



*NSF International Standard /
American National Standard*

NSF/ANSI 61 - 2008

Drinking Water System Components -
Health Effects



Prepared by
The NSF Joint Committee on Drinking Water Additives

Recommended for Adoption by
The NSF Council of Public Health Consultants

Adopted by
The NSF Board of Directors
June 1988

Revised October 1988	Revised September 2000
Revised May 1990	Revised November 2000
Revised May 1991	Revised February 2001
Revised May 1992	Addendum September 2001
Revised September 1994	Revised July 2002
Revised January 1995	Addendum August 2002
Revised July 1996	Editorial Revision February 2002
Revised September 1996	Revised September 2003
Revised November 1996	Editorial Revision October 2003
Revised January 1997	Revised November 2004
Revised January 1997	Addendum March 2005
Revised March 1997	Revised October 2005
Revised July 1997	Revised March 2007
Revised November 1998	Revised July 2007
Revised January 1999	Addendum October 2007
Revised November 1999	Revised December 2008

Published by

NSF International
P.O. Box 130140, Ann Arbor, Michigan 48113-0140, USA

For ordering copies or for making inquiries with regard to this Standard, please reference the designation "NSF/ANSI 61 – 2008."

Copyright 2008 NSF International
Previous editions © 2007, 2005, 2004, 2003, 2002, 2001, 2000, 1999, 1998, 1997, 1996, 1995, 1994, 1992, 1991, 1990, 1988

Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from NSF International.

Printed in the United States of America.

Disclaimers¹

NSF, in performing its functions in accordance with its objectives, does not assume or undertake to discharge any responsibility of the manufacturer or any other party. The opinions and findings of NSF represent its professional judgment. NSF shall not be responsible to anyone for the use of or reliance upon this Standard by anyone. NSF shall not incur any obligation or liability for damages, including consequential damages, arising out of or in connection with the use, interpretation of, or reliance upon this Standard.

NSF Standards provide basic criteria to promote sanitation and protection of the public health. Provisions for mechanical and electrical safety have not been included in this Standard because governmental agencies or other national standards-setting organizations provide safety requirements.

Participation in NSF Standards development activities by regulatory agency representatives (federal, local, state) shall not constitute their agency's endorsement of NSF or any of its Standards.

Preference is given to the use of performance criteria measurable by examination or testing in NSF Standards development when such performance criteria may reasonably be used in lieu of design, materials, or construction criteria.

The illustrations, if provided, are intended to assist in understanding their adjacent standard requirements. However, the illustrations may not include *all* requirements for a specific product or unit, nor do they show the only method of fabricating such arrangements. Such partial drawings shall not be used to justify improper or incomplete design and construction.

Unless otherwise referenced, the annexes are not considered an integral part of NSF Standards. The annexes are provided as general guidelines to the manufacturer, regulatory agency, user, or certifying organization.

¹ The information contained in this Disclaimer is not part of this American National Standard (ANS) and has not been processed in accordance with ANSI's requirements for an ANS. Therefore, this Disclaimer may contain material that has not been subjected to public review or a consensus process. In addition, it does not contain requirements necessary for conformance to the Standard.

This page is intentionally left blank.

