



EXPLAINING THE NEW STANDARDS AND REGULATIONS FOR LEAD FREE WATER METERS

The Health Effects of Lead

For more than a century, lead was commonly used in plumbing fixtures. In fact, the word plumbing and the symbol for lead, Pb, derive from the word Plumbum which is Latin for lead. Readily available, malleable and resistant to corrosion, lead and lead alloys were utilized in applications that included potable water. In more recent years, studies have begun to show the possible negative health effects of lead exposure; according to the USEPA, these effects can range from physical and mental developmental delays in some babies and young children, to kidney disease, stroke, and cancer in adults. As a result of these findings, government and industry have taken steps to limit the use of lead in manufactured products, especially those that come in contact with drinking water.

NSF/ANSI Standard 61, first adopted in October 1988, set performance requirements to limit the potential health effects of drinking water system components. Section 8 of NSF 61 deals specifically with mechanical devices, including water meters and other in-line devices used to measure or control the flow of water in distribution systems.

Performance Standard for Lead

At the time of this writing, NSF 61 standard is the law in 46 states. In 2007, an amendment, Annex F, was added to NSF/ANSI 61 modifying an existing performance standard for chemical extraction, to measure whether contaminants that leach out of the product or material into drinking water exceed acceptable levels.

As of July 1, 2012 (the end of a five-year implementation period established when the Annex F requirements were first adopted), the revised standard will continue to evaluate drinking water system components for health effects, but with more stringent requirements. Whereas the existing NSF/ANSI 61 Annex F performance

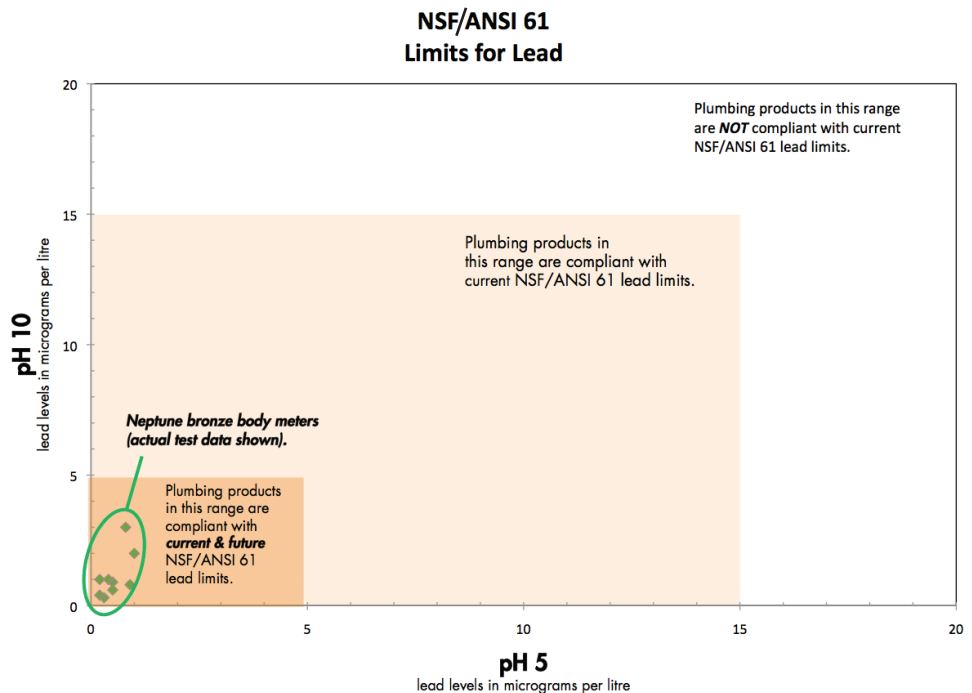


Figure 1: In determining the lead content of various products, NSF performs separate tests using water that is basic (i.e., pH = 10) and acidic (pH = 5). The results are plotted on an XY graph where the X (or horizontal) axis is the amount of lead leached from a product in a sample of acidic water and the Y (or vertical) axis is the amount of lead leached in a sample of basic water. Products that comply with the current NSF/ANSI 61 certification of 15 µg/L lead level requirements in both acidic and basic water fall inside the light orange box on the graph. The products that also comply with the new lead requirements per NSF/ANSI 61 Annex F of 5 µg/L lead fall inside the dark orange box. The actual test results for all of Neptune's bronze-body meters are plotted as green diamonds on the graph. Clearly, Neptune's meters not only meet the NSF/ANSI requirements of today but also the more stringent Annex F requirements that will be effective July 1, 2012.

