TO: Joint Committee on Drinking Water Treatment Units

FROM: Dr. Robert Powitz, Chair of the Joint Committee

DATE: January 16, 2024

SUBJECT: Proposed revisions to:
NSF/ANSI 42: *Drinking Water Treatment Units – Aesthetic Effects* (42i128r2)
NSF/ANSI 44: *Residential Cation Exchange Water Softeners* (44i54r2)
NSF/ANSI 53: *Drinking Water Treatment Units – Health Effects* (53i153r2)

Revision 2 of NSF/ANSI 42 issue 128, NSF/ANSI 44 issue 54, and NSF/ANSI 53 issue 153 is being forwarded to the Joint Committee for consideration. Please review the proposal and **submit your ballot by February 6, 2024** via the NSF Online Workspace <www.standards.nsf.org>.

Please review all ballot materials. When adding comments, please include the section number applicable to your comment and add all comments under one comment number whenever possible. If you need additional space, please use the attached blank comment template in the reference documents and upload online via the browse function.

Purpose

The proposed revisions add criteria for health-based claims for the removal of manganese to NSF/ANSI 44 and 53, and update language in NSF/ANSI 42 to clarify aesthetic versus health-based claims. **Revision 2** adds clarifying language on the 0.02 mg/L effluent concentration value.

Background

A 2019 issue paper noted that manganese in small amounts is essential to human health, but elevated levels in drinking water have been shown to have negative health impacts. However, DWTU standards do not currently include a health-based claim for the removal of manganese.

Also in 2019, the Water Quality Association (WQA) partnered with NSF International, Health Canada, the Standards Council of Canada, and the American National Standards Institute to issue a temporary standard to address this gap, WQA ORD1901. The longer-term goal was to incorporate manganese claims into the NSF/ANSI DWTU standards so that the WQA temporary standard could be withdrawn to eliminate duplication of standards.

Subsequently, a task group explored how health-based claims for the removal of manganese could be incorporated into NSF/ANSI drinking water treatment standards and developed this ballot.

The **revision 1 (r1)** ballot added manganese health claims to NSF/ANSI 44 and 53, and updated manganese sections in NSF/ANSI 42.

The **r1 ballot** received 21 affirmative votes (78%), six negative votes (22%), and one abstention. Comments from Jeffrey Kempic, Andrew Lombardo, Art Lundquist, Darren Lytle, and Joe Wolff requested adding clarifying language on why 0.02 mg/L was chosen as the passing effluent concentration. This **r2 ballot** adds this explanatory note to the standards. A comment from Tedd Schneidewend requested clarifying that filters would not operate correctly outside the test pH parameters. This is covered in the proposed changes to NSF/ANSI 53 under Section 7.4.2.5, Metals reduction test waters, and Section 8, Instruction and information.

Please refer to the original issue paper (DWTU-2019-14), the manganese discussion excerpt from the 2019 DWTU Joint Committee annual meeting, the latest task group meeting summary, and the r1 comments and responses for additional background information.

789 N. Dixboro Road, Ann Arbor, Michigan 48105-9723 USA
T +1 734 769 8010 | **F** +1 734 769 0109 | **www.nsf.org**

If you have any questions about the technical content of the ballot, you may contact me in care of:

Dr. Robert Powitz
Chair, Joint Committee on Drinking Water Treatment Units
c/o Monica Milla
Joint Committee Secretariat
NSF
(734) 214-6223
mmilla@nsf.org

[Note: The recommended changes to the standard which include the current text of the relevant section(s) indicate deletions by use of ~~strikeout~~ and additions by gray highlighting. Revision 2 additions are shown in yellow highlighting. Rationale statements are in *italics* and only used to add clarity; these statements will NOT be in the finished publication.]

NSF/ANSI 42:

Drinking Water Treatment Units – Aesthetic Effects

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7.3.5 Iron and manganese reduction testing

7.3.5.1 Iron and manganese reduction claims

Claims for iron or manganese reduction may be made when tested in accordance with Section 7.3.5. To qualify for an iron or manganese reduction claim, the system shall reduce the concentration of the substance from the influent challenge so that, prior to the 100% sample point, 90% of the product water sample concentrations are less than or equal to the maximum product water concentrations in Table 7.5. Samples collected at the 100% sample point shall be less than or equal to the maximum product water concentrations in Table 7.5.

