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United States Environmental Protection Agency
Lead and Copper Rule Workshop:
Lead in Plumbing Fittings and Fixtures
July 26 and July 27, 2005

Welcome, Background and Introductions

Dr. Scott Summers of the University of Colorado at Boulder began the United States Environmental Protection Agency (EPA) Workshop on Lead in Plumbing Fittings and Fixtures by welcoming the participants on the expert panel and the observers in the audience. He explained the purpose of the workshop was to gather information in a non-defensive manner from the expert participants on their issues, concerns, and suggestions with respect to lead in plumbing materials. All panel members would have the opportunity to present their issues, particularly during a session in which each member would take turns elucidating an issue, concern, or suggestion in 10 words or less, which would be recorded for further discussion in breakout group sessions. Observers would also be afforded the opportunity to express issues during an open forum. He then reviewed the agenda and introduced Eric Burneson of EPA's Office of Groundwater and Drinking Water.

Mr. Burneson also welcomed the participants and then introduced EPA staff, including Cynthia Dougherty, the Director of the Office of Groundwater and Drinking Water. Mr. Burneson then provided background and framework for the workshop. He described the requirements of the Safe Drinking Water Act with respect to lead in plumbing materials. In Section 1417(a)(1), SDWA prohibits the use of lead pipes, solder, and flux:

A. No person may use any pipe, any pipe or plumbing fitting or fixture, any solder, or any flux after June 19, 1986, in the installation or repair of
    i. Any public water system; or
    ii. Any plumbing in a residential or a non-residential facility providing water for human consumption, that is not lead free (within the meaning of lead free in subsection (d)).

In Section 1417 (d), the SDWA defines "Lead Free":

(1) When used with respect to solders and flux refers to solders and flux not containing more than 0.2 percent lead
(2) When used with respect to pipes and pipe fittings refers to pipes and pipe fittings containing not more than 8.0 percent lead
(3) When used with respect to plumbing fittings and fixtures, refers to plumbing fittings and fixtures in compliance with standards established in accordance with subsection (e).

In Section 1417 (e), SDWA describes the standard setting process that applies to plumbing fittings and fixtures.

(1) The Administrator shall provide accurate and timely technical information and assistance to qualified third-party certifiers in the development of voluntary standards and testing protocols for the leaching of lead from new plumbing fittings and fixtures…
(2) …If a voluntary standard is not established…[by August 1997]…the Administrator shall..[by August 1998] promulgate regulations setting a health-effects based performance standard establishing maximum leaching levels from new plumbing fittings and fixtures…

Mr. Burneson explained that, in 1997, the Agency determined that NSF 61, Section 9, satisfied the requirement for a voluntary standard. Thus, the obligation to issue regulations was not triggered.

Recently, EPA has undertaken a national review of the Lead and Copper Rule (LCR) and other issues related to lead in drinking water. The review is largely in response to the lead occurrence in District of Columbia (DC) drinking water. As part of this review, EPA has held a series of workshops examining specific issues. This workshop is the sixth in a series of such workshops. Previous workshops have dealt with the following topics:

- Simultaneous Compliance
- LCR Monitoring Protocols
- Public Education
- Lead Service Line Replacement
- Lead in Schools and Childcare Facilities

The topic of lead in plumbing materials was raised at several of the workshops. For example, in the Simultaneous Compliance workshop, it was suggested that plumbing codes be changed to provide true "lead-free" materials. In the Lead Service Line Replacement Workshop and Monitoring Protocols Workshop, research on the contribution of lead service lines and other components such as meters and plumbing to lead levels in tap water were identified as a need. The Lead Service Line Replacement Workshop also identified the needs for additional guidance on balancing the choice of plumbing materials with electrical codes and water quality. In the LCR Monitoring Protocols, guidance on validating plumbing materials during sampling site selection was identified as a need.

In March of 2005, EPA released its Drinking Water Lead Reduction Plan. This workshop is one element of that plan to exchange information on issues, constraints, and challenges associated with lead in plumbing materials. Other parts of the plan include updates to guidance documents on simultaneous compliance, especially with the new requirements of the upcoming Stage 2 Disinfectants/Disinfection Byproducts Rule, and on lead in schools. Regulatory changes are also part of the plan, including those to enhance LCR implementation, improve monitoring requirements, clarify sampling, refine the criteria for reduced monitoring, require notification to states of treatment changes, modify customer awareness provisions, and address the ability of utilities to test out lead service lines. Broader issues related to the LCR will be addressed as the Agency conducts its National Primary Drinking Water Rule review on its six-year cycle.

The goal of this workshop is to identify key issues associated with lead in plumbing materials and potential action items to address issues. This workshop is somewhat unique as the past workshops have focused on EPA guidance or regulatory changes. The Agency does not have direct oversight of this issue, so this workshop takes a broader perspective not limited only to EPA actions. The workshop participants are not expected to reach a consensus, but rather to provide EPA with a range of viewpoints on the critical issues and most appropriate strategies to further reduce lead in plumbing components throughout the United States.

Introduction of panel

Dr. Summers next had the panel members introduce themselves and provide a short description of the role of the organization they represent with respect to lead in plumbing. Attachment A contains the list of panelists and their organizations.

Standards and Test Protocols

Two speakers gave presentations relating to standards and test protocols.

ANSI/NSF Standard 61 Sections 8 and 9 presented by Clif McLellan, NSF

Clifton J. McLellan, the Director of Toxicology Services for NSF International, delivered a presentation on the NSF International (NSF) and American National Standards Institute (ANSI) Standard 61. He explained that NSF 61 is an American National Standard for evaluating the health effects of products used in drinking water applications. NSF 61 covers all products with drinking water contact from source to tap. The standard is concerned with all potential extractants, not just lead. The standard does not evaluate product performance beyond the leaching of lead and other substances.

NSF 61 was developed in response to a 1984 RFP from USEPA to establish minimum requirements for the control of potential adverse human health effects from products that contact drinking water. The NSF 61 development contract was awarded to a consortium led by NSF including the American Water Works Association (AWWA), the American Water Works Association Research Foundation (AwwaRF), the Association of State Drinking Water Administrators (ASDWA) and the Conference of State Health and Environmental Managers (COSHEM). NSF 61 was first adopted in 1988 and continues to be overseen by a consensus-based joint committee that includes representatives from regulatory entities, manufacturers, and product users, each group with a one third representation.

Many products are covered by the Standard, including the following:

- Pipes and Related Products (e.g. pipe, hose, fittings) (Sec 4)
- Protective and Barrier Materials (e.g. cements, coatings) (Sec 5)
- Joining and Sealing Materials (e.g. gaskets, adhesives) (Sec 6)
- Process Media (e.g. activated carbon, ion exchange resins) (Sec 7)
- Mechanical Devices (e.g. water meters, valves, filters) (Sec 8)
- Mechanical Plumbing Devices (e.g. faucets, drinking fountains, and components) (Sec 9)

The process by which products are evaluated begins with obtaining detailed information about each material that comes into contact with water in that product. The materials are then reviewed to determine potential extractants. Laboratory extraction testing is then performed and results are normalized to potential at-the-tap values. The normalized results are evaluated against health-based acceptance criteria.

For example, water meters are evaluated for cold-water end uses. The metal testing requires exposures at both pH 5 and pH 10. Organics require pH 8 exposures. The devices are conditioned for 16 days, with exposures analyzed for the final 12-16 hours.

Product exposure types include "in vessel" and "in product." Care is taken to only expose normally wetted surfaces for a product. Exposure controls are used throughout the exposure process. As an example, faucet exposures are performed as "dump and fill", that is, the faucets are not plumbed in and are not tested under pressure.

Laboratory evaluations include measurement of metal (regulated and non-regulated) and non-metal (material and formulation specific analysis that includes scans for volatile organic compounds, halogenated compounds, polynuclear aromatic compounds, phthalates, phenolics, and others) contaminants. For example, plastics and elastomers are tested for monomers, antioxidants, and initiators. Coatings are tested for solvents, monomers, accelerants, and co-solvents. Cements, as well as sealants and adhesives, are tested for various contaminants.

Toxicology evaluations are based on regulated contaminants and non-regulated contaminants. Products are evaluated for regulated contaminants based on the EPA and Health Canada determinations and EPA's Integrated Risk Information System (IRIS), and the Health Canada Advisory Database. NSF has developed more than 600 risk values for non-regulated contaminants to address leaching of chemicals from materials that contact drinking water.

Mr. McLellan explained that plumbing products within a building are generally regulated at the State, county and city levels through plumbing codes. These local codes are normally based on Model Plumbing Codes such as the United Plumbing Code (UPC), the International Plumbing Code (IPC), and the National Standard Plumbing Code (NSPC). The UPC, IPC and NSPC all reference NSF 61 for pipe, fittings and faucet but do not reference NSF 61 for in-line valves. For municipal products from the water treatment plant to the building, 44 States currently require NSF Standard 61 compliance by policy, regulations or legislation. In addition, 40 States require ANSI Accredited Third Party Certification. Compliance depends on bid specifications requiring NSF 61 compliance/certification. There is often a high degree of specification for epoxy coatings and filtration media, with a lower degree of specification for brass valves.

To illustrate the differences between end use products and in-line products, he detailed the application regulations for faucets and valves. For faucets, most plumbing codes require faucets to be listed to NSF 61. SDWA (1996) also requires that faucets and fountains comply with national standards. As a result, most faucets sold at the retail and wholesale levels in the United States are certified to NSF 61. In contrast, for valves, the model plumbing codes do not require NSF 61 for in-line devices. SDWA (1996) also does not require that in-line devices comply with NSF 61, but does require these devices contain less than 8 percent lead. The result, however, is that few of these products are NSF 61 certified and may be contributing high levels of lead in plumbing systems and LCR violations. The number of faucets that are NSF 61 certified (5,287) is much higher than the number of certified valves (465), meters (181), or backflow preventers (8).

Mr. McLellan next detailed the formula for a successful national standard, including active participation by regulators, manufacturers and users in standard development; inclusion of the standard in State plumbing codes; and inclusion of the requirements in bid specifications.

He next described the ongoing development of NSF 61 involving regulators, manufacturers, and users. Issues have been raised regarding the evaluation of products containing lead associated with recent issues in Washington, D.C. and reports of non-compliance to the Lead Contaminant Control Act (LCCA) and the LCR. These issues have come from many sources and fall into one of four categories: the chemistry of the test water; how the results are converted from the lab test to the estimated “at the tap” exposure; the acceptance criteria used for Standard 61; and miscellaneous issues.

With respect to water chemistry, issues that have been addressed include the following.

- Clarification regarding the use of fresh test water
- Concerns about aggressiveness of pH 5 water associated to lead extraction (it was not intended to address lead).
- Clarification regarding a product meeting extraction requirements at pH 5 and at pH 10. Mr. McLellan also noted that due to past confusion, the language of the standard has been changed so that it is clear that a product must be tested in *both* pH 5 and pH 10 water. He also added that to his knowledge, this was not a confusing issue to any product certifiers that have certified products under Standard 61.

Issues requiring further consideration include the following.

- Galvanic effects of brass-copper connections

- Changing Standard 61 test water to include testing using chloramines rather than chlorine.

He next presented information on the types of alloys used in products certified under NSF 61. A review of all of the metal alloys that have been submitted to NSF showed that 89 percent of the parts which are used to make valves, meters etc. were made of alloys with less than 3.7 percent lead and 75 percent were less than 1 percent lead. Further, 99 percent of parts that are used to make faucets were made of alloys with less than 3.7 percent lead and 37 percent of these parts were less than 1 percent lead. This is far below the level allowed by the SDWA. NSF believes that the current requirements of the standard and the stringency of the testing are some of the reasons the percentage of the alloys submitted for testing are so low.

He then presented extraction results for NSF Section 9 products.

