Summary of Substantive Changes
between the 2016 with Addendum 1 and 2017 editions of
NSF/ANSI 61, "Drinking Water System Components - Health Effects"

Presented to the IAPMO Standards Review Committee on February 12, 2018

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

- Added exceptions for concrete aggregate to the established minimum test batteries and included concrete aggregate to the material-specific analysis requirements (see Section 3.3.2 and Table 3.1)
- Changed the evaluation of lead content from an optional verification to a requirement for compliance with NSF 61 (see Section 3.6).
- Clarified to include an allowance for test assembly end closures that allow water to contact the typically wetted surfaces of test samples (see Section 4.5.2, and Annex B).
- Added a requirement for concrete aggregate sampling (see Section 5.1).
- Clarified that the interior surfaces of tank covers are wetted surfaces and added a new equation for the normalized concentration of each contaminant for concrete aggregate (see Section 5.5 and 5.7).
- Added additional substances and updated several pass/fail values for the drinking water criteria (see Table D1).

Section 3.3.2, Established minimum test batteries: Added the following concrete materials to the exceptions for material specific testing:

3.3.2 Established minimum test batteries

The materials listed in Table 3.1 or Table 3.2 shall be tested for the indicated analyses and any formulation-dependent analyses identified during the formulation-dependent analyte selection. Products, components, or materials made exclusively from materials in Table 3.1 shall not require testing if:

— their diluted surface area-to-volume ratio in the application is less than or equal to 0.001 or 0.0001 for static or flowing conditions respectively, or

— the material is uncoated concrete for use in a water storage structure of 1.33 x 106 L (0.35 x 106 gal) or greater and any admixtures used have been evaluated to this standard and found compliant within the use levels in the concrete, or

— the material is uncoated concrete or for use in applications with a diluted surface area-to-volume ratio less than or equal to 0.8 in2/L or 0.08 in2/L for static or flowing conditions respectively, and any admixtures used have been evaluated to this standard and found compliant within the use levels in the concrete, or

NOTE — The addition of the criteria for concrete water storage structures is in recognition of the diminishing value of investigations on those with high volumes (low surface area-to-volume ratios) where admixtures have separately been verified as compliant with this standard and the water storage structure is separately monitored for regulated contaminants including radionuclides.

— the material is in a high flow device and used exclusively at public water treatment facilities. For the purposes of this section, high flow devices are limited to chemical feeders, disinfection generators (e.g. chlorine dioxide, hypochlorite, ozone and ultraviolet), electrodialysis technologies, microfiltration technologies, nanofiltration technologies, reverse osmosis and ultrafiltration technologies.

Table 3.1, Material-specific analysis: Added concrete aggregate as follows:

Material type	Required analyses
….	
Chrome/nickel plating	regulated metals[2], nickel
Concrete[16]	regulated metals[2]
Concrete aggregate[16]	*Regulated metals[2], radionuclides*
Copper	regulated metals[2]
….	

[15] The testing may be waived for a specific analyte, where formulation information indicates that it is not present.

[16] Concrete aggregate sampling is required only if the method for testing for individual concrete components is used. Aggregate sampling is not required if concrete cylinders are tested for the constituents in Portland and hydraulic cements.

Section 3.6, Lead content of products: Changed the evaluation of lead content from an optional verification to a requirement for compliance with NSF 61 as follows:

3.6 ~~Weighted average l~~Lead content of products

~~Products being evaluated for weighted average lead content shall be~~ With the exception of those exempted in the Safe Drinking Water Act of the United States, the wetted surfaces of products shall have a weighted average lead content less than or equal to 0.25 percent when evaluated in accordance with NSF/ANSI 372 – Drinking water system components – lead content. For the purpose of this section, product shall refer to anything individually evaluated for compliance under the standard, including materials and components. Solders and fluxes shall have a lead content no more than 0.2 percent.

Section 4.5.2, Preparation of test samples: Clarified to include an allowance for test assembly end closures that allow water to contact the typically wetted surfaces of test samples as follows

4.5.2 Preparation of test samples

4.5.2.1 To the extent possible, test samples shall be prepared 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 intended to be used in the field. When the use of test assemblies is required, they shall be constructed in a manner as to not cover an otherwise wetted surface. Test assembly end closures that marginally increase the volume of the test assembly beyond the volume at which the product is intended to be used in the field may be used. Components and materials added to the test sample to form the test assembly shall be present in the control sample.

Section 5, Barrier materials:

Section 5.1, Scope: Added a requirement for concrete aggregate sampling as follows:
The requirements of this section apply to products and materials intended to form a barrier providing containment of drinking water or to prevent drinking water contact with another surface. The products and materials that are covered include, but are not limited to: coatings and paints applied to fittings, pipes, mechanical devices and non residential storage tanks including the interior surface of tank covers; linings, liners, bladders and diaphragms; and constituents of concrete and cement-mortar (e.g., Portland and blended hydraulic cements, admixtures, sealers, and mold release agents). These products and materials can be field-applied, factory-applied, precast, or cast in place.