Contents

1	Purpose, scope, and normative references.....	1
1.1	Purpose.....	1
1.2	Scope.....	1
1.3	Normative references.....	1
1.4	Limitations.....	3
1.5	Alternate products or materials.....	3
1.6	Significant figures.....	4
2	Definitions.....	4
3	General requirements.....	6
3.1	General.....	6
3.2	Information and formulation requirements.....	6
3.3	Identification of analytes.....	8
3.4	Products manufactured from annex C acceptable materials.....	9
	Table 3.1 – Material-specific analyses.....	9
4	Pipes and related products.....	12
4.1	Scope.....	12
4.2	Definitions.....	12
4.3	General requirements.....	12
4.4	Sample requirements.....	13
4.5	Extraction procedures.....	13
4.6	Analysis.....	18
4.7	Normalization of contaminant concentrations.....	19
4.8	Evaluation of contaminant concentrations.....	20
	Table 4.1 – Example single time point conditioning schedule.....	21
	Table 4.2 – Single time point exposure schedule.....	21
	Table 4.3 – Example multiple time point conditioning/exposure schedule.....	22
	Table 4.4 – Pipes – normalization factors and assumptions.....	23
	Table 4.5 – Fittings (installed at regular intervals) – normalization factors and assumptions.....	24
	Table 4.6 – Example normalization calculations.....	25
5	Barrier materials.....	26
5.1	Scope.....	26
5.2	Definitions.....	26
5.3	General requirements.....	27
5.4	Sample requirements.....	27
5.5	Extraction procedures.....	28
5.6	Analysis of extraction water.....	31
5.7	Normalization.....	32
5.8	Evaluation of contaminant concentrations.....	33
	Table 5.1 – Paint and coating system sample preparation.....	34
	Table 5.2 – Single time point exposure sequence.....	34
	Table 5.3 – Multiple time point exposure sequence.....	34
	Table 5.4 – Surface area-to-volume ratios for tanks or storage vessels.....	35
6	Joining and sealing materials.....	36
6.1	Coverage.....	36
6.2	Definitions.....	36
6.3	Material and extraction testing requirements.....	36
6.4	Items of special significance.....	36

7	Process media	36
	7.1 Scope	36
	7.2 Definitions	37
	7.3 General requirements	38
	7.4 Sample requirements	39
	7.5 Extraction procedures	40
	7.6 Analysis	42
	7.7 Normalization	42
	Table 7.1 – Product-specific minimum test batteries for process media products	45
	Table 7.2 – Process media exposure weight-per-volume ratios	46
	Table 7.3 – Maximum conditioning expansion rates for filtration and adsorption media	47
	Table 7.4 – Exposure schedule for process media of ≥ 0.25 mm in diameter	47
8	Mechanical devices	47
	8.1 Coverage	47
	8.2 Definitions	47
	8.3 Device, component, or material requirements	48
	8.4 In-line devices, components, and materials	48
	Table 8.1 – Examples of mechanical devices	50
9	Mechanical plumbing devices	51
	9.1 Coverage	51
	9.2 Definitions	52
	9.3 Device, component, or material requirements	52
	9.4 Exposure and normalization	53
	9.5 Evaluation of normalized contaminant concentrations	54
10	Instructions and information	54
Annex A	A1
	A.1 General requirements	A1
	A.2 Definitions	A1
	A.3 Data requirements for published risk assessments	A4
	A.4 Data requirements for new or updated risk assessments	A5
	A.5 Data requirements for evaluating short-term exposures	A6
	A.6 Risk estimation for published assessments	A7
	A.7 Risk estimation using new and updated risk assessments	A8
	A.8 Risk estimation for short-term exposure (STEL calculation)	A14
	A.9 Development of chemical class-based evaluation criteria	A15
	A.10 Key elements of a risk assessment for drinking water additive chemicals	A16
	Table A1 – Qualitative risk assessment data requirements	A25
	Table A2 – Quantitative risk assessment data requirements	A26
	Table A3 – TACs for qualitative risk assessment	A27
	Table A4 – Uncertainty factors	A27
Annex B	B1
	B.1 Background	B1
	B.2 General evaluation requirements	B1
	B.3 Joining and sealing materials	B4
	B.4 Mechanical devices	B6
	B.5 Mechanical plumbing devices	B10
	B.6 Collection and preservation of extraction media after exposure	B13
	B.7 Analysis methods	B13
	B.8 Normalization	B19
	B.9 Extraction water preparation	B25
	Figure B1 – Exposure sequence for mechanical plumbing device	B28