Table 7.5
Iron and manganese reduction requirements

Contaminant	Average influent challenge concentration	Individual influent sample point limits [a]	Maximum product water concentration [b]	Compound
iron (Fe^{+2})	3 to 5 mg/L or 9 to 11 mg/L	3 to 5 mg/L ± 15% or 10 mg/L ± 20%	0.3 mg/L	appropriate water source
manganese (Mn^{+2}) [c]	1 to 2 mg/L	1 to 2 mg/L ± 15%	~~0.05~~ 0.02 [d] mg/L	appropriate water source

[a] Equals average influent challenge concentration variability plus one of the following, in order of availability:

1. Acceptable continuing calibration verification (CCV) limits stated in the appropriate U.S. EPA Method.
2. Acceptable spike recoveries as stated in the appropriate U.S. EPA Method.
3. Opinion of laboratory professionals – No guidance available in U.S. EPA Method.

[b] Not all secondary substances are listed in this standard because they are not normally found in drinking water or are not affected by drinking water treatment systems. Hydrogen sulfide and phenol are listed because they are found in water and may be aesthetically displeasing.

[c] Alternately, the specifications in NSF/ANSI 53 may be used.

[d] Note — The effluent criteria of 0.02 mg/L is based on the aesthetic target for Canada.

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7.3.5.6 Influent challenge

A water supply with the following specific characteristics shall be used:

temperature	20 ± 3 °C (68 ± 5 °F)
TDS	200 to 500 mg/L
turbidity	< 1 NTU

Alternately, the specifications in NSF/ANSI 53 may be used.

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8 Instruction and information

8.1 Installation, operation, and maintenance instruction

8.1.1 Information setting forth complete, detailed instructions for installation, operation, and maintenance shall be provided with each system or be publicly accessible online. Upon request, manufacturers shall submit physical copies of installation, operation, and maintenance instructions. Specific information shall include:

— model number and trade designation;

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— for products meeting the definition for personal hand held devices, a statement that these devices are for individual use only.

— statement for products making an aesthetic only manganese reduction claim (systems compliant with NSF/ANSI 53 manganese reduction requirements do not require this language):

"The reduction of manganese is intended to reduce only the aesthetic effects manganese has on water. Manganese reduction under NSF/ANSI 42 only does not imply meeting any health effects claims."

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8.4 Performance data sheet

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8.4.2 Where applicable, the following information shall also be included:

— model number of replacement components;

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— statement for systems making bacteriostatic claims:

"The term 'bacteriostatic' indicates that the system limits the passage or growth of bacteria that may already exist in the incoming water. It does not mean that water leaving the system is safer to drink than water entering the system."

— for systems that claim chlorine reduction based on chloramine reduction as a surrogate, identification of the basis of the chlorine reduction claim. The chlorine influent concentration shall be specified as 2 mg/L, the chlorine product water concentration shall be calculated based on the percent reduction of chloramine, and the stated percent reduction for chlorine shall be equal to that achieved for chloramine; and

— systems making claims for nominal particulate reduction (85%) shall include the size range classification of the test particles as specified in Table 8.2.

— statement for products making an aesthetic only manganese reduction claim (systems compliant with NSF/ANSI 53 manganese reduction requirements do not require this language):

"The reduction of manganese is intended to reduce only the aesthetic effects manganese has on water. Manganese reduction under NSF/ANSI 42 only does not imply meeting any health effects claims."

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Table 8.1
Performance data sheet reduction claims

Substance	Influent challenge concentration	Maximum permissible product water concentration
chloride	800 mg/L ± 10%	250 mg/L
foaming agent	5 mg/L ± 10%	0.5 mg/L
hydrogen sulfide	1.0 mg/L ± 10%	0.05 mg/L
iron	3 to 5 mg/L	0.3 mg/L
manganese	1 to 2 mg/L	~~0.05~~ 0.02 [a] mg/L
phenol	5.0 mg/L ± 10%	0.25 mg/L
sulfate	800 mg/L ± 10%	250 mg/L
TDS	1500 mg/L ± 10%	500 mg/L
zinc	10 mg/L ± 10%	5 mg/L
[a] Note — The effluent criteria of 0.02 mg/L is based on the aesthetic target for Canada.		

Rationale:
Updates manganese language to reflect adding health-based manganese claims to NSF/ANSI 44 and 53.