Concrete aggregate sampling is required only if the method for testing for individual concrete components is used. Aggregate sampling is not required if concrete cylinders are tested for the constituents in Portland and hydraulic cements.

Section 5.5, Extraction procedures: Added a reference to a new equation in Section 5.7.2 for normalized concentration of each contaminant for concrete aggregate as follows:
5.5.2 Preparation of test samples
5.5.2.1 *~~In all cases t~~Test samples shall be prepared such that a minimum surface area-to-volume ratio of 50 cm^2/L (29 in^2/gal) is achieved during the exposure, and so that the entire surface to be exposed is covered by exposure water. For concrete aggregate evaluations, the media shall be tested at a laboratory evaluation ratio no less than the field use level calculated in accordance with 5.7.2. Samples shall be rinsed with cold tap water and then in reagent water, meeting the requirements of Annex B, section B.9.2.1 unless manufacturer's instructions direct otherwise.*

5.7 Normalization: Clarified that the interior surfaces of tank covers are wetted surfaces and added a new equation for the normalized concentration of each contaminant for concrete aggregate:
5.7.1 Normalization for tanks/storage vessels
5.7.1.1 The following equation shall be used to calculate the normalized concentration of each contaminant for tanks or other storage vessels: contaminant for tanks or other storage vessels:

$$\text{Normalized contaminant concentration} = \text{laboratory contaminant concentration} \times \frac{SA_F}{V_F} \times \frac{V_L}{SA_L} \times \text{24 h hours of exposure}$$

where:

SA_F/V_F = *Surface area to volume ratio for the specified tank capacity, as defined in Table 5.6*
SA_L = *Surface area exposed in the laboratory*
V_L = *Volume of extraction water used in the laboratory*

When the length of the exposure being normalized is other than 24 h in length, the normalized value shall be adjusted to reflect a 24-h exposure.

Products used as barriers for tanks or storage vessels shall use the surface area-to-volume ratios shown in Table 5.6. Surface area-to-volume ratios for products used as barriers in tanks or storage vessels with a capacity other than those shown in Table 5.6 shall be determined on a case-by-case basis, as described in 5.7.1.2.

NOTE — Due to the potential for condensation to form on the interior surfaces of water storage tank and reservoir covers, which may leach contaminants and then drip into the water tank or reservoir, the interior surface of these covers shall be considered water contact materials. Table 5.6 and 5.7.1.2 thus include the surface area of the roof (ceiling) in the calculation of the water contact surface area to volume ratio of the tank or storage vessel

5.7.1.2 Calculation of the surface area-to-volume ratio for tanks or storage vessels
The following assumptions shall be used in determining the surface area-to-volume ratio for each nominal tank capacity:

— the tank has a smooth interior surface;
— the tank is cylindrical in shape;
— the tank is installed in a vertical position; and
— the roof (ceiling) of the tank is in contact with drinking water.

The following equation shall be used to calculate the surface area-to-volume ratio for tanks or storage vessels of capacities that do not appear in Table 5.4:

Volume in gallons:
surface area to volume ratio (in2/L) = 119.5 x (0.1702 x Y/X)0.66 x (X + 1/2) Y
where:
X = the ~~length~~ height/diameter ratio of the tank or storage vessel
Y = the volume (in gallons) of the tank or storage vessel

5.7.2 Normalization for ~~all other end uses~~ concrete aggregate

~~*For barrier materials that have end uses other than tanks or storage vessels, normalization shall be performed using the following equation, or to the normalization requirements of the section of this Standard which addresses the specific end use of the barrier material.*~~

The following equation shall be used to calculate the normalized concentration of each contaminant for concrete aggregate evaluations. Table 5.8 provides examples of calculated aggregate field use assumptions for several reservoir capacities.

$$\text{Normalized contaminant concentration} = \text{laboratory contaminant concentration} \times \frac{\text{aggregate field use assumption (g/L)}}{\text{laboratory evaluation ratio (g/L)}}$$

where:

$$\text{aggregate field use assumption (g/L)} = \text{ratio of concrete structure's wetted surface area to structure's volume (in 2/L)} \times \text{correlation of concrete volume to evaluated concrete surface area (in3/in2)} \times \text{aggregate mass per volume of concrete (g/in3)}$$

— Ratio of concrete structure's wetted surface area to structure's volume: The surface area-to volume ratios shown in Table 5.6 shall be used. Surface area-to-volume ratios for products used as barriers in tanks or storage vessels with a capacity other than those shown in Table 5.6 shall be determined on a case-by-case basis, as described in 5.7.1.2.

— Correlation of concrete volume to evaluated concrete surface area: 0.1 (in^3/in^2)

NOTE —The 0.1 in^3/in^2 value accounts for 100% of the aggregate exposed within the top 0.1 inch of concrete.

— aggregate mass per volume of concrete (g/in^3): Concrete mix design specific value.

