USEPA
Lead and Copper Rule Workshop 2: Monitoring Protocols
Summary
May 12, 2004 – May 13, 2004
St. Louis Airport Marriott

Facilitated by R. Scott Summers, University of Colorado-Boulder

The facilitator, Scott Summers, began the meeting by welcoming the panel participants and observers. Scott described the approach of the workshop as identifying as many technical issues as possible related to monitoring under the Lead and Copper Rule (LCR). For the identified issues, the goal is to discuss solutions, both demonstrated and potential, and identify information gaps.

After introductions (see Attachment A for the attendance list), Eric Burneson of EPA's OGWDW explained that the purpose of the workshop was to exchange information on the sampling protocols of the LCR, including challenges in complying with the LCR and strategies for overcoming those challenges. As part of the 6-year review cycle, EPA is in the initial stages of assessing the LCR. This workshop, and future planned workshops, is part of a broader review of the LCR; in addition, EPA is always updating guidance and training. The expected outputs of this workshop (i.e., information on lead and copper sampling problems and solutions) will assist EPA in determining further actions, including suggestions for additional guidance, identification of rule provisions that could be modified, and data gaps. Eric emphasized that the workshop was not seeking to reach consensus, but rather to exchange information on national problems.

Ron Bergman of EPA's OGWDW summarized the sampling provisions in the LCR. The LCR went into effect in 1991, with more recent revisions in 2000. At this point, there has been over 10 years of experience with implementing the rule. EPA would like to tap into that experience to guide potential changes in guidance and/or the rule. Ron explained that the rule provisions are not strictly health-based, but rather designed around an action level that triggers other activities and optimization of corrosion control. The purpose of the monitoring under the LCR, particularly the water quality parameter monitoring, is to demonstrate optimization of corrosion control. The action level is calculated at the 90^{th} percentile. The system takes samples, ranks then high to low, and then picks the 90^{th} percentile value. This means that not all consumers will receive water that will be below action level at all times. The rule allows some samples above action level at any time (up to 9%). The monitoring protocol includes taking samples at the tap, focusing on the highest potential for lead, as much of the potential lead leaching comes from inside the consumer's home. Sample sites are selected based on the identification of materials seeking the highest potential lead levels (tier system). The sample protocol is also geared towards identifying high lead levels by having customers take the sample as the cold, first draw in the morning. The sample size and frequency were designed to balance burden and representativeness, and were derived from the literature on process control statistics. Reduced monitoring is allowed under specified circumstances. States can require additional monitoring after a change in treatment or source. The Rule also has water quality parameter monitoring provisions.

Ron identified potential national issues associated with monitoring and sampling for the LCR:

- Does current tiering identify highest risk sites?
- Are vulnerable subpopulations, such as day care centers, represented and protected?
- How should multifamily dwellings be handled?
- How does the first draw sample relate to daily exposure?
- Are the current directions on flushing sufficient?
- Are there situations when more frequent monitoring is required?
- Are the samples numbers sufficient for very large systems?
- Should treatment changes trigger more monitoring?
- Is there better way to demonstrate corrosion control?

The panel had the following discussion on the rule provisions.

- The current focus of the rule is on locations with the highest lead levels, why not copper? The assumptions were that copper and lead leach similarly and that lead is more important. If the focus were on lead levels, then copper would also be captured. Evidence over the past several years makes it clear that high copper occurs in homes that the rule does not target, namely new copper-plumbed homes. With the current tier systems, the homes with the greatest potential for high copper levels are not sampled at all.
- Where did the .015 Action level come from? This value was derived based on the capabilities of corrosion control processes to adequately control lead concentrations at tap. This is not a health based number. In 1990, the first draw sample was tested in 100,000 homes and, based on that sample population, it was estimated that 25% of systems would exceed the 90^{th} percentile.
- The sampling protocols allow invalidation of a sample under four specific criteria in the regulation.
- Daycares and schools present challenges. Episodic water use in schools compounds problems (weekends stagnation).

After this initial discussion, three utilities provided case studies to the panel.

Case Study #1: Fairfax County, VA Presented by Jeanne Bailey

Jeanne Bailey of Fairfax County, VA presented the first case study. Fairfax services a population of 1.2 million in Virginia, with about a 60% retail, 40% wholesale split. Most of the housing in the county is fairly young. They have no lead service lines, as the few existing lead lines were replaced back in the 1980s. Some houses still have internal lead lines. The system uses chloramines and zinc orthophosphates for wholesale considerations.