µg/L

A microgram per liter or litre (µg/L) is a unit of measurement of mass concentration that shows how many micrograms of a certain substance are present in one litre of a usually liquid or gaseous mixture. Micro is the prefix for 1/1,000,000th so 1 **microgram** is 1/1,000,000th of a gram. For reference, there are 454 grams in a pound.

pH

In chemistry, pH is a measure of the acidity or basicity of an aqueous solution. Pure water is said to be neutral, with a pH close to 7.0 at 25 °C (77 °F). Solutions with a pH less than 7 are said to be acidic and solutions with a pH greater than 7 are basic or alkaline. The pH scale runs from 1 to 14.

standard for leached lead is currently 15 micrograms per liter, or $\mu\text{g/L}$, the total allowable concentration (TAC) under Annex F will be reduced by two-thirds to just $5 \mu\text{g/L}$.

With the exception of Neptune's products, many devices that are *currently* in compliance with NSF/ANSI 61 *will not be compliant* once the revisions go into effect. For instance, NSF has compared test results from various manufacturers' fittings, valves, and meters to the Annex F requirements for in-line devices and fittings under four inches in diameter. Results showed a large number of failures under the new screening (see the graph in Figure 1).

Content Standard for Lead

Going beyond a leaching standard, NSF International worked with the State of California to develop Annex G, a lead content standard that demonstrates compliance with California AB1953, which went into effect in January 2010 (at roughly the same time, Vermont enacted a similar law and Maryland is set to do the same in January 2012). Annex G deals not with leaching but with the amount of lead in products and fittings that come into contact with the water we drink.

Currently, Annex G reflects existing law in just a few states, but that will change in the next couple of years. On January 4, 2011, President Obama signed legislation revising the definition for "lead free" within the Safe Water Drinking Water Act (SDWA) as it pertains to "pipe, pipe fittings, plumbing fittings, and fixtures". The changes are due to go into effect 36 months after the date enacted, on January 4, 2014. Annex G, soon to be NSF 372, will demonstrate compliance to this federal law. Also in 2014, in order to maintain compliance to the SDWA, certification to NSF 61 will also require certification to NSF 372.

Neptune: Meeting New Lead Free Standards – Before They're Set

In January 2001 Neptune Technology Group, the only North American water meter manufacturer with its own bronze foundry, converted its production facilities to drop all the lead from its meters. While

