U.S. Environmental Protection Agency
NDWAC LEAD AND COPPER WORKING GROUP

May 29-30, 2014

Location:
Cadmus Corporate Office
1555 Wilson Blvd. Suite 300
Arlington, VA 22209

Meeting Summary

Meeting Objectives/Desired Outcomes:

- *Welcome new members.*
- *Share follow up ideas and questions concerning corrosion control topic from last meeting.*
- *Provide input on questions related to sample site selection.*
- *Plan next steps.*

A. Welcome, Introduction, Meeting Objective and Agenda

Ms. Gail Bingham, the meeting facilitator from RESOLVE, welcomed everyone to the second meeting of the National Drinking Water Advisory Committee (NDWAC) LCR Working Group (hereafter referred to as the "LCRWG" or "Group").[1] She explained that the first LCRWG meeting on optimal corrosion control treatment (OCCT) and the May 14, 2014 webinar on sample site selection set the foundation for today's meeting on possible revisions to site selection requirements under the Lead and Copper Rule (LCR). She asked each LCRWG member and all meeting attendees to introduce themselves.

Mr. Eric Burneson, Office of Ground Water and Drinking Water (OGWDW), welcomed everyone to the meeting and thanked the LCRWG for their time and commitment. He thought the March meeting was very productive and hoped the LCRWG found the May webinar useful. He noted their challenges are substantial because they are working with a "complicated puzzle". He hoped the LCRWG would continue to have patience and persistence.

Mr. Burneson mentioned the addition of two new LCRWG members: Dr. Hector Gonzalez, Director of the City of Laredo, TX Health Department and Dr. Yanna Lambrinidou, President of Parents for Non-Toxic Alternatives. He explained that neither could attend this meeting but that Mr. Paul Schwartz would serve as Dr. Lambrinidou's alternate.

[1] Please see Attachment A for a list of the LCRWG members and meeting presenters. Please see Attachment B for a copy of the meeting agenda. Please see Attachment C for a list of the meeting attendees.

Ms. Bingham described the handouts provided to the LCRWG, which included an updated list of the LCRWG members, a revised timeline for webinars and LCRWG meetings, and the sample site selection primer[2]. She described the timeline in more detail, noting that the first four meetings focus on a subset of issues and that she will use the summaries of these meetings to develop a straw man for meetings 5 and 6. During these last two meetings, the LCRWG will have an opportunity to discuss the full range of topics in an integrated way and seek consensus on a final report. She encouraged the LCRWG to have an open dialogue because the exchange of ideas will improve the straw man. She reminded the LCRWG that at this point, they are both learning and providing input and do not need to reach consensus.

Ms. Bingham went through the agenda and explained that the sample site selection questions on the agenda are based on the white paper[3] developed by the internal EPA Work Group and are the questions for which EPA wants LCRWG input. She noted that the sample site selection primer provides more detail on each topic and lays out options for the LCRWG to consider. She indicated that Lisa Christ would provide a summary of the May webinar presentations and the Group should share their own reflections from the past meeting or webinar, discuss where we stand and ask general questions or specific questions on any materials provided to them prior to the meeting.

She asked the LCRWG if they had questions and in response:

- One member suggested that the March 2014 meeting summary not use the term "recommended" because the Group has not made recommendations.
- Another asked if the summary would be posted to EPA's website to which Mr. Burneson replied that although the primary audience is the LCRWG, the notes will be posted to EPA's website to provide transparency to the public regarding the rule revision process.

Based on these discussions, EPA and the LCRWG agreed that all meeting summaries should first be reviewed by the Group prior to finalization.

Ms. Bingham reported that Dr. Lambrinidou requested via e-mail that the group discuss public education (PE) for lead and also copper PE in the context of what has been done for lead. She noted that PE will be discussed at the September LCRWG meeting.

B. Summary of Site Selection Webinar

Lisa Christ, (EPA OGWDW) provided a summary of each of the May 14, 2014 webinar presentations on sample site selection. She appreciated LCRWG members' active participation and their many questions during the webinar. During that webinar[4]:

[2] Please see Attachment D for the sample site selection primer.
[3] Refers to the "LCR Long-term Revisions White Paper" that was among the materials provided to the LCRWG for the March 2014 meeting.
[4] The webinar recording, presentations for and questions raised during this webinar can be found at: https://epa.connectsolutions.com/p7k8hb9ngm5/.

- Mike Messner, an EPA statistician, provided information to consider when starting a sampling plan, which including considering: the purpose of the data collection, what are you trying to estimate/measure, the quality of data needed for your purpose, and cost.
- Mike Schock, EPA Office or Research and Development (ORD), talked about the importance of sampling at the highest risk sites to ensure OCCT effectiveness and public health protection. He made the following points:
  - Sites that yield the highest lead levels differ from those that yield the highest copper levels. Copper release occurs when there is new plumbing, and in areas where water is aggressive to copper. For lead, highest releases are from locations with partial or full lead service lines (LSLs) and metallic plumbing devices.
  - Lead release within a distribution system varies based on water quality characteristics (e.g., some water quality zones may be aggressive towards lead).
  - Post-treatment deposition of lead in interior plumbing and physical disturbances can impact lead levels.
- Lisa Donahue, EPA Region 3, discussed the current sample site selection requirements and some potential questions/revisions being considered including:
  - Should the tiering criteria be different for systems with and without LSLs?
  - Should lead and copper sites be separate?
  - Should copper waivers be allowed if systems do not have water that is aggressive to copper?
- Maggie Rodgers with Cleveland Water shared her experience developing a sampling pool for lead and copper testing. She noted that building an accurate LSL inventory requires data to which a water system would not necessarily have access (e.g., historical information, building permit, age of structure). She showed the process of identifying and recruiting customers for LCR samples and the challenges they face in meeting the requirements.
- Ross Cooper with the State of Nevada talked about his State's experience in locating sampling sites and collecting samples. He identified the following challenges: locating new sample sites, gaining cooperation from homeowners, and collecting samples annually or triennially in a summer window. In some instances, samples are collected from inappropriate sites, which cannot be invalidated under the current rule's invalidation criteria so the results from these sites must be included in the 90th percentile calculation and can lead to violations.

Following her overview, Ms. Christ also provided an explanation of the Lead Contamination Control Act (LCCA) in response to a question from one of the LCRWG members. She explained that the LCCA required schools to identify and to remove lead-lined coolers. Originally the LCCA included a monitoring component but a court case decided that it was an unfunded mandated. After 2004, EPA developed guidance for voluntary monitoring, recommendations, and mitigation measures. There is

no federal requirement to monitor at schools that are served by PWSs; however, those that are PWSs, must monitor in accordance with the LCR.

The remainder of this meeting summary is organized by the following broad discussion topics and concludes with public comments and Closing Remarks, Next Steps, and Action Items:

- *Overarching Comments*
- *Data Quality Objectives and Monitoring Goals*
- *If Highest Risk Sites ("Sentinel Monitoring") Allow for Proper CCT Assessment*
- *Separate Tiering Structures for LSL and Non-LSL Systems*
- *Separate Sampling Sites for Lead and Copper*
- *Copper Waivers*
- *Healthy Homes*
- *Copper Health Effects and Public Education*

C. Overarching Comments

Below are some overarching comments provided by individual members of the LCRWG over the two-day meeting:[5]

- Before collecting a sample, we should understand why are we collecting the data, how are we using it, if it reproducible, how it connects to operational change (e.g., need to install or adjust corrosion control treatment), and how it connects to the goal of public health protection.
- Corrosion is a big issue for PWSs and if not properly controlled, can cause public health concerns, infrastructure impacts, and customer complaints. A water system's corrosion control program needs to be comprehensive and include not just lead and copper but all metals.
- The 90th percentile approach means that 10% of homes could be above the action level (AL); therefore, the rule as its structured may not be addressing important public health issues. The work done on lead in paint and dust includes a house-by-house investigation, but this is not extended to water. There is a suggestion in new literature that lead in tap water is a problem, and its relative contribution to blood lead levels is misunderstood.
- Revisions to the copper requirements should be based on the health risk of copper, its impacts on a small subpopulation (Wilson's disease), and its potential to passivate.
- The Group cannot consider the LCR in isolation, but must also consider the impacts on other treatment processes such as filtration and disinfection.
- The rulemaking process should consider how a revision will be enforced. A future LCRWG meeting should include a speaker from the Office of Enforcement and Compliance Assurance

[5] Note: No attempt was made to reach consensus on any of these points. These ideas will be considered for inclusion in the LCRWG's report at future meetings.

(OECA) on Next Gen compliance in which enforcement is considered during the rule development process.

- Systems and States are basing corrosion control treatment (CCT) decisions on samples that are not collected by trained personnel. Relying on homeowners introduces too many variables.
- The Group should consider the role of PE more broadly, including its possible use in lieu of monitoring and/or treatment, how to more effectively deliver it to the most appropriate audience, and how to provide a clear and appropriate message.
- EPA needs to work with its partners and develop new partnerships to build a more effective lead reduction program. EPA should also consider options for lead reduction that extend beyond the LCR.

D. Data Quality Objectives and Monitoring Goals

The LCRWG discussed the role of data quality objectives (DQOs) in the monitoring process. One member provided the DQOs process (Figure 2) from EPA's 2006 guidance, "Guidance on Systematic Planning Using the Data Quality Objectives Process". He noted that any LCR sampling and data collection revisions should include DQOs to allow for reliable and reproducible data. In response:

- One member asked whether the original LCR considered DQOs. Mr. Burneson clarified that the original rule included DQOs but was written prior to the 2006 guidance. He added that EPA will provide the LCRWG with a 1991 memorandum from Jeff Cohen, which explains the basis for the current LCR sampling protocol.
- One member questioned if the 2006 DQO guidance might be more rigorous than what is needed for compliance monitoring.
- Another asked how monitoring would change based on DQOs. One member indicated that the DQOs would require us to identify the goal of the monitoring (e.g., CCT effectiveness, exposure and risk reduction). Setting DQOs could help determine if we are trying to accomplish too many goals with our data collection and whether the current data collection is adequate (e.g., whether the LCR sampling protocol allows for the identification of particulate lead).