Fairfax relies on customers to sample. Customers collect two samples: a sample at the initial draw and a sample after a 5 minute flush. Customers are provided detailed instructions (form, checklist). In accordance with guidance for their certifying laboratory, Fairfax includes an

exclusion statement that specifies the conditions under which a sample can be excluded. Sites are resampled if a sample is excluded. Customers are sent reminders and then called as an additional reminder. As incentive, Fairfax provides results in writing to homeowners who sample and pays $5 per sample. If a sample is above the action level, the customer is contacted and the site is resampled.

Schools are also sampled in the same manner. Coordination and response is handled by the school's environmental manager. A customer can request a lead sample at a cost of $35.

Even though Fairfax serves an affluent and educated population, Fairfax has difficulty in recruiting and keeping volunteers. Fairfax has identified 10,000 tier 1 homes, of which 100 need to be sampled. Approximately 25% of the sample residences turn over each time sampling is required.

The panel discussed the case study:

- In answer to a question, Jeanne Bailey explained that Fairfax identifies tier 1 houses through meter installation records. There were some early spot checks to confirm the presence of lead-based solder, but now the presence is assumed.
- A panel member asked how many utilities conduct lead sampling on demand and how frequently? In Fairfax, they usually have about a dozen homeowners who request that lead samples be taken each year, but this year there have been 136 requests already due to local publicity. Cincinnati also offers testing at the customers request, usually at a rate of about 40-50 per year. After a press story, they received 300 calls. Cobb County charges $25 per test and performs about 25-30 per year. Portland receives about 150 requests per year from homeowners in their own service area and in consecutive systems that receive their water.
- In response to a panel question, EPA clarified that a sample should be counted for compliance in the estimation of the 90th percentile when a site is resampled.

Case Study #2: Frequency of Sampling Presented by Howard Woods of Idaho DEQ

Howard began addressing his view of the purpose of sampling. His questions include:

- How much lead and copper exposure is there?
- Is the exposure correctible through treatment?
- Should lead service lines be replaced?
- Is problem unrelated to water delivered to home?

The state (ID) deems when a process change is effective in reducing lead or copper. How is this decided? ID requires two consecutive semesters of samples after action level failure. After source or process changes, when should states increase monitoring frequency and for how long? It is desirable to collect samples so that lead and copper samples are correlated with samples from other treatment processes. ID requires quarterly water quality parameter monitoring to coordinate with tap samples. Water Quality Parameter (WQP) samples are also required after treatment change. The state must determine optimal water quality parameters before monitoring

can be reduced. Without samples, how can the state make a determination? The state has little support. Source samples are required only after the exceedance of an action level. These are not needed if there is no lead at that tap. Recently, the state has been holding developers responsible for ensuring the quality of newly developed source waters. Developers are required to take water quality samples before homes are built and then follow up with tap samples in new homes. Copper levels in new homes can be high, but the levels go down over time. Immediate installation of treatment may be premature.

Case Study #3: Sample Site Selection Presented by Maggie Rodgers of Cleveland Division of Water

Maggie Rodgers of Cleveland Division of Water described the challenges facing Cleveland Water in selecting and maintaining sample sites. The system has 4 water treatment plants, feeding into one distribution system. However, Ohio EPA originally classified this as 2 distribution systems, resulting in the need for 200 samples. Lead service lines were used in the area until 1952. Because there had been major growth in the city before that time, there are plenty of Tier 1 sites. In 1992, Tier 1 sites were identified through account records and with letters sent to verify the presence of lead materials and solicit participation in sampling. Cleveland also used a variety of methods to identify housing developments built in the mid-80's that potentially could have lead solder. After verification of lead solder in the house, residents were recruited for participation. Despite these efforts, there were not enough participants. Utility employees were asked to participate, with few takers. The action level was exceeded based on the 1992 sampling, so orthophosphate was chosen for corrosion control.

In subsequent years, the action level was not exceeded, but the recruitment and retention of sampling participants remained difficult. The situation was helped when Ohio EPA designated Cleveland as having only one distribution system, therefore requiring only 100 samples. Finally, in 1999, Cleveland offered a $100 credit on the water bill if the customer provided a sample. Customers stopped dropping out and were more prompt in sending in samples. In 2000, Cleveland went to reduced monitoring and were able to drop uncooperative customers from their sampling program. Over half of the remaining sites have lead service lines (as tracked by the database).

