Summary of Substantive Changes
between the 2012 and the 2013 editions of
NSF 42 "Drinking Water Treatment Units - Aesthetic Effects"

Presented to the IAPMO Standards Review Committee on June 9, 2014

General: The change to this standard will likely have an impact on currently listed products. The significant changes are:

- Expanded and revised the acceptance criteria for materials in contact with drinking water (see Section 4.1.3 and Tables 1, 2 and 3).
- Added requirements for the reporting of data (see Section 4.1.4).
- Added additional requirements for the analytical methods used to evaluate materials (see Section 4.2.1).
- Added additional requirements for gas chromatography/mass spectroscopy analysis (see Section 4.3).
- Revised extraction testing parameters and added additional contaminates for evaluation (see Tables 1, 2 and 3).
- Added requirements for materials in contact with the user's mouth (see Section 4.4).
- Added a structural integrity test for personal hand-held devices (see Section 5.4).
- Included requirements for the evaluation of hand held drinking water treatment units (see Section 7 and Annexes D and E).
- Revised procedure for handling premature filter plugging during testing (see Section 7 and Annex F).
- Added a marking requirement for hand-held drinking water treatment units (see Section 8.1).

Section 4.1.3, Acceptance criteria: Expanded and revised the acceptance criteria for materials in contact with drinking water as follows:

4.1.3.2 TIC identification and quantitation shall be conducted in accordance with section 4.3.1.2. Additional TIC identification and quantitation should be verified using a standard of the compound in question or an alternate approved analytical method. Additional TIC identification and quantitation is recommended when the contaminant is a health risk or when the "Probability Based Matching" process in section 4.3.1 .2 is inconclusive. When possible, the product manufacturer should assist and support the testing laboratory in the identification of a standard for the compound and an appropriate analytical method, if applicable, so that confirmatory identification and quantification can be performed. If a standard and an adequate alternative analytical method are not available to verify the identification and quantitation of the compound, the TIC shall be evaluated according to section 4.3.1 .2.

NOTE: Manufacturers may not be privy to formulation information, so they may not be able to assist a testing laboratory to identify a standard for the compound that extracted. Refer to Section 4.3.1.2 when the manufacturer does not have material formulation information.

4.1.3.3 Unknown contaminants detected by GC/MS analysis for which identification is unable to be made after performing the steps in 4.3.1 shall be reported in accordance to 4.1.4.2.

~~*Note*~~ *4.1.3.4 The concentration of active agents or additives used in the drinking water treatment process shall be evaluated in the product water as specified in 6.10. The concentration of active agents or additives used in the drinking water treatment process shall not be evaluated during extraction testing.*

~~*4.1.3*~~*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 1, 2, and 3 and Annex A, D, and E of NSF/ANSI 61.*

Section 4.1.4, Data reporting: Added requirements for the reporting of data as follows:
4.1.4.1 All contaminants identified and detected at or above the reporting limit shall be reported with the identification of the contaminant, the concentration, and whether it exceeds the acceptance criteria as required in Section 4.1.3. Contaminants detected below the reporting limit shall be reported to the manufacturer as less than the reporting lim it's value.
Example: If the lab's reporting limit is 1.0 mg/L for analyte "X" and the concentration was detected at 0.5 mg/L, the lab shall report less than 1.0 mg/Lor <1 .0 mg/L.

4.1.4.2 If the extractable contaminant cannot be identified following the procedures in 4.3.1 the laboratory shall supply the manufacturer with the approximate molecular weight along with any additional information about the compound.

Section 4.2.1, Analytical methods: Added additional requirements for the analytical methods used to evaluate materials as follows:
4.2.1.1 The laboratory shall validate the analytical method to the reporting limit (RL) concentration following the procedures established in the referenced method. The laboratory shall evaluate its method detection limit (MDL) in reference to the RL. In all cases, the RL shall be equal or greater than the MDL. When preparing its calibration standards, the lowest calibration point shall be at or less than the RL.

4.2.1.2 For extracted techniques (e.g., USEPA Method 625), regarding the concentration of the lowest calibration point, the laboratory shall apply the concentration factor due to sample preparation. For example, a sample one liter extracted, and the extract concentrated to 1.0 milliliter, for a factor of 1000, if the RL is set to 0.2 ug/L, then the lowest calibration point would be at or less than 0.2 mg/L.

NOTE - See Annex C for additional information on GC/MS and other alternative methods.

Section 4.3, Gas chromatography/mass spectroscopy (GC/MS) analysis: Added additional requirements for gas chromatography/mass spectroscopy analysis as follows:
4.3.1 General requirements for GC/MS analysis
When determined to be required following a product-specific formulation review, USEPA Analytical Methods for semi-volatiles and volatiles that include mass spectral libraries shall be performed on

products or components, and shall include full-range mass spectral libraries to monitor for non-target compounds.

Testing for semi-volatiles (e.g. USEPA Method 625 or 528 or 525.2) and volatiles (e.g. USEPA Method 524.2 or 524.3) shall be conducted using the required target compounds in Tables 2 and 3 and the laboratory's RL shall be no greater than the RL's listed in Tables 2 and 3.