Several LCRWG members stated the need to first understand the purpose of monitoring before they could begin discussing the more detailed questions in the agenda regarding sample site selection. The Group identified the following 11 purposes or questions that could potentially be addressed by monitoring:

1. Is corrosion control treatment (CCT) optimized?
2. Is new CCT necessary?
3. Is a customer at risk from lead in water?
4. If a LSL is present, is it a problem?
5. Is a systematic approach to LSLR needed?

6. What is the contribution of lead in water, in the context of a community's overall approach to public health risk from lead? What is the nature of the problem in a community?
7. Is there a particulate component to the problem?
8. Is/Has the treatment changed in the system that would affect corrosivity?
9. Is there construction that is increasing lead exposure?
10. What is the risk at a community-wide scale?
11. What is the risk to the most vulnerable?

LCRWG members provided the following preliminary input on what type of monitoring and other actions may be needed to answer a subset of these questions (#1, #2, #3, #8, #10, and #11).

1. How can monitoring help determine if CCT is optimized?

- Under the current rule, systems start with a study, define what level of CCT is needed, consider simultaneous compliance issues, and other metals, and possibly consider some scale analyses. Monitoring should consist of water quality parameters (WQPs) that are specific to the CCT and not include tap monitoring. WQPs are inexpensive, easy, and currently collected by water systems across the distribution system.
- The monitoring protocol should require samples to be standardized and be collected at the same locations to allow the results to be repeatable. This removes other variables so that systems can detect true changes.
- Monitoring should target places where CCT failure may occur.
- We should specify minimum number of samples when assessing a treatment process (e.g., CCT) but not a maximum. The current rule has disincentives for additional monitoring. One member asked if a PWS might game the system by over-sampling at low lead sites and under-sampling at those with high lead levels. Other members did not think this would be an issue because States could detect irregularities (e.g., atypical increase in the number of samples above the minimum without explanation). Further, if monitoring is restricted to WQPs to assess CCT, oversampling is not a problem.

2. What kind of monitoring is needed to help determine if new CCT is necessary?

Mr. Burneson clarified that under the current rule, this question only applies to systems serving 50,000 or fewer because larger systems will already have CCT in place. He added that for systems serving more than 50,000 people, the question could be expanded to ask if re-optimization is appropriate.

LCRWG members provided the following input:

- For systems serving 50,000 or fewer without CCT, monitoring indicates if CCT is needed. These systems will sometimes have a blip with a high round above AL and be triggered into CCT steps. They can voluntarily continue tap monitoring while they consider CCT. Mr. Del Toral added when these no longer have an action level exceedance (ALE) for 2 consecutive 6-month periods they can discontinue CCT. He added that this situation applies to the majority of systems serving 50,000 or fewer with ALEs.
- If systems serving 50,000 or fewer no longer have an ALE, States like to understand why.
- Monitoring is relevant, but may be telling you that you need something other than CCT.
- Theoretically, every system should know where they stand with CCT including their pipe material. Every system should have some level of study.
- To answer both questions 1 and 2, we need to ask if the system has lead. The Group needs to think more broadly about whether or not there are better ways to determine if a system has optimized CCT.
- Systems serving 50,000 or fewer people only know if they are optimized if they do not exceed the AL.[6]

One member asked for clarification on the definition of optimization. Did it mean that the system must meet the maximum contaminant level goal (MCLG) of zero, or if some lead is acceptable? In response, Mr. Burneson explained that systems work with their States to identify appropriate system-specific CCT, after which the State identifies optimal water quality parameters (OWQPs) that define OCCT. A lead ALE triggers the CCT process, PE, and potentially lead service line replacement (LSLR). It does not technically trigger re-optimization. Mr. Del Toral added that all systems serving more than 50,000 have to minimize lead levels at the tap without violating other rules. Systems serving 50,000 or fewer that are at or below the lead AL of 15 µg/L are deemed optimized.

[6] Under § 141.81(b) of the current rule, a system may be deemed to have optimized corrosion control if it meets any of the following criteria:

1. It serves ≤ 50,000 and its 90th percentile levels for lead and copper do not exceed the AL for two consecutive 6-month monitoring periods. These systems can qualify with or without CCT.
2. It serves any size population, already had CCT in place prior to the effective date of the 1991 LCR (i.e., prior to December 7, 1992), and has provided supporting documentation.
3. It serves any size population and its 90th percentile lead level and highest source water lead level is < 0.005 mg/L (the practical quantitation level) for two consecutive 6-month monitoring periods. The system also cannot exceed the copper AL.
4. It serves any size population, its source water lead level is < method detection limit, and its 90th percentile lead level is ≤ 0.005 mg/L (the practical quantitation level) for two consecutive 6-month monitoring periods. The system also cannot exceed the copper AL.

3. Is a customer at risk from lead in water?

- Two members provided their experience handling customer calls about lead as follows:
  - If we have not sampled at the customer's home we cannot answer if his/her water is safe to drink. In that instance, we explain the rule and the potential risks.
  - We explain steps the system is taking to reduce lead, possible sources of lead in their homes, and steps they can take to reduce lead in their drinking water (e.g., water testing, flushing, installing a filter). We also tell them that if they have lead-containing components in their home, there is a risk.
- Customers may not understand that they may need to take measures to reduce their lead exposure when the message from the water system is that they meet the federal standards.
- Some members questioned the extent of the responsibility of the PWS as follows:
  - What is the system's responsibility regarding specific lead exposure at every home. Are they responsible for providing the "tools" to the homeowners to answer this question for themselves?
  - How can the regulation hold a water system responsible for what is inside the house? Sample site selection should be more focused on service line and finished water quality.
  - If the goal of Safe Drinking Water Act (SDWA) is public health risk reduction, is CCT enough, or must a system do everything it can to protect public health even when it is outside of the system's control (e.g., home plumbing materials)?
  - There are limits to the responsibility of systems for lead and copper exposures within each individual household. EPA has science-based organizations that can field consumer concerns about lead and copper that are more than willing to be in a partnership to help water systems.
- One member provided a handout titled "Reducing the Risk of Exposure to Lead in Drinking Water." He explained that this is a residual risk curve and is based somewhat loosely on a WaterRF risk governance project. Level of risk is on the y-axis, and cost to reduce it on the x-axis. The highest risk issues have changed since the LCR came into regulation years ago. The member explained that risk from soluble lead has been well addressed to date such that any additional reductions in risk would come at very high costs, whereas risk from particulate lead when LSLs are disturbed is still high. Should the changes in the regulation now address what remains as the highest risk? He asked, does the system need to sample or help the customer understand if they have a LSL and under what conditions the presence of a LSL could provide greater lead release? It may not be the water sample that gives us the most reasonable answer.
- SDWA constrains the goal of the LCR to public health, which is not the same as protecting an individual. It allows consideration of vulnerable populations but not the vulnerable individual. In response to this comment, Mr. Burneson noted that SDWA is not the limiting factor in terms of protection of individuals. SDWA's authority is over water system, not over homeowners. The complication is that, unlike other drinking water rules, the contaminant is not in the source

water but typically from plumbing materials. The LCR attempts to address variability in lead levels at the tap that can result due to differences in water quality within the system and with plumbing materials and thus, the variability in risk to lead across the community, by looking for worst-case lead and copper sites. The sampling scheme is not designed to answer the question, "Is my water safe?"

- Interventions that affect the community as a whole can be applied on a population basis or on an individual basis. For example, EPA required the removal of lead from fuel, and now gasoline is no longer a source of lead exposure. Lead in drinking water sources is more complicated, because although lead in solder has been banned, older solder still exists in some homes. We need to think about revisions in real-world context, and not in terms of whether the intervention is population-based or not.

8. Is/Has the treatment changed in the system that would affect corrosivity?

- If the system makes a treatment change, they should conduct more studies to determine if it will impact other treatments and conduct WQP monitoring.[7]

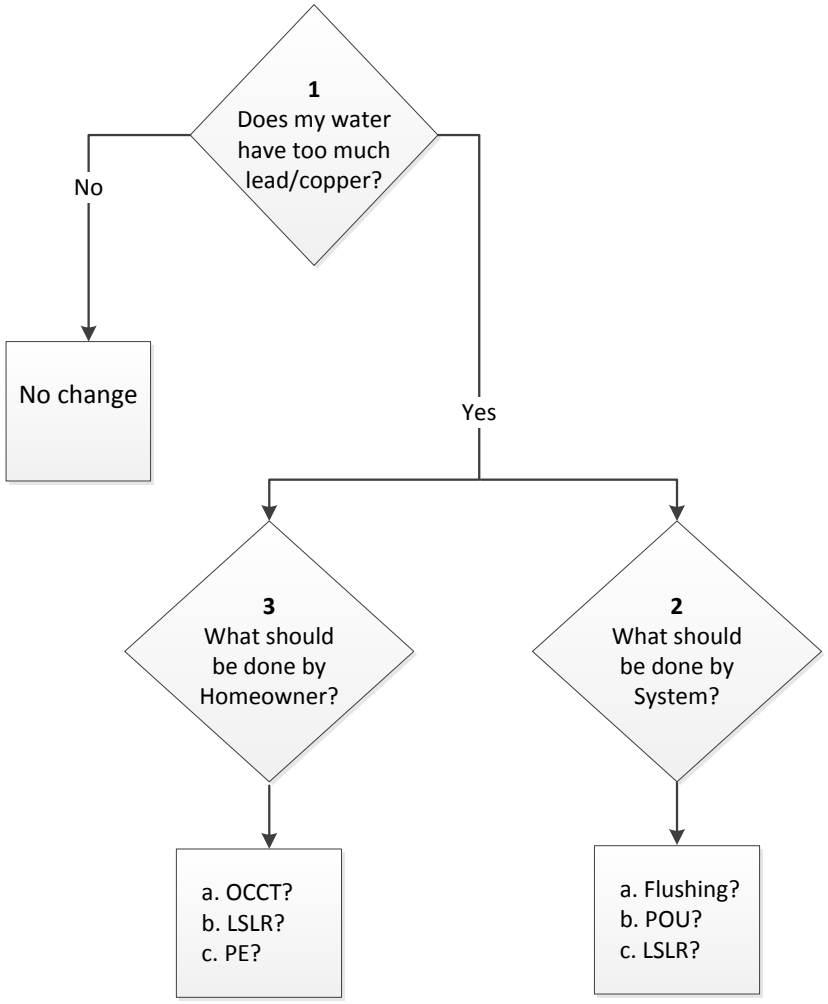
10. What is the risk at a community-wide scale?/11. What is the risk to the most vulnerable?

