Drinking water system components — Lead content

The following has been drafted in response to the motion made at the last DWAJC meeting to consider establishment of a separate standard to house the lead content evaluation procedure adopted into NSF/ANSI 61 as Annex G. The items below were drawn upon to develop this first draft. The goal is to be an NSF/ANSI standard, but until it's adopted by ANSI it will just have the NSF designation.

1. The basic framework is as was as sent to DTSC last Fall. (procedural version)
2. Added in Annex G as adopted from NSF/ANS 61, 2008.
3. Added in lead content verification methodology as currently under round robin evaluation.
4. Added in solders and fluxes so it addresses lead content requirements for all drinking water products.
5. Added a definition section and populated with items from the verification method proposed. Also added a spot where a definition for "rigid insert" could be placed along with a recommendation.
6. Attached an "informative annex" to house recommendations for products recommended for inclusion and exclusion from these requirements.
7. Copied in most of the Foreword from Std 61, and added a paragraph about this standard.

The drafting of this into its' own standard does have the advantage of allowing each NSF Joint Committee to determine how to incorporate its requirements into their standards. For instance;

1. Under NSF/ANSI 61, the Drinking Water Additives Joint Committee could still establish this as an optional requirement under Annex G. The contents of the annex will change from containing the methodology to specifying requirements regarding compliance (which are optional at this point).
2. For the NSF/ANSI 14, their Joint Committee may want to consider making compliance mandatory for all potable water products as most either already comply or likely will by January 1, 2010.
3. The NSF Drinking Water Treatment Unit Joint Committee that oversees all of the POU and POE standards can determine how they should be applied and any unique issues that will arise (such as what to do with the media, RO membranes, etc).
4. The NSF Food Service Equipment Joint Committee that oversees NSF food service equipment standards can determine if and how they should be applied and any unique issues that will arise.

This also allows application to products falling outside the scope of NSF/ANSI 61 or exempted from evaluation without mandating compliance with NSF/ANSI 61.

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NSF International
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Contents

Foreword [1]

In response to a competitive request for proposals from the U. S. Environmental Protection Agency (USEPA), a Consortium led by NSF International (NSF) agreed to develop voluntary third-party consensus standards and a certification program for all direct and indirect drinking water additives. Other members of the Consortium include the American Water Works Association Research Foundation, the Association of State Drinking Water Administrators, the Conference of State Health and Environmental Managers, and the American Water Works Association. (COSHEM has since become inactive as an organization.) Each organization was represented on a steering committee with oversight responsibility for the administration of the cooperative agreement. The Steering Committee provides guidance on overall administration and management of the cooperative agreement. Currently, the member organizations remain active in an oversight role.

Two standards for additives products were developed. NSF/ANSI 60: – *Drinking water treatment chemicals — Health effects* covers many of the water treatment chemicals, also known as direct additives. NSF/ANSI 61: *Drinking water system components — Health effects*, covers all indirect additives products and materials. Testing to determine the potential of a product to impart taste and/or odor to drinking water is not included in that Standard.

NSF/ANSI 61 was developed to establish minimum requirements for the control of potential adverse human health effects from products that contact drinking water. It does not attempt to include product performance requirements that are currently addressed in other voluntary consensus standards established by such organizations as the American Water Works Association, the American Society for Testing and Materials, and the American National Standards Institute. Because this Standard complements the performance standards of these organizations, it is recommended that products also meet the appropriate performance requirements specified in the standards of such organizations.

NSF/ANSI 61, and subsequent product certification against it, has replaced the USEPA Additives Advisory Program for drinking water system components. USEPA terminated its advisory role in April 1990. For more information with regard to USEPA's actions, refer to the July 7, 1988 *Federal Register* (53FR25586).

This standard, NSF ___: *Drinking water system components – Lead Content* is the third in this series of standards overseen by the Drinking Water Additives Joint Committees and is intended to be used in with NSF/ANSI 61 for the purpose of minimizing lead extraction from drinking water products. NSF ___ can also be used with other drinking water product standards, or to demonstrate compliance with jurisdictional or contractural requirements with lead content restrictions on drinking water contact products.

This Standard and the accompanying text are intended for voluntary use by certifying organizations, utilities, regulatory agencies, and/or manufacturers as a basis of providing assurances that adequate health protection exists for covered products. Product certification issues, including frequency of testing and requirements for follow-up testing, evaluation, enforcement, and other policy issues, are not addressed by this Standard.

This Standard was developed by the NSF Joint Committee on Drinking Water Additives using the consensus process described by the American National Standards Institute.