NSF/ANSI 44:

Residential Cation Exchange Water Softeners

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7 Elective performance claims – Test methods

The following specifications shall apply to all water softener classifications except as noted.

7.1 Scope

The following requirements and performance ratings shall be verified by tests:

- capacity tests:
  - salt efficiency (mandatory for efficiency rated systems only); and
  - water consumption during regeneration (mandatory for efficiency rated systems only).
- radium and barium reduction if claimed.
- manganese reduction if claimed.

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7.2 Barium and radium reduction

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7.2.4.2 Barium reduction test procedure

a) The challenge water shall contain 10.0 mg/L of equivalent barium when prepared with barium chloride.

b) A dynamic operating test pressure of 241 ± 34 kPa (35 ± 5 psig) shall be established.

c) The salt dosage(s) shall be set at the manufacturer's lowest salt dose and the system shall be regenerated in accordance with the manufacturer's instructions.

d) The flow rate shall be set at the maximum service flow rate for systems tested for barium reduction.

e) The system shall be operated to the hardness exhaustion point (per Section 6.6.2.7.h) until three consecutive cycles for hardness reduction do not vary more than 10% from the average.

f) The influent challenge and product water samples for barium analysis shall be collected when hardness of 1.0 gpg (1.0 gpg = 17.1 mg/L) is reached and at intervals of hardness effluent at 5 gpg (5 gpg = 85.5 mg/L), 10 gpg (10 gpg = 171 mg/L), and 20 gpg (20 gpg = 342 mg/L). This sampling frequency will be used to verify barium reduction.

7.3 Manganese reduction

The product water manganese concentration shall not exceed 0.02 mg/L manganese.

NOTE — The health-based claim for manganese was primarily developed to satisfy a need for such products in Canada. The effluent criteria of 0.02 mg/L is based on the aesthetic target for Canada which is lower than the health advisory level in the U.S. and the maximum allowable concentration in Canada of 0.5 mg/L. This is because the task group which developed requirements for a health-based manganese claim felt that, from a consumer perspective, it would be confusing if a product qualified to remove manganese as a potential health concern did not also take care of the potential aesthetic concerns related to manganese.

7.3.1 Challenge water

A water supply with the following characteristics shall be used.

manganese [a]	1.0 ± 0.1 mg/L
magnesium hardness	5 ± 1 gpg (85.5 ± 17.1 mg/L)
calcium hardness	15 ± 1 gpg (256.5 ± 17.1 mg/L)
iron	<0.1 mg/L
pH [b]	7.0 ± 0.5
temperature	18 ± 5 °C (65 ± 10 °F)
total dissolved solids (TDS) [c]	400 to 600 mg/L
turbidity	<1.0 NTU
sodium	≤5.0 gpg (85.5 mg/L)

[a] Added as manganese chloride

[b] Adjust pH, if needed, with sodium hydroxide or hydrochloric acid.

[c] Raise the TDS with sodium chloride (NaCl), if necessary, to achieve the minimum of 400 mg/L.

7.3.2 Manganese reduction test procedure

a) Prepare challenge water per Section 7.3.1.

b) A dynamic operating pressure of 241 ± 34 kPa (35 ± 5 psi) shall be established.

c) The salt dosage(s) shall be set at the manufacturer's lowest salt dose and the system shall be regenerated in accordance with the manufacturer's instructions.

d) The flow rate shall be set at the maximum service flow rate.

e) The system shall be operated to the hardness exhaustion point (per Section 6.6.2.7.h) until three consecutive cycles for hardness reduction capacity do not vary more than 10% from the average.

f) Influent and product water samples shall be collected and analyzed for manganese at the beginning and at 25%, 50%, 75%, and 100% of each service cycle established through testing in Section 7.1.1.5.

~~7.3~~ 7.4 Conformance by calculation

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~~7.3.1~~ 7.4.1 Calculation limitations

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~~7.3.2~~ 7.4.2 Calculation procedure

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~~7.3.2.1~~ 7.4.2.1 Exchange capacity

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~~7.3.2.2~~ 7.4.2.2 Pressure drop

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Rationale:
Adds health-based claims for the removal of manganese to NSF/ANSI 44.