- Are there parameters that allow the PWS to more broadly assess risk for a community or segments of a community? If not, PWSs can let the customer call them or target areas to contact. If looking at a broader community, we probably should not use customer-collected samples.
- Dr. Schock explained random daytime monitoring (RDM) that is used by the UK to understand exposure of the population as a whole based on World Health Organization (WHO) guidelines. Approximately 35,000 samples are collected each year from randomly selected households. Benefits to this approach are the large number of samples that make it statistically useful and the samples are collected by trained water system personnel. The weakness is that this approach does not target the most sensitive population or high risk areas. Under the LCR, monitoring is focused on the worst-case situation and a much smaller number of samples.
- In response to Dr. Schock's explanation, one member noted that UK's sampling program uses a completely different approach from the current LCR or from that being considered for the revisions (i.e., RDM, government employees collect samples). It provides a methodology to understand what is going on at a community basis but may not be a viable option in this country.
- We need blood lead testing and not water samples to find the most vulnerable in our population. We would need a feedback loop that could include health agencies. Once we identify a child with a high blood lead levels, we address water-related issues.

EPA and the LCRWG also discussed other ways to think about the 11 potential goals of monitoring. Mr. Burneson prepared a flowchart that consisted of three basic questions. (A schematic of the flowchart is also provided below.)

[7] Also refer to Section H on Copper Waivers for a more detailed discussion of copper corrosivity.

1. *"Does my water have too much lead/copper?" If "No", then no change. If "Yes", ask:*
2. *"What should be done by the system?" Possible answers include OCCT, LSLR, PE.*
3. *"What can be done by the homeowner?" Possible answers include flushing, point-of-use (POU) devices, and LSLR.*



LCRWG members provided the following suggested modifications to the flowchart:

- Clarify if the first question applies to just the PWS or to both the individual homeowner and PWS. In response, Mr. Burneson indicated that it applied to both.
- We need to ask if there is a lead or copper risk at both the system and at the home from lead- or copper-containing materials. At the homeowner level, we might be able to answer "No", but at a community-wide level, we might be able to say the risk is sufficiently low. Another member disagreed and indicated that the question should be focused on whether the water system has too much lead and copper in their water because we are not taking action based on an

individual home. This member also suggested asking about the presence of LSLs or a lead fixture and noted that the answer could trigger different levels of PE depending on the source of lead.

- Perhaps the chart should start at another question altogether? We could first ask, *"Is my system optimized for CCT?* If "Yes", the second question would be, *"What is the risk?*, and *"Does the system have LSLs?"*.
- The system should be at the top of the decision tree because they are obligated to ask if they have CCT. On the sampling side, we may be able to answer "No" if there is a feasible sampling protocol that allows the system to assess if they have too much lead or copper.
- In response to question #2, add "partnerships" as a possible action that could be taken by the water system if there is a concern about drinking water exposure to lead.
- The Group may need three flow diagrams. One each for systems with and without CCT, and one for homeowners.

Mr. Kempic made a slight modification to the flowchart to clarify that a "No" response to the question "Does my water have too much lead/copper?" should not end at "No change" but be expanded to indicate "No change at system" and then to ask the additional question, "What should be done by the homeowner?" Ms. Bingham indicated that the Group can revisit the monitoring questions and flowchart at a later date.

E. If Highest Risk Sites ("Sentinel Monitoring") Allow for Proper CCT Assessment

LCRWG members provided the following input on whether sampling at highest risk sites would allow the system to properly assess whether they had optimized their CCT:

- OCCT is system-specific and the rule needs to allow systems to determine what is optimized for them and to monitor using WQPs. Under the current rule, systems are monitoring for health risk (lead or copper), collecting data that we don't fully understand and using it to define OCCT. Systems need a better toolbox for OCCT that is not overly prescriptive, and could include looking at lead scale. The current rule tries to use the same set of monitoring to determine OCCT and to assess public health.
- There could be parallel tracks for systems with CCT and for ones without CCT. For those with CCT, the determination of optimization should consider all metals -- not just lead and copper. Further, monitoring should rely on WQPs and not on monitoring in the homes that typically uses untrained people (i.e., homeowners). Monitoring for systems without CCT should address public health issues. Systems that must install CCT should conduct an initial study, define treatment, and maintain it based on WQPs.
- Revisions need to consider not only if the system has CCT or not, but its size, and whether it has zones with different water qualities. For systems serving 50,000 or fewer without CCT, tap samples indicate if they have a lead or copper problem.

- We need different sampling locations, including POU devices, to determine if CCT is effective, as opposed to just WQP monitoring to identify what is being done at the treatment plant.
- We need to understand the water coming into the home to better understand if CCT needs to be adjusted. There are too many variables that impact sampling results, and currently, we assume if a sample is high in the home, we need to adjust CCT.
- Revisions could provide a greater reliance on samples in the distribution system as a basis for CCT decisions because they are collected by the water system, as opposed to tap samples that are collected by the homeowners.
- There should not be the mindset that, if systems have high lead levels at the tap, they need to conduct lead monitoring. Sampling may not be the best approach in all instances.
- One member noted after talking with four shifts of operators regarding CCT, they were unclear what additional information EPA needs because they believe they have the information necessary to produce good finished water.
- A CCT program could be broader to include flushing, main replacement, and galvanized pipe replacement because orthophosphate and pH adjustment will not address galvanized pipe.

The LCRWG also discussed the use of investigative monitoring prior to making decisions on CCT adjustment to determine why the system has a high lead level or ALE (e.g., faucet with high lead content).

F. Separate Tiering Structures for LSL and Non-LSL Systems

LCRWG members provided the following comments and questions regarding separate tiering criteria for systems that have LSLs and those that do not:

- Some members thought that the concept of separate tiering made sense. Specific comments included:
  - We should have separate tiering for LSLs and non-LSLs because the approach for handling these two type of systems should be different. For systems without LSLs, OCCT is enough and tap sampling is not needed. For systems with LSLs, we need to identify systems that have LSLs, conduct some monitoring at homes with LSLs to help customers understand if they have lead exposure issues but not require sampling on a routine basis at homes.
  - We should have a separate tier for LSLs to target the worst-case scenario.
  - Tier 1 should focus on LSLs but should be expanded to include daycares and schools with LSLs. One member added a caveat that schools may close in the late afternoon, resulting in first-draw samples that have longer standing times than those collected at homes.
- Some questioned the need for continued monitoring for systems that are optimized as follows:
  - It is important to first understand the question we are answering before we talk about the tiering structure. If I'm an optimized system, why is sampling necessary? Eliminating

monitoring for systems that are optimized may provide more of an incentive for systems serving 50,000 or fewer to optimize.

- Non-LSL systems that are not optimized should conduct monitoring but what is the value of monitoring for LSL systems if they are optimized?
- Why would systems need to monitor if they are optimized and do not have LSLs?

- Some members discussed some potential issues with separate LSL and non-LSL tiering criteria as follows:
  - If the Tier 1 definition is narrowed to just LSLs, it may be more difficult for systems to find enough people that will participate and remain in the sampling pool and thus, we run the risk of more monitoring and reporting violations.
  - For EPA's new possible tiering criteria, why are metallic plumbing components listed as Tier 1 for non-LSL systems but Tier 3 for LSL systems? It may be simpler to have one set of criteria.
- Some members provided general comments or questions regarding high-risk sites:
  - How does the question "what constitutes a high risk home" tie back to repeatable samples that can be useful for making operational decisions? Mr. Burneson clarified that EPA is asking the LCRWG for some refinements instead of revamping the entire rule. He reminded the Group that the LCR is a treatment technique rule and not a maximum contaminant level (MCL) rule. EPA issues a treatment technique rule when it is not economical or technological feasibility to monitor and control for all contaminants. We do it for LCR because of sources of lead. CCT is the primary mechanism for controlling lead and the purpose of monitoring is to determine if CCT is effective or if additional actions are needed. Is this the right approach, or should we be characterizing the risk to the community? He explained that we are refining triggers for additional actions but if the LCRWG wants to go beyond this, he is not opposed.
  - One member provided a handout from Part 2 of an AWWA Webinar Program: Communicating with Customers about Lead and Lead Service Lines (May 21, 2014). The graphs were titled "LCR Sampling Missed High Lead." The member noted that the liter with the highest lead result can vary from location to location due to the many sources of lead in homes and schools and other factors. Therefore, how do we design a reproducible, reliable sampling program that identifies the sample that is most likely to yield the highest lead results, that is not onerous to implement? There is a lot we can discuss about the need for more research but this Group will need to move from research to implementable regulation.
  - Could the tiering criteria be revised to target locations with children, such as schools or daycares, and not use the general term, "building".
  - Has EPA considered or is there research on the use of a highest risk sampling station that would replace sampling in the home? In response, Steve Via, AWWA, indicated his organization is currently conducting that study. Mr. Burneson reminded the Group that the question of the feasibility of monitoring from a pipe loop/rig for copper in lieu of tap sampling is in the site selection primer and white paper. One member noted that the

laboratory for his water systems has had success using coupon testing for steam generating systems but does not know how well this would translate to lead testing.