The panel discussed the case study:

- One panel member noted that in their program, homes with high lead tended to stay in the sampling program, while homes with non-detects dropped out, potentially skewing results.
- One panel member speculated that homes with high lead levels drop out more frequently because they are tired of the frequent sampling.
- Cleveland tried to analyze their data to look for correlations between locations with high lead levels and water quality parameters, but was unsuccessful.
- Winnipeg has a similar problem with sampling sites dropping out. They are conducting a pipe loop study with harvested lead pipe at the same time as tap samples. They hope to develop a correlation between data from pipe loop studies and tap samples that will allow them to run loop studies to determine compliance.

- Consecutive systems have an even harder task to get samples. The best incentive is credit towards water bill. This practice tends to retain customers
- The panel discussed whether low flow situations (where the water and corrosion inhibitor are not getting through in sufficient volume) should be used as a sample site. Some felt that these sites were not representative of system conditions and were not appropriate to use. However, others felt that although it is harder to meet the action level under such conditions, these sites represent a valid section of the population (i.e., people living there and drinking water).
- When the rule was being developed, there was worry about the lead leaching completely out of 50-50 lead/tin solder over time. That is, there was a concern that if old homes with 50:50 solder were included in the sampling program, no lead would be found. As a result, only homes built after 1982 and before the lead ban were allowed in the tier 1 classification. If the concern about the lead leaching completely out of 50:50 solder was valid, now that so much time has passed, the copper homes in tier 1 classification are much older and should have much lower lead levels. Is there is a significant decline in lead levels as lead solder ages? According to several panel members representing utilities, there is not much difference in these homes.
- If the hypothesis used to write the rule was valid, Tier 1 homes are also getting older and the 90^{th} percentile may drop below 15, simply because the system has aged.
- The panel members repeated that there is not much difference in these homes, but there may also be contribution by leaded brass in faucets, but there isn't enough information.
- If a home is shown to have lead above the AL, should a standard suggestion be putting in new plumbing?
- If new plumbing were installed, often it would be copper with unleaded solder, but new copper homes have more trouble with high levels of copper. To what degree is copper legitimately a tier 1 issue, or is the concern regarding Cu declining?
- Is the present tier structure appropriate for copper plumbing? That is, is the tier system truly targeting the worst case with respect to copper?
- Copper may be worst in new homes with new copper plumbing (2,000 to 5,000 ppb), which would not be captured under existing sampling protocols.
- Systems rely on questionnaires to determine changes that may lead to different results such as installed new bathrooms or changes sampling site.
- What is the impact of hot water on lead levels? Another hypothesis used in writing the protocols of the original rule was the hypothesis that hot water is more corrosive than cold water. It is difficult to test because many faucets have leakage between hot and cold water. Should the hot water caution to customers be dropped? There are many variables involved, including the potential reservoir of unknown particulates in the hot water heater.

Post-Optimization Lead and Copper Control Monitoring Strategies AWWARF Project
Presented by Gregory Kirmeyer, EES

Gregory Kirmeyer discussed a soon to be released AWWARF project on lead and copper monitoring strategies. The objectives of the project were to develop a statistically valid protocol for lead and copper tap sampling to assess major treatment change or source change and to develop an online accelerated testing device to predict real time levels. Lead levels can be highly variable and dependent on a number of factors. Based on actual sampling data, the research project calculated typical coefficients of variation. Lead was more variable than copper and there is more variation between site than within sites. A statistically valid sampling protocol can then be designed using these coefficients of variation. The research project also identified site selection criteria and data collection and analysis criteria designed to reduce variability so that monitoring more easily discerns impacts due to changes in treatment. The research project also involved designing an online corrosion cell that was successful for copper, but lead is more complicated.

The panel had the following discussion on the presentation.