Table 1. Faucet data ordered by lead in product [sum of % Pb x SA]

					Alloy 1			Alloy 2			Alloy 3			Alloy 4		
Product Identifier	Lead in Water: [Q Statistic]	Lead in Product: [Sum of % Pb x SA]	Total SA (sq in)	Total # of Metal Parts	% Pb	SA	# of parts	% Pb	SA	# of parts	% Pb	SA	# of parts	% Pb	SA	# of parts
Faucet C	1.6	21	8	2	2.5	8	2									
Faucet B	0.5	23	15	2	1.5	15	2									
Faucet A	0.5	45	33	2	1.5	20	1	1.2	12	1						
Faucet A	3.9	45	33	2	1.5	20	1	1.2	12	1						
Faucet F	1.2	60	24	12	2.5	23	11	3.5	1	1						
Faucet F	0.8	63	70	5	3.7	5	3	1.6	29	1	0.1	36	1			
Faucet D	4.2	70	38	14	2.5	18	8	3.7	7	5	0	13	1			
Faucet H	12	86	82	7	1.6	40	2	3.7	5	4	0.1	36	1	2.5	2	1
Faucet E	3.8	114	64	6	2	7	4	3	33	1	0.1	24	1			
Faucet G	9.4	132	75	8	3.7	11	6	1.4	64	2						
Faucet G	10	132	75	8	3.7	11	6	1.4	64	2						
Faucet I	3.6	181	74	9	3.7	32	7	1.5	41	1	0.1	1	1			

Refer to report body for a description of the data in each tables columns.

Similar results were also presented for Section 8 products.

					Alloy 1			Alloy 2			Alloy 3			Alloy 4		
Product Identifier	Lead in Water: [Estimated "at-the-tap" concentration]	Lead in Product: [Sum of %Pb x SA]	Total SA (sq in)	Total # of Metal Parts	%Pb	SA	# of Parts	%Pb	SA	# of Parts	%Pb	SA	# of Parts	%Pb	SA	# of Parts
Meter A	1.4	22	9	1	2.5	9	1									
Meter A	6.1	22	9	1	2.5	9	1									
Meter D	8.1	34	152	6	0	38	3	0.25	114	2	4.5	1	1			
Meter D	38	34	152	6	0	38	3	0.25	114	2	4.5	1	1			
Meter D	39	34	152	6	0	38	3	0.25	114	2	4.5	1	1			
Meter C	0.4	40	160	5	0	1	3	0.25	159	2						
Meter B	0.9	51	210	13	0	6	11	0.25	204	2						
Meter B	2.4	51	210	13	0	6	11	0.25	204	2						
Meter B	5.7	51	210	13	0	6	11	0.25	204	2						
Valve B	4.1	57	143	5	0.2	120	2	3.7	2	1	0	8	1	2	13	1
Valve B	6	57	143	5	0.2	120	2	3.7	2	1	0	8	1	2	13	1
Valve E	93	115	19	4	6	19	4									
Valve E	100	115	19	4	6	19	4									
Valve A	7.9	169	67	1	2.5	67	1									
Valve A	12	169	67	1	2.5	67	1									
Valve D	200	181	111	11	3.7	32	7	1.5	41	1	0.07	1	1	0	37	2
Valve D	270	181	111	11	3.7	32	7	1.5	41	1	0.07	1	1	0	37	2
Valve D	320	181	111	11	3.7	32	7	1.5	41	1	0.07	1	1	0	37	2
Valve D	420	181	111	11	3.7	32	7	1.5	41	1	0.07	1	1	0	37	2
Valve C	7.4	208	81	4	2.5	76	3	3.7	5	1						
Valve C	13	208	81	4	2.5	76	3	3.7	5	1						
Valve F	80	264	87	5	6	23	2	2	64	3						
Valve F	480	264	87	5	6	23	2	2	64	3						
Valve F	530	264	87	5	6	23	2	2	64	3						

Based on these results, there does not appear to be a linear relationship between the lead composition and lead extraction results. How the product is processed can lead to different results. This underscores the need to conduct testing. A standard that is based solely on the percent of lead in an alloy could miss important differences in performance due to factors such as the following:

- Use and efficacy of lead wash solutions
- Non-lead metal constituents of the alloy
- Distribution and consistency of lead within alloy
- Processing (machining vs. casting or extrusion)
- Potential lead contamination in the processing
- Consistency of processing between metal parts
- Product design

There are areas needing clarification when discussing changes to Standard 61. There is confusion about dose and concentration. Dose and concentration are not the same and should not be compared directly. For example, a device holding 5 milliliters (ml) with a concentration of 1000 micrograms per liter (µg/L) is equivalent to a dose of 5 µg (5ml x 1L/1000ml x 1000µg/1L). The LCR action level is 15 µg/L for the 90th percentile sample in a system. If you assume an adult consumes 2L /day, the daily dose is 30µg (15µg/L x 2L/day = 30 µg). The LCCA limit for lead is 20 µg/L. If you assume children drink 1L of water a day and it is all consumed at school their daily dose would be 20 µg. When you treat dose and concentration as if they are the same, it is misleading and gives an improper representation of the concerns regarding lead exposure.

There are also inconsistencies between sample size and acceptance criteria between LCR, LCCA and NSF Standard 61. For example, the sample size for LCR is 1 L, while the sample size for LCCA is 0.25 L. The acceptance criterion for LCR is 15 µg/L while the criterion under NSF 61 for faucets is 11 µg/L. Currently there is a proposal for NSF to have a distinction for faucets intended for schools evaluated at 250 ml to match the LCCA collection volume.

In addition, there are complexities of evaluating test water chemistry and applying that information to actual, real world waters. There are many factors that may influence lead extraction including pH, total inorganic and organic carbon, dissolved oxygen, disinfection chemicals (chlorine vs. chloramines), galvanic effect, natural organic material, stagnation time, the presence of biofilm, corrosion inhibiting chemicals, alkalinity, and total dissolved solids. The effects of any of these factors are not additive and every water is unique. Consideration must be made for all large systems, small systems and systems using ground water versus surface water. . Further, determination of an appropriate test water should not be made based upon any single constituent (i.e., chloramine).

He concluded by noting that compliance to NSF 61 needs to be strengthened by requiring buyers of devices to purchase certified products. This can be accomplished by changing the plumbing codes to require that all products meet a national standard. Also, changes in test water chemistry should consider all contaminants and not just lead. A significant amount of research is still required to address interactions of water chemistry components with a comparison to small, large and systems using ground water versus surface water. He stated that NSF Standard 61 is an important national standard that is protective of public health because it addresses regulated as well as non regulated contaminants. Data that provides information for improvement of Standard 61 needs to be evaluated critically and revisions to NSF 61 should be made appropriately. To these ends, future work at NSF includes a study designed to test brass materials with “real waters” from around the U.S. including water from large systems, small systems and wells. The bottom-line goal for this work is to do a side by side comparison of the aggressiveness of the test water compared to “real waters” and how that related to actual lead exposure.

California's Experience using Proposition 65 to Reduce Lead in Plumbing Fixtures presented by Ed Weil, CA DOJ

Ed Weil, Supervising Deputy Attorney General with California Department of Justice, presented on California’s experience using Proposition 65 (CA Prop 65) to reduce lead in plumbing fixtures. He began by summarizing the provisions of CA Prop 65. It was adopted by voter initiative in 1986 as the “Safe Drinking Water and Toxic Enforcement Act of 1986” (California Health & Safety Code section 25249.5 et seq.). Under CA Prop 65, the State establishes a list of over 700 chemicals known to cause either cancer or birth defects or other reproductive harm. Prop 65 prohibits the knowing discharge of those chemicals into “any source of drinking water" unless the discharger can show that the amount of the chemical would pose "no significant risk."

CA Prop 65 still allows some emission of these chemicals, but requires a "clear and reasonable warning" of exposures of those chemicals, whether exposure occurs through consumer products, air emissions, or any other means, subject to the same "no significant risk" defense. For drinking water, plumbing devices cannot comply with a warning. The law applies to discharges of a chemical 20 months after chemical is placed on the list regardless of whether specific standards for the chemical have been adopted. This creates an incentive for the quick development of a standard. This also places the burden of proof on the companies emitting chemicals.

Specific to lead, CA Prop 65 regulations define 0.5 µg/day as the safe harbor exposure level for lead. This level considers cumulative exposure from multiple sources and was developed based on information in a 2003 New England Journal of Medicine article that indicated that a 10 µg/dl lead level results in a 10 point IQ decrement in children. Mr. Weil also mentioned that setting the lead exposure maximum at 0.5 µg/day was based on cumulative exposure, not acute exposure. Translating this level into a product standard is an issue.

CA Prop 65 is enforced exclusively through litigation. Cases may be brought by the California Attorney General or private parties (similar to the Federal Clean Water Act). It does not provide any permitting/regulatory authority.

California became concerned about lead from plumbing fixtures when, in 1992, NRDC brought to the State's attention data concerning lead in first-draw water from faucets based on lead exposure from the first draw. For sandcast brass, the data indicated a first draw exposure to lead of 40 to 125 µg/day. For fabricated brass faucets the data indicated a lead exposure of 3 to 10 µg/day. Further, the SDWA definition of "lead free" might not eliminate lead exposure, the water treatment options to control lead, such as corrosion control, were limited, and the EPA/NSF standard setting process was slow and focused more on technical, rather than health, issues.

The State filed *People of the State of California v. American Standard, et al.* in 1992. The case was not ultimately resolved until 1996. The case wound its way through the courts with various decisions. The California Supreme Court ultimately held that the law did apply to drinking water systems up to the point of the tap. Ultimately, all defendants settled. One of the primary issues was how to determine the actual exposure from faucets in terms of the relationship of bench test to actual use and actual consumption from faucets. Based on a variety of factors, CA concluded that a residential kitchen faucet that achieved a Q test of 5 ug/L on the NSF-61, Section 9 test would result in an exposure of 0.5 ug/day (the safe harbor exposure level) to an average user of the faucet. Since other types of faucets are not used as much for drinking water, CA concluded that a Q test score of 11 ug/L for other faucets would result in exposure of 0.5 ug/day.

Thus, under the terms of the settlement, NSF Section 9 test methods would be used, but the results are applied to a different standard, namely 5 µg/L for residential kitchen faucets and 11 µg/L for all other faucets. The standard for kitchen faucets was phased in over two and a half years, with warnings issued in the interim. Noncompliance can result in civil penalties, the proceeds of which go towards a "lead education fund," and attorney's fees.

CA Prop 65 has been applied to other elements of the water system, including spouts on water purification systems, check valves, drinking water fountains, water meters, galvanized pipe, and submersible well pumps. The issue with spouts on water purification systems is that although the initial lead content has been removed from water during treatment, the resulting treated water is chemically very aggressive and could cause additional leaching if there is lead material in the spout.

Because CA Prop 65 is enforced through private citizen litigation, there are no fixed standards from system component to system component. There are varying degrees of effectiveness and aggressiveness that require some monitoring of results. Litigation is essentially being used as a regulatory vehicle. Under this type of system, it is difficult to address scientific and technical issues, such as determining the level of exposure from an individual component.

Initially, the response to CA Prop 65 from manufacturers was that the reductions in lead could not be achieved. It had never been investigated because there was no regulatory concern. Now, manufacturers may be gaining a competitive advantage by meeting the CA Prop 65 standard. As a result of CA Prop 65, there have been large changes in the lead content of sand-cast brass. There has been much less change in mold and fabricated brass. There are also side benefits to reducing lead content, including reduced worker exposure, lower air emissions, and less hazardous waste produced.

Mr. Weil concluded by summarizing the attributes of CA Prop 65. CA Prop 65 addressed reducing the sources of lead in a system, rather than trying to control leaching through corrosion control. The process that CA Prop 65 uses is less cumbersome than some regulatory processes, but is not ideal in that it relies on litigation. The process allows for the negotiation of the best standard for an individual component, although the resulting standards are not necessarily scientifically based. It looks at the contribution of each individual component. Controversial aspects of CA Prop 65 include the State-by-State approach and private enforcement. Lessons learned from implementing CA Prop 65 that could be applied to the current process include the effectiveness of reducing the source of lead and the ability to push the technology if given reason to address the issue. In addition, given research showing IQ decrements seen at even low levels of lead, the ability to address the contribution of individual components to baseline lead levels is important.