Mr. Burneson acknowledged that the LCRWG needs to understand the sampling protocol, which will be the subject of the next webinar and meeting to more fully comment on the sample site selection options EPA is considering. Ms. Bingham added that the Group will have an opportunity to revisit this discussion after they've had a chance to talk about all of the other topics and questions in the white paper.

G. Separate Sampling Sites for Lead and Copper

Several LCRWG members thought lead and copper should be sampled at separate sites.

Additional comments included:

- If lead and copper are sampled at separate sites, require fewer samples (e.g., for a system that collect 50 samples, do not require 50 lead and 50 copper samples).
- Copper sampling should be conducted at the highest risk sites, which includes new construction. However, systems that do not have a relationship with the building department may have difficulty finding locations with new construction that could be part of the sampling pool.
- For systems with water that is aggressive toward copper, require targeted copper PE through the building department to all new homes instead of monitoring. This approach is easier than having the PWS contact the building department for the names and addresses of people constructing new homes.

H. Copper Waivers

Several LCRWG members indicated that a copper waiver based on WQP testing might be a viable option. To give more confidence in this direction, one member raised the point that high levels of copper in drinking water, stains sinks, cause a metallic taste, and may create pinhole leaks. In contrast, there are no aesthetic effects when high levels of lead are found in drinking water. If there are high levels of copper at the tap, the water system will know due to customer complaints. Mr. Burneson noted that there is a range above the MCLG of 1.3 mg/L where people don't necessarily see or taste the copper. Mr. Kempic added that customers might taste it before discoloration occurs. Based on recent research on the aesthetic effects of copper by Dr. Andrea Deitrich at Virginia Tech, people have a wide variety of taste/smell responses to copper. Another member suggested replacing the term "waiver" with "aggressive" and "non-aggressive bins" because the term "bins" is used for other rules and the term "waiver" may be perceived negatively by the public.

Several members asked questions about passivation of copper pipe (i.e., when the pipe no longer releases copper in to the water) including the length of time for passivation. In response, Dr. Schock indicated that water quality drives how long it takes new copper pipes to passivate. In aggressive water, passivation may occur within 5 to 40 years. In water that is not aggressive, passivation may occur in just a few days. High alkalinity waters are the most aggressive and have the longest passivation times. He

added that high alkalinity waters are typically ground water systems with limestone aquifers. Dr. Schock was asked how passivation is impacted when water quality changes. He indicated that if distribution system water quality changes from non-aggressive to aggressive, systems will need to be concerned with new copper plumbing but not existing, previously passivated copper plumbing. Other copper waiver-related discussion topics included:

- Aggressive Water Characteristics/How to Characterize Systems.
- Retesting to Determine If Water Is Still Non-Aggressive.
- Possible Requirements Based on Water Aggressiveness.
- Whether WQP Monitoring Costs for Copper Waivers Offset Copper Monitoring Savings.

The discussions pertaining to each of these subtopics are provided in more detail below.

Aggressive Water Characteristics/How to Characterize Systems

EPA and the LCRWG talked about the characteristics of waters that may be non-aggressive toward copper.

- Dr. Schock indicated that some geographic influences can affect water aggressiveness. For example, areas with a lot of limestone typically have high alkalinity waters and will be more aggressive to copper. When ground water systems install oxidation for iron removal or disinfection, alkalinity becomes important and the water may become more aggressive. Mr. Kempic added that more ground water systems will be required to install disinfection under the Ground Water Rule.
- One LCRWG member distributed a handout titled "Water Qualities that Would not Require Monitoring for Copper" with the following bullets:
  - Waters that are anoxic – primarily ground water without chlorine and pH > 6.5.
  - pH > 7.2 and alkalinity < 50 mg/L as $CaCO_3$.
  - pH > 7.5 and alkalinity < 150 mg/L as $CaCO_3$.
  - pH > 8 and alkalinity < 250 mg/L as $CaCO_3$.
  - Any water with orthophosphate > 3.3 as PO_4 – would primarily apply to lower pH waters with high alkalinity and not otherwise exempt from above.

LCRWG members provided some initial thoughts on monitoring or other methods to identify water aggressiveness:

- The determination of water aggressiveness should be:
  - Low cost so money could be put into actions.
  - Easily implemented by small systems; otherwise, they may not apply for a copper waiver.
- Require routine copper monitoring on a regular basis. If testing at new homes is not feasible, conduct WQP monitoring.

- Do not make the WQP monitoring requirements for small systems onerous by requiring monitoring at all Total Coliform Rule (TCR) sites or to be conducted more frequently than TCR monitoring. Possibly allow smaller systems to collect WQP samples at one location and infrequently.
- Systems could be given a "menu" of options to determine if they have water that is aggressive to copper. They could do sampling and base the determination on water quality characteristics, or run a pipe loop. Monitoring at new homes would necessitate a change in sampling locations over time, which would be difficult.
- We have 20 years of copper data from homes. Perhaps, pipe loop testing could be used in some cases to prove that water is not aggressive.
- Some were in favor of using WQP monitoring to assess water aggressiveness for reasons that included:
    - It is inexpensive and could be done by the operator. One member stated that certified operators must be able to test for pH.
    - It is currently required under the LCR for systems with CCT.
    - pH and alkalinity are important water quality parameters that most systems should know.

The Group also discussed possible binning of systems by water aggressiveness. Member comments included:

- There could be three bins: (1) one for systems with non-aggressive water based on water quality, (2) one for systems with aggressive water based on water quality, and (3) one for systems where the water quality is in-between and more information is needed.
- Some members discussed whether to consider those systems with non-aggressive water due to CCT separately from those that have naturally non-aggressive water. Systems with naturally non-aggressive water could potentially have less frequent monitoring than those with non-aggressive water due to treatment. The Group would need to consider whether this complicates the rule requirements.
- One member questioned if small systems elected to conduct copper monitoring instead of applying for the copper waiver, what is the benefit if they have no new copper and what bin are they in?
- One member recommended that EPA issue guidance on how to place systems in bins and needed actions based on their bin assignment.

LCRWG members provided preliminary input on how to identify systems with zones of water quality that is aggressive to copper:

- Zonation is a large system issue. Hydraulic models that were developed by larger systems for the initial distribution system evaluation (IDSE) for the Stage 2 Disinfectants and Disinfection Byproducts Rule or for the Ground Water Rule could be used to assess blending in the distribution system.

- Small water systems may not have hydraulic zones but they will have zones where disinfection levels will vary including dead zones.

Possible Requirements Based on Water Aggressiveness

One member asked for clarification whether treatment that is effective for lead may have copper issues. In response Dave Cornwell indicated that poly and blended phosphate are not good for copper passivation. A system that uses a polyphosphate would need to move to orthophosphate. In addition, the orthophosphate dosage for copper control is generally higher than that for lead. Dr. Schock added that sometimes systems will have isolated high copper levels (e.g., large systems in supplemental well fields, or with new developments). These systems may need to treat a specific well and not the entire system. One idea is to restrict the usage of copper piping, which may be a more viable option that treatment for smaller water systems. This is an area that is not currently being addressed and could potentially be an AWWA standard or guidance.

The Group talked about possible monitoring, CCT, and PE requirements for systems based on water aggressiveness. Member comments included:

- We could consider allowing a system that is placed in a non-aggressive bin but later finds new copper sites to retain their waiver because the new copper may passivate in a few months. Also we could require them to conduct some PE until they can demonstrate the new copper has passivated.
- Systems with slightly aggressive water due to a change (e.g., chlorination) could test copper pipe to determine passivation time. If passivation occurs in a few days or a month, then consider PE instead of CCT.
- For systems that do not have CCT and exceed the copper ALE only (no lead ALE), requiring PE instead of CCT may be preferred because copper is an issue at new homes/new construction and passivates over time.
- For systems that have very aggressive water that do not have CCT in place, we could consider:
    - CCT or monitor for 6 months in new homes. If the system passivates quickly, then require PE.
    - PE instead of CCT.
- We should have some monitoring for systems with aggressive water as well as consider the role of PE. The Consumer Confidence Report is another source of information on copper and could be considered in determining how frequently these systems need to monitor.

Some members thought that most systems would have non-aggressive water toward copper and that some may only have an issue for a short time due to passivation. A member requested information on EPA's best estimate of the number of systems that can qualify for a copper waiver. Mr. Kempic noted that one of the challenges of the copper waiver process is that the treatment environment is not static because more systems will be required to disinfect and add arsenic treatment. Systems will need to look

at alkalinity when they add an oxidative process. Thus, the data EPA has is a snapshot of today but may not hold as we move forward.