- Similar to the Winnipeg situation, can we develop better tools to determine whether treatment is improving or not improving, rather than performing sampling?
- Pilot plant studies or loops with harvested pipe studies may be more reproducible.
- The research did use some pipe loop study data.
- For older pipe loops, the approach can be pretty accurately used.
- When revising the rules, other approaches judging progress should be explored.
- Small skid mounted loops, particularly for copper, can provide historical information.
- In one loop study, there were changes over time in polyphosphates. Over long term, perhaps you could sample the pipe loops and then sample homes, to correlate pipe loop for regulatory use.
- Copper is different than lead, there is a more rapid effect.
- Corrosion online monitors can provide good reliable data and instantaneous corrosion rates for general corrosion and pitting.
- Operational control is big gap; there is more that we could do.
- There are better analytical tools and protocols to optimize corrosion control now available.
- How useful are these tools for systems that have lots of corrosion happening at the same time? Can they get at different mechanisms for corrosion?
- Pipe loops are effective at measuring uniform corrosion (i.e., chemical corrosion), but not biocorrosion.
- The water industry needs better process control similar to the chemical industry.
- Very high rates of corrosion are easy to measure. Lower rates of corrosion are more subtle and harder to measure.
- From a biological perspective, recent studies have demonstrated the effects of lead and cadmium at the single cell gene expression level, etc. Toxicology literature may indicate a lead level in water no greater than 5 ppb. This is a tough standard to head toward.

- Cadmium is rarely discussed but is a frequent corrosion byproduct in pipes. Testing has found cadmium violations in schools.
- There is a data gap as to daily exposure to put with health data. There is a lot of first draw data, but not much on later water samples.
- The take home message of the AWWARF study is that when doing lead and copper monitoring to determine impacts of treatment changes, the 90th percentile value can be very variable. The mean is easier to use to detect changes. The median (50th percentile) also showed changes better. The frequency distribution of the data provided the most robust presentation from which to track any changes over time. Some are uncomfortable with using the mean because these are very often low number in most systems. However, the mean may be appropriate for distinguishing impacts for treatment changes, but not health-based triggers. Several panelists agreed that the median would be a more reliable measure of the central tendency.
- Some have found that studies with pipe loops, coupons, etc were not able to predict the performance of some systems
- Is it possible to put together a system that is similar enough to predict the real world?
- Often when a rule is written, public interprets exceedance of action level as a health effect. Public education needs to be different.
- Getting a grasp on variability is difficult.
- In the experience of one state, there are often reasons to explain high results. Should there be an investigation of the sample before triggering into public notification?
- EPA guidance should be more explicit on how to exclude samples because once the sample is sent to the lab, it must be considered a good result and included in 90th percentile calculations.

Open Floor Discussion

The facilitator then opened the floor to comments from the non-panel meeting observers.

- Linda Tatro of Passaic Valley Water Commission discussed legislation that was passed a year ago. The legislation puts the onus on homeowners to have private wells tested and the results available at closing if a house is sold.
  - With regards to LCR sampling, homeowners with high values do not drop out; homeowners with negative values tend to drop out more frequently.
  - In some urban areas, it is very difficult to identify an adequate supply of single-family homes.
  - The rule is nebulous on the testing of consecutive systems. Results can be different between systems and there is no control over consecutive systems.
  - Major droughts have big effects.
- Kathy Moriarty of Bangor Water District (Maine) discussed the importance of ensuring that lead solder is present in proposed tier 1 locations. Systems can't make assumptions based on year built.
  - The rule focuses on lead solder, however there can be other sources of lead. Her system has no lead service lines, but still had lead in water. They determined that

meters were the source. They tested new meters and older meters in the system and detected lead levels over 1,000 ppb from some meters.
    - Even with "lead free" meter they were getting high lead numbers in service or during test. Lead free should be lead free
    - When you put in new meters, you will get substantial amounts lead. If you replace new meters with no lead added alloys, this will reduce lead and the reduction will show up in monitoring.
    - Bangor experience made them realize that the time has come to truly have no lead materials. They have incorporated this in their bid specs and expect to do this a lot more in future.
- Other systems have had problems particularly with large compound meters, with bypasses controlled by lead weights.
- One panel member cautioned that taking out a meter and introducing water may not be a good test because removing the meter may have caused damage.
- Others are not surprised at high levels from meters.
- In a published study water of meters from CA towns, the meters were removed or tested in the system. All 30 meters discharged less than 5 ppb. Age was not a factor. One town had discharges in the 30-50 ppb. Brand and age of meter did not matter. Corrosivity of water was determining factor.
- Steve Drda from Nebraska Public Drinking Water Program discussed small system issues. In NE, there are many small systems. The kinds of solutions that this panel might come up with may rope in a lot of little fish and cost a lot of money. In small systems, a larger percentage of homes are sampled and half are non-transient non-community.
    - Tiering system applies for small systems but many don't know if there are lead service lines.
    - In the LCR sampling for small systems, all it takes is one sample over the action limit to trigger action, either more expensive sampling or costly treatment.
    - Small systems should be allowed to comply with an action other than treatment, such as a flushing program or POU devices.
- Bob Atkinson of Missouri Department of Natural Resources: Getting all consecutive systems in compliance at the same time is challenging. He has some secondary systems purchasing from another state.
- Kevin Dixon of Black & Veatch: Perhaps there should be a separate workshop focusing solely on small systems LCR issues.
    - Small system issues should only ease the burden on small system but allow same level of health protection.