4.3.1.1 Target compounds shall be validated in accordance with the requirements of the referenced method. USEPA Methods 524.2 and 625 have specific validation requirements including precision and accuracy requirements as well as demonstration of sensitivity (Method Detection Limit Study or MDL).

For USEPA Method 625, the minimum instrument operation requirements for GC/MS analysis shall be in accordance with ~~USEPAMethod 625 with the addition of~~ those protocols as defined by the method with the following modifications:

-To guard against significant drift from an i nitial instrument calibration to subsequent instrument batches, the average chromatographic peak area of each internal standard in the calibration curve shall be determined. The chromatographic peak area of each internal standard in the continuing calibration shall be greater than 50% and not more than 200% of that average;

-Due to the number of characteristics of the analytes associated with method 625, while a continuing calibration check (CCC) is performed, concentrations of 10% of the target compounds for each analysis (e.g., base/neutral, base/neutral/acid, acid) shall be allowed to fall outside the range of 70% to 130% (outlier) of the true value. None of the concentrations shall be allowed to fall below 50% or above 200% of the true value. If a positive sample analyte result is identified for any outlier, a second CCC shall be performed. If the second CCC determines the sample analyte result no longer to be an outlier, the sample shall be reanalyzed. However, if the second CCC also determines the analyte to be an outlier, a new calibration curve shall be determined and the sample shall be reanalyzed.

~~-If commercially available mass spectral libraries are utilized, a minimum size of 100,000 compounds shall be required.~~

NOTE - At the laboratory's discretion, a calibration may be performed specifically for the compound in question, with the reporting of its data from this second calibration. It should be understood, that if the laboratory utilizes this approach (calibrating for the specific analyte) all method requirements as specified by 625 shall be achieved.

4.3.1.2 TICs are identified by comparison of the spectrum of the unknown to the mass-spectral reference library utilizing "Probability Based Matching" (as available from instrument manufacturers) as well as interpretation by the analyst. The laboratory shall report the TIC with the best match factor (the match factor shall not be reported) except in the following circumstances:
a) Due to the complex nature of GCMS interpretation and identification, when reviewing the list of possible matches for any particular TIC peak, the laboratory has the authority to assign the identification to a compound "hit" with a lower numeric match factor from the library search algorithm.
b) The laboratory may determine that none of the returned compounds by the automated search algorithm is a good match for the unknown peak. I n this case the compound is reported as a "Unknown."

c) The laboratory may utilize manual spectral interpretation to identify the peak in question.
d) All TICs detected at a concentration greater than or equal to 3.0 ppb shall be reported.
The library used during the analysis shall be NIST 2007 or most current version. Additional spectra libraries may be used to assist in the identification of unknown compounds. For TICs, the concentration is estimated by comparison of its total ion area response to the total ion area response of the nearest internal standard. For TIC's, a response factor of "1" (one) shall be utilized for the purposes of calculating the TICs estimated concentration.

NOTE - It should be understood that when utilizing mass-spectrometer library searches to identify unknown chromatographic peaks (sometimes called "TICs") that the concentration is estimated assuming that the response of the TIC is the same as the internal standard. However, for example, when analyzing for traditional semi volatile compounds by USEPA method 625, the range of response factors is typically 0.1 to 2. Because the response factor is used as a reciprocal, and assuming that the response for the TIC falls within the range of the compounds for which the system is typically calibrated, the true concentration for this TIC would range up to 1O times greater to one half the reported TIC concentration.

4.3.1.3 Unknown Compounds - contaminants detected by GC/MS analysis but are not identified and quantified against a known mass spectrum or standard shall be evaluated as follows:
a) The molecular weight shall be reported or, if no molecular ion is identifiable, a minimum value for the molecular weight (for example, if the highest mass ion for the TIC has a m/z of 143, then report MW >=143).
b) The chemical class information shall be reported if this determination is possible.
c) The laboratory shall report the presence of the common halogens chlorine and bromine utilizing their characteristic "M+2" patterns.
d) The product material formulation(s) shall be reviewed for potential identification of the unknown contaminant(s) as an ingredient or byproduct;
e) The manufacturer shall be notified and requested to provide supporting information that enables identification of the unknown contaminant(s);
f) Structure activity relationships (SAR) shall be utilized when sufficient structural identification of the unknown contaminant(s) can be made; and
g) Alternative methods of analysis that may identify the unknown contaminant(s) shall be considered, such as classifying the unknown into a chemical class.
Contaminants that are identified after performing one or more of the above steps shall be evaluated in accordance with 4.1.3:2 and 4.1.3.3. The product manufacturer, laboratory toxicologist and laboratory chemist shall assist the testing laboratory in the identification of a standard for the compound and an appropriate analytical method, if applicable, so that confirmatory identification and quantification can be performed when needed. Standard validation is needed when the identified compound is not reported in the formulation review conducted in 4.2

NOTE - Items "b" and "c" above may be automated utilizing software available from NIST with their mass-spectral database

4.3.1.4 Contaminants detected by GC/MS analysis for which no identification can be made after performing the above steps shall not be considered in the determination of product compliance to this Standard. When unknown contaminants are detected in the extractant water, the testing laboratory shall report the analytical results.