Retesting to Determine If Water is Still Non-Aggressive

The Group discussed when a system might need to retest to determine if they still have non-aggressive water. Member suggestions included:

- Triggering retesting of parameters such as alkalinity and pH, when the system makes certain changes such as adding or switching to a new source or a changing/addition disinfection. Other related comments included:
  - The current LCR requires systems to notify the State if they have a change in treatment and to obtain approval for a new source. The Rule also provides State discretion to require additional monitoring.
  - A downside to using source/treatment changes as triggers is that the next operator or homeowner's association may not realize he/she must tell the Primacy Agency about these changes and the retesting may not occur.
  - Only apply the retesting triggers, such as new sources and treatment change/addition to systems serving 50,000 or fewer people. Retesting is not needed for systems serving more than 50,000 people because they are already conducting on-going WQP monitoring to assess their CCT.
- Picking a timeframe for retesting could be simpler than identifying what changes warrant continued testing. Build on existing rules by requiring the collection of WQPs at coliform sites.
- Using the sanitary survey (done every 3 to 5 years) as a check to determine if there has been a treatment change. Some States will take samples and send them to their lab.

Whether WQP Monitoring Costs for Copper Waivers Offset Copper Monitoring Savings

The LCRWG was asked to provide feedback on the question, *"Does the WQP monitoring necessary to obtain and maintain the copper waiver offset the savings of not monitoring for copper for small and medium systems?"* Some member indicated that they could not address the question until they had more detail on how to monitor for copper waivers (e.g., will field tests be allowed) and knew the number of lead and copper samples that will be required if samples are collected from separate copper sites. LCRWG members also asked about the cost of WQP monitoring compared to copper sampling. In response to this question:

- Dave Cornwell indicated that his lab does not charge for pH (may be $5) and most have meters. Alkalinity may cost around $20.
- Mr. Burneson noted that copper analyses are $20- $30.
- One member explained that many small systems would contract with a lab to collect and analyze a sample for a number of WQPs including alkalinity and pH, which cost $75 per sample in her State.

Other comments provided by LCRWG members included:

- The bin sorting may be worth the cost, if the rule is revised to conduct copper monitoring only at high-risk copper sites.
- The transaction costs to sample copper from a new home/new construction is greater than collecting a WQP sample in the distribution system (i.e., TCR site) because PWSs will need to solicit volunteers from the individuals who own or rent these homes and some may decline to participate.

I. Healthy Homes

Several LCRWG members discussed the US Department of Housing and Urban Development's (HUD's) Healthy Homes Initiative (HHI) that includes a lead component to remove leaded paint from inside and outside the home, including deteriorated lead-paint in household dust and soil.

LCRWG members provided additional comments on the scope of the current HHI:

- The HHI does not include testing of lead in water or LSLR.
- The HHI conducts an evaluation of homes with children that have elevated blood lead levels for sources of lead resulting from leaded paint. Water is not generally considered as a possible source and if water is sampled, it is collected by someone who is not knowledgeable about the water system.
- The HHI is focused on low income housing. LSLs are more universally distributed and can be an important source of lead.

The LCRWG discussed the possibility of bettering aligning the goals and scope of the HHI with those of the LCR to reduce lead exposure from all sources. Specific comments and questions included:

- Could there be an effort to change the law to allow the HHI to go beyond lead in paint and to also pay for LSLR. It does not make sense when lead abatement is done to leave a LSL in place.
- Lead advocacy folks could be helpful in pushing to include lead risk in water in abatement programs.
- If we establish a relationship with the housing authority and they are already conducting lead removal work, the utility could come in and collect a water sample.

EPA and the LCRWG also discussed ideas for achieving LSLR beyond the LCR:

- One LCRWG member suggested meeting with individuals who are involved with the HHI and to provide them with a decision tree for homes with LSLs that includes constructive recommendations.
- Mr. Burneson explained that Jerry Ellis (OGWDW) had discussions with HUD regarding LSLR. One possible option is the Community Development Block Grant (CDBG) that provides funds for local community development activities. These activities include infrastructure development that

could apply to LSLR. However, he was unsure if water systems meet the qualifications to apply for a CDBG.

- One LCRWG member questioned if LSLR could be tied to the sale of a home. Specifically, if a home inspection could be expanded to require the detection of LSLs and the removal of those lines to be negotiated as part of the sale of a property. This is similar to the requirement in some States to provide smoke detectors or the removal of an underground storage tank before a house is sold. Based on the 80% turnover in ownership in the last 20 years in his State, this approach could result in the removal of a lot of LSLs.

Other comments provided by LCRWG members included:

- As leaded paint is removed from homes, over time, lead in water may be considered a more important source of lead.
- Boston has a lead mitigation program and will test the water of any child with elevated lead levels and for anyone that requests to have their water tested.
- A request for the LCRWG to get a synopsis of the most current lead in drinking water health effects studies to better understand the lead source contribution from drinking water, and the cost to communities to remove lead as opposed to the cost of elevated blood lead levels. The presumption is that if we divert money from lead removal in paint, soil and dust, to drinking water, we are taking a step backwards.

J. Copper Health Effects and Public Education

Sensitive Subpopulations to Copper

EPA provided a brief discussion of copper health effects and individuals with Wilson disease (i.e., the copper sensitive subpopulation):

- Mr. Burneson indicated that the sensitive subpopulation consists of individuals with Wilson Disease, which he believes affects 1 in 100,000 people.
- Nicole Shao, EPA ORD, explained that Wilson Disease is the inability to process copper. This impacts liver and kidneys. She explained that copper health effects will be the subject of a future webinar.
- Mr. Burneson indicated that the copper MCLG is not based on Wilson Disease impact but gastrointestinal distress.
- Matt Robinson (OGWDW) stated that copper consumption is thought of in terms of total body burden, and considers all routes of consumption that include both diet and water. Wilson Disease is a result of a genetic defect in the body's ability to process and eliminate copper. It first affects the liver, and though symptoms typically first appear during the teenage years, many people aren't diagnosed until mid-life. Copper accumulation in these individuals can cause liver and/or neurological problems.

LCRWG members had some general comments regarding PE and how it could be more effectively conveyed. Copper PE will be one of the main topics of the September 2014 LCRWG meeting.

General Comments

- PE may be less about health effects and focused instead on reducing exposure from copper in new homes.
- The Group should think more holistically about PE to consider not only whether we need copper PE but to look at lead PE and how PE can affect choices on plumbing and cost when people are building new homes or renovating existing ones.
- PE should provide information on the right types of faucets to install during new construction/remodeling and could include information from NSF International.
- It is important to identify the appropriate triggers for PE because it may not be warranted in every situation.
- Recent literature suggests that problems from exposures to lead at the tap have not been fully understood and is growing in relative contribution with respect to children and pregnant woman in a way that has not been assessed before. There are environmental justice issues with individuals who are getting elevated blood levels and little testing of age groups where they are most affected by even small doses. Because of this, we may need a much broader and deeper PE campaign to health care providers and sensitive subpopulations.

How to More Effectively Convey Copper PE

One LCRWG member noted that to target copper education to those affected, it is important to understand how likely someone is to know that they have Wilson Disease and the risks that someone would be negatively affected by copper before they knew they had Wilson Disease. In response, Mr. Burneson indicated that National Research Council (NRC) prepared a report in 2000 on copper in drinking water. EPA will provide the LCRWG will this link and discuss copper health effects in more detail in the next webinar.

Some members talked about the purpose of PE and how to it could be more effectively conveyed that included:

- The best opportunity to provide copper PE is at locations where people apply for new construction permits.
- If flushing is a recommended mitigation method in the PE materials, we need to think about how long we would require flushing. The message we include in the PE materials needs to be carefully considered.
- For systems with water that is aggressive toward copper, require targeted PE to only new construction that would be delivered through the building department. Do not provide the wrong education to people. Target only to people that should get the materials. Otherwise, it drives them to use bottled water because they get the message that they should not drink tap water.

- To determine how to best educate the consumer, we need to focus on "touch points" where the water system already has an interaction and how they can affect this interaction. For new customers, an option could be for the utility to check the plumbing before providing service. For new construction, the building authority is in the best position to provide education that could potentially extend beyond the consumers to the plumbers and the individual who commissions and inspects the property.

K. Public Comments

One individual provided public comments on Day 1 and another on Day 2 of the meeting. Each is summarized below.

Day 1 – Public Comments

Regu Regunathan, a consultant to a trade association of point-of-entry (POE) and POU equipment manufacturers and dealers, provided public comments. He has practiced in this field 50 years and was a member of NDWAC. He has participated in many workshops, including those on arsenic and lead. He presented two ideas for monitoring. One is to use continuous sampling that can provide information about contaminant levels over time (e.g., day or week, etc.). The other is to measure contaminants from an NSF International-certified POU filter at specific intervals (e.g., monthly).

Day 2 – Public Comments

George Rizzo, EPA Region 3, noted that one of the States in his Region has many small ground systems with low pH that do not exceed copper level because they do not have much copper-containing plumbing. When they have metallic plumbing, they replace it with PVC materials. Therefore, he sees the copper issue as almost self-correcting. Over time, systems will replace copper pipe if local plumbing codes allow it.

Closing Remarks, Next Steps, and Action Items

Mr. Burneson thanked the LCRWG for their time, expertise, and constructive ideas. He was impressed how the Group was able to reach clarity on certain points and really narrow down on the big issues.

The next meeting will be on the sampling protocol and copper PE and will be held on September 18 and 19 in Cadmus' corporate office in Arlington, VA.

