MEMORANDUM

TO: Joint Committee on Drinking Water Additives – System Components

FROM: France Lemieux, Chairperson

DATE: January 16, 2017

SUBJECT: Proposed revision to NSF/ANSI 61 – *Drinking water system components- Health effects* (61i127)

Draft 2 of NSF/ANSI 61 issue 127, is being forwarded by the DWA Task Group on Concrete Aggregate to the Joint Committee for balloting. Please review the changes proposed to this standard and **submit your ballot by February 7, 2017** via the NSF Online Workspace.

Please note – extensive revisions are being proposed from the original ballot (r1), and therefore a new vote tally will be determined for draft 2. Your last recorded vote from the previous ballot draft revision will not be carried forward. Please respond affirmative, negative or abstain to the content of this revision. Comments on the prior revision will not be carried forward.

Purpose

The proposed revision will add exposure and normalization criteria specific to concrete aggregate under section 5 and will add concrete aggregate to the material-specific analyses requirements under Table 3.1 of NSF/ANSI 61.

Revision 2 also includes the following:

- clarification that concrete aggregate testing is optional;
- the establishment of surface area to volume ratio for concrete; and
- the addition of criteria identifying when the testing of concrete isn't required under NSF/ANSI 61.

Background

At the 2014 annual DWA-SC JC meeting on December 4, 2014, the recommendation was made to add criteria to evaluate concrete aggregate on its own rather than the need for testing in the form of concrete cylinders. The proposed method will allow the option for direct measurement of the leachates in the loose media and normalization of the surface area to volume ratio for differing tank sizes. This has been suggested as viable option that provides a simple solution but one that is still conservative and that will eliminate the concern that other components may contribute to contamination.

Upon balloting in 2015, a number of comments were received, including a request to clarify that concrete aggregate testing is optional, the establishment of surface area to volume ratio for concrete, and the addition of criteria identifying when the testing of concrete isn't required under NSF/ANSI 61. The task group has addressed these comments in this revised proposal for ballot. The criteria established was based on analysis of extraction results over a 5-year period on cement and concrete testing.

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Please see the attached meeting summary excerpts and the updated issue document submitted by the task group (DWA-61-2016-4) under the referenced items for additional information.

Public Health Impact

This revision will have no negative impact on public health.

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

Chairperson, Joint Committee
c/o Monica Leslie
Joint Committee Secretariat
NSF International
Tel: (734) 827-5643
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[Note – the changes are seen below using strikeout for removal of old text and gray highlights to show the suggested text. ONLY the highlighted text is within the scope of this ballot.]

NSF/ANSI Standard
for Drinking Water System Components – Health Effects

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3 General requirements

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3.3.2 Established minimum test batteries

The materials listed in Table 3.1 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 10^6 L (0.35 x 10^6 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 seprately been verified as compliant with this standard and the water storage structure is seperately monitored for regulated contamaminants including radionuclides.

Reason: Added based on analysis of extraction results over a 5-year period on cement and concrete testing.

– the material is in a high flow device exclusively used 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, reverse osmosis and ultrafiltration technologies.

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Table 3.1 – Material-specific analysis

Material type	Required analysis

Concrete[16]	regulated metals[2],
Concrete aggregate[16]	Regulated metals[2], radionuclides
Portland and hydraulic cements[16]	GC/MS[1], regulated metals[2], dioxins and furans, radionuclides, glycols and ethanolamines[12]

[2] antimony, arsenic, barium, beryllium, cadmium, chromium, copper, lead, mercury, selenium, thallium. Chromium shall be evaluated against the pass/fail criteria of chromium VI as a screening level. If the normalized result exceeds this criteria, the sample shall be tested according to the method described in Section B.7.3 and shall be evaluated against the pass/fail criteria listed in Table D1 for the tested product. Regardless of chromium species, the total chromium pass/fail criteria shall not be exceeded.

[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.

Reason: Added for clarity

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5 Barrier materials

5.1 Scope

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; 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.

Reason: Added for clarity

5.2 Definitions

5.2.1 admixture: A material other than water, aggregates, hydraulic cement, and fiber reinforcement used as an ingredient of concrete or mortar and added to the batch immediately before or during its mixing.

5.2.2 aggregate: Granular material, such as sand, gravel, or crushed stone used with a cementing medium to form hydraulic-cement concrete or mortar.