NSF/ANSI 53:

Drinking Water Treatment Units — Health Effects

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7.4.2 General metals reduction

7.4.2.1 General metals reduction testing

Claims for chemical reduction may be made for the specific metal contaminants shown in Table 7.12 when tested in accordance with Section 7.4.2.1. To qualify for a metal reduction claim, the system shall reduce the influent concentration(s) so that all effluent concentrations are less than or equal to the maximum effluent concentrations shown in Table 7.13.

Table 7.13

General metals reduction requirements

Substance	Individual influent sample point limits [a] (mg/L)	Average influent challenge [b] (mg/L)	Maximum effluent concentration (mg/L)	U.S. EPA Method(s)	Compound
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copper	3.0 ± 25%	3.0 ± 10%	1.3	200.8	$CuSO_4$ 5 H_2O
manganese	1.0 ± 30%	1.0 ± 10%	0.02 [c]	200.8	$MnCl_2$
mercury	0.006 ± 25%	0.006 ± 10% (added as inorganic mercury)	0.002	200.8	$Hg(NO_3)_2$ H_2O
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NOTE 1 — Contaminants not listed in this table should be added in their molecular form.

NOTE 2 — Metal salts using alternate counter ions may be used if interferences and synergistic effects are avoided.

[a] Equals average influent challenge concentration variability plus one of the following, in order of availability:

1. Acceptable continuing calibration verification (CCV) limits stated in the appropriate U.S. EPA Method.
2. Acceptable spike recoveries as stated in the appropriate U.S. EPA Method.
3. Opinion of laboratory professionals – no guidance available in U.S. EPA Method.

[b] Reason for influent challenge levels: challenge concentrations should be selected to simulate what a system will be challenged with in the field and to provide an accurate and reproducible indicator of performance. The following sequence of criteria is used to select challenge concentrations:

a) The upper percentile concentration of available occurrence data (the concentration for which there is high probability [$P < 0.05$] that 95% of the population will be exposed to waters of lower concentration). Occurrence data shall come from national monitoring programs administered by the U.S. EPA or the USGS. Other occurrence data shall be accepted by the Joint Committee on Drinking Water Treatment Units.

b) The concentration obtained by multiplying the U.S. EPA's published MCL by three. This concentration will not be adequate when U.S. EPA MCL is very low.

[c] NOTE — The health-based claim for manganese was primarily developed to satisfy a need for such products in Canada. The effluent criteria of 0.02 mg/L is based on the aesthetic target for Canada which is lower than the health advisory level in the U.S. and the maximum allowable concentration in Canada of 0.5 mg/L.This is because the task group which developed requirements for a health-based manganese claim felt that, from a consumer perspective, it would be confusing if a product qualified to remove manganese as a potential health concern did not also take care of the potential aesthetic concerns related to manganese.

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7.4.2.5 Metals reduction test waters

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

Parameter	Low pH	High pH
alkalinity (as $CaCO_3$)	10 to 30 mg/L	100 to 250 mg/L
hardness (as $CaCO_3$)	10 to 30 mg/L	100 to 200 mg/L
pH [a]	6.5 ± 0.25	8.5 ± 0.25
polyphosphate (as P)	< 0.5 mg/L	< 0.5 mg/L
TDS	< 100 mg/L	200 to 500 mg/L
temperature	20 ± 2.5 °C (68 ± 5 °F)	20 ± 2.5 °C (68 ± 5 °F)
turbidity	< 1 NTU	< 1 NTU

[a] For manganese reduction testing, the testing shall only be required at one pH level due to manganese's abilities to be filtered more easily when oxidized, which happens at higher pH levels. The manufacturer shall select a pH of either 6.5 ± 0.25 or 8.5 ± 0.25. The literature shall specify that manganese reduction is applicable only at the tested pH and above.

Where precipitation of the metals occurs, deionized water shall be used instead of water from a public water supply. Appropriate calcium salts, or magnesium salts, or both, shall be added to provide the desired TDS (refer to table of standard Ksp values). The pH adjustment required shall not cause precipitation of the metals.

7.4.2.6 Regeneration and backwash

Systems that use regeneration as part of the operating cycle shall pass the applicable requirements after the completion of a minimum of three operating / regeneration cycles. Nonregeneration systems that recommend backwashing over the life of the system shall be backwashed at the manufacturer's recommended interval with a minimum of one backwash at the midpoint of the test.