The following table contains action items from the meeting and a list of outstanding action items from the March 2014 meeting:

Action Items from the NDWAC LCR Working Group Meetings

Row	Action Item	Responsibility[1]
	ACTION ITEMS FROM MAY 29 AND 30 MEETING	
1	Provide March meeting summary: 1. LCRWG to provide comments to Gail by June 6. 2. Track changes version to LCRWG for approval (if cannot be approved via email will add to September agenda). Final meeting notes in 508 compliant format.	1. LCRWG 2. RESOLVE Cadmus
2	Send final operating protocol to LCRWG that reflects input from March meeting	RESOLVE
3	Send link to first webinar and Google Doc site to non-LCRWG attendees	RESOLVE
4	Distribute meeting summary for May meeting.	CADMUS/EPA/RESOLVE
5	Organize and expand Google Docs site to be complete repository for all important LCRWG information: 1. Create site map and cross reference them to materials. 2. Add materials from first webinar, white paper, other important background materials, and additional handouts provided by members during the meeting. 3. Determine best approach for others to add information to the site. Post March and May meeting notes after LCRWG approves them.	1. EPA 2-4: EPA/RESOLVE
6	Send "doodle" polls to LCRWG members regarding availability for upcoming: 1. Second webinar (September 9, 10, or 11). 2. Fourth meeting (second week of November). Webinar for fourth meeting (November 5 or 6).	RESOLVE
7	Distribute 1991 Jeff Cohen memo that includes the rationale for the current sampling protocol.	EPA
8	Provide legal expert on the interpretation of control for the LSLR webinar.	EPA
9	Provide speaker from OECA on Next Gen compliance.	EPA
10	Provide health information on copper including: 1. Link to the National Research Council's copper health effects study. 2. Statistics on people with Wilson's disease and likelihood people will know they have the disease.	EPA

Row	Action Item	Responsibility[1]
11	Provide estimate of the number of systems that may qualify for a copper waiver.	EPA
12	For the September webinar/meeting: 1. Provide lead PE as context for copper PE discussion. 2. Ensure copper PE includes a discussion of potential PE needs for system that have water that is aggressive toward copper. Include the role PE can play in both lead and copper to affect choices on plumbing materials and cost.	EPA/RESOLVE
OUTSTANDING ACTION ITEMS FROM MARCH 25 AND 26 MEETING (Numbering reflects March 2014 Action Item List)		
8	Determine whether definition of backsliding on public health is specific to one rule or can apply across multiple rules.	EPA
10	If available, provide additional, existing background materials to LCRWG: Lead level trends for some Massachusetts systems	Steve Estes-Smargiassi
11	Assess availability of other requested information/conduct analysis as needed. 1. National statistics on lead and copper ALEs to answer if there are systems for which CCT is not working? It will be important to distinguish systems that have exceeded the action level for lead versus exceeding the action level for copper. Of those systems that have exceeded action levels, how many have implemented other optimization requirements (or made adjustments in OCCT as required by primacy agencies?) 4. Description of LSLR process including steps, timing, and costs of partial and full LSLR. 5. Information from IEUBK model on impact of blood lead level on infants consuming lead at 15 µg/L. 10. List of stakeholders that are involved with lead and copper control (e.g., plumbing equipment manufacturers, building industry, public health agencies, water systems, regulatory agencies). 14. How many large, medium, and small systems are estimated to be required to re-optimize (i.e., how many will exceed the lead/copper action level) under new rule?	EPA

Acronyms: µg/L = micrograms per liter; ALE = action level exceedance; CCT = corrosion control treatment; IEUBK model = Integrated Exposure Uptake Biokinetic model; LCR = Lead and Copper Rule; LCRWG = LCR Working Group; LSLR = lead service line replacement; NDWAC = National Drinking Water Advisory Council; OECA = Office of Enforcement and Compliance Assurance; PE = public education. **Notes:** [1] Unless otherwise stated, EPA refers to the Standards and Risk Management Division (SRMD).

List of Attachments

- Attachment A – List of Lead and Copper Rule Working Group Members and Meeting Presenters
- Attachment B – Meeting Agenda
- Attachment C – List of Attendees
- Attachment D – Sample Site Selection Primer

ATTACHMENT A

Second NDWAC Lead and Copper Working Group Meeting

List of Lead and Copper Rule Working Group Members and Public Commenters

May 29 and 30, 2014

NDWAC LCR Working Group
Christina Baker: Deputy Public Counsel, Office of the Public Counsel, State of Missouri
Leon Bethune, Director, Director of Office of Environmental Health, Boston Public Health Commission
Gary Burlingame: Laboratory Director, Philadelphia Water Department
Marilyn Christian: Manager, Environmental Health Programs, Harris County Public Health
Matthew Corson: Manager, Environmental Compliance, American Water
Derrick Dennis: Water Quality Unit Supervision, Office of Drinking Water, State of Washington
Stephen Estes-Smargiassi: Director of Planning, Massachusetts Water Resources Authority
Hector Gonzalez, Director Health Department, Laredo, Texas[1]
Thomas G. Neltner: Senior Attorney, Natural Resources Defense Council
John Sasur Jr.: Three Rivers Fire District, Massachusetts
Paul Schwartz: Water Alliance[1]
Robert C. Steidel: Director Department of Public Utilities, City of Richmond Virginia
June Swallow: Chief, Division of Water Quality, Rhode Island Department of Health
Lynn Thorp: National Campaigns Director, Clean Water Action
Chris Wiant: President, Caring for Colorado
Nse Obot Witherspoon: Executive Director, Children's Environmental Health Network
EPA Office of Ground Water and Drinking Water
Eric Burneson: Division Director, Standards and Risk Management Division
Lisa Christ: Branch Chief, Targeting and Analysis Branch
Public Commenters
Regu Regunathan, Water Quality Association
Meeting Facilitator: Gail Bingham, RESOLVE

[1] Hector Gonzales and Yanna Lambrinidou could not attend. Paul Schwartz served as Dr. Lambrinidou's alternate.

ATTACHMENT B

U.S. Environmental Protection Agency

NDWAC LEAD AND COPPER WORKING GROUP

The Cadmus Group, Inc.
1555 Wilson Blvd., Suite 300 | Arlington, VA 22209
703.247.6161

May 29-30, 2014

Agenda

Meeting Objectives/Desired Outcomes:

- **Welcome new members;**
- **Share follow up ideas and questions concerning corrosion control topic from last meeting;**
- **Provide input on questions related to sample site selection; and**
- **Plan next steps.**

Advance materials: LCR White Paper; Sample Site Selection Primer

Thursday May 29th, 2014

8:45-9:00 Informal gathering

9:00-9:30 Welcome, Introductions, Meeting Objectives/Agenda, Materials and Logistics

Advance materials: Proposed agenda

Welcome: Eric Burneson, Director, Standards and Risk Management Division, Office of Groundwater and Drinking Water
Introductions: Gail Bingham, *facilitator*

9:30-10:45 Discussion: Follow up on Key Points from Meeting One and the Webinar

Objectives: Recap topics covered by speakers on corrosion control at the March meeting and on sample site selection on the May webinar. Address any unanswered or follow up questions (see printout of webinar Q&A and Chat Room). Share "take-aways."

10:45-11:00 BREAK

11:00-12:15 Discussion: Sample Site Selection (Targeting Sites)

Objectives: Provide initial input on questions posed in the white paper and on the webinar. Initial ideas will be included in the meeting summary for members to reflect upon and consider for inclusion in final report.

Suggested Discussion Questions:

- How should sample site selection tiering criteria be developed to capture the highest risk sites for both lead and copper in a simple, health protective, and cost effective way? What factors should be considered?

- At what sites should lead and/or copper samples be taken to be representative of the greatest release for each contaminant?
- Other questions from the webinar?

12:15-1:30 LUNCH *[on your own]*

1:30-1:45 Public Comment

1:45-3:00 Discussion: Sample Site Selection (Sampling Schemes LSL and Non-LSL systems)

Objectives: Provide initial input on questions posed in the white paper and on the webinar. Initial ideas will be included in the meeting summary for members to reflect upon and consider for inclusion in final report.

Suggested Discussion Questions:

- Under what circumstances and how could sampling for lead and copper occur at separate sites? If so, what could the potential sampling scheme look like?
- Should the sample site selection criteria for LSL systems and non-LSL systems differ to prioritize sampling from locations likely to demonstrate the greatest release for each contaminant? If so, what would that sample site selection criteria look like?
- In LSL systems, what are the advantages and disadvantages of relying on lead from the lead service lines as the lone sentinel for optimal corrosion control?
- Other questions from the webinar?

3:15-3:30 BREAK

3:30-4:30 Discussion: Sample Site Selection (Number of Samples and Cost)

Objectives: Provide initial input on questions posed in the white paper and on the webinar. Initial ideas will be included in the meeting summary for members to reflect upon and consider for inclusion in final report.

Suggested Discussion Questions:

- How many samples for each contaminant would be needed to be statistically significant?
- What are the cost implications of developing separate sampling sites and maintaining separate sampling pools?
- Other questions from the webinar? (e.g. implications of invalidation criteria for the number of samples needed. *Note: other questions related to invalidation criteria may be more applicable at September meeting.*)

4:30-5:00 Discussion: Sample Site Selection (Targeting Sites 'reprise')

Suggested Discussion Questions: Return to the morning discussion questions and questions raised on the webinar, e.g. based on what we know now, what should we consider when we look to change the sampling criteria of the LCR?

5:00 ADJOURN FOR THE DAY

Friday, May 30th, 2014

8:45-9:00 Informal gathering

9:00-9:15 Review Day Two Agenda

Objective: Reflections from Day One and confirm agenda for today.

9:15-10:30 Discussion: Sample Site Selection (Copper-specific questions)

Objectives: Provide initial input on questions posed in the white paper and on the webinar. Initial ideas will be included in the meeting summary for members to reflect upon and consider for inclusion in final report.

Suggested Discussion Questions:

- What age copper piping should be sampled in order to capture the greatest likelihood of copper release?
- Would taking copper samples from pipe rigs (with copper the same age as in the distribution system) be useful in helping to reduce sampling burden for large systems? If so, how, and how should the data be used to determine action level compliance?
- Other questions from the webinar?

10:30-10:45 BREAK

10:45-12:15 Discussion: Sample Site Selection (Copper Waivers and Water Quality Parameters)

Objectives: Provide initial input on questions posed in the white paper and on the webinar. Initial ideas will be included in the meeting summary for members to reflect upon and consider for inclusion in final report.