Table B1 – NSF/ANSI 61 products.....	B29
Table B2 – Exposure summary	B29
Table B3 – Extraction water selection	B30
Table B4 – Test samples joining and sealing materials	B30
Table B5 – Exposure sequence for cold applications	B30
Table B6 – Exposure sequence for hot applications	B30
Table B7 – Product exposure ¹	B31
Table B8 – In-line device exposure sequence	B31
Table B9 – Other mechanical device exposure sequence	B31
Table B10 – Extractant water collection and preservation	B32
Table B11 – Normalization factors, assumptions, and examples pertaining to – <i>water main joining and sealing materials</i>	B33
Table B12 – Data available for determination of lead test statistic	B39
Table B13 – Values of k_1 for determining test statistic Q	B39
Table B14 – Values of k_2 for determining retest statistic R	B39
Table B15 – 1-L volume of extraction water	B40
Annex C	C1
C.1 Purpose	C1
C.2 Evaluation of acceptable materials	C1
C.3 Extraction testing.....	C1
C.4 Documentation	C1
Table C1 – Acceptable materials.....	C2
Annex D	D1
D.1 General	D1
D.2 USEPA and Health Canada drinking water criteria	D1
D.3 NSF International peer-reviewed drinking water criteria.....	D1
D.4 Drinking water criteria based on USEPA guidance concentrations	D2
D.5 Threshold of evaluation (TOE) chemical list	D2
Table D1 – U. S. Environmental Protection Agency and Health Canada	D3
Table D2 – NSF International peer-reviewed drinking water criteria.....	D8
Table D3 – Drinking water criteria based on USEPA guidance concentrations.....	D12
Table D4 – Threshold of evaluation chemicals ¹	D24
Annex E	E1
E.1 General	E1
E.2 NSF International drinking water criteria (not externally peer-reviewed).....	E1
E.3 Informational threshold of evaluation chemicals	E2
Table E1 – NSF International drinking water criteria (not externally peer reviewed)	E3
Table E2 – Threshold of evaluation chemicals having datasets from which specific TAC/SPAC values, or CBEL values, could be set using Annex A ¹	E5
Annex F	F1
F.1 Background	F1
F.2 Incorporation of revisions into standard	F2
F.3 Revisions.....	F2
F.4 Additional information on lead	F5
F.5 References	F6
Annex G	G1
G.1 General	G1
G.2 General Evaluation Protocol	G1
G.3 Weighted average lead content calculation.....	G1
G.4 Lead content of water contact surfaces	G2
G.5 Example weighted average lead content calculation	G2

Table G1. Example of weighted average lead content calculations..... G3

Foreword²

In response to a competitive request for proposals from the U. S. Environmental Protection Agency (USEPA), a Consortium led by NSF International (NSF) agreed to develop voluntary third-party consensus standards and a certification program for all direct and indirect drinking water additives. Other members of the Consortium include the American Water Works Association Research Foundation, the Association of State Drinking Water Administrators, the Conference of State Health and Environmental Managers, and the American Water Works Association. (COSHEM has since become inactive as an organization.) Each organization was represented on a steering committee with oversight responsibility for the administration of the cooperative agreement. The Steering Committee provides guidance on overall administration and management of the cooperative agreement. Currently, the member organizations remain active in an oversight role.

Two standards for additives products were developed. NSF/ANSI 60: – *Drinking water treatment chemicals — Health effects* covers many of the water treatment chemicals, also known as direct additives. This Standard, NSF/ANSI 61: *Drinking water system components — Health effects*, covers all indirect additives products and materials. Testing to determine the potential of a product to impart taste and/or odor to drinking water is not included in this Standard.

NSF/ANSI 61 was developed to establish minimum requirements for the control of potential adverse human health effects from products that contact drinking water. It does not attempt to include product performance requirements that are currently addressed in other voluntary consensus standards established by such organizations as the American Water Works Association, the American Society for Testing and Materials, and the American National Standards Institute. Because this Standard complements the performance standards of these organizations, it is recommended that products also meet the appropriate performance requirements specified in the standards of such organizations.

NSF/ANSI 61, and subsequent product certification against it, has replaced the USEPA Additives Advisory Program for drinking water system components. USEPA terminated its advisory role in April 1990. For more information with regard to USEPA's actions, refer to the July 7, 1988 *Federal Register* (53FR25586).