~~7.4.2.6~~ 7.4.2.7 Cycle time

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~~7.4.2.7~~ 7.4.2.8 Methods – POU

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~~7.4.2.7.1~~ 7.4.2.8.1 Plumbed-in systems without reservoirs and all faucet-mounted systems

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~~7.4.2.7.1.1~~ 7.4.2.8.1.1 Refrigerator filters without integral flow control

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~~7.4.2.7.1.2~~ 7.4.2.8.1.2 Refrigerator filters without integral flow control, with water dispenser and ice maker

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~~7.4.2.7.2~~ 7.4.2.8.2 Plumbed-in systems with reservoirs

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~~7.4.2.7.3~~ 7.4.2.8.3 Nonplumbed pour-through-type batch treatment systems

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~~7.4.2.7.3.1~~ 7.4.2.8.3.1 Systems with a manufacturer's recommended use pattern

~~7.4.2.7.3.2~~ 7.4.2.8.3.2 Systems without a manufacturer's recommended use pattern

~~7.4.2.7.3.3~~ 7.4.2.8.3.3 Mouth-drawn drinking water treatment units

~~7.4.2.7.3.4~~ 7.4.2.8.3.4 Squeeze bottle drinking water treatment units

~~7.4.2.8~~ 7.4.2.9 Method – POE

~~7.4.2.9~~ 7.4.2.10 Sampling

8 Instruction and information

8.2 Data plate

8.2.3 Where applicable and appropriate, the following information shall also be included:

— model number(s) of replacement components;

— statement of intended use for microcystins:

"WARNING: This system is for use on water supplies that have been treated to public water systems standards. This system has been tested to demonstrate effective reduction of microcystins, however, in the event of a reported cyanotoxin event in your water supply, other cyanotoxins may be present in the drinking water which may not be effectively reduced by this system. In the event of a cyanotoxin notification, follow the recommendations of your drinking water authority."

— where the physical size of the system does not permit affixing the caution statements, the statements shall be prominently displayed in the literature accompanying the system.

— statement for systems making manganese reduction claims:

"*This system's ability to reduce manganese related to health issues is dependent on the pH of the water. Using this system on waters with a pH outside the recommended level voids the manganese reduction claim."*

8.4 Performance data sheet

Table 8.1
Performance data sheet reduction claims

Substance	Influent challenge concentration (mg/L)	Maximum permissible product water concentration (mg/L)
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lindane	0.002 ± 10%	0.0002
manganese	1.0 ± 10%	0.02 [a]
mercury ⋮	0.006 ± 10%	0.002
[a] NOTE — The health-based claim for manganese was primarily developed to satisfy a need for such products in Canada. The effluent criteria of 0.02 mg/L is based on the aesthetic target for Canada which is lower than the health advisory level in the U.S. and the maximum allowable concentration in Canada of 0.5 mg/L. This is because the task group which developed requirements for a health-based manganese claim felt that, from a consumer perspective, it would be confusing if a product qualified to remove manganese as a potential health concern did not also take care of the potential aesthetic concerns related to manganese		

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8.4.3 Where applicable and appropriate, the following information shall also be included:

— model number of replacement component;

— electrical requirements;

— pressure drop of new system in kPa (psig) at rated flow (POE and bottled water systems only);

— minimum working pressure in kPa (psig);

— minimum operating temperature in °C (°F);

— pH requirements (when system makes manganese reduction claim);

— statement for activated carbon systems:

"Do not use with water that is microbiologically unsafe or of unknown quality without adequate disinfection before or after the system."

Additional statement for activated carbon systems claiming cyst reductions:

"Systems certified for cyst reduction may be used on disinfected waters that may contain filterable cysts."

NOTE — Systems that are compliant with NSF/ANSI 55 Class A or other standards that cover technologies to treat microbiologically unsafe water (e.g., U.S. EPA Guide *Standard and Protocol for Testing Microbiological Water Purifiers* or NSF P231) are examples of demonstrating adequate disinfection before or after the system.

— statement for manganese reduction systems:

"*This system has been tested for the reduction of manganese. The efficiency of its removal capability is dependent on the pH of the incoming water. Do not use on waters that have a pH outside the specified pH. Compliance with the requirements under NSF/ANSI 53 for manganese reduction will also satisfy the aesthetic concerns that manganese introduces.*"

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Rationale:

Adds health-based claims for the removal of manganese to NSF/ANSI 53.