Panel Discussion

- A distribution system is variable. How does guidance deal with that issue?
- Water quality parameter monitoring plans do not talk about condition of water in system in areas such as low flow areas.
- Should nitrification and chloramination parameters be considered?
- How can monitoring for water quality parameters deliver an estimate of lead, in conjunction with modeling?

- There needs to be more guidance on actions to take if water quality parameters are exceeded, for example, targeted flushing or sampling.
- How can or should schools and daycares be accommodated for in the LCR monitoring?
- Lead is not gone when action level is met.
- There are problems with attaining sample sites based on distribution system characteristics. Sampling should reflect sentinel sites.
- There are problems in cities with more than 50% lead service lines.
- In response to sampling, should the current customer flushing instructions be changed?
- The response requirement to an action level trigger should not wait 6 months for the end of the monitoring period.
- There should be an upper limit for routine samples and additional sampling.
- Is there a need to look at data on the service line contribution to lead levels?
- Should changes be made in sampling considering that the first draw, liter sample would not, in most cases, capture the effects of lead service lines?
- Is there a need for sampling after partial lead service line replacement? Risk can be addressed by more aggressive flushing protocol.
- Is there a need for sampling after sampling after full lead line replacement?

Before eliciting comments on monitoring, the panel discussed broader LCR issues for consideration.

- When collecting lead and copper information, it is important to agree on the purpose of the sampling. Will the information be used to measure exposure, occurrence, leaching or corrosion effectiveness?
- The LCR as currently structured seems to compress a lot of goals into one program.
- The main purpose of monitoring under the present rule is to assess the effectiveness of corrosion control treatments.
- Does it provide adequate information on exposure?
- The sampling protocol is designed around assessing effectiveness of corrosion control treatment; any measurement of exposure is secondary.
- The role for public health officials, on the other hand, is to minimize public exposure and health impacts. The current rule doesn't fully achieve this goal because optimization of corrosion control does not address outliers. Other mechanisms may be more effective.
- Should this rule review effort rehash the basic approach of the rule (i.e., exposure assessment or treatment technique)?
- An exposure assessment rule and resulting sampling would be Pandora's box, requiring thousands of samples.
- EPA is not contemplating a fundamental change in the rule's approach. Within the limitation of the construct that we have, exposure is not easy to assess. Within the limit of optimal corrosion control, are there suggestions for other workshops?
- Congress directed EPA to have regulation on lead and copper. The LCR as it stands has many components that have been relatively successful in reducing lead and copper levels. The purpose of this workshop and other is to fine-tune the rule, to generate ideas to make the rule better.

The facilitator next solicited specific comments from the panel. Attachment B contains the list of comments. The comments were then sorted by into five issue groups for further discussion.

- Sampling Frequency and Triggers
- Sampling Site Selection/Location
- Sampling Protocol
- Sampling of Water Quality Parameters
- Other Issues

Some crosscutting issues should be considered for all of the issue groups. These included:

- Effects on lead
- Effects on copper
- Small systems
- Consecutive systems
- Information gaps
- Guidance
- Rule review
- Consequences

The panel was broken up into five sub-panels, with each sub-panel discussing one issue group.

Reports from Issue Breakout Groups

After discussing and considering the issues, each panel group summarized their topic for the full panel.

Before presenting the results of the breakout group discussion, the facilitator once more allowed comments from the non-panel observers.

Open Floor Discussion

- Steve Drda from Nebraska Public Drinking Water Program: Some of the ideas proposed will be challenging to address reasonably and effectively, especially from a small system perspective. The number of samples could balloon for a small system to close to 1 sample per person serviced.
    - This represents a greater burden on a per person basis. Small systems are currently paying more for water.
    - Simple solutions, such as flushing lines, may be more appropriate for small systems.
    - Solutions that are scientifically valid may be more a villain than a hero if the burden is too great.

