Summary of Substantive Changes
between the 2019, 2020 and the 2021 editions of
NSF/ANSI 53 "Drinking Water Treatment Units -Health Effects"

Presented to the IAPMO Standards Review Committee on May 16, 2022

General: The changes to this standard may have an impact on currently listed products. The substantive changes are:

- Added an exception for non-pressurized systems for materials exposure requirements, added provisions for systems that include heating or cooling options, and systems with only encapsulated filter element(s) (see Section 4.3)
- Added requirements for systems designed to operate at atmospheric pressure (see Section 5.4.4)
- Changed the water fountain lower edge spacing requirements from 2 to 1 inch (see Section 6.5)
- Added requirements for TOC adjustment and NDMA reduction testing (see Section 7.2)
- Added an analyte to Table 4.2 and Table 8.1, and added evaluation criteria for n-nitrosamine removal as Section 7.2.7 and Informative Annex 7
- Corrected two instances of Pb(NO3) to Pb(NO3)2 in Section 7.4.3.5.2.3.1, and updates Table 7.13 to add a column for the individual influent sample point limit, for consistency with Table 7.11.

Section 2, Normative references:

21 CFR, ~~Parts 170-199,~~ Food and Drugs, Subchapter B, Food for Human Consumption, Parts 170-199[3]
~~US EPA,~~ 40 CFR Part 136[~~7~~], *~~National Primary Drinking Water Regulations~~ Guidelines Establishing Test Procedures for the Analysis of Pollutants*[3]
~~US EPA,~~ 40 CFR Part 141[~~7~~], *National Primary Drinking Water Regulations*[3]
~~US EPA,~~ 40 CFR Part 143[~~7~~], *Other Safe Drinking Water Act Regulations, Subpart A, National Secondary Drinking Water Regulations*[3]
APHA/AWWA/WEF, Standard Methods for the Examination of Water and Wastewater, (hereinafter referred to as Standard Methods) twentieth edition[4]
EPA-600/R-05-054, Method 521: Determination of Nitrosamines in Drinking Water by Solid Phase Extraction and Capillary Column Gas Chromatography With Large Volume Injection and Chemical Ionization Tandem Mass Spectrometry (MS/MS), September 2004[5]
EPA-814/B-95-003, ICR Protozoan Method for the Detecting Giardia Cysts and Cryptosporidium Oocysts in Water by a Fluorescent Antibody Procedure, June 1995[5]

Section 4.1, Materials in contact with drinking water: Updated the referenced Standards to the currently applicable documents as follows:

4.1.3 Acceptance criteria

4.1.3.1 *Materials in contact with drinking water shall not impart levels of target compounds or tentatively identified compounds (TICs) that exceed the total allowable concentration (TAC), maximum contaminant levels (MCLs), or maximum acceptable concentration (MAC) criteria specified in ~~NSF/ANSI 61 Annex D, Table D.1~~ NSF/ANSI/CAN 600, Table 4.1: Drinking water criteria. Any extractable contaminants not listed in the referenced tables shall be reviewed and shall not exceed criteria developed in accordance with ~~NSF/ANSI 61 Annex A~~ NSF/ANSI/CAN 600, Section 3: Toxicology review and evaluation procedures.*

4.1.3.5 *Whole system or component assembly extraction testing may be waived if components, when separately tested, meet the requirements of this standard and are assembled in a manner that does not introduce any new components or materials, increase the surface area-to-volume ratio of previously evaluated components, or present potential concern based on cumulative factors. The reported extractable concentrations for components shall be arithmetically added to ensure that the whole system or component assembly meets the allowable levels in accordance with Tables 4.1, 4.2, and 4.3, ~~Annexes A, D, and E of NSF/ANSI 61NSF/ANSI/CAN 61,~~ and NSF/ANSI/CAN 600.*

Section 4.2, Materials evaluation: Added an exception for non-pressurized systems for materials exposure requirements, added provisions for systems that include heating or cooling options, and systems with only encapsulated filter element(s) as follows:

4.2.3 Exposure

4.2.3.1 *The system or component(s) of a system shall be installed, flushed, and conditioned in accordance with the manufacturer's instructions using the exposure water specified in Section 4.2.2 at an initial inlet static pressure of 340 kPa (50 psig). Nonpressurized systems, e.g., pour through products, shall be exposed at atmospheric pressure.*

4.2.3.2 *The system or component(s) shall be refilled with the exposure water specified in Section 4.2.2 and maintained for 24 h at a temperature of 23 ± 2 °C (73 ± 3 °F). A ~~2 L~~ water sample shall then be collected in accordance with Section 4.2.3.3. The system or component(s) shall be flushed according to the manufacturer's instructions, refilled, and maintained for another 24 h at a temperature of 23 ± 2 °C (73 ± 3 °F). A second ~~2 L~~ water sample shall be collected in accordance with Section 4.2.3.3. The system or component(s) shall again be flushed according to the manufacturer's instructions, refilled, and maintained for a third period of 24 h at a temperature of 23 ± 2 °C (73 ± 3 °F). A third ~~2 L~~ water sample shall be collected in accordance with Section 4.2.3.3.*

4.2.3.3 *A ~~minimum sample volume of~~ daily 2-L ~~shall be collected at each sample point. If the water holding volume of the product is greater than 2 L, the entire volume shall be collected in a suitable collection vessel, and a 2-L subsample obtained from this volume~~ collection volume is recommended to ensure there is sufficient volume in the composite sample to conduct the requested analyses. If the water holding volume of the product is greater than 2 L, the entire volume shall be collected in a suitable collection vessel, and a 2-L subsample obtained from this volume. If the water holding volume of the product is less than 2 L, sufficient samples shall be exposed to provide ~~the required 2-L~~ at least 1/3 of the volume required for analysis of extractant water at each sample point. The maximum number of samples exposed shall not exceed 16 with 125 mL of extractant water drawn from each sample. If the components with a water holding volume that is less than 250 mL and is able to be identified as one that will only occur once in the flow path of dispensed treated water (such as diverters, faucets, RO shutoff valves, or specialty components) then a volume of 250 mL shall be drawn from each sample using a maximum number of eight samples.*

4.2.3.4 *All samples collected shall be composited and analyzed in accordance the applicable methods referenced in Section 2. For multiple outlet systems, a composite sample shall be collected from all potable water outlets. The unit volume of the system shall be divided by the total number of potable water outlets and this amount shall be collected from each outlet. Systems that are designed to heat or cool the product water shall be connected to an appropriate power source and operated to heat or cool the water. The system shall be operated at the manufacturer's default temperature setting. If adjustable, the system shall be operated at the highest setting available.*

4.2.3.5 *Systems with adsorptive or absorptive media shall be tested with and without the media. Testing without media shall include removal of any granular adsorptive or absorptive media, and removal of any*

adsorptive or absorptive replacement elements. Systems that contain only encapsulated filter element(s) that are unable to be operated with the element removed, are exempt from without media extraction testing.

***4.2.3.6** Systems with only encapsulated element(s) containing absorptive or adsorptive media but provide a component(s) to allow the consumer to dispense untreated water, without media extraction testing shall be performed on the system in the manner that the system is operated with the bypass component(s) installed. Additional conditioning instructions should be provided in this case if applicable. NOTE — Systems may include an option or design feature which allow the water system to operate even when a filter cartridge is removed, such as a bypass valve, dummy cartridge, bypass plug, or other bypass mechanism.*

Section 5.4, Structural integrity test methods: Clarified requirements as follows:

5.4.2 Hydrostatic pressure test – Complete systems

Systems designed to operate only at atmospheric pressure shall be exempt from the hydrostatic pressure test but shall be watertight in normal use. For complete systems designed for open discharge, the components downstream of the system on/off valve that are not subject to pressure under the off mode, and that either contain no media subject to plugging or are not designed to contain media, shall be exempt from the hydrostatic pressure test but shall be watertight in normal use. Components that are downstream of the system on/off valve but upstream of media subject to clogging shall meet the requirements of this section. The following procedure shall be used for the hydrostatic pressure testing of other complete systems:

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Section 5.4.4, Cycle Test: Added requirements for systems designed to operate at atmospheric pressure as follows:

5.4.4 Cycle test

Systems designed to operate at atmospheric pressure shall be exempt from the cyclic pressure test but shall be watertight in normal use. For complete systems designed for open discharge, the components downstream of the system on/off valve that are not subject to pressure under the off mode, and that either contain no media subject to plugging or are not designed to contain media, shall be exempt from the cyclic pressure test but shall be watertight in normal use. Components that are downstream of the system on/off valve but upstream of media subject to clogging shall meet the requirements of this section.

The following procedure shall be used for the cyclic testing:

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Section 6, Minimum performance requirements: Clarified requirements, and changed the water fountain lower edge spacing requirements from 2 to 1 inch as follows:

6.5 Product water dispensing outlets

Product water dispensing outlets other than drinking fountain outlets, if provided, shall be designed, constructed, and located so that the discharge orifice is directed downward. ~~and t~~The lower edge of the outlet shall be at an elevation not less than 51 mm (2 in) above the flood rim of the waste receptacle.

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***6.5.1.4** The lower edge of the drinking water outlet shall be at least ~~51~~25 mm (~~2~~1 in) above the flood rim of the waste receptacle.*

Section 7.2, Chemical reduction claims: Added requirements for TOC adjustment and NDMA reduction testing as follows:

7.2.1.5 General test water

A public water supply shall be used with the following specific characteristics maintained throughout the test for contaminant reduction claims:

pH	*7.5 ± 0.5*
Temperature	*20 ± 2.5 °C (68 ± 5 °F)*
TDS	*200 to 500 mg/L*
TOC	*> 1.0 mg/L[1]*
Turbidity	*< 1 NTU*
[1] If naturally present in source water at adequate concentration. Adjustment of TOC is given in Section 7.2.1.5.1.	

7.2.1.5.1 TOC adjustment

Specification indicated in Section 7.2.1.5 shall be maintained if naturally occurring TOC is available in the source water at levels greater than 1.0 mg/L. If concentration of TOC needs to be increased to meet the minimum specification, chlorinated tannic acid as prepared in accordance with Annex N-7 shall be added to the test water to achieve a specification of TOC at 1.5 ± 0.5 mg/L.

7.2.1.5.2 *Methanol shall be used as the solvent when needed to introduce a contaminant to the test water.*

7.2.2.5 General test water

A public water supply shall be used with the following specific characteristics maintained throughout the test for contaminant reduction claims:

pH	*7.5 ± 0.5*
Temperature	*20 ± 2.5 °C (68 ± 5 °F)*
TDS	*200 to 500 mg/L*
TOC	*> 1.0 mg/L[1]*
Turbidity	*< 1 NTU*
[1] If naturally present in source water at adequate concentration. Adjustment of TOC is given in Section 7.2.2.5.1.	

7.2.2.5.1 TOC adjustment

Specification indicated in Section 7.2.2.5 shall be maintained if naturally occurring TOC is available in the source water at levels greater than 1.0 mg/L. If concentration of TOC needs to be increased to meet the minimum specification, chlorinated tannic acid as prepared in accordance with Annex N-7 shall be added to the test water to achieve a specification of TOC at 1.5 ± 0.5 mg/L.

7.2.7 N-nitrosodimethylamine (NDMA) reduction testing

7.2.7.1 NDMA reduction claim

Claims for NDMA reduction may be made when tested in accordance with Section 7.2.7.1, so long as maximum effluent concentrations denoted in Table 7.15 are not exceeded.