This Standard and the accompanying text are intended for voluntary use by certifying organizations, utilities, regulatory agencies, and/or manufacturers as a basis of providing assurances that adequate health protection exists for covered products. Product certification issues, including frequency of testing and requirements for follow-up testing, evaluation, enforcement, and other policy issues, are not addressed by this Standard.

This version includes the following revisions:

- Issue 77 Clarified minimum requirements for information and formulation
- Issue 78 Established criteria within NSF / ANSI 61 for reactivated and regenerated media
- Issue 79 Established a procedure for when a lead content requirement needs to be met in addition to current chemical extraction requirements of the standard
- Issue 80 Revised the tolerance for percent relative humidity during mortar cube preparation, and provided definitions of different manifold types and clarification on testing of different manifold types

² The information contained in this Foreword is not part of this American National Standard (ANS) and has not been processed in accordance with ANSI's requirements for an ANS. Therefore, this Foreword may contain material that has not been subjected to public review or a consensus process. In addition, it does not contain requirements necessary for conformance to the Standard.

- Issue 81 Clarification of the minimum requirements for information and formulation (section 3) by specifying for which products a formulation review is not necessary and setting a de minimus level below which products do not require the same review
- 2007a addendum 1.0 Updated Section 5, adding “immediate return to service paint/coating systems” to the definition section, and adding language providing transparency regarding product testing and certification of coatings. (Joint Committee Issue 75). Updated Sections 4 and 8 to standardize the testing of metallic products and components by addition of specific instructions for assembly of samples so that the laboratory surface area-to-volume ratio is equal to or greater than the surface area-to-volume ratio at which the product is in-tended to be used in the field. (Joint Committee Issue 76)

This Standard was developed by the NSF Joint Committee on Drinking Water Additives using the consensus process described by the American National Standards Institute.

Suggestions for improvement of this Standard are welcome. Comments should be sent to Chair, Joint Committee on Drinking Water Additives, c/o NSF International, Standards Department, P.O. Box 130140, Ann Arbor, Michigan 48113-0140, USA.

Consortium organizations³

NSF International

Popularly referred to as NSF, NSF International is a noncommercial agency. It is incorporated under the laws of Michigan as a not-for-profit organization devoted to research, education, and service. It seeks to solve problems involving man and his environment. It wishes to promote health and enrich the quality of life through conserving and improving that environment. Its fundamental principle of operation is to serve as a neutral medium in which business and industry, official regulatory agencies, and the public come together to deal with problems involving products, equipment, procedures, and services related to health and the environment. It is conceived and administered as a public service organization.

NSF is perhaps best known for its role in developing standards and criteria for equipment, products, and services that bear upon health. NSF was the lead organization in the Consortium responsible for developing this Standard. NSF conducts research; tests and evaluates equipment, products, and services for compliance with standards and criteria; and grants and controls the use of NSF registered Marks.

NSF offers product certification (Listing Services) for all products covered by its standards. Each program has established policies governing the associated product evaluation, Listing Services, follow-up, and enforcement activities. The NSF Listing Mark is widely recognized as a sign that the product or service to which it relates complies with the applicable NSF standard(s).

AWWA Research Foundation

The mission of the American Water Works Association Research Foundation (AWWARF) is to sponsor practical, applied research on behalf of the drinking water industry of North America. The scope of the research program embraces all aspects of water supply operation, from development and maintenance of water resources to treatment technologies and water quality issues, from storage and distribution system operations to health effects studies and utility planning and management activities. AWWARF serves as the centralized industry institution for planning, managing, and funding cooperative research and development in drinking water, including the subsequent transfer of technology and results for practical application by the water utility community.

AWWARF's purpose in this cooperative program is to provide a communication link with the water utilities throughout North America and serve as the focal point for identification of research needs of the water supply industry with respect to the additives program.