Suggested Discussion Questions:

- What age copper piping should be sampled in order to capture the greatest likelihood of copper release? What are the challenges and opportunities?
- How could water quality parameter data be used to accurately assess which systems are likely to need copper monitoring and which do not?

    - How might these data be used to develop copper monitoring waivers for systems meeting specific water quality criteria?
    - Do you have or know of data that EPA could consider to develop such waivers
- What strategies could be used to help identify systems with zones of water quality aggressive to copper? For lead?
- What might copper waiver conditions look like, including water quality and non-water quality based conditions?
- Does the WQP monitoring necessary to obtain and maintain the copper waiver offset the savings of not monitoring for copper for small and medium systems?
- Other questions from the webinar?

12:15-1:30 LUNCH *[on your own]*

1:30-1:45 Public Comment

1:45-2:45 Open Discussion

Objectives: Return to "targeting sites" questions as needed. Reflect on what can be answered given current knowledge of both lead and copper. Provide initial input on other questions/topics of interest to working group members.

2:45-3:00 Wrap up and Next Steps

3:00 ADJOURN MEETING

ATTACHMENT C

Second NDWAC Lead and Copper Working Group Meeting - *List of Attendees*

May 29 and 30, 2014

First Name	Last Name	Affiliation
John	Arnett	Copper & Brass Fabricators Council
Christina	Baker	State of Missouri
Leon	Bethune	Boston Public Health Commission
Scott	Biernat	Association of Metropolitan Water Agencies
Gail	Bingham	RESOLVE
Gary	Burlingame	Philadelphia Water Department
Eric	Burneson	EPA
Bob	Cantilli*	EPA
Rachel	Carson*	EPA
Lisa	Christ	EPA
Marilyn	Christian	Harris County Public Health
David	Cornwell	EE&T
Matthew	Corson	American Water
Ross	Cooper	State of Nevada
Miguel	Del Toral	EPA
Derrick	Dennis	State of Washington
Lisa	Donahue	EPA
Laura	Dufresne	Cadmus
Jerry	Ellis	EPA
Stephen	Estes-Smargiassi	Massachusetts Water Resources Authority
Chris	Fultz	EPA
Dan	Hansen*	International Association of Plumbing and Mechanical Officials (IAMPO)
Anne	Jaffe Murray	Cadmus
Jeff	Kempic	EPA
Frank	Letkiewicz	Cadmus
Christopher	Lindsay*	IAMPO
Dave	Lipsky	New York City Dept. of Environment
Suril	Mehta	EPA
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*Attended May 29, 2014 session only.

ATTACHMENT D

Sample Site Selection Primer

Introduction

The goal of the sample site selection criteria is to cost effectively target locations which assesses the effectiveness of a public water system's corrosion control treatment and trigger additional actions to reduce exposure when necessary. Water systems must compare sampling results to an Action Level (AL). The AL for lead is 15 µg/L and the AL for copper is 1.3 mg/L. Both contaminants have maximum contaminant level goals (MCLG) based on established health effects. For lead the MCLG is zero and for copper the MCLG is 1.3 mg/L, the same as the action level. In the Lead and Copper Rule (LCR), water systems must prioritize sample sites locations (often residences) within the distribution system which are at a high-risk of elevated lead and/or copper in the water Lead and copper levels can vary between systems and sites based on water quality, and distribution system and usage characteristics. Selection and use of these elevated lead and copper sites enables a smaller number of sample sites than random or geographic site selection procedures.

The Current Rule

The 1991 LCR established a tiering system for prioritizing the selection of sampling sites based on the likelihood of the sites to release elevated levels of lead and copper; for lead, sites with lead service lines (LSLs), lead pipes, or copper pipes with lead solder; for copper, copper pipes with lead solder.

There are three tiers for community water systems (CWSs) and two for non-transient non-community water systems (NTNCWSs), with Tier 1 being the highest priority. Systems must use all Tier 1 sites if available. If systems cannot identify enough Tier 1 sites to meet their minimum sampling requirements, they must select Tier 2 sites, followed by Tier 3 sites, and then representative sites. The actual number of sites sampled depends on the size of the population served by the system (hereafter, "system size") and distribution system characteristics. Tier 3 sites are currently only applicable to CWSs. Table 1 describes the lead and copper site selection criteria in the current rule.

Table 1: Current Lead and Copper Site Selection Criteria

Tier	CWSs	NTNCWSs
Tier 1	Collect samples from Single Family Residences (SFRs)*: • with copper pipe and lead solder installed after 1982 *(but before the effective date of the State's lead ban)*, or with lead pipes; and/or • Are served by Lead Service Lines (LSLs). For any system with LSLs, 50% of the samples must come from LSL sites and 50% of the samples must come from sites with lead pipes or copper pipes with lead solder. **Tier 1 samples can be collected from MFRs if they represent at least 20% of structures served by the water system.*	Collect samples from buildings: • with copper pipe and lead solder installed after 1982 (but before the effective date of the State's lead ban), and/or • Are served by LSLs. For any system with LSLs, 50% of the samples must come from LSL sites and 50% of the samples must come from sites with lead pipes or copper pipes with lead solder.

Tier	CWSs	NTNCWSs
Tier 2	Collect samples from buildings, including multifamily residences (MFR): • with copper pipe and lead solder installed after 1982, or with lead pipes; and/ or • Are served by LSLs. For any system with LSLs, 50% of the samples must come from LSL sites and 50% of the samples must come from sites with lead pipes or copper pipes with lead solder.	Collect samples from buildings with copper pipe and lead solder installed before 1983.
Tier 3	Collect samples from SFRs with copper pipes with lead solder installed before 1983.	N/A
	Representative Sample: If a CWS or NTNCWS cannot collect enough samples from tiered sites, it must collect them from sites where the plumbing is similar to that used at other sites served by the water system (§141.86(a)(5)).	**Acronyms:** LSL = lead service line; MFR = multi-family residence; N/A = not applicable; SFR = single family residence; CWS = Community Water System; NTNCWS = Non-transient, non-community water system.

Number of Samples

The number of samples each system must take under the LCR is important to have in mind when considering potential changes to the sample site selection criteria. For example, an increase in the number of sites that must be sampled will result in increased cost and burden for utilities, and increased oversight for Primacy Agencies.

The current LCR sampling protocol requires water systems to collect one-liter, first-draw samples from taps in selected households for testing; currently, all CWSs and NTNCWSs must collect lead and copper tap samples. Transient, non-community water systems are not subject to the lead and copper regulations. The frequency of the monitoring and number of samples to be collected and analyzed is based primarily on a system size and its tap water monitoring results. Standard monitoring for the LCR has systems collecting samples every six months.

Systems must collect a minimum number of samples from sites based on system size indicated in the table below.

Table 2. Minimum Number of Lead and Copper Tap Samples for Systems

System Size (population served)	No. of Samples Standard Monitoring	No. of Samples Reduced Monitoring
>100,00	100	50
10,001-100,00	60	30
3,301-10,000	40	20
501-3,300	20	10
101-500	10	5
$\leq$ 100	5	5

Lead Free and the Safe Drinking Water Act

The 1986 Safe Drinking Water Act Amendments banned the use of lead solder and lead pipes under Section 1417. These Amendments were signed into law on June 19, 1986. States were required to begin enforcing the law within two years of enactment (June 19, 1988). Some States had lead bans in effect prior to the passage of the SDWA Amendments, so effective dates for lead bans will vary from State to State.

Section 1417 of the SDWA was amended under the 2011 Reduction of Lead in Drinking Water Act. These SDWA Amendments have focused on the lead content of brass and bronze fixtures in water distribution systems that are covered under SDWA. The 2011 Reduction of Lead in Drinking Water Act reduced the allowable lead content in pipe, pipe fittings, plumbing fittings and fixtures to be no more than 0.25% as a weighted average of the wetted surface area of the components that make up the pipe, fitting or fixture. Some products were exempted from coverage under this portion of SDWA. The Reduction of Lead in Drinking Water Act became effective on January 4, 2014.

The 2013 Community Fire Safety Act added fire hydrants to the list of products that are exempted from the lead free requirements of SDWA. Section 3 of the Community Fire Safety Act also required EPA to consult with and seek the advice of the National Drinking Water Advisory Council on potential changes to the regulations pertaining to lead under the SDWA and request the Council to consider sources of lead throughout water distribution systems, including through components used to reroute drinking water during distribution system repairs.

Typical lead sources include lead service lines, lead-based materials in the premise plumbing (leaded solder, brass/bronze fittings, and galvanized piping), faucets, and water meters. Leaded solder was banned by the 1986 SDWA Amendments with an effective date no later than two years after enactment (June 19, 1988). The contribution of each of these sources was evaluated by measuring lead in sequential samples taken at the tap

after a minimum 6-hour stagnation time (profile sampling). The average percent contribution in Table 3 is based on the "mass of lead" – which is the contribution to the entire sequence of samples and not just the first draw sample. This study did not examine components that are used to reroute drinking water during distribution system repairs.

Table 3. Average Percent Contribution of Major Lead Sources[1]

Lead Source	Average Percent Contribution to the Mass of Lead Measured at the Tap During Profile Sampling[2]
Lead Service Lines	50-75%
Premise Piping	20-35%
Faucets	1-3%

[1]Sandvig, et al., 2008. Contribution of Service Line and Plumbing Fixtures to Lead and Copper Rule Compliance Issues. Am. Water Works Assn. Research Foundation (now: Water Research Foundation).

[2]From sites with lead service lines. Based on mass of lead results measured at the tap from sequential samples.