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5.5 Extraction procedures

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5.5.2 Preparation of test samples

5.5.2.1 ~~In all cases, test~~ 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.

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5.7 Normalization

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:

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

where:

SA_F/V_F = Surface area to volume ratio for the specified tank capacity, as defined in Table ~~5.4~~5.6

SA_L = Surface area exposed in the laboratory

V_L = Volume of extraction water used in the laboratory

Reason: Correction to table reference in existing standard

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.

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~~5.6:

Reason: Correction to table reference in existing standard

$$\text{surface area to volume ratio (in}^2\text{/L)} = 119.5 \times \frac{(0.1702 \times Y/X)^{0.66} \times (X + 1/2)}{Y}$$

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 concrete aggregate

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 assmptions 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:

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

- 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: ~~0.80~~ 0.1 (in3/in2)

  Note: ~~This value is based on the concrete test cylinder size normally used for testing (4" x 8").~~ The 0.1 in3/in2 value accounts for 100% of the aggregate exposed within the top 0.1 inch of concrete.

Reason: Review of literature found research reporting a water penetration depth in concrete to a depth of 0.91 inch when exposed under high pressure (0.75 MPa or 109 psi). Given the lower pressure of concrete water storage tanks (0.089 MPa at 30 feet depth) a proportionally lower value was selected for this criterion (0.91 x 0.089/0.75). This value also equates to 10% of the aggregate exposed in the top 1 inch of concrete surface.

- Aggregate mass per volume of concrete (g/in3): Concrete mix design specific value.

5.7.3~~2~~ Normalization for all other end uses

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5.7.~~3~~4 Over time exposure calculations.

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Table 5.6 – Surface area-to-volume ratios for tanks or storage vessels

Nominal capacity (gal)	Surface area (ft^2)[1]	Length/diameter ratio	Surface area-to-volume ratio (in^2/1 L)
5	5.3	5.0	40.4
10	8.4	5.0	32.0
25	15.5	5.0	23.6
50	22.0	3.0	16.8
75	28.9	3.0	14.6
100	35.0	3.0	13.3
200	55.1	2.9	10.5
300	71.3	2.7	9.0
400	85.8	2.6	8.2
500	99.0	2.5	7.5
600	110	2.3	7.0
700	121	2.2	6.6
800	132	2.1	6.3
900	141	1.9	5.9
1,000	150	1.8	5.7
1,500	196	1.8	5.0
2,000	238	1.8	4.5
3,000	312	1.8	4.0
4,000	378	1.8	3.6
5,000	438	1.8	3.3
6,000	495	1.8	3.1
7,000	548	1.8	3.0
8,000	600	1.8	2.9
9,000	648	1.8	2.7
10,000	696	1.8	2.6
20,000	1,104	1.8	2.1
30,000	1,447	1.8	1.8
40,000	1,753	1.8	1.7
50,000	2,034	1.8	1.6
60,000	2,297	1.8	1.5
70,000	2,545	1.8	1.4
80,000	2,782	1.8	1.32
90,000	3,010	1.8	1.27
100,000	3,228	1.8	1.23
200,000	5,125	1.8	0.97
250,000	5,946	1.8	0.90
500,000	9,439	1.8	0.72

Table 5.6 – Surface area-to-volume ratios for tanks or storage vessels

Nominal capacity (gal)	Surface area (ft^2)[1]	Length/diameter ratio	Surface area-to-volume ratio (in^2/1 L)
750,000	12,370	1.8	0.63
1,000,000	14,980	1.8	0.57
1,500,000	19,630	1.8	0.50
2,000,000	23,780	1.8	0.45
5,000,000	43,810	1.8	0.33
7,500,000	57,400	1.8	0.29
10,000,000	69,530	1.8	0.26

[1] Surface area calculations include the sides, floor, and roof (ceiling) of a tank.

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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	~~144~~18
10,000	2.6	~~65.5~~8.2
100,000	1.23	~~31.0~~3.9
~~1,000,000~~ 250,000	~~0.57~~0.90	~~14.4~~2.8
~~10,000,000~~	~~0.26~~	~~6.55~~

[1]Based on example concrete with a designed weight of 150 lbs/ft^3 and an aggregate content representing 80% of that weight.

Reason: ***Exposure and normalization criteria specific to concrete aggregate added per 2014 DWA-SC JC meeting discussion (December 4, 2014). This will eliminate concerns that other components may contribute to contamination.***