Awwa Research Foundation
Advancing the Science of Water®

PARTNERSHIP PROJECT: THE PERFORMANCE OF NON-LEADED BRASS MATERIALS

FUNDING PARTNER: TZW (Germany)

Objective

This project would identify and prioritize key water quality characteristics and changes that might adversely impact the performance and leaching of non-leaded brass drinking water distribution system components over typical component lifetimes. This project would determine the water quality impacts on short- and long-term performance of non-leaded brass components, and determine the inorganic compounds (i.e., Se, Bi, Pb, Cu, and Sb) likely to be released from the non-leaded brass components under a variety of water quality conditions.

Recommended Budget:

AwwaRF Budget: $300,000 Total Budget: $450,000

Controversial Issues

Brass manufacturers may feel threatened about testing that may result in sub-optimal performance or poor leaching characteristics of their particular non-leaded brass product.

Staff Comments

While this particular project focuses on the performance and leaching potential of non-leaded brass materials, it only represents the first phase of a multi-year research effort that would also address the associated short-term and long-term operation and maintenance issues that may arise with the use of non-leaded brass components in the distribution system.

TZW leads the European Union initiative on corrosion and has done a great deal of work in this area.

The AwwaRF Project Manager should include an NSF International representative on the Project Advisory Committee.

Background

While there has been a great deal of effort to “get the lead out” of drinking water systems, some distribution system and plumbing components still contain minute amounts of lead that can leach

into finished drinking water. Lead can leach from brass materials such as meters, valves, and faucets, lead solder, and other metal materials that contain very small amounts of lead from the manufacturing process. In order to reduce public exposure to lead and to help utilities to comply with the Lead and Copper Rule, brass manufacturers are now offering new non-leaded brass alloys for use in distribution system components. These new non-leaded brasses (0.1 to 0.25 percent lead by weight) contain much less lead than older brass alloys that have been referred to as "lead-free" (typically 1.0 to 6.0 percent lead by weight). Although uniform regulatory requirements have not been set, water utilities throughout the U.S. have begun to specify non-leaded brass materials for their distribution systems. A 2000 study by Asarco, a major manufacturer of copper and other metal products, found that of 301 U.S. water utilities that responded to their survey, 20 percent had plans to replace their lead-containing brass components. A water utility survey conducted as a part of the report *Contribution of Service Line and Plumbing Fittings to Lead and Copper Rule Compliance Issues* (AwwaRF 91167) found that ten of 30 survey respondents had developed their own specifications for either lead-free or non- leaded brass components. Very recently, the California Assembly passed a bill (AB 1953) that will define "lead-free" for distribution system materials as not more than 0.25 percent lead content, effective July 1, 2010. This bill was supported by utilities such as East Bay MUD, LADWP, Contra Costa Water District, and San Francisco PUC. Drinking water utilities need to understand the performance of these non-leaded components in the field, as well as their potential to release inorganic compounds into finished drinking water.

The research specified by this RFP was identified as a high priority research need by the panel of water utility representatives, brass and component manufacturers, consultants, and industry representatives that participated in the 2006 AwwaRF project, *Performance and Metal Release of Non-Leaded Brass Meters, Components, and Fittings* (AwwaRF 91174). The objective of this project was to provide definition and structure to the issues surrounding the current state of knowledge, testing protocols, performance, regulatory environment, and research gaps pertaining to the widespread use of utility owned non-leaded brass materials.

Non-leaded brasses can contain a variety of metals that may be released into finished drinking water including bismuth, selenium, copper, tin, zinc, nickel, antimony, and lead. These new brass alloys often contain higher levels of these metals to obtain the desired properties achieved by lead in the traditional brass alloys. While there are currently no US drinking water regulations for bismuth and tin, the elements of selenium, lead, copper, nickel, and zinc are all known to cause negative health consequences and therefore have Maximum Contaminant Level Goals (MCLGs) and Maximum Contaminant Levels (MCLs) as regulated by the USEPA. The potential of non-leaded brasses to leach metals into potable water has not been examined adequately. More research needs to be done in order to gain a better understanding of the leaching propensity of these alloys.

The water industry has a limited understanding of the physical and structural characteristics of non-leaded alloys that impact performance (i.e., stress corrosion, cracking, erosion, dezincification, etc.). The importance of understanding both short-term and long-term field performance of components is critical to utilities, as they begin to specify and install non-leaded brass components in their systems.

Research Approach

For the purposes of this research project, “non-leaded brass” is defined as having 0.1 to 0.25 percent lead by weight.

The research would first identify key water quality characteristics and changes that can cause metal release in leaded, non-leaded, surface-coated, and chemically treated brass alloys. The research team should gather and evaluate historical information from utilities and other organizations, and then develop and implement a field data collection program that provides additional data on information that is lacking in the historical data.

The research should identify raw and treated water quality characteristics that are representative of North American drinking water systems (including surface and ground water sources and both raw and finished water), using existing data and information collected from state and federal government agencies, professional organizations, and utilities. The team should then develop and implement testing protocols that expose metal components to the identified water quality conditions. These should include water qualities typical of average conditions as well as conditions representing the worst exposure potential. The project should obtain representative non-leaded brass materials and test them for metal release under NSF/ANSI Standard 61, Sections 8 and 9 methods, as well as actual field conditions. The results should then be compared. The team should focus on a suite of contaminants likely to be released from non-leaded brasses, including Se, Bi, Pb, Cu, Sb, and others.

Finally, the team should determine the short-term and long-term performance effects on non-leaded brass materials under aggressive water quality conditions. The physical and structural performance characteristics should include stress corrosion, cracking, erosion, dezincification, etc. Results of the testing must be compared to a subset of actual short- and long-term performance behavior to establish the test method validity. The team should also propose and design a long-term performance testing protocol. Short-term performance is defined as obtaining information on leaching and performance of components using relatively immediate, short-term testing procedures, such as ANSI certification testing. Long-term performance is defined as understanding these characteristics (leaching, structural, and mechanical) over the long-term life of the components. Accelerated testing is one means towards evaluating long-term performance.

The final product of this research should provide drinking water utilities with a comprehensive review of leaching characteristics of non-leaded brass alloys under a variety of representative water quality conditions. The final report should include information on how to mitigate negative water quality impacts, including recommendations for further research in this area. The report should also provide a review of water quality impacts on short- and long-term performance of non-leaded brass components. The ultimate goal for short- term and long-term performance data gathering should be to develop overall performance criteria for non-leaded brass components based on health and serviceability to use in future specifications and procurements.