Considering Modifications to the LCR Sample Site Selection Criteria

The 1991 LCR requires CWSs to collect samples at taps from residences that have lead pipes and/or are served by a lead service line, and/or from sites that have copper pipes with lead solder installed after 1982 (but before the effective date of the State's lead ban) (Table 1). The rationale for the 1991 LCR sample site selection structure was to sample first from sites with the greatest likelihood of finding elevated lead levels at the time to serve as the sentinel sites for corrosion control effectiveness. As an example, the lead solder date requirement was based on studies in which lead leaching from solder was found to decrease with age. Therefore, samples collected from more recently soldered copper pipes would be expected to have higher lead results. Now, more than twenty years have passed since lead solder was banned in all jurisdictions and the leaded solder installed before the lead ban is likely leaching at much lower levels than when it was first installed (USEPA, 1988).

Given what we know about lead and copper release over time, and since new scientific information from the research exists regarding lead and copper release patterns raise the question of whether the current sample site selection criteria should be revised. Key points include:

Lead

- Full and partial LSLs represent the greatest source of lead to drinking water. Partial lead service line replacements are frequently associated with short-term elevated drinking water lead levels, that tend to gradually stabilize overtime, sometimes at levels below and sometimes at levels similar to those observed prior to the replacement (USEPA, 2011). The current criteria do not solely prioritize sampling from LSLs (full or partial);
- Studies have shown that higher lead levels are found in water in contact with lead service lines vs. first-draw, first-liter samples (Del Toral et al. 2013; Boyd 2004)
- Because lead release from solder decreases with time, research suggests that these sites now are likely releasing much lower levels of lead during the stagnation period (levels that could be comparable to contributions by brass plumbing components and interior pipe corrosion byproduct scales) (USEPA, 1988).
- Lead has been shown to accumulate in corrosion scales or deposits formed in premise plumbing, downstream of LSLs and can be released sporadically, often in response to treatment changes or line disturbances. (Del Toral et al. 2013)

Copper

Published corrosion literature since 1991 on copper has shown that copper and lead leaching patterns differ. The original LCR sample site selection criteria for copper no longer targets highest-risk copper sites, since these sites have now aged (copper corrosion decreases over time) Water chemistry and pipe age play a more dominant role than what was originally thought for copper release.

- Corrosion can occur to copper plumbing of any age. However, in the presence of certain water qualities, copper levels in excess of the action level are most likely to occur in newly constructed homes and buildings with copper plumbing, or at sites that have been recently renovated with new copper plumbing (Grace et al. 2012; Turek et al. 2011; Schock and Sandvig 2009; Rajaratnam et al. 2002; Edwards et al. 2001; Lagos et al. 2001; Schuerman et al. 2000; Knobeloch et al. 1998; Schock et al. 1995; Schock et al. 1994)
- Corrosion of new copper pipes is not a problem for many water systems. It is limited to water systems that have water quality aggressive to copper. Water chemistry characteristics that contribute to copper release also can vary in different zones within a distribution system as well as between different systems with respect to aggressiveness to copper (Schock and Lytle 2010; Edwards et al. 2001, 1996; Friedman et al.1999; Broo et al. 1997; Ferguson et al. 1996; Schock et al. 1995; Schock et al. 1994);
- When age and water quality variation is taken into account, there is less variability in copper release than lead release (Kirmeyer et. al. 2004, 1994; Merkel et al. 2002; AwwaRF 1990).

Lead and Copper

- Differences exist between lead and copper release; thus, high risk sites for lead and copper differ;
- Water chemistry variations within the water distribution system can vary temporally and spatially (Grace, 2012; Schock 1994). Because water qualities such as pH, alkalinity, and temperature affect the solubility of these metals in water, variations in water qualities within the distribution system could affect where high risk sites are found. In order to capture high-risk sites, it is important that sampling schemes consider zones where water quality is aggressive to these contaminants;
- Research since the 1991 rule indicates that brass and other metallic premise plumbing materials may be a more significant immediate and long-term source of lead in drinking water than originally believed, especially in newer homes (Kimbrough, 2007, 2001; Edwards et al. 2001; Lagos 2001; Lagos et al. 2001; Hidmi and Edwards 1999; Knobeloch et al. 1998; Kirmeyer et al. 1994).

In light of this new information, EPA is seeking input on identifying how the sample site selection criteria for lead and copper could be modified to capture the current sources of high risk sites for lead and copper in a simple and cost effective way. We also seek input on the choice of sites for lead and copper sample collection (in order to be representative of each contaminant).

A few approaches EPA is considering are:

- Separate tiering structures for lead service line and non-lead service line systems;
- Separate sampling sites for lead and copper;
- Waiver of copper monitoring based on water quality parameters that demonstrate water quality not aggressive to copper. This could be used to exempt systems from copper monitoring (copper monitoring waiver);

Options for Revising the Sample Site Selection Criteria: Separate Tiering Structures for Systems with Lead Service Lines (LSL)

One option for revising the sample site selection criteria is to create separate tiering structures for systems with lead service lines. Table 4 outlines one possible way of creating separate tiering for LSL systems.

Table 4: One Option for Revising the Lead and Copper Sample Site Selection Criteria

Tier	CWSs and NTNCWSs *with* Lead Service Lines	CWSs and NTNCWSs *without* Lead Service Lines
Tier 1	Sample from SFRs served by full or partial LSLs or contain lead interior plumbing.**	Sample from SFRs with known metallic plumbing components.*
Tier 2	CWSs: Sample from buildings, including MFRs, served by full or partial LSLs or with lead interior plumbing. NTNCWSs: Sample from buildings, including MFRs, served by full or partial LSLs or with lead interior plumbing.	CWSs: Sample from buildings, including MFRs, with known metallic plumbing components* NTNCWSs: Sample from structures, including MFRs, with known metallic plumbing components.*
Tier 3	CWSs: Sample from buildings, including MFRs, with known metallic plumbing components.* NTNCWSs: Sample from structures, including MFRs, with known metallic plumbing components*	Sample from representative sites throughout the distribution system.

***Metallic plumbing components** include lead or brass plumbing components and copper pipes with lead solder, steel, and galvanized steel.

**LSL samples would not be tested for copper.

Acronyms: LSL = lead service line; MFR = multi-family residence; N/A = not applicable; SFR = single family residence; CWS = Community Water System; NTNCWS = Non-transient, non-community water system

Considerations for separate tiering structures for LSL and non-LSL systems:

- Prioritizes lead release from LSLs and PLSLs;
- Has separate tiering structure for LSL and non-LSL systems;
- Considers existing brass as an equally important contributor of lead as soldered joints. Brass/bronze components installed after January 4, 2014 are required to contain less than 0.25% lead and sites containing only these newer brass and bronze materials may not be high risk for lead corrosion;
- Lead and copper are co-sampled from the same tap *when LSLs are not present*;
- LSL systems would not have to monitor for copper at LSL sites; they would conduct copper monitoring only if they run out of LSL sites;
    - LSL systems may still have areas with new copper piping or renovated copper piping/plumbing as part of their system which would not get sampled;

Separate Monitoring Sites for Lead and Copper

The Table 4 site selection scheme could include sampling at separate sites for lead and copper (for both LSLs and for non-LSL systems). This would require a separate sampling pool for copper, and would allow for copper to be sampled at sites likely to leach elevated levels of copper. These separate copper sites could be

structured (tiered, or prioritized) in such a way to capture copper samples from sites most likely to leach elevated levels of copper (new copper, and systems/water quality zones with water qualities which aggressively leach copper).

Considerations for separate lead and copper sampling sites:

- Allows for copper monitoring to target new copper plumbing (sites with highest potential for copper release), while still allowing lead monitoring to target older plumbing with LSLs and PLSLs (sites with the highest potential for lead release).
- Separate sampling sites will better assess corrosion control effectiveness for both lead and copper;
- Systems must maintain two sampling pools of available sampling sites, potentially increasing burden and costs for systems, and potentially increasing burden for Primacy Agencies and customers who collect samples;
- Some water systems may have to install copper corrosion control that have not previously been required to under the current sampling requirements.

Copper Monitoring Waiver

One possibility for reducing the sampling burden for copper is to use water quality parameters to characterize the potential aggressiveness of water to copper plumbing with sufficient precision to help reduce both the total number of systems required to monitor for copper and the total number of samples needed to be taken.

Studies have shown that where water quality is aggressive to copper, especially for newly-installed copper pipe, it is possible for maximum soluble copper levels to approach and/or exceed the MCLG of 1.3 mg/L (Reiber, et al. 1997; Edwards et al. 1996; AWWA 1993; AWWA 1988;). It is possible that the monitoring burden could be reduced by allowing systems that demonstrate water qualities which are not aggressive to copper to receive copper monitoring waivers. Some criteria that may be used as a starting point for determining waiver eligibility could include:

- The system provides no disinfection or oxidation treatment, and the pH is at or above 6.5;
- The pH is at least 7.0 and up to 7.5, and alkalinity is at or below 200 mg/L (as $CaCO_3$);
- The pH is greater than 7.5 and the alkalinity is at or below 250 mg/L (as $CaCO_3$);
- The system has installed optimal corrosion control for lead[8].

Considerations for copper monitoring waivers:

- Copper sampling is limited only to those systems with water quality aggressive to copper, reducing overall sampling burden;
- Allows copper monitoring to target new copper plumbing (sites with the highest potential for copper release), while still allowing lead monitoring to target older plumbing with LSLs and PLSLs (sites with the highest potential for lead release);
- Some systems may incur a new and ongoing monitoring cost for water quality parameters unless they are currently required to monitor them to demonstrate optimal corrosion control. The number of samples and frequency of water quality monitoring may offset the savings from the copper monitoring waiver;

[8] Further discussion of this criterion is necessary. Systems with optimal corrosion control for lead may still have sources of water quality aggressive to copper and insufficient treatment in place to control for copper.

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