Suggestions for improvement of this Standard are welcome. Comments should be sent to Chair, Joint Committee on Drinking Water Additives, c/o NSF International, Standards Department, P.O. Box 130140, Ann Arbor, Michigan 48113-0140, USA.

[1] The information contained in this Foreword is not part of this Standard and has not been processed in accordance with ANSI's requirements for an ANS. Therefore, this Foreword may contain material that has not been subjected to public review or a consensus process. In addition, it does not contain requirements necessary for conformance to the Standard.

NSF Standard
for Drinking Water Additives —

Drinking water system components – Lead content

1 Purpose, scope, and normative references

1.1 Purpose

This standard establishes a uniform set of procedures for the determination of the weighted average lead content of products, materials, and components that convey or dispense water for human consumption through drinking or cooking.

1.2 Scope

The procedures in this standard can be applied to determine the weighted average lead content of any product, material, and component that conveys or dispenses water for human consumption through drinking or cooking. To facilitate a uniform application of this standard, a recommendation for product coverage is provided in annex A.

1.3 Normative references

The following documents contain procedures referenced in these procedures.

ASTM E255-07. Standard practice for sampling chemical copper and copper alloys for the determination of chemical composition.

ASTM E478-03. Standard test methods for chemical analysis of copper alloys

ASTM E29-02. *Standard Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications*[5]

1.4 Significant figures

For determining conformance with the specifications in this standard, the Rounding Method in ASTM E29 *Standard Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications* shall be used.

2 Definitions

2.1 method detection limit (MDL): As defined in 40 CFR Part 136, Appendix B, the minimum concentration of a substance that can be measured and reported with 99% confidence that the substance concentration is greater than zero. The MDL is determined from analysis of a minimum of seven aliquots of standard (known quantity of analyte in reagent matrix) at concentrations that are in the range of the estimated detection limit.

2.2 method validation: Verification of an analytical procedure performed by determining the method detection limit.

2.3 **reporting limit (RL):** The lowest concentration of analyte that can be reliably reported.

2.4 **rigid liner:** [Definition needed. How about…: *A component contained inside an otherwise wetted surface, sealed with a permanent barrier*. - Pete]

3 General requirements

Solders and fluxes shall have a lead content less than or equal to 0.2%. All other products shall have a lead content less than or equal to 0.25% as determined through sections 3.1 and 3.2.

3.1 Single component products

For single component products covered by this requirement (e.g. pipe and fittings), the lead content of the component material must be less than or equal to 0.25%.

3.2 Multi-component products

For products that are composed of more than one wetted component, the product must be made of materials that, taken together as individual whole products, have a weighted, wetted surface area that meets the 0.25% lead content limitation.

3.3 Lead verification analysis

Product testing is performed to assure the lead content is less or equal to that required in Sections 3.1 and 3.2. If the lead content of all wetted components is less than or equal to 0.25%, then no additional information is required. If the lead content of any component in a multi-component product exceeds 0.25%, then the calulation of the products weighted average lead content is to be performed as required in Section 4. The calculation requires that the material specification for lead content and wetted surface area for each component be known. The results of the lead verification analysis is then compared with the lead content of the component used in the weighted average lead calculation to determin compliance.

4 Calculation of weighted average lead content

4.1 Product Information and formulation requirements

The following information shall be established to determine the lead content specification and wetted surface area of each component of the product to be evaluated:

- the intended end use of the product (drinking and/or cooking);
- a list of all of components and materials and their corresponding surface areas that come into direct contact with water;

  NOTE – For internal threaded products, the wetted surface area shall include 25% of the threaded area(s).
- the lead content range of each material as specified by reference to a national or international standardized material specification (e.g. UNS copper alloy specification). If the material is not formulated to a national or international standardized specification, the manufacturers material specification shall be used.

4.2 Lead content of water contact surfaces

The lead content of the material specification used to produce wetted components shall be used to determine compliance with this standard. For lead contents of materials that are provided as a range, the maximum content of the range shall be used. When the lead content of individual components is to be verified, the procedures in Section 5 shall be followed.

For verification of individual sample compliance, lead content verification by testing can be used as an alternate to the maximum lead content of the material specification.

4.3 Use of Liners

When lead-bearing surfaces have been excluded from water contact by use of a rigid liner (e.g. plastic sleeve) sealed with a permanent barrier, the lead content of the liner shall be used.

4.4 Weighted average lead content calculation

The weighted average lead content of the wetted component of a product can be calculated using information that is provided as part of the manufacturer's submittal under section 3.1. All of the wetted surfaces are to be included in the weighted average lead content calculation, not just those surfaces that contain lead.