- Kevin Dixon of Black & Veatch: Schools and daycare centers are really difficult from utility perspective.
  - Perhaps a workshop specifically for schools and daycare issues is warranted.
  - Schools and daycares are a perplexing, but important because of the vulnerable population.
  - Sample integrity is difficult to maintain.
  - Another method for obtaining samples (besides homeowner sampling) is needed.
- Wendy Marshall, USEPA Region 10: The current flushing guidelines may not be appropriate. With respect to the guidance on getting to cold water, in some houses with crawl spaces, water is cold all the time.
  - It is also hard to judge time when flushing, particularly with children.
  - As a result, tap flushing recommendations may not always be followed. As attractive as flushing is as an alternative, it is a difficult strategy to monitor and make work.

Reports from Issue Breakout Groups

After discussing and considering the issues, each panel group summarized their topic for the full panel.

Sampling Frequency and Triggers

- There is a lot of interaction with other issue groups. There are major overlaps with sampling protocol/location.
- Sampling frequency and triggers should be determined based on what is being evaluated and how much data is needed.
- Compliance monitoring is not designed to adequately evaluate changes in source or treatment.
- Original frequencies were based on detecting when systems exceed levels.
- There is a need to assess the maintenance of optimal treatment.
- How variable is a system? What is the effect on water quality parameters, lead and copper?
- What is the impact of physical changes? Seasonal operational changes?
- Issues: The LCR frequency is OK. Is reduced monitoring adequate?
- Perhaps there should be less frequent lead and copper monitoring and more frequent monitoring of water quality parameters.
- Monitoring frequency should change with major change in source or treatment. What constitutes a major change?
- Frequency should depend on: changes in water quality characteristics; water quality stability of the system; and physical changes.
- One size solution does not fit all situations. Guidance (not rule language) is needed on defining a major change and resulting changes in monitoring to evaluate impacts.
- What level of physical change triggers monitoring?
- Once the Action Level has been triggered, should there be a change in monitoring frequency? What about individual health triggers?

- Is there any way to justify changes in frequency for small systems? It depends on a number of factors.
- The number of samples should not be more than the number of taps.
- Could increased monitoring or removal of lead service lines be performed in lieu of treatment?
- For consecutive systems, guidance for meaningful synchronization/frequency is needed.
- Data gaps include the sensitivity of the type of sample collected to changes in lead/copper, impact on frequency of sampling.
- If there is a major change, such as a water meter change, should a warning be conveyed to homeowners?
- There are no guidelines on sampling after an exceedance.
- Relative priority of recommendations-in general, guidance is better than rule because of flexibility.
- Should there be different triggers (i.e., action levels) for different actions?

Site Selection/Location

- The purpose of LCR sampling is to evaluate the effectiveness of corrosion control, whether corrosion control is adequate or needs adjustment.
- The LCR sampling does not assess exposure or sensitive populations.
- There needs to be public education on this issue.
- Other sampling programs are needed.
- For compliance sampling, guidance on screening to eliminate non-representative sites or other factors that contribute to lead. This can result artificially high or low readings.
- Sampling should focus on those factors that can be controlled by changes in water quality.
- More work is needed on grounding, softening, and plumbing. The public notification language contains specific wording on grounding which may or may not be appropriate. Also, if softening is found to be an issue then that should be included in the mandatory language.
- Site selection should be different for small systems, may not just be fewer samples, but a different structure altogether.
- Maintaining a consistent sample set is recommended. This allows a system to track levels over years to assist in the evaluation of treatment practices.
- The definition of tier 1 requires a change in the rule. However, 2 conflicting options were offered: expand the definition to include newer homes or limit only to those homes with lead service lines.
- Data gaps: More work is needed on the relative contribution of sources, softening and grounding, public education, and mandatory notification language.
- Also, more information is needed on surrogates for metal release, probes, coupons, and different types of sampling.
- Guidance is needed on consecutive system monitoring and regionalized lead and copper sampling.

- Combined monitoring could be a very thorny issue, because agreements are already in place. Guidance would allow systems to combine monitoring, but not mandate.

Sampling Protocol

- Rule review is needed on the issues of the contribution of lead service lines (profiling of sampling locations); the exclusion or invalidation of samples; and less customer involvement in taking samples.
- Less customer involvement in sample selection
- The rule should explore allowing sampling stations/locations under utility control, using surrogate lead release devices, simpler procedures, first draw samples, and procedures after action level exceedance.
- The rule review should also consider how multiple samples from the same site should be handled (average in 90^{th} percentile), different protocols for lead and copper, and school sampling procedures
- Guidance is needed on: monitoring to evaluate treatment change; validating plumbing materials during site selection; reflecting equilibrium conditions; simplifying procedures to eliminate potential gaming; defining procedures for multi-family locations; and doing process control monitoring.
- Data gaps include re-examining public tap flushing guidance and differences in stagnation for lead vs. copper.
- A public education workgroup is really needed to help the public understand real issues and minimize own exposure.