The Association of State Drinking Water Administrators

The Association of State Drinking Water Administrators (ASDWA) is a nonprofit organization whose eligible membership is comprised of drinking water program administrators in each of the 50 states and seven U. S. territories. Through the organization, representatives speak with a collective voice to Congressional committees, the United States Environmental Protection Agency (EPA), professional and trade associations, water utilities, and the general public on issues related to state drinking water programs. With its mission of protecting the public health through assurance of high-quality drinking water, and promoting responsible, reasonable, and feasible drinking water programs at the state and federal levels, the Association is a valued contributor to the consortium, and to the program. It provides the link between the additives program and the state drinking water programs.

³ The information contained in this section is not part of this American National Standard (ANS) and has not been processed in accordance with ANSI's requirements for an ANS. Therefore, this section may contain material that has not been subjected to public review or a consensus process. In addition, it does not contain requirements necessary for conformance to the Standard.

The Conference of State Health and Environmental Managers

The Conference of State Health and Environmental Managers (COSHEM), known formerly as the Conference of State Sanitary Engineers (CSSE), is currently inactive as an organization. It brought to the consortium expertise and involvement of state health and environmental program managers. The Conference was the focal point for health concerns of all state environmental programs, including drinking water, wastewater, air, solid and hazardous wastes, radiology, occupational health, and food. A standing committee on water supply focused on drinking water issues and kept the membership informed. The Conference played an important role early in the program through two-way communication with state health and environmental program decisionmakers.

American Water Works Association

The purpose of the American Water Works Association (AWWA) is to promote public health, safety, and welfare by improving the quality and increasing the quantity of water delivered to the public, and to developing and furthering an understanding of the problems relating thereto by:

- advancing the knowledge of the design, construction, operation, water treatment, and management of water utilities;
- developing standards for procedures, equipment, and materials used by public water supply systems;
- advancing the knowledge of problems involved in the development of resources, production, and distribution of safe and adequate water supplies;
- educating the public on the problems of water supply and promoting a spirit of cooperation between consumers and suppliers in solving these problems; and
- conducting research to determine the causes of problems with providing a safe and adequate water supply, and proposing solutions thereto in an effort to improve the quality and quantity of the water supply provided to the public.

AWWA brings to the Consortium its established position as the largest public drinking water association in North America, with a broad membership that includes utilities, consultants, manufacturers/distributors/agents, contractors, and other organizations with a direct interest in drinking water.

NSF/ANSI Standard for Drinking Water Additives —

Drinking water system components – Health effects

1 Purpose, scope, and normative references

1.1 Purpose

This Standard establishes minimum health effects requirements for the chemical contaminants and impurities that are indirectly imparted to drinking water from products, components, and materials used in drinking water systems. This Standard does not establish performance, taste and odor, or microbial growth support requirements for drinking water system products, components, or materials.

1.2 Scope

1.2.1 This Standard is intended to cover specific materials or products that come into contact with: drinking water, drinking water treatment chemicals, or both. The focus of the Standard is evaluation of contaminants or impurities imparted indirectly to drinking water. The products and materials covered include, but are not limited to, process media (e.g., carbon, sand), protective materials (e.g., coatings, linings, liners), joining and sealing materials (e.g., solvent cements, welding materials, gaskets), pipes and related products (e.g., pipes, tanks, fittings), mechanical devices used in treatment/transmission/distribution systems (e.g., valves, chlorinators, separation membranes, point-of-entry drinking water treatment systems), and mechanical plumbing devices (e.g., faucets, endpoint control valves).

1.2.2 Point-of-use drinking water treatment devices are not covered by the scope of this Standard.

1.2.3 Fire hydrants are not covered by the scope of this Standard.

1.3 Normative references

The following documents contain requirements that, by reference in this text, constitute requirements of this Standard.

APHA, *Standard Methods for the Examination of Water and Wastewater*, twentieth edition⁴

ASTM A240/A240M-05. *Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications*⁵

ASTM A269-04. *Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service*⁵

⁴ American Public Health Association (APHA), 800 I Street, NW, Washington, DC 20001

⁵ ASTM International, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2859