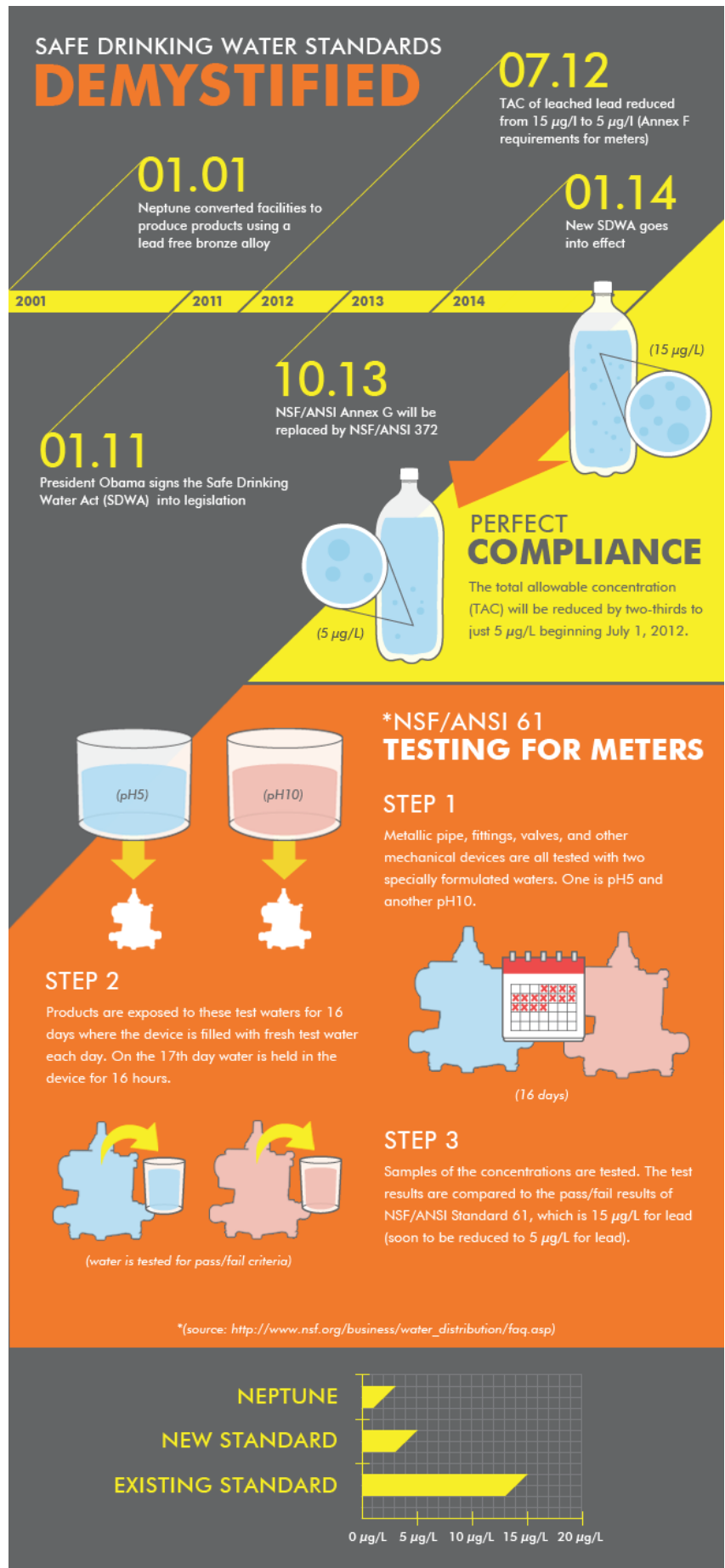


Figure 2: Annex G sets a standard to measure the weighted average lead content (WLC) of 0.25 percent or less, based on wetted surface area. The steps for testing are referenced in Figure 2. In October 2013, Annex G will be retired and replaced by the new NSF/ANSI Standard 372 – containing the same procedures used to calculate the weighted average lead content of 0.25 percent or less (see formula in Figure 3), but adding content verification testing. NSF/ANSI 372 will be a stand-alone content standard and will not require NSF/ANSI 61 certification.

NSF TEST PROCEDURE

First, samples are washed with cold tap water and then treated with reagent water to remove any dirt or debris accrued during shipping. The reagent water is developed through reverse osmosis, is distilled water, or is developed through a comparable filtration process. Next, the samples are conditioned by being filled with the extraction water (pH5 or pH10) at room temperature for 14 days. The water is changed at least 10 times during the 14 day conditioning period with a minimum period of 24 hours per exposure. After the conditioning period is completed, the product is ready for the exposure process (NSF/ANSI 61-2010a).

Exposure is the period in which the device is exposed to extraction water that will be used to analyze the amount of contaminants in the product. During exposure the specimen is filled with extraction water for two 24 hour periods. After each 24 hour period, the water is disposed of and the specimen is refilled. After the two 24 hour periods the specimen is exposed to extraction water for a 12 to 16 hour period. At the end of this final exposure period, the water is prepared for analysis and the final report is generated. The total exposure time is 17 days (NSF/ANSI 61-2010a).

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

Figure 3 : Formula to Calculate Weighted Average Lead Content

This formulation should be used when calculating the weighted average lead content of products. Where: WLC = weighted average lead content of a product; LC_c = maximum percentage lead content of a component; WSA_c = wetted surface area of a component; WSA_t = total wetted surface area of all components; n = number of wetted components in a product

Source: NSF International

much of the water meter industry still uses a less expensive, easier-to-machine bronze alloy containing seven percent lead – and defined as “81 brass” by the Copper Development Association – Neptune has used only lead free bronze in its water meters for over a decade.

The switch to lead free operations required a concerted effort not just to use a lead free bronze alloy to produce castings, but also required changes in machining operations and maintenance of test equipment. These changes were required to improve manufacturability and to prevent potential lead contamination throughout the process. Although a lead free alloy costs more than a leaded alloy, Neptune has continued to price its water meters competitively in the marketplace.

The benefits have been well worth the work and expense, because the lead free bronze-body meters Neptune produces are environmentally safer for customers, while the dedicated lead free facilities are healthier for its employees.

Further, in operating its own lead free foundry for over a decade, Neptune can maintain strict control over raw materials used, thus eliminating the chance for lead contamination of its products. Other manufacturers, using third-party foundries, may find this level of control very challenging. Many of the raw materials used in other meter bodies would not even be acceptable in Neptune’s foundry.

Of course, as lead free standards become law, many water meter manufacturers will have to scramble to either meet the requirements for lead free bronze or try to work around the requirements with unproven plastic or composite meters. The synthetics used in plastic or composite meters are often less durable than a lead free bronze alloy, and

are at particular risk for damage during installation. Often, when plastic or composite meter thread damage occurs, the entire meter must be thrown out. Another disadvantage utilities face when using plastic or composite meters is the interruption of a building’s electrical grounding, causing a hazard to occupants and utility personnel alike. Perhaps the most important advantage lead free bronze has over synthetics is its field-proven performance; as manufacturers rush to market with plastics or composites to avoid the new regulations for lead free bronze, utilities can wind up as the “guinea pigs” for untried new products.

Summary

In the effort to restrict the use of lead in water meters and other plumbing fixtures, standards for lead performance and content are becoming stricter, and state and federal regulations will reflect the changes. NSF/ANSI is changing the requirements for lead leaching (Standard 61 Annex F) in drinking water system components; and, when it goes into effect on January 4, 2014, the new Safe Drinking Water Act will mandate lead content (reflected in NSF 372).

Neptune Technology Group already met the requirements years ago – in the field, with tested and proven lead free bronze alloy meters. By anticipating that environmental standards for lead in drinking water would only get stricter over time, Neptune made an investment that has paid off for the environment, for its employees, and for its business. Moving forward with lead free bronze alloy products was both the right thing to do and the *smart* thing to do. 🌱