Questions and Comments from Panel

- A panelist questioned whether the use of manufacturing processes, such as washes, for compliance is monitored for variability. Mr. McLellan noted that wash processes are monitored, documenting items such as changes in tanks, temperatures, or ingredients.

- A panelist observed that it is interesting and promising that 75 percent of parts have lead levels less than 1 percent. There has been a strong movement in the industry to reduce lead that has perhaps been pushed by Prop 65. It is encouraging that a large percentage brass parts only have small amounts of lead. It seems that the regulation is driving technology.
- The panelist further noted that, although the relationship between percent lead and the Q statistic is not perfectly linear, there is a definite trend in results: less lead in alloys is associated with a lower Q statistics. This trend was strong in the data. A major confounder is wash systems which may be responsible for variability in test results. If the parts were tested after real residential use for a year, then we might see a stronger correlation between lead leaching and lead in the alloy. When there is no lead in the alloy, other factors are not as important. This has been confirmed in testing.
- In response, Mr. McLellan cautioned against reading too much into these results. The data represents the number of individual parts of plumbing products and does not distinguish between large or small parts. A small spring is counted the same as the body of a meter; therefore we should be cautious in interpreting the data.
- A panelist noted that although each device in a typical household may have a relatively low content of lead, there are often many devices in a household. Each individual device in-line may contribute to the lead burden. It makes more sense to try to figure out the total lead burden, but determining how much each device contributes can be difficult.
- A panelist asked if CA Prop 65's 5 µg/L requirement applied to each individual device in a kitchen faucet. Mr. Weil responded that it applied to each device.
- A panelist asked for an explanation what a "wash" is. Another panelist responded that a wash is a process to remove lead from the surface of products or components. A number of manufacturers have developed mild acid washes to selectively dissolve lead from cast products. These washes remove the lead available to leach at the surface of a product or component.
- Another panelist asked if washes are used to comply with lead leaching performance standards. Mr. McLellan replied that is was common for Section 9 products, but less common for other products.
- One panelist asked, from the utility perspective, if the lead substitutes may be part of the problem with respect to health implications down the pike? Mr. McLellan responded that NSF has looked at the health effects of bismuth and is redoing the risk assessment. He believed that the health criteria for bismuth would be significantly higher than lead (i.e., would need significantly higher exposure to produce adverse health effects). He also felt that a lower percentage of bismuth leaches as compared to lead.
- An EPA representative responded that selenium has an MCL (maximum contaminant level) set by EPA so that provides some guidelines. The question is how much selenium is leaching out of products. EPA is also considering developing a draft

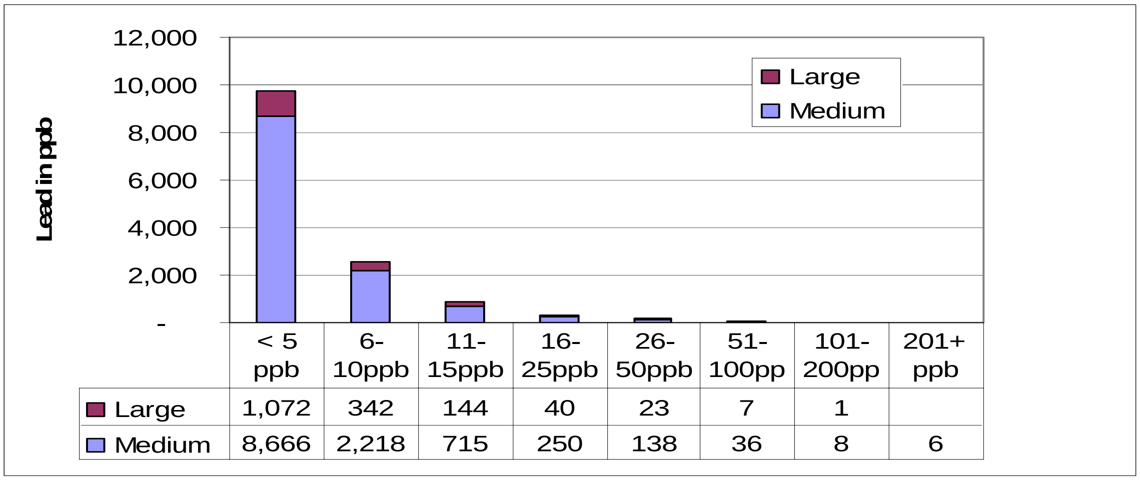
health advisory on bismuth and questioned Mr. McLellan's assertion regarding the potential risk.

- A panelist described the testing of no or low lead alloys that has been performed by the Environmental Quality Institute of the University of North Carolina, Asheville, that evaluated bismuth and selenium discharges for plumbing components made with alternative materials. In general, levels of discharge are coming out quite low for selenium and bismuth, about the same percentage as lead. If the alternative materials are less toxic than lead, leaching at similar levels as lead suggests the resulting water would be safer.
- Another panelist asked about plumbing for schools in regard to CA Prop 65. In a school setting, water from a kitchen faucet is much less likely to be consumed than a drinking water fountain, yet the kitchen faucet has to meet a higher standard. Also, kitchen faucets have a stricter standard but bathroom faucets could also be a source of drinking water. Mr. Weil responded that the standard for kitchen faucets was stricter than NSF standards, which the drinking fountains are still required to meet. He also stated that it depends greatly on consumer education and practices with regard to bathroom faucets as a source of drinking water.
- A panelist commented that the NSF standard has been adopted indirectly in almost 100 percent of plumbing codes through a reference in an ASME standard on endpoint devices. Has this indirect penetration been evaluated? Mr. McLellan responded that although actual penetration is almost 100 percent, some companies sell end-point products that are not certified, particularly in smaller stores.
- With respect to CA Prop 65, a panelist asked if there was a single location in which all of the summary judgments have collected so that manufacturers have one source for information. Harmonization that relates criteria to standards is needed. Education of consumers and manufacturers is essential. Some of these activities may be difficult because EPA and other parties have limited authority under law.

Utility Challenges presented by Jack DeMarco, Greater Cincinnati Water Works

Jack DeMarco of Greater Cincinnati Water Works (GCWW) began by stating that all utilities have the ultimate challenge of insuring that drinking water delivered to consumers is safe to drink at all times. Utilities are concerned about the public's exposure to lead from a number of possible pathways. Primary sources of lead exposure for children include deteriorating lead-based paint, lead contaminated dust, and lead contaminated residential soils. Although not considered a major route of exposure, water borne lead may also be a pathway. Public health professionals seem to put lead in water at a low priority.

He then presented data from an EPA presentation at the 2005 AWWA Annual Conference on how water utilities are doing in complying with the LCR. According to the data, 96 percent of the 90^{th} percentile samples reported by large and medium utilities had lead concentrations below the 15 µg/L Action Level. About 90 percent have 90^{th} percentiles less than 10 µg/L.



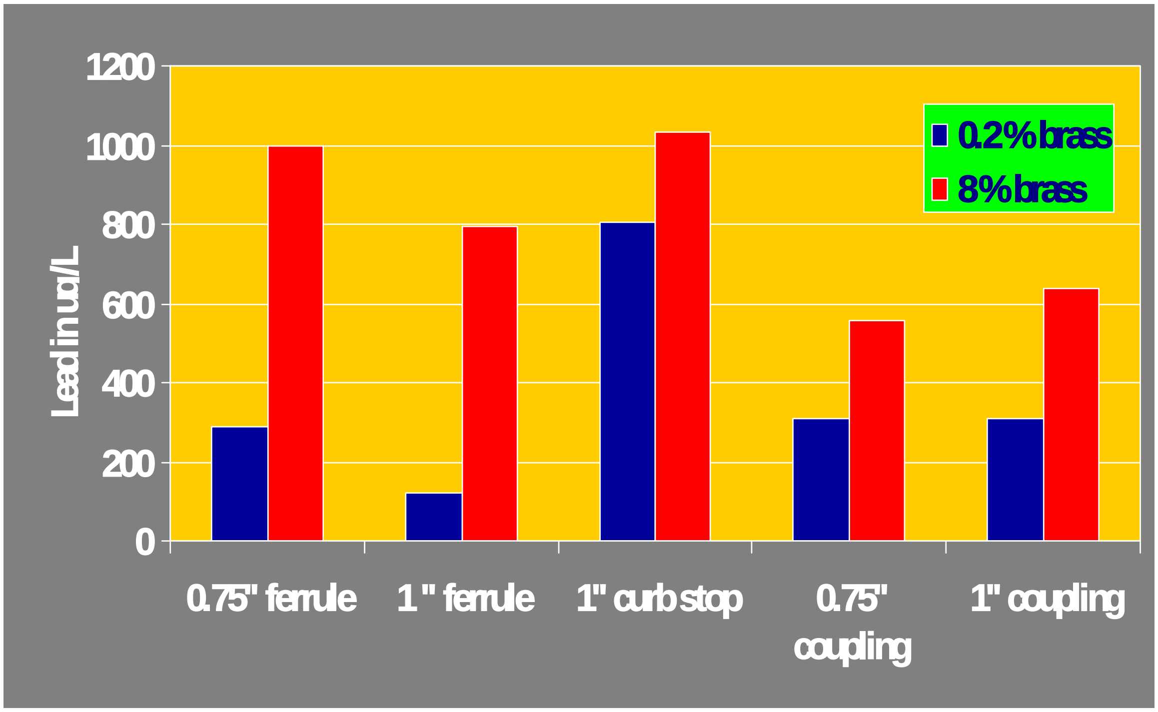
	< 5 ppb	6-10ppb	11-15ppb	16-25ppb	26-50ppb	51-100pp	101-200pp	201+ ppb
Large	1,072	342	144	40	23	7	1	
Medium	8,666	2,218	715	250	138	36	8	6

Mr. DeMarco presented information on 166 systems that had exceeded the action level in 1992-93. In recent monitoring, 151 of those 166 systems were below the Action Level, a 90 percent reduction in the number of systems exceeding the Action Level. Clearly utilities are learning to do a better job protecting public health and LCR is having an impact.

The utility challenge is to cope with distribution system material that may contain lead. Jack DeMarco presented information on the variety of materials in the GCWW distribution system. These materials do not seem to create problems with respect to lead. Cast iron mains can create red water problems when dealing with other issues, such as corrosion control measures. GCWW has an estimated 28,500 service lines that contain lead. In addition, the numerous valves and meters in the system could be sources of lead. For GCWW, from the curb stop to the house is the homeowners' responsibility. Little is known about these service branches, valves, meters, fittings, Point-of-Entry/Point-of-Use (POE/POU) devices, and fixtures. Even with lead service lines, the 90^{th} percentile value is less than 10 µg/L.

The tools available to reduce exposure to lead from water include corrosion control (pH and orthophosphate addition) and management of materials containing lead in plumbing products. The corrosion control measures appear to be effective in reducing lead, however they may produce other types of problems. Also, pH control may cause deposition that freezes pumps.

GCWW has performed materials testing using actual distribution system water. At a 6 hour hold, old brass meters leached 1,240 µg/L (94.7 µg/L adjusted to 1 liter) while new envirobrass meters leached 28 µg/L (4.9 µg/L adjusted to 1 liter). They also conducted tests of fittings (at a 6-hour hold).



GCWW found a big difference between 8 percent brass fittings and 0.2 percent brass fittings, but does not understand why the curb stop value is high.

He then presented data on what it might cost to install 8 percent versus 0.25 percent lead fittings for a theoretical utility (Utility 1) and its customers. As a ballpark estimate, it would cost 20 percent more to the utility for materials and 27 percent more for homeowners (because of the bigger area of responsibility) to install 0.25 percent lead fittings as opposed to 8 percent fittings. Mr. DeMarco also presented information on another hypothetical utility (Utility 2) in which all of the costs were borne by the utility. In this case, the increase in costs is estimated at 30 percent.

