MEMORANDUM

TO: Joint Committee on Drinking Water Treatment Units

FROM: Bob Powitz, Chairperson

DATE: July 15, 2019

SUBJECT: Ballot for NSF/ANSI 53 – Drinking Water Treatment Units – Health Effects (53i115r2)

Revision 2 of NSF/ANSI 53 issue 115 is being forwarded to the Joint Committee for balloting. Please review the proposal and submit your ballot by August 5, 2019 via the NSF Online Workspace <www.standards.nsf.org>.

Please note that if you do not return a vote for this revised ballot, your last recorded vote from the previous draft revision will remain in effect.

This ballot also addresses any unresolved negatives received from the previous ballot (53i115r1). At the close of this ballot, all results will be tallied to determine if the requirements for consensus have been satisfied.

Purpose

The proposed revision will add a performance reduction claim for perfluorocatanoic acid (PFOA) and perfluorocetane sulfonate (PFOS) for non-regenerable drinking water treatment devices that use anion exchange media.

Revision 2 incorporates comments received from the previous ballot (53i115r1) to correct an inconsistency between Table 7.7 and 7.8 in the overall average and single point tolerances in the influent challenge water, and adds clarifying language to the method. Original comments have been included under the referenced items.

Background

In recent years there have been growing concerns on the prevalence of perfluorinated compounds, a suspected carcinogen, in drinking water. These compounds, which were originally used in the manufacturing of nonstick materials, are now found everywhere because of their resistance to degradation. In 2016, the USEPA issued a lifetime Health Advisory for PFOA and PFOS in drinking water. Under these guidelines, utilities are required to notify the consumers when the chemicals exceed 70 parts per trillion (PPT) (individually or combined) in drinking water.

In 2017, a task group was formed and charged with developing PFOA/PFOS reduction protocols for three technologies: activated carbon, reverse osmosis, and anion exchange. The ballots addressing activated carbon and reverse osmosis were recently approved and
have been published in the 2018 editions of NSF/ANSI 53 and 58, respectively. This ballot includes the proposed addition of the reduction protocol under NSF/ANSI 53 for anion exchange.

This issue was presented at the 2018 DWTU JC meeting and the committee unanimously voted to send the proposed revision to ballot. Please see the original issue papers (DWTU-2017-2 and DWTU-2018-1) and the 2017 and 2018 DWTU meeting summary excerpts under the referenced items for additional information.

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

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Chairperson, Joint Committee  
c/o Monica Leslie  
Joint Committee Secretariat  
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Tel: (734) 827-5643  
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7.2.6 Non-regenerating PFOA / PFOS reduction testing

This protocol is designed for non-regenerable POU and POE devices using anion exchange media.

7.2.6.1 PFOA/ PFOS reduction claim

Claims for PFOA / PFOS reduction are permitted when tested in accordance with Section 7.2.6 as long as maximum effluent concentrations in Table 7.7 are not exceeded.

Table 7.7
PFOA/PFOS reduction requirements

<table>
<thead>
<tr>
<th>Substance</th>
<th>Influent challenge (mg/L)</th>
<th>Maximum effluent concentration (mg/L)</th>
<th>US EPA Method(s)</th>
<th>Compound</th>
</tr>
</thead>
<tbody>
<tr>
<td>PFOA (perfluorooctanoic acid CAS #335-67-1) and PFOS (perfluorooctane sulfonate CAS # 1763-23-1)</td>
<td>0.0015 ± 30%</td>
<td>0.00007²</td>
<td>Refer to Annex L³</td>
<td>PFOA and PFOS</td>
</tr>
</tbody>
</table>

¹ Influent challenge levels for PFOS were based on the upper percentile concentration per EPA’s UCMR3 occurrence data (2013-2015) (the concentration for which there is high probability [P <0.01] that 99% of the population will be exposed to waters of lower concentration). Influent challenge levels for PFOA were based on the upper percentile concentration of private well and public water supply sampling in Hoosick Falls New York (the concentration for which there is high probability [P <0.10] that 90% of the population will be exposed to waters of
Table 7.7
PFOA/PFOS reduction requirements