The following formulation shall be used when calculating the weighted average lead content of products:

$$WLC = \sum_{c=1}^{n} \left(LC_c \times \left[\frac{WSA_c}{WSA_t} \right] \right)$$

where;

WLC	=	weighted average lead content of product
LC_c	=	percentage lead content of component
WSA_c	=	wetted surface area of component
WSA_t	=	total wetted surface area of all components
n	=	number of wetted components in product

The results of the weighted average lead calculation shall be rounded to two decimal places, after calculating and summing the lead content of the individual components, but prior to determination of compliance with lead content requirements.

4.5 Example weighted average lead content calculation

The following is an example of how this weighted average lead content calculation is conducted on a faucet with 13 wetted components.

1. Identify those components of the faucet that water flows through and comes into contact with during the normal operation (wetted components).

2. Use the percentage of lead content within each component (supplied by the component manufacturer or supplier). Table 1, column 4 provides the lead content for each of the wetted components.

3. Determine the percent of total wetted surface area represented in each component using the part specifications.

    a. The *wetted surface area* of each component that comes into direct contact with water is required under 3.1 (to be provided by the manufacturer). Table 1, column 2 shows the *wetted surface area* of the subject faucet.

b. Add the areas of the wetted surface for each component together: this is the *total wetted surface area of the faucet*.

c. For each component, divide the *area of its wetted surface* by the *total wetted surface area of the faucet (times 100)*: this is the percent of total wetted surface area of each component (see Table 1, column 3).

$$\text{Percent wetted surface area} = \frac{\text{Wetted surface area of component}}{\text{Total wetted surface area}} \times 100$$

4. For each component, multiply the percentage of lead content by the percent of total wetted surface area of that component: this is the *contributing percent lead for each component* (Table 1, column 5).

$$\text{Contributing percent lead} = \frac{\text{Percent wetted surface area}}{100} \times \frac{\text{Percent lead content}}{100} \times 100$$

5. Calculate the weighted average lead content of the faucet by totaling the *contributing percent lead for the components that make up the wetted surface* of the faucet (Table 1, column 5). For the faucet to be in compliance with requirements, this total must be no more than 0.25%.

5 Lead content analysis

5.1 Analysis of copper alloys

5.1.1 Sampling of components

Sample from parts can be obtained by various methods, such as drilling, turning, sawing, or milling. Where possible, blend material from a minimum of three areas taken at random locations across the part, so as to obtain a sample that is representative of the properties of the entire component. Care should be taken not to include coating materials in the sampled material. With the exception of very large parts, test pieces should be drilled or sawed completely through in order to avoid over, or under, representation of the center portion.

Note: Additional guidance on sampling of copper alloys is provided in ASTM E255: *Standard practice for sampling Copper and Copper Alloys for the Determination of Chemical Composition*.

5.1.2 Sample preparation

Dissolve a minimum of 0.1 gram of sample in accordance with ASTM E 478 *Standard Test Methods for Chemical Analysis of Copper Alloys*. If an alternate sample preparation method is desired, method validation shall be completed, including the corresponding method of analysis, to a method detection limit of at least 0.01 % lead prior to the application of the method (see section 2.1).

5.1.3 Analysis

Analyses for metals shall be performed, except as otherwise provided for herein, in accordance with currently accepted U. S. Environmental Protection Agency (EPA) Methods (see 40 CFR Part 141 and Methods for Chemical Analysis of Water and Wastes, EPA 600/4-79-020). When no EPA method is provided, analyses shall be performed in accordance with *Standard Methods for the Examination of Water and Wastewater* (most current edition). If neither of these two documents addresses the required parameters and matrix, or if an alternate method is desired, method validation shall be completed prior to the application of the method (see section 2.1) to a method to a method detection limit of at least 0.01 % lead.

5.1.4 Quality control

Sample preparation and analysis procedures should be validated for the matrices to be tested. All the quality assurance/quality control protocols and other requirements specified in a method should be followed. If a specified protocol is not followed, a justification for the deviation should be explicitly addressed.

- Duplicate samples should be processed on a routine basis. A duplicate sample is a sample brought through the whole sample preparation and analytical process. A duplicate sample should be processed with each analytical batch or every 20 samples, whichever is the greater number.

5.2 Non-copper alloy components

The lead content shall be verified by a procedure established as appropriate for that material type.

5.3 Lead content screening

Screening of components by methods, such as XRF, OES Arc Spark, SEM/EDS are acceptable provided the instrument is calibrated to standard reference materials, and if a copper alloy, the procedures used for have been validated to Section B.7.8.1. At a minimum, the following should be taken into consideration with a screening method.