Cost to Utilities (Utility 1)

ITEM All ¾''	8% LEAD	0.25% LEAD	2005 COST DIFFERENCE
Ferrule	$20.60	$24.72	$4.12
Curb Stop	$33.09	$39.70	$6.61
Ins coupling	$22.00	$26.40	$4.40
Totals	$75.69	$90.82	$15.13 (20%)

Cost to Homeowners (Utility 1)

ITEM All ¾''	8% LEAD	0.25% LEAD	2005 COST DIFFERENCE
DA Valve PWA Valve Expander	$14.98 $13.60 $7.96	$28.08 $25.80 $14.93	$13.10 $12.20 $6.97
Meter	$71.00	$68.00	-$3.00
Totals	$107.54	$136.81	$29.27 (27%)
Fittings	?	?	?
Fixtures	?	?	?

Cost to Utilities (Utility 2)

ITEM All 1''	High Lead Bronze (1)	Low Lead Bronze (2)	2001 COST DIFFERENCE
Curb Valve	$17.46	$19.17	$1.71
Tailpiece 1	$3.86	$6.64	$2.78
Tailpiece 2	$3.86	$6.64	$2.78
Meter	$18.04	$23.80	$5.76
Totals	$43.22	$56.25	$13.03 (30%)

(1) 85-5-5-5 Bronze
(2) Federalloy

Mr. DeMarco posed the question of whether utilities would support mandatory lower lead in materials for all potable water use. In his opinion, utilities would support this in the same manner as the move to lower lead concentrations in solder. If utilities are allowed to change out over time, not as an edict or on a mandatory deadline, he thinks utilities will support such a change. Allowing adequate time for adjustments is key. Time would be required to allow manufacturing to be able to handle the demand. Also, time is necessary so that installation would occur as a part of the normal replacement cycle for a utility. For example, change over could be made during kitchen and bath remodeling for faucets and fittings, during major home renovation for lead service branches and fittings, during meter replacement programs for meters and fittings, and during water main maintenance and replacement for service branches and fittings. GCWW has decided to move in that direction and has recently issued request for proposals that specify low lead materials.

He concluded by discussing data gaps that present a challenge for utilities, including the following.

- How much does waterborne lead contribute to blood lead levels i.e. what lead concentration in water is most appropriate to ensure that blood lead levels are less than 1 µg/dl?
- Will the 90th percentile approach continue at the 15 µg/L Action Level?
- Will the World Health Organization recommended approach (a maximum water lead concentration) be incorporated into United States standards?
- What is the household fixtures and fittings contribution to the water lead concentration?
- What is the life cycle for the low lead brass?
- How much time is necessary to reduce inventory of existing products at both manufacturing and utility stores?
- Are there any concerns over lead replacement material(s) used in low lead brass?
- Does NSF 61 properly manage lead levels in plumbing products?

Questions and Comments from Panel

- A panelist asked about the costs for corrosion control treatment, under the assumption that these costs could be thought as a trade-off against the costs of reducing lead in plumbing materials. Mr. DeMarco responded that the costs for maintaining a high pH are relatively low, about $90,000 per year. He can provide more information on costs.
- A panelist from another utility remarked that the presentation also represented concerns at his utility. He asked what water was used to evaluate lead leaching from meters. Mr. DeMarco responded that they performed testing using his system's tap water as would actually occur in practice, with a pH of 8.6, low alkalinity (~50-60), TOC of 0.6, and sodium hexametaphosphate (01.5 mg/l P) added (although it was not added for corrosion control). He noted that the utility has problems when they operate a much higher pH due to calcium buildup in the distribution system.

- A panelist from a State drinking water agency asked if the State agency had been involved in the lower standards for lead content in plumbing. Mr. DeMarco responded that the state had been informed but has not commented on the current bid package for lower lead content fittings.
- A panelist asked for a more consistent use of terminology. In the plumbing industry, fixtures are waste receptacles, such as a bathtub or toilet, while a fitting conveys water.
- A panelist commended GCWW for its pro-active approach. He explained that the test results for meters were similar to experiments conducted at the Environmental Quality Institute. He states that longer term testing results in a wider gap in lead leaching, meaning that the longer the time, the wider the gap between the leaching from products with different lead content. There is also a difference between 6 and 18 hour hold times. In addition, the analysis of costs is very similar, where they concluded about 20-25 percent higher costs for low lead alloys. Using assumptions of 1 percent replacement of meters per year and 1 percent growth per year for new meters, the resulting increase in the residential utility bill is estimated at $0.04 per month.
- Mr. DeMarco clarified that since GCWW is doing a complete replacement of meters to implement automatic reading, the change to lower lead meters will be quicker.
- Another panelist cautioned that the cost of the alloy itself represents only one cost factor. Other factors to consider include the cost to manufacturers to change over to using those alloys, application specific issues, and other corrosion characteristics.

Status and Summary of AwwaRF Project 3018: Contribution of Lead Service Line and Plumbing Fixtures to Lead and Copper Rule Compliance Issues presented by Gregg Kirmeyer of HDR/EES

Gregg Kirmeyer of HDR/EES summarized AwwaRF Project 3018: Contribution of Service Lines and Plumbing Fixtures to Lead and Copper Rule Compliance Issues. Mr. Kirmeyer explained that the purpose of project is: “To research and quantify the contribution of lead service lines, utility-owned inline devices, and customer-owned plumbing fixtures to Lead and Copper Rule (LCR) compliance issues”. The objective of the project is to quantify the sources of lead as water moves from the main to the tap. The project will sample all of the components from main to tap to understand how each contributes to the lead levels in drinking water at the tap.

He discussed the project approach, which involves several activities, including writing issue papers, conducting workshops, conducting a utility survey, preparing case studies, conducting field and pilot activities, analyzing pipe scale, evaluating data, and developing criteria and guidance. Issue papers have been completed on the following topics.

- LCR compliance
- LSL replacement, partial vs. full

- Lead in in-line components, plumbing fixtures/ premise piping
- Lead scale formation and solubility
- ‘Get the lead out’ programs
- Corrosion treatment techniques
- Conflicting rules related to corrosion treatment and DBPs

The utility survey is in the process of being sent to 95 utilities representing a range of system sizes and geographic regions. It covers items such as lead service lines in place, jurisdiction issues, replacement techniques and costs, physical characteristics, presence of lead sources and replacement efforts, water quality monitoring data on lead source contributions, and impacts of lead source replacement. This survey is being done in coordination with a 2004 AWWA survey.

The 15 case studies will cover utility experiences with full and/or partial LSL replacement, leaded meter replacement, and fixture replacement. The survey will identify additional utilities to be subjects of case studies.

The field activities are focused on identifying sources of lead and assessing their specific contribution to lead levels at the tap. The field activities will also aim to identify best management practices for partial replacement of service lines. Several utilities are conducting water quality monitoring before and after lead service line replacement and replacement of faucets. Additional utilities are needed to participate in evaluating faucet contributions to lead at the tap. The lead sources are also being evaluated for scale. This portion of the project is currently in progress.

The pilot studies will evaluate the lead source contributions in a pilot setting from lead pipe (on-going), faucets (early fall 2005 start), and meters (early fall 2005 start). The pilot studies will also provide specimens for scale analyses. The aim of the scale analysis is to characterize scales from piping, components and fixtures and to evaluate the scale with respect to water quality conditions.

During the data evaluation stage, the research team will evaluate and summarize results with respect to lead source contributions of utility owned versus customer owned materials, the estimated reductions in lead levels at the tap for various lead source replacement scenarios versus corrosion treatment, the impact of pipe-cutting techniques, and the impact of water quality conditions on scale composition.

The criteria and guidance will be developed to assist utilities in evaluating lead source replacement versus water treatment, including flow-charts to aid the decision-making process. The guidance will be tested at the utility level.

A number of organizations are participating in this 3-year research project, including utilities, associations, and manufacturers. The project is in its initial stages, with data collection over the next 12 to 18 months, with data evaluation and reports in the following year. It is anticipated that it will be 2 years out before the reports become available. In closing, Mr. Kirmeyer indicated that there is additional information on AwwaRF on the internet.

Questions and Comments from Panel

- A panelist questioned whether the impact of CA Prop 65-compliant plumbing components was being evaluated. Mr. Kirmeyer replied that this research project is not addressing that issue. Another panelist noted that the changes due to CA Prop 65 were gradual over time and companies that changed products to comply with CA Prop 65 changed their products nationwide.
- A panelist asked if testing was being conducted on products that were installed throughout the country. Another panelist responded that the products being tested will be NSF certified, but noted that performance might vary due to variability in water conditions.
- NSF will also be receiving faucets of the same models used in the AwwaRF study and testing to the Standard 61 protocols to compare the performance under test water conditions and actual water quality conditions.
- Mr. Kirmeyer explained that periodic sampling will be conducted based on a protocol that requires sampling immediately before and after faucet replacement and weekly for 2-3 months after the replacement.
- A panelist asked if sufficient information would be collected in the case studies to measure the aggressiveness of the water and if so, would there be a background comparison. Mr. Kirmeyer responded that they would have historical data for comparison purposes and would flush samples before and after replacement.

Status and Summary of AwwaRF Project 3112: Performance and Metal Release of Non-leaded Brass Meters, Components, and Fittings presented by Anne Sandvig of HDR/EES

Anne Sandvig of HDR/EES discussed a new AwwaRF project titled AwwaRF Project 3112: Performance and Metal Release of Non-leaded Brass Meters, Components, and Fittings. The purpose of the project is: “To define issues surrounding the current state of knowledge, testing protocols, performance, regulatory environment, and research gaps pertaining to the widespread use of residential sized non-leaded brass meters, components, and fittings within water utility distribution systems and premise plumbing.” The approach to the project includes developing white papers on non leaded materials, conducting an expert workshop, and summarizing findings to identify research needs.

The white papers will deal with topics such as the following.

- Composition, lead content, mechanical properties, ASTM specifications for non-leaded brass
- Impacts on the manufacturing industry and on utility operation and maintenance procedures

- NSF protocols
- Metals release potential (selenium, bismuth, lead, copper)
- Health effects of selenium/bismuth
- Other alternative materials that may be, or become, available
- Utility/state experiences

The goal of the AwwaRF expert workshop is to identify and prioritize issues related to non-leaded materials, identify research needs, and develop a research plan for performance, testing, and the impacts on drinking water. The research advisory committee consists of a variety of parties, including manufacturers, utilities, associations, and EPA. The final report will include a summary of current knowledge on performance of non-leaded brass alloys, research roadmap and preliminary structure for top priority projects, and an independent review of ANSI/NSF testing protocols. The AwwaRF workshop is anticipated to take place in later October or early November, with final reports within a year.

Questions and Comments from Panel

- A panel member asked if galvanic corrosion is going to be evaluated. Galvanic corrosion could at least incorporate grounding separate to help understand different results. The AWWA policy statement opposes electrical grounding to water system components, but the grounding safety is considered a more critical issue. Ms. Sandvig responded that galvanic corrosion was not going to be specifically evaluated, but may come into play with the evaluation of scales.
- A panelist posed if there was a need for performance standards by alloy composition. Ms. Sandvig responded that there may be but it is difficult to implement. It is taken at face value that products will be in the ball park of those they replace.
- One panelist asked about the expectations for the useful life of alternative materials. Would they have a similar length of duration as current products? Panelists representing manufacturers explained that before they make a change to a low lead alloy, they conduct years of testing on corrosion, including field testing for 5 years. As to the expected life, products made with alternative alloys have the same warranty as other products. Several of these alternative alloys have been used in other specific applications, commonly under more severe application conditions.

Manufacturer's Concerns: Historical and Future Perspective presented by Craig Selover, Masco Corp.

Mr. Selover began by stressing that manufacturers are committed to providing products that deliver safe drinking water. They believe that performance based standards, such as NSF 61, are the best means of evaluating plumbing products. Performance based standards provide both products that protect drinking water quality and options to manufacturers to deliver products with features that consumers want in terms of safety, style, function, and value. With performance based standards, manufacturers are free to select the technologies or combination of technologies that meet consumer demands.