<table>
<thead>
<tr>
<th>Substance</th>
<th>Influent challenge (mg/L)</th>
<th>Maximum effluent concentration (mg/L)</th>
<th>US EPA Method(s)</th>
<th>Compound</th>
</tr>
</thead>
<tbody>
<tr>
<td>lower concentration. This influent concentration is higher than the maximum concentration per US EPA's UCMR3 occurrence data (2013-2015). PFOS and PFOA will be added gravimetrically in a ratio of five parts PFOA to 10 parts PFOS by weight to achieve the total influent concentration.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total of both PFOS and PFOA. Based on US EPA Health Advisory level which includes a margin of protection for the most sensitive populations.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Any needed modification / improvement on the method shall be performed as described and validated within the method. If alternate methods are used they shall be validated as equivalent or better in precision and accuracy than the specified method.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

7.2.6.2 Apparatus
Refer to 7.1.2 Figure 2 for an example of the test apparatus.

7.2.6.3 Analytical methods
All analyses shall be conducted in accordance with the applicable methods referenced in Section 2 and Annex L.

7.2.6.4 Premature filter plugging
If a product prematurely plugs prior to the completion of the required test volume, the volume of the final sample point collected prior to plugging becomes the final test volume to determine capacity.

Applicable actions to remediate premature filter plugging for this tests method are contained in Annex H, Sections H.1, H.2, H.3, and H.6.

7.2.6.5 PFOA / PFOS reduction test water
a) A water supply shall be treated by reverse osmosis, then shall be treated by deionization (RO/DI) water and shall have a conductivity of less than 2 μS / cm.

b) All chemical additions shall take place either after the test tank is filled with the RO/DI water, or while the test tank is being filled. Reagent grade chemicals shall be used for all additions to adjust the RO/DI water to meet the following specific characteristics:

Table 7.8
PFOA/PFOS influent water characteristics

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Target value</th>
<th>Overall average tolerance</th>
<th>Single point tolerance</th>
</tr>
</thead>
<tbody>
<tr>
<td>SO₄²⁻</td>
<td>200 mg/L</td>
<td>± 20%</td>
<td>± 30%</td>
</tr>
<tr>
<td>Cl⁻</td>
<td>100 mg/L</td>
<td>± 20%</td>
<td>± 30%</td>
</tr>
<tr>
<td>alkalinity as CaCO₃</td>
<td>200 mg/L</td>
<td>± 20%</td>
<td>± 30%</td>
</tr>
<tr>
<td>PFOA</td>
<td>0.0005 mg/L</td>
<td>± 40% / 30%</td>
<td>± 20% / 40%</td>
</tr>
</tbody>
</table>
PFOS 0.0010 mg/L ± 10%30% ± 20%40%

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Acceptance Limits</th>
</tr>
</thead>
<tbody>
<tr>
<td>temperature</td>
<td>20 °C (68 °F) ± 2.5 °C (± 5 °F)</td>
</tr>
<tr>
<td>turbidity</td>
<td>&lt; 1 NTU</td>
</tr>
<tr>
<td>pH</td>
<td>7.5 ± 0.5</td>
</tr>
</tbody>
</table>

1. Acceptable continuing calibration verification (CCV) limits stated in the appropriate US EPA Method.
2. Acceptable spike recoveries as stated in the appropriate US EPA Method.