Water Quality Parameters

- Currently water quality parameter samples are collected at total coliform sampling sites.
- Guidance should indicate that water quality parameters should be sampled at sites that are representative of lead and copper sampling, as well as the distribution system as a whole.
- Define consecutive systems consistently within all rules.
- Research is needed on water quality parameters and surrogates.
- Guidance is also needed on training for operators on lab methods and proper process control.
- Guidance is needed that relates water quality parameters to treatment and corrosion control strategies.
- We need to assess and apply what we have learned over the past 13 years of experience.
- In guidance, we need a protocol for inclusion of new parameters (AOC, biostability, chlorine) into WQP monitoring which will identify how to monitor and how these parameters relate to the corrosion control objective of the LCR.
- There is a disconnect between timing of sampling for water quality parameters and lead and copper sampling that makes evaluation difficult.

- Because lead and copper sampling is at the tap and voluntary, the logistics are hard to coordinate.
- Rule review is needed of excursion reporting, particularly excursion sampling.
- For systems using blended ortho-phosphate, should both or just total PO4 be measured? Manufacturers should be able to provide specifics for their products.
- States need additional guidance from the USEPA in setting WQP values and sampling criteria to determine optimal corrosion control. There is currently inconsistent treatment among states.

Other Issues

- Actions to "Get the Lead Out" of plumbing materials could include workshops and white papers, with a long term program to revisit the Lead Contamination Control Act.
- To get the lead out of schools and daycare, EPA should clarify and communicate existing requirements, ASAP, which include a call for sampling the water. EPA should also pursue guidance for communication of these requirements across EPA regions and other closely related government organizations.
- EPA should hold a number of workshops with white paper outcomes on issues of school sampling and remediation, such as how to sample, how to flush taps, techniques for remediation, and techniques for communication. The guidance document for schools and daycares will need to be updated as a result.
- EPA should conduct an internal review of LCR language to make it clearer and more readable, with emphasis on explaining the triggers and response to exceedances.
- Develop alternative means for small utilities. Small utilities can better reduce lead exposure at times by other means than corrosion control treatment.
- Convene a workshop(s) with manufacturers and others on alternatives to lead in brass.
- Workshops involving experts in communication, health care, and other stakeholders should be held to improve general public education and to update the SDWA public notification language (should be more clear and consistent).
- Workshops should also be held with a focus on small systems that include owners, operators, associations, regulators, and consultants. Issues to be considered include costs and applicability, and alternative treatment methods, such as POU devices, bottled water, flushing, and materials replacement.
- EPA should be more directly involved in public education because lead can be problem that extends beyond utilities' reach (private wells and plumbing on consumer's premises).
- More is needed on the role of copper health effects since copper is an acute toxin. There is no legal requirement on copper and guidance is needed, including copper educational materials and an assessment of the long-term health effects. Perhaps the action level needs to be optimized.
- Other issues include red water, the benefits and concerns with the use of plastic pipe, and the benefits and concerns with the use of phosphate inhibitors.
- Systems in transition need better tools for public education.

- In many cases, the lead 90th percentile has been reduced by 80% due to corrosion control. A more overall strategy than just lead service line replacement is needed and this includes public education.

Eric Burneson of EPA concluded the workshop by once again thanking the panel for their participation. A summary of the workshop will be circulated to the panel for suggestions. The summary will then be made available to the public. EPA will continue to gather information on lead and copper issues, such as an assessment of compliance and detailed evaluations of systems that have had success in reducing lead levels. Future workshops are planned on such issues as lead service line replacement, health effects, and public education requirements. If panel members are aware of appropriate experts, EPA would welcome suggestions for future workshops. In the longer term, EPA will make a determination if there are national problems with compliance or the rule itself, depending on information collected. EPA will also consider to what extent national problems should be addressed through modifications to guidance (with panel members perhaps being asked to provide input at the appropriate time), training, regulations, research, NSF committees, or other means.