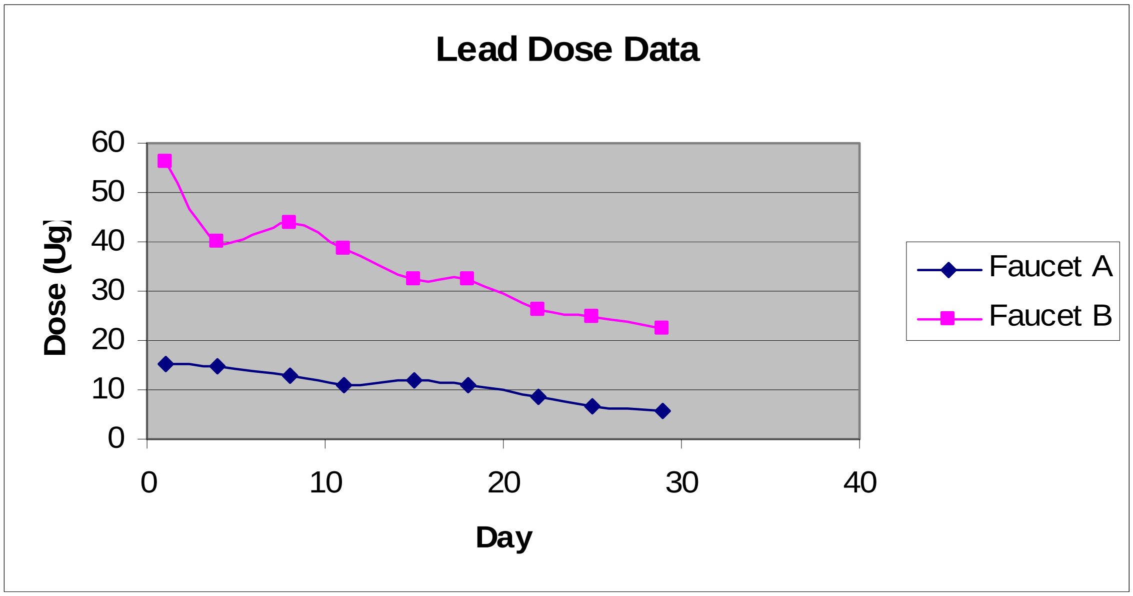
He then discussed the regulatory and legal requirements that plumbing products must meet with respect to lead. For products used in water distribution and plumbing systems, the SDWA Amendments of 1996 make it illegal to introduce into commerce products that contain greater than 8 percent lead and that do not meet the performance requirements of NSF 61. Plumbing products are also regulated by State or municipal plumbing codes that regulate which products can be legally installed in a plumbing system.

Currently, 98 percent of all plumbing code regulations are based on Model Plumbing Codes, each of which contain requirements that plumbing products comply with NSF 61 for Sections 4 and 9 (but not Section 8). As a practical matter, large plumbing manufacturers cannot differentiate between products sold in jurisdictions requiring NSF 61 compliance and those which do not. Therefore, to be sold universally in the United States, manufacturers certify the products to be NSF compliant. For Section 8 products, one Model Code does require compliance for the plumbing products covered. The Plumbing Manufacturers Institute and NSF are working together to provide the correct language for a code change in the other major Model Code.

Mr. Selover then clarified plumbing industry terminology. A fixture is a receptor that receives potable water after discharge. By definition a fixture does not contain potable drinking water, and therefore is not subject to lead in drinking water regulations. Mr. Selover recommends correcting current regulations and legislation to reflect industry terminology and avoid confusion in executing regulation.

With respect to NSF 61, he noted that plumbing manufacturers have participated actively in the development of NSF 61 since 1984. Representatives from manufacturers are members of the NSF Joint Committee that has equal representation from manufacturers, water utilities, and regulatory bodies. He summarized the requirements of some of the different sections of NSF 61 applicable to this workshop and then focused on Section 9. Section 9 applies to mechanical plumbing (endpoint) devices that account for the last 1 liter before discharge. These devices are evaluated based on a Pass-Fail "Q" statistic. Section 9 is the only section of the standard that takes a statistical approach to lead leachates. Criterion are based on a short term (19 day) potential for acute exposure and does so on a dose and not a concentration basis. In this respect, Section 9 does not look at lead on a comparable basis with other Sections, and takes into account multiple exposure sources.

He presented examples of early lead dose data (from around 1990) that show decreasing lead dose levels over 30 days of testing. Based on short-term exposure considerations, these products now would not currently pass the standard.



Based on Section 9 of Standard 61, the higher the variability in the results, the more difficult it is to pass the test. Also, if the volume of water that a product contains is high (such as a faucet with a long neck) the resulting Q value will be high. Thus, a different choice of materials or technologies may be used for high-volume products.

The nature of the leachate reaction is driven by the availability of water quality parameters, not lead. The reaction stops when water quality parameter drivers have been exhausted.

Differences in how brass alloys are made will affect how lead leaches from them. The behavior of lead in cast alloy is different than wrought alloy. For wrought alloy (used to make rods or tubes), the lead content is uniformly distributed throughout the rod cross section in small globules. Lead leaching results where lead particles are exposed from machining. For cast alloy, copper and zinc solidify as the alloy cools. Lead is drawn, through capillary action, to plug gaps between the copper/zinc crystals. The lead is drawn to the warmest (last to cool) part of the casting which is usually the interior waterway surface where core sand insulates. Thus, the area of the product that is exposed to water is lead rich compared to the alloy overall.

Since 1992, the plumbing industry has responded to the requirements of NSF 61 in a few different ways. A variety of brass materials had been used in the manufacturer of different products. Where materials used meet the NSF “Q” criteria, no change was necessary. When materials would cause failure, manufacturers developed alternative processes and material formulations. The particular selection of process or material formulation was based on a variety of concerns, including product line configuration, manufacturing capabilities, resources, and consumer needs. Among the alternatives developed and used effectively are lower lead content alloys, substitute cast alloys (bismuth, silicon, selenium), washing processes, and plating/coating/lining processes.

Mr. Selover then provided examples of several different types of plumbing industry products (variety of faucets) and the multitude of approaches employed to meet NSF 61 with the approach for each product being unique. A variety of technologies and techniques are used to meet the standards, while still getting consumer value. Flexibility to choose among the options is important to meet all needs. There are numerous other product performance criteria effecting material selection, including burst strength/water hammer resistance, bending/torque strength, durability, machinability, functionality in high mineral content water, ability to apply decorative finishes, abuse/vandalism resistance, and hot/cold water temperatures.

Recent issues have increased awareness of lead, including the elevated lead levels in the District of Columbia water system. Also, high lead levels in Philadelphia public schools are being investigated with the industry volunteering to help understand the situation. Changes to NSF 61 are being considered. The NSF Standard 61 Joint Committee formed a Lead Task Group that will consider issue such as the composition of challenge water and the lead pass/fail criteria. This task force plans to visit Philadelphia schools to better understand the issue there.

He concluded by explaining that manufacturers are working to learn more about LCR exceedances and LCCA school elevated lead levels to understand the causes and the appropriate changes that may be necessary to the standard and products. Manufacturers believe that performance based standards such as NSF 61 are the best means for evaluating plumbing products. Performance based standards provide products that protect drinking water quality while allowing manufacturers the creativity to deliver what consumers want in terms of safety, style, function, and value. Finally, Mr. Selover stressed that manufacturers are committed to providing products that deliver safe drinking water.

Questions and Comments from Panel

- A panelist asked what the cost has been to meet Standard 61. Mr. Selover responded that it’s hard to determine costs. The changes have come over a number of years in which new technologies have been developed. In addition, there has been inflation over that time period. It is really difficult to figure out the impact of one factor among many. Also, foreign competition puts on price pressure.
- Another manufacturer on the panel noted that the changes that have been made vary from manufacturer to manufacturer based on their sophistication, machinery, resources and scope of product line. The changes can be quite complex. The burden has been immense and costly.
- Given the California leaching standard of 5 µg/L for kitchen faucets, one panelist asked if a product sold in Pennsylvania or Massachusetts would deliver the same water quality in terms of lead performance. Mr. Selover responded that the product would deliver in accordance with 11 µg/L NSF 61 leaching standard. If the company was also a party to the CA agreement and also sold in CA, a kitchen faucet would

probably deliver a concentration of 5 µg/L or 11 µg/L for a bathroom faucet. Mr. Selover noted that as a practical matter, if a manufacturer is supplying CA, it is not logistically possible to sell different products in different places, thus the rest of the country will receive the same lower lead products that are made for CA.A panelist noted that consumer labeling could be improved to reflect what standards the faucet is meeting. One brand at a big box store is labeled as meeting NSF 61, but not Prop 65. Consumer labeling could provide a competitive advantage.

- Another panelist responded that there is a lot of compliance with CA Prop 65, but it is not noted in product packaging. Big box stores are selective about which products they sell, so it would be surprising if products that they sell are different than those sold in CA.
- Mr. Selover noted that we are lacking information on the aggressiveness of water around the country, particularly for ground water, and that it would be helpful to have that information as they are developing products. We do not have a good way to capture data to evaluate products differently under a wide range of water quality parameters. We may have some limited data from LCR exceedances, but this is not a broad representation. Money would be well spent to gather this type of information. Most parameters are not reportable in a national database.

Open Forum Discussion

Dr. Summers then opened up the discussion to those observers who signed up to comment.

- Brad Homiston of Kohler Inc. commented that to meet NSF 61 or CA Prop 65 standards there are cast brass products at 1.5 percent lead that pass these standards. Given this, he asked why push for a standard based on absolute weight percentage of lead instead of a performance test? He added that brass is a family of alloys with different casting characteristics and practices, with a variety of other processes that can be used to meet standards. Water meters are red brass. In yellow brass, the addition of bismuth can cause cracking issues. Like water, bismuth migrates into cracks and expands by 3 percent as it solidifies. There is concern about the impact in field use or machining. In addition, a draft health advisory for bismuth was released about a year ago with no MCL set. From a manufacturing point of view, if bismuth is used as a replacement for lead in alloys, this change involves up front costs, design changes and practice modifications. This could have large capital implications for manufacturers. It would be nice to know where EPA is going to settle on the bismuth health issue before significant investment is made.
- Mark Anderson, of Ford Meter Box, commented that studies are showing that bismuth and selenium could be in short supply, with competing European and Japanese demands. The result of short supply would be price increases, as demonstrated by the recent increase in the price for imported selenium that has increased to over $50 per pound from $9 per pound over a short time frame.

- Davis Anderson, of Chicago Extruded Metals Co., a small brass extrusion mill, commented that most of the discussion in the workshop has focused on the cast side of the industry. The wrought side of the industry will have different issues. He is not familiar on whether a non-lead solution exists for all wrought applications. There may be no effective substitutes for lead for certain applications. The substitutes do not machine well or do not have field characteristics for product use. Health effects testing that is translated into a health effects-based performance standard would provide the most protection to the consumer, and allow the industry to adapt most effectively. If there is a change, the industry has done a good job of applying technology to meet health effects goals. A prescriptive formula would limit the ability of the industry to use alternative means of complying. The industry hopes to find replacements for lead in its products, but those do not exist at the current time. Lead provides many good things to a product and lasts a long time. Lead in products is currently necessary to meet consumers' needs.

Identification of Issues

The facilitator next solicited specific comments from the panel that summarized the main point of an issue. Attachment B contains the list of comments. The comments were placed into one of the following four categories:

- NSF Standards and Testing Protocol
- Alternative Materials/Treatment Technology
- National/State/Local/Industry/Consumer Practices
- Miscellaneous

The panel was divided into four breakout groups, with each group discussing one issue category listed above.

Breakout Group Reports

Report from NSF Standards and Testing Protocol Breakout Group

This group felt there were two approaches towards setting a standard. One is to implement prescriptive limits that control the allowable lead percentage in materials. The other approach is to continue with a performance-based metal leaching standard with third-party certification. Both approaches require adequate enforcement. The enforcement issues would be different for either approach, and alone do not favor one approach over another.

Using prescriptive criteria has several benefits and disadvantages. One benefit is that this method rules out the vagaries of testing and lead leaching over the long term. It is important to note that this benefit is subject to further research. One disadvantage is that there is still a need for performance-based criteria for other contaminants, thus testing and certification would still need to be conducted, even with the prescriptive criteria. In addition, a prescriptive based standard is not currently feasible for all component types and does not apply to very small items.