**Rationale:** Revision 2 - Revised overall average and single influent tolerance levels to be consistent with Table 7.7 per comment by R. Herman on r1 ballot.

c) Dissolve enough sodium bicarbonate (NaHCO₃) in RO/DI water to achieve a test tank concentration of 336 mg/L NaHCO₃. This should be equivalent to 200 mg/L of alkalinity expressed as CaCO₃. Stir and transfer the solution to the test tank.

d) Adjust the pH of the test tank solution using hydrochloric acid (HCl) or sodium hydroxide (NaOH) to 7.5 ± 0.5. Record the amount HCl used.

e) Dissolve enough magnesium sulfate (MgSO₄·7H₂O) in RO/DI water to achieve a test tank concentration of 200 mg/L as sulfate. Sodium Sulfate (NaSO₄·7H₂O) may be substituted for 75% of the magnesium sulfate if the presence of hardness interferes with the proper operation of the device under test.

f) Dissolve enough perfluorooctanoic acid (PFOA) and perfluorooctanesulfonic acid (PFOS) in RO/DI water to achieve a test tank concentration of 0.0005 mg/L of PFOA and 0.0010 mg/L of PFOS.

g) Mix and measure the final pH, and adjust as needed. Mixing shall be minimized thereafter throughout the duration of the test.

h) Dissolve enough sodium chloride (NaCl) in RO/DI water to achieve a test tank concentration of 100 mg/L of chloride. Balance this number with the amount of chlorides added from the HCl for pH control to maintain a target of 100 mg/L. Stir and transfer to the test tank.

i) Each tank of water prepared shall have all of the parameters specified in Table 7.8 verified by analytical methods.

**7.2.6.6 Cycle time**

The systems shall be operated on a 50%-on / 50%-off cycle basis with a 15 to 40 min cycle, up to 16 h per 24 h period, followed by an 8 h rest under pressure (a 10%-on / 90%-off cycle may be used if requested by the manufacturer for POU systems but for POE systems only 50%-on / 50%-off cycle shall be used).

**7.2.6.7 Method – POU**

Two systems shall be conditioned using the PFOA / PFOS reduction water specified in Section 7.2.6.5 with the test contaminant present. The conditioning volume shall be excluded from the volume measured as the influent challenge volume for capacity and sample point determination.
7.2.6.7.1 Plumbed-in systems without reservoirs and all faucet-mounted systems

Two systems shall be conditioned in accordance with the manufacturer’s instructions and Section 7.2.6.7.

The systems shall be tested using the influent challenge water at the maximum flow rate attainable by setting an initial dynamic pressure of 410 ± 20 kPa (60 ± 3 psi). The pressure shall not be readjusted although the system may experience some change in dynamic pressure. The operating cycle specified in Section 7.2.6.6 shall be used.

7.2.6.7.1.1 Refrigerator filters without integral flow control

Chemical reduction testing for refrigerator filters without an integral automatic fixed flow rate control shall be performed at a controlled flow rate that is equal to or greater than the rated service flow of the refrigerator filter system and refrigerator plumbing.

7.2.6.7.1.2 Refrigerator filters without integral flow control, with water dispenser and ice maker

If the refrigerator filter does not include an integral automatic fixed flow rate control, and supplies water to both a water dispenser and an ice maker, then any chemical reduction testing shall be performed at a controlled flow rate equal to or greater than the tested flow rate of the icemaker or the tested flow rate of the water dispenser, whichever is greater.

7.2.6.7.2 Plumbed-in systems with reservoirs

Two systems shall be conditioned in accordance with the manufacturer’s instructions and Section 7.2.6.7.

The system shall be tested using the influent challenge water at the maximum flow rate attainable by setting an initial dynamic pressure of 410 ± 20 kPa (60 ± 3 psi). The pressure shall not be readjusted although the system may experience some change in dynamic pressure. Where the design of the system does not lend itself to the operating cycle specified in Section 7.2.6.6, the operating cycle shall be a repetitive complete filling and emptying of the reservoir. It is acceptable to run this cycle continuously for 24 h per day.

7.2.6.7.3 Nonplumbed pour-through-type batch treatment systems

Two systems shall be conditioned in accordance with the manufacturer’s instructions and Section 7.2.6.7.