Table 5.8 – Example aggregate field use assumptions

Nominal reservoir capacity (gal)	***NSF/ANSI 61, Table 5.6 surface area-to-volume ratio (in^2/L)***	***Calculated field use 1 assumption for mass aggregate per reservoir volume (g/L)***
1,000	*5.7*	*18*
10,000	*2.6*	*8.2*
100,000	*1.23*	*3.9*
250,000	*0.90*	*2.8*
[1]Based on example concrete with a designed weight of 150 lbs/ft^3 and an aggregate content representing 80% of that weight.		

Annex B, Product/material evaluation: Clarified to include an allowance for test assembly end closures that allow water to contact the typically wetted surfaces of test samples and changed the term “method blank” to “control sample” as follows:

B.2.8.1 ~~Method blanks~~ Control Samples

~~Method blanks~~ Exposure controls shall be prepared using the same ~~reagent~~ extraction water and in the same manner as product samples, but no product shall be added. Any uncoated substrate, ~~as applicable,~~ or other non-product components or materials of test assemblies shall be included. ~~Method blanks~~ Exposure controls shall be processed with all samples. The control samples shall be evaluated for all target analysis as the product samples. The results for the control samples analysis shall be subtracted from the results for the corresponding product sample analysis prior to normalization.

~~B.2.8.2 Method standards~~

~~Method standards shall be prepared along with all samples. Method standards are prepared in the same manner as method blanks, except that a known amount of the expected contaminant is added.~~

B.4.2 Sample preparation

Prior to conditioning and exposure, the samples shall be washed as described in Annex B, section B.2.4, unless the manufacturer's instructions direct otherwise. When required, the device shall be properly prepared per the manufacturer's recommendations.

***B.4.2.1** To the extent possible, test samples shall be prepared 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 intended to be used in the field. When the use of test assemblies is required, they shall be constructed in a manner as to not cover an otherwise wetted surface. Test assembly end closures that marginally increase the volume of the test assembly beyond the volume at which the product is intended to be used in the field may be used. Components and materials added to the test sample to form the test assembly shall be present in the control sample.*

***B.4.2.2** Metal and metal-containing product samples that are connected to pipe or tubing products under normal installation conditions shall be attached to lengths of pipe or tubing of the appropriate nominal diameter for the extraction test. ~~Plugs shall not be used in a manner that cover an otherwise wetted surface~~. When preparing a test sample in this manner, the assembly shall be designed such that the volume of the test sample plus the attached pipe or tubing is equal to the VF(static) for the product when the unit volume exceeds 1 liter. If the unit volume of the product being tested is less than 1 liter, the attached pipe volume combined with the product volume shall be equal to 1 L (± 5%) for the test sample. ~~The pipe or tubing material used in the assembly shall also be present in the method blank as required in Annex B, section B.2.8.1~~*

When the test sample contains internal threaded outlets, 75% of the threaded surface area(s) shall be covered by insertion of a threaded component of the appropriate diameter to produce a watertight seal. The threaded component shall also be present in the ~~method blank (see Annex B, section B.2.8.1).~~ control sample. Assemblies should be made of relatively inert materials and designed in a manner that eliminates or minimizes the occurrence of the same contaminant being present in the control and the test sample whenever possible. The control shall be made of the same material and exposed at the same surface area to volume ratio as the test sample. Threaded products shall be assembled by threading a pipe material which has been cut to an appropriate length equal to the VF(static). For products being tested that are less than 1 liter, the attached pipe volume combined with the product volume shall be equal to 1 L (± 5%) for the test sample. When preparing a product which has a soldered joint, the control shall be prepared using the same solder and extension material as the test sample. Products with quick connect fitting ends are most easily assembled by attaching polyethylene tubing, cut to the appropriate length and diameter using the same polyethylene tubing for the control.

Non-metal product samples that are connected to pipe or tubing products under normal installation conditions may be prepared as described for metal and metal-containing product samples. Non-metal containing products may also be prepared so that the laboratory surface area-to-volume ratio is equal to (± 5%) or greater than the surface area-to-volume ratio at which the product is intended to be used in the field.
Components (e.g., gaskets or "O" rings) of a mechanical device that are wetted under normal operating pressures but are not wetted under the conditions of a static exposure shall be tested separately from the assembly in an "in vessel" exposure. The laboratory surface area for the "in vessel" exposure shall be, at a minimum, ten-fold greater than the wetted surface area of the product to ensure that the reporting level of the analysis, when normalized, is equal to or less than the pass/fail criteria for all contaminants. The result of the "in vessel" exposure shall then be normalized to the applicable surface area of the product.

B.5 Mechanical plumbing devices

~~B.5.4.3 Method blanks~~

~~Method blanks are prepared using the same reagents and in the same manner as samples, but no sample is added. An uncoated substrate, as applicable, shall be included. Method blanks shall be processed with all samples.~~

~~B.5.4.4 Method standards~~

~~Method standards shall be prepared along with all samples. Method standards are prepared in the same manner as method blanks, except a known amount of the expected contaminants is added.~~

Annex D, Table D1 – NSF/ANSI 61 drinking water criteria; Added additional substances and updated several pass/fail values for the drinking water criteria.

Annex H (informative), Water quality criteria considerations for piping materials in contact with drinking water: This informative annex was added to the standard.