Performance-based criteria, on the other hand, have the benefit of offering flexibility for innovation and technology. In addition, testing protocols cover additional contaminants such as other metals and organic compounds. This method leaves open the issue of test realism versus real world water exposures since different types of water flow through plumbing devices, although monitoring may only capture the effects of a few types of water. The group felt that this should be the recommended approach.

The next issue discussed was the degree of stringency for the test procedure. To address this issue, the group asked if the current test waters are representative, and whether any one water could be representative. The group did not have an answer, but laid out the following two research goals. First of all, they felt it was very important to understand the spectrum of "aggressiveness of waters" and to determine where to set a benchmark. This is important to know for public health as well as for administrators to understand what changes in water protection are appropriate. The group was not sure what current regulations say about individual water systems and suggested that an assessment consider well systems also. Secondly, the group recommended that EPA investigate the known instances of NSF 61 compliant devices leading to high lead leaching. It would be of value to determine if a NSF 61 compliant device causes an exceedance in the lead action level for different reasons than non-compliance devices. It was noted that the CA Prop 65 criteria are not based on health effects. Although the focus of this workshop is to address lead, it was noted that under the LCR, there are no additional requirements "triggered" when the copper action level is exceeded. When the lead action level is exceeded, public education and lead service line replacement is required, but no additional steps are required to lower copper levels in tap water. They felt this question could be added to the AwwaRF study discussed earlier by Gregg Kirmeyer at HDR/EES.

Another issue mentioned by the panel was the request that there be an alignment of evaluation criteria with LCR and LCCA specifications. The group noted that the current test, or compliance with NSF 61, does not guarantee compliance with LCCA due to the normalization factor, dwell time, contaminant level, and other reasons. Compliance with NSF 61 and non-compliance with LCCA can be shown mathematically. For example, if a sample is normalized to 1 L, the sample will pass. However, if you normalize the sample to 250 mL, the sample may fail. The group suggested that EPA or NSF update Standard 61 to allow for an approval option as an LCCA compliant device. At the same time, group asked whether this would create confusion by adding too many levels of approval. Another option posed by the group is to consider altering Q values, or normalization factors, in all sections of NSF 61 so that a device that is NSF compliant will also be compliant with the LCCA. This option has the benefit of being less confusing and allowing less lead into the water, but it forces change. The main point of the group was that if a device is labeled NSF 61 compliant, then it should meet the product use and sampling assumptions of LCCA.

The group then discussed whether current drinking water criteria are sufficiently protective of public health. The group felt that testing is generally a worst-case scenario, as compared to long-term leaching, since testing is from a new product when leaching is higher and most drinking water flows through aged devices with expected lower leaching. Currently, there is some recognition of multiple devices, but assumption for many in-line devices may need to be re-evaluated. Manufacturers have succeeded in producing kitchen faucets and drinking fountains meeting lower acceptance criteria. Lastly, the group recommended that the latest blood lead level medical data should be evaluated. The group felt that in general, less lead (in water or representative blood lead levels) is better and that a goal of zero (which is consistent with the LCR's Maximum Contaminant Level Goal for lead) is a legitimate goal. In short, we are doing a good job in reducing lead today, but tomorrow could be better in terms of lead exposure from drinking water.

Next, the group discussed factors impacting the decision to increase the stringency of the regulation. One factor to consider is whether EPA would take one big step in modifying standards or several stepwise adjustments. The group asked whether technologies currently exist to satisfy interim levels while long-term solutions are developed. Considering the resources needed for re-tooling and market costs, the group generally favored lowering the lead levels once, with a long time allowed to come into compliance. If the time allowed to come into compliance was too short, there was also an issue of material availability. Lastly, the group noted that changing too many parts of a standard at once may add complexity and cost. Thus, it might make more sense to begin by changing parts of the standard that are less complex (i.e. Q value).

Another question posed by the panel is whether hot water is considered drinking water. This is an important question since hot water performs differently than cold water in certain alloys and materials, which could effect the selection of alternative materials. It is also important to note that the directional effect of hot water is not always the same. For example, sometimes hot water may increase leaching, but other times it may have no effect on leaching. Finally, the group mentioned that an NSF committee is currently considering the specificity of temperature in testing.

Another issue discussed by the group was the simultaneous contribution of lead from parts within a device or multiple devices in a system. This is an important issue because approximately 6-12 in-line devices may be placed in between the main and the homeowner. The group suggested that EPA needs to re-evaluate how the current standard deals with multiple devices for in-line and end-point use. The group noted that the current standard has some "aspects" to deal with this, but it is not clear that they do enough.

The panel stated that there is a need to validate that the standard accounts for the long-term performance of acid washed components. The purpose of the acid wash procedure is to remove residual lead from surfaces of devices. The group was not sure of the long term effectiveness of acid washing, and would like additional information so that they could have confidence in this method. Some questions the group posed are whether the test results are representative of performance over the long term and whether relative extraction in real waters may differ from relative extraction in test waters.

Another question posed to the group was whether AWWA (or AwwaRF or NSF) should develop a simple test protocol for utilities to use to evaluate devices in their own waters. The group noted that systems may want to know the local performance of devices. Questions on how to conduct research include how to conduct dump/fill or pipe loop studies. In general, the group felt that a simple test to figure out what is going on would be very helpful. For example, they would like a standardized test that reveals whether there is an actual difference between the water of two systems, rather than a test that could have different results because of different test protocols.

The group next discussed the need to review and reconsider inconsistencies among Section 9 & the rest of NSF 61. The group felt that each part of NSF 61 should be reviewed to validate the rationale underlying the requirements of the standard and to iron out inconsistencies where appropriate. Specific terms of the NSF 61 that needs to be reviewed include the following: test waters, pass/fail criteria, statistical methods, and use and application of product. The group also suggested that someone document what NSF 61 is supposed to do (i.e. the goals) and the rationale of achieving that goal in a background or white paper addressing the questions posed above and in this workshop. Lastly, a member of the group suggested that NSF hire a technical writer to re-write the standard so it is easier to follow and more understood by the users of the standard.

The group then discussed the use and enforcement of Section 8 in utility specification. The group noted that a good standard is great but needs to be used to be useful. The plumbing code enforcement personnel are unable to inspect enough, so there needs to be a way to ensure that all products that have new performance standards make it to the market.

Lastly, the group recommended that to be successful, the activities of this process must be coordinated with NSF Committees. The group suggested that EPA consider giving a presentation back to these committees. The group also cautioned EPA to avoid overlap and duplication of effort, and recommended that they coordinate research.

Questions and Comments from Panel

- A panelist noted that an item added late in the discussion was a recommendation that health based criteria be reconsidered through EPA/Health Canada. The current LCR structure is based on a treatment technique. A health-based standard would improve the ability to reduce lead under those exposure protocols.
- A panelist asked what happens in the distribution system with sources of lead from NSF certified products longer than 3 weeks into the product life. Generally, lead leaching levels are lower over time. LCR monitoring data may indicate longer term performance because samples are taken considerably longer in a product’s life than 3 weeks.

- The speaker, in response to this question, thought that lead could either increase or decrease over time. There is considerable uncertainty, particularly with respect to acid washed devices. This is an important research question.
- Some products are acid washed before certification. In this case, the product may test at 11, and not go down by very much once in use. However, another product may test at 11 and go down to 1 or 2 within 4 months. Thus, there is a big difference in the long run. However, the initial NSF tests suggest that the devices initially leach the same amount.
- The speaker added that it would be helpful to look at the leachates of classes of appropriate devices (or general categories) over 6 months, 1 year, 5 years, etc. to gain more insight into this subject.
- In general, the NSF standards should not focus on specific technologies, such as acid washing, but should stick to evaluating the performance of the product as a whole.
- One utility tested meters and saw the lead concentrations go down after one month of usage. After one year, there was barely any leaching although it is not known exactly when this leaching stopped.
- If 15/11 was a health-based limit, such issues would not be important because it would not matter how a product met the limit.
- A panelist cautioned that the previous discussions on the results of “surface-washed” products appear to be specific to case products, not wrought products. It should be noted that surface-washing can be used for both types of alloy products and that the long-term leaching performance may differ depending on whether the alloy is a cost or wrought alloy.
- The speaker suggested that this is not so much a “problem” as it is an issue that should be dealt with. The main point is that they want accurate sampling so that they know homeowners are not drinking contaminated water.
- There might be a different lead level goal if we consider the health effects from acute vs. long term exposure.
- A panelist suggested that NSF 61 testing represents the “worst case scenario” and that people should assume that lead keeps dropping after testing. Also, with multiple devices in the same test water, one normalizes to 1L and adds a dispersion factor of 3, which is essentially controlling for the same phenomena twice.
- Another panelist brought up the fact that there was one extraction method, but 2 normalization methods. The result of product exposure are normalized to both static and flowing field use assumptions.

Report from Alternative Materials Breakout Group

The first suggestion from this group is that EPA should compile and document a list of possible alternative materials, such as brass alloys and other possible replacement material. This document should evaluate the life cycle and manufacturing performance of the new materials and determine where and how a new material may be applied. Specifically, it would be important to look at the performance, durability, and leaching results from any potential alternative material. In addition, the document should evaluate new materials with respect to the NSF 61 leaching protocol and possible changes in disinfectant. The document should also examine manufacturing obstacles. For example, what is the manufacturing process? Is it feasible? What specific obstacles currently exist? Lastly, the document should look at the cost and availability of alternative materials. It may be best to look at classes of materials and determine the availability of that class. If the class of materials is not currently available, it is important to research the time frame for when those materials will become sufficiently available.

The breakout group also recommended a study that would examine the long term effectiveness of manufacturing treatments such as acid washing, coating, plating, and other surface treatments on lead leachates. One potential area of study highlighted by the group is research into the long-term performance of surface protective treatments, especially in regards to the amount and type of leachates. In addition, the panel suggested a study on the importance of manufacturing process controls.

Another recommendation made by the breakout group was that EPA needs to complete the study on health effects of bismuth, a potential alternate material. The group speaker mentioned that EPA has nearly finished this document, but it needs to be put into a publishable format and made available to the public. A potential caveat is that most of the health information on bismuth has focused on bismuth in pharmaceuticals, where bismuth is in the +3 oxidation state. However, there are two other oxidation forms, +4 and +5. It is important to understand the oxidation form of bismuth leachates, and make sure it is compatible, or the same, as the oxidation form studied in the health data of the currently unpublished EPA document.

The group also suggested that a study be conducted in order to look at the impact of brass recycling. For example, the study should address disposal and use of current leaded brass supplies. The group also pondered what to do with the material if the current demand sharply declines. For example, if the brass is disposed of, will the lead eventually leach out? Is there some type of treatment that must be applied prior to disposal?

Finally, the group suggested that EPA prepare a white paper comparing the potential health effects due to leaching of traditional brass alloys and alternate brass alloys as it relates to lead, bismuth, selenium, copper, and zinc. This paper could also include other topics mentioned in the first slide of this breakout group report (paragraph 1 of this summary).

Questions and Comments from Panel

- If we conduct research to understand how a technology performs over time, we can also understand how products using that technology will also perform over time.

- We would need to include analysis of leaching of other metals from alternative alloys under NSF 61 Section 9, as well as the appropriate range of test waters.
- A document of current alternative materials would be useful. It may be difficult to compile because many companies may not want to share such proprietary information. However, EPA should have the goal of acquiring as much information as possible regarding alternative materials.
- The NSF protocol may need to be altered for alternative materials. Is the Q statistic appropriate for other materials, such as selenium?
- The speaker responded by saying that lead is the only material/metal for which a Q statistic is determined, and the test results are gathered over multiple days. Other materials are only tested once, after day 19.
- Another panel member brought up the fact that alternative brass materials, or other alloys with selenium or bismuth, are only practical for cast alloys and do not necessarily apply to wrought alloys. He reminded the panel that this is a complex problem with many issues and that we should be careful of sweeping generalizations in terms of product/alloy compositions and performance.