If the effluent reservoir capacity is equal or greater than two times the volume of the influent reservoir, multiple successive influent reservoir fills shall be performed until the remaining volume in the effluent reservoir is less than the influent reservoir volume. The resulting volume for each filling of the effluent reservoir shall be the batch volume. If the volume of the effluent reservoir is less than two times the volume of the influent reservoir, the batch volume shall be the influent reservoir volume.

Example:

<table>
<thead>
<tr>
<th>Influent volume (L)</th>
<th>Effluent volume (L)</th>
<th>Batch (L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0</td>
<td>1.8</td>
<td>1.0</td>
</tr>
<tr>
<td>1.2</td>
<td>2.5</td>
<td>2.4</td>
</tr>
<tr>
<td>1.4</td>
<td>4.0</td>
<td>2.8</td>
</tr>
</tbody>
</table>
7.2.6.7.3.1 Systems with a manufacturer’s recommended use pattern

Two systems shall be tested using the appropriate influent challenge water using the manufacturer’s use pattern. The use pattern shall include information about the rest period between the fillings. The rest period after the influent reservoir has drained given by the manufacturer shall not exceed 75 min and include a tolerance of at least ± 15 min. The systems shall be operated up to 16 h per 24 h period, followed by an 8 h rest period. Exceptions to the rest period are permissible for laboratory operational needs (e.g., water preparation, equipment malfunctions).

7.2.6.7.3.2 Systems without a manufacturer’s recommended use pattern

Two systems shall be tested using the appropriate influent challenge water. The systems shall be operated up to 16 h per 24 h period, followed by an 8 h rest period. The test cycle shall include a rest period of 30 to 90 min after the influent reservoir has drained. The total volume per day shall be limited to 10 batches. Exceptions to the rest period are permissible for laboratory operational needs (e.g., water preparation, equipment malfunctions).

7.2.6.7.3.3 Mouth drawn drinking water treatment units

Products meeting the definition for mouth drawn drinking water treatment unit shall be evaluated using the method specified in Annex F.

Two systems shall be conditioned in accordance with the manufacturer's instructions and Section 7.2.6.7.

7.2.6.7.3.4 Squeeze bottle drinking water treatment units

Products meeting the definition for squeeze drawn drinking water treatment unit shall be evaluated using the method specified in Annex G.

Two systems shall be conditioned in accordance with the manufacturer's instructions and Section 7.2.6.7.

7.2.6.8 Method – POE – Full scale units

Two systems shall be conditioned in accordance with the manufacturer’s instructions using the PFOA / PFOS reduction water specified in Section 7.2.6.5 with the test contaminant present. The conditioning volume shall be excluded from the volume measured as the influent challenge volume for capacity and sample point determination. The systems shall be tested using the influent challenge water (Section 7.2.6.5) at the rated service flow at an initial dynamic pressure of 410 ± 20 kPa (60 ± 3 psi). The pressure shall not be readjusted although the system may experience some change in dynamic pressure. The flow rate shall be controlled to the rated service flow or the maximum flow rate achievable through the entire test, but if the flow rate cannot be maintained at greater than 25% of the rated service flow, the test shall be terminated. The operating cycle specified in Section 7.2.6.6 shall be used.

7.2.6.9 Sampling

The effluent of the test system shall be sampled after a minimum of one bed volume has passed through the column or half of the cycle “on” time has passed, whichever is greater.
7.2.6.9.2 PFOA and PFOS

For systems with performance-indication devices, during the "on" portion of the cycle, influent and effluent samples shall be collected for PFOA and PFOS analysis at the start of the test (after the passage of 10 unit volumes) and at 25%, 50%, 75%, 100%, and 120% of the estimated capacity. For systems without performance indication device, during the "on" portion of the cycle, influent and effluent samples shall be collected for PFOA and PFOS analysis at the start of the test (after the passage of 10 unit volumes) and at 50%, 100%, 150%, 180% and 200% of the estimated capacity.

Rationale: Revision 2 – Revised for clarity per R. Herman’s comment on r1 ballot.