Attachment A

USEPA Lead and Copper Rule Monitoring Protocol Workshop Panel List St. Louis, MO; May 12-13		
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Attachment B
Issues Identified by the Monitoring Panel

For Consideration by All Groups:

- Rule Review
- Guidance
- Data Gaps
- Small Systems
- Consecutive Systems
- Treatment

Water Quality Parameters:

- Locations to best assess corrosion control
- Standardize a lead release surrogate device
- Conduct monitoring at entry points in distribution systems (corrosion rates, MPY)
- Process control procedures and guidance
- Additional parameters to assess simultaneous compliance
- Increase water quality monitoring parameters in distribution system
- AOC, Cl_2 biostability found best yet water age
- Disconnect between water quality parameters measurement and lead/copper (timing)
- Review of excursions reporting under minor revisions
- For systems using branded orthophosphate, both ortho and total should be required

Sampling Protocols:

- Measuring contributions of lead service lines
- Guidance on monitoring to evaluate treatment changes
- Evaluation/Validation of plumbing materials at sampling site
- Clear guidance on exclusion/invalidation of samples
- Less customer involvement in sampling (explore sample selections)
- Revise flushing recommendations
- First flush samples wrong trigger for lead service line replacement

Sampling Procedures:

- Samples should reflect lead sources and equilibrium conditions
- Simpler procedures = fewer errors, gaming
- Standardize a lead release surrogate device
- Methods for soluble vs. particulate lead
- For lead service lines – 2 or 3 samples
- Lead dissolved vs. particulate, yes spikes illuminated
- Average multiple samples from same tap before computing 90^{th} percentile
- New sampling procedures for period following exceedance

- Different protocols for lead and copper
- How to address multiple samples from same site
- Minimize burden on customers
- Bring/allow samples points under utility control
- Above action level worst case profiling needed
- Exclude samples not representative of corrosive water
- Service line protocol include first draw and 3 subsequent samples
- Determine impact of flushing on particulate lead
- Lead six hour stagnation, for copper, when is the maximum, need stagnation curve
- Clarification of turbidity and digestion
- School sampling protocol
- Flushing? Use value but random particulates? Can't predict release
- LCR monitoring needs process control
- Different protocol for multi-family locations

Sample Location:

- Better site screening
- Monitoring for all schools and day care
- Revise tier system to "Lead #1"
- Expand tier system to 1960-1986
- Samples should reflect lead sources and equilibrium conditions
- Clean water rights for schools and day care
- Any rigorous data on grounding or softening
- Current rule systematically misses copper sites
- Criteria for joint monitoring plans for consecutive systems
- Conduct monitoring at entry points and distribution system for corrosion rates
- New procedures for period following exceedance
- Provide flexibility in sample site selection randomization
- Bring sample locations under utility control
- Should newer faucets be tier 1 sites
- Verification of sample site validation (is there really lead)
- Two pools? Random and consistent?
- Number of samples should not exceed number of taps

Sample Frequency and Triggers

- Sampling Protocol after treatment
- First flush sample wrong trigger for lead service line removal
- Reduce sample burden to encourage getting the lead out
- Is reduced monitoring a good idea?
- New procedures for requirements following exceedance
- Common sampling frequency in consecutive systems
- Require more frequent monitoring following change in treatment

- Focused monitoring for small systems
- Post monitoring for meter replacement and lead service line replacements
- Guidance on data analysis beyond the 90th percentile
- What high level provides immediate action
- Number of samples should not exceed number of taps
- Are special samples included in the 90th percentile
- Sampling should be punitive
- Allow 100% residential monitoring in place of treatment options (for small systems)

Other Issues:

- Clean water rights for schools and day cares
- Re-examine guidance on public education
- Does sampling support appropriate customer action
- Reduce the "No lead" material specification from 8% to 0.2% lead
- Alternatives to treatment for small water supplies
- Clarify lead hazard notification for schools
- Guidance and assistance for small systems on simultaneous compliance
- Study/project to evaluate softener impacts on corrosion control
- Better coordination with health departments
- Public notification and CCR: specific language for copper/lead and water quality parameter monitoring failure
- Web page information on materials
- General better public education on water quality
- LCR to provide award/incentive for discontinuing lead/brass installation
- Urgent national reminder of the requirements for testing drinking water in schools and daycares
- Convene industry forum on removing lead from brass entirely
- NSF 61 testing procedure
- Guidelines for customer facility assessment during real estate transaction
- Rethink mandatory public education language
- Increase standards for manufacturing plumbing devices
- Rule in English
- Clarify mandatory lead remediation requirements for schools
- Increased post-lead service line replacement evaluation and consumer guidance