the seams of metal drums.

NOTE: High pressure may develop in an airtight drum should rapid decomposition of the chlorinated lime occur.

6.2.2 *Calcium hypochlorite.* Calcium hypochlorite may be shipped in approved corrosion-resistant containers or in metal drums. Sealing compound shall not be used at the seams of the metal drums.

6.2.3 *Sodium hypochlorite.* Sodium hypochlorite solutions may be shipped in glass carboys; in approved plastic containers; or in suitably lined, thoroughly clean tank trucks of approximately 5,000 gal (18,926 L) capacity.

6.2.4 *Net weight.* The net weight or net volume of packaged or containerized material shall not deviate from the recorded weight or volume by more than an absolute value of 2.5 percent. If exception is taken to the weight or volume of the material received, acceptance or rejection shall be based on the weight or volume of not less than 10 percent of the packages or containers received, selected at random from the shipment.

6.2.5 *Security requirements for nonbulk shipments.* Packaged product shall be stored, shipped, and delivered in tamper-evident packaging as defined in Sec. 3,

item 7, or an alternative method or methods may be agreed on by the manufacturer and purchaser that provide a reasonable assurance of protection against tampering.

6.2.6 *Security requirements for bulk shipments.* Bulk quantities of product shall be secured by employing one of the following security measures (or a combination of measures):

6.2.6.1 *Seals.* Bulk quantities of product may be sealed with a uniquely numbered tamper-evident seal(s). The seal numbers shall be recorded and disclosed on shipping documents such as the Bill of Lading. Seals shall be inspected upon receipt of product by the purchaser, and evidence of tampering or removal should be reported to the carrier and supplier.

6.2.6.2 *Chain of custody.* A continuous chain of custody shall be maintained between the manufacturer and the purchaser during storage and shipment if so specified by the purchaser.

6.2.6.3 *Alternative method.* An alternative method or methods may be agreed on by the manufacturer and purchaser that provide reasonable assurance of protection against tampering.

Sec. 6.3 Affidavit of Compliance

The purchaser may require either (1) an affidavit from the manufacturer that the material provided complies with all applicable requirements of this standard or (2) at the time of delivery a certificate of analysis of the material detailing the desired items.

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APPENDIX

Recommendations for the Handling and Storage of Hypochlorite Solutions*

This appendix is for information only and is not a part of ANSI/AWWA B300.

Several key factors have been identified that affect the formation of perchlorate, bromate, and other contaminants in hypochlorite solutions. The major factors impacting perchlorate formation parallel those that also affect the decomposition of hypochlorite: temperature, ionic strength, concentration, and pH. By using the information gathered in the study referenced subsequently and by applying the “Predictive Model” to hypothetical liquid hypochlorite storage scenarios, several quantitative and qualitative recommendations can be made:

1. *Dilute stored hypochlorite solutions upon delivery.* The decomposition of hypochlorite and subsequent formation of chlorate and perchlorate is dependent upon hypochlorite concentration and ionic strength. Higher ionic strength and hypochlorite concentration will drive the reaction toward a greater production of chlorate and perchlorate while also increasing the rate of decomposition of hypochlorite. By diluting a 2M hypochlorite solution by a factor of 2, the rate of perchlorate formation decreases by a factor of 7 because of the combination of concentration and ionic strength effects. A fourfold dilution of a hypochlorite solution will decrease the rate of formation by a factor of 36. A tenfold dilution of a hypochlorite solution will decrease the rate of perchlorate formation by a factor of 270.

2. *Store the hypochlorite solutions at lower temperatures.* Higher temperatures speed up the chemical decomposition of hypochlorite and the subsequent formation of chlorate and perchlorate. Every 5°C (9°F) reduction in storage temperature will reduce the rate of perchlorate formation by a factor of approximately 2. To minimize temperature increases, the product should be stored out of direct sunlight.

3. *Control the pH of stored hypochlorite solutions at 11–13 even after dilution.* Storage of concentrated hypochlorite solutions at pH values lower than 11 is not recommended because of accelerated decomposition of hypochlorite ion/hypochlorous acid and the consequent formation of chlorate, even though lower pH can reduce the amount of perchlorate formed. When the pH is higher than 13, perchlorate formation is enhanced because of the ionic strength effect. As such, utilities should continue to insist that

* AWWA and Water Research Foundation. 2009. “Hypochlorite—An Assessment of Factors That Influence the Formation of Perchlorate and Other Contaminants.” Denver: AWWA.

manufacturer specifications include pH control in the range of 11–13. Given the typical pH range of on-site generation (OSG) hypochlorite (9–10), such solutions should be used as soon as possible after manufacture and should not be stored for more than 1–2 days.

4. *Control the removal of transition metal ions by purchasing filtered hypochlorite solutions and by using low-metal ion concentration feedwater for the OSG systems and dilution water.* The presence of transition metal ions results in an increased degradation rate of hypochlorite. While this degradation is concomitant with reduced perchlorate formation, the free available chlorine concentration is also reduced, forcing a utility to use a higher volume of a hypochlorite solution, which results in higher mass loading of contaminants such as perchlorate, chlorate, and bromate.

5. *Use fresh hypochlorite solutions when possible.* Hypochlorites will naturally decompose to produce oxygen, chlorate, and perchlorate. Less storage time will minimize the formation of these contaminants in the hypochlorite solution. Rotate stock and minimize the quantity of aged product in storage tanks prior to the delivery of new product. A fresh hypochlorite solution will also contain a higher concentration of hypochlorite, thereby reducing the amount of solution required to obtain the target chlorine residual. Again, higher hypochlorite concentration in a fresh hypochlorite solution will correspond to lower concentrations of contaminants dosed.

6. *For utilities using OSG hypochlorite, use a low-bromide salt to minimize the amount of bromide present in the brine.* Bromate formation will occur rapidly in hypochlorite solutions in the presence of bromide. By controlling the amount of bromide in the salt and source water used for on-site generation, bromate formation can be minimized.

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