Section 7.3, Mechanical filtration reduction claims: Clarified procedure requirements as follows:

7.3.1.6.5.3 Asbestos challenge procedure

The asbestos challenge procedure shall be performed as follows:

a) The asbestos suspension specified in Section 7.3.1.4.3 shall be added to the water just prior to the sample point. The asbestos suspension specified feed shall be 10 bed volumes, or one filling volume of the influent reservoir, whichever is greater.

b) The test dust loading water, specified in Section 7.3.1.4.2, shall be used until the time required to complete one cycle has increased to 133% of the original ~~cycle~~ filling time.

c) The asbestos challenge test water, specified in Section 7.3.1.4.3, shall be used for 10 bed volumes, or one filling volume of the influent reservoir, whichever is greater.

d) The test dust loading water shall be used until the time required for one filling cycle has increased to 200% of the original ~~cycle~~ filling time.

e) The asbestos challenge test water, specified in Section 7.3.1.4.3, shall be used for 10 bed volumes, or one filling volume of the influent reservoir, whichever is greater.

f) The test dust loading water shall then be used until the time required for one filling cycle has increased to 400% of the original ~~cycle~~ filling time.

g) The asbestos challenge test water, specified in Section 7.3.1.4.3, shall be used for 10 bed volumes, or one filling volume of the influent reservoir, whichever is greater.

7.3.1.7.1 Batch treatment systems

Influent and effluent samples shall be collected:

— at the beginning of the "on" portion of the second cycle, or passage of 10 bed volumes; and

— at the beginning of the "on" portion of the second cycle of challenge test water introduced when the ~~original filling~~ time required for one filling cycle has increased ~~by~~ to 133%, 200%, and 400% of the original filling time.

7.3.2.1.6.3.3 Cryptosporidium parvum oocyst challenge procedure

The C. parvum oocyst challenge procedure shall be performed as follows:

a) The challenge test water, specified in Section 7.3.2.1.4.3, shall be used until the end of the eighth cycle.

b) The test dust loading water, specified in Section 7.3.2.1.4.2, shall be used until the time required to complete one filling cycle has increased to 133% of the original ~~cycle~~ filling time.

c) The general test water without challenge, specified in Section 7.3.2.1.4.1, shall be used for two cycles.

d) The challenge test water, specified in Section 7.3.2.1.4.3, shall be used for four cycles.

e) The test dust loading water shall be used until the time required for one filling cycle has increased to 200% of the original ~~cycle~~ filling time. Steps c and d shall then be repeated.

f) The test dust loading water shall then be used until the time required for one filling cycle has increased to 400% of the original ~~cycle~~ filling time. Steps c and d shall then be repeated.

7.3.2.1.7.2 Batch treatment systems

Influent (aliquot is removed by inserting a pipette to the midpoint of the raw water reservoir) and effluent samples shall be collected:

— at the beginning of the "on" portion of the eighth cycle; and

— at the beginning of the "on" portion of the fourth batch of challenge test water introduced when the ~~original filling~~ time required for one filling cycle has increased ~~by~~ to 133%, 200%, and 400% of the original filling time.

7.3.2.2 Polystyrene microsphere reduction for systems other than those used in bottled water plants

7.3.2.2.1 Polystyrene microsphere reduction claim for systems other than those used in bottled water plants

The polystyrene latex microspheres shall have 95% of particles in the range of 3.00 ± 0.15 µm. The size variation of the polystyrene microspheres shall be confirmed by electron microscopy. The spheres shall have a surface charge content of less than 2 ueq/g. The microspheres shall contain a fluorescein isothiocyanate (FITC) dye or equivalent. The system shall reduce the number of polystyrene microspheres from an influent challenge of at least 50,000 (5 × 104) polystyrene microspheres per liter by at least 99.95% at every individual unit effluent sample point when tested in accordance with Section 7.3.2.2.