Questions and Comments from the Observation Gallery

- One observer mentioned that, from his experience, bismuth leachates are in the oxidation forms +3 and +5, and that bismuth leaching tends to be minimal in drinking water. He also added that bismuth is an ingredient in the product Pepto Bismol, and therefore, he doubts there would be a large health concern from bismuth.

Report from the National/State/Local/Industry/Consumer Practices Breakout Group

The breakout group mentioned that EPA must move progressively on a fast track to identify and address any changes in regulatory program requirements such as NSF and other standards. In doing so, EPA should maintain the current structure of the state / local / utility authority. The group noted that this was not an action item, but a recommendation or request since time is being lost while public health continues to be put at risk from on-going exposure to lead in their drinking water.

The group then recommended that standardized procedure(s) be developed for evaluating the contribution of lead from plumbing components. The procedures should address the following issues: real world conditions that are site-specific and not just the conditions of the controlled laboratory and new materials and effects of changes in practice (manufacturing, treatment, etc) on existing materials. This procedure should be applied to evaluate lead contribution of all plumbing components, both cumulatively and individually.

The next recommendation made by the group was to develop and implement an approach to improve compliance with existing requirements to sell NSF 61 compliant plumbing components at state and local level which address the following:

- Define coverage of standard including utility, home, school etc. Currently, the specific requirements and differences among each group are not clear.
- Evaluate the impact of compliance with Sections 4 and 8 of NSF 61
- Evaluate the impact of 3rd party certification for Sections 4, 8, and 9 of NSF 61, and specifically consider why certification is only required for Section 9, but not for Sections 4 nor 8.
- Assignment of state agency responsibilities for enforcement: the group expressed their concern that the role of enforcement is currently lacking
- Make information available to public via centralized warehouse, such as an electronic database or website The breakout group went on to explain that the centralized warehouse should include items such as:

    - A single source for identifying NSF certified products
    - Status of state implementation of plumbing codes
    - Plumbing code requirements to address lead in schools

Such a clearinghouse is important considering that five agencies are involved with certification standards, and many different states and cities have different plumbing codes. In short, the goal of the centralized warehouse would be to provide all the various types of information from all the various sources at one location.

The group also recommended that research on the cost implications of plumbing choices to consumers be conducted. The research should be summarized into user friendly materials to explain the implications to consumers. The public materials should include a cost analysis comparing various plumbing material options and an explanation of public health implications of plumbing material choices. This information should be dispersed widely and made available to the public. Once completed, this publication could be another item placed in the centralized data warehouse. Adding web links on the centralized warehouse web site would allow consumers to conduct additional research on their own regarding the certification of various products.

Another recommendation made by the group was to develop and implement a program to assist consumers in making better informed choices of plumbing materials. This program should include consumer labeling of plumbing materials, involving a concise, clearly-worded label. The label should also describe the product compliance with the NSF standard, and describe the estimated exposure to the contaminant of concern, such as lead, from the product.
The label should be prominently placed on the product. The group cautions that misleading labeling should be avoided, as should confusing labels, such as using the SDWA definition of “lead-free” on a label. Other ways to minimize confusion include having a website link on the label that is linked to other health related materials. The group also recommended that free explanatory literature should be published and placed in big box home improvement stores.

An additional recommendation made by the group is that standardized technical education materials should be available for plumbers and consumers. This information should be distributed through EPA and relevant State and local entities. Such entities should also have camera-ready (i.e., easily reproducible) copies available so that it can be easily dispersed. Educational materials should also be provided to design engineers, architects and others that design plumbing and pipe systems. All educational materials should be standardized, and the group suggested that they be placed in the centralized warehouse.

The group also suggested that a study should be conducted to determine if there is a correlation between elevated lead levels with particular plumbing products at sample sites. This site does not necessarily need to be a monitoring site. Such a study should evaluate whether plumbing components are certified at sites where LCR monitoring finds high levels of leads. In other words, how often do lead exceedances occur where NSF 61 compliant devices have been used? The group also suggested that other field based study strategies be considered.

The group recommended that it be determined if there is a health based need to change the current uniform national standard for lead content. If so, it is also important to determine appropriate timing for implementing the rule, such as planning a realistic overall schedule for any changes. This is a particular concern of the manufacturing industry.

Lastly, it should also be determined whether the lead content of utility and household components should be covered by plumbing codes or by the SDWA.

Questions and Comments from the Panelists

- A panelist noted that the rules regarding the lead content of utility and household components should be covered by plumbing codes. These codes had the greatest leverage to drive technological change. In other words, placing changes in the plumbing codes was the best place to create a competitive advantage for those companies who are able to manufacture low, or no, lead devices. Local plumbing codes are also an effective enforcement tool.
- The speaker mentioned that a written agreement is needed that explains what agencies/entities are in charge of what aspects of enforcement. In addition, it is important to know what devices are leaching more than they theoretically should be.
- A panelist discussed that plumbing codes are often adopted at the local and county, not State levels. There is often no discussion between the State drinking water entities and the people working on the plumbing codes. It would be helpful to strengthen this connection, but this can be tough in some states that have many jurisdictions.
- A panelist stated that, in general, many new plumbing codes refer to NSF 61 and therefore, essentially require that such components be listed under NSF 61. There needs to be increased dialogue between those that develop plumbing codes and those that implement the plumbing codes.
- A panelist mentioned that where he is from, they have a city code and utilities have no jurisdiction. Unless rules are written in the plumbing codes, there is a difficult time enforcing them.
- A panelist mentioned the example of lead solders in Pennsylvania that was discussed in the white paper/issue paper handed out for this meeting. In Pennsylvania, interns were in charge of inspecting hardware stores, and

identifying stores that sold lead solders. They focused on larger hardware stores. This was an effective way to minimize the number of lead solders sold in PA, although it took a while to take effect.

- The speaker mentioned that you need to have state enforcement power prior to beginning an effort. In addition, in the speaker's state, they are very short staffed. She mentioned that you need to decide and understand the responsibilities of various entities.
- The panelist added that in Pennsylvania the lead free solder provisions are State law, and reminded the panel that only 1-2 interns completed all the work, which was a relatively small percentage of manpower, even in small offices.
- A panelist stated that, on behalf of a listing agency, there may be some hesitation in turning over information and having someone else compile it into one list. This is because the existence of some agencies is based entirely on maintaining their database. Thus, combining all databases would raise issues such as who is to pay and maintain each portion of the database. Another solution is to just have electronic links to each database/listing agency.
- A panelist responded that data is currently available, but people need to know where to go to find such data. One way is to search by manufacturer. An improvement would be to standardize how certifiers organize their data.
- A panel member noted that the ASME standard regarding faucets requires NSF 61. Thus, if a product is considered ASME certified, then it must also be NSF 61 certified. However, it will only be marked as ASME certified. Thus, creating a national standardized format as to how to list such products would be helpful.
- A panel member agreed that having a central website that would be based off the EPA website with links to other sources would be very helpful.

Questions and Comments from the Observation Gallery

- An observer noted that in Canada, they standardized how certifiers publish their information. They also have a central website, from which there are links where people can go to the certifiers' web sites.
- An observer from EPA Region 3 mentioned that a potential opportunity to decrease lead in drinking water is to create a market force by participating in the Green Building program. Through that program, one can place information regarding ways to lower lead levels in drinking water into the specifications for new buildings and renovations.
- Another observer mentioned that the CDC issued a report that said there had been "stunning progress" to decrease the health risk from lead. He asked whether this is being taken into consideration and wondered if it was still pertinent to remain on a fast track to decrease lead in drinking water.
- A panelist responded that new health information has reported that the level of lead that can produce negative health impacts is dramatically lower that previously thought. So, although we have made progress in reducing the health risk from lead, there is still a lot to be done.

Report from the Miscellaneous Breakout Group

The group classified sets of comments received by the panel into similar subjects, or types of issues. The first subject was "real world data from systems and LCR compliance," which came from Issues # 1, 10, 11, 12 & 3, under Miscellaneous Items in Attachment B to this summary.

For Issue #1, the panel had stated that there was a need for better data collection to "chase the evaluation of issues such as water quality parameters (WQPs)". For example, there is a need to look at the correlation between treatment and WQPs, and determine how that relates to lead exceedances data so that we can determine which waters are most aggressive towards lead.
Some parameters that are important to look at include pH, alkalinity, disinfectant levels, inhibitor levels, and system treatment. Most of these parameters are a good first step, since most utilities are already testing for them. Additional parameters to test for would ideally include oxidation/reduction potential and chlorine/chloramines. In addition, EPA should encourage and implement development of a national database

Issue #10 suggested that regulatory provisions should allow real world utility samples, from devices or households, be used to assess the problem and determine the contribution of various potential sources. In other words, if a utility has a 90^{th} percentile lead level near 14 µg/L, how best can they assess the problem? In response to this issue, the group asked if a utility collects additional samples to assess the contribution of individual system components to elevated lead levels, would these samples be included in compliance calculations. A member of the group knew that samples could be collected and not included in compliance calculations as long as it's not a compliance sampling site, or, if it is, that the volume is different or the sample is not collected during the compliance monitoring period. If such testing reveals the source of lead levels at that site, the group asked whether that site can be dropped. No one was aware that an answer exists, and the group suggested that there may need to be guidance and/or regulation changes to address what is appropriate to do at this point.

Comment #11 from the panel asked how much of the optimal corrosion control burden is due to brass devices. The group concluded that the answer is not known and more data needs to be collected. The group thought that there might be some existing data within utilities and academia, although more data needs to be collected, compiled, and summarized.

Issue #12 from the panel asked what is known about galvanic effects contribution to lead leaching and the contribution of lead from legacy sources (solder, pipe). The group concluded that more data needs to be collected, or if data is not available, research needs to be conducted on the effects from plumbed in components versus individual components and on grounding. The group warns that this is a complicated problem and there may be some other effects that need to be researched, but we currently do not fully understand them. The group also mentioned that these tests could be conducted in the lab or in the field.

Issue #3 from the panel addressed on-going challenges of long term compliance with upcoming rules, such as the Stage 2 Disinfectants/Disinfection Byproducts Rule and the Long Term 2 Enhanced Surface Water Treatment Rule, and associated products. The group mentioned that EPA is currently updating the Simultaneous Compliance Manual, which may be of interest to many group and panel participants since the DC incident. Furthermore, many participants wanted to feel confident that if they make a change in treatment to solve a problem, it will not lead to other problems. For example, how does the chemistry change if utilities install new devices? Or, if there is change in treatment, what is the corresponding impact on lead leaching characteristics of brass products? The group recommended that this information be incorporated into the Simultaneous Compliance Manual revisions.

The next set of panel issues addressed by this breakout group all dealt with health issues.

Issue #2 from the panel asked what is sufficiently health protective for regulatory/exposure standards. The group suggested that EPA update/revise toxicological information to incorporate current data. This should include the California health information used to develop CA Prop 65 dose of 0.5 µg/d and other medical studies.

Issue #4 from the panel recommended that a specific level of safety be articulated, such as a safe level of lead in the water. Furthermore, the group wanted to know how the current regulation of 15 µg/L was assessed, and using the most up to date health information, where it should be today.

In Issue #6, the panel wanted EPA to calculate the effects of water-borne lead on blood lead levels. They were specifically interested in knowing what the percent of the blood lead level is associated with leachates from applicable NSF devices. In response, the group hypothesized that the exact proportion from applicable NSF devices varies, depending on target population and risk assessment assumptions. CDC had previously conducted some testing along these lines in DC and found that the correlation was variable, especially because it was unknown how much of total water consumption was from tap water at homes. For example, a homeowner may drink the majority of their drinking water at work and restaurants. The group suggested that further studies change their methods so that a tighter link could be established between the lead tested in water that is actually consumed by the people who give blood samples analyzed for lead. The group also recommended that EPA revise the risk assessment for lead using more recent/current information, which includes the contribution from multiple sources. In addition, regulations should be based on the most complete information possible. The group emphasized that industry should not be regulated to a particular level unless scientific data supports that level. Lastly, the group asked how the '15' and '11' values in NSF devices from Section 9 of the NSF Standards relate to blood lead levels.

The next set of panel issues addressed by this breakout group all relate to definitions.