- Surfaced scanned should be clean, dry, and free of coating. Even slight overspray of coatings can significantly reduce lead content readings.
- Part finishes that remove surface lead, such as acid washes, will affect surface lead content readings and may effect the value of the screening analysis as a substitute for coring.
- Part size, shape, and condition of the surface can impact reading. Area analyzed should be no smaller than the instrument observation window. Shapes, such as curved surfaces, should be minimized.
- Lower lead content parts may require longer read times to produce accurate results.

[I did not change the content, but did change the order and section #s for 5.2 and 5.3 – Pete]

Table 1. **Example of weighted average lead content calculations.**

1	2	3	4	5
Component No.	**Wetted surface area[1] (total = 61.96 in^2)**	**% wetted surface area (total = 100%)**	**% lead content**	**Contributing % lead**
1	17.31	27.94	0.05	0.01
2	1.15	1.86	2.86	0.05
3	4.99	8.05	0.23	0.02
4	18.25	29.45	0.05	0.01
5	11.14	17.98	0	0.00
6	4.02	6.49	0	0.00
7	1.09	1.76	1.30	0.02
8	0.54	0.87	0	0.00
9	0.91	1.47	2.54	0.04
10	0.76	1.23	0	0.00
11	1.02	1.65	2.54	0.04
12	0.35	0.56	2.54	0.01
13	0.43	0.69	2.54	0.02
			Weighted average lead content =	**0.23% (in compliance)**

Note- Calculated data for each component in columns 3 and 5 show in this table with two decimal places to increase readability. When the calculation is performed, rounding to 2 decimal places is only performed on the final result.

Annex A
(informative)

Recommendation for Products evaluated to this standard

A.1 Scope

The procedures in this standard can be applied to determine the weighted average lead content of any product, material, and component that conveys or dispenses water for human consumption through drinking or cooking. To facilitate a uniform application of this standard, a recommendation for product coverage is provided in Annex A.

A.2 Products to specifically include in coverage

The following products are recommended for evaluation, as they are commonly intended to dispense water for human ingestion.

[I've added this here just as a place holder/starting point – Pete]

- All NSF/ANSI 61, Section 4 products with a nominal ID of < 4";

  Note – Scope of Section 4: The requirements in this section apply to pipes and pipe-related products and the water-contact materials associated with these products. Pipe-related products include, but are not limited to, the following items: fittings, couplings, mini-manifolds, flexible and rigid tubing, riser tubing, dip tubes, hoses, well casings, drop pipes and well screens.]

- All NSF/ANSI 61, Section 8 in-line devices;

  Note - Definition of in-line device from section 8.2.4**:** A device (used to measure or control the flow of water) installed on a service line or building distribution system downstream of the water main and upstream of endpoint devices.

- All NSF/ANSI 61, Section 9 end point devices; and

  Note – Scope of Section 9: This section covers mechanical plumbing devices, components, and materials that are typically installed within the last liter of the distribution system (endpoint devices) and are intended to dispense water for human ingestion. In-line devices are excluded from this section. Point-of-use and point-of-entry water treatment devices are excluded.

- Solders and fluxes.

A.3 Products to specifically exempted from coverage

The following products are recommended for exemption from evaluation, as they are not intended to dispense water for human ingestion.

- bath and shower valves, shower heads of all types, and Roman tub valves;
- all drains;
- backflow prevention devices which protect/separate potable water systems from industrial and laboratory water supplies (in-line backflow preventors that separate building potable water systems from water mains or provide integral protection for kitchen, bar or lavatory faucets are not exempt);

- flexible plumbing connectors and flexible risers not intended for potable water applications (i . e. washing machines, dishwashers, etc.);
- commercial kitchen pre-rinse assemblies that do not include an auxiliary spout or other outlet; and
- utility, laundry, laboratory, bidet, and shampoo fittings; faucets with a hose thread spout end or with a quick disconnect end; faucets that are self-closing, metering, or electronically activated; and nonlavatory hand wash stations.

[Note: Product exemptions are noted from the American National Standard for evaluation of the health effect of drinking water system components (NSF/ANSI 61) or are specifically excluded in the California Health and Safety Code Section 116875]

A.3.1 Additional products recommended to exempt from coverage

In addition, pipe and pipe fittings made of all plastic materials certified to meet potatable water end uses under NSF/ANSI 14 or certified to meet NSF/ANSI 61 as these products cannot contain lead bearing materials.