7.3.2.2.6.3.3 Polystyrene microsphere challenge procedure

The polystyrene microsphere challenge procedure shall be performed as follows:

a) The challenge test water, specified in Section 7.3.2.2.4.3, shall be used until the end of the eighth cycle.

b) The test dust loading water, specified in Section 7.3.2.2.4.2, shall be used until the time required to complete one filling cycle has increased to 133% of the original ~~cycle~~ filling time.

c) The general test water without challenge, specified in Section 7.3.2.2.4.1, shall be used for two cycles.

d) The challenge test water, specified in Section 7.3.2.2.4.3, shall be used for four cycles.

e) The test dust loading water shall be used until the time required for one filling cycle has increased to 200% of the original ~~cycle~~ filling time. Steps c and d shall then be repeated.

f) The test dust loading water shall then be used until the time required for one filling cycle has increased to 400% of the original ~~cycle~~ filling time. Steps c and d shall then be repeated.

7.3.2.2.7.2 Batch treatment systems

Influent (aliquot is removed by inserting a pipette to the midpoint of the raw water reservoir) and effluent

samples shall be collected:

— at the beginning of the "on" portion of the eighth cycle; and

— at the beginning of the "on" portion of the fourth batch of challenge test water introduced when the ~~original filling~~ time required for one filling cycle has increased ~~by~~ to 133%, 200%, and 400% of the original filling time.

7.3.2.3 Polystyrene microsphere reduction for systems used in bottled water plants

7.3.2.3.1 Polystyrene microsphere reduction claim

The polystyrene latex microspheres shall have 95% of particles in the range of 3.00 ± 0.15 µm. The size variation of the polystyrene microspheres shall be confirmed by electron microscopy. The spheres shall have a surface charge content of less than 2 ueq/g. The microspheres shall contain a FITC dye or equivalent. The system shall reduce the number of polystyrene microspheres from an influent challenge of at least 50,000 (5 × 104) polystyrene microspheres per liter by at least 99.95% at every individual unit effluent sample point when tested in accordance with Section 7.3.2.2.

7.3.3.7.2 Batch treatment systems

Influent (aliquot removed by inserting pipette to midpoint of raw water reservoir) and effluent samples shall be collected at the beginning of the "on" portion of the fourth cycle and after each "on" cycle when the ~~original filling~~ time required for one filling cycle has increased ~~by~~ to 133%, 200%, and 400% of the original filling time.

Section 7.4, Metals reduction testing:

7.4.3.5.2.3.1 Solution preparation

The solutions for generating the lead pH 8.5 test water shall be prepared as follows:

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— soluble lead stock solution: 4 mL 1:1 diluted concentrated nitric acid to 1 L RO/DI H2O; then add 3.6 g $Pb(NO_3)_2$. Store the solution in a plastic container for no more than 90 d.

— insoluble lead stock solution: add 1.6 g $Pb(NO_3)_2$ to 1 L RO/DI H2O (RO/DI pH should be already below 6.5; if it is not, let the water sit with exposure to the atmosphere until its pH is below 6.5). Store the solution in a plastic container for no more than 30 d.

Section 7.5, Microcystins reduction claims: Clarified test method requirements as follows:

7.5.7 Methods

Systems shall be conditioned using the test contaminant specified in Table 7.14 and test water in Section 7.5.5. The conditioning volume shall be excluded from the volume measured as the influent challenge volume for capacity and sample point determination.

Section N-1.6, Procedure: Editorially revised influent requirements as follows:

N-1.6.1 Sample collection

Influent samples shall be collected in 1-L bottles containing 1 mL 1.0% polyoxyethylene sorbitan mono-oleate (0.01%). All samples shall be refrigerated until analyzed. Influent samples shall be collected in singlicate. 3 L of the effluent shall be collected. The first liter of effluent shall be used as the test sample. The test samples shall be collected in 1-L bottles containing 1 mL 1.0% polyoxyethylene sorbitan mono-oleate (0.01%). All samples shall be refrigerated until analyzed. The second and third liters of effluent shall be used for QC samples. The second and third liters of effluent shall be composited and poured into two 1-L bottles each containing 1 mL 1.0% polyoxyethylene sorbitan mono-oleate (0.01%). All samples shall be refrigerated until analyzed.

Samples shall be stained and mounted within 24 h of collection.