In response to Issue #5, which was simply "terminology," the group stated that terminology must be consistent among entities and groups (i.e., "plumbing devices" versus "fixtures"). Lastly, the group recommended that entities refer to product standards (NSF standards) for definitions.

In Issue #7, the panel asked whether hot water is considered drinking water. The group stated that to get hot water, the water must run for a while, except for instant hot water dispensers. There might be cases where people drink hot water, such as for baby formula. But, generally people drink cold water. Therefore, certification should be based on normal practical applications, which is cold water. In conclusion, the group decided that hot water should be considered drinking water, but it should be considered a low priority.

Issue #9 from the panel requests that EPA change the definition of “lead free” from the 1996 SDWA definition. The group agreed with this recommendation, especially because this definition can easily lead to confusion between “lead free”, “low lead”, and “no lead”, or “no lead added”. In addition, “lead free” is misleading to the consumer since “lead free” will probably be understood to mean 0 percent lead by the consumer, yet may contain 0.2 percent to 8 percent lead. Senator Jeffords attempted to define the level of lead by calling “no lead” any device less than 0.2 percent lead and “low lead” for any device that is equal to or less than 2 percent lead in draft legislation (Lead-Free Drinking Water Act of 2005). Another option for describing “no lead” and “low lead” is to state the percentage of other materials in the device, rather than the percent of lead. Thus, a “no lead” device would be at least 99.8 percent lead free brass. The definition could also be based on use of pipe, fitting and component.

In the last group of questions is Issue # 14, which urged EPA to revisit LCR flushing regarding commonality in public education language. The group responded that EPA is currently evaluating revisions to public education guidance recommendations on flushing times. If a water system has information on appropriate flushing times to reach water in the main, then the state can allow that utility to use that flushing time in their public education language.

Lastly, the group asked how do you verify what products comply with the law. Is it if a product is less than or equal to 8 percent lead? The group pointed out that SDWA does not require verification, only compliance. The group recommended that SDWA require third party verification for compliance.

Questions and Comments from the Panel

- A panelist stated that using water quality parameters to determine aggressive waters should not be limited to waters that are aggressive in terms of leaching lead, but also other types of alloys and metals, such as zinc.
- A panelist suggested that before terminology can be standardized and put in writing, it must be agreed upon by all parties.
- A panelist from a utility mentioned that utilities already have a source of information on lead levels in their systems from their 90^{th} percentile compliance monitoring samples. This data might provide a rough cut that could allow comparisons from waters from two different treatment plants with two different sets of water quality parameters. Many utilities have this type of information which would be a basis for a good database. Although there may be variability among the utilities and their data collection methods, it would be a good place to start.
- A panelist from a utility stated that it is important for EPA to revisit its suggestions on flushing times and involve utilities in providing new estimates.

There is great variability among utilities in terms of how much flushing time is necessary if lead levels are exceeded.

- The speaker added that guidance is needed in terms of how to determine an appropriate flushing time.
- A panel member suggested that utilities can look at exceedance data to determine the relationship between high lead levels and lead service lines (LSLs). He also urged that lead and copper data be compared to water quality data.
- Another panel member felt that to standardize terminology, it would be important to start with building codes and look at how they define specific terms. A good goal would be to come up with a definition that makes the most sense to the user. The panel member also mentioned that NSF 61 defines hot water as 62^{o}C for residential areas and 82^{o}C for commercial buildings. However, there could be a reason to change the hot water testing protocol since hot water is tested by continuously running hot water. However, in practice most people run hot water and then it cools in the pipes afterwards.
- A panel member opined that, with respect to water temperature, most people believe that any water coming from the tap is considered tap or potable water, no matter the temperature of the water. Far less people consume hot water, making it less of a priority, but it is still drinking water.
- Another panelist agreed and said that is why the group concluded that hot water is drinking water, but of low priority. He also said that flushing is only a temporary solution for water providers that can not fix the problem right away. Consumers, especially from the West Coast where water conservation is pushed, do not like this, and it can often result in a negative reaction. Ultimately, the sources of lead need to be addressed.
- The speaker mentioned that in his experience with flushing, the majority of complaints from consumers involved the money spent on flushing water. In Washington, D.C., they encouraged consumers to flush lines in the morning by taking a shower or washing dishes. These were activities that customers normally paid for, but were now just changing when they conducted such activities.
- A panelist mentioned that EPA is developing a model that addresses the relationship of waterborne lead to blood lead levels.
- A panelist was surprised that people still use hot water for baby formulas. Public health information, and some utilities, advertise that parents should use cold water and heat it up for baby formulas.
- A panelist observed that these actions were uncertain as they are based on consumer compliance.
- A panel member explained that NSF testing for many Section 8 devices was discretionary about the actual temperature used for testing. Companies can create a competitive advantage by making devices that have the highest level of protection, such as testing at 82^{o}C.

Questions and Comments from the Observation Gallery

- An observer recommended that EPA use a risk based approach when trying to develop a regulation based on sparse or uncertain data. This approach includes the likelihood that lead gets leached, the likelihood the lead reaches a consumer, and the likelihood that the lead will reach consumers in sufficient levels to cause an adverse health effects.

- An observer from Canada mention that it is important to look at blood levels not just from NSF 61 certified products, but from all products that leach lead.
- A representative from EPA clarified that EPA does have a health based value for lead, and that value is “0”, meaning there is no acceptable threshold for adverse health effects from lead. Lead is also listed as a “Class B2 probable human carcinogen”, further supporting the health goal of “0”.
- An observer referred to the Jeffords’ Bill and the exact definitions of lead free as defined in that bill.

Conclusion and Adjournment

Eric Burneson concluded the workshop by thanking the panelists and observers for providing a successful examination of lead in plumbing, including identification of issues and steps to take to address those issues. There are a number of actions that EPA can take, either alone or in cooperation with stakeholders. He added that although EPA does not necessarily have the resources to address all actions, reduction of lead in plumbing is an important priority. EPA will consider a prioritization process and will work with others in the room to identify priorities and determine who could follow up on these actions.

Dr. Summers adjourned the workshop by once again thanking the speakers and panelists who respected the process, resulting in a constructive and helpful experience.

Attachment A

Lead in Plumbing Fittings and Fixtures

Expert Panelists

Rand Ackroyd, Rand Engineering
Greg Bell, Cambridge Brass
Mike Briggs, International Association of Plumbing and Mechanical Officials
Jack De Marco, Greater Cincinnati Water Works
Yvette Depeiza, Massachusetts Department of Environmental Protection
Steve Estes-Smargiassi, Massachusetts Water Resources Authority
William Geers, NIBCO
Richard Giani, District of Columbia Water and Sewer Authority
Peter Greiner, NSF International
David Hartman, Greater Cincinnati Water Works
David Heumann, PE, MBA, Los Angeles Department of Water and Power
Jeff Kempic, U.S. Environmental Protection Agency
Andy Kireta, Jr., Copper Development Association
Donald Kullmann, Neptune
Richard Maas, PhD, University of North Carolina Asheville
Clif McLellan, NSF International
Lee Mercer, Moen
Erik Olson, Natural Resources Defense Council
Mike Schock, PhD, U.S. Environmental Protection Agency
Jeff Scilingo, Watts Regulator Co.
Craig Selover, Masco Corp
David Viola, Plumbing Manufacturers Institute
Jim Wailes, American Water Works Association
Robert Weed, Copper Development Association
Ed Weil, California Department of Justice

Attachment B

Identification of Issues

NSF Standards & Testing Protocols

1. Performance criteria addresses differences in product application
2. Better understanding of the relationships between NSF, test waters, and RWDW (real world drinking water)
3. Performance vs. prescriptive testing
4. NSF Section 8 direct specification of what constitutes water quality regarding temperature (A specification for what water temperature the test should be conducted)
5. NSF testing procedures for combined parts
6. Standard test procedures for non-lead brass
7. Should criteria mirror LCR and LCCA?
8. What should metal performance release be in real world?
9. Are we read for a California-like (Prop 65) standard nationwide?
10. What is appropriate volume for normalization?
11. Longer term (2 months) effects of passivation
12. Target and benchmark for lead levels in water
13. Update (i.e. Reduce) NSF lead discharge standards to reflect medical studies
14. When is acid wash appropriate?
15. Align NSF 60/61, and LCR & LCCA protocols
16. Coordinate activities of EPA efforts and NSF committees
17. Commonality in methods between NSF 61 Section 8 and Section 9
18. What percent of blood lead levels come from NSF certified (i.e. just 15 or 11 µg/L certified) products? (NOTE: removed and given to other group)
19. Uniform test with adjustment factors for water qualities
20. Lead contributions from multiple components (in dwelling)
21. Establish level of aggressiveness from NSF test standards
22. Should separate water qualities be developed for private wells vs. public systems
23. Real world LCR data does not provide direct evidence about device performance, especially NSF compliant vs. non-compliant devices

Alternative Materials and Technologies

1. Allow manufactures creativity and innovation with processes and materials
2. How effective is acid washing in the long-term?
3. Exposure compliance and health effects from lead brass vs. non-leaded brass
4. Cost and availability of alternative materials/technology
5. Health risk of alternatives vs. health risks of lead
6. Impact on recycled materials (such as those not used any more, i.e. brass)
7. What is current demand and short and long-term availability of alternative materials?
8. Manufacturing solutions impact on performance and reliability
9. Long-term performance testing regime for 99.8 percent lead free
10. Leaching performance of alter casting alloys in chloramine waters

11. Application differences between cast and wrought alloys
12. Application differences for alloys for Section 8 and Section 9
13. Safe harbor lead content standards
14. Understanding lead contribution from legacy sources (NOTE: given to Misc. group)
15. Is there a goal for plastics as an alternative?
16. Market adjustment period needed
17. Prioritize list of obstacles to adopting low-leaching lead
18. Need EPA MCL for Bismuth
19. Side by side comparison of service branches with 8 percent and 0.25 percent lead
20. 99.8 percent lead free conversion cost related to utility water rates

National/State/Local/Industry/Consumer Practices

1. Not a crisis, but a missed opportunity to reduce exposure
2. What procedures do utilities use to evaluate the contributions of fixtures/fittings?
3. Improve compliance /enforcement of national standards
4. How can we assure effective compliance with ANSI/NSF 61?
5. Centralized location for information
6. Who speaks for consumers regarding cost of standards?
7. Review of practical implementation schedule for and use of in-line components
8. One central location for determining certification with standard
9. Can utilities and schools realistically get control of plumbing materials
10. Voluntary compliance methods to encourage utility conversion to 99.8 percent and lead free products
11. National standard setting should address consumer vs. water system devices
12. Consumer labeling for consumer choice (e.g. energy label)
13. How do we link to plumbing engineers designing buildings?
14. Correlation of LCR exceedances and certified equipment?
15. Understanding lead contribution from all system components
16. Should existing plumbing codes mandate compliance or SDWA?
17. Recommend SDWA regulations require ANSI accredited 3rd party certification for Section 4, 8, and 9, with respect to lead
18. Collection of information from states on implementation of plumbing codes
19. Need for single uniform national standard for lead in products
20. Standardize consumer education materials regarding lead and plumbing materials
21. Stepwise vs. gradual approach from 8 percent to 0.2 percent lead
22. State/Local/Utilities retain right to protect consumers
23. Avoid misleading consumers about “lead free”

Miscellaneous

1. Need better data collection to “chase” the evaluation of issues (WQPs, etc.)
2. Sufficiently health protective regulatory/exposure standard
3. Addressing ongoing challenges of long term compliance (Stage 2, LT2, etc), and products

4. Articulate level of safety regarding levels of lead in the water
5. Terminology
6. Calculation of the association between blood lead levels and exposure to lead from applicable plumbing products
7. Is hot water drinking water?
8. Align NSF 61, LCCA and LCR protocols
9. Change definition of "Lead Free," the 1996 SDWA definition
10. Regulation provisions that allow real world utility samples (devices or households) to assess contribution
11. How much of OCCT burden is due to brass devices?
12. What is known about galvanic effects contribution to lead leaching?
13. Revisit LCR flushing regarding commonality in public education language