Section 4.4, Materials in contact with the user's mouth: Added requirements for materials in contact with the user's mouth as follows:
Materials not in contact with water but in contact with the user's mouth during normal use shall meet the requirements of NSF/ANSI Standard 51 for food zone materials.

Section 5.4, Structural integrity test methods: Added a structural integrity test for personal hand held devices as follows:
5.4.5 Personal Hand Held Devices
Personal hand held devices that do not meet the definition of a squeeze bottle shall be exempt from structural integrity testing but shall be watertight during all testing.

5.4.5.1 Cycle test - squeeze bottles
Structural integrity performance for squeeze bottles shall be evaluated by applying 20 ± 1 kg of force in 5 second intervals. The outlet of the bottle shall be plugged.
The following procedure shall be used for testing:
1) Use a water temperature of 20 + 3 °C (68 + 5 °F) throughout the test. Adjust the test water to a temperature at which condensation will not form on the surface of the test unit.
2) The test bottle shall be evaluated at the following fill volumes: 95%, 75%, 50%, and 25% of the total unit void volume. For each fill volume, fill the test bottle with water and plug the outlet.
3) Connect the test bottle to the mechanical hand apparatus shown in figure 2. The apparatus shall be positioned around the center of the test bottle unless an alternate location to grip the bottle is specified in the manufacturer's literature.
4) The volume (ml) per squeeze of the test bottle shall be measured to determine the number of squeezes that shall be applied to the bottle during the test (volume dispensed from a Yi full bottle during a 5 second squeeze with 20 ± 1 kg of force). The total number of squeezes shall be evenly divided among each fill volume, so that each fill volume is being run for 25% of the test. The test bottle shall be evaluated as follows:
a) For devices with replaceable cartridges, the test bottle shall be tested to 400% capacity of the cartridge life.
b) For sing le-use, disposable devices, the test bottle shall be tested to 200% capacity of the cartridge life.
5) The bottle shall be operated with 20 ± 1 kg of force applied by the mechanical hand for 5 ± .5 seconds. The force rise at the initiation of each cycle shall be 1.5 ± .5 second. Each squeeze shall be followed by a minimum 5 second rest period with <0.5 kg of force applied to the bottle. This operational cycle shall be performed for the required number of squeezes at each bottle fill volume.
6) The system shall be inspected for watertightness periodically throughout the test, prior to each change in fill volume, and at the end of the test.

Section 7, Elective performance claims - test methods: Added testing for hand-held drinking water treatment units and revised the procedure for handling premature filter plugging during testing in the following sections:

- *7.2 Bacteriological performance*
- *7.3 Chemical reduction testing*
- *7.3.2 Chloramine reduction testing*
- *7.3.3 Chlorine reduction testing*

- *7.3.4 Hydrogen sulfide and phenol reduction testing*
- *7.3.5 Iron and manganese reduction testing*
- *7.3.6 pH adjustment testing*
- *7.3.7 Zinc reduction testing*
- *7.4 Mechanical reduction testing*
- *7.5 Scale control testing*

Testing requirements added for hand held drinking water treatment units are as follows:
7.2.4.2.1 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 D.
Two units shall be conditioned in accordance with the manufacturer's instructions using the appropriate general test water specified in 7.2.3 with the test contaminant present.

7.2.4.2.2 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 E.
Two units shall be conditioned in accordance with the manufacturer's instructions using the appropriate general test water specified in 7.2.3 with the test contaminant present.

The procedure for handling premature filter plugging during testing is as follows:
7.3.7.4 ~~*Servicing of components*~~ *Premature filter plugging*
~~*If clogging occurs during testing, systems with separate mechanical filtration components shall have the mechanical filtration components replaced or serviced in accordance with the manufacturer's instructions in order to maintain manufacturer's rated service flow rate.*~~
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 test method are contained in Annex F sections F.1 and F.3.

Section 8.1, Installation, operation, and maintenance instruction: Included the following requirement for hand held drinking water treatment units:
-for products meeting the definition for personal hand held devices, a statement that these devices are for individual use only.

Revised the following tables:
Table 1 - Extraction testing parameters
Table 2 - ~~*Formulation dependent extraction testing parameters*~~ *Extraction testing parameters (Semi-Volatiles)*
Table ~~*4*~~*3 -* ~~*Non-specific extraction testing parameters*~~ *Extraction testing parameters (Volatiles)*
Table ~~*3*~~*4 - Materials listed in U. S. Code of Federal Regulations*

Added the following normative Annexes:
Annex D, Test method for evaluating mouth drawn water treatment units
Annex E, Test method for evaluating squeeze bottle drinking water treatment units
Annex F, Methods and procedures to